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Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS)
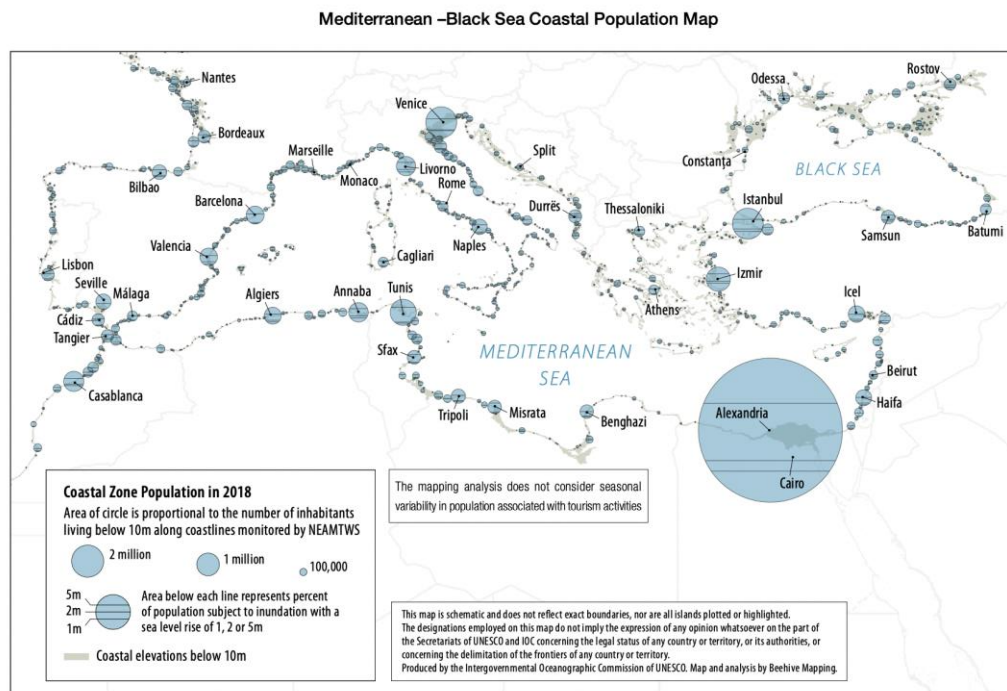
Development of a Coastal Multi-Risk Perception, Resilience Study and Survey Questionnaires

Tsunami, Storm Surge, Sea Level Rise

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1. Introduction

Coastal zones are naturally exposed to different ocean hazards. Human induced climate change favors the increase in frequency and intensity of storm surges and sea level rise (SLR). Tsunami is an additional low frequency, but high consequence and impact coastal hazard. These ocean hazards pose a serious threat to most coastal communities around the globe. Several South-Mediterranean countries are highly vulnerable to tsunamis, SLR and storm surges as they have densely populated coastal areas and hold a large share of coastal tourism activities. A coastal zone population map for the North-Eastern Atlantic, Mediterranean and Connected Seas (NEAM) region produced by IOC/UNESCO in 2020 (Fig. 1) shows that around 116 million inhabitants in 2018 lived in the Low Elevation Coastal Zone (LECZ; coastal elevation below 10m), highlighting the vulnerability of the NEAM region to coastal hazards.

Fig. 1 NEAM coastal population map, IOC-UNESCO 2020

According to NOAA's Global Historical Tsunami Database, between 2000 BC and 2019, from all documented tsunamis, 15% have been recorded in the Mediterranean Sea[1]. The IPCC's recently published Assessment Report 6 (AR6; 2021) provides new evidence for future climate change impacts on Earth's system. With an improved and more holistic modeling approach, climate change impacts can be predicted more precisely. On a global scale, the shared socio-economic pathway (SSP) SSP5-8.5 scenario could lead to a global SLR of 0.23m by 2050 and 0.77m by 2100, relative to the period from 1995 to 2014 (IPCC, 2021). Storm surges will increase because of rising ocean surface and sea surface temperatures and will have stronger repercussions on coastal zones with rising sea levels. An increase in the intensity and

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[1] https://doi.org/10.7289/V5PN93H7

frequency of storms could be devastating for populations living in coastal zones and exposed assets.

Despite existing models and probabilistic forecasts for all the three hazards, the risks posed by them are largely underestimated in South-Mediterranean countries. Regulations, policies, standard operating procedures, and reliable preparedness measures are usually lacking. In the case of a significant event, in particular tsunami, these gaps could be disastrous in terms of human life loss. Not only on a governmental level these risks are sparsely addressed, also among coastal populations and tourists, the rapid and slow onset hazards may not be perceived in the right way, impacting considerably disaster responses. Awareness on the coastal hazards, risks, and appropriate responses must be enhanced to enable proper timely actions when individuals discern the precursors of an imminent disaster.

To better understand the current level of risk perception of sea level related hazards in countries in the North-Eastern Atlantic, Mediterranean and Connected Seas (NEAM) region, a preliminary literature was carried out for the NEAM region, which then focused on the following selected South-Mediterranean countries: Cyprus, Egypt, Malta, and Morocco. It highlights current knowledge on sea level related hazards and risk perceptions, the methods as well as approaches used in earlier studies. We also propose an approach and methodology to guide the development of a multi-risk perception and resilience study on tsunami, storm surge, and sea level rise in the selected countries, based on existing studies. Moreover, the literature review helps to determine research gaps, which will guide the present study.

2. Current state of sea level related risk knowledge

2.1. Sea level related risk perceptions in the NEAM region

The currently available literature on perceptions of tsunami and other sea level related risks (SLR and storm surge) for the NEAM region is sparse. Some efforts have been made in investigating local populations' risk perceptions, especially through a project funded by the European Union (EU), the Assessment, STrategy and Risk Reduction for Tsunamis in Europe (ASTARTE) project. Between 2013 and 2016, it aimed at increasing the tsunami resilience in the NEAM region through improving preparedness of coastal communities. Therefore, six objectives have been defined[2]: i) Assessing long term recurrence of tsunamis; ii) Improving the identification of tsunami generation mechanisms; iii) Developing new cost-effective computational tools for hazard assessment; iv) Ameliorate the understanding of tsunami interactions with coastal structures; v) Enhance tsunami detection capabilities, forecast and early warning skills in the NEAM region; and vi) Establishing new approaches to quantify vulnerability and risk and to identify the key components of tsunami resilience and their implementation in the NEAM region.

In the framework of the ASTARTE project, the perception of tsunami risk has been investigated in nine different test sites (Goeldner-Gianella et al. 2017; ASTARTE, 2017; Liotard et al. 2017), from which one was situated in our area of interest (Tangier, Morocco). The eight other test sites were situated in France, Greece, Italy, Norway, Portugal, Spain, and Turkey. A total of more than 1500 people have been interviewed in the NEAM region, in places with high tsunami risk from different sources (earthquake, rockslide, volcanic eruption). The findings of this project indicate that European and North-African coastal cities, such as Tangier, display a range of different awareness, preparedness and understanding levels for the tsunami hazard. This suggests that tsunami risk must be addressed in a context specific setting. While people in Sines (Portugal) and Tangier are mostly aware of the tsunami hazard (71,4% of interviewed people in Sines and 75,3% in Tangier were aware of the threat posed to their cities), they remain not very resilient to the tsunami hazard, as they have poor knowledge about past events, tsunami triggering sources, early warning systems and preparedness measures. There is an underestimation of tsunami risks on the Atlantic coast, whereas tsunami risk is overestimated in the Western Mediterranean. The extensive studies showed also that exposed people did not have the most appropriate behaviors and intentions regarding tsunamis (e.g. refusal of evacuation or need to confirm event with family members before starting to evacuate). The lack of appropriate tsunami information (absence of official evacuation sites, poor signages) reflects the low level of preparedness measures and risk perception at different levels. Another important finding is that tourists travelling to highly exposed coastal areas are even less informed and aware about prevailing coastal risks than local populations. It is argued that no appropriate tsunami risk culture exists in Europe, due to long return times of tsunamis, which lead people to underestimate the risk. These findings show that even in countries which theoretically have all the means to better prepare for tsunamis, lack basic information and education on the topic. These findings are important to take into account in order to design and improve Disaster Risk Reduction (DRR) and Disaster Risk Management (DRM) strategies.

Another recent study and survey to draw on in the NEAM region about tsunami risk perceptions is the study of Cerase *et al.* (2019), that was carried out in two pilot regions in Italy, among 1021 people, representing about 3.2 million people. With computer assisted telephone interviews (CATI), the researchers investigated the current level (if any) of the coastal population's tsunami risk perception in highly exposed sites subject to long return times. The survey showed that the risk of a tsunami occurring in this area is underestimated by half of the surveyed sample; regional disparities of risk perception are visible, probably influenced by more recent risk experience. Further findings suggest that risk perception among

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[2] http://www.astarte-project.eu/index.php/astarte-objectives.html

the surveyed population varies depending on the type of risk, the risk context, and the specific background of the person. However, it should be noted that both, the ASTARTE project, and the study of Cerase et al. (2019) are limited to tsunami risk. They only focus on tsunami risk perception, a hazard with long return times and do not consider other coastal hazards.

A very comprehensive study of the German North Sea coast (González-Riancho et al., 2015) aimed to better investigate storm surge risk by assessing the resilience of a community, which depends on institutional, legal, and social capacities. Risk perceptions among stakeholders differ from citizens' risk perceptions, leading to inefficient DRR strategies. In order to address this discrepancy, they suggest involving citizens' risk perception from the beginning of the development of DRR strategies.

Birkmann et al. (2010) carried out a study on the tsunami risk in Cadiz (Spain), in order to identify how tsunami risk could be assessed and measured. They highlighted that local risk perception is quasi-inexistent and risk reduction authorities do not yet seriously include the tsunami risk in DRR strategies, thus risk perception has not been further investigated. It should be noted for effective people-centered EWS to work, information about people's vulnerability and response capacities are urgently needed.

