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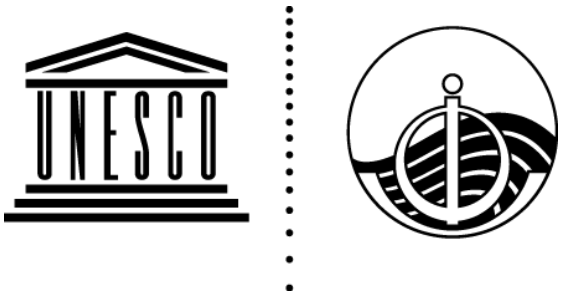

Capacity Assessment of Tsunami Preparedness in the Indian Ocean

Status Report, 2018

UNESCO

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Capacity Assessment of Tsunami Preparedness in the Indian Ocean

Status Report, 2018

By the ICG/IOTWMS Task Team on Capacity Assessment of Tsunami Preparedness

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National Reports of participating countries are compiled in a supplement to this report.

Report prepared by: ICG/IOTWMS Task Team on
Capacity Assessment of Tsunami Preparedness

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The Capacity Assessment of Tsunami Preparedness in the Indian Ocean region was the primary activity of the intersessional Task Team on Capacity Assessment of Tsunami Preparedness. The Task Team convened from 2017 to 2019 under the governance of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) chaired by Dr Andi Eka Sakya. (2017–2019) and currently by Prof. Dwikorita Karnawati.

The Task Team on Capacity Assessment of Tsunami Preparedness was chaired by Dr Harkunti Rahayu (Indonesia) with Vice-chair Ms Vijaya Sunanda Manneela (India). Membership of the Task Team included Dr Yuelong Miao (Australia), Mr Budiarta (Indonesia), Ms Eny Supartini (Indonesia), Mr Ardito Kodijat (IOTIC), Mr Saw Bun Liong (Malaysia), Mr Al-Yaqdan Al-Siyabi (Oman), Dr Dilanthi Amaratunga and Dr Richard Haigh (both invited experts from the University of Huddersfield's Global Disaster Resilience Centre).

The underpinning survey was designed by the Task Team on Capacity Assessment of Tsunami Preparedness during a series of meetings and testing trials with select Member States. The questionnaire assimilated and built upon the existing ICG/IOTWMS National Reports, Post-IOWave Surveys and IOC/UNESCO Post-Event Assessment Surveys. The survey was constructed on SurveyMonkey, an online survey platform.

The ICG/IOTWMS Secretariat circulated the online survey to the Tsunami National Contacts of ICG/IOTWMS Member States. The Tsunami National Contacts oversaw and coordinated the completion of the survey through consultation with national stakeholders involved in end-to-end tsunami warning including the National Tsunami Warning Center and Disaster Management Agencies.

The dataset underpinning the regional analysis for Capacity Assessment of Tsunami Preparedness includes timely survey responses from 20 IOTWMS Member States, namely Australia, Bangladesh, Comoros, France (Indian Ocean Territories), India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Singapore, Sri Lanka, Tanzania, Thailand and Timor Leste.

The survey results were analysed and compiled by Dr Richard Haigh, Dr Dilanthi Amaratunga and Dr Pournima Sridarran and Dr Harkunti Rahayu. Dr Srinivasa Kumar Tummala, Mr Tony Elliott and Ms Nora Gale made substantive contributions to authoring this report.

The report greatly benefited from reviews by Dr Thorkild Aarup and Mr Ardito Kodijat of IOC/UNESCO.

FOREWORD

In response to the destructive tsunami of 26 December 2004 in the Indian Ocean, which killed almost 228,000 people, the Intergovernmental Oceanographic Commission of UNESCO received the mandate from the United Nations to establish three new regional tsunami warning systems to complement the first system in the Pacific Ocean. Following the formal establishment of the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS), its governing organ, the Intergovernmental Coordination Group for IOTWMS (ICG/IOTWMS), facilitated missions to assess the state of tsunami readiness in 16 countries that had been affected by the 2004 Indian Ocean tsunami. The findings were published in the 2005 Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean (IOC/INF-1219) and provided critical inputs to the eventual design and development of the IOTWMS. The three regional tsunami warning systems established in 2005 are now operational in the Caribbean and adjacent seas (CARIBE-EWS), the North-East Atlantic, Mediterranean and connected seas (NEAMTWS) and the Indian Ocean.

Recognising the importance of knowing the current status of tsunami preparedness in the Indian Ocean region, the ICG/IOTWMS at its 11th session (Putrajaya, Malaysia, April 2017) established a Task Team on Capacity Assessment of Tsunami Preparedness in the Indian Ocean. In 2018, the Task Team designed and conducted an extensive online survey covering all aspects of the end-to-end tsunami warning and mitigation system. The online questionnaire was built upon the ICG/IOTWMS National Report Template, Post-IOWave Exercise Surveys, and IOC/UNESCO Post-Event Assessment Surveys. It included five sections: basic information; risk assessment and reduction; detection, warning and dissemination; public aware-ness, preparedness and response; and a narrative text within each section to be prepared by different stakeholders to reflect national specifics within an end-to-end tsunami warning and mitigation system.

With 20 ICG/IOTWMS Member States responding, the 2018 assessment provides a new baseline of the status of tsunami preparedness capacity in the region. It also identifies specific gaps and prioritises capacity development requirements at both regional and national levels. The results clearly indicate that there has been considerable improvement across all components of the IOTWMS since 2005. Nevertheless, the IOTWMS is not a static system and must further improve, evolve, and adapt to better serve the needs of its Member States. A case in point are the 2018 Palu and Sunda Strait tsunami events in Indonesia that highlighted the need to strengthen warning capabilities and enhance preparedness to deal with near-field and atypical sources of tsunami such as coastal landslides and volcanic flank collapse.

I trust that the important findings of this report will encourage Member States to continue and increase efforts towards enhancing tsunami policies, plans and guidelines; hazard and risk assessments; tsunami detection warning and dissemi-nation; and step up awareness and response. The IOC, through the IOTWMS Secretariat, generously supported by Australia and Indian Ocean Tsunami Information Center (IOTIC), generously supported by Indonesia, will continue to coordinate and facilitate the efforts of Member States to bridge gaps in capacities and strengthen the end-to-end tsunami warning and mitigation system. The upcoming UN Decade of Ocean Science for Sustainable Development (2021–2030) offers a great opportunity to build collabo-rations and pursue activities that will lead to transformative enhancements of tsunami and multi-hazard early warning systems. I warmly congratulate ICG/IOTWMS, its Task Team on Capacity Assessment of Tsunami Preparedness, and, most importantly, all Member States and experts who contributed to this important assessment.

Vladimir Ryabinin
Executive Secretary of IOC
Assistant Director-General of UNESCO

EXECUTIVE SUMMARY

The Indian Ocean tsunami of 26 December 2004 was associated with a magnitude 9.1 earthquake located 160 km off of the west coast of northern Sumatra, Indonesia. The tsunami waves resulted in over 230,000 casualties and displacement of over 1 million people in coastal communities around the Indian Ocean making it the most destructive tsunami in history. Recognising the need for a tsunami early warning system in the Indian Ocean region, the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) was established in 2005 as a subsidiary body of the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (IOC/UNESCO), with the objective to mitigate the hazard posed by local and distant tsunamis in all parts of the Indian Ocean.

After several years of international cooperation and development coordinated by the IOC/UNESCO, the IOTWMS became fully operational on 31 March 2013 when the Tsunami Service Providers (TSPs) of Australia, India and Indonesia assumed full responsibility for the provision of tsunami advisory services for the Indian Ocean region. The Secretariat of the ICG/IOTWMS was established at the Perth Programme Office in support of IOC/UNESCO and has been funded and hosted by the Australian Bureau of Meteorology (BoM) since 2005. The Indian Ocean Tsunami Information Centre (IOTIC) is based in Jakarta, Indonesia, and has been funded and hosted by the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG) since 2014.

Between May and September 2005, IOC/UNESCO coordinated missions to 16 Indian Ocean Member States, namely Bangladesh, Comoros, Indonesia, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Somalia, Sri Lanka, Tanzania and Thailand, to identify capacity building requirements for an effective and durable tsunami warning and mitigation system in the Indian Ocean. The findings of these missions contributed to the *Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean* (IOC/INF-1219). The 2005 capacity assessment provided a regional overview of existing capacity and identified support requirements of Member States to build regional capacity in tsunami warning and mitigation.

Considering the importance of conducting an up-to-date capacity assessment of the tsunami preparedness in the Indian Ocean 13 years after the first survey, the ICG/IOTWMS at its 11th session (Putrajaya, Malaysia, April 2017) established the inter-sessional Task Team on Capacity Assessment of Tsunami Preparedness. The Task Team designed and conducted an online survey questionnaire covering all aspects of the end-to-end tsunami warning and mitigation system. Twenty (20) ICG/IOTWMS Member States, namely Australia, Bangladesh, Comoros, France Indian Ocean Territories, India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Singapore, Sri Lanka, Tanzania, Thailand and Timor-Leste, provided timely inputs to the assessment. This publication provides a baseline of the current status of tsunami preparedness capacity in the region, identifies specific gaps and prioritises capacity development requirements at both the regional and national levels with an overarching view of strengthening the end-to-end tsunami warning and mitigation system in the Indian Ocean.

The *IOTWMS Medium Term Strategy, 2019-2024* (IOC/2019/TS/144) provides a framework and forward direction for the development of the IOTWMS in the medium term. This 2018 capacity assessment of tsunami preparedness in the Indian Ocean complements the Medium Term Strategy by providing a new baseline of the status of the IOTWMS at the beginning of the five-year cycle. These two documents combined with the IOTWMS 2019

Factsheet[1] provide an overview of the governance and structure of the IOTWMS; details of its detection, warning and dissemination systems; the status of current capacity in end-to-end tsunami warning and mitigation; and an outline of the strategic objectives, plans and activities for the IOTWMS up to 2024. In addition, IOC/UNESCO and its ICG/IOTWMS have continued to facilitate dialogue by organizing international conferences, symposiums and meetings to exchange scientific knowledge and best practices for tsunami warning systems, and these have also provided guidance to the IOTWMS on charting its future direction and priorities.

The 2018 capacity assessment reviews the high-level strategic documents and progress in end-to-end tsunami warning and mitigation in Indian Ocean Member States. Specific reference has been made to the three pillars of end-to-end tsunami warning systems: (i) tsunami risk assessment and reduction; (ii) detection, warning and dissemination; and (iii) tsunami awareness, preparedness and response.

The capacity gaps and support requirements that have emerged from the 2018 Indian Ocean capacity assessment of tsunami preparedness are intended to provide recommendations for future capacity development activities in the Indian Ocean region (section 5) along the following four strategic elements of the end-to-end tsunami warning and mitigation system.

Policies, Plans and Guidelines

It is encouraging that most countries are fairly advanced in terms of establishing tsunami policies and guidelines. Nineteen (19) countries have some form of national tsunami policy and 18 countries have some form of tsunami disaster risk reduction plans. Seventeen (17) countries have some form of national tsunami guidelines, 14 countries have national tsunami guidelines that address the preparedness phase and emergency response phase, whereas only 10 countries address the prevention, mitigation, and rehabilitation and construction phase. Across policies, plans and guidelines, as well as national to local levels, there is a recurring trend of greater focus on tsunami within the emergency phase of disaster management. While the rehabilitation and reconstruction phase may share many similarities with other hazards, the lack of tsunami specific focus for the preparedness, prevention and mitigation phases is more difficult to explain.

The most commonly identified support requirements include increasing availability of tsunami policies, plans and guidelines at the prevention and mitigation, preparedness, and recovery and reconstruction phases of disaster management with particular emphasis on the local level. The guiding documents can either be for only tsunami or for multiple hazards including tsunami.

Risk Assessment and Reduction

Risk assessment and reduction initiatives are essential starting points for developing effective tsunami preparedness activities at the national level to enable disaster risk reduction. It is encouraging that most countries are fairly advanced in terms of conducting hazard and risk assessments. Notably, in all phases of disaster management there is a general trend such that the most initiatives have been undertaken at the national level, to a lesser extent at the local level, and the least at community level.

Hazard assessments have been carried out in all 20 participating countries and a large majority (18 countries) conducted these in a multi-hazard framework. Risk assessments,

[1] *Tsunami warning and mitigation systems to protect coastal communities: Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) 2005–2019*, IOC/BRO/2019/7.

which estimate likely effects of hazards, were conducted in 16 countries and 15 of these were conducted in a multi-hazard framework.

The most commonly identified support requirements include increasing both the engagement of national, regional or international actors in the carrying out of tsunami hazard and risk assessments and the availability of publicly accessible data for tsunami hazard and risk assessments. Notably capacity development is needed for tsunami hazard assessment, especially in the areas of hazard mapping, inundation mapping and evacuation mapping; for city, village and community level tsunami risk assessments; and for developing products from tsunami risk assessments, such as risk maps, evacuation maps, guidelines and action plans. The survey shows that capacity exists in some surveyed countries to deliver and share training on hazard mapping and inundation mapping in the region.

Detection, Warning and Dissemination

An effective tsunami warning system involves the rapid detection and quantification of the earthquake source, forecasting and verification of wave propagation and the likely threatened areas, and development and dissemination of information about the threat to coastal communities to enable appropriate response. These initiatives have received much focus, particularly during the developmental phase of the Indian Ocean Tsunami Warning and Mitigation System (2005–2014) and underpin the downstream response.

All 20 countries reported that they have a national capacity to assess and/or receive potential tsunami threat information and advise/warn their coastal communities. Eighteen (18) countries reported that the organisation responsible for assessing and/or receiving potential tsunami threat information operates 24/7. Eighteen (18) countries reported producing national level threat forecast information, while 14 countries also produce local level information. Thirteen (13) countries reported having the capability of analysing real-time seismic and sea-level data for potential tsunami threat while 12 countries also reported having the capability for tsunami modelling to support generation of threat forecasts.

The most commonly identified support requirements are for increasing the capacity to analyse real-time seismic and sea-level data for tsunami threat and also for tsunami modelling to support generation of threat forecasts. The survey also revealed the need to increase the frequency of tabletop or similar tsunami warning exercises to review and test Standard Operating Procedures (SOPs) and reduce the potential for complacency among countries that have not recently experienced a tsunami event.

Public Awareness, Preparedness and Response

It is essential that coastal communities that are vulnerable to the effects of tsunamis are knowledgeable of their underlying risks, effects to livelihood, and appropriate response strategies. The downstream response was highlighted as a key priority during the 10th Anniversary Conference of the Indian Ocean tsunami (Jakarta, November 2014) and has since gained momentum with the Indian Ocean Tsunami Ready initiative, which builds community capacity to respond to a tsunami threat.

Most countries have Standard Operating Procedures that address the operation of a 24/7 emergency operating centre (18 countries), receiving information from the National Tsunami Warning Centre (18 countries), and response criteria and decision-making (17 countries). Most countries (18) also have SOPs for downstream operations that address warning dissemination; communication with the NTWC; evacuation call procedures; communication with local government and other stakeholders; and media arrangements (17 countries). All countries took part in the Exercise Indian Ocean Wave 18(IOC/2018/TS/138) organized by

the ICG/IOTWMS in 2018 and 10 countries reported conducting village or community level exercises.

Overall, despite Standard Operating Procedures being widely available for most aspects of upstream and downstream early warning operation, many countries are requesting further support to develop them, along with the associated human resources and infrastructure. The lack of community level evacuation Standard Operating Procedures is also notable and significantly worse than other aspects that were examined in this survey. The Palu and Sunda Strait tsunamis in Indonesia in 2018 have highlighted the need to develop SOPs that are appropriate for near-field, rapid onset events. This will be a challenge for the IOTWMS and specific SOP training will need to be developed for countries that are vulnerable to such hazards.

Countries indicated that they require support from the Indian Ocean Tsunami Information Centre (IOTIC) to develop or enhance public awareness including the development of tsunami awareness programmes, activities or campaigns, and participation by international agencies or experts. When assessing national status against the 11 indicators of Indian Ocean Tsunami Ready, the weakest areas include designated and mapped tsunami hazard zones and community risk reduction plans.

Support requirements are needed to improve country Standard Operating Procedures at the interface between upstream and downstream operations, including the operation of 24/7 emergency operation centre, receiving information from the NTWC, and response criteria and decision-making, as well as the associated human resources and infrastructure. Support for improving Standard Operating Procedures to address warning dissemination, communication with the National Tsunami Warning Centre, communication with other stakeholders, evacuating call procedures, communication with local government and media arrangements. The associated human resources and infrastructure are also required as is the development of community level evacuation Standard Operating Procedures. Furthermore, the willingness of countries to share their Standard Operating Procedures to share good practices across Member States should be capitalised upon. It was also noted that increased participation in global events such as Global Disaster Risk Reduction Day (13 October) and World Tsunami Awareness Day (5 November) would serve as a means of maintaining tsunami awareness in the Member States.

Fifteen (15) countries reported that their evacuation infrastructure is integrated within their evacuation plans. Training and sharing of Member States' experiences of different types of evacuation infrastructure would assist other countries to develop infrastructure that is appropriate for their needs and circumstances.

The issue of complacency among countries that have not experienced a tsunami event since 2004 is a potential risk to the long-term sustainability of the IOTWMS and is difficult to manage when many countries experience other more frequently occurring hazards such as cyclones and flooding. It is important to conduct tsunami exercises and drills to test SOPs and maintain public awareness. However, a balance needs to be struck between maintaining awareness and preparedness and over-sensitising communities to infrequent events, which could in itself lead to loss of interest and/or an increase in complacency. The incorporation of tsunami exercises at city, village, community and school levels will require countries to develop capacity in accordance with the Tsunami Ready indicators, which will require strong commitment at national government level. IOTIC can provide support through the Indian Ocean Tsunami Ready (IOTR) initiative but the countries themselves will need to provide the resources and have the commitment to achieve IOTR recognition.

Due to the infrequency of tsunami events, it is important that efforts are focused on strengthening the inter-generational awareness of communities to strengthen their long-term

resilience. In this regard, tsunami awareness, education and preparedness should be embedded in school curricula from an early age. IOTIC has a vital role to play in the development and sharing of tsunami related knowledge and the development and implementation of educational programmes, as well as organising workshops and training programmes together with the Secretariat to develop the capacity of IOTWMS Member States.

It is important to sustain operations of the IOTWMS Secretariat and IOTIC over the long term to ensure efficient functioning of the end-to-end Indian Ocean Tsunami Warning and Mitigation System.

1 INDIAN OCEAN TSUNAMI WARNING AND MITIGATION SYSTEM

The December 2004 Indian Ocean tsunami was caused by a magnitude 9.1 earthquake off of the west coast of northern Sumatra, Indonesia. The tsunami ranked the most destructive tsunami in the historical record resulting in over 230,000 causalities and more than one million people around displaced along the coasts of the Indian Ocean. Under the mandate of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, an Intergovernmental Coordination Group (ICG) for the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) was formally established by Resolution XXIII-12 at the IOC Assembly (Paris, June 2005).

1.1 GOVERNANCE AND STRUCTURE

The IOTWMS is an important component within the IOC/UNESCO framework for Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS). The governance of IOTWMS is provided through an Intergovernmental Coordination Group (ICG), under IOC/UNESCO. All 28 Member States within and bordering the Indian Ocean are members of the ICG, which elects a Chairperson and two Vice-Chairpersons at the biennial sessions. The ICG/IOTWMS reports to the IOC Assembly. Intersessional work of the ICG is currently (2019–2021) pursued through the following bodies that provides for wide representation and contributions by all the IOTWMS Member States as well as other experts:

- Steering Group,
- Working Group 1 on tsunami risk, community awareness and preparedness,
- Working Group 2 on tsunami detection, warning and dissemination,
- Sub-regional Working Group for the North West Indian Ocean,
- Task Teams:
    - Capacity assessment of tsunami preparedness (2017–2019),
    - Indian Ocean wave exercise [renewed each session],
    - Tsunami preparedness for a near-field tsunami hazard (2019–2021), and
    - Scientific tsunami hazard assessment of the Makran subduction zone (2019–2021)

The Secretariat provides facilitation, coordination and support to the activities of the ICG/IOTWMS. Hosting and funding for the Secretariat is provided by the Government of Australia through its Bureau of Meteorology in Perth.

The Indian Ocean Tsunami Information Centre (IOTIC) provides support for the countries of the Indian Ocean region in disaster risk reduction, focusing on tsunamis, through the preparation and dissemination of awareness and preparedness materials and the development of educational programmes. Hosting of IOTIC is provided by the Government of Indonesia via the Agency for Meteorology, Climatology and Geophysics (BMKG) in Jakarta.

1.2 THE IOTWMS STRATEGIC PILLARS AND FOUNDATIONAL ELEMENTS

The IOTWMS Medium Term Strategy[2] describes the basic directions towards continuously improving the IOTWMS to meet stakeholder requirements during the period 2019–2024. It describes strategic objectives to ensure an effective and efficient tsunami warning and mitigation system that is interoperable with the other ocean basins and seas. This IOTWMS Status report outlines the current status of the system and complements the Medium Term Strategy which outlines the strategic pillars and objectives, foundational elements, plans and activities for the IOTWMS in the medium term. The IOTWMS is a fully integrated end-to-end warning system built on three strategic pillars: (i) tsunami risk assessment and reduction; (ii) tsunami detection, warning and dissemination and (iii) tsunami awareness, preparedness and response.

1.2.1 Risk Assessment and Reduction

Evaluation of tsunami risk consists of both hazard assessment (i.e. specifying potential tsunami sources, wave heights along the coast, inundation and estimated tsunami arrival times) and risk assessment (i.e. estimating the exposure and vulnerability of coasts likely to be affected by tsunami hazards and estimating damages to life and property). The objective is to determine where the dangerous locations are along a coast and how strongly a tsunami could affect those areas. Both hazard and risk assessments need to be conducted by each Member State, who is best placed to understand the natural environment and its vulnerability conditions (from social economics, physical and environment aspects) of its coastal area. These assessments might utilise recent and historical data, and hazard scenarios computed for Indian Ocean-wide and local tsunamis. Risk assessment is an essential starting point for developing efficient tsunami preparedness activities at the national level to enable disaster risk reduction activities that reduce community exposure and vulnerability to tsunami and other ocean-related threats. It is also fundamental to the two other pillars.

1.2.2 Detection, Warning and Dissemination

An effective tsunami warning system involves the rapid detection and quantification of the earthquake source, forecasting and verification of wave propagation and the likely threatened areas, and development and dissemination of information about the threat to the “last mile” to enable communities to respond. Detection involves the implementation and development of seismic and sea-level observing systems that enable rapid assessment and verification of the threat.

Warning involves the rapid analysis of local earthquakes capable of generating local tsunamis; forecasting of wave propagation and potential impacts for regional and ocean wide tsunamis; and conveying that information in interoperable message formats.

Dissemination involves the timely and accurate distribution of threat and warning information from and between warning centres, and from National Tsunami Warning Centres (NTWCs) to the community. Tsunami threat and warning information for the Indian Ocean should be harmonised with other ocean basins as far as possible, taking into account the recommendations of the Working Group on Tsunami and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG), which ensure global coordination, whilst recognising any specific requirements for the Indian Ocean.

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[2] UNESCO/IOC. 2019. *Indian Ocean Tsunami Warning and Mitigation* System (IOTWMS*): Medium Term Strategy, 2019–2024*. Paris, UNESCO. Technical Series No. 144. (IOC/2019/TS/144)

The Indian Ocean has major tsunami sources in primarily two regions (related to the Sumatra-Sunda-Banda [Indonesia] and Makran [North West Indian Ocean] trenches) with warnings developed on national and regional (ocean-wide) scales. The following are descriptions of strategic developments for national warning systems and regional detection and threat information systems.

National tsunami warning systems are a critical component in the end-to-end system for both local and distant tsunamis, due to the inalienable, sovereign national responsibility of Member States for informing communities at risk and urging or ordering immediate evacuation. Regional tsunami services deal with tsunamis capable of propagating over a vast area of the Indian Ocean, affecting a number of countries. These systems use regional and global observational networks of seismic and sea-level data, and require prompt and reliable communication means to deliver threat information determined by Tsunami Service Providers (TSPs) to countries around the Indian Ocean. This tsunami threat information has the role of triggering the national warning procedure in each Member State for ocean-wide tsunamis.

1.2.3 Awareness, Preparedness and Response

It is essential that the communities that are vulnerable to the effects of tsunamis are knowledgeable with their underlying risks, their effects to livelihood, and how to respond when they happen through simple cost-effective and culturally-sensitive awareness programmes, and whenever possible, mainstreamed to gender and livelihood issues. Such programmes would include developing participatory evacuation plans and disseminating information through the media, workshops/seminars, awareness materials, the internet, signage and billboards. If not already in existence, tsunami-related curriculum programmes should be developed to build that inherent capability in young adults and children.

Due to the nature of tsunamis, Member States must be able to respond quickly and efficiently. This is all the most important for Member States, which are threatened by near-field tsunamis that leave only a few minutes for community response. This requires putting in place systems and processes to enable cost-effective response coordination (preparedness). These systems and processes would include response management structures, evacuation plans and maps, communication systems amongst emergency services, emergency operation centres, shelters and other basic necessities to support evacuees/victims, as well as medical, search and rescue infrastructures.

