https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

Tsunami risk perception in Central and Southern Italy.

Lorenzo Cugliari[1], Massimo Crescimbene[1], Federica La Longa[1], Andrea Cerase [1,2], Alessandro Amato[1], Loredana Cerbara[3]

[1]National Institute of Geophysics and Volcanology, 00153, Roma, Italy
[2] Department of Communication and Social Research, La Sapienza University, 00198, Roma Italy
[3]Institute for Research on Population and Social Policies, National Research Council, 00185, Roma, Italy

Correspondence to: Lorenzo Cugliari (lorenzo.cugliari@ingv.it)

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

Abstract

The Tsunami Warning Center of the National Institute of Geophysics and Volcanology (CAT-INGV) has been promoting, since 2018, the study of tsunami risk perception in Italy. Between 2018 and 2021 the semi-structured questionnaire on the perception of tsunami risk was administered to a sample of 5,842 citizens residing in 450 Italian coastal municipalities, representative of more than 12 million people. The survey was conducted with the Computer Assisted Telephone Interview (CATI) methodology, described in Cerase et al. (2019) who published the results of the first pilot survey (about 1,000 interviews). The large sample and the socio-demographic stratification give an excellent representation of the resident population in the surveyed Italian coastal municipalities. Moreover, in 2021 an optimized version of the questionnaire was also administered via Telepanel (a tool for collecting proportional and representative opinions of citizens) representative of the Italian population, which included 1,500 people distributed throughout the country.

In this work we present the main results of the three survey phases, with a comparison among the eight surveyed regions, and between the coastal regions and some coastal metropolitan cities involved in the investigations (Rome, Naples, Bari, Reggio Calabria and Catania).

Data analysis reveals heterogeneous and generally low tsunami risk perception. Some seaside, in fact, show a good perception of tsunami risk while others, such as in Apulia and Molise, reveal a lower perception, most likely due to the long time elapsed since the last event and the lack of memory. We do not find relevant differences related to the socio-demographic characteristics (age, gender) of the sample, whereas the education degree appears to affect people's perception. The survey shows that the respondents' predominant source of information on tsunamis is the television and other media sources (such us newspapers, books, films, internet etc.) while the official sources (e.g. civil protection, local authorities, universities and research institutes) do not contribute significantly. Also, we found an interesting difference in people's understanding of the words tsunami and maremoto, the local term commonly used in Italy until the 2004 Sumatra event, which should be taken into account in scientific and risk communication. The nationwide sample shows lower tsunami risk perception compared to the average of the coastal sample, confirming the need for thorough information campaigns directed to tourists.

Our results are being used to drive our communication strategy aimed at reducing tsunami risk in Italy, to activate dissemination and educational programs (data driven), to fill the data gap on tsunami risk perception in the NEAMTWS area, and to implement multilevel Civil Protection actions (national and local, top-down and bottom-up). Not least, outputs can address a better development of the Tsunami Ready program in Italy.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

1. Introduction

The Mediterranean region is highly exposed to tsunami risk, as witnessed by several recent events (Yalçıner et al., 2017; Triantafyllou et al., 2021; Dogan et al. 2021), basin-wide or local historical events (Maramai et al., 2014; Papadopoulos et al., 2014; Solov′ev et al., 2000; Maramai et al., 2021), and by the recent assessment of seismically induced tsunami hazard (Sørensen et al., 2012; Basili et al., 2021). However, the tsunami risk in the Mediterranean is thought to be underrated, due to the low frequency of events, as for other regions of the world (Dawson et al., 2004; Dogulu et al., 2014; UNESCO-IOC, 2017; Amato, 2020; Necmioğlu et al., 2021). It is therefore important to raise awareness among people, as well as of local authorities responsible for civil protection measures and emergency management, and national / regional authorities.

The Sendai Framework for Disaster Risk Reduction 2015-2030 gives high attention to Early Warning Systems (EWS), suggesting to "invest in, develop, maintain and strengthen people-centered multi-hazard, multisectoral forecasting and early warning systems, …; develop such systems through a participatory process; tailor them to the needs of users, including social and cultural requirements, in particular gender…". The strong emphasis on people means that any communication strategy should be based on a preliminary assessment of people's knowledge, awareness and perception of the risk. Moreover, the "needs of users" must be studied and understood, to reach people and communities in the right way using the best language and communication channels, and to have an optimal response in case of an impending inundation.

The Italian Tsunami Alert Center (Centro Allerta Tsunami, CAT) of the Italian National Institute of Geophysics and Volcanology (INGV) is part of the national Tsunami Warning System called SiAM (Italian national warning system for tsunami of seismic origin), established in 2017 with a Prime Minister Directive (G.U. n.128 del 05-06-2017). The SiAM is coordinated by the Civil Protection national Department (DPC), and besides the CAT-INGV, includes ISPRA. This latter acts as Tsunami Service Provider (TSP) for UNESCO Member States of the NEAM region (Amato et al., 2021), as well as National Tsunami Warning Center (NTWC) and Tsunami Focal Point (TFP) for Italy. Among the tasks of CAT, besides the tsunami surveillance / warning and the hazard assessment, there are also scientific and risk communications activities on tsunamis. CAT manages a dedicated web site (www.ingv.it/cat/en/), where people can find information on tsunami hazard/risk, on the warning system, on historical events, news on projects, papers, campaigns and drills.
In this perspective, the activities of the CAT include the assessment of tsunami risk people's perception. These researches aim to improve risk analysis and decision making, develop methods for eliciting opinions about risk, provide a basis for understanding and anticipating possible public reactions to tsunami hazards, enhancing risk communication among lay people, technical experts and policy makers (Slovic et al., 1982; Slovic, 1987; Wildavsky and Dake, 1990; Slovic, 2001; Rippl, 2002).
This paper presents the data on tsunami risk perception collected in Central and Southern Italy between 2018 and 2021. The study involved the administration of a semi-structured questionnaire to a sample of 5,842 people in 450 coastal municipalities.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

2. Studies on tsunami risk perception, a brief overview

Risk perception studies taking into account the socio-cultural and psychological aspect, assess people's response to natural hazards and the behaviors they would adopt in response to the risks. People's perceptions - individually or collectively - of a natural hazard are also influenced by individual factors such as personality, age, beliefs, gender, education level, knowledge, and culture (Slovic, 1982; Slovic and Peters , 2006; McIvor et al., 2009; McNeill et al., 2013; Wachinger et al., 2013).

Human behavior is driven by perceptions (Slovic, 1987) rather than scientific knowledge about "facts" (Renn, 1990). Therefore, it becomes strategic for those involved in risk mitigation and communication, to have in-depth studies on the process that influences our ability to assess the risk of a natural phenomenon (Slovic, 1982) like tsunamis. Tsunamis are known to be a phenomenon with a low probability of occurrence but high impact, able to produce devastating consequences that would affect large areas and have serious consequences for human lives (Behrens et al., 2021; Rafliana et al., 2022). The low occurrence frequency is one of the variables that directly influence the risk perception, which makes these phenomena, in some contexts such as the Mediterranean, out of the collective consciousness, often inducing authorities not to undertake effective actions to reduce the risk.

However, tsunamis' low frequency of occurrence does not reduce their destructive potential. Moreover, how important it is to study people's perceptions of natural hazards (Lindell, 2000; Paton, 2010; Wachinger, 2013; Bonaiuto, 2016), particularly tsunami risk perceptions, emerges in various studies conducted in at-risk countries that were affected by tsunamis, such as for example, the 2004 Indian Ocean tsunami or the 2011 Japan tsunami (Kurita et al., 2007; Sugimoto et al. 2010; Alam, 2016; Arias, et al., 2017; Akbar et al., 2020).

The historical catalog of tsunami effects in the Mediterranean (Maramai et al., 2014) cites over 200 documented events for the whole area. More recently, in the Euro-Mediterranean area, 26 earthquakes above magnitude 5.5 occurred at sea or near the coast between 2017 and July 2022, triggering the activation of CAT. Among them, 10 earthquakes generated an alert level for possible sea level change including 6 Advisory (possible sea level change, less than 1 meter) and 4 Watch (possible sea level change with estimated run-up values above 1 meter), two of which caused damages in Greece and Turkey (Yalçıner et al., 2017; Dogan et al., 2019; Cirella et al., 2020; Dogan et al., 2020; Triantafyllou et al., 2020)

In addition, variables to be considered from a comprehensive perspective include the large growth in population living along the Euro-Mediterranean coasts. This phenomenon, occurring since the Second World War and intensified in recent decades, also includes the development of tourist facilities and large industrial complexes. These intensive forms of settlements require multi-risk analytical hazard approaches where the socio-cultural and psycho-social aspect becomes prominent. In this framework, strengthening tsunami risk perception studies that survey the opinions of employees, daily commuters as well as seasonal workers and tourists who increase the coastal human presence and consequently the risk is needed. The need to assess tsunami risk perception has been highlighted by several authors as a key to improving emergency behaviors and minimizing population risk by limiting casualties and infrastructure damage (Ho et al., 2008; Martin et al., 2009; Ritchie and Roser, 2014; EMDAT, 2019).

3. The CAT-INGV tsunami risk perception studies

Amid increasing international attention to tsunami risk, CAT-INGV since 2018 has been promoting tsunami risk perception studies to provide oriented support to civil protection activities and develop data-driven, context-appropriate risk communication strategies.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

Moreover, the CATI questionnaire's structuring and administration methodology make it an excellent tool to collect a large, standardized, retraceable and cost-effective amount of data. (Dawson et al., 2004, Cugliari et al., forthcoming). Furthermore, The questionnaire as a survey method to study tsunami risk perception is widely used in the international context (see for example Apatu, 2013; Sun, 2013; Lindell, 2015; Lindell, 2016; Jon., 2016; Fraser, 2016; Wei, 2017; Buylova, 2020)

3.1 The tsunami risk perception questionnaire

In this study we have used the questionnaire designed and described in Cerase et al., 2019 (and available in the English version in the 2019 paper's SOM), consisting of 6 sections and 27 items that allow us to detect respondents' opinions regarding knowledge, tsunami risk perception, tsunami representation, cultural attitudes toward risks (Douglas and Wildavsky, 1982), and through which channels respondents have been informed about tsunamis and would like to receive an alert in case of tsunami.
The same questionnaire, implemented and administered in 2018 was subsequently administered in 2020 and 2021 by the same CATI methodology to extend the coverage to six more Italian regions and achieve better statistical representativeness.

3.2 - Study area and sample characteristics

The coastal belts are the most densely populated territory and where the largest urban centers are developed. 20% of the EU's approximately 500 million inhabitants live in the coastal area, and in 2018, in Italy, 28% of the total population (more than 17 million inhabitants) resided in coastal municipalities. Between 1951 and 2011, the increase in coastal population was about 29%. Sardinia, Sicily, Apulia and Calabria together represent about 64% of the national coastline. The Italian region with the most coastal population is Latium (due to the presence of the municipality of Rome, a metropolitan city) followed by Sicily and Campania. Coastal areas are also among the most densely populated with an average of 398 inhabitants per km^2, compared to 167 in noncoastal areas. This is also due to the presence of large urban centers including 10 regional capitals (Report ISTAT, 2020).

