Institute of Geodynamics
NATIONAL OBSERVATORY OF ATHENS

CoastWAVE PROJECT

Report on risk perception survey in the town of Samos

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1. CITATION PAGE

The 2023 Risk Perception Survey was implemented by the Institute of Geodynamics, National Observatory of Athens

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The island of Samos is located in the North-Eastern Aegean Sea and belongs to the North Aegean administrative region. The study site is the town of Samos. Samos, a port town on the island of Samos in Greece, is the capital of the regional unit of Samos and of the municipality of East Samos. It is also known by its old name of Vathy, although this now usually refers to the old hillside suburb of Ano Vathy (Wikipedia).

Information on the demographics for the town of Samos were collected from the Hellenic Statistical Authority (HSA) who provided us with all the available statistical information (characteristics of the population and the buildings) corresponding to the year 2011. While the latest census in Greece was conducted in the year 2021, its detailed information has not been made available yet to the scientific community.

Examining the evolution of the population of the island of Samos over the last ~110 years (Figure 1), we notice a sudden drop in the 50s and 60s, which the population almost halved compared to its peak in the 1920s. Following that sudden drop, the population of the island has stabilized just over 30.000, with minor changes since the 1970s.

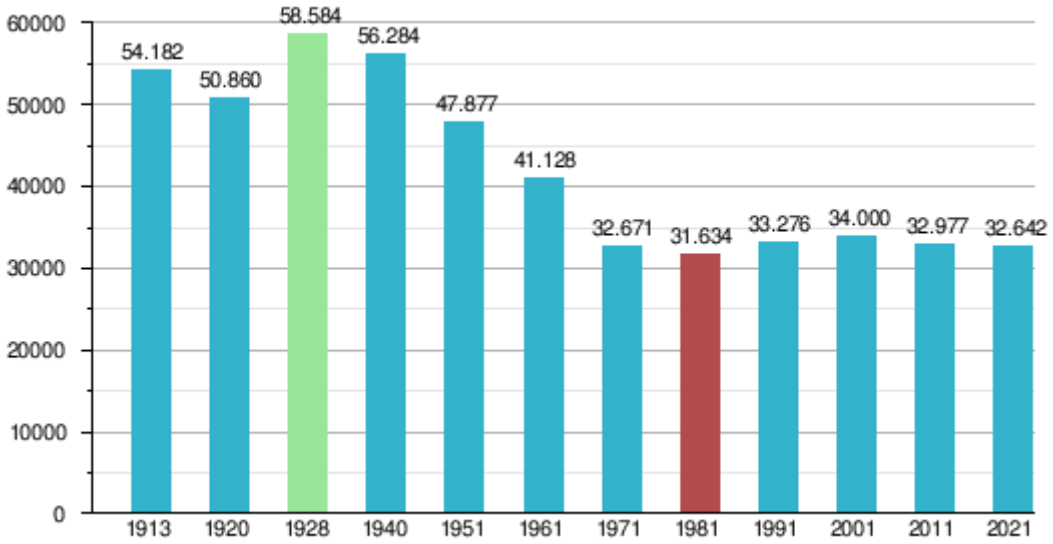

Figure 1. Evolution of the population of the island of Samos over the past ~110 years (Σάμος - Βικιπαίδεια (wikipedia.org)).

According to the HAS data (census 2021), the island as a whole has a population of 32,642 inhabitants while the population of the urban complex of the capital (Samos - Vathy) exceeds 9,500 inhabitants, with 5.951 in Samos and 3.767 in Vathy. From the analysis of the last available detailed data (census 2011), the population of the town of Samos town counted 6,191 in year 2011, while the combined population with Vathy was 8,079 (Figure 2), from which 4,086 were men and 3,993 were women (Figure 3).

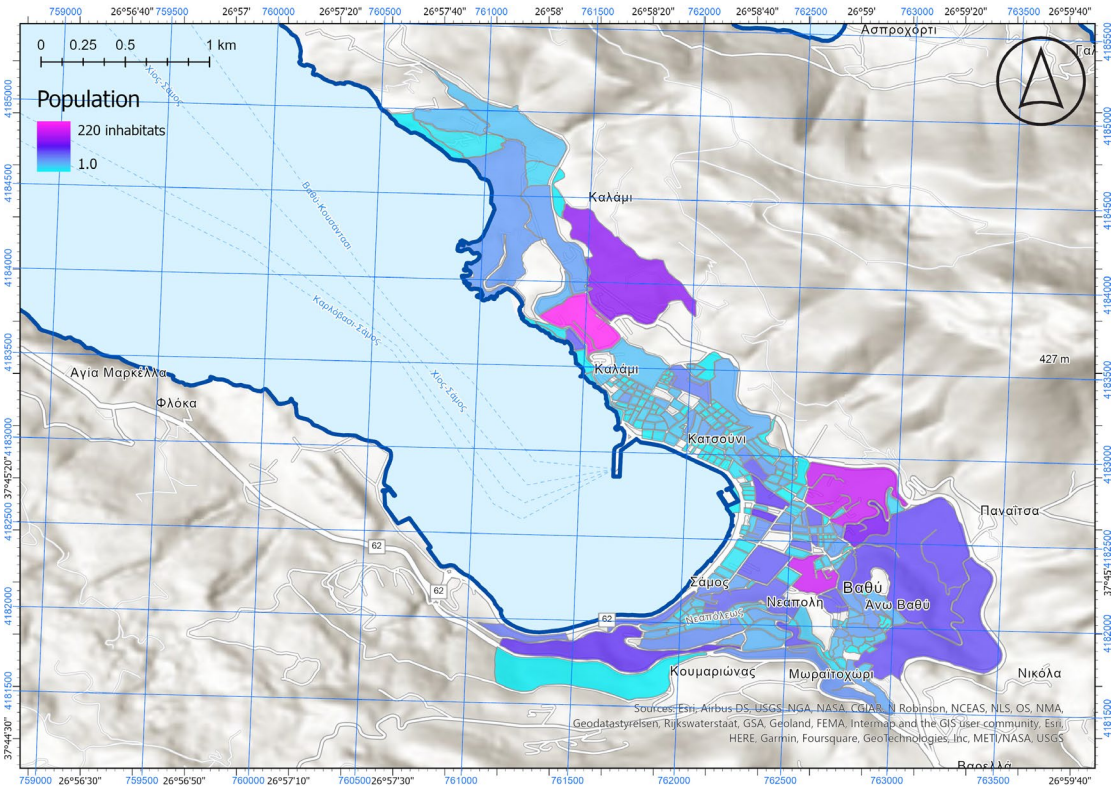

Figure 2. Population distribution of the urban complex of Samos – Vathy, according to the census of 2011.

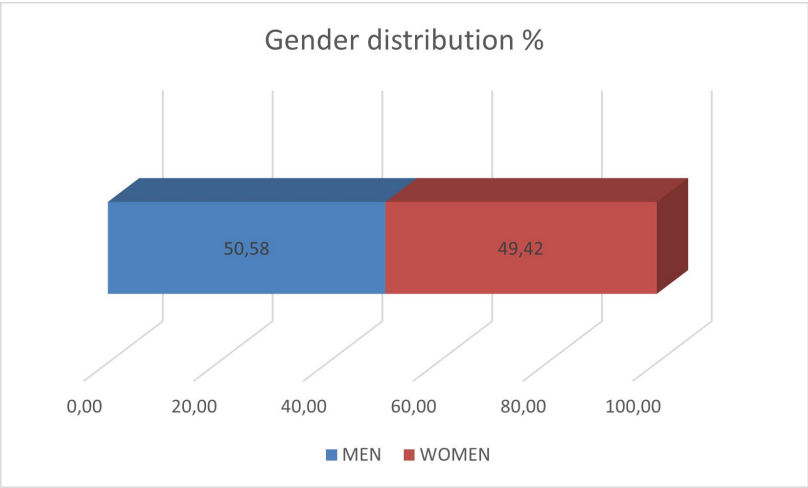

Figure 3. Gender distribution of Samos-Vathy according to the 2011 census.

