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HARVEST STRATEGIES FOR TROPICAL TUNA IN ARCHIPELAGIC WATERS OF INDONESIA: UPDATE

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Fayakun Satria, Lilis Sadiyah, I Gede Bayu Sedana,
Trian Yunanda, Putuh Suadela

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Introduction

The Western and Central Pacific Fisheries Commission (WCPFC) has adopted the Conservation and Management Measure on establishing a harvest strategy for key fisheries and stocks in the Western and Pacific Ocean (CMM 2014-06) to ensure the long-term conservation and sustainable use of the highly migratory fish stocks of the WCPO in 2014. In the following year, a work plan for the adoption of harvest strategies (HS) has been agreed. The development and implementation harvest strategies for major tuna species is also consistent with Indonesia's rights and obligations as a member of the international governance bodies for these highly migratory stocks: Regional Fisheries Management Organizations (RFMOs). Indonesia intends to develop Harvest Strategies within its Archipelagic Waters which are compatible with measures mandated by the RFMOs. In addition, implementation of the monitoring, assessment and management measures, which form the essential elements of a harvest strategy, are central to achieve certification of fisheries to international standards for sustainability, an important milestone for the private sector in Indonesia, and to safeguard against local depletions of tuna stocks.

Indonesia intends to develop scientifically-tested harvest strategies for tropical tuna in the Indonesia's Archipelagic Waters (IAW). This development has been initiated since November 2014. The aim of developing the HS is to enable Indonesia to manage its tropical tuna fishery within its IAW in an adaptive way which can be measurable and predictable in achieving its management objective. This work is a participatory and consultative process which involves a spectrum of relevant stakeholders, including central and local Government, fishery managers, fishing associations, industry stakeholders, private sector companies, international and local Non-Government Organizations (NGOs), fishery scientists and experts.

Indonesia's Archipelagic Waters (IAW) encompass Fisheries Management Areas (FMAs) 713, 714 and 715, and are identified as the priority areas for this initiative due to the significant role it plays for Indonesian tuna fisheries. In recent years, the proportion of tuna catches from those areas has increased relative to the national tuna catches. A strong residential behavior has been

reported by Rice et al. (2014)[1] for skipjack, and highlighted during the WPEA, *Three Country Stock Assessment Workshop*, held in Vietnam in 2015, for skipjack and yellowfin tuna. Therefore, the development and implementation of harvest strategies for tuna fisheries in Indonesian archipelagic waters demonstrates Indonesia's commitment to long-term sustainability of these nationally and regionally important resources. It is the intention that this process will initially focus on these three FMAs but will, at a later date, be expanded to include all national waters.

This is the first attempt to develop harvest strategies for Indonesia's tuna fisheries, a specific harvest strategy framework has been developed through a collaborative work between the Center for Fisheries Research (CFR), Ministry of Marine Affairs and Fisheries (MMAF), Indonesia and the WCPFC under the West Pacific East Asia – Sustainable Management (WPEA-SM) with the involvement of the Commonwealth Scientific and Industrial Research Organization (CSIRO) experts. WPEA-SM has supported the development of Indonesia's National Tuna Management Plan (NTMP) and the interim harvest strategy framework for tropical tuna fishery in Indonesia's archipelagic waters (FMAs 713, 714 and 715) as well as the port-based sampling program for at least 10 years. This paper provides an update of the process of the HS development for the tropical tuna in the Indonesia's archipelagic waters (FMAs 713, 714 and 715) up to mid of 2020.

Harvest Strategy Development Process

The process of development to current status of the harvest strategy has been conducted in a consultative, collaborative and multi-stakeholder approach. Lead government institutions have been the Directorate of Fish Resources Management, Directorate General of Capture Fisheries (DGCF) and CFR, both under MMAF. Under the direction of the Directorate of Fish Resources Management and by instruction from the Director General for Capture Fisheries a steering committee was established comprised of officials from DGCF, Centre for Fisheries Research and some external expert advisors (from CSIRO and the Pacific Community (SPC)). During the initial process, the consultation has involved experts from three RFMOs (WCPFC,

[1] Rice, J., Harley, S., Davies, N. & Hampton, J. (2014). Stock assessment of skipjack tuna in the Western and Central Pacific Ocean. Presented at the Scientific Committee Tenth Regular Session in Majuro, Republic of the Marshall Islands 6-14 August 2014. WCPFC-SC10-2014/SA-WP-05.

Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and Indian Ocean Tuna Commission (IOTC)) which Indonesia is a member.

Additionally, a technical group was established and led by the Centre for Fisheries Research which included technical guidance and input from CSIRO, whom have extensive experience in the harvest strategies and MSE (Management Strategy Evaluation), and also with support from various stakeholders that include NGOs and academia.

Multi-stakeholder consultations and technical workshops have taken place over the past couple of years, fostering a transparent and participative environment for harvest strategy development. A summary table that shows a time-line of progress to develop Indonesia's harvest strategies of tropical tuna in its Archipelagic Waters can be found in Figure 1. The interim harvest strategy for tropical tuna in Indonesia's Archipelagic Waters had been launched at the Third *Bali Tuna Conference* in 2018 (WCPFC14-2017-DP26 and WCPFC15-2018-DP28). A management objective and limit reference point have been agreed, while five candidates of management measures were agreed, with target reference points still in discussion.

Technical Workshops – Scientific Related Process

In 2016, thirteen data-sets were submitted as the first submission for harvest strategy work. These datasets were collected from 2010 – 2015, and three data-sets were selected for further harvest strategy development (WCPFC-SC14-2018/MI-IP-06, Satria and Sadiyah, 2018). The second data submission was in March 2019 for data collected from 2016 – 2018. Six data-sets were received, the summary is provided in Table 1 (including the previous 3 data-sets selected, i.e. 7 datasets in total). These datasets were combined with the previous 3 data-sets selected from the first data submission, to get longer time series data. Number of trips of pole-and-line, handline and longline tuna fisheries for the two data submissions (data from 2010 – 2018) are provided in Table 2, 3 and 4, respectively.

In order to investigate whether the data meets the minimum requirements for harvest strategy work, and possible improvement of source of abundance and size indices, the *Exploratory Data Workshop* was conducted from 9th – 10th May 2019. The 7 datasets were then used in the analyses (CPUE standardization to estimate relative abundance indices and selectivity

estimation). The updated analyses on the CPUE standardization and selectivity estimation were presented and discussed during the 5th technical workshop that was held from 28 – 29 October 2019.

Prototype Operating Models (OMs) have been developed for skipjack and yellowfin tuna, based on the relevant WCPFC regional stock assessments. These models provide the basis for testing the performance of specific alternative harvest strategies and providing government and stakeholders with results to select the most appropriate harvest strategy for each species for implementation. Summary of specification and process of developing prototype OMs and preliminary examples of harvest strategy framework for skipjack tuna and yellowfin tuna in Indonesian archipelagic waters is provided by Hoshino *et al*. (2018). These models are conditioned using the WCPO stock assessment outputs as well as Indonesian port-sampling data. Progress of the harvest strategy development has been reported in the Scientific Committee meeting of the WCPFC - SC14 (WCPFC-SC14-2018/MI-IP-06) and WCPFC – SC15 (WCPFC-SC15-2019/MI-IP-11), and Regular Session of the Commission – WCPFC 14 (WCPFC14-2017-DP26) and 15 (WCPFC15-2018-DP28).

Further works are required to determine productivity of tropical tuna (population biology parameters) in the Archipelagic Waters that required in the operating models (in the context of MSE), and its socio-economic information and bio-economic modeling for the different sectors of the tuna fisheries. These are expectedly covered by the collaboration between CFR – MMAF and CSIRO under ACIAR project (FIS/2016/116) that commenced since late 2018.