In Turkey, some research work has been done on the perception of coastal flood risk in general, however not particular on sea level rise. Yildiz et al. (2021) investigated children's (11 to 14 years) risk perception and knowledge on flood preparedness, with promising but improvable outcomes. Children's perception of flooding as well as preparedness measures in the city of Gölcük is quite good and assessments after a local event, proved that children placed even more importance on preparedness measures. Another flood hazard perception study among almost 900 people revealed that most local people have already experienced a flooding and were thus aware of this hazard and expect loss of property or life (Anilan and Yüksek, 2017). An interesting finding was that local people perceived that preparedness and mitigation measures are a shared responsibility among citizens and municipalities. However, no tsunami risk and storm surge perception study has been found for Turkey.

In Greece the efficiency of TEWS has been investigated (Papadopoulos et al., 2020; Heidarzadeh et al., 2017), as well as the long-term impact of recovery for resilience (Coccossis et al., 2021) or the assessment of vulnerability to the tsunami hazard (Papathoma et al., 2003). Studies on the perception of ocean related risks, especially tsunamis are very rare. A study on natural hazard perception in general on Sporades Island (Greece), including floods and tsunamis, showed that risk is perceived in terms of expected damage and loss and not in terms of probability to occur (Karanikola et al., 2015). They found also that citizens wished for better and more neutral risk communication, i.e., without exaggerating or underestimating the real situation as well as preferred communication channels – findings that might help improve natural hazard management and communication. In the framework of the ASTARTE project, Papageorgiou et al. (2015) rolled out a questionnaire among 113 people in Heraklion, of which only 46% were locals, to investigate tsunami risk perception. Risk perception and knowledge among the local population was very low, even visitors showed better knowledge on the topic.

None of these studies carried out in the NEAM region considered multi-hazard risk perception, which is a crucial element to guide decision makers and disaster risk managers in designing appropriate integrated policies and guidelines and save lives in the case of such events. People also respond constantly to a plurality of risks, rather than to a single hazard and risk. The literature review shows that children and young adults are underrepresented in risk perception studies, yet they are key elements and driving forces in preparedness and evacuation measures by communicating their knowledge to parents and other family members (Mitchell, 2008). This could be useful, in particular in communities where the elderly and vulnerable people are more isolated from their surrounding communities. The studies carried out are relatively small in terms of their scope.

The IOC UNESCO's Tsunami Ready programme aims to achieve 100% vulnerable coastal communities to be Tsunami Ready by 2030. To effectively address this ambitious goal and to support TR implementation, it should be considered to increase efforts in understanding ocean hazard perceptions. Existing studies may consider DRR approaches, but lack integrating a holistic resilience approach, that leverages individual's risk perceptions in designing preparedness, risk reduction and adaptation strategies, communication, and educational materials.

2.2. Sea level related risk perceptions in the target countries

To date, coastal hazard risk perception is not very well understood in South Mediterranean countries, as the risks are generally underestimated, by politicians, decision makers and citizens, even though the threats are well known and understood among the scientific community. Tsunami and other sea level related hazards, coastal exposure, vulnerability and risks are heterogeneous, depending on region and area (e.g. densely populated areas; different importance of economic sector; presence of critical infrastructures in coastal areas) among the South Mediterranean countries. Hazards will occur regardless of any precautionary measures, whereas vulnerability is sought to be a dynamic process, that is always context specific (Ivčecić et al., 2021). According to the UN University and the Institute for Environment and Human Security (UNU-EHS, 2014), vulnerability refers to the "propensity or predisposition to be adversely affected", highlighting the changing character of vulnerability, depending on underlying conditions such as poverty or aging populations.

For example, Jelinek et al. (2009) assessed the risk of tsunamis in Alexandria as high, due to the fact of historical tsunamis in 365 AD and 1303 that have destroyed the world city of Alexandria back then. Tsunamis in the NEAM region have relatively long return times (Cerase et al., 2019) and slow-onset risks such as sea level rise can be problematic as repercussions are not felt directly, leading to an underestimation of risks. Morocco and Egypt for instance have experienced several tsunamis in the past and currently exhibiting high coastal exposure (i.e. population, tourism). It should be noted that disaster risk reduction plans in these countries usually identify coastal hazards such as tsunamis, storm surges or sea level rise and acknowledge the risks posed by them. However, seemingly there is a lack of appropriate community driven risk evacuation maps or preparedness measures (for example Egypt's national plan to reduce disaster risk, National Committee for Crisis Management and Disaster Risk Reduction (NCCMDRR)).

A handful of studies exist that investigate local risk awareness or perception of tsunami and other sea-level related hazards in Morocco, Egypt, Spain, and Malta, but none for Cyprus. Ivčević et al. (2020) provided the only multi-hazard (earthquake, SLR, tsunamis, landslides, soil erosion) risk awareness study that could be found for Morocco (Tangier, Tetouan, Al Hoceima). They highlighted the vulnerability of the North Moroccan region, naturally prone to natural hazards, as it has an important economic, demographic and touristic value. They considered that the discrepancy between scientifically founded knowledge and its traditional and local appropriation is increasing the vulnerability of populations.

Studies from Paradise (2011) in Agadir (Morocco) and Omira et al. (2013) in El Jadida (Morocco) show similar results. While Omira et al. note that there is a need for a robust TWS and the absence of defense structures in a highly exposed area could be an indicator of low risk perception at decision level, Paradise highlights people's association of tsunamis with divine punishments, suggesting that the socio-cultural background might play an important role in risk preparedness.

Appleby-Arnold (2020) used a bottom-up approach to investigate disaster preparedness in Malta. Participants of a one-day "Citizen Summit" seemed to be very interested in disaster preparedness, not least because of their bad intentions regarding disaster response and preparedness: After having experienced an earthquake, most of the Maltese would call family or friends to verify the event and eventually get advice.

One study has explored the vulnerability of Morocco's Nador lagoon to SLR and storm surge hazards, suggesting that the area could become an area of high risk, if the (at this time) still sparsely populated lagoon won't see appropriate policies to limit urbanization of the region, increasing vulnerabilities (Raji et al., 2013). The risk perception has not been addressed.

Kloos et al. (2015) concluded that slow onset hazards such as SLR in Alexandria, Egypt, usually imply low levels of hazard risk perceptions as there is no immediate danger. Preventive resettlements of parts of Alexandria's most vulnerable areas, are not perceived as an adequate solution. In this regard, it would be interesting to explore if there is a nexus between communities' unwillingness to resettle as a preventive measure and the willingness or not to evacuate in the face of an imminent threat, considering the availability of new tools (Community Tsunami Ready).

Our review shows that sea level hazard risk perception studies in the NEAM region are relatively rare. Most importantly, apparently, there are no multi-coastal hazard risk perception studies although the NEAM region is highly exposed to coastal hazards such as tsunamis, sea level rise and storm surges, or a combination of all of them, which could have disastrous consequences, in terms of loss of lives as well as economic and cultural damage. Especially children's perception to multi-hazards and risks is not very well investigated, despite children possibly being important levers for building strong disaster risk resilience.

2.3. Resilience

The broader goal of the study relates with current challenges in Disaster Risk Reduction (DRR), EWS and "Resilience". The concept of resilience is complex and not easy to understand or describe, as it has undergone many uses, applications, changes, and adaptations over the last century.

Alexander (2013) analyzes the concept very well and leads the reader through different scientific domains, their appropriation of the concept and how it evolved. In particular, he noted that the term's popularity and versatility have led to confusion and ambiguity, especially because it is often used without clarifying its meaning and how it is used and referred to in other disciplines. Alexander (2013) mentions the challenges of using the concept in the field of DRR. He explained that the term resilience can be used for every system that experiences a shock, regardless of the nature or magnitude of that shock. Mathevet and Bousquet (2014) for example described the resilience of socio-ecological systems as follows: a resilient system has the "capacity to absorb disturbances of natural or human origin and to reorganize itself so as to maintain its functions and structure". According to the authors, an increased resilience of socio-ecological systems will allow us to better respond to future shocks and disturbances from natural or human origin. The IPCC (2012) adds the time dimension to the concept by defining resilience as: "The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions". Thus, a higher resilience is what a society should aim for. There are various definitions and understandings of resilience, but almost all of them have one characteristic in common: they all express the dynamism of the system that is undergoing or will undergo a shock. Despite the large number of literature on the topic of resilience, Abeling and Chang Seng et al. (2018) noted that the concept still lacks the social dimension and focuses too much on environmental characteristics. Nevertheless, this gap is now increasingly being pointed out by research. In earlier works, a particular focus was brought on interdisciplinary research at the individual and collective levels through a dedicated project called emBRACE (emBRACE 2012a, 2012b). Abeling and Chang Seng et al. (2018) also noted a divergent conceptualization: while the grey literature conceives resilience more as an outcome than a process, the academic literature is unwilling to see it as something fixed. The emBRACE project aimed to build better resilience to natural disasters in Europe by identifying all dimensions of resilience in a socio-ecological system, thus particularly

considering the social dimension of DRR. The project aimed at creating networks of active stakeholders and sharing knowledge in DRR and DRM, not only within governments or NGOs, but also among local populations that are exposed to sea level related hazards and finally the communities they form. The latter form a social capital that can be translated into more or less active networks as well as into relationships of trust and cooperation with those responsible for crisis management. Improving these relationships is essential for collective resilience but should not be considered as a direct indicator for measuring the resilience of a community. Almedom (2013) noted that 'outside' experts cannot build an individual's or a community's resilience, but only provide impulses to build resilience through self-organization and local governance. It should be kept in mind that resilience building is an adaptive and ongoing process, that depends on various indicators and their interdependencies. Weichselgartner and Kelman (2015) noted one of the currently biggest gaps of DRR and Early Warning Systems (EWS): resilience should be a shared responsibility of the whole society, and not only for the risk managers and associated organizations. However, for EWS to be successful, their benefits need to be recognized politically and obtain appropriate budget, policies, and legislation from the local to the national level (Golnaraghi, 2012).

