

FISHERIES MONITORING, CONTROL AND SURVEILLANCE IN THAI WATERS

1. INTRODUCTION

Fisheries are one of Thailand's most important activities, contributing about 2 -3% to GNP annually and accounting for 11% of agricultural GNP. Thai marine fisheries production derives from the Gulf of Thailand and from the Andaman Sea. During the past decade, Thailand's marine fisheries production averaged about 2.5 million t/yr. In 1997, Thailand's marine fisheries production was 2.9 million t, of which marine capture accounted for 2.6 million t and marine aquaculture for 300 000 t.

Prior to 1960, the fishing industry in Thailand consisted almost entirely of small scale-fisheries. A great expansion in marine fisheries occurred in the early 1960s through the introduction of the otter-board trawl. As a result, the number of fishing vessels increased markedly – about 24 times. The fishing fleet has rapidly expanded; not only the number of fishing vessels but also their size and catch capacity. In 1982, there were approximately 19 556 powered fishing boats registered in Thailand, and they gradually declined to about 16 054 commercial fishing boats in 1987. Recently, the Department of Fisheries (DOF) reported that there are 17 281 powered fishing boats registered in 1995.

Marine fisheries in Thailand developed during the period of the First National Economic and Social Development Plan (1962-1966) to the Fifth National Economic and Social Development Plan (1982-1986). During these two decades, the fishery resources in Thai waters have been heavily exploited. It is estimated that Thai waters have been overfished for a long time. However, the total catch attributed to the fishery in Thai waters has reached a plateau and has not declined. This is probably because landings of catches taken outside Thai territorial waters are included in the catches and the total catch is being maintained as a result of change in the species composition and size structure of stocks. There is also evidence that trash fish make up between 60 and 70% of the catch landed by trawlers, whereas edible fish account for only 20 to 30%.

The decline in catch per unit of effort (CPUE) and in biomass of fish stock in Thai waters is mainly due to the excess fishing effort of the trawl fishery. Therefore the Sixth National Economic and Social Development Plan (1987–1991) to the Eighth National Economic and Social Development Plan (1997–2001) placed emphasis on fishing in Thai waters. These National Plans make provision for DOF to reduce number of trawlers and pushnetters, support small-scale fisheries, enhance marine and coastal fishery resources in Thai waters, etc. During the past two decades, DOF has attempted to implement the National Plans by issuing several regulations aimed at reducing the number of trawlers and pushnetters, providing large amounts of budget and manpower for fisheries patrol units to enforce laws and regulations, etc.

This report reviews the current situation of marine and coastal fisheries in Thai waters, Thai fishery laws and regulations, fisheries conservation in Thailand, and institutions responsible for marine fishery conservation and management. It also outlines the activities of fisheries monitoring and surveillance in Thai waters.

2. CURRENT FISHERIES IN THAILAND

Fisheries are crucial to all developing countries, including Thailand, because of their contribution to GDP, foreign exchange earnings, domestic nutrition needs, employment, a wide range of ancillary industries, and a way of life for many local communities. Fisheries production in Thailand is derived from both inland and marine resources. Inland fisheries production comes from freshwater capture fisheries and aquaculture, which is practised throughout the country. Marine fisheries production comes from capture fisheries both within the EEZ of Thailand and neighbouring countries' waters, and from coastal aquaculture. Marine fisheries production accounts for 90% of total production and inland fisheries for 10%. In 1994, the fishery industries contributed approximately \$US 1 494 million (1.39%) of Thai GDP, and accounted for 12.5% of agricultural GDP. Fisheries production was 3.5 million t, valued at \$US 2 120 million.

2.1 Coastal aquaculture

DOF reported that Thai fisheries production was approximately 3.5 million t in 1994, of which capture fisheries represented 85.3% (marine fisheries 79.5% and inland fisheries 5.8%) and aquaculture 14.7% (coastal aquaculture 9.8% and freshwater 4.9%). The original objective of developing aquaculture in Thailand was to supply cheap protein for domestic consumption. This changed after the development of coastal aquaculture during the 1970s and 1980s; now most coastal aquaculture is for export, particularly marine shrimp production. The development of marine shrimp aquaculture has expanded rapidly in terms of technology, number of farmers and areas of farming. In comparison, other coastal aquaculture and mariculture activities, such as sea bass, blood cockle and oyster culture, have developed slowly. This is probably because the aquaculturists do not have sufficient knowledge for proper management.

2.2 Coastal capture fisheries

2.2.1 Demersal fisheries

Prior to 1950, Thai fishermen used traditional fishing gear and non-motorized fishing boats to catch demersal fish. From 1952 to 1960 there were several fishing trials with trawl gear by private companies. However, these attempts were not successful due to the lack of technical experience, low profit and some difficulties in selling demersal fish because the consumer were not familiar with the species. Following an agreement for economic and technical cooperation signed in 1960 between The Governments of Thailand and Germany, otter-board trawls were introduced to Thai fishermen. As a result, the number of trawlers increased remarkably. In 1964, fishermen from Samutprakam Province succeeded in developing a beam trawl for catching shrimp, and this type of fishing gear became popular alongside the otter-board trawl, resulting in the total number of registered trawler increasing from 99 units in 1960 to 11 000 units in 1989, which fell to 8 718 units in 1992.

