TDT Gazette

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The SEAFDEC Training Department in Retrospect Through 35 years of Fisheries Development

The Training Department Today Gazette

The Training Department Today Gazette is a special publication published by the SEAFDEC Training Department to promote its activities towards sustainable fisheries in the ASEAN Region.

SEAFDEC Training Department
P.O.Box 97, Phrasamutchedi
Samut Prakan 10290, Thailand

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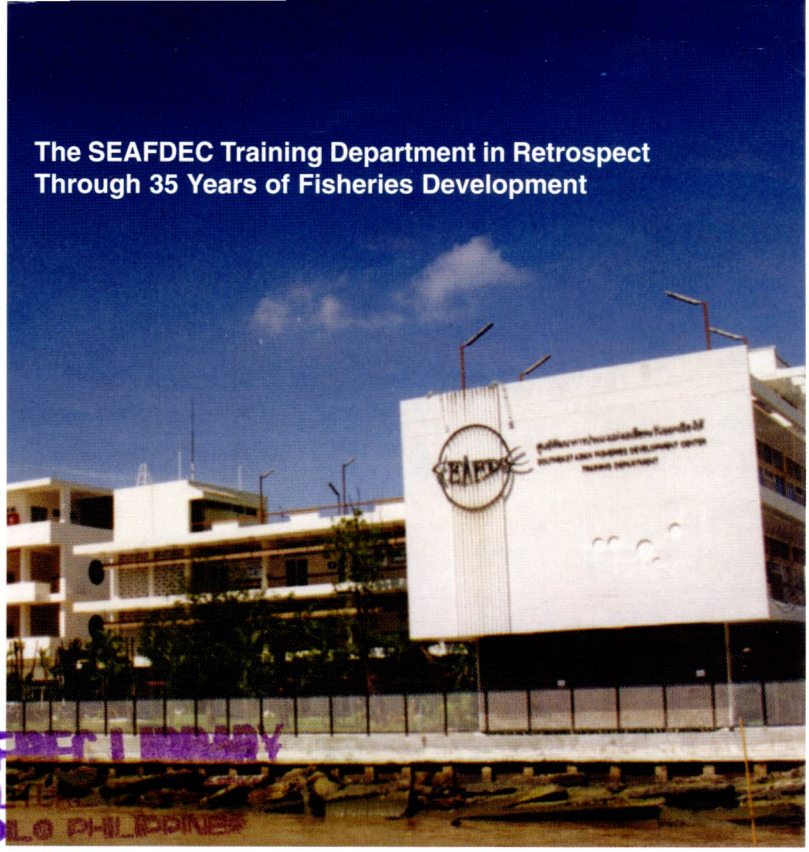

The Training Department Today Gazette

Publication of SEAFDEC Training Department

WHAT IS SEAFDEC TRAINING DEPARTMENT?

SEAFDEC Training Department is a Technical Department of the Southeast Asian Fisheries Development Center. It was established in 1968 in Samut Prakan, Thailand, to develop marine fisheries technologies for the better use of marine resources.

OUR MISSION

Development of marine capture fisheries and sustainable coastal fisheries is for the benefit of member countries through manpower development, research, information, and the promotion of sustainable fisheries.

MEMBERSHIP

SEAFDEC membership is open to all Southeast Asian Countries. The Member Countries of SEAFDEC at present are Brunei Darussalam, Cambodia, Indonesia, Japan, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

TRAINING DEPARTMENT

P.O.Box 97, Phrasamutchedi
Samut Prakan 10290, Thailand
Tel : (662) 4256100
Fax : (662) 4256110, 4256111
E-mail : td@seafdec.org
http://td.seafdec.org

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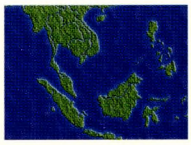

New Horizons

Research & Development

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FOREWORD

It falls to me as the Secretary-General incumbent at SEAFDEC to recognize the passing of 35 years in the annals of the organization, and in recognition of the passage of time, this record of history, present thinking and ambitions has been compiled. Although SEAFDEC as an organization was conceived in 1967, it is only in very recent years that the plight of the fisheries in Southeast Asia has achieved public attention and has become an emotive and divisive issue with much greater political significance. Thus it is that SEAFDEC has to a large degree changed its approach while its mandate remains largely the same. This change has particular influence on the Training Department, which this compilation of documents reflects.

The name "Training Department" is to some degree misleading, as the activities of the department are much greater and far-reaching than the name suggests. Certainly, the department does conduct training courses, but over the years the necessity for these has declined. In comparison to the investigative, research and coastal fisheries management consultancy and assistance work carried out, actual training pales into insignificance today. As the tenor and tempo of fisheries development increases, the need for other and new training courses will increase, but these may well be carried out in the more remote areas rather than in the Department buildings. Another vitally important function of TD is the dissemination of information and the provision of facilities and media materials to carry the message of fisheries sustainability and environmental concerns, as the political climate changes toward such protection and influence, so this work will increase in quantity and stature.

On the occasion of this starting TD today and the 35-year anniversary, I wish to record my personal thanks to all the staff who have contributed to the activities of the Training Department and for the support that I have enjoyed personally.

Panu Tavarutmaneegul
SEAFDEC Secretary-General

HOW IT ALL BEGAN

Immediately after the Second World War, the fishing operations in Southeast Asia were limited to what were then the territorial seas limits of national sovereignty, the twelve nautical miles from shore zone. For the most part, fishing vessels did not have engines and the gear used was traditional and by today's standards was primitive. The fishing effort in those days was barely enough to meet the national demands. Even at that time a lucrative market in fish exports had been perceived and in the late 1950s many Southeast Asian nations started to increase their fishing effort. By the late 1950s, the trawl was introduced into Thailand from the West with a resulting dramatic increase in landed catch. Heavy investment in gear and boats was the natural outcome because the seas were considered as an inexhaustible source of wealth, food and having a vast fish export potential. It was also perceived that to tap the huge marine resources potential, trained men would be needed, such that in 1967 the idea of the Southeast Asian Fisheries Development Center was conceived. As a logical extension of this, the Training Department was introduced and came into operation in 1970 to train fisheries personnel in marine fishing technology and navigation in a training course of one-year duration.

During the 35 years since its establishment in 1968 the Training Department, as with SEAFDEC in general, has gone through many variations in operation to keep pace with the changes that have occurred in industrial and coastal small-scale fishing throughout the Southeast Asian region. As the global recognition of the decline in fishery resources has become more sharply defined, so the recognition of SEAFDEC has

The SEAFDEC Training Department in Retrospect Through 35 Years of Fisheries Development

Apiwat Thamakasorn and Rupert Elstow

increased such that all member nations of ASEAN, except for the Lao PDR that has only minimal fisheries activities, have joined SEAFDEC as members of the family. Thus it is that SEAFDEC and the Training Department serves the fishery needs of 10 SEAFDEC member countries.

From the beginning, it was seen that fisheries development required fisheries training. Over the last 35 years the objective of the SEAFDEC Training Department (TD) has been to develop modern fishery technologies for the better use of marine resources. The mandate of training in such fisheries practices has not changed dramatically, however, the methods and emphases of the training have been modified to keep abreast of the demands made upon the natural fishery stocks by the extended SEAFDEC family. As the demand for fish has grown so the technology to catch fish has developed and become more and more sophisticated to the point of evident over-exploitation of the natural stock. The consumption of fish is a source of high-grade, but cheap protein for the people, however, as stocks have become reduced and more difficult to catch so the economic return for the fishermen has become a serious problem leading to greater fishing effort to increase their economic return.

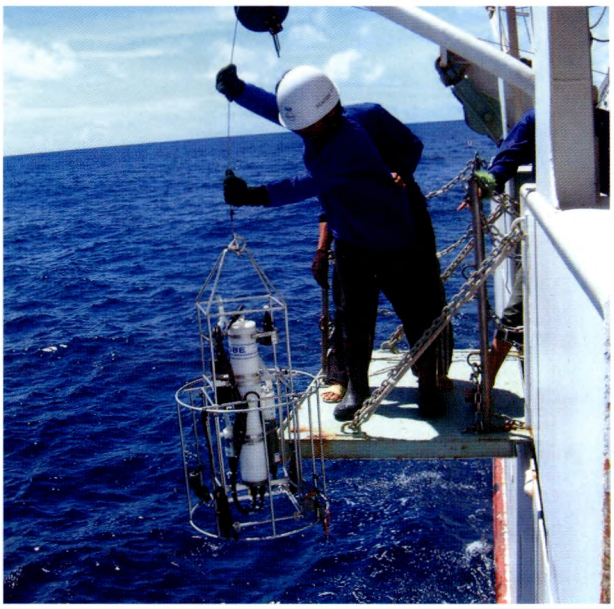
While TD was conceived in 1968, other departments pursuing different aspects of fisheries were inaugurated. The Marine Fisheries Research Department MFRD in Singapore also came into being in 1968 and its original mandate was marine fisheries research until the early 1980s when it changed its emphasis to that of Fisheries Post Harvest Technology. The foundation of an Aquaculture Department, now AQD, in the

Philippines was agreed by the SEAFDEC Council of Directors in 1969, but actually commenced operations in July 1973. The last department to be inaugurated was MFRDMD or the Marine Fishery Resources Development and Management Department in Malaysia, which commenced operation in 1992. Their work focuses on the provision of assistance to member countries in the development and management of marine resources.

THE WORK OF THE TRAINING DEPARTMENT

The first training course offered in 1970 was a one-year course on marine fishing and navigation, which included science and English language studies. This course was repeated in 1971. The third training course offered in 1972 was a two-year course. It soon became evident that training courses of this duration were difficult for employers to accept and there was difficulty in selecting suitable candidates to undertake the courses. Subsequent courses were tailored by reducing the duration to 18 months. At the same time that training courses were offered the Training Department inaugurated what is now the Information & Extension Division. It started with the Library and Technical Information dissemination through its publications, over the years more than 60 have been published in the form of research papers, monographs, statistics bulletins and departmental annual reports.

In 1978, MFRD in Singapore transferred their marine research activities to TD, such research placed emphases on oceanography, fishing gear technology, fisheries resources assessment, statistics and socio-economics. Work was carried out, even in the early 1980s to design shrimp trawls that released small and undersized stock and fish. Apart from training, TD has emphasized fishing gear design and new technology and the department is now a powerhouse for change to responsible fishing technologies in the region.



Over the years, the Training Department has continued training programs for fishers, fishery officers, extension workers, marine and refrigeration engineers, navigators, statisticians and the broad range of disciplines involved in regional fisheries. As better teaching methods have evolved, the duration of the training courses has reduced and become more intensive. The use of safety and advanced electronic equipment including RADAR, side-scan SONAR, fish finding devices and all the modern accoutrements of fishing have been taught.

Our most distinguished visitors

Without doubt the visit, during July of 1999, by Their Imperial Highnesses the Prince and Princess Akishino of Japan was a highlight of great significance. Their visit to Thailand was at the invitation of the Government of Thailand on the occasion of the 72nd anniversary of His Majesty the King Bhumipol Aduldej. The Prince and Princess graciously took the time out of their busy schedules to visit the Training Department. This was not their only connection with SEAFDEC and the Training Department, in 1992, Their Imperial Highnesses presided over the launch and dedication of M.V. SEAFDEC the research and training vessel.

Left: *The TD Library, without this store of knowledge we should be lesser beings.*
Top: *The quest for sea-truth through research is constant.*
Top (next page): *Their Imperial Highnesses, Prince and Princess Akishino record their visit.*
Right: *M.V. SEAFDEC, the technology and research vehicle.*
Top right: *The dormitory, a home from home.*
The new Fishing Workshop.
The simulator takes the guesswork out of fishing without seasickness.

The Secretary-General presented Their Highnesses with a short report and a token of deep appreciation before they signed the special guest book.

TD facilities and research and training vessels.

From the very beginning SEAFDEC has had the practical aspects of fisheries very much in mind and has been lucky with its offices, dormitory and workshops. Sited on the edge of the urban sprawl that is Bangkok and on the Western bank of the Chao Phrya River, near the mouth. TD is ideally situated for berthing its research and training vessels and provides a model environment for the trainees attending the courses. The first vessel acquired was M.V. Paknam, a stern trawler donated by the Japanese Government for TD to carry out its shipboard training programs, she served valiantly, if not adequately, until she was replaced by M.V. SEAFDEC in 1993, again through the great generosity of the Government of Japan. This elegant and excellently equipped vessel serves as both a training ship and a platform for detailed and advanced oceanographic and fisheries research. At 1,200 tons this vessel is the mainstay of the SEAFDEC fleet, which is augmented by M.V. Platoo a glass fibre vessel used for inshore research and training. The last of the working vessels is M.V. Plalung a locally built trawler, used by TD for training in Purse Seine deployment. These last two vessels are now becoming quite old and although they have been maintained with loving care they have passed the end of their useful life. It is expected that these two vessels will be replaced by a single vessel of about 200 tons, which will be employed in the drive toward sustainable coastal fisheries and for inshore research, however, she will also be more capable than Platoo and Plalung for work in deeper waters.

The various buildings at TD are very adequate for conducting training courses in both lecture rooms and workshops. Separate from the main building complex are the marine engineering workshops and an in-house printing room. There is a new building, finished in 2002, comprising a new net loft for the design and manufacture of fishing gear, a flume tank for testing gear design in water flow conditions, a research laboratory and the Ship Division. There are also offices for the Research Division

and offices for the embryo, but not yet established coastal fisheries management section. In the main building the Administrative Division is housed together with the Information and Extension Division, the excellently equipped Audio-Visual Section and the Training Division. Also in the main building are the offices for the vital Finance Division and the offices of the Secretary-General and his Deputy. The Library with several thousand technical books, periodicals and journals is sited close to the main building.

There is a dormitory for the trainees including a canteen, fitness room and recreational areas. For ceremonies and celebrations a multi-purpose building is sited in the spacious gardens near the tennis courts.

Among the training aids there is a very high tech fishing simulator that includes state of the art equipment to set up through computer control many situations that can occur in fishing operations.

TRENDS THAT HAVE INFLUENCED THE DEVELOPMENT OF TD

The international trend to allow greater national control over fisheries resources culminated in the implementation of the United Nations Convention on the Law of the Sea initiative, which is the 200 nautical mile " Exclusive Economic Zone". This extension of national sovereignty was recognized as a major development in fisheries. It had the effect of localizing the Training Department efforts to address the coastal fisheries problems and the socio-economic conditions of the fishing communities. Thus, it is that the emphasis of the training courses has changed and while training in responsible fishing technology continues, these have been augmented by training courses for extension officers. In extension training, much attention is being given to socio-economic conditions and the need for an improvement in the standards of living for the fishing communities and the alleviation of poverty.

Another trend that has affected the activities of the Training Department is that close attention is given to national and regional fisheries policy changes with a clear observation on cause and effect. While it is well recognized that fish stocks are in a very depleted state, only in very recent years have national policies taken note with activities, either to devolve national governmental authority to more local control, or that national policies have strengthened, demonstrating a more determined will to manage their fisheries. These conditions have led the Training Department into many collaborative activities with wider international implications and diversified technical skills and knowledge. From the earliest days collaborative work was undertaken with the various regional departments of fisheries, with ESCAP and the Directorate of Fisheries of Vietnam, and this was long before Vietnam became a member nation of SEAFDEC. Other collaborative efforts continued with ICLARM, the FAO/BOBP program and up until today these continue, the latest being work in Indonesia and the Philippines with the FAO/GEF project in conjunction with the Departments of Fisheries in those two countries. These international collaborations are now regularized in Memoranda of Understanding with prominent seats of university learning in Thailand, Japan, Canada and Australia. There is now a very close cooperation and affinity with FAO in Rome. All of these have the tendency to allow the Training Department to adopt a more holistic approach to the difficulties of managing the multi-species environment typical of tropical fisheries. Of particular note in the collaborative field has been the ASEAN-SEAFDEC link through the Fisheries Consultative Group (FCG). This allows SEAFDEC to have a direct voice in the fisheries affairs of the region and to gain an even closer appreciation of the fishers problems and difficulties.

Consonant with the advance in program status, in 1999, the Training Department undertook the drafting of Regional Guidelines that supported the FAO Code of Conduct for Responsible Fishing Operations. The FAO Code is a generic document for fisheries and is applicable both to mono-species and to tropical fisheries environments. Using the technical expertise vested in the department and following the approval given by the Council at the 30th Council Meeting the Regionalization of the Code of Conduct for Responsible Fisheries was completed. An abstract of the process is given here:

The thirtieth SEAFDEC Council meeting fully approved and supported the program for the Regionalization of the Code of Conduct for Responsible Fisheries. In response to the approved policy decision by the Council, SEAFDEC implemented a course of action aimed at achieving a Regionalization of the Code of Conduct for Responsible Fisheries (RCCRF) with the objective of securing sustainable fisheries in the region.

The department identified the "RCCRF Phase1: Responsible Fishing Operations" as falling within our skills, in-house expertise and training mandate and having identified active Fishing Technology Experts within the region the process of achieving an RCCRF started.

By conducting a series of meetings involving, in the initial stage, the identified core-experts, a pre-meeting was held followed by a full consultation of over 50 regional fisheries technology experts and finishing with a post-meeting of the core-experts, a completed set of Regional Guidelines for Responsible Fishing Operations supporting an RCCRF was achieved. The post-meeting also defined and interpreted Plans of Action leading to promoting political acceptance of the Guideline principles and their implementation within the region.

In March 1998, the SEAFDEC Council of Directors at the Thirtieth Meeting of the Council, in Bandar Seri Begawan, Brunei Darussalam produced a **Resolution on the SEAFDEC Strategic Plan** wherein the following extracts particularly highlight the future direction of the Training Department:

- ***Affirming*** that an effective and integrated approach to fisheries with due emphasis on those for coastal fisheries will result in a long-term and significant gain in food supply, income and wealth, as well as in economic growth.

- ***Also affirming*** that the question of fisheries resource sustainability needs to be addressed adequately because Asia still depends heavily on fish as a source of animal protein, and that fisheries development provides a firm guarantee for the continued availability of a dependable food source that must be safely secured.

- ***Recognizing*** that SEAFDEC is ready to play a role as a regional collaborative platform for all its member countries and other Southeast Asian countries

- ***Reaffirming*** that the commitment of SEAFDEC towards closer working relations, collaboration and cooperation with ASEAN for sustainable development.

- ***Also recognizing*** that the multi-discipline approach appears to be most effective in solving the fisheries problems.

Resolve that the following strategies could be used as guides to realize the goal set by the SEAFDEC mandate:

Strategy

- Placing emphasis on regional issues and anticipated external problems.
- Promoting efficient and sustainable uses of fisheries resources.
- Facilitating intra-regional exchanges of expertise and information.
- Strengthening mechanisms for regional collaboration.
- Avoiding duplication of efforts.
- Increasing the visibility of SEAFDEC activities.

A MOST SIGNIFICANT LANDMARK

The greatest single event that has created change in the direction of SEAFDEC with connective effect on the Training Department was the magnificently successful ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: "Fish for the People". The conference was convened in Bangkok in November 2001 and was a collaborative venture between the Association of Southeast Asian Nations (ASEAN) and SEAFDEC in conjunction with the Food and Agriculture Organization of the United Nations (FAO) and having magnificent support from the Government of Japan. The conference was hosted by the Department of Fisheries of Thailand and had the multiple objectives of reviewing the regional situation of fisheries, analyzing the problems to be faced and formulating policies and strategies to achieve the sustainable management of Southeast Asian fisheries. The Millennium Conference covered all aspects of fisheries from aquaculture through deep-sea to international agreements. There were some 800 delegates and participants taking part in

Our effort today is to work on great things together and the rewards are: "Fish for the People" tomorrow.

the conference and their deliberations culminated in several important resolutions and plans of action.

