

3.2 Eels

Anguillid eels (Family Anguillidae) are distributed throughout tropical and temperate waters, except for the Eastern Pacific and South Atlantic (Silfvergrip, 2009, in Crook and Nakamura, 2013). There are 19 species of eels under Genus *Anguilla* that had been reported in the world, of which 11 species are found in tropical waters (Ege, 1939 in Watanabe *et al.*, 2009), and 10 species or subspecies are distributed in the Southeast Asian region (**Figure 65**), namely: *Anguilla bicolor bicolor* McClelland 1844, *A. bicolor pacifica* Schmidt 1924, *A. marmorata* Quoy and Gaimard 1824, *A. celebesensis* Kaup 1856, *A. nebulosa nebulosa* McClelland 1844, *A. interioris* Whitely 1938, *A. borneensis* Popta 1924, *A. bengalensis* Gray 1831, *A. luzonensis* Watanabe, Aoyama & Tsukamoto 2009, *A. japonica* Temminck & Schlegel, 1846 (Ege, 1939 in Watanabe *et al.*, 2009; Castle and Williamson, 1974; Arai *et al.*, 1999; Fahmi, 2015; Watanabe *et al.* 2009; Yoshinaga *et al.*, 2014).

The global production of eels has risen dramatically from 17,750 metric tons in 1950 (only 3% came from aquaculture or eel farming) to 280,000 metric tons in 2007 (96% from eel farming), after which the production stabilized in 2008-2010 (FAO, 2012 in Crook and Nakamura, 2013). However, wild populations of Anguillid eels have declined considerably over the last 30 years because of several factors, including fishing for trade (Dekker *et al.*, 2009 in Crook and Nakamura, 2013).

In the present situation, only Indonesia and Philippines have provided the data on the production quantity of Anguillid eels from inland capture fisheries in Southeast Asian waters (**Table 61**). The trend of the total production of Anguillid eels (captured, excluding aquaculture) had been increasing since 2012, although the reasons or causes of such increases remain unknown.

The need to promote the conservation and management of eel resources has been attracting much attention while the resources of the temperate Anguillid eels, such as *A. japonica* (Japanese eel), *A. anguilla* (European eel) and *A. rostrata* (American eel), have rapidly decreased. Since 2009, *A. anguilla* has been listed in CITES Appendix II virtually prohibiting their export and import. To compensate the shortage of supply from these temperate Anguillid eels, tropical Anguillid eels such as *A. bengalensis* (Indian mottled eel), *A. bicolor bicolor* (Indonesian shortfin eel), and *A. marmorata* (marbled eel) became the most economically-important Anguillid eel species in the region. It is therefore necessary that these resources should be conserved and managed properly, to ensure that these would not become critically endangered and be listed on the CITES Appendices.

SEAFDEC had summarized the current situations and issues on both eel fisheries and eel culture in the Southeast Asian region in the “Regional Policy Recommendations on Conservation and Management of Eel Resources and Promotion of Sustainable Aquaculture” (SEAFDEC, 2015c) for sustainable management of tropical Anguillid

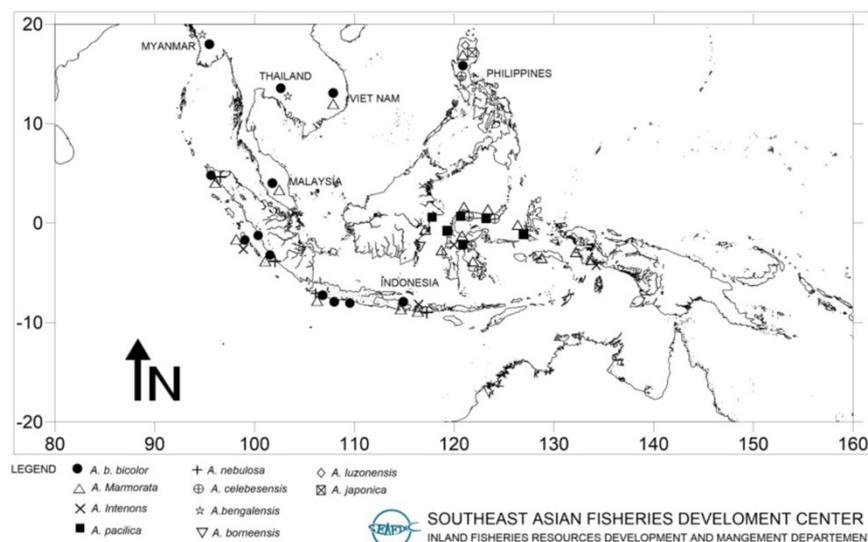


Figure 65. Distribution of Anguillid eels in Southeast Asia
Source: SEAFDEC/IFRDMD (2016)

Table 61. Production of Anguillid eels from inland capture fisheries in Indonesia and the Philippines from 2007 to 2013 by quantity (metric tons)

Country	2007	2008	2009	2010	2011	2012	2013
Indonesia	1,235	645	1,060	1,149	557	2,691	2,939
Philippines	NA	710	835	719	867	1,149	2,489

NA: Data not available

Source: SEAFDEC (2010a; 2010b; 2011; 2012a; 2013; 2014; 2015a; 2016a)

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.