Paving the Way for the Development of Non-detriment Findings: Towards precise species identification of sharks and rays in Southeast Asia

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CITES defines non-detriment finding as "*a conclusion by a Scientific Authority that the export of specimens of a particular species will not impact negatively on the survival of that species in the wild. The non-detriment finding by a Scientific Authority is required before an export or import permit or a certificate for an introduction from the sea may be granted for a specimen of an Appendix-I species, and before an export permit or a certificate for an introduction from the sea may be granted for a specimen of an Appendix-II species*." Many species of sharks and rays have been listed in the CITES Appendices in view of the increasing exploitation of such species that has become an international concern resulting in the promotion of their conservation and management through the enforcement of trade management measures and control. Considering that listing of commercially-exploited aquatic species in the CITES Appendices, *e.g.* sharks and rays, would have certain impacts not only on the management of the fisheries of these species but also on the economies of many countries of the region that have been trading some of the species and their "look-alikes" as well as trading in parts of their processed forms, SEAFDEC has been implementing projects that would help the Southeast Asian countries in addressing the issues concerning such species that had been listed in the CITES Appendices. In the case of sharks and rays, SEAFDEC has been supporting the countries in their efforts to improve data collection, especially in recording the landings of sharks and rays at species level, by enhancing the capacities of the countries in species identification. With sufficient knowledge and skills in the precise identification of the species found in the waters of Southeast Asia, the countries could continue trading the commercially-exploited aquatic species that are listed in the CITES Appendices provided these are accompanied with non-detriment findings. Thus, SEAFDEC has also been advocating the establishment of non-detriment findings that provide the scientific evidence to prove that trading of such commercially-exploited aquatic species would not endanger the survival of the wild populations of such species.

Among the approximately 100 commercially-exploited aquatic species (CEAS) listed in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as of 2016, 12 species of sharks and 18 species of rays had been listed under the CITES Appendices. Specifically, the basking shark (*Cetorhinus maximus*), whale shark (*Rhincodon typus*), oceanic whitetip shark (*Carcharhinus longimanus*), porbeagle shark (*Lamna nasus*), scalloped hammerhead shark (*Sphyrna lewini*), smooth hammerhead shark (*Sphyrna zygaena*), great hammerhead shark (*Sphyrna mokarran*), great white shark (*Carcharodon carcharias*), silky shark (*Carcharhinus falciformis*), pelagic thresher shark (*Alopias pelagicus*), bigeye thresher shark (*A. superciliosus*), and thresher shark (*A. vulpinus*) had been listed in Appendix II of CITES. For rays, all six species of sawfishes (family Pristidae) had been listed in Appendix I, while all 12 species of devil rays (three species of manta and nine species of mobula) are listed in Appendix II of CITES (**Table 1**).

CITES which was entered into force on 1 July 1975, is an international agreement among governments that works towards ensuring that the international trade in specimens of wild animals and plants does not threaten their survival in the wild. Sets of criteria and guidelines have therefore been developed by CITES for the evaluation of CEAS, whether or not a certain species should be listed under the CITES Appendices. Once listed in the CITES Appendices, the specimens of such species would be subjected to certain international trade controls, which implies that all import, export, re-export, and introduction from the sea of such species must be authorized through a licensing system indicating the relevant information on the effects of trade on the status of the species, which could be proven through the development of non-detriment findings (NDFs). Nonetheless, the inclusion of any CEAS in the CITES Appendices would serve as means of addressing the problem on the conservation and management of such species.

Improvement of Data Collection for Development of NDFs

Although the waters of Southeast Asia is believed to host the richest elasmobranch diversity in the world, the actual status of such resources, *e.g.* sharks and rays, could not be established due to various reasons that include the inadequacy of data on catch landings and utilization at species level (Wanchana *et al.*, 2016a). It is also the same situation that contributes to the difficulties of the ASEAN Member States (AMSs) in their efforts of pursuing the sustainable management of sharks and rays fisheries and in complying with relevant international requirements to avoid the listing of certain species of sharks and rays in the CITES Appendices.

CITES enforces some controls for the trade in specimens of species listed in the CITES Appendices to ensure that trading of such species or parts and products derived thereof would not be detrimental to the survival of the species in the wild. One of the control measures is through the NDFs which provide the assurance that the harvest and trade of such species do not harm the wild populations. The development of NDFs

is required even before any of the listed species intended for the export market or introduced from the sea are fished and landed, where introduction from the sea refers to the landing of CITES-listed species taken from the high seas and not under the jurisdiction of any State (Mundy-Taylor *et al*., 2014). The first step in developing NDFs is information gathering (**Table 2**), which also implies that the available information should focus on the species being considered for the development of the NDFs. At the Southeast Asian scene, this would require the need to improve the data collection systems, especially for the species of international concern, *e.g.* CEAS that include sharks and rays.

