

# Impacts of Tsunami Disaster on Thai Fishing Communities and Their Coastal Resource Management

津波災害がタイの漁村および沿岸域資源管理に与えた影響に関する研究

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# Impacts of Tsunami Disaster on Thai Fishing Communities and Their Coastal Resource Management

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## 1. Introduction

Several months after Thai fishery industry was damaged by Tsunami disaster in December 2004, fishers and their families started to recover from the critical situation. Fishers were continuously suffering during this recovering period as they lost the means of their production. Local fishers in Phang-Nga Bay area had so far made much effort to establish a sustainable resource management framework with participatory and decentralized approaches. Hence they faced the problem to maintain their livelihood and income opportunities after the disaster, this might reduce fishers' awareness on coastal resource utilization. People fell in poverty and excused to use natural resources without considering environmental consequences. This might lead to deterioration of coastal resources and fall into the 'tragedy of commons' again (Hardin, 1968; Ostrom et al., 2002).

In the following phase of recovery process, there were many sources of effort to re-establish fishery activities. The management of vast demolition as caused by a disaster like Tsunami was the first experience of the Thai government. The relief works and compensation still had some obstacles, and they were not smoothly done in practical way. It needed a systematic management of relief and rehabilitation work, the absence of which might cause unequal or duplicated help. The vision concerned about the exceeding capacity of fishing efforts after re-establishment was widely discussed. If the fishing boat or fishing gear was compensated to affected fishers much more than their own capacity, it might put more pressure on fishery resources (Adger et al., 2005; FAO, 2005; Kurien, 2005). In the region of affected countries, related organizations such as FAO adopted the strategic framework for rehabilitation of fisheries and aquaculture activities, which had principle to keep well managed and based on adoption of internationally recognized best practices, sustainability, protection of the environment through participatory coastal management approaches (RAP Publication 2005/09).

This study had two objectives. The first objective was to explore the effects of the Tsunami disaster on fishers' activities. The second objective was to investigate how resource users and

local people would keep the sustainability of coastal resource management after the crisis.

The study was conducted during June, 2005 among fishing communities of Thai Tsunami affected areas, where fishers were involved in both capture fisheries and aquaculture. Interviewing of staffs having responsibility of relief work and coastal resource management were also conducted. A structured questionnaire was adopted in order to interview 106 selected fishers who were affected by the Tsunami. The questionnaire included issues such as household economy, fishing activities and opinion toward the effect of change after disaster. The effects, as regards environmental impact, were evaluated in the economic and social aspect of people together with an environmental aspect (OECD, 1993; Morse et al., 2000; Reed et al., 2005). Moreover, the institutional aspect such as the management rules had an important role to sustain the resources (Charles, 2001; UNCSD, 2001). With this concept, the survey was concerned all these four aspects to determine the effects of the Tsunami on coastal resource management.

The selected study areas were Krabi Province, one of Andaman seacoast provinces where seriously affected both capture and aquaculture fisheries (Table 1). Two sub-districts were selected to conduct survey. AoLukNoi Sub-district was considered as aquaculture community while KhaoThong Sub-district was heavily related in capture fisheries (Figure 1).

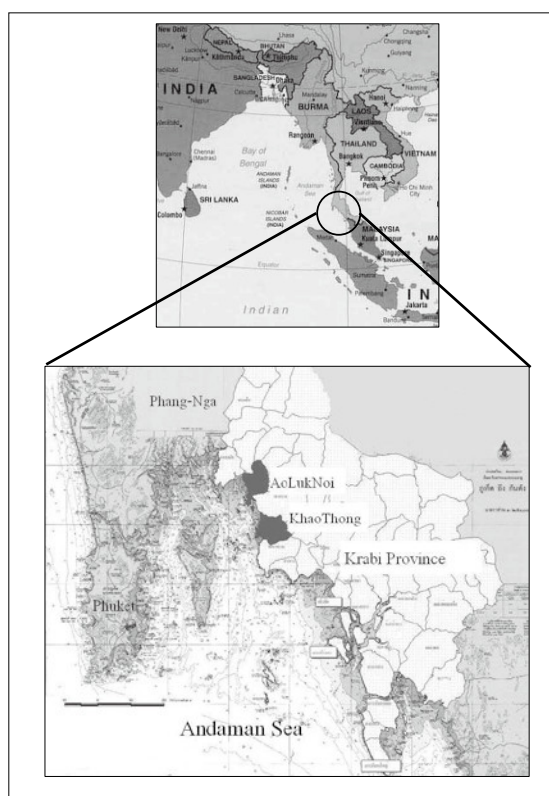


Figure 1 Map of study areas in Krabi Province

Table 1 Summary of damages by Tsunami in Krabi Province

Damaged items	Whole area	Krabi Province
Large scale fishing boat (unit)	1,337	308 (23.0%)
Small scale fishing boat (unit)	3,978	828 (20.8%)
Fishing gear (unit)	49,548	47,273 (95.4%)
Fish cage (Sq.m.)	1,266,931	64,806 ( 5.1%)
Licensed area for coastal aquaculture (Sq.m.)	3,151,392	48,592 ( 1.5%)

Source: Krabi Provincial Fisheries Office, June 2005

## 2. Case of AoLukNoi Sub-district

### 1) Fisheries activity of AoLukNoi Sub-District

AoLukNoi Sub-District, AoLuk District located in Krabi Province, Southern part of Thailand. AoLukNoi composed of six villages, two of which faced to the sea. Bakan village was located along the canal named 'Klong Bakan' that was connected to Andaman Sea. It was quite a large village with 396 households and about 1,900 inhabitants. Majority of the houses were constructed nearby the canal. Main occupations were fisheries and their related activities, including both capture fisheries and aquaculture. There was about 20% of households had rubber and palm plantation as major income sources of the households.

Capture fisheries was a major job for the people in this village. There were about 300 fishing boats. The fishers mainly used small sized fishing boats with less than 10 meters in length and mechanized outboard engine with 13-75 hp. The fishing gears employed were shrimp trammel net, crab bottom net, fish gill net, crab trap, grouper trap and shallow water set net. The fishing grounds were along the 'Klong Bakan canal' and in coastal area in front of their Sub-district and adjacent water in Phang-Nga Bay.

The survey conducted in June 2005 revealed that fishers mainly employed only one type of fishing gear (40.5%). Most of these fishers were operating cage culture in the same time. They tended to used fishing gears such as grouper trap and crab trap. They flexibly switched work time between capture fishing and cage culture (Table 2).