Member States should also plan and conduct exercises on a regular basis to test early warning systems and evacuation planning and emergency response planning at all levels. To ensure that government officials, Non-Governmental Organisations (NGOs), private sector and community representatives are able to provide the required response, sustainable capacity-building programmes should be developed and delivered. Member States should consider the implementation of Indian Ocean Tsunami Ready guidelines[3] that provide a structured and systematic framework for building community preparedness. Considering the infrequent nature of tsunamis, effort should be made to pursue community preparedness using a multi-hazard approach.

1.2.4 Foundational Elements

The Medium Term Strategy defines the following foundational elements that support the three strategic pillars:

[3] *Guidelines for Indian Ocean Tsunami Ready Programme* – Indicators, Checklist, National Recognition and Pilot Implementation Plan. Version 7. IOTIC, 28 September 2017.

1. **Interoperability**: free, open and functional exchange of tsunami information;

2. **Research**: enhanced understanding and improved technologies and techniques;

3. **Capacity Building**: training, technology and knowledge transfer;

4. **Funding and Sustainability**: resources to sustain an effective IOTWMS;

5. **Outreach**: knowledge of system utilities, capabilities and limitations;

6. **Indian Ocean Tsunami Information Centre** (IOTIC).

Each of the foundational elements is important for supporting the vision, structure, strategic objectives and sustainability of the IOTWMS. In the context of this report, capacity building, funding and sustainability, outreach and the activities of IOTIC are particularly relevant elements as they relate to the overall preparedness of the IOTWMS and the survey of Member States informs an assessment of gaps and identification of requirements for further support to develop capacity for strengthening the IOTWMS at regional, national and local levels.

1.3 IMPLEMENTATION

The IOTWMS Steering Group helps coordinate and monitor overall Medium Term Strategy implementation through and on behalf of the ICG/IOTWMS. This Capacity Assessment of Tsunami Preparedness (CATP) report forms a new baseline over which progress of the IOTWMS can be routinely monitored by the ICG. The survey will be repeated biennially to coincide with every ICG session allowing the ICG to assess the status of the IOTWMS against Key Performance Indicators (KPI), monitor progress, identify gaps and prioritise requirements of the Member States based on survey inputs to this report. Effective implementation of the Medium Term Strategy will lead to strengthening of the national and regional systems, in addition to valuable contributions towards implementation of international frameworks such as the Sendai Framework for Disaster Risk Reduction (2015–2030), United Nations 2030 Agenda Sustainable Development Goals (SDGs) and the United Nations Decade of Ocean Science for Sustainable Development (2021–2030).

2 INDIAN OCEAN CAPACITY ASSESSMENT OF TSUNAMI PREPAREDNESS

2.1 BACKGROUND

Following the Indian Ocean tsunami of 26 December 2004, from May to September 2005, IOC/UNESCO coordinated an assessment of capacity building requirements for an effective and durable tsunami warning and mitigation system in the Indian Ocean by facilitating expert missions to 16 Member States[4] affected by the tsunami. The resulting 2005 Indian Ocean capacity assessment[5] provided a regional overview of existing capacity as well as important support requirements of Indian Ocean Member States to build regional capacity in tsunami

[4] Bangladesh, Comoros, Indonesia, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Somalia, Sri Lanka, Tanzania and Thailand.

[5] UNESCO/IOC, UN-ISDR/PPEW, WMO. 2005. *Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean: Consolidated Report for 16 Countries Affected by the 26 December* 2004 Tsunami. Paris, UNESCO. (IOC/INF-1219)

warning and mitigation. The most common support requirements identified by most countries in the region included:

- Assistance to harmonise existing practices and protocols in data collection, monitoring, evaluation, and warning communication to achieve international standards and interoperability of tsunami early warning systems in the region.

- Assistance to establish real-time regional and local seismic and sea level networks with real-time data acquisition, display, and analysis to support the monitoring and detection of tsunami hazards.

- Equipment upgrade and capacity building in Global Telecommunication System (GTS) to upgrade communications lines and capacities to National Meteorological Services responsible for the receipt and issuance of tsunami warnings and enable them to disseminate warnings more effectively to the designated stakeholder and authorities.

- Training and software for numerical modelling to support the development of inundation maps and for evaluation of tsunami hazards and vulnerability.

- Educational modules on multi-hazards and their impacts including tsunami targeted at various stakeholders (trainers of risk managers, schools) including school curriculum on the tsunami and other hazards early warning system process.

- Regional training activities on overall multi-hazards early warning system process to strengthen linkages between key organisations, including media, technical agencies, and risk managers.

- Need for equipment upgrades and capacity building related to utilisation of satellite information for multi-hazard early warning systems including tsunami.

Other common support requirements identified by three to five countries in the region were:

- Upgrade dissemination mechanisms for marine warnings.

- Assistance to strengthen GIS capabilities and applications to disaster management to aid in planning and preparedness, event emergency response, and post-disaster recovery to aid in planning and preparedness, event emergency response, and post-disaster recovery.

- Electronic versions of existing materials on tsunamis and other disasters that can be adapted, translated and disseminated.

Considering the importance of conducting an up-to-date capacity assessment of the tsunami preparedness in the Indian Ocean, the ICG/IOTWMS at its 11th session (Putrajaya, Malaysia, April 2017) established the inter-sessional Task Team on Capacity Assessment of Tsunami Preparedness (TT-CATP, 2017–2019). This Task Team was chaired by Dr Harkunti Rahayu (Indonesia) with representatives from Australia, India, Indonesia, Oman, Malaysia, the Indian Ocean Tsunami Information Centre (IOTIC), ICG/IOTWMS Working Groups and invited experts from the Global Disaster Resilience Centre of the University of Huddersfield. Further details on the membership of TT-CATP are provided in Annex I.

2.2 PROGRESS TO DATE AND FRAMEWORK FOR FUTURE DEVELOPMENT OF IOTWMS

Much progress has been made in establishing the IOTWMS since 2005. Risk Assessment Guidelines[6] have been created, observing networks have been enhanced (>150 seismic stations, >100 sea level stations, 11 tsunameters), awareness material generated and the IOTWMS continues to conduct communication tests, capacity development workshops and tsunami drills. A comprehensive overview of the IOTWMS in 2019 can be found in the IOTWMS Factsheet 2019 (IOC/BRO/2019/7, including details of the seismic and sea-level networks, communications tests, tsunami drills and IOTWMS performance against Key Performance Indicators.

The IOTWMS has been designed and implemented through the joint efforts and contributions of its Member States and other partners under the coordination of IOC/UNESCO. In the early years of the IOTWMS, considerable effort and resources were directed towards developing the upstream, detection, warning and dissemination components of the system. The IOTWMS became fully operational on 31 March 2013 when the TSPs of Australia, India and Indonesia assumed full responsibility for the provision of tsunami advisory services for the Indian Ocean region. At this important juncture, the IOTWMS turned its attention to identifying gaps in the system and work that still needed to be done. Current and future work of the ICG/IOTWMS is now focused towards sustainability of and improvements to the system, as well as enhancing community awareness and response mechanisms in its Member States. In addition to the work of its Steering Group and Working Groups, the ICG/IOTWMS has been guided by the decisions and recommendations of the Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG) of IOC/UNESCO, which coordinates and harmonises tsunami warning and mitigation systems at the global level. Additionally, IOC/UNESCO has facilitated dialogue by organizing international conferences, symposiums and meetings to exchange scientific knowledge and best practices for tsunami warning systems, and these have also provided guidance to the IOTWMS on charting its future direction and priorities, as outlined below:

International Conference to Commemorate the 10th Anniversary of the Indian Ocean Tsunami (Jakarta, Indonesia, 24–25 November 2014 [7])

The objectives of this conference were to report on and document the achievements of the previous 10 years of the IOTWMS; to highlight gaps in the system and work that still needed to be done; and to seek the re-commitment of the IOTWMS Member States and other partners to continue investing in the system to ensure its long-term sustainability. The conference recognised that capacity development for public awareness and preparedness for self-protection should be a continuous programme at national level and recommended a more strategic approach to the integration of tsunami early warning into national and local disaster management. It also recommended a stronger focus on resilience by enhancing community engagement and improving skills and knowledge.

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[6] UNESCO/IOC. 2009. *Tsunami risk assessment and mitigation for the Indian Ocean: knowing your tsunami risk and what to do about it*. Paris, UNESCO, IOC Manuals and Guides No. 52, Second edition 2015 (English) (IOC/2009/MG/52 Rev.)

[7] UNESCO/IOC. 2015. *The Indian Ocean tsunami warning and mitigation system 10 years after the Indian Ocean tsunami: achievements, challenges, remaining gaps and policy perspectives: summary statement*. Paris, UNESCO. (IOC/BRO/2015/2)

Advances in Tsunami Warning to Enhance Community Response (Paris, France, 12–14 February 2018[8])

The aims of the symposium were to review the latest and potential new technologies and procedures for estimating tsunami threat; to consider ways of estimating uncertainties in threat assessments; and to examine ways of utilizing enhanced tsunami threat information for emergency response decision-making. Recommendations for national and international initiatives were made. At the national level, countries were encouraged to work towards including tsunami risk management in multi-hazard legislative and policy frameworks. At international level, recommended initiatives included further support for Small Island Developing States (SIDS) and collaboratively improving and sharing tools, methodology, information and procedures in tsunami warning, emergency response, community awareness and preparedness.

Scientific Tsunami Hazard Assessment of the Makran Subduction Zone (Kish Island, Islamic Republic of Iran, 8 March 2019[9])

The expert consultation was convened to bring regional and international experts together to collectively enhance understanding of the Makran Subduction Zone (MSZ). Priorities for future work were agreed including the enhancement of networks and exchange of seismic, sea-level and Global Navigation Satellite System (GNSS) data among MSZ Member States; further offshore active seismic profiling for constraining deformation mechanisms to quantify strain accumulation and earthquake potential; production of a Probabilistic Tsunami Hazard Assessment (PTHA) and the undertaking of tsunami risk assessments in coasts bordering the Makran region; and the review of tsunami early warning strategies against the background of experiences with near-field tsunami sources in Palu and Sunda Strait.

Strengthening Tsunami Early Warning in the North West Indian Ocean Region through Regional Cooperation (Muscat, Oman, 1–6 September 2019[10])

Two meetings were convened to discuss strengthening tsunami early warning in the North West Indian Ocean. The first meeting reflected on national strategies for tsunami early warning and community preparedness especially in the context of near-field tsunamis. The meeting agreed to strengthen national coordination mechanisms for tsunami early warning by establishing National Working Groups comprising representatives from the National Tsunami Warning Centre (NTWC), National Disaster Management Organisation (NDMO), Local Disaster Management Organisations (LDMOs), media organisations and other stakeholders in end-to-end tsunami warning as well as national experts on seismology and tsunami modelling.

The second meeting was an expert meeting on unified tsunami hazard assessment of the MSZ that resulted in the formulation of a strategy for regional cooperation to develop a regional tsunami hazard map for the Makran region. The experts agreed that future research should be focused on building a comprehensive seismo-tectonic source model for the MSZ

[8] IOC/UNESCO. 2018. *Advances in Tsunami Warning to Enhance Community Responses, 12–14 February 2018, Paris; Summary Statement*. Paris, UNESCO, pp.8. English. (IOC/BRO/2018/3)

[9] IOC/UNESCO. 2019. *Summary Statement from the Expert Consultation on Scientific Tsunami Hazard Assessment of the Makran Subduction Zone, 8 March 2019.* Perth, UNESCO. (IOC/BRO/2019/3 Rev.)

[10] ICG/IOTWMS. 2019. *Strengthening tsunami early warning in the North West Indian Ocean region through regional cooperation – Summary of Meetings, Muscat, Oman, 1–6 September 2019*. Perth, IOC (ICG/IOTWMS/MSZ/MR/Sep19).

and on the need to undertake a unified PTHA for the region. A community seismic model should also be developed to take into account the characteristics of the MSZ seismicity.

Lessons Learnt from the 2018 Tsunamis in Palu and Sunda Strait. (Jakarta, Indonesia, 26–28 September 2019[11])

Indonesia was hit by two destructive tsunamis in late 2018, in Palu and Donggala on 28 September, and in Sunda Strait on 22 December. The atypical and complex nature of these tsunamis challenged traditional understanding of tsunami hazard, warning and response mechanisms and the international symposium was convened to promote scientific dialogue on tsunami science based on the lessons learnt from the events; to consider the future direction of tsunami early warning and mitigation systems for events of non-tectonic origins with short warning times; and to stimulate dialogue on the relevance of scientific findings to policies and actions. Key recommendations arising from the symposium were:

- More research needs to be done on tsunamis triggered by volcanoes and other atypical sources to enhance early warning and preparedness;
- Developing and maintaining a culture of self-evacuation is critical for saving lives from locally generated tsunamis;
- Ensure development of effective timeline driven early warning chains and Standard Operating Procedures to deliver simple and actionable messages to the public;
- Increase the focus over the next 10 years on downstream/last mile component of the end-to-end warning system; and
- Build capacity at community level to understand natural and official warnings and the appropriate response.

2.3 METHODOLOGY

The 2018 capacity assessment was designed to provide a benchmark of the current status of the IOTWMS, identify specific gaps and prioritise capacity development requirements at both the regional and national levels for strengthening the end-to-end tsunami warning and mitigation system in the Indian Ocean. The assessment was conducted through an online survey questionnaire covering all aspects of the end-to-end tsunami warning and mitigation system. The questionnaire assimilated and built upon the existing ICG/IOTWMS National Reports, Post-IOWave Surveys and IOC/UNESCO Post-Event Assessment Surveys. The survey was disseminated through IOC Circular Letter 2742 with a unique link assigned to the designated Tsunami National Contact (TNC) for each of the 24 active[12] Member States of the ICG/IOTWMS. The survey had five distinct sections: basic information; risk assessment and reduction; detection, warning and dissemination; public awareness, preparedness and response; and narrative with each section requiring inputs from different stakeholders based on their national responsibility in the end-to-end tsunami warning and mitigation system.

[11] IOC/UNESCO. 2020. *UNESCO-IOC and BMKG International Symposium: lesson learnt from the 2018 tsunamis in Palu and Sunda Strait, Jakarta, Indonesia, 26–28 September 2019*: *summary statemen*t. Paris, UNESCO. (IOC/BRO/2020/1)

[12] Although the ICG/IOTWMS has 28 Member States, 4 Member States are inactive and do not participate in ICG activities. Nevertheless, the IOTWMS is designed to protect all ICG Member States whether active or inactive.

The dataset underpinning the regional analysis and preparation of the 2018 Capacity Assessment is based on the responses received from 20 of ICG/IOTWMS Member States by 10th January 2019[13]. The responding Member States were:

Australia, Bangladesh, Comoros, France (Indian Ocean Territories), India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Singapore, Sri Lanka, Tanzania, Thailand and Timor-Leste.

Submission of responses was timed to coincide with Member States' formal reporting to the twelfth session of the ICG/IOTWMS (Kish, Islamic Republic of Iran, 9–12 March 2019) eliminating the need for countries to submit a separate national report. Information submitted by Member States was analysed by the TT-CATP for preparation of the IOTWMS Status Report. This report was presented for consideration of Member States at the ICG/IOTWMS-XII session and approved for publication as an IOC Technical Series document subject to incorporation of any inputs received from the Member States. In order to ensure that the status and progress of the IOTWMS is routinely and effectively monitored, future capacity assessments will also be timed to coincide with the biennial ICG sessions.

3 CURRENT STATUS

3.1 POLICIES, PLANS AND GUIDELINES

High-level documents provide a structure and framework for the implementation of tsunami initiatives in a country and can assist with the designation of resources towards specific initiatives. Tsunami is often incorporated within a multi-hazard framework, which can effectively integrate and increase the visibility of tsunami within national frameworks.

3.1.1 Policies

Countries were asked to confirm the availability and type of national tsunami policy they have, including whether it is multi-hazard or standalone, and which phases of the disaster management lifecycle it addresses, from prevention and mitigation, through to preparedness, emergency response, and rehabilitation and reconstruction (Figure 1).

The responses have indicated that 19 of the 20 countries (95%) have some form of national tsunami policy and the country without one commented that it is under development. A large majority have addressed tsunami as a part of a multi-hazard policy. Ninety percent (90%) of countries have a national policy that addresses the emergency response phase and 80% one that addresses the rehabilitation and reconstruction phase. Seventy-five percent (75%) of countries have a national policy that addresses the prevention and mitigation phase and/or the preparedness phase.

[13] The report from South Africa was submitted after the regional analysis had already been completed and therefore it was not possible to include their responses in the analysis. However, their national report is included in the supplement to this report.

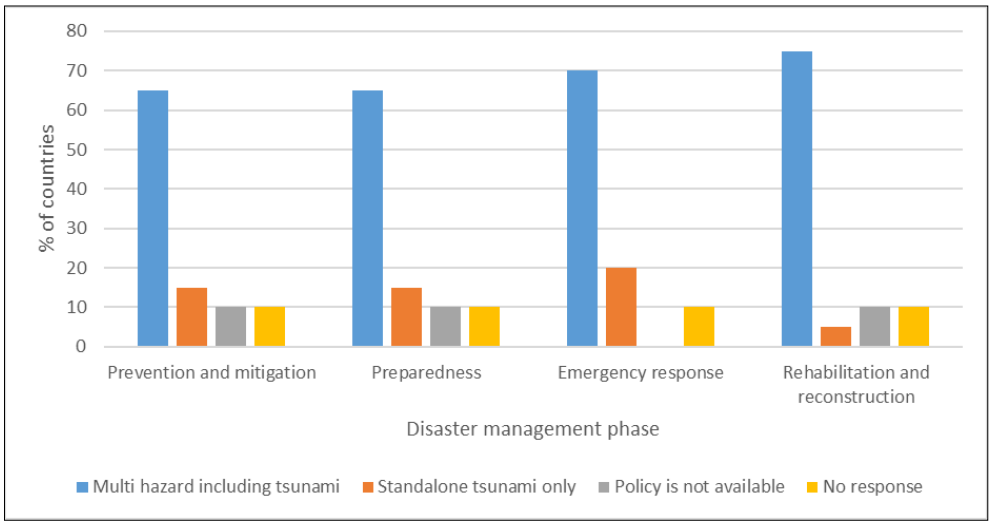

Figure 1. Types and phases of national tsunami policy

Using the same approach, countries were asked to confirm the availability and type of local tsunami policy they have, including whether it is multi-hazard or standalone, and which phases of the disaster management lifecycle it addresses, from prevention and mitigation, through to preparedness, emergency response, and rehabilitation and reconstruction (Figure 2). The responses indicated that 15 of the 20 countries (75%) have some form of local tsunami policy. Three of the countries without have commented that it is under development. For those countries with some form of local tsunami policy, the majority have included tsunami as a part of a multi-hazard policy. Seventy-five percent (75%) of countries (15) with a policy have addressed the emergency response phase, whereas for each of the other phases, only 55% countries have addressed tsunami, either as a standalone or multi-hazard policy.

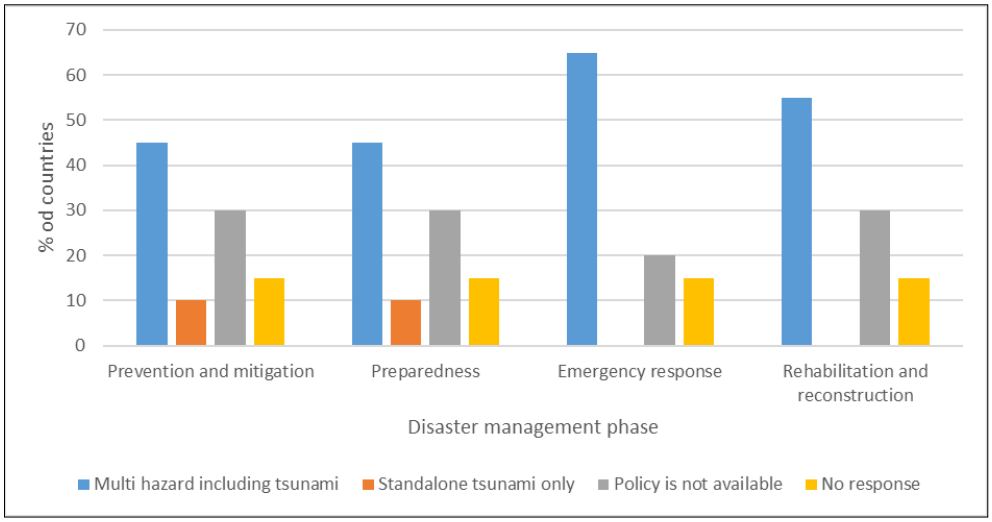

Figure 2. Types and phases of local tsunami policy

3.1.2 Plans

Countries were asked to confirm the availability, level and type of tsunami risk reduction plans they have, including whether it is multi-hazard or standalone, whether it is at the national, local or community level, and which phases of the disaster management lifecycle it addresses, from prevention and mitigation (Figure 3), through to preparedness

(Figure 4), emergency response (Figure 5), and rehabilitation and reconstruction phases (Figure 6).

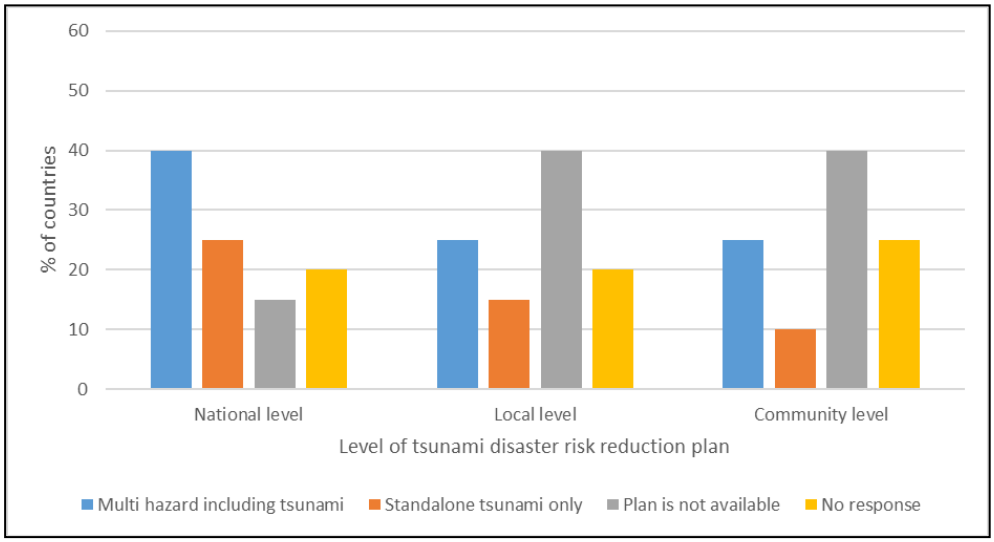

Figure 3. Availability of national, local and community level tsunami disaster risk reduction plans during prevention and mitigation phase

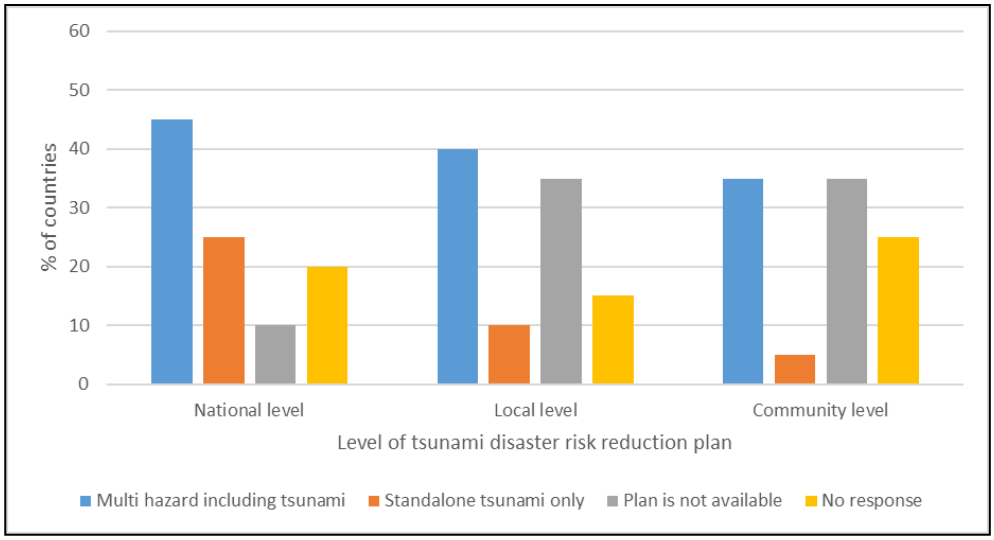

Figure 4. Availability of national, local and community level tsunami disaster risk reduction plans during preparedness phase

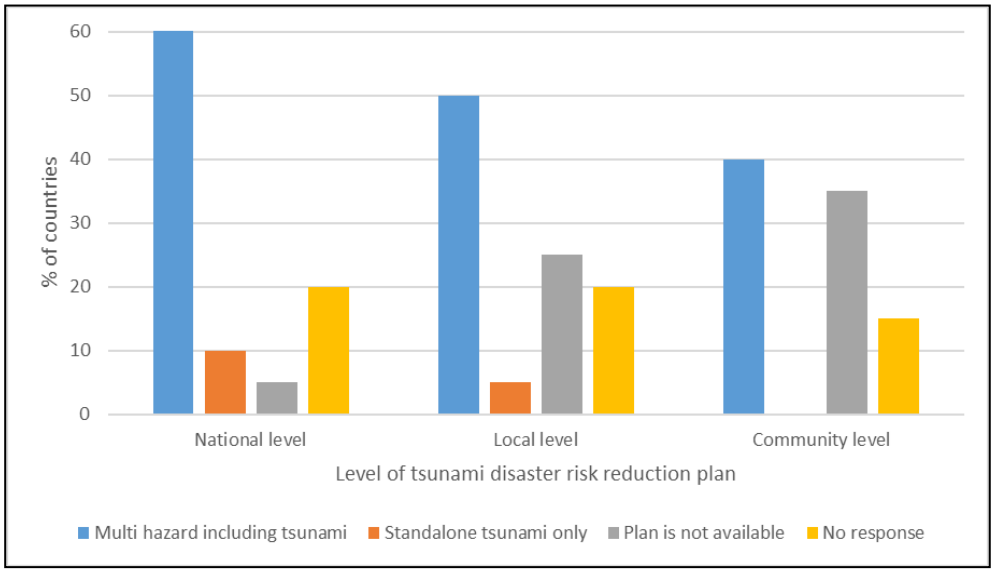

Figure 5. Availability of national, local and community level tsunami disaster risk reduction plans during emergency response phase

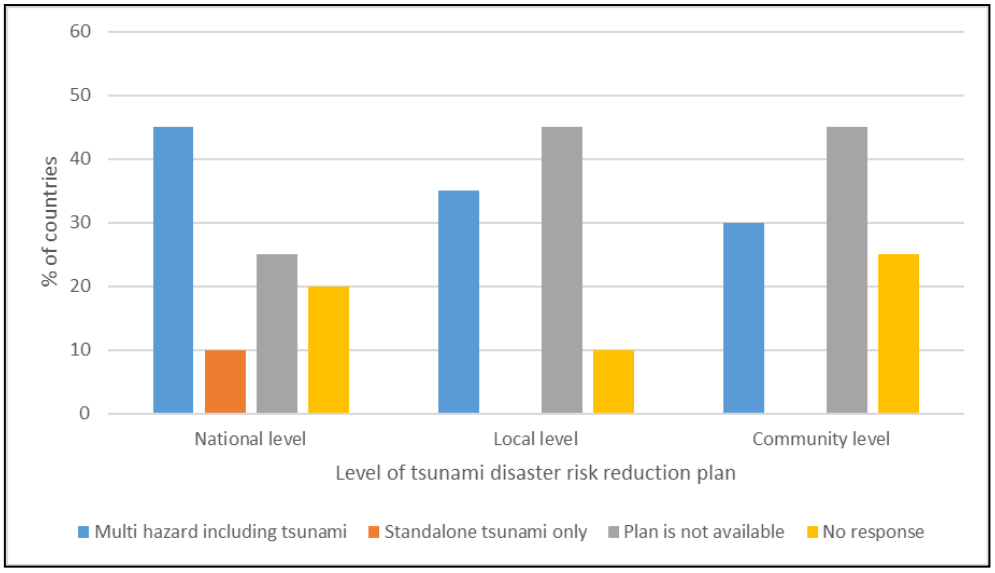

Figure 6. Availability of national, local and community level tsunami disaster risk reduction plans during rehabilitation and reconstruction phase

The responses have indicated that 90% of countries have some form of tsunami disaster risk reduction plans, while 1 out of 2 countries without plans commented that they are under development. A significant majority of countries have addressed tsunami risk reduction as a part of a multi-hazard plan, rather than as standalone plans.