Table 1. Species of sharks and rays listed in the CITES Appendices (as of 2016).

English Name	Scientific Name	CITES Appendix	Year listed
Basking shark	*Cetorhinus maximus*	Appendix II	2002
Whale shark	*Rhincodon typus*	Appendix II	2002
Great white shark	*Carcharodon carcharias*	Appendix II	2004
Porbeagle shark	*Lamna nasus*	Appendix II	2014
Oceanic whitetip shark	*Carcharhinus longimanus*	Appendix II	2014
Scalloped hammerhead shark	*Sphyrna lewini*	Appendix II	2014
Great hammerhead shark	*Sphyrna mokarran*	Appendix II	2014
Smooth hammerhead shark	*Sphyrna zygaena*	Appendix II	2014
Silky shark	*Carcharhinus falciformis*	Appendix II	2016
Thresher sharks (all three species)	*Alopias* spp.	Appendix II	2016
Sawfishes (all 6 species)	*Pristis* spp. and *Anoxypristis cuspidata*	Appendix I	2007
Manta rays (all three species)	*Manta* spp.	Appendix II	2014
Mobula rays (all nine species)	*Mobula* spp.	Appendix II	2016

Table 2. Structure of the NDF process for sharks and rays (adapted from Mundy-Taylor *et al*., 2014)

Steps	Sections	Concerns to be addressed
Information gathering		
1. Preliminary considerations and information gathering	1.1 Review origin and identification of specimen	1.1a Is the specimen subject to CITES controls?
		1.1b Where or from which stock of the species, was (will) the specimen (be) taken?
	1.2 Review legality of acquisition and export	1.2 Was (will) the specimen (be) legally obtained and is export allowed?
	1.3 Compile information on management context	1.3 What does the available management information tell us?
NDF development		
2. Intrinsic biological vulnerability and conservation concern	2.1 Evaluate intrinsic biological vulnerability	2.1 What is the level of intrinsic biological vulnerability of the species?
	2.2 Evaluate conservation concern	2.2 What is the severity and geographic extent of the conservation concern?
3. Pressures on species	3.1 Evaluate trade pressures	3.1 What is the severity of trade pressure on the stock of the species concerned?
	3.2 Evaluate fishing pressures	3.2 What is the severity of fishing pressure on the stock of the species concerned?
4. Existing management measures	4.0 Evaluate whether management is adequate to mitigate the concerns, pressures, and impacts identified	4.1a Are existing management measures appropriately designed and implemented to mitigate the pressures affecting the stock or population of the species concerned?
		4.1b Are existing management measures effective (or likely to be effective) in mitigating the pressures affecting the stock or population of the species concerned?
5. Non-detriment Finding and related advice	5.0 Based on the above evaluations, use judgment to make a Non-detriment Finding by setting mandatory NDF conditions, if required, and provide related advice	5.1 What is the final outcome of the previous steps? Based on the outcomes of the previous steps, the Scientific Authority should use its judgment to decide whether: Is it possible to make a positive NDF (with or without associated conditions? OR Is a negative NDF required?
NDF is completed		
6. Further measures		6.1 Identify actions necessary to implement or improve monitoring, management, and other measures

Capacity Building for Improved Collection of Information on Sharks and Rays

The Southeast Asian Fisheries Development Center (SEAFDEC) through its Training Department (SEAFDEC/TD) and Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) has been promoting the improvement of data collection of sharks and rays found in the Southeast Asian waters, by carrying out several activities generally aimed at enhancing the capability of the region's fisheries sector in compiling and utilizing sharks and rays statistics and information to support the sustainable management of the fisheries of such commodities, as well as boosting the understanding of concerned stakeholders about the resource situation of sharks and rays in Southeast Asia.

In one of the Technical Meetings organized by SEAFDEC in 2013, a major finding confirmed that the national statistics on sharks and rays compiled by the Southeast Asian countries have been reported by groups (*i.e.* sharks or rays) and not by species. Moreover, recording of essential information such as biological data has been insufficient due to inadequate number of enumerators capable of identifying sharks and rays at species level. Thus, it was agreed that the regional activities on sharks and rays should start with building the national capacities of the concerned ASEAN Member States (AMSs) in identifying the species of sharks and rays, while robust national shark landing data collection systems should also be established.