Common practices and exercises around education, awareness raising, and preparedness measures carried out today are still based on a "top-down" approach. Project activities and decision-makers often try to implement a methodology that they consider useful to the exposed populations, however, without considering populations' knowledge or shortcomings about risk management. But this people centered approach is essential to DRR, as the literature review shows that developing good and effective disaster risk management plans - that can be easily understood and implemented by the exposed and vulnerable populations - requires a "bottom up" approach. A bottom-up approach emphasizes the need to listen to and actively engage with local populations to understand how they perceive risks and what they feel is the best solution to tackle DRR and lead to effective resilience construction among the affected population (UNESCO Office Apia, 2014; Perry and Lindell, 2003; Blaikie et al., 2005; Almedom, 2013; González-Riancho et al., 2015).

The "Sharing Perceptions of Adaptation, Resilience and Climate Knowledge" (SPARCK) (UNESCO Office Apia, 2014) project is a good example for a "bottom-up" approach in DRR, where the intervention and participation of local people in understanding risk perceptions and finding solutions is desired. The SPARCK project, carried out in three pacific island countries, engaged local populations to investigate their perception on climate change and tried to examine their decision-making processes as well as their adaptive capacities. Better understanding local populations' perceptions and gaps in knowledge provide valuable information for resilience building. This example of investigating climate change perceptions can be adapted to other contexts in the DRR field, for example in the proposed study, extending its application to other stakeholders, institutions, and hazards. Only when the different actors' and stakeholders' points of view are understood and embraced, appropriate education measures and incentives can drive change for a more effective and efficient disaster risk reduction methodology, eventually leading to a better resilience of the socio-ecological system. Risk management actors should, when developing risk reduction strategies, incorporate the results of the participatory approach while including scientific expertise to ensure that the proposed DRR measures are understood and adopted by individuals and the whole community.

The same applies to risk communication, which nowadays still follows an unilinear, top-down approach. As each disaster is context specific, so is risk communication, often times failing because local people were not sufficiently listened to. Poljansek et al. (2017) highlight that one dimension of resilience can be addressed when using different risk communication channels at the same time, provided risk perception has been understood and incorporated. They emphasize the role of (innovative) technologies and social media in effective disaster risk communication at different levels.

2.4.   Existing survey methods

Several methodologies exist for carrying out surveys. In the reviewed literature Computer Assisted Telephone Interviews (CATI), telephone and in-person surveys were among the most used methods. Cerase et al. (2019) used the CATI method and interviewed a sample of around 1000 people. In the framework of the ASTARTE project, around 1500 in-person interviews in 9 test sites were conducted (Baptista et al., 2017; Goeldner-Gianella et al., 2017; and Liotard et al., 2017). Therefore, people were randomly approached at the beaches. A comparative study regarding disaster preparedness in Malta and Romania used a very interesting approach: the empirical data for the study has been collected during a one-day public event labeled as "Citizen Summit" (Appleby-Arnold et al., 2020). Another comparative study in France and Romania (Constantin et al., (2018) among a sample of 250 interviewees (shop owners, employees, local populations, and people representing authorities and tourists) showed the importance of interviewing different stakeholders. Thus, we acknowledge that the multi-hazard study to be carried out, should be based on interviewing three to four different target groups, seems to be an important aspect. Elshirbiny et al. (2020) used an online survey and semi-structured interviews to get empirical data on public risk perception of climate change in Egypt.

2.5.   Implementation strategy / framework

The Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO), in particular the Tsunami Unit contribute to IOC's High Level Objectives[3] by assisting Member States to assess in particular tsunami risk in local communities, to implement and coordinate effective Early Warning Systems (EWS), as well as to educate communities on the risks and appropriate preparedness measures. In close collaboration with different Working Groups (WGs) and Task Teams (TTs), the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) and the IOC Secretariat constantly strive to achieve the NEAMTWS strategy that is based on three EWS pillars. Pillar three on Tsunami Education, Awareness and Preparedness in NEAM region needs special attention. Thus, for the IOC to effectively enhance pillar three, it is imperative to better understand and improve coastal hazard risk perception in exposed communities, as well as to broaden the knowledge and science on this important topic.

Besides the ambitions and aspirations of the ICG/NEAMTWS, the UN Decade of Ocean Science for Sustainable Development (2021-2030) proposes a framework for "the science we need, for the ocean we want". Two of the seven societal outcomes are: "*A safe ocean where people are protected from ocean hazards*" and "*A predicted ocean where society has the capacity to understand current and future ocean conditions*". Actions that could be taken in favor of these expected outcomes in the framework of the proposed study are the development or the update of national policies, regional and national capacity development activities or plans, and the improvement of EWS.

2.6.   Key objectives of the proposed study

A multi-hazard risk perception study would be desirable in the following selected South Mediterranean countries, displaying various levels of exposure, vulnerability, and risks to tsunamis, SLR and storm surge hazards: Cyprus, Egypt, Malta / Spain, and Morocco.

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[3] https://ioc.unesco.org/about/mission-vision

Based on the literature review and identified research gaps, the following six key objectives for conducting a multi-hazard risk perception study in the selected South Mediterranean countries are proposed:

i. Collect data on target groups' knowledge and characterization of sea-level related hazards (tsunamis, sea-level rise, and storm surge): Assess how the target groups perceive and understand the risks posed by these ocean sea level related hazards in order to understand different perspectives on and levels of risk perception, as well as to identify crucial gaps and misconceptions related to risk perception.

ii. Investigate target groups' preparedness measures and response patterns, including the willingness to evacuate in the case of an anticipated sea level related event.

iii. Better understand the target groups' incentives to change behaviors (e.g. willingness to evacuate) and identify people's trust and confidence in risk management authorities and governments.

iv. Improve awareness and education measures in the target countries, as well as improving communication strategies.

v. Support the establishment of pilot Tsunami Ready communities in the selected countries.

vi. Contribute to better measure the status of resilience among the pilot communities.

2.7. Implications for NEAMTWS' programme on 'Tsunami Ready'

A Tsunami Ready (TR) Team was recently established under the ICG/NEAMTWS WG 4 (Public Awareness, Preparedness and Mitigation). TR constitutes a crucial element for achieving pillar three of the NEAMTWS strategy and for communicating and disseminating strategies. The survey that is anticipated in the selected countries will provide an important baseline for sea level related risk perception (including tsunamis) studies in NEAM region and beyond. It will help to better design and implement TR pilot projects in the target communities/countries, eventually leading to enhanced tsunami and other sea level related risks communication strategies, as well as products that can be shared with Member States, ICG/NEAMTWS, local communities and other partner agencies. It could also be adapted to other country specific contexts and thus used in other regions around the globe.

2.8. The disaster risk reduction approach

The study to be conducted will contribute to all four of the Sendai Framework's priorities[4]: 1) Understanding disaster risk; 2) Strengthening disaster risk governance to manage disaster risk; 3) Investing in disaster risk reduction for resilience and 4) Enhancing disaster preparedness for effective response and to "Build Back Better".

All the key objectives identified for the study align with the Sendai Framework's priorities. Especially the first priority "Understanding disaster risk" urges for a holistic DRR approach. It does not suffice to only understand one component of a complex socio-ecological system. All components must be addressed and understood, including their interdependencies and dynamics on individual and community levels. It is equally important to understand how an individual perceives the risks he or she is exposed to, as well as how a community perceives the same risks. Individual and community risk preparedness are important indicators for DRR,

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[4] https://www.un-spider.org/risks-and-disasters/sendai-framework-drr#no-back

which can be influenced by diverse factors and vary according to people's, groups' and communities' overall risk preparedness. Thus, both, the individual and the community level should be considered in a DRR approach.

3. Proposed methodology for the study and survey

The study that will be carried out, based on the six key objectives and the literature review, will draw on the following framing questions to guide the study and survey:

- Do lack of disaster risk memory (no culture of risk / lack of experience with disasters) and lack of information (missing education on natural hazards) affect strongly individual or community disaster risk perceptions in target communities?
- How does vulnerability (demographic factors such as age, children, family/ friends in risk zones, ...) and the possession of assets (infrastructures or resources) in exposed areas affect people's willingness to disaster preparedness measures and effective response patterns (especially for rapid onset hazards such as tsunamis)?
- Does community affiliation increase trust and participation in DRR strategies and increase resilience?
- Can resilience of individuals and communities to natural hazards be enhanced through improved capacity building, training, and adoption of new tools, such as Tsunami Ready recognition?

