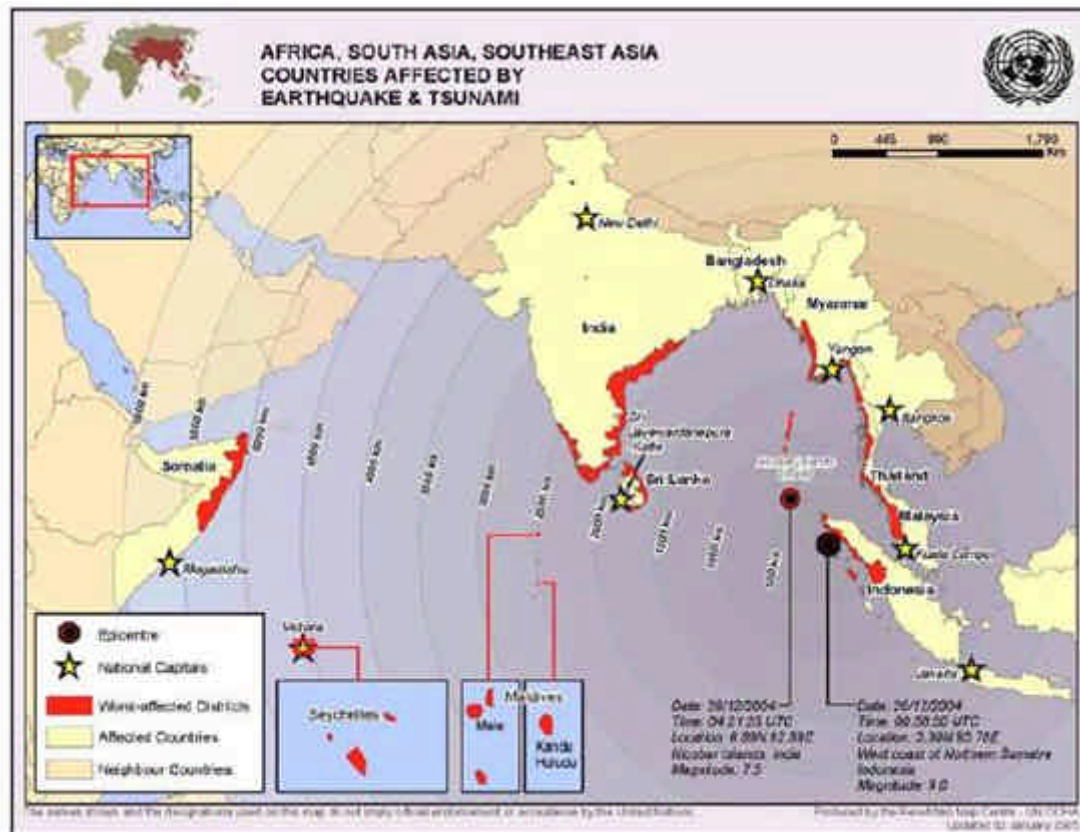


**Impacts of the Tsunami on Fisheries, Aquaculture and Coastal Livelihoods**

**- Update on the situation of the affected areas-  
(As of 17:00 hrs 07 January 2005)**

**NACA/FAO/SEAFDEC/BOBP-IGO**



This is a very early report of the impacts on coastal livelihoods of the Indian Ocean tsunami. It will be constantly built up as more information is included, and made meaningful with subsequent analyses. The purpose of this assessment effort is to determine the needed resources and efforts to quickly restore shattered livelihoods in the stricken communities. This report has been jointly developed by staff from NACA, FAO, SEAFDEC and BOBP-IGO for internal use. Every possible effort has been made, considering the circumstances, to verify the information. The report is considered appropriate at the time of its preparation. It will be updated as appropriate in the light of further knowledge gained at subsequent stages of evolution of the situation. The Organizations concerned make no warranty, express or implied, as to the accuracy, reliability or content of the material, text and any graphics in this information product. FAO also declines all responsibility for updating the material and assumes no responsibility for errors and omissions in the material provided in the information product.

The assessment should then be in consultation with other like-minded organizations, governments, communities, and other stakeholders translated into priority needs. The needs will be addressed by projects designed to provide the best possible impact on restoring shattered livelihoods and rehabilitating affected communities as well as the sources or bases for their livelihoods that may also have been seriously damaged.

The information in here is from India, Indonesia, Malaysia, Myanmar, Sri Lanka Thailand, and the Maldives.

The estimated death toll/missing person as of 6 January 2005 based on the World Health Organization Situation Report No. 7 (covering period 4 January 2005) are listed in table below.

Country	Dead	Injured	Missing	Displaced
Indonesia	94,081	>2,500	1,341	271,908
	30,196	15,683	3,846	834,849

Sri Lanka <sup>[2]</sup>				
India <sup>[3]</sup>	9,571	3,281 - Tamil Nadu only	5,914	627,119 (384,956 people in 532 relief camps).
Thailand	5,187	8,457	38,10	
Maldives	82	1,313	26	8,352 (8,500 evacuated to other islands).
Myanmar <sup>[4]</sup>	59	43	3	3,205 (638 households)
Bangladesh	2			

This report consists of two parts: Part I is a qualitative, quantitative and graphic report of damages and Part II is an example of developing an indicative level of funding to rehabilitate or restore the sources of livelihoods that have been damaged. The case draws from published reports and what we know of Aceh and North Sumatra (from our Asia-Pacific Marine Finfish R and D Network).

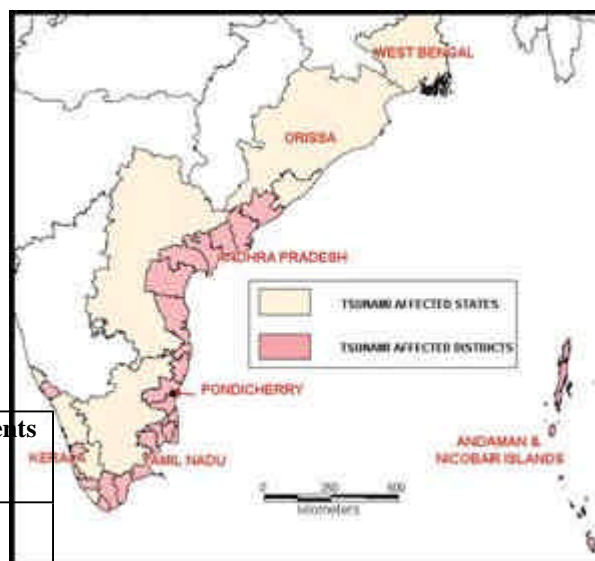
For a more useful document, a third section should include a more detailed resource needs including technical assistance (costed, even if voluntary), technical support services, and infrastructure. It will not include direct grants of cash to families. A fourth section may be a set of priorities as a basis for formulating projects. We welcome suggestions.

## PART I. IMPACT

### INDIA

#### General

The Tsunamis caused extensive damage in Southern regions of India and Andaman & Nicobar Islands affecting a total of 2,260 km of coastline. The waves were reported to be as high as 3 -10 meters in southern India and penetrated 300 m to 3 km inland. The worst-affected regions were the Andaman and Nicobar Islands, the States of Tamil Nadu, Pondicherry, Andhra Pradesh and Kerala.



#### Loss of human Lives

District	Number killed	Number missing	Number of relief Camps	Comments
Andaman & Nicobar Islands	901	5,914	111	
Tamil Nadu	7,923	383	412	
Pondicherry	579		46	
Andhra Pradesh	105	11	Nil	
Kerala	170		35	

The majority of 106 people killed in the Andhra Pradesh were fishermen.

#### Fisheries

The fisheries sector in Tamil Nadu, Andhra Pradesh and Andaman & Nicobar Islands has suffered major damages - some firm estimates would be available only in the next 7-10 days, when the areas become accessible. Worst hit places like Nagapattinam have been closed (both entry and exit) fearing epidemics. BOBP-IGO is closely monitoring the situation through its NGO network.

Qulachal, Cape Comarin, Velankanni, etc: many fishing villages in these areas loss human life, fishing boats, shelters and other belongings.

**Tamil Nadu:** There are 591 fishing villages and 362 Fish landing Centres, which are mostly small and cater to the needs of small mechanized fishing crafts and traditional boats. The total number of 698 268 fishers were engaged in fisheries (2000) with some 10 000 mechanized fishing vessels, 21 000 vallams and 28 000 catamarans. The fisheries sector in Tamil Nadu has suffered major damages. Besides loss of lives and assets such as houses and personal belongings, fishing boats and nets, the fisheries infrastructure (Fishing Harbours and fish Landing Centres) has also suffered heavy damages.

**Andhra Pradesh:** Fishers along 1,000 km coastline here were the worst hit by tsunamis. Fishers lost some 2,000 fishing boats and 47,370 nets. The trawlers, fishing equipment and fish stored for exports were all damaged at Visakhapatnam. Nearly 300,000 fishers were rendered jobless and they are estimated to be losing Rs. 50 million a day. Fishing is a major trade activity in coastal Andhra. The state produces 200,000 tonnes of marine fish every year.

#### Aquaculture

Many hatchery facilities in the southern India regions were severely affected with damages; in Kovalam, Marakanam and Pondy belt, most of the shrimp hatcheries have lost their pump houses, fencing etc; shrimp farms at Cuddalore, Chidambaram, Sirkali were severely affected with collapsed bunds and damaged pumps; shrimp farms in Vellar estuaries (Chidambaram, sirkali) were heavily damaged from seawater inundation; sea based farms in Tharangampadi, Vedaranyam, Nagapattinam, Velankanni were severely hit by tsunami with their bunds obliterated and their equipment including motors and pumps destroyed.

Catches from wild fisheries will decline because of damages to fishing boats/vessels and will impact on shrimp broodstock and also impacting adversely on the likelihood of having a crop in the next season.

**Kerala:** total loss is estimated around Rs. 149 lakh, at least 14 shrimp hatcheries affected covering 4 districts (Kollam, Alleppey, Ernakulam, and Kannur). Most of these are small-scale hatcheries, but some may have employed a few local workers who are now livelihood being affected

**Tamil Nadu:** total loss is estimated at around Rs. 627 lakh, which including a 120 ha of small-scale shrimp farms in Nagapattinam and Karaikal (Pondicherry) districts, and 11 hatcheries. The compound wall of the lobster fattening centre in Chennai was totally damaged.

