

STATUS OF COASTAL FISHERIES IN PHANG-NGA BAY AND CURRENT ISSUES FOR MANAGEMENT

Jate Pimoljinda

Andaman Sea Fisheries Development Center
Department of Fisheries, Phuket Thailand

1. INTRODUCTION

Phang-nga Bay is the largest bay on the Andaman Coast of Thailand and covers the northeastern shore of Phuket, and the entire shoreline of Phang-nga and Krabi Province (Fig 1). A unique feature of the Bay is the presence of large monolithic limestone islands, particularly in the upper reach of the Bay. The many islands scattered throughout the bay provide habitat and shelter to a wide diversity of the Bay's wildlife. Most of the bottom bed is mud and muddy sand with a maximum depth of about 35 meters. Extensive mangrove areas of approximately 3000 square kilometers are found along the shore line, and some areas are occupied by sea grasses.

The Bay receives nutrient and freshwater inflow from several rivers and streams. The most significant source of nutrients and freshwater comes from the Phang-nga river, and helps to make Phang-nga Bay a rich spawning ground and nursery ground for an abundance of marine aquatic animals. Important economic species providing sources of income for the livelihood of fishermen are marine shrimp, lobster, swimming crab, blue crab, short-necked clam and many species of fish including chub mackerel, pomfret, etc.

2. TRENDS IN THE PHANG-NGA BAY FISHERY

For the last two to three decades, Phang-nga Bay has been a biologically productive area, rich in aquatic resources. Fishing took place mainly in the waters just in front of the villages, and fishermen used artisanal fishing gears such as bamboo stake trap, hook and line and fish traps, among others. Gear used depended on geographic conditions and species targeted. Consumer demand for favorite species largely dictated targeted species during different seasons. However, with the development of fisheries and the increase in Thailand's population the demand for marine products for consumption has also increased, causing competition in fishing efficiency. Furthermore, many types of fishing gear and new fishing methods such as trawlers, light luring fishing techniques and push net, were introduced into the area. As a result, marine products have declined drastically. Competition for fishing grounds and conflicts between fishermen using different fishing methods have finally occurred in the Bay.

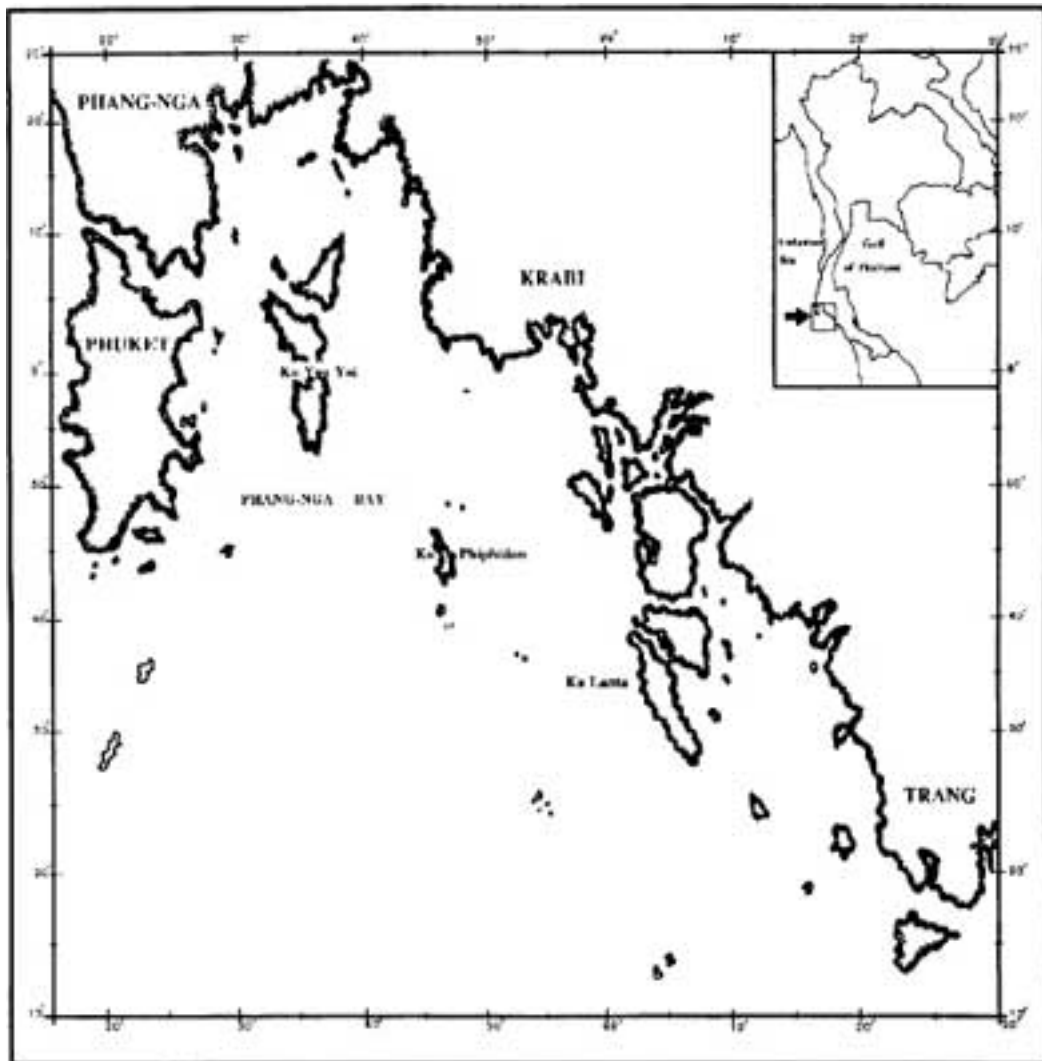


Fig. 1. The map of Phang-naga Bay.

