Examining a management measure of key purse seine vessels for recovering bigeye tuna stock in the western and central Pacific Ocean

WCPFC-SC12-MI-WP-09

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Introduction

- ✓ Harley et al. (2015) reported that for the specific 27 vessels bigeye tuna comprise 12% of their total tuna catch (i.e., all set types) versus 4% for the rest of the fleet (237 vessels) (**Table 3** of Harley et al. 2015, SC11-MI-WP-07).

Table 3: Comparison of some features of catch and effort for those vessels that were in the top 10 bigeye catching vessels at least once in the period 2010–13 versus the rest of the fleet. Analysis is based on observer data.

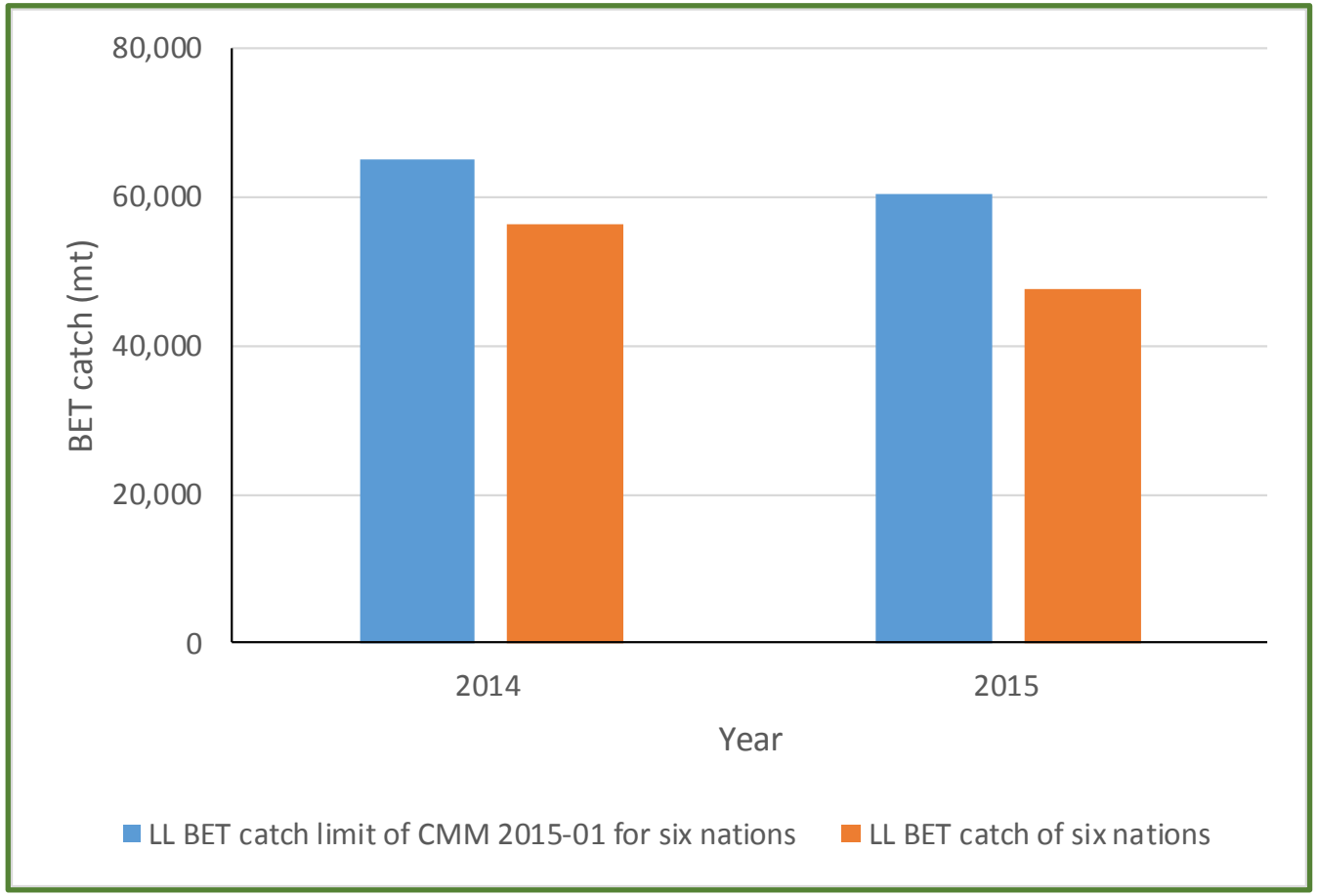
Key purse seine vessel

Criteria	Bigeye catching vessels top	rest
Average annual number of vessels	27	237
Average annual total tuna catch (mt)	119,719	702,227
Average annual total bigeye catch (mt)	14,484	30,131
Bigeye proportion of total tuna	0.12	0.04
Proportion effort on FADs	0.6	0.43
Proportion FAD sets with bigeye	0.62	0.42
Proportion FAD sets with >50% bigeye	0.09	0.03