**Andhra Pradesh:** According to officials 400 fish tanks were damaged. Unofficial estimated loss at Rs. 500 million. Aquaculture farms over 400 acres were also damaged. The state's seafood industry accounts for 25-30 percent of India total seafood exports. Most of the hatcheries were not much affected except Thupilipalem in Nellore District. Seabass hatcheries in Thirumullaivasal were badly affected with one farm totally submerged.

No casualty at Rajiv Gandhi Centre for Aquaculture (RGCA) from Tsunami although most of RGCA staff were present at hatchery and farm at the time of Tsunami hit the Nagapattinam coast. At Karakkal farm, Tsunami waves hit at 8.50 A.M. while two RGCA staff were grading the fingerlings stocked in the cages. By seeing the huge waves, they ran to the western side jumping into the water and swim away and saved their life. However, four persons who were traveling in the road located in front of RGCA farm were washed away by the waves and their dead bodies were recovered from at the farm later. The waves damaged our farm equipments and bunds. Similarly, at the hatchery around 12 of our staff were working at the time when Tsunami strike. They also escaped by running away from waves. Many of our fishes died due to power failure and insufficient water exchange. Our pipelines and other machineries were damaged. However, no significant damage occurred to the buildings.

**Sources:**

- B.Vishnu Bhat. JD (Aqua) MPEDA;
- Aquaculture sectors
- Website: (<http://www.newkerala.com/news-daily/news/features.php?action=fullnews&id=51744>)
- Y.C. Thampi Samraj, Project Director, RGCA

# INDONESIA

## General

An early estimation of loss of production and income based on Indonesia Aquaculture Statistics (2002) published by the Directorate General of Aquaculture (DGA) (Ministry of Marine Affairs and Fisheries, Indonesia) in 2004 amounted to US\$70 million, based on assumption that 40% of the farms were damaged by the tsunami.

Early status report prior to January 5, 2005 by various senior officers from the DGA Indonesia (Mr Agus Budhiman, Director of Seed Production and Ms Maya Sudjarwo, Director for International Cooperation) provided a very brief inside into the potential damage caused and pledged for help in assisting creating jobs for the victims for those who are in Northern Sumatra particularly Aceh province.

Mr Andy Pradjaputra (ASEAN Foundation, Jakarta) also ascertains that ASEAN Foundation will contribute to the rehabilitation of tsunami-hit areas in whatever efforts and ways it can.

The following information indicates potential losses based on published "pre-tsunami" information on the status of cage culture in North Sumatra, west coast region close to the epicenter of the 9.0 Richter scale earthquake. The area available for marine fish farming was almost 400 ha, mostly in Central Tapanuli and Sibolga districts (Tapien Nauli Bay). In 1989, there were only 14 cage farms, but by 1994 the number had increased to 398 (Robert Napitupulu, 1998). Since the development of grouper hatchery production technology by the Research Centre for Mariculture-Gondol and other development centers (Lampung, Batam and Situbondo), grouper fingerlings from hatchery have become more readily available and abundant, which stimulated the rapid expansion of grouper farming in Indonesia from 2002. It is very likely that the number of farms in North Sumatra, by the date of the tsunami, was in excess of 1,000 farms. A cage unit (4 cages) usually employs 2 people. Many of the farms have more than 4 and up to 20 cage units. Annex 2 provides some details statistics of aquaculture production in Sumatra, the statistics are based on Indonesia Aquaculture Statistics 2002, Directorate General of Aquaculture 2004.

## Loss of Lives

Based on World Health Organization Situation Report No 7 (covering period up to 4 January, 2005), there are confirmed 94,081 dead, more than 2,500 injured, 1,341 missing and 271,968 displaced. There are 1,550 villages destroyed in 172 sub-districts. WHO also estimated some 500,000 people without food or water in Northern Sumatra, particularly Aceh.

## Fisheries

There is no report available as yet on the impact on fisheries, either small-, medium- or large-scale. However, it is expected an excessive damage and losses to the fishing industry in Northern Sumatra not only on life, equipment but also on the natural fisheries resources.

## Aquaculture

Aquaculture losses caused by earthquake and tsunami in Nanggroe Aceh Darussalam (NAD) and North Sumatra, Indonesia on 26 December 2004 by official DGA Indonesia estimated based on ground survey are amounted to US\$ 210,835,555. The breakdown of the damages and losses are listed below:

### 1. Aquaculture activities profile

The earthquake and tsunami occurred in Nanggroe Aceh Darussalam Province and North Sumatra on 26 December 2004 have a very big impact on aquaculture activities especially those are located near the coastal area; brackishwater ponds, shrimp and fish hatcheries and Regional Centre for Brackishwater Aquaculture Development (BBAP Ujung Batee).

#### a. Brackishwater Aquaculture ( Pond) culture in NAD Province

Brackishwater aquaculture activities in 11 districts covering a total area of 36,597 ha (2003) with total production of 2,603 t valued at US\$80,821,782 were lost. The brackishwater aquaculture production consist of 8,261.4 t of shrimp, 5,113.9 t of milkfish and 11,227 t of others (consist of seabass, mullet, crabs, etc.) (Table 1).

**Table 1: Brackishwater pond culture by area and production in NAD province, 2003**

No.	District	Area (ha)	Production (t)				Production Value (x Rp. 1000)	Production Value (US\$)
			Shrimp	Milkfish	Others	Total		
1	South Aceh	25.0	5.3	3.6	7.3	16.2	517,400	57,488.9

2	West Aceh	289.0	55.5	36.1	74.2	165.8	2,800,650	311,183.3
3	Aceh Besar	1,006.0	716.9	220.5	895.6	1,833.0	30,534,400	3,392,711.1
4	Kota Banda Aceh	724.3	667.6	424.6	809.5	1,901.7	59,969,300	6,663,255.6
5	Kota Sabang	28.0	-	514.0	-	514.0	4,549,000	505,444.4
6	Pidie	5,056.0	788.4	648.6	928.2	2,365.2	59,798,740	6,644,304.4
7	Bireuen	5,146.7	2,254.2	1,127.3	2,723.6	6,105.1	200,926,020	22,325,113.3
8	North Aceh	10,520.0	1,485.5	1,058.2	3,055.6	5,599.3	149,187,032	16,576,336.9
9	East Aceh	7,822.0	2,288.0	1,081.0	2,733.0	6,102.0	219,113,500	24,345,944.4
10	Kota Langsa	2,122.0						
11	Aceh Tamiang	3,858.0						
	<b>Total</b>	<b>36,597.0</b>	<b>8,261.4</b>	<b>5,113.9</b>	<b>11,227.0</b>	<b>24,602.3</b>	<b>727,396,042</b>	<b>80,821,782</b>

Pond canals has rehabilitated through Fisheries Support Service Project (FSSP), funded by World Bank in 1995; SPL-JBIC INP 23 Project funded by Japan government in 1999/2000 and Indonesian government budget (*APBN*), costed a total of US \$ 9,322,667 as it is shown in the Table 2.

**Table 2: Rehabilitation of brackishwater pond irrigation in NAD province**

No.	District	Brackishwater Area (ha)	Brackishwater Area Irrigated (ha)			Production Value (x Rp. 1000)	Production Value (US\$)
			FSSP	SPL	APBN		
1	South Aceh	25	-	-	-	-	-
2	West Aceh	289	-	-	-	-	-
3	Aceh Besar	1,006	-	-	-	-	-
4	Kota Banda Aceh	724	-	-	-	-	-
5	Kota Sabang	28	-	-	-	-	-
6	Pidie	5,056	-	950	100	11,846,000	1,316,222
7	Bireuen	5,147	-	-	50	200,000	22,222
8	North Aceh	10,520	3,000	900	700	49,544,000	5,504,889
9	East Aceh	7,822	1,000	400	750	21,314,000	2,368,222
10	Kota Langsa	2,122	-	-	-	-	-
11	Aceh Tamiang	3,858	-	-	100	1,000,000	111,111
	<b>Total</b>	<b>36,597</b>	<b>4,000</b>	<b>2,250</b>	<b>1,700</b>	<b>83,904,000</b>	<b>9,322,667</b>

Note: FSSP: Fisheries Support Services Program  
 SPL: Sub Program Loan  
 APBN: National Allocated Budget for Development

*b. Regional Centre for Brackishwater Development (BBAP) in Ujung Batee - NAD*

The Centre located in Aceh Besar district, it is about 16 km from Banda Aceh, the capital city of the province. The Centre is responsible for the aquaculture development of 2 villages in Masjid Raya sub-district. These villages are Durung village (3.55 ha) and Neheun village (6.28 ha).

The tasks and functions of the Centre are as follows:

- Development of seed technology of brackishwater fish culture
- Development of growing technology of brackishwater fish culture
- Identification and monitoring of pest and disease in the pond and their environment
- Transfer of technology to the fish farmers
- Restocking of brackish water fish commodity;
- Dissemination of technology through training for students and other institutions

The facilities at the BBAP including:

- Shrimp broodstock pond
- Milkfish and grouper broodstock pond
- Shrimp and fish hatchery
- Live food tanks
- Sea water reservoirs
- Larvae tanks
- Brackishwater pond
- Laboratory for feed
- Laboratory for pest and disease
- Meeting room
- Housing for staff
- Library
- Mosque

*c. Private Shrimp Hatchery*

There are 17 private shrimp hatcheries in Aceh consist of mainly small- and medium-scale hatcheries. The total production of shrimp post-larvae (PL) from these hatcheries estimated to be around 200 million PL per year. However, now all these hatcheries have been severely damaged so operation is not possible in the short-term.

**2. Losses estimation**

*a. Lost of infrastructure and production facilities*

Most of private sector brackishwater ponds and shrimp hatcheries were badly damaged. The facilities in BBAP, Ujung Batee are also badly damaged.

