SPECIAL REPORT

Exchanging Information on Catadromous Eels in Southeast Asia

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Catadromous eels consist of fish species belonging to genus *Anguilla*. They start their lives in the ocean and migrate to the shore as larvae (leptocephali) that metamorphose into juveniles called "glass eel" and go up rivers with pigmentation (called "elver") then spend several years in freshwater as "yellow eel." Mature and ready to spawn, they swim downstream (called "silver eel") and head to the spawning ground in the ocean, and after spawning they die. The morphology of Anguillid eels (yellow eel) is unlike that of the other freshwater fishes. Anguillid eels have a long cylindrical shape and continuous dorsal, caudal and anal fins. They also have pectoral fins but no pelvic fins. Anguillid eels are distributed throughout tropical and temperate waters, except for the Eastern Pacific and South Atlantic (Silfvergrip, 2009 in Crook & Nakamura, 2013). According to the Food and Agriculture Organization of the United Nations (FAO) data, global eel production has risen dramatically from 17,750 tons in 1950 (only 3% coming from aquaculture/eel farming) to 280,000 tons in 2007 (96% from eel farming), after which production stabilized in 2008 to 2010 (FAO, 2012 in Crook & Nakamura, 2013). 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 & Nakamura, 2013).

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

Catch statistics are the most important basic data for assessing the current status and trend of fish resources. In order to evaluate the relative abundance of eel resources, there is a need to develop the catch statistics on eels, especially the tropical Anguillid eels in Southeast Asia. However, data on catch statistics of Anguillid eels in the region are insufficient. It is therefore necessary to establish an inventory system as soon as possible for the conservation, management and sustainable utilization of the tropical Anguillid eel resources and also for future development of the eel industry in the region.

To address the issues on data collection on eels, IFRDMD organized the First Workshop on Enhancement of Sustainability of Catadromous Eel Resources in Southeast Asia on 27-29 April 2016 in Palembang, Indonesia. Government fisheries officers from Malaysia, Myanmar, Philippines, Thailand, Viet Nam and Indonesia, professors/scientists from Indonesian universities, representative of an eel industry in Indonesia, Fisheries Policy Adviser of the Japan International Cooperation Agency (JICA) and the scientists/researchers from Secretariat, AQD and IFRDMD attended the Workshop which was mainly aimed at exchanging information on the status of eel fisheries/eel farming in their respective countries. The Workshop discussed the important and controversial issues on the eel industry in Southeast Asia and came up with recommendations and the way forward, as shown in the following Table:

Capture of glass eels using scoop net at the mouth of Cimandiri River, Indonesia (above); and Fyke net used to capture fish at the mouth of Poso River, Indonesia (right)

Table 1. Recommendations and Way Forward for Enhancing the Sustainability of Anguillid Eels in Southeast Asia

Issues	Recommendations and Way Forward
1. Improving data collection and statistics on Anguillid eels	• Considering that information on status and trends of eel resources are necessary for management for sustainability of the species, and since data collection on status and trends of eels which inhabit the deep ocean is not possible, monitor the trends of eel juveniles caught for aquaculture purposes as these could provide some pictures on the trend of eel population in their natural habitats. • To facilitate data collection by the countries, develop standardized template by harmonizing the existing templates currently used by the countries, and indicate that data compiled on eels should be categorized as: 1) Glass eels = transparent / non-pigmented; 2) Elvers (Kuroko) = pigmented, up to 50 grams; and 3) Yellow/ Silver eels = above 50 grams • Collect catch data by weight, which could be used for calculating the number of juveniles caught; fishing hours; fishing gears, etc. • Also collect data on production of eels from aquaculture. • For marketable size eels, difficulties have been encountered by many countries in reporting eel catch statistics because Anguillid eels are recorded under the group of "eels" together with the other eels or "others" together with other unidentified fish, thus, efforts should be made to improve the statistics on eels in the future.
2. Increasing survival rate during culture of glass eels to elvers	• The most critical stage in eel aquaculture in the region is from glass eels to elvers, which takes 3-4 months and survival rate has been recorded to be very low, but records in Japan showed survival of cultured *A. bicolor* from glass eels to elvers was as high as 90% and in Indonesia up to 55% (in a company supervised by Japan), and up to 90% in laboratory-scale. Therefore, there is a need to improve and extend eel aquaculture technologies to enhance survival rate in culture farms, and optimize the utilization of glass eels which could eventually lead to increased eel production in the region. • In glass eels, particularly for *A. bicolor*, 5-7 cm in length are the most appropriate size for aquaculture to attain high survival and growth, and since it had been difficult to regulate the catching size of glass eels, it is necessary to develop other measures, *e.g.* identification of appropriate geographical areas for catching, appropriate collecting season, etc. and continue R&D in the culture of eels, *e.g.* optimum water quality (physical and chemical), feeding/nutrition (*e.g.* appropriate protein and lipid content requirement), disease management, etc.
3. Compilation of existing information/ researches from Southeast Asian countries	• Considering that several studies relevant to Anguillid eels have been undertaken and published by researchers in several Southeast Asian countries, including those published in national languages, it is therefore necessary to compile such information to facilitate further research studies and undertake activities towards the conservation and management of the species.
4. Mitigating problems on unregulated trade of eels	• Establish regulations on trading of eels, taking into consideration those that are available in several countries, *e.g.* exportation of eels smaller than 150 grams is prohibited in Indonesia and smaller than 15 cm in length in Philippines. • Considering that Anguillid eels command high price while demand had been increasing, large quantities of glass eels are being traded without proper regulation and recording in some cases. Therefore, measures should developed and imposed to prevent illegal trade and laundering of glass eels, and such measures should focus on those that could be undertaken by exporting countries.
5. Restocking and resource enhancement measures	• Considering the migratory nature of Anguillid eels, from the deep ocean to freshwater rivers, of which the migratory route along the river could be long with obstacles/conditions that hinder their migration, *e.g.* fishing activities, cross-river obstacles, and habitat degradation, therefore, restocking of eels could be considered as an option.

In order to compile good statistics, the participants agreed to: (1) collect statistics on catch of juvenile eels using a harmonized template (to be developed), comprising minimum data requirements (*e.g.* catch and effort data, location, gears) with standard definitions of the different stages of eel juveniles, to facilitate data collection, and separately recording data on catch of glass eels, elvers and yellow/silver eels; and (2) identify appropriate check points (eel farms, quarantine station, local/ national government). Moreover, for improving the statistics on eel production (marketable size), separate the statistics on production of Anguillid eels from other eels, and other fishes (aggregated species), and collect information on Anguillid eel farming. To prevent illegal trade and laundering of glass eels, the participants supported the conduct of studies on market chain of catadromous eels originating from Southeast Asia; and improvement of regulations/monitoring systems on smuggling-exportation of glass eels. In addition, restocking could also contribute to enhancing the awareness of stakeholders on the need to conserve eel resources. For resource enhancement, closed season (*e.g.* for certain period) should be more appropriate than closed areas, but this should be based on what is most appropriate in the situations of respective countries.

Additional information could be obtained from SEAFDEC/ IFRDMD (*Dr. Satoshi Honda, Dr. Dina Muthmainnah*, and *Ms. Ni Komang Suryati*)