Our survey was carried out in three different phases. The first survey phase, concluded in 2018 (April 4 to May 4, 2018) covered Apulia and Calabria regions where 1021 questionnaires were collected (Cerase et al., 2019). In the second survey phase, carried out between Dec. 27, 2019 and Jan. 8, 2020, 614 questionnaires were collected in the coastal municipalities of Molise, Basilicata and Eastern Sicily. In the third survey phase, completed in 2021 (between Dec. 21, 2020 and Jan. 8, 2021), 4,207 questionnaires were collected in the coastal municipalities of Latium, Campania, Sardinia, southern and northern Sicily.
The 2021 administration included all the coastal metropolitan cities of central and southern Italy (ISTAT, 2020). This is relevant for Civil Protection because Naples, Rome, Palermo Messina and Catania areas are some of the most densely populated Mediterranean coastal cities (UNESCO-IOC, 2020; Eurostat, 2022). Adding to these cities also Bari, Reggio Calabria and Cagliari, also sampled in 2018 and 2021, we reach about 6 million inhabitants.
All these regions were chosen because southern Italy, particularly the Ionian side, have the highest tsunami hazard (Basili et al., 2021; Basili et al., 2019) compared to other Italian regions (Liguria, Marche, Abruzzo, Veneto, etc.) with lower hazard. By the way, it is our intention to complete the survey in the next one-two years in order to have a comprehensive view of the Italian coastal territory on tsunami risk perception.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

	1st Stage		*2nd Stage*			*3rd Stage*				
	Apulia	**Calabria**	**Molise**	**Basilicata**	**Eastern Sicily**	**Latium**	**Campania**	**Sicily (except eastern)**	**Sardinia**	Total
Total Residents	1,716,797	1,120,698	43,800	58,385	834,881	3,786,704	1,925,984	2,137,306	859,721	**12,484,236**
Coastal Municipalities	67	116	4	7	29	20	40	96	71	**450**
No. Respondents	722	491	100	140	374	1,034	1,170	1,221	782	**5,842**
Total	**1021 Respondents**		**614 Respondents**			**4207 Respondents**				
	2018 / 2020 / 2021 – Territorial and socio-demographic distribution									
	Regions		**No. of provinces**		**Coastal municipalities**		**Respondents**		**Km of coast surveyed**	
	8		**37**		**69,8%** (450/645)		**5,842** (12,484,236 pop tot)		**77,9%** (6,166km)	

Table 1. Sample distribution in the three survey stages

Table 1 shows the distribution of the sample by survey stage and region. The survey covered a total of 8 regions, 37 provinces, achieving 69.8% coverage of coastal municipalities for a total of 6,166 km of coasts surveyed and 5,842 interviews conducted, that are considered representative of 12,484,236 residents (ISTAT, 2021).
The sampling design was structured respecting robust statistical standards with attention to the population representativeness of even smaller coastal municipalities. The sample is stratified by age, gender and coastal regions. In order to have a more statistically robust sample, education degree was considered as a stratification variable for the third survey stage (n=4,207).

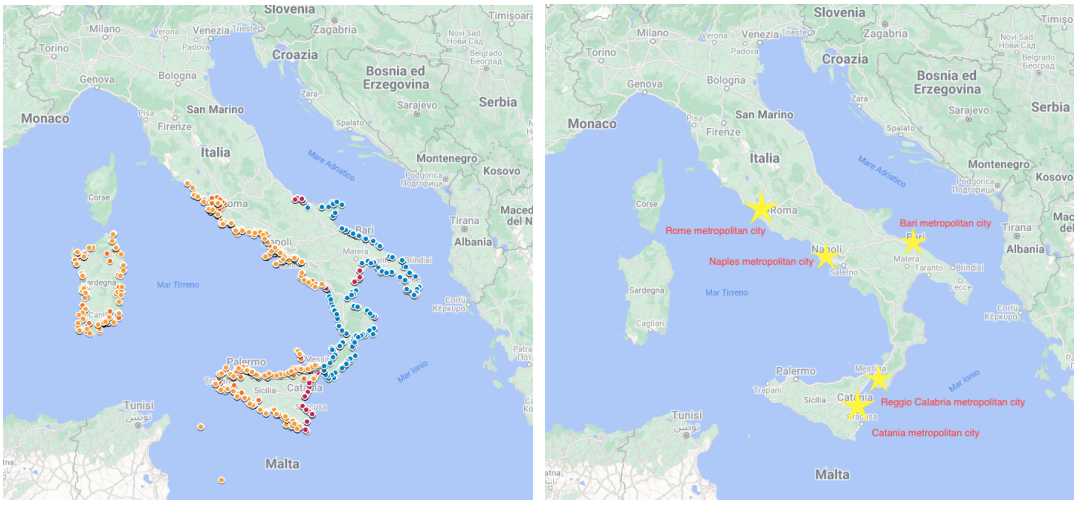


Figure 1. (Maps Data modified from: © Google Maps, 2022) Maps of the CATI interview distribution (left) and coastal metropolitan cities (right). The different color dots, on the left map, indicate the different survey phases: blue shows the interviews in the first survey phase (2018), red shows the second survey phase (2020), and yellow shows the distribution of interviews in the third survey phase (2021). Yellow stars, on the right map, indicate metropolitan cities (provincial capitals) where population density is high for a wide territorial area.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

3.3 - Sample validation for the three survey phases (Cronbach's alpha and T-test), statistical data processing

The three surveys were carried out in different years, this required a greater methodological accuracy and some preliminary statistical operations to validate and verify the data.
First, we verified that the samples were statistically uniform, independent, and representative in estimating the reference population mean. Further, whether the datasets could be aggregated into a single matrix to produce robust outputs and correlations. For this, we used the T-test (Student, 1908). The T-test (or Students'test) is widely used to study the connection between natural hazards and risk by considering a specific variable to compare statistical averages within a group (see e.g., Buylova, 2020; Musacchio, 2021; Liu, 2021). The T-test was applied to questionnaire's items nr. 8; 12; 14; 16; 20 which are multiple choice questions, and to 21; 23; 24 which are Likert scale questions batteries, between the first and the second surveys (2018-2020) and in the first and third surveys (2018-2021), respectively. The results of T-test with a confidence interval of 95% confirm that the samples are statistically uniform, together correlable and, consequently, analyzable in a single data matrix.
Once obtained the T-test confirmations, we verified that the data collected were consistent and significant as a part of a robust sample. We calculated Cronbach's alpha (Cronbach, 1988; 1951) on the items comprising questionnaire sections numbers: 2, 3, 4, 5 and 6. The resulting alpha values between $0{,}61 \leq \alpha \leq 0{,}83$ are generally considered optimal to corroborate the variable reliability (Nunnally, 1975). Particularly, values near $\alpha=0.80$ or greater have an optimal consistency degree (Peterson, 1994). The alpha values resulting from our comparisons ranged from $0{,}74 \leq \alpha \leq 0{,}89$.

3.4 - The national sample (National Sample)

The third survey phase (2021) also included the questionnaire administration to a sample representative of the whole Italian population distributed by proportional shares.
This has been done through a digital platform that reaches users - who are registered with the proprietary company - through a link on their smartphones (named TelePanel by the company). The link allows access to the on-line, re-adapted questionnaire, that users independently complete. Survey respondents are subscribed to the service and are paid by the commissioning company. The company, as owner of the sample, takes care that it respects scientific criteria and that the sample reproduces the same compositions of the population strata. The sample is generally used to survey shared-interest opinions, political polls, national trends and customs.
Proportional shares are respected and the sample is stratified according to the following variables: age, gender, geographic area, educational qualification and profession.
The national sample questionnaire surveyed the opinions of 1,500 respondents and was administered in the same period of the CATI survey.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

4. Results and discussion

The principal results of the three surveys are presented in two paragraphs: Tsunami risk perception and Knowledge about tsunami.
The map below (fig. 2) shows the geographical positions of the coastal areas where the survey was conducted (by region) and the seas surrounding Italy.

Figure 2. (Maps Data modified from: © Google Maps, 2022). Map of surveyed Italian coasts and corresponding seas.

4.1 Tsunami risk Perception

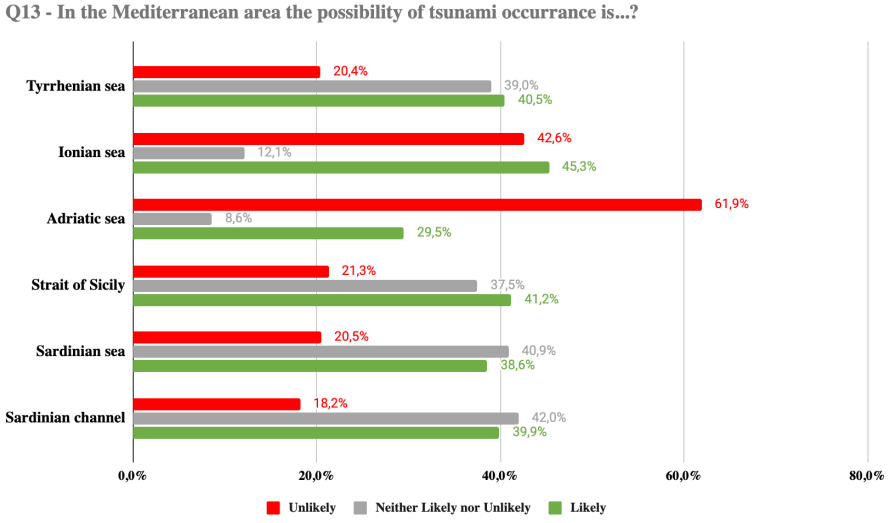
The risk perception is preliminary calculated considering the item Q13 "*In the Mediterranean Sea the occurrence of a tsunami is…*?" and Q16 "*Do you think that the coast of your municipality could be hit by a tsunami*?".

Survey data show that tsunami risk perception differs in relation to the seaside.

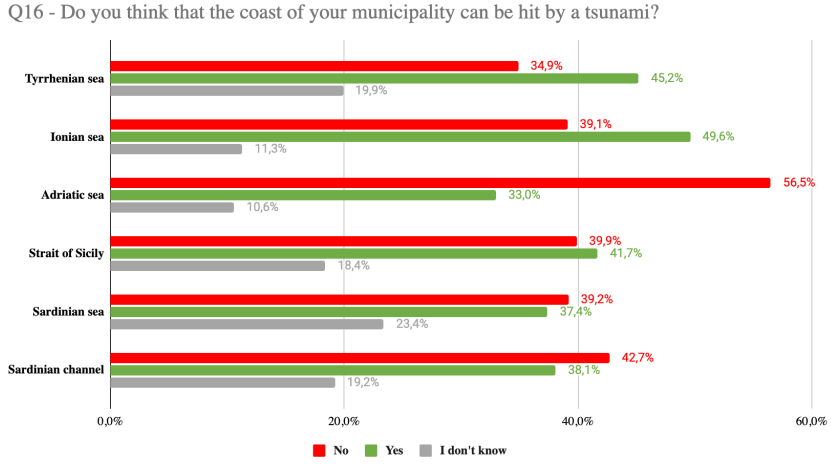
https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

263 **Q13 - Possibility of tsunami in the Mediterranean Sea**



264
265 **Figure 3. - Q13 - Tsunami risk perception in the Mediterranean sea by coastal regions**
266
267 Figure 3 shows tsunami risk perception for events in the Mediterranean divided by respondents'
268 coastal seaside. In general, about 40% of the interviewed believe that a tsunami is likely to
269 occur in the Mediterranean area. While respondents from the Adriatic coast disagree: 62% think
270 a tsunami cannot occur.
271
272 **Q16 - Possibility of your municipality's coasts being hit by a tsunami**
273
274
275
276
277
278
279
280
281
282
283
284
285



286 **Figure 4. - Q16 - Tsunami risk perception in respondents' municipalities by coastal regions**

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

Figure 4 shows the distribution of answers to the specific question about the likelihood of a tsunami hitting the respondents' municipalities. The sample from the Ionian and Tyrrhenian sides seem to have a higher tsunami risk perception (49.6% and 45.2%, respectively). Differently, in the Adriatic coast municipalities, respondents have a lower perception of tsunami risk, as for the previous question (Fig. 2). In fact, only 33% of them believe that their municipality may be affected by a tsunami and 56.5% believe it will not.

