

Taiwan's National Plan of Action for the Conservation and Management of Sharks

- 1. Introduction (basic principle and objectives)

Taiwan, as a responsible fishing nation, is fully aware that fisheries activities have an important role in the supply of food to human beings. Taiwan although is not a member of United Nations duly respects:

- (1) The awareness of the international society that fisheries are an important industry having the function to ensure social and economic welfare of the people around the world (Kyoto Declaration on Sustainable Contribution of Fisheries to Food Security and its Action Plan).
- (2) The international agreement that states commit themselves to the conservation and sustainable use of marine living resources (United Nations Conference of Environment and Development (UNCED) and Chapter 17 of Agenda 21).
- (3) Code of Conduct for Responsible Fishing of the United Nations Food and Agriculture Organization (FAO) that calls for promotion of contribution of fisheries to food security. Taiwan recognizes that sharks are important fisheries resources and many states and international organizations concern fisheries impacts on shark stocks. Therefore, Taiwan has proposed an effective and feasible National Plan of Action on sharks by taking into account the internationally agreed codes of conduct in order to implement appropriate conservation and management of sharks. The species subjected to this Action Plan are Elasmobranchii (sharks/rays) living or migrating in Taiwanese exclusive economic zone (EEZ) and Elasmobranchii caught by Taiwanese fisheries outside the EEZ. The fisheries subjected to this Action Plan are all harvesting those species.

Taiwan recognizes that sharks provide tremendous amounts of protein, food and considerable economic incomes. Doubtlessly, sharks are precious marine resources. Noticing that according to UN's Law of the Sea, highly migratory species should be jointly managed by regional or subregional organizations and pelagic sharks are no exception. Currently many regional fisheries management organizations (RFMOs) have been set up all over the world. These organizations incorporate manpower, resources and funds to carry out the long-term research and assessment on shark stocks. With much experience on management, member states can execute conscientious assessment and consultation to resolve any difficulty related to marine resources. In addition, resolution adopted this way is compulsory for all member states and goals for conservation can thus be realized. For this reason, any issue regarding conservation and management of marine resources should be deliberated on under consultation of FAO and the framework of RFMOs. Thus, using trade control to monitor marine resources in a rash moment seems not an appropriate way for shark management.

- 2. Shark fauna in Taiwan

There are 8 orders, 25 families, 52 genera, and 91 species of shark as well as 3 orders, 16 families, 24 genera, and 55 species of skate and ray in Taiwan's waters (Shen 1993). Several new records of shark and ray were reported in recent years.

- 3. Shark fisheries
 - 3.1. Historical overview

Over the last 10 years, annual shark landing combined coastal, offshore and far sea in Taiwan averaged between 39,000 and 55,000 metric tons. Eighty-five percent of Taiwan's shark landings are from far sea fisheries and 15% are from coastal and offshore fisheries.
 - 3.2. Coastal and offshore fisheries

The major bases for coastal and offshore shark fishery are in Chengkung and Nanfangao. These two harbors together landed 2,019 MT of shark accounting for 37.4% of Taiwan's total coastal and offshore shark landings (5,394MT). Most of fishing vessels in Nanfangao target sharks from September to the following April and shift to other species such as tuna and billfish in the remaining months of the year.

The major fishing method of shark fisheries in Nanfangao is the bottom longline. The dominant species are blue shark, *Prionace glauca*, shortfin mako, *Isurus oxyrinchus*, scalloped hammerhead, *Sphyrna lewini*, smooth hammerhead, *S. zygaena*, bigeye thresher, *Alopias superciliosus*, pelagic thresher, *A. pelagicus*, sandbar shark, *Carcharhinus plumbeus*, silky shark, *C. falciformis*, oceanic whitetip shark, *C. longimanus*, spinner shark, *C. brevipinna*, and dusky shark, *C. obscurus*. In Chengkung, the large-mesh drift-net target bigeye threshers and pelagic threshers. The mid-water longline target requiem sharks, scalloped hammerhead, blue shark and shortfin mako. In addition to the above two fishing ports, Tongkang is also an important fishing port for shark fishery. Sharks are the by-catch of tuna longline fishery at Tongkang.
 - 3.3. Far sea fisheries

Most sharks are the by-catch of tuna longline and trawl fisheries. However, there are some longliners directly target on sharks. As most of the sharks are bycatch, the catch statistics are not in detail. To improve the quality of catch data, the observer program will be expanded and the number of sampling vessels will be increased. The major shark bycatch species are blue shark (70-80%), mako sharks, thresher sharks, hammerhead sharks and oceanic whitetip shark (*Carcharhinus longimanus*). Most of these bycatches are landed and sold at foreigner bases and few are transported back to Taiwan by transport vessels.
- 4. Data collection

Taiwanese fishing vessels harvest varieties of shark species. For coastal and offshore fisheries direct targeting on sharks are common but most of far sea fishing vessels catch sharks as the by-catch. Therefore, it is difficult to get the accurate estimate of sharks caught by far sea fisheries. Taiwanese shark catch data were collected from various channels as follows:

 - 4.1. Catch provided by commercial fishing vessels

These data are from the logbooks of commercial fishing vessels. There is only one category of shark in the logbook of far sea fisheries in the past. Starting from 2003, this category was further divided into four categories namely blue shark, mako shark, silky shark, and others to better understand the catch composition.
 - 4.2. Landing data in Taiwanese ports

In two fishing ports, the landing data include species and weight of sharks which were caught in coastal and offshore waters of Taiwan. However, species information was not available for those landings caught by far sea fisheries. Only sampling vessels and observers provided species-specific catch information in recent years.

