

## RESOURCE ENHANCEMENT

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### I. BACKGROUND

Resource enhancement in the maritime of Thailand comprises mainly of three activities, namely, releasing of fingerlings, mangrove planting and installation of artificial reefs (ARs). Releasing fingerlings and producing juveniles for coastal aquaculture involves major aquatic species such as the banana shrimp, tiger prawn, sea bass, swimming crab, and mud crab, their sizes follow certain organization requirements. ARs were first installed in 1978 in Rayong Province and later to other places in the Gulf of Thailand and the Andaman Sea. The materials used for the ARs were concrete tubes, concrete cube frames and old metals from cars, trains and ships. Mangrove planting, not a direct responsibility of the Department of Fisheries (DOF), has been carried out by the Department of Marine and Coastal Resource (DMCR), making it a co-management activity of two organizations; the DMCR for maintaining the nursery of the mangrove trees, and the DOF for coordinating the planting activities with the fishermen.

### II. ESTABLISHMENT OF ARTIFICIAL REEFS

The DOF installed ARs at the project site of the Integrated Coastal Resource Management-Pathiew District (ICRM-PD) from March to April 2004. Two groups of 1750 pieces of concrete cube frames, 1.5x1.5x1.5 m were installed at 12 m depth covering an area of 2 km<sup>2</sup> and set at the following latitude and longitude (Fig. 1):

Position 1		Position 2	
A. Lat. 10-48.20 N	Long. 99-28.05 E	E. Lat. 10-49.00 N	Long. 99-28.85 E
B. Lat. 10-48.20 N	Long. 99-28.30 E	F. Lat. 10-49.00 N	Long. 99-29.35 E
C. Lat. 10-47.20 N	Long. 99.27.00 E	G. Lat. 10-48.50 N	Long. 99-28.70 E
D. Lat. 10.47.20 N	Long. 99.26.75 E	H. Lat. 10-48.50 N	Long. 99-28.20 E

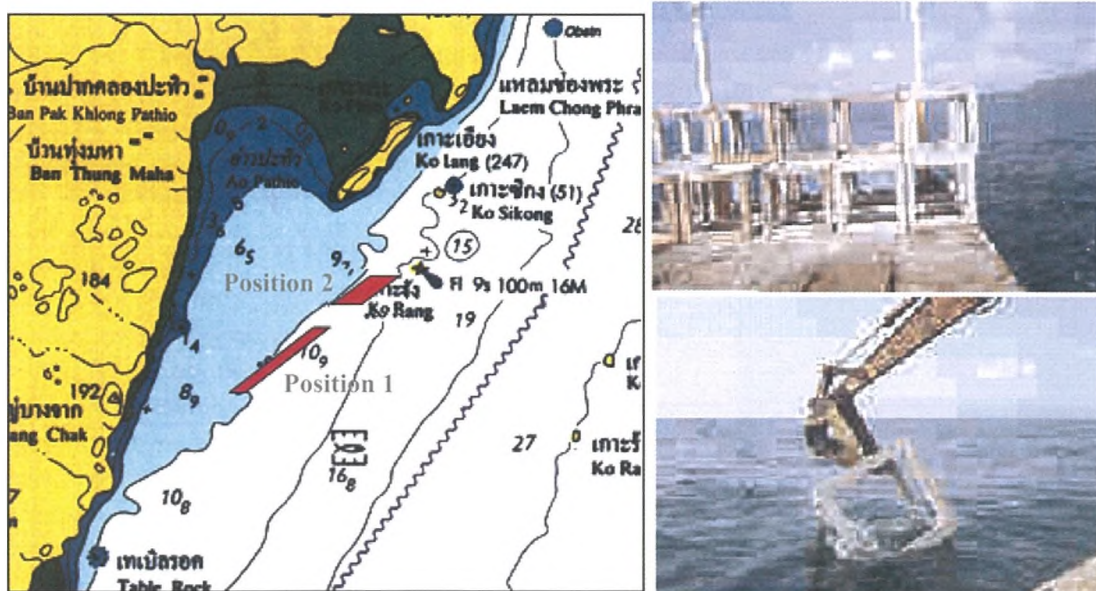


Fig. 1 Layout of two groups of ARs set at the ICRM-PD project site

The positions of groups 1 and 2 of the three types of ARs: 40,100 and 115 pieces, respectively are shown in Fig. 2.