Regarding the age of the total population, 19,01% were younger than 19 years old, 32,53% were in the 20-39 age group, 26,65% were between 40 and 59 and 22,81% were older than 60 years old (Figure 4).

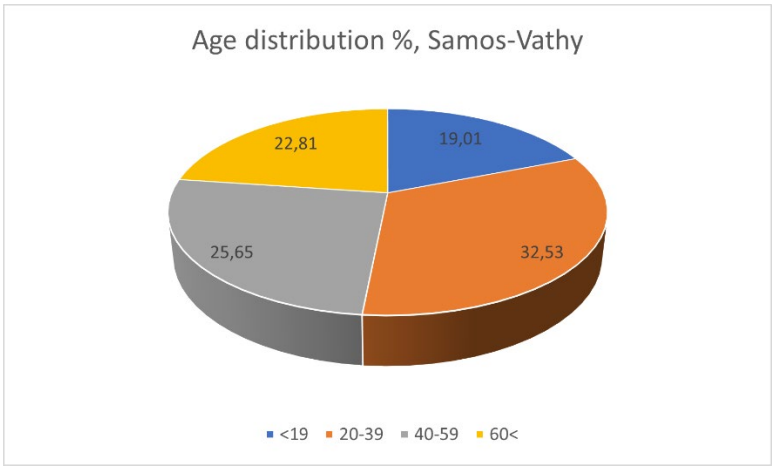

Figure 4. Age distribution of Samos- Vathy according to the 2011 census.

Figure 5 provides the age distribution of men and women for the town of Samos-Vathy.

Figure 5. Age distribution (%) of men and for women in Samos- Vathy according to the 2011 census.

Regarding the level of education, which is presented in Figure 6, 25,41% of the population had a university degree (bachelor, master's or Phd). 38,40% had graduated from middle or high school, 20,94% from primary school and 8,54% had not attended school at all. 6,71% of the population was born before 2004, so they had not yet completed the compulsory education.

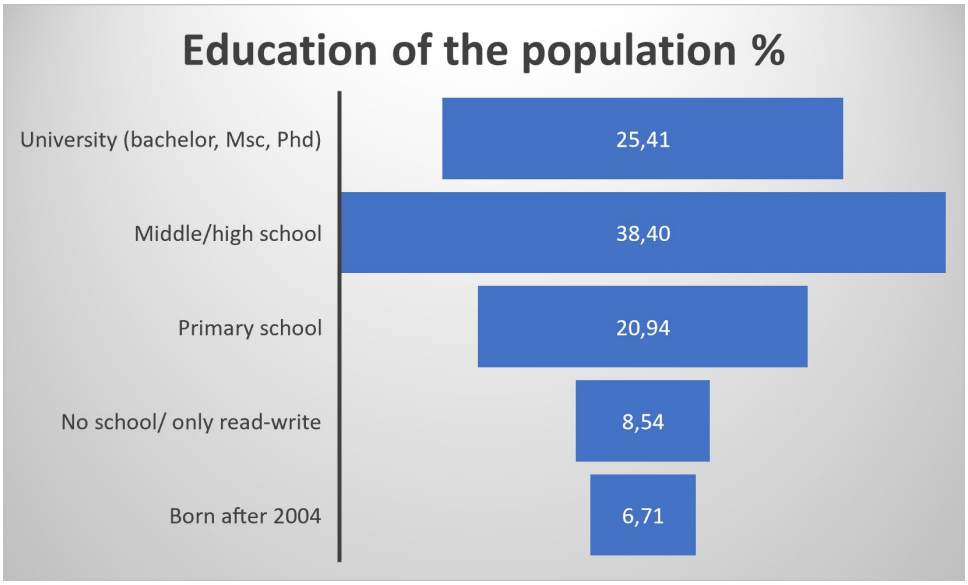

Figure 6. Educational level of the population of Samos-Vathy according to the 2011 census.

5. Introduction

The CoastWAVE project is designed to strengthen the resilience to tsunamis and other sea level-related hazards of vulnerable coastal communities in the North-Eastern Atlantic, Mediterranean and connected seas (NEAM) region. At the end of the project selected communities will have an improved understanding of tsunami and sea-level related risks and better communication strategies to govern sea-level related risk, and the chance to be recognized as Tsunami Ready communities; as well as an improved framework for the sustainability of the existing Inexpensive Device for Sea Level (IDSL) Network.

The community selected in Greece to participate in the CoastWAVE project and implement the full cycle of the Tsunami Ready Recognition Program is the town of Samos. Samos was impacted by the 30/10/2020 Samos - Aegean tsunami which followed a 6,7M_L earthquake with the epicenter lying just offshore the north coast of Samos. The Samos- Aegean tsunami of 2020 is arguably considered to be the most important tsunami event in the Aegean Sea since the Amorgos earthquake and tsunami 1956. The 2020 tsunami resulted in wave runup up to 3,8 m, causing one casualty and significant damage to the affected coastal communities (Dogan et al., 2021; Kalligeris et al., 2021).

6. Survey methodology

The questionnaire was first prepared in English and subsequently translated into the languages of the countries participating in the CoastWAVE project. The questionnaire was translated to the Greek language by an official translator and was then distributed to the Greek project team who made additional improvements to the translation. Only the online version of the questionnaire was utilized in the study and no hard copies were distributed.

In February 2023, the National Observatory of Athens, in collaboration with the Municipality of East Samos, organized a tsunami awareness activity in the town hall intended for the general public. A press release for the event was published in the local media which included a hyperlink to the questionnaire. The organizers also sent out the hyperlink to the questionnaire along with the invitations to the participants (people from civil protection, educational section, operational authorities). Moreover, a poster that included details about the project activities and the questionnaire was posted at the town hall. Before closing the questionnaire, it was presented in the tsunami awareness events involving two local schools that were organized in May 2023.

7. Questionnaire

Within the framework of the Intergovernmental Coordination Group for the North-Eastern Atlantic, the Mediterranean and Connected Seas Tsunami Early Warning and Mitigation System (ICG/NEAMTWS) and the EU-DG-ECHO/UNESCO-IOC CoastWAVE Project, IOC/UNESCO developed a questionnaire on the perception of coastal risks and preparedness to tsunami, storm surge and sea level rise to better understand how coastal populations perceive these natural hazards and risks, and develop recommendations for enhanced risk communication strategies and products in the region. The questionnaire consists of 66 questions divided in 5 parts. The first part includes personal information (residence, gender, age, education). The second part includes questions about people's knowledge on tsunamis, sea level rise and storm surge, and the third is about risk exposure (residence/work/school distance from the shoreline, other people they live with, etc.). The fourth part of the questionnaire includes questions about risk assessment, preparedness and response, and finally the fifth part includes information about tsunami risk governance.

8. Survey implementation

8.1 Training/ Field work

Since it was decided to disseminate the questionnaire online and not in hard copy, no training or special field work was deemed necessary.

8.2 Data processing

The results of the survey were post-processed by UNESCO via the "Enterprise Online Survey Software Alchemer". Alchemer is a flexible and easy to use software, which allows users to immediately collect feedback, analyze, extract and present results, without requiring specialized IT knowledge.

8.3 Response rates

The questionnaire was distributed to people from different sectors and ages in the island of Samos, Greece. 49 (is this correct? Because in Alchemer it shows 56 responses in some questions) people started the questionnaire, but almost half of them (we don't know how many) reached the end.

9. Results

9.1 Personal information

The questionnaire was distributed in the town of Samos, Greece and it was answered by 49 people. All the participants stated that they live in Samos. 55,1% of them were women, 42,9% were men and 2% preferred not to answer. The age of most of the participants ranged between 35-54, but we also received answers from other age groups (Figure 7).