Stakeholder Workshop – Management Related Process

During the Stakeholder workshop in 2017, five priority selected management measures were selected (WCPFC15-2018-DP28):

a. Limit on use of Fish Aggregating Devices.
b. Spatial closures (of important spawning or nursery grounds) and temporal closures (during important events such as spawning).
c. Number of fishing days (per gear, for semi industrial and industrial vessels).
d. Number of vessels – limited entry (per gear; for semi industrial and industrial vessels through licensing, permits, taxing, royalties).
e. Total Allowable Catch (TAC) limits per Fisheries Management Area.

The 1st *Harvest Strategy Implementation Workshop* in November 2018 has involved various relevant stakeholders and international experts including Harvest strategy expert from SPC. The workshop recommended that there are no additional fishing permits for industrial fishing vessels (>30 GT) catching yellowfin and skipjack tuna until the NTMP completes its review in 2019.

The 2nd harvest strategy implementation workshop was held from 30 – 31 October 2019. During this workshop, the five priority selected management measures were discussed. All stakeholders attended the workshop, including relevant central and local Governments, fishing associations, industry and private sector stakeholders, international and local Non-Government Organizations, Scientists and Academics, agreed to implement these management measures, until the harvest strategies fully developed for the tropical tuna in the IAW. Review of the NTMP has been conducted since 2019, and currently in the process of public consultation. The updated NTMP will be legalized after its finalization this year.

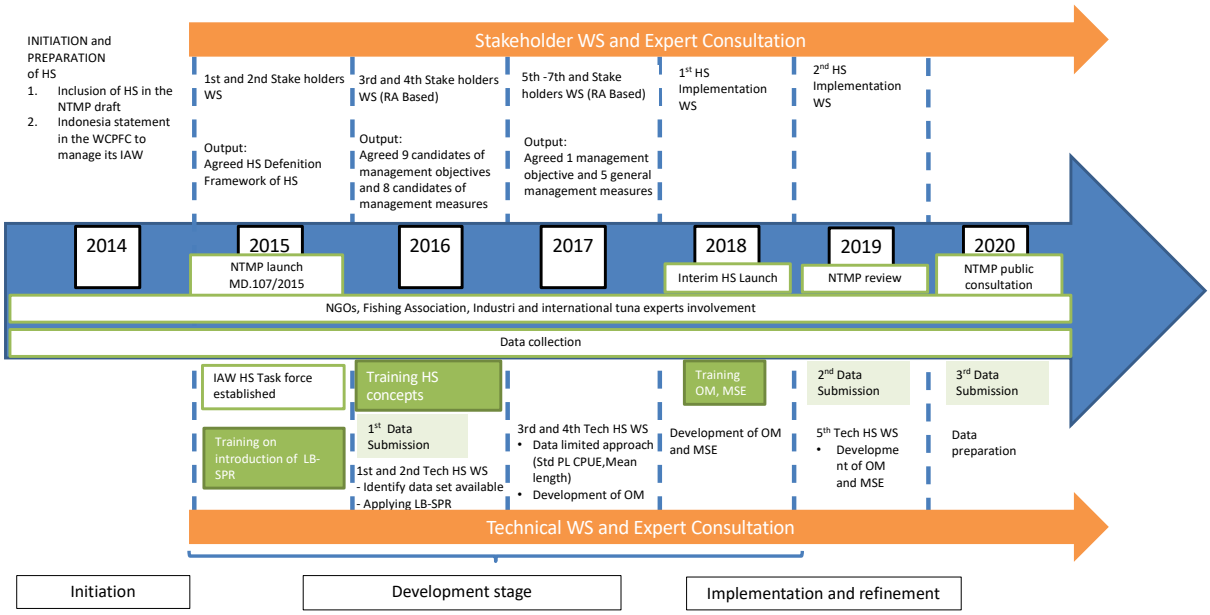

Figure 1. Summary of Harvest Strategy Development Process for Tropical Tuna in the Indonesia's Archipelagic Waters (modified from Satria and Sadiyah (2018))

Table 1. Summary of datasets submitted to the Third data submission in March 2020 (combined with the previous submissions).