There are more than one thousand marine species from approximately 135 families in Thai waters, which can be divided into three groups, namely pelagic fish, demersal fish and invertebrates. The common and valuable target pelagic species are Indo-Pacific mackerel (*Rastrelliger brachysoma*), Indian mackerel (*R. kanagurta*), scads, tunas (*Thunnus tonggol*, *T. albacares*, *Euthynnus affinis*, *Auxis thazard*), sardines, anchovies, carrangids, etc. The most common group of target demersal fish of high economic value include snappers, groupers, threadfin bream, monocle bream, lizard fish, bigeye, etc. The target invertebrate group of high

economic value comprises more than ten species of shrimp, cephalopods, crabs, mussels, clams, etc.

Total marine production in 1994 was 3.1 million t, composed of 30.3% pelagic fish, 29.5% trash fish, 12.3% shrimp, 9.1% demersal fish, 5.5% other food fish, 4.6% cephalopod, 4.4% molluscs, 1.6% crab and 2.7% other.

The fishing gears used in the capture fisheries can be categorized into large-scale or small-scale fishing gears. The large-scale fishing gears are trawls (otter-board trawl, otter-boom trawl, pair trawl, beam trawl), purse seines (Chinese purse seine, Thai purse seine, light luring purse seine, anchovy purse seine, squid light luring fishing) and pushnet. The small-scale fishery production was about 13% of the total marine production. Most small-scale fishermen use gill nets to catch shrimp, crab and fish.

The total number of fishing gears in 1994 was 17 657, comprising 12 567 large-scale fishing gears (71.2%; made up of 36.7% otter-board trawl, 11.7% squid light luring, 9.7% pair trawl, 8.6% purse seine, 3.7% pushnet and 0.9% beam trawl) and 5 090 small-scale fishing gears (28.8%; made up of 11.6% shrimp gill net, 7.8% crab gill net, and 9.3% other (fish gill net, longline, drift net, encircle gill net)).

The commercial trawlers form four classes according to their length, i.e., less than 14 m; 14-18 m; 18-25 m; and more than 25 m. The otter-board trawlers with a length less than 14 m operate in shallow zones, mostly inshore. The otter-board trawlers in the 14-18 m group operate in deeper water. The otter-board trawlers longer than 18 m operate offshore and outside Thai territorial waters.

2.2.2 Pelagic fisheries

Prior to the development of marine fisheries in the 1960s, pelagic fish species were mainly caught in inshore waters in the Gulf of Thailand by non-mechanized boats and traditional types of fishing gears, such as bamboo stake trap and set bag nets. In 1925, the Chinese purse seine was introduced into the chub mackerel fishery in the Gulf of Thailand. After the end of the Second World War, many Chinese purse seines were modified into Thai purse seines, using a mesh size of 2.5 cm. Mackerel encircling gill nets or green purse seines using a mesh size of 4.7 cm were also introduced. In 1973, several luring techniques were introduced, such as payao with coconut leaves.

Pelagic fish are mainly caught by purse seines, making up about 82-85% of all gears used. The number of registered purse seiners increased from 585 units in 1979 to 1 175 units in 1994. The pelagic fish caught by purse seines (including anchovy purse seine and Chinese purse seine) comprised 28.2% anchovy, 21.1% Indo-Pacific mackerel, 15.2% round scad, 12.9% small tunas, 12.2% sardines, 5.1% Indian mackerel, 3.6% hardtail scad, and 1.0% bigeye scad.

In the Gulf of Thailand, the fishing grounds for Indo-Pacific mackerel are found along coastal areas from the upper part of the Gulf to the southwest coast of the Gulf, whereas the fishing grounds for Indian mackerel and sardines are deeper, at between 30 m and 70 m. Round scad fishing grounds are found at more than 50 m depth. Small tunas are found along the coast of the Gulf and in the central part of the Gulf. Anchovies are mainly found along the coast from the eastern part of the Gulf through to the southwest of the Gulf.

Pelagic fish represented 30.3% of total marine production. The largest quantity and value of landings consisted of 25 species of 13 families. The total pelagic catch in 1994 was 953 710 t, consisting of 17.8% anchovies, 16.2% sardines, 13.7% tunas, 15.5% Indo-Pacific mackerel, 6.8% Indian mackerel, 7.8% scads, 4.1% bigeye scads and 18.1% other (wolf herring, trevallies, black banded king fish, mullets, pomfrets, etc.). Pelagic fish production between 1989 and 1994 ranged from 703 471 t to 953 669 t, of which production from the Gulf represented 67.5% and production from the Andaman Sea represented 32.5%.

2.2.3 Invertebrate fisheries

The main species in the invertebrate group are very important for Thai fisheries because most of the marine produce from this group can be exported. The important species are shrimp, squid, cuttlefish, octopus and swimming crab.