In the three-stage survey sample (n = 5,842), no significant variations are observed for the tsunami risk perception in relation to the gender of the respondents.

More significant differences emerge in relation to educational degrees. The sample with low educational degree showed more uncertainty in responses associated with the "*I don't know*" modality (23.4% and 23.1%, respectively, versus 11.2% of those with high educational degrees and 15% of those with medium educational degrees); a high educational degree is correlated with a significantly higher tsunami risk perception (48.2%) compared to 37.9% for those with a low educational degree.

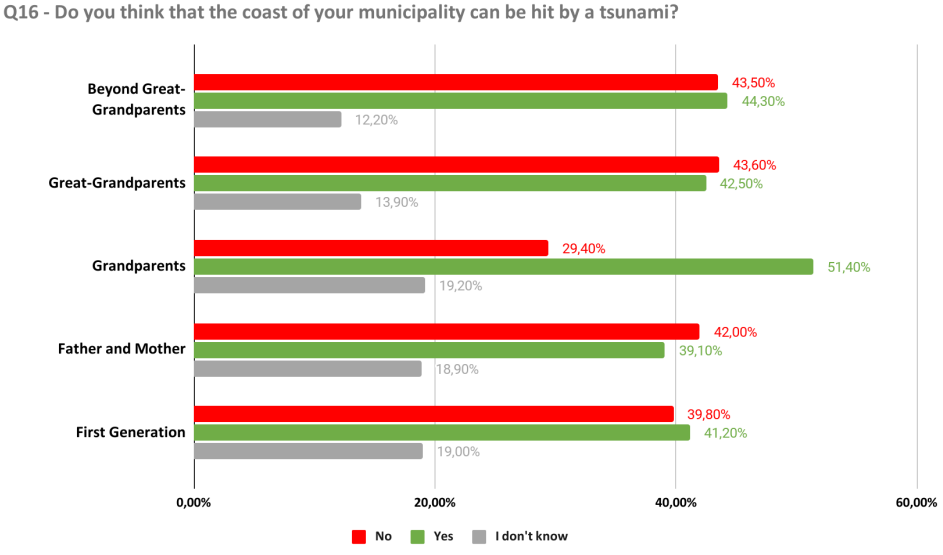


Figure 5. Tsunami risk perception in municipalities according to the numbers of generations of residence in the area.

The graph in fig. 5 - reporting the tsunami risk perception in municipalities according to the numbers of generations of residence in the area - shows an interesting finding. In fact, risk perception is highest at 51,4% for the third generation (*my grandparents lived there*), whereas the average response rate for other generations is about 40%. These findings are consistent with recent studies based on an interdisciplinary historical-anthropological approach (e.g., Garnier and Lahournat, 2022). Indeed, these studies highlight the role of memory transmission of past disasters, more generally cultural memory, as an effective tool for DRR (Brokensha et al., 1980; Fernando, 2003; Gregg et al., 2006; Cohen, 2011; Sutton et al., 2021).

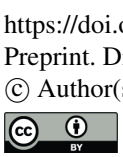
https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022


Natural Hazards and Earth System Sciences
Discussions

4.1.1 Tsunami risk perception in surveyed regions

This subsection moves from the results of our previous paper where a significant difference in tsunami risk perception between Apulia and Calabria was found, despite the comparable, high tsunami hazard of the two regions (Basili et al., 2021). In the first region only 30% of respondents think their region could be hit by a tsunami and 57.5% think it could not, whereas the results for Calabria are very different, with more than 66% yes and 25% no (Fig. 6).
In order to verify the perception of other regions' inhabitants, we have compared the answers to the same question (Q16) related to the regions investigated in the second and third survey phases.
The graph below (fig. 6) shows the percentages of responses collected for Q16 question for all the regions. The results show a strong heterogeneity among different regions, with the aforementioned Calabria and Apulia as end-members of risk perception. Molise, adjacent to Apulia in the Adriatic Sea, is on the low perception side with slightly higher values than this latter (40% yes, 53% no). Basilicata, with a few municipalities facing on both the Ionian and the Tyrrhenian coasts, has a slightly higher perception, with 44% yes and 48% no. Moving to the Central Tyrrhenian Sea, Latium and Sardinia show equal distributions of yes and no with a large number of "*I don't know*" (40, 40, and 20, respectively). Historical catalogs do not report relevant tsunamis for these two regions. Southern Tyrrhenian regions (Campania and Sicily) exhibit higher risk perception (48% and 46% yes, 36% and 33% no, respectively), even if not as high as Calabria. This can be explained with the presence of known tsunamis (as the 1908 event) or known potential tsunami sources, as active volcanoes of the Neapolitan area and the Southern Tyrrhenian).
These results are consistent with the similar study, by Gravina et al. (2019). In that case, inhabitants from southern Italian regions facing the Tyrrhenian Sea were asked: "*Do you consider to be actively exposed to a tsunami risk?*". 21% of interviewees answered *"highly"*, more than 42% *"quite"* and over 30% *"low"*. Nonresponses were 9%.
In addition, these regions, including Calabria, are highly seismically active, and people experienced frequent and even strong earthquakes. The traces of these events, present in the territory, rises people' s memory from generation to generation.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022



Natural Hazards and Earth System Sciences
Discussions

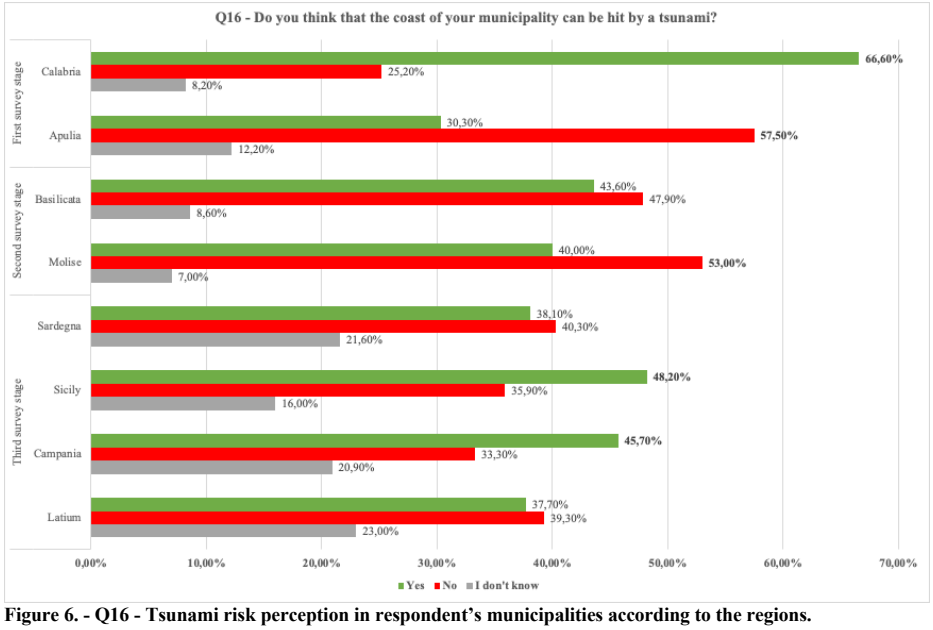


Figure 6. - Q16 - Tsunami risk perception in respondent's municipalities according to the regions.

4.1.2 Tsunami Risk Perception in Metropolitan area and seaside

We started from the research hypothesis that the perception of tsunami risk could be different between the inhabitants of metropolitan cities and those residing in the municipalities of the relative coast. In our opinion, this comparison is particularly relevant for metropolitan cities in which the exposed value (in terms of human lives, industries and infrastructures) is considerably higher than the adjacent, less populated coasts.
The following graphs (figures 7-11) show the risk perception surveyed in coastal metropolitan cities (Rome, Napoli, Bari, Reggio Calabria and Catania) in relation to the risk perception of the seaside on which the city lies (tab. 2).

Region	Latium	Campania	Apulia	Calabria	Sicily
Metropolitan coastal city	**Rome**	**Naples**	**Bari**	**Reggio Calabria**	**Catania**
Sub demographic areas	6	5	2	5	2
Total municipalities	121	92	41	97	58
Total residents	4,342,000	4,250,000	1,261,000	549,000	1,068,000
Resp by metropolitan city	**824**	**938**	**169**	**134**	**155**
Resp by seaside	**3201**	**3201**	**549**	**910(Ioni)/3201(Thyrr)**	**910**

Table 2. Demographic data of in-depth metropolitan areas and sample size by city and seaside (Source ISTAT, 2022. Database accessed on 07/2022 at: http://dati.istat.it/index.aspx?lang=en&SubSessionId=2c2456e1-fbc4-45fa-bdd3-bab2caf314ac)

To prevent statistical bias the data for each individual metropolitan city were removed from the coastal data on which the city is located. We also carried out the T-test for independent samples from which a significant difference between the averages of the two samples

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

(metropolitan cities and coastal slopes) were found. We used the test to indicate the sample statistical uniformity and comparability.
The graph in Figure 5 shows the comparison between the sample of the Metropolitan city of Rome and the relative Tyrrhenian coastal slope. In the case of the metropolitan city of Rome it is important to remember that Rome (2.7 million inhabitants) cannot be considered entirely a coastal city, even if some densely populated districts (like Ostia, with its 231,000 inhabitants) are entirely located on the seaside.
This is probably the reason why the average of the tsunami risk perception in Rome (fig. 7) seems to be lower than the Tyrrhenian. Indeed, only 36.3% of the respondents believe that a tsunami may hit their municipality, versus the 48,2% of respondents living in the Tyrrhenian seaside.

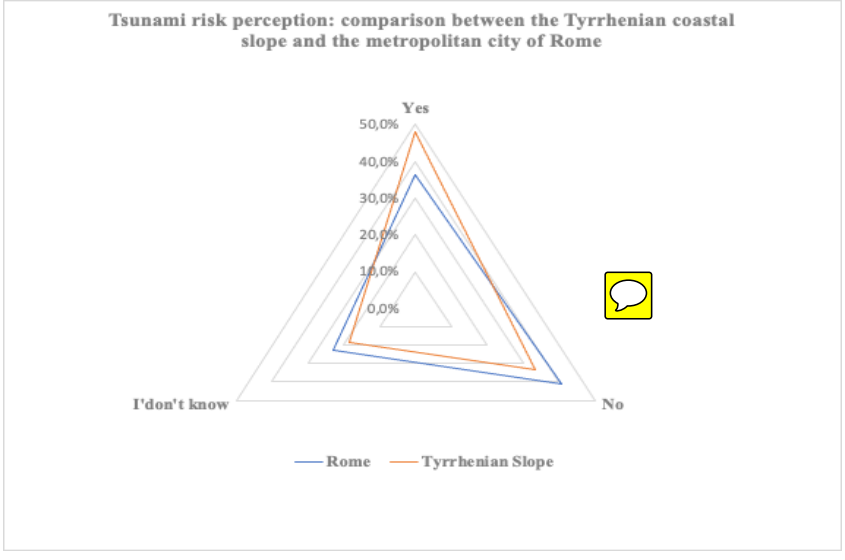


Figure 7. Tsunami risk perception: comparison between the Tyrrhenian coastal slope and the metropolitan city of Rome. (Q-16. Do you think that the coast of your municipality could be hit by a tsunami?)