Some fishers tried to increase household income by engaging in cage culture. There were 70 households involved in cage culture. They set up their cages along the canal. The main species cultured here were grouper (*Epinephelus cocoides*), oyster (*Crassostrea belcheri*) and green mussel (*Perna viridis*) (Table 3). Fish culture adopted the floating raft type. For shellfish culture, they used hanging rope style. The total number of cage along KlongBakan canal was

**Table 2 Number of fishing gear employed by fishers and major type of fishing gear**

Number of type of fishing gear	Percentage	Type of fishing gear	Percentage
No fishing	13.5	Crab trap	32.4
One type	40.5	Shrimp trammel net	29.7
Two types	32.4	Crab bottom net	24.3
Three types or more	13.5	Grouper trap	18.9
Total	100	Mackerel gillnet	16.2
		Sand whiting fish gillnet	8.1
		Sardine gillnet	5.4
		Seabass gillnet	2.7
		Squid trap	2.7
		Shallow water set net	2.7
		Total	100

Source: Field survey (2005)

**Table 3 Number of species in culture by a farmer and major species**

Number of type of culture	Percentage	Species of culture	Percentage
No culture	37.9	Grouper	59.4
One type	45.9	Oyster	21.9
Two types	8.1	Green mussel	15.6
Three types or more	8.1	Sea bass	3.1
Total	100	Total	100

Source: Field survey (2005)

estimated nearly 1,000 cages. Cage farmers preferred grouper than other species, since it was a high value species. They got higher profit from grouper production and marketing. They sent products to hotels and restaurants in Krabi and Phuket cities, the famous tourist places of the region.

## **2) Aquaculture pattern in Bakan village**

Cage culture in this village was classified into two groups according to the scale of production: small-scale culture with 4–40 cages and large-scale culture with more than 40 cages up to 132 cages. Ninety percents of cage farmers belonged to the small-scale group that needed less investment cost. They formerly operated capture fishing by using fish gill net, crab trap and grouper trap. They shifted culturing little by little from capture fishery. At the beginning, they constructed one or two cages nearby their houses to store fishes that were trapped from mangrove area. They sold only crab or other species of fish to collectors in their village. The small and less-value fish caught by gill net were used as baits for feeding grouper. After they sold those cultured fishes, they could expand the scale of cages' production. Finally, the main source of income in fisheries activity derived from cage culture, not from capture fishing anymore.

The large-scale cage culture establishments in Bakan had been operated by only 5-6 fishers, who operated cage culture as the main business. They used to buy the fish fingerings from other fishers in the village who did not own any fish cages. If the amount of fish fingering was not enough, they bought it from outside-collectors, such as from Phang-Nga or Surat Thani Province. Large scale cage culture needed a large volume of bait, 70–200 kg per day. The price of bait was 10 baht per kg. They bought it from middlemen in village and Krabi city being 40 km far. Since the demand of bait for feeding fish was very high, there were 4–5 fishing boats operated fish gill net to catch only sardines (*Sardinella* spp.) to sell as bait in Bakan and other areas.

The cage culture in Bakan could continue and expand in number since they had never experienced the water pollution. The fish-farming business trended to get large return, so that many fishers wanted to establish their own cages. Most fishers mentioned that they got daily

income from capture fishing to spend day by day. But they got bigger amount of money when they sold cultured fishes monthly or periodically. The livelihood of fishers in Bakan village was getting better with cage culture fishery.

### 3) Damage of fishery activities from Tsunami

Almost all fishers and cage farmers in Bakan village got affected from disaster. Some boats that float nearby the canal's bank were sunk down by the tidal wave. Many boats were partially broken. Most of the fishing gears such as shrimp trammel net, fish gill net that left on boats or in the temporary huts near shore were swept by the wave. The stationary gears, like shallow water set net installed near coastline, were completely collapsed (Table 4).

Comparing with other types of fishery activity, aquaculture got the most serious damage in term of value than others. Fish farmers said the entire stocking fishes disappeared after the wave swept all cages. Stocking fishes were almost the marketable sizes that were ready to be sold prior to the coming new year. They had already spent 8-12 months to feed these fishes but they lost all within a few hour. Total damaged value in cage culture was estimated about 14.1 million Baht from 59 fish cage farmers. The loss per fish-farmer ranged from 10,000 to 4,000,000 Baht depending on the size of operation (1 US \$ = 38 Baht). Small-scale farmers got damage around 53,800 Baht on average, while large-scale farmers lost 1,768,800 Baht on average (Table 5).

The losses of 37 households sample derived from both capture fisheries and aquaculture

**Table 4 Summary of damage in Bakan village**

Type of damage	Number of fishers	Damage value (Thai Baht)	Amount of compensation (Thai Baht)
Fishing gear	36	455,000	292,200
Boat	14	200,000	173,300
Aquaculture	59	14,100,200	1,009,500
Total	109	14,755,200	1,475,000

Source: Department of Fisheries, August 2005  
Note: 1 US \$ = 38 Thai Baht

**Table 5 The level of damage value in aquaculture**

Level of damage	Number of fisher	Damaged value	Avg.damaged value	Unit: Thai Baht
				Min.-Max. of damaged value
Less than 100,000 Baht	38	2,044,000	53,790	7,000-100,000
100,001-200,000 Baht	10	1,796,500	179,650	120,000-200,000
200,001-300,000 Baht	6	1,415,700	235,950	205,700-270,000
More than 300,000 Baht	5	8,844,000	1,768,800	700,000-3,960,000
Total	59	14,100,200		

Source: Department of Fisheries, August 2005

**Table 6 The damaged value and percentage of loss of fishing gears**

Fishing gear	The average value of fishing gears before tsunami (Thai Baht)	The average loss amount of fishing gears after tsunami (Thai Baht)	% of loss relative to the value of fishing gears before tsunami
Fishing boats and engines	53,067	38,047	71.7
Shallow water set net	70,000	70,000	100
Sardine gill net	8,200	8,200	100
Sea bass gill net	16,000	16,000	100
Crab trap	3,500	3,500	100
Grouper trap	4,600	4,600	100
Mackerel gill net	9,640	7,520	78
Crab gill net	8,750	7,200	93.8
Shrimp trammel net	8,760	6,320	72.2
Sand whiting fish gill net	3,000	1,500	50
Fish cage culture	64,988	40,213	61.9
Shellfish culture	108,875	84,125	77.3

Source: Field survey (2005)

(Table 6). The assessment figures were prepared in three categories: the average value of fishing gears before the tsunami, the average loss amount of fishing gears after the tsunami and percentage of loss relative to the value of fishing gears before the tsunami. Fishers have lost fishing boats and engines, with being estimated at 72% of the value they had owned before the tsunami. The amount of losses in capture fisheries are including fully damaged of shallow water set net, sardine gill net, sea bass gill net crab trap and grouper trap. Partially damaged gears were mackerel gill net, crab gill net, shrimp trammel net and sandfish gill net. On the other hand, the loss of fish cages and shellfish culture had put high value damaged.

