

Box 5. Measures to address the issues that plague the Southeast Asian coral reefs (<i>Cont'd</i>)	
<ul style="list-style-type: none"> • Reduce Overfishing <ul style="list-style-type: none"> - mitigate the effects of overfishing by making sure that major endeavors are focused on not only on reducing fishing effort but also developing alternative livelihoods for fishers considering that overfishing is the most pervasive threat evaluated for Southeast Asia - reducing the fishing effort as this would result in higher catches per fishing hour and higher incomes for those still engaged in fishing. In some cases, no-take zones need to be established around breeding areas and fish migration paths 	
<ul style="list-style-type: none"> • Regulate the International Trade in Live Reef Organisms <ul style="list-style-type: none"> - Regulating the trade in live reef organisms must be done at many levels: at the local level, by retraining fishers on the disadvantages of using destructive fishing practices; and at the national level, testing and monitoring are essential and should be improved in both exporting and importing countries so that regulators can identify and endorse “sustainably” caught species 	
Management and Planning	
<ul style="list-style-type: none"> • Develop Tourism Sustainably <ul style="list-style-type: none"> - properly implement tourism projects as these can provide important incentives for effective management and conservation of coral reefs - promote the development and use of certification schemes, accreditation, and awards that facilitate best practices for hotels, dive operators, and tour operators as these could provide incentives for eco-friendly development 	
<ul style="list-style-type: none"> • Adopt Policies to Reduce Greenhouse Gas Emissions and Climate Change <ul style="list-style-type: none"> - adopt measures that reduce coral bleaching for although most corals are already living in water temperatures near the upper limit of their tolerance, climate change threatens to push water temperatures to levels at which the frequency of mass coral bleaching and mortality could increase - take actions to reduce greenhouse gas emissions as this is critical to mitigating the effects of global climate change on Southeast Asian reefs considering the uncertainty associated with climate projections 	
Information and awareness	
<ul style="list-style-type: none"> • Improve Mapping, Monitoring, and Networking of Information on Coral Reefs to Support Better Management <ul style="list-style-type: none"> - ensure that managers and communities receive the information and management tools necessary to make sound management decisions - monitoring programs on coral reefs should be linked with monitoring of population and development, including upland activities, because this integration of information is a key to understanding changes in coral reef status and to managing the resources - better organization and collection of information, including the establishment of a centralized information node, is crucial as this would enable the whole region to adopt to improved strategic approaches to protecting reefs 	
<ul style="list-style-type: none"> • Raise Public Awareness <ul style="list-style-type: none"> - ensure that the economic and ecological values of coral reefs and the degree to which corals are currently being damaged by human activities are widely understood - the use of models in the implementation of sustainable coral reef management is largely ineffective because of inadequate education and awareness of laws, management strategies, and general understanding of marine resource management issues - introduce to - promote major awareness-raising campaign to change behavior and create political will among the managers and general public on the aspects of policy change 	

3.1.6 Inland Species

Irrawaddy Dolphin

The Irrawaddy dolphin (*Orcaella brevirostris* Owen in Gray, 1866) is a species of dolphin found near the coasts and in estuaries in some parts of Southeast Asia. It is usually 1.0 m long weighing about 10 kg at birth but could reach 2.3 m long at full maturity. An adult can weigh more than 130 kg and its life span is about 26–30 years (Tun, 2007). Due to its decreasing population, urgent conservation measures are appropriate and being called for to ensure their sustainability. Irrawaddy dolphins are listed as globally endangered by the IUCN Red List Authority (Minton *et al.*, 2017). The Irrawaddy dolphin is also in Appendix I of CITES which disallows all commercial trade in species that are threatened with extinction.

The Irrawaddy dolphin belongs to a group of migratory mammals in foraging habitats in the Southeast Asian

region and India. The species' movement is seasonally changing depending on the water level and food supply. These freshwater dolphins inhabit the far upstream not only in nearshore marine waters, as opposed to the other members of their species. In Southeast Asia, their distribution is in the Mekong River in Cambodia and Lao People's Democratic Republic, the Ayeyarwady River in Myanmar, Mahakam in Kalimantan of Indonesia, and two brackish lagoons in Songkhla, Thailand (**Figure 84**). Spatial distribution of freshwater dolphin in East Kalimantan, Indonesia is found in Kaman, Pela Kecil, Bank of Pela Besar Rivers, Semayang, and Melintang Lakes. Freshwater dolphins have been used as ecotourism attractions for local and foreign tourists. Some efforts have been made to conserve the freshwater dolphins in East Kalimantan, Indonesia, namely: habitat protection from pollution and sedimentation, fisheries area protection to provide natural food, and increased local people's role in conserving the existence of these dolphins (Dharmadi *et al.*, 2008).