Proportion of bigeye from bigeye dominated sets	0.34	0.21
Proportion of tuna from bigeye dominated sets	0.09	0.03

Introduction

- ✓ SC11 noted that around one-third of the purse-seine catch of bigeye is taken by a small component (~10%) of the fleet (key purse seine vessels)….
- ✓ During the WCPFC12 a CCM requested analyses for various combinations of FAD set limits and longline bigeye catch limits (paragraph 321 of the WCPFC12 report)…..
- ✓ At early July 2016, just before SC12, we can find a document of WCPFC-SC12-MI-IP-07 which could be successive analysis of Harley et al. (2015), however the document is assigned as information paper.
- ✓ Thus we are afraid that there is no discussion about the key purse seine vessels issue during SC12.

Introduction



From Annual reports of six nations
Table 2 of SC12-AR-CCM-03, Table 2 of SC12-AR-CCM-09, Table 2 of SC12-AR-CCM-10, Table 1 (b) of SC12-AR-CCM-12, Tables 2 and 4 of SC12-AR-CCM-23, Table 1f of SC12-AR-CCM-27

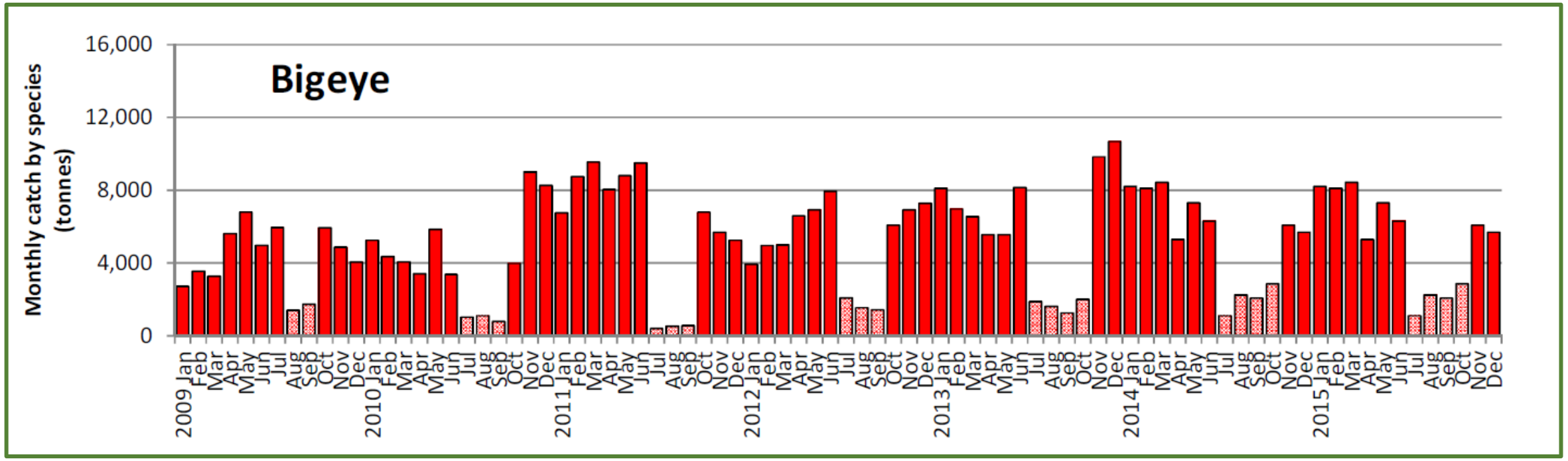
- ✓Catch limit of bigeye tuna of CMM 2015-01 for longline of six nations are not exceeded.

