Sustainable Management of Neritic Tunas in Southeast Asia: longtail tuna and kawakawa in focus

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Oceanic and neritic tunas are abundant and commonly found in the waters throughout Southeast Asia. While oceanic tunas migrate over oceans and seas, neritic tunas mostly inhabit the economic zones and sub-regional marine waters of Southeast Asia. All tuna resources are economically important in Southeast Asia, generating export revenues for the countries and providing important protein sources for domestic consumption. While the catch of the oceanic tunas is reported to have declined but that of the neritic tuna species continues to increase making these species becoming more important and increasingly the target of exploitation by commercial and local fisheries, especially now that attractive prices are offered by processing companies for such species. Therefore, it is necessary to address the status of and uncertainties in the distribution, migration, and utilization of neritic tuna stocks in the waters and sub-regions of Southeast Asia, prior to the development of appropriate tuna management measures and plans at the national and sub-regional levels.

While management efforts with regards to the exploitation of oceanic tunas in Southeast Asian waters are prescribed by the Tuna Regional Fisheries Management Organizations (Tuna RFMOs), such as the Indian Ocean Tuna Commission (IOTC) and the West Central Pacific Fisheries Commission (WCPFC), important works are also being carried out in the Southeast Asian region for the development of regional approaches to manage the utilization of neritic tunas as well as establishment of collaborative management plans for neritic tuna fisheries to ensure the sustainable use of the available regional resources and maximize the economic benefits from neritic tuna fisheries. Recognizing that regional collaboration is vital for the sustainability of these rich and important transboundary resources, the SEAFDEC Member Countries during the 45th Meeting of the SEAFDEC Council in April 2013, agreed to strengthen regional cooperation for the conservation and management of neritic tuna fisheries in the Southeast Asian waters and called for the development of a plan of action for regional cooperation on neritic tunas in the Southeast Asian region.

At the outset, the SEAFDEC Secretariat and Marine Fishery Resources Development and Management Department (MFRDMD) reviewed the status of neritic tuna capture fisheries in the Southeast Asian region, and with technical support from relevant SEAFDEC Member Countries, came up with the preliminary status and trend of the region's neritic tuna stocks. Based on the recommendations of experts from the SEAFDEC Member Countries pointing towards the need to strengthen regional or sub-regional cooperation for the sustainable utilization of the region's neritic tuna resources based on scientific evidence, SEAFDEC/MFRDMD embarked on a stock assessment project for neritic tunas. Therefore, with the support from a Stock Assessment Expert of the Fisheries and Education Agency (FREA) of Japan and Southeast Asian scientists, a stock assessment of the region's most economically important neritic tuna species, the kawakawa and longtail tuna, was carried out with the objective of generating the corresponding total allowable catch (TAC) for such species. Moreover, to address the possible consequences in the adoption of the TAC in view of the associated uncertainties, risk assessment of these neritic tuna stocks was also carried out.

Neritic Tuna Fisheries of Southeast Asia

In the Southeast Asian region, neritic tunas are caught commercially by three main fishing gears (Siriraksophon, 2013), *e.g.* purse seines and ring nets in the Philippines, and drift-gillnets in Indonesia and other countries. Moreover, three types of purse seine operations are also common in many Southeast Asian countries such as purse seines with the use of searching methods or associated with fish aggregating devices (FADs) or with the use of luring lights. In Thailand, as in other neighboring countries such as Cambodia, Malaysia, Myanmar, Brunei Darussalam, and Indonesia, the purse seine currently being used had evolved from the Chinese purse seine and became widely used after 1957, which had been developed with a unique style of seining appropriate to the conditions of the Southeast Asian countries' waters and was initially developed to catch small pelagic fishes other than tunas. In the case of Thailand, targeting of the small tunas by the Thai purse seine fisheries started only in 1982 after the expansion of Thailand's tuna canning industry. The operation using the Thai purse seine is labor-intensive, involving 30-40 crew members working on vessels ranging in length overall from 25 to 30 m. Lengths of the nets range from 800 to 1250 m, while net depths range from 70 to 120 m, and mesh sizes ranging from 2.5 to 9.7 cm. Nowadays, modern purse seiners in the region are already equipped with radar, depth sounder, sonar transceiver, and satellite navigational instruments.