#### **4) Effects of disaster from fishers' viewpoint**

After the disaster, many changes occurred including fishery resources, fishing activity and fishery society. The result showed both negative and positive effects to fishing community (Table 7).

##### *- Economic aspect*

All fishers and cage farmers in Bakan village admitted the income gained from fishery activity sharply declined and remained low level throughout 2005. The catch had decreased and the price of fish was not increased. The reason behind consumers' avoidance of eating marine fish, according to them, was that they (the consumers) had a negative idea about the fish landed. Those fishers who had to borrow money or loan from relatives or friends to invest new fishing gear and new equipments of cage culture accounted for 75% of the sampled fishers. Local people rushed to establish a new financial group, and to revitalize the currently existing groups. They expected that these groups would work as a conduit of financial assistance. Some

fishers had never borrowed money from the groups before the Tsunami, although they joined the groups as members. They had had money enough to invest and pay expenses on daily basis. However, they heavily borrowed money after the crisis.

- *Social aspect*

Fishers and people were very nervous about the terror of natural disaster. Although they did not feel safe in living in the coastal communities, they did not want to move out there. They preferred to stay nearby the sea, rather than inland housing lots. Since almost all the people in village got more or less effect from the disaster, the mutual help among them to rebuild their effort was strengthened.

- *Environmental aspect*

Catch was very low for a few months after the Tsunami. The fishers compared their status of catch with that of the same period of the previous year. Moreover, the size of fish that they caught after the disaster became smaller. There was the increasing of using small-sized fish during this recovery period. When fishers trapped the juvenile grouper for culturing in cage, catch of fish, shrimp and crab in mangrove area were decreased.

- *Institutional aspect*

Sub-district Administrative Organization (Ao.Bo.To.- in Thai) was a local government unit that provide the initial help for affected people. Its emergency budget was allocated in order to help people to secure their daily life. Fishers in Bakan village together with Ao.Bo.To. replanted mangrove trees in sub-district coastal area to enhance aquatic resources.

**Table 7 Rank of the major effects by fishers' opinion in AoLukNoi Sub-district**

Aspect of effects	Direction of change	Percentage of fishers
<i>Economic aspect</i>		
Income of fishing activities	Decreased	100
Price of harvested fish	Decreased	86.5
Depending on loan and other credit	Increased	75
<i>Social aspect</i>		
Nervous to next disaster	Increased	91.9
Mutual help among people	Increased	43.2
Being member of people's group	Increased	33.3
<i>Environmental aspect</i>		
Fishery production compare with the same period of last year	Decreased	67.5
Size of caught fish around your sub-district	Decreased	38.9
Aquatic animals in mangrove area (include fish larvae)	Decreased	27
<i>Institutional aspect</i>		
Supported facilities from sub-district level	Increased	41.7
Replantation of mangrove trees	Increased	38.9
Utilization of small-sized fish	Increased	21.6

Source: Field survey (2005)



## **5) Re-building capacity in fishery activities**

The first priority of recovery work in fishing village was commonly the same as other affected areas. Fishers were eager to re-establish fishing activities as quick as possible, so that they could earn income to support their livelihood. Some cage farmers had little idea about accessible financial sources for new investment. They roughly estimated one unit of cage culture to cost 16,000 Baht. This did not include fish fingerings. To restart fishing activities in Bakan, there were many ways that fishers combined them together.

### *- Government source of help*

The relief help to Bakan came from many sources. The initial help started from Ao.Bo.To., which was the local government organization. Ao.Bo.To. AoLukNoi gave 1,000-3,000 Baht for emergency help to the affected people. Department of Interior released special budget to hire the 105 jobless people in Bakan village to clean up public areas within 25 days. This policy aimed at helping people to earn additional money during the recovery period.

Relief help from government agencies supported people to start their occupation. Department of Fisheries, Ministry of Agriculture and Cooperatives provided not more than 20,000 Baht per damaged boat. The compensation for lost boat or crack down boat got 60,000 Baht to buy the new boat. The lost and damaged fishing gear was to be replaced by a new set of fishing gear with 10,000 Baht per fisher. All cage farmers sought the compensation for the losses and damages; however, they received not more than 20,000 Baht per person.

Compensation from government might not be enough to recover all the losses and damages. Cage farmers could rebuild a small part of the cages that they had own with this compensation, but they still needed other sources of loan for re-investment.

### *- Non government source of help*

In Bakan village, CARE foundation program was established to provide loans to affected fishers. They organized and joined the membership of a group with revolving fund operation. At the beginning, 80 members formed a group and achieved consensus to manage funds through the guidance of CARE's staff. They raised loan from the group, ranging from 20,000–50,000 Baht, depending on size of their culture operation. Beside loan activity, CARE trained members to manage group's activity in long term.

### *- Self-help in recovery period*

Fishers and farmers started to recover their sunken fishing boats and lost fishing gears and cage's equipments after disaster. Some could be repaired and reused, but others were completely destroyed. Fish cage farmers in Bakan village organized a group on a voluntary basis to help each other. The group collected fish as much enough as dealers needed, so they

did not bring their harvested fish to market by themselves. Also farmers reduced the cost of cage's equipments by buying them in the big amount to get the lowest price per unit. Fish cage farmers' group of Bakan village was not registered with the Department of Fisheries, but it was the spontaneous group that they formed in recovery period.

- *Other sources of help*

In the aftermath of a disaster, several sources of organizations provided financial aid in order to repair and reconstruction. In case of the standard amounts were not big enough to cover all reconstruction, other financial sources were needed for the re-investment process. People in Bakan village also got financial assistance or loan in other sources such as saving groups, village fund groups and women's groups in their community. In addition, some people had to ask loan from private moneylender.