Attachment F: Bigeye Longline Catch Limits by Flag

CCMs	Catch Limits			
	2014	2015	2016	2017
CHINA	9,398	8,224	8,224	7,049
INDONESIA	5,889	5,889*	5,889*	5,889*
JAPAN	19,670	18,265	18,265	16,860
REPUBLIC OF KOREA	15,014	13,942	13,942	12,869
CHINESE TAIPEI	11,288	10,481	10,481	9,675
USA	3,763	3,554	3,554	3,345

*Provisional and maybe subject to revision following data analysis and verification

Introduction



From FigureA5 of SC12-GN-WP-1. Monthly catch of bigeye tuna.

✓The FAD closure seem to be well complied.

Introduction

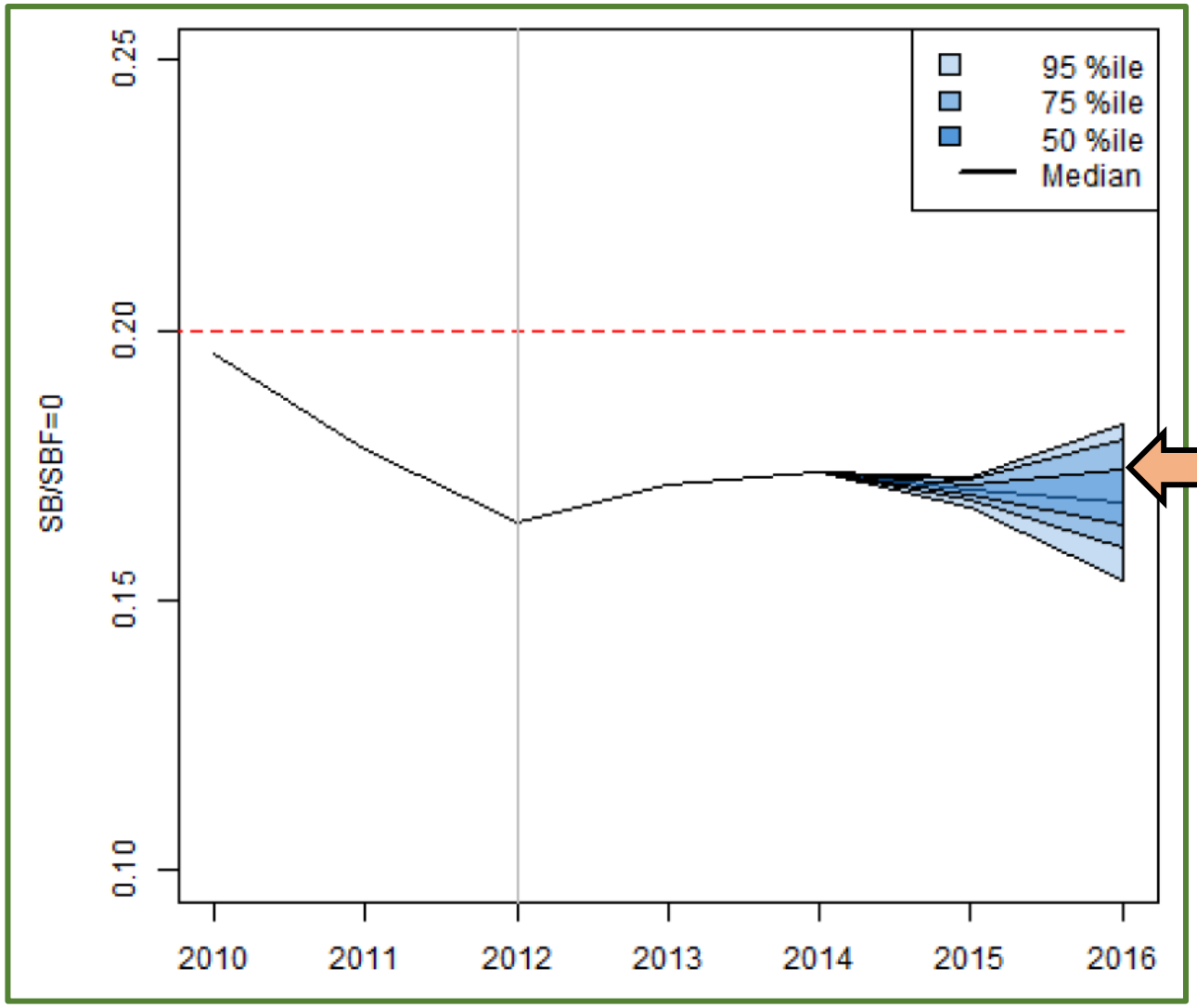
- ✓ The effect of CMM2014-01, which is substantially equivalent to CMM 2015-01, was evaluated by future projection (SPC, 2015; WCPFC12-2015-12_Rev1).