Furthermore, it was found that fishing activities of each fishing village are based on many factors such as transportation and electricity. For example, in villages with good road connections to towns, each fisherman will use many kinds of fishing gear, as all of the catch can be sold to middlemen who come to buy directly at the landing site. On the contrary, middlemen are less able to come to villages that lack transportation facilities and infrastructure. Consequently, at these villages that lack infrastructure, only some species can be sold because of the long transport time to markets. This constrains the fishermen to catch only the species that enjoy high market demand. Moreover, illegal fishing by commercial fishing boats in prohibited areas of the Bay automatically limits artisanal fishing activities and further increases the hardship of disadvantaged small-scale fishermen.

2.1 Fishing gears used in Phang-nga Bay

Several types of artisanal and commercial fishing gears were used during the last decade in Phang-nga Bay when fishing activities were conducted without limitations and regulations. The gears are described below:

1. Trawler: Single trawlers and twin trawlers were the most common fishing gears operating in Phang-nga Bay. The original target species were economically important demersal species. However, when resources later declined, those fishing boats changed their target species to catch trash fish to sell to fish meal processing plants.
2. Small otter beam trawl: The target species of this kind of fishing gear is shrimp, but other species are also caught with this gear type. These include crab, squid, pelagic fish and economically important demersal species.
3. Light luring purse seiner: This is one kind of commercial fishing boat that is operated in the outer part of Phang-nga Bay by using light to attract schools of fish.
4. Anchovy encircling net: This fishing gear is designed to catch anchovy during the daytime. However, because of the degradation of resources and also the disturbance from light-luring purse seiners, catch from this gear type has decreased to almost zero. These purse seiners attract schools of anchovy and frighten the fish from schooling the following day. As a consequence, these anchovy fishing boats have changed their fishing method to operate during the night by also using light to attract fish schools, much like the light-luring purse seiner. However, this kind of fishery is illegal and creates many problems at present.
5. Trammel net: This fishing gear aims to catch shrimp and is quite commonly used in Phang-nga Bay.

6. Crab gill net: This is another selective fishing gear that mainly catches crab.
7. Sand whiting gill net: This gill net has been designed to catch sillagid species.
8. Push net: The push net is one of the most destructive fishing gears and also one of the most popular. Since its introduction it has been commonly used in Phang-nga Bay. The target species of this fishing gear includes primarily shrimp; small sizes of other small economic species are also caught.
9. Grouper tray: This fishing gear aims to catch mainly small grouper for selling to fishermen engaged in grouper cage culture to rear up to marketable size which is very high-priced.

Apart from the fishing gears mentioned above, there are some other fishing gears operated in Phang-nga Bay, but most of them are used for subsistence - the catch just feeds the fisher families.

3. CURRENT STATUS OF THE FISHERIES IN PHANG-NGA BAY

Utilization of fisheries resources in Phang-nga Bay has historically been exclusively by small-scale fisherfolk using artisanal fishing gears. One might assume that it is not a serious problem, but because of the rapid expansion of commercial fisheries (large number of fishing boats, new types of fishing gear and technologies), severe pressure has been placed on coastal areas, and commercial boats have begun to enter into the new commercially unexplored fishing grounds of Phang-nga Bay. The Bay is not within the limit of the trawlers and when they enter the Bay, they are fishing illegally. Furthermore, the fishing grounds and fishing habitats have been destroyed by those destructive fishing gears. Most destructive gears found in the bay could be identified as follows:

1. Trawling: Before 1979 every kind of trawler could freely operate in Phang-nga Bay with good catch rates. Ratanachote and Noothong (1969) reported the result of a monitoring survey by the arch Vessel Pramong 3. Results showed the catch in Phang-nga Bay in 1969 was 160 kg/hr, comprising 48.5 % valuable species and 51.5 % trash fish. This catch rate decreased to about 38 kg/hr in 1988, and comprised about 33.3 % valuable species and 66.7 % trash fish. The composition of trash fish was found to be about 30.1 % small economic species and about 36.6 % trash fish (Chantawong, 1993). Finally, these trawlers changed the target species to trash fish just to feed fish meal factories. The consequence of this depletion of resources seems serious.

2. Push net: This is another destructive fishing gear operated along the shore line, particularly in the productive area of shrimp. Over 290 ~~push~~ netters have been recorded

operating in the bay. Most of them are the long tail boats of 8-10 meters using 5-10 HP engines. Normally, **push** nets are used in the night after sunset, and at a depth less than 10 meters. Each operation will take 1-1.5 hours and a night's fishing (with a number of operations) can last 3-10 hours. However, during neap tide, fishing may last all night long.

Boonragsa and Nootmorn (1990) reported the fishery and resources status of push nets. Average catch was about 67.4 kg/trip, comprising mainly trash fish (about 85.4 %) and 14.6% economically valuable species. Marine shrimp comprised about 10.3 % or about 6.91 kg (Table 1) of the economically valuable species. Moreover, it was found that the trash fish catch was composed of true trash fish 56.10% and small economic species 43.9% (Table 2) which was sold in the form of trash.

The push net is highly efficient in catching trash fish, because the cod end used is just only 2 cm. It has been classified as a heavily destructive fishing gear. The capital for one set of push net was calculated as approximately 1,000-2,500 baht and can last for about one year (Aosomboon, 1988). The average income was about 460 baht while expenses averaged 270-300 baht. A technical analysis by Boonragsa and Nootmorn (1990) found that if shrimp were to grow **up** for a period of time, the value of the shrimp will register multiple increase, as illustrated in Table 3.

3. Small otter beam trawl: This is another kind of bag net popularly used in Phang-nga Bay and Krabi Bay in the past. About 50 trawlers are still being used in Krabi area at present. This fishing gear can typically operate two times a night with an operation time of 4-5 hour/haul except during high tide. Boonragsa (1988) reported a study of this fishery. The average total catch rate was about 104.86 kg/trip/boat, comprising 32.1% valuable species and 67.9 % trash fish (Table 4). The composition of trash fish was found to be 38.2 % of small economic species and 61.8 % true trash fish. It is therefore believed that this type of fishing gear is one of the more destructive gears.