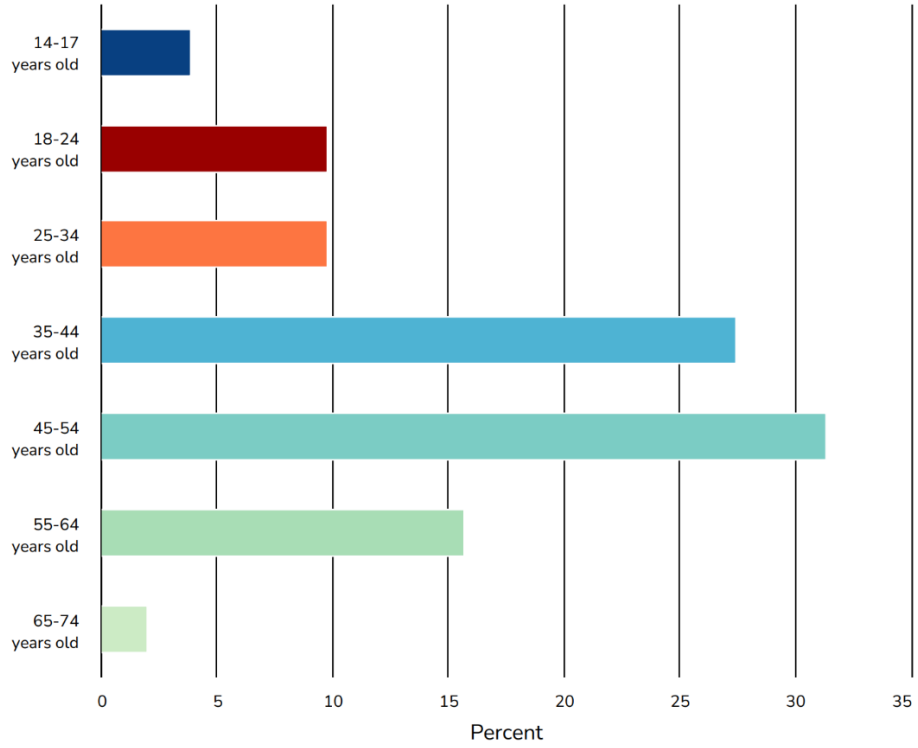

Figure 7. Age distribution of the questionnaire participants in Samos.

Concerning the working sector, 14,3% of the participants work in tourism, 24.5 in education, 24,5% were emergency responders, and 36,7% of them didn't have any relation with the above sectors (Figure 8). Moreover, most of the participants (67,3%) were university graduates (Figure 9).

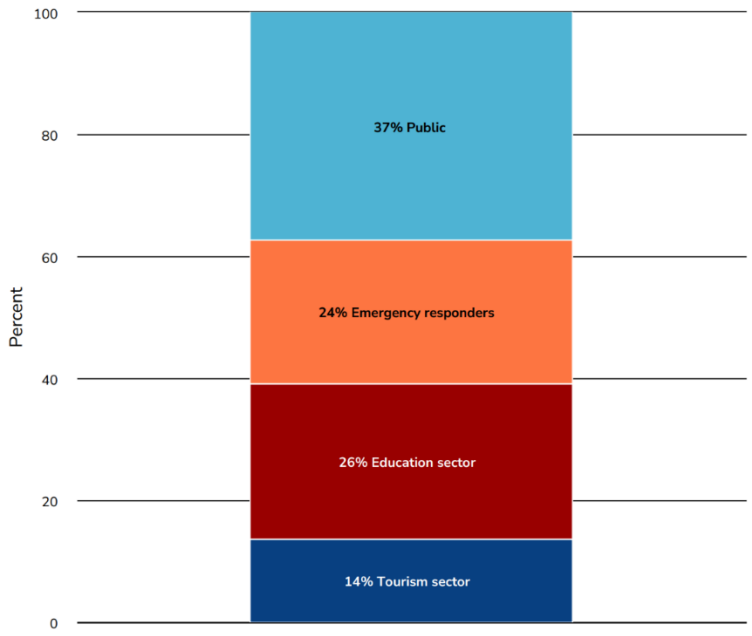

Figure 8. Distribution of working sectors corresponding to the questionnaire participants in Samos.

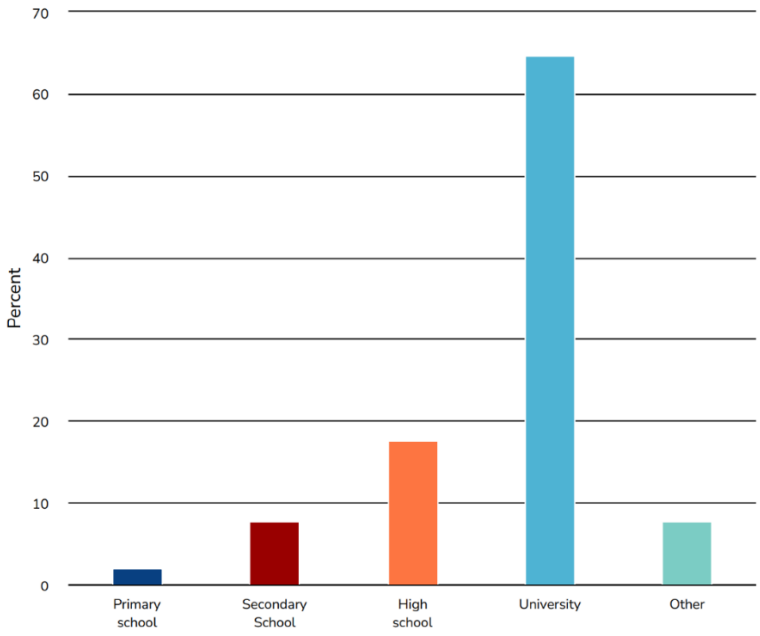

Figure 9. Distribution of education level corresponding to the questionnaire participants in Samos.

9.2 Awareness, Knowledge

In this part of the questionnaire, participants were asked questions about their knowledge on tsunamis, sea level rise and storm surge. All of the participants had heard about tsunamis, 29,6% about storm surge and 77,8% about sea level rise (Figure 10). Also, 59,3% of them had experienced a tsunami, whereas only 11,5% had experienced a storm surge event.

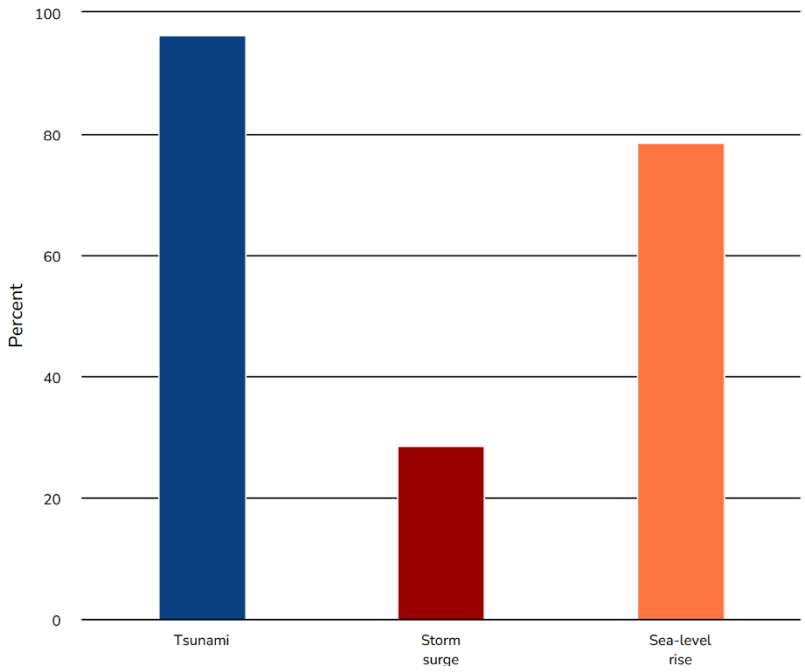

Figure 10. Distribution of answers to the question "Have you ever heard about tsunamis, storm surge and sea level rise?" for the questionnaire survey undertaken in Samos.