National taxonomic activity for proper identification of shark and ray species based on SOP developed by SEAFDEC

While efforts had been sustained to address the concerns on sharks and rays data collection in the Southeast Asian region, regional training-cum-workshops were organized by SEAFDEC to improve the capacities of relevant stakeholders in the AMSs on elasmobranch identification at species level, with initial focus given to trainers capable of conveying the knowledge gained to the local shark landing enumerators in their respective areas of assignments. In 2015, the participating countries from the AMSs agreed on the format and template for data collection on sharks and rays, leading to the development by SEAFDEC of the Standard Operating Procedures (SOPs) for sharks and rays data collection (Wanchana *et al*., 2016b; SEAFDEC, 2017).

Regional Activities on Sharks and Rays Data Collection and Species Identification

In support of the region's efforts towards sustainable management of sharks and rays fisheries in the waters of Southeast Asia, SEAFDEC with financial support from the Government of Japan through the Japanese Trust Fund and the European Union (EU) through the CITES Secretariat, implemented the "Regional Project on Sharks and Rays Data Collection" starting in 2015. To date, the major outputs of the Regional Project included: 1) initial compilation of regional sharks and rays data at species level in the Southeast Asian region; 2) improved human resources capacity of concerned AMSs on sharks and rays identification and data collection; 3) updated information on sharks and rays in the Southeast Asian region; and 4) national reports on landings of sharks and rays.

In order to step up the region's efforts to promote the sustainable management of sharks and rays resources, a stock assessment model was established which is appropriate for converting landing data on sharks and rays stocks into scientific information. The "Yield Per Recruit Model" or YPR Model" (Pattarapongpan, 2018) was therefore adapted considering the short-term data situation in the Southeast Asian region. Consequently, training-workshops were organized by SEAFDEC in 2018 to strengthen the capacity of researchers from the SEAFDEC Member Countries on stock assessment of sharks and rays using YPR Model. The important aspect of using the YPR model is the quantification of the effect of size selection and fishing mortality on the yield from a fixed number of individuals that enters the fisheries, *i.e.* recruitment, by incorporating the growth parameters as inputs for the model. However, during the 2018 training, it was found that the growth parameters estimated from the length frequency data, appeared biased due to insufficient landing data. In obtaining the accurate growth parameters, the ideal number of fish samples should be at least 500 tails for each species and the length measurements of the samples must comprise the lengths of all samples from small to large size. This situation led to some difficulties in estimating the YPR of the targeted shark species based on the data available in the Southeast Asian region. Nevertheless, in determining the reliable growth parameters, the use of length-at-actual age analysis could be pursued. This led to an agreement during the 2018 training that the age-length analysis should be adopted to be able to determine the accurate growth rate. As a result, the training workshop on age determination was organized by SEAFDEC in April 2019 for the main purpose of building the human resource capacity of the AMSs in this aspect.

Building on the progress of the regional activities carried out by SEAFDEC from 2013 to 2018, the CITES Secretariat collaborated with SEAFDEC through a Small-Scale Funding Agreement (SSFA) and provided assistance to the four (4) information-poor AMSs Parties, *i.e.* Cambodia, Myanmar, Philippines, Viet Nam, on the improvement of their systems of collecting catch data on sharks and rays at species level. Moreover, the SSFA is also meant to support the other

three (3) AMSs Parties, *i.e.* Indonesia, Malaysia, Thailand, where data is already available for the development of their respective national NDFs. More specifically, the SSFA is aimed at improving the capacity of the AMSs in developing robust NDFs for CITES-listed species of sharks and rays by supporting the compilation of primary data to make sure that all Parties in the AMSs, especially those that have no or limited or little available data due to inadequate data collection systems, would be able to develop their respective national NDFs.

National Capacity Building in Data Compilation of Sharks and Rays at Species Level

Under the SSFA, national workshops have therefore been organized by SEAFDEC to continue the process of compiling catch data on sharks and rays, especially in countries where data had been insufficient for developing the national NDFs, *e.g.* Cambodia, Myanmar, Philippines, and Viet Nam. Considering the results of data collection activities during 2013-2018, SEAFDEC has continued to promote the compilation of landing data on sharks and rays at species level in selected landing sites of the aforementioned four countries.

Promoting the guidelines on photography techniques for taxonomic and stock assessment purposes

National capacity building activities had therefore been carried out with the main objective of enhancing the capacity of enumerators in the proper identification of sharks, rays and skates at species level as well as in the management of their respective landing data compilations (SEAFDEC, 2019 unpublished). Hands-on practice on species identification, length measurement and weight recording of the samples of selected specimens was carried out. Some samples of sharks and rays were taken back to the laboratories for the photography training sessions using the SOP on Sharks, Rays, and Skates Data Collection in the Southeast Asian Waters (SEAFDEC, 2017) as reference during the training on the techniques for taking photographs of sharks and rays for taxonomic purposes. Practical sessions on the use of the standard template for data compilation and management were also organized to enhance the knowledge and skills of the enumerators in this aspect of their works.