Shrimps

Shrimps come from many species, such as banana prawn (*Penaeus merguensis*), giant tiger prawn (*P. monodon*), green tiger prawn (*P. semisulcatus*), school prawn (*Metapenaeus* spp.) – which are big in size – and other, smaller shrimp in the genera *Metapenaeopsis*, *Parapenaeopsis*, and *Trachypenaeus*. Most are caught by trawl net and pushnet, except for banana shrimp, which can be caught by shrimp gill net. The shrimp trawlers, up to 14 m in length, operate in the shallow water along the coast, and especially near the mouths of rivers.

Squids

More than 10 species of squid have been recorded in Thai waters and the economically important species are *Loligo duvauceli*, *L. chinensis* and *Sepioteuthis lessoniana*. Squids are distributed from shallow water to a depth of 50 m in the Gulf of Thailand. *Loligo duvauceli* is found more at a depth of 20-40 m, while *L. chinensis* is found at 40-50 m depth. A high abundance of *Sepioteuthis lessoniana* was found at 10-30 m depth. The major fishing gear in squid fishery are the otter-board trawl, pair trawl, squid light luring cast net and lift net, squid trap for *S. lessoniana* and squid jigging. Squid light luring cast net and lift net between them were responsible for 90% of the total catch of squid. Fishing is along the coast on both eastern and western coasts of the Gulf of Thailand, including around the islands in the Gulf.

Cuttlefish

Cuttlefish is mostly caught by trawler using otter-board trawl or pair trawl. There are three main species: *Sepia recurvirostra*, *S. pharaonis* and *S. aculeata*. Cuttlefish is distributed over all the Gulf and the small sized ones are found in shallow water areas. Frozen cuttlefish is the main export product.

Swimming crab

The blue swimming crab (*Portunus pelagicus*) is one of the swimming crabs found in Thailand. The main fishing gear is swimming crab gill net, used along the coastline, especially in the area close to the mouth of rivers or where the bottom is muddy. Trawl nets and pushnets also catch the swimming crab. At present the price of this crab is very high and it is in demand by consumers.

2.2.4 Fish landing sites and trends in annual fisheries landings

The fish landing sites in Thailand are approximately 657, which include 14 fishing ports of the Fish Marketing Organization (FMO) and 643 private fishing ports. The trend in annual fisheries

landings at major landing sites has been an increase, from 2 099 986 t in 1983 to 3 150 233 t in 1994.

3. INTERNATIONAL RELATIONS IN FISHERIES RESOURCES MANAGEMENT

For international relations policy, DOF recognizes that regional cooperation and bilateral cooperation among neighbouring countries are needed to solve the regional issues for sustainable fisheries development and to contribute to acceleration of economic and technical development. Some of the policies areas are:

- joint research to find areas for fishing within ASEAN waters and conduct biological and ecological studies including the variation and definition in terms of species, gear, fleet areas, units of exploitation, assessment and management;
- exploration of the shared stocks at boundaries between the ASEAN countries in terms of quota or other methods; and
- establish joint ventures among the ASEAN countries, including fishing facilities and infrastructure.

To achieve these policies, DOF has worked closely with the neighbouring countries, fishing nations and interested organizations, at two levels: cooperation with international and regional organizations; and bilateral cooperation.

3.1 Cooperation with International and Regional Organizations

DOF is now working closely with many international organizations, including:

- Southeast Asian Fisheries Development Center (SEAFDEC)
- Network of Aquaculture Centres in Asia and Pacific (NACA)
- Bay of Bengal Programme (BOBP)
- Indian Ocean Tuna Commission (IOTC)
- Asian-Pacific Fisheries Commission (APFIC)
- Marketing Information and Advisory Services for Fish Products in the Asia/Pacific Region (INFOFISH)
- Association of Southeast-Asian Nations (ASEAN)
- International Centre for Living Aquatic Resources Management (ICLARM)
- International Development Research Centre (IDRC)
- International Network on Genetics in Aquaculture (INGA)
- Asia-Pacific Economic Cooperation (APEC)
- Food and Agriculture Organization of the United Nations (FAO)

3.2 Bilateral cooperation

DOF realizes that the development of relations on the basis of mutual respect and trust is highly necessary. Therefore joint efforts to develop appropriate technology for the improvement of fisheries activities as well as to promote investment in fishery industry should be strengthened. Developing countries inevitably need advanced technology, coupled with great amount of capital and well-trained manpower for their sustainable fisheries development. The technology transfer

element could be obtained through the joint efforts of various institutions in those countries. In this connection, DOF has made proposals for grant-aid projects, cooperative research projects, technical assistance projects, study development projects, etc. The following projects are some of the cooperation programme that DOF has initiated with some countries and institutions with the objective of enhancing technical and economic development.