The future planning for the Training Department, planning was encapsulated in the **SEAFDEC 5-year Conference follow-up program.**

The emphases for the Training Department tend away from the training on capture fisheries toward training on coastal fisheries management. However, the implications of the FAO Code of Conduct for Responsible Fisheries are still very much on the future agenda.

The overall SEAFDEC/TD program encompasses the following:

1. Toward Decentralized Management for Sustainable Fisheries in the ASEAN Region
2. Improvement of Fishery Statistical Systems and Mechanisms
3. Responsible Fishing Technologies and Practices
4. Resource Enhancement
5. Identification of Indicators for the Sustainable Development and Management of Capture Fisheries in the ASEAN Region
6. Information Gathering for Capture Inland Fisheries in ASEAN Countries

The TD activities under the 5-year plan are clarified as being in:

- Responsible fisheries technology
- Resource enhancement
- The exploitation of underutilized species
- Statistics as a means of stock assessment
- Coastal fisheries management

In the current work on Responsible Fisheries Technology the emphasis is on selective fisheries and to some extent in conjunction with the protection of endangered species. This work is being conducted in a collaborative atmosphere and features two devices that have the potential of being selective in terms of size of individual fish. The first device designed a couple of years ago was in response to the ban on the import into America of shrimp using gear that offered no protection for turtles. This American derived imposition gave rise to the TED or Turtle Excluder Device. TD improved upon devices designed in Mexico and produced its own TTFD, the acronym standing for the Thai Turtle Free Device. This design is eminently successful and is being demonstrated and implemented in the countries where the by-catch of turtle is prevalent. The TED was followed by a design that intends to solve a much more difficult and complex problem, that of releasing juvenile and immature fish of a targeted species. Unless juveniles and immature fish can be released, the problem of over-exploitation becomes self-perpetuating. Thus, using the vast amount of technical expertise available at TD a device known as a JTED has been created. The JTED, or Juvenile and Trash Excluder Device when installed in a trawl is a mechanical device to separate and release alive, juveniles from the targeted catch The device will also separate out detritus and plastic materials very often found while fishing, particularly in coastal areas and environments. A collaborative project is presently underway under the FAO/GEF project and the Departments of Fisheries in Indonesia and the Philippines to demonstrate and improve the design of such devices.

Under the banner of Resource Enhancement, The Training Department is working collaboratively with the DOF, Thailand, on artificial reefs and habitat improvement for the depleted species in the coastal zones. One purpose of this project is to determine if certain species of fish have a preference for a particular type of artificial reef leading to selective and specific species habitat improvement for recruitment and development.

Apart from fisheries training the only real deep-sea activity being undertaken by TD is an investigation to identify underutilized species. The present targets, there may be others later, are squid and species of deep-sea or neritic

tuna. It is certainly possible that this study will also identify hitherto un-exploited species of edible fish, flora and fauna.

The use of statistics in stock assessment in more visible environments is well known, but the use in stock assessment in an obscure and abstruse environment like fisheries is a horse of a very different colour. Work is presently being done in this field and that work is supported by collaboration in workshops and other activities with FAO. If the magnitude of decline or rehabilitation of the widespread fisheries scene can be measured, that is a huge step forward in solving or regulating problems or management. This ongoing work is one of the features of the 5-year follow-up plan. The abstruse and esoteric technologies being developed through computer programming and the visible landings of fish on the fish-dock hold promise of measuring stock levels. In the past, the making of assessments of stock levels was like a blind man in a dark room looking for a black cat that's not there, now high-tech solutions are being found through computers and remote sensing technologies.

The last feature for the present and the immediate future is the study on coastal fisheries management. This in-depth study includes the effect and implementation of devolved authority from central government to local levels, the reasons why fishing effort is so high and is so prevalent, the socio-economic effects of decline in coastal fisheries stocks, the identification of alternative sources of income for fishers and their families and the alleviation of fishing community poverty. A pilot project in conjunction with the DOF, Thailand, is being undertaken in a province in the south of the country. The work entails a deep study of the socio-economic environment and the market pressures that predicate the law of diminishing returns on the coastal fishing communities within the whole Southeast Asian region.

The increased national and regional visibility of SEAFDEC, and with it, the Training Department, has given cause for some hope in restoring the natural fisheries resources of the region. The application of even more advanced technology in resource level assessment and resource catch selectivity and preservation are the watchwords of TD activities. The objective now, is not to catch as much as possible, but to leave the little ones behind and alive for tomorrow. The subject of fish is both emotive and political, and apart from the present trends in budgetary constraint the apathy of the general public toward environmental degradation and the less than positive will and determination of some governments to ameliorate the conditions of their fisheries are major strictures that limit the application of remedial action. Although SEAFDEC is an inter-governmental organization it does not have, nor can it exercise, executive authority and may only advise member nation governments on ways and means to improve their fisheries situation. It is subject to the will and determination of regional governments as to whether the advice offered is adopted.

Thus it is that TD, although beset by budgetary constraints and pressures to advance the understanding of fisheries problems and working within the ***5-year SEAFDEC follow-up plan*** *are mobilizing their wealth of expertise to find ways and means to achieve "****Fish for the People****". Although this is a brief review of thirty-five years of Training Department work in gaining knowledge and experience, the past is far less important than the future.*

Top left: *The inauguration ceremony of the conference.*
Bottom: *A sunset over the coastal village, embracing the hopes and dreams of the fisherfolk. Since time coming, the plentiful marine food supply and the flourishing of coastal fisheries have provided the fisherfolks with sustenance and economic base*

OVERVIEW OF THE FISHERIES SECTOR IN THE SOUTHEAST ASIAN REGION

By Panu Tavarutmaneegul

Fig 1. Map of Southeast Asian Countries

The seas of Southeast Asia form part of the South China Sea, constituting about 2.5% of the World Ocean. Bordered by Brunei Darussalam, Cambodia, China, Hong Kong, Indonesia, Malaysia, the Philippines, Singapore, Taiwan , Thailand and Vietnam (Fig 1), most of these seas are under the jurisdiction of the archipelagic States of Indonesia and the Philippines.

Though Taiwan is usually considered an East Asian country, it is included in this paper because it is bordering the South China Sea. The paper also includes the Lao PDR and Myanmar. Lao PDR is the only country in the region, which is land-locked, and solely engaged in inland capture fisheries and freshwater aquaculture.

THE ROLE OF FISHERIES IN THE NATIONAL ECONOMIES

The Fishery sector plays an important role in Southeast Asia in supplying protein to the population, generating income and employment, and stimulating economic growth. The estimated annual per capita consumption of fish in 1998 averaged 35.3 kg in Thailand to 50 kg in Malaysia (global average 15.2 kg/capita/year).

Income from the export of fresh, frozen, canned and filleted fishery products has become an important foreign exchange source for many countries in the region. The export value of fish and fishery products from the region totaled US$ 9,914 million in 1999, with Thailand contributing the biggest share – 41.5% or 1.2 million mt - valued at US$ 4,110 million.

With a share of 40.5% or US$ 1,594 million in the total fisheries imports in the region in 1999, Hong Kong ranks first in imports, followed by Thailand with US$ 840.7million (21.4%) and Taiwan US$ 556.7 million (14%).

TOTAL FISHERY PRODUCTION

Rapid development of fishing technologies during the late 1950s and during the 1960s with the introduction of purse seine, gill net and trawl fisheries, as well as the introduction of modern aquaculture practices, had increased the region's contribution to world fishery production from less than 10% in the 1950s to 17% in 1980s and 30% in the 1990s. The annual growth rate of the region's fisheries during the 1980s was 10%, while the global growth rate was about 2% during the same period. In 1999 Southeast Asia produced 19.3 million mt of fish. Indonesia, Thailand and the Philippines were the largest producers. During 1995-99, total fish production increased by 33.4% (4.8 million mt). The total production of Indonesia increased by 78%, while that of Thailand increased by 1.49% in terms of landed quantity. Without Indonesian figures in value, the major producers were Thailand (US$ 4,996 million), the Philippines (US$ 2,302.5 million) and Malaysia (US$ 1,294.3 million).

MARINE CAPTURE FISHERIES

Marine capture fisheries are conducted both by commercial and over four million small-scale fishermen using a wide variety of fishing gear. Marine fish catch in

1999 contributed 75.1% (14.5 million mt) of the total production. Total catches showed an increase of 46.2% (4.58 million mt) during 1995-1999. The major contributors to marine catches are Indonesia (6.38 million mt), Thailand (2.72 million mt) and the Philippines (1.73 million mt). During the same period, the value of marine production increased by US$ 11.6 million in Thailand (0.65 %) but decreased by US$ 281.4 million (15.27 %) in the Philippines.

The rapid growth of commercial trawling since the late 1960s and the increasing use of such fishing gear as push nets by small-scale fishermen have resulted in a remarkable decline in demersal fishery resources in areas like the Gulf of Thailand, Manila Bay and the Malacca Straits.

An increasing quantity of trash fish of poor market value (0.33 million mt) was caught in 1999 (4.38% of total marine catch), which had a market value of US$ 27.6 million (0.71% of total landed value). Changes in species composition and a progressive reduction in size of caught fish are clear indicators of over-fishing.

Pelagic fish; including mackerel (0.57 million mt), sardine (0.61 million mt), scad (0.9 million mt) and anchovies (0.28 million mt); contributed about 30.7% (2.35 million mt) of the total marine catch in 1999. There are signs of stock depletion of many commercially important pelagic species from over-fishing in such areas as the Gulf of Thailand.

Tuna fisheries contributed 13.4% (1.03 million mt) of total marine production in 1999, with a value of US$ 96.1 million (2.48% of total landed value), caught mainly by Indonesia and the Philippines. The most important species were kawakawa or Eastern Little Tuna (*Euthynnus affinis*, 263,143 mt), skipjack tuna (*Katsuwonus pelamis*, 355,043 mt), frigate and bullet tuna (*Auxis* spp., 254,398 mt), longtail tuna (*Thunnus tonggol*, 61,108 mt) and yellowfin tuna (*Thunnus albacares*, 168 mt).

Shrimp resources in the coastal waters have also been fully exploited. The catch of shrimps amounted to 426,310 mt in 1999 (US$ 443.2 million or 11.4% of total catch value). 0.21 million mt of cephalopods (squids, cuttlefishes and octopus) was caught in 1999 with a market value of US$ 189.4 million (4.88% of total value). Although the potential yield of these resources is estimated at 600,000 mt per year in the areas, the resources might already be fully exploited in some areas like the Gulf of Thailand.

Coastal fishery resources of the South China Sea region have been over-fished and depleted to varying degrees. Unless new fishing grounds or new fish stocks like deep sea shrimps, cephalopods and fish are identified, there is hardly any potential for a further expansion of marine capture fisheries.

One of the major problems in managing multi-species, multi-gear tropical fisheries is the lack of sufficient information on the population dynamics and biometrics of these species to estimate their maximum sustainable levels of exploitation.

INLAND CAPTURE FISHERIES

Inland capture fisheries play an insignificant role in the total fish production in Southeast Asia. The fisheries have been under severe stress in recent years because of the deterioration of water quality from sedimentation and pollution from domestic, industrial and agricultural sources, reclamation of breeding habitats including swamps, ecological interference and diversions from dams and other such barriers etc.

In 1999, world inland production totaled 48.8 million mt. Capture fisheries produce 8.5 million mt (17.4%) and inland aquaculture produce the remainder. China, with a production of nearly 2.3 million mt, produces 26.9% of the world total.

Southeast Asian inland fish catch of 1.24 million mt in 1999 contributed 6.5% of the total fishery production in the region. Indonesia, Myanmar, Thailand, Vietnam, and Cambodia are the most important inland capture countries in the region. Indonesia had the highest production of 0.33 million mt, followed by Cambodia (0.23 million mt), Thailand (0.21 million mt) and Vietnam (0.17 million mt)

Expansion of inland fisheries in Cambodia, Myanmar and Thailand led to an increase of total production in the region to 189,728 mt during 1995-1999 while production in Indonesia and the Philippines showed decreasing trends during the same period.

In 1999, the major inland fishery products were miscellaneous fish (792,929 mt), cyprinids including carp, barbel etc. (104,614 mt), molluscs (87,858 mt), cichlids like tilapia (76,383mt), snakehead (68,654 mt), catfishes (31,163 mt), gouramis (49,868 mt) and crustaceans (16,032 mt). Thailand was the top producer of cyprinids and cichlids. Indonesia topped the list in the production of catfish, gourami, snakehead and crustaceans.

Recognized that official production data are generally unreliable. In order to get a more realistic idea of the size of the fishery, the MRC/DOF/Danida Project for the management of the Freshwater Capture Fisheries of Cambodia has set up a catch assessment system based on stratified random sampling of the catch and frame survey information on fishing gears utilized in the large and medium-scale fisheries. In addition, socioeconomic household surveys carried out in 1994-1995 provide catch estimates of the medium-scale and family fisheries. Their data for the annual inland production increase from 75,000 mt up to 300,000-400,000 mt.

AQUACULTURE

Aquaculture has a great potential to increase fish production and income for coastal populations. Constraints in aquaculture development can be overcome by local capacity building and the development of small-scale and decentralized aquaculture systems with small-scale hatcheries, nursing trading networks and on-farm back-yard breeding.

Up to the 1970s, the contribution of aquaculture to fish production in the region was negligible. Aquaculture has increased considerably in importance after several

countries prioritized its development to augment fish food supply and to increase export earnings. Aquaculture development accelerated rapidly in the 1980s at an average growth rate of 28% per year, as compared to about 4% during the 1970s, and the production increased to over 2 million tons in the 1990s.

Between 1995 and 1999 the yield from aquaculture reached 3.55 million mt, valued at US$ 7,783.9 million. The Philippines was the leading producer with 0.95 million mt, accounting for 26.73% of the total production; followed by Indonesia (0.88 million mt, 24.87%), Thailand (0.69 million mt, 19.48%) and Vietnam (0.48 million mt, 13.54%). In terms of value, Indonesia ranked first with US$ 2,204 million, accounting for 28.3% of the total value. Total aquaculture production increased by one million mt (38.96%) during the 1995-1999 period with an increase in value of US$ 3,089 million (65.78%).

The most important products are seaweeds, shellfish (cockles, oysters, mussels etc.), shrimps (mainly tiger prawn, *Penaeus monodon* and the freshwater prawn, *Macrobrachium rosenbergii*), fishes (carp, tilapia, catfish, milkfish, gourami, eels etc.) and crabs.

Coastal Aquaculture

Brackish water aquaculture plays a significant role in food fish production and in generating business investments, foreign exchange, employment and livelihood in most Southeast Asian countries.

A wide range of aquatic products are produced, including penaeid shrimp, milkfish, mussels, oysters, mud crab, and seaweed. In 1999, The Philippines was the largest producer (0.86 million mt), followed by Indonesia (0.51 million mt) and Thailand (0.44 million mt). The most important species were tiger prawn (0.36 million mt), milkfish (0.43 million mt), other fishes including seabass, grouper, bream and mullet (62,348 mt), and blood cockles (141,590 mt).

Freshwater Aquaculture

Cambodia and the Lao PDR produce mainly freshwater fishes and are potential growth areas for freshwater aquaculture. World fish production in terms of quantity and value is much higher in the freshwater environment than the marine and brackishwater environments. In 1999, about 38.3% (1.35 million mt) of aquaculture production in the region came from freshwater culture. Vietnam was the top producer with 0.38 million mt (28% of total freshwater culture production), followed by Indonesia (0.37 million mt), Thailand (0.25 million mt), Taiwan (0.12 million mt) and the Philippines (88,258 mt). The major species cultivated are miscellaneous fish (0.45 million mt), carp and barbel (0.4 million mt), followed by cichlids like the tilapia (0.31 milion mt), and catfishes (0.1 million mt).

Fig 2. A plentiful supply of fish from inland resources

Developments in Aquaculture Technologies

Since its establishment in 1973, the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC) has played an important role in developing and disseminating aquaculture technologies both inside and outside the region, with particular emphasis on (a) development and improvement of culture techniques; (b) production of genetically improved broodstock; (c) production of adequate supplies of quality seeds; (d) development of cost-effective feeds and dietary supplements; (e) control and prevention of diseases; and (f) development of sea-farming and sea-ranching techniques. Culture techniques of prawns and milkfish have received particular attention because of their economic importance. Major achievements were the development of broodstock and hatchery/nursery techniques for tiger prawns, and the completion of the life-cycle of milkfish in captivity. Advances have also been made in hormone-induced spawning of mangrove red snapper (*Lutjanus argentimaculatus*), spontaneous spawning of grouper (*Epinephelus suillus*), improved spawning and fry production techniques of Asian seabass (*Lates calcarifer*) and fry production of the rabbit-fish.

POST-HARVEST PROCESSING AND INFRASTRUCTURE DEVELOPMENT

With the introduction of efficient, modern fishing gear and techniques in the region since early 1960s, the fishing fleet has also been modernized and expanded. Indonesia has the largest fishing fleet of over 400,000 vessels, followed by Thailand with 54,538 and Malaysia with 32,672 boats and vessels. The number of trawlers in Thailand has increased from about 100 in 1960s to about 13,000 in 1990s, however the fleet has recently shrunk in size.

A large number of Japanese, Taiwanese and Korean long-liners and purse-seiners were also fishing, mainly for tuna in Southeast Asian waters and surrounding seas during the 1970s and 1980s. These fisheries later decreased with the reduction in the fish stocks and eventually stopped with the promulgation of the United Nations Convention on the Law of the Seas, when most of the Southeast Asian waters came within the jurisdiction of the Exclusive Economic Zones (EEZ) of the coastal states.

Fish is generally consumed fresh, but is also salted, dried, fermented, processed into fish balls, fishcakes, and fish sausages, Surimi etc. or into value- added products in frozen, filleted or canned forms. A large number of factories have been established for manufacturing fish sauce and paste, processing and packaging of fish fillets, squid and shrimp, production of fish balls, sausages, Surimi etc., and canning of tuna, sardine, mackerel and milkfish. Even trash fish of poor market value is increasingly commercially. In Thailand and Malaysia alone almost one million mt of trash fish is used every year to produce fishmeal. Modernization and development of harvesting and post-harvesting technologies have been well supported by the construction of fishing harbors, establishment of marketing infrastructures, cold storage and ice plants, development of refrigerated transport, and provision of training and extension work. It has been estimated that in Thailand alone over 7,000 establishments like fish processing factories, provide employment for about 70,000 people, mainly women.

ISSUES OF SUSTAINABLE DEVELOPMENT AND STRATEGIES FOR MANAGEMENT

The fish stocks in the coastal waters of the region are generally depleted for various reasons. Environmental degradation of habitat is caused by the use of harmful fishing gear and methods, and by pollution from domestic, industrial and agricultural sources, Ineffective enforcement of fisheries management systems and regulations further aggravate the situation, which is further complicated by the fact that fishery resources are still widely regarded as a common property with free and open access.

Fisheries management policies need to be shifted from maximizing catches to optimizing the long-term net socio-economic benefits, through the establishment of rights based fisheries systems, effective management of fishing capacity, control and prevention of pollution, resource enhancement programs, and the decentralization of fisheries management. The strengthening of fishery information and statistical databases are essential to support such processes. In this connection, highest priority in fishery research should be assigned to the development of stock assessment methodologies applicable to the multi-gear, multi-species fisheries of Southeast Asia.

Major issues of aquaculture development in the region are (a) prevention of conflicts in land use, and control of further destruction of mangrove forests for aquaculture expansion; (b) prevention of saltwater seepage into agricultural land; (c) the need to maintain the water quality of the farms and the prevention of pollution in the surrounding waters from farm effluents; and (d) other environmental aspects as reduction in the natural spawning and nursery grounds of coastal organisms and coastal biodiversity of fauna and flora. Technological aspects as (a) the development of standardized techniques for cultivating species like penaeid prawns, groupers, snappers, mudcrabs etc.; (b) development of breeding, hatchery and nursery techniques for their fry; (c) production of high quality feed supply; and (d) control and prevention of epidemics and diseases etc. are also in need of prioritized attention.