Tsunami risk perception in the Naples metropolitan city (fig. 8) is slightly higher than the average surveyed on the Tyrrhenian side. 47.2 % of respondents said that a tsunami could hit the coasts of their municipality compared to the Tyrrhenian slope average, which - excluding the metropolitan city of Naples - has a value of 44.9 %.
31.8% of respondents believe that a tsunami is unlikely to hit their municipality's coast, and 21% say they don't know the answer.
These data are consistent with the seaside average and it diverges from the starting hypothesis. These data could be related to multi-hazard variables that lead the municipalities' residents to express a greater risk perception due to the presence of the Vesuvius volcano, the seismic memory of the 1980 Irpinia earthquake, and the frequent bradiseisms and micro-earthquakes that occur in the Neapolitan area (i.e., in the Phlegrean Fields). Traces of these events are also found in the literature, such as the case of the tsunami of 1345, documented by the Italian famous writer Francesco Petrarca in his "*Letters on Familiar Matters*" (Bernardo and Petrarca, 1985) , and recently described in Rosi et al. (2019).
Moreover, the city of Naples and the coastal municipalities of its hinterland, have high exposure due to civil settlements and industrial complexes including some Major Accident Hazard

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

Industries (Tinti and Armigliato, 2003; De Pippo et al., 2008; Grezio et al., 2012) that are located on the coast. Last but not least, the metropolitan city of Naples has one of the highest coastal population densities in Europe, with concentrations ranging between 500 and 2,500 inhabitants per km^2(ISTAT, 2020).

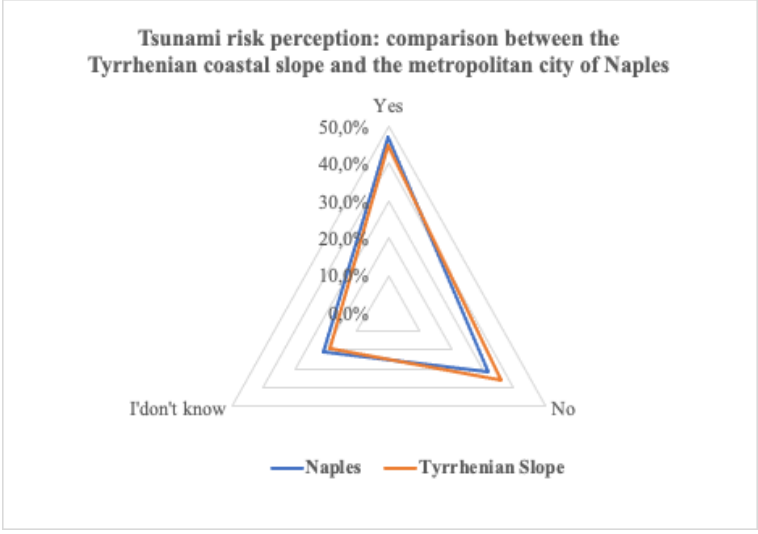


Figure 8. Tsunami risk perception(Q-16): comparison between the Tyrrhenian coastal slope and the metropolitan city of Naples.

The average risk perception for the metropolitan city of Bari is low (fig. 9), in line with the Adriatic coast. In fact, we observe that only 34.3 % of respondents believe that a tsunami could hit their municipality, versus 32.4 % of those residing in municipalities on the Adriatic coast. We also observe that 54.4% of respondents say a tsunami could not hit their coastal municipality, compared to 57.4% of the average of those living in coastal municipalities on the same seaside.

The perception results appear to be low compared with the estimated hazard for the southern Adriatic coast and Bari metropolitan city, which is medium/high (Basili, et al., 2021). The estimated hazard takes into account the strong earthquakes occurring along the Hellenic arc, able to generate tsunamis that would hit the Adriatic and Bari coasts. The low tsunami risk perception may also be influenced by the absence of recent tsunami events (Maramai et al., 2019) as already noted in our previous paper.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

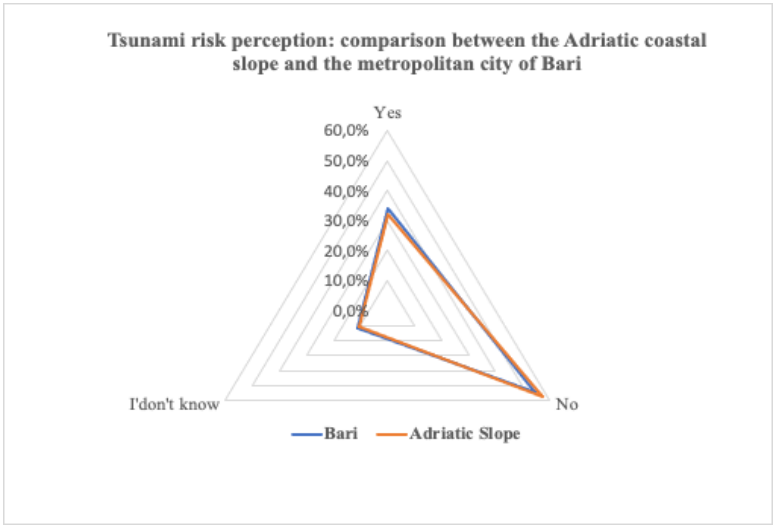


Figure 9. Tsunami risk perception (Q-16): comparison between the Tyrrhenian coastal slope and the metropolitan city of Bari

The tsunami risk perception in the metropolitan city of Reggio Calabria is on average high (fig. 10). The graph shows that 70.9% of respondents believe that the city may be hit by a tsunami compared to the average of 46.5% of respondents living in the Ionian slope's remaining municipalities and 45% of those living in the Tyrrhenian slope's municipalities. Furthermore, data analysis shows that only 8.9% of respondents answered "*don't know*" to the specific question. This percentage could indicate that residents of the metropolitan city of Reggio Calabria, have a greater tsunami risk knowledge of their area, compared to the other metropolitan cities considered in the analysis. The high tsunami risk perception is likely related to the 1908 tsunami, which had a strong impact on the territory, causing widespread damage and about 2,000 casualties (attributed to the tsunami), which still today holds a high media echo, currently in resident's memory.
In addition, residents' tsunami risk perception is in line with the high tsunami hazard estimated for the Reggio Calabria area (Basili et al., 2021).

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

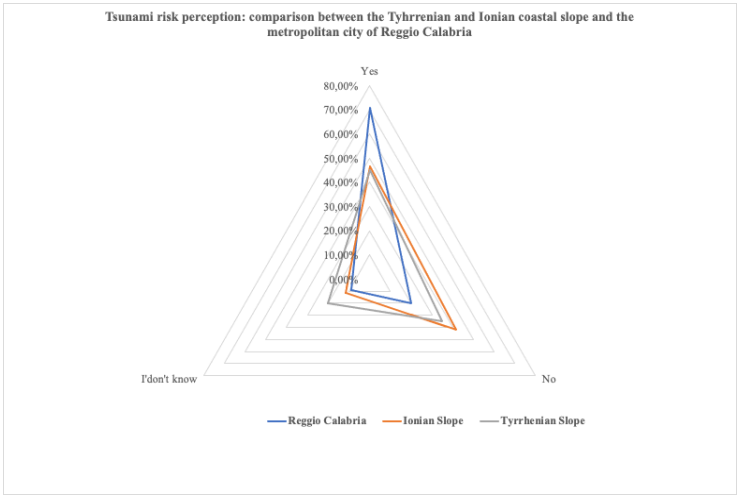


Figure 10. Tsunami risk perception(Q-16): comparison between the Tyrrhenian coastal slope and the metropolitan city of Reggio Calabria

The tsunami risk perception in Catania metropolitan city (fig. 11) is slightly higher (49,7%) than the risk perception of respondents of the Ionian coastal slope (45,8%). Only 11,6% of the respondents answered *"I don't know"*, in line with the responses from the other coastal slope municipalities. The percentage of tsunami risk perception in Catania, is probably associated with the presence of easily recognized hazards (e.g., volcanic risk and ash management due to the close Etna volcano, frequent earthquake shaking, etc.). In addition, industrial complexes and refineries along the coast increase the exposed value, and possibly the risk perception. Not least, the tsunami hazard (Basili et al., 2021) in the Catania area is quite high, due to both local and distant tsunamis.

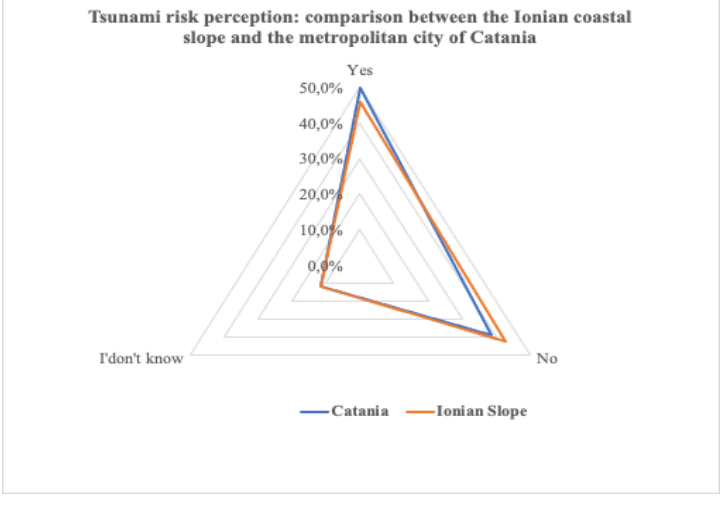


Figure 11. Tsunami risk perception (Q-16): comparison between the Ionian coastal slope and the metropolitan city of Catania

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Comparison among metropolitan cities (fig. 12) shows a higher tsunami risk perception in Reggio Calabria, Catania, and Naples. These cities, throughout history, have been repeatedly affected by disruptive natural events including strong earthquakes, volcanic eruptions and tsunamis. The difference in risk perception between metropolitan areas and coastal slopes remains the subject of further study. Bari metropolitan city has a low tsunami risk perception even though it is located in a stretch of coastline where tsunami hazard is considered medium/high. This could be associated with events that occurred in the distant past and the low frequency of occurrence of earthquakes.