3.1. Conceptual Framework

The proposed methodology is based on an extensive literature review and the guiding questions that have been elaborated. The following proposed draft conceptual framework pays special attention to factors affecting individual and community risk perception and how these translate into preparedness measures. It captures: 1) General context and individual and community risk perception influenced by vulnerability and socio-cultural factors; 2) Mitigation, assessment and preparedness influenced by external factors; 3) Disaster response and factors affecting individual and collective response patterns; 4) Recovery and learning opportunities affecting adaptation policies and enhancing resilience. Resilience will eventually impact individual and community risk perception and preparedness measures. This conceptual framework got partly inspired by previously existing frameworks, from González-Riancho et al. (2015), the SPARCK UNESCO project, and the Tsunami Ready Guideline (IOC, 2021), by assessing the resilience of a community, as well as by leveraging lessons learned to improve policies and resilience.
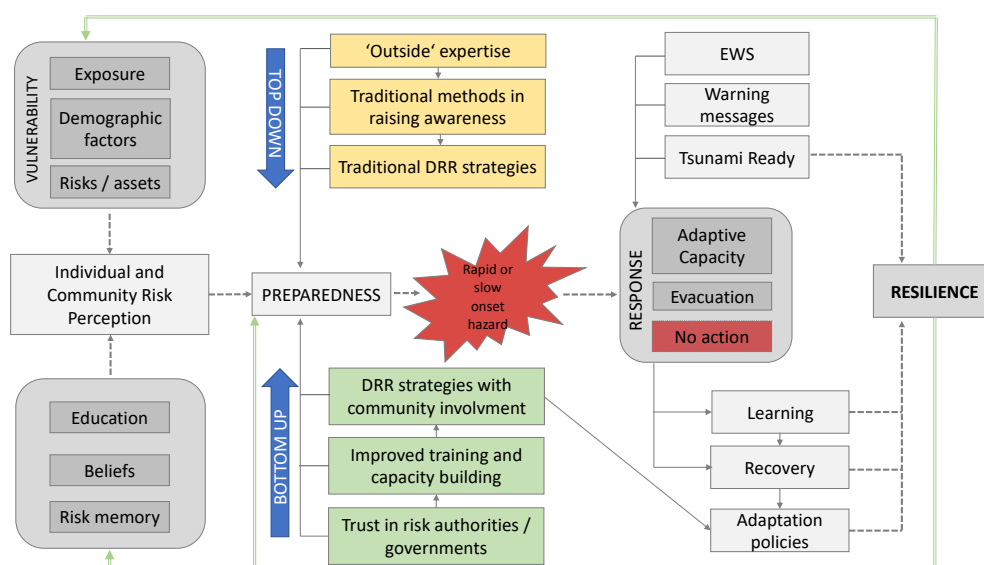

Fig 2: Proposed draft resilience framework driven by vulnerability of exposed individuals and communities, their socio-cultural background and preparedness measures. Source: Schmid and Chang Seng (2021)

3.2.   Survey target groups

Three different target groups have been identified for the study, based on the group's assumed ability to share knowledge and experiences, due to their current occupation. Each of the target groups plays an important role in preparing, mitigating, and responding to the coastal hazards, however on different levels and with various means to do so. We recognize that the level of knowledge, awareness, perception, and experience may be heterogenous among a group. The following target groups have been determined:

1) **Education sector**: Schools / universities – pupils, students, teachers, professors (with a special attention paid to children under 14 → other survey methodology)
2) **Tourism sector**: hotel, restaurant, and shop owners; tourists
3) **DRR sector**: CPAs, ministries, DRR stakeholders; Civil Society: individuals (community level shall be investigated too)

3.3.   Survey questionnaire

The survey should be structured and adapted to each target group. The two different and detailed survey question sets can be found in the annexes. Based on the concept of resilience, taking into account internal and external dimensions of the dynamic system, four different parts for the survey questions have been identified and are elaborated below.

3.3.1. General context and individual and community risk perception influenced by vulnerability and socio-cultural factors

The survey starts with questions about people's social, educational, religious, and economic background. Survey participants are also asked if they live, work, or possess other assets (i.e. arable land) close to the shore, in order to identify levels of vulnerability, possible biases and causal links to background. Important questions will be about "risk memory", trying to assess if experience eventually affects preparedness measures and response patterns. The question on living or working close to the shore could also be used as the control variable for the study.

3.3.2. Pre-disaster: Awareness, education, risk perception, mitigation, assessment and preparedness levels influenced by external factors

The pre-disaster phase contains five main components (awareness and education; risk / hazard perception; mitigation; assessment; preparedness), where boundaries sometimes are not clearly identifiable, thus a question can be situated in one or more components – or in between. This part will in particular be important for later analyses and understanding behavioral patterns, as well as for assessing current levels of any TR implications in target communities.

Awareness and Education

Awareness and educational measures do not necessarily demand active engagement from people receiving them. It is more like information that one gains, more or less passively and may impact the individual in context specific situations. However, governments, CPAs, NGOs or (international) organizations for example need to be active in order to deliver education and awareness raising among populations through information material, school curricula or other educational activities such as the World Tsunami Awareness Day. Questions for stakeholders may therefor differ from the rest of the sample. Papagiannaki (2019) found that all variables

related to awareness finally show an increased correlation with disaster response efficacy, thus the need to properly assess them.

Risk / hazard perception

Awareness and education, among other factors (for example personal experience, perceived probability of a hazard) influence the perception of risks of individuals or communities. People can only perceive risks when they are aware of them. Fear for example is an emotion that is linked to awareness or non-knowledge about a phenomenon. Fatalistic thinking may impact risk perception and could lead to not taking precautions before a disaster event, or in the case of an event to be passive and incapable to act (Tufekci-Enginar et al., 2021; Quarantelli, 1998). This part tries to identify current levels of hazard and risk perceptions, and related indicators such as understanding of risks, under- or over-representations of hazards, disaster experience and impacts of potential events. It also aims at identifying crucial gaps and misinformation about the ocean hazards.

Mitigation, assessment, and preparedness

Mitigation, assessment and preparedness on the other hand demand active engagement and participation at every level (individual, collective, community, CPAs, governments, institutions, ...).
Mitigation and assessment can include the mapping of hazards affecting a region or protective (hard) infrastructures such as walls. Amato (2020) acknowledges that the NEAM region is currently widely missing data and tsunami vulnerability and risk maps. It is an important indicator to measure advancements in Tsunami Ready. Preparedness measures from an institutional or governmental point of view can vary and include evacuation or vulnerability maps, the development and distribution of outreach material about what to do in the case of an event, or performing exercises and drills, such as NEAMWave. Mitigation and preparedness measures can address various temporal levels, ranging from short term goals such as improving warnings, to medium term goals (i.e. the elaboration of evacuation maps and emergency plans) and long term strategies, including urban and territorial settings or policies (Pascale et al., 2015).
Regarding local populations, that are not necessarily involved in DRR measures, this section aims in particular at identifying their level of knowledge about preparedness measures, as well as their involvement in such activities. Moreover, this component investigates if people feel that there is cohesion, and if they feel to belong to a group / community or not at all. A sense of community may be an important indicator for measuring disaster resilience (Alshehri et al. 2015). It is a strong signal to understand whether a Tsunami Ready community will sustain its status or not.
Further, opinions on DRR and DRM responsibilities are asked, including for example: 'Who should be responsible for DRR?' or 'What are the DRR challenges?'. These questions help to identify if people think they should be consulted for developing DRR strategies and if they feel like they have a say. As Weichselgartner and Kelman (2015) showed, "disaster resilience is not solely the domain of a disaster professional but a shared responsibility across society", this part of the survey tries also to understand the willingness of local populations to be part of future policy making processes or if they feel, DRR is something external to them, something that does not concern them.

3.3.3. Disaster response and factors affecting individual and collective response patterns

This component identifies how preparedness measures translate into behavioral patterns, knowledge, information, comprehension of trust and participation in EWS, on individual and collective levels. It will be interesting to compare visions of stakeholders with the visions of the other target groups. Another important topic in this part is the flexibility of institutions.

Institutional preparedness could hinder flexibility in some critical situations, leading to inefficient response to disasters.

The Tsunami Ready programme is an assessment, preparedness, and response tool at the same time. As the study also aims at supporting the implementation of pilot TR communities, the indicators for the TR guidelines have been integrated in the survey questionnaire.

3.3.4. Post-disaster: Recovery and learning opportunities enhancing resilience

This section aims to identify potential risk reduction measures after a disaster, which are harder to identify, as hopefully no event will happen, and responses have to be more abstract and imagined. In disaster situations, the system is tested, and gaps and challenges are revealed. These can then be addressed accordingly if there is enough financial support to do so. A disaster always comes with learning and recovery opportunities, that can change the initial state of the socio-ecological system. This section may be more interesting for stakeholders, as they are currently involved in DRR strategies. However, as the project strives to mainstream active involvement of every citizen, this component should in future assessments not be limited to stakeholders.

3.4. Conducting the survey

Regarding the literature reviewed and taking into account the sanitary situation and the considerable length of the survey, a mixed interviewing methodology is suggested, consisting of combining in person interviews (through citizen summits), workshops/trainings and web-based surveys.

3.4.1 Citizen Summit Survey combined with a training / workshop

In two or three communities that are considered to be highly exposed to all three of the hazards, the organization of a "1-day Citizen Summit", bringing together the different target groups, could be very useful. This would allow to combine the interview/survey, followed by a training / workshop and finally to measure the impact of the training with a second survey / interview after a certain time has elapsed. The second survey could also be conducted after successful TR implementation of the target communities. However, this method is costly, time consuming and participants should be offered an incentive to participate (e.g. mobile phone credit), it could only be carried out with a small sample of maybe 30-60 people per community. Such an event would need a meticulous preparation in order to guarantee the best representation of the population as possible, but seems to be the most promising method. It would also allow to collect data that could be used in a later stage, to answer questions that might come up with the end of this project. This approach would also align with the necessity described in sections 2.1. and 2.3., to involve citizens from the beginning in disaster risk reduction strategies to understand their points of view, increase acceptance of measures and increase awareness among the non-scientific community.

3.4.2. Focus group approach

We acknowledge that the proposed Citizen Summits are an ambitious endeavor. Another approach, the focus group approach could be equally useful to collect data by actively involving and engaging a carefully selected sample, though in a smaller setting and on a smaller scale.

Information / Interactive Workshop / Training

Smaller events, such as information or interactive workshops / trainings of two to three hours could be proposed in all of the finally selected pilot TR communities. These events could have different objectives, ranging from raising awareness about the sea level related hazards and preparedness measures to the specific steps of becoming a TR community. The survey could be asked to be completed online in preparation of the workshop. This method is less costly, less time consuming and easier to organize, to carry out and to assess.

Engaging Children

A special attention should be paid to children under the age of 14. In addition to the proposed survey that can be adapted to different target groups, it is suggested to follow another approach for children under 14 years, based on a fun and exciting activity that engages them. With the help of games where children have to physically position themselves in a room to answer a question, responses could be more accurate as concentration levels do not drop as fast as with a purely technical questionnaire. Thus, children should be "interviewed" in person, with the permission of their parents. Such an approach needs a very meticulous preparation, animation, and assessment phase. Despite this adapted approach, the survey length must be shortened, and questions should be reformulated to make them easily understandable and maybe even with only yes – no answer possibilities. This could also be an opportunity to raise awareness to natural hazards affecting local regions among the youngest pupils, who could play an important role in future DRR strategies.