Data series name/source	Sampling period	Sampling freq.	FMA coverage	% landing/gear coverage	Source of effort/catch data	Rel. abundance?	Size indices?	On-going?
CFR – WPEA (Port Sampling)	2010 - 2019	Daily	713 - 715	30% of # vessels landed. PL,PS,SHL,TLH,TR, LHL,LL	Effort (fishing days, hooks), total catch volume per port-sampled vessel	√ SKJ, YFT, BET, ALB (Bitung)	√	√
CFR – ACIAR (CSIRO) (Port Sampling)	Oct 2013 - Dec 2015	Daily	714, 715	20% of # vessels landed. Mainly HL and TL, but also PL, PS at 4 ports	Number of fishing days, catch per trip recorded by enumerator	√ SKJ, YFT, BET	√	-
MDPI (Port Sampling)	2016 - 2019	Daily	713 - 715	HL, PL, PS, TL	Effort (fishing days), Catch (per landing by species)	√ SKJ, YFT, BET	√	√
MDPI (Observer)	Jul - Dec 2019	Setting	713 - 715	HL	Effort (fishing days), Catch (per setting by species)	SKJ, YFT, BET	√	√
SFP (Port Sampling)	2016 - 2019	Daily	713 - 715	HL	Effort (fishing days), Catch (per landing by species)	√ SKJ, YFT, BET	√	√
DGCF (Logbook)	2016 - 2019	Setting	713 - 715	PL, PS, HL, LL	Effort (fishing days, hooks), Catch (per landing by species)	√ SKJ, YFT, BET	N/A	√
DGCF (Observer)	2016 - 2019	Setting	713 - 715	PL, HL, LL, PS	Effort (fishing days, setting, hooks), Catch (per vessel by species)	√ SKJ, YFT, BET	Length - Weight	√

Data series name/source	Sampling period	Sampling freq.	FMA coverage	% landing/gear coverage	Source of effort/catch data	Rel. abundance?	Size indices?	On-going?
AP2HI (Port Sampling)	Jan - Dec 2019	Daily	713 - 715	PL, HL	Effort (fishing days), Catch (per trip by species)	SKJ, YFT, BET, ALB	√	√
AP2HI (Observer)	2017 - 2018	Setting	713 - 715	PL	Effort (fishing days, setting), Catch (per setting by species)	√ SKJ, YFT, BET	√	√
RIMF (Port Sampling)	Feb 2018 - Dec 2019	Daily	713 - 715	HL, LL, PL, PS, TL	Effort (fishing days, no. of hooks, no. of setting), Catch (per trip by species)	SKJ, YFT, BET	√	√
YKAN (Port Sampling)	Jan - Dec 2019	Daily	713 – 715	PL, HL, TL, PS, GL, LL	Effort (fishing days, no. of seting), Catch (per trip by species)	SKJ, YFT, BET	√	√

Notes: CFR – Center for Fisheries Research; DGCF – Directorate General for Capture Fisheries; MDPI – Masyarakat dan Perikanan Indonesia; AP2HI – Asosiasi Perikanan Pole and Line dan Handline Indonesia; SFP – Sustainable Fisheries Partnership; WPEA-SM – West Pacific East Asia-Sustainable Management, ACIAR – Australian Centre for International Agricultural Research, RIMF – Research Institute for Marine Fisheries, YKAN - Yayasan Konservasi Alam Nusantara.

Table 2. Number of pole and line trips collected (the first up to the third data submissions combined). The first submission is data from 2010 – 2015, the second submission is data from 2016 – 2018 and the third submission is for 2019 data only.

Data series name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CFR-WPEA-SM [P]	657	584	391	572	557	283	61	396	128	184
MDPI [P]	-	-	-	34	50	37	604	106	24	-
MDPI [O]	-	-	-	-	-	-	-	-	-	-
CFR-ACIAR [P]	-	-	-	16	74	27	-	-	-	-
SFP [P]	-	-	-	-	-	-	-	-	-	-
DGCF [L]	-	-	110	650	669	670	591	671	704	1465
DGCF [O]	-	-	-	-	-	-	15	8	60	26
AP2HI [P]	-	-	-	-	-	-	-	-	-	21
AP2HI [O]	-	-	-	-	-	-	-	20	89	102
RIMF [P]	-	-	-	-	-	-	-	-	663	141
YKAN [P]	-	-	-	-	-	-	-	-	-	187

[P] = Port Sampling, [O] = Observer, [L] = Logbook

Table 3. Number of handline trips collected (the first and second data submissions combined). The first submission is data from 2010 – 2015, the second submission is data from 2016 – 2018 and the third submission is for 2019 data only.