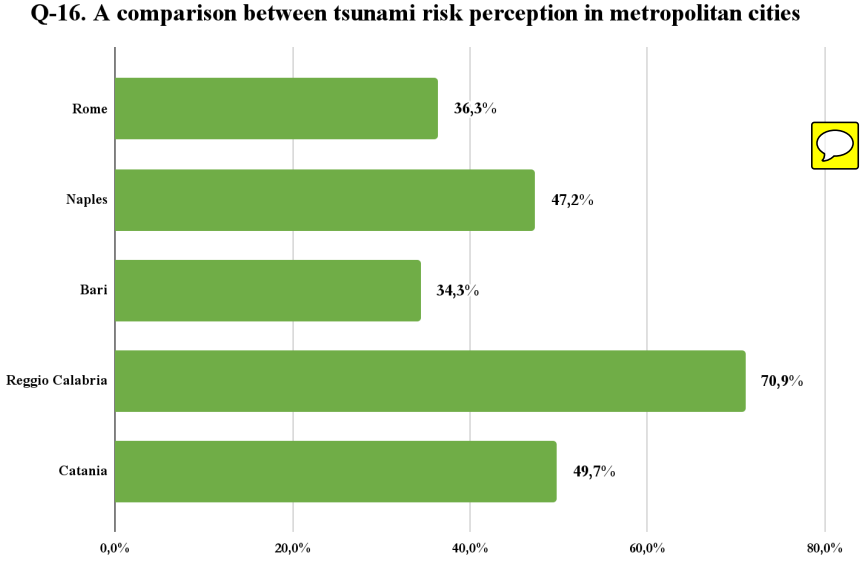


Figure 12. Tsunami risk perception (Q-16): comparison between the metropolitan cities

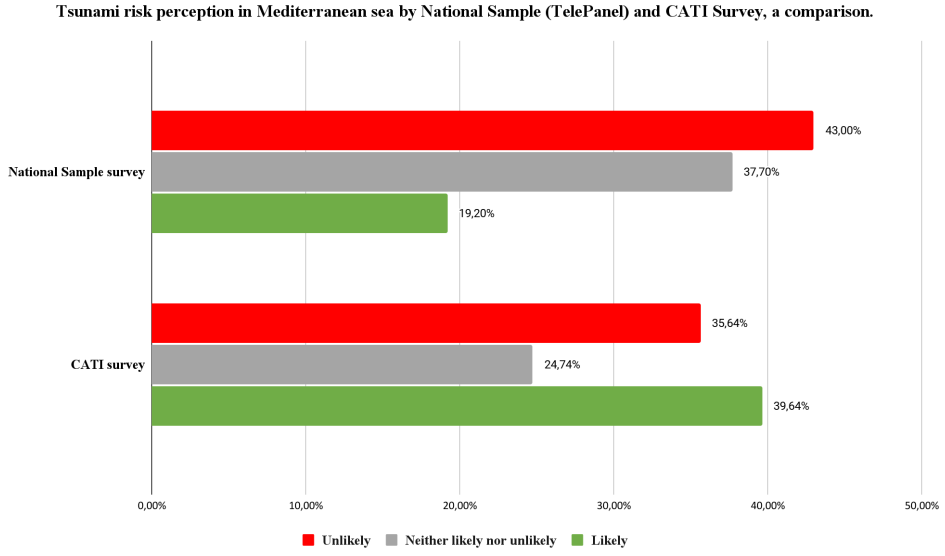
4.1.3 Tsunami risk perception: comparison with a national sample

In this section, we compare the tsunami risk perception in the Mediterranean area (Q-13), surveyed among the whole coastal population and a national population sample (National Sample survey n = 1,500). From the graph (Fig. 13), it can be seen that risk perception is higher in coastal communities (39.4%, CATI survey) and lower in the national average (19.2% National Sample survey). Minor variations can be observed in the other response modes. A difference of 13% also emerges in the central mode "*Neither likely nor unlikely*" from which low tsunami knowledge is assumed.
The National Sample survey becomes of primary relevance to also investigate the risk perception of the population not living in coastal areas who might face this risk in a summer vacation context even in non-national territories. This result is not surprising, considering the lower familiarity of non-coastal inhabitants with sea activities - and hazards - compared to coastal cities residents. Also, we should consider that the tsunami risk for people spending for instance a two-week's vacation in a seaside location is statistically much lower compared to

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions

584 the risk to which a coastal resident is exposed. We anticipate that this result strongly suggests
585 the need for a communication effort specifically oriented to tourists.
586 These data can be considered representative of the national mean related to the tsunami risk
587 perception and may be used for comparison with data related to the same specific groups of
588 population living on the coasts.
589



590
591 **Figure 13: Tsunami risk perception in Mediterranean Sea by National Sample and CATI Survey, a comparison.**

592 **4.2 Tsunami Knowledge**

593 **4.2.1 Phenomenon description: elicitations of the terms tsunami and maremoto**

594 In order to deepen understanding of people's tsunami knowledge we continued the
595 investigation on qualitative attributes of the tsunami phenomena started the our previous paper.
596 The first step is aimed at exploring the differences between the Japanese word "*tsunami*",
597 broadly used in the international scientific community, and the word "*maremoto*" (literally
598 seaquake), being a common alternative in colloquial Italian language. The overall results of
599 this research confirm the different meanings attributed to these two terms by respondents.

600 Figure 14 shows that the largest part of the sample shows greater familiarity with the term
601 "tsunami" (57%) while "maremoto" drops by several percentage points (43%). The word
602 "tsunami" seems to sound more familiar for those who have higher education levels (66%) and
603 less familiar to people over 65. Some interesting differences regarding the usefulness of the
604 two terms are related to local characteristics and will be further investigated. For example in
605 Reggio Calabria metropolitan city interviewees generally use the term maremoto to identify
606 the phenomenon (57%) whereas in Naples the term tsunami is more familiar (63%).

607 We could hypothesize that past events do differently shape the way the phenomenon is
608 acknowledged and understood, as culture provides different resources to address these events,
609 where traditional environmental knowledge plays a prominent role along with scientific

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

communication. These aspects are reflected in social representations (Moscovici, 1961) as well as in language being used to express such representations (Moscovici, 1976).

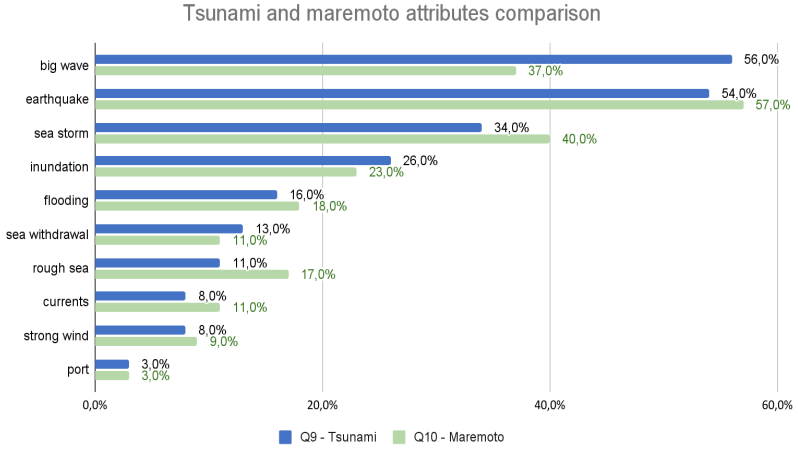


Figure 14: Tsunami and maremoto attributes comparison

Data in fig. 12 show that the word "tsunami" is mostly associated with *big wave* (56%), *earthquake* (54%) and *sea storm* (34%), and in a more detached position *inundation* (26%), *flooding* (16%) and *sea withdrawal* (13%). Instead, the word "maremoto" is first associated with *earthquake* (57%), then with *sea storms* (40%) and *big waves* (37%). *Inundation* (23%) and *flooding* (18%) are still present along with *rough sea* (17%).

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022


Natural Hazards and Earth System Sciences
Discussions

4.2.2 - Knowledge about causes of tsunamis

With regard to the alleged causes of tsunamis, they are generally attributed correctly to earthquakes 74% as the main cause, then to volcanic eruptions (44%), ~~t~~in agreement with the most frequent tsunami causes worldwide (NCEI/WDS, 2022) and in the Mediterranean (Maramai et al., 2014).
In general, it is observed that tsunami knowledge is not directly related to the gender and distribution of the interviewees but directly increases with instruction level and decreases with age (young, highly educated people under 50 years old are best informed).
Meteorological phenomena ~~t~~are mentioned by 19% of the respondents. In general terms this is ~~is~~ somehow overestimated, but we know that meteotsunamis are rather frequent in the Mediterranean, especially in the Adriatic Sea (Šepić et al., 2009; Vilibić et al., 2009; Maramai et al., 2022). However, it is possible that people confuse sea storms with (meteo)tsunamis. To verify this, we carried out a bivariate analysis that can provide some clues for this belief. Indeed, data highlight higher percentages for those who live in municipalities overlooking the Sea of Sardinia as well as the Channel of Sardinia which are frequently swept by strong winds of Maestrale, which can locally originate sea storms with waves several meters high.
We also note that weather conditions are most frequently mentioned by people with low education levels (22%) versus 15% of the sample with high educational level.
Furthermore, landslides are properly indicated as a possible tsunami caused by 14,8% of respondents, as well as meteorites and space objects. A similar question, about tsunami risk perception induced by rock landslides, was asked in the survey conducted in Norway during the ASTARTE project by Goeldner-Gianella (2017). In Norway, respondents correctly show high tsunami risk perception induced by rock landslides. This result is mainly due to the frequency of rock collapses occurring locally, and to citizens' trust in local institutions for how tsunami risk is managed and how information is disseminated (Goldner Gianella et al., 2017).

4.2.3 - Knowledge about tsunami effects

Knowledge about tsunami effects are investigated by Q22 (*Try to figure out the effects of a tsunami / tsunami on the coasts of your region. How far do you agree with the following statements?*) Results show that in general, people are well aware about tsunami possible effects on the coasts of their region. In particular, deaths and serious injuries are recalled by 93,9% of their sample; damages to houses, buildings and infrastructures by 93.1%, and negative impacts on economy and occupation and on economy are both indicated by 89,4%. Worth to say that despite high rates of knowledge about tsunami possible impacts, women, most educated people, and people aged up to 65 years show slightly higher percentages, as well as the inhabitants of the municipalities included in the area hit by the 1908 Messina Strait tsunami. As to resume, these kinds of effects are well known and present to interviewees.

The data also show a catastrophic representation of tsunami effects that does not correspond to the expected effects on the Italian coasts where moderate-sized tsunamis are more likely to occur. This scenario probably comes from the diffusion of the catastrophic images of the tsunamis that occurred in Sumatra in 2004 and in Japan in 2011, widely conveyed by television and social media. Given that macro-effects of a tsunami are well recognized and understood, micro-effects at local and individual level seem to appear unfamiliar to respondents.

Indeed data show that large coastal flooding is acknowledged by 83% and sea withdrawal by 77%, and the possibility that a small tsunami might drag an adult into the sea is known by 75% (Q23). Only 24% of respondents think that fleeing to the beach after a strong earthquake is an

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

appropriate behavior. The question about the possibility that a large tsunami with waves up to 20 meters may occur in the Mediterranean Sea raises some concerns, as only 46% of the overall sample considers it as a real possibility. Cross-tables highlight some unexpected surprises, such as higher rates of youngsters (31%) and women (27%) who consider fleeing to the beach a proper response to a massive earthquake.

4.2.4 - Data on the sources information

Data on the sources of information being used by the interviewees provide a relevant framework to address and improve tsunami risk communication. As for the previous paper, we have decided to group different sources into homogeneous categories. Data provide a clear indication on the central role of television, that is indicated as an information source by almost 90% of the sample. More in detail, TV news reaches 83% of respondents and documentaries or scientific channels reach 23%. Other traditional broadcast media, considered as a unique category including newspapers, books, radio and movies, are found to reach 58% of the public. Considering disaggregate penetration rates, newspapers were mentioned by 35%, books by 19%, movies by 12% and finally radio had 8%. Surprisingly enough, the whole internet sources show a penetration rate of about 18% and interpersonal sources such as friends, relatives and neighbors weigh for 5%.

As noticed in the first step of the research, the impact of institutional and scientific sources appear to be a problematic issue urging the development of a proper and effective risk communication strategy, since their overall penetration rate is a mere 3,5%. More in detail, single rates are about 2% for the Civil Protection, 1,6% for Universities and Research Institutions and barely a 1% for local administrative entities such as the Region, the Province and the Municipalities. The residual category other has been mentioned by only 35 people, corresponding to 0,6%. This suggests that a strong effort is needed for institutional parties to fill this gap, offering more capillary information using state-of-the-art communication channels.