- 4.3. Catch data provided by sampling vessels

The questionnaires were distributed to more than 50 sampling vessels of far sea fishery in the past several years. Species-specific catch data are collected to validate the data from logbook.

- 4.4. Catch data provided by observers

The observer program was initiated in 1999 by scientist and implemented by government in 2001 to validate the catch data come from the above three sources. In the present, there are 9 observers on Taiwanese far sea tuna longline fishing vessels collecting the information of major catch, species-specific by-catch, effort, and by-catch rate. The number of observers will increase to 20 in the near future.

- 5. Utilization

- 5.1. Coastal and offshore catch

The sharks landed in Taiwan either from coastal, offshore or far sea fisheries are fully utilized. Their meats are used as common food, materials for fish steak, paste products or fish ball. Their skins are used as raw materials for skin products, their cartilages are used as pharmaceuticals, their livers are used as the material for vitamin pills, and their teeth are used as decoration.

- 5.2. Far sea catch

For those fisheries operated far away from Taiwan, contain parts of shark catch are brought back to Taiwan, and other parts are landed in nearby foreign ports and sold to local markets.

- 6. Shark research in Taiwan

- 6.1. Fishery biology

In addition to taxonomy, Wang and Chen (1981, 1982) reported reproductive biology and age and growth on the smooth dogfish, *Mustelus griseus*, in northwestern Taiwan waters. Chen et al. (1988, 1990) described age and growth, and reproduction biology of the scalloped hammerhead shark, *Sphyrna lewina*. The first record of 300 embryos of a female whale shark was reported by Joung et al. (1996). Fishery biology of the bigeye thresher shark, *Alopias superciliosus* has been reported in recent years, i.e., reproduction (Chen et al. 1997) and age and growth (Liu et al. 1998). Joung and Chen (1995) and Chen et al. (1996) described the reproductive biology of the sandbar shark, *Carcharhinus plumbeus*, and the blacktip sawtail catshark, *Galeus sauteri*, respectively. Fishery biology of the pelagic thresher shark, *Alopias pelagicus* and the spinner shark, *Carcharhinus brevipinna*, have been described by Liu et al. (1999) and Leu (1997), respectively.

Shark fishery in Taiwan has been reported by several authors i.e., the deep-sea shark fishery in Taiwan (Chen et al. 1979), a detailed description of Taiwan shark fishery including fish fauna, biology, fishing grounds, catch and trades (Chen et al. 1996); a preliminary study

on the whale shark catch and fishery in Taiwan (Chen et al. (1997). Chang et al. (1995) described cellular DNA contents and cell volumes of batoids. Chen et al. (2001) suggested that the starspotted smooth-hound, *Mustelus manazo*, in Taiwanese and Japanese waters are two different populations. Chen (1996) analyzed heavy metal concentration of the sawtail catshark and concluded that the concentrations of Cd and Hg are due to biomagnification of food and accumulation. Demographic analysis of the scalloped hammerhead indicated that the population can not withstand heavy exploitation starting from young age (Liu and Chen 1999).

- 6.2. Tagging program

To reveal the mystery of migratory route and ecology of whale shark, a tagging program was started in 2001. Five out of the seven individuals been tagged with satellite tags have been successfully traced.

- 7. Stock assessment

To date, the stock assessment of sharks has implemented for a few pelagic species in Taiwanese waters. No stock assessment has been done on those stocks caught by far sea fishery because of the lacking of data.

- 7.1. Pelagic species

The stock status of the bigeye thresher shark, pelagic thresher shark, and scalloped hammerhead in Taiwanese waters has been examined. All the three stocks seem in a condition of optimal utilization. However, the mean weight of the carcass for scalloped hammerhead decreased in recent years suggesting this species need to be monitored closely. The stock assessment on other species will be done in the near future.

- 7.2. Demersal species

As the demersal species are usually small comparing with pelagic species and they are not sold through the regular auction channel, it is difficult to collect the necessary data including catch and effort data to implement the stock assessment. In stead of the traditional stock assessment methods, a bioenergetic approach is applied on the bamboo shark. In addition, the stock status of demersal species are evaluated by their frequency of occurrence and catch following the IUCN criterion.

- 8. Education and extension

It is important to evoke social interest in the idea of sustainable utilization and management of sharks not only among fishermen but also general public. To achieve this goal, Taiwanese government has taken several steps as follows:

- (1) Distribution of species identification booklet for sharks to fishermen.
- (2) Hosting international shark conference with environmental group.
- (3) Promoting sustainable utilization concepts to fishermen and general public through workshops.
- (4) Distributing video films of shark fishery and whale shark fishery management poster.
- (5) Educational program for fisheries enterprises and young students.