Drift-gillnets also play an important role in neritic tuna fisheries, especially in the early period of development of small pelagic fisheries in many Southeast Asian countries but its use had now been overtaken by the purse seines. However, drift-gillnets are still important gear for some Southeast Asian countries such as Indonesia, and in Viet Nam where 37% of the country's total production of neritic tunas at 72,650 metric tons is caught using the drift-gillnets (Thong, 2013).

Issues, Challenges and Regional Plan of Action

The series of regional technical consultations on neritic tunas conducted by SEAFDEC with its Member Countries identified the key issues that impede the promotion of sustainable utilization of neritic tunas in the Southeast Asian region. These include: insufficient data and information; undetermined status of neritic tuna stocks; open access system of the fisheries; inadequate management of neritic tuna resources in some areas; inadequate understanding of tuna management and conservation measures; negative impacts of climate change on neritic tuna stocks; negative impacts of fisheries on the marine ecosystem; illegal, unreported and unregulated (IUU) fishing practices; inadequate infrastructures in fishing ports and landing sites; post-harvest losses and product quality deterioration; inadequate intra-regional and international trade; insufficient benefits to people involved in neritic tuna fisheries and industries; inferior working conditions in fishing vessels; absence of sub-regional action plans for neritic tuna fisheries; insufficient information on status and trends of neritic tunas at sub-regional level; and limited support to intra-regional and international trade. In an effort to address such issues and concerns, the SEAFDEC Member Countries adopted the Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (SEAFDEC, 2015) with six (6) objectives and 16 Plans of Action as shown in **Table 1**.

Table 1. Important features in the Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region

Objectives	Issues and Concerns	Adopted Plan of Action
I) Determining available data and information, improving data collection and developing key indicators	1) Insufficient data and information	1) Improve Data Collection and Analysis for Neritic Tunas
	2) Undetermined status of neritic tuna stocks	2) Assess Neritic Tuna Stocks and Develop Resource Key Indicators
II) Improving sustainable fisheries management	3) Open access system	3) Promote Management of Fishing Capacity
	4) Inadequate management of neritic tuna resources in some areas	4) Promote Sustainable Utilization of Neritic Tuna Resources
	5) Inadequate understanding of tuna management and conservation measures	5) Enhance Understanding of the Management and Conservation Measures of Neritic Tunas
	6) Negative impacts of climate change on neritic tuna stocks	6) Mitigate the Impacts of Climate Change on Neritic Tuna Stocks
III) Improving sustainable interaction between fisheries and marine ecosystem	7) Negative impacts of fisheries on the marine ecosystem	7) Reduce Negative Impacts of Neritic Tuna Fisheries on the Marine Ecosystem
IV) Improving compliance to rules and regulations and access to markets	8) Illegal, unreported and unregulated (IUU) fishing	8) Combat IUU Fishing in the Southeast Asian Region
	9) Inadequate infrastructures in fishing ports and landing sites	9) Improve Infrastructures in Fishing Ports/Landing Sites
	10) Post-harvest losses and product quality deterioration	10) Improve Post-harvest Techniques and Product Quality
	11) inadequate intra-regional and international trade	11) Enhance Intra-regional and International Trade
V) Addressing social Aspects	12) insufficient benefits to people involved in neritic tuna fisheries and industries	12) Improve the Benefits for People Involved in Neritic Tuna Fisheries and Industries
	13) inferior working conditions in fishing vessels	13) Improve working conditions of labor
VI) Enhancing regional cooperation	14) absence of sub-regional action plans for neritic tuna fisheries	14) Enhance and/or Develop Sub-regional Action Plans for Neritic Tuna Fisheries
	15) insufficient information on status and trends of neritic tunas at sub-regional level	15) Assess the Status and Trends of Neritic Tunas at Sub-Regional Level
	16) limited support to intra-regional and international trade	16) Enhance Intra-regional and International Trade

Actions taken by SEAFDEC and the AMSs

Since the adoption of the Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (RPOA-Neritic Tunas), SEAFDEC with the support from the ASEAN Member States (AMSs) has been implementing several regional action plans in the respective countries of the Southeast Asian region, as shown in **Box 1**.