When people were asked about the actions they would take in case of a tsunami, most of them mentioned that they would go away from the shore, and they would move to a safer place. Moreover, the participants were asked to describe the tsunami with three words. The words that were mostly used were "flooding", "drowning" and "waves". In the same question about storm surge, the three words that prevailed were "flooding", "rise" and "unknown". Last, for sea level rise, the most common answers were "flooding", "ice melting" and "disasters".

Most people believe that tsunamis are caused mainly from earthquakes, but a tsunami could also happen from the explosion of a volcano. According to the participants, the main cause of the storm surge is gravity, and the sea level rise is a result of climate change and the ice melting.

In addition, 55,6% of the participants consider that there is a high possibility that a tsunami will occur in the coastal zones of the Mediterranean region within the next ten years (Figure 11), 42,3% believe that it is highly possible for a storm surge event to happen during this time (Figure 12) and 48,1% that the Mediterranean will experience sea level rise in the next ten years (Figure 13).

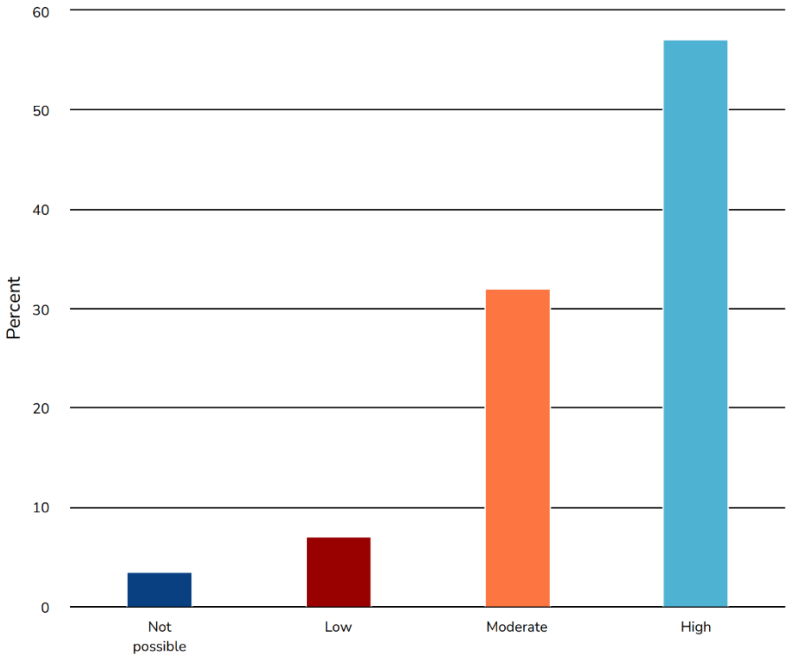

Figure 11. Distribution of answers to the possibility of the occurrence of a tsunami in the coastal zones of the Mediterranean region in the next 10 years according to the questionnaire survey undertaken in Samos.

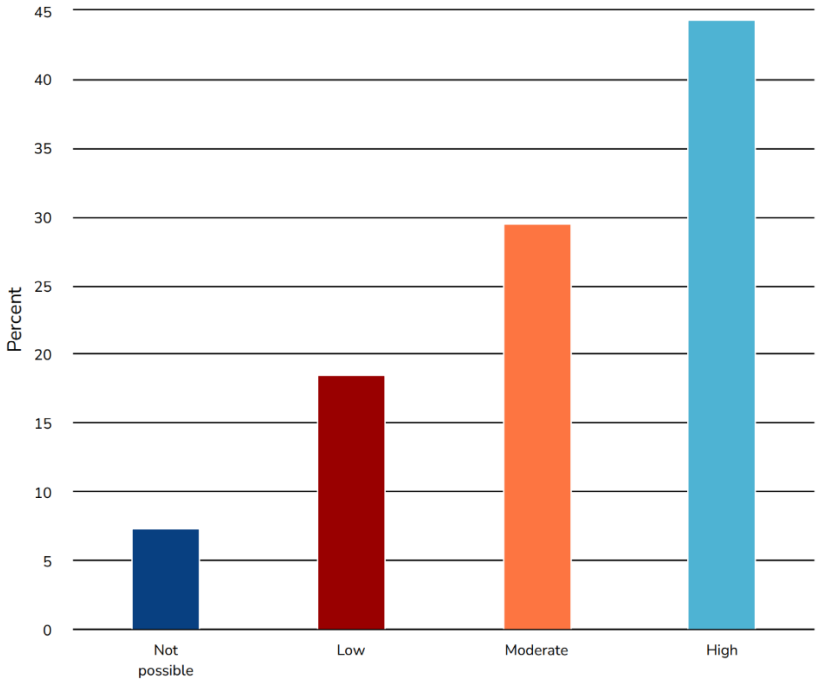

Figure 12. Distribution of answers to the possibility of the occurrence of a storm surge in the coastal zones of the Mediterranean region in the next 10 years according to the questionnaire survey undertaken in Samos.

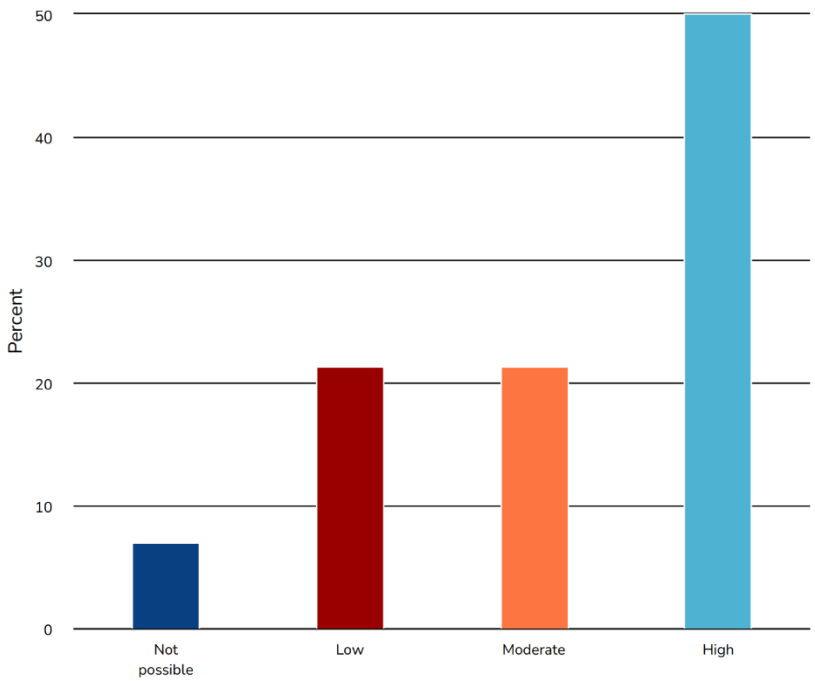

Figure 13. Distribution of the possibility of the occurrence of sea level rise in the coastal zones of the Mediterranean region in the next 10 years according to the questionnaire survey undertaken in Samos.

At a local level, most participants believe that it is highly possible that their community will experience a tsunami (Figure 14) and sea level rise (Figure 16) in the next 10 years and there is moderate possibility to experience a storm surge event (Figure 15).

