

3. Awareness and Response

In a broad-brush way, this section discusses the current status of response capabilities in 4 regions on tsunamis and sea-related hazards. The section will also pay a specific attention to small island developing states and least developing countries, and how these states and communities at risks can equally access capacity development programs to reduce tsunami risks. The aim of understanding the current state of tsunami awareness and response is to emphasize the importance to understand how awareness response capability demands mutual and reciprocal relations with 1). built risk knowledge perceptions and, 2). its given warning system infrastructures. These are clearly reflected in the IOC UNESCO three pillars of TWS strategy.

In regards with risk perceptions and knowledge, the series of tsunami events in Japan in the past century had given a positive example on how it had in turn increased awareness and capabilities to respond to the future tsunami threats. These capacities are built from long-term and extensive countermeasure efforts. Although at the same time, it also created long term social problems in relocations along with disrupted livelihoods (Suppasri, et al, 2015) of which the communities had to figure ways to recover. However, this is not always the same case in many regions in the world. The 2004 Indian Ocean tsunami for example, reflected the very concerning level of awareness, let alone response capabilities in many affected countries as there were no tsunami warning information available for the public during the time. This was also the case for small islands context, for example, the Niuaupolu island – Tonga tsunami in 2009 (Clark, et.al. 2011). The event had evidently showed how the absence of prior knowledge and education contributed to absence of capacities to self-evacuate. These self-evacuation capacities are particularly important for small island contexts in which the waves might arrive within minutes, and where warning infrastructures and information found its limitations.

The varied level of awareness and responses are very much shaped by the diverse risk perceptions with different embedded factors. These factors include among others memory of past events, experiences, risk knowledge and information, media exposures, culture beliefs, socio-psychological factor and many more (Rafliana, 2022). In a nutshell, risk perceptions play instrumental roles in influencing the levels of awareness and the way one would respond to tsunami threats and warnings. The effectiveness of response also dependent to the quality and accessibility towards official warning information. It is even more crucial to understand, as tsunami warning system are counted as contemporary technology, that many coastal communities at are still working their way to incorporate warning systems in the daily lives.

Historically, tsunamis in Japan¹ and the Pacific² marked the early era of national and basin-wide tsunami warning system development. Decades later, significant events such as the Indian Ocean 2004 Tsunami triggered the development and strengthened warning systems in the Indian Ocean, Caribbean and North Europe and Mediterranean regions. Significant events such as the Indian Ocean 2004 and Great Japan tsunami 2011 had contributed in greater global attention and awareness on tsunamis. All

¹ After 1933 Sanriku tsunami (Shuto & Fujima, 2009)

² 1946 Alaskan tsunami and 1960 Chile tsunami are two prominent events in the development of Pacific Tsunami Warning System (Igarashi et.al., 2011)

the events provided lessons on the importance of awareness and response capabilities and how they become the core prerequisites for an effective warning system.

3.1 Response Capability

This subsection summarizes the recent reports related with awareness and response capability in 4 different regions. The subsection also addresses the gaps based on the current reports. In general, the Indian Ocean provided more solid empirical information on the capacities at the national level, by comparing the IOTWMS status between 2005 and 2018. The other regions report many promising progresses and also plans that are rather recent (2012 to 2021). The Tsunami Information Centers (TICs) in the 4 regions contributed significantly in facilitating the exchanges and repository development of tsunami awareness and education materials, that is crucial in strengthening response capabilities. The contemporary tsunami events also proven to be the important factor for improvements particularly when occurring in the region. While others have less frequent experiences, it became immensely challenging to prioritize public education, awareness and response capabilities as a national priority.