The estimated total amounted to US\$ 210,835,555, which consists of:

1)	Brackishwater ponds in NAD Province	=	US\$ 202,811,782
2)	Private Shrimp hatcheries	=	US\$ 6,233,33
3)	BBAP, Ujung Batee	=	<u>US\$ 1,790,444</u>
	<b>Total</b>	<b>=</b>	<b>US\$ 210,835,555</b>

*b. Victims*

The number of tsunami victims in BBAP, Ujung Batee consists of 20 people died and 11 people missing.

## UNOSAT Satellite Images for Aquaculture Site in Aceh

Satellite images obtained from UNOSAT provide a comparison of before and after tsunami in Aceh on aquaculture sites. These aquaculture sites may culture a range of marine finfish (milkfish, seabass, mullet etc.) and crustaceans (crabs, shrimps, etc.).

The severity of the damages is apparent. Figure 1 shows the aquaculture areas have been totally destroyed. The aquaculture sites in Figure 2 is slightly inland compare to the area in Figure 1, the severity of the damaged is also the same.



Figure 1 (Source: UNOSAT <http://unosat.web.cern.ch/unosat/asp/charter.asp?id=55>)







Figure 2 (Source: UNOSAT <http://unosat.web.cern.ch/unosat/asp/charter.asp?id=55>)

# MALAYSIA

## General

The northern states of west coast peninsular Malaysia are badly affected. About 5,200 fishers with estimated loss of RM 29.3 million; 155 fish farmers with estimated loss of RM23.9 million are affected. The government is giving RM 500 per family as initial help. (*DG Fisheries, Malaysia*)

Follow by a visit to Penang on January 5, 2004, the DG Fisheries Malaysia (Dato Junaidi Che Ayub) said that it is vital to make a quick assessment of the losses incurred by the fishers. Dato Junaidi talked to the fishers in Penang and they want help to repair their boats, nets and engines so that they can go out to sea again because that is the only profession they are good at. DOF Malaysia is helping with this aspect. However, it is necessary to find out fishers who are now reluctant to go to sea again, after the traumatic experience. DOF Malaysia is also trying to conduct a survey so that fishers who do not want to continue fishing activities can be trained to do other economic activities. It is also necessary to do an assessment on the fishery resources to determine the impact caused by Tsunami. (*DG Fisheries, Malaysia*)

## Loss of human Lives

Based on various sources, it is estimated around 68 were killed as a result of tsunami, mostly in Penang. The western and northern coasts of Penang, facing Indonesia was the worst hit, with most dead count come from that area.

## Fisheries

Some 3,500 people were evacuated in Kedah and 800 in Penang. The tsunami reportedly caused losses estimated at around RM30 million (US\$8 million) in the four affected northern states of Penang, Kedah, Perlis and Perak.

About 1,000 fishermen have been affected, and the fishing industry is likely to take a jolt. Prices of seafood could rise. Before the tsunami, Penang recorded fishing hauls valued at some RM150 million a year. (Source: [http://www.atimes.com/atimes/Southeast\\_Asia/GA04Ae05.html](http://www.atimes.com/atimes/Southeast_Asia/GA04Ae05.html))

The coastal fishing communities suffered the most in Malaysia. Fishing livelihoods lost in various areas in Malaysia are listed below:

- Teluk Kumbar, Penang – 128 fishing boats damaged with losses totaling RM 500,000.
- Gertak Sanggul, Penang – 32 boats damaged.
- About 4,696 people in Kedah and 1,600 villagers in Penang were evacuated from their homes to relief centers. There was 1,146 people affected in Balik Pulau, Penang, and the estimated cost (in terms of losses) was RM 2.3 million.
- Pulau Betong, Penang - villagers estimate that about 200 boats were damaged (media reports 40) and quite a number of houses. The damage per boat is estimated between RM 10,000 to 30,000.
- Kuala Sungai Burung, Penang – fishers cooperative house damaged – losses estimated at RM 100,000.
- Tanjung Piandang, Perak – about 50 large boats and 67 small boats damaged.
- Bagan Datoh, Perak – one fishing jetty collapsed, 7 big and 40 small boats damaged.
- Kuala Perlis – most of the 2,000 inshore fishers reported poor daily catches since the tsunami catching below 5 kg vs 10 kg before (Star, 6 Jan.).

(*Dr. Wing-Keong Ng, School of Biological Sciences Universiti Sains Malaysia, Penang*)

## Aquaculture

Floating cage farms at Tanjung Dawai (Penang) were very severely damaged, farmers lost everything, their cages smashed by the tsunami. Floating cage farms at the south of Bukit Tambun area were wracked, and estimated loss of around RM 10 million. At Pulau Aman, some cages were damaged with loss of fish (*Dr. Leong Tak Seng, Penang*).

Many wooden village houses facing the open sea along the Kuala Muda coast near the National Marine Prawn Fry Production and Research Centre, Pulau Sayak were damaged and 10 lives lost. In Penang the death toll was higher with more than 35 people reported killed. Most the cages in Tanjong Tokong in Penang were broken all fish including 1 m giant groupers were found dead along the beach due to oxygen depletion as the gills were clogged up with mud during the tsunamis. No report on other places except damaged fishing boats in the affected areas. Deep sea cages in Langkawi ok (*Mr Chuah Toh Thye, Pulau Sayak, Kedah*).

Some 110 fish farmers living along coastal Sungai Aceh in Penang farming groupers, seabass and snappers covering a total water surface area of 120 ha. The estimated losses from tsunami in this area alone is greater than RM 10 million.

The investment cost for each cage farms (usually more than 20 cages) are expected to be around RM 300,000 – 400,000. The annual production in this area alone accounted for a total of 600 t of marine finfish. Thousands of dead fish (around 100 t) were found dead at Pasir Pandak beach near Teluk Bahang, Penang (ref CNN photo). Small-scale oyster farmers in Penang also suffered losses. One oyster farmer losses about RM 20,000 when 40 of his 140 oyster cages were destroyed (*Dr. Wing-Keong Ng, School of Biological Sciences Universiti Sains Malaysia, Penang*)

#### **Currently Unknown Impacts on Aquaculture and Fisheries**

- About 6,900 hectares of mudflats on the west coast of Peninsular Malaysia are used for the extensive culture of blood cockles, *Anadara granosa*. Major culture states are Perak, Selangor and Penang. Malaysia is the largest producer of cockles with about 70,754 tons in 2001. Huge quantities of dark mud were spewed by the tsunami onto land. The effects on Malaysia's premier cockle breeding mud flats, especially in the coastal areas of Penang, remains to be seen.
- About 24,000 tons of tiger shrimp, *Penaeus monodon*, was produced in Malaysia in 2002. Many of the shrimp hatcheries are still dependent on wild broodstock for their supply of larvae. The impact of the tsunami on the surrounding seas where these adult shrimp are caught remains unknown.
- Malaysia is one of the top 5 Asian producers of marine finfish, producing about 8,691 tons in 2002. For some species such as groupers, many cage farmers are still dependent on wild-caught seed to stock their cages. Wild-caught adult fish are also used in hatcheries for spawning. The impact of the tsunami on this supply line for the marine finfish aquaculture, if any, is not known.
- Immediate destruction to mangrove swamps and forests along the coasts is currently not known. Slow destruction of the mangrove forest could result from changes in the soil topography compromising water run-offs, changes in soil salinity, etc., as a result of the tsunami. Compromised health of the mangrove ecosystem may compromise fishing returns in the coastal areas of northern Malaysia.

(*Dr. Wing-Keong Ng, School of Biological Sciences Universiti Sains Malaysia, Penang*)

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## **MALDIVES**

### **General**

The tsunami inundated the entire country. Because of the low elevation of the country there was nowhere to run and at least one third of the entire population of some 100,000 people were severely affected. The initial damage assessment is daunting: more than one third of all inhabited islands are completely or severely destroyed and hundreds of boats, jetties and harbours were destroyed or damaged.

## **MYANMAR**

### **General**

The southern coast of Myanmar was hit by the waves around four hours later. Unlike for the coasts of Thailand or Sri Lanka, the Myeik Archipelago reduced the Tsunami's force, before impacting the coast of Tanintharyi Division. On its way to the Ayeyarwaddy coast, the wave had also severely hit the Adaman Islands (India). This might partly explain the smaller scale of damage inflicted on the southern areas of Myanmar. The Myanmar coast is also characterized by its hilly geomorphology.

### **Loss of lives**

Official Myanmar media reported that 53 people had died in the waves in 17 fishing villages with another 21 people still missing. The hardest hit area is the Laputta Township in the Ayeyawaddy Division where 34 people are officially reported dead and hundreds of families are without shelter. Casualties were also reported in southernmost Tanintharyi division and Rakhine state in the west, with the Co Co islands off the coast particularly hard hit. Several hundreds of fishermen of Myanmar origin may have lost their lives off the Thai coast, thus affecting the livelihoods of their families in Myanmar.

The World Food Program (WFP) reported that hundreds of fishermen were probably killed in Myanmar by Indian Ocean killer waves.

### **Fisheries**

Some 17 seaside fishing villages have been reported as destroyed and some 778 people homeless. Seasonal fishing villages are common at this time of the year. One known examples is a village, 220 miles (352 kilometres) southwest of the capital Yangon in Ayeyarwaddy division, that sprang up barely a month ago as families built bamboo and thatch huts for the post-monsoon fishing season. The fishing village of some 600 people was swept into the sea by killer tsunamis, leaving 17 dead and scores of families with nothing but shattered lives.

There was particular concern about fishing communities and the ethnic Salone and Moken, commonly referred to as sea gypsies, a UN official told AFP.

Fisherman Maung Maung, 36, told AFP he had been out to sea with seven other men on a trawler when they were caught by the wave and capsized.

"All our boats overturned but we managed to hold on and keep afloat until rescue arrived," he said.

Source: [http://www.channelnewsasia.com/stories/afp\\_asiapacific/view/125398/1/.html](http://www.channelnewsasia.com/stories/afp_asiapacific/view/125398/1/.html)

### **Aquaculture**

Little aquaculture was being practiced along the impacted coast.