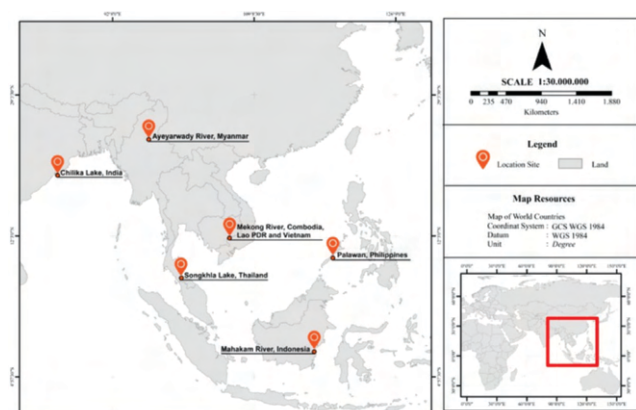


Figure 84. Distribution of Irrawaddy Dolphins in Southeast Asia

Traditional fishing in the Ayeyarwady River of Myanmar avails of a cooperation fishing between the Irrawaddy dolphins and cast-net fishers that have never been described in any world fisheries record. The Irrawaddy dolphins, which are respected by the fishers living on the shores of Ayeyarwaddy River, help the fishers in their cast-net fishing in a cooperative way. The dolphins give the signal for the fishers to row their canoes back and forth, and when the dolphins show their flukes up the water surface pointing straight to the sky, it means that fishers should stop their canoes and wait for another signal for the proper time to throw their nets (Tun, 2007).

Several factors affect the declining population of freshwater dolphins, one of which is habitat degradation. The gillnet entanglement incidents in Cambodia and electric fishing practices in Myanmar are the most critical threats that confront the dolphin population. Furthermore, dolphin-watching tourism has also become a threat to some populations due to harassment and collisions with tourists' vessels (Smith *et al.*, 2007). In Mahakam, Indonesia, dolphin movements are being obstructed by large barges transporting coal. Their natural food supply that has been dwindling in their habitats also adds to the factors, since the supply of Irrawaddy dolphins' main food which includes fish, crustaceans, and squids, especially white fishes, have also decreased. Therefore, the supply of food for the dolphins in their habitats should be managed for their sustainability.

Most Southeast Asian countries had already established their respective national laws on protecting and conserving the freshwater dolphin as well as developed their own National Plan of Action (NPOA) on Conserving and Protecting Freshwater Dolphins and their Habitats. In Indonesia, the Irrawaddy dolphin has been considered a protected animal based on the Ministerial Decree of Agriculture No. 35 in 1975. This recognition has been considered during the development of the country's National Plan of Action (NPOA) on marine mammals including the freshwater dolphin based on the Ministerial Decree of Marine Affairs

and Fisheries No. 79. In the Philippines, the Irrawaddy dolphin is protected under FAO 185-1 and by other legislation protecting the Malampaya Sound such as the Philippine Wildlife Act and Presidential Proclamation 342 which declared Malampaya Sound as a Protected Landscape and Seascape. Myanmar created a new protected area for the population of critically endangered Irrawaddy dolphins living in the Ayeyarwady River of central Myanmar. In 2012, the Government of Cambodia issued the sub-decree "Mekong Dolphins Managerial Protection Area" which bans and restricts any use of gillnets either entirely or during certain times of the year (WWF, 2017). Furthermore, the Government of Thailand declared that the Tarutou Island is the largest Marine National Park in Southern Thailand for biodiversity protection including that of the Irrawaddy dolphins.

Asian Arowana

The Asian Arowana has been listed in Appendix I of CITES since 1 July 1975 and is endangered by the IUCN Red List (Larson & Vidthayanon, 2019) due to its high demand and low population, and its trading is banned except for captive breeding. In Indonesia, since January 2021 as mentioned in the Ministry of Marine Affairs and Fisheries Decree, the Arowana *Scleropages formosus* is defined as a protected fish species with full protection status. The wild population of this species is low and has low fecundity, and the species has strong schooling behavior that needs specific requirements for developing the management measures necessary for their long-time survival.

The Asian Arowana or Asian bony tongue (*Scleropages formosus*, Muller & Schlegel 1840) is a valuable ornamental freshwater fish with some varieties. These species are very popular as aquarium fish due to their symbols of good luck and prosperity, influenced by the Chinese culture. There are four color variances of Arowana: Super Red, Red Tailed-Golden, Green, and Silver Asian. The highest price goes to the Arowana Super Red and the lowest to the Green Arowana.