- ✓ The results, including four scenarios of combinations of fishing mortality by longline and purse seine, revealed that only under the optimistic scenario achieved the CMM objectives **by 2032**, with F less than FMSY.

Scenario	Scalars relative to 2012		Average F_{2032}/F_{MSY}	Average $SB_{2032}/SB_{F=0}$	Risk SB_{2032} < LRP
	Purse seine	Longline			
Status quo	1	1	1.21	0.24	32%
Pessimistic	1.02	0.97	1.18	0.25	28%
2015 choices	0.95	0.84	1.06	0.29	11%
Optimistic	0.76	0.84	0.93	0.33	2%

Table from WCPFC12-2015-12_Rev1

Introduction



From Figure 11 of SC12-SA-WP-03.
Stochastic projection results of bigeye spawning biomass.

- ✓ Furthermore, the median of the projection surely upward trend from 2015 to 2016 but it is slight change.
- ✓ In addition, we should recognize that the FAD closure started at 2009, thus small bigeye in 2009 can grow to be matured fish, and affect the spawning biomass status.
- ✓ The catch limit of LL was also implemented since CMM2008-01.

- ✓ In summary, there could be basically no violation of CMM 2015-01 and its predecessors, however the CMMs have not yet affect substantially to the spawning biomass of BET.

Introduction

- ✓ Originally CMM2013-01, the predecessor of CMM2015-01, include the option for expanding the duration of FAD closure, however the implementation of the option has been stacked in last two years even though the BET stock status is under LRP.

- ✓ Thus, an exploration into alternative management option is useful if it can achieve the objectives in shorter period or even under pessimistic fishing mortality scenario.

Table 3: Comparison of some features of catch and effort for those vessels that were in the top 10 bigeye catching vessels at least once in the period 2010–13 versus the rest of the fleet. Analysis is based on observer data.