# SRI LANKA

## General/ Loss of Life

The following is a summary of the scale of the disaster in Sri Lanka.

- Total deaths: 33,513
- Total displaced persons: 773,712
- Total injured: 15,686
- Total missing: 3,870
- Total completely damaged houses: 96,541
- Total number camps: 652

The government has declared 100 m from coastal line as a 'restricted zone' and no construction will be permitted within this zone and is planning to start resettlement in non-restricted areas shortly.

### Fisheries

Information provided by the Ministry of Fisheries and Aquatic Resources indicated that:

- Around 7600 fishermen are now reported dead in seven districts
- Maximum deaths reported from Batticaloa and Ampara districts
- Missing fishermen is estimated at 5686 in 4 out of the 14 affected districts
- Displaced families is now estimated at 90657 in six districts, majority from Batticaloa district (57829)
- Fully damaged boats Island wide is estimated at 22940, this includes 12000 traditional boats, 750 multiday boats, 9550 day fishing boats and 640 beach seine vessels in the districts of Colombo, Negombo, Jaffna, Kilinochchi, Mullaitu, Tricomalee, Batticaloa, Ampara, Hambantota, Matar, Gale and Kaluthara. Partially damaged boats is estimated at 900 of which 450 are multiday boats and 450 day fishing boats.

The bulk of the boats destroyed or damaged are the small non-motorized boats owned and operated by the poorest of the community. Ten out twelve of the main fishing ports have been devastated with extensive loss of essential infrastructure such as ice plants, cold rooms, workshops, slipways and marine structures. The basins of the harbors are clogged with racked vessels and need to be cleared.

### Aquaculture

Little aquaculture was being practiced along the impacted coast.

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# THAILAND

## General

Six provinces facing the Andaman Sea which were hit hard by the tsunamis are Ranong, Phang-gna, Krabi, Phuket, Trang and Satun. The damages on fisheries and aquaculture are estimated at 1.34 billion baht (USD 343 million). Some 15,802 floating cages for fish farming in these 6 provinces were damaged or totally lost. A total of 3,539 fishing boats were damaged or totally lost wrecked.

### Loss of Lives

The Department of Disaster Prevention and Mitigation confirmed damages in Thailand as of 30 December 2004 as follows:

Province	Death				Injuries				Missing
	Thai	Foreigner	Not identified	Sum	Thai	Foreigner	Not identified	Sum	Sum
Phuket	151	111	17	279	386	225	661	1,272	1,815
Phangnga	1,073	510	0	1,583	4,320	1,253	0	5,573	2,376
Krabi	108	88	171	367	0	0	2,649	2,649	1,913
Ranong	162	2	0	164	189	14	0	203	16
Satun	6	0	0	6	15	0	0	15	0
Trang	3	2	0	5	57	9	46	112	1
Total	1,503	713	188	2,404	4,967	1,501	3,356	9,824	6,121

The death toll increased from 1,543 as of 28/12/2004 to 2,404 on 30/12/2004, while still over 6,000 people are missing.

The above up-dated statistics also indicated that two-third of people killed by the Tsunami are Thai national.

Phuket has been declared an emergency area, but indications are now that Phang-nga is the worst affected province.

Based on World Health Organization Situation Report No 5. (covering period 2-3 January, 2005), there are confirmed 4,993 dead, 8,457 injured, and 3,810 missing.

### Fisheries

Some 3,539 fishing boats were either damaged or total wrecked, 93% are small-scale fishing boats. Estimates indicate that 2,923 fisheries households were affected. Estimated damages on fisheries alone would amount to USD 16.6 million.

The primary source of figures regarding lost vessels will be the Thai Department of Fisheries which has a figures of approximate numbers of fishing vessels in the affected provinces (figures for lost vessels have already been announced on Thai television).

Regarding lost vessels, the announcement listed only about 15 large vessels but a very significant (in the thousands) of lost small-scale vessels. The small vessels were driven by the waves inland where they were subsequently wrecked. The vessels are typically 4 meter long hardwood built traditional fishing vessels that are powered by the diesel long tail engine. (A crude estimate of cost of a vessel is in the region of \$1,000-2,000. The engine costs about \$800 upwards. The vessels use a range of small-scale gears.

In some areas (i.e. those with very heavy concentrations of tourism such as Phuket) many of the fishing vessels are not used for fishery purposes, but are used for transporting tourists.

There will be a major distinction between damage to vessels and actual loss (i.e. irreparable damage that requires replacement). In the case of replacement of the vessel, I am somewhat concerned that the original wood that the vessels were constructed from may not be readily available and reconstruction of the original type of vessel may not be possible. Replacement with a fiberglass composite structure may not be useful (if the design is not appropriate) and certainly would not be as strong as the original vessel. Engines that power this design are typically diesel long tail engines these may be more favoured in place of 'modern' outboard engine (which run on petrol and may not be as robust or flexible as the original).

b) Damage or loss of fishing gears

This is extremely difficult to assess unless the gear is assumed to have been associated with the vessel. In this was the vessel and the gear operated are assumed to be lost together.

Gear replacement is a lower cost intervention that can get fishing folk fishing again and assume that they are able to repair damaged vessels themselves. In this circumstance the assistance of gear provision is [probably significantly less that the costs of boat repair.

*b) Damage to shore-based property and services.*

Land based infrastructure has also been affected in some areas – this sort of structure would be landing sites, ice making and storage facilities. Some of these facilities would be state owned or operated or possibly through cooperative type ventures.

Many ventures would also be privately owned by entrepreneurs (i.e. not directly involved in fishery production).

An assessment would have to at last get a breakdown of the number of harbour sites that were directly impacted by the wave. There has been a great deal of minor damage in areas not in the actual path of the wave and this can be readily rectified and should not be a focus of intensive rehabilitation.

Details of damages and losses reported by DOF Thailand are listed Table 1. The initial estimated fishing boat damaged and cost from DOF, Thailand dated December 28, 2004 were 2,818 boats with a total of cost of Baht 476 million. The updated (January 4, 2004) version is listed below and the losses will have been much greater than Baht 476 million with a total of 3,539 fishing boat damaged or total wrecked.

### **Fishing boats damaged or total wrecked**

- Phuket: 981
- Phang-nga: 725
- Satun: 580
- Krabi: 250
- Trang: 303
- Ranong: 700

### **Aquaculture**

*c) Damage to aquaculture operations*

The west coast of Thailand has significant amounts of coastal aquaculture based in and around mangrove areas, especially in the creeks and delta mouths. The scale of these operations is extremely varied but can crudely be broken into:

- i) very small scale artisanal shellfish operations – crab fattening, mussel strings and other low input structures, individual fish cage operations (grouper, sea bass etc.)
- ii) larger scale water based aquaculture operations – typically these are fish cage operations and involve multiple cages.
- iii) Land based aquaculture operations (lower investment) - this would typically be fish ponds (unusual) and small shrimp pond operations (more typical)
- iv) Larger scale and-based aquaculture operations – these involve greater investment and would be larger shrimp farms which have many ponds (more than three. Also included 9and particularly affected in Phuket and somewhat in Phang-nga are shrimp hatcheries since these are often located at the water since in the most exposed areas (to get clear seawater) they have been significantly damaged). However the owners of these cannot be classified as small-scale or poor and invariably have other sources of income

The initial estimated aquaculture floating cage damaged and cost from DOF, Thailand dated December 28, 2004 were 27,409 cages with a total cost of Baht 1.28 billion. The updated (January 4, 2004) version is listed below and the losses may be less than Baht 1.28 billion since the damaged cages are less than the original estimated, with a total of 15,802 cages been damaged.

## **Floating cages damaged and loss**

- Phuket: 2,415



- Krabi: 1,150
  - Satun: 7,167
  - Trang: 842
  - Ranong: 4,228
-

**Table 1: Preliminary report of damage cost on fisheries from Tsunami disaster on 26 December 2004**

	Province	Sub province	Farmers	Damage Area (Rai)	Type		Fishing Boat		Bamboo Trap		Floati net
					Pond	Cage	Large	Small	Large	Small	
1	Satun	La-ngu				6,772	15	363	119	37	
		Tungwa				315		50	15	100	
		Muang				50		152			
		Ta-Pae				30					
	Total		4			7,167	15	565	134	137	
2	Trang	Kinghadsamran				5		51			
		Likao				158		51			
		Palean				128		21			
		Kandang				551		180			
	Toal		4			842		303			
3	Krabi	Muang, Aourook Klong Tom Lanta Island Nua-Klong				1,150		250		150	
		Total		5			1,150		250		
4	Ranong		1,659	200		4,228		700			
		Total	1	1,659	200	0	4,228		700		
5	Pnang-Nga	Muang	50								
		Takoatung	80	108.5	1,293		2	19			
		Koayao	370				1	200			
		Kuraburi	250					31			
		Taimuang	110	16	252		102	50			
		Takoa-Pa	140	58.5	800		70	250			
	Total	6	1,000	183	2,345		175	550			
6	Phuket	Muang	123	469.02		1,063	54	623			
		Talang	141	49.58		1,352		258			
		Krattoo						46			
		Total	3	264	518.6	0	2,415	54	927		
	Total	22	2,923	901.6	2,345	15,802	244	3,295	134	287	

Source: Department of Fisheries (Thailand), dated January 4, 2005.

Note: 1 Rai = 2/5 acre = 1,600 m<sup>2</sup>

**UN seeks fishing, farm help**

Natasha Bitu

January 05, 2005

THE UN will ask Australia to donate fishing equipment and send farming experts to help avert starvation in the tsunami disaster zone, during top-level talks in Jakarta tomorrow.

The UN's Food and Agriculture Organisation warned that at least 2 million victims faced food shortages, with thousands risking starvation in Indonesia and Sri Lanka.

"The situation is dramatic because those areas were already in a situation of vulnerability," the chief of FAO's emergency operations, Fernanda Guerrieri.

"Areas like Sumatra and Sri Lanka were already very poor - the only resources of the people is their fishery.

"They have lost their fishing boats, they have lost everything. In those areas there is a risk of starvation."