Habitat degradation is a major threat to the declining population of Asian Arowana in Southeast Asia. Also known as dragonfish, Arowana is native in Southeast Asia and is distributed from Cambodia, Indonesia, Southern Myanmar to the Malay Peninsula, and Viet Nam (**Figure 85**).

These species inhabit the backwaters, swamps, and flooded forests, but also occur in lakes, rivers, reservoirs, and waterways. In Malaysia, they spend the day in *Pandanus* roots and other structures, and are active at night, being nocturnal, for feeding (Scott, 1976). The spawning season of *S. formosus* in Cambodia begins towards the end of the dry season (March–April) and usually takes place in approximately three months (Rowley *et al.*, 2008).

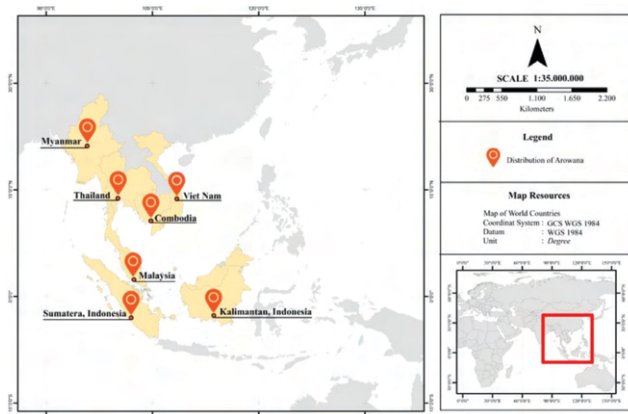


Figure 85. Distribution of Arowana in Southeast Asian

Arowana breeding and farming are being practiced in many Southeast Asian countries such as Indonesia, Malaysia, and Singapore. The First successful artificial breeding of Asian Arowana was in the Sembawang Field Experimental Station (PPD, Singapore) in 1981 (Yue *et al.*, 2004). Domestication of the Super Red Arwana has been successfully carried out by the private sector in Indonesia (Mustarudin *et al.*, 2012).

3.2 Challenges and Future Direction

Several aquatic species inhabiting the waters in the Southeast Asian region (both marine and inland) have been exploited through commercial fishing operations leading toward the over-exploitation of most species. Some species are also vulnerable to exploitation because of their very nature and characteristics, and the fishing practices used that threaten their continued existence, thus, requiring the establishment of measures or regulations to control their catch and trade. While the conservation and sustainable utilization of species inhabiting national waters could be effectively regulated mainly through national legislation, there are species that due to their nature, have stocks/resources that are shared among or migrate across territorial waters of two or more countries, or even undergo long-distance migration until the high sea areas. When their existence is being threatened, then such species become an international concern. During the past decades, several commercially-exploited aquatic species have been placed under international concern, *e.g.* tunas, sharks and rays, anguillid eels, sea cucumbers, among others, requiring the countries and organizations in the Southeast Asian region to cooperate in exchanging information as well as pursue the development of coordinated directions to address the emerging issues and challenges that confront the sustainability of those species. Considering therefore that several aquatic species of international concern are commercially exploited by the AMSs, the concerned countries, as well as relevant institutions and organizations, should consider the following aspects in developing their future directions on the sustainable utilization of such species:

Monitoring global discussion and facilitating the development of regional positions

- The AMSs and relevant organizations should follow-up on the results of discussions at the international fora, such as the CITES on the possible listing of commercially-exploited aquatic species into the Appendices, *e.g.* the upcoming session of the Conference of the Parties and discussion by relevant CITES Committees; recent regulations put into practice by importing countries, such as the U.S. Marine Mammal Protection Act (MMPA), among others.
- Relevant regional organizations, *e.g.* ASEAN and SEAFDEC, should consider initiating discussions among their member countries on the status of aquatic species under international concern that are subjects for discussion at relevant international fora and supporting the development of common/coordinated positions among the AMSs to be reflected at such relevant fora.

Improving data collection on aquatic species under international concern

- The AMSs should continue collecting data and information through various means, on species protected under their respective national legislations and those listed under CITES Appendices, considering that the catch data of such species are no longer compiled resulting in unavailability of data to support research studies related to the stock status of the species, and to be used as a reference during the development of Non-detriment Finding Documents required for the trade of the species (listed under the CITES Appendices) or other documents required by importing countries.
- Relevant organizations/institutions should consider sustaining their capacity building activities for relevant officers or enumerators on species identification, *e.g.* species identification based on the external morphology at landing ports, species identification by the customs for imported and exported products, based on products' various post-harvest forms (*e.g.* shark fins, dried seahorses, dried sea cucumbers).
- Relevant organizations/institutions should consider introducing and providing capacity building on appropriate methodologies for stock assessment of species under international concern to come up with information on the status and trends of such species.
- Considering the insufficient information on population, species distribution, behavior, and migration of marine mammals in the region, relevant organizations/institutions should introduce and provide capacity building activities on appropriate methodologies for the

collection of such information to ensure that the species and their habitats would not be impacted by fishing activities, and on the development and management of the coastal and marine resources.

