Disaster by Tsunami and its countermeasures in Japanese fishing villages

1. Middle Japanese sea earthquake 1983
2. South west offshore of Hokkaido earthquake 1993

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Fishing ports, villages, grounds in Japan

- Coast line length 33,468km
- Fishing villages along coast 4,792
- Fishing ports 2,972
- Fishing grounds
- Fishing boats 254,768

- These suffer from convulsion of nature in Japan, especially Tsunami.
Characteristics of climate in Japan

South west offshore of Hokkaido earthquake 1993

Middle Japanese sea earthquake 1983

(Epicenter)
Middle Japan sea earthquake 1983

- 1983 26th May Noon, magnitude 7.7
- Dead 104, damaged house 5,346, amount of fishing port damage ¥3,073 million
- Damage ship 2,651 (¥2,064 million), fishing implement (¥3,011 million)
Height of Tsunami going up

Hachimori fishing port: 10m80cm
Aonae fishing port: 4m50cm
Hachimori town (Akita pref.)

Rocky coast with terrace

Sand Coast

Height of seawall

Hachimori Fishing port

Iwadate fishing port
Attack by tsunami (Hatake fishing port Akita pref.)
Hachimori fishing port

After tsunami attack
Different of tsunami height with embankment

There are three embankment types at Hachimori sand coast.

- Only offshore bank
- Offshore bank and seawall
- Double offshore bank and seawall
The fishing villages that suffered heavy damage were following topographical features:

- Near estuary
- Coast terrace with no guards
- Bank, embankment
- Cape stick out to tsunami direction
- Heavy damage
Aonae fishing port in Hokkaido was damaged by Middle Japan sea earthquake 1983
(Aonae fishing port that would suffer damage again 1993 Hokkaido south west offshore earthquake)

Flood area and tsunami direction
Tsunami from south and south-east
Tsunami arriving time 10 minutes after
It would mean important for evacuation.

Fishing boats were pushed up to quay
South west offshore of Hokkaido earthquake 1993

- 1993 12th July 22o’clock magnitude 7.8
- Dead 201, damaged house 21,160, amount of fishing port damage ¥26,341million
- Damage ship 1,300 (¥1,323million), fishing implement (¥13,467million)
Tsunami height and attack time after earthquake, and level of damage

- **Aonae**: 10.7m, 4 minutes
- **oota**: 8.1m, 5 minutes
- **kamiura**: 5.6m, 5 minutes
- **inaho**: 7.9m
- **Monai**: 12.4m, 5 minutes
- **Aonai**: 11.0m, 4 minutes
- **Okusiri IS. (large-scale)**

The south part of Hokkaido
Flood area and tsunami direction

Tsunami from three directions

Different from 1983 tsunami
Height
Direction
Arriving time
Fire occurred

Fire occurred after tsunami in fishing village
Amplify ratio the lower, port basin area the larger

Figure 4 Area within the port and tsunami runup height
Tsunami higher fishing vessel damage the major

Tsunami runup height within the port and fishing boat damage rate

Tsunami flood the stronger house damage the major

Relationship between the water flow pressure and the damage rate of houses
Photo after tsunami

Aonae fishing port

Kamiura fishing port
Photo after tsunami

Ota fishing port
Basic Concept of a Disaster Restoration Plan at Aonae fishing village

1. Construction of a fishing port and village resistant to disasters
2. Regional revitalization centering on the fishery industry
3. Construction a port and village with a high level amenities
Construction of a fishing village resistant to disasters

1. Countermeasures against earthquake and tsunami disasters (bank height H11.8m, H6.0m, ground H6.0m)
2. Countermeasures against fire
3. Evacuation system (arrival from anywhere to 6.0m height within 3 minutes)
4. Information system on disaster prevention (At seismic intensity 4, simultaneously and automatically The alarm for tsunami are announced)
5. Safe keeping of fishing boats
Framework of recover Aonae fishing village and port

Figure 7 Countermeasures against tsunamis and houses
Aonae recover master plan
Photo after recover at Aonae

Artificial ground

fill mound and high ground
Photo after recover at Aonae

Fullfill mound and seawall
Cooperative shed

Artificial ground
Countermeasures of tsunami at fishing villages

1. Fishing ports and breakwater facility is effective for tsunami
2. Topography weakness is recovered by fishing port facility or another
3. Improvement Hazard map
4. Alarm instrument
5. Evacuation road