Ms Guerrieri said UN officials would discuss the need for at least \$US50 million in food and farm aid over the next six months at tomorrow's tsunami summit in Jakarta.

"All assistance would be most welcome from the Australian Government," she said.

"Aid could be in different forms - in cash, in kind, in investment and in technical assistance.

"Australia is very well placed to assist with technical assistance, and with assistance in kind like boats, engines and nets for the fisheries sector."

Fisheries and aquaculture had been hardest hit by the tsunami, Ms Guerrieri said.

"The priority is restoring their capacity to fish and the first step will be to give them back their equipment.

"That would also increase their self-reliance and decrease reliance on food aid."

Ms Guerrieri said the tsunamis had caused "huge damage" to food supplies by wiping out fisheries and crops, wrecking roads and railways, contaminating arable soil with salt and decimating the families who worked the land.

The "first stage" of farm and fishery rehabilitation could take two years, she said, although UN Secretary-General Kofi Annan has warned the region may take a decade to recover.

(Source: The Australian [http://www.theaustralian.news.com.au/common/story\\_page/0,5744,11853212%5E401,00.html](http://www.theaustralian.news.com.au/common/story_page/0,5744,11853212%5E401,00.html))

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**Other Related News - India*****Poor fishermen get back to sea***

Sowmya Aji Mehu

Times News Network [Saturday, January 01, 2005 10:28:19 am]

BANGALORE: Even as heart-rending stories of tsunami deaths and devastation are sweeping the South, poverty has forced Karnataka's fear-stricken fishermen back into the sea at the dawn of the New Year.

The 1.75 lakh fishermen, who live in hamlets along Karnataka's 356 km coastline, are among the poorest of the state's citizens. They lead a hand-to-mouth existence entirely dependent on the day's fishing.

Over the last six days, with the Karnataka administration issuing tsunami warnings, an alert all along the coastline and evacuating people from the beaches, fishing on the West coast has come to a near-total halt. "This is the fishing season. Any loss of fishing days means the fisherman loses the day's turnover," fisheries director H S Veerappa Gowda told TOI.

(Source: <http://timesofindia.indiatimes.com/articleshow/977629.cms>)

## ***Isolated Indian Fishing Villages on The Bay Of Bengal Hit Hard By the Recent Tsunami Face Monumental Task of Rebuilding Homes, Boats, Nets and Other Equipment and Caring for Those Who Lost Loved Ones***

PONDICHERRY, India, Jan. 1 /PRNewswire/ -- An Indian non-governmental organization (NGO) that implements HIV/AIDS prevention, education and treatment programs in all 35 states of India and its Union Territories is using its medical expertise, its national network and its long-term presence in local villages to facilitate the distribution of relief supplies and to initiate reconstruction efforts, following the tsunami that devastated coastal regions of India on the Bay of Bengal.

Among the hard-hit fishing communities in the Union Territory of Pondicherry (on the Bay of Bengal in Southeast India) the NGO, FXB India -- the national branch of the worldwide Association Francois-Xavier Bagnoud (FXB) that implements 87 HIV/AIDS programs in 18 countries -- is helping the local government to distribute food packets, drinking water, medicines, clothing and a support-in-cash in the villages of Kanagachettikulam, Periya Kalapet, Chinna Kalapet and Pillai Chawadi where FXB programs exist.

A quick survey of damage done by the tsunami showed that in these villages:

- \* Nearly 500 houses have been totally destroyed in the havoc.
- \* About 1,000 families have lost their belongings.
- \* More than 2,000 people are absolutely homeless and displaced.
- \* Nearly 250 mechanized boats (including outboard & in-board motor boats) and 280 country crafts (catamarans) are either fully or p

In the medium and long-term, there is an urgent need to:

- \* Facilitate the reconstruction of houses,
- \* Repair boats, catamarans and trawlers,
- \* Repair or provide new nets,
- \* Provide educational aids for school going-children and healthcare facilities especially for children.
- \* Offer grief counseling, care and support for the victims of the tsunami.

### ***Kerala fishermen devastated by tsunami***

Fishing communities in Kerala districts, which were thrashed by the December 26 tsunami waves, are desperately trying to get things back to normal.

The fishing community living along the coastline is the worst affected by the tsunami disaster.

Battered by the tsunami waves, the once idyllic town of Allapad in Kollam district now resembles a ghost town.

#### ***Sea wrecks havoc***

Eighty of the 160 people who died in Kerala are reported to be from Allapad. The fishermen who survived have fled the village. The whole town is tangle of torn fishing nets and broken boats.

"The water came and climbed over the coconut trees. That was the height of the waves, which washed away everything," said Shahzi, a fisherman.

"We are in a state of utter and complete depression. We have no home, no clothes and no livelihood. Where shall we go?" he asked.

"We are now scared to go into the sea and our families and government too are preventing us from going," said another fisherman.

(Source: <http://www.ndtv.com/template/template.asp?template=Tsunami&slug=Kerala+fishermen+devastated+by+tsunami&id=66183&callid=1&category=National>)

(Source: <http://www.mcot.org/query.php?nid=33701>)

### ***Indian fishermen to stick by sea despite tsunami***

The tsunami hit India's fishing community hardest as the southeastern coast is dotted with small fishing villages with

poorly-constructed houses -- some made of brick and bad quality concrete -- and shacks located right on the beach.

Many of these were sitting ducks for the tsunami.

An initial estimate by authorities in Tamil Nadu state showed that around 85 percent of the nearly 700,000 people displaced in the state were fishermen or their families.

Most of the dead were women and children who could not scramble fast enough to escape the waves. About 100,000 fishermen homes and some 40,000 boats were badly damaged.

(Source: <http://www.alertnet.org/thenews/newsdesk/B200420.htm>)

### ***Relief work needs direction***

By: Shradha Sukumaran

January 2, 2005

*Tamil Nadu*

Suyam has adopted three interior villages in Akkarapettai panchayat in Tamil Nadu's worst hit area Nagapattinam where 12,000 people have died. Muthuram points out that the area needs provisions for the kitchen systems that the relief workers are providing each family with.

Each catamaran costs Rs 10,000 to replace and fishnets between Rs 5,000-10,000. Suyam has toured Velankani, Kameshwaram and Meenawar colony and feel that victims need to cook their own food, build the boats themselves.

(Source: <http://web.mid-day.com/news/nation/2005/january/100672.htm>)

### ***January 4, 2004, Tamil Nadu***

Fishing, along with agriculture and tourism, which together constitute the backbone of the Nagapattinam district's economy, were badly affected by the tsunami.

According to reports, thousands of mechanised boats and country craft have been damaged and washed away by the waves, which will have a major impact on the fishing industry, especially on export of shrimps and other varieties.

During 2002-03, export of fish and fishery exports stood at a value of Rs 2507.87 crore. According to a report, the state had a fisherman population of 7.37 lakh, out of which 2.80 lakh were actively engaged in fishing from 591 fishing villages.

Fishermen in the Nagapattinam district accounted for more than 25 per cent of the district's 14,87,055 population as per 2001 census, were the worst affected as their fishing trawlers and over a lakh country boats and fishing nets were washed away by the waves.

Nagapattinam district exported prawn worth Rs 100 crore every year, a fishing department official said adding it would take another six months for this sector to return to normal.

(Source: <http://www.chennaionline.com/colnews/newsitem.asp?NEWSID=%7BFF51812B-8F8C-4C61-9305-548EB7E13008%7D&CATEGORYNAME=Tamil+Nadu>)

### ***Small fishing communities across Indian Ocean lost their livelihoods to the mammoth waves***

By Chris Tomlinson, Associated Press Writer

December 31, 2004

In Nagapattinam harbor, the tsunami tossed fishing trawlers like children's toys onto seawalls and buildings, destroying not only individual livelihoods but an important part of the region's economy.

The fishermen of devastated Tamil Nadu state in southern India were among the most prosperous of this region's inhabitants. Now homeless and jobless, they must find a way to cope, along with the communities that depended on their income.

The 130-foot trawlers were the pride of the southern Indian fishing fleet, sometimes spending three or four days at sea to fill their holds and returning with a profitable catch. One trip could earn \$2,300, a fortune in India.

With 2,400 family-owned trawlers, and 17,000 smaller boats, the state's fisherman were an important part of the economy. Now, most of the families live on the floors of wedding halls, schools or temples, relying on handouts.

Most of the boats were destroyed, and the rest were all damaged.

"I have no idea where my boat is, or what happened to it. I see planks and booms on the seas, but I can't tell if they are from my boat," said P. Sephurmani, his children crowded around him in a secondary school serving as a shelter.

The same scene was repeated down the Indian coast and across southern Asia. Not only homes were destroyed, but countless small economies that had depended on the sea, from villages in Sri Lanka where catamarans were carried up to a mile inland and broken apart, to Malaysia 3,000 miles across the Indian Ocean where the waves smashed fishing boats beyond repair.

Seafood prices have risen in some districts because of shortages, though the problem so far has not become acute.

The fishermen in Nagappatinam say that even if hulls are undamaged, most trawlers have been flooded, the huge diesel engines will have to be rebuilt and all of their nets replaced. A new boat can cost \$32,500 and nets cost \$5,000, a prohibitive expense for many in this poor state.

"It all depends on the government. If the government helps us, we can rebuild. If not, we are helpless," Sephurmani said.

Time is also working against them. The men can only fish for seven months of the year, because of government restrictions and the onset of bad weather in the Indian Ocean. The season was just starting when the tsunami hit, and the soonest they could expect to be fishing again - with quick government action - will be within six months, when the season is almost over.

There is also the new fear of the sea.

"I feel agitated whenever I go to the sea now, I feel afraid. I never had that before," said Sephurmani, who lost his sister and brother-in-law to the tsunami.

Across the Palk Strait in Sri Lanka, at the Jumaliya fishing village in eastern Trincomalee, at least 73 fishing boats were destroyed, wiping out the community's only livelihood. Some boats tore through homes while others were carried as far as a mile inland.

Farana Saleem sat on Jumaliya's beach, murmuring incomprehensibly, her hazel eyes swollen from the tears running down her cheeks. She not only lost her home, but also her only son. Inconsolable, Saleem refused to speak.