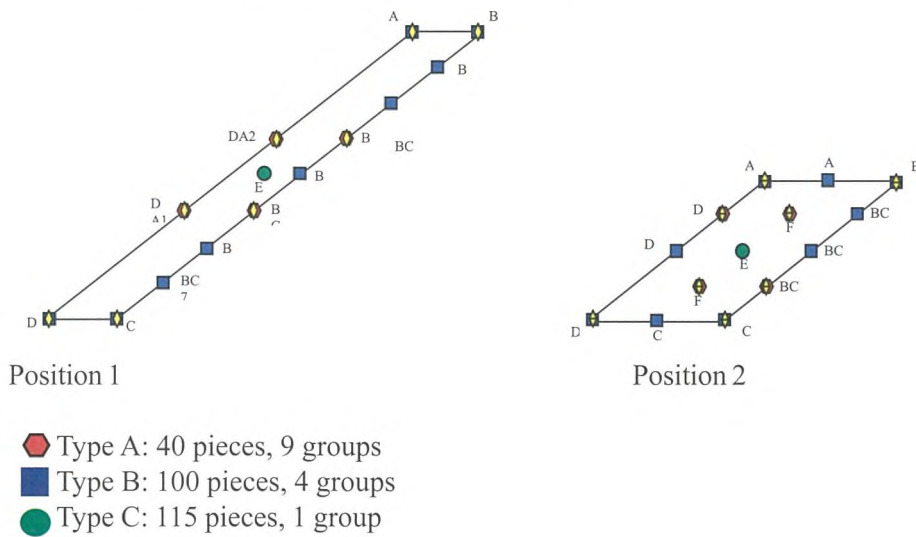


Fig. 2 Layout of ARs set in positions 1 and 2

After the end of project in 2006, the fishermen asked DOF to install more ARs in the project site. The DOF considered the request and provided a budget of 3,000,000 Baht for the installation of ARs in a 1 km<sup>2</sup> area fronting Ban Thung Ma Ha (Fig. 3). The total ARs installed was 675 pieces as of March 2007.

Results

The SEAFDEC-TD conducted a survey on marine resource at the ARs area in November 2003 (1<sup>st</sup> survey) and August 2004 (2<sup>nd</sup> survey) by fish trap, squid trap, bottom gill net and collapsible trap. The staff found 64 marine species, the top 10 species of which are listed in Table 1.

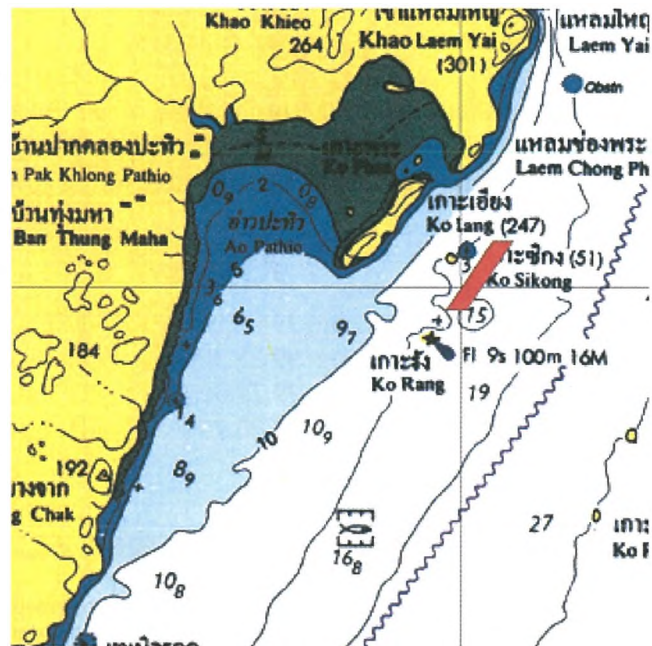


Fig. 3 Layout of ARs set at ICRM-PD project in March 2007

Table 1 List of top 10 marine species found at the ARs in the ICFM-PD project site