Box 1. Regional action plans implemented by the Southeast Asian countries with respect to the RPOA-Neritic Tunas

- Compilation and review of existing data and information on neritic tunas from all related national agencies to understand the status, trend and biological parameters
- Review and strengthening of data collection systems on neritic tunas
- Capacity building for data enumerators, observers, port inspectors, scientists, or other key data informants on species identification and biological information
- Determination of the type of data required for stock assessment or key indicator analysis
- Utilization of the existing Standard Operating Procedures (SOPs) for data collection to determine fisheries key indicators on status and trend of neritic tunas
- Conduct of research on neritic tunas at national level (*e.g.* stock assessment, biological, genetics, tagging programs)
- Capacity building on stock assessment
- Development of the Regional Plan of Action for Managing of Fishing Capacity, and promote sustainable management of fishing capacity
- Enhanced involvement of the AMSs in regional and sub-regional research and study on the impact, adaptation, and mitigation measures of climate change on fisheries particularly on neritic tunas (on-going)
- Conduct of risk assessment on the effective management of neritic tunas based on the stock assessment of individual species
- Conduct of R&D on suitable fishing methods and practices for sustainable utilization of neritic tunas resources and their promotion to the AMSs
- Strengthening of cooperation among the AMSs and with other RPOA-IUU participating countries in combating IUU fishing under the RPOA-IUU Framework (on-going)
- Development and promotion of the ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain in the ASEAN Region
- Providing technical support to promote proper handling and preservation of neritic tunas onboard and at ports (on-going)
- Development and implementation of traceability system to monitor movement of neritic tuna fish and products in the supply chain for export (*i.e.* origin of catch, transport, processing, storage and distribution)
- Development of arrangements and partnership between fisheries authorities or related agencies and fisheries industries regarding implementation of labor standards in fisheries in accordance with national laws, the International Labor Organization (ILO) Work in Fishing Convention of 2007 (C188/ Work in Fishing Convention, 2007) No. 188 and other related ILO Conventions
- Review of the existing action plans in sub-regions such as Sulu-Sulawesi Seas, Gulf of Thailand, South China Sea, and Andaman Sea
- Establishment of cooperation on R&D to support sub-regional management of neritic tuna fisheries
- Establishment of the SEAFDEC scientific working group on neritic tunas for regional stock assessment and providing scientific advice for policy considerations on neritic tunas management
- Conduct of regular meetings of SEAFDEC scientific working group at a sub-regional and regional levels
- Promotion of the development of ASEAN Catch Documentation Systems
- Enhancement of the promotion of neritic tuna fish and fishery products from small-scale operators