Mental map

Signorino (2014) identified that only few risk perception studies consider the use of mental maps, that are prepared by the interviewees based on their feelings what the area(s) at risk comprise(s). Mental maps could be optionally used in our study, possibly during the Citizen Summits and the interactive workshops, in order to identify gaps or misconceptions on spatial hazard and risk perception. Ultimately, it could help to better prepare people for hazardous events, as their understanding of the surrounding could be enhanced and safe areas might be better visualized among the non-scientific community.

Web-based survey

In addition, and due to the sanitary context, a larger sample of surveys should be carried out online. With more and more people accessing the internet, the best way to conduct a larger survey sample would be via a web-based survey. Given the length and the complexity of some questions, some people might prefer having as much time as they want or need to answer the questions. Taking the time to think about answers might be complicated during CATI interviews, as respondents can easily feel rushed to answer. Thus, a well and clearly structured web-based survey, could possibly lead to a higher participation rate and accuracy of responses as during phone (CATI) interviews. Moreover, promoting web-based surveys is less resource-demanding than contacting people via phone, as the hyperlink to the survey could be easily shared by institutions and on social media platforms. With this method, a sample of 1000-3000 people seems feasible, if an incentive is given, such as the chance to win a voucher. However, web-based surveys are less selective and cannot guarantee that only affected or targeted people participate.

3.5. Selection of study countries/ sites

The selection of the study sites will depend on:

i. Level of exposure, vulnerability and risk of target countries / communities
ii. Coastal resilience cooperation opportunities
iii. Cooperation and sustainability factors

3.5.i. Exposure, vulnerability, and risk of target countries

Densely populated coastal areas (megacities such as Alexandria, Egypt, with around 5.2 million inhabitants), tourist hotspots (such as Tangier, Morocco) and important economic hubs make the coastal population and critical infrastructure of South Mediterranean countries vulnerable to sea-level related hazardous events. The selected coastal communities, infrastructures and resources should naturally be exposed to the three ocean hazards and show similar vulnerability trends in the development pathways in the near future. Test sites that have already experienced a sea level related event in the (near or distant) past are in particular interesting for the study, linking risk perception to risk memory. Vulnerability can also be exaggerated by inappropriate building structure in coastal areas.

3.5.ii. Coastal resilience opportunities

The study should be rolled out in coastal communities that will serve as NEAM pilot TR recognition communities in the future. The selected sites need to be aligned with existing or potential new partner project activities. The study intends to align with the IOC European Union DG/ECHO (Directorate-General for European Civil Protection and Humanitarian Aid Operations) CoastWave NEAMTWS project on strengthening the resilience of coastal communities in the North-Eastern Atlantic and Mediterranean Region to the impact of tsunamis and other sea level-related coastal hazards to be implemented in Cyprus, Egypt, Greece, Malta, Morocco, Spain, and Turkey.

3.5.iii. Cooperation and sustainability factors

As a European Union (EU) funded project, expertise and cooperation can be asked from the European Commission's science and knowledge service and the Joint Research Centre (JRC).

Setting the framework for this study has been done by UNESCO/IOC. However, carrying out the survey in local communities needs strategic partners and ideally people with experience living in the target regions. Thus, cooperation with other internal or external institutions as well as experts and short-term consultants (for carrying out the survey in the field) is indispensable. Consultants should have sufficient knowledge about the study sites and speak the local language. A close cooperation with UNESCO's field offices should be considered. The following field offices could be approached: Cairo (specialized in 'Policy and Capacity Building' and 'Social and Human Sciences'), and Maghreb region in Rabat (Morocco; specialized in education, young people and non-formal education).

Moreover, close cooperation is planned with ICG/NEAMTWS member states, that have conducted similar work, e.g., France and Italy. CPAs and TSPs would be encouraged to be involved. The ICG/NEAMTWS' WG4, the Tsunami Ready Team and individual experts are essential to this study.

Some other institutions (research and academic) could be:
* Centre National de la Recherche Scientifique et Technique (Morocco)
* German International Development Agency (GIZ)
* Global Initiative on Disaster Risk Management (GIDRM)

- Institute of Oceanology (Egypt)
- National ministries
- OECD
- UNDRR

The project seeks to find communities willing to continue efforts once the project has ended. Thus, attention should be paid to choosing test sites that are able to address such hazards on a long-term basis and independently. This means, expertise and the needed staff must already be available or made available within the national's DRR framework.

In concertation with future cooperation institutes, study sites should be selected, if possible, exposed to all three of the investigated hazards and in the case of tsunami hazard, being possibly impacted by near-field and far-field tsunamis. In the following table, we suggest a primary list of cities or regions that could be interesting for the study, and those proposed by member countries.

City / region (country)	Recent and historical events	Exposure and vulnerability	Coastal resilience opportunities	Cooperation and sustainability factors
Alexandria (Egypt)	- Alexandria: 365 AD and 1303 → earthquakes and tsunami[5] destroying the world city at the time	- Egypt is the third most populated country on the African continent, with several megacities on the shore - population: 5.3 million in 2021[6] - port city with critical and important economic infrastructures → 80% of Egypt's imports and exports[7] - 40% of Egyptian industry - tourism hotspot: millions of local and international tourists each year[8] - vulnerable to SLR: inundation, waterlogging, increased flooding, salinization - 0.5m rise = losses of land, installations & tourism will cause US$32.5 billion damages[9] - projections suggest displacement of 6 million people due to 1m SLR[10] - tsunami hazard is classified as "medium", meaning there is at least a 10% chance of a potentially damaging tsunami occurring in the upcoming 50 years - damages are estimated to account for at least US$8.5 million	- National Strategy for Crisis, Disaster Management and Disaster Risk Reduction (2010) - EWS established in the following governorates (with assistance from UNDP): Port Said, Cairo, Luxor and Alexandria - Enhancing Climate Change Adaptation in the North Coast of Egypt (2018-2024) → reduce coastal flooding risk in Egypt's North coast with the development of the Integrated Coastal Zone Management (ICZM) Plan	- UNESCO field office in Cairo - department dedicated to crisis and disaster management was established at the Information and Decision Support Center (IDSC) of the Egyptian Cabinet of Ministers
Tangier (Morocco)	- several tsunamigenic earthquakes that might	- Morocco naturally prone to ocean hazards, as it borders the Mediterranean and the Atlantic Ocean	- GFDRR FY19, Global Program for Safer Schools	- UNESCO field office in Rabat - League of Arab States

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[5] Hassan et al. (2020)

[6] https://worldpopulationreview.com/world-cities/alexandria-population

[7] http://www.alexandria.gov.eg/Alexandria/default.aspx, 2014

[8] Tourism Promotion Authority of Alexandria Governorate, 2019 http://www.alexandria.gov.eg/

[9] IPCC: https://archive.ipcc.ch/ipccreports/sres/regional/index.php?idp=30

[10] El Raey, 2010

	have impacted Tangier[11] - recent paleo -tsunami studies identified high-energy deposits that might be associated with a tsunami event dated circa 216–218 BC[12] - first tsunami found in the written Arabic documents in Morocco dates from 22 May 881[13], where it is mentioned that the tsunami impacted the coastal strip of North Morocco including Tangier[14]	- 1,835 km of coastlines - very exposed to SLR → coastal flooding risk is very high, owing to climate change effects (132 million US$ damage) - most important socio-economic pole in Northern Morocco - modelling identified that 10% and 24% of the area will be at risk of flooding respectively for minimum (4 m) and maximum (11 m) inundation levels[15] - Tangier (688,356 inhabitants); Al Hoceima (395,644 inhabitants); Tétouan (326,261 inhabitants)[16] - Morocco has a "medium" classification for a tsunami to occur (10% probability in the next 50 years)	- Fund Against the Effects of Disaster in Morocco[17]	- Arab Local Government Advisory Stakeholder Group and the Arab Media Group for Disaster Risk Reduction - Ministry of the Interior
El Jadida (Morocco)	- high tsunami risk - ravaged by the 1755 Lisbon tsunami	- coastal urbanization, coastal facilities, and tourism - "first on the Moroccan Atlantic coast to be reached by tsunami waves triggered by regional earth- quakes generated in SW Iberia"[18]	- some small coastal breakwaters in place[19] - already existing: tsunami impact study and evacuation plan - could serve as forecast point[18]	
Eastern coastline Malta → Marsaxlok k ?		- tsunami hazard not well defined[20] - one of the most densely populated countries worldwide - most of the population and touristic infrastructure is concentrated along the eastern low-lying coastline, exposed to tsunamis from near-field and far-field sources - densely populated low-lying bays or rias of Mellieha Bay, Xemxija, Salini, Gzira, Msida, Marsaskala, St Thomas Bay, Marsaxlokk and Birzebbuga - tsunami and multi-hazards could pose an economic risk of around	- National Risk Assessment (NRA)[22] → establishing an agreed practice for defining priorities in emergency and disaster management	- UNESCO field office in Venice

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[11] Rodriguez 1932 ; Peláez et al., 2007

[12] Luque et al. 2002

[13] El Mrabet 1991; Kaabouben et al. 2009

[14] Abi Zaraa, in El Mrabet 1991

[15] Snoussi et al.; 2009

[16] https://worldpopulationreview.com/countries/morocco-population/

[17] Ministry of the Interior

[18] Omira et al. 2009

[19] Omira et al. 2013

[20] Mueller et al., 2020

[22] https://ec.europa.eu/echo/sites/echo-site/files/malta_peer_review_report_-_en.pdf

		US$ 14 million to Malta's population[21]		
Limassol and Larnaca (Cyprus)		- "southern coast of Cyprus, that is the most affected according to historical reports and one of the most developed regions of the island with important ports and touristic centers like Limassol and Larnaca."[23]		(- UNESCO field office in Venice)

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[21] https://www.preventionweb.net/countries/mlt/data/