- 9. International cooperation

- 9.1. Whale shark tagging and trade

A whale shark tagging and trade program was proposed to better understand the migratory route and ecology of whale shark and to collect the catch and trade information of whale shark in the Pacific region.

- 9.2. Data exchange

To better understand the stock of sharks, specimens and muscle of several species have been exchanged with foreign scientists. More effort is needed on the data exchange of trade in the future.

- 9.3. Reduction of whale shark catch from set net

An international cooperation research program on this issue was started in 2001. Australian and Taiwanese researchers work together to find a way to reduce the bycatch of whale shark from set net.

- 9.4. Regional cooperation

Taiwanese representatives and scientists will actively participate the meetings of FAO fisheries section or RFMOs such as WCPFC, IATTC, IOTC, ICCAT, ISC, and CCSBT to exchange fisheries statistics data with other countries for the propose of implementing stock assessment.

- 10. Management measures

- 10.1. Fisheries act and wildlife conservation act

Considering shark management measures of RFMOS and population status of sharks, the management measures of sharks in Taiwan are based on domestic fisheries act and wildlife conversation act to ensure the sustainable utilization and conservation of sharks.

- 10.2. Shark management working group

A shark management working group composed of scientists, administrators and fishermen was established in 2001 to discuss shark management and conservation issues.

- 10.3. Whale shark management

Most whale sharks in Taiwan waters are caught by harpoon and set-net with a small proportion by longline and gill net. There is no dedicated whale shark fishery in Taiwan. Due to a significant decline of whale shark catch from 1995-1998 and its characteristic slow growth and late maturity, the fishery management scheme of this species has been initiated in 2001.

- 10.3.1. Catch-report scheme

The catch-report scheme was implemented from 2001. The fishermen are mandatory to fill the catch sheet including length, weigh, sex, time, and fishing gear to the local government when they catch the whale shark. A total of 89 individuals were caught in the period July 1, 2001 to June 30, 2002 and 80 individuals were reported from July 1, 2002 to June 30, 2003. As basking shark and great white shark have been listed as Appendix II of the red list of CITES, these two species have been added to the report list since 2005.

- 10.3.2. TAC

Based on the information of catch-report system, the total allowable catch (TAC) of the whale shark was set as 80 individuals for the period July 2002 to June 2003. Because the TAC system runs well, Taiwanese government announced another TAC quota of 120 individuals for whale shark in the period from July 2003 to December 2004. The TAC reduced to 65 individuals in 2005 and to 60 individuals along with a size limit of 4 m in 2006. The size limit will be evaluated every year.

- 10.3.3. Trade

As the whale shark has been categorized as Appendix II of the red list of CITES, permission for export is required for whale shark export. A specific custom code was set for whale shark in 2002 to monitor the import of this species.

- 10.3.4. Ecotourism

In addition to consumption, the whale shark has been captivated in marine biology aquarium for educational propose. An international workshop on whale shark ecotourism was held in Taiwan in 2005 and the feasibility of the whale shark ecotourism will be evaluated.

- 10.4. Promotion of sustainable utilization

Taiwanese government realizes that many shark stocks have been overexploited and fully supports the concept of sustainable utilization. The finning activity of far sea fishery is not encouraged and fishermen were requested to completely utilize the shark resources. A series of workshop were held to promote and educate fishermen the concept of shark conservation and complete utilization. A technique of developing the new product of blue shark is undergoing to promote the utilization of the most common bycatch species for far sea fisheries.

- 10.5. Precautionary approach

Although the total catch of coastal and offshore shark fisheries increase significantly, some species have decreased as a percentage of total catch while others have increased. Certain demersal species once common in coastal and offshore fisheries have shown a decline in catch over the past 10 to 20 years due to the overexpansion of coastal trawl fisheries. The following species have become difficult to find: the starspotted smooth-hound *Mustelus manazo*, potless smooth-hound *Mustelus griseus*, *Squalidae* and *Centrophorus* spp.. However, the multi-species nature of trawl fisheries makes species-specific management problematic. Although existing data are insufficient to draw reliable conclusions on trends in Taiwan's shark fisheries, a precautionary approach can be used as a tool for fishery managemet. In future, more data on species catch levels and fishing effort must be collected. Only then will it be possible to create a workable management regime should that prove necessary.

- 10.6. Ban finning practice

To ban the finning practice, several RFMOs such as ICCAT, IOTC, and ICCAT have put that sharks fins shall not surpass more than 5% to carcass weight for all the sharks landed in the resolution. To compliance these resolution, Taiwanese government has requested

our far fisheries vessels to ban finning practice and follow the regulation on the proportion between shark fins and carcass weight of RFMOs.

- 10.7. Set up shark management scheme

To ensure the sustainable utilization and to promote the complete utilization of sharks, Taiwanese government plans to monitor the fishing activities and shark catch via VMS and set up the criterion of a certain proportion between shark fins and carcass weight for all the sharks landed in Taiwan in the near future. The reduction of fishing effort or TAC management scheme will be implemented if the shark resources were proved to decline significantly. In addition, the concept of complete utilization of sharks will be promoted continuously.