Across all four phases of the disaster management lifecycle, availability of plans was significantly higher at the national level, followed by the local level. There was least availability at the community level. For example, at the emergency response phase 75% of countries have national level plans, while 55% have local and 40% have community level plans. This pattern was similar in all phases of disaster management.

Availability of tsunami plans was highest during the emergency phase. For example, the 75% of countries with national plans at the emergency phase exceeds those during the prevention and mitigation phase (65%), the preparedness phase (70%) and the rehabilitation and reconstruction phase (55%). This pattern was replicated at the local and community levels, with availability at the emergency phase exceeding other phases.

All countries (100%) reported that their tsunami disaster risk reduction plans were based on hazard and/or risk assessments.

3.1.3 Guidelines

Countries were asked to confirm the availability and type of national tsunami guidelines they have, including whether it is multi-hazard or standalone, and which phases of the disaster management lifecycle it addresses, from prevention and mitigation, through to preparedness, emergency response, and rehabilitation and reconstruction (Figure 7).

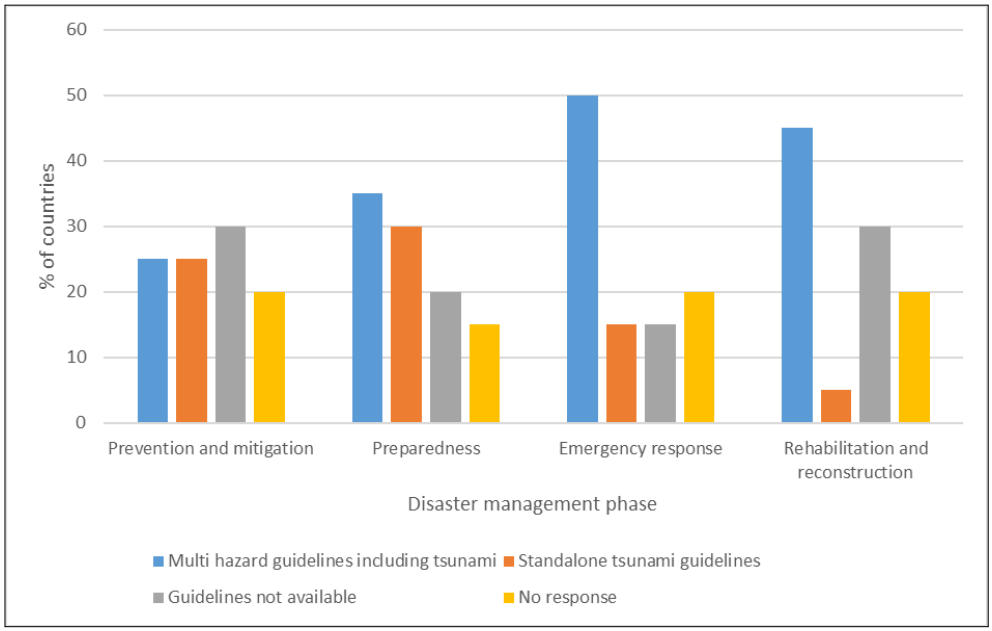

Figure 7. Types and phases of national tsunami guidelines

The responses indicate that 17 of the 20 countries (85%) have some form of national tsunami guidelines. At the prevention and mitigation phase and preparedness phase there was a mix of standalone guidelines and those that address tsunami as a part of a multi-hazard guidelines. At the emergency response phase, and rehabilitation and reconstruction phase, they predominantly addressed tsunami as a part of national multi-hazard guidelines.

Sixty-five percent (65%) of countries have national tsunami guidelines that have addressed the preparedness phase and emergency response phase, whereas only 50% of countries have addressed the prevention and mitigation, and rehabilitation and reconstruction phases.

Using the same approach, countries were asked to confirm the availability and type of local tsunami guidelines they have, including whether it is multi-hazard or standalone, and which phases of the disaster management lifecycle it addresses, from prevention and mitigation, through to preparedness, emergency response, and rehabilitation and reconstruction.

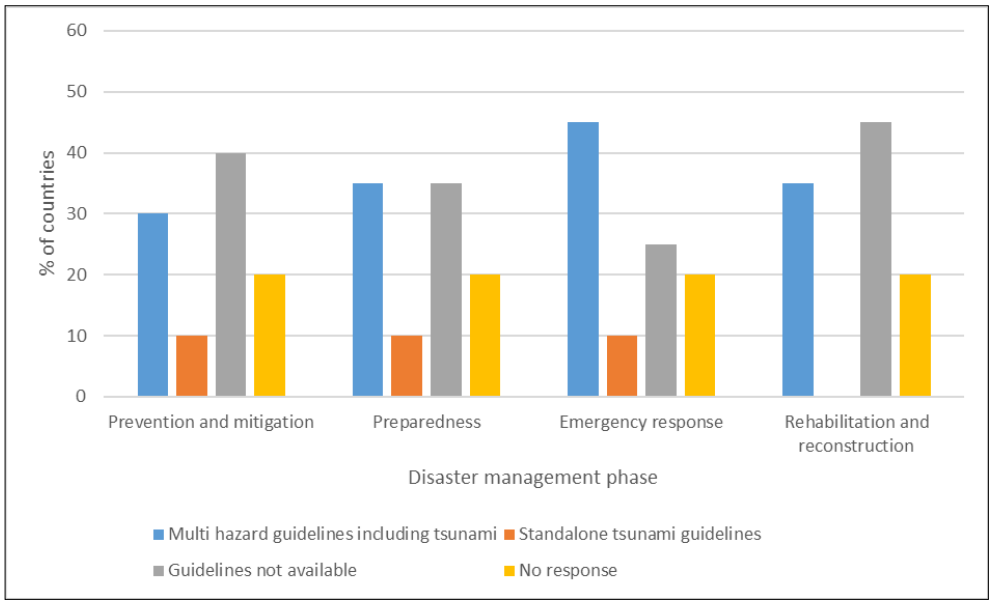

Figure 8. Types and phases of local tsunami guidelines

The responses indicate that 16 of the 20 countries (80%) have some form of local tsunami guidelines. Across the disaster management phases, the majority have addressed tsunami as a part of multi-hazard guidelines. Fifty-five percent (55%) of countries have local tsunami guidelines that have addressed the emergency response phase. They are not as commonly found in other phases, including preparedness (45%), prevention and mitigation (40%), and rehabilitation and reconstruction (35%).

3.2 RISK ASSESSMENT AND REDUCTION

3.2.1 Hazard Assessment

Countries were asked to confirm whether a hazard assessment had been carried out, and if so, what type of assessment (i.e. specifying potential tsunami sources, wave heights along the coast, inundation and estimated tsunami arrival times).

The results show that all 20 countries participating in this survey (100%) conducted hazard assessments to understand the threats to their territory.

Figure 9 shows the type of hazard assessment carried out by each country. Eighteen countries (90%) reported conducting a multi-hazard assessment that includes tsunami of which 2 countries (10%) both a single hazard assessment on tsunami and a multi-hazard assessment including tsunami. Two countries (10%) conducted a single hazard assessment on tsunami only.

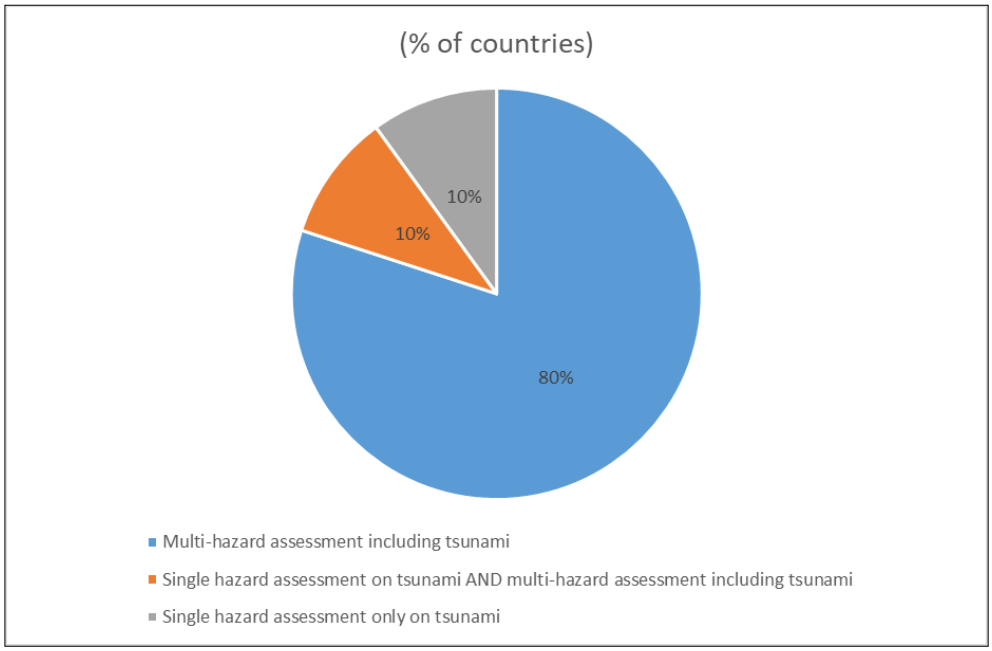

Figure 9. Type of hazard assessment

For those countries that carried out multi-hazard assessments, respondents were asked to identify the types of hazard that were included in the assessment.

Figure 10 shows the number of hazards included in the multi-hazard assessments conducted by each country. Out of the 18 countries that conducted a multi-hazard assessment, 1 country included 8 hazards, and 3 countries included 7 hazards covering tsunami, cyclone, drought, earthquake, epidemic, flooding, landslide, and volcanic eruption. Five countries included 6 hazards, 2 countries included 4 hazards, and 4 countries included 3 hazards.

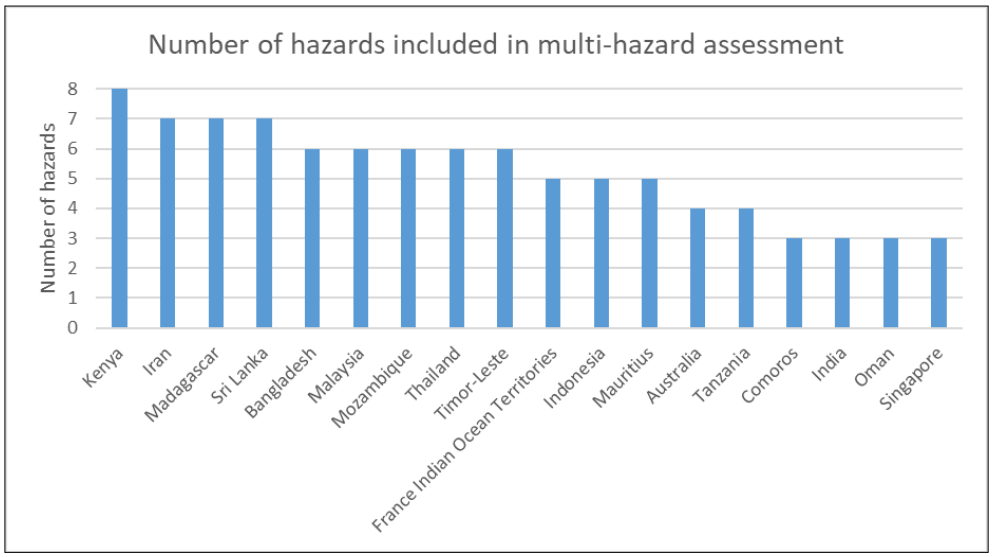

Figure 10.Number of hazards included in a multi-hazard assessment

As shown in Figures 9 and 11, all 20 respondent countries included tsunami in their hazard assessment. Seventeen (17) of the countries who did multi-hazard assessments also included flooding (85% of total), 15 included cyclones (75% of total) and 14 (70% of total)

included earthquakes (Figure 11). Less common hazards included were drought and landslides (55%), epidemics (35%) and volcanic eruptions (20%).

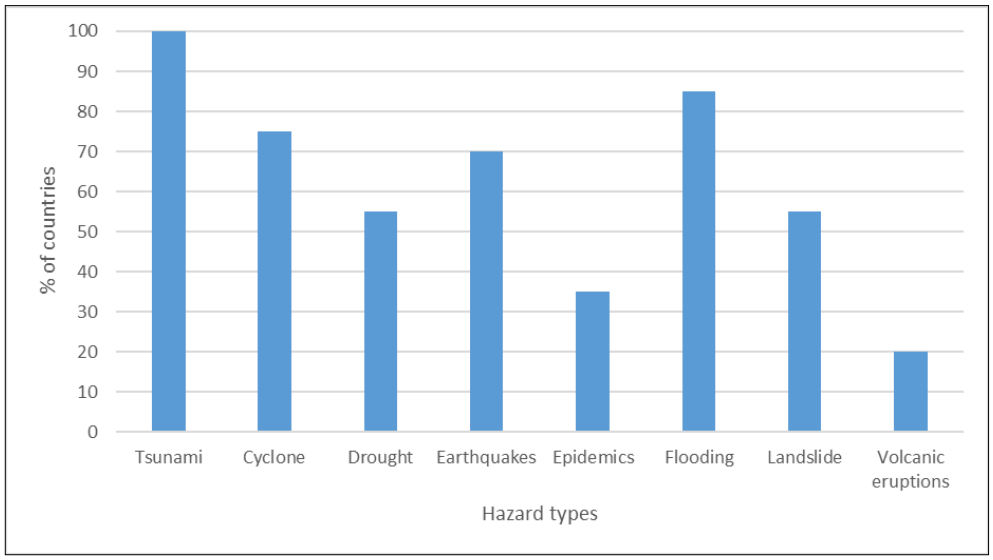

Figure 11. Types of hazard included in multi-hazard assessment

Countries were asked to identify which organisation(s) is/are responsible for the tsunami hazard assessment and at what level they are carried out.

Seventy-five percent (75%) of tsunami hazard assessments carried out by countries involved a national agency, 45% a national or local university, 40% a national or international consultant, and just 20% an international agency (Figure 12). Forty-five percent (45%) of tsunami hazard assessments involved multiple organisations.

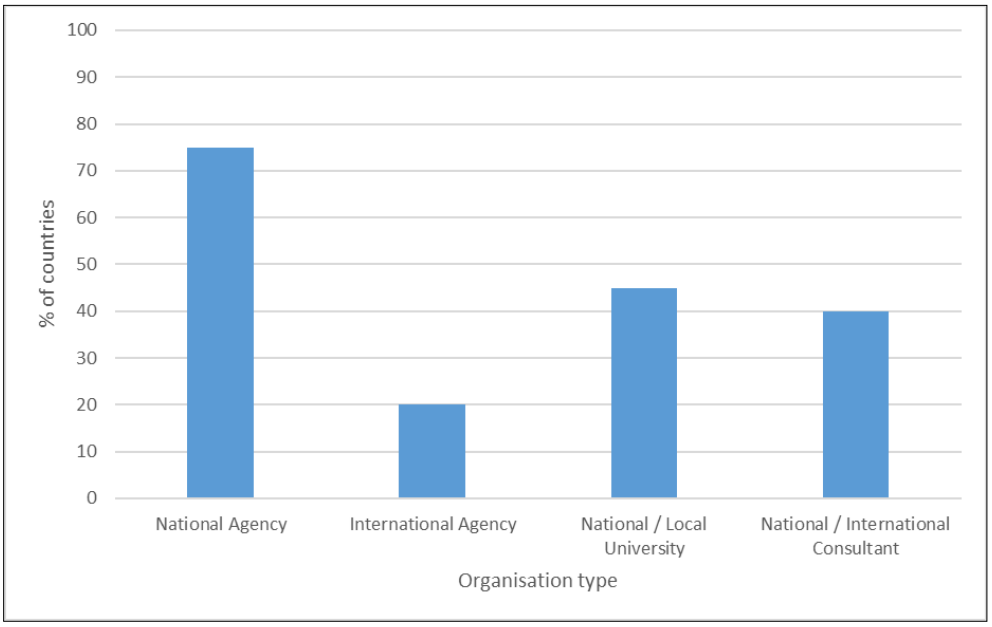

Figure 12. Organisation(s) responsible for the tsunami hazard assessment

Sixty-five percent (65%) of countries carried out the tsunami hazard assessment at the national level, 40% at the regional level, 45% at the city level and 30% at the village level (Figure 13). Fifty percent (50%) of countries carry out hazard assessments at multiple levels.

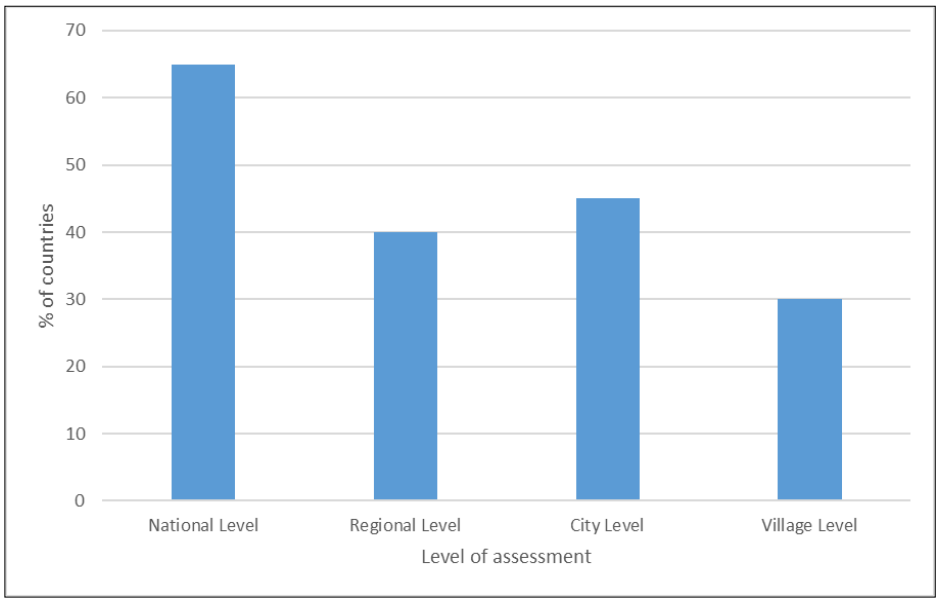

Figure 13. Level at which tsunami hazard assessment was carried out

Countries were then asked to identify the type of data used to support their tsunami hazard assessment and whether that data is publicly available.

17 countries (85%) identified two or more data types used to support their tsunami hazard assessment, while 3 countries did not identify any data types. Bathymetry and topography were the most widely used data to inform tsunami hazard assessment (Figure 14). Fifty-five percent (55%) of the 20 countries used seismo-tectonic models, and 55% of countries also used infrastructure details. However, none of the data sources are widely available to the public. Land cover data was reported as publically available in 7 of the 13 countries that used it, whereas infrastructure data was publicly available in just 3 of the 11 countries that used this data to inform tsunami hazard assessments.

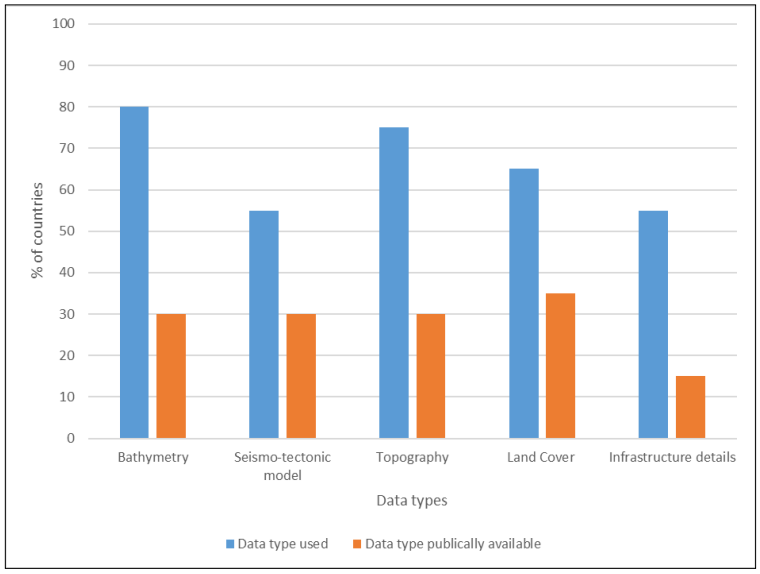

Figure 14. Data types used for tsunami hazard assessment

The number and type of products to emerge from the tsunami hazard assessment varied greatly across the 20 respondent countries. The most common products (Figure 15) were inundation maps (80%) and hazard maps (70%). The other products have been developed by less than 50% of countries.

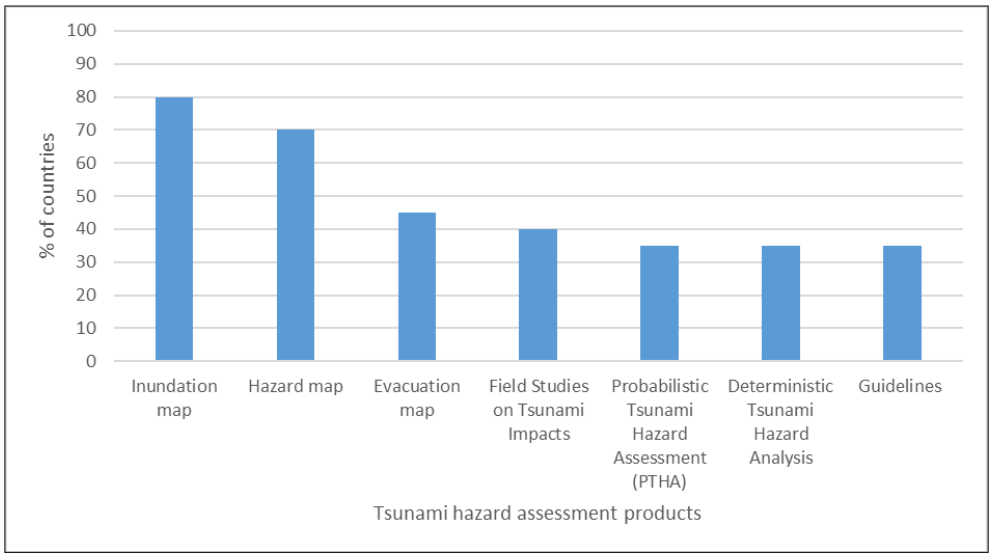

Figure 15. Products from tsunami hazard assessment

A majority of countries have produced 3 products or fewer while Thailand has produced all 7 products (Figure 16).