Post-harvest losses and wastage of fish caught are high in Southeast Asia, and estimated to be about 25% of the landed volume. Post-harvest technology development has played an important role in reducing this wastage through the introduction of new products and alternate means of utilization. However, there is still a need to improve facilities and infrastructure for fish handling, processing, marketing, distribution, etc.

Several recent global initiatives have wide-ranging implications for the fisheries of Southeast Asia and concerted collective action is needed to adjust the fishery management policies and strategies both at the national and regional levels. Regional cooperation plays a vital role in economizing in the costs of fish production, improving shrimp farm management and development of technologies, harmonization of fishery product quality standards; and collective trade negotiations for developing fishery product exports.

Both the fisherfolk and the public also need to be made aware, through the media and other suitable publicity measures, of the importance of utilizing food resources in a sustainable manner and the role of environmental protection. In this context, the Code of Conduct for Responsible Fisheries should be given widest publicity for this purpose.

Fig 3. Various products from fisheries

THAI COASTAL FISHERIES AND MANAGEMENT ISSUES IN THAILAND: Through A Case of a Collaborative Pilot Project in Chumporn Province

Masahiro Yamao,
Phattareeya Suanrattanachai,
Sumitra Ruangsivakul
and Kongpathai Saraphaivanich

DEVELOPMENT OF THE FISHERIES INDUSTRY AND SMALL-SCALE FISHERIES IN THAILAND

Thailand ranks as the tenth largest producer in fish volume in the world. The total volume of fisheries production in 1998 was 3.5 million tons. The capture fisheries sector amounted to 2.9 million tons (83.0 %), while the culture sector is 0.6 million tons (17.0%). The marine capture fisheries sub-sector was 2.7 million tons and had a share of 77.3 % of the total production. The development of Thai fisheries was attributed largely to the rapid growth of marine capture fisheries,which increased from 1.7 million tons in 1981.

Development of Export-oriented Fisheries Industry and as a Great Food Fish Producer in the World

In 1998, Thai fisheries produced 124,547 million Baht in value, which was three times more than in 1990. They increasingly depended upon coastal aquaculture. This lucrative sub-sector contributed almost half the total production (49.4 %), reaching 61,526 million Baht. The marine capture fishery sharply reduced its share from 71.1 % in 1985 to 38.8 % in 1990 and has been less capable of further expansion since the mid 1990s.

Fisheries Food Center in Asia

Keeping pace with the rapid development of marine capture fisheries and coastal aquaculture, the fisheries processing industry has rapidly expanded its production capacity and has become very competitive in the world market. By using cheaper raw materials and employing skilled workers, the industry succeeds in exploiting great value-added products including ready-to-eat and ready-to-cook products that are exported to large importers like Japan, U.S.A. and the EU.

The Gap between Export-oriented Food Business and Small-scale Fisheries

The great success of export-oriented fisheries and food business industries is attributed to small-scale fisheries and aquaculture production, characterized as labor-intensive and resource-exploitative in nature. Provision of cheaper raw materials is possible under *de-facto* open-access to fisheries resources. Small-scale fisheries and aquaculture puts increasing production effort with improving means of production. They often fall into a sort of vicious circle of resource over-exploitation. The price level of raw materials goes up, while quality reduces. Together with the growing Thai economy, the wage rate has risen sharply. Fisheries food business has increased the import of raw materials to maintain its competitiveness, and as a result, structural changes take place in export-oriented fisheries.

The Struggle of Small-scale Fisheries

The Great Majority are Small-scale Fisheries

Shown by the 2000 Intercensal Survey of Marine Fishery, the great majority of fisheries households (establishments) are grouped into the category of small-scale fisheries. This statistical data defines small-scale fisheries as those undertake by households that employ non-powered boats, outboard powered boats, inboard powered boats of less than 10 gross tons, or have no boat at all. The number of small-scale fisheries households amounted to 51,078 in 2000, being 92.3 % of all fishing households. The number of commercial fisheries was 7,041 in number, being 12.1 % of the whole.[1]

Coastal Resources are an Important Livelihood Source

Fisheries households involved in marine capture fisheries received an annual income of 89,684 Baht in 2000, out of which 73,072 Baht (81.5 %) came from fishing activities. [2] The family members usually diversify livelihoods and depend on multiple sources of income including those of wage laborers, agriculture, fisheries-related activities and trading. In coastal communities, fisheries and related-activities bring additional income sources to the local people. They often invest in small-scale boats and gear to create job opportunities for family members. The old, the young and women collect fish and shell from the beach for "dishes tonight", and for small processing. Utilization of coastal resources should be appreciated more than any economic indicators show and have a big ripple effect on the local and household economics.

Poverty, Scarcity of Job Opportunities and High Profitability

In coastal fisheries, at least three incentives effect the rapid expansion of production. In over-crowded fishing communities with a scarcity of job opportunities, poor small-scale fishers and their family members depend heavily upon coastal resource utilization. Fishing business attracts unemployed and underemployed people, as they achieve a daily cash income source. High profitability is a decisive factor causing resource exploitation. In more concrete terms, during this decade, anchovy fisheries have rapidly developed with the provision of investment and job opportunities in coastal communities. This is because of a strong incentive from foreign markets. Export-oriented grouper culture still gives economic incentive to small-scale fishers. Under *de-facto* free entry to fisheries, people increasingly invest in coastal fisheries and move from one to another lucrative fishery.

The Lack of Workable Management Frameworks in Coastal Fisheries

Over-capitalization and over-fishing are common phenomena everywhere in coastal fishing grounds. Near-shore areas especially are over-crowded. The number of fishing boats categorized as small-scale fisheries increased from 46,181 in 1995 to 51,078 in 2000, with an increase rate of 10.6 %. Small-scale boats may continue to increase in number. Coastal waters are very congested. Trawl and push net fishing are prohibited within 3 km from the beach, but their illegal operations are widespread throughout the country. Conflicts in the near-shore areas occur frequently between these illegal (commercial) and small-scale fishers. It is very hard for the government fisheries agencies to exercise strict control over the illegal boats. They lack personnel and budget. Small-scale fishers often damage aquatic resources in their immediate fishing grounds by using destructive fishing gear, too. The local community does not always keep small-scale fishers on target for the sustainable use of resources.

New Directions in Coastal Fisheries Management

Past Development of the CBFM Approach

The DOF has made enormous effort to make community development and community-based fisheries management (CBFM) successful by completing a series of fishing community development programs, "Small-scale Fisheries Development Scheme (SFDS)".[3] It provided financial subsidies to fishing communities, with such purposes as investment in small landing places and other facilities, supply of fishing and aquaculture equipment, and the installation of artificial reefs. Encouraging the targeted people to form into groups was a very important activity, not only providing revolving funds for micro credit activities, but also changing the groups into a unit of coastal fisheries management.

People's Efforts to Establish Sustainable Management

Fishers, stakeholders and NGOs have so far planned and implemented projects on the establishment of self-awareness and self-regulating management frameworks. They often cooperate with central and local government.[4] These projects, which apply the concept and approach of CBFM, succeed in enhancing people's awareness of the necessity for the sustainable use of coastal resources. They induce and increase pressure on fishers and all stakeholders to abandon destructive fishing operations. It is reported that many push netters have ceased and now employ resource friendly fishing gear. As in the Phangnga Bay, and in Pattani and Narathiwat Provinces, local communities evolve into autonomous management bodies. They tend to set up local networks of communities in adjacent areas. These

self-dependent trials are now given higher and positive appraisal.

Preparation of New Fisheries Laws

In Thailand, the central government still retain a majority of the authority to control fisheries. The present fisheries laws do not have any specific content on the mechanisms and procedures of localized fisheries management. Local fishers and stakeholders are not allowed to participate. The present legal framework does not contain provisions for devolving management functions to strengthen the roles of local government. To establish a sustainable coastal fisheries management, the DOF proposes new approaches and frameworks. Thai marine territorial waters may be divided into "Commercial Marine Fishery Zones" and "Coastal Marine Fishery Zones". A "designated community" becomes a primary management body in coastal fisheries, which means a specific geographic area set up by the government. This community may be delegated rights and responsibilities as regards the management and implementation of appropriate measures for local resource utilization. The "Local Fishery Committee" functions as a management and coordination body within certain defined areas. By adopting such new concepts, the proposed fisheries laws describe the issues of community-based fisheries management (CBFM).

Towards a New Phase of Fisheries Decentralization

Having passed the stage of experimental pilot projects, Thai coastal fisheries have reached a turning point at which the successful lessons and experiences of CBFM should be extended throughout the country and formulated into a well-designed and legal system of coastal resource management. Prior to the amendment of the fisheries laws, the DOF has begun to organize new types of project, the major purpose of which is to search for a workable locally based system on management issues. This is based on an achieved consensus between fishers, stakeholders and local governments. The local government administrative system is in the process of decentralization, in which sub-district administrative organization (Ao.Bo.To) enhances its capacity in planning and implementing matters of community development and people's welfare. The Ao.Bo.To and local government are stepping up their involvement in local coastal resource and environmental campaigns, though the amendment of fisheries laws remains uncertain.

STRATEGY OF A COLLABORATIVE PROJECT IN CHUMPORN

Background to the Project Under the FCG scheme

The Fisheries Consultative Group (FCG) scheme is a strategy for finding solutions to common problems that occur widely in the SEAFDEC member countries. SEAFDEC has developed the regionalization of the Code of Conduct for Responsible Fisheries. Under this scheme, a lead department of SEAFDEC implements a particular type of pilot project in collaboration with host countries. In coastal resource management, Thailand (DOF) acts as the lead country among the SEAFDEC member countries and TD is the lead implementing department of SEAFDEC. The DOF and the TD agreed to put together a collaborative pilot project in this field. Technologies, knowledge and lessons learned through the implementation of this project will be transferred to other SEAFDEC member countries through the information mechanism. This may be useful to help the member countries to review their own policies and steer new directions in coastal fisheries resource management.

Socio-economic Surroundings at the Project Site

The project site is located in Tambol Pakklong, Pathew District, Chumporn, in the southern part of Thailand. In 2002, the population is 4,152, in 892 households. The number of households engaged in fishing operations is 243. They employ a wide variety of fishing gear, including falling nets, cast nets, gill nets, traps, hand lines and so on. Multiple fishing gear fisheries are undertaken in six fishing villages (Moobaans). Squid, anchovy and shrimp are important economic species, contributing to the growth of the local economy. During the last five years, anchovy fisheries have been widely extended throughout Tambol Pakklong. Shrimp gill net fishery brings a large source of fisheries income to small-scale fishers households. There are many seasonally

migratory fishers to catch shrimp from adjacent areas during the monsoon season.

Increasing Catch Effort and Conflicts

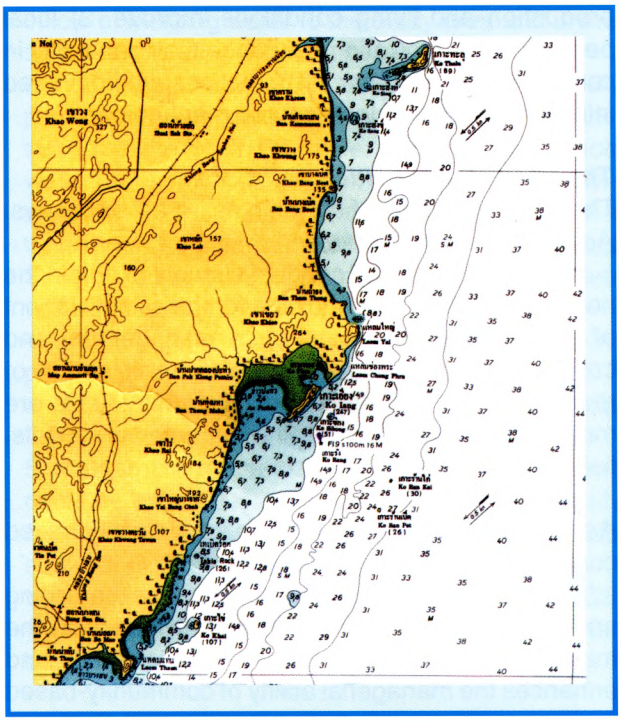
The number of small-scale fishing boats in Pakklong has steadily increased and fishing pressure becomes greater. Both agriculture and fisheries households continuously build small-sized and outboard engine boats for their younger family members. Underemployment prompts a further investment in capture fisheries. Small-scale fishers often employ destructive fishing gear for use in their immediate fishing grounds. Conflicts occur among themselves. Enormous numbers of crab traps covered by fine mesh sized nets are scattered indiscriminantly in front of their Moobaans. These traps target the smaller sizes of crab. Crab trap gill net fishers claim that crab resources are severely damaged by trap fishers. This is a typical example of a management problem. Trawl and push net boats illegally fish within the 3-km line from the beach, although the local people continue to protest. Small-scale boat owners also condemn anchovy purse seine fisheries in the near-shore areas as being irresponsible and reckless. They tend to distrust government fisheries agencies in charge of monitoring and controlling illegal fishing operations. Almost all fishers and resource users admit that coastal fisheries resources are depleted and are further deteriorating year by year.

Lack of Institutional Arrangements at Local Level

The present management framework should enable monitoring and control of fisheries at local level. In Tambol Pakklong, Pathew District and Chumporn Provincial Offices of Fisheries are in charge of registration, licensing, taxation, and monitoring. However, effective management measures cannot be achieved by these government agencies, because of a shortage of personnel and budget allocation. Not all fishers and resource users who employ fishing gear are subject to registration and licensing. The greater majority of small-sized and outboard engine boats are not registered. Local fisheries administration does not have a substantive picture of fishing gear and boats employed and operational. [5]

Who will be responsible for local fisheries management?

In Tambol Pakklong, fishers know how to avoid stiff competition in fishing grounds and how to settle conflicts. Their ways are mostly based upon individualism. Setting aside strengthening management functions of the District and Provincial Offices, there may be three alternative institutions that will take charge of management activities: Moobaan administration, Ao.Bo.To and fishers groups. These are more autonomous in nature. It is ideal that such local autonomous organizations and any



representatives of fishers and stakeholders will take some designated roles and issues of management.

The Purpose and Activities of the Project

Establishing a viable model and workable framework of locally based coastal resource management (LBCRM) in Tambol Pakklong is one initial objective of the collaborative project. Before starting this project, the DOF decided to proclaim the demarcation of coastal fishing grounds preserved for small-scale fisheries (145 square km), achieving consensus between local fishers at the project site. The project is expected to include the management of the demarcated zones by fishers and resource users, where particular types of fishing operations including trawl and push nets are prohibited. The LBCRM is modeled on the concept of CBFM, but more specifying on how to establish networks of primary management units at sub-district level.

Approach and Overall Objectives

This project adopts a comprehensive approach, which will encourage the active participation of fishers and resource users in management, supported by the creation of alternative job opportunities inside and outside the fishing communities. This helps to reduce fishing effort and pressure on coastal resources. The project has three overall objectives: first, is the establishment of sustainable coastal resource management at local level; second, is the rehabilitation of coastal resources and third, is the alleviation of poverty in coastal fishing communities. At least four results are expected from the implementation of this project: 1) locally based management in Pathew is successful, 2) people's

production and living conditions improve, 3) local people and organizations enhance their capability in community development, 4) practices are converted into the DOF's coastal resource management.

The Project's Activities and Core

The project consists of six main activities, as follows:

Activity I : Base line survey

The project staff conduct surveys to obtain the necessary information and data for the establishment of sustainable coastal resource management and community development, with the participation of resource users and stakeholders. Survey fields are mainly the oceanography and environmental aspects, fishing techniques, and socio-economic aspects.

Activity II : To encourage and extend locally based coastal resource management

The project encourages responsible fishing and aquaculture operation and participation in the management of the demarcated coastal zones and enhances the managerial ability of community-based management groups, their networks and Pakklong Ao.Bo.To.

Activity III : Encouragement of local businesses

The project assists the people to increase their income by improved technologies of handling, marketing and processing fisheries products, and by creating job opportunities outside capture fisheries. The project can support the "One Village, One Product" scheme promoted by Ao.Bo.To and other government agencies.

Activity IV : To enhance human resource capability and participation

Participatory training and educational courses will be planned and prepared. Preparation of the courses should be considered on the purposes and practices of Activities II and III.

Activity V : To develop extension methodologies and strengthen the extension system

Extension services are required to develop their technologies and methodologies. Texts, manuals and any visual methods through experiments on extension and training activities should be prepared and developed.

Activity VI : To rehabilitate and enhance coastal resource

Through consultation with resource users, the DOF will deploy artificial reefs around the demarcated zones, and release fingerings.

The core activities are Activities II and III.

Two Phases of the Project Activities

The project has two development phases. The first phase focuses mainly upon the activities of a base line survey and training matters with a campaign for enhancing awareness building. Rehabilitation activities will be started in the first phase with a plan for the installation of artificial reefs. During the second phase, the project concentrates on the establishment and functioning of a management framework and the promotion of alternative job opportunities.

Implementing Agencies

Besides the people and Ao.Bo.To at the project site, there are several government agencies and groups joining this project. The Chumporn Marine Fisheries Development Center (CMFDC), Provincial and District Offices of Fisheries, the Coastal Aquaculture Center and the SEAFDEC Training Department are core agencies, sharing responsibility and developing coordination among them. TD will undertake functions like training, text & manual development, research and advice.

Toward the Establishment of LBCRM

Sequence Plan for LBCRM

The project has a sequence plan for extending the LBCRM framework in which three development stages are prepared. In the first stage, the main activities are the expansion of the comprehensive coastal management campaign and the providsion of programs of education and training. In the second stage, resource users and stakeholders are encouraged to develop their own regulating activities within the legal framework currently prevailing. Ao.Bo.To and community-based management units (CBMUs) will achieve a consensus on self-regulatory resource utilization. Institutional arrangements should be strengthened at this stage. A further development of self-regulatory activities with a monitoring function will be in the third stage. By the end of the project, LBCRM should work well.

Contexts of LBCRM

The project proposal for LBCRM-PD does not describe what function and authority a LBCRM will have in Tambol Pakklong. This is because the completion of proclaiming a new fisheries act takes much time and many sequential steps for adjustments and compromises among the stakeholders. Though having not yet proclaimed a new fisheries act, a new regime of coastal fisheries management contains the following provisions. A designated community becomes a primary unit of management, while a local fisheries committee has functions that include information, consultation and coordination at local level. The government puts forward a decentralization program of local administration and development with the empowerment of Ao.Bo.Tos and people's organizations. Management and conservation of local

resources and the environment are the main tasks in these organizations. [6] Considering both elements of decentralization and the new fisheries act, an appropriate LBCRM in Tambol Pakklong should be designed. Given different geographical, resource, environment, and socio-economic surroundings, there will be many variations of LBCRM framework throughout the country.

Networks of CBMUs

One highlight of this project is that fishers, stakeholders and local government agencies will cooperate to organize and manage CBMUs and their networks. The CBMUs are expected to act in representative, consensus, suggestion, implementation, enforcement and adjustment functions. This will be a long process. The focus will be on the roles of representative and consensus at an earlier stage of the project. Moobaan (village) administration has a decisive role to achieve consensus at primary level. Local NGOs may enhance the people's concerns on coastal resource management and stimulate cooperative activities. CBMUs' networks will arrange and conduct self-regulating activities, while resolving conflicts between communities at sub-district level. Such a network is a core institution built into the Ao.Bo.To system, and acts as a representative of coastal resource users.