	Bigeye catching vessels	
Criteria	top	rest
Average annual number of vessels	27	237
Average annual total tuna catch (mt)	119,719	702,227
Average annual total bigeye catch (mt)	14,484	30,131
Bigeye proportion of total tuna	0.12	0.04
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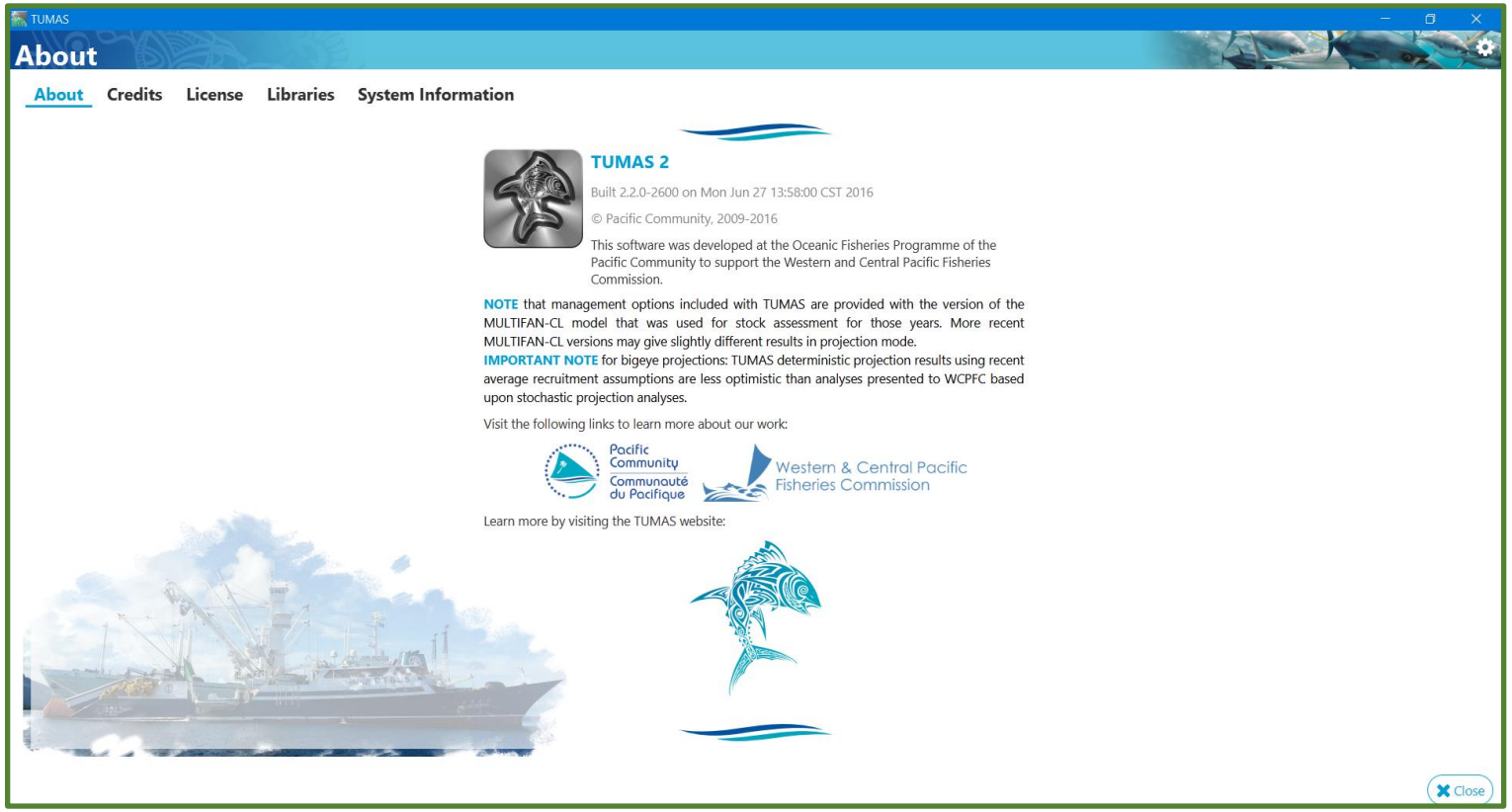
From **Table 3** of Harley et al. 2015, SC11-MI-WP-07).

Introduction

- ✓The aim of this study is to facilitate discussion of a purse seine management option for the key purse seine vessels with higher bigeye catch percentage during SC12.

- ✓We invite SC12 to consider the management options regarding to purse seine fishery including the key purse seine vessels issue, and to request SPC to conduct related analyses including precise future projections using the vessel-level purse seine data.

Method



http://distribute.spc.int/OFP/tumas/releases/2.2/TUMAS-2.2-setup-x64.exe

(Released at June 27th 2016)

✓ We conducted a future projection to evaluate **only one management option** which is reducing the 27 key purse seine vessel's higher bigeye catch ratio (12 % of the total annual tuna species catch) to the average value (4 %) of the other purse seine fleet (237 vessels) using **TUMAS ver. 2.2** based on the bigeye tuna stock assessment in 2014.