"I don't know where to start and have lost my will to live," said Abdulla, Farana's husband. A battered tin roof, wooden walls and a broken plastic basin were all that remained of their home.

### ***Sea, the provider took it all away***

Tamil Nadu, the state hit worst by the tsunami, has 314,000 fishermen, Kerala another 200,000, Andhra Pradesh nearly 700,000 lakh and Pondicherry almost nearly 43,000 fishermen. Nearly 90% of the 9,479 dead are believed to be from fishing families with more than 7,800 in Tamil Nadu alone. Entire villages perched on the edges have been washed away along the 2,260 km of the coastline.

The main damage to the coastal economy is to the fishing industry. Nearly half the country's catch of about 6,000,000 tonnes (2001-02 figures) is from the sea. Tamil Nadu accounts for nearly 400,000 tonnes in marine landings a year, Andhra Pradesh about 250,000 tonnes and Kerala over 500,000 tonnes. The east coast has shrimp farms along creeks.

The estimates of damage are fluid but here is one estimate from Tamil Nadu: 124,000 houses, 373 villages, 23,000 catamarans, 8,500 vallams, 3,245 mechanised boats, 1,24,600 nets. And that's about Rs 10,000 to Rs 4,000,000 per boat, depending on the type, and Rs 25,000 per fishing net.

Source: *The Times of India*.

<http://timesofindia.indiatimes.com/articleshow/980692.cms>

### ***Fishing operations resume in Kerala***

Kerala Chief Minister Oommen Chandy Tuesday announced fishing operations in the state have resumed. Kerala has 200,000 people engaged in fishing and close to a million people are dependant on the fishing industry.

"We have already announced distribution of free ration in the coastal areas and have identified 217,989 families to it would be distributed for a month," said Chandy. "Till Monday this ration had reached 44,811 families and the remaining would be given by Wednesday," he said.

Source: New Kerala

<http://www.newkerala.com/news-daily/news/features.php?action=fullnews&id=54858>

### ***Indian fishermen test the waters after tsunami: Nagapattinam***

An initial estimate by authorities in Tamil Nadu showed that around 85 percent of the nearly 700,000 people displaced in the state were fishermen or their families. Most of the dead were women and children who could not scramble fast enough to escape the waves.

The bigger trawlers, larger than a two-storey house, still lie smashed up inland, tossed aside like toys in a child's bedroom. Before the fleets can sail again, even those boats not too badly damaged need new nets, engines, oars and other equipment.

Source: ANI (via New Kerala).

<http://www.newkerala.com/news-daily/news/features.php?action=fullnews&id=55053>

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### **Other Related News – Indonesia**

#### ***Aid competes with market economy in Banda Aceh***

By Shawn Donnan in Banda Aceh

January 3 2005 18:30

At the Lamboro market on Monday, fishmonger Aiyub Putih was struggling to sell the fish he had driven six hours south to buy from aquaculture farms in East Aceh a few days before.

People, he said, "are scared to eat fish. They think there are still many dead bodies in the sea".

(Source: <http://news.ft.com/cms/s/c3be45ca-5db2-11d9-ac01-00000e2511c8.html>)

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### **Other Related News - Myanmar**

#### ***Hundreds of Myanmar fishermen likely killed by tsunami: UN***

On Saturday, official Myanmar media reported that 53 people had died in the waves in 17 fishing villages. Another 21 people were reported missing, 43 injured and 778 homeless. The World Food Program fears that hundreds of fishermen may have died, and reports that 30,000 people are in immediate need of shelter, food, drinking water and medical attention.

Source: Channel NewsAsia

[http://www.channelnewsasia.com/stories/afp\\_asiapacific/view/125750/1/.html](http://www.channelnewsasia.com/stories/afp_asiapacific/view/125750/1/.html)

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### **Other Related News – Sri Lanka**

#### ***Tsunami destroyed Sri Lankan fishing***

Only about 20 percent of the fishing boats in Sri Lanka's northeast survived the Dec. 26 tsunami, leaving more than 1 million people without livelihood. In northern Sri Lanka no one is eating fish, once a mainstay of the diet. Some people reportedly believe the fish are feeding on human corpses washed out to sea. Fishing officials say 10 of the country's 12 cooperative fishing harbours were damaged by the tsunami.

Source: United Press International (via Washington Times).

<http://washingtontimes.com/upi-breaking/20050104-123158-8659r.htm>

#### ***Sri Lankans shun fish after grisly rumours***

Many Sri Lankans are shunning fish as rumours spread that the sea creatures were eating the bodies of tsunami victims and could spread disease. About 10,000 people a day usually flock to the main fish market in the country's capital,

Colombo, but few vendors or customers showed up on Tuesday.

Disappointed vendors blamed it on false reports that diseases could be caught from fish that had feasted on some of the 30,000 Sri Lankans killed by the tsunami. Fish is a dietary staple in the country. Many fishermen died, while others lost their boats and fear returning to sea. The fishermen are largely poor and observers say they will need low-interest loans or grants to get back on the water.

Source: *CBC News*

<http://www.cbc.ca/story/world/national/2005/01/04/srilanka-050104.html>

## Other Related News – Thailand

### *Plan to help fishing villages drawn up*

According to an initial survey, altogether about 20,000 fishing families and 2,000 trawlers were affected by the tsunamis in Ranong, Phangnga, Phuket, Krabi, Trang and Satun provinces.

Hamron Mukhura, of the Friends of the Andaman group, said several of the affected fishing communities have received zero assistance so far due to communication and transport problems, while some are not even listed for help.

“The tsunamis have inflicted so much destruction and left fishermen, whose very lives depended on their fishing trawlers, with nothing,” he said.

(Source: [http://www.bangkokpost.com/News/02Jan2005\\_news06.php](http://www.bangkokpost.com/News/02Jan2005_news06.php))

### *TDH Project to Develop Seafarming Opportunities for fishers and coastal families: by Mr Alessandro Montaldi, Project Manager (Dec 27)*

#### *The project was provided technical assistance by NACA and DOF*

“The project office in Phang Nga was destroyed along with all equipment and documents. Nobody was harmed as it was a Sunday and none was working. The news we receive from the diving and boat industry is terrifying, with death tolls estimated by the thousands. We had just ended a week-long update survey by boat in Phang Nga and Phuket on mariculture activities, with so many changes and new features installed. Most are gone. At Sarasin bridge a Thai-Taiwanese farm and hatchery bred *Plectropomus* spp. from Taiwan has gone. Cages are broken and all the fish have escaped. Most small-scale fishermen in the inner Phang Nga Bay have lost boats, nets and cages, while a more devastating scenario can be seen along the ocean coast of Phang Nga and Ranong. Most villages swept away, Kao Lak completely destroyed with loads of corpses still floating offshore. All cages have gone in Satun and Trang, plus boats and gears. It is ground zero for tourism and seafarming. I decided in consensus with TDH headquarters to suspend the project for the moment and dedicate resources to the emergencies and first reconstruction of small-scale fisheries. We will try to do everything we can, even if the conditions now are still quite chaotic. Even today we had to run away two times from the shoreline based station and villages on false alarms of aftershocks waves. It is the greatest devastation ever for many Asian coastal communities and businesses. Please do something about that through NACA.”

### *Thai fishing industry damaged by tsunamis*

MCOT News, January 4, 2005

Damage to Thailand's fishing industry as a result of last week's tsunamis is estimated to more than two billion baht (US\$51 m), according to Agriculture and Cooperatives Minister Wan Muhamad Noor Matha.

Over 3,000 large fishing boats and some 1,000 smaller fishing boats were damaged when the tsunamis struck Thailand's six southern provinces of Phuket, Phang Nga, Krabi, Ranong, Satun and Trang. More than 10,000 fish breeding containers in the sea were also damaged.

The government plans to initially offer compensation of no more than 200,000 baht (\$5,109) for each large fishing boat, 70,000 baht (\$1,788) for a smaller fishing boat, and 12,000 baht (\$306) for a fish breeding container, according to the agriculture and cooperatives minister.

(Source: <http://www.mcot.org/query.php?nid=34440>)

### *Phuket's tourism, fishing industries decimated by tsunami*

It is believed 10,000 fishing boats may have been lost in the tsunami. The government is giving close to US\$1,000 to



every fishermen who has lost a boat. It is also building 4,500 temporary housing units for the families made homeless by the disaster.

Source: Channel News Asia.

<http://www.channelnewsasia.com/stories/southeastasia/view/125695/1.html>

### ***Govt to compensate fishermen affected by tsunami***

Thailand's government plans to compensate the country's fisherman for their losses as a result of last week's tsunami disaster according to a government minister. The deputy agriculture minister, Newin Chidchob has finished an early assessment of the damages done to the fishing and coastal farming by the tidal waves. Compensation is planned as follows: A small fishing boat will get 30,000 baht, a big ship will get within 95,000 baht and damaged coastal fish farms will receive 12,000 baht. He indicated that compensation for damage on a larger scale would need further discussion. The official preliminary estimate of the cost of the disaster to ships and coastal fishing is over one billion baht. 70 percent of affected fishermen have registered for help.

Source: TNA (via MCOT.org)

<http://www.mcot.org/query.php?nid=34448>

### ***Compensation for Thai fishermen***

Deputy Agriculture Minister Newin Chidchob said the ministry expects to pay compensation to large and small-scale fishing operators soon. About 4,200 fishing trawlers sank after tidal waves struck the Andaman shoreline. About 3,500 of them were small fishing vessels. Small-scale fishermen will receive compensation no later than February, while operators of large trawlers will be compensated by March.

Source: Bangkok Post

[http://www.bangkokpost.com/News/04Jan2005\\_news121.php](http://www.bangkokpost.com/News/04Jan2005_news121.php)

Industry acts to stress seafood safety

***Consumers fear metal, other contamination***

**Sujintana Hemtasilpa Phusadee Arunmas**

*Bangkok Post January 6, 2005*

Thailand's fishery and seafood processing industries moved yesterday to restore consumers' confidence that it is perfectly safe to eat seafood, which many people fear will be contaminated from exposure to the remains of tsunami victims.