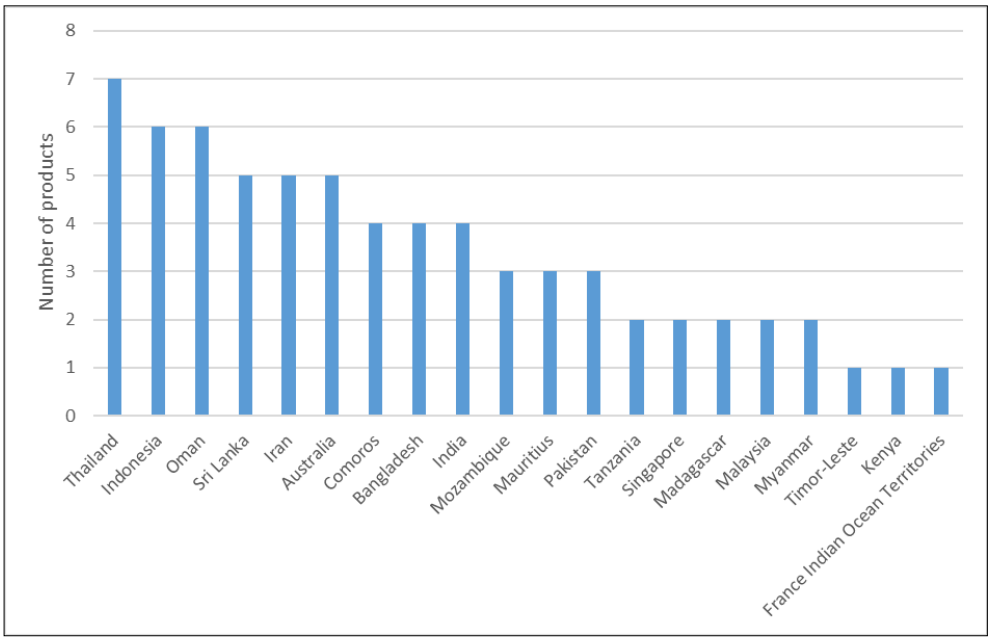

Figure 16. Number of tsunami assessment products

Countries were then asked to rate their capacity to undertake tsunami hazard assessment using a five-point scale, from very poor to very good (Figure 17). The responses indicated wide-ranging capacity across the 20 respondent countries. Forty-five percent (45%) of countries rated themselves as having very good or good capacity to

undertake tsunami hazard assessments, while 35% of countries rated themselves as having fair capacity. Twenty percent (20% of countries rated themselves as having poor capacity.

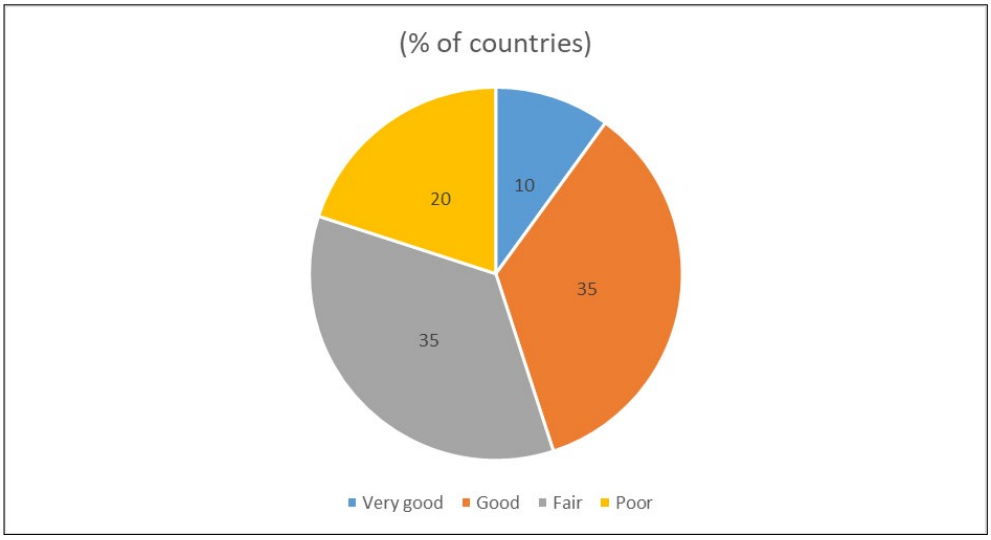

Figure 17. Capacity to undertake tsunami hazard assessments

In a similar manner, each respondent was then asked to rate their country's priorities for capacity improvement across six areas of tsunami hazard assessment, using a five-point scale, from not a priority to essential (Figure 18). The responses indicated that all areas require capacity improvement in at least some countries, but using a weighted response across the 20 respondent countries[14], evacuation mapping was ranked as the highest priority for capacity improvement, followed by hazard mapping and inundation mapping (Table 1).

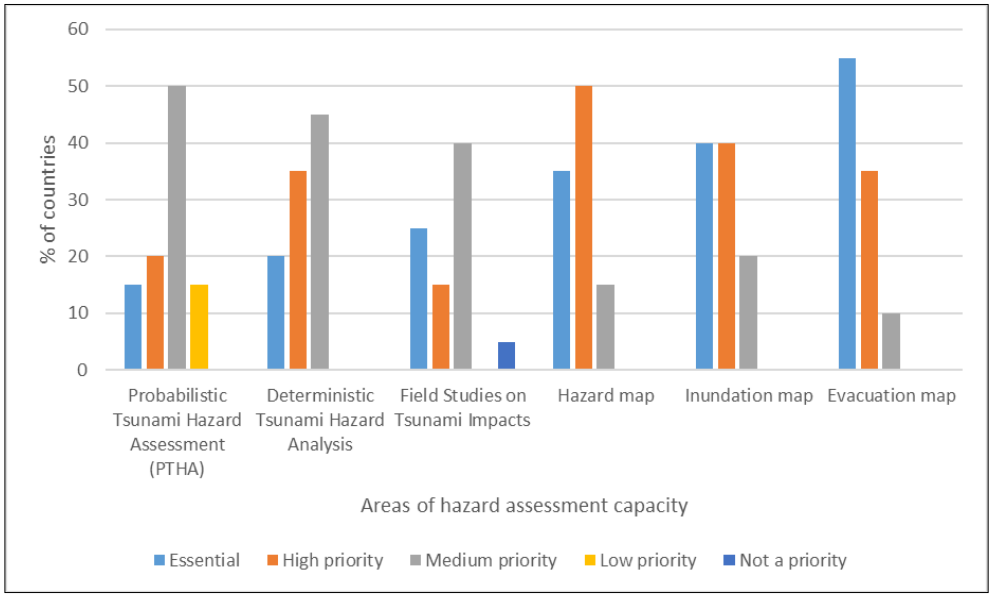

Figure 18. Capacity areas to undertake tsunami hazard assessments

14

$RII = \frac{\sum W}{A \times N} \; (0 \leq R \leq 1)$

Where RII is the weighted response, W is the weightage given to each factor, A is the highest weight, and N is the number of respondents

Areas of tsunami hazard assessment	RII[3]	Rank
Evacuation map	0.89	1
Hazard map	0.84	2
Inundation map	0.84	3
Deterministic Tsunami Hazard Analysis	0.75	4
Field Studies on Tsunami Impacts	0.72	5
Probabilistic Tsunami Hazard Assessment (PTHA)	0.70	6

Table 1. Ranking of priority areas for capacity improvement in tsunami hazard assessment

Countries were also asked to rate their capacity to give training and/or consultancy to other countries on the same six aspects of tsunami hazard assessment, using a five-point scale, from no capacity to very good capacity (Figure 19). Forty percent (40%) of the 20 respondent countries indicated very good or good capacity to give training on hazard mapping and inundation mapping, while 35% of countries indicated the same on evacuation mapping. For the other three areas, probabilistic tsunami hazard assessment, deterministic tsunami hazard analysis and field studies on tsunami impact, just 3 (15%) of the 20 countries indicated very good or good capacity.

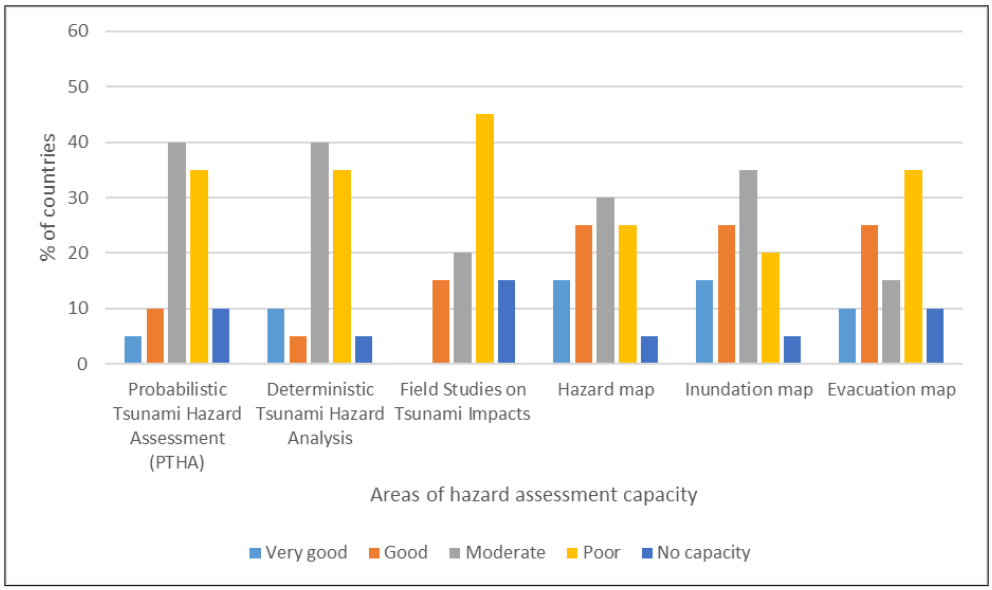

Figure 19. Capacity to give training and/or consultancy on areas of tsunami hazard assessment to other countries.

3.2.2 Risk Assessment

Countries were then asked to consider the extent and nature of tsunami risk assessments carried out. (i.e. estimating likely tsunami effects to the coasts and estimating damages to life and property).

The results show that 16 of the 20 countries participating in this survey (80%) have conducted tsunami risk assessments.

Figure 20 shows the type of risk assessment carried out by each country. Twelve (12) countries (60% of the surveyed countries) reported conducting a multi-hazard risk assessment that includes tsunami, 3 countries (15%) both a single hazard assessment on tsunami and a multi-hazard assessment including tsunami, and 1 country (5%) a single hazard assessment on tsunami only.

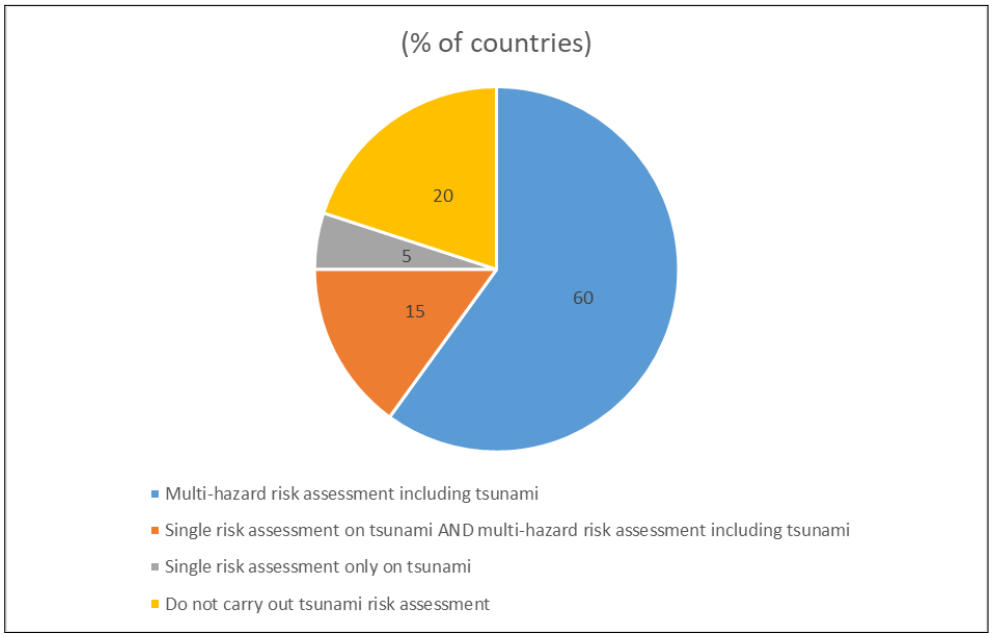

Figure 20. Types of risk assessment

Of all 15 countries that have carried out multi-hazard risk assessments including tsunami, 50% or more considered flooding, cyclones and earthquakes as the other types of hazard of their multi-hazard risk assessment (Figure 21). Less common hazards included were epidemics and volcanic eruptions. Strong winds, forest fires and lightning were each considered by one of the 15 countries that carry out multi-hazard risk assessments.

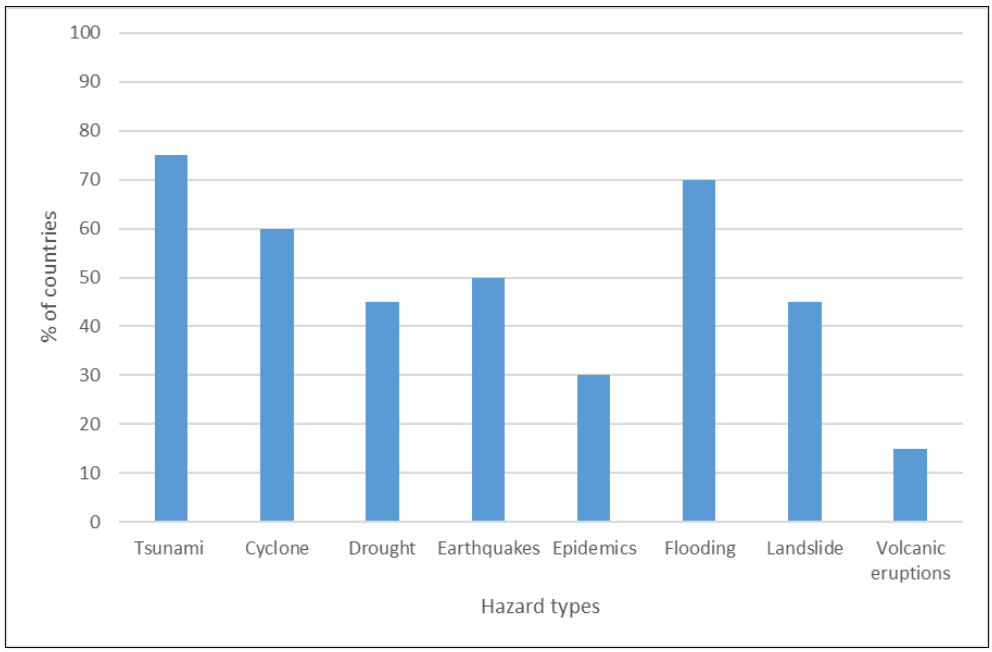

Figure 21. Types of hazard included in the multi-hazard risk assessment

Countries were asked to identify the organisation(s) responsible for carrying out risk assessments and the level at which they are carried out.

The organisation(s) responsible for carrying out tsunami risk assessments vary across the respondent countries (Figure 22). In 55% of countries, a national agency was fully or partially responsible, and a national or local university was at least partially responsible in 25% of countries. A national agency or international consultant was at least partially responsible in 25% countries, while 20% countries indicated that an international agency was at least partially responsible. In 20% of countries, the tsunami risk assessment was the responsibility of multiple actors.

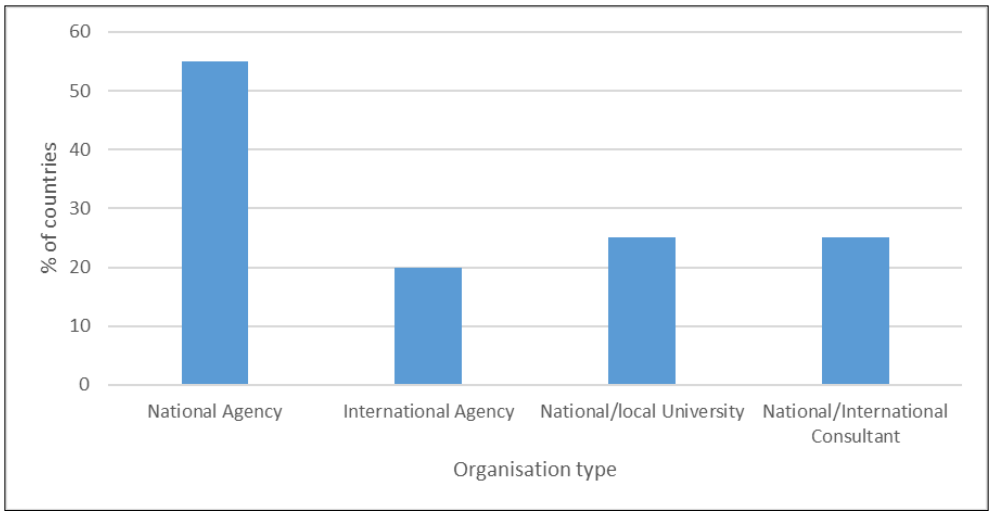

Figure 22. Organisation(s) responsible for the tsunami risk assessment

Of the 16 countries that carried out tsunami risk assessments, 11 conducted them at national level, 8 at regional level and 6 at city level (Figure 23). Only 4 countries have carried out village and/or community level risk assessments. Six (6) countries have carried out risk assessment at multiple levels.

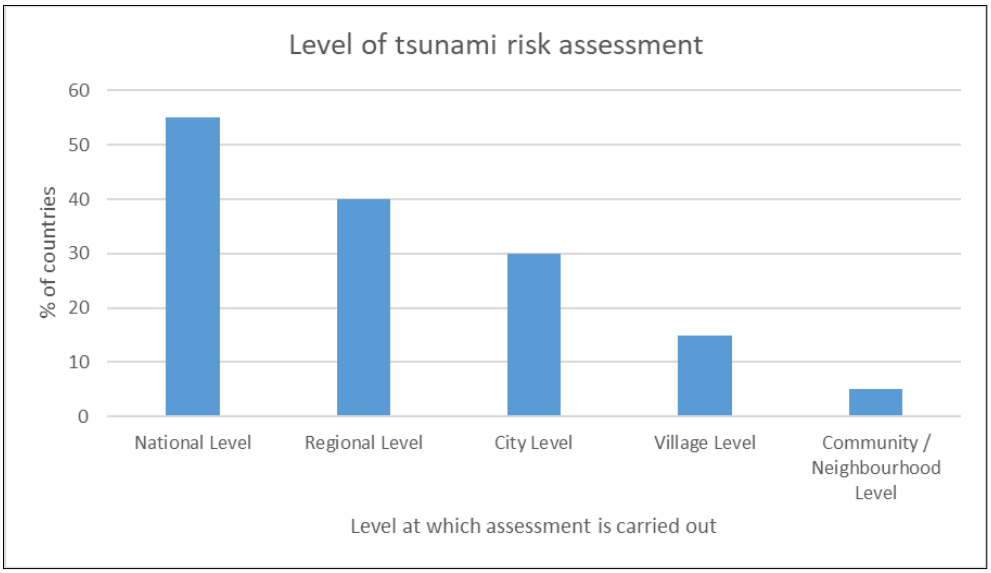

Figure 23. Levels at which the tsunami risk assessment is carried out

Countries were then asked to identify the types of product that emerge from the tsunami risk assessment.

The number and type of products that have been developed from the tsunami risk assessment varied across the respondent countries (Figure 24). A risk map was produced by 11 of the 16 countries (55% of all countries) that have conducted tsunami risk assessments. Evacuation maps, guidelines and action plans have also been produced, but each of them by less than half of the respondent countries that do tsunami risk assessments. Ten (10) countries have developed 2 or more products.

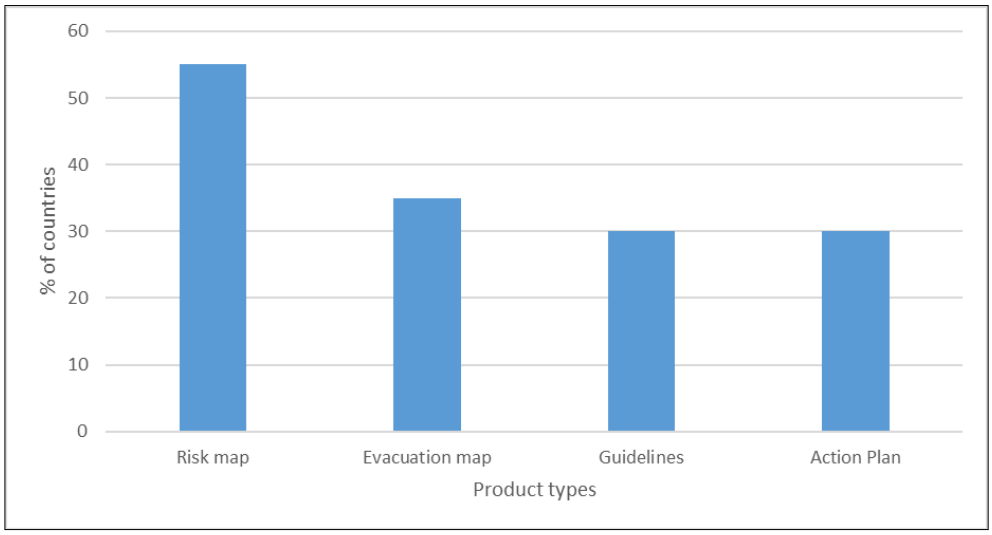

Figure 24. Types of product to emerge from the tsunami risk assessment

Each country was also asked to rate their capacity to undertake tsunami risk assessments using a five-point scale, from very poor to very good. The responses indicated wide-ranging capacity across the 20 respondent countries (Figure 25). Thirty-five percent (35%) of countries rated their capacity as very good or good. Twenty-five percent (25%) rated themselves as having fair capacity, and 35% of countries rated their capability as poor or very poor.

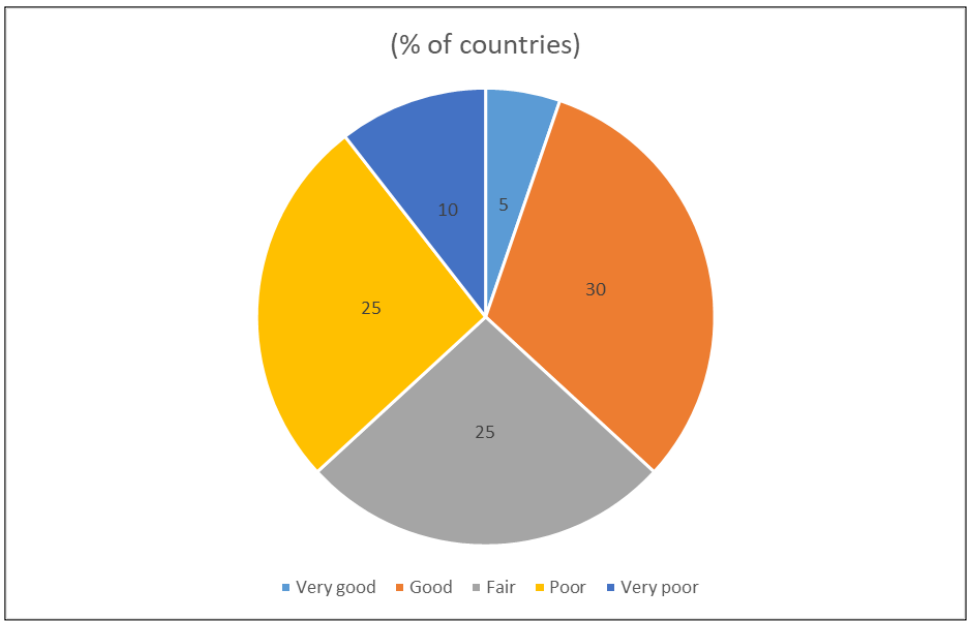

Figure 25. Capability to undertake tsunami risk assessment

Using a similar approach, each country was then asked to rate their priorities for capacity improvement across five level of tsunami risk assessment, using a five-point scale, from not a priority to essential (Figure 26).

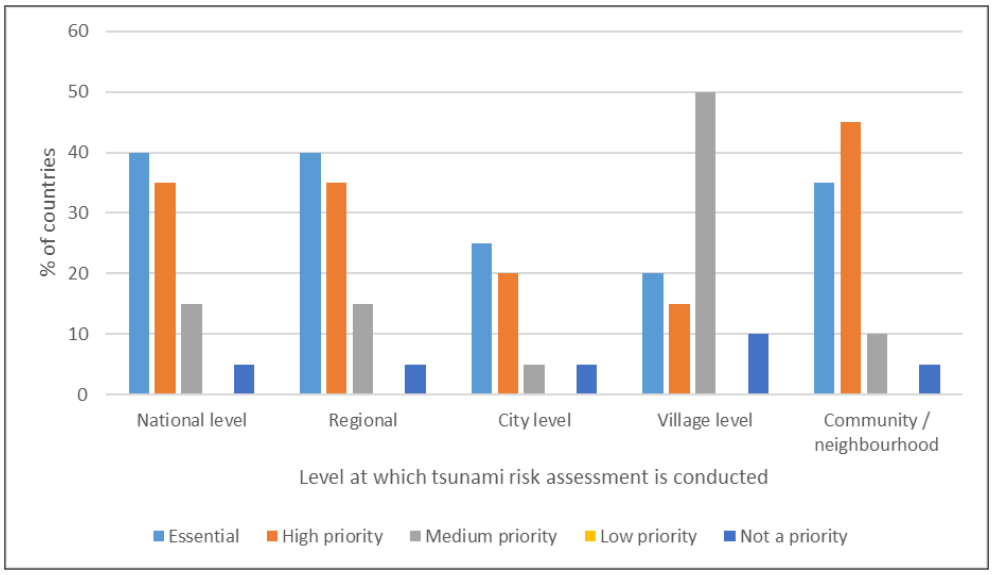

Figure 26. Priorities for improvement in capacity for tsunami risk assessment

The responses indicated that all areas require capacity improvement in at least some countries but using a weighted response across the 20 respondent countries[15], city level risk assessment was ranked as the highest priority for capacity improvement, followed by village and community levels (Table 2).