- Memorandum of Understanding (MOU) between Thailand and the Philippines in 1997. The two countries agreed to strengthen cooperation in the following fields:
 - Technical Exchange on Prawn Disease Prevention and Control
 - Technical Exchange on Fish Processing Technology
 - Joint Fishing Venture
- Agreement on Bilateral Cooperation in Fisheries between Thailand and Mexico in 1992, with the objective of strengthening economic relations and promoting scientific and technical cooperation as well as to support investment and co-investment in fisheries matters, especially in the field of aquaculture, tuna capture and canned tuna industry.
- MOU on Cooperation in Agriculture between Thailand and the People's Republic of China in 1997, to promote scientific and technical cooperation in the field of agriculture on the basis of equality and mutual benefit.
- Agreement on Fisheries Cooperation between Peru and Thailand, to further develop economic cooperation relations and promote scientific and technological cooperation as well as to support investment in fisheries matters, especially in the field of aquaculture and deep-sea fishing.

3.2.1 Cooperation in Fisheries between Thailand and Indonesia

Pursuant to the Third Ministerial Meeting on Agriculture Cooperation between Thailand and Indonesia in 1996, both sides agreed that cooperation in the field of fisheries should be promoted in the following areas:

- Conducting joint fishing trials on highly migratory fish and the utilization of Fish Aggregating Devices (FAD) in tuna purse seining.
- Exchange of experts in hatchery construction (coastal fish), fish processing, fish feed and fish disease.
- Cooperation in trade and marketing of fishery products by means of exchange of information and experts.

To achieve some of these areas of cooperation, DOF dispatched the research vessel *MV Mahidol* to undertake fishing trials to the north of Irian Jaya, west Pacific Ocean, within the EEZ of Indonesia about 50 miles beyond the territorial waters, as requested by Indonesia. Scientists of both sides participated in the operation, from 16 July to 13 September 1997.

The result of fishing trials conducted over 51 days yielded a total tuna catch of 153 t with an average catch rate of 10 t/haul and 3 t/working day. Most of the tuna were caught from floating logs and fixed payaos, and comprised skipjack tuna (63%), yellowfin tuna (28%), bigeye tuna (6%), and other (2%). The most productive tuna fishing grounds were found to the north and northeast of Biak.

As agreed by both parties before starting the project, if the result of the fishing trial proved successful, the Thai fishing fleet would be given high priority to fish in Indonesian waters. As for fishing cooperation, it is estimated that about 1 000 Thai fishing vessels would operate in

Indonesian waters on the basis of mutual benefit for private sectors of both sides because Indonesia has large fishing grounds to be exploited. The MOU between Thailand and Indonesia would provide the conditions to facilitate private sector operators to operate their fishing successfully.

3.2.2 DOF/DANIDA Scientific Cooperation programme

The five-year programme started in 1995, sponsored by the Danish Government through DANIDA. This programme provides technical assistance for the Thai counterparts, such as fellowships to undertake study and training programmes in Denmark. It also provides a Chief Technical Adviser (CTA), Technical Advisers (TAs), scientists, research materials and equipment as well as the appropriate technical and administrative support. This also includes the supply of a Marine Research Vessel for Phuket Marine Biological Centre. The objectives of this project are to study the marine biology in the tropical area, the ecology in the estuarine areas, biodiversity and the impact of heavy metals, etc.

3.2.3 Pilot project for marine ecosystem protection and eco-sustainable development in Adang Archipelago, Tarutao Marine National Park, Andaman Sea

This project is implemented by Africa 70, in collaboration with DOF and with financial support from the European Union. It is a 28-month project with the objective of restoring and preserving the abundance and biodiversity of marine life and resources in Thai waters in a framework of sustainable management of fisheries and aquaculture activities of coastal communities. This project also supports DOF capability to define and establish the terms of implementation of a comprehensive management plan for marine life biodiversity conservation and sustainable socio-economic development of small-scale fisheries communities in Adang Archipelago in Satun Province.

4. ACTIVITIES ON FISHERIES MONITORING

4.1 Role of Marine Fisheries Division

The Marine Fisheries Division has four main tasks:

- To do research regarding marine resources, fisheries and the environment, to provide management measures for sustainable development of the marine resources and environment, including rehabilitation of coastal fisheries resources and development of small-scale fisheries.
- To conduct experiments and develop non-destructive fishing gears and appropriate fishing gears compatible with the present situation of fisheries.
- To cooperate with outside organizations and the private sector in fisheries researches.
- To provide fisheries information as requested by the private sector, students, researchers from other institutions, universities, etc.

The Marine Fisheries Division has divided its research areas as follows:

- Marine Resources Survey** The major activities concern taxonomy of marine animals and aquatic plants, fish stock abundance (CPUE), biomass estimation, spatial distribution,

mapping of species composition and species distribution, including estimation of catching capacity.