National Workshop and Training on Sharks Data Collection for Enumerators in Myanmar

Organized in Yangon, Myanmar (**Figure 1**), the National Workshop on 22-24 July 2018 was mainly aimed at enhancing the capacity of enumerators from the Department of Fisheries of Myanmar in identifying sharks, rays and skates at species level, as well as in promoting landing data management for sharks and rays.

Thus, the process for systematically recording and reporting the landings of sharks and rays at species level had been initiated; results from the 2017 shark data collection in Myanmar as well as the summary of the regional data had been disseminated; shark data collection plan in Myanmar established; and four collection sites had been identified (**Figure 1**), *i.e.* Haingyi Island in Ayeyarwady Division, Tabotseik at Launglone Township in Tanintharyi Division, Ye in Mon State, and Yangon. The Training in Myanmar paved the way for the country to fulfill the CITES provisions for trade of certain species of sharks and rays listed in Appendix II of the CITES Appendices.

Figure 1. Map of Myanmar showing the collection sites for data on sharks and rays

National Workshop and Training on Sharks Data Collection for Enumerators in Cambodia

Phreah Sihanouk Province in Cambodia was the venue of the National Workshop on 20-22 August 2018, which came up with a tentative plan and an agreement on the landing sites to be considered. These are in Kampot and Preah Sihanouk (**Figure 2**). The Training supported the efforts of the country to collect primary data on sharks landed and to record the information at species level. More specifically, the Training enhanced the knowledge of the enumerators on the need to compile the country's landing information on sharks and rays, as well as on the appropriate management and utilization of the data collected in 2016. The enumerators also improved their

Figure 2. Map of Cambodia showing Kampot and Phreah Sihanouk Provinces

skills in the taxonomic analysis of elasmobranch species and mustered their capacity in data collection based on the SOP on Sharks, Rays, and Skates Data Collection in the Southeast Asian Waters (SEAFDEC, 2017).

National Workshop and Training on Sharks Data Collection for Enumerators in Viet Nam

The National Workshop in Vung Tau, Viet Nam on 27-28 September 2018 followed the same framework of the Project as well as the experience from the one-year sharks/rays data collection activities in 2017. Two landing sites were identified for the data collection activities, *i.e.* Ben-Da in An Giang Province and Phuoc Tinh in Vung Tau Province (**Figure 3**). Development of the text and contents for posters and books on sharks, skates and rays of Viet Nam had been initiated.

Thus, Viet Nam would continue to collect landing data and other relevant information on sharks and rays after the country's enumerators shall have already been capacitated to implement the SOP on Sharks, Rays, and Skates Data Collection in the Southeast Asian Waters (SEAFDEC, 2017)

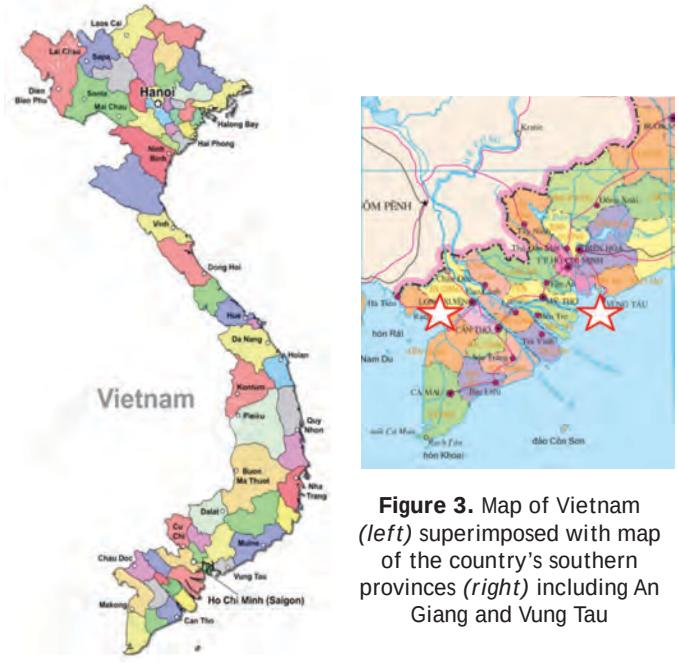

Figure 3. Map of Vietnam *(left)* superimposed with map of the country's southern provinces *(right)* including An Giang and Vung Tau

National Workshop and Training on Sharks Data Collection for Enumerators in the Philippines

The Training on Taxonomic Identification based on the Data Collection Protocol for Sharks and Rays was organized in Iloilo City, Philippines on 15-17 January 2019 in close collaboration with the Philippine Bureau of Fisheries and Aquatic Resources (BFAR).