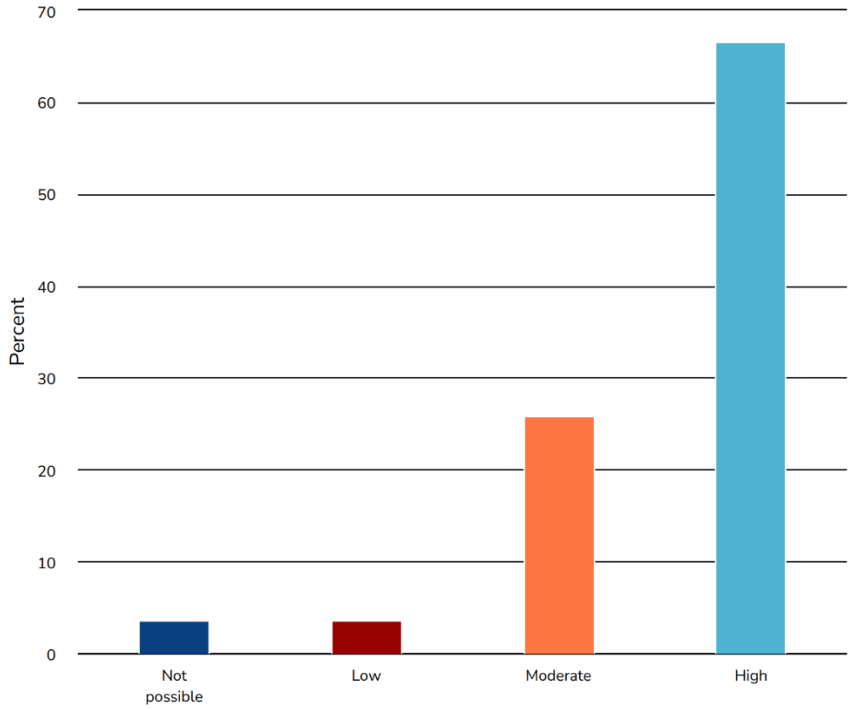

Figure 14. Distribution of the possibility for a tsunami event to occur in the community in the next 10 years according to the questionnaire survey undertaken in Samos.

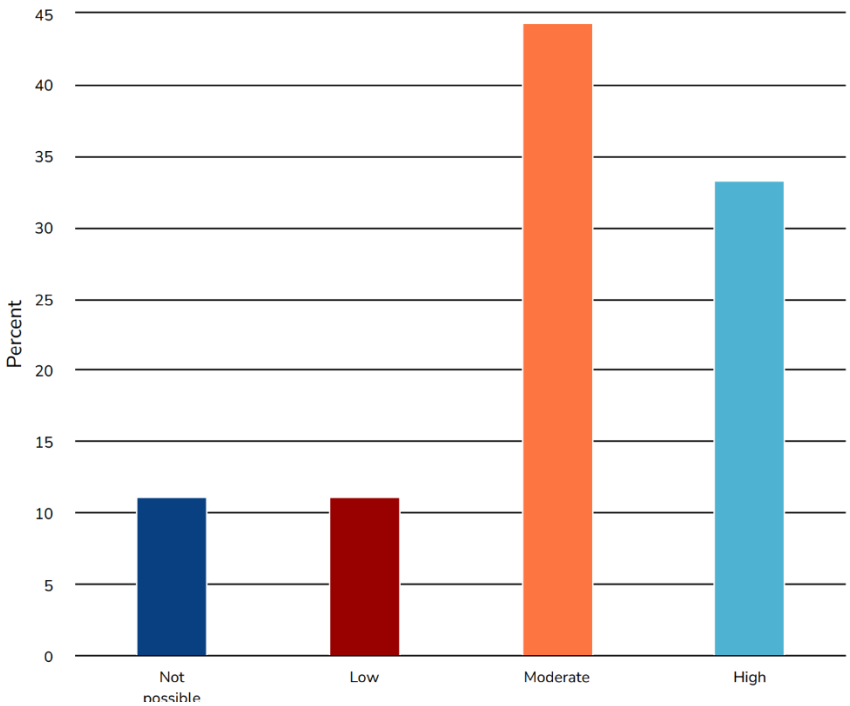

Figure 15. Distribution of the possibility of a storm surge event to occur in the community in the next 10 years according to the questionnaire survey undertaken in Samos.

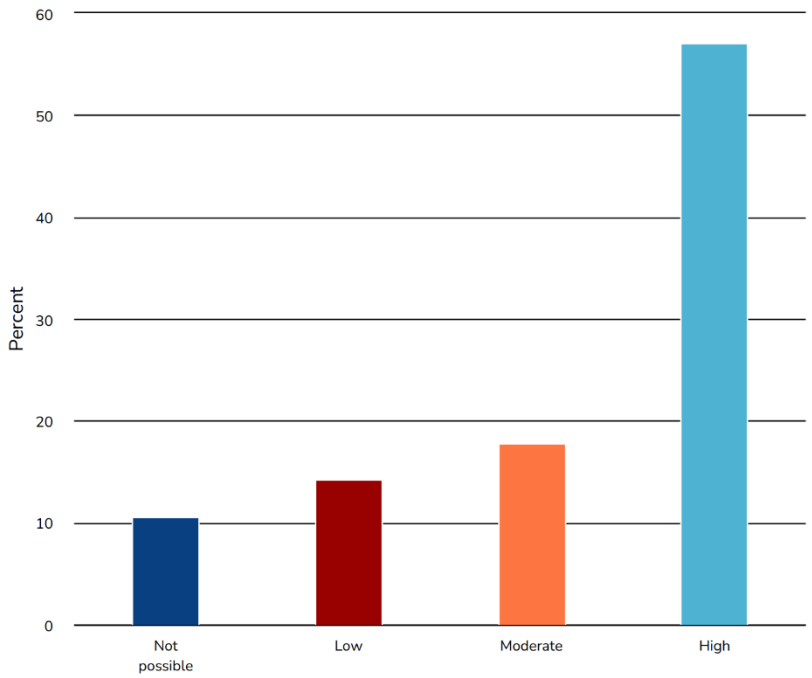

Figure 16. Distribution of the possibility of sea level rise to occur in the community in the next 10 years according to the questionnaire survey undertaken in Samos.

When people were asked about the impacts of a tsunami, storm surge and sea level rise for the coastal regions of the North-Eastern Atlantic and the Mediterranean, most of them answered that the impacts would be moderate (in terms of loss of life and

property damage). When they were asked the same question about their community, they still believe that the impacts will be moderate for the occurrence of a tsunami or a storm surge, but the answers were more balanced for sea level rise (Figure 17).

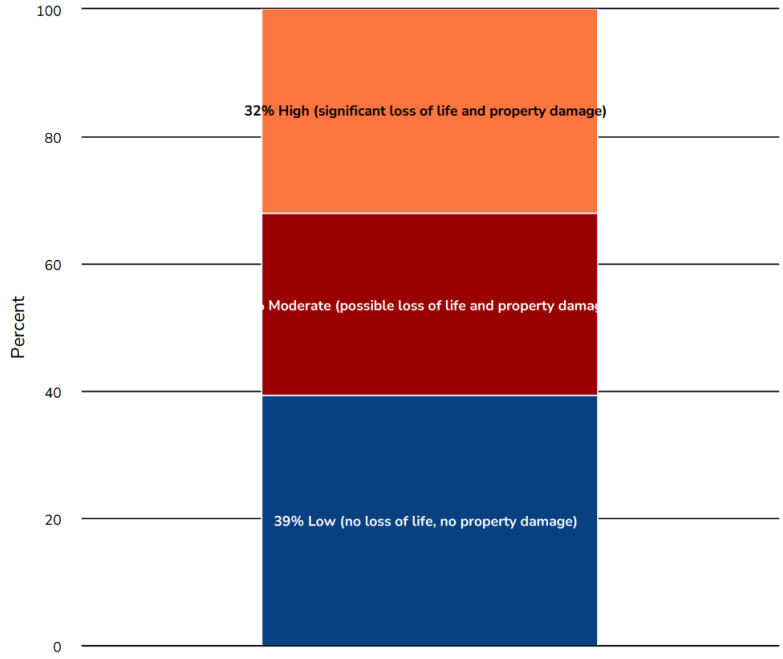

Figure 17. Distribution of answers on the estimated impacts (loss of life and property damage) of sea level rise in coastal regions of the community according to the questionnaire survey undertaken in Samos.