While some Thais have begun to shun seafood and sales at local markets are slipping, Hong Kong's Food and Environmental Hygiene Department has suggested fish may have ingested heavy metals churned up from the seabed by the earthquake on Dec. 26.

The Thai Overseas Fisheries Association said that since more than 50% of the seafood supply in Thailand was from the deep ocean outside Thai territory, the local fishery industry has not yet been seriously affected by signs of consumer unease.

The Public Health Ministry's Health Department yesterday reaffirmed that most fish and shellfish are not likely to feed on corpses as feared by many consumers. Most fish species feed only on sea plants and plankton, while those eating animals tend to eat living prey, a department official said.

Association manager Pornpoj Ngamviriyathum, said the tsunami had not caused any shortage of seafood supplies in the country. Accordingly, he did not think prices would rise across the seafood supply chain of major businesses.

However, seafood supplies for local consumption in the six affected provinces could fall short as small-scale fishermen in the areas have lost their trawlers and fishing equipment, said Mr Pornpoj.

More than 3,000 trawlers have been reported missing in the affected provinces, especially Ranong, and about 500 are waiting to be retrieved from the sea. It was estimated the tsunami has caused 500 million baht loss to local fishermen.

The Fisheries Department, meanwhile, plans to issue an extra certificate to ensure foreign buyers of the safety and sanitation of fishery products exported from Thailand.

Jarantada Karnasuta, the department's deputy director-general, said there had been requests from foreign buyers for assurances that seafood shipments were free from toxic heavy metals.

Department experts have been scrutinising water standards in the affected areas in addition to increasing inspections export shipments for which supplementary certificates would be issued.

Of the 1.9 million tonnes of fishery products exported by Thailand last year, only 40,000 tonnes came from Andaman sea.

Mr Pornpoj also underlined the fact that most of the seafood brought back into the country by Thai fishery companies comes from areas outside Thai territory in the South China and Arafura seas.

The Arafura Sea is located between Australia and Indonesia, and far away from Sumatra.

For this reason, deep-water seafood supplies in Thailand have not been affected, he added.

Prantalay Marketing Co, the distributor of Prantalay frozen seafood, said that its raw-materials were also from Arafura Sea, and that both its domestic and export sales have not been hurt.

Prantalay operates 14 trawlers, each of which has a 100-tonne capacity, in the Arafura Sea, according to general manager Anurat Khokasai.

Nevertheless, sanitary experts say fish and other types of seafood that are well-cooked, at temperatures of at least 74 degrees Celsius for 15 seconds, are safe to eat.

According to a technical officer at the Food and Water Sanitation Division, fish and seafood from the Andaman sea and other areas affected by the tsunami are safe to eat if they are cooked.

Local governments in the six affected southern provinces are also trying to assure residents that seafood is safe for consumption. Krabi province, for instance, yesterday held a seafood dining event attended by more than 100 local government officials and residents.

(Source: [http://www.bangkokpost.com/Business/06Jan2005\\_biz11.php](http://www.bangkokpost.com/Business/06Jan2005_biz11.php))

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## Part II. Magnitude of Funding Required for Rehabilitation

As mentioned above, this section provides an example of assessing and determining the level of funding required to rehabilitate destroyed sources of livelihoods. The first example is on cage structures which are a production unit, the second is on hatcheries which are support facilities.

### Indicative cost of re-establishing facilities for livelihoods in Indonesia

The attached costs and return estimates for cages and small-scale multipurpose hatcheries can be used to estimate the direct costs to restore or set up in new coastal areas cages and hatcheries (Annex 3 and 4).

We are using this case below as an example of estimating losses and estimating the level of funding needed to restore what has been lost.

Based on the statistics from Indonesia, the first table below shows the number of fish farming households, their production level and the value of the production.

### Synthesis of Coastal Aquaculture\* Statistics Based on Directorate General for Aquaculture Official Statistics for 2002

Districts	Household Number	Production (mt)	Income (Rp. 1,000,000)
Aceh	18,066	24,505	439,303
North Sumatra	23,391	32,863	1,362,807
<b>Total</b>	<b>41,457</b>	<b>57,368</b>	<b>1,802,110</b>

\* "Coastal aquaculture" includes marine culture, brackishwater pond culture, floating cages, and paddy field for small-scale integrated aquaculture.

This table assumes a severity of damage of 50% in Aceh and 30% in North Sumatra. This assumption (needless to say should have to be "ground-truthed" gives a picture of how many fish farming households were affected and the loss in production volume and its value.

## Calculation of Coastal Aquaculture Livelihood Impact by Tsunamis (based on a an assumed level of severity)

Districts	Assumed damage	Households affected	Production loss (mt)	Income loss (US\$)*
Aceh	50%	9,033	12,253	24,405,778
North Sumatra	30%	7,017	9,859	45,426,889
<b>Total</b>		<b>16,050</b>	<b>22,112</b>	<b>69,832,667</b>

\* US\$1 = Rupiah 9,000

The data from published sources give the following information:

#### a. Cost of rehabilitating production cages:

The total floating cage production for these two areas is 3,497 (mt). It is common for a small-scale floating cage farm to produce around 300-400 kg (average 350 kg) of fish from a 3x3x3m net cage. Thus to produce 3,497 mt of fish requires a total of around 10,000 net cages.

The assumed severity of damage would yield a total of 4,000 net cages (40%) destroyed. To rehabilitate these damaged cages a total of 1,000s unit floating cages is needed (i.e. 1 unit = 4 cages). A unit of floating cage farm requires US\$ 6,000. For 1,000 units a total of US\$6 million is needed.

This is a rough but illustrative estimation but it should be pointed out that the US\$6 million in this calculation is only the capital investment. Operating expenses are not included. Annex 3 - Small-scale floating cage farm model -- gives the details of operating costs. The model is based on the production of groupers (a high value food fish). Should if lower value, low input species such as milkfish, seabass, or tilapia are the targets, operating expenses would be lower.

#### b. Cost of establishing support facilities, i.e. hatcheries:

The seed requirement of 4,000 cages is 1 million fingerlings, which is required to produce 350 kg of fish (500 gram a piece) per cage per year at an estimated survival rate of around 70%.

Produce 1 million grouper fingerlings will require a total of about 40 small-scale hatcheries with an annual production of 25,000 fingerlings each. Annex 4 shows a small-scale hatchery economic model.

The total investment (both capital and operating expenses) for each small-scale hatchery is around US\$5,000 (Annex 4). Thus, building or rebuilding 40 small-scale hatcheries would need US\$ 200,000 is needed.

Small-scale hatcheries in Indonesia obtain fertilized eggs from government hatcheries, which were not affected. They hatch and rear the fertilized eggs for eventual sale to growers. A hatchery is therefore a livelihood activity by itself for a household.

All these calculations are rough estimations. And it may not be necessary for all of the cage farms to produce high value food fish species such as grouper. It would be urgent to produce a lot of low-cost fish, should the tsunami wave also destroyed the corals and breeding grounds of the usual wild species that the fishers used to catch.

For food security other species such as milkfish and tilapia may be good alternatives. For these low value species investment are lower and culture systems other than cages can be used, for example earthen ponds.

## **Estimating the Cost of Rehabilitating Thailand's Cage Farming Sector: a rough guideline**

Based on a survey conducted under a NACA/Deakin University project carried out by Mr Sih Yang SIM during late 2002 to 2004 period, the following are some of the basic investment costs needed to set up a small-scale floating cage farm with 4 net cages for culture of marine food fish species such as groupers, seabass and snappers.

A small-scale cage farm with 4 net cages (3x3x3 m) and a small house covering a total of 40m<sup>2</sup> water surface area will require a total capital investment of 159,000 baht (USD 1 = 39 Baht). The break down of the capital investment costs are listed below:

- Wooden structure and small house: 60,000 baht
- Net Cage: 16,000 baht (i.e. 4 cages x 4,000 baht)
- Small boat: 25,000 baht
- Generator: 13,000 baht
- Others: 35,000 baht

The real damages and losses sustained among floating cage farmers is not easy to estimate as they may own 4 cages up to 60 cages or even more. Some farmers may even have more than one boat. The loss of "fish-on-hand" is difficult to calculate as some farmers may have a standing crop of fish that ranged from 5 cm to 1 kg fish

The estimated losses from the tsunamis can only be based on the loss of farming system, i.e the farm, without taking into consideration the fishes that were in the cages, unless there is an economical and effective way to obtain these details – which may not really be necessary – from farmers.

Probably the next best way is to make an assumption that every 4 cages damaged represent one small-scale farm so the cost of the damages and losses can be calculated accordingly. However, we are aware that most small-scale farms will have more than 4 cages.

Finally in terms of restoring the damages, the costs of materials for cages would, even before the tsunami, have been escalating. Thereafter, the materials would have gone up even more as the priority now is construction of houses. A 30-40% increase in the cost of a cage unit would be a reasonable starting point for estimation of rehabilitation costs of the cage farming sector.

**Annex 1: Photographic record**

**INDIA**

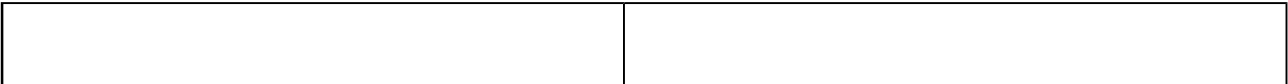
**Post-tsunami**

*Photos from the BOBP-IGO Director (Dr Y.Yadava)*



**INDONESIA**

**Pre-Tsunami**





Fishing village at North Sumatra, close to Aceh. This photo was taken in 2000 during a field trip by DOF/NACA, they would have been destroyed. (S.Y. Sim, NACA)



Floating cage farms located at the river mouth at North Sumatra, several hundreds of these units are in the area, employing thousands directly and indirectly. (S.Y. Sim, NACA)

**MALAYSIA**

**Pre-tsunami**

The photos below show examples of facilities and structures that would have been washed away.