Functions of Ao.Bo.To

In Tambol Pakklong, the project attempts to explore a *Tambol-based* coastal resource management system, in which Ao.Bo.To would have several functions, i.e., 1) an administrative unit of fisheries management, 2) to support resource users' activities on coastal resource management, 3) to make legitimate resource user decisions and arrangements. The Ao.Bo.To assists the development of registration of fishing gear, fishing boats, and aquaculture ponds. The project identifies selective functions that the Ao.Bo.To and coastal resource users can take over from the Provincial and District Office of Fisheries. This attempt will be made on a voluntary basis by the time of the completion of the amendment of the fisheries act and regulations. The Ao.Bo.To supports fishers and resource user activities in various ways, to achieve consensus and agreement on the sustainable use of the demarcated coastal zones. The Ao.Bo.To enables legitimate resource user decisions and their agreement, though it may find difficulty in extending its function to the management of local resources and environment because of a lack of personnel and budget.

CONCLUSIONS

The Project's Contribution to a New Regime of Local Coastal Resource Management

Seeking Viable Models

Considering the past experiences on pilot projects on CBFM and CM approaches, both people and government agencies have made great effort to set up a comprehensive strategy for coastal fisheries resource management and community development. Prior to the amendment of the fisheries laws, the DOF has taken up the challenge of building a new institutional framework at pilot project sites through consultation with the people and their organizations. Although the role and nature of LBCRM-PD are seen as a pilot project, the success of this project may, not only bring about a viable model(s), but also hint at a mechanism for sharing responsibility among local governments (provinces and districts), Ao.Bo.To and the people. The project's activities will provide a profound insight into a direction of development of policy for coastal fisheries resource management.

Experiments on the roles of Ao. Bo.To

There may be some doubt and disagreement over whether an Ao.Bo.To can become mature enough to take charge of coastal resource management. This will be investigated through the implementation of the project activities. In actual implementation, fishers and resource user organizations – of whatever type – should be the foundation of the self-regulatory management regime of demarcated coastal zones. The project will experiment and show one applicable model. Moreover, the Ao.Bo.To will arrange several kinds of fisheries registration and licensing, in collaboration with fishers and stakeholders.

Elements Supportive to the Development of LBCRM

Through the implementation of the project activities so far, it is assumed that the following elements will be vital to the establishment of LBCRM. Training and educational matters should be targeted at local government officers, besides enhancing awareness about the sustainable use of coastal resources. Local governments will take more responsibility for management issues, together with the decentralization programs. Local government officers should be well trained to promote and guide people's self-regulatory activities. This project will accumulate the technologies and information on human capacity building necessary to push forward the decentralization of coastal fisheries management.

As a Community and Social Development

The project adopts an integrated approach in which coastal resource management and community development are interlocked. In recent years, such a complicated approach has become available in many Thai coastal communities. The government prepares a number of community development programs with generous financial and technical support to encourage local business. Fishers and resource users access these programs. In Tambol Pakklong, most households have multiple memberships of people's groups and community-based arrangements, whose main purpose is to provide micro credits. These financial arrangements help fisheries households diversify income sources and reduce dependence on coastal resources.

The New Direction of TD under the FCG scheme

Attention to Domestic Concerns

Under the FCG scheme, the TD is expected to prepare new activities on coastal resource management like research, training and advisory functions. Training matters are widely acknowledged as the most important among TD's activities. The TD arranges a series of training courses that should target a particular country(ies), considering cultural, socio-economic and biological backgrounds, besides preparing general guidelines and theoretical frameworks for coastal resource management. This is because coastal resource management issues are likely to be domestic concerns, even if the widely accepted concepts and framework of CBFM and Co-management can be applied.

Enhancement of the Advisory Capability

Advisory functions will be included into the new direction of the TD's activities. Its staff members are accumulating knowledge and experiences gained in their involvement in LBCRM projects. These will soon be converted into advisory descriptions for the DOF and local government agencies concerned. Then, TD will prepare to transfer accumulated lessons and advisory experiences to other member countries through the SEAFDEC information mechanism. In other words, bi-laterally-based training and advising should be solid.

Making Core of Networks for Expertise and Information

In the Southeast Asian region, lessons and experiences on coastal resource management projects, their related issues and topics, are sufficiently accumulated to be transferred among member countries of the SEAFDEC. Resource management programs and projects are diverse, covering many issues and topics. TD will act as a core of network for expertise and information, and assist the member countries to effectively organize comprehensive pilot projects and training courses, in collaboration with other organizations and networks.

End note

[1] Generally speaking, small-scale fisheries have a meager amount of catch while commercial efforts account for more than 80 % of total catch in volume. However, this statement does not indicate the reality of coastal fisheries. There are a wide variety of economic groups and classes in smallscale fisheries. Some are definitely capital-intensive in nature. Accurately, unequal resource distribution takes place both in small-scale and coastal fisheries. Those fishers who operate in coastal fisheries, regardless of whether or not they are categorized into "small-scale fisheries", are in stiff competition.

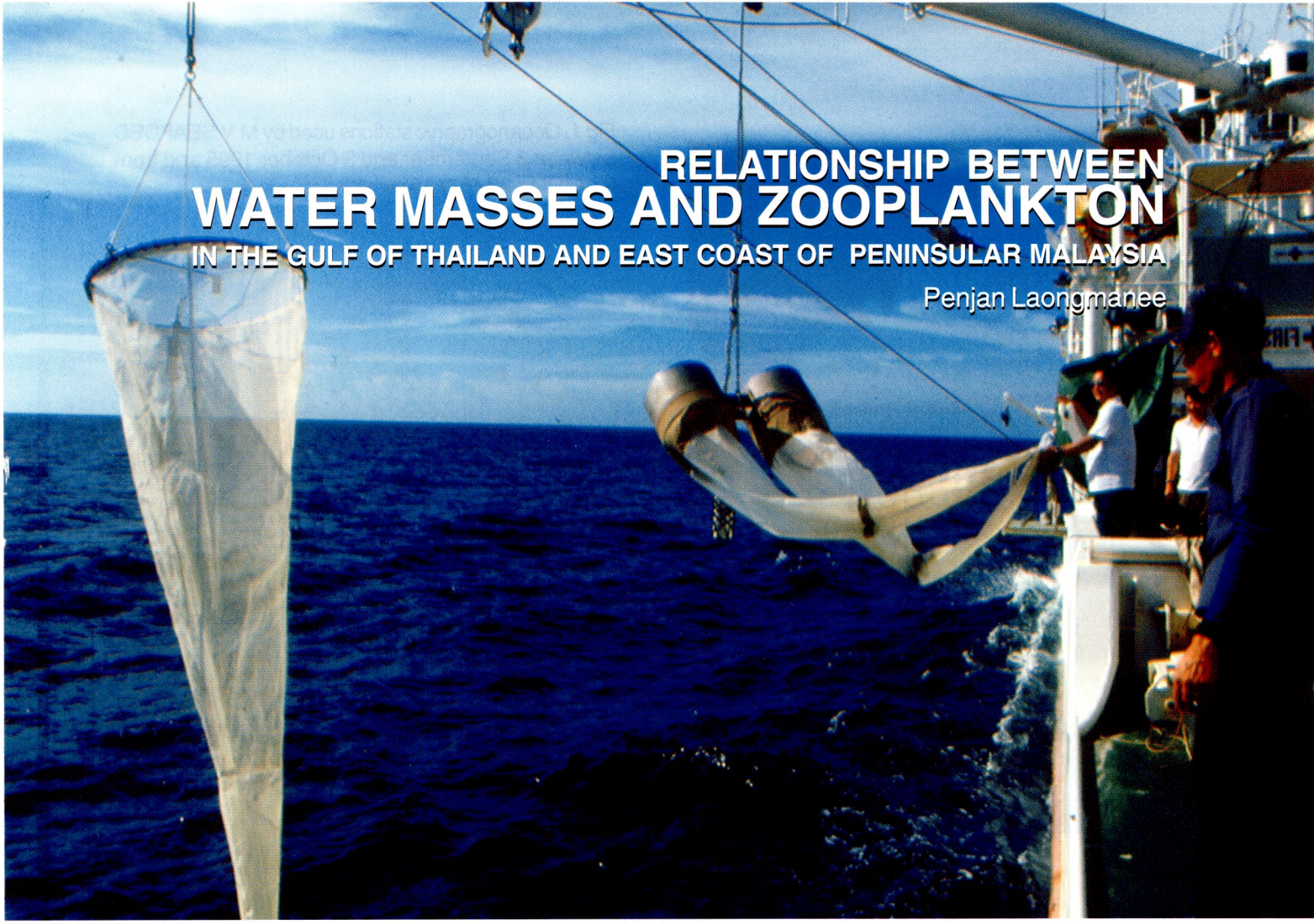
[2] Report of the 2000 Income of Small-scale Marine Capture Fishery Household Survey. National Statistics Office.

[3] The SFDS ended in 2001 and has generated a number of successful pilot projects in both the fields of community development and community-based management.

[4] Foreign governments and international donor agencies occasionally bring financial and technical support.

[5] Only the figures of the Census surveys (1995 and 2000) are available.

[6] There is much disagreement over whether the Ao.Bo.To and/or local communities become owners of local resources. Since the 1990s,in the development of the reforestation program, the concept of social forestry has developed and is widespread through the North and the Northeast. However, agreement has not been achieved yet as regards the common property right of forestry resources. This is a very controversial issue.



RELATIONSHIP BETWEEN WATER MASSES AND ZOOPLANKTON IN THE GULF OF THAILAND AND EAST COAST OF PENINSULAR MALAYSIA

Penjan Laongmanee

INTRODUCTION

Most of the studies on the relationship between the physical and chemical properties of water and biological data were done by studying the relationship between individual parameters with individual species or each group of marine life which might not be appropriate, as individual species usually relate to several parameters. The study on water masses, which tries to classify water by their properties and origins, may give a better answer than the each parameter study. Because each water mass can be composed of the same kind of organic or inorganic matter, minerals, trace metals etc., which are important for life. The objectives of this study are to classify and study the distribution of water masses in the Gulf of Thailand and East Coast of Peninsula Malaysia and to determine the relationship between those water masses and zooplankton in the area.

METHODOLOGY

The Southeast Asian Fisheries Development Center (SEAFDEC) carried out two intensive field observations in the western part of the Gulf of Thailand and the East Coast of Peninsular Malaysia in September 1995 and April-May 1996. It was the first systematic and intensive oceanographic measurement, since the Joint Thailand-Vietnam-US NAGA Expedition in 1959-1961 (Robinson, 1963). Unfortunately, the study areas could not cover all the Gulf of Thailand area because of the exclusive economic zone (EEZ) of a neighbor country. However, the SEAFDEC survey data was the most complete and accurate oceanographic data set in this area.

The Gulf of Thailand is a semi-enclosed Gulf with two sills at the southern most part. The first sill runs from the Camau Peninsula (08°42'N, 103°11'E) to the southwest about 100 km at a depth of less than 25 m. The second runs from Kota Bharu (06°15'N, 102°23' E) at a depth of less than 50 m to the northeast for 150 km. There is a channel connecting the deepest part of the Gulf to the South China Sea. This underwater channel is about 60 m in depth and about 50 km wide at the center of the mouth of the Gulf of Thailand (Piyakarnchana, 1989). The average depth is about 50 meters. The East Coast waters of the Malay Peninsular are a part of the South China Sea. The depth of the study area was between 22 and 78 meters. The average depth being 57.4 meters (Fig 1).

Sources of data

Data was obtained from two-survey cruises of M.V.SEAFDEC in the Gulf of Thailand and East Coast of Peninsular Malaysia under the Interdepartmental Collaborative Research Program in the South China

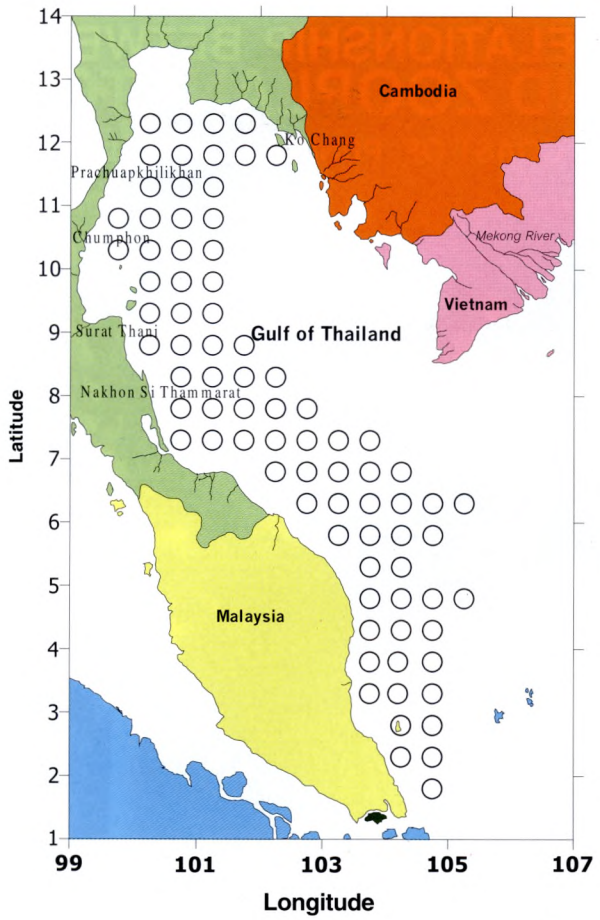


Fig 1. Oceanographic stations used by M.V.SEAFDEC between 3 September and 3 October 1995 and from 23 April to 23 May 1996

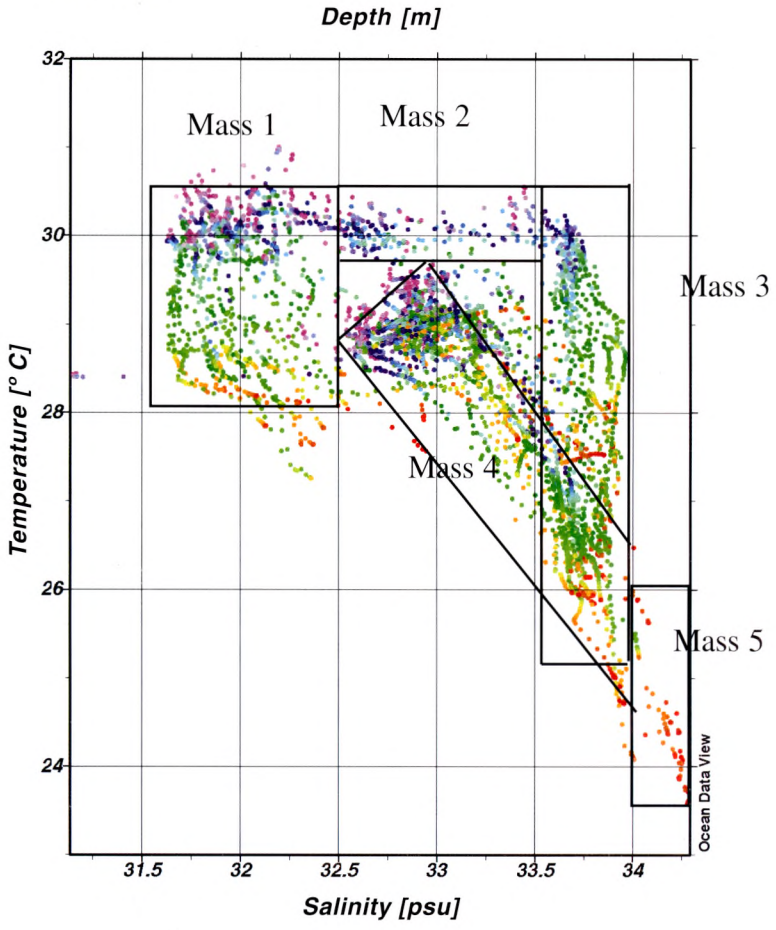


Fig 2. TS-diagram of all data

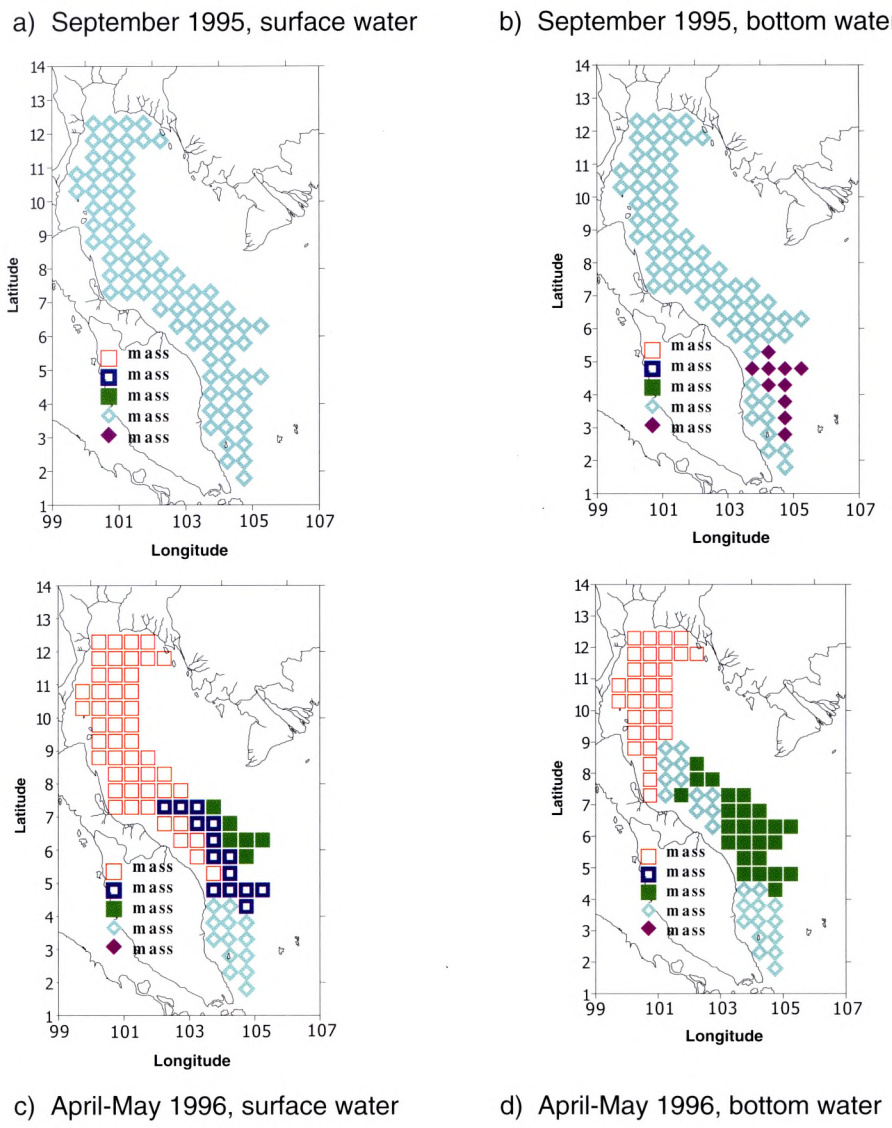


Fig 3. Distribution of water masses identified by TS-diagram

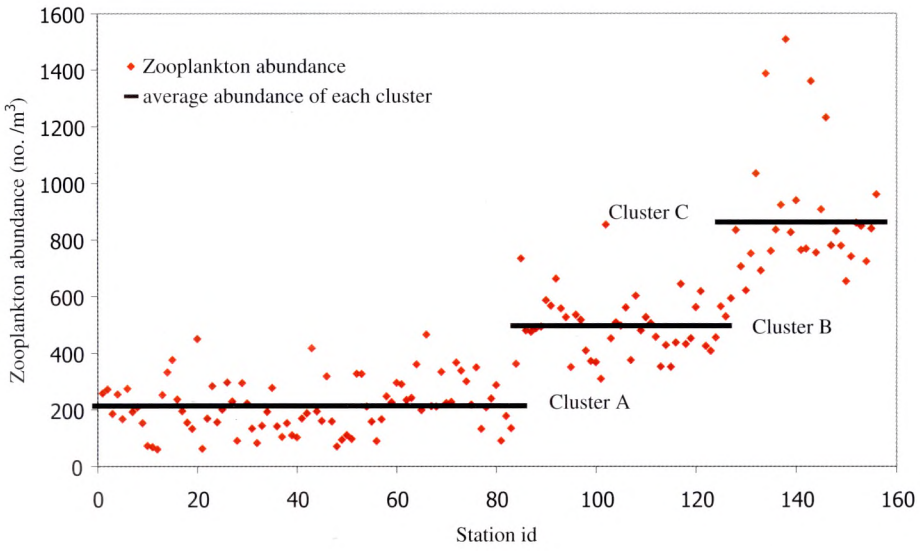


Fig 4. Comparison between total abundance of zooplankton in each station of each cluster