4. FISHERIES MANAGEMENT INITIATIVES IN PHANG-NGA BAY

Management of fisheries in Thailand commenced more than 10 years ago, but the output was not so satisfactory. This may be because inappropriate methodologies have been used. The fisherfolk are also not so clear about technology transfer and fisheries resources management measures. This is largely due to the fact that fisherfolk are not given the opportunity to provide feedback to government officials on management decision-making. The implementation strategies have therefore been adjusted and improved to meet development targets. The activities that have been performed thereafter are can be divided as follows:

Table 1 Catch rate (kg/trip) and species composition of catch by push netting in Phangnga Bay in 1988-1989.

| Species | 1988 | | 1989 | | Average | |
|--------------------|--------------|------|--------------|------|--------------|------|
| | catch rate | % | catch rate | % | catch rate | % |
| Large size prawn | 5.11 | 8.5 | 5.34 | 7.2 | 5.23 | 7.8 |
| Small size prawn | 1.47 | 2.4 | 1.89 | 2.6 | 1.68 | 2.5 |
| Total prawn | 6.58 | 10.9 | 7.23 | 9.8 | 6.91 | 10.3 |
| Valuable fish | 0.57 | 0.9 | 0.90 | 1.2 | 0.73 | 1.1 |
| Crab | 1.91 | 3.2 | 2.23 | 3 | 2.07 | 3.1 |
| Squid | 0.13 | 0.2 | 0.07 | 0.1 | 0.10 | 0.1 |
| Trash | 51.43 | 84.8 | 63.75 | 85.9 | 57.59 | 85.4 |
| Grand total | 60.62 | | 74.18 | | 67.40 | |

Source: Boonragsa and Nootmorn (1990).

Table 2. Catch rate (kg/trip) and species composition of trash by push netting.

| Group of fish | Catch rate (kg/trip) | | | | | |
|---------------|----------------------|------|--------------|------|--------------|------|
| | 1988 | | 1989 | | Average | |
| | weight | % | weight | % | weight | % |
| Invertebrate | 10.91 | 21.2 | 9.82 | 15.4 | 10.37 | 18 |
| Demersal fish | 8.67 | 16.9 | 7.03 | 11 | 7.85 | 13.6 |
| Pelagic fish | 5.81 | 11.3 | 8.36 | 13.1 | 7.08 | 12.3 |
| Trash fish | 26.04 | 50.6 | 38.54 | 60.5 | 32.29 | 56.1 |
| Total | 51.43 | | 63.75 | | 57.59 | |

Source: Boonragsa and Nootmorn (1990)

Table 3. Income obtained from banana prawn (*P. merguensis*) in various sizes 1988 - 1989.

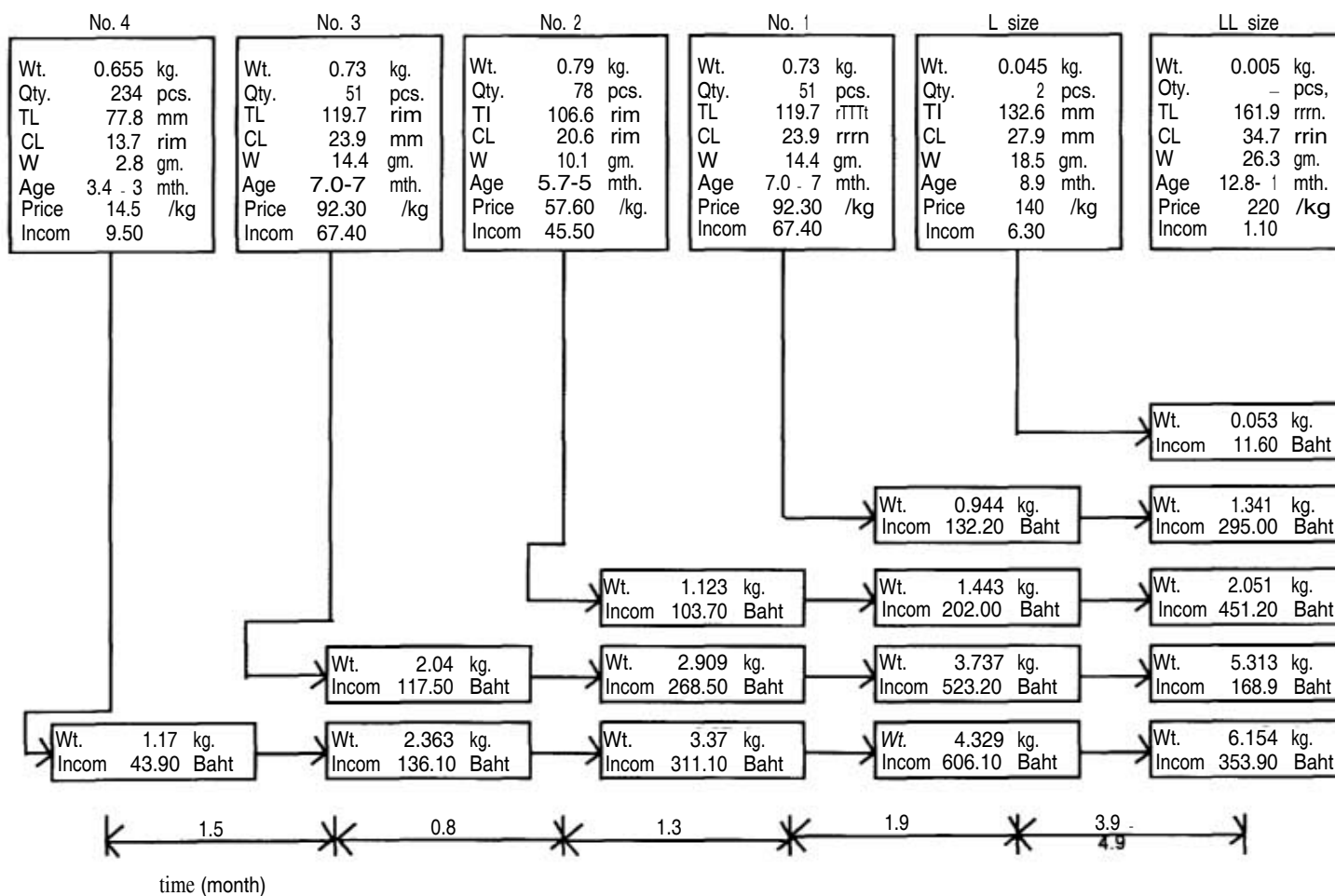


Table 4. Catch rate (kg/trip/boat) and species composition of small otter trawl Phang-nga Bay 1988.