Stock Assessment of Neritic Tunas

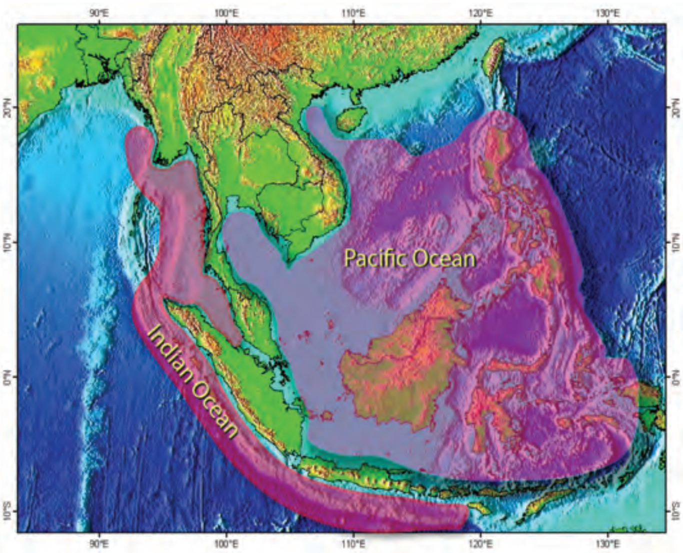

Fig. 1. Two stocks of kawakawa and longtail tuna are reported to be found in: (1) Pacific Ocean side; (2) Indian Ocean side of the Southeast Asian waters (Willette *et al*., 2016)

In the report of Willette *et al*. (2016), two stocks of neritic tunas are commonly found in the Southeast Asian waters, *i.e.* the Pacific Ocean and Indian Ocean stocks that align with the FAO fishing areas 57 and 71, respectively (**Fig. 1**). Based on such findings, SEAFDEC/MFRDMD initiated in 2016 the stock assessment of commercially-important neritic tunas, such as kawakawa (*Euthynnus affinis*) and longtail tuna (*Thunnus tonggol*) for the Pacific and Indian Ocean sides of Southeast Asia using such techniques as the CPUE standardization, and ASPIC and Kobe plots. The results of the stock assessment activity, conducted in collaboration with concerned AMSs and with the technical support of *Dr. Tsutomu Nishida* from FREA in Japan and other experts of the SEAFDEC Member Countries, are shown below:

Stock assessment of longtail tuna (LOT)

Based on the results of the stock assessment using the Kobe plot (Nishida *et al*., 2016), it was found that the stock status of longtail tuna in the Indian Ocean side of the Southeast Asian waters as of 2014, is already in the red zone, implying that the stock has been overfished and still overfishing continues. Results of the Kobe plot for LOT indicating that TB/TBmsy=0.89 and F/Fmsy=1.11, means that the current total biomass (TB) is 11% lower than the MSY level, and fishing pressure (F) is 11% higher than the MSY level (**Fig. 2**). Although the catch peaked in 2011, this decreased in 2014 in spite of the slight recovery of the stock in 2014. However, the probability of uncertainties in the unsafe zone (red, orange and yellow areas) of the 2014 point is very high at 78%. Thus, the catch and fishing pressure should be decreased to their MSY levels, *i.e.*, 37,000 metric tons and 0.51%, respectively.

For LOT in the Pacific Ocean side, the stock status as of 2013 was in the green (safe) zone. Results of the Kobe plot indicated that TB/TBmsy=2.22 and F/Fmsy=0.18 implying that TB is 122% higher than the MSY level and F is 82% lower than the MSY level (**Fig. 3**). The catch peaked in 2008 but afterwards it sharply decreased to 193,000 metric tons in 2013, the lowest level since the 1980s, one of the reasons why the stock status is considered to be very safe and the probability of uncertainties in the unsafe zone (red, orange and yellow areas) in 2013 is nil (0%). Therefore, the catch and fishing pressure could be increased but should be less than the MSY levels of TB and F at 200,000 metric tons and 1.07%, respectively.

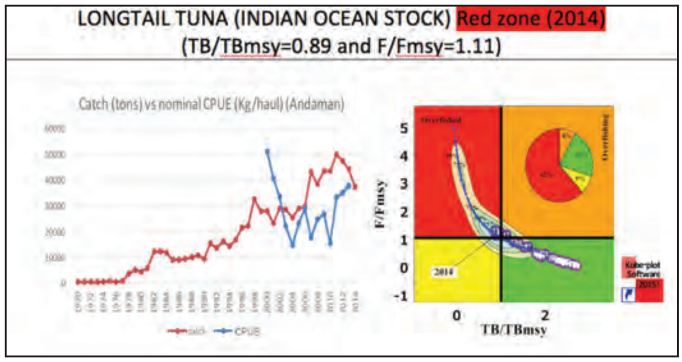

Fig. 2. Results of stock assessment of longtail tuna in the Indian Ocean side of Southeast Asia using Kobe plot