Priority level	RII[15]	Rank
Tsunami risk assessment at city level	0.82	1
Tsunami risk assessment at village level	0.82	2
Tsunami risk assessment at community / neighbourhood level	0.82	3
Tsunami risk assessment at national level	0.73	4
Tsunami risk assessment at regional level	0.67	5

Table 2. Priorities for capacity improvement in tsunami risk assessment

Each country was also asked to rate their capacity to give training and/or consultancy to other countries on the same five levels of tsunami hazard assessment (from community to national), using a five-point scale, from no capacity to very good capacity (Figure 27). For each level, there were no countries that indicated very good capacity to deliver training on tsunami risk assessment. Thirty percent (30%) of countries rated themselves as having good capacity to give training at the national level, and 20% at the regional and city levels. Only 15% of countries rated themselves as having good capacity to deliver training at the village or community level.

15 $RII = \frac{\sum W}{AxN} \; (0 \leq R \leq 1)$

Where RII is the weighted response, W is the weightage given to each factor, A is the highest weight, and N is the number of respondents

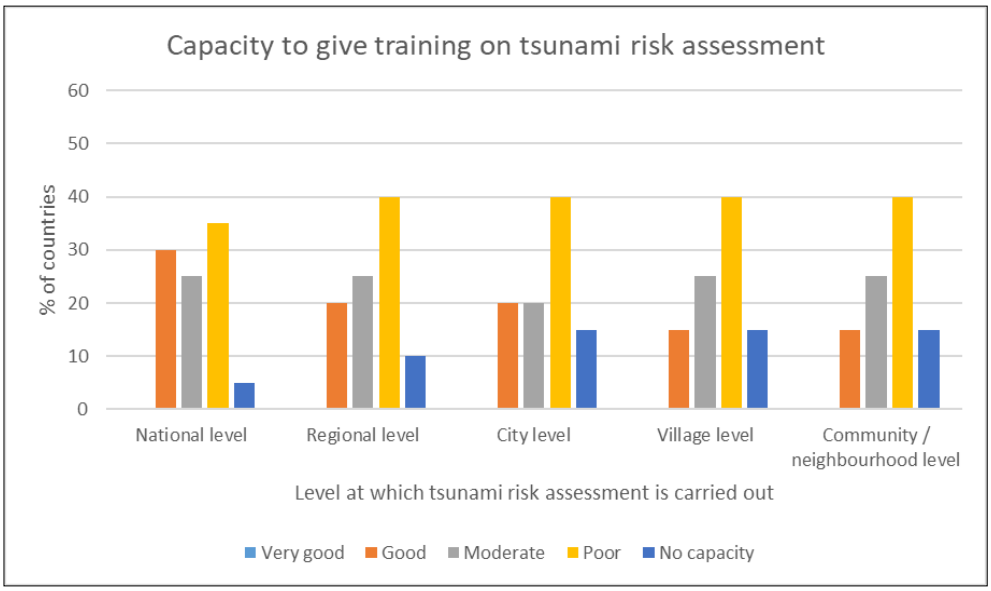

Figure 27. Capacity to give training on tsunami risk assessment (from community to national levels).

3.3 DETECTION, WARNING AND DISSEMINATION

3.3.1 Detection and Warning

All countries (100%) reported that they have a national capability to assess and/or receive potential tsunami threat information and advise and/or warn their coastal communities.

Countries were asked to confirm the type of data they use for the coastal forecast zones (CFZs) of their coastline to determine national threats (Figure 28). Forty-five percent (45%) of countries rely solely on the data provided by the IOTWMS Tsunami Service Providers (TSPs) to identify CFZs, while 45% of countries use TSP data and their own threat assessment data. Five percent (5%) of respondent countries rely solely on their own threat assessment data.

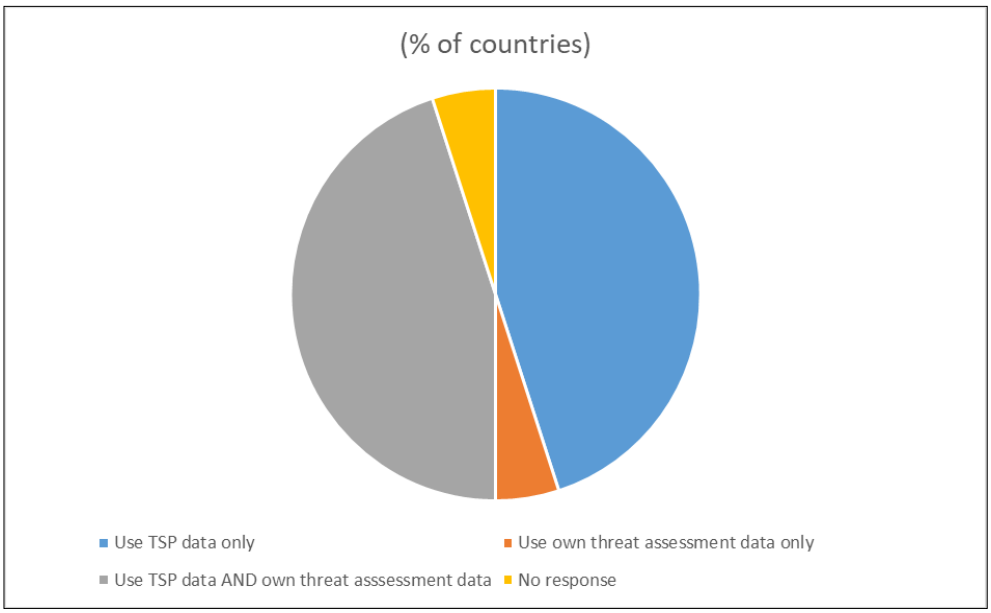

Figure 28. Data use for the Coastal Forecast Zones (CFZ) of a country's coastline to determine national threats.

Ninety percent (90%) of respondent countries reported that the organisation responsible for assessing and/or receiving potential tsunami threat information operates 24x7. Comoros reported operating 12 to 15 hours per day, and Iran is currently looking to move towards 24x7 operations.

Countries were also asked to confirm what type of infrastructure is available to enable 24x7 operations (Figure 29). Computers and the internet were reported by 100% of respondents, while landline telephones and mobile phones or cell phones were reported by over 90% of respondents. Fax, Global Telecommunication System (GTS) and Uninterruptible Power Supply (UPS) were also widely reported (over 70%). Satellite phones and Very Small Aperture Terminal (VSAT) were reported by 25% or less of respondents.

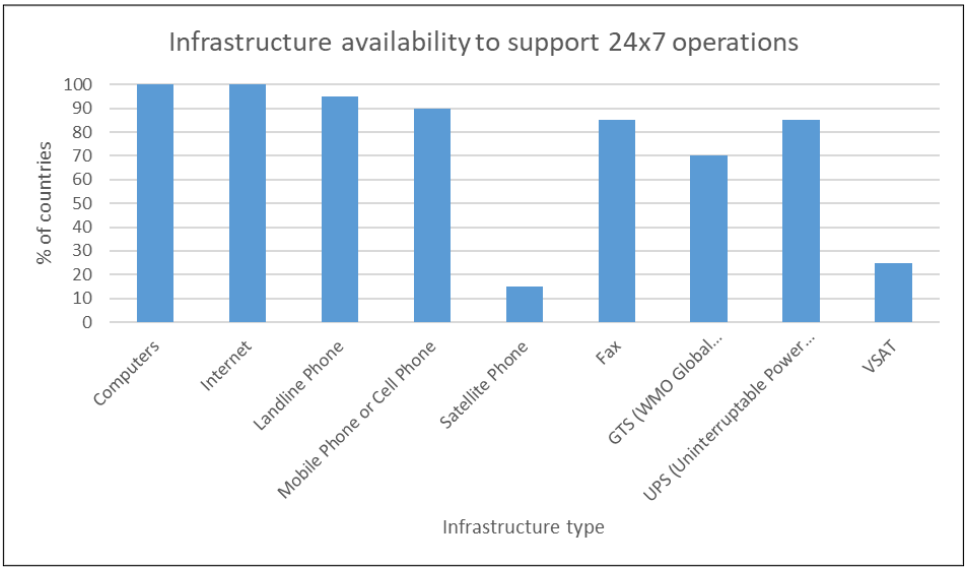

Figure 29: Infrastructure availability to support 24x7 operations

Countries were asked to report the level of tsunami threat forecast information produced by the responsible organisation (Figure 30). Ninety percent (90%) of countries have produced national level threat forecast information, while 70% of countries have produced local level information. Six (6) countries (30%) have produced ocean-wide information. 80% of countries have produced multiple levels of tsunami threat forecast information.

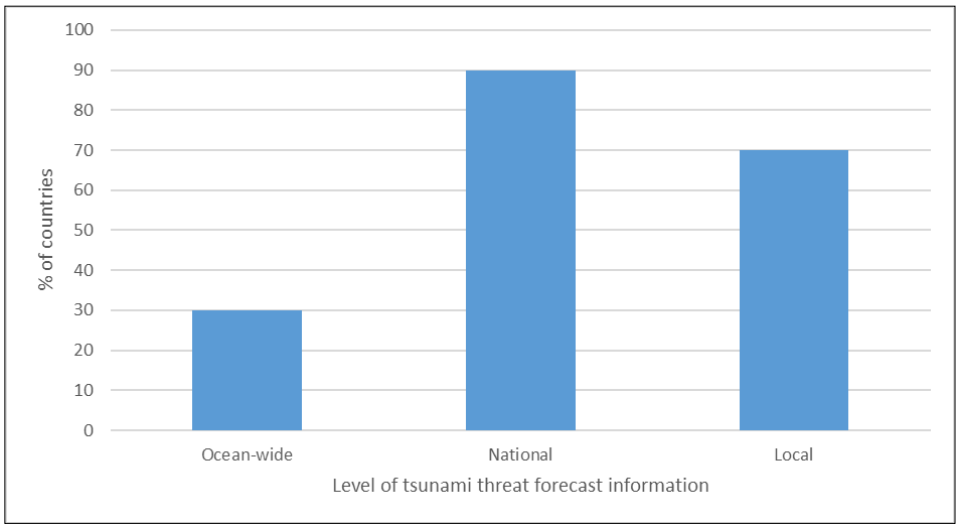

Figure 30: Level of tsunami threat forecast information is produced by the responsible organisation

Countries were also asked about their access to national or international seismic networks, and access to national or international sea-level networks. Ninety percent (90%) of respondent countries reported that the responsible organisation has access to national or international seismic networks. These ranged from a national seismic network to the California Integrated Seismic Network (CISN), the United States Geological Survey (USGS) Network, Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES), TSPs, Real-time seismic data from the International Monitoring System (IMS) of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), and Incorporated Research Institutions for Seismology (IRIS).

Sixty-five percent (65%) of respondent countries reported that the list of broadband seismometers operated by their country is listed accurately in the IOTWMS seismic network database. Two countries reported that stations had been added to their network when compared to the database listing.

Eighty-five percent (85%) of respondent countries reported that they have access to national or international sea level networks.

Eighty-five percent (85%) of respondent countries reported that the list of sea level stations operated by their country is listed accurately in the IOTWMS sea level network database.

Countries were also asked about other national observing networks used for tsunami early warning (Figure 31). Fifty-five percent (55%) of countries (11) reported that they have no other observing networks in operation, and one country did not provide a response (5%). Fifteen percent (15%) of respondent countries have deployed Global Navigation Satellite System (GNSS) / Global Positioning System (GPS) stations, and a further 15% have deployed coastal radars. Fifteen percent (15%) of respondents identified other national observing networks, including Deep-ocean Assessment and Reporting of Tsunami (DART) buoys and high frequency (HF) radars.

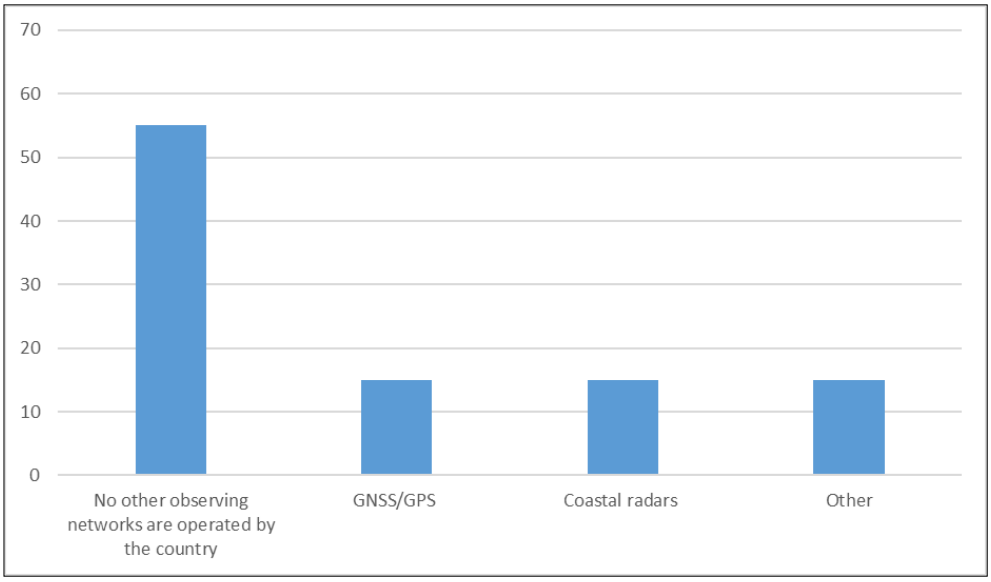

Figure 31. Other observing networks operated and used for tsunami early warning

Countries were asked to report on their capacity to analyse real-time seismic and sea level data for tsunami threat, their capacity for tsunami modelling to support generation of threat forecasts, as well as the software tools they use to support these initiatives. Sixty-five percent (65%) of respondent countries (13) have the capability of analysing real-time seismic and sea-level data for potential tsunami threat. The associated software used varies across the countries. Examples include: SeisComP3, JISView, Linuh,

OTPAS (Operational Tsunami Prediction and Assessment System), Tsunami Observation and Simulation Terminal (TOAST), Antelope, SeisAn, CSDP-IAS (Seismic data Analysis), Tide tool, Bulletin Hydra, and in-house developed applications for analysis of sea-level data.

Sixty percent (60%) of respondent countries also have the capability for tsunami modelling to support generation of threat forecasts, although two of these countries identified that their current tools are not adequate for accurate threat forecasts. Utilised software included ComMIT, WINITDB, TSUNAMI, TSUCAT, OTPAS, TOAST, easywave, Mhras, TUNAMI, COMCOT, MOST Model, Geoware proprietary software, In-house developed application which uses TUNAMI-N2 and ADCIRC models.

Eighty percent (80%) of the respondent countries reported that the organisation responsible for identifying a potential tsunami threat also issues national tsunami watches, advisories, alerts and/or warnings.

Countries were also asked to report on their participation in communication tests and drills. Ninety-five percent (95%) of respondent countries reported that their country's NTWC and/or TWFP participated in the 6-monthly communications tests conducted by the IOTWMS TSPs. Timor-Leste reported that it did not participate.

Twenty (20) of the respondent countries (100%) reported that their country's NTWC and/or Tsunami Warning Focal Point (TWFP) participated in the ocean-wide Tsunami Drill (e.g. IOWave exercise) conducted in the ICG/IOTWMS inter-sessional period.

Countries were also asked to report on any recent experiences of tsunami, specifically those that occurred after 2004. Twenty percent (20%) of respondent countries reported that they were impacted by a tsunami after the Indian Ocean tsunami on 26 December 2004. However, Indonesia was the only country to report damage/losses from events including Mentawai (2010), Aceh (2012), and Palu (2018).

Australia reported that although there was no major damaging tsunami affecting it, there were two noteworthy ones. The 17 July 2006 Java event generated a very localised impact to Steep Point of Western Australia where a camp site was destroyed and inundation reached 200 m inland. No tsunami warning was issued. A field impact assessment survey was subsequently conducted. Tide gauge observations along the Western coasts provided little clue to this very localised impact. For the 11 March 2011 Japan event, the Joint Australian Tsunami Warning Centre (JATWC) issued a National No Threat Bulletin to Australia for this event. A few tide gauges in Australia recorded tsunami waves up to 55 cm. Unusual currents and waves were noted at Port Kembla and Sydney Harbour. Several swimmers were washed into a lagoon at Merimbula NSW although it was inconclusive whether this was due to the tsunami. Overall, the impact to Australia is minor.

India reported that there was no event, which generated a major tsunami. However, on 11 April 2012 ‘twin’ events (M 8.5 and M 8.2) generated a minor tsunami, and NTWC-India issued appropriate bulletins for those events.

3.3.2 Dissemination

Countries were asked to report on how their tsunami information (warning, public safety action, etc.) is disseminated (Figure 32). Email is used in all countries and Short Message Service (SMS) and television were used by 95% of the respondent countries (19). Telephone, fax, websites and radio were also widely used to disseminate tsunami information (85%). Social media, sirens, police/military and public alert systems were used in 50% or more of respondent countries. Less common methods (40% or less) include

megaphones, very high frequency (VHF) radio, Virtual Private Network (VPN) and door-to-door warnings.

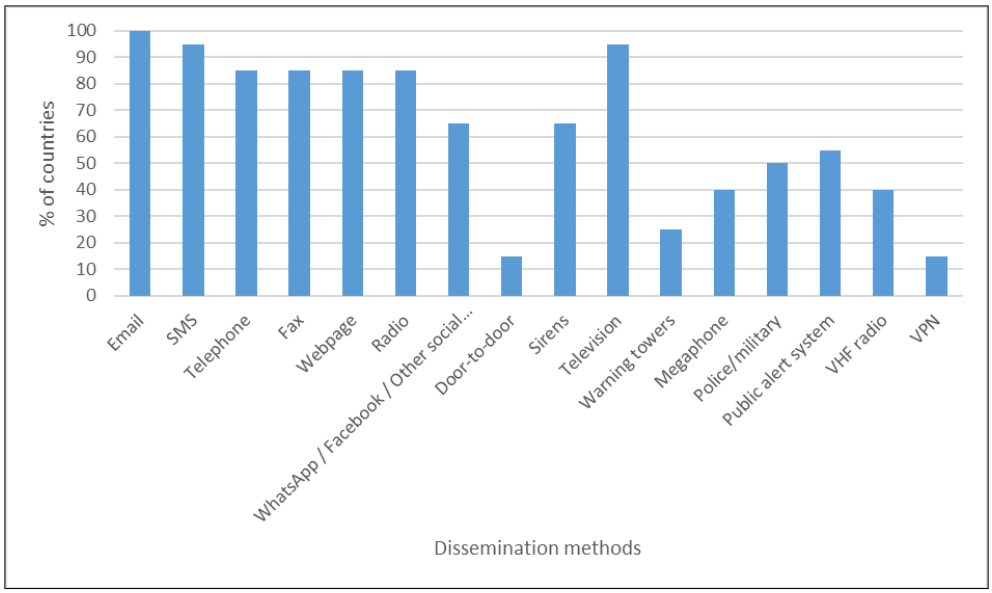

Figure 32. How tsunami information is disseminated

3.4 AWARENESS, PREPAREDNESS AND RESPONSE

3.4.1 Standard Operating Procedures

Countries reported on the availability of standard operating procedures (SOPs) for emergency response during the upstream stages of tsunami early warning (Figure 33). The responses indicated that most countries have SOPs that address the operation of a 24/7 emergency operation centre (90%), receiving information from the NTWC (90%) and response criteria and decision-making (85%). However, many countries also require support to develop SOPs in all three aspects (60–70%). Similarly, they also require support to develop human resources in these areas, especially 24/7 emergency operations and response criteria / decision-making (70%). Support to develop infrastructure across all three aspects is also required in many countries (65–75%).

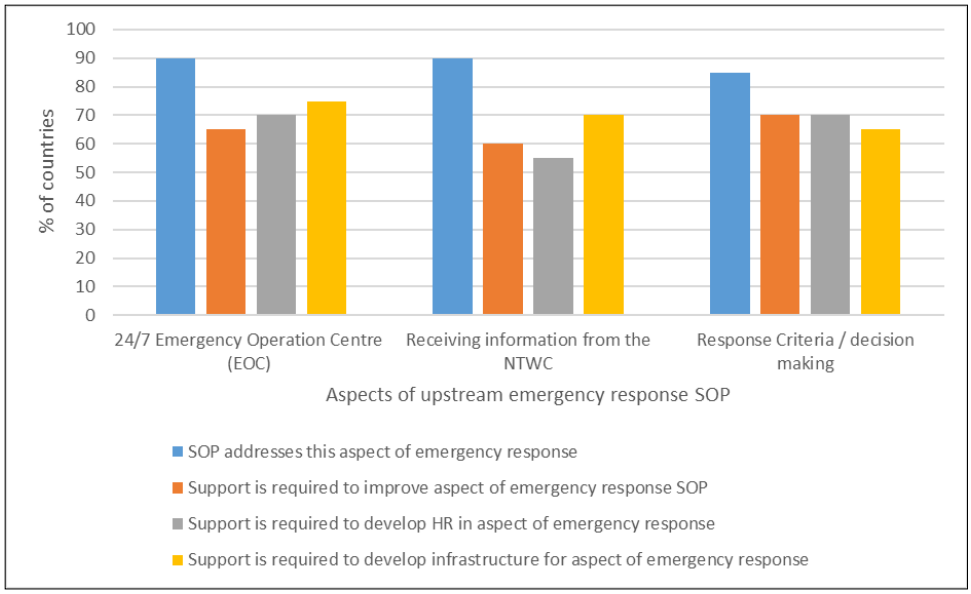

Figure 33. Support required to develop upstream emergency response SOP

Using the same structure, countries reported on the availability of SOPs for emergency response during the downstream stages of tsunami early warning (Figure 34). Most countries have SOPs that address warning dissemination, communication with the NTWC and communication with other stakeholders (90%), evacuation call procedures, communication with local government and media arrangements (85%). Community level evacuation SOPs were only available in 65% of countries.

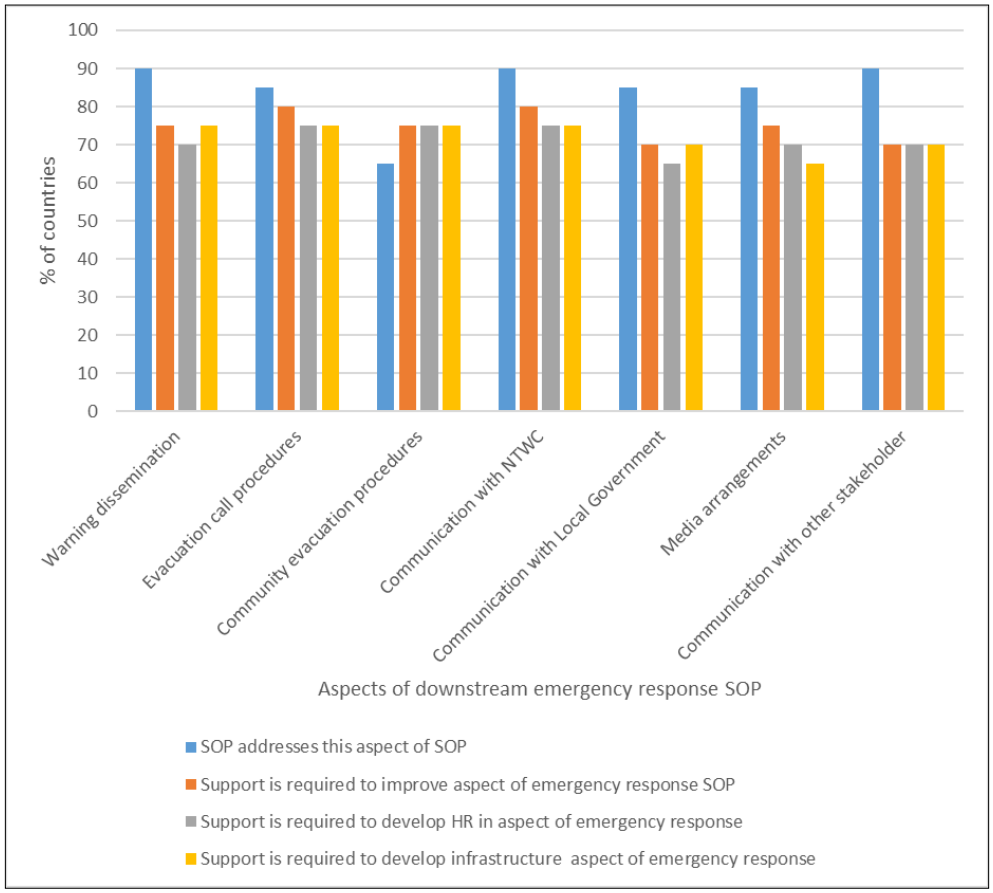

Figure 34. Support required to develop downstream emergency response SOP

However, despite widespread availability, many countries require support to develop SOPs in all seven aspects (70–80%). Many countries also require support to develop human resources and infrastructure across all seven aspects (65–75%).