| Species | Average all year round | |
|------------------|------------------------|------|
| | catch rate | % |
| Large size prawn | 8.84 | 8.5 |
| Small size prawn | 17.35 | 16.5 |
| Total prawn | 26.19 | 2.5 |
| Good fish | 3.89 | 3.7 |
| Crab | 0.83 | 0.8 |
| Squid | 2.77 | 2.6 |
| Trash | 71.18 | 67.9 |
| Grand total | 104.86 | 100 |

Source: Boonragsa and Nootmorn (1390).

Table 5. Total catch rate, valuable species and trash fish (kg/hr) collected by research vessel Pramong10 in Phang-Nga Bay in 1986, 1990, 1993 and 1994.

| <i>Year</i> | total catch rate (kg) | valuable fish (kg) | trash fish (kg) | big mackerel (kg) | small mackerel (kg) | operation (time) |
|-------------|-----------------------------|--------------------------|-----------------------|-------------------------|---------------------------|---------------------|
| 1986 | 34.66 | 16.42 | 18.25 | 0.1471 | 0.0045 | 119 |
| 1990 | 39.95 | 15.36 | 24.60 | 0.2904 | 0.0026 | 3 |
| 1993 | 49.90 | 22.53 | 27.38 | 0.5353 | 0.0000 | 38 |
| 1994 | 55.98 | 19.68 | 36.31 | 0.7745 | 0.0426 | 32 |

4.1 Legislative approaches

Many Ministerial regulations and fishery issues have been established, but the most important and at present are :

1. Ministerial regulation issued on 1 August 1979 prohibits each type of trawler and bag net with a motorized boat from fishing in Phang-nga Bay (Fig. 2). Since fishery officers cannot cover the whole area, illegal fishing still goes on, particularly in shallow waters near the coast which patrol boats cannot enter.

2. Ministerial regulation issued on 11 April 1985 prohibits each type and size of trawler, and enclosed net gill net with a mesh size less than 4.7 cm, from fishing in Phang-nga Bay and Krabi area during the period 15 April - 15 June every year (Fig. 3). This regulation was initially not so effective because it was not completely understood by fishermen. Enforcement by means of advertising, posters and video films helped clarify the picture. This, coupled with increased surveillance by fisheries patrol boats, has strengthened the effectiveness of the regulation.

Monitoring of the effectiveness of the closed area management measure has been conducted just before, in between and after the closing season every year since 1986. The result can be summarized as follows:

Demersal fisheries: Monitoring surveys of the status of demersal fisheries resources have been conducted by the research vessel Pramong 10 of the Andaman Sea Fisheries Development Center. Phang-nga Bay was divided into 15 stations for monitoring purposes as shown in Fig. 4. It was recorded that the average total catch increased each year. Catch in 1993-1994 showed a particularly significant increase, compared to the catch of 1986 and 1990. However, in 1994, catch decreased slightly in terms of economically valuable species caught, and increased significantly in quantity trash fish. The small size of chub mackerel composed in the trash fish has also significantly increased in 1994 (Table 5). It was also found that the catch rate in the closed area during the closed season showed significant difference from those before and after closed season (Table 6). But right after the end of the closed season, many types of trawlers, particularly pair trawlers immediately entered and began fishing in the area, causing a drastic decrease of fish stock.

Pairoh Sutthakorn, et al. (1995) reported on the follow-up conservation measures in Phang-nga Bay by a pair trawl surveys in 1995 the last day of measurement, about 50 pairs of trawlers were ready to fish. The catch record collected from nine pairs showed an average total catch of 3800 kg/haul operation or 1190 kg/hr - very high indeed. The average composition of catch was about 69.43 % (mostly chub mackerel more than 43%), 10.04 % demersal species and 20.53 % trash fish.