Method

- ✓ The last year of the stock assessment analysis in 2014 is 2012, so the period for the future projection of this study is from 2013 to 2022.
- ✓ The actual implementation for the management option is simple, that is, we assigned the catch scalar of four FAD (associated) fisheries as **0.79**.
- ✓ The catch scalar is catch ratio for the future projection period relative to the average catch from 2010 to 2012.
- ✓ The projection was based on the average recruitment in recent ten years (2002-2011) and the reduced constant FAD catch mentioned above. In addition, at the time TUMAS ver. 2.2 can allow one recruitment option in recent 10 years.

Method

		Key vessels (27 vessels)	Rest vessels (237 vessels)	Total
From Table 3 of Harley et al (2015)	Annual total tuna catch (mt)	119,719	702,227	
	Annual total bigeye catch (mt)	14,484	30,131	44,615
	Bigeye proportion of total tuna	12.098 %	4.290 %	
Target bigeye catch (t)	bigeye catch (t) assumed bigeye proportion of the rest vessels (4.290%)	5,135.9 (=119,719*4.290 /100)	30,131 (=702,227*4.290 /100)	35,266.9
	Catch scalar of four FAD fisheries for TUMAS			0.79 (=35,266.9 / 44, 615)

Corrected bigeye catch by factor* (for reference of actual bigeye catch limit)

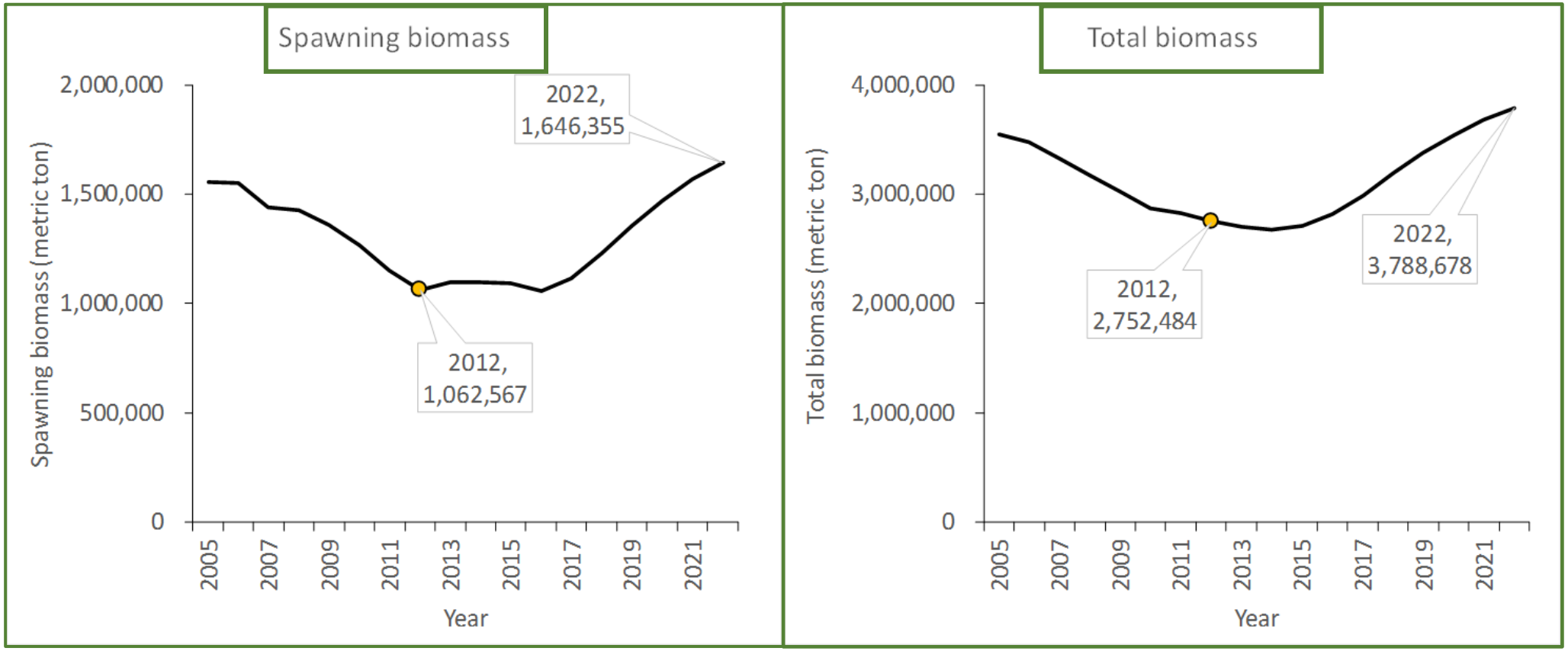
1.483 (Total bigeye catch (t) from 2010-2013 is 66,204.8 t (Table 8 of WCPFC-SC11-2015/ST IP-1), the bigeye catch used Harley et al (2015) is 44,615 t, thus the conditional factor is 1.483 (=66,204.8 / 44,615). The actual target catch is 52,300.8 (=35,266.9 * 1.483) and scholar is 0.79 (=52,300.8 / 66,204.8)