Data series name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CFR-WPEA-SM [P]	706	1619	1121	2174	1809	1042	3805	3367	4166	1996
MDPI [P]	-	-	226	1363	1657	4068	4944	4874	5246	3464
MDPI [O]	-	-	-	-	-	-	-	-	-	41
CFR-ACIAR [P]	-	-	-	76	145	162	-	-	-	-
SFP [P]	-	-	-	-	-	194	345	1313	1321	559
DGCF [L]	-	-	50	187	345	376	402	320	441	1165
DGCF [O]	-	-	-	-	-	-	8	-	9	13
AP2HI [P]	-	-	-	-	-	-	-	-	-	302
AP2HI [O]	-	-	-	-	-	-	-	-	-	-
RIMF [P]	-	-	-	-	-	-	-	-	681	1158
YKAN [P]	-	-	-	-	-	-	-	-	-	266

[P] = Port Sampling, [O] = Observer, [L] = Logbook

Table 4. Number of longline trips collected (the first and second data submissions combined). The first submission is data from 2010 – 2015, the second submission is data from 2016 – 2018 and the third submission is for 2019 data only.

Data series name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CFR-WPEA-SM [P]	131	196	164	40	63	12	30	34	131	52
MDPI [P]	-	-	-	-	-	-	-	-	-	-
MDPI [O]	-	-	-	-	-	-	-	-	-	-
CFR-ACIAR [P]	-	-	-	-	-	-	-	-	-	-
SFP [P]	-	-	-	-	-	-	-	-	-	-
DGCF [L]	-	-	22	167	25	30	13	51	16	46

DGCF [O]	-	-	-	-	-	-	-	12	1	-
AP2HI [P]	-	-	-	-	-	-	-	-	-	-
AP2HI [O]	-	-	-	-	-	-	-	-	-	-
RIMF [P]	-	-	-	-	-	-	-	-	1	-
YKAN [P]	-	-	-	-	-	-	-	-	-	2

[P] = Port Sampling, [O] = Observer, [L] = Logbook

Table 5. Number of purse seine trips collected (the first and second data submissions combined). The first submission is data from 2010 – 2015, the second submission is data from 2016 – 2018 and the third submission is for 2019 data only.

Data series name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CFR-WPEA-SM [P]	693	70	52	77	81	539	947	892	587	635
MDPI [P]	-	-	-	-	-	-	-	-	-	-
MDPI [O]	-	-	-	-	-	-	-	-	-	-
CFR-ACIAR [P]	-	-	-	-	-	-	-	-	-	-
SFP [P]	-	-	-	-	-	-	-	-	-	-
DGCF [L]	-	-	-	-	-	-	825	1686	1836	5876
DGCF [O]	-	-	-	-	-	-	1	-	89	79
AP2HI [P]	-	-	-	-	-	-	-	-	-	-
AP2HI [O]	-	-	-	-	-	-	-	-	-	-
RIMF [P]	-	-	-	-	-	-	-	-	4960	9512
YKAN [P]	-	-	-	-	-	-	-	-	-	25

[P] = Port Sampling, [O] = Observer, [L] = Logbook

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This paper is prepared by: Fayakun Satria[1)], Lilis Sadiyah[2)], I Gede Bayu Sedana[2)], Trian Yunanda[3)], Putuh Suadela[3)]

[1)] Research Institute for Marine Fisheries, Center for Fisheries Research, MMAF.
[2)] Center for Fisheries Research, MMAF.
[3)] Directorate of Fish Resources Management, Directorate General of Capture Fisheries, MMAF**.**
[4)] Jakarta University of Fisheries, MMAF.

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