Ninety-five percent (95%) of the countries surveyed have indicated their willing to share SOPs with IOTIC and other countries.

Countries were asked to confirm the communication methods used for communicating with emergency response organisations (Figure 35). For National Disaster Management Organisations (DMOs), telephones, fax, email and SMS are all widely used in many countries (75% or more). The situation is similar for Local DMOs (65% or more).

For communicating with the media, the telephone, fax and email are the main methods (75% or more).

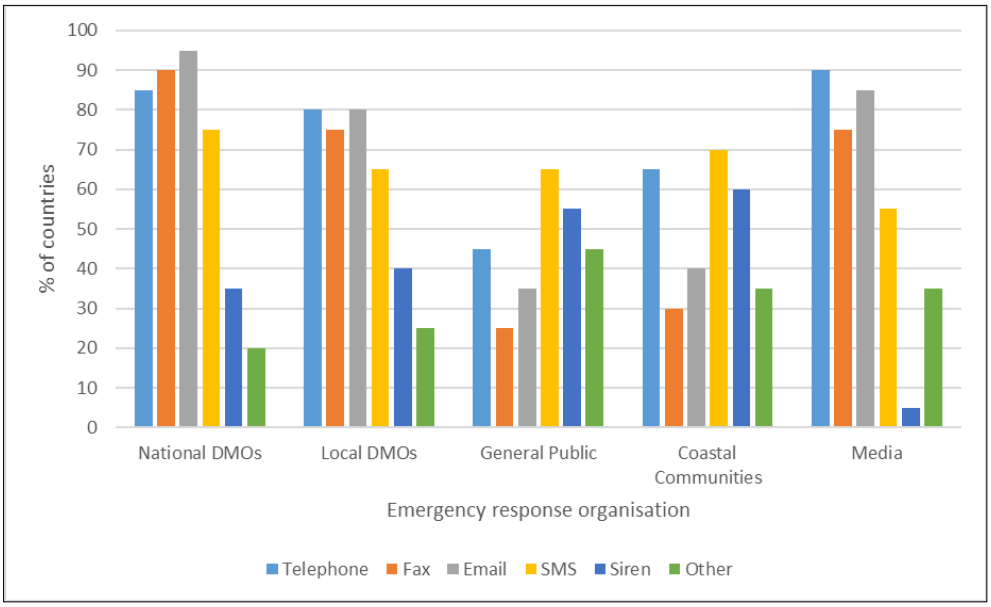

Figure 35. Communication methods for emergency response

Unsurprisingly, the pattern of responses for the general public and coastal communities is similar, with SMS and sirens used widely (55% or more). Telephones are widely used for communicating with coastal communities (65%), but less so for the general public (45%).

Other communication methods mentioned by countries include websites, social media, radio, dedicated applications, broadcast alert systems and television.

3.4.2 Evacuation Infrastructure

Countries were asked to indicate the availability of four different types of evacuation infrastructure in their country (Figure 36). Natural or artificial hills for vertical evacuation are the most widely available evacuation infrastructure, identified by 65% of the countries. Evacuation shelters are available in 55% of countries, whereas less common are evacuation signage (45%) and vertical evacuation structures (35%).

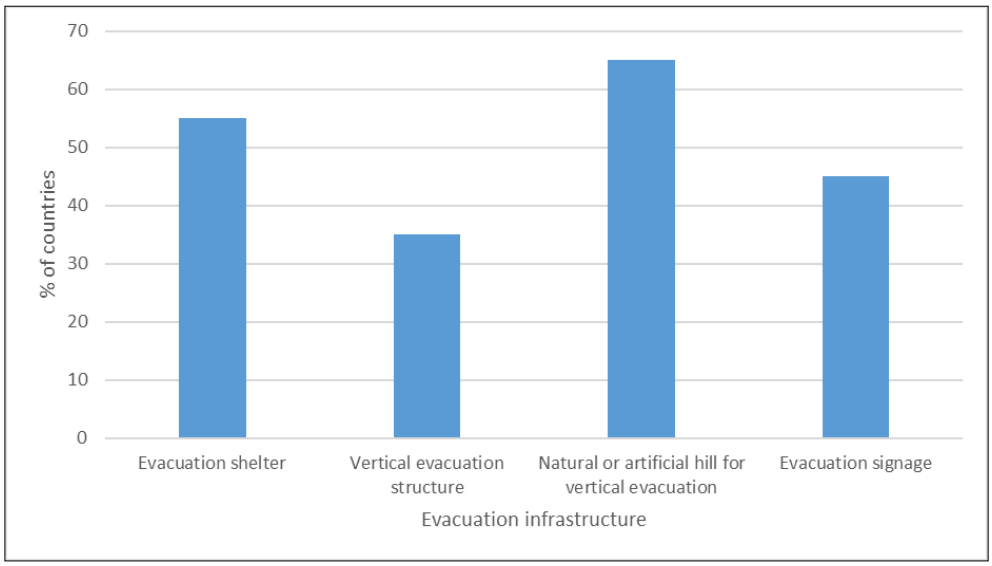

Figure 36. Evacuation infrastructure

Seventy-five percent (75%) of the 20 respondent countries reported that their evacuation infrastructure has been integrated within their evacuation plan (Figure 37).

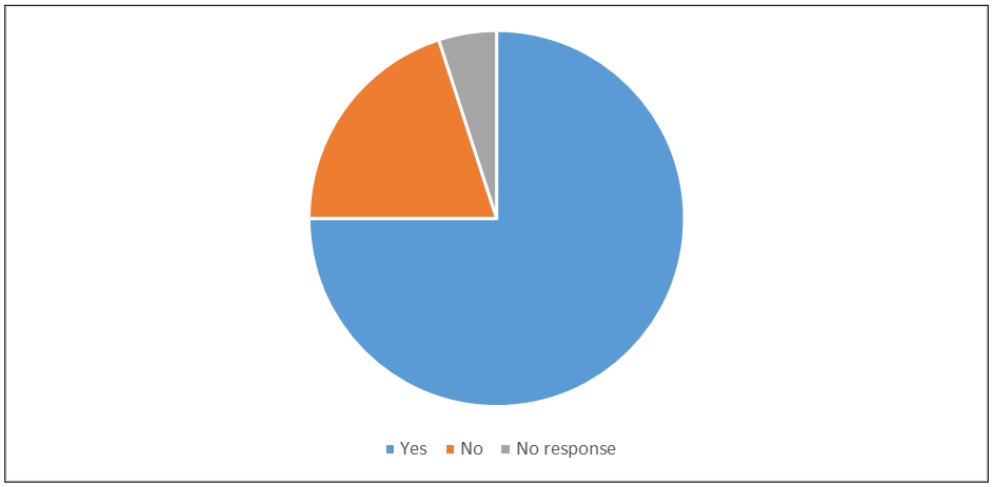

Figure 37. Integration of evacuation infrastructure into evacuation plan

3.4.3 Tsunami Exercises

Sixty-five percent (65%) of respondent countries reported that they have tsunami exercises incorporated within their national policies and 80% have tsunami exercises incorporated within national guidelines.

All 20 respondent countries reported conducting tsunami exercises at one or more levels during the inter-sessional period (Figure 38). Exercises have been conducted at the national level within 70% of countries and at the regional level in 55% of countries. Village and community level exercises have been conducted in 50% of countries. Other levels are less common, including the city (35%) and school (30%).

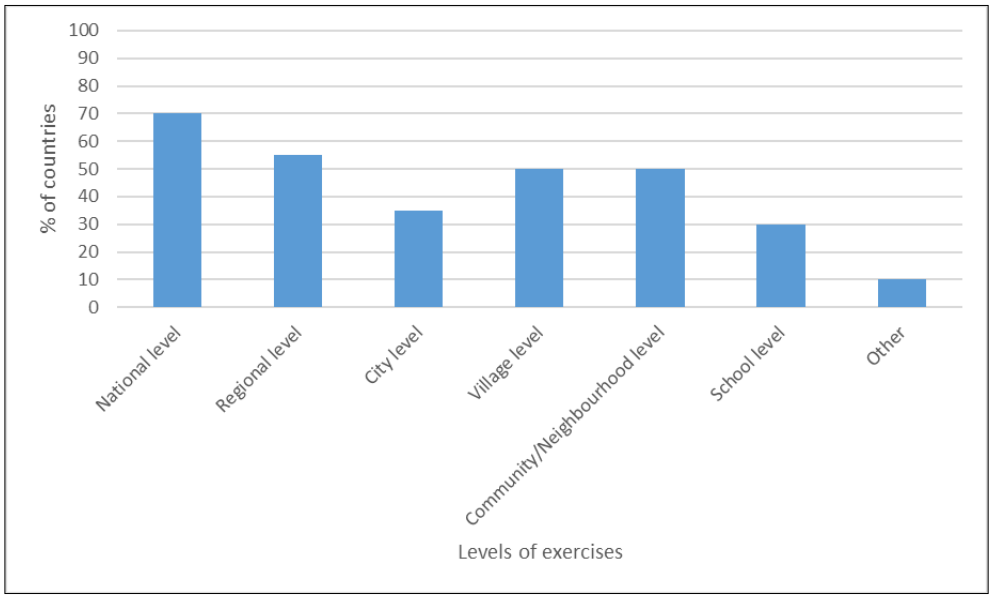

Figure 38. Levels of tsunami exercise conducted

Countries were asked to report on the type of tsunami exercise activities that have been undertaken in their countries during the ICG/IOTWMS inter-sessional period (Figure 39).

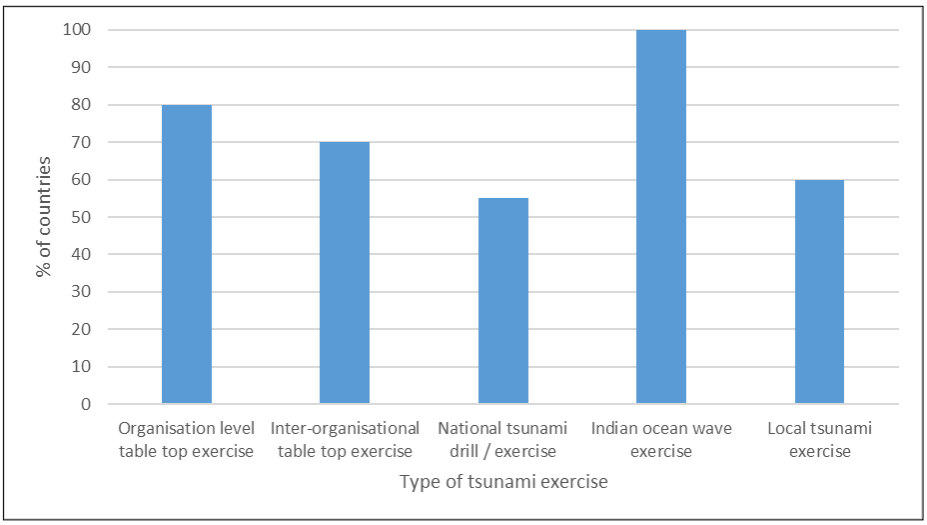

Figure 39. Types of tsunami exercise conducted

All ofof 20 respondent countries (100%) reported that they took part in the Indian Ocean Wave exercise. Tabletop exercises have also been widely undertaken, both within organisations (80%) and as inter-organisational exercises (70%).

Local tsunami exercises have been undertaken by 60% of respondent countries, marginally more than at the national level (55%).

3.4.4 Public Awareness

Countries were asked to identify the organisation responsible for tsunami public awareness programmes in their countries (Figure 40). In the majority of the respondent countries, the National Disaster Management Office takes responsibility (65%), but the National Tsunami Warning Centre (25%) and Local Disaster Management Office (5%) were also identified as the responsible organisation in some countries. One country reported that this is the responsibility of multiple organisations, including the National Disaster Management Organisation (NDMO), Local Disaster Management Organisation (LDMO), NTWC and international organisations.

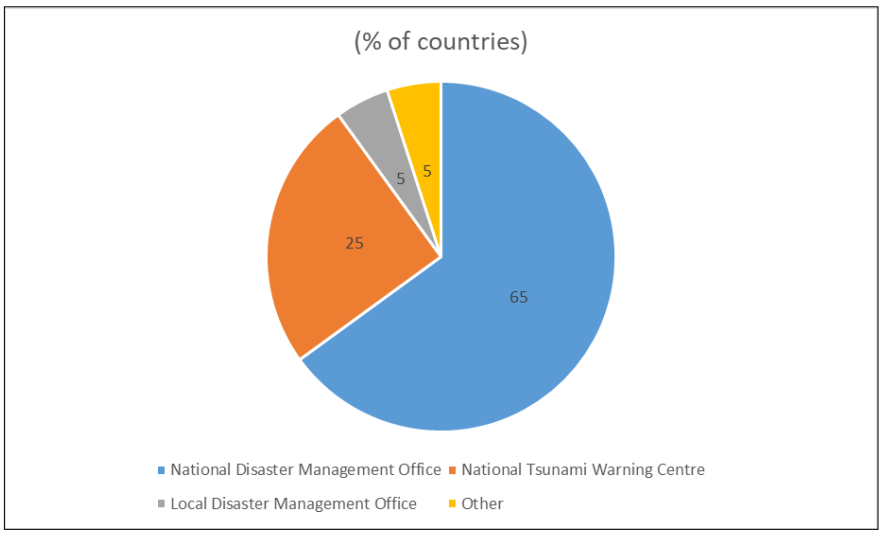

Figure 40. Organisation responsible for tsunami public awareness programmes

Countries were asked to identify what tsunami-related education and awareness materials they have developed and used (Figure 41). Posters (75%), leaflets and flyers, booklets and video/oral media (65%) have been identified by the majority of the respondent countries. Education materials such as teaching kits (50%) and school curricular (45%) were also used in many countries. Information boards, indigenous knowledge, signage and public evacuation maps have been less commonly used materials. Australia and Singapore have developed dedicated websites with educational material (as noted in the survey comments).

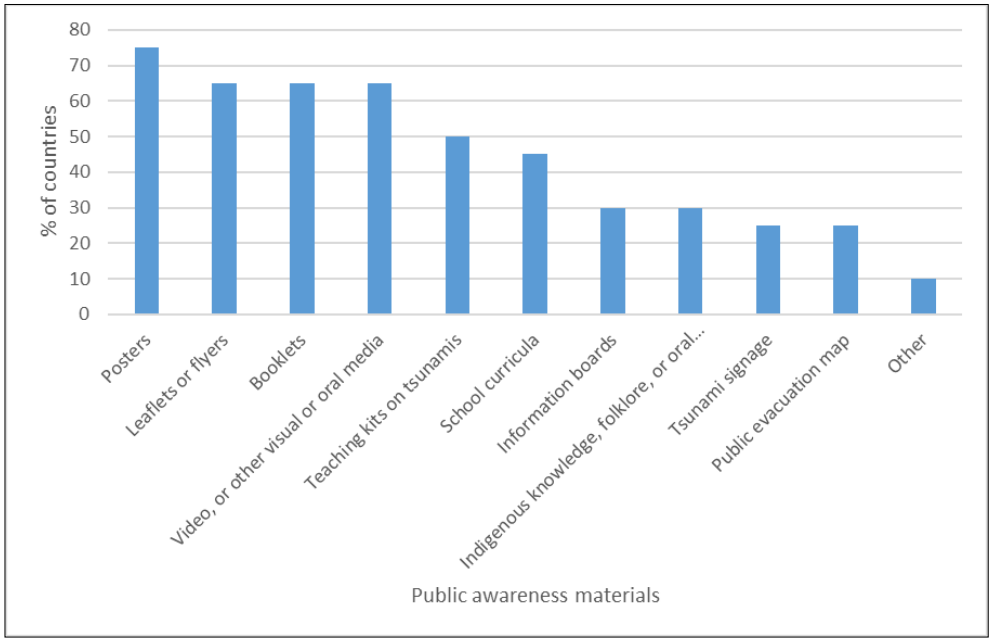

Figure 41. Types of public awareness materials

Ninety-five percent (95%) of the respondent countries confirmed that they are willing to share education and awareness materials with the Indian Ocean Tsunami Information Centre (IOTIC) and other countries.

Countries were asked to confirm whether or not they carry out a range of public awareness activities (Figure 42). The responses varied greatly across countries. School and child-related awareness activities (80%) and tsunami exercises (75%) have been carried out most widely. A majority of the respondent countries also have carried out preparedness outreach activities and exhibitions (55%), whereas less than half of the countries have participated in Global Disaster Risk Reduction Day (45%) or have carried out competitions or similar to highlight tsunami safety (20%).

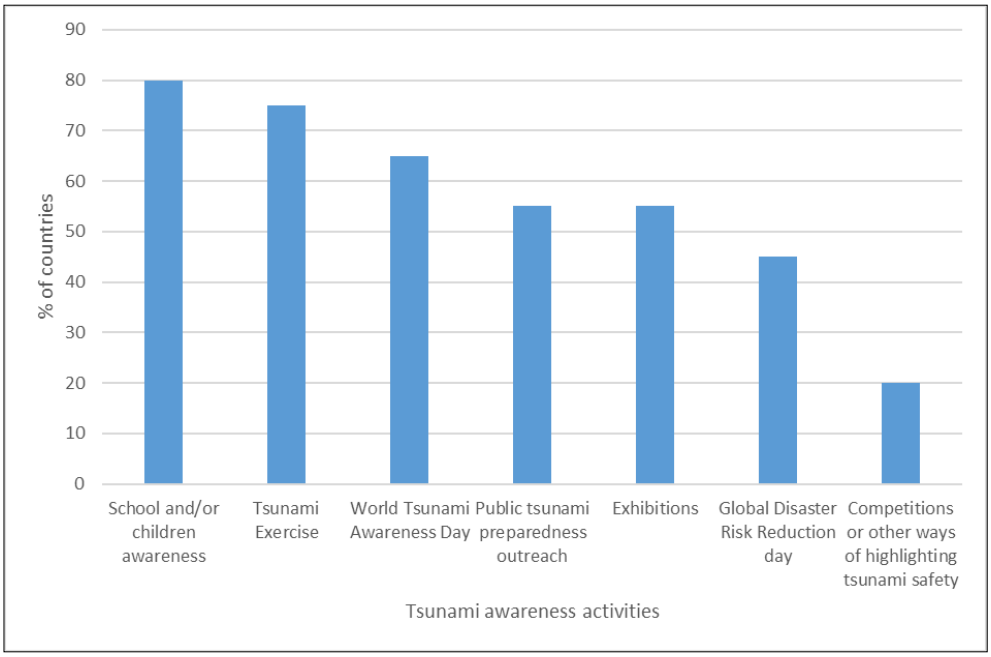

Figure 42. Types of public awareness activity

Countries were asked to indicate any areas in which they required support from the IOTIC to develop or enhance public awareness in their country (Figure 43). Support was requested by the majority of countries for all four areas of public awareness provision. Support in the development of tsunami awareness programmes, activities or campaigns, and participation by international agencies or experts were the most widely requested by 85% of the respondent countries.

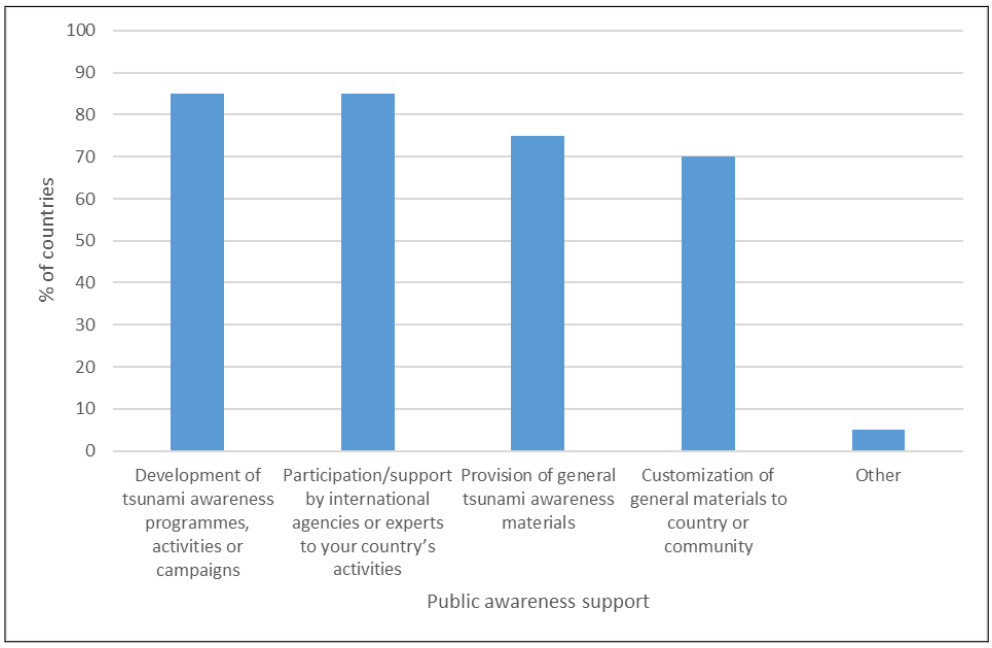

Figure 43. Support required for public awareness activity

Fifty percent (50%) of the respondents have offered to support other Member States to develop or enhance public awareness. The type of support on offer included to provide experts or share their materials and to conduct or support training activities.

Thirty-five percent (35%) of respondents confirmed that their countries are piloting the Indian Ocean Tsunami Ready (IOTR) initiative.

Countries with communities that participated in the Indian Ocean Tsunami Ready (IOTR) initiative were asked to provide a general ranking of their performance against the IOTR indicators, using the scale 1 (very poor) to 5 (very good) (Figure 44). It is important to note that some countries who responded that they are not piloting IOTR still chose to rank their performance against the IOTR indicators.

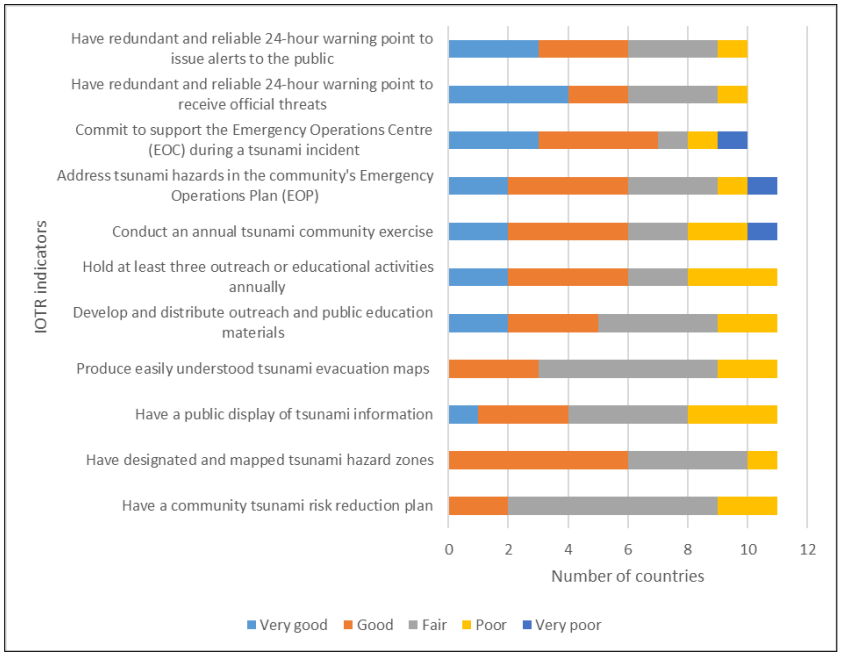

Figure 44. Performance against IOTR indicators

Performance varied greatly among the respondent countries (10), and between the 11 indicators. Performance in having redundant and reliable 24-hour warning points to receive information and alert the public were rated very good or good by 6 of the 10 responding countries, with no country rating as very poor. Commitment to support the Emergency Operation Centre (EOC) during a tsunami, address tsunami in a community's Emergency Operation Plan (EOP) and conduct an annual tsunami exercise were also rated very good or good by 6 or more of the responding countries. However, for each of these aspects one country rated themselves as very poor.

The weakest areas of performance included designated and mapped tsunami hazard zones (no countries were very good, 4 countries rated as fair, 1 as poor), and community risk reduction plans (no countries rated as very good, 7 countries rated as fair, 2 as poor).

4 REGIONAL OVERVIEW OF IOTWMS STATUS AND CAPACITY SUPPORT REQUIREMENTS

This section provides a regional overview of the current status of the IOTWMS and identifies gaps and priorities for further capacity development based on the responses of the 20 countries that completed the online survey. A general comparison to the status of the IOTWMS in 2005 is also provided where relevant. However, the 2005 and 2018 assessments are not directly comparable as the 2005 assessment was a baseline survey that focused mainly on capacity building requirements in the countries affected by the 26 December 2004 whereas the 2018 survey is a wider assessment of the current capacity that has been developed since 2005 in terms of policies, systems, and technological and human

capacity. Furthermore, 16 countries participated in the 2005 assessment compared to 20 countries in the current survey with only 14 countries in common. Although the 2005 survey questions do not map directly on to the 2018 questionnaire, it is possible to group similar questions according to the broad categories of policies, plans and guidelines, and the three pillars: (i) risk assessment and reduction; (ii) detection, warning and dissemination; and (iii) tsunami awareness, preparedness and response. On this basis, Table 3 provides a comparison of the status of the IOTWMS in 2005 and 2018 in which the percentage columns refer to the percentage of countries participating in each survey answering "yes" to the related question, with a "partial yes" in the 2005 assessment counted as a "half yes". Given the differences between the two assessments, Table 3 is intended to provide a broad comparison only to indicate the scale of capacity improvement in the IOTWMS since 2005.

