Box 6. Challenges and issues on conservation and management of tropical Anguillid eels

- Catch statistics is one of the most fundamental data to monitor the present status and recent trend of both fisheries and fishery resources. However, data and accuracy on catch statistics of Anguillid eels in the region had not been sufficient (Honda *et al.*, in press). In addition to concerns on precision of the statistics itself, there had been confusions resulting from the different naming and classification of the stages or size classes of juvenile Anguillid eels in each country and/or area. Furthermore, catch statistics of Anguillid eels are sometimes mixed with other look-a-like species, such as the rice-paddy eels.
- Regulations on trading of eels are available in several countries, *e.g.* export of eels smaller than 150 g is prohibited in Indonesia and smaller than 15 cm in length in the Philippines. Effective implementation of these laws and regulations is therefore crucial to conserve the eel seed resources.
- Considering the migratory nature of Anguillid eels, *i.e.* from the deep oceans to freshwater rivers, their migratory routes along rivers could be long with obstacles and conditions that hinder migration. In addition to fishery, utilization of inland waters by human activities also causes the decrease of eel resources due to habitat alteration, pollution, and so on, which could create negative impacts on eel habitats in inland waters resulting in decreased eel resources. Extensive habitat loss also plays an important role together with regional climate phenomena and overfishing, in the decline of the Japanese eel in East Asia. Integrated management planning is therefore necessary for the restoration and protection of Anguillid eel's habitat (Chen *et al.*, 2014).
- Regarding the eel culture industry in the Southeast Asian region, reports indicated very low survival rate of juvenile eels in artificial ponds and aquariums posing serious problems for the management of eel farms as well as efficient use of natural eel seed resources.

eel resources in the region. These recommendations had been adopted by the Forty-seventh Meeting of the SEAFDEC Council in April 2015. Nonetheless, the typical challenges and issues that should be improved are indicated in **Box 6**.

After the surveys on Anguillid eel fisheries and eel culture conducted in the SEAFDEC Member Countries, the "Way forward for Enhancing the Sustainability of Catadromous Eels in Southeast Asia" is summarized and the detailed issues and required concrete actions to solve these problems are also identified (*http://www.seafdec.or.id/*). The SEAFDEC Member Countries have been requested to exert efforts in conserving the Anguillid eel resources of the region in a coordinated manner.

3.3. Sea Turtles

The Southeast Asian region has one of the biggest sea turtle nesting populations in the world. Six out of the seven species of sea turtles are confirmed to nest or inhabit the Southeast Asian waters. These are the leatherback (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), Olive Ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricate*), loggerhead (*Caretta caretta*), and the Kemp's Ridley (*Lepidochelys kempi*) which can only be found in eastern Indonesia waters. The flatback turtle, although its nesting locality is restricted to Australian territories, forages within the Indonesian waters (Limpus *et al*., 2002). The green turtle is the most dominant species in Southeast Asia and serves as the guideline in the formulation of management plan.

Indonesia had been recognized as the main habitat of green turtles in the region, recording more than 100 nesting beaches throughout country followed by Philippines, Malaysia, Myanmar, Thailand, Viet Nam, and Cambodia. Selingan Island in Sabah, Malaysia has been reported to have the highest number of nesting beaches for green turtles in the region with annual nests that range from 10,000 to 12,000. For the leatherback turtle, the nesting population at Indonesia's Irian Jaya nesting beaches is reported to be the highest in the region recording more than 100 nestings annually followed by Philippines and Malaysia as recorded in 2010. However, lack of comprehensive tagging activities on sea turtles is the main issue that needs to be addressed in order to obtain the actual nesting population of sea turtles in the region.

The waters of Southeast Asia are also the main feeding grounds for the green and hawksbill turtles, where sea grass beds and coral ecosystems are their main foraging habitats. Results of the migration study on adult female sea turtles using satellite technology in the Southeast Asian countries conducted from 2008 until 2012 with funding support from SEAFDEC/MFRDMD, had indicated several possible sea turtle foraging habitats in the region such as Brunei Bay (Malaysia and Brunei Darussalam), Derawan Archipelago (Indonesia), Palawan Island (Philippines), Andaman Island (Myanmar), Sipadan and Mabul Islands (Malaysia), and Riau Archipelago (Indonesia and Singapore). In most of the foraging habitats, large groups of sea turtles consisting of various ages, spend their life in the foraging habitats for feeding and leave the habitats for nesting somewhere in the region. Hence, it is essential for each country in the region to protect the sea turtles and their habitats in the mainland as well as in open seas.