- **Population Analysis and Stock Assessment** This section is concerned with population analysis at the species level, changes in population structures, assessment of the resources both in group of species and single species, analysis of the status of the resources and fisheries, fishing grounds, including evaluation changes in fisheries affecting the resources. The results are used in combination with other biological information to propose management measures for the sustainable exploitation of fisheries.
- **Marine Life History Research** The major activities of this section is identification of fish eggs, larvae and juveniles related to spatial distribution assessments, studies on recruitment, growth, maturity, life history, spawning grounds and seasons, fecundity, food and feeding behaviour, food chain, and includes parasites and diseases of important marine species.
- **Marine Environment Research** The major tasks of this section concern analysis of the primary production of the sea, studies on phytoplankton and zooplankton, and spatial distribution, culturing of unicellular marine algae and plankton species (including those responsible for *red tides* in the Gulf of Thailand), benthos communities, bottom topography, chemical and physical properties of seawater, marine population, heavy metal residues, and effects of changing environment on marine life. Routine data collection is made by using a research vessel and the results are used to provide information for environmental protection, fisheries and aquaculture, including export fish processing products.
- **Fishing Ground Improvement and Development** This section is responsible for developing and increasing the income of small-scale fishermen, assessing the coastal resources and fisheries situation, improving fishing grounds, providing information on type and site of artificial reefs installation, and installing the artificial reefs. The purposes of artificial reefs installation are to enhance coastal resources by releasing the native aquatic species into the artificial reefs, and to reduce conflicts between commercial fishing and small-scale fishing because the artificial reefs obstruct nearshore trawl fishing. This section also provides fishery facilities and fishing ports for small-scale fisheries, and establishes fishermen's group in order to introduce fishing rights systems for community-based fishery management.
- **Fishing Gear and Fishing Boat Development** The major tasks of this section are to survey, analyse and design appropriate fishing boats and gear for sustainable fishery development. This section is also responsible for designing standard research vessels and fishery patrol boats. It also provides extension and training programme for designing, repairing and inspecting fishing boats.

4.2 Additional means for coastal fisheries management

4.2.1 Artificial reef installation

Artificial reef installations can be divided by size into 3 categories: small, medium or large. The small-sized artificial reefs (0.5 km²) are installed in front of fishing villages; the medium-sized artificial reefs (up to 25 km²) are installed for a group of fishing villages, and the large-sized artificial reefs are installed for provincial needs. The artificial reefs installation project is planned for five years (1997-2001), covering an area in the Gulf of Thailand and the Andaman Sea. The

plan calls for the annual installation of small-sized artificial reefs at 110 sites, medium-sized artificial reefs at 22 sites and large-sized artificial reefs at 5 sites. The sites will be decided by the Department of Fisheries on the basis of requests to the provincial fisheries officers by the fishermen through their leader or the committee of a fishing village. The budget will be about 314 million baht per year.

The objectives of the artificial reef installation programme are to:

- provide fish shelters, spawning and feeding areas;
- enhance fishery resources and help improving the income of fishermen because fishermen can fish at the artificial reef close to their village, reducing fuel costs;
- use the artificial reefs as an obstacle to trawlers and help protect the areas;
- release fish fry and shrimp fry into the artificial reefs areas for biodiversity enhancement; and
- encourage the fishermen to protect and maintain their artificial reefs and encourage the fishermen to use non destructive fishing gear.

The installation of artificial reefs also serves as a first step in establishing a fishing rights system based on community-based management.

4.2.2 Sea ranching

Sea ranching will be implemented in conjunction with the artificial reefs installation project. One year after installing an artificial reef, fry of local species of shrimp and fish will be released into the artificial reef area. Typical species are white shrimp, red snapper, grouper and swimming crab. In each year of the project, about 2 million shrimp fry will be released at each site.

4.2.3 Community-based management

The community-based management project was started in 1996. Two fishing villages, in Prachuab Kiri Khan and Phang-Nga Provinces, were selected pilot sites. The first step was to train the fishermen to understand the concepts and practices of fishing rights systems, fishing quotas, fishing zones, resources conservation, community-based management, etc. This project plans to train fishermen in all coastal provinces of both the Gulf of Thailand and the Andaman Sea. The training programme and the establishment of community-based management are requested by the fishing villages in consultation with the provincial fisheries officer. Currently this project has budget shortfall problems.

The ultimate goals of the project are to increase the sense of responsibility of fishermen so as to conserve and rehabilitate their fishery resources and marine environment on their own, and to minimize conflicts between commercial and small-scale fishermen. Owing to the limited fishery resources and their overexploited nature, this project is viewed as an appropriate approach for the present situation.

4.2.4 Seagrass plantations

Seagrass beds are found in many areas of Thai waters, both in the Gulf of Thailand and in the Andaman Sea. Seagrass beds in Trang Province are protected by law because there is a last school of Dugong living in that area and the seagrass beds provide food and shelter for them. In some parts of Thai waters the DOF has launched a seagrass plantation programme to help rehabilitate and enhance coastal and marine living resources.

4.2.5 Marine sanctuaries

Apart from protecting seagrass areas, the DOF also protects coral reefs and other marine living species, such as giant clam (*Tridacna* sp.). The Fisheries Act, B.E. 2490 (1947) and subsequent amendments authorizes the DOF to proclaim sanctuary areas protecting such marine living species.