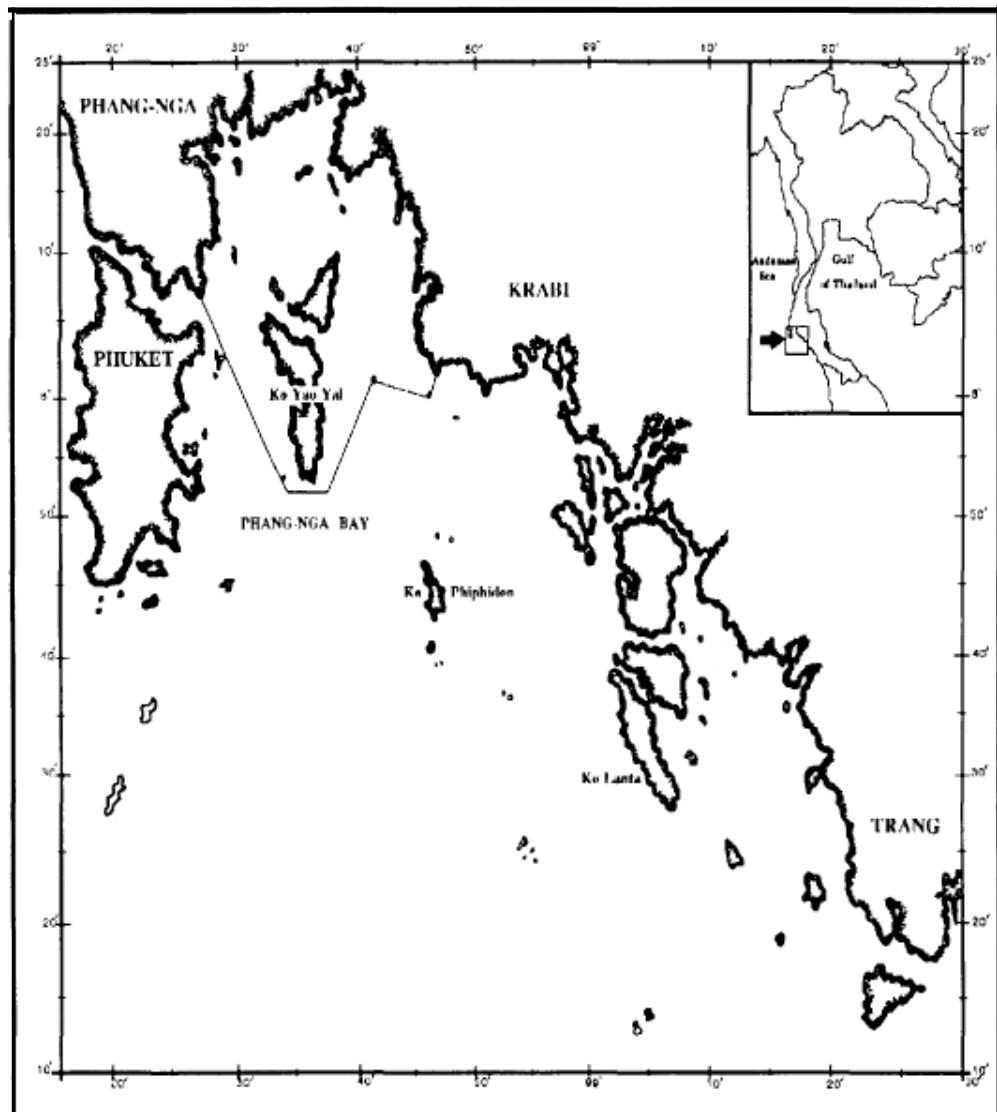


Fig. 2. Illustration of area prohibited of fishing using trawl net, push net and every kind of bag net with motorized boat (Ministerial Regulation issued 1 August 1979).

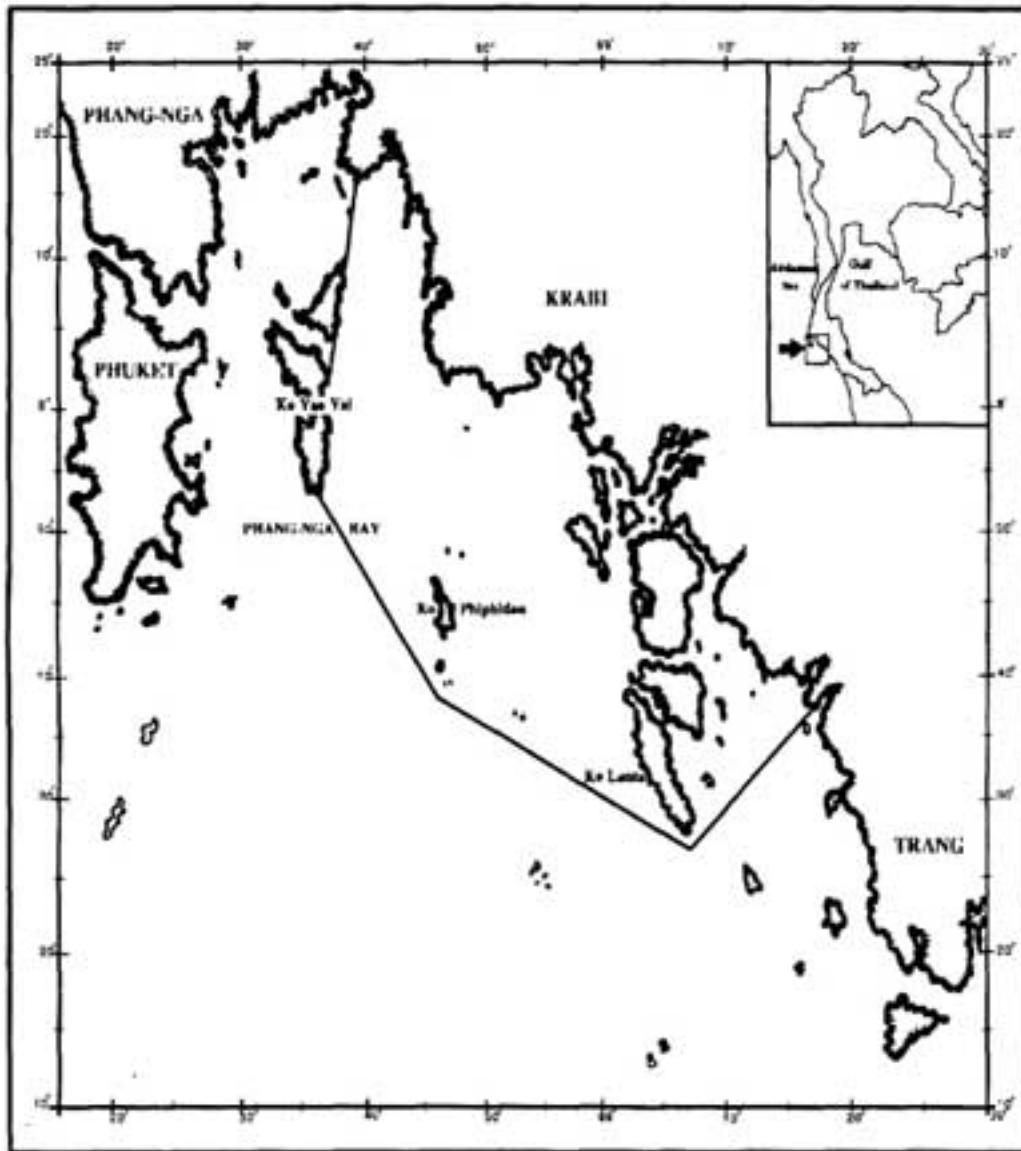


Fig. 3. Illustration of closed area for all kinds of trawlers, purse seiners, gill netters of mesh size less than 4.7 cm. during 15 April to 15 May every year (Ministerial Regulation issued 11 April, 1985).