Method

- ✓ The bigeye catch of purse seine in Harley et al (2015) contained the catch of both school types (FAD (associated) and unassociated), nonetheless the catch scalar is assigned only for the FAD fisheries.
- ✓ Because there was no detail information about the catch ratio by school types in Harley et al. (2015) and the percentage of bigeye catch by school type is dominated by the FAD (associated) set (89.5% in average from 2010 to 2013).

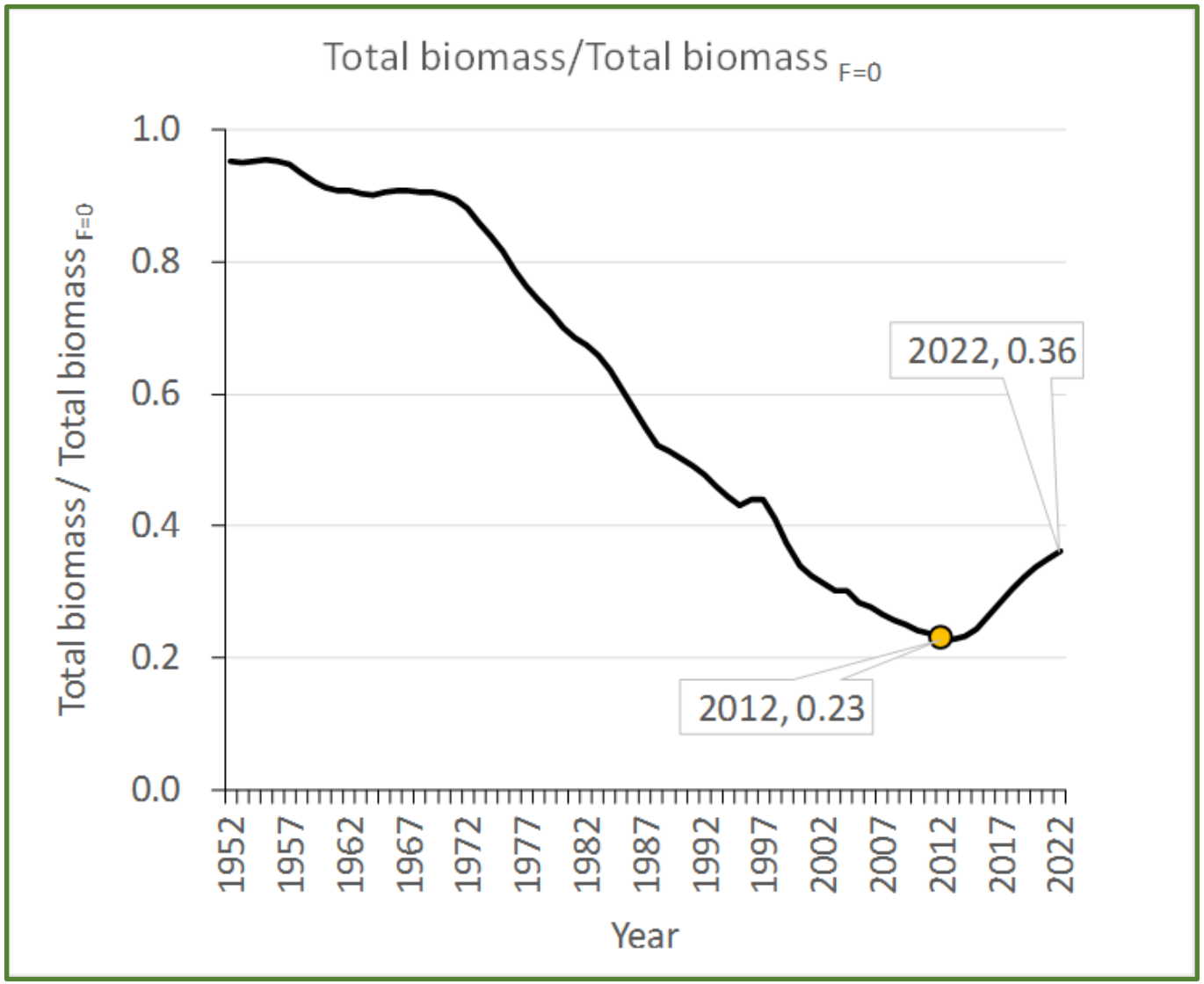
- ✓ Harley et al. (2015) mentioned that "*We examined what differences might exist between those `top' vessels with high bigeye tuna catches versus the rest of the fleet. There was no strong difference in the regions of the WCPO fished*", thus the catch scalar (catch ratio for the future projection period relative to the average catch from 2010 to 2012) for all four FAD fisheries were assigned as **0.79**.
- ✓ The four FAD fisheries were S-ASS All 3 (region 3), S-ASS All 4 (region 4), S-ASS All 8 (region 8) and S-ASS All 7 (region 7). The fishery definition is same for the Multifan-CL fishery definition in 2014 assessment.