The survey in June 2005 had the sample of 37 fishers in Bakan village to response the structured questionnaire for financial need and financial assistance sources of fishing gears reconstruction. Financial assistance was requested to repair their loss. The distribution of aid to tsunami-hit fishers in the first six months did not cover their needs yet. Most of the donors continued to help the poor by offering many recovery programs. However, they did not have clear information on actual needs and lacked mechanisms to deliver direct assistance.

A summary of source of financial assistance in Bakan village was shown in Figure 2. Most of the fishers received financial assistance from Department of Fisheries (77%). Apart from the Department of Fisheries, other sources were other government agencies and private moneylenders who provided financial assistant to the tsunami affected people.

Combination of self-help and relief help from outside could start the fishing activities in Bakan village after stopping for several months. Fishers and cage farmers tried to earn income

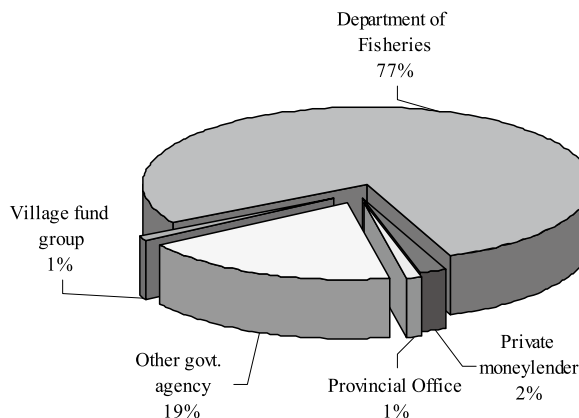


Figure 2 Source of financial assistance in Bakan village

**Table 8 Range of monthly household income during six months after the Tsunami**

Range of income	Fishers	Percentage
Less than 5000 Baht	5	13.5
5001 - 10000 Baht	15	40.5
10001 - 15000 Baht	3	8.1
15001 - 20000 Baht	5	13.5
20001 - 25000 Baht	1	2.7
25001 - 30000 Baht	3	8.1
More than 30000 Baht	5	13.5
Total	37	100

Source: Field survey (2005)

as fast as possible. The monthly household income was surveyed by type of fishery activities. During 6 months after the Tsunami, 40.5% of fishers had fisheries income from 5001–10,000 Baht (Table 8). That was less than national average monthly income, which was 14,617 Baht (National Statistics Office, 2004).

#### **6) Coastal resources management activities and Tsunami aftermath**

In the past, most of fishers employed push net for fishing activity. This gear operated with engine boat near shoreline had huge negative impact on coastal resources. It was used to catch all species of fish including juvenile fish. According to Fisheries Act, push net was declared as illegal fishing gear if it operated within 3 km from shoreline. This coastal area was declared to be conservation area for fish stock.

There were some conflicts among fishers who employed push net and crab net, since they used the same fishing ground. The coastal area in front of AoLukNoi was not so wide. There were a good number of small islands within the immediate coastal area, under which this area became fertile fishing grounds. Push net fishers in Bakan village were prohibited to operate in this adjacent area. To stop this conflict, push net fishers had to change their fishing gear to other types such as shrimp trammel net or crab trap. After they stopped operating push net, they started to carry out fish cage culture in their village's canal. Some fishers found that their catch increased after few months of stopping push net. However, some fishers could not change fishing gear, because they did not have skill for new gear. They decided to operate fish cage culture instead of capture fishing.

Nowadays, Bakan village does not have any push net operators. Fishers have realized the importance of mangrove forest along Bakan canal as the nursery ground of fish's juvenile. In particular, juvenile of grouper was the most important in economic terms, because it was caught to stock in fish cages. That could reduce investment cost in terms of fish fingerling for cage culture.

Before attacked by the Tsunami, the system of cage culture in this area was like open access. Who ever came to set cage first could reserve that place. They normally set up their cages nearby their houses. After the Tsunami, some fishers could start to set up cage culture with their own money earlier than other fishers who did not have enough money. However, according to the consensus among people, they set up their cages at the same place as it was before to avoid conflict with others.

People have a plan for replanting mangrove trees in the Sub-district's area in 2006, since some parts of mangrove were damage by the Tsunami. They recently have purposed project 'Community's mangrove forest' to look after and manage some parts of mangrove forest by local people.

### 3. Case of KhaoThong Sub-district

#### 1) Fisheries activity of KhaoThong Sub-district, Muang District

KhaoThong Sub-district located in the northern part of Krabi Province, being 24 kilometers far from Krabi city. It was composed of six villages. Four villages were located along the coastline or along the canals connecting to the sea. The main livelihoods of people in the locality were agriculture and fisheries. Rubber and palm were major products from the agriculture sector. Beside this, tourism became one of the most attractive businesses. Because of a numerous number of islets and limestone mountain, the locality was an attractive tourist site. Both Thai and foreigners came to ThaLane village to enjoy snorkeling and canoeing. The landing place in ThaLane village was a terminal pier where tourists get on boat to visit KoYao district of Phang-Nga Province.

Capture fisheries in this sub-district were divided into two groups. The first employed stationary fishing gear, namely shallow water set net. This gear was widely used in KhaoThong village and ThaThongLang village, which were located in front of beach (Figure 3). In KhaoThong Sub-district, there were more than 150 units of shallow water set nets. The second group employed some fishing gears like the squid trap, collapsible crab trap, fish gill net, hook and lines, which had to move fishing grounds depending on the

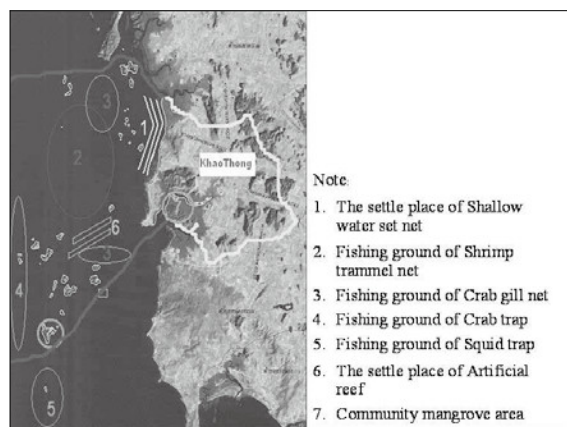


Figure 3 Map of fishing ground in KhaoThong coastal area

schools of fish. Most fishers in ThaLane village and ThaPhru village were using these movable types of gear.