Developing aquaculture technologies to reduce pressure on species under international concern

- Relevant institutions should consider developing technologies for aquaculture of species under international concern, e.g. seahorses, sea cucumbers, anguillid eels, with a view to reducing the threats from fishing to the natural population of the species.

Enabling trade of aquatic species under international concern

- Relevant organizations should provide capacity building on the development of documents required for the trade of fish and fishery products, e.g. NDF document for the trade of species listed under the CITES Appendices, or other documentary evidence showing that the harvest of certain fish and fishery products are conducted in a way that no harm was created to the specific species that are subject to the trade-related regulations.

4. Responsible Fishing Practices

4.1 Status, Issues, and Concerns

4.1.1 Reduction of Impacts of Fishing on the Environment

The conduct of fishing activities can create impacts not only on the targeted species and resources but also on the other resources associated with the existence of the dependent species. These include the benthic communities at the bottom of the oceans where bottom-towed fishing gear is operated to target the pelagic resources. Moreover, endangered, threatened, and protected (ETP) aquatic species including sea turtles and marine mammals could also be impacted by fishing gear being operated at the surface and sub-surface water columns. Since the 1990s, several regional studies had been undertaken by researchers to determine the impacts on the resources, of fishing activities that catch juveniles or non-target species and bring about bycatch and discards. Fishing activities could also result in degradation of the environment and habitats due to the very nature of the fishing techniques used, e.g. use of dynamite or poison, or the inappropriate use of otherwise acceptable gear, e.g. using trawls in coral reefs or seagrass beds.

Impacts of Fishing on the Fishery Resources

Fishing activities can have direct and indirect impacts on the abundance and spawning potentials of the fishery

resources, and possibly on population parameters, e.g. growth, maturation, among others. Fishing could also modify the structure of fish populations, such as size, sex ratio, species composition, not only of the target species or resources but also of their associated and dependent species, as well as other ETP species living in the ecosystems. FAO (2010a) described the impacts of fishing on biodiversity, which could occur in the following forms: (i) modification of community structure, e.g. trophic structure; (ii) reduction in species richness or other taxonomic diversity indices; and (iii) risk of local extinction, i.e. severe reduction of the impacted populations to the extent of becoming threatened, endangered, or even locally extinct.

The negative impacts of fishing activities on the fishery resources could occur in all fishing practices without appropriate fisheries management to control fishing capacity as well as IUU fishing (FAO, 2010a). Excessive fishing activities could result in overfishing categorized into three common types as shown in **Box 6** (Froese & Pauly, 2022). Increased fishing pressure beyond the level that can be tolerated by the system, for a protracted period of time, carries the risk of reaching the destructive levels of fishing. Measures to counteract overfishing should therefore be established by policymakers and promoted to the stakeholders before fishing activities reach the unsafe and unsustainable level.

Box 6. Common types of overfishing	
Growth overfishing	When the range of fishing mortality is above the rate of F_{max} , and the loss in weight from total mortality exceeds the gain in weight due to growth.
Recruitment overfishing	When the rate of fishing is above the recruitment of the exploitable stocks that becomes significantly reduced. This is characterized by a greatly reduced spawning stock and decreased proportion of mature fish in the catch. Generally, very low recruitment year after year could lead to stock collapse if prolonged and combined with poor environmental conditions.
Ecosystem Overfishing	Occurs when the species composition and dominance of an ecosystem is significantly modified by fishing, e.g. with reductions of large, long-lived, demersal predators and increases of small, short-lived species at lower trophic levels.

Highly-efficient fishing gear, e.g. trawl on benthic community structures, could negatively affect the infaunal and epifaunal communities, and its effect tends to increase with the depth and stability of the substrates (Jennings & Kaiser, 1998). For example, the chronic impact of the iron dredge clam fishing includes the transformation of the benthic organism population from being a group of economic fishery species (clam) to being decomposer and scavenger (e.g. of the polychaetes, starfishes, sea urchins) Meanwhile, FAO (2022) summarizes the impacts of major fishing gears on the fishery resources as shown in **Box 7**.