Of course, data deserve further analysis by means of data reduction procedures, aimed at aggregating variables into new indicators and producing synthetic more effective understanding of the considered phenomena.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

5. Discussion and conclusive remarks

The three surveys on tsunami risk perception, conducted between 2018 and 2021, started from the necessity to study and understand the level of knowledge of tsunami risk and the awareness of Italian citizens living in or visiting coastal areas exposed to tsunami hazard.
To date, these surveys represent a relevant sample of the Italian population, both for the number of interviewees and for the adopted methodology (5,842 CATI interviews carried out on over 6000 km of coastline with moderate to very high tsunami hazard, plus a nation-wide "telepanel" sample representative of the whole Italian population).

The main results show that the tsunami risk perception varies significantly according to the coastal region. In particular, regions in the Adriatic (Apulia, Molise) show very low levels of risk perception compared to Calabria, Sicily and Campania, both on the Ionian and the Tyrrhenian seaside. Latium and Sardinia lie in the middle, with equal numbers of people thinking that a tsunami could hit their region.
Educational degree affects tsunami risk perception indeed: the higher the educational degree, the higher the tsunami risk perception.
On the contrary, data analyses show that tsunami risk perception is not influenced by either gender or age. A slight difference is observed in the middle age group in which interviews of 35-49 years appear to have a slightly higher perception. The elderly show the lowest frequency percentage in the response modality *"I don't know"* associated with low tsunami risk perception.

These data agree with several studies carried out on local cultures have shown how communities that have experienced disastrous natural events in their past, developed better resilience and preparedness (Dekens, 2007) to these calamitous events. Such knowledge, which differs from scientific knowledge (Flavier et al., 1995), is associated with the historical memory of past experiences learned and transmitted through rituals, traditions, narratives and folk songs (e.g. Smong Song in Simeulue Island) (McAdoo et al., 2006; Rahman et al., 2017; Rahman et al., 2018; Sutton et al., 2021) and defined in a different way as: "local knowledge", "traditional knowledge"*, "indigenous technical knowledge", "peasants knowledge", "traditional environmental knowledge" and "folk knowledge"* (Sillitoe, 1998; Mercer et al., 2007; Mercer et al., 2012).
Memories of previous disasters both inform people's knowledge of their environment and vulnerability and also influence their risk interpretation and response to future disasters (Arunotai, 2008). Collective memory, relying on oral tradition shared by a specific group, most commonly the family, tends to disappear with the death of the last eyewitness to the event (the three-generation limit). Cultural memory, supported by documents (such as newspapers, archives, images) and memorials as tangible signs for the community, ensures that disaster meanings and interpretations are recorded and transmitted from generation to generation. These forms of cultural memory, considered by Mercer (Mercer et al., 2010) as an existing or acquired knowledge set by local communities are born and maintained through the accumulation of experiences, social relations, community practices and institutions, and their transmission across generations.
Garnier and Lahournat's (2022) study highlights how Japan Stone Monuments, representing elements of both tangible and intangible culture for the population, demonstrate the existence of disaster memory and reflect a desire to commemorate and transmit significant past events to current and future generations. These findings highlight the importance of oral transmission between generations about tsunami risk and could be very useful for designing effective

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022


Natural Hazards and Earth System Sciences
Discussions

information and communications activities about tsunami risk reduction (Spahn et al., 2010; Løvholt et al., 2014; Oktari et al., 2018; Sutton et al., 2020).

In ~~the~~ work we also carried out a comparative analysis on tsunami risk perception between the metropolitan areas and the respective coasts (see paragraph 4.1.1), starting from the hypothesis that risk perception could be different among the population residing in a large city and the population of small municipalities distributed along the seaside. The territorial units analyzed were selected based on exposure (higher coastal population density or proximity of major urban settlements to the coast) and territorial vulnerability (high concentration of anthropogenic activities such as industries or intensive tourism activities) according to ISTAT (Italian national statistical institute) data.

The goal of this comparison is both to highlight possible differences in perceptions associated with densely populated urban areas, and to provide a solid basis for targeted risk mitigation actions in specific contexts (for example to improve and better address the Tsunami Ready Program - Valbonesi et al., 2019; Valbonesi, 2022).

The results indicate that in Reggio Calabria, Catania and Naples indeed there are significant differences in the tsunami risk perception compared to the relative seaside. This data is most evident in Reggio Calabria (71%) with a difference of over 25 percentage points compared to the Tyrrhenian (45%) and Ionian (46%) sides of the same region (Calabria).

The data continues to be significant, albeit less evident, for Catania (50%) and the Ionian seaside (46%) and for the city of Naples (47%) and the Tyrrhenian seaside (45%). It is useful to underline that the metropolitan city of Bari, despite being in a stretch of coast considered to be at high risk, has significantly lower values of perception of the tsunami risk (34%), in line with the data for the whole Adriatic coast (32%). Tsunami risk perception in the metropolitan area of Rome seems to be lower than on the Tyrrhenian coast. Probably this is because Rome cannot really be considered a coastal town because most of its over 3 million inhabitants live far from the sea. The presence within the metropolitan area of Rome of the town of Ostia, a very populous municipality (over 231,000 inhabitants) lying along the Tyrrhenian coast, is not enough to raise the overall risk perception of the capital. It would be interesting to deepen this aspect with specific analysis of the local residents, commuters and visitors. Given the city's proximity to the coast (about 20 km), it is also worth considering the large daily (as well as seasonal) tourist flows that in the summer period occur.

The Telepanel data (n = 1,500), collected in the same time period as the third survey, deserve particular attention because they are a representative sample of the population at the national level, that means people predominantly living far from the seaside. Comparing the tsunami risk perception of the Telepanel with the surveys carried out on the coastal population, it emerges that the coastal population on average has a perception of risk significantly higher than the national average of about 20 percentage points. These data suggest that it is necessary to pay particular attention to the coastal tourist areas where every year millions of people spend their holidays. Providing capillary information along the beaches and in the harbors, indicating escape routes and meeting points, establishing redundant alarm systems, are the main tools to be put in place to reduce the tsunami risk of both residents and tourists.

As for the knowledge of tsunamis, we started by considering the different associations linked to the two terms that are commonly used in the Italian language: tsunami and maremoto.

Results indicate that most of the sample is more familiar with the term tsunami (57%). The word tsunami is more familiar to those with a higher level of education (66%) and less familiar to people over 65 years old.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022


Natural Hazards and Earth System Sciences
Discussions

However, there are some differences that appear to be linked to local characteristics and which will be the subject of further investigation.
It is interesting to notice that the two terms are associated with different phenomena. For instance, the term tsunami is mostly related to the occurrence of a great destructive wave, while the word tsunami is more often related to the occurrence of an earthquake.

As for the knowledge of the causes that generate tsunamis, in general the sample correctly attributes the occurrence of a tsunami to earthquakes and to volcanic eruptions, in line with scientific knowledge. Furthermore, tsunami knowledge does not seem to be linked to the gender and the areas of residence of the interviewees but increases according to the educational degree and inversely to age (people with higher education degree and younger than 50 years old appear to be more informed).

Our data indicate that in general people are aware of the possible effects of tsunamis on their regions. However, this knowledge appears to be closely influenced by the media representation of the great tsunamis that occurred in Japan (2011) and Sumatra (2004). This type of media representation could turn out to be misleading with respect to the more modest phenomena that can be generated by smaller tsunamis, more frequently expected in the Italian coastal territory, but also capable of causing serious damage and victims.
Moreover, our data indicate that television continues to play a central role in conveying information relating to the tsunami risk, while the information role played by social media and the web appears to be still marginal. A particularly problematic aspect concerns the poor visibility of scientific institutions, civil protection and local authorities to be recognized by the interviewees as official sources of information on the tsunami risk.

Our results suggest that the loss of memory of past events affects the perception of risk by citizens and communities, making more difficult and even ineffective risk mitigation actions (see for example Kurita et al, 2007; Sugimoto et al. 2010; Arias et al., 2017 and Wei et al., 2017). Memory and recollections (such as commemorations of past events) are relevant for the development of risk mitigation strategies and to increase the population resilience. More specifically, a work of awareness raising aimed at attributing a sense and a meaning to the memory is needed in order to reduce the risk. We believe that the results of this study, although limited to central and southern Italy, can be used in other countries of the NEAM region and worldwide to orient communication strategies and risk reduction actions.

In the near future, given the large amount of data collected in the three surveys, we will focus on the creation of synthetic indexes for the perception and knowledge of tsunami risk.
We are also working to deepen the knowledge related to the cultural differences in the perception of risk which seem to be very influenced by the local culture of reference. We are confident that this will allow us to better explain the differences in perception and knowledge that the data show in the different slopes and metropolitan cities. Finally, our efforts will be focused on translating the results of risk perception analyzes into effective communication strategies for tsunami risk reduction. Not least, the 2018 pilot survey results - published in in the our previous paper - were extensively used in developing and improving the CAT website content. Moreover, several relevant aspects of the study made it possible to better address approaches in risk awareness campaigns such as "Io Non Rischio" (a Civil Protection campaign) as well as undertake dissemination campaigns aimed both to raise awareness and survey tsunami risk perception in schools (one of the Tsunami Ready program indicators).

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

References

Akbar, Z., Suryaratri, R. D., Tri, Y., et al.: Disaster Risk Perception and Household Disaster Preparedness: Lesson Learned from Tsunami in Banten. In IOP Conference Series: Earth and Environmental Science (Vol. 448, No. 1, p. 012099). IOP Publishing, https://doi.org/10.1088/1755-1315/448/1/012099, 2020.

Alam, E.: Earthquake and tsunami knowledge, risk perception and preparedness in the SE Bangladesh. J. Geogr. Nat. Disasters, 6(1), 1-7, http://.doi.org/10.4172/2167-0587.1000154, 2016.

Amato, A.: Some reflections on tsunami early warning systems and their impact, with a look at the NEAMTWS, Boll. Geofis. Teor. Appl. 61, http://.doi.org/10.4430/bgta0329, 2020.

Amato A., Avallone A., Basili R., et al.: From seismic monitoring to tsunami warning in the mediterranean sea. Seismological Research Letters 92 (3): 1796–1816. https://doi.org/10.1785/0220200437, 2021.

Apatu, E. J., Gregg, C. E., Wood, N. J., et al.: Household evacuation characteristics in American Samoa during the 2009 Samoa Islands tsunami. Disasters, 40(4), 779-798, https://doi.org/10.1111/disa.12170, 2016.

Arias, J. P., Bronfman, N. C., Cisternas, P. C., et al.: Hazard proximity and risk perception of tsunamis in coastal cities: Are people able to identify their risk?. PLoS one, 12(10), e0186455, https://doi.org/10.1371/journal.pone.0186455, 2017.

Arunotai, N.: Saved by an old legend and a keen observation: The case of Moken sea nomads in Thailand. In: Shaw, R, Uy, N, Baumwoll, J (eds) Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learnt from the Asia-Pacific Region. Bangkok: UNISDR Asia and Pacific, 73–78, 2008.

Basili, R., Brizuela, B., Herrero, A., et al.: The making of the NEAM Tsunami Hazard Model 2018 (NEAMTHM18). Front. Earth Sci., https://doi.org/10.3389/feart.2020.616594, 2021.