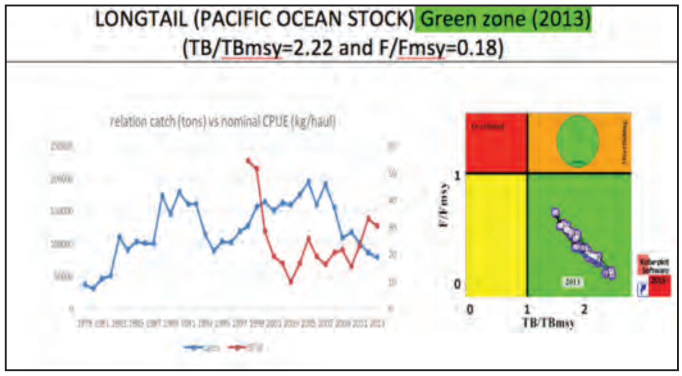

Fig. 3. Results of stock assessment of longtail tuna in the Pacific Ocean side of Southeast Asia using Kobe plot

Stock assessment of kawakawa (KAW)

The 2014 stock status of kawakawa in the Indian Ocean side was in the green zone with F/Fmsy=0.75 and TB/TBmsy=1.28. This means that F is 25% lower than MSY level and TB is 28% higher than its MSY level (**Fig. 4**). Although the stock of KAW in the Pacific side is in the safe condition, the fishing pressure and catch should not exceed the 2014 point because the level of uncertainties around this point is 53% (red, orange and yellow areas in the Kobe plot), while 47% is in the safe (green) zone.

For KAW in the Pacific Ocean side, the current stock status is in the safe zone (green in the Kobe plot) with TB/TBmsy=1.29 and F/Fmsy=0.74. This implies that TB is 29% higher than the MSY level and F is 26% lower than the MSY level (**Fig. 5**). This could be due to the significant catch decrease after 2002 (peak level) and the current catch level which is low.

The Kobe plot also shows that there is no probability that uncertainties in the 2013 estimates fall in the unsafe zone (red, orange and yellow areas in the Kobe plot). Thus, the current catch and F levels could be maintained but should be kept under the MSY levels of TB and F at 185,000 metric tons and 0.43%, respectively.

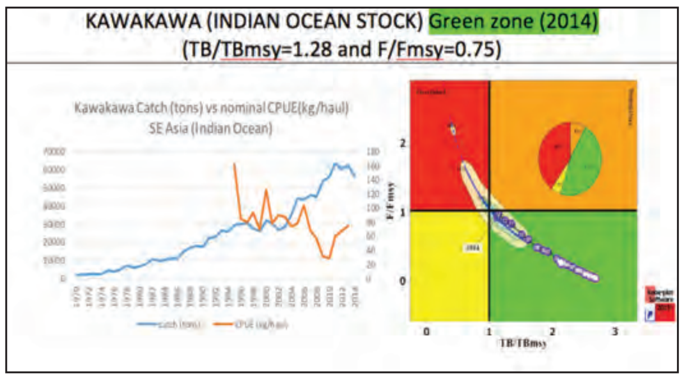

Fig. 4. Results of stock assessment of kawakawa in the Indian Ocean side of Southeast Asia using Kobe plot

In carrying out the stock assessment of these neritic tuna species, the catch data from the Food and Agriculture Organization (FAO) and IOTC, as well as the catch data compiled by the coordinators of the SEAFDEC Neritic Tuna Project, were referred to. While almost all data are basically national statistics and could have wide ranges of uncertainties, the vague stock structures could have also contributed to the uncertainties in the results. In addition, considering that the CPUE data are based on the information provided by the Department of Fisheries of Thailand, as the plausible CPUEs from the other Southeast Asian countries were not available, the status of the stocks as results of the assessment could have been mainly influenced by the CPUE series of Thailand, in which case, it might not have been extensive enough for the results of the stock assessment to be reliable.