According to the participants in the survey, sea level rise, sea level retreat and earthquake are typical natural signs of a tsunami. Also, in case of a tsunami event occurring in the coastal regions of the North-Eastern Atlantic and Mediterranean, most participants answered that the height of the wave will range between 50 cm and 5 m. Most of the answers to this question are equally distributed to three categories within that range (Figure 18).

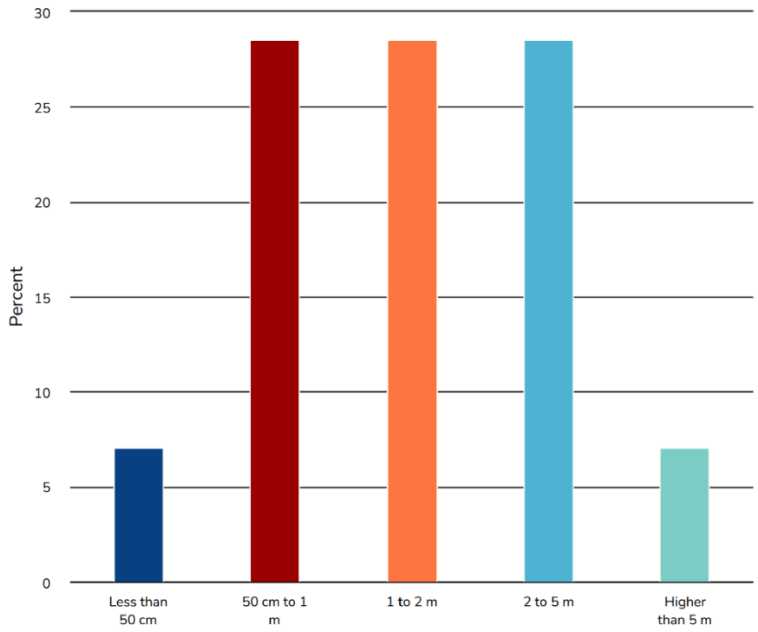

Figure 18. Approximate tsunami height in the coastal regions of the North-Eastern Atlantic and the Mediterranean according to the questionnaire survey undertaken in Samos.

When people were asked about the time it will take for a tsunami to arrive to the coastal region of the community, most people (48,1%) answered 10-20 minutes, 33,3% less than 10 minutes, 14,8% believe that it takes 20-30 minutes for a tsunami to approach the shore, and 3,7% answered more than 30 minutes. Most people don't know if their municipality has the necessary capacities and infrastructure to alert or inform local population for earthquake, tsunami, storm surge (46%, 40,7% and 46,2%, respectively) and 44,4% of them believe that such necessary capacities and infrastructure do not exist in their municipality. Also, 74,1% of the participants mentioned that their municipality doesn't display any evacuation signs that indicate evacuation routes in case of a tsunami, storm surge, or for sea level rise.

9.3 Exposure and sense of exposure

In this part of the questionnaire, people had to answer questions related to the degree of their exposure to the mentioned hazards. 44% of the participants live with people dependent on them (children, elderly people etc.). Concerning the distance their home is from the shore, 40% of the participants answered that they live less than 5 minutes on foot from the coast, 40% answered 5-10 minutes and 20% said that they need more than 10 minutes to reach the seashore on foot. Also, 52% of them answered that they need less than 5 minutes on foot to reach the shore from their workplace/school (Figure 19).

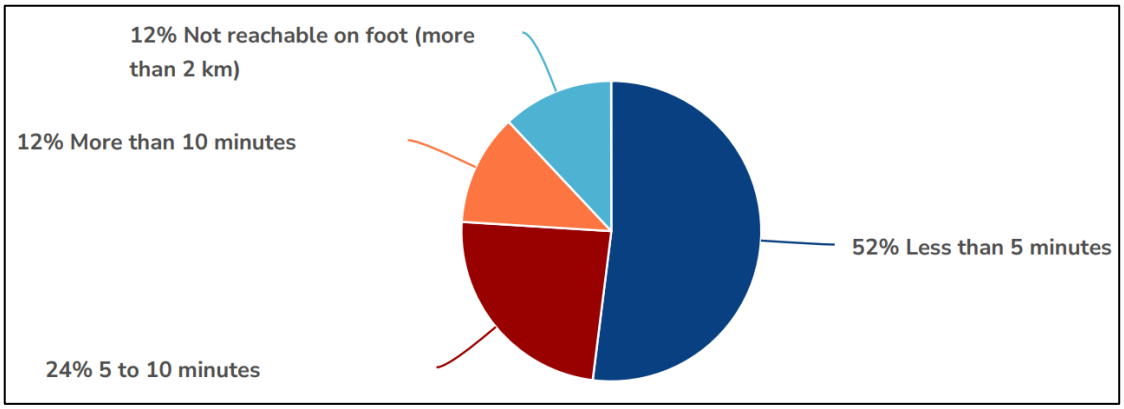

Figure 19. Distance of the workplace/school from the seashore on foot according to the questionnaire survey undertaken in Samos.

9.4 Assessment, preparedness, and response

When people were asked how these sea level related disasters could be reduced or avoided, the vast majority (87%) answered that collective actions are needed, 26,1% believe that these disasters could be reduced by individual actions and 13% answered that the impact of a natural disaster can't be reduced.

Most of the survey participants don't know if their municipality has an evacuation or resettlement plan in place for tsunamis (60,9%) or storm surge (73,9%), and the majority of them haven't taken any precautions or measures against tsunamis (73,9%), storm surge (100%) or sea level rise (91,3%). Moreover, 70% of the people who answered the questionnaire, hadn't ever heard, or participated in an evacuation exercise, drill or other actions related to tsunami, storm surge and sea level rise. When people were asked what they would do if they were on the coast and they felt a strong earthquake, 83% of them stated that they would move away from the shore (Figure 20). 47,8% of the participants answered that having disabled people or children under their care will affect their ability to evacuate (Figure 21).

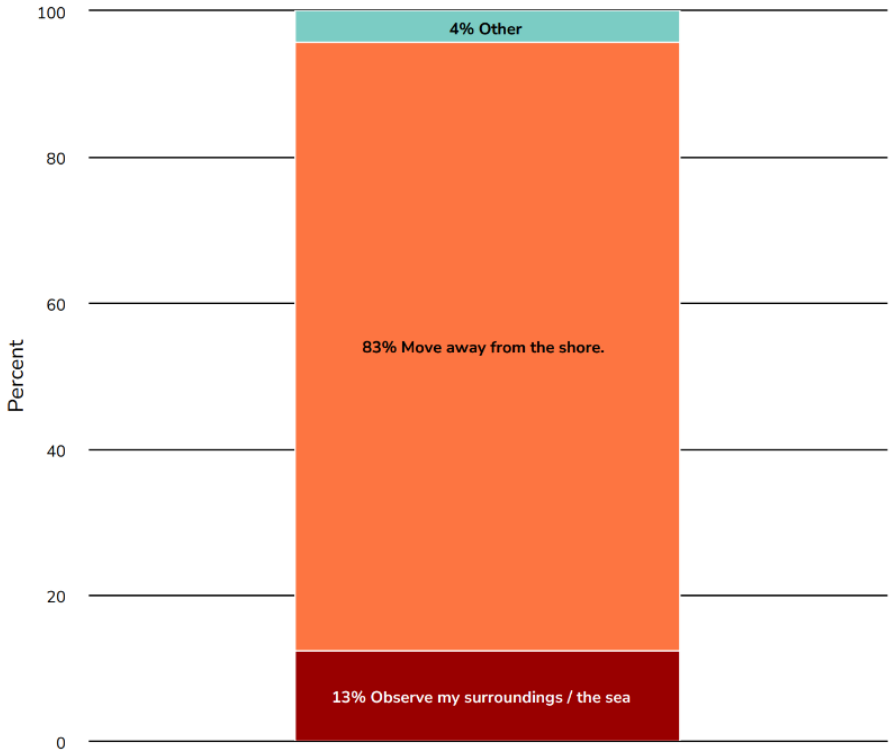

Figure 20. Answers received for the question: "What would you do if you were on coast and feel a strong earthquake?" according to the questionnaire survey undertaken in Samos.