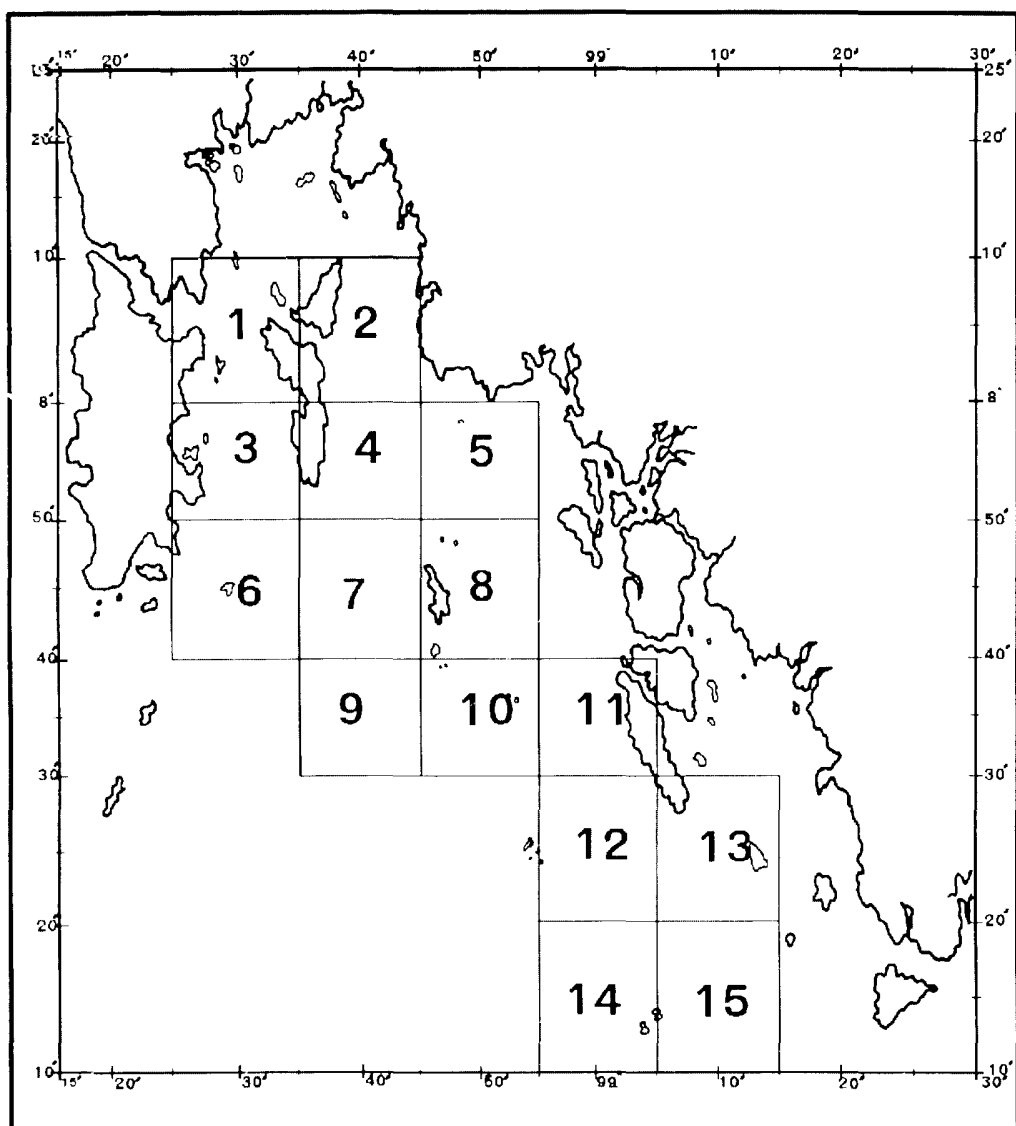


Fig. 4 Illustration of grid stations in Phang-nga Bay for demersal resources survey by research vessels Pramong 10

Table 6. Total catch rate, valuable species, trash fish, Mackerel (kg/hr) from inside, outside, and off the closed area during, before, in between and after closing season in 1986, 1990, 1993 and 1994.

| Year | Duration | Total | | | Good fish | | | Trash fish | | | Mackerel (L) | | | Mackerel (S) | | |
|------|----------|-------|-------|-------|-----------|-------|-------|------------|-------|-------|--------------|--------|------|--------------|-------|------|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 1986 | Average | 35.84 | 31.83 | — | 16.45 | 16.35 | — | 19.40 | 15.48 | — | 0.15 | 0.14 | — | 0.006 | 0.00 | — |
| 1990 | Pre | 31.12 | 22.38 | — | 11.68 | 10.35 | — | 19.44 | 12.03 | — | 0.09 | 0.05 | — | 0.00 | 0.00 | — |
| | In | 33.73 | 28.53 | — | 18.42 | 15.58 | — | 15.32 | 12.95 | — | 0.15 | 0.16 | — | 0.02 | 0.00 | — |
| | Post | 24.75 | 12.53 | — | 13.30 | 5.03 | — | 11.45 | 7.50 | — | 0.17 | 0.15 | — | 0.01 | 0.00 | — |
| | Average | 45.46 | 31.14 | — | 15.76 | 14.71 | — | 29.7 | 16.43 | — | 0.2163 | 0.4089 | — | 0.00 | 0.007 | — |
| 1993 | Pre | 28.86 | 36.55 | — | 10.00 | 15.78 | — | 18.86 | 20.77 | — | 0.10 | 0.93 | — | 0.00 | 0.00 | — |
| | In | 84.62 | 52.26 | — | 18.418 | 22.83 | — | 66.14 | 29.43 | — | 0.07 | 0.33 | — | 0.00 | 0.00 | — |
| | Post | 55.27 | 18.50 | — | 24.02 | 9.00 | — | 31.25 | 9.50 | — | 14.00 | 0.10 | — | 0.00 | 0.00 | — |
| | Average | 59.23 | 30.67 | 48.01 | 24.02 | 17.89 | 21.95 | 35.21 | 12.78 | 26.05 | 0.66 | 0.27 | 1.16 | 0.00 | 0.00 | — |
| 1994 | Pre | 29.47 | 35.27 | 16.27 | 11.14 | 17.27 | 11.26 | 18.00 | 18.00 | 5.00 | 0.12 | 0.00 | 4.75 | 0.00 | 0.00 | — |
| | In | 87.92 | 30.92 | 50.61 | 31.91 | 11.68 | 32.61 | 56.01 | 19.24 | 18.01 | 0.73 | 0.56 | 0.34 | 0.00 | 0.00 | — |
| | Post | 51.99 | 28.15 | 56.41 | 24.41 | 23.37 | 16.64 | 27.37 | 4.78 | 39.78 | 0.89 | 0.16 | 0.64 | 0.00 | 0.00 | — |
| | Average | 72.32 | 42.12 | 43.92 | 22.74 | 14.59 | 22.92 | 49.59 | 27.53 | 21.00 | 1.12 | 0.48 | 0.65 | 0.02 | 0.00 | 0.18 |
| | Pre | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| | In | 87.91 | 56.95 | 55.22 | 24.17 | 14.71 | 27.04 | 63.74 | 42.23 | 28.18 | 1.19 | 0.18 | 0.70 | 0.05 | 0.00 | 0.32 |
| | Post | 58.04 | 32.24 | 29.80 | 21.42 | 14.51 | 17.77 | 36.62 | 17.73 | 12.04 | 1.05 | 0.68 | 0.60 | 0.00 | 0.00 | 0.00 |