[23] Tinti et al. 2013

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Annex I: Questionnaire for the education sector (except pupils under the age of 14), the tourism sector (restaurant or shop owners, beach workers, tourists) and the Civil Society

* Resilience indicators / criteria and components based on the work of the emBRACE project (2012)

Nb	Part	Resilience Indicator / criteria*	Component*	Survey question	Response possibility	TR Guidelines	Intention of the question
1				What is the postal code of the community you are living in?	Please provide your postcode:		Control variable
2		*Individual socio-demographic characteristic*	Culture and diversity	How do you identify?	• Female • Male • Non-binary • Transgender • Other, please specify:		Identify if risk perception can be linked to a specific gender
3	I - General context and individual and community risk perception influenced by vulnerability and socio-cultural factors	*Individual socio-demographic characteristics*	Culture and diversity	What is your age?	• (12-17 years) • 18-24 years • 25-34 years • 35-44 years • 45-54 years • 55-64 years • 65-74 years • 75 years and older		Identify if risk perception can be linked to a specific age
4		*Education*	Education; Culture and diversity	What is your highest academic qualification?	• None • High School ☐ Bachelor's degree or equivalent ☐ Master's degree or equivalent • PhD or equivalent • Other, please specify:		Identify if risk perception can be linked to a specific educational background
5		*Employment*	Culture and diversity	What is your current employment status?	• Pupil / Student • Employed for wages • Self-employed		Identify if risk perception can be linked to a

					Homemaker • Unemployed, looking for work • Unemployed, not looking for work • Military • Retired • Unable to work • Other, please specify:		specific working background
6		*Employment*		How long have you been working in your current position?	Please specify:		
7		*Exposure*	Exposure	How far do you live from the shore?	• Within 200m from the shore • Less than 1 km away • 1km-5km • 5km-10km • More than 10km away ☐ I don't know		Identify exposure; Control variable
8		*Exposure*	Exposure	How far is your workplace / school / university from the shore?	• Within 200m from the shore • Less than 1 km away • 1km-5km • 5km-10km • More than 10km away ☐ I don't know		Identify exposure; Control variable
9		*Exposure*	Exposure	Do you possess other assets within 2km from the shore? (e.g. arable land, second home, …)	• Yes, please specify: • No • I don't know		Identify vulnerability
10		*Social characteristics; Spirituality*	Culture and diversity	Do you have a religious belief?	• Yes, please specify: • No ☐ I don't know		Identify eventual biases because of religious beliefs
11		*Household preparedness*	Exposure; Coping capacity	What is your current household composition?	• I live alone • I live with my partner/ spouse, without children		Identify vulnerability

					• I live with my partner/ spouse, with children • I live only with children • I live with other adults • I live with (a) disabled person(s) • I live with elderly people		
12		*Community preparedness; Social support*	Exposure	Do you have family members or close friends living or working close to the shore? (Within 2 km)	• Yes, please specify how many people: • No ☐ I don't know		Identify vulnerability
13		*Individual / Household resources*	Preparedness; Adaptive capacity	Do you have money savings?	• Yes • No • I don't want to say		Identify vulnerability
14	II - Pre-disaster: Awareness, education, risk perception, mitigation, assessment and preparedness levels influenced by external factors	*Risk awareness and perception*	Education; Knowledge; Information	Have you ever heard about the following hazards, and do you know what they are?	a) Tsunami • Yes • No • I don't know b) Sea Level Rise (SLR) • Yes • No • I don't know c) Storm surge • Yes • No • I don't know		Identify level of education
15		*Risk awareness and perception*	Education; Knowledge; Information	If yes, where have you heard/learned from these hazards?	*Please specify for:* a) Tsunami: b) SLR: c) Storm surge:		

16		*Risk awareness and perception*	Education; Knowledge; Information	What can be triggers of these hazards?	Please specify for each: a) Tsunami: b) SLR: c) Storm surge:		Identify level of education
17		*Risk awareness and perception*	Education; Knowledge; Information	How would you describe each of the hazards? Use adjectives, nouns, associations you have with it (pictures, news stories, …)	a) Tsunami: b) SLR: c) Storm surge:		Identify level of education
18		*Risk awareness and perception*	Education; Knowledge; Information	TSUNAMI: What can be precursor signs of a tsunami?	Please specify:		Identify level of education
19		*Critical awareness*	Livelihood; Wellbeing	Are you concerned about coastal hazards and risks in your community?	• Not concerned at all • Not really concerned • Somewhat concerned • Very concerned • Highly concerned		Identify awareness level
20		*Critical awareness*	Awareness and knowledge; Information	Are you aware of an EWS for any of these hazards in your community/ region?	• Yes • No • I don't know		Identify awareness level
21		*Critical awareness*	Awareness and knowledge; Information	Do you know about hazard maps for each of the hazards in your municipality?	Please specify for each: a) Tsunami: b) SLR: c) Storm surge:	ASSESS1	Identify awareness level
22		*Critical awareness*	Information and communication	Does your municipality display hazard information publicly?		PREP2	Identify awareness level
23		*Critical awareness*	Communication; Protection	Do you agree that an effective EWS and early actions can save lives and reduce damage to infrastructures?	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Sendai Framework

24		*Understanding of hazards and consequences*	Awareness and knowledge; Preparedness	I understand well the different coastal hazards and risks and I know what to do in the case of an event.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Understanding of hazards and risks
25		*Understanding of hazards and consequences*	Awareness and knowledge; Exposure	Do you think the Mediterranean Sea can experience a tsunami, a storm surge, or sea level rise? Their occurrence is …	Their occurrence is … a) Tsunami ☐ … not existent ☐ … very low ☐ … low ☐ … moderate ☐ … high ☐ … very high b) SLR ☐ … not existent ☐ … very low ☐ … low ☐ … moderate ☐ … high ☐ … very high c) Storm surge ☐ … not existent ☐ … very low ☐ … low ☐ … moderate ☐ … high ☐ … very high		
26		*Understanding of hazards and consequences*	Impact severity	… Their impact is …	Please specify for each: a) Tsunami ☐ … not existent ☐ … very low ☐ … low ☐ … moderate ☐ … high		Identify impact of potential event

					□ … very high b) SLR □ … not existent □ … very low □ … low □ … moderate □ … high □ … very high c) Storm surge □ … not existent □ … very low □ … low □ … moderate □ … high □ … very high		
27		*Understanding of hazards and consequences*	Awareness and knowledge; Exposure	Do you think that the coastal areas of your municipality can be affected by these hazards?	Please specify for each hazard. a) Tsunami: • Yes • No • I don't know b) SLR: • Yes • No • I don't know c) Storm surge • Yes • No • I don't know		Under- or over-estimation of risk
28		*Understanding of hazards and consequences*	Awareness and knowledge; Exposure	Which South-Mediterranean countries or regions do you think are most likely to be affected by these hazards?	Please specify for each hazard. a) Tsunami: b) SLR: c) Storm surge:		Under- or over-estimation of risk

29		*Understanding of hazards and consequences*	Impact severity; Awareness and knowledge	Tsunami: A tsunami in the Mediterranean can be:	• very small (> 10 cm) • small (10 cm - 50 cm) • moderate (50 cm - 99cm) • big / high (1m - 5m) • very big / high (5m - 10m) • extremely big (>10m)		Under- or over-estimation of risk
30		*Understanding of hazards and consequences*	Impact severity	Do you think the impact of each of the hazards could be increased? If yes, how? (Natural processes, human processes, …)	a) Tsunami: b) SLR: c) Storm surge:		Under- or over-estimation of risk
31		*Understanding of hazards and consequences*	Awareness and knowledge; Impact severity	Tsunami: Imagine you experience an earthquake, and a tsunami was triggered. When would you think could the tsunami strike the coast?	Please specify:		Under- or over-estimation of risk
32		*Understanding of hazards and consequences*	Awareness and knowledge; Impact severity	How much flooding would you expect in your municipality in the case of an event?	Please specify for each: a) Tsunami: b) SLR: c) Storm surge:		Under- or over-estimation of risk
33		*Experience; perception; Interpretation of previous disaster experiences*	Experience; Impact severity	Have you ever experienced one or more of these hazards? When was it? Please specify for each.	• Yes • No • I don't know		Identify experience with disasters
34		*Experience; perception; Interpretation of previous disaster experiences*	Experience; Impact severity	Has a family member or a (close) friend ever experienced one or more of these hazards? When was it? Please also think about past events you are aware of that may have affected your grandparents.	Please specify for each. a) Tsunami: • Yes • No • I don't know b) SLR: • Yes		Identify experience with disasters

				• No • I don't know c) Storm surge: • Yes • No • I don't know			
35		*Social capital*	Culture and diversity	When you hear that one of these hazards has turned into an event, which describes best your feelings?	• I cannot do anything about it • It was god's will • It is a natural phenomenon, that cannot be anticipated • Humans caused this event • Other, please specify:		Identify fatalistic thinking or religious beliefs that influence risk perception
36		*Individual preparedness and mitigation, assessment*	Preparedness; Adaptive capacity; Technical	Did you take any precautious measures to any of these hazards?	• Yes, please specify: • No • No, but I want to		
37		*Mitigation; Insurance*	Preparedness; Economic	Do you have an insurance for any of these hazards?	• Yes • No • No, but I want to		
38		*Community preparedness, mitigation, assessment*	Preparedness; Coping capacity	Do you know if your community has an evacuation plan for a tsunami or storm surge event?	• Yes • No	PREP1	Identify if means of distributing existing information material are working well
39		*Individual preparedness;*	Preparedness; Adaptive / coping capacity	The impact of a natural disaster can be reduced or minimized by individual actions.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		
40		*Community preparedness; Community*	Preparedness; Adaptive / coping capacity	The impact of a natural disaster can be reduced or minimized by collective / community actions.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree		

		empowerment for action			• Strongly agree	
41		*Understanding of hazards and consequences*	Place attachment	In case you live/ lived in an area at risk, would you consider preventive resettlement to protect yourself (and your loved ones) from an ocean related hazard?	• Yes • No • Maybe	
42		*Understanding of hazards and consequences*	Place attachment	And what if there was an incentive if you proceed to resettle? What would you consider as good compensation?	Please specify:	
43		*Social support; community bonds; network structures*	Culture and diversity; Communication	Do you know your neighbors?	• Yes • No • I know them a bit	Sens of community
44		*Social support; community bonds; network structures*	Culture and diversity; Communication	Your neighbor is asking you a big favor, would you help?	• Yes • No • Maybe	Sens of community
45		*Social support; community bonds; network structures*	Culture and diversity; Communication	Do you participate in any community activity?	• Yes • No • No, but I want to	Sens of community
46		*Social support; community bonds; network structures*	Culture and diversity; Wellbeing and livelihood	I feel that I belong to a community.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	Sens of community
47		*Intentional patterns*	Governance; Preparedness	Do you think you/ your sector should actively assist in Disaster Risk Reduction (DRR) or Disaster Risk Management (DRM) activities?	• Not at all • Not really • Yes, to some extent • Yes, a lot • Yes, very much	Whose responsibility is DRR or DRM?