## 2) Damage of fishery activities after Tsunami

KhaoThong Sub-district was attacked by the Tsunami. Most of the fishers in this sub-district got affected from the disaster. The fishing boats were normally anchored near shore or near a fishing pier. They were hit and crashed to fishing pier or crashed with other boats. The total value of damage was estimated 5,716,050 Baht, including fishing boat, fishing gear and aquaculture (Table 9).

The sample of affected fishers in KhaoThong Sub-district was 69 households, most of whom (89.9%) were capture fishers. The major types of fishing gears were shallow water set net and crab trap (38.5% and 24.2% , respectively) as presented in Table 10.

The damaged value of main fishing gears and fishing boats was estimated by affected fishers. Figure 4 illustrates that most types of the fishing gear were almost fully damaged.

The fishing gear that got the most serious effect from the disaster was shallow water set net. It was the stationary fishing gear set up in the tidal zone of near shore. This passive fishing

**Table 9 Number of fishers and estimated damaged value in KhaoThong Sub-district**

Village	Type of damage					
	Fishing boat		Fishing gear		Aquaculture	
	No. of fisher	Damage value (Baht)	No. of fisher	Damage value (Baht)	No. of fisher	Damage value (Baht)
NaiSra	1	10,000	2	13,000	4	670,600
KhaoThong	11	237,000	57	1,380,600	1	20,000
ThaLane	30	405,600	15	211,250	3	83,000
ThaPhru	1	60,000	1	10,000	1	20,000
ThaThongLang	9	78,500	63	1,928,400	17	588,100
Total	52	791,100	138	3,543,250	26	1,381,700

Source: Department of Fisheries, August 2005

**Table 10 Category of sample in KhaoThong Sub-district by type of fishery activity**

Category of sample	Percentage	Type of fishing gear	Percentage
Only capture	89.9	Shallow water set net	38.5
Capture & culture	7.2	Crab trap	24.2
Fishing labour	2.9	Squid trap	17.6
Total	100	Crab gill net	13.2
		Sand whiting fish gillnet	2.2
		Mackerel gillnet	1.1
		Shrimp trammel net	1.1
		Pushnet	1.1
		Hook and line	1.1
		Total	100

Source: Field survey (2005)

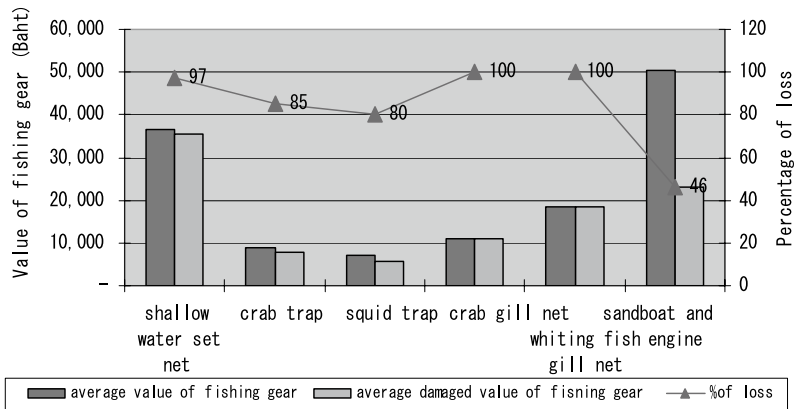


Figure 4 The average damaged value and percentage of lost of main fishing gears

gear caught fish by using the tidal change. All set nets were swept by giant waves in that day of the Tsunami. These were collapsed after two or three hits of strong waves. The nets were torn and lost in the sea. Most of the sticks that made a collecting chamber and lead line of set net were broken. The fishers collected some remaining of set net to repair and re-construct later on.

Collapsible crab trap was another fishing gear severely damaged. The average number of crab trap per fisher was 100 units. These traps were sunk in the fishing ground. When the wave attacked, they were swept and lost from the fixing place. The buoys which marked for indicating place of traps were lost, so fishers could not find the remaining traps.

In tourism sector, travel companies in KhaoThong area provided cottage and restaurant for tourists. Canoeing trip was one of the most attractive activities for tourists. The route of canoe was around the ‘community forest,’ which was preserved and protected by the community. Even though mangrove forest was not much destroyed by the Tsunami, the number of tourist was less and less. The people still feel afraid that the disaster might occur again. They also did not know the real situation of tourist place.

One staff of a travel company said that the period should be the pick season for tourists. The number of tourists per day was almost 100 persons. They got group tour from Krabi city or other provinces everyday. After the Tsunami, they had guests only two or three groups a month visited in the community. Some of their staff such as tour leaders, housekeepers and workers had laid off until the number of tourist is increasing. As a result, local people lost job as an alternative income outside fisheries.

### **3) Effects of disaster from fishers' viewpoint**

In KhaoThong fishing communities, drastic changes after the Tsunami caused in several aspects (Table 11). Most of the fishers pointed out that the economic changes were remarkable. Income derived from fishing activities decreased in most (80.6%) of the fishers' households. Shallow water set net that were a major device had yet reinstalled. Fishers just started to buy new equipments to reconstruct the set nets, thereby making them increasingly spending money. Meanwhile household expenditure increased due to a rapid rise of gasoline price.

People in KhaoThong were still nervous to next possible disaster. The social activities such as traditional ceremony celebrated in the village's mosque and the friendship sport competition were not changed. People contained their activities with relatives, friends and community as before. One-third of the respondents (32.3%) said they increasingly communicated with others to exchange information on relief help from outsiders, and the way to recover their occupations. Especially among the shallow water set net fishers, they had mutual help to reinstall new sets of fishing gear, because this fishing gear needed lot of manpower to settle it at once. With this crisis, people gave much more help to friends and relatives to restart their fishing activities again.

Fishers employing fish gill nets had already started to operate fishing. Production decreased compare with that of the year 2003, because Tsunami waves destroyed the fishing habitat. Fish or larvae in mangrove area disappeared even though it was the nursery ground for many species of aquatic living resources.