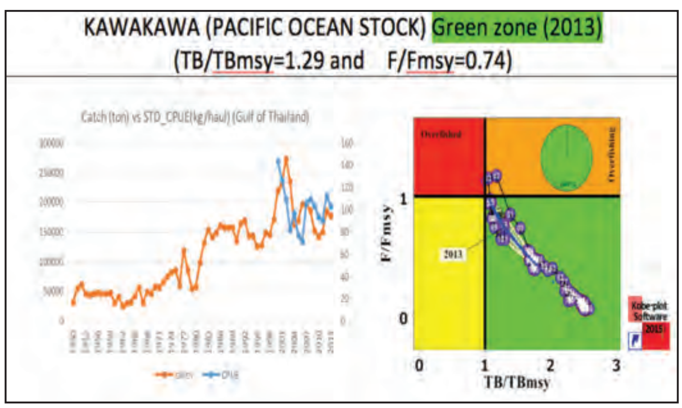

Fig. 5. Results of stock assessment of kawakawa in the Pacific Ocean side of Southeast Asia using Kobe plot

Although there are a number of caveats in this stock assessment effort, there are also some positive evidences that the results are likely realistic. For example, the relationship between catch and CPUE from all four cases, are found to be negatively correlated, indicating that both trends are likely sensible. Hence, the results of the stock assessment are likely believable. Moreover, the results of the assessment of the neritic tuna stocks in the Indian Ocean side of the Southeast Asian waters are similar to those established for the whole of the Indian Ocean by the IOTC (IOTC, 2015; IOTC-WPNT06-2015-21).

Risk Assessment of the Neritic Tuna Stocks

Risk assessment of kawakawa (*Euthynnus affinis*) and longtail tuna (*Thunnus tonggol*) resources in the Southeast Asian waters was also carried out by SEAFDEC/MFRDMD applying the same basic methods as those used by the Tuna RFMOs (Nishida, 2016), *i.e.* the Kobe II Strategy Management Matrix (Kobe II). This is considering that the Kobe II Matrix presents the probabilities that violate and do not sustain the TBmsy (Total Biomass at the MSY level) and Fmsy (fishing pressure at the MSY level) in 3 years and 10 years later using 10 different catch scenarios, *i.e.* current catch levels, MSY levels, ± 10%, ± 20%, ± 30%, and ± 40%. This means that if 10 different catch levels or scenarios were to continue up to the next 10 years, Kobe II would provide the probabilities violating or not sustaining the TBmsy and Fmsy in the 3rd and 10th year.

The Tuna RFMOs use as total allowable catch (TAC), the catch levels which can sustain the TBmsy and Fmsy in 10 years with 50% as the threshold value, which is close to the MSY catch levels. However, different threshold values could also be used, as with the SEAFDEC Neritic Tuna Project, which chose to adopt a more conservative measure and considered 40% as appropriate for its purpose. For a more optimistic measure which could be more advantageous to fishers but is a less conservative approach, a threshold value of 60% could also be an option. The graphical presentations of the results of the Kobe II Matrix using the Kobe plot software (Nishida *et al*., 2015) are presented in order that non-technical persons such as managers, the industries and the public in general, can easily understand the real situation of the neritic tuna stocks of the Southeast Asian region.

Risk assessment of kawakawa (KAW) stocks

Results of the risk assessment of kawakawa stocks in the Indian Ocean using the Kobe II Matrix, which are presented in **Table 2**, suggest that if the 2014 catch at 59,756 metric tons is continued, the risk of violating the TBmsy and Fmsy is more than 67% in 10 years. For the MSY level at 55,380 metric tons, the risk of violating the TBmsy and Fmsy is less than 45%. Thus, the total catch of kawakawa in the Indian Ocean side of the Southeast Asian waters should be less than its MSY level of 55,380 metric tons. This means that the current catch level at 59,800 metric tons (ave. for 2012-2014 catch) should be decreased by 7%.