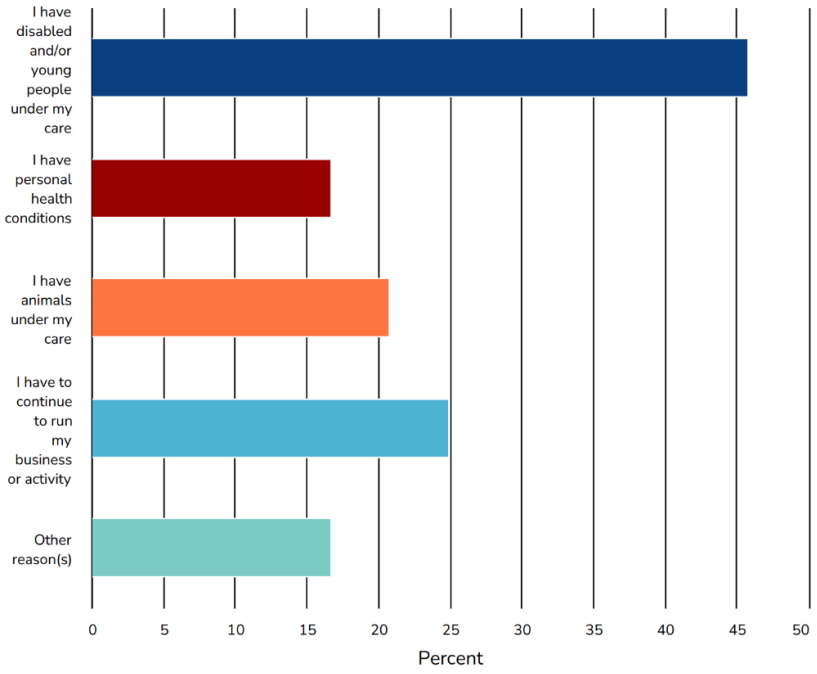

Figure 21. Answers received for the question "What could affect your ability to evacuate to a safe area?" according to the questionnaire survey undertaken in Samos.

9.5 Governance

In this last part of the questionnaire, participants from the emergency response/management sector were asked questions concerning the management of a

possible crisis related to sea level hazards. Most participants believe that their municipality is not able to manage emergency response operations during a possible tsunami (71%), storm surge (67%) or for sea level rise (71%).

Moreover, participants believe that civil protection agencies are foremost responsible for managing a crisis in their municipality, but that also the Fire Service, Coast Guard, Police, and the Municipality share a significant percentage of the responsibility (Figure 22).

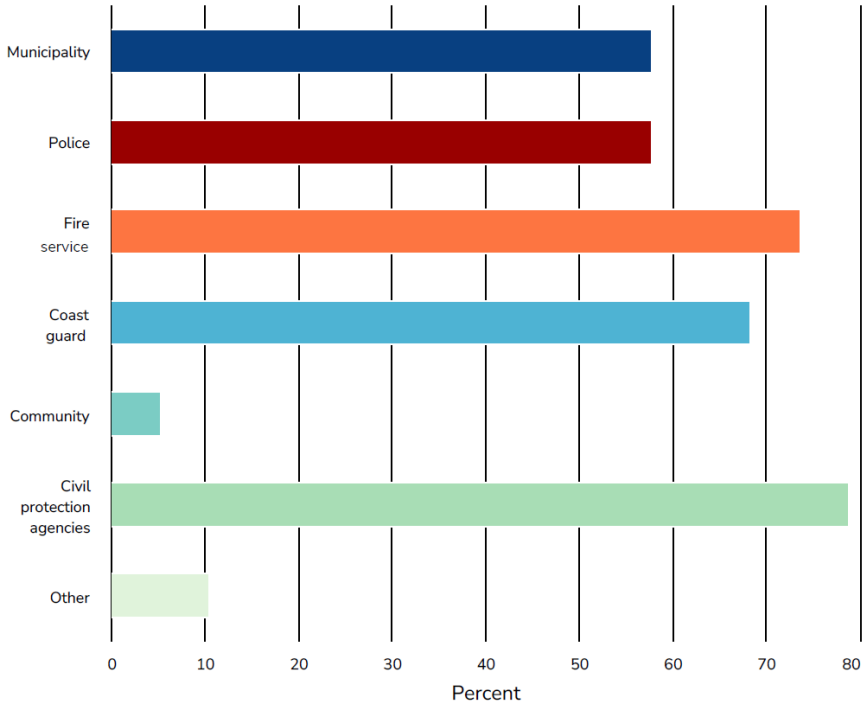

Figure 22. Authorities responsible for managing a crisis in the municipality according to the questionnaire survey undertaken in Samos.

In addition, according to the survey participants, the municipality and the civil protection agencies are mostly involved in the emergency response or disaster risk management and reduction (Figure 23). Finally, 40% of people strongly agree and 40% neither disagree nor agree with the statement: “The impact of different hazards is considered in decision-making processes”.

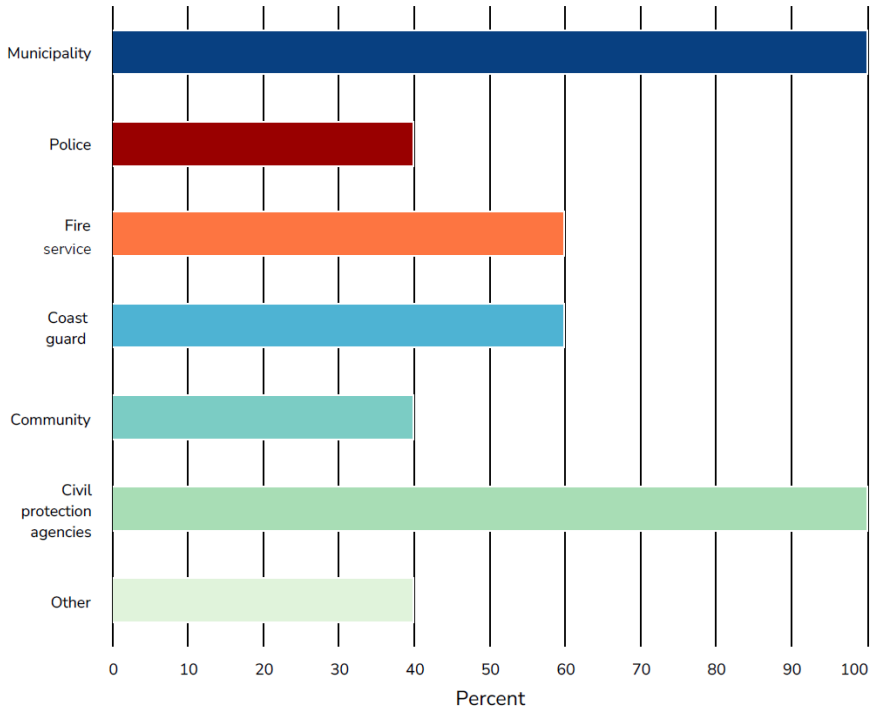

Figure 23. Authorities currently involved in the emergency response or disaster risk management and reduction according to the questionnaire survey undertaken in Samos.

10. Key findings

10.1 Characteristics of Survey Respondents

Population and Composition

The processing of the questionnaires showed an equal distribution between the two genders (male and female), which is a good representation of the true population of Samos according to the census data. Where there is a significant difference is in the age distribution with almost 60% of the questionnaire responders falling in the age range between 35 and 55 years, while only 28% of the inhabitants fall into this age group. So, more than half of the sample represents the ~1/3 of the true population.