48		*Active stakeholders; Prevention and control; Institutions*	Governance	In your opinion, who is currently involved in DRR or DRM?	Please specify:		Whose responsibility is DRR or DRM?
49		*Intentional patterns; Prevention and control; Institutions*	Governance	In your opinion, who should be involved in DRR & DRM?	Please specify:		Whose responsibility is DRR or DRM?
50			Preparedness; Response; Governance; Infrastructure and technical	What do you think is the biggest problem to effectively managing coastal hazards/risk?	Please specify:		Identify challenges in DRR / DRM
51		*Collective action and decision-making*	Governance; Innovation and capital	Do you think that more could be done in terms of DRR or DRM? If yes, by whom?	• Yes • No • I don't know		Identify challenges in DDR / DRM
52		*Capacity building for early warning; Skills training*	Preparedness	Have you ever heard of or participated in a (tsunami) exercise or drill, such as NEAMWave exercise? This can include evacuation exercises.	• Yes • No • I don't know	PREP4 & PREP5	
53		*Safe evacuation routes identified and maintained, known to community members*	Information and communication; Preparedness	Do you know if your municipality displays evacuation signs?	• Yes • No • Maybe	PREP2	
54		*EWS capable of reaching everyone*		Do you know if your municipality uses acoustic warnings for tsunamis, storm surges or SLR?	• Yes • No • Maybe		

55		*Community understanding of characteristics and functioning of local natural environment and ecosystems and the potential risks associated*	Response	Imagine you are at the beach. You feel a (strong) earthquake. What would you do?	Multiple answers possible. • Continue what I was doing • Call someone I trust for advice / confirmation • Observe my surroundings/ the sea • Check social media/ news • Evacuate the beach • Other, please specify:		Identify behavioral patterns / willingness to evacuate
56	III - Disaster response and factors affecting individual and collective response patterns	*Community understanding of characteristics and functioning of local natural environment and ecosystems and the potential risks associated*	Response	If you answered with "Evacuate the beach", where would you go?	Please specify:		Identify behavioral patterns and knowledge of safe places
57		*Local organizational structures for emergency response*	Coping capacity	The municipality I live/ work in has the capacity to manage emergency response operations during a tsunami event.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	RESP 2	Identify behavioral patterns
58		*People-centered EWS*	Information and communication	Which communication channel would you prefer for alert messages?	Please order from most important to least important: TV; Radio; Internet (social media); Acoustic warnings; Warning application; SMS; Email; If any other:		Identify means of communication
59		*Redundancy; Rapidity; Robustness; Resourcefulness;*	Information and communication	My community has redundant and reliable means to receive official (tsunami) warnings 24/7.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	RESP 3	Identify means of communication

		People-centered EWS			• I don't know		
60		*Local organizational structures for emergency response*	Response; Governance	The municipality I live/ work in addresses these hazards in community emergency operations or response plans.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree • I don't know	RESP 1	
61		*Beliefs; Personality; Corruption*	Information and communication	Do you trust in warnings from official authorities?	• Yes • No • Maybe		Identify trust in authorities
62	IV – Post-disaster: Recovery and learning opportunities enhancing resilience	*Coping with adverse circumstances; Positive adjustment/ adaptation*	Innovation; Adaptive and coping capacity	After a disaster happened, do you think building back better in safe areas can reduce disaster risk?	• Yes • No • I don't know		Sendai Framework
63		*Coping with adverse circumstances*	Governance	If there was a disaster event in your municipality with loss of lives, who would you account responsible for it?	Please specify:		

Annex II - Questionnaire for stakeholders involved in DRR strategies

Nb	Part	Resilience Indicator / criteria*	Component*	Survey question	Response possibility	TR Guidelines	Intention of the question
1				What is the postal code of the community you are living in?	Please provide your postcode:		Control variable
2		*Individual socio-demographic characteristic*	Culture and diversity	How do you identify?	• Female • Male • Non-binary • Transgender • Other, please specify:		Identify if risk perception can be linked to a specific gender
3	I - General context and individual and community risk perception influenced by vulnerability and socio-cultural factors	*Individual socio-demographic characteristics*	Culture and diversity	What is your age?	• (12-17 years) • 18-24 years • 25-34 years • 35-44 years • 45-54 years • 55-64 years • 65-74 years • 75 years and older		Identify if risk perception can be linked to a specific age
4		*Education*	Education; Culture and diversity	What is your highest academic qualification?	• None • High School ☐ Bachelor's degree or equivalent ☐ Master's degree or equivalent • PhD or equivalent • Other, please specify:		Identify if risk perception can be linked to a specific educational background
5		*Employment*	Culture and diversity	What is your current employment status?	• Pupil / Student • Employed for wages • Self-employed		Identify if risk perception can be linked to a

				• Homemaker • Unemployed, looking for work • Unemployed, not looking for work • Military • Retired • Unable to work • Other, please specify:		specific working background
6		*Employment*		For which organization are you working? What is your current position within the organization?	Please specify:		
7		*Employment*		How long have you been working in your current position?	Please specify:		
8		*Exposure*	Exposure	How far do you live from the shore?	• Within 200m from the shore • Less than 1 km away • 1km-5km • 5km-10km • More than 10km away ☐ I don't know		Identify exposure; Control variable
9		*Exposure*	Exposure	How far is your workplace / from the shore?	• Within 200m from the shore • Less than 1 km away • 1km-5km • 5km-10km • More than 10km away ☐ I don't know		Identify exposure; Control variable
10		*Exposure*	Exposure	Do you possess other assets within 2km from the shore? (e.g. arable land, second home, …)	• Yes, please specify: • No ☐ I don't know		Identify vulnerability
11		*Social characteristics; Spirituality*	Culture and diversity	Do you have a religious belief?	• Yes, please specify: • No ☐ I don't know		Identify eventual biases because of religious beliefs

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12		*Household preparedness*	Exposure; Coping capacity	What is your current household composition?	• I live alone • I live with my partner/ spouse, without children • I live with my partner/ spouse, with children • I live only with children • I live with other adults • I live with (a) disabled person(s) • I live with elderly people		Identify vulnerability
13		*Community preparedness; Social support*	Exposure	Do you have family members or close friends living or working close to the shore? (Within 2 km)	• Yes, please specify how many people: • No ☐ I don't know		Identify vulnerability
14		*Individual / Household resources*	Preparedness; Adaptive capacity	Do you have money savings?	• Yes • No • I don't want to say		Identify vulnerability
15	II - Pre-disaster: Awareness, education, risk perception, mitigation, assessment and preparedness levels influenced by external factors	*Preparedness; Social support*	Education	What education measures do you undertake for each of the hazards?	Please specify for: a) Tsunami: b) Sea Level Rise (SLR): c) Storm surge:	ASSESS1-3; PREP3&4	Identify level of perceived education
16		*Community preparedness*	Education	The local population does know well the different hazards.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Identify level of perceived education
16		*Risk awareness and perception*	Education; Knowledge; Information	What can be triggers of these hazards?	Please specify for each: a) Tsunami: b) SLR: c) Storm surge:		Identify level of education

17		*Risk awareness and perception*	Education; Knowledge; Information	How would you describe each of the hazards? Use adjectives, nouns, associations you have with it (pictures, news stories, …)	a) Tsunami: b) SLR: c) Storm surge:		Identify level of education
18		*Risk awareness and perception*	Education; Knowledge; Information	TSUNAMI: What can be precursor signs of a tsunami?	Please specify:		Identify level of education
19		*Critical awareness*	Livelihood; Wellbeing	Are you concerned about coastal hazards and risks in your community?	• Not concerned at all • Not really concerned • Somewhat concerned • Very concerned • Highly concerned		Identify awareness level among a supposedly more sensitized group
20		*Community preparedness*	Preparedness, Protection	Do you have an EWS in place for at least one of the hazards?	• Yes, please specify: • No • Not yet, but soon		Identify preparedness level
21		*Community preparedness*	Preparedness, Protection; Information	Do you have hazard maps for each of the hazards in your municipality?	Please specify for each: a) Tsunami: b) SLR: c) Storm surge:	ASSESS1	Identify preparedness level
22		*Community preparedness*	Preparedness, Protection; Information and communication	Does your municipality display hazard information publicly?	• Yes • No • Not yet, but soon	PREP2	Identify preparedness level
23		*Critical awareness*	Communication; Protection	Do you agree that an effective EWS and early actions can save lives and reduce damage to infrastructures?	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Sendai Framework
24		*Understanding of hazards and consequences*	Awareness and knowledge; Preparedness	I understand well the different coastal hazards and risks and I know what to do in the case of an event.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Understanding of hazards and risks

| 25 | | *Understanding of hazards and consequences* | Awareness and knowledge; Exposure | Do you think the Mediterranean Sea can experience a tsunami, a storm surge, or sea level rise? Their occurrence is … | Their occurrence is …
a) Tsunami
☐ … not existent
☐ … very low
☐ … low
☐ … moderate
☐ … high
☐ … very high

b) SLR
☐ … not existent
☐ … very low
☐ … low
☐ … moderate
☐ … high
☐ … very high

c) Storm surge
☐ … not existent
☐ … very low
☐ … low
☐ … moderate
☐ … high
☐ … very high | | |
| 26 | | *Understanding of hazards and consequences* | Impact severity | … Their impact is … | Please specify for each:

a) Tsunami
☐ … not existent
☐ … very low
☐ … low
☐ … moderate
☐ … high
☐ … very high

b) SLR
☐ … not existent
☐ … very low
☐ … low | | Identify impact of potential event |