No	Common name	Species	1 <sup>st</sup> survey		2 <sup>nd</sup> survey	
			Number	Weight(g)	Number	Weight(g)
1	Pufferfish	<i>Arothron nigropunctatus</i>	171	10524	16	835
2	Croaker	<i>Johnius sp.</i>	165	10242	271	20918
1	Indo-pacific mackerel	<i>Rastreliger brachysoma</i>	111	6296	32	1805
4	Ponyfish	<i>Leiognathus sp.</i>	52	680	239	3362
5	Smooth-tailed trevally	<i>Selaroides leptolepis</i>	28	749	141	4600
6	Long tongue sole	<i>Cynoglossus lingua</i>	19	712	1492	57852
7	Flathead	<i>Sarsogona tuberculata</i>	11	586	638	37531
8	Blue swimming crab	<i>Portunus pelagicus</i>	32	3335	177	15480
9	Thredfin bream	<i>Nemipterus sp.</i>	30	1876	84	3678
10	Spotted butter fish	<i>Scatophagus argus</i>	24	1336	31	2525



### III. MANGROVE PLANTING

Thung Ma Ha Bay is the richest mangrove area in Pathiew District with an area of about 6,552 rai. At present, the area has decreased by about 2,000 rai because shrimp farmers have converted part of the mangrove area for culture and for building dam inside the forest to keep water to be used in the shrimp farms. During low tide, the mangroves die affecting the nursery grounds of marine species. At first, Thailand Environment Institute coordinated the mangrove planting project in 2001-2002, after which DOF and SEAFDEC continued implementing the project under the ICFM-PD.

In 2005, the Pakkhong Fisherman Group (PFG) was established. Its members agreed to plant mangrove trees on Mother's Day of every year starting in 2005.

#### Preparation

During the Fisherman Group Committee Meeting, they agreed to distribute the responsibilities such as transporting the mangrove tree seedlings, providing the planting equipment, locating the area for planting and identifying the location for the ceremony. Then the CMDEC asked the Twelve Mangrove Forest Development Stations providing the mangrove tree seedlings to preside the ceremony and invited nearby schools and heads of villages to participate in the activities.

#### Results

In 2005 and 2006, 1000 and 2000 mangrove tree seedlings were planted, respectively (Fig. 4), near the forest area knowing that the forest could protect the seedlings wind and waves. In the previous two years, a mistake was made when the seedlings were planted far from the forest so that in the monsoon season, the seedlings were uprooted and some of the trees died. Now, they people feel possessive while observing the mangrove trees growing. Trespassers are driven away by officers responsible for protecting the mangrove area.



Fig 4 Planting mangrove at Thung Ma Ha Bay

### IV. POST LARVAE RELEASING

Post larvae releasing supports the resource enhancement objective of the ICRM-PD project co-organized by SEAFDEC and CMDEC, Department of Fishery Thailand. Post larvae releasing also leads to increased income for the small scale fishermen. In the project area, the fishing gears are the squid net, shrimp gill net, crap tab and fish gill net. The main species released were fingerlings of the banana shrimps, tiger shrimps, blue swimming crabs and sea bass provided by the Chumphon Coastal Aquaculture Station (CCAS). The size of the shrimps was 1-2 cm, sea bass 1-2 in and blue swimming crab 4-6 cm (Fig. 5). Until now, there has been good support and participation in the activity by the locals, such as the local organizations that provided the equipment for the ceremony as well as the students and the fishermen.



Fig. 5 Releasing of fingerlings

## 1. Number of post larvae released

Since 2002, the total number of released fingerlings was 7,498,000 broken down as follows:

- Banana shrimps: 4,300,000
- Tiger prawns: 3,000,000
- Sea bass: 154,000
- Blue swimming crabs: 44,000

Releasing of the swimming crabs was done later because of their bigger sizes. As a form of natural conservation, the local organization established a crab bank to keep the gravid crabs and after spawning these are sold in the markets.