For each of the following four strategic elements of the end-to-end tsunami warning and mitigation system a set of recommendations (R) is provided under section 5.

4.1 POLICIES, PLANS AND GUIDELINES

In 2005, most countries had national platforms or other mechanisms in place for guiding disaster risk reduction in general and many had national tsunami warning and mitigation coordination committees or similar in place, and 12 of the 16 countries assessed had established disaster coordination mechanisms at community level. However, relatively few countries had tsunami emergency plans, tsunami evacuation plans or tsunami signage in place. In 2018, most countries (19 out of 20) have some form of national tsunami policy, with the majority of countries addressing tsunami as part of a multi-hazard policy. Policies at local level are less prevalent with 15 countries having some form of local tsunami policy. Eighteen (18) countries have some form of tsunami disaster risk reduction plan, again mostly in a multi-hazard framework. Across the four phases of the disaster management cycle, the availability of plans is higher at national level followed by local level with least availability at community level. Notably, all countries reported that their tsunami risk reduction plans are based on hazard and/or risk assessments.

Fewer countries (13 out of 20) have some form of national tsunami guidelines and not all phases of the disaster management cycle are covered by guidelines. However, there is more availability at the local level with 16 countries having some form of local tsunami guidelines, with the majority of these countries addressing tsunami as part of multi-hazard guidelines.

Across policies, plans and guidelines, from national to local level, there is a recurring trend of greater focus on tsunami within the emergency phase of disaster management. While the rehabilitation and reconstruction phase may share many similarities with other hazards, the lack of tsunami specific focus for preparedness and the prevention and mitigation phases is more difficult to explain and further support should be provided to countries requiring assistance to develop policies, plans and guidelines for these phases. Support may also be required to increase the availability of policies, plans and guidelines at the local level for countries that express a need for such assistance. (Recommendations 1-2)

4.2 RISK ASSESSMENT AND REDUCTION

4.2.1 Hazard Assessment

Less than half of the countries assessed in 2005 had conducted tsunami hazard evaluations and numerical modelling of tsunami inundation had been conducted by less than a quarter of countries. All countries participating in the 2018 survey have conducted tsunami hazard assessments and a majority have these as part of multi-hazard assessments. A wide range of organisations have undertaken these assessments including national agencies, national or local universities, national or local consultants, international agencies or a combination of

multiple agencies. In many countries, there is reliance on a sole national agency to carry out hazard assessments. There is therefore an opportunity to increase engagement of other national, regional or international actors, such as research institutes and universities. Their expertise in areas such as hazard assessment would help to address some of the capacity shortcomings revealed at the national level, particularly the areas of hazard, inundation and evacuation mapping.

The level at which these assessments have been carried out also differs among countries, although this may partly be explained by the wide variations in geographic area, population size and hazard threats among them. Thirteen (13) countries have carried out the tsunami hazard assessment at a national level, 8 at the regional level, 9 at the city level and 6 at the village level. Half of the participating countries have carried out hazard assessments at multiple levels.

Countries draw upon a range of data types to support their tsunami hazard assessment, mainly bathymetry, topography and land cover. The availability of this data has considerably improved since 2005 but in many cases, the data is not publicly available. Although the reasons for not making data publicly available were not examined in the survey, it may be due to the cost of making it available, a lack of understanding on how this data could be used for the benefit of others, security, data protection or similar. Whatever the reasons, countries should be encouraged to increase the availability of publicly accessible data for tsunami hazard and risk assessment.

The number and type of tsunami hazard assessment products produced by the participating countries varied greatly but mostly these were inundation and hazard maps. The reason for the difference in the type of products produced is partly explained by the widely varying capacities to undertake the assessments. The survey results also indicate the requirement for capacity improvement tsunami hazard assessment in some countries, with evacuation mapping ranked as the highest priority, followed by hazard mapping and inundation mapping. The survey results show that the capacity to offer training in these areas is already available across the Member States of the IOTWMS and that this could be used to develop those countries with poor capacity. (Recommendations 3-8)

4.2.2 Risk Assessment

In the 2005 assessment, less than a quarter of the participating countries had conducted tsunami vulnerability assessments, which are components or risk assessments. In the 2018 assessment, 16 out of 20 countries have conducted tsunami risk assessments of which 15 included tsunami as part of a multi-hazard assessment, with flooding, cyclone and earthquake hazards included in addition to tsunamis by 50% or more of countries. Less common hazards included were epidemics and volcanic eruptions.

As with hazard assessments, it would appear that in many countries there is sole reliance on a national agency to carry out risk assessments and there may be opportunity to increase engagement of other national, regional or international actors, such as research institutes and universities. Their expertise in areas such as risk assessment would help to address some of the capacity shortcomings revealed at the national level. It would also help to strengthen the link between science, policy and action.

The survey results indicate that most of the countries that have carried out tsunami risk assessment did so at national level, some did so at regional and city level but only 4 out of 20 countries conducted risk assessments at village and/or community level. These differences may in part be explained by the variations in geographic area, population size and hazard threat, but may also be due to inadequate capacity. The survey indicates wide-ranging capacity to undertake tsunami risk assessment across the 20 participating countries.

Seven (7) countries rate their capacity as very good or good, 5 countries rate themselves as having fair capacity, and 7 countries rate themselves as poor or very poor. There is therefore a need to increase the capacity of these countries to undertake tsunami risk assessments, particularly at city, village and community level.

The wide-ranging capacities among countries may also explain the variations in the number and type of products developed from the tsunami risk assessment. A risk map has been produced by 11 of the 16 countries in order to conduct tsunami risk assessments. Evacuation maps, guidelines and action plans have also been produced, but each of them by less than half of the countries that do tsunami risk assessments. The survey results also indicate that countries have limited capacity to provide training to other countries in tsunami risk assessment. In particular, only 3 countries rated themselves as having the capacity to deliver training at village or community level. (Recommendations 3-8)

4.3 DETECTION, WARNING AND DISSEMINATION

4.3.1 Detection and Warning

In 2005, nearly all of assessed countries (15 out of 16) had an agency for receiving international tsunami warnings from Pacific Tsunami Warning Center (PTWC) and/or Japan Meteorological Agency (JMA) and staffed 24x7, but few (3 countries and 3 partially) had a national agency for monitoring and warning their citizens of regionally or locally generated tsunamis. In the 2018 survey, all countries reported that they have the capability to assess and/or receive potential tsunami threat information and provide advisories or warnings to their coastal communities. Most countries (18 out of 20) reported that the organisation responsible for assessing and/or receiving potential tsunami threat information operated on a 24x7 basis and 16 countries reported that this organisation also has responsibility for issuing national tsunami watches, advisories, alerts and/or warnings.

In 2005, less than half of the countries assessed were receiving real-time seismic and sea-level data. In 2018, 18 out of 20 countries reported that they have access to national or a variety of international seismic networks such as the California Integrated Seismic Network (CISN), Seedlink and IRIS. Seventeen (17) countries are able to access national or international sea level networks via the GTS, IOC sea level monitoring website or Tide Tool. The 3 countries that do not have access to sea level data (Madagascar, Mozambique and Pakistan) should be encouraged to access the international networks via the readily and freely available monitoring tools. Thirteen (13 out of 20) countries have the capability to analyse real-time seismic and sea-level data using a wide variety of software tools. However, further support is required to improve the capacity of the 7 countries that do not have capability to analyse real-time seismic and sea level data.

Twelve (12 out of 20) countries reported having the capability to use tsunami models to support the generation of threat forecasts using software tools including ComMIT, TUNAMI, TOAST, COMCOT, MOST and other in-house developed applications. The wide variety of tools could hinder the ability of the region to provide training and support for those countries that have inadequate modelling capacity. However, the IOTWMS has focused much effort since 2006 on conducting tsunami modelling training using the ComMIT tool which also forms the basis to the Indian Ocean Tsunami Ready training programme coordinated by IOTIC and the IOTWMS Secretariat. The IOTWMS should also consider providing further support to those countries that wish to build their capacity in tsunami modelling to support the generation of national tsunami threat forecasts.

Four (4 out of 20) countries reported that they had been impacted by a tsunami since 26th December 2004, although only Indonesia had suffered damage/losses from these events. The lack of recent experience of tsunami events in many countries poses a number of

threats to effective early warning, including loss of commitment, a reduction in priority level, difficulty in obtaining resources, lack of practical experience within agencies and their staff, and lack of experience or engagement among the public. Tsunami drills and exercises are therefore important to test communications links, maintain a state of readiness in the warning and response agencies and maintain public awareness. In this context, all countries except Timor-Leste reported that their NTWC and/or TWFP had participated in the 6 monthly IOTWMS communications tests and all countries had participated in the biannual IOWave exercises. The IOTWMS should review and consider increasing the frequency of tabletop or similar tsunami warning exercises to test SOPs and reduce the potential for complacency among countries that have not experienced a recent tsunami event. (Recommendations 9-12)

4.3.2 Dissemination

Countries use a wide range of media to disseminate tsunami information (warnings, public safety action, etc.) to their citizens. Email messaging is used by all countries and most countries (19 out of 20) also use SMS and television broadcasts. Other media widely used include, telephone, fax, websites and radio. Social media, sirens, and public alert systems are used by about half of the countries.

4.4 AWARENESS, PREPAREDNESS AND RESPONSE

4.4.1 Standard Operating Procedures

In the 2005 capacity assessment, the existence of Standard Operating Procedures was not explicitly addressed. However, closely related awareness and response procedures were assessed. For example, local government disaster preparedness and emergency response had been assessed or partially assessed by 10 of 16 countries. On the other hand, response procedures for regionally or locally generated tsunamis were in place in only 3 countries. The 2018 survey results indicate that 18 out of 20 countries have developed SOPs for their upstream operations. For downstream operations, most countries have developed SOPs for warning dissemination, communications with the NTWC and other stakeholders, evacuation call procedures and media arrangements. However, fewer countries (13) have developed SOPs for community level evacuation.

Overall, despite SOPs being widely available for most aspects of upstream and downstream early warning operation, many countries have requested further support to develop them, along with the associated human resources and infrastructure. The lack of community level evacuation SOPs in 35% of countries (7) is also notable and significantly worse than other aspects that were examined in this survey and it is apparent that many countries will require further support to develop these. Encouragingly, 19 of the 20 countries surveyed indicated their willingness to share SOPs with IOTIC and other countries, which would provide a good basis for capacity building across the Member States. The IOTIC should capitalise on this willingness by coordinating the sharing of SOPs among the Member States. (Recommendations 13-21)

4.4.2 Evacuation Infrastructure

Evacuation infrastructure is in place in at least 17 (out of 20) countries of which 13 countries rely on natural or artificial hills for vertical evacuation. Evacuation shelters are available in 11 countries and vertical evacuation structures are available in 7 countries. These countries either suffered high fatalities during the Indian Ocean Tsunami of 26 December 2004 (India, Indonesia, Sri Lanka and Thailand) or have multi-hazard vertical evacuation structures in place for other hazards such as cyclones (Bangladesh and Mozambique). A majority of countries (15 (out of 20) reported that their evacuation infrastructure is integrated within their

evacuation plan. The IOTWMS and IOTIC should consider organizing a training workshop to share Member States' experience of different types of evacuation structure to assist countries to develop infrastructure that is appropriate for their needs and circumstances. (Recommendations 13-21)

4.4.3 Tsunami Exercises

In the 2005 assessment, only 1 country (Thailand) had tested or exercised its response procedures and another 4 countries reported partial testing. Six (6 out of 16) countries reported that their publics were aware or partially aware of what a tsunami is and knew of how to respond to one. In the 2018 assessment, all 20 countries reported that they had conducted tsunami exercises at one or more levels (national, regional, city, village, community, and school) during the period between ICG/IOTWMS sessions and all countries participated in at least one Indian Ocean Wave (IOWave) exercise. National level exercises included organisational and inter-organisational tabletop exercises. Local (village to school level) tsunami exercises were undertaken in 12 countries and further support may be required to incorporate tsunami exercises at these levels. Thirteen (13) countries have incorporated tsunami exercises into their national policies and 16 countries into their national guidelines. (Recommendations 13-21)

4.4.4 Public Awareness

In 2005, community level education and preparedness programmes for national hazards or tsunami existed in nearly half of the countries assessed. However, tsunami education and public outreach programmes were partially in place in only 2 out of 16 countries affected by the 2004 tsunami. Earthquake and tsunami hazards and preparedness were incorporated or partially incorporated into educational curricula for school children in 5 out of 16 countries. In 2018, public awareness programmes were the responsibility of the NDMOs in 13 countries, the NTWC in 5 countries and the LDMO in 5 countries. In one country (Thailand), many organisations at national and local level have responsibility for promoting public awareness programmes, which perhaps is also the reality in many other countries. The survey asked the countries to indicate the tsunami-related education and awareness material that they have developed from a broad list of 10 categories as listed in Table 3. Posters, leaflets and flyers, video or other visual/oral media and booklets are the most commonly used and tsunami signage and public evacuation maps were the least commonly used. This implies that relatively few countries have developed evacuation maps and consequently have not introduced evacuation signage. Nearly all countries indicated their willingness to share their educational and awareness material with IOTIC and other countries. IOTIC should consider assisting countries to develop educational material to encourage the incorporation of tsunami awareness into school curricula. All countries except Singapore also requested assistance from IOTIC to develop or enhance public awareness with support in the development of tsunami awareness programmes, activities or campaigns the most widely requested.

Each country will develop educational and awareness material that is appropriate to its own risk profile, including its exposure to hazard, demography and vulnerability of its population, and it is natural that there will be a variety of different material developed across the Indian Ocean region. It is notable that Sri Lanka has developed material across all 10 categories and 5 other countries have material in 8–9 of the categories. On the other hand, Singapore has not developed any educational and awareness material which reflects its low tsunami risk.

The range of tsunami awareness activities undertaken varies greatly across the countries (see Table 3). Sixteen (16 out of 20) countries have undertaken school and child-related awareness activities and 15 countries have conducted tsunami exercises. However, only 9 countries have participated in International Disaster Risk Reduction Day (held annually on 13

October) or have conducted competitions or similar activities to highlight tsunami safety (4 countries). The IOTWMS should raise awareness of global events such as World Tsunami Awareness Day (held annually on 5 November since 2016) and International Disaster Risk Reduction Day as a means of maintaining tsunami awareness in the Member States.

The Indian Ocean Tsunami Ready (IOTR) initiative is being piloted in 7 of the 20 respondent countries although an additional 4 countries chose to rank their performance against the IOTR indicators listed in the survey. Of the 7 countries that are piloting IOTR, self-assessed performance varies greatly across the indicators, with upstream indicators being generally rated higher than downstream indicators. This suggests that further attention needs to be paid to areas such as outreach and public education and community tsunami risk reduction plans. For the additional 4 countries that ranked their IOTR performance, their self-assessed performance is generally lower across all indicators and these countries may therefore be candidates for future IOTR interventions. (Recommendations 13-21)

	IOTWMS Status 2005		IOTWMS Status 2018	
Policies, Plans and Guidelines	• Legal framework in place for disaster warning formulation, dissemination and response	59%	• National tsunami policy in place	90%
	• National platform or other mechanism in place for guiding disaster risk reduction in general	94%	• Local tsunami policy in place	60%
	• National Tsunami Warning and Mitigation and Coordination Committee or some other coordination mechanism in place	59%	• National tsunami disaster risk reduction plan in place • Local tsunami disaster risk reduction plan in place	75% 55%
	• Disaster coordination mechanisms at community level established	75%	• Community tsunami disaster risk reduction in place • National tsunami guidelines established	40% 70%
	• Tsunami emergency plans, tsunami evacuation plans and/or signage exist indicating routes to safety or higher ground	19%	• Local tsunami guidelines established	60%
Risk Assessment and Reduction	• Tsunami hazard evaluation conducted prior to 26 December 2004	44%	• Tsunami hazard assessment conducted	100%
	• Historical record of past earthquakes and tsunamis documented	37%		
	• Tsunami vulnerability assessment conducted	22%	• Tsunami risk assessment conducted	75%
	• Numerical modelling studies conducted to calculate inundation from tsunamis	22%	• Numerical modelling conducted for hazard assessment (PTHA and/or DTHA)	35%
	• Accurate bathymetry and topography data exist for the coastlines	25%	• Bathymetry used for tsunami hazard assessment • Topography used for hazard assessment	85% 80%
Detection, Warning and Dissemination	• International tsunami warnings received for teletsunamis from PTWC and/or JMA	94%	• National capability to assess and/or receive potential tsunami threat information and advise and/or warn coastal communities	100%
	• Agency receiving warnings staffed 24x7	94%		
	• National or regional tsunami warning centre to monitor and warn of regionally or locally generated tsunami in operation	28%		
	• Warning centre staffed 24x7	31%	• Warning centre staffed 24x7	90%
	• Real-time seismic data received	41%	• Access to national or international seismic networks	90%

	• Sea level data available real-time to the central monitoring site, or available in near real-time	41%	• Access to national or international sea level networks	85%
Standard Operating Procedures	• Local government disaster preparedness and emergency response assessed	59%	• Warning dissemination SOPs in place • Evacuation call SOPs in place	90% 80%
	• Community and ordinary citizen disaster preparedness and emergency response assessed	25%	• Community evacuation SOPs in place	60%
	• Response procedures for regional or locally generated tsunami in place	19%		
Tsunami Exercises	• Response procedures have been tested or exercised	19%	• Tsunami exercises conducted at national level • Tsunami exercises conducted at regional level • Tsunami exercises conducted at city level	70% 55% 35%
	• Public is aware of what a tsunami is and how to respond to both locally generated and distant tsunamis	37%	• Tsunami exercises conducted at village level • Tsunami exercises conducted at community level • Tsunami exercises conducted at school level	50% 50% 30%
Awareness, Preparedness and Response	• Community level education and preparedness programmes for national hazards or tsunami exist	47%	• Tsunami related education and awareness material	
	• Tsunami education and public outreach programme in place	6%	- Leaflets or flyers - Posters - Booklets	65% 70% 60%
	• Earthquake and tsunami hazards and preparedness is incorporated into educational curricula for school children	12%	- Information Boards - Tsunami signage - Video or other visual/oral media - Indigenous knowledge - Teaching kits - School curricula - Public evacuation maps	30% 25% 65% 35% 50% 45% 25%
	• Training programmes for the media on tsunami hazards, mitigation, warning and preparedness exist	22%	• Media arrangement SOPs in place	80%

Table 3. Comparison of status of IOTWMS in 2005 and 2018. The percentage columns refer to the percentage of countries participating in each survey answering “yes” to the related question, with a “partial yes” in the 2005 assessment counted as a “half yes”. The 2005 percentages are based on responses from 16 countries and the 2018 percentages are based on responses from 20 countries, with 14 countries in common. Given the differences between the two assessments, the table is intended to provide a broad comparison only to indicate the scale of capacity improvement in the IOTWMS since 2005.

5 RECOMMENDATIONS TO ADDRESS CAPACITY GAPS AND SUPPORT REQUIREMENTS

The following is a summary of the capacity gaps and support requirements that have emerged from the 2018 Indian Ocean capacity assessment of tsunami preparedness. They are intended to provide recommendations for future capacity development activities in the Indian Ocean region.

Policies, Plans and Guidelines

R1. Provide support to increase availability of tsunami policies, plans and guidelines at the prevention and mitigation, preparedness, and recovery and reconstruction phases of disaster management; and

R2. Provide support to increase availability of tsunami policies, plans and guidelines at the local level, either as standalone or as part of a multi-hazard approach.

Risk Assessment and Reduction

R3. Increase engagement of other national, regional or international actors in the carrying out of tsunami hazard and risk assessments;

R4. Increase the availability of publicly accessible data for tsunami hazard and risk assessments;

R5. Increase the capacity for tsunami hazard assessment, especially in the areas of evacuation mapping, hazard mapping and inundation mapping;

R6. Capitalise on the existing capacity in Member States for delivering training on hazard mapping and inundation mapping;

R7. Increase the capacity for city, village and community level tsunami risk assessments; and

R8. Increase the capacity for developing products from tsunami risk assessments, such as risk maps, evacuation maps, guidelines and action plans.

Detection, Warning and Dissemination

R9. Provide support to increase the capacity for analysing real-time seismic and sea-level data for tsunami threat;

R10. Provide support to increase the capacity for tsunami modelling to support generation of threat forecasts;

R11. Undertake a further study to examine whether there is a need for so many different software tools to be used to analyse data for tsunami threat or tsunami modelling; and

R12. Increase the frequency of tabletop or similar tsunami warning exercises to review and test SOPs, and reduce the potential for complacency among countries that have not experienced a recent tsunami event.

Awareness, Preparedness and Response

R13. Provide support for countries to improve their SOPs at the interface between upstream and downstream, including the operation of a 24/7 emergency operation centre, receiving information from the NTWC, and response criteria and decision-making, as well as the associated human resources and infrastructure;

R14. Provide support for countries to improve their SOPs to address warning dissemination, communication with the NTWC, communication with other

stakeholders, evacuation call procedures, communication with local government and media arrangements, as well as the associated human resources and infrastructure;

R15. Provide support for the development of community level evacuation SOPs;

R16. Capitalise on the willingness of countries to share their SOPs to share good practices across Member States;

R17. Provide training and share Member States' experience of different types of evacuation infrastructure;

R18. Provide support to incorporate tsunami exercises into cities, villages, communities and schools;

R19. Provide training and share Member States' experience of different public engagement materials;

R20. Develop educational materials such as teaching kits, and encourage the incorporation of tsunami awareness into the school curricula; and

R21. Raise awareness of the Global Disaster Risk Reduction Day (13 October) and World Tsunami Awareness Day (5 November).

6 CONCLUSIONS

The overarching vision of the IOTWMS is to save lives and protect property and infrastructure. To achieve this the IOTWMS has been designed and developed as an interoperable system based on best practices and operational technology providing timely and effective advice to the NTWCs. The *IOTWMS Medium Term Strategy 2019–2024* (IOC/2019/TS/144) provides a framework and forward direction in which the IOTWMS will develop in the five-year period 2019–2024. The 2018 capacity assessment of tsunami preparedness in the Indian Ocean complements the Medium Term Strategy by providing a baseline of the status of the IOTWMS at the beginning of the five-year cycle. These two documents combined with the *IOTWMS 2019 Factsheet* (IOC/BRO/2019/7) provide an overview of the current status of the IOTWMS, and an outline of its strategic objectives, plans and activities in the medium term.

The 2018 capacity assessment has shown that there has been considerable improvement across all components of the IOTWMS since the baseline assessment conducted in 2005 in the immediate aftermath of the December 2004 Indian Ocean tsunami. Nevertheless, the IOTWMS is not a static system and must improve, evolve and adapt to serve the needs of its Member States. In particular, the 2018 Palu and Sunda Strait tsunami events have highlighted the need to strengthen warning capabilities and enhance community preparedness to deal with events generated by near-field, atypical sources such as coastal landslides and volcanic flank collapse.

In terms of policies, plans and guidelines, the survey reveals that there is greater focus on tsunami within the emergency phase of disaster management. Although the rehabilitation and reconstruction phase shares similarities with other hazards, the lack of tsunami specific focus for the preparedness, prevention and mitigation phases is difficult to explain and further support should be provided to countries requiring assistance to develop policies, plans and guidelines for these phases. The need for support to increase availability of policies, plans and guidelines has previously been identified at the conference to commemorate the 10th anniversary of the Indian Ocean Tsunami in November 2014 (IOC/BRO/2015/2), which recommended that national tsunami programmes should be codified in law and that key functions should be institutionalised. The 2018 capacity assessment survey shows that most countries are working towards including tsunami risk management in multi-hazard legislative and policy frameworks.

The need to improve capacity in tsunami hazard and risk assessment has been identified in several fora since 2014 and is a key activity of IOTWMS Working Group 1 on Tsunami Risk, Community Awareness and Preparedness. Inundation modelling has been identified as a priority to better inform evacuation planning and community responses and Probabilistic Tsunami Hazard Assessment will help provide estimates of uncertainties to assist decision makers. The 2018 tsunamis in Palu and Sunda Strait demonstrated that tsunami hazard assessments are generally too broad to facilitate detailed local planning or to address all potential sources and the hazard assessments will need to be revised for at-risk countries based on more recent data and scientific understanding.

Although capacity for analysing real-time seismic and sea-level data and tsunami modelling has improved considerably in many countries of the Indian Ocean region, there are still some countries that require support to develop this capacity and develop their self-sufficiency to generate threat forecasts. To some extent, this is being achieved through regional cooperation, for example in the North West Indian Ocean. However, more rapid and accurate assessments of earthquake source characteristics for near-field events are required to enable timely community responses, and real-time modelling incorporating earthquake focal mechanism and sea level observations should be explored to provide more accurate tsunami forecasts.