In addition, the Wildlife Reservation and Protection Act, B.E. 2535 (1992), also included coral species and giant clam in the list of protected species for which the taking, killing, trading, possessing, breeding, exporting or importing is prohibited.

5. THAI FISHING REGULATIONS AND CONTROL

Thailand emerged in the mid-1970s as a major distant-water fishing nation (DWFN) in Southeast Asia at the very time when the introduction of 200 nautical mile EEZs made distant-water fleets difficult to maintain. All major coastal states in Southeast Asia have declared such EEZs: Thailand extended its maritime jurisdiction February, 1981. The introduction of extended offshore zones left Thailand as a "zone-locked state," i.e., with no direct access to the high seas except through the waters of neighbouring states. For the Thai fishing fleet, the extension of zones meant that approximately 300 000 km² of fishing grounds formerly used by Thai boats were now within the national jurisdiction of neighbouring states. It also made fisheries relations with neighbours a major concern for the government and the fishing industry.

The role of the DOF Division of Law and Treaties in relation to fisheries MCS within Thai waters include:

- training both fishery authorities and Thai fishermen as appropriate concerning fisheries laws and regulations. In particular, for Thai fishermen, the focus is on the concept of sustainable conservation and exploitation of natural living resources within Thai waters;
- studying and analysing fisheries laws and regulations in order to ensure that they remain appropriate for the current fisheries situation; and
- providing advice to government authorities working in various offices, particularly the fishery authorities who mainly work in the area of fishery MCS within Thai waters.

5.1 Thai fisheries legislation

Thailand enacted the *Fisheries Act* in 1947, which has 73 articles dealing with fishing areas, licences, fishery statistics, fisheries control, prosecution of offenders, and also fish culture. Some of the Sections of this Act have been amended by the *Fisheries Act* No. 2 of 1953, and a second amendment was made by the *Fisheries Act* No. 3 of 1985.

There are certain restrictions on fishing methods. For example, it is illegal to use a mesh of less than 2 cm bar size; the use of a trawl net is absolutely banned in fresh waters, and its use in inshore areas is prohibited up to a distance of 3 km from the tidal zone. Furthermore, traditional use of toxins and explosives are banned because they indiscriminately kill fish regardless of species and size. Very stiff penalties are attached to this practice.

Prevention of illegal fishing in neighbouring states' waters by Thai fishermen is covered by the *Fisheries Act* No.3 of 1985, whereby owners of fishing vessels who order or allow their crews to illegally fish within foreign waters will be held responsible for repatriating the crews of those vessels by paying any fine levied. At the same time, Section 64*bis* specifies that owners of these fishing vessels who do not follow the law's Directive are liable to a fine of 200 000 baht or imprisonment for a maximum of five years. Thailand enacted these new provisions to increase

penalties, in order to force Thai fishermen to stop fishing illegally in neighbouring states' EEZs. This enforcement will be one means to reduce fisheries conflicts between Thailand and the authorities of Malaysia and Indonesia.

5.2 Fisheries management: law enforcement and control

Section 6 of Chapter 1 of the *Fisheries Act* of 1947 states that fisheries are divided into four categories, namely (1) Preservation fisheries; (2) Leasable fisheries; (3) Reserved fisheries; and (4) Public fisheries.

Moreover, Section 7 states that “the Provincial Council, with the approval of the Minister, is empowered to make notification determining fisheries within their province to be in the category of preservation fisheries, leasable fisheries or reserved fisheries. Fisheries which are not included in the notification under paragraph one shall be regarded as public fisheries.”

The Minister of Agriculture and Cooperatives, or the Provincial Governors in their jurisdiction and with the approval of the Minister, is empowered to determine, through implementing Section 32 of the *Fisheries Act* of 1947:

- the size of mesh and dimension of every kind of fishing implement, and size, kind, number and parts of any fishing implements permitted in fisheries;
- fishing implements which are absolutely prohibited for use in fisheries;
- the distance between each stationary gear;
- the methods of using every kind of fishing implement;
- the spawning and breeding seasons, and fishing implement and methods of fishing in any fisheries during the said seasons;
- the kind, size and maximum number of aquatic animals the fishing of which is permissible; and
- certain kinds of aquatic animals the fishing of which is absolutely forbidden.

Ministerial Rules and Regulations concerning the conservation and management of marine living resources are considered in more detail below.

5.2.1 Prohibition of the use of certain types of fishing gear during the spawning and breeding seasons of some commercial important species

Ministerial Regulation of 28 November 1984

A conservation area of approximately 26 400 km² was declared in the Gulf of Thailand to protect several commercially exploited species of demersal and pelagic fish during their spawning and breeding seasons, from 15 February to 15 May each year. This fishery regulation prohibits fishing by all types and sizes of trawlers (with the exception of beam trawlers), all types of purse seiners (except for anchovy purse seiners operating in daylight from February 15 to March 31 only) and gill nets with mesh size less than 4.7 cm. The Regulations apply along the coastline of Prachuap Khirikhan, Chumphon and Surat Thani provinces, as well as Khanom district in Nakhon Sri Thammarat province in the Gulf of Thailand.