** 1. Inside the closed area
 2. Outside the closed area
 3. Off the closed area

Pelagic fisheries: Normally, purse seiners for pelagic species will operate in the outer part of Phang-nga Bay and Krabi area. During the closed season, these purse seiners will move to fish off the closed area and come back right after the season ends. Data collected during January to May showed that the average total catch will range from 1 300 to 4800 kg/trip with a high percentage of chub mackerel, Indian mackerel and sardine. The catch rate of chub mackerel appeared to increase from 13 kg/trip in January to 506 kg/trip in February **and** 1191 kg/trip in March. This might be because of the new recruitment of small chub mackerel. But in April, the catch rate was reduced to 214 kg/trip, perhaps because most of the purse seiners operated fishing off the closed area.

4.2 Management Measures

Many activities geared towards managing coastal resources have been implemented in fishing communities along the coast. These measures could be classified as follows:

1. Construction of infrastructure for the communities: These include for example, landing site, repair hall, fish processing building, fresh water stocking tanks retaining wall etc. based **on** the need of each village.

2. Training and grouping: Training courses have been organized for three groups of fisherfolk – fisherfolk leaders, fishermen and fisher-women; and students – in order to educate them on resources management and conservation assessment.

3. Extension on coastal aquaculture: Coastal aquaculture has been introduced to the fisherfolk to supplement their income. They have been provided with tools, materials and seeds besides technical assistance. At present, coastal aquaculture has been expanded throughout the coastal area of both the Andaman coast, and the east coast and could yield good benefits to fisherfolk. In the early stage, cage culture was very popular. Species that have been commonly found throughout the coast are sea bass, red snapper and grouper. Fish fingerling will generally be collected from the wild except sea bass fry which can be bought from hatcheries. But as the price of grouper is much higher than those of sea bass and red snapper, most fish cage farmers have changed to culture of this species. Apart from fish cage culture, shrimp culture has **now** become very intensive and the culture area has **now** been expanded to cover most parts of Phang-nga Bay. 1992 record reported shrimp production of 3,210 tons valued at 473.5 million Bnht, obtained from shrimp culture ponds of about 2760 rai or 460 ha.

4. Construction of artificial reefs: Artificial reef construction in Phang-nga Bay has been initiated since 1983 by using circle concrete blocks, used tires etc. (Niyom Lohakarn, et al. 1983). Because most of the sea bottom in Phang-nga Bay consists of mud and muddy sand, a part of the module used easier got sunk. Some other modules were destroyed by the trawlers. **In** 1985 when the Marine Fisheries Conservation Unit was established in Phuket

and the Ministerial regulation for closing some areas of fishing between 15 April and 15 June was issued, artificial reefs became an important tool for conservation. Two types of artificial reefs were installed. The first type consisted of reefs constructed just in front of fishing villages. The second type is the larger reef, about 50 square km. in area, aimed to prevent trawlers from illegal fishing in the prohibited area within 3 km offshore. It also serves as a big fishing ground for small-scale fishermen. At present, quite a number of artificial reefs have already been installed in the coastal area as shown in Fig. 5.

5. Awareness-building in fisheries for fisherfolk: This is a most important subject to be included in any management approach that would be applied in Phang-nga Bay. It is needed to create a better understanding within the fisherfolk community of conservation measures, protection of resources and fishing grounds in front of villages from outsiders, use of appropriate fishing gears, knowing how to utilize resources and surveillance of the environment in the area. These could be considered as a basic approach, which would meet the target of long-term development in the future.

6. Community-based fisheries management: Management of coastal fisheries resources could never have success without co-operation from fisherfolk. Of course, at the beginning they have to be guided by extension workers and gradually increase their responsibilities in resources management until they will be considered to be independent and could be responsible for all activities. This will be one of the indicators to indicate their readiness for participating in the TURFs project.

5. CONCLUSIONS AND RECOMMENDATIONS

It could be said that fisheries resources management in the past had emphasized infrastructure development more than academic development of the fisherfolk. Without an emphasis on academic development, the fisherfolk could not absorb what has been introduced. Most of the fisherfolk still have a strong respect in traditional beliefs and it is therefore rather difficult to change their minds to accept the new technology unless they can prove or try the technologies themselves first-hand. Even though the infrastructure has been successfully implemented, it was found that without a clear explanation of its use, the fishermen seemed to fear to use them. Finally no one became in charge or took responsibility of those constructions.