The results of the risk assessment of kawakawa stocks in the Pacific Ocean side using Kobe II Matrix shown in **Table 3**, suggest that if the MSY level of the catch at 185,400 metric tons were to continue, the probability of violating the TBmsy and Fmsy is less than 56%. Thus, the total catch of kawakawa in the Pacific Ocean side of the Southeast Asian waters should be less than the MSY level of 185,400 metric tons. This means that the current catch level at 171,000 metric tons (ave. for 2011-2013) can be increased by 9%.

Table 2. Probabilities (%) of violating TBmsy and Fmsy in 3 years (2017) and 10 years (2024): kawakawa, Indian Ocean side of the Southeast Asian waters

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	90%	93%	100%	110%	120%	130%	140%
					MSY level	Current catch (*)				
10 catch scenarios (tons)	35,854	41,829	47,805	53,780	55,380	59,756	65,732	71,707	77,683	83,658
$B_{2017} < B_{MSY}$	20	24	30	39	41	46	57	64	73	80
$F_{2017} > F_{MSY}$	9	14	20	36	42	59	80	95	100	100
$B_{2024} < B_{MSY}$	7	10	17	36	44	67	87	99	100	100
$F_{2024} > F_{MSY}$	7	9	16	35	45	71	95	100	100	100

(*) The current catch level is the average catch in 3 recent years (2012-2014).

Table 3. Probabilities (%) of violating the TBmsy and Fmsy in 3 years (2016) and 10 years (2023): kawakawa, Pacific Ocean side of the Southeast Asian waters

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	90%	100%	109%	110%	120%	130%	140%
10 catch scenarios (tons)					Current catch (*)	MSY level				
Projected catch (tons)	102,571	119,666	136,762	153,857	170,952	185,400	188,047	205,142	222,238	239,333
$B_{2016} < B_{MSY}$	5	12	17	26	32	39	40	50	58	65
$F_{2016} > F_{MSY}$	0	0	0	0	16	41	46	73	90	96
$B_{2023} < B_{MSY}$	0	0	0	1	18	56	63	88	96	99
$F_{2023} > F_{MSY}$	0	0	0	0	3	56	66	93	99	100

(*) The current catch level is the average catch in 3 recent years (2011-2013)

Risk assessment of longtail tuna (LOT)

Results of the risk assessment of longtail tuna stocks using the Kobe II Matrix shown in **Table 4**, suggest that if the MSY level of the catch at 37,580 metric tons were to continue, the probabilities of violating the TBmsy and Fmsy are less than 53% in 10 years. Thus, the total catch of longtail tuna in the Indian Ocean (Southeast Asian waters) should be less than the

MSY level of 37,580 metric tons. This means that the current catch level at 43,000 metric tons (ave. for 2012-2014) should be decreased by 13%.

Results of risk assessment of longtail tuna stocks in the Pacific Ocean side using the Kobe II Matrix (**Table 5**) show that the catch level producing the 50% probabilities violating the TBmsy and Fmsy 10 years later (2023) could not be established, additional Kobe II Matrix analysis and corresponding diagrams had to be made as shown in **Table 6** to cover 50%, 100%, 150%, and 200% of the current catch level. The new results suggest that even if the current catch were increased to the MSY level of 196,700 metric tons (123%), the risk of violating the TBmsy and Fmsy is about 50%. Thus, the total catch of longtail tuna in the Pacific Ocean (Southeast Asian waters) can be increased to the MSY level of 196,700 metric tons. This means that the current catch level at 88,200 metric tons (ave. for 2011-2013) can be increased to 108,500 metric tons (*i.e.* 196,700-88,200=108,500 metric tons) or 123%.