Ministerial Regulation of 11 April 1985

Conservation measures for protecting the breeding species in their spawning and nursery grounds were extended to the Andaman Sea, and an area of approximately 1 800 km² at Phangnga and Krabi was declared as a zone of conservation through selectively controlled fishing by closed seasons and/or prohibition of selected fishing gear during 15 April to 15 June each year. The same rules concerning the types of prohibited fishing gears as applied in the Gulf of Thailand were extended to the conservation zone in the Andaman Sea as well.

5.2.2 Prohibition of certain types of fishing gear in some areas*Ministerial Regulation of 20 July 1972*

This regulation prohibits fishing by trawlers and pushnets within a distance of 3 km from the shoreline and within a perimeter of 400 m of any stationary fishing gear in the Gulf of Thailand. This regulation serves the purpose of maintaining the productivity of these nearshore waters as the catches from these areas were found to have dropped below their potential yield. Furthermore, 80% of the total catch consisted of small fish, at least half of which were the juveniles of economically important species.

Ministerial Regulation of 18 February 1974

Use of any kind of shellfish rack within a distance of 3 km from the shoreline was prohibited along the entire coastline of Thailand, as this type of fishing destroyed the nursery grounds of young shellfish, as reflected in the drastic drop in shellfish catch per unit effort.

Ministerial Regulation of 1 August 1979

This regulation prohibits fishing operations using all types of trawls and pushnets closer than 3 km from the shoreline and 400 m from any stationary fishing gear in the Andaman Sea. This is essentially an extension of the similar Ministerial Regulation for the Gulf of Thailand.

5.2.3 Protected areas*Ministerial Regulations of 27 February 1989 and 15 May 1989*

These regulations established protected areas for the conservation of coral reefs around Khai, Charakhay, Thalao, Khalok and Hin Phae Islands off the coast of Chumphon province in the Gulf of Thailand, and coral reefs at Patong Bay of Phuket province along the Andaman Sea coast.

Ministerial Regulation of 9 May 1991

A marine turtle nesting area of approximately 1.6 km² at Kra Island off Trat province in the Gulf of Thailand was established as a protected area to shelter the turtles during the breeding season.

5.2.4 Protection of endangered and threatened species*Ministerial Regulations of 14 April 1949, 19 November 1980, 11 August 1981 and 15 October 1981*

These regulations prohibit the catching of sea turtles, collection of their eggs or export of sea turtle shells in a processed or unprocessed form. The conservation measures became essential to protect the dwindling populations from further depletion.

Ministerial Regulation of 9 August 1961

This regulation prohibits catching dugong in the Gulf of Thailand and Andaman Sea, as this species was fast becoming endangered in Thai waters.

Ministerial Notification of 18 June 1990 regarding prohibition of fishing any dolphin

This notification states that “no person shall fish any dolphin from the sea of all coastal provinces without receiving written permission from the Director-General or except any fishing activities done by the authority assigned by the Director-General.”

5.2.5 Prohibition on use of poisons and stupefying chemicals, explosives and electric stunning

Fishing methods using any poisons and stupefying chemicals, explosives or electric stunning are very dangerous means of fishing natural aquatic animals because they wipe out all organisms in the vicinity, including eggs, fingerlings and juveniles. Thus, Sections 19 and 20 of the *Fisheries Act* of 1947 regulate that no person shall do any act stupefying the aquatic animals in fisheries, or lay therein poison or any substance dangerous to aquatic animals, and that no person shall use explosives in fisheries except for scientific purposes and after permission has been obtained from the Minister of Agriculture and Cooperatives.

5.2.6 Prohibition and restrictions on certain types and sizes of fishing gears

Ministerial Regulation of 14 February 1983

The night-time operation of purse seine nets using light lures and a mesh size of less than 2.5 cm is forbidden in the Gulf of Thailand, as the luring lamps are found to attract a higher percentage of small fish in comparison with traditional fishing methods.

Ministerial Regulation of 5 November 1981

A minimum mesh size limit of 3.2 cm was set for all types of fishing gear using light lures to catch squids in the Gulf of Thailand, as the luring light was found to attract an extremely high quantity of small squids and the total annual catch of squids from the Gulf had shown a clearly discernible decrease in recent years.

6. ACTIVITIES ON FISHERIES Surveillance

6.1 Role of the Fishery Resources Conservation Division

The Fishery Resources Conservation Division is responsible for formulating fishery conservation policies and measures for both inland and marine fisheries, drafting the fisheries regulations, implementing fishery conservation policies and measures, and enforcing the fisheries laws and regulations. The Division has two branches for fisheries monitoring, surveillance and enforcement, namely the Marine Fisheries Patrol Sub-Division, and the Inland Fisheries Patrol Sub-Division. The Inland Fisheries Patrol Sub-Division is responsible for patrolling and enforcing fisheries laws and regulations in inland waters, such as rivers, canals, reservoirs and lakes, while the Marine Fisheries Patrol Sub-Division is responsible for patrolling and enforcing fisheries laws and regulations in coastal and sea areas of both the Gulf of Thailand and the Andaman Sea.