## 2. Evaluation after Releasing

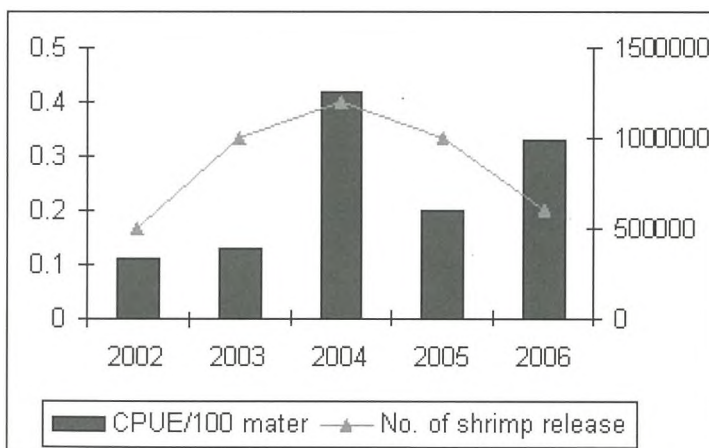
### 2.1 Monitoring by landing survey

From 2002 to 2006, monthly monitoring of the released stocks was done by the project staff considering the total catch of the fishermen through a landing survey. Two species recorded were banana shrimps and swimming crab that were collected by shrimp trammel net, crab tap and crab gill net.

### 2.2 Results

CPUE of banana shrimp during short season from 2002 to 2006 was 0.11, 0.13, 0.42, 0.20 and 0.33 kg/100 meters, respectively. The relationship between the CPUE and the number of post larvae released is shown in Fig. 6. In 2005, the CPUE trend was lower because the year indicated the highest number of fishing boats.

As for the banana shrimps, the average size released was 1-2 cm in December, May and June of each year. The size of shrimps recaptured from trammel net in 2002-2006 was 15.91, 16.08, 16.08, 17.50 and 13.69 cm, respectively. Since the shrimps were between 7-9 months old (Taweab, 1994), it could be assumed that the shrimps in the fishing area come from the stocks released. In 2004, Rochjanarut et al studied the average size of banana shrimps caught by shrimp trammel net in November to February of the next year at the ICRM-PD project site. The results showed that the average size recaptured was 15.73 cm and were believed to be 8-9 months old. Thus, the shrimps must have come from the stocks released in June 2004.



**Remarks:**

Fishing season

In 2002 ; Jan and Aug 2002

In 2003 ; Nov 2003-Feb 2004

In 2004; Dec 2004-Jan 2005

In 2005; Nov 2005-Jan 2006

In 2006; Nov 2006-Dec 2006

**Fig.6** Relationship between CPUE and number of post larvae of banana shrimps released



For the blue swimming crabs, the number of juveniles released in 2004 and 2005 totaled 40,000 and 3,700, respectively. The number of crabs caught by crab trap in 2002-2006 was 746,226; 898,653; 1,450,304; 2,355,114; and 1,142,710, respectively. The relationship between the number of recaptured and released crabs is shown in Fig. 7.

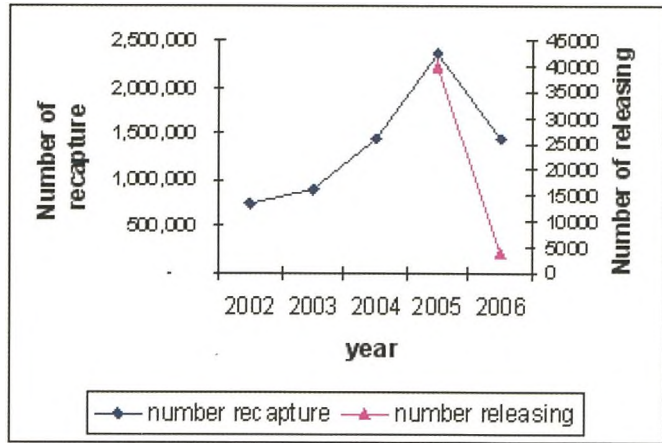


Fig. 7 Relationship between number of crabs recaptured and released

### 3. Monitoring by tagging

Tagging technique is a method used to estimate the number of marine animals recaptured after their released. The target two species tagged were sea bass and banana shrimps.