The venue was crucial for the Training because Region VI (Western Visayas) of the Philippines comprising the Provinces of Iloilo, Antique, Aklan, Capiz, Guimaras, and Negros Occidental (**Figure 4**), is surrounded by productive fishing grounds, of which the Visayan Sea and Guimaras Strait are known fishing grounds for sharks and rays species. Moreover,

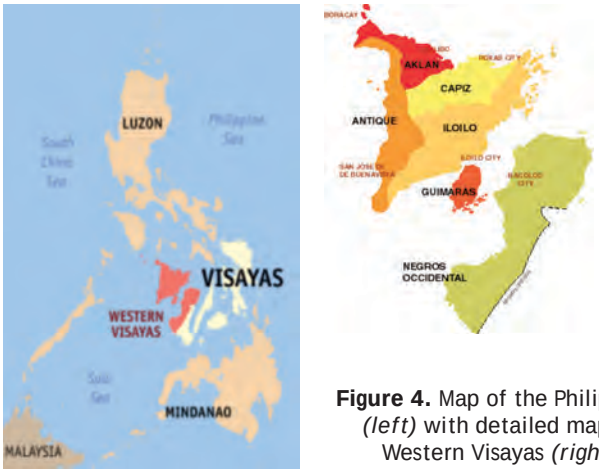

Figure 4. Map of the Philippines *(left)* with detailed map of Western Visayas *(right)*

BFAR records also show a long-term series of catch landings for sharks and rays in Western Visayas, but the veracity of the taxonomic identification in terms of species classification of such landings is still not certain due to the inadequacy of the needed expertise.

The Training was therefore considered crucial for the field enumerators of the Philippines, especially those coming from the Western Visayas, for henceforth they would be able to report the data on sharks and rays not only in terms of volume of catch but also classified in terms of species. Compilation of biological information as well as establishment of the catch and effort of the sharks and rays landings, were also notable for the enumerators as the stock status of certain targeted sharks and rays species could be determined. These information are necessary for the establishment of the country's NDFs for sharks and rays species, considering that catch, trade and utilization data have not been properly documented and/or reported before.

Identification of shark and ray specimens at species level based on the Key to Order of Sharks, Rays and Skates; and Key to Family of Sharks and Rays

Examination of the internal organs of shark specimens, especially its reproductive organs

Morphological study and species identification *(left)* using the Guides provided during the Training, leading to the identification of the shark sampled *(right)* as *Carcharhinus sorrah*

Nonetheless, various issues and concerns that confronted the enumerators during the course of their sampling activities were raised including: refusal of some boat operators and owners to divulge information on their landings of sharks and rays; difficulties in identifying the species as most of the sharks and rays have already been cut into pieces prior to landing; absence of gills, fins, and other parts when sharks and rays are landed; difficulties in collecting information, especially for those species that have been regulated under the Philippine Fisheries Administrative Order or FAO 193 or the "Ban on the Taking or Catching, Selling, Purchasing and Possessing, Transporting and Exporting of Whale Sharks and Manta Rays." Moreover, an apprehension was raised by fishers about the collection of data and information on sharks and rays as the information could be used by BFAR to develop regulations to ban the catching of other species of sharks and rays. Small-scale fishing boats in the Philippines with no registration numbers also made it difficult for enumerators to properly record the relevant and required information.

Way Forward

The proposed listing of commercially exploited aquatic species (CEAS) into the Convention on the CITES Appendices is one of the crucial issues that could impact not only on the management of fisheries but also on the economies of the countries in the region. Such impacts are anticipated not only as a result of regulation in trade of the species being listed into the CITES Appendices, but also trade of look-alike species, as well as trade in parts or processed forms of the species. Furthermore, the listing of species into the CITES Appendices could lead to the termination of data collection on landings of such species, resulting in the unavailability of data and information on the status of the species.

With the aforesaid concerns as the backdrop, SEAFDEC would continue to follow-up with the abovementioned four countries on the progress of their efforts to improve the compilation of data and information on sharks and rays at species level. Moreover, SEAFDEC would also organize national workshops in the three countries where data is available for the development of NDFs, *i.e.* Indonesia, Malaysia, and Thailand. The NDFs developed by these countries would be shared with the other Southeast Asian countries as well as with the other Parties to CITES through the CITES mechanism.

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