6.2 Number and size of fisheries patrol

(i) Inland Fisheries Patrol Sub-Division

- Number of stations: 21
- Number of staff: 208
- Number of patrol boats: 86, comprising
 - length 5-6 m: 64
 - length 10 m: 22

(ii) Marine Fisheries Patrol Sub-Division

- Number of stations: 9
- Number of staff: 320
- Number of patrol boats: 80, comprising
 - length 6-10 m: 26
 - length 10-15 m: 13
 - length 15-18 m: 2
 - length 18-24 m: 21
 - length 24-30 m: 3
 - length over >30 m: 3
 - outboard-engined craft: 12

6.3 Record of performance

Both Sub-Divisions are active in MCS. However, it should be noted that inland fisheries in Thailand are operated by small-scale fishermen on a subsistence basis, whereas coastal and marine fisheries involve both small-scale and commercial fishermen. Therefore law enforcement in inland fisheries is quite lax compared to that for commercial fisheries in coastal and marine areas. This is also because inland fishermen basically use non-destructive fishing gears, whereas coastal and marine fishermen generally wish to use more destructive fishing gears. Overall, inland fishermen contravene less, as shown by the record: in 1997, violations of fishery laws by inland fishermen were 570 offences by 503 offenders, while coastal and marine fishermen violated the fishery laws in 751 cases, with 2 847 offenders.

6.4 Main Task Force for MCS

Basically, the coastal and marine fisheries in Thailand generate much more serious problems than do inland fisheries. These problems include the depletion of fish stocks, overfishing, the use of destructive fishing gears, conflicts between many resources users, deterioration of coastal and marine environment, pollution, etc. Therefore the DOF has to place more emphasis on coastal and marine fisheries. Three key regulations are given high priority in coastal areas, namely prohibition of the use of trawl or pushnet with motorized fishing boat within 3 km of the shore; ensuring respect for the areas closed for three months during the spawning season of Indo-Pacific Mackerel in the Gulf of Thailand, and similarly the closed season in the Andaman Sea. The fisheries patrol boats have to patrol and monitor the 3 km line along the coasts of Thailand all year round in order to deter trawlers and pushnetters from violating the regulation. The area inshore of the 3 km line is reserved for small-scale fishermen.

The areas closed for three months annually in the Gulf of Thailand during the spawning season of the Indo-Pacific Mackerel and in the Andaman Sea for other species require special attention. Some types of fishing gears are prohibited, such as otter-board and pair trawls, purse seines, and Chinese purse seines with mesh less than 4.7 cm. During the closed season the DOF establishes a special task force to monitor and enforce the law strictly. Apart from using patrol boats, air craft are also used for MCS, in addition to the use of other technology and equipment such as radar, satellite system, etc.

6.5 Other measures for compliance

The DOF realizes that monitoring and surveillance are costly due to the large costs involved in building patrol boats, purchasing fuel, hiring staff, etc. Therefore other measures have been sought to encourage the fishermen to comply with the fishery laws and regulations. These have included campaigns aimed at fishermen, to increase public awareness by providing information regarding fisheries conservation and management, fisheries laws, regulations and enforcement to fishermen and their family members; establishing voluntary groups to help conserve fishery resources; and training student groups in fisheries conservation and management. It is expected that these measures would help increase the awareness of Thai fishermen regarding responsible fisheries.

6.6 Other activities

The DOF also undertakes other activities to help fishermen, such as providing the rescue boats to help fishermen when natural disasters occur, and providing special boats to monitor the quality of the coastal and marine environment by analysing the quality of sea water regularly, including monitoring for heavy metals which may accumulate in sea water or the tissues of shellfish or other coastal living resources.

7. CONCLUSIONS

The problems of coastal and marine fisheries in Thailand lie in the depletion of fish stocks, the use of destructive fishing gears, overfishing, excess fishing fleet capacity, conflicts between many resources users, ignorance, violations of the laws and regulations by fishermen, deterioration of the coastal and marine environments, pollution, etc. In this regard, the Thai government has attempted to resolve these problems for many decades without success. Certainly, there are many reasons to explain the failures, such as the nature of common property in fishery resources, lack of strict implementation of a limited entry policy and other policies, shortage of manpower and equipment to enforce the laws, lack of coordination between the government agencies concerned (e.g., Harbour Department), etc.

Regarding law enforcement, during the past decade the government has put more efforts into this by allocating more budget for MCS, but nevertheless there are still some fishermen violating the laws. Therefore it is believed that MCS alone does not elicit compliance from fishermen. Other measures are needed to help increase compliance from fishermen, in combination with MCS activities, such as establishing community-based fishery management, providing information to increase awareness among fishermen and their family members of fishery conservation and responsible fisheries, establishing voluntary groups, providing training

programmes for students, etc. It is expected that these measures will help encourage fishermen to operate more responsibly in the long run.