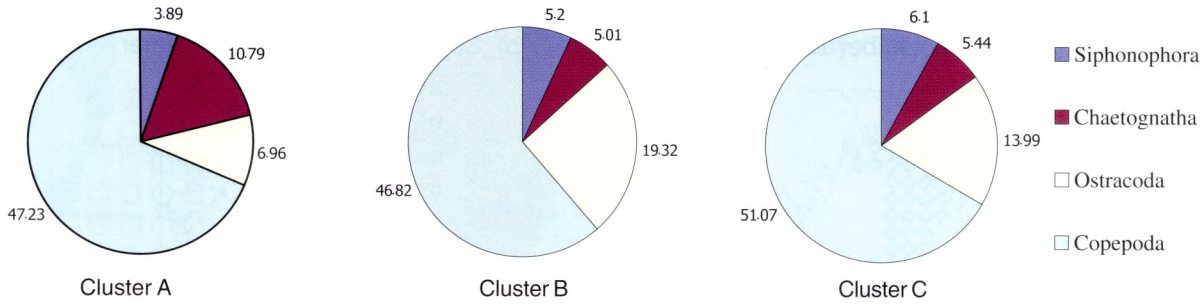


Fig 5. Average percentage of four main abundance species of zooplankton in each cluster

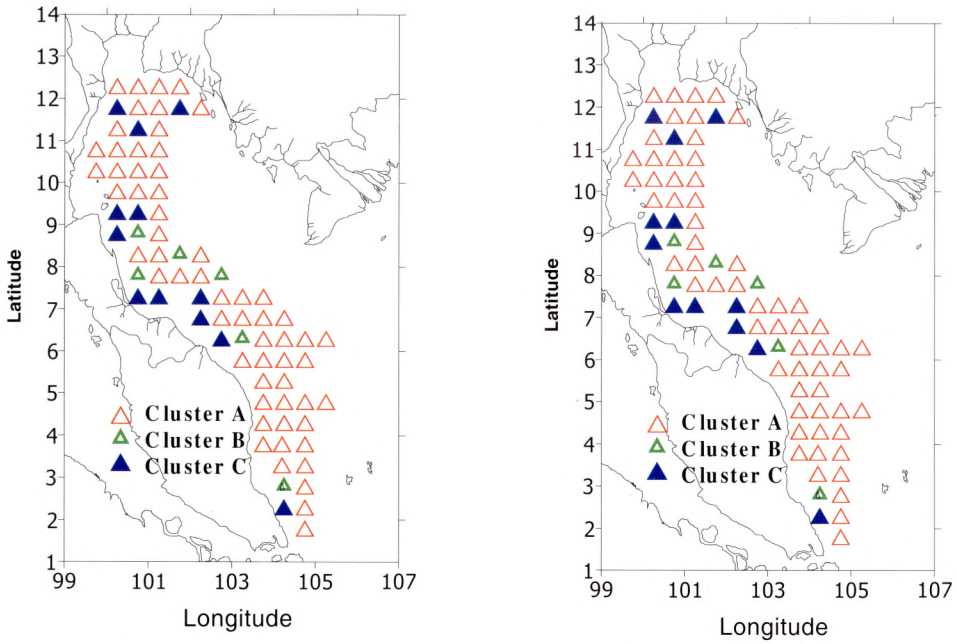


Fig 6. Distribution of zooplankton cluster

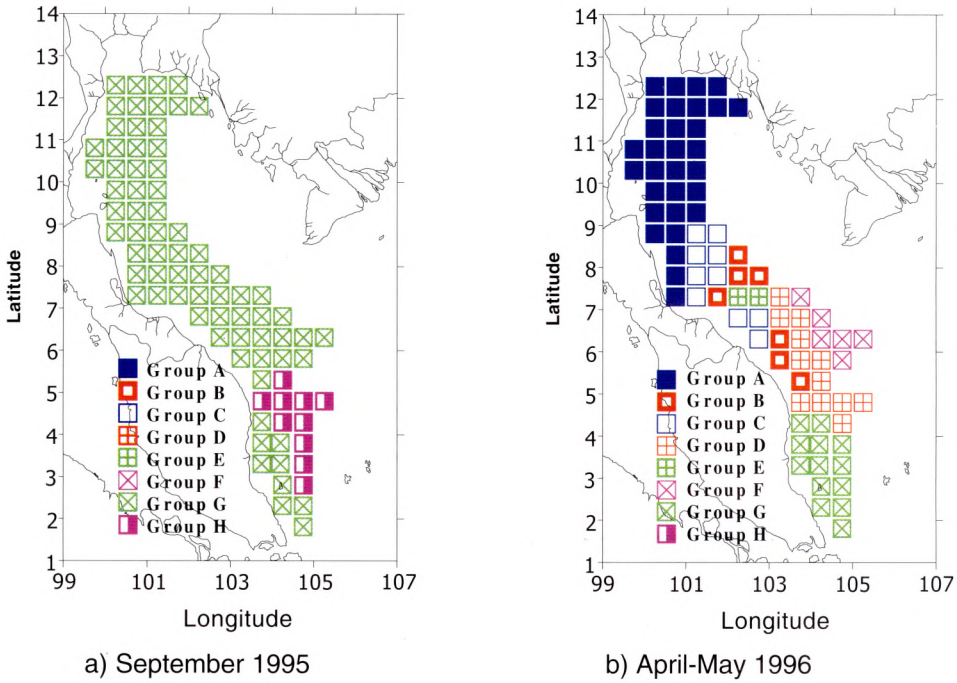


Fig 7. Distribution of composite water masses A to H (table 1)

Table 1 Type of water mass in mixing layers and bottom layers of composite water masses A to H

Group	Mixinglayer	Bottomlayer
A	mass 1	mass 1
B	mass 1	mass 3
C	mass 1	mass 4
D	mass 2	mass 3
E	mass 2	mass 4
F	mass 3	mass 3
G	mass 4	mass 4
H	mass 4	mass 5

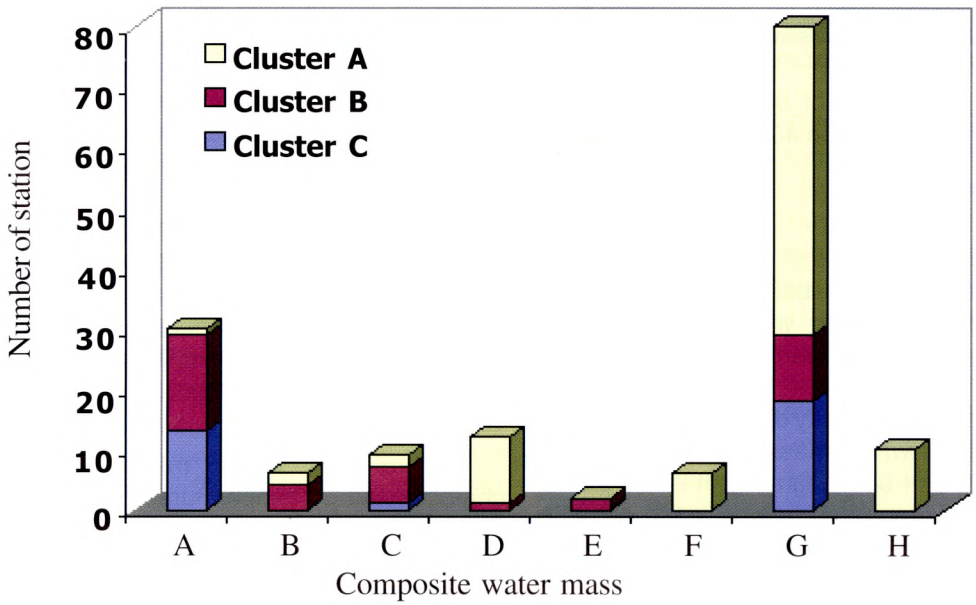


Fig 8. Number of clusters of A, B and C zooplankton in each composite water mass

Sea area of the Southeast Asian Fisheries Development Center. The first cruise was between 3 September and 3 October 1995. The second cruise was from 23 April to 23 May 1996, with a total of 81 oceanographic stations (Fig 1). Station no. 27 was surveyed only during the second cruise.

Oceanographic data were collected using the onboard Falmouth Integrated CTD instrument with conductivity, temperature and pressures sensors having an accuracy of ± 0.003 mmhn, ± 0.003 °C and ± 0.03%, respectively. Raw counts of each variable were recorded and averaged at every 1 meter interval using FSI post acquisition data analysis software.

Total abundance (no/m^3) and species composition of zooplankton from the study of Jivaluk (1999) were used in this study. Zooplankton samples were collected by Bongo net oblique hauls.

Water mass identification procedure

A water mass is defined as a body of water with a common formation history, usually based upon the observation that water renewal in the deep ocean is the result of water mass formation in contact with the atmosphere and spreading from the formation region. A point in the functional relationship of water mass is defined as a water type. Direction and quantity of the spreading and mixing of a water mass with other water masses can be tracked by analyzing the distribution

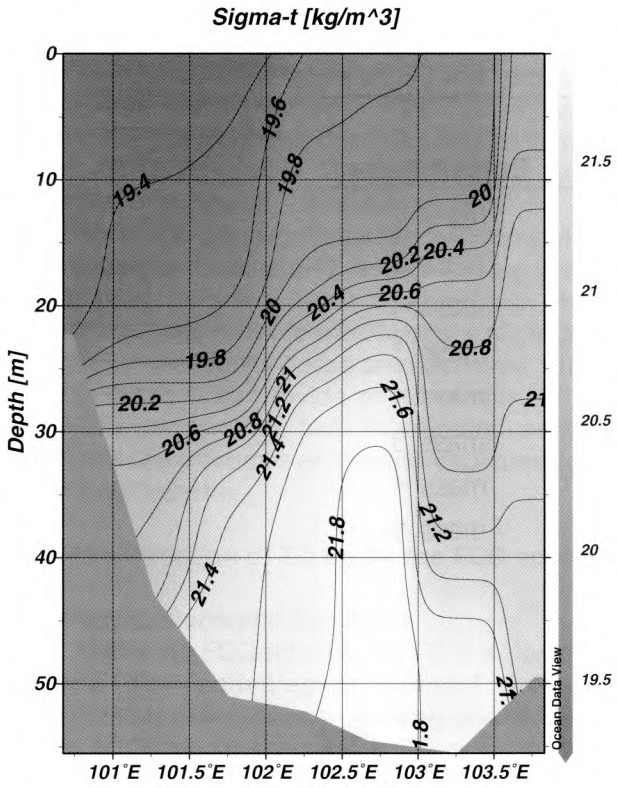


Fig 9. Vertical distribution of sigma-t along latitude 7° 20'N (from station 40 to 46) in April - May 1996

of conservative properties, that is, they altered only by processes occurring at the boundaries of the ocean by mixing with the other water masses, like temperature, salinity, etc. (Open University, 1989).

The temperature-salinity diagram (TS-diagram) is a basic tool for water mass classification and analysis in deep-sea oceanography. It is the plot of two conservative properties against each other. A water mass with uniform temperature and salinity including water masses in mixed layers shows up in a TS-diagram as a single point. Other water masses, which present some variation of their properties with depth, are shown in the TS-diagram as curves.

The temperature and salinity data of all depths were plotted against each other using Ocean Data View Software (ODV). ODV presents depth as a Z-axis with colors for each X, Y coordinate. Results of the TS-diagram being presented as the range of temperature and salinity of each water mass.

Relationship between water mass and zooplankton data analysis

Zooplankton cluster analysis, function of S-PLUS 2000 Software, was applied to determine the group of stations with similar species composition and abundance of zooplankton. The squared Euclidean distance algorithm was used to calculate the inter-individual distance for clustering. The available zooplankton data was represented for the whole water column, therefore, results from cluster analysis determine the relationship with water masses classified by TS-diagram, which are applied for the whole water column data.

RESULTS

Water masses identification

Water masses in the study area from two seasons were identified by TS-diagram as five masses (Fig 2). The first water mass (mass 1) was characterized by high temperatures between 28-30.5 °C and low salinities between 31.5-32.5 psu. Mass 1 was found in the inner of the Gulf of Thailand during April-May 1996 (Fig 3 c and d).

The second water mass (mass 2) was characterized by temperatures between 29.5-30.5 °C and salinities between 32.5-33.5 psu. This water mass was found at the mixed layer water near the mouth of the Gulf of Thailand during April-May 1996 (Fig 3 c).

The third water mass (mass 3) was characterized by temperatures of 27-30.5 °C and salinities of 33.5-34 psu. and was found at the area of the mouth of the Gulf of Thailand (Fig 3 c and d).

The fourth water mass (mass 4) was characterized by temperatures between 25-30 °C and salinities between 32.5-34 psu. This type of water was found in the whole study area during September 1995 and in the southern and middle part of the study area during April- May 1996 (Fig 3 a - d).

The fifth water mass (mass 5) was characterized by temperatures between 23.5-26 °C and salinities of more than 34 psu. This was found at the bottom layer (more than 50 meters) offshore of eastern Peninsular Malaysia (st. 63-69, 73,74 and 78) in September 1995 (Fig 3 b).

The Relationship between water mass and zooplankton

Cluster analysis was used to group survey stations by similarity of species composition and abundance of zooplankton into three clusters.

Average total abundance of each station in cluster A, B and C were 214, 497 and 862 no/m^3, respectively (Fig 4). The average percentages of the top four high abundance zooplankton species are shown in Fig 5. The dominant species of zooplankton in both survey periods were copepod. Total zooplankton increased because of the increase in copepod abundance.

From Fig 4 and 5, the characteristics of cluster A were high abundance of chaetognatha (twice the

abundance in cluster B and C) and low average total abundance. The ratio of dominant species of clusters B and C were similar. The different characteristic was the total abundance, in which cluster C was higher.

The distributions of clusters in each station are shown in Fig 6. Most of the stations during September 1995 displayed cluster A zooplankton. Cluster A zooplankton were also found in April-May 1996 at the boundary between the Gulf of Thailand and the South China Sea (Fig 6 b).

Six stations at the central and southern parts of the study area in September 1995 were cluster B zooplankton. Their distribution did not have any special pattern (Fig 6 a). In April-May 1996, large distributions of cluster B zooplankton (35 stations) were found throughout the study area, except near the mouth of the Gulf of Thailand (Fig 6 b). Cluster C zooplankton was found in both survey periods at the coastal area.

Zooplankton samples were collected by oblique haul, so it was not possible to find the species composition and abundance in each layer, while type of water mass at the lower and upper layers of some stations was different. Therefore, survey stations were grouped by considering both surface and bottom water masses as shown in Fig 7. for determining the relationship between water mass and zooplankton.

Distribution of cluster A zooplankton coincided with the presence of composite water mass G and H in September 1995 and D and F in April-May 1996 (Fig 6, 7 and 8). Cluster B zooplankton stations were observed mostly in composite water masses A, B and C (Fig 8). Cluster C zooplankton stations were observed at composite water masses G in September 1995 and A in April - May 1996 (Fig 6, 7 and 8) which are coastal areas.

DISCUSSION

Characteristics and distribution of water masses

Characteristics of water masses and their distribution suggest that there were five water masses in the study area. The water masses are named following their originating area.

1. Characteristics of water mass 1 (29.5-30.5 °C, 31.5-32.25 psu) were different from the characteristics of all other water mass in the adjacent areas (Rojana-anawat et al., 2000 and 2001). This water mass originates in the study area of the so called Gulf of Thailand water mass (GOT water mass).
2. Characteristics of mass 2 (29.5-30.5 °C, 32.5-33.5 psu) could be overlaid with the characteristics of the water mass near the Mekong river (Rojana-anawat et al., 2001). This water mass could be an inflow of Mekong water to the study area and is the so called Mekong water mass.
3. Characteristics of Mass 3 (27-30 °C, 33.5-34 psu) could be overlaid with the characteristics of the surface of the South China Sea water mass (surface water to 50 meter depth) from the study of Rojana-anawat (2000 and 2001). It shows the intrusion of a water mass from the surface layer of the South China Sea to the study area (Surface South China Sea water mass, SSCS).
4. Characteristics of Mass 4 (25-30 °C, 32.5-34 psu) were between the characteristics of the GOT and SSCS water masses. It should be a mixture of GOT water mass and SSCS water mass.
5. Characteristics of Mass 5 (23.5-26 °C, >34 psu) could be overlaid with the subsurface of the South China Sea water mass (SuSCS water mass) in the study of Rojana-anawat et al. (2000 and 2001). It was suggested that there was an intrusion of SuSCS water mass into the study area at 50 to 150 meter depths.

Seasonal variation of water mass distribution

The seasonal variation of the horizontal distribution of water masses in this area is mainly influenced by monsoon winds, different water densities and tidal currents. (Lowwittayakorn, 1998 , Snidvongs 1998 and Yanagi et al., 2001).

During September 1995, which is the Southwest monsoon season, there was a strong inflow of surface layer of the SCS water mass to the Gulf of Thailand at the west coast, the strong winds induce mixing with the local GOT water mass. This explanation was encouraged by the study of Yanagi et al. (2001) that stratification is weak in this season. The whole area except the bottom water of the East Coast of Peninsular Malaysia was occupied by a mixture of the GOT and SSCS water masses (Fig 3 a and b). The bottom water of the East Coast of Peninsular Malaysia (50-80 m) was occupied by the SuSCS water mass. This observation implies that there was an intrusion of SuSCS water mass from the South China Sea under the influence of wind and density difference.

In April-May 1996 which is a transition period between the Northeast to Southwest monsoon season, stratification occurred over the whole area at depths greater than 30 meter because of large sea surface heating and weak sea surface wind. The development of stratification separated high temperature and low salinity GOT water mass at the upper layer from the others beneath it (Fig 3 c and d).

It was observed in this study that the SSCS water flowed into the Gulf of Thailand at the bottom layer and both surface and bottom layers at the mouth of the Gulf of Thailand while GOT water flowed out of the Gulf of Thailand at the upper layer (Fig 3 c and d). The SSCS water mass at the bottom in the Gulf of

Thailand should flow from the South China Sea through the channel connecting the deepest part of the Gulf of Thailand and the South China Sea (Fig 9). Yanagi et al., 2001 suggested that it was because the density difference between the head of the Gulf of Thailand and the tip of Peninsular Malaysia which is about 2.0 sigma-t at 20 m below the water surface in this season. The intrusion was limited in horizontal distribution only at the deep area of the Gulf of Thailand (> 80 meter).

The Mekong water mass was found only at the surface layer of stations at the mouth of the Gulf of Thailand and east coast of Peninsular Malaysia (Fig 3 c). This water mass came from a coastal jet flowing southwestward along the southeast coast of Vietnam under the influence of the Northeast monsoon wind as indicated by Shaw and Chao (1994). The coastal jet water is from mixing between the South China Sea water mass and run off from the Mekong River. Although, there was no coastal jet during the survey period because of the weak NE monsoon wind but the Mekong water mass still remained in the area.