Result



- ✓ The spawning biomass and total biomass of bigeye tuna showed increasing trend after 2017 and 2015.
- ✓ Small bigeye tuna, which survive the purse seine FAD fishery, can grow and increase its biomass after three years implementing the management measure, and the biomass of matured bigeye will increase after five years.

Result



- ✓ The total biomass / total biomass $_{F=0}$ is considered as some proxy of the limit reference point (20% spawning biomass / spawning biomass $_{F=0}$) and showed increasing trend after 2015 and reached to 0.36 in **2022** which is similar to the level of the late of 1990s.

- ✓ In addition, there is no default direct output of TUMAS related to the limit reference point.

Introduction

- ✓ The effect of CMM2014-01, which is substantially equivalent to CMM 2015-01, was evaluated by future projection (SPC, 2015; WCPFC12-2015-12_Rev1).

- ✓ The results, including four scenarios of combinations of fishing mortality by longline and purse seine, revealed that only under the optimistic scenario achieved the CMM objectives **by 2032**, with F less than FMSY.

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Optimistic	0.76	0.84	0.93	0.33	2%

Table from WCPFC12-2015-12_Rev1

Discussion

There are many rooms for improvement of the future projection in this study.

① The future projection doesn't consider uncertainty in the case of **low recruitment**.
② The effect of the **FAD management implemented** after 2014 is not considered. Thus the relationship between the already implemented FAD closure and the assumed measure in this study is not clear.
③ It is well-known that the bigeye CPUE of FAD fishery in the eastern part of WCPO is higher than those in the western area, so the key vessels seem to operate in the eastern part of WCPO. The future projection scenario considering **area-specific management** option using vessel level data is adequate and should lead to more realistic results. The vessel level data also allow the future projection for the bigeye **catch limit by vessel**, which is already suggested in Harley et al (2015).
④ The purse seine catch by **school type** should be considered.

Recommendations

- ✓ Note that the examined management option (reducing the key vessel's higher bigeye catch ratio (12% of the total annual tuna species catch) to the average value (4%) of the other purse seine vessels) resulted in substantial positive impact to recover the bigeye tuna spawning biomass, although the key purse seine vessels comprised only 10% in vessel number of the fishery.

- ✓ Consider that management options regarding to purse seine fishery including the key purse seine vessels when providing advice to WCPFC13.

Acknowledgement

We are greatly acknowledged Dr. Graham Pilling and SPC stuffs for updating the TUMAS.

Terima Kasih
Thank you