Tsunami Preparedness Analysis for the Community of Legundi Island - Lampung

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Abstract. The eruption of Mount Anak Krakatau caused massive amounts of material avalanches, which caused a tsunami in late 2018. Based on the author's observational notes, in small Island Legundi that located in Sunda Strait waters, there were many houses, public infrastructure, and government offices that were severely damaged. In this paper, the tsunami preparedness survey was carried out through a questionnaire survey and a personal interview with victims of the 2018 Sunda Strait Tsunami. The questionnaire obtained a variety of necessary information to find out the preparedness of the Legundi Island community to face tsunami, including the demographics of victims, tsunami awareness, and evacuation behaviour. This research concludes that the coastal-community that affected tsunami in Legundi was not prepared well, both disaster and evacuation knowledge.

1. Introduction

The eruption of Mount Anak Krakatau caused massive amounts of material avalanches, which caused a tsunami in late 2018. The affected areas were not only on the mainland of Sumatra (Lampung Province) and Java (Banten Province) but also several small islands in the Sunda Strait waters, one of them is Legundi Island. Legundi Island is located between the Krakatau Mountain and the mainland of Sumatra. Legundi Island Village is a part of the Pesawaran Regency (Lampung) and has 6 (six) sub-villages, namely Selesung 1, Selesung 2, Kramat, Tamansari, Labuhan Agung and Siuncal (see Figure 1).

The severe damage hit Selesung 1 and Selesung 2 sub-villages with almost 200 households were suffered in Legundi Island. Based on the author's observation, there were many houses, public infrastructure, power plants, mosques and local government offices that were severely damaged. [1] noted that tsunami inundation height on the island reached 3.38 m on this island.

The post-tsunami survey had been conducted in [2] and later on published in a journal paper in [1]. This survey inspected the technical parameters of tsunami wave based on tsunami’s watermark a few weeks after the event, which were inundation height and detail location. There are no specific reports about the community behaviour of Legundi Island in term of tsunami preparedness (social study). Hence, this research objective is to analyze the tsunami behaviour and preparedness of Legundi Island’s community which is geographically remote, occupied by a relatively small number of people, and had never experienced the extreme natural hazard beforehand.
2. Methodology

The tsunami preparedness survey was carried out through a questionnaire and a personal interview method with victims of the 2018 Sunda Strait Tsunami. This survey was conducted on Legundi Island, precisely in Selesung 1 & 2 sub-villages, on 1-2 July 2019. Data collection was done randomly for two days living on the island to ensure the representative results.

The questionnaire was designed to obtain a variety of necessary information to find out the preparedness of the Legundi Island community to face tsunami, including demographics of victims, tsunami awareness, evacuation behaviour, and post-disaster. The table below (see table 1) is a concise list of the questions.

| Category                                  | Question                                                                 |
|-------------------------------------------|--------------------------------------------------------------------------|
| Demography                                | Q1. Gender, age, occupation, distance from home to the beach              |
| Tsunami awareness and evacuation behaviour | Q2. How dangerous is the tsunami for you?                                |
|                                           | Q3. Is tsunami information provided by the government sufficient?        |
|                                           | Q4. Where do you get tsunami information?                                |
|                                           | Q5. What do you do when a tsunami occurs?                                |
|                                           | Q6. How do you save yourself? Where? How long? Any difficulty?           |
| Post-disaster                             | Q7. When do you feel safe back home?                                     |
|                                           | Q8. Is there any evacuation route? How useful?                           |
|                                           | Q9. Is there an early warning system (ews)? How useful?                   |
|                                           | Q10. Is there a shelter zone? How useful?                                |
|                                           | Q11. How necessary is the implementation of tsunami drilling, news, disaster evacuation routes and disaster shelter in your area? |
3. Results and Discussion
The survey collected 30 respondents during the survey; this information is representative enough to describe the overall population of around 200 households who experienced the tsunami in the Selesung 1 and Selesung 2 (Legundi Island). Demographics of respondents consisted of 57% men and 43% women and age distribution was evenly distributed, for adolescents, youth, adults, and the elderly. In general, respondents were farmers (16%), fishermen (16%), housewives (32%), and others. The distance from the respondent's houses to the beach covered less than 100 m (20%), 100-300 m (40%), 300-500 m (37%), and the rest were more than 500 m. Overall, the tsunami-affected communities on Legundi Island were native coastal communities living near the coast (see figure 1 to see the more detail of the information).
The following table (see table 2) describes the characteristics of disaster awareness and evacuation behaviour for the people of Legundi Island. They were very aware of the danger of a tsunami and naturally knew how to save lives in this severe event (reaching a higher place). Unfortunately, infrastructure evacuation did not support yet here, and natural hazard public education was considerably very less as well. People found some underlying difficulties during the evacuation, such as unclear directions, ineffective routes, and even harmful routes with sharp bushes.

**Table 2. Characteristics of Legundi Society for disaster awareness**

| Characteristics of Legundi Society Disaster Awareness |
|-------------------------------------------------------|
| • 100% of respondents claimed that the tsunami was very dangerous, and all claimed that tsunami information was not enough provided by the government. (Q2 & Q3) |
| • Sources of information about tsunamis: 31% TV, 31% radio, 16% internet, and the rest are other sources. (Q4) |
| • 66% of residents immediately prepared for evacuation after knowing of the tsunami came, 16% contacted relatives, and the rest are others. (Q5) |
| • 93% of residents evacuate to high ground, and 67% say it takes 15-30 minutes to reach them. (Q6) |
| • Some difficulties during evacuation: unclear directions/routes (25%), bringing family members (22%), streets full of people (20%), panic (18%), the rest said other reasons. (Q6) |
| • Residents feel safe returning home: 47% in 1-3 days, 20% in 3-7 days, 20% after a week, the rest are less than a day. (Q7) |
Regarding the use of disaster evacuation methods (post-disaster), 20% of residents admitted that they had previously installed disaster evacuation routes, but all of them claimed to have no clear direction (Q8). 33% of residents use a disaster safe place (shelter) in the form of public facilities such as schools (junior & senior high schools) and feel quite useful because it is located in a high ground (Q10). 100% of residents claimed that an early warning system (radio, siren, and buoy) had never been installed in their village area, and there had never been a tsunami drilling before (Q9). All residents hope for the use of disaster evacuation methods for the people of Legundi Island (Q11). People confessed that no early warning system (ews) that alerting before the wave’s stroke unless social alerting system among the neighbourhood.

4. Conclusion and Future Research
This research has conducted a preparedness survey of the people of Legundi Island who were affected by the 2018 Sunda Strait Tsunami disaster. Based on the survey, it appears that the community was not prepared for the tsunami disaster that occurred, felt traumatic with the tsunami, did not have enough disaster evacuation preparation.

This research clearly shows the urgency of the implementation of disaster evacuation programs on this island, such as tsunami drilling, installation of evacuation route signs, construction of appropriate disaster shelter, and installing early warning system (ews). This study also revealed that the community did not have sufficient information about the tsunami. If the government or third parties (for example NGOs, and universities) will disseminate disaster information to Legundi Island, then TV and Radio media is the best suggestion chosen.

In the future, this social research can be combined with numerical research on Legundi Island. Tsunami modelling (local scale) aims to determine the technical tsunami pattern (energy and wave direction) and potentially affected zones. This information is essential for designing a comprehensive disaster evacuation method.

Acknowledgements
Authors wishing to acknowledge the P3MI-ITB program financially supports the research.

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