Mixing of GOT and SSCS water mass was found in two areas. The first was at the bottom layer of the centre of the study area between the area of the GOT water mass and the intrusion of the SSCS water mass. This water mass should originate from the turbulent mixing which is most pronounced along the isopycnal surface (Open University, 1989). Fig 3 d and Fig 8. showed that the GOT and SSCS water masses occupied the isopycnal surface of the first area. The second area was both surface and bottom water of the southern part of the study area. Mixing of the GOT and SSCS water masses in this area should be the remaining water mass from the Northeast monsoon season that stratification was not present because of sea surface cooling and the strong Northeast monsoon wind (Yanagi et al., 2001).

Ecological implication

The presence of the SSCS water mass either surface or bottom water or both layers (water mass group B, D and F) in TS-diagram coincided with the area of zooplankton cluster A, which was in a high abundance ratio of chaetognatha and low total abundance of zooplankton (Fig 6 and 7). This suggests the possibility to use SSCS water mass as the indicator of low total abundance of zooplankton with the high proportion of chaetognatha area. Jiwaluk (2001) also reported a high abundance ratio of chaetognatha in the area of open sea water mass in Vietnamese waters that has the same characteristics as the SSCS water mass (Rojana-anawat et al, 2001).

REFERENCES

Jivaluk, J. 1999. Distribution, abundance and composition of zooplankton in the Gulf of Thailand and East Coast of Peninsular Malaysia. Proceedings of the first technical seminar on marine fishery resources survey in the South China Sea, area I. Bangkok, 1997. pp. 256-284.

Jiwaluk, J. 2001. Composition, abundance and distribution of zooplankton in Vietnamese water. Proceeding of the SEAFDEC seminar on fisheries resources in the South China Sea, area IV. Hai Phong, 2000. 77-93.

Lowwittayakorn, S. 1998. Analysis of sea surface temperature and salinity from oceanographic buoys with circulation patterns in the Gulf of Thailand from mathematical model. Master's Thesis, Department of Marine Science, Graduate School, Chulalongkorn University (in Thai).

Open University Course team. 1989. Ocean circulation: Oceanic water masses. Great Britain: BPCC Wheatons.

Piyakarnchana, T. 1989. Yield dynamics as an index of biomass shifts in the Gulf of Thailand ecosystems. Biomass yields and geography of large marine ecosystems. pp. 95-142.Washington: Westview Press.

Robinson, M.K. 1963. Physical oceanography of the Gulf of Thailand. A report on the results of the NAGA expedition, 1959-1961. California: Scripps Institution of Oceanography. pp. 34-50.

Rojana-anawat, P., Natinee, S. and Siriporn, P. 2000. Characteristics of water mass in the Western Philippines water. Proceeding of the SEAFDEC seminar on fisheries resources in the South China Sea, area III. Metro Manila, 1999. pp. 291-307.

Rojana-anawat, P., Siriporn, P., Natinee, S. and Somboon, S. 2001. Temperature, salinity, dissolved oxygen and water masses of Vietnamese water. Proceeding of the SEAFDEC seminar on fisheries resources in the South China Sea, area IV. Hai Phong, 2000. pp. 346-355.

Shaw, P.T. and Chao, S.Y. 1994. Surface circulation in the South China Sea. Deep Sea Research 41(11/12). pp. 1163-1683.

Snidvongs, A. 1998. The oceanography of the Gulf of Thailand: Research and management priorities, Vol 1. SEAPOL integrated studies of the Gulf of Thailand.

Yanagi, T., Sachoemar, S.I., Takao T. and Fujiwara, S. 2001. Seasonal variation of stratification in the Gulf of Thailand. Journal of Oceanography 57(4). pp. 461-470.

TUNA PURSE SEINE OPERATION BY M.V. SEAFDEC IN THE EAST INDIAN OCEAN

Pratakphol Prajakjitt

INTRODUCTION

M.V. SEAFDEC, the Fisheries Training and Research Vessel, has conducted tuna purse seine fishing in the East Indian Ocean from 1994 until today. Because of the situation of declining coastal fishery resources in the Southeast Asia region, oceanic fishery resources are expected to be the new sources of protein in the future. Tuna and tuna-like species are also considered as under exploited oceanic fishery resources. The research objectives are to determine the abundance of tuna species, identify appropriate fishing methods and fishing techniques and also the oceanographic aspects that are related.

Southeast Asian countries, especially Thailand, have an advantage in shorter distances from their base to the fishing grounds. Results of the exploration might be useful for those who would like to establish a tuna purse seiner fleet for operations in the East Indian Ocean, which is considered to be a new fishing ground for tuna purse seine compared with others.

MATERIALS

Purse seiner

Principal particulars of M.V. SEAFDEC

Length over all	65.02 m
Length between perpendiculars	57.00 m
Breadth, molded	12.00 m
Draft, molded	14.658 m
Service speed at 4.50 m draft	14.3 knots
Max.sea trial speed (measured)	16.640 knots
Dead weight	744.42 tons
Gross tonnage	1178 tons
Net tonnage	354 tons
Total complement	63 P
Fish hold capacity (bale)	145.38 m^3
Freezing room capacity	20.48 m^3
Freezing ability (brine)	20t/day
(Air blast)	1.6t/36 hr

Skiff boat (SEAFDEC No.2)

Overall length	9.96 m
Legnth between perpendiculars	9.00 m
Breadth, molded	5.00 m
Draft, molded	1.2 m
Designed weight	7.3 tons

Work boats (SEAFDEC No. 3 and 4)

Overall length	6.26 m
Length between perpendiculars	5.97 m
Breadth, molded	2.79 m
Draft, molded	1.05 m
Designed weight	2.5 tons

Purse seine net

The Tuna and skipjack purse seine net of M.V. SEAFDEC was made by Nichimo Co.,Ltd. With a total net length of 1,155.9 m (contracted), it is composed of 20 portions. The netting yarn is all nylon and the bunt part (portions 1-2) are constructed with 90-160 ply/90 mm mesh size and 40 ply/ 105 mm mesh size in the body part of the net (portion5-18). The wing attached to the bunt (portion 3-4) is made of 60 ply/90 mm mesh size and the right wing (portion 19-20) is 60 ply/105 mm and 90 ply/ 105 mm. The upper and lower selvages are constructed of Polyethylene Ultra Cross (PE UC) 320 ply/150 mm 5 meshes depth. The floats are made of Plastic EVA, with dimensions of 160(L) x 190(D) x 33(H.D.) and a buoyancy of 4,000 grams. They are yellow in color. The chain is made of Super Alloy, with a diameter of 11 and 13 mm. It is attached with a bridle chain with single rope 10 pieces and plus bridle chain double 64 pieces. The purse ring is made of Galvanized Iron, 22 mm-diameter x 260 mm.

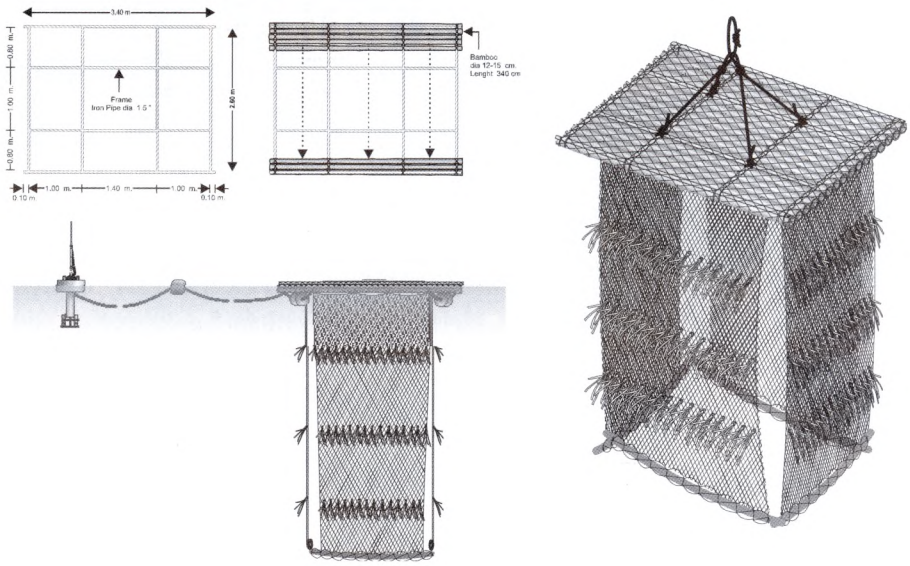


Fig 1. Construction of a FAD (Fish Aggregating Device) of M.V. SEAFDEC

Fig 2. Searching for floating objects

Fish Aggregating Devices (FADs)

The FADs are of the floating type composed of 3.5 m bamboo poles sequentially tied around a 1.5 inch-diameter iron-pipe frame of 3.4 x 2.7 m^2. The FADs are covered by large size twine net to provide more shade and strength. Beneath the FADs, there are four pieces of 7 m net hanging like a 'skirt' and these are decorated with white rope to attract the fish to their shelter. Construction and dimension of the M.V. SEAFDEC FADs are given in Fig 1.

Nautical instruments for fishing

M.V. SEAFDEC has three frequency (28 kHz, 75kHz and 94 kHz) Color Scanning Sonar installed, one 288 kHz Color Echo-sounder, two Wet-paper Echo-sounders with frequencies of 28 and 50 kHz . There are also two sets of Radio direction finder for locating the position of radio buoys. Three Net-Zonde receivers; 40,50 and 60 kHz for detecting net depth while shooting and hauling the purse wire. There are also environment observation instruments related to fishing including a Doppler sonar current indicator and general weather observation systems and a NOAA receiving system.

In the work boats, SEAFDEC No. 3 and 4, a 200 kHz Tele-sounder is installed. These are used for detecting fish schools beneath FADs before and during fishing operations. Echo traces from Tele-sounders are converted and transmitted in the form of radio signals to M.V. SEAFDEC these are converted back to show a trace on the monitor on the bridge.

METHOD

Setting FADs and locating fish and fishing grounds

Determination of environmental information including wind, current direction and speed, the FADs were set in an area of latitude 01°N-06°S longitude 082°-090°E. This position is chosen because of the available information on the FAD's drift rate and direction, this is recorded year by year, to avoid FADs drifting into the Indonesian Exclusive Economic Zone (EEZ) and drifting away eastward which is too far for conducting fishing operations because of the limited time available. Others considerations for the selection of the FAD setting areas relate to the present catch

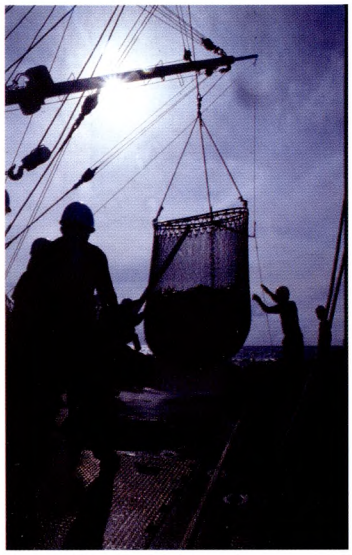


Fig 3. Scooping the fish

information from the Japanese tuna purse seiner fleet. Other indications are the appearances of a front (or frontal zone), drifting garbage or flocks of birds. Setting FADs in such areas may attract tuna schools sooner (Pokapan, 1997).

Searching for floating objects or flotsam like drifting logs and garbage etc. is another way to locate tuna schools. The attraction of fish to floating objects has long been observed. This behavior is explained, both in terms of floating objects serving as a single orientation point in the middle of the ocean and in terms of a gradual build up of a food chain community under and around the floating objects (Ben-yami,1994). Searching for floating objects by the crew of M.V. SEAFDEC, was done after the vessel left the Indonesian EEZ from early morning until twilight. There are three sizes of enlarging power, 7x50, 10x50, and 20x120 binoculars used in the ship for searching from the Compass Deck. After finding interesting flotsam, the vessel is maneuvered dead slow to check for fish schools by the Scanning sonar and Echo sounder. If a few fish are detected a small FAD and radio buoy are attached to attract more fish for operations at the next opportunity. On the other hand, if there are a lot of fish, the radio buoy and light buoy are attached for purse seine fishing operations the next morning.

Fishing operation

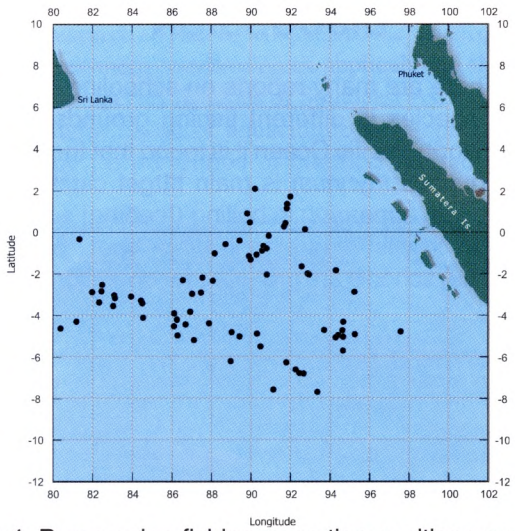


Fig 4. Purse seine fishing operation positions carried out in 1993-1998

On the operating day, the ship will approach the target area and will interrogate the radio buoy and receives both course and distance from the radio direction finder schools and environmental conditions, including wind, current speed and direction, which are considered in the decisions whether to fish or not and for net shooting. There are many times that the operation is canceled because of too few fish detected by the acoustic equipment, too strong a wind, too strong a current or strongly contravening directions among each current layer.

When the proper time arrives, the two work boats-SEAFDEC No.3 and 4 are launched and ordered to go to the FAD. When the crew have made fast to the FAD, a 2 KW underwater lamp is prepared and submerged to a depth of 10 meters beneath the work boat which is tied up nearest to the FAD awaiting the order from the Master fisherman to switch it on. Meanwhile as the preparations and the luring light progress, the Master fisherman and staff observe the Tele-sounder monitor on the bridge to estimate the amount of fish aggregated beneath and around the FAD. As previously mentioned, M.V. SEAFDEC is a starboard side shooting purse seiner, the vessel sets the surrounding net in a clockwise direction at a speed of 10 knots.

Time usage on net hauling depends on the quantity of catch. It may take 4-5 hours if the catch exceeds 70 tons. The skiff is used, during the catch transfer from bunt to fish holds, to keep the bunt float line at a distance from the seiner's side and to help in scooping the catch from the bunt. After all the catch is transferred, the bunt part is pulled out into the water for cleaning then all gear is rearranged for the next fishing operation.

Catch handling

After scooping fish from the bunt part of the net, the catch is passed through the revolving funnel situated at the stern and then to the fish hold. Because the catch of a tuna purse seine is often a large amount, the brine-freezing system is used as the first step to refrigerate the catch rapidly and dry freezing will be used later to maintain the catch in good condition (Munprasit and Chanrachkij, 1993). The brine solution is prepared by dissolving salt in seawater, at a ratio about 1:4, this is pumped into the fish hold and mixed using a submerged pump circulating system. The specific gravity must be checked frequently untill it is 1.17(at 15°C) by Hydrometer or 21.1 in the Baume scale. This is the ideal specific gravity for achieving the lowest freezing point(-21.2°C) of the NaCl solution. The solution is then transferred to another fish hold and refrigerated to -18°C. Excess salt in the fish hold is used for dissolving for the next catch. Brine stock will be transferred to each fish hold to about one-third of its capacity. Catch is transferred into fish hold until

90 percent of the capacity is reached, This allows space for fish body expansion after freezing, the full fishhold is treated with brine solution and wooden screens are used to cover the hatch to press all fish under the brine. The catch is submerged in brine solution for at least 12 hours or until the temperature is -15°C, afterwards, the solution can be discharged and kept in other fish holds. The catch might then be transferred to dry freezing room or kept in the fish hold at a temperature of -40°C until it is unloaded ashore.

RESULT

Position of the fishing operations & Quantity of catch

There were 73 fishing operations conducted by M.V. SEAFDEC from 1993-1998. The total catch was 1955.4 tons and the average catch per unit effort (CPUE) was 26.79 tons. Fishing operations were carried out in the area of latitude 02° N-08° S, longitude 080°-098° E, radiating around The Ninety East Ridge. Fishing operations in 1993-1994 were carried out mostly to the northward and eastward of the Ninety East Ridge. The five operations of 1993 were carried out in November and the total catch was 39 tons. In 1994, there were 7 operations in February-March and 6 in October-November. The total catch was 354 tons with an average catch per operation of 27.23 tons. In 1995, there were 20 operations, 11 in February-March and 9 in October-November. In the early period of 1995, M.V. SEAFDEC operated above latitude 03° S in between longitude 088°-096° E and had a total catch of 376.4 tons. In the late period, operations took place under latitude 03° S longitude 084° - 094° E, with a total catch of 156 tons. Total average catch per operation in 1995 was 26.62 tons.

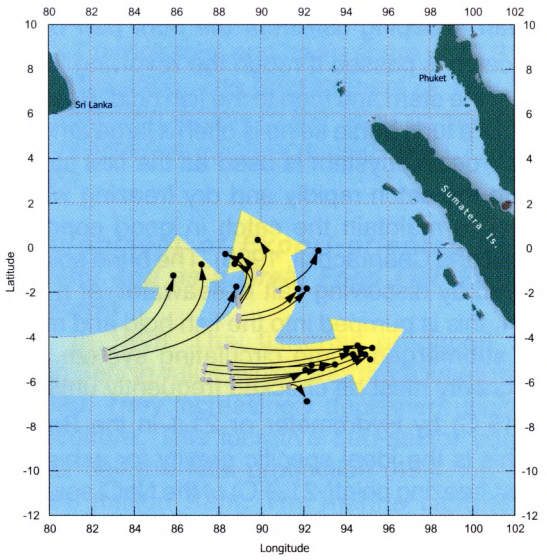


Fig 5. Overlaid drifting routes of FADs and model of surface current during Feb.-Mar. in 1994-96 and 1998

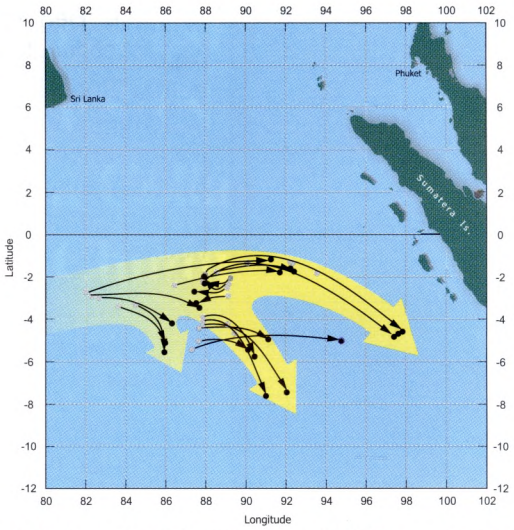


Fig 6.Overlaid drifting routes of FADs and model of surface current during Oct.-Nov. in 1994-96 and 1998

There were 14 fishing operations in 1996, 8 times in March and 6 in October-November. All fishing operations in this year took place under latitude 01°S. The average catch per operation was comparatively high at 36.71 tons, and the total catch was 514 tons. In the following year, 1997, the total catch decreased to 142 tons in 13 operations which were carried out to the eastward of latitude 088° E in between latitude 02° - 05° S. The average catch per fishing operation in 1997 was 10.92 tons. In 1998, there were 8 fishing operations, 5 in February-March and the rest in November-December. The operation positions were below latitude 02° - 08° S in between longitude 087° - 098° E. The total catch during the year was 374 tons in which 340 tons were caught in the early period. There was a big haul of 200 tons, at latitude 04°53'.3S longitude 095°14'.9 on 13 March which increased the average catch per operation of this year to 46.75 tons.