Therefore, to carry out efficient management of fisheries resources to reach the target of development, the following recommendations should be taken into consideration:

1. Timing: As previously mentioned, most small scale fisherfolk earn their living from fishing methods that are based on old traditional beliefs and it is rather difficult to change their mind. Some activities that take quite a long time to get the result, like

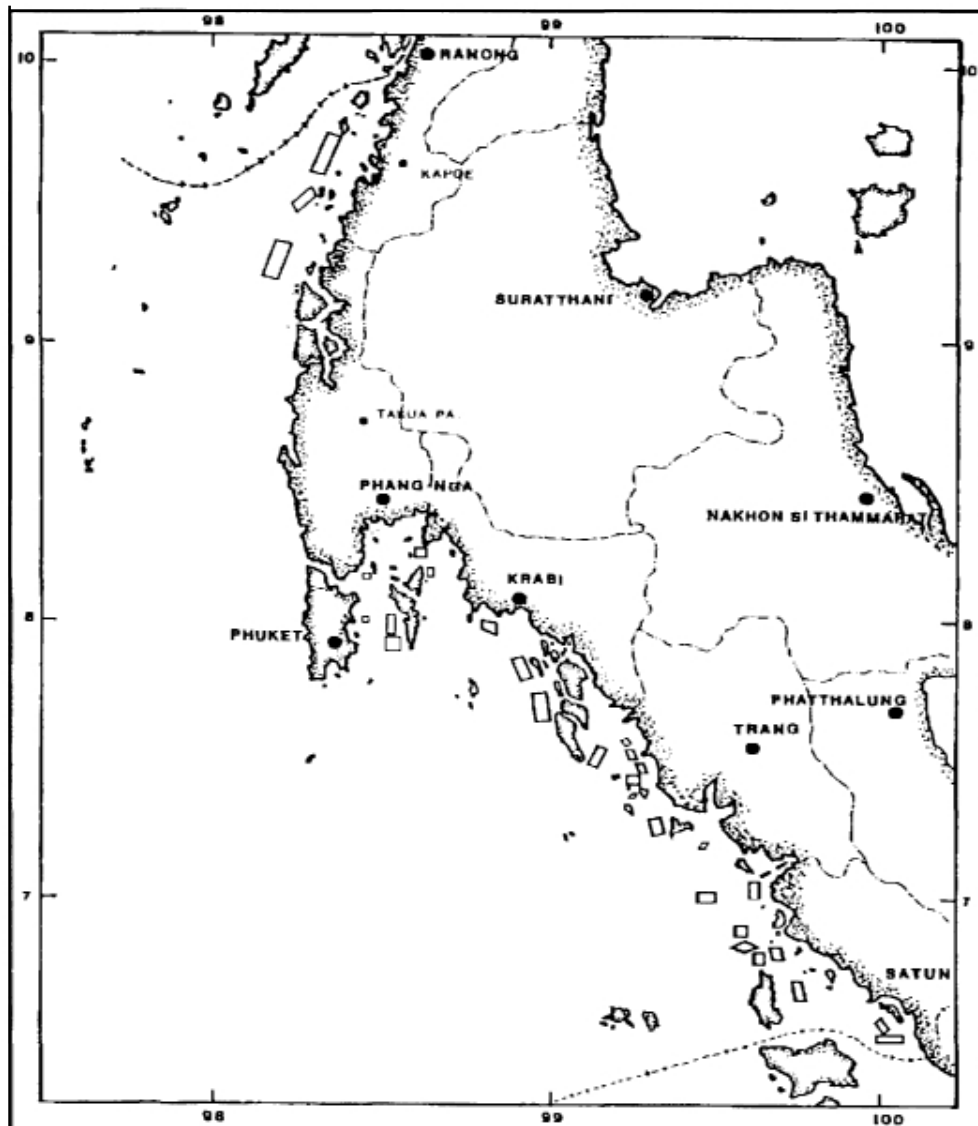


Fig :5 Illustration of artificial reefs construction on the Andaman Coast since 1986 - 1994

conservation measures for example, can involve quite complicated procedures and will make the fisherfolk confused without clear explanations. Therefore, to simplify the participatory approach of fisherfolk, confidence must be created among fisherfolk before moving forward to the next step.

2. Education: At present, education in fishing villages has developed slowly. This may be because of poverty or lack of encouragement to children. In addition, some family leaders think that after graduating, their children must come back to be fishermen. Further, in many schools, basic academic tools are in short supply. Therefore, the government should pay more attention to these poor fishing villages and provide opportunities for the young to acquire qualifications. For the older generation, awareness building is essential, and could be done through radio, TV, video, posters, training etc.

3. Infrastructure: To improve the living standard of fishing communities, essential infrastructure such as roads, electricity and water works should be built. At present, a number of fishing villages still have no roads for vehicles nor electricity, and there is a continual shortage of fresh water and drinking water, especially during the dry season. The fishing communities must buy fresh water from the sellers and it is quite expensive. Health care is also essential for fisherfolk. Normally, traditional cures have been popularly used in the fishing villages. Even health stations have been established, but they can only take care of common ailments. In Thailand's coastal communities, many of these activities have been implemented by the DOF. However, it appears that many of the activities have not been utilized, or have lacked management and maintenance, largely because of a lack of clarity in objectives. To attain development targets, activities should be coordinated so that they are carried out together and at the same time.

4. Personnel: Winning the confidence of fisherfolk is not just a matter of giving some introduction to the fisherfolk and leaving them to continue the activity by themselves, for this might make them confused and would not necessarily solve any problem. Therefore, to be close to the fisherfolk, and work together with them on a more practical level, the extension workers should spend full time in the villages. However, those personnel must have a good understanding of the work to be done, have good experience to help the fisherfolk solve the problems and should have good human relations to more efficiently help development.

5. Law and regulation enforcement: To obtain sustainable fisheries resources management, the enforcement should be effective. Many old regulations should be revised and updated. Fisherfolk must follow all regulations issued and furthermore the surveillance of illegal fishing and environment impairments should be performed with close cooperation of fisherfolk and the officers.

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