3.1.1. Indian Ocean

Through the IOC UNESCO Coordination, the regional tsunami warning system in the Indian Ocean region was fully operational 9 years after the catastrophic event in 2004. It was realized that the effort to build preparedness and sustain the initiatives took even longer. UNESCO started coordinating the development in 2005, by conducting a dedicated assessment on the existing capacities among 10 out of 16 ICG IOTWMS member states; which during the time were understandably low. The assessment mapped supports needed in the context of public awareness. With the increase capability of monitoring, detections and warning system services provisions including 3 tsunami service providers (TSPs), and also reflecting from consecutive tsunami events in the region after 2004, the IOTWMS conducted a rigorous assessment for 20 member states in 2018. Most of the national institutions are disaster management offices, and several were NTWCs. Promising results shows, among others, on the increase of national level capacities through development of public education materials informed by hazard and risk assessments, evacuation maps, involvement in regional and national drills, and establishing national SOPs on warning response. At least 7 countries are piloting their Indian Ocean Tsunami Ready program (IOTR). Stronger engagements are needed at local level, and most countries are still working on this. Indonesia, being the most affected by 2004 tsunamis and following tsunami events afterwards is able to place tsunami risk reduction policies as among the national priority planning, and evidently developed programs down to the local and community levels. However, this is not the case for the low recurrent or low risk countries, including for example Singapore.

3.1.2. Pacific

An effort was made by the ICG PTWS in 2011 to assess the current capacities of the member states on its awareness and response, and to identify the underlying gaps and needs. However the response were quite low with only 11 member states providing feedbacks out of (number of PTWC member states). Nevertheless, the region has been very active in conducting PacWaves and also SOPs trainings for NTWC and NDMOs, including bridging the different actors in the warning system to collaborate. At country level, several member states had developed rigorous response capacities for example the US, Japan, Chile and New Zealand. New Zealand for example, developed their response capacities after the 1960s Chilean tsunami. But the 2004 Indian Ocean event managed to conduct a national

review and refurbish the tsunami risk reduction policy in the country. The 2011 Great East Japan tsunami was also a significant influence for the nation's improvements (Johnston et.al, 2014).

3.1.3. Caribbean

The Caribbean region created a dedicated task team on Communication and dissemination in 2013. The task team reviewed the many progresses and challenges in warning dissemination, and also making use of Wave Exercises to learn the many lessons and challenges related to communication and dissemination, including the use of the many varieties of media and social media. However, there are no available report to understand the current status of response towards official warnings. Interestingly, the ICG Caribe reported lessons from the 2016 Caribe Exercise, underlining the vulnerability of communication network that potentially hinder the effectiveness of preparedness and response towards tsunamis.

3.1.4. North European and Mediterranean

The North European and Mediterranean (NEAM) region had among the most highly valued history of 1755 Lisbon, and 1908 Messina destructive tsunamis. In regards with the development of standards and implementing education and response strategies, the NEAM member states are relatively challenged by the long return period of tsunamis. The aforementioned historical events were not sufficient in constructing and maintaining tsunami risk perceptions in most of the region. On the other hand, the ICG/NEAMSTWS members are at least 40 countries and reaching 130 million people living in tsunami risk areas, of which most coasts are dependent to marine tourism and coastal livelihood. It took almost a century and another event in the Indian ocean 2004, that the NEAM countries strategize against the foreseen tsunami risks and started developing their TWS implementation plans. The plans followed by the establishments of 10 NTWCs and 5 Tsunami Service Providers (TSPs). Similar with other regions, it took time and social processes for the region to build from their knowledge and perceptions into sustained awareness and education activities. The latest NEAMTWS report indicated that tsunami exercises took place from 2012 to 2021. As of capacity strengthening at the end-users' side, such as Tsunami Ready programs, the region is currently exploring interests from member states for implementation. Greece, on the other hand, had the longest initiatives on public education activities back dated in 1983 as the Earthquake Planning and Protection Organization (EPPOS) was established. As the NTWC in Greece established in 2012, it follows with education and awareness programs. Challenges remained, as a survey provided empirical evidences on the level of tsunami awareness, showing that tourist and visitors are more aware of tsunami risks than of the locals (IOC UNESCO, 2021). In general, there are needs to further develop national response capacities in the region, and followed by capacities at the local and subnational level.