Basili, R., Brizuela, B., Herrero, A., et al.: NEAMTHM18 Documentation: the making of the TSUMAPS-NEAM Tsunami Hazard Model 2018. Istituto Nazionale di Geofisica e Vulcanologia (INGV), http://doi.org/10.5281/zenodo.3406625, 2021.

Behrens, J., Løvholt, F., Jalayer, F., et al.: Probabilistic tsunami hazard and risk analysis: a review of research gaps. Frontiers in Earth Science, 9, 628772, https://doi.org/10.3389/feart.2021.628772, 2021.

Bernardo, A. S., and Petrarca, F.: Letters on familiar matters: Rerum familiarum libri XVII-XXIV. Book XXI and Book, 24, 172-180, 1985.

Bonaiuto, M., Alves, S., De Dominicis, S., et al.: Place attachment and natural hazard risk: Research review and agenda. Journal of Environmental Psychology, 48, 33-53, https://doi.org/10.1016/j.jenvp.2016.07.007, 2016.

895 Boschi, E., Guidoboni, E., Ferrari, et al.: Catalogue of Strong Italian Earthquakes from 461 BC
896 to 1997 (Appendix to volume 43 N° 4, 2000). Annals of Geophysics, 43, 609–868, 2000.
897
898 Brokensha, D. W., Warren, D. M., and Werner, O.: Indigenous knowledge systems and
899 development, University Press of America, Washington D.C., 1980.
900
901 Buylova, A., Chen, C., Cramer, L. A., et al.: Household risk perceptions and evacuation
902 intentions in earthquake and tsunami in a Cascadia Subduction Zone. *International journal of*
903 *disaster risk reduction*, *44*, 101442, https://doi.org/10.1016/j.ijdrr.2019.101442, 2020.
904
905 Cirella, A., Romano, F., Avallone, A., et al.: The 2018 M w 6.8 Zakynthos (Ionian Sea, Greece)
906 earthquake: Seismic source and local tsunami characterization. *Geophysical Journal*
907 *International*, *221*(2), 1043-1054, https://doi.org/10.1093/gji/ggaa053, 2020.
908
909 Cohen, E.: Tourism and land grab in the aftermath of the Indian Ocean tsunami. Scandinavian
910 Journal of Hospitality and Tourism, 11(3), 224-236,
911 https://doi.org/10.1080/15022250.2011.593359, 2011.
912
913 Cronbach, L. J.: Coefficient alpha and the internal structure of tests. Psychometrika, Vol.16,
914 297-334, https://doi.org/10.1007/BF02310555, 1951.
915
916 Cronbach, L. J.: Internal consistency of tests: Analyses old and new. Psychometrika, 53 – 63,
917 https://doi.org/10.1007/BF02294194, 1988.
918
919 Dawson, A.G., Lockett, P., and Shi, S.: Tsunami hazards in Europe. Environment
920 International,30(4), 577 -585, https://doi.org/10.1016/j.envint.2003.10.005, 2004.
921
922 Dekens, J.: Local knowledge for disaster preparedness: A literature review. International
923 Centre for Integrated Mountain Development (ICIMOD), Kathmandu,
924 https://doi.org/10.53055/ICIMOD.474, 2007.
925
926 De Pippo, T., Donadio, C., Pennetta, M., et al.: Coastal hazard assessment and mapping in
927 Northern Campania, Italy. Geomorphology, 97(3-4), 451-466,
928 https://doi.org/10.1016/j.geomorph.2007.08.015, 2008.
929
930 Dogan, G. G., Annunziato, A., Papadopoulos, G. A., et al.: The 20th July 2017 Bodrum–Kos
931 Tsunami Field Survey. Pure and Applied Geophysics, 176(7), 2925-2949,
932 https://doi.org/10.1007/s00024-019-02151-1, 2019.
933
934 Dogan, G.G., Yalçıner, A.C., Yuksel, Y. et al. The 30 October 2020 Aegean Sea Tsunami:
935 Post-Event Field Survey Along Turkish Coast.Pure Appl. Geophys. 178, 785–812:
936 https://doi.org/10.1007/s00024-021-02693-3, 2021.
937
938 Dogulu, N., Karanci, N., and Lavigne, F.: Review of the existing work on tsunami resilient
939 communities and identification of key indicators and gaps. ASTARTE Deliverable, 9(2),
940 2014.
941
942 Douglas, M., and Wildavsky, A.: How can we know the risks we face? Why risk selection is a
943 social process 1. Risk analysis, 2(2), 49-58, https://doi.org/10.1111/j.1539-
944 6924.1982.tb01365.x, 1982.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

945
946 EMDAT: Natural Disasters: Number of deaths by type of natural disaster [WWW Document].
947 Int. Disaster Database, Univ. Cathol. Louvain. Bruselas, Belgica. (Accessed on 03.2022), 2019.
948
949 Fernando, J. L.: NGOs and production of indigenous knowledge under the condition of
950 postmodernity. The Annals of the American Academy of Political and Social Science, 590(1),
951 54-72, https://doi.org/10.1177/0002716203258374, 2003.
952
953 Flavier, J. M., Jesus, A. D., and Navarro, C. S.: The regional program for the promotion of
954 indigenous knowledge in Asia. The cultural dimension of development: indigenous knowledge
955 systems., 479-487, 1995.
956
957 Fraser, S. A., Doyle, E. E., Wright, K. C., et al.: Tsunami response behaviour during and
958 following two local-source earthquakes in Wellington, New Zealand. International Journal of
959 Disaster Risk Reduction, 16, 123-133, https://doi.org/10.1016/j.ijdrr.2016.02.008, 2016.
960
961 Garnier, E.; Lahournat, F.: Japanese stone monuments and disaster memory–perspectives for
962 DRR. Disaster Prev. Manag. Int. J. 2022, 31, https://doi.org/10.1108/DPM-03-2021-0089,
963 2022.
964
965 Gravina T., Mari N., Luca, F., et al.: Tsunami risk perception along the Tyrrhenian coasts of
966 Southern Italy: the case of Marsili volcano. Natural Hazards, 97(1), 437-454,
967 https://doi.org/10.1007/s11069-019-03652-x, 2019.
968
969 Gregg, C. E., Houghton, B. F., Paton, D., et al.: Natural warning signs of tsunamis: human
970 sensory experience and response to the 2004 great Sumatra earthquake and tsunami in
971 Thailand. Earthquake Spectra, 22(3_suppl), 671-691, https://doi.org/10.1193/1.2206791, 2006.
972
973 Grezio, A., Gasparini, P., Marzocchi, W., et al.: Tsunami risk assessments in Messina, Sicily–
974 Italy. Natural Hazards and Earth System Sciences, 12(1), 151-163,
975 https://doi.org/10.5194/nhess-12-151-2012, 2012.
976
977 Ho, M. C., Shaw, D., Lin, S., et al.: How do disaster characteristics influence risk perception?.
978 Risk Analysis: An International Journal, 28(3), 635-643, https://doi.org/10.1111/j.1539-
979 6924.2008.01040.x, 2008.
980
981 ISTAT, R.: Rapporto annuale 2020. La situazione del paese,
982 https://www.istat.it/it/archivio/244848, 2020.
983
984 Jon, I., Lindell, M. K., Prater, C. S., et al.: Behavioral Response in the Immediate Aftermath of
985 Shaking: Earthquakes in Christchurch and Wellington, New Zealand, and Hitachi, Japan.
986 International journal of environmental research and public health, 13(11), 1137,
987 https://doi.org/10.3390/ijerph13111137, 2006.
988
989 Kurita, T., Arakida, M., and Colombage, S. R.: Regional characteristics of tsunami risk
990 perception among the tsunami affected countries in the Indian Ocean. Journal of Natural
991 Disaster Science, 29(1), 29-38, https://doi.org/10.2328/jnds.29.29, 2007.
992
993 Lindell, M. K., and Whitney, D. J.: Correlates of household seismic hazard adjustment
994 adoption. Risk analysis, 20(1), 13-26, https://doi.org/10.1111/0272-4332.00002, 2007.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Lindell, M. K., Prater, C. S., Gregg, C. E., et al.: Households' immediate responses to the 2009 American Samoa Earthquake and Tsunami. International journal of disaster risk reduction, 12, 328-340, https://doi.org/10.1016/j.ijdrr.2015.03.003, 2015.

Lindell, M. K., Prater, C. S., Wu, H. C., et al.: Immediate behavioural responses to earthquakes in Christchurch, New Zealand, and Hitachi, Japan. Disasters, 40(1), 85-111, https://doi.org/10.1111/disa.12133, 2016.

Liu, Y., Yu, J., Yin, Q., et al.: Impacts of human factors on evacuation performance in university gymnasiums. Physica A: Statistical Mechanics and its Applications, 582. https://doi.org/10.1016/j.physa.2021.126236, 2021.

Løvholt, F., Setiadi, N. J., Birkmann, J., et al.: Tsunami risk reduction–are we better prepared today than in 2004?. International journal of disaster risk reduction, 10, 127-142, https://doi.org/10.1016/j.ijdrr.2014.07.008, 2014.

McIvor, O., Napoleon, A., and Dickie, K. M.: Language and culture as protective factors for at-risk communities. International Journal of Indigenous Health, 5(1), 6-25, https://doi.org/10.18357/ijih51200912327, 2009.

McNeill, I. M., Dunlop, P. D., Heath, J. B., et al.: Expecting the unexpected: Predicting physiological and psychological wildfire preparedness from perceived risk, responsibility, and obstacles. Risk Analysis, 33(10), 1829–1843, https://doi.org/10.1111/risa.12037, 2013.

Maramai, A., Brizuela, B., and Graziani, L.: The Euro-Mediterranean tsunami catalogue. Annals of Geophysics. Annals Geoph. 57(4), S0435. doi:10.4401/ag-6437, 2014.

Maramai A., Graziani L., and Brizuela B.: Italian Tsunami Effects Database (ITED). Istituto Nazionale di Geofisica e Vulcanologia (INGV). https://doi.org/10.13127/tsunami/ited.1.0, 2019

Maramai, A., Graziani, L., and Brizuela, B.: Italian tsunami effects database (ITED): the first database of tsunami effects observed along the Italian coasts. Frontiers in Earth Science, 9, 596044, https://doi.org/10.3389/feart.2021.596044, 2021.

Maramai, A., Brizuela, B., and Graziani, L.: A Database for Tsunamis and Meteotsunamis in the Adriatic Sea. Applied Sciences, 12(11), 5577, https://doi.org/10.3390/app12115577, 2022.

Martin, W. E., Martin, I. M., and Kent, B.: The role of risk perceptions in the risk mitigation process: the case of wildfire in high risk communities. Journal of environmental management, 91(2), 489-498, https://doi.org/10.1016/j.jenvman.2009.09.007, 2009.

Mauelshagen, F.: Flood disasters and political culture at the German North Sea coast: a long-term historical perspective. Historical Social Research, 32(3), 133-144. https://doi.org/10.12759/hsr.32.2007.3.133-144, 2007.

McAdoo, B. G., Dengler, L., Prasetya, G., et al.: Smong: How an oral history saved thousands on Indonesia's Simeulue Island during the December 2004 and March 2005 tsunamis. Earthquake Spectra, 22(3_suppl), 661-669, https://doi.org/10.1193/1.2204966, 2006.

1045
1046 McIvor, O., Napoleon, A., and Dickie, K. M.: Language and culture as protective factors for
1047 at-risk communities. International Journal of Indigenous Health, 5(1), 6-25,
1048 https://doi.org/10.18357/ijih51200912327, 2009.
1049
1050 Mercer, J., Dominey-Howes, D., Kelman, I., et al.: The potential for combining indigenous and
1051 western knowledge in reducing vulnerability to environmental hazards in small island
1052 developing states. Environmental Hazards, 7(4), 245-256,
1053 https://doi.org/10.1016/j.envhaz.2006.11.001, 2007.