DISCUSSION

There are many reports on schooling patterns of tuna species in different fishing grounds. In the eastern North Pacific Ocean it is found that the Bluefin tuna (*Thunnus thynnus*) is main target catch of the purse seiner, appearing in boiling (feeding) schools[1], breezing schools[2] and also in black spot[3] patterns. The feeding schools are preferred for operations rather

[1] *Boiling school, Feeding school, Boilers* : Fish feeding intensively, and often in conjunction with marine birds, crowding upon the prey and creating an impression of the top of boiling pot.
[2] *Breezing school, Breezers* : Fish swimming very close to the surface of the water, usually in the single direction, creating ripples which resemble those created by a light breeze.
[3] *Black spots* : Subsurface schools appearing to the ship borne observer as black or dark spots.

than the other two mentioned patterns. Ben-Yami (1994) explained that it might be the fact of directional motion of the feeding tuna school is slower, less prudent and swimming more shallowly. In the eastern tropical Pacific Ocean, American tuna fishermen depend on porpoises for locating Yellowfin and Skipjack tuna schools (Green, Perrin and Petrich, 1971). About half the seine-caught Yellowfin tuna from the eastern Pacific are captured from schools associated with porpoises, spotted dolphins (*Stenella graffmani*), spinners (*S. longirostris*) and common dolphins (*Delphinus delphis*). Therefore, fishermen in these fishing grounds use binoculars to search for the spouting of porpoises at the sea surface. Tuna purse seine fishing in the Pacific Ocean also use aircraft, both fixed-wing and helicopters, for scouting fish schools, porpoises, birds or flotsam in the wider areas. Similarly, Japanese tuna purse seiner fleets operating off the West Coast of Africa also search for signs of birds, whales or porpoises for locating tunas schools. However, schooling patterns like boilers, breezers or black spots are rarely seen in the east Indian Ocean. Schools of tuna in these fishing grounds are frequently found aggregating under flotsam and drifting garbage. Therefore, drifting FADs are widely used for aggregate tuna in the area. From the study of the relationship between days of FAD's drifting and quantity of catch (correlation and regression analysis) by Pokapan (1997) found that there is a significant relationship between them (correlation coefficient = 0.5214). Japanese purse seiners operating in the East Indian Ocean have 28-46 FADs (Chantawong *et.al*, 1995) for alternating use in fishing operations throughout the season. When they find their FADs drifting too far or nearly inside the Indonesian EEZ, the FADs are picked up and reset again in the selected area. M.V. SEAFDEC, as mentioned previously, is operating in only two periods of the year in February-March and October-November. Thus, during such long time intervals between the working periods, at the end of each period, all FADs must be picked up. This results in a lower number of drifting days for the FADs in the fishing grounds. Anyway, a good relationship between SEAFDEC's Japanese Master fisherman and other Japanese purse seiners', like the Nipponn Maru, Fuguichi Maru, could relieve this trouble by exchanging, setting and resetting FADs between them. Furthermore, fishing ground information is exchanged to determine the best fishing spot for that period. Obviously, there is great advantage in fleet fishing operation over single-seiner operation.

REFERENCES

Chantawong, P., Suksawas, C. and Ubol-suwan, N. 1995. Tuna purse seine fishery in the East Indian Ocean, Department of Fisheries, Thailand. 17 pp. (in Thai)

Chantawong, P. 1996. Some biological parameters and longline fisheries of tunas in the East Indian. Department of Fisheries, Thailand. 31 pp. (in Thai)

Green R.E., Perrin W.F. and Petrich B.P. 1971. The American tuna purse seine fisheries. In Kristjonsson, H. (Ed.) : Modern fishing gear of the world 3. Fishing News Books, England. 182-193 pp.

Munprasit, A. and Chanrachkij I. 1993. Observation report on tuna purse seine fishing operations around Seychelles Waters onboard Nippon-Maru, 8 November 1992 to 7 January 1993. Southeast Asian Fisheries Development Center TD/RES/32. 39 pp.

Pickard, G.L. and Emery, W.J. 1990. Descriptive physical oceanography-An introduction .Butterworth-Heinemann, Oxford. 320 pp.

Pokapan, V. 1997. The tuna purse seine trial with Thai fisherman. Oceanic Fisheries Division, Department of Fisheries, Thailand. 46 pp. (in Thai)

SEAFDEC.1996. M.V. SEAFDEC cruise report of 1995 Volume 1: The Shipboard Training Activities in 1995. Southeast Asian Fisheries Development Center/Training Department, Thailand. 399 pp.

SEAFDEC.1997. M.V. SEAFDEC cruise report of 1996 Volume 1: The Shipboard Training Activities in 1996. Southeast Asian Fisheries Development Center/Training Department, Thailand. 315 pp.

SEAFDEC.1998. M.V. SEAFDEC cruise report of 1997 Volume 1: The Shipboard Training Activities in 1997. Southeast Asian Fisheries Development Center/Training Department, Thailand. 258 pp.

SEAFDEC.1999. M.V. SEAFDEC cruise report of 1995 Volume 1: The Shipboard Training Activities in 1998 part 1. Southeast Asian Fisheries Development Center/Training Department, Thailand. 210 pp.

SEAFDEC.1999. M.V. SEAFDEC cruise report of 1995 Volume 1: The Shipboard Training Activities in 1998 part 2. Southeast Asian Fisheries Development Center/Training Department, Thailand. 380 pp.

Shibata, K. and Nishimura M._____ . Analysis of Fish-finder records-VIII-Classification and interpretion of echo trace on the tuna fishing ground. College of Marine Science and Technology, Tokai University. 25 pp.

Siriraksophon, S., Rojana-anawat, P., and Seurungreong S. 1997. Special report; Tuna research conducted in the Indian Ocean. SEAFDEC Newsletter, 20(4): 8-9.

Sugano, S. and Yamamura, S. 1971. Japanese tuna purse seining off West Africa. In Kristjonsson, H. (Ed.) : Modern fishing gear of the world : 3. Fishing News Books, England. 198-205 pp.

THE USE OF NEW HIGH STRENGTH NETTING MATERIAL

Worawit Wanchana

REVIEW OF NEW NETTING MATERIALS USED IN FISHING GEAR

The main features of recent development in fishing gear and methods are the improvement of gear shape and more particularly larger gear sizes, increased towing speeds and gear handling (Fridman, 1986). In the late 1980s, Dutch State Mine (DSM) introduced high strength and high modulus polyethylene fibers. DSM has developed an improved gel spinning process that can produce polyethylene fibers having a higher strength 15 times more than a comparable steel wire and double the strength of any matching aramid (Joyce, 1993). Since then, new high strength netting material of high-performance polyethylene (HPPE) fiber has been introduced for use in fishing materials. HPPE fibers are now used in several parts of various types of fishing gear in Europe including bottom and pelagic trawls. In Japan, the HPPE net has been used for bottom gill nets and is under investigation for use in trawl nets. The reason for using HPPE is the significant advantage of the higher breaking strength as compared with the conventional netting twines. It also offers a reduction in twine size and reduces the resistance of the fishing gear in water, resulting in energy saving.

The actual selection of netting materials does not depend on one property alone, like high strength, but also other important factors like durability and cost that must be taken into account. The durability and cost of netting materials are an important consideration for material selection, because the expenses of nets represent the major part of the total investment for fishing equipment. Therefore, the higher cost of HPPE as compared with the conventional materials is still a considerable factor for wider use of this material in fishing gear.

Advantages of HPPE

It was reported that the breaking strength of HPPE was about 3 times higher than that of conventional twines of similar denier (Wanchana, 2002). Basically, the breaking strength of a twine can be estimated using its diameter as $T \approx k D^2$ where T is the breaking strength, k is a constant, and D is the twine diameter (Prado, 1990). So that the diameter of twines can be reduced by about 40% when using HPPE and yet be similar in breaking strength.In trawl nets, fishers should consider the reduction in drag to construct a bigger net size, or to reduce the fuel consumption, or even to use a less powerful towing engine in the boat. For these reasons, one advantage that should be discussed here is the use of HPPE for the drag force reduction in twines. Fridman (1986) described that the drag force in a straight line (twine, rope, etc.) can be estimated by the following formula.

$$R = C \times L \times D \times q \qquad \ldots(1)$$

where R is the drag force (drag resistance), C is the drag coefficient, L is the length, D is the diameter, and q is the hydrodynamic stagnation pressure ($= \rho V^2/2$: ρ = specific gravity, V = velocity of fluid flow). Fridman also described that the drag coefficient C depends mostly on the angle between the material (twine or rope) and the flow direction, because the pattern of dependence of C at any angle is similar for different types of material. When all terms except D are neglected, it can be seen in equation (1) that the reduction in drag resistance directly varies with the twine diameter. Similar to the results of estimation for the reduction in twine diameter, the drag reduction in twines using HPPE can be estimated to be about 40%.

The selection of netting material depends on the factors of high strength, long-term durability and price. The overall results studied by Wanchana indicated that HPPE had comparatively higher performance for long-term durability (high resistance to fatigue, high resistance to UV-irradiation, etc.) when compared to conventional twines. A comparison between the price of HPPE (about 10 times higher price than conventional netting: Torring, 2000) and conventional netting twines should be discussed more in detail on a weight basis. This is because netting materials are generally sold by weight and the assumption is that diameter reduction should compensate for its high cost. The weight of the netting twine can be calculated by the following equation:

$$W = \rho \times \pi \times D^2 \times L \qquad \ldots(2)$$

where W is the weight of netting, ρ is the specific gravity, $\pi = 3.14$, D is the diameter and L is the length. When comparing the difference in weight between PE and HPPE, HPPE twine is about 35 % lighter than that of PE because the reduction in diameter is about 40% yet having the same breaking strength. This shows that the cost of HPPE netting may be comparatively increased only by 3.5% even though the netting per unit weight is 10 times more expensive (Torring, 2000). It is clearly seen that even if the price of stronger netting material per unit of weight is higher, it can often be compensated by its lighter weight.

APPLICATIONS OF HPPE IN FISHING GEAR

Trawls

HPPE fishing nets are considerably easier to handle because thinner twines make lighter nets. The use of lightweight and thinner twines will reduce the resistance in the water (drag) and result in energy saving. The lower drag resistance will be advantageous by towing a larger net using a similar engine power or towing at a higher speed. As HPPE has a high strength and smaller twine, the total size of the net can be significantly reduced or larger nets can be assembled for the same weight of net. A consequence of the net size reduction will also be an advantage for storage space of the net on the fishing vessel. For instance, the same size of fishing vessel can store and use a larger net with the same volume of twine when using HPPE. Although the larger nets or towing at a higher speed with using HPPE nets may result in a higher catch, good balance between marine fishery resources and the catching effort must be taken into serious consideration to avoid over-fishing.

In a trial using HPPE for a pelagic trawl net, it was reported that knot slippage occurred in the front part of the net when HPPE was used all over the net (Kriele, 2000). Kriele also reported that the net became stable when using conventional PE in the wing parts and the rest of the net body using HPPE. This means that shape stability of the nets is an important factor to avoid knot slippage or even breakage caused by imbalance of the load. In another report, HPPE nets with double knots are being manufactured to prevent such knot slippage in the single knotted twines (Fishing News International, Oct. 1999). It can be suggested that the increase in towing speed when using HPPE should have more advantages in increasing catching efficiency in pelagic trawls because the swimming speed of pelagic fishes are considerably higher than those of demersal fishes.

Bottom trawl nets make particularly high demands on the netting material that should primarily have high knot strength, high extensibility, small diameter and high abrasion resistance (Klust, 1973). Because HPPE twine has lower elongation at breaks (small extensibility), the application of HPPE for the bottom trawl nets requires a proper net design, similar to that of the pelagic trawl as already mentioned. Although HPPE has a very good abrasion resistance, the service life is not longer than that of thicker conventional nylon when the bottom part of the net is in direct contact with the highly abrasive sea bottom (Kinoshita, 1998). It was reported that HPPE was used in combination with high-tenacity polyester twines (Fishing News International; Feb., 1995).

Generally, higher elongation twines will be able to absorb higher kinetic energy because of their load-elongation characteristics. The higher elongation twines can withstand shock loads (sudden changes of load in twines) better than low elongation twines (Kristjonsson, 1959). Kristjonson suggested that HPPE twine is slippery and has a low elongation, so that a sudden change of load in HPPE nets may cause knot slippage or even breakage. For this reason, the stability of the net shape using HPPE twines is an important factor to prevent local overloading. Therefore, a suitable trawl net design of using HPPE net for different towing conditions is very important.

Other fishing gear

As HPPE has a specific gravity slightly less than water, it floats. Therefore, the problem of fishing gear stuck on the sea bottom during fishing operations may be considerably reduced when using HPPE twines, for bottom longline and bottom drift gill net, this should be an advantage. Gill nets and most of the longlines are classed as passive gear, which are placed in the way of moving fish or fish schools (Klust, 1973). Therefore, good catch efficiency of these types of fishing gear requires a low visibility in water. The use of HPPE for some gill nets or longlines may have additional advantages because the thinner twine is considerably less visible. Although there are no current reports on the application of HPPE use for longline, HPPE could be used for longline fishing gear on the basis of thinner twine with high strength. A net manufacturer in Japan reported that HPPE nets have been used in lobster gill nets (Kinoshita, 1997).

APPLICATIONS OF HPPE FOR THAI FISHING GEAR

In Thailand, marine fisheries contributed about 79% of total fisheries production in 1996. Since the early 1990s, the marine fisheries production growth rate has been fairly steady, but is likely to reach a maximum sustainable yield in the near future (FAO, 2000). FAO reported also that small to medium-sized fishing boats of less than 50 gross ton decreased in number, those of more than 50 gross ton had increased in number in the past decade. It can be considered that commercial fishing gear has become more important for marine capture fisheries in Thailand. As critical economic conditions in Thailand were observed during the past few years, a problem of the declining numbers of people engaged in marine capture fisheries was also reported (SEAFDEC, 1993). Therefore, the use of new netting materials like HPPE for commercial fishing gear can be introduced to improve the catch efficiencies by reducing fuel consumption and the use of long-life netting materials, etc.

In 1995, total fishing gear registrations in Thailand were 17,950, including trawl nets (50.0 %), surrounding nets (7.4 %), gill nets (28.4%), push nets (4.0 %) and others (10.2%) (FAO, 2000). This indicates that most of the netting materials used in the Thai fishing gear are polyethylene and polyamide (nylon) according to the type of fishing gear. For trawl nets, HPPE can replace polyethylene because of the many advantages as already mentioned.

The problems in the fishing industries of the Southeast Asian countries, especially in Thailand, are mostly concerned with the decline of fisheries resources. The problems of over-fishing, less selective fishing gear, increased catching effort, low quality of the caught fish (especially the catch by trawl nets), and the increasing cost of fuel have been recently observed in Thailand. For trawl nets, the quality of fish catch could be improved by reducing the towing period (towing at higher speed) by using thinner-netting twines like HPPE. The thinner-netting twines should also incur less damage to the fish, and give a greater chance for small fish to escape from the net (Lowry, 1996). HPPE could also be used with the aim of reducing the cost of fuel consumption because it has less drag resistance.

REFERENCES

FAO. 2000. Fisheries Country Profile: FID/CP/THA Rev. 3., Kingdom of Thailand. http://www.fao.org/waicent/faoinfo/fishery/FCP/FICP_THA_E.ASP.

Fridman A.L. 1986. Calculations for fishing gear designs. FAO fishing manual. 241pp.

Fishing News International. 1999. Double knots stop slippage: 5.

Fishing News International, February. 1995. New-type netting in big demand. pp 32-33.

Joyce M.A. 1993. High-performance fibres. The Textile Institute: 25. pp 46-56.

Kinoshita Seimo. Co. Ltd. 1997. Super Q. Dyneema Product Guide (in Japanese).

Kriele J. 2000. Designs and benefits of nets in Dyneema. Conference of Fishing gear system March 27-29, 2000, Session 8.

Kristjonson H. 1959. Modern fishing gear of the world, FAO. Fishing News Book. 607pp.

Kulst G. 1973. Netting materials for fishing gear. FAO Fishing Manuals. 173pp.

Lowry N. and Robertson J.H.B., 1996. The effect of twine thickness on cod-end selectivity of trawls for haddock in the North Sea. Fisheries Research:26. pp 353-363.

Southeast Asian Fisheries Development Center (SEAFDEC). 1993. Fishery Statistic Bulletin for the South China Sea 1992.

Torring P. 2000. Netting materials for the new millennium. Conference of Fishing gear system March 27-29, 2000, Session 8.

Wanchana W. 2002. Studies on fatigue properties of high-performance polyethylene netting twine. Ph.D. Thesis, Laboratory of Marine Science and Technology, Tokyo University of Fisheries.

STUDY ON *THE JUVENILE AND TRASH EXCLUDER DEVICES (JTEDs)* IN MALAYSIA

Bundit Chokesanguan,
Somboon Siriraksophon, Rosidi Ali,
Suppachai Ananpongsuk and Chaichan Mahasawadee

It has been recognized for some time that trawling in shallow coastal waters has an adverse impact upon the bio-diversity of the areas and more directly, catches the juveniles and immature fish seeking both for food and protection in the target waters. There are several unanswered regional questions to which the solutions should be found. It has been found possible to selectively harvest single target species, but where there is a diversity of target species, as there are in tropical waters, the identification of the most suitable Bycatch Reduction Devices (BRDs) / Juvenile and Trash Excluder Devices (JTEDs) to perform the selective harvesting has yet to be established. It may well be that a variety of selective devices could be used, but certainly the experimental approach will identify the most suitable designs.

Today, the development of fishing technology has placed more emphases on the design of devices having the aim of selectively harvesting the target catch while at the same time reducing the level of undesirable catch in the form of juveniles, immature commercial fish and non commercial fish. In 1998 and 1999, SEAFDEC Training Department carried out a series of experiments with varying degrees of success, in the Gulf of Thailand. These experiments investigated the use of shrimp trawls equipped with various types of Turtle Excluder Devices (TEDs). The preliminary results and conclusions from these experiments were reasonably good in terms of catching and release efficiency of economically important fish species. Comparing nets with and without TEDs proved the efficiencies of the designs.

In the year 2000, a study was carried out in the waters of other countries in this region, starting with the experiments on JTEDs in Brunei Darussalam in September 2000. In this experiment, the design of the devices had been refined and the results indicated an immediate and satisfactory improvement. In May 2001, JTEDs were introduced into Vietnam in collaboration with RIMP of Vietnam. The experiment and demonstrations were carried out at Cat Ba Island in Hai Phong Province. Malaysia was the selected country for the implementation of such devices that can be beneficial as the Department of Fisheries of Malaysia, also has a project on selective fishing gear in the West Coast of the Peninsular Malaysia.

The objectives of the activity in Malaysia are as follows; 1) to conduct experiments and evaluations on a new type of JTED for fish trawl nets, 2) To evaluate and determine the catching and escape level efficiency of JTED designs, and 3) To promote suitable JTEDs under the responsible fishing technology and practices program through training and demonstration to Malaysian fishermen.

This paper describes the results of the Juvenile and Trash fishes Excluder Device (JTEDs) tested onboard a Malaysian Fishing Trawler in cooperation

with the Department of Fisheries, Malaysia. In particular, it provides estimates of Catch per Unit Effort (CPUE) of trawl fishery, catch composition in day and night times, distribution of length-frequencies for the capture fishes and released fishes using two different grid intervals.

MATERIALS AND METHODS

Experiments on JTEDs attached to fish trawl nets were conducted in cooperation with the Department of Fisheries, Malaysia between12 - 15 September 2001 in the waters off the coast of Kedah on the west coast of Peninsular Malaysia. Fig 1 Shows the fishing area and local fishing trawler employed for the experiments.