3.2. Implementation of UNESCO-IOC Tsunami Ready Program

Tsunami Ready Program embodied key indicators that indicates how communities at risk build capacities respond to warning and tsunami threats. The program is adopted by IOC UNESCO – Tsunami Unit based from experiences from the US, since 2015 firstly piloted in the Caribbean region. The program became part of the UN Ocean Decade, aiming at 100% of communities at risk to be recognized as Tsunami Ready Community by 2030. The Tsunami Ready program through different tools provided, were directed or initiated mostly by the NTWCs at the national level. For example, the Tsunami Ready program recognitions in India are launched and initiated by INCOIS, and in Indonesia by BMKG. It resonates the urge to prepare and ensure communities capability to respond to tsunami warning

information and to act upon it, through official international recognition represented by UNESCO. To date, there are at least 28 communities in different sites and countries currently recognized as Tsunami Ready Community. These communities are equipped with webinars and forms of virtual forums to discuss and interact with key Tsunami Program officers in the different regions. It also includes video and tutorials and Tsunami Ready Viewer using Virtual Reality media.

Challenges pertain as communities are not at all a homogenous group, and they are highly dynamic and mobile, and also interconnected with larger societies. This is reflected for example in the NEAMS context where tourism industry plays pivot role in the region's development. Or the recently recognized Tsunami Ready communities of Tanjung Benoa in Bali, Indonesia in 2022, who are at the moment facing the threats of mean sea level rise and impacts of coastal reclamations, that will hinder their evacuation planning and the effectiveness of their response towards tsunami warning. Or in the times of pandemic where the problem exacerbates towards more complex risks beyond tsunamis, and communities had to work around different ways in dealing with such cascading risks. In this sense, recognitions of Tsunami Ready program should also recognize and overcome the barriers and challenges that often are beyond the communities and beyond merely tsunami risks.

3.3. Highlights on SIDS and LDCs

For Small Island Developing States (SIDS) and Least Developed Countries (LDCs) in particular, addressing single-hazards risk policies and implementations, and also global formats of awareness and response are often highly challenging. These are due to limited available resources, including communication and dissemination infrastructures that complies to the local contexts. On the other hand, most of the SIDS and coastal LDCs are heavily dependent to the coastal resources. Creating more dependencies towards external resources on technologies and warning systems without building stronger local capacities, could also in turn create new vulnerabilities. It is understood that the scientific knowledge about tsunami histories in small island countries are still relatively limited. Responses might need to address both 1) potentials of short lead time tsunamis with ground shakes as and alarming sign, but also 2) tele-tsunamis that reaches in hours with no natural phenomena to decide for evacuation. Stronger trans-national infrastructure networks and communication would need prioritizations, aside continuous and sustaining public education and awareness rising.

3.4. Institutionalizing Tsunami Awareness and Response

Awareness and also response changes throughout time, shaped by new knowledge and experiences and also interventions. Responses towards tsunamis, being shaped by different perceived risks, are often difficult to predict, for example in rural as compared to urban areas, main lands and small islands, areas with higher frequency of events as to compare with lower frequency of events. As the society continuously changing, long-term strategies in tsunami awareness and response should also adapt and evolve.

Effectiveness of awareness and response can be tested in two ways, 1) through drills and exercises, and 2) real events. All the Wave Exercises, and also smaller scale exercises need to be reflected and documented for education purposes and use. Countries with tsunami risks needs to collaborate for example with UNESCO-ITST (International Tsunami Survey Team) assessing real events should also address and document the response of NTWCs, local government and community responses at local level to a particular tsunami event or phenomena. These lessons should be integrated in disaster risk

education at school curriculums and within development planning from village and community level, engaging all related key stakeholders. Comprehensive understanding of the importance of awareness and response requires multi-transdisciplinary endeavor that engage all possible stakeholders, and all possible innovations in overcoming challenges towards effective risk reduction efforts.

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