Table 4. Probabilities (%) of violating the TBmsy and Fmsy in 3 years (2017) and 10 years (2024): longtail tuna in the Indian Ocean side of the Southeast Asian waters

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	87%	90%	100%	110%	120%	130%	140%
				MSY level		Current catch (*)				
10 catch scenarios (tons)	25,807	30,108	34,409	37,580	38,710	43,011	47,312	51,613	55,914	60,215
$B_{2017} < B_{MSY}$	48	51	55	57	58	61	64	68	71	74
$F_{2017} > F_{MSY}$	35	41	49	56	59	71	79	87	92	96
$B_{2024} < B_{MSY}$	31	36	45	54	57	71	80	87	90	94
$F_{2024} > F_{MSY}$	31	35	42	53	57	75	87	92	96	98

(*) The current catch level is the average catch in 3 recent years (2012-2014)

Table 5. Probabilities (%) of violating the TBmsy and Fmsy in 3 years (2016) and 10 years (2023): longtail tuna, Pacific Ocean side of the Southeast Asian waters

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	90%	100%	110%	120%	130%	140%	223%
					Current catch(*)					MSY
10 catch scenarios (tons)	52,894	61,710	70,526	79,341	88,157	96,973	105,788	114,604	123,420	196,700
$B_{2016} < B_{MSY}$	0	0	0	0	0	0	0	0	0	0
$F_{2016} > F_{MSY}$	0	0	0	0	0	0	0	0	0	0
$B_{2023} < B_{MSY}$	0	0	0	0	0	0	0	0	0	52
$F_{2023} > F_{MSY}$	0	0	0	0	0	0	0	0	0	53

(*) The current catch level is the average catch in 3 recent years (2011-2013)

Table 6. Probabilities (%) violating the TBmsy and Fmsy in 3 years (2016) and 10 years (2023) if the current catch were increased by 50%, 100%, 150% and 200%: longtail tuna, Pacific Ocean side of the Southeast Asian waters

Reference point and projection timeframe	Alternative catch projections (relative to the average catch level from 2011–13) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)					
	Current catch (*)			MSY		
Catch level Increased by	0%	50%	100%	123%	150%	200%
Projected catch (tons)	88,157	132,236	176,314	196,700	220,392	264,471
$B_{2016} < B_{MSY}$	0	0	0	0	0	0
$F_{2016} > F_{MSY}$	0	0	0	0	0	78
$B_{2023} < B_{MSY}$	0	0	24	52	84	100
$F_{2023} > F_{MSY}$	0	0	19	53	88	100

Way Forward

The promotion and implementation of the RPOA-Neritic Tunas in the Southeast Asian region should be intensified to ensure the sustainability of the region's neritic tuna resources. It is for such reason that the various fora organized by SEAFDEC to discuss the sustainability of such resources, recommended for the implementation of the ASEAN Catch Documentation Scheme for marine capture fisheries in the AMSs, particularly for neritic tuna fisheries.

Moreover, those fora also suggested that joint trade promotions should be established within and outside the region through the ASEAN Tuna Working Group; exchange of information among the AMSs, *e.g.* legal frameworks, policies and management, trade rules and regulations at sub-regional and regional levels on neritic tuna fisheries should be intensified; the security and safety issues for all types of fishing activities should be recognized by implementing skills training programs; and that the assessment of post-harvest losses of neritic tunas should be conducted while the various ways of reducing post-harvest losses should be identified and described.

Furthermore, those fora had also considered it vital for the AMSs to ensure that their surveillance activities and enforcement are strengthened; control of the importation, landing or transshipment at ports of neritic tunas from vessels presumed to have carried out IUU fishing activities in the ASEAN region without prior clarification from vessel owners or concerned flag States is enforced; measures to refrain the conduct of business transaction with owners and vessels presumed to have carried out IUU fishing activities are established; platforms and fora to facilitate cooperation among scientists and managers are created; the development of information, education and communication (IEC) programs on sustainable use of resources is supported; and management measures to control the fishing effort and capacity at national level and sub-regional levels are developed.

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