The effects were relieved by many sources. The Sub-district Administrative Organization (Ao.Bo.To.) helped local people with their limited capacity, but it was the important organization to facilitate the relief help to affected people. More than one-third of the respondents (35.3%) mentioned that Ao.Bo.To. tried to find out the source of relief help and bring to village. The representative of Ao.Bo.To.'s council contacted to outside organization and proposed the livelihood recovery projects, for example the alternative income generating project was brought to the women's group. This group got the equipments to make the chilly paste and sell it at the Krabi city market. This work could generate income during the restarting period of fishing activities.

The utilization of fishery resource became worse in a viewpoint of conservation after affected by the Tsunami. The fishers caught small-sized fish, by using fine mesh size of net. They said the amount of catch would be less if they avoided small-sized fish, they could not get enough money to spend for daily expenses. However, to enhance the stock of resources, fishers and Ao.Bo.To. provided a program to release the small larvae of aquatic living resource.

**Table 11 Rank of the major effects by fishers' opinion in KhaoThong Sub-district**

Aspect of effects	Direction of change	Percentage of fisher
<i>Economic Aspect</i>		
Income of fishing activities	Decreased	80.6
Expenditure for fishing	Increased	70.6
Household expenditure	Increased	60.8
<i>Social Aspect</i>		
Nervous to next disaster	Increased	84.9
Mutual help among people	Increased	34.8
Time spend for community meeting	Increased	32.3
<i>Environmental Aspect</i>		
Fishery production compare with the same period of last year	Decreased	69.5
Size of fish was caught found around your Sub-district	Decreased	43.4
Aquatic animals in mangrove area (include fish larvae)	Decreased	39.1
<i>Institutional Aspect</i>		
Supported facilities from Sub-district level	Increased	35.3
Utilization of small-size fish	Increased	23.2
Enhancement of fish larvae	Increased	20.3

Source: Field survey (2005)

Even mangrove forest was not destroyed in vast area by the Tsunami, mangrove trees at river mouth were fallen down by strong waves. A conservation group and local people replanted mangrove trees at the damaged area. They considered that mangrove forest was the naturally important protection from disaster.

#### **4) Re-building capacity of fishers**

People initially received aids by government through the Provincial office. The first aid was for daily expense, being 2,000 Baht per head. Those who were affected by Tsunami reported their losses to the leader of village. The leader and committee of village investigated and estimated the real losses and damages of household. Fishers could request compensation or help from related organization with the village's certificate of devastation. Both government sources and non-government sources provided various kinds of relief help to KhaoThong people (Table 12).

In case of fisheries sector, the Department of Fisheries (DOF) took the responsibility to compensate the loss of fishing boat and fishing gear. Most fishers (66%) in KhaoThong Sub-district obtained financial assistance from the DOF (Figure 5). Fishers sent the village's certificate of devastation to Krabi Provincial Fisheries Office. The officer assessed the damage of each fisher at village. A damaged fishing boat was to be compensated up to 20,000 Baht. If they lost fishing gears, they got compensation of not more than 10,000 Baht.

Beside the DOF, non-government organizations (NGOs) played an important role in supporting fishers. The CARE foundation offered funds to inhabitants in KhaoThong Sub-district



(12 %). Fishers could borrow money from the funds that the CARE donated to buy materials to make fishing gears. The funds would be rotated to other people who would also need source of investment. Meanwhile, the CARE foundation formed a youth group to undertake natural resource conservation activities.

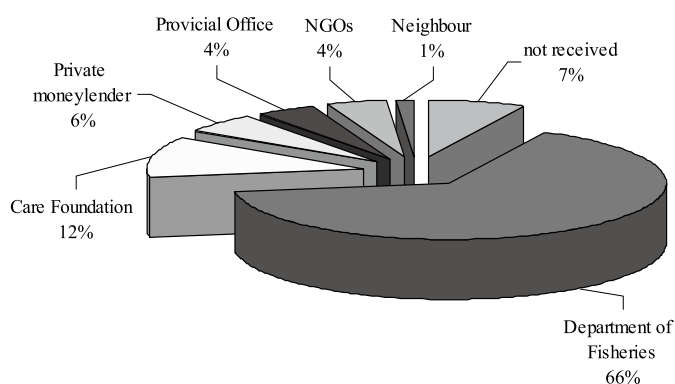
From the survey conducted in June 2005, we found that 7 % fishers did not get any assistance. As their damage was not substantial, they did not request for any compensation. However, some of them were not able to submit a request for compensation within the deadline. Moreover, some fishers were financially supported by those middlemen, with whom they dealt on a regular basis. It was reported that instead of fishers the boat owners submitted the request for compensation, which caused the relief help unsystematic to some extent. Some received relief from many sources, while others could not access to any source of relief help (Figure 5).

Shallow water set net fisher got compensation at the rate of 10,000 Baht per person. The

**Table 12 Summary of relief help in KhaoThong Sub-district**

Source	Organization	Type of help
Government	1. Krabi Provincial Office	<ul style="list-style-type: none"> <li>Initially aid for diary expense, 2,000 baht per head</li> <li>Compensation that not more than 20,000 baht per damaged boat</li> </ul>
	2. Department of Fisheries	<ul style="list-style-type: none"> <li>Compensation that not more than 10,000 baht for losing fishing gear</li> <li>Compensation that not more than 20,000 baht per farmer for damaging fish cage culture</li> </ul>
	3. Ministry of Interior	<ul style="list-style-type: none"> <li>Hiring 30 jobless people per village to do public work</li> </ul>
	4. Others	<ul style="list-style-type: none"> <li>Collaborative project between DOF and Italy government provide new set of fishing gear for fishers in project's area</li> </ul>
NGOs	1. Red Cross Association, Thailand	<ul style="list-style-type: none"> <li>Construct new fishing boat for 50 fishers who lost his boat</li> </ul>
	2. CARE foundation	<ul style="list-style-type: none"> <li>Providing rotation fund to village and forming youth group in community to be volunteer in natural resource conservation</li> </ul>
	3. Honda company	<ul style="list-style-type: none"> <li>Repairing boat's engine for all fishers</li> </ul>

Source: Field survey (2005)