#### 3.1 Experiment

On 8 December 2006, a total of 111 sea bass with length 6-10 cm were tagged under the spine dorsal fin using a tag gun (Fig. 8). After tagging, the fishes were treated with Iodine and kept in a 1 m<sup>3</sup> tank for 28 days. After 17 days, 3 fishes died while 25 fishes died after culturing for 26 days. On 5 January 2007, the remaining fishes were taken to the ponds. A CCAS officer concluded that the fishes died in the tanks because of limited swimming space and when the fishes became stressed they were prone to infection. It was therefore recommended that the suitable period for observing the fish before releasing them should not be more than 2 weeks.



Fig. 8 Position of the tags in shrimps and in sea bass

#### 3.2 Procedure

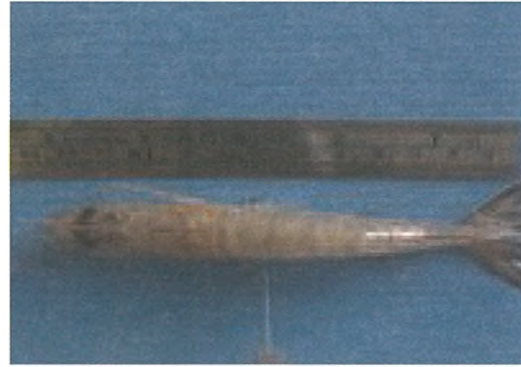
On 22-24 December 2006, Professor Hiroshi Fishimi from Japan was invited by SEAFDEC/TD to teach tagging technique for shrimps to the project staff. He also provided 3 tag guns and 50,000 tag pins (Fig. 9).



Fig. 9 Professor Hirishi Fushimi teaching CMDEC staff the tagging technique on 22-24 December 2006

On the first day of May 2007, tagging was started for 372 banana shrimps with size 6-9 cm and ave size of 7.12 cm. After releasing for 20 days tag number A788 was recaptured by trammel gill net. It was observed that the shrimp increased in size by 2.4 cm (Fig. 10). For sea bass tagging was done on 11-15 June and released on 21 June 2007, total number tagged was 1,000 fishes.

Before and after releasing, announcements in the radio and newspapers were made regarding the shrimps tagged by CMDEC. A reward has been arranged for people who can turn over a tagged shrimp to the Center.



**Fig. 10** Size of shrimp recaptured by trammel gill net on 21 May 2007

## V. CONCLUSION

1. The shape of ARs in the project site was concrete cube frame. The ARs were installed in three groups valued at 9,000,000 Baht. The ARs could be referred to as “marine animal habitat” because 64 marine species were found in this area, comprising mainly the Pufferfish, Croaker and Indo-Pacific mackerel, etc.
2. Mangrove planting activity was conducted by the Pakklong Fisherman Group since 2005. Since they know the benefits from mangrove forest, they have volunteered to drive away trespassers and report them to the officer who is responsible for enforcement in the mangrove forest.
3. In five years, the trend of CPUE on banana shrimps and the number of blue swimming crabs have increased and assumed that the stocks must have come from the post larvae released. Although landing survey could surmise increasing CPUE of marine animals from post larvae released still the number of marine animals recaptured could not be estimated. Tagging was therefore carried out in order to confirm the number of marine animals recaptured based on the number released, and also in order to establish their growth rate and migration pattern.

## VI. REFERENCES

- Taweep B. 1994. Relationship between size and growth rate of *Penaeus merguensis* in the Lower Gulf of Thailand. Report in technical research seminar of DOF in 1994, during 19-21 September 1994. P 328-336.
- Rochjanarut R. , Thawon R., Jiraporn R. and Kuanruthai S. 2004. Marine Shrimp from Shrimp Trammel Net in Locally Based Coastal Fisheries Management, Pathew Districk, Chumphon Province. TD/RP/88, LBCFM-PD No.31. SEAFDEC and Department of Fishery . 11 p.