1. JTED Designs

The SEAFDEC/Training Department, having consideration to the efficiency of the escape levels for small or juvenile/trash fishes, developed a new type of JTED which was modified from the NOFI TRAOMSO A/S Sort-X . The size of the JTED frame was 50 by 80 cm and comprised of three pieces. The sorting grid of 12 mm and 20 mm which covered 0.8 sq. meters were placed at angle of attack of about 120 °, in mouth of the codend part. In the experiments, a cover net was mounted covering the device to collect the escaped species. Fig 2 shows the installation and operation diagram of the JTEDs.

2. Experiment and Data Collection

Fishing experiments for the JTEDs were scheduled, and carried out during daytime from 0900 - 1600 hrs and in the nighttime from 1900 - 2430 hrs. To compare catch composition and testing the JTED for shrimp trawl operation two different bar spacings of 12 and 20 mm were tested during both day and night time fishing.

One hour trawling with a towing speed of 4 to 5 knots was scheduled. The water depth, measured by sounding methods was between 20 and 28 m.

Catch data, by total weight taken from the codend and the covernet were recorded. For species identification, samples were randomly drawn from each haul. They were sorted by species and group. Each group or species were weighed in grams and individually measured for the fork length for determination of the length-frequency of the catch from both codends.

3. Data Analysis

All catch data from each trip was determined into percentage of catch composition and catch per unit effort (CPUE in kg/hr). Because of the size the compositions of populations fished, escape levels determined experimentally differ, thus the estimated escapement at length are applied to length frequencies of commercial catches. Estimates of "overall escapement" were calculated as the weight or number of fish in the covernet divided into the total caught in the cover net and codend.

Length - frequencies of major economically important species, from both cover net and codend were analyzed in relation to the percentage escapement. Trash fishes were not measured.

RESULTS AND DISCUSSION

1. CPUE and Catch Composition

The catch per unit effort (CPUE) in the experimental ground are between 27.54 to 48.93 kg / hr / haul in daytime and 31.69 to 35.11 kg / hr / haul in the night time operations. Fig 3 shows the catch composition by group (by percentage of total weight) between day time and night time operations. Comparison between day and night time operation found that the percentage of catch composition are clearly different. Percentage of trash fishes, pelagic species and cephalopod group in day time trawling are higher than at night. The amount of catch for pelagic species, especially in day time is about 7 times higher than night time trawling. In contrast, demersal species found at night time are about 3 times higher than in day time trawling. Large shrimp like *Penaeus* sp. are found both in day and night time, however there are many small shrimps including *Metapenaeus* sp. and *Tachypenaeus* sp. in night time trawling only.

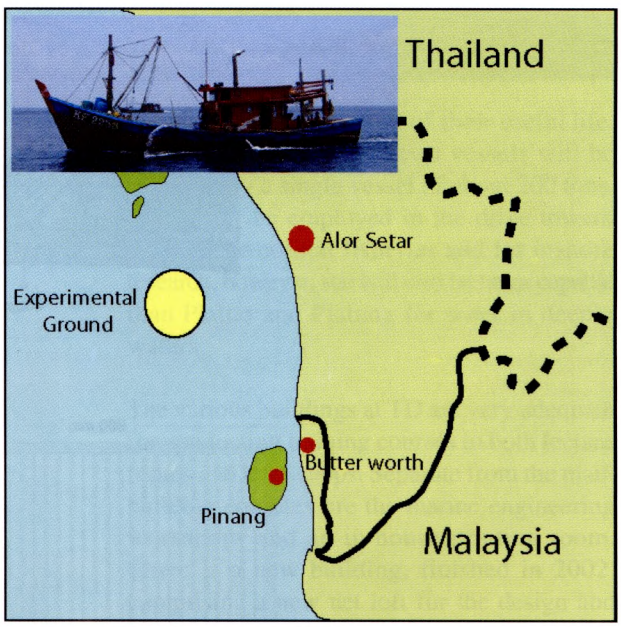


Fig 1. Experimental ground off Alor Setar,

Commercial species commonly found in this experimental ground are *Rastrelliger brachysoma*, *R. kanagarta*, *Atule mate*, *Upeneus sulphureus*, *Selaroides leptolepis*, *Nemipterus* sp., *Priacanthus macracanthus*, large shrimp (*Penaeus* sp.), *Loligo* sp. and *Sepioteuthis* sp.

2. Escape Levels

The overall escape levels of each target group (without consideration of size) in day time trawling between 20 mm and 12 mm bar spacing have been compared as shown in Fig 4. The difference in escape levels between the two bar spacing are relatively great, not only for the trash fishes group but also the target group. About 73 % of total catch were released by JTED with the 20 mm of bar spacing, and about 35 % escape levels for the 12 mm bar spacing. The trash fish group represents the highest escape levels which are about 87 % and 70 % for both 20 mm and 12 mm bar spacing of JTEDs respectively. Averaged, 63 % and 44 % of the pelagic fish and shrimp are released by a 20 mm bar spacing JTED. Whilst the 12 mm bar spacing released less than 10 % of the pelagic fish and shrimp. About 2-3 % of the total catch is crab including swimming crab, in which 100% were found to be captured in the codend.

3. Length Frequency of Catch and Escape Levels

From the overall escape level results without consideration of the size of the escaped fish, it is not possible to determine a suitable bar spacing for the two JTEDs.

Length frequency of the catch found in the codend and cover net for different bar spacing of 20 mm and 12 mm is very useful data to decide the size of bar spacing in JTEDs. The results from the comparative study of the length frequency of some commercial or dominant species like *Rastrelliger brachysoma, Atule mate, Nemipterus* sp., large shrimp (*Penaeus* sp.), *Loligo* sp. and *Sepioteuthis* sp. caught during experimental trawling with different bar spacings of JTED are shown in Fig 4.

The relationship between the length frequency and percentage of escape levels of the *Rastrelliger brachysoma* show that their fork length found during this period varied from 120 –170 mm as shown in Fig 4a. The results of escape level indicate that 100 % of the *Rastrelliger brachysoma* size larger than 120 mm will be caught by a 12 mm bar spacing JTED. In contrast, about 40% of the *Rastrelliger brachysoma* can escape when using a 20 mm bar spaced JTED.

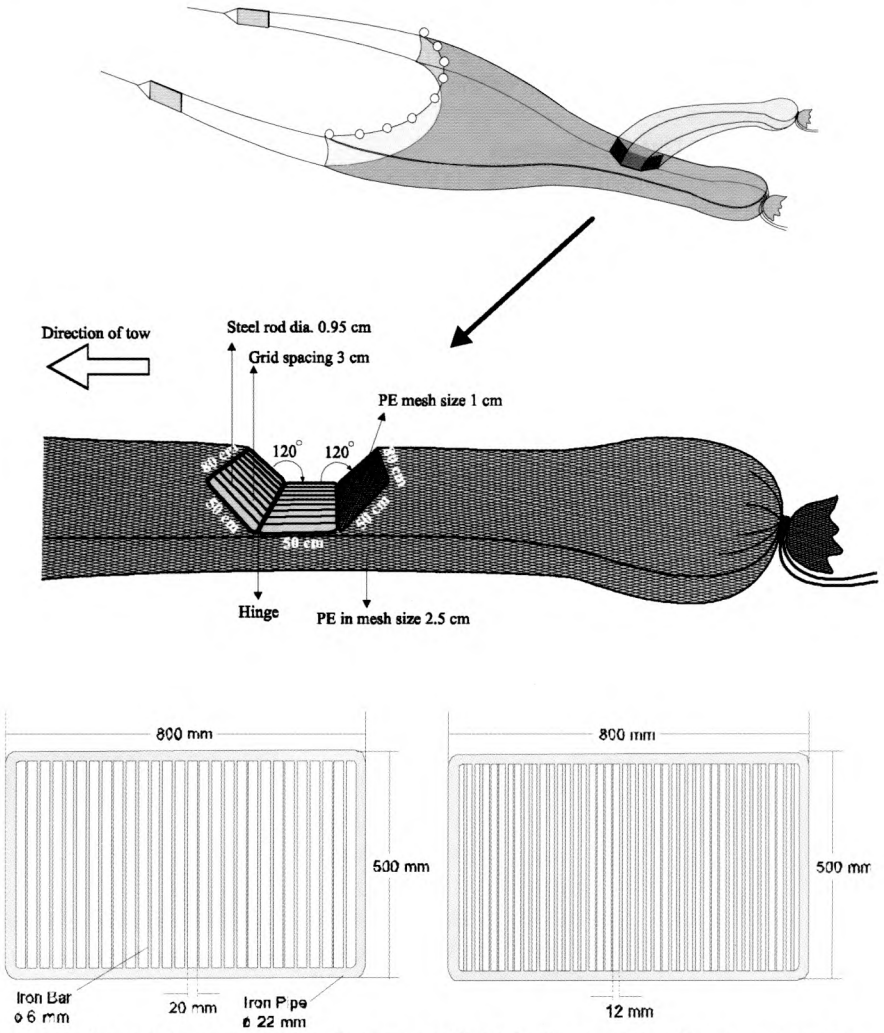


Fig 2. Installation of the juvenile and trash excluder devices on the fish trawl net for the experiments

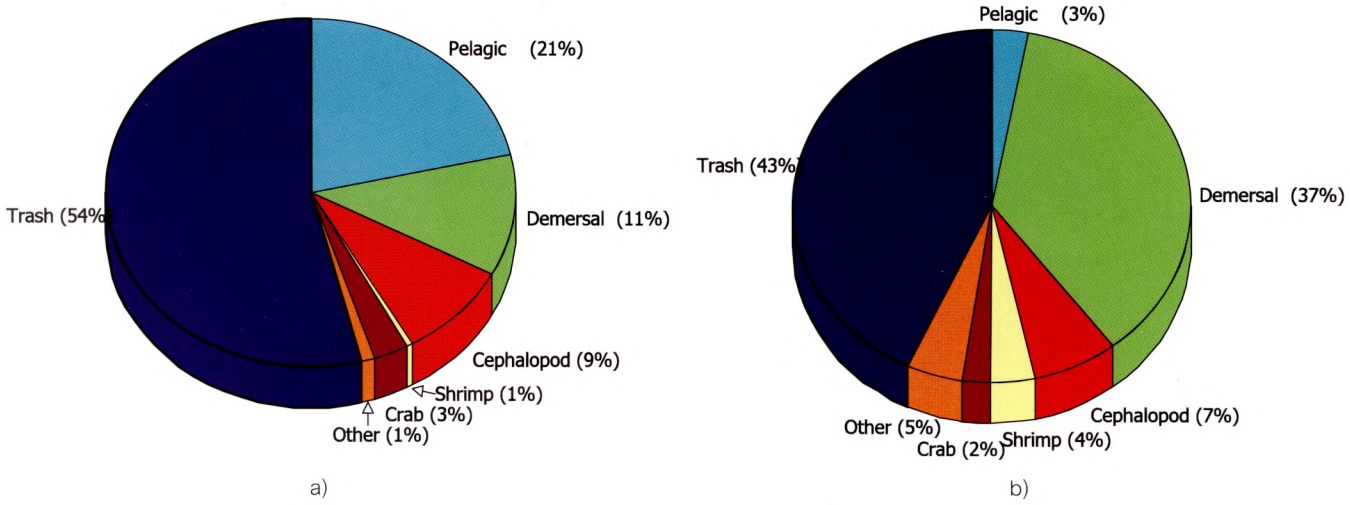


Fig 3.Catch composition of day and nighttime experiments, a) daytime and b) nighttime.

The 12 mm bar spacing JTED show good efficiency in catching medium and larger sizes (>120 mm) of *Rastrelliger brachysoma* both in day and night time trawling.

For *Nemipterus sp.*, the fork length varied from 30 - 230 mm as shown in Fig 4b. The escape results of the 12 mm bar spacing JTED shows it to be very good in selecting the larger sizes of *Nemipterus* sp. (> 110 mm) and releasing the small sizes during day time trawling. For night time trawling with a 12 mm JTED, about 45 % of smaller sizes of fish (<110 mm) were caught in the codend, this is because they live near the bottom and may directly pass through the codend not through the sorting grid. It showed also the escape levels for 20 mm bar spacing.

The same escape results were found for *Atule mate* (Fig 4c).

The dominant species in trash fish composition were the juveniles of *Siganus* sp. All were in the juvenile stage size smaller than 70 mm More than 70% of these juveniles were released through the sorting grid.

Many squid and cuttlefish were found especially in day time trawling. The squid found in this area were from 30 - 140 mm mantle length. About 80 % of the total catch of squid escaped through the 20 mm bar spacing JTED and about 50 % could escape through the 12 mm JTED in day time trawling. It is probable that the squid move vertically to the upper layer at night time, therefore, less squid were caught during the day time experiments.

For cuttlefish the escape levels related to the size of the cuttlefish, which varied from 50 – 290 mm mantle length. Using the 20 mm JTED could release about 65 % of the 50 - 130 mm cuttlefish. For the 12 mm JTED, only cuttlefish of less than 100 mm could escape, however, they were very few in number.

Large shrimp like *Penaeus merguiensis* and *P. semisulcatus* varied between 100 – 200 mm Fig 4d shows the escape results of shrimp for the 12 mm bar spaced JTED, there is no significant difference in the catch of large shrimp between day and night time. It indicates that only about 5% of the total shrimp could escape from the sorting grid of 12 mm bar spacing and about 95% of shrimp (>100 mm) were caught in the codend. In the case of the 20 mm bar spaced JTED, some large shrimp (up to 190 mm long) could escape. This shows the efficiency in size selection of the 12 mm spaced sorting grid.

CONCLUSION

The Implementation and introduction of selective devices is very urgent in the Southeast Asia Countries because of the over-fishing of the marine resources of both demersal and pelagic fish. The JTED is one of the size selection devices that can be used to release small sizes of fish and catch only the larger sizes. The principal of using this device is that the target species or large size of fish, shrimp or squid / cuttlefish should be retained in the codend and the small/juvenile should be released. From the experiments in this study, the 12 mm bar spacing JTED may be a suitable device to release the juvenile and small fishes including trash fish for sustainable fishing. Detailed studied must to be carried out to confirm this conjecture.

Other factors like easy installation and operation for fishermen must also be considered. A design review and improvement of the devices to fulfil these factors is essential.

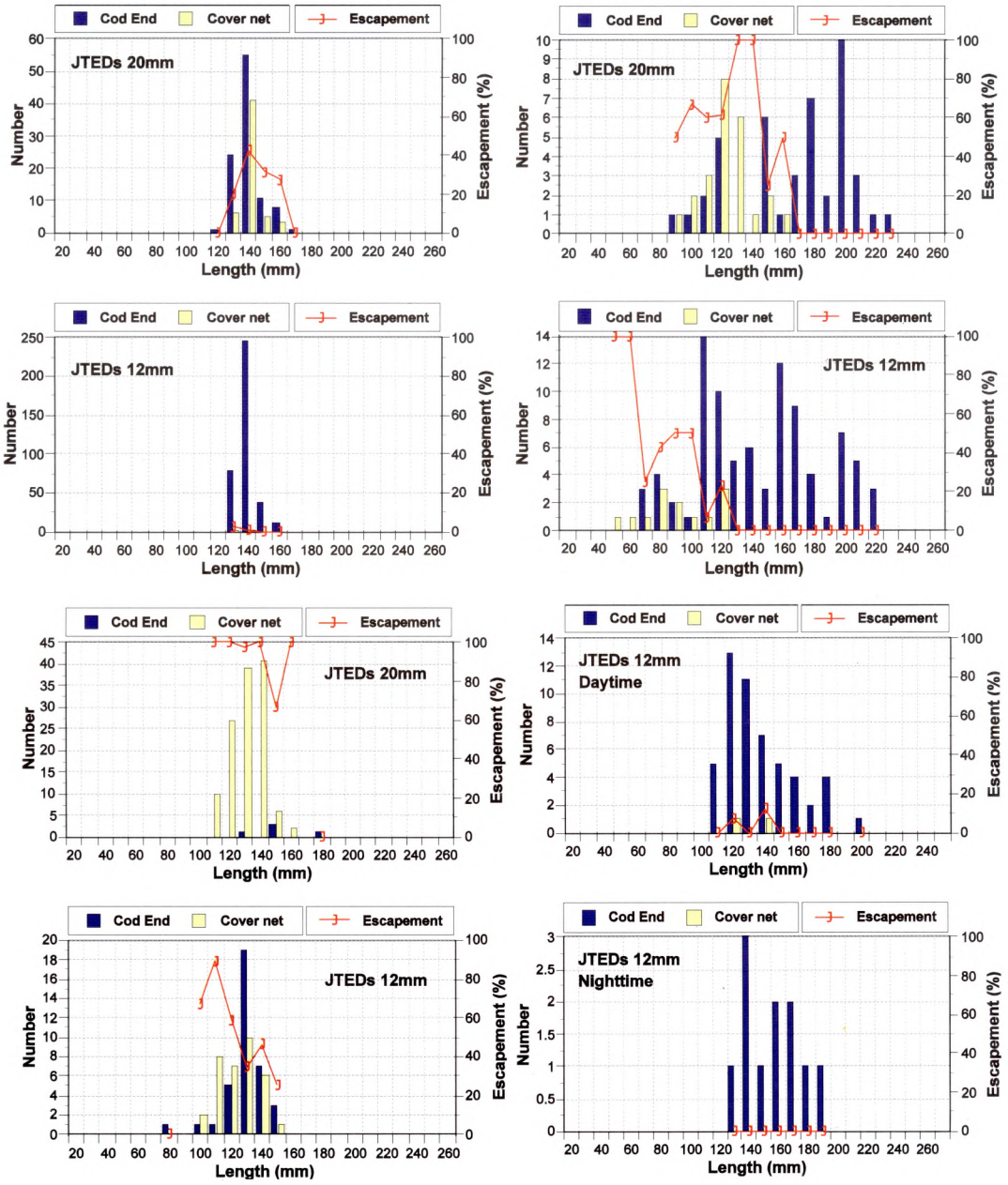


Fig 4. Length frequencies of some commercial or dominant species like *Rastrelliger brachysoma (a) Nemipterus* sp.*(b), Atule mate (c),* and large shrimp (*Penaeus* sp.) (*d*) which were caught from experimental trawling with different bar spacings of the JTED

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REFERENCES

Alverson, D.L., Freeberg, M.H., and Murawski, S.A. 1994. A Global Assessment of Fish Bycatch and Discards. FAO Fisheries Technical Paper No. 3 Rome, 233 p.

Isaksen, B., J.W., Valdemarsen, R.B. Larsen and L. Karsen. 1992. Reduction of by-catch in shrimp trawl using a rigid separator grid in the aft belly. Fish. Res: 13. pp 335-352.

Main, J., and G.I. Sangster. 1985. Trawl experiments with a two-level net to minimize the undersizedgadoi by-catch in a *Nephrops* fishery. Fish. Res: 13. pp 335-352.

SEAFDEC, 2000. Study on Juvenile and Trash Excluder Devices (JTEds) in Thailand. Training Department, Southeast Asian Fisheries Development Ceneter. TD/ RES/47. 17 p.

Tokai, T., S. Omoto and K. Matuda. 1994. Mesh selectivity of unmarketable trash fish by a small fishery in the Seto Inland Sea. Nippon Suinsan Gakkaishi: 60. pp 347-352 (In Japanese)

Tokai, T. 1997. Methodology of evaluating selectivity performance-Two selective processes of trawl sorting devices: Fish encountering and being sieved. Proceeding Southeast Asian Fisheries Development Center. pp 242-247.

Watson J.W., J.F. Mitchell and A.K., 1986. Trawling efficiency device: a new concept for selective shrimp trawling gear. Mar. Fish. Rev: 48. pp 1-9.

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