Floating cage farms in Kedah which grow various marine fish species located at the river mouth may already been destroyed by the tsunami. These big scale operations employed hundreds of people from the local community. (S.Y. Sim, NACA)



Small fishing village which is by the river mouth in Kedah. The tsunami would have destroyed the houses, fishing boats and the coastal fishery resources. (S.Y. Sim, NACA)



Fishing ground for bivalves and floating cage farms (behind), in Penang providing livelihoods and

income for many would all have been destroyed by the tsunami. (S.Y. Sim, NACA)

**Post-tsunami**



Dead groupers littering a Penang beach, most likely from aquaculture (because of their uniform size). From a CNN website.

# THAILAND

**Pre-tsunami**

The following photos, taken at various times before the tsunami likely destroyed them, illustrate the source of immediate livelihoods, direct and indirect employment opportunities in these rural communities that have been lost.



Small-scale floating cage farms in Krabi, this photo was taken in February 2004. This location is most likely to be one of the areas affected by tsunami, due to its proximity to the sea. (S.Y. Sim, NACA)



Happy fish farming lady in Krabi who liked to help small fishermen by buying their catches. Is she still capable of helping others? What kind of assistance does she need as well? (S.Y. Sim, NACA)

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Floating cages in Satun close to the open sea, these small-scale farms would not have escaped the destructive force of the tsunami. (S.Y. Sim, NACA)



Small-scale fishermen in Satun area. Do they still have their boat? In the short and medium term would they have fish to catch? (S.Y. Sim, NACA)



This is one of the fishing village in Phang-nga bay area under TDH/DOF/NACA project, severely affected by the tidal wave. The community lost their fishing boats, and cages, and shelters have been damaged. (S.Y. Sim, NACA)



Small-scale floating cage farms in Phang-nga bay area which would surely been damaged by tsunamis. (S.Y. Sim, NACA)

#### Annex 2: Indonesia Aquaculture Statistics 2002, Directorate General of Aquaculture 2004

##### The number of aquaculture households by type of culture in Sumatra Province in 2002

Districts	Total	Marine culture	Brackishwater pond	Freshwater pond	Cage	Floating cage net	Paddy field
Nangro Aceh Darussalam	23,339	--	12,514	5,234	39	--	5,552
North Sumatra	34,689	447	1,633	10,969	329	992	20,319
West Sumatra	56,088	--	2	49,637	1,118	1,335	3,996
Riau	21,113	4,937	585	11,453	4,118	--	20
Jambi	15,758	--	820	11,914	1,243	1,508	273
South Sumatra	22,901	--	375	9,245	4,751	--	8,530
Banka Belitung	1,588	20	120	19	--	1,429	--
Bengkulu	3,193	--	66	703	46	--	2,378
Lampung	41,251	90	18,536	15,425	1,047	213	5,940
<b>Total</b>	<b>219,920</b>	<b>5,494</b>	<b>34,651</b>	<b>114,599</b>	<b>12,691</b>	<b>5,477</b>	<b>47,008</b>

##### Aquaculture areas and the number of aquaculture household and farmer in Sumatra Province for 2002

Aquaculture areas			



Districts	Number of fish farmers	Number of households	Gross Area	Net Area
Nangro Aceh Darussalam	47,096	23,339	40,970	26,310
North Sumatra	82,694	34,689	26,051	23,065
West Sumatra	97,180	56,088	8,118	8,982
Riau	31,192	21,113	3,529	3,143
Jambi	24,936	15,758	3,075	2,543
South Sumatra	29,347	22,901	4,514	4,420
Banka Belitung	1,916	1,588	517	506
Bengkulu	6,690	3,193	1,610	1,534
Lampung	86,030	41,251	60,641	26,113
<b>Total</b>	<b>407,081</b>	<b>219,920</b>	<b>149,025</b>	<b>96,616</b>

*Aquaculture Production by type of culture in Sumatra for 2002 (mt)*

Districts	Total	Marine culture	Brackishwater pond	Freshwater pond	Cage	Floating cage net	Paddy field
Nangro Aceh Darussalam	27,449	--	22,292	2,764	180	--	2,213
North Sumatra	43,960	489	22,651	10,718	379	3,497	6,226
West Sumatra	27,922	--	--	17,141	4,562	4,401	1,818
Riau	26,491	7,095	1,050	15,974	2,362	--	10
Jambi	6,208	--	1,452	2,263	1,159	1,308	26
South Sumatra	35,703	--	14,377	11,368	5,769	--	4,189
Banka Belitung	315	77	121	115	--	2	--
Bengkulu	4,341	--	722	1,767	381	--	1,471
Lampung	34,122	136	23,610	8,934	130	299	1,013
<b>Total</b>	<b>206,511</b>	<b>7,797</b>	<b>86,275</b>	<b>71,044</b>	<b>14,922</b>	<b>9,507</b>	<b>16,966</b>

*Aquaculture Production by type of culture in Sumatra for 2002 (Rp.1,000,000)*

Districts	Total	Marine culture	Brackishwater pond	Freshwater pond	Cage	Floating cage net	Paddy field
Nangro Aceh Darussalam	481,016	--	403,478	39,825	1,888	--	35,825
North Sumatra	1,511,881	32,885	1,246,324	146,267	2,806	25,075	58,523
West Sumatra	322,214	--	--	230,904	38,607	33,022	19,681
Riau	676,382	426,436	46,139	179,087	24,630	--	90
Jambi	119,877	--	47,406	53,265	8,951	10,092	163
South Sumatra	1,075,889	--	909,258	126,452	370	--	39,809
Banka Belitung	13,745	6,713	6,005	1,012	--	15	--
Bengkulu	79,905	--	32,898	22,169	4,037	--	20,801
Lampung	1,023,659	14,230	895,868	101,560	909	1,803	9,289
<b>Total</b>	<b>5,325,168</b>	<b>480,264</b>	<b>3,587,375</b>	<b>900,543</b>	<b>102,717</b>	<b>70,807</b>	<b>184,181</b>

**Annex 3: Small-Scale Marine Finfish Farm Model - Indonesia**

The estimated investment cost of small-scale floating cage farm for marine finfish species is listed below. This farm consists of 4 units, each unit consists of 4 (3x3x3 m) cages. A unit can support a household with 4 – 6 family members, or provide two full time jobs for the local community. It can be also be used to grow low cost-low input food fish such as milkfish, in which case some of the figures below will be different.

<b>Capital Investment Items</b>	<b>US\$*</b>
• Raft (US\$ 1,765/unit x 4 units)	7,060
• Hut (serve as a guard house and storage)	3,530
• Net (US\$ 300/roll x 20 rolls)	6,000
• Boat (small boat with outboard motor)	2,950
• Others (anchors, rope, a small generator, etc)	4,200
<b>Total Costs</b>	<b>23,740</b>

Note: Based on data from Indonesia: exchange rate: US\$1 = Rp 8,500.

The Profit and Loss Financial Statement for small-scale floating cage farm based on production of 3,500 kgs market size (500 gram/fish) grouper is presented as follows. One production cycle is 12 months, and the survival rate is assumed at 70%.

			<i>US\$</i>
<b>Revenue:</b> Sales of grouper (production × price) (3,500 kg × US\$9)			<b>31,500</b>
<b>Operating Expenses</b>			
• Fingerlings (US\$0.60 x 10,000)	6,000		
• Food (US\$1.00 x 3,500 kg x 1.4 FCR)	4,900		
• Wages (US\$ 120/person/month x 2 person x 12 months)	2,880		
• Others (US\$500 x 12 months)	6,000	<b>19,780</b>	
<b>Non-operating Expenses</b>			
• Depreciation – 20% per year of Capital Investment	4,748		
• Interest rate expenses – 15% per year	3,561	<b>8,309</b>	
<b>Total Expenses</b>			<b>28,089</b>
<b>Profit (Loss)</b>			<b>3,411</b>

## Annex 4: Small-Scale Multispecies Hatchery Model

The estimated investment cost (excluding land) of small-scale hatchery for multispecies which can be used for various marine finfish and crustaceans is listed below. This type of operation can create two full time jobs for local community, and can support an aquaculture household with at least four members in the family.

Capital Investment Items	US\$*
• Roofed larval & rotifer tanks	470
• Microalgae tanks	353
• Submersible pump	88
• Power installation	59
• Emergency generator set	353
• Air blowers – 100 watt	764
• Seawater pump – 5 hp	353
• PVC piping	235
• Miscellaneous	176
<b>Total Costs</b>	<b>2,851</b>

Note: Based on data from Indonesia: exchange rate: US\$1 = Rp 8,500.

The estimated Profit and Loss Financial Statement for small-scale multispecies hatchery based on production of grouper fingerlings per year is presented as following:

			US\$
<b>Revenue:</b> Sales of grouper fingerlings (production × price) (9,000 tails × US\$0.60)			<b>5,400</b>
<b>Operating Expenses</b>			
• fertilised eggs (100,000 x 3 cycles)	53		
• rotifer and brine shrimp enrichment products	118		
• brine shrimp	88		
• artificial diets	388		
• electricity	88		
• workers salaries	565		
• land lease	540		
• miscellaneous	176		
		<b>[5]</b>	<b>2016</b>
<b>Non-operating Expenses</b>			
• depreciation – 3% per year of Capital Investment	[6]		
	86		
• interest rate expenses – 30% per year	[7]		
	855	<b>[8]</b>	<b>941</b>
<b>Total Expenses</b>			<b>[9]</b>
			<b>2,957</b>
<b>Profit (Loss)</b>			<b>2,443</b>

[1] 172 sub-districts and 1,550 villages destroyed

[2] Affected families 212,223; houses 103,753

[3] Dwelling unites 136,198; villages 883; cropped areas 4,171ha

[4] 592 houses of 17 villages destroyed

[5] This amount 'Operating Expenses'

[6] This amount represents the 3 % of the total 'Capital Investment', i.e US\$ 2,581 x 3 %

[7]

This amount represents the 30% of the total 'Capital Investment', i.e US\$2,581 x 30 %

[8]

This amount represents the total 'Non-operating Expenses'

[9]

This amount represents 'Total Expenses' which is the sum of 'Operating Expenses' plus 'Non-operating Expenses'