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				□ … moderate □ … high □ … very high c) Storm surge □ … not existent □ … very low □ … low □ … moderate □ … high □ … very high		
27		*Understanding of hazards and consequences*	Awareness and knowledge; Exposure	Do you think that the coastal areas of your municipality can be affected by these hazards?	Please specify for each hazard. a) Tsunami: • Yes • No • I don't know b) SLR: • Yes • No • I don't know c) Storm surge • Yes • No • I don't know		Under- or over-estimation of risk
28		*Understanding of hazards and consequences*	Awareness and knowledge; Exposure	Which South-Mediterranean countries or regions do you think are most likely to be affected by these hazards?	Please specify for each hazard. a) Tsunami: b) SLR: c) Storm surge:		Under- or over-estimation of risk
29		*Understanding of hazards and consequences*	Impact severity; Awareness and knowledge	A tsunami in the Mediterranean can be:	• very small (> 10 cm) • small (10 cm - 50 cm) • moderate (50 cm - 99cm) • big / high (1m - 5m) • very big / high (5m - 10m)		Under- or over-estimation of risk

30					• extremely big (>10m)		
30		*Understanding of hazards and consequences*	Impact severity	Do you think the impact of each of the hazards could be increased? If yes, how? (Natural processes, human processes, …)	a) Tsunami: b) SLR: c) Storm surge:		Under- or over-estimation of risk
31		*Understanding of hazards and consequences*	Awareness and knowledge; Impact severity	Tsunami: Imagine you experience an earthquake, and a tsunami was triggered. When would you think could the tsunami strike the coast?	Please specify:		Under- or over-estimation of risk
32		*Understanding of hazards and consequences*	Awareness and knowledge; Impact severity	How much flooding would you expect in your municipality in the case of an event?	Please specify for each: a) Tsunami: b) SLR: c) Storm surge:		Under- or over-estimation of risk
33		*Experience; perception; Interpretation of previous disaster experiences*	Experience; Impact severity	Have you ever experienced one or more of these hazards? When was it? Please specify for each.	• Yes • No • I don't know		Identify experience with disasters
34		*Experience; perception; Interpretation of previous disaster experiences*	Experience; Impact severity	Has a family member or a (close) friend ever experienced one or more of these hazards? When was it? Please also think about past events you are aware of that may have affected your grandparents.	Please specify for each. a) Tsunami: • Yes • No • I don't know b) SLR: • Yes • No • I don't know c) Storm surge: • Yes • No		Identify experience with disasters

#							
				• I don't know			
35		*Social capital*	Culture and diversity	When you hear that one of these hazards has turned into an event, which describes best your feelings?	• I cannot do anything about it • It was god's will • It is a natural phenomenon, that cannot be anticipated • Humans caused this event • Other, please specify:		Identify fatalistic thinking or religious beliefs that influence risk perception
36		*Individual preparedness and mitigation*	Preparedness; Adaptive capacity; Technical	Did you take any precautious measures to any of these hazards?	• Yes, please specify: • No • No, but I want to		
37		*Mitigation; Insurance*	Preparedness; Economic	Do you have an insurance for any of these hazards?	• Yes • No • No, but I want to		
38		*Community preparedness, assessment and mitigation*	Preparedness; Coping capacity	Does your community have an evacuation plan for a tsunami or storm surge event?	• Yes • No	PREP1	Identify if means for protecting populations exist
39		*Community preparedness, assessment and mitigation*	Preparedness; Coping capacity	If you have evacuation maps for the local levels, when did you prepare them?	Please specify:	PREP1	Identify if means of protecting populations are up to date
40		*Individual preparedness;*	Preparedness; Adaptive / coping capacity	The impact of a natural disaster can be reduced or minimized by individual actions.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		
41		*Community preparedness; Community empowerment for action*	Preparedness; Adaptive / coping capacity	The impact of a natural disaster can be reduced or minimized by collective / community actions.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		

42		*Understanding of hazards and consequences*	Place attachment	In case you live/ lived in an area at risk, would you consider preventive resettlement to protect yourself (and your loved ones) from an ocean-related hazard?	• Yes • No • Maybe	
43		*Understanding of hazards and consequences*	Place attachment	And what if there was an incentive if you proceed to resettle? What would you consider as good compensation?	Please specify:	
44		*Social support; community bonds; network structures*	Culture and diversity; Communication	Do you know your neighbors?	• Yes • No • I know them a bit	Sens of community
45		*Social support; community bonds; network structures*	Culture and diversity; Communication	Your neighbor is asking you a big favor, would you help?	• Yes • No • Maybe	Sens of community
46		*Social support; community bonds; network structures*	Culture and diversity; Communication	Do you participate in any community activity?	• Yes • No • No, but I want to	Sens of community
47		*Social support; community bonds; network structures*	Culture and diversity; Wellbeing and livelihood	I feel that I belong to a community.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	Sens of community
48		*Intentional patterns*	Governance; Preparedness	Do you think you/ your sector should assist more actively Disaster Risk Reduction (DRR) or Disaster Risk Management (DRM) activities?	• Not at all • Not really • Yes, to some extent • Yes, a lot • Yes, very much	Whose responsibility is DRR or DRM?

49		*Active stakeholders; Prevention and control; Institutions*	Governance	In your opinion, besides you, who is currently involved in DRR or DRM?	Please specify:	Whose responsibility is DRR or DRM?
50		*Intentional patterns; Prevention and control; Institutions*	Governance	In your opinion, who should be involved in DRR & DRM?	Please specify:	Whose responsibility is DRR or DRM?
51		*Identify challenges in DRR*	Preparedness; Response; Governance; Infrastructure and technical	What do you think is the biggest problem to effectively managing coastal hazards/ risk?	Please specify:	Identify challenges in DRR / DRM
52		*Collective action and decision-making*	Governance; Innovation and capital	Do you think that more could be done in terms of DRR or DRM? If yes, by whom?	• Yes • No • I don't know	Identify challenges in DDR / DRM
53		*Identify challenges in DRR*	Preparedness; Response; Governance; Infrastructure and technical	Which preparation measures are currently undertaken? What are the main constraints?	Please specify:	
54		*Prevention and control*	Preparedness	Are there any protective hard infrastructures? If yes, how efficient are they?	Please specify:	
55		*Capacity building for EWS; skills training*	Preparedness; Response	Are there any exercises or drills for one of these hazards?	Please specify:	
56		*Knowledge-based decision making*	Governance; Protection	The impact of different hazards is considered in decision-making processes.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	

57		*Safe evacuation routes identified and maintained, known to community members*	Information and communication; Preparedness	Does your municipality display evacuation signage?	• Yes • No • I don't know	PREP2	
58		*EWS capable of reaching everyone*		Does your municipality use acoustic warnings for tsunamis, storm surges or SLR?	• Yes • No • I don't know		
59		*Community understanding of characteristics and functioning of local natural environment and ecosystems and the potential risks associated*	Response	Imagine you are at the beach. You feel a (strong) earthquake. What would you do?	Multiple answers possible. • Continue what I was doing • Call someone I trust for advice / confirmation • Observe my surroundings/ the sea • Check social media/ news • Evacuate the beach • Other, please specify:		Identify behavioral patterns / willingness to evacuate
60	III - Disaster response and factors affecting individual and collective response patterns	*Community understanding of characteristics and functioning of local natural environment and ecosystems and the potential risks associated*	Response	If you answered with "Evacuate the beach", where would you go?	Please specify:		Identify behavioral patterns and knowledge of safe places
61		*Local organizational structures for emergency response*	Coping capacity	The municipality I work for has the capacity to manage emergency response operations during a tsunami event.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	RESP 2	Identify behavioral patterns
62		*People-centered EWS*	Information and communication	Which communication channel do you prefer for disseminating alert	Please order from most important to least important:	RESP3 & 4	Identify means of communication

				messages? Which ones are you currently using?	TV; Radio; Internet (social media); Acoustic warnings; Warning application; SMS; Email; If any other:		
63		*People-centered EWS*	Information and communication	Who is responsible for issuing warning messages?	Please specify:		Identify roles
64		*Redundancy; Rapidity; Robustness; Resourcefulness; People-centered EWS*	Information and communication	Stakeholders have redundant and reliable means to receive official (tsunami) warnings 24/7.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	RESP 3	Identify means of communication
65		*Local organizational structures for emergency response*	Response; Governance	Stakeholders address these hazards in community emergency operations or response plans.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree	RESP 1	
66		*Beliefs; Personality; Corruption*	Information and communication	Local populations trust in official warnings	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Identify trust in authorities
67		*Knowledge-based decision making*	Response, Government	The organization I work for is flexible in responding to changing disaster situations.	• Strongly disagree • Disagree to some extent • Neither disagree, nor agree • Agree • Strongly agree		Identify institutional flexibility
68	IV – Post-disaster: Recovery and learning opportunities	*Coping with adverse circumstances; Positive adjustment/ adaptation*	Innovation; Adaptive and coping capacity	After a disaster happened, do you think building back better in safe areas can reduce disaster risk?	• Yes • No • I don't know		Sendai Framework

| 69 | enhancing resilience | *Coping with adverse circumstances* | Governance | If there was a disaster event in your municipality with loss of lives, who would you account responsible for it? | Please specify: | | |