1054
1055 Mercer, J., Kelman, I., Taranis, L., et al.: Framework for integrating indigenous and scientific
1056 knowledge for disaster risk reduction. Disasters, 34(1), 214-
1057 239, https://doi.org/10.1111/j.1467-7717.2009.01126.x, 2010.

1058 Moscovici, S.: La psychoanalyse, son immage et son publique, Paris, PUF,
1059 https://doi.org/10.2307/3319763, 1961.

1060 Moscovici, S.: Social influence and social change, London, Accademic Press, trad.it.
1061 Psicologia delle minoranze attive, Torino, Boringhieri, in Palmonari, A. (1995), Processi
1062 simbolici e dinamiche sociali", Bologna, Il Mulino, 1976.

1063 Musacchio, G., Eva, E., Crescimbene M., et al.: A protocol to communicate seismic risk in
1064 schools: design, test and assessment in Italy. Ann. Geophys. 64(3) https://doi.org/10.4401/ag-
1065 8533, 2021.
1066
1067 National Geophysical Data Center/World Data Service: NCEI/WDS global historical tsunami
1068 database. National Oceanic and Atmospheric Administration, National Centers for
1069 Environmental Information. https://doi.org/10.7289/V5PN93H7, 2017 [access 07.2022].
1070
1071 Necmioğlu, Ö., Turhan, F., Özer Sözdinler, C., et al.: KOERI's tsunami warning system in the
1072 eastern mediterranean and its connected seas: a decade of achievements and challenges.
1073 Applied Sciences, 11(23), 11247, https://doi.org/10.3390/app112311247, 2021.
1074
1075 Nunnally, J. C.: Psychometric theory—25 years ago and now. *Educational Researcher*, *4*(10),
1076 7-21. https://doi.org/10.3102/0013189X004010007, 1975.
1077
1078 Oktari, R. S., Shiwaku, K., Munadi, K., et al.: Enhancing community resilience towards
1079 disaster: The contributing factors of school-community collaborative network in the tsunami
1080 affected area in Aceh. International Journal of Disaster Risk Reduction, 29, 3-12,
1081 https://doi.org/10.1016/j.ijdrr.2017.07.009, 2018.
1082
1083 Papadopoulos, G. A., Gràcia, E., Urgeles, R., et al.: Historical and pre-historical tsunamis in
1084 the Mediterranean and its connected seas: Geological signatures, generation mechanisms and
1085 coastal impacts. Marine Geology, 354, 81-109, https://doi.org/10.1016/j.margeo.2014.04.014,
1086 2014.
1087
1088 Peterson, R.: A Meta-Analysis of Cronbach's Coefficient Alpha. Journal of Consumer
1089 Research. 21. 381-91. 10.1086/209405. http://doi.org/10.1086/209405, 2014.
1090

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

1091 Paton, D., Sagala, S., Okada, N., et al.: Making sense of natural hazard mitigation: Personal,
1092 social and cultural influences. Environmental Hazards, 9(2), 183-196,
1093 https://doi.org/10.3763/ehaz.2010.0039, 2010.
1094
1095 Rafliana, I., Jalayer, F., Cerase, A., et al.: Tsunami risk communication and management:
1096 Contemporary gaps and challenges. International Journal of Disaster Risk Reduction, 102771,
1097 https://doi.org/10.1016/j.ijdrr.2021.102771, 2022.
1098
1099 Rahman, A., Sakurai, A., and Munadi, K.: The analysis of the development of the Smong story
1100 on the 1907 and 2004 Indian Ocean tsunamis in strengthening the Simeulue island community's
1101 resilience. International journal of disaster risk reduction, 29, 13-23,
1102 https://doi.org/10.1016/j.ijdrr.2017.07.015, 2018.
1103
1104 Rahman, A., Sakurai, A., and Munadi, K.: Indigenous knowledge management to enhance
1105 community resilience to tsunami risk: Lessons learned from Smong traditions in Simeulue
1106 island, Indonesia. In IOP Conference series: earth and environmental science (Vol. 56, No. 1,
1107 p. 012018). IOP Publishing, https://doi.org/10.1088/1755-1315/56/1/012018, 2017.
1108
1109 Rippl, S.: Cultural theory and risk perception: a proposal for a better measurement. Journal of
1110 risk research, 5(2), 147-165, https://doi.org/10.1080/13669870110042598,2002.
1111
1112 Ritchie, H., and Roser, M.: Natural Disasters. Our World in Data. The BE Journal of Economic
1113 Analysis and Policy, 8(1), 1935-1682, Available on line:
1114 https://ourworldindata.org/grapher/natural-disaster-death-
1115 rates?time=1900..2018&country=~All+natural+disasters, 2009 (accessed on July 2022).
1116
1117 Rosi, M., Levi, S. T., Pistolesi, M., et al.: Geoarchaeological evidence of middle-age tsunamis
1118 at Stromboli and consequences for the tsunami hazard in the Southern Tyrrhenian Sea.
1119 Scientific reports, 9(1), 1-10, https://doi.org/10.1038/s41598-018-37050-3, 2019.
1120
1121 Šepić, J., Vilibić, I., and Belušić, D.: Source of the 2007 Ist meteotsunami (Adriatic Sea).
1122 Journal of Geophysical Research: Oceans, 114(C3), https://doi.org/10.1029/2008JC005092,
1123 2009.
1124
1125 Sillitoe, P.: The development of indigenous knowledge: a new applied anthropology. Current
1126 anthropology, 39(2), 223-252, https://doi.org/10.1086/204722, 1998.
1127
1128 Slovic, P., and Peters, E.: Risk perception and affect. Current directions in psychological
1129 science, 15(6), 322-325, https://doi.org/10.1111/j.1467-8721.2006.00461.x, 2006.
1130
1131 Slovic, P., and Weber, E. U.: Perception of risk posed by extreme events. in risk management
1132 strategies in an uncertain world. Palisades, NY, 2002.
1133
1134 Slovic, P.: Perception of risk. Science 236, 280–285 https://doi.org/10.1126/science.3563507,
1135 1987.
1136
1137 Slovic, P., Fischhoff, B., and Lichtenstein, S.: Why study risk perception?. Risk analysis, 2(2),
1138 83-93, https://doi.org/10.1111/j.1539-6924.1982.tb01369.x, 1982.
1139
1140

Solov'ev, S. L., Soloviev, S. L., Solovieva, O. N., et al.: Tsunamis in the Mediterranean Sea 2000 BC-2000 AD (Vol. 13). Springer Science and Business Media, 2000.

Spahn, H., Hoppe, M., Vidiarina, H. D., et al.: Experience from three years of local capacity development for tsunami early warning in Indonesia: challenges, lessons and the way ahead. Natural Hazards and Earth System Sciences, 10(7), 1411-1429, https://doi.org/10.5194/nhess-10-1411-2010, 2010.

Student: The probable error of a mean. Biometrika 6:1–25, https://doi.org/10.2307/2331554, 1908.

Sugimoto, M., Iemura, H., and Shaw, R.: Tsunami height poles and disaster awareness: Memory, education and awareness of disaster on the reconstruction for resilient city in Banda Aceh, Indonesia. Disaster Prevention and Management: An International Journal, 19(5), 527-540, https://doi.org/10.1108/09653561011091869, 2010.

Sun, Y., Yamori, K., Tanisawa, R., et al.: Consciousness of disaster risk and tsunami evacuation: a questionnaire survey in Okitsu, Kochi Prefecture. Journal of Natural Disaster Science, 34(2), 127-141, https://doi.org/10.2328/jnds.34.127, 2013.

Sutton, S. A., Paton, D., Buergelt, P., et al.: Sustaining a Transformative Disaster Risk Reduction Strategy: Grandmothers' Telling and Singing Tsunami Stories for over 100 Years Saving Lives on Simeulue Island. International Journal of Environmental Research and Public Health, 17(21), 7764, https://doi.org/10.3390/ijerph17217764, 2020.

Sutton, S. A., Paton, D., Buergelt, P., et al.: Nandong Smong and Tsunami lullabies: Song and music as an effective communication tool in disaster risk reduction. International Journal of Disaster Risk Reduction, 65, 102527, https://doi.org/10.1016/j.ijdrr.2021.102527, 2021.

Tinti, S., and Armigliato, A.: The use of scenarios to evaluate the tsunami impact in southern Italy. Marine Geology, 199(3-4), 221-243, https://doi.org/10.1016/S0025-3227(03)00192-0, 2003.

Triantafyllou, I.; Gogou, M.; Mavroulis, S. et al.: The Tsunami Caused by the 30 October 2020 Samos (Aegean Sea) Mw7.0 Earthquake: Hydrodynamic Features, Source Properties and Impact Assessment from Post-EventField Survey and Video Records. J. Mar. Sci. Eng. 2021, 9, 68. https://doi.org/10.3390/jmse 9010068, https://doi.org/10.3390/jmse9010068, 2021.

UNESCO-IOC (Intergovernmental Oceanographic Commission); 2017: 10 years of the north-Eastern Atlantic, the Mediterranean and connected seas Tsunami Warning and mitigation System (NEAMTWS): accomplishments and challenges in preparing for the next tsunami. IOC/INF-1340, 59 pp., https://unesdoc.unesco.org/ark:/48223/pf0000247393, 2017.

UNESCO-IOC: Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS) 2005–2020. https://unesdoc.unesco.org/ark:/48223/pf0000373791, 2020.

Vilibić, I., and Šepić, J.: Destructive meteotsunamis along the eastern Adriatic coast: Overview. Physics and Chemistry of the Earth, Parts A/B/C, 34(17-18), 904-917, https://doi.org/10.1016/j.pce.2009.08.004, 2009.

Valbonesi, C., Amato, A., and Cugliari, L.: Tsunami Ready in Italy: first steps. In EGU General Assembly Conference Abstracts (pp. EGU21-12521), https://doi.org/10.5194/egusphere-egu21-12521, 2021.

https://doi.org/10.5194/nhess-2022-212
Preprint. Discussion started: 6 September 2022

Valbonesi, C.: Tsunami Ready Programme in NEAM region: strategies, responsibilities and further advancements to protect communities from tsunamis (No. EGU22-11876). Copernicus Meetings, https://meetingorganizer.copernicus.org/EGU22/EGU22-11876.html?pdf, 2022.

Wachinger, G., Renn, O., Begg, C., et al.: The risk perception paradox—implications for governance and communication of natural hazards. Risk analysis, 33(6), 1049-1065, https://doi.org/10.1111/j.1539-6924.2012.01942.x, 2013.

Wei, H. L., Wu, H. C., Lindell, M. K., et al.: Assessment of households' responses to the tsunami threat: A comparative study of Japan and New Zealand. International Journal of Disaster Risk Reduction, https://doi.org/10.1016/j.ijdrr.2017.09.011, 2017.

Wildavsky, A., and Dake, K.: Theories of risk perception: Who fears what and why?. Daedalus, 41-60, http://www.jstor.org/stable/20025337, 1990.

Yalçıner, A., Annunziato, A., Papadopoulos, G., et al.: The 20th July 2017 (22: 31 UTC) Bodrum-Kos Earthquake and Tsunami: Post Tsunami Field Survey Report. Report published online on www. emsc-csem. Org, 2017.