**Figure 5 Source of financial assistance in KhaoThong Sub-district**

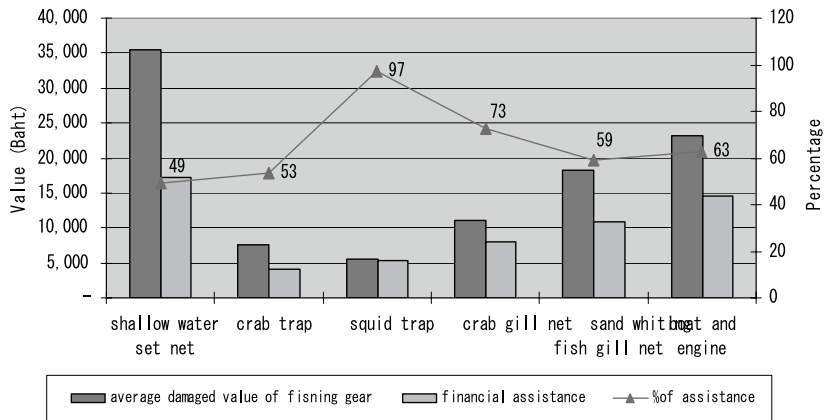


Figure 6 The damaged value and assistant value by type of fishing gear

cost of one set was about 9,000–12,000 Baht. But the fishers, who had more than one set or had other types of fishing gears, reported that the compensation could not cover all of their losses. The survey data showed that shallow water set net fishers got 49% of assistance relative to their loss (Figure 6). There were about 15% of set net fishers re-installed new set during three months after the Tsunami. Others could not start to rebuild their fishing gears and needed other source of investment.

### 5) Coastal resources management activities and Tsunami aftermath

Coastal area in KhaoThong Sub-district was used in many activities with multi-purposes. They used the same area for both fishing and non-fishing activities. Shallow water set net was one of fishing activity that widely on the coastal area. Meanwhile tourism was a growing sector in the utilization of coastal area, especially around mangrove forest. Thus, multiple activities were found in the same area. People in KhaoThong Sub-district discussed and adjusted the utilization of each activity to avoid conflict among them.

#### - *Self-monitoring for illegal fishing*

Before 1992, fishers in KhaoThong used to operate push net fishing. Push net was a fishing gear which tied the net at front side of boat. The net was lowered down in the water above the seabed and was pushed forward by boat's engine. Naturally this fishing gear was very destructive, especially when it was operated near shore or in the mangrove zone. It was the active fishing gear that caught every size of fishes. Conflicts occurred between push net and other types of fishing gear. The push net often broke other gears such as gill net or crab trap, although the laws prohibited operating push net within 3 km far from shoreline. Meanwhile

social sanction to push net was increased, KhaoThong fishers gradually phased out push net fishing and changed to employ other type of gears like squid trap and crab trap.

A leader of Sub-district, together with committee of each village, set up a monitoring team to protect their own coastal area from illegal fishing. Their monitoring and controlling were supported by Ao.Bo.To., a local organization. They provided a speed boat for surveillance mission within its sea boundaries. With the effective monitoring, the push net fishing by outsiders decreased, and eventually disappeared from KhaoThong coastal area.

- *Community's mangrove forest*

Mangrove forest covered the 3.2km<sup>2</sup> coastal area of KhaoThong Sub-district, which was used to be under the charcoal production. When the concession was expired in 1999, government stopped allowing charcoal concession in mangrove area. Local people realized the importance of mangrove forest as the hatchery and nursery ground for aquatic resources. They started to replant mangrove trees in the deteriorated forest, requesting the Royal Forestry Department to manage and conserve mangrove forest by themselves. They got 0.9km<sup>2</sup> of mangrove forest to proclaim as 'Community's mangrove forest' (CMF). Committee of villages (especially the village which have mangrove area) formed a mangrove conservation group to monitor and look after CMF. They set up rules for utilization mangrove area for the purpose of sustainable resource use, for instance; the motorized boat did not allow passing through CMF area, cutting any tree for any purpose was prohibited. The local people and village got an award from a Thai conservation organization namely 'Green Globe Award', since they were an outstanding in managing and conserving community's forest.

- *Set net management by community's agreement*

KhaoThong coastal area had high density of shallow water set net. The Department of Fisheries had policy to control the number of set net. The officer did not issue new license for set nets. The installation of fishing gears set up in the tidal zone might affect to other resource users. It needed a good management on area utilization. Set net fishers and these fishers who employ other types of fishing gear discussed and adjusted to achieve agreement of installing place.

After the Tsunami, the activities in coastal area were suspended for a few months. Shallow water set net was swept and cleared from the shore zone. Fishers had to reconstruct their gears, thereby the traditional agreement was considered again. Fishers helped each others to install set net, so they must install in the right place where was accepted by the agreement. This was the traditional way to control coastal utilization's agreement.

Since a lot of wood sticks were used to re-construct set nets, the village leader had

campaigned to prevent using mangrove trees. The mangrove conservation group promoted the importance of mangrove forest as a natural protection wall from Tsunami disaster. Fishers agreed to use other type of wood to conserve the community mangrove forest.

#### **4. Practical mechanism for dealing with disaster's effects**

##### **1) Learning from the loss**

Impact of the Tsunami affected fishing communities in terms of fishers' income and their activities on coastal resource management. Even if the fishery resources were not much damaged, an increasing pressure of fishing caused both positive and negative impacts on the resources during the recovery process. The effects from one aspect, e.g. economic, social, environmental or institutional aspect, affected the others. For example, the effect of economic aspect, in which fishers suffered from lower income and incurred high expenditure in fishing activities, affected the environmental aspect. They tended to have less concern for environment and resource conservation (e.g. catching small-sized fishes). The fishers tried to earn money as much and fast as they could. They caught all sizes of fish, including small-sized or juvenile fishes.

Meanwhile, in a positive way, people realized the importance of mangrove which would protect village from the strong wave. They replanted mangrove trees to maintain the natural wall and enhance the fish-habitat. Their awareness on the importance of sustainable resource use was needed for coastal resource management.

##### **2) Changing from crisis to opportunity by strengthening social network**

Rebuilding fishers' household income was given a higher priority in the recovery process. Comparing with capture fisheries, aquaculture faced heavier damage in value. The investment cost of aquaculture was very high. It took long time to get benefit. The combination of all relief helps and self-help would quickly recover their losses. Therefore, cage farmers joined together to organize whatever the type they would benefit from, in order to reduce operation's expenditure and to manage the supply to market.

The capacity of fishing communities to recover their activities relied on relief help from outside and mutual help among themselves. The social network was the important link among local people to solve confronting problems. Strengthening the social network in community achieved sustainable self-management. The relief help supported not only their fishing activities, but also the alternative job for generating income. The family members could earn money to maintain their livelihood.