3.3.1 International-related Issues on Utilization of Sea Turtles

Illegal take and trade of marine turtles can assume various forms, from poaching of animals and eggs from nesting beaches to illegal taking of the animals from the sea. Typically, green and leatherback turtles are hunted for their meat; while the hawksbill turtle for its carapace as raw materials for various craftworks; while the eggs of loggerhead and olive ridley turtles are considered a delicacy. Turtle meat consumption reportedly still occurs in 75% of the Indian Ocean and South-East Asia (IOSEA) Signatory States, while trade in shell products seems to be predominant in many countries of East Asia.

Poaching of green and hawksbill turtles appears to be perpetrated mainly by Chinese and Vietnamese turtle fishers operating in the Coral Triangle area, especially in the waters of Indonesia, Malaysia, and Philippines. The main regional trade route for whole turtles and turtle derivatives seems to originate from Indonesia, Malaysia, and Philippines. Such products are directed mainly towards East Asia, where the demand is on the rise. For example, the mainland Chinese markets demand for turtle meat and other parts for medicine, and the Japanese and Taiwanese markets demand for the turtle scutes (*bekko*) to be used for traditional crafts. Therefore, the establishment of strong cooperation among the countries is highly needed for combating sea turtle poaching, exploitation activities, as well as illegal trade of sea turtles and their derivatives.

Some countries in the region have enacted legislations to prohibit direct take and domestic trade in turtles and turtle derivatives, with a number of countries having increased fines or tightened prohibitions in recent years. However, there is still considerable room for improvement in some countries where existing fines are inadequate as a deterrent to illegal activity, where lack of harmonization of legislations across states or provinces induces domestic trade, and where there is existing legislation but this is poorly enforced.

3.3.2 Conservation and Management of Sea Turtles in Southeast Asia

Recognizing the importance of protecting and conserving sea turtles and their foraging habitats, SEAFDEC/MFRDMD as a regional institution responsible for the conservation and management of sea turtles, developed the Regional Plan of Action (RPOA) of Sea Turtle Foraging Habitats in Southeast Asian Waters in 2014. The said RPOA has six objectives, and each Southeast Asian country could set their respective deadlines for carrying out the RPOA based on their capabilities. The objectives of the RPOA are to: 1) protect and conserve sea turtle foraging habitats; 2) reduce direct and indirect causes of sea turtle mortality in foraging habitats; 3) strengthen research and monitoring of sea turtle foraging habitats; 4) increase community participation through information dissemination and education; 5) strengthen integrated management of sea turtles; and 6) secure funding for Sea Turtle Conservation.

Several programs and actions had been proposed in order to achieve these objectives, which were prepared as guidelines for each AMS to carry out according to their own capability. The outputs and indicators of each activity are also proposed in the RPOA for the evaluation of the country's achievements.

3.3.3 Existing Measures Undertaken by Relevant AMSs

Sea turtles are highly migratory species and inhabit the seawaters and foraging habitats in the Southeast Asian region. Sea turtles that forage in one particular habitat might have originated from several nesting sites located at several countries in the region. Hence, strengthening regional cooperation on protecting and conserving the sea turtles and the ecosystem in their foraging habitats is highly recommended. Regional cooperation and collaboration of expertise, manpower, and facilities is vital to ensure that the RPOA could be effectively implemented.

Most Southeast Asian countries had already established their respective national laws on protecting and conserving the sea turtles as well as developed their own National Plan of Action (NPOA) on Conserving and Protecting Sea Turtles and Their Habitats. In addition, all Southeast Asian countries had their own laws responding to the CITES regulation, considering that all sea turtles species are listed in Appendix I, meaning that international trade of the species for commercial purpose is prohibited. Moreover, the IUCN also listed the hawksbill turtle as critically endangered, while the green, olive ridley, and loggerhead sea turtles have been categorized as threatened.

Furthermore, most of the countries in the region have their own educational and awareness programs targeting various groups of communities for the conservation and protection of sea turtles and their habitats. Universities, NGOs, and local governments had been involved by assisting the national government in the implementation of such programs. For instance in Malaysia, at least 200,000 people had participated annually in the program conducted by provincial agencies with assistance from NGOs and universities. The establishment of national networking between federal and local agencies, NGOs, institutes of higher education, and local community groups is very essential for the implementation of the programs as well as to assist governments in the enforcement of the relevant national laws.

3.4. Sea Cucumbers

Sea cucumbers are echinoderms and the most traded species, with leathery-like skin and elongated or cucumber-like body. There are more than 1,400 species worldwide but only less than 80 species are considered commercially-important (Purcell *et al*., 2013). Sea cucumbers are more diverse in the tropical areas, particularly in Southeast Asia which is considered as the center of biodiversity, particularly the Indo-Malay-Philippine Archipelago, also known as IMPA (Carpenter and Springer, 2005). Fifty-two species, mainly from the Genus *Holothuria*, *Actinopyga*, *Bohadschia* and *Stichopus* are being actively exploited in the East and Southeast Asian region (Choo, 2008a).