Educational Level

There is a similar behavior in the educational level of the respondents: ~2/3 of the survey participants have a university degree, while only 20% of the inhabitants are of this educational level.

Sector

The responses to the questionnaires showed an equal distribution in the different work sectors, which provides a well-balanced sample for the purposes of the survey. The corresponding statistic for the general population cannot be verified through the census data.

10. 2 Patterns by Characteristics of Survey Respondents

Awareness/Knowledge

The most significant finding of the survey in the category of awareness and knowledge is that almost all the respondents are aware of tsunamis. In contrast, less than 30% have heard of storm surge. Moreover, a high percentage of the participants to the survey (almost 70%) believe that a tsunami can occur in their community in the next ten years, which is more or less the same with the percentage of those who have experienced a tsunami, referring most probably to the October 2020 event.

Exposure and sense of Exposure

The results of the questions related to exposure revealed that ~80% of the participants live and work within 10 minutes from the coast, thus in close proximity to the hazard zone.

Assessment, Preparedness and Response

The vast majority (almost 90%) of the participants believe that collective actions are needed to mitigate risk from sea related hazards. Between tsunamis, storm surge and sea level rise, most of the participants are more concerned about tsunamis. However, it is also noteworthy that the same number of participants is highly concerned about sea level rise and tsunamis. On the other hand, out of the three sea related hazards, storm surge received the most replies for not being of concern. In terms of having knowledge of whether their municipality has an evacuation or resettlement plan in place, respondents did not know whether there are such plans in place for tsunamis or storm surge. However, for the same question a resounding 100% of the respondents replied that there is a resettlement plan in place for sea level rise, which warrants further investigation.

Regarding taking precautionary measures against these sea related hazards, the majority of respondents replied that they have not taken any such measures and that they don't have any kind of insurance against any of the three sea related hazards. In terms of the respondents' participation in drills, exercises or other actions related to tsunamis, storm surge and sea level rise, the majority (over 70%) replied negatively. Most importantly for the preparedness and response section of the questionnaire, almost 80% correctly responded that they would move away from the coast after they feel a strong shaking due to an earthquake, However, it should be taken into account in evacuation planning that just over 45% of the participants stated that having

disabled or young people in their care could affect their ability to evacuate and move to a safe area.

Governance

In this section of the questionnaire intended for participants working in the emergency response/management sector, on the ability of the municipality to manage emergency response operations during a possible sea level related hazard, including tsunamis, storm surge and sea level rise, a large number of respondents (~70%) replied negatively. Regarding the identification of the agencies currently involved in the emergency response or disaster risk management and reduction, all respondents identified the municipality and civil protection agencies, 60% identified the Fire Service and Coast Guard, whereas 40% identified the Police, the community in general and other agencies. Finally, almost 2/3 of the respondents believe that the impact of different hazards should be considered in the decision-making processes.

11. Discussion

This questionnaire survey was conducted in the town of Samos, Samos Island, Greece, within the framework of the CoastWAVE project. In total, 49 residents of Samos took part in the survey. The sample corresponds to a small fraction of the total population of Samos, but nevertheless provides a valuable outlook into the local risk perception related to sea related hazards. The age of the survey participants ranged between 14- 74 years old, however the sample includes a high percentage of respondents in the age group between 35 to 55 years old which does not reflect the true percentage of the general population. Moreover, ~2/3 of the participants are university graduates which generates a sample bias in the educational level compared to the general population. In terms of the working sector, the equal distribution of sample provides adequate data for the analysis.

11.1 Tsunami hazard

With respect to tsunami hazard, most of the participants had experienced a tsunami in the past, most likely the 2020 Samos-Aegean tsunami. The majority believes that it is highly likely that the Mediterranean region and their community will experience a tsunami in the next 10 years. The majority also believes that a future tsunami will cause moderate impacts for both the coastal zones of the North-Eastern Atlantic and

the Mediterranean Sea and in their community. A significant percentage (~40%) of the participants responded that a high impact is expected both at regional and local level. In the question of what would be the approximate height of a tsunami that can happen soon (e.g., in the next 10 years) in coastal regions of the North-Eastern Atlantic and Mediterranean, the majority of responses ranging between 0,5 – 5 m reflect the expected moderate to high impact from tsunamis and showcase a good understanding of the impact metrics by the participants.

The responses on the question related to the expected arrival time of a tsunami in their community show the awareness of the participants of the local tsunamigenic faults following their experiences during the 2020 Samos-Aegean event. The overall tsunami awareness of the respondents was further highlighted by the identification of natural signs of a tsunami and the majority of responses on self-evacuation following a strong shaking due to an earthquake.

The combination of the short expected arrival time of the waves, the proximity of the respondents' home and workshop to the coast, and the expected moderate to high impact was possibly reflected in their concern for the risk and impact from tsunamis in their community. The respondents' concern on tsunami risk may also have been influenced by their lack of knowledge of an evacuation plan for tsunamis being in place and/or on their lack of participation in exercises or drills related to this hazard.

11.2 Storm surge

A much smaller percentage of respondents (~30%) have heard of storm surge compared to tsunamis, 15% have ever experienced a storm surge event, and 26% of respondents did not know whether they had experienced storm surge in the past. These findings are noteworthy since the town of Samos is susceptible to this particular hazard with known past instances of impact along the waterfront of the town of Samos. The responses could have reflected the true knowledge of the respondents, but it could also be that the scientific term of this hazard in Greek is not well known among the survey participants.

Regarding the question related to the likelihood of experiencing storm surge at regional level, the answers are similar to those for tsunami hazard. However, the respondents find it less likely to experience storm surge compared to tsunamis at the community level. Overall, the respondents also believe the impact to coastal regions from storm surge to be less in the case of storm surge compared to tsunamis, both at

regional and community level. Finally, while the majority of survey participants is concerned about the risk and impact from storm surge in their community, a significant fraction of the survey participants is not concerned about storm surge compared to tsunamis (>40% for storm surge, compared to <5% for tsunamis).

11.3 Sea level rise

Sea level rise is a long-term hazard, as opposed to the episodic nature of tsunamis and storm surge. Moreover, the exposure of the population to the hazards of tsunami and storm surge depends on the sea level, which interlinks the risk perception of the sea related hazards studied through the questionnaire.

A significant percentage of the survey respondents (more than 70%) have heard about sea level rise, scoring in-between tsunamis (with the highest percentage) and storm surge (with the lowest percentage). In terms of the expectancy of sea level rise in the next 10 years, the scores for sea level rise are similar to the other two hazards. However, on the community level, the respondents perceive sea level rise to occur in the next 10 years with higher likelihood compared to storm surge. In terms of expected impacts, at the regional level sea level rise scores higher compared to storm surge, whereas at the community level the responses on the three levels of impact were balanced. In terms of the feeling about risk and impact in their community, sea level rise scores higher compared to storm surge, and an almost equal number of respondents is highly concerned for both tsunamis and sea level rise, however, more respondents were not concerned about sea level rise compared to tsunamis. This result shows a mixed risk perception on the local impacts of sea level rise by the survey participants.

11.4 General remarks

It is noteworthy that the majority of participants is not aware whether the necessary capacities and infrastructures to inform local people for any of the above hazards are in place and they mention that their community doesn’t display evacuation signs neither for the case of a tsunami nor for storm surge. The majority also feels that their municipality is not able to manage emergency response operations during a tsunami, surge storm, or sea level rise. Most participants feel concerned about the risk and impact that the three hazards could cause to their community, and they believe that collective actions are needed in order to reduce or avoid the potential impacts. These

findings show that more work in needed in risk management and risk communication for sea related hazards at the community level.

Concerning self-preparedness, most of the participants mention that they haven't taken any precautionary measures and they don't have any kind of insurance against any of the three discussed hazards. High awareness for tsunamis is very encouraging and provides an important foundation for building a Tsunami Ready community in Samos.

12. References

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