### **3) Importance of systematic process of relief help**

The efficient and systematic processes of relief help are the important factors to recover the capacity of fishing community. It needs the center of relief help at local level to distribute assistance throughout and equally among affected people. Formation of emergency village committee which represents each part of local people is required to coordinate between people and any source of help. Thus, the Ao.Bo.To. is the official and well-known organization that performs as the gateway for outsiders who want to contact with local community. Ao.Bo.To. and the emergency village committee can be the efficient facilitator to help people released from critical situation both in economic and coastal resource management.

In addition, the awareness of sustainable resource use should be enhanced to avoid the collapse of resource management. The fishers' understanding on the harmful effects of excessive use and non-selective utilization to coastal resource should be promoted at the time of rebuilding process.

The natural disaster can not expect when it will happen. The research on the resilience of fishing community to deal with disaster should be extended to explore the suitable preparation for local people and local organization whenever they will face the crisis as natural disaster in future.

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### **References**

- Adger, W.N., Hughes T.P., Folke C., Carpenter S.R. and Rockstrom J. 2005. "Social-ecological resilience to coastal disaster", *Science* 309: 1036–1039
- Asia-Pacific Fishery Commission. 2005. "Regional Strategic Framework: Rehabilitation of Fisheries and Aquaculture in Tsunami Affected Countries in Asia", FAO, RAP Publication 2005/09
- Charles, A. 2001. "Sustainable Fishery System", Saint Mary's University, Halifax, Nova Scotia, Canada.

- Department of Fisheries. 2005. "Report of damage assessment in fisheries sector from Tsunami 2004", Ministry of Agriculture and Cooperatives, Department of Fisheries. (in Thai)
- FAO, Committee on Fisheries. 2005. "Rehabilitation of the fishing communities and the fisheries and aquaculture sectors affected by the Tsunami in the Indian Ocean", Rome, Italy, 7–11 March 2005. COFI/2005/Tsunami.
- Hardin, G. 1968. "The tragedy of the commons", *Science* 162: 1243-1248.
- Kurien, J. 2005. "Tsunamis and a secure future for fishing communities", *Ecological Economics* 55: 1–4
- Krabi Provincial Fisheries Office. 2005. "Report of damage assessment in fisheries sector from Tsunami 2004 in Krabi Province", Ministry of Agriculture and Cooperatives, Department of Fisheries. (in Thai)
- KhaoThong Sub-district Administrative Organization. 2005. "Sub-district's Development Plan Year 2005", KhaoThong Sub-district, Krabi Province, Thailand, p.1–13. (in Thai).
- Morse, S., McNamara N., Acholo M., and Okwoli B. 2000. "Visions of sustainability, Stakeholders, Changes and Indicators", Ashgate Publishing Ltd., England.
- National Statistical Office. 2006. "The 2004 Report of Socio-economics Survey of Households in Thailand", National Statistical Office, Office of the Prime Minister, Thailand. (in Thai)
- OECD. 1993. "OECD Core Set of Indicators for Environmental Performance Reviews. A Synthesis Report by the Group on the State of Environment", Organization for Economic Co-operation and Development, Paris.
- Ostrom, E., Dietz T., Dolsak N., Stern P.C., Stovich S., and Weber E.U. (Eds.). 2002. "The Drama of the Commons", Committee on the human dimensions of global change. Division of Behavioral and Social Sciences and Education, Washington, DC: National Academy Press. 521 p.
- Reed, M.S., Fraser E.D.G., and Dougill A.J. 2005. "An adaptive learning process for developing and applying sustainability indicators with local communities", *Ecological Economics*, Available online at [www.sciencedirect.com](http://www.sciencedirect.com)
- United Nations Commission on Sustainable Development. 2001. "Indicators of sustainable development; framework and methodologies", Background paper No.3, United Nation, New York.

# **Impacts of Tsunami Disaster on Thai Fishing Communities and Their Coastal Resource Management**

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PHATTAREEYA Suanrattanachai, and PORNPRAPA Sakulsaeng

## **Abstract**

Thai fishery industries were heavily damaged by the Tsunami disaster in December 2004. Both marine capture fisheries and aquaculture have so far struggled with huge loss and damage of people's livelihoods. This paper had two objectives. The first was to assess the effects of the Tsunami disaster on fishers' activities (both in value and in non-value aspects). The second was to investigate how resource users and local people keep the sustainability of coastal resource management after the crisis. The Tsunami affected fishing communities in terms of fishers' income and their activities on coastal resource management. The fishers were likely to try to earn money as much and fast as they could, by increasing their catch effort. They caught all sizes of fish, including small-sized or juvenile fishes. Meanwhile, in a positive way, local people realized that they should increase effort to conserve and transplant mangrove trees to expand nursery grounds of fishes and to protect from tidal waters. As fast as the fishers can relieve from critical situation, especially economic crisis, they have to reduce any risks of destroying coastal resource. Their awareness about the importance of sustainable use is an essential factor to make recovery programs of fishing communities.

**Key Words:** Tsunami disaster, disaster effects, recovery, coastal resource management, sustainability of coastal resources

# 津波災害がタイの漁村および沿岸域資源管理に与えた 影響に関する研究

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ポンプラバ・サクンセン

## 要約

2004年12月にタイ南部の沿岸部を襲ったインド洋大津波によって、タイの水産業は大きな打撃を受けた。本論文の目的は、第1に、津波が漁業者に及ぼした諸影響を評価すること、第2に、資源利用者と地域住民が津波災害後にいかに資源利用の持続性を保とうとしているかを明らかにすることである。漁業・養殖業の生産手段の相当部分が損害を受け、被害漁村の多くで沿岸域資源利用のあり方に顕著な変化がみられた。漁民の多くは現金収入を得るために漁獲努力量を増やした。違法操業が横行し、魚体の大きさにかかわらず漁獲する行為が目立った。その一方、津波災害の教訓から、住民の間では、マングローブ林の植林と保全の必要性が広く認識されるようになった。植林用苗木の育成が盛んになり、マングローブ域内の魚類の産卵場所の保全が進められた。経済的な危機から脱するには、沿岸域資源の破壊的な利用を減らし、持続的な資源利用に努める必要があるという認識が広まっている。資源利用者および住民が持続的な資源利用をはかる必要性を認識することが、漁村復興を成功させる重要な要素になっている。

キーワード：災害の影響、復興、沿岸域資源管理、沿岸資源の持続性