The IOTWMS Secretariat and IOTIC have worked with the IOTWMS Member States since 2008 to assist them to develop their tsunami warning and emergency response SOPs. However, the 2018 survey responses clearly indicate that further support is required, particularly for downstream activities such as community evacuation and at the interface between the upstream tsunami warning and downstream emergency management operations. Furthermore, the Palu and Sunda Strait tsunamis have highlighted the need to develop SOPs that are appropriate for such near-field, rapid onset events. This will be a challenge for the IOTWMS and specific SOP training will need to be developed for countries that are vulnerable to such hazards.

The issue of complacency among countries that have not experienced a tsunami event since 2004 is a potential risk to the long-term sustainability of the IOTWMS and is difficult to manage when many countries experience other more frequently occurring hazards such as cyclones and flooding. It is important to conduct tsunami exercises and drills to test SOPs and maintain public awareness. However, a balance needs to be struck between maintaining awareness and preparedness, and over-sensitising communities to infrequent events, which could in itself lead to loss of interest and/or an increase in complacency. The incorporation of tsunami exercises at city, village, community and school levels will require countries to develop capacity in accordance with the Tsunami Ready indicators, which will require strong commitment at national government level. IOTIC can provide support through the Indian Ocean Tsunami Ready initiative but the countries themselves will need to provide the resources and have the commitment to achieve Tsunami Ready recognition.

Due to the infrequency of tsunami events, it is important that efforts are focused on enhancing the inter-generational awareness of communities to strengthen their long-term resilience. In this regard, tsunami awareness, education and preparedness should be embedded in school curricula from an early age. IOTIC has a vital role to play in the development and sharing of tsunami related knowledge and the development and implementation of educational programmes, as well as organizing workshops and training programmes together with the IOTWMS Secretariat to develop the capacity of IOTWMS Member States.

It is important to sustain operations of the IOTWMS Secretariat and the IOTIC over the long term to ensure efficient functioning of the end-to-end Indian Ocean Tsunami Warning and Mitigation System.

ANNEX I

CONTRIBUTORS TO THE 2018 STATUS REPORT

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ANNEX III

COMPARATIVE LISTS OF COUNTRIES SURVEYED IN THE 2005 AND 2018 ASSESSMENTS

(by alphabetical order)

2005 Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean (IOC/INF-1219) – Consolidated Report for Countries Affected by the 26 December 2004 Tsunami	**2018** Capacity Assessment of Tsunami Preparedness in the Indian Ocean –Status Report (IOC Technical Series, 143)
	Australia
Bangladesh	Bangladesh
Comoros	Comoros
	Overseas France (Indian Ocean)
	India
Indonesia	Indonesia
	Iran (Islamic Republic of)
Kenya	Kenya
Madagascar	Madagascar
Malaysia	Malaysia
Mauritius	Mauritius
Mozambique	Mozambique
Myanmar	Myanmar
Oman	Oman
Pakistan	Pakistan
Seychelles	
	Singapore
Somalia	
	South Africa[16]
Sri Lanka	Sri Lanka
Tanzania	Tanzania
Thailand	Thailand
	Timor-Leste

[16] The report from South Africa was submitted after the regional analysis had already been completed and therefore it was not possible to include their responses in the analysis. However, their national report is included in the supplement to this report.

ANNEX III

SUMMARY TABLES OF SURVEY RESPONSES

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
HAZARD ASSESSMENT	4a)	**Has your country undertaken a hazard assessment?**	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	4b)	**What type of hazard assessment has been carried out?**	MH+T	MH+T	T; MH+T	MH+T	MH+T	MH+T	MH+T	MH+T	MH+T	MH+T	MH+T	MH+T	T	MH+T	T	T, MH+T	MH+T	MH+T	MH+T	MH+T	MH+T
	4c)	**What type of multi-hazard assessment has been carried out? (select all that apply)**																					
		Tsunami	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		Cyclone	●	●	●	●	●	❍	●	●	●	❍	●	●	❍	●	❍	❍	❍	●	●	●	●
		Drought	❍	●	❍	❍	❍	❍	●	●	●	●	●	●	❍	❍	❍	❍	●	●	●	●	●
		Earthquakes	●	●	❍	●	❍	●	●	●	●	●	❍	●	❍	●	❍	●	❍	●	❍	●	●
		Epidemics	❍	❍	❍	❍	❍	●	●	●	●	●	❍	●	❍	❍	❍	❍	❍	●	❍	❍	❍
		Flooding	●	●	●	●	●	●	●	●	●	●	●	●	❍	❍	❍	●	●	●	●	●	●
		Landslide	❍	●	❍	●	❍	●	●	●	●	●	●	❍	❍	❍	❍	❍	❍	●	❍	●	●
		Volcanic eruptions	❍	❍	●	●	❍	●	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
		Other	❍	❍	❍	❍	❍	●	❍	●	❍	❍	❍	●	❍	●	❍	❍	❍	●	❍	❍	●
	4d)	**Who did the tsunami hazard assessment in your country? (select all that apply)**																					
		National Agency	●	●	❍	❍	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	❍	●	❍
		International Agency	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	●	❍	❍	❍	❍	❍	❍	●	●
		National / Local University	●	❍	❍	●	❍	●	●	❍	❍	❍	●	●	❍	❍	❍	●	❍	❍	●	●	❍
		National / International Consultant	●	●	●	❍	❍	●	❍	❍	❍	❍	●	❍	❍	●	❍	❍	❍	●	❍	●	❍
	4e)	**At what level was the tsunami hazard assessment carried out? (select all that apply)**																					
		National Level	●	●	●	❍	●	●	❍	●	●	●	●	❍	❍	●	❍	●	❍	●	❍	●	❍
		Regional Level	●	❍	❍	●	●	●	●	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	●	●
		City Level	●	❍	❍	❍	❍	●	❍	❍	●	❍	●	●	❍	●	●	❍	❍	❍	❍	●	●
		Village Level	❍	❍	❍	❍	❍	●	●	❍	❍	❍	●	❍	●	❍	❍	❍	❍	●	❍	●	❍
	4g)	**Data used for hazard assessment and whether it is publicly available?**																					
		Bathymetry - Used for hazard assessment	●	●	?	●	●	●	●	●	●	●	●		●	●	●	●	●	●	?	●	●
		Bathymetry - Publicly available	●	●	?	●	❍	❍	●	●	❍	❍	❍		?	❍	●	❍	●	?	❍	❍	●
		Seismo-tectonic model - Used for hazard assessment	●	?	?	?	●	●	●	●	❍	●	?		●	●	●	●	❍		●	●	❍
		Seismo-tectonic model - Publicaly available	●	?	?	❍	❍	❍	●	●	❍	●	?		?	●	●	❍	?		●	❍	❍
		Topography - Used for hazard assessment	●	●	?	●	●	●	●	●	●	●	●		●	●	❍	●	●	●	?	●	●
		Topography - Publically available	●	●	?	●	❍	❍	●	●	❍	❍	❍		?	?	❍	●	●	?	❍	❍	●
		Land Cover -Used for hazard assessment	●	●	?	●	●	●	❍	❍	●	●	❍		●	●	●	●	❍		●	●	❍
		Land Cover - Publicly available	●	●	?	❍	●	●		❍	❍	❍	?		?	?	❍	●	●		●	●	❍
		Infrastructure details - Used for hazard assessment	●	?	?	●	●	●	❍	❍	●	●	❍		●	●	❍	❍	●	●	●	●	❍
		Infrastructure details - Publicly available	❍	?	?	❍	❍	❍		❍	❍	❍	?		?	●	❍	❍	●	?	●	●	❍

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
HAZARD ASSESSMENT	4h)	**What products do you have from the tsunami hazard assessment? (select all that apply)**																					
		Probabilistic tsunami hazard assessment	●	●	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	●	❍	●	❍
		Deterministic tsunami hazard analysis	❍	●	❍	❍	●	❍	●	❍	❍	❍	❍	❍	❍	●	❍	●	❍	❍	❍	●	●
		Field studies on tsunami impacts	●	❍	❍	❍	●	●	❍	❍	❍	●	❍	❍	❍	●	❍	❍	❍	●	●	●	❍
		Hazard map	●	●	●	❍	●	●	●	❍	❍	●	●	●	❍	●	●	❍	●	●	●	●	❍
		Inundation map	●	●	●	●	●	●	●	❍	●	❍	●	●	●	●	●	●	●	●	❍	●	❍
		Evacuation map	❍	❍	●	❍	❍	●	●	❍	●	❍	●	●	●	❍	❍	❍	❍	●	❍	●	❍
		Guidelines	●	❍	●	❍	❍	●	●	●	❍	❍	❍	❍	❍	●	❍	❍	❍	❍	❍	●	❍
	4i)	**On a scale of 1 (Very poor) to 5 (Very good), please rate your country's capability to undertake tsunami hazard assessment**																					
		Rating	4	2	3	3	5	3	4	3	2	4	4	3	2	4	5	4	4	2	4	3	3
	4j)	**On a scale of 1 (Not a priority) to 5 (Essential), what is the priority level in your country to improve capacity in the following areas of tsunami hazard assessment?**																					
		Probabilistic tsunami hazard assessment	3	5	2	3	4	4	3	5	4	3	3	3	3	2	3	2	3	5	3	4	3
		Deterministic tsunami hazard analysis	3	5	3	4	5	4	3	5	4	3	5	3	4	2	2	4	4	4	3	4	3
		Field studies on tsunami impacts	1	5	2	3	4	4	3	5	5	4	3	4	4	3	3	2	3	4	4	4	3
		Hazard map	2	5	4	5	5	5	4	5	4	4	5	4	4	2	4	2	4	5	4	4	4
		Inundation map	2	5	4	3	5	5	4	5	4	4	5	4	5	2	4	2	4	5	4	5	4
		Evacuation map	3	5	4	5	4	5	4	5	4	5	5	4	5	5	4	2	4	5	5	5	4
	4k)	**On a scale of 1 (No capacity) to 5 (Very good), what capacity does your country have to give training and/or consultancy on tsunami hazard assessment to other countries?**																					
		Probabilistic tsunami hazard assessment	4	2	2	2	4	3	3	1	2	3	3	2	3	3	5	1	2	2	3	3	2
		Deterministic tsunami hazard analysis	4	2	2	2	5	3	5	1	2	3	3	2	3	3		3	2	2	3	3	2
		Field studies on tsunami impacts	3	2	2	2	4	3	3	1	2	4	1	2	2	2		1	2	2	4	3	2
		Hazard map	4	2	2	3	5	4	5	1	2	4	4	3	3	2	5	3	3	3	4	3	2
		Inundation map	4	2	2	3	5	4	5	1	2	4	4	3	3	3	5	3	3	3	4	3	2
		Evacuation map	4	2	2	3	4	4	5	1	2	4	4	3	2	2		1	3	2	5	3	2
RISK ASSESSMENT	5a)	**Has your country undertaken a tsunami risk assessment?**	●	●	●	●	●	●	❍	●	●	❍	●	●	●	●	❍	●	❍	❍	●	●	●
	5b)	**What type of risk assessment?**	MA+T	MA+T	T, MA+T	MA+T	MA+T	MA+T		MA+T	MA+T		MA+T	MA+T	T	MA+T		T, MA+T			MA+T	T, MA+T	MA+T
	5c)	**What hazards have been considered in your multi-hazard risk assessment? (select all that apply)**																					
		Tsunami	●	●	●	●	●	●		●	●		●	●	●	●		●			●	●	●
		Cyclone	●	●	●	●	●	❍		●	●		●	●	❍	●		❍			❍	●	●
		Drought	❍	●	❍	❍	❍	●		●	●		●	●	❍	❍		❍			●	●	●
		Earthquakes	●	●	●	❍	❍	●		●	●		❍	●	❍	●		❍			❍	●	●
		Epidemics	●	❍	●	❍	❍	❍		●	●		❍	●	❍	❍		❍			❍	●	❍
		Flooding	●	●	●	●	●	●		●	●		●	●	❍	❍		●			●	●	●
		Landslide	●	●	❍	●	❍	●		●	●		●	❍	❍	❍		❍			❍	●	●
		Volcanic eruptions	❍	❍	❍	●	❍	●		●	❍		❍	❍	❍	❍		❍			❍	❍	❍
		Other	❍	❍	❍	❍	❍	●		●	❍		❍	●	❍	●		❍			❍	❍	●

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
RISK ASSESSMENT	5d)	**Who did the tsunami risk assessment in your country? (select all that apply)**																					
		National Agency	❍	●	❍	●	●	●		●	●		●	●	●	❍		●			❍	●	❍
		International Agency	❍	❍	❍	❍	❍	❍		❍	❍		❍	●	●	❍		❍			❍	●	●
		National/local University	❍	❍	❍	❍	❍	●		❍	❍		●	●	❍	❍		❍			●	●	❍
		National/International Consultant	❍	●	●	❍	❍	●		❍	❍		❍	❍	❍	●		❍			❍	●	❍
		Other	●	❍	❍	❍	❍	●		❍	❍		❍	❍	❍	❍		❍			❍	❍	❍
	5e)	**At what level was the tsunami risk assessment carried out? (select all that apply)**																					
		National	❍	●	●	❍	●	●		●	●		●	❍	❍	●		●			❍	●	●
		Regional	●	❍	❍	●	●	●		❍	●		❍	❍	❍	❍		❍			●	●	●
		City	❍	❍	❍	❍	●	●		❍	●		❍	●	❍	●		❍			❍	●	❍
		Village	❍	❍	❍	❍	❍	●		❍	❍		❍	❍	●	❍		❍			❍	●	❍
		Community / Neighbourhood	❍	❍	❍	❍	❍	❍		❍	❍		❍	❍	❍	❍		❍			❍	●	❍
	5h)	**What products do you have from the tsunami risk assessment? (select all that apply)**																					
		Risk map	❍	●	●	●	●	●			❍		●	●	❍	●		●			❍	●	●
		Evacuation map	❍	❍	●	❍	❍	●			●		❍	●	●	❍		❍			❍	●	●
		Guidelines	●	❍	●	❍	●	❍			❍		❍	❍	❍	●		❍			●	●	❍
		Action Plan	❍	❍	❍	❍	❍	●			❍		●	❍	❍	●		●			●	●	❍
		Other	❍	❍	❍	❍	●	❍			❍		❍	❍	❍	❍		❍			❍	❍	❍
	5i)	**On a scale of 1 (Very poor) to 5 (Very good), please rate your country's capability to undertake tsunami risk assessment**																					
		Rating	4	2	3	4	5	4		1	2	3	2	3	2	4	1	4	4	2	2	4	3
	5j)	**On a scale of 1 (Not a priority) to 5 (Essential), what is the priority level of your country to improve capacity in the following areas of tsunami risk assessment?**																					
		National Level	2	5	2	1	4	3		5	5	3	5	3	2	2	4	2	5	4	4	5	3
		Regional Level	3	5	1	3	4	4		5	5	3	5	3	3	2	3	0	4	3	4	3	3
		City Level	3	5	4	4	4	4		5	5	4	5	4	4	4	5	0	4	5	4	5	3
		Village Level	2	5	4	4	4	4		5	5	4	5	4	5	3	5	0	4	5	4	5	3
		Community / Neighbourhood Level	2	5	4	4	4	4		5	4	5	5	4	5	3	5	0	4	5	4	5	3
	5k)	**On a scale of 1 (No capacity) to 5 (Very good) what capacity does your country have to give training and/or consultancy on tsunami risk assessment to other countries?**																					
		National Level	4	2	2	3	4	4		2	2	3	4	3	2	3	1	4	2	2	4	3	2
		Regional Level	4	2	2	3	4	3		2	2	3	4	3	2	2	1	1	2	2	4	3	2
		City Level	4	2	2	2	4	3		2	2	3	1	4	2	3	1	1	2	2	4	3	2
		Village Level	3	2	2	2	4	3		2	2	4	1	4	2	3	1	1	2	2	3	3	2
		Community / Neighbourhood Level	3	2	2	2	4	3		2	2	4	1	4	2	3	1	1	2	2	3	3	2

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
POLICIES	6a)	**Does your country have a national tsunami policy? For each of the four disaster management phases listed below, select standalone policy / multi hazard policy / policy not available.**																					
		Prevention and mitigation	MH+T	MH+T	MH+T	MH+T	T	MH+T		MH+T	MH+T	N/A	N/A		MH+T	MH+T	MH+T	T	N/A	MH+T	MH+T	T	MH+T
		Preparedness	MH+T	MH+T	MH+T	MH+T	T	MH+T		MH+T	MH+T	N/A	N/A		MH+T	MH+T	MH+T	T	N/A	MH+T	MH+T	T	MH+T
		Emergency response	MH+T	MH+T	MH+T	MH+T	T	MH+T		MH+T	MH+T	MH+T	MH+T		MH+T	MH+T	MH+T	T	N/A	MH+T	MH+T	T	MH+T
		Rehabilitation and reconstruction	MH+T	MH+T	MH+T	MH+T	T	MH+T		MH+T	MH+T	N/A	N/A		MH+T	MH+T	MH+T	MH+T	N/A	MH+T	MH+T	MH+T	MH+T
	6b)	**Does your country have local tsunami policies? For each of the disaster management phases listed below, select standalone policy / multi hazard policy / policy not available.**																					
		Prevention and mitigation	N/A	MH+T	N/A	N/A	MH+T	MH+T		MH+T	MH+T	N/A	N/A		MH+T	MH+T	T	N/A	N/A	MH+T	MH+T	T	
		Preparedness	N/A	MH+T	N/A	N/A	MH+T	MH+T		MH+T	MH+T	N/A	N/A		MH+T	MH+T	T	N/A	N/A	MH+T	MH+T	T	
		Emergency response	N/A	MH+T	N/A	N/A	MH+T	MH+T		MH+T	MH+T	MH+T	N/A		MH+T	MH+T	MH+T	N/A	N/A	MH+T	MH+T	MH+T	
		Rehabilitation and reconstruction	N/A	MH+T	N/A	N/A	MH+T	MH+T		MH+T	MH+T	N/A	N/A		MH+T	MH+T	MH+T	N/A	N/A	MH+T	MH+T	MH+T	
PLANS	7a)	**Does your country have national, local and community level tsunami disaster risk reduction plans? For each of the four disaster management phases listed below, select standalone plan / multi hazard**																					
		National - Prevention and mitigation	MH+T	MH+T		MH+T	T	T		MH+T	MH+T	N/A	MH+T			MH+T	MH+T	T	MH+T	N/A	N/A	T	T
		Local - Prevention and mitigation	T	MH+T		N/A	MH+T	T		N/A	MH+T	N/A	N/A			MH+T	N/A	N/A	MH+T	N/A	N/A	T	MH+T
		Community / Neighbourhood Level - Prevention and mitigation	MH+T	MH+T		N/A	MH+T	T		N/A	MH+T	N/A	N/A				N/A	N/A	MH+T	N/A	N/A	T	MH+T
		National - Preparedness	MH+T	MH+T		MH+T	T	T		MH+T	MH+T	N/A	MH+T			MH+T	MH+T	T	MH+T	MH+T	N/A	T	T
		Local - Preparedness	T	MH+T		N/A	MH+T	T		N/A	MH+T	N/A	N/A		MH+T	MH+T	N/A	N/A	MH+T	MH+T	N/A	MH+T	MH+T
		Community / Neighbourhood Level - Preparedness	MH+T	MH+T		N/A	MH+T	T		N/A	MH+T	N/A	N/A				N/A	N/A	MH+T	MH+T	N/A	MH+T	MH+T
		National - Emergency response	MH+T	MH+T		MH+T	T	MH+T		MH+T	MH+T	MH+T	MH+T			MH+T	MH+T	T	MH+T	MH+T	N/A	MH+T	MH+T
		Local - Emergency response	T	MH+T		MH+T	MH+T	MH+T		N/A	MH+T	MH+T	N/A			MH+T	N/A	N/A	MH+T	MH+T	N/A	MH+T	MH+T
		Community / Neighbourhood Level - Emergency response	MH+T	MH+T		N/A	MH+T	MH+T		N/A	MH+T	MH+T	N/A				N/A	N/A	MH+T	MH+T	N/A	MH+T	N/A
		National - Rehabilitation and reconstruction	N/A	MH+T		MH+T	T	MH+T		MH+T	MH+T	N/A	N/A			MH+T	MH+T	MH+T	MH+T	N/A	N/A	MH+T	T
		Local - Rehabilitation and reconstruction	MH+T	MH+T		N/A	MH+T	MH+T		N/A	MH+T	N/A	N/A			MH+T	N/A	N/A	MH+T	N/A	N/A	MH+T	N/A
		Community / Neighbourhood Level - Rehabilitation	MH+T	MH+T		N/A	MH+T	MH+T		N/A	MH+T	N/A	N/A				N/A	N/A	MH+T	N/A	N/A	MH+T	N/A
	7b)	**Are your country's tsunami disaster risk reduction plans based on hazards and risk**	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
GUIDELINES	8a)	**Does your country have national tsunami DRR guidelines? For each of the four lifecycle phases, select standalone guidelines / multi hazard guidelines / guidelines not available.**																					
		Prevention and mitigation	T	MH+T	N/A		T	T		MH+T	MH+T	N/A	N/A			MH+T	N/A	T	N/A	N/A	MH+T	T	N/A
		Preparedness	T	MH+T	N/A		T	T		MH+T	MH+T	N/A	N/A		T	MH+T	N/A	T	N/A	MH+T	MH+T	T	MH+T
		Emergency response	T	MH+T	N/A		T	MH+T		MH+T	MH+T	N/A	MH+T			MH+T	N/A	T	N/A	MH+T	MH+T	MH+T	MH+T
		Rehabilitation and reconstruction	N/A	MH+T	N/A		T	MH+T		MH+T	MH+T	N/A	N/A			MH+T	N/A	MH+T	N/A	N/A	MH+T	MH+T	MH+T
	8b)	**Does your country have local tsunami DRR guidelines? For each of the four lifecycle phases, select standalone guidelines / multi-hazard guidelines / guidelines not available.**																					
		Prevention and mitigation	T	MH+T	N/A		MH+T	N/A		MH+T	MH+T	N/A	N/A			MH+T	N/A	N/A	N/A	N/A	MH+T	T	N/A
		Preparedness	T	MH+T	N/A		MH+T	N/A		MH+T	MH+T	N/A	N/A			MH+T	N/A	N/A	N/A	MH+T	MH+T	T	N/A
		Emergency response	T	MH+T	N/A		MH+T	N/A		MH+T	MH+T	MH+T	T			MH+T	N/A	N/A	N/A	MH+T	MH+T	MH+T	N/A
		Rehabilitation and reconstruction	N/A	MH+T	N/A		MH+T	N/A		MH+T	MH+T	N/A	N/A			MH+T	N/A	N/A	N/A	N/A	MH+T	MH+T	N/A

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PILLAR 2 - DETECTION, WARNING & DESSIMINATION	DETECTION AND WARNING	9a)	**Does your country have a national capability to assess and/or receive potential tsunami threat information and advise/warn its coastal communities?**	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		9b)	**Does your country utilise the data provided by the IOTWMS Tsunami Service Providers (TSPs) for the Coastal Forecast Zones (CFZ) of your country's coastline to determine national threats or does it undertake its own threat assessments? (select all that apply)**																					
			Use TSP data	❍	●	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●
			Use own threat assessments	●	❍	❍	❍	●	●	●	❍	●	●	❍	❍	❍	●	●	●	❍	❍	❍	●	❍
		9d)	**Does the organisation responsible for assessing and/or receiving potential tsunami threat information operate 24x7?**	●	●	❍	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		9e)	**What / which infrastructure is available to enable 24x7 operations? (select all that apply)**																					
			Computers	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
			Internet	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
			Landline Phone	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
			Mobile Phone or Cell Phone	●	❍	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●
			Satellite Phone	●	❍	❍	●	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	❍	❍
			Fax	●	●	●	●	●	●	●	❍	❍	●	●	●	●	●	●	●	●	●	●	●	❍
			GTS (WMO Global Telecommunication System)	●	❍	❍	●	●	●	❍	●	❍	●	●	●	●	●	❍	●	●	●	●	●	❍
			UPS (Uninterruptable Power Supply)	●	●	❍	●	●	●	●	●	❍	●	●	●	●	●	❍	●	●	●	●	●	●
			VSAT	●	❍	❍	❍	●	●	❍	❍	❍	●	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍
		9f)	**Which level of tsunami threat forecast information is produced by the responsible organisation? (select all that apply)**																					
			Ocean-wide	●	❍	❍	●	●	●	❍	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
			National	●	●	●	❍	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	●	●
			Local	●	❍	●	❍	●	●	●	❍	❍	●	❍	❍	●	●	●	●	❍	●	●	●	●
		9g)	**Does the organisation have access to national or international seismic networks?**	●	●	❍	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		9h)	**Is the list of broadband seismometers operated by your country listed accurately in the IOTWMS seismic database?**	●	●	❍	●	●	❍	❍	❍	●	●	●	❍	❍	●	❍	●		●	●	●	●
		9j)	**Does the organisation have access to national or international sea level networks?**	●	●	●	●	●	●	●	●	❍	●	●	❍	●	●	❍	●	●	●	●	●	●
		9k)	**Is the list of sea level stations operated by your country listed accurately in the IOTWMS sea level database?**	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	❍	●	●	●		●	●
		9m)	**What other observing networks are operated by your country and used for tsunami early warning?**																					
			No other observing networks are operated by the country	❍	●	❍	●	❍	●	●	❍	●	❍	●	●	❍	❍	●	●	❍	●	●	❍	❍
			GNSS/GPS	●	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍
			Coastal radars	❍	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	●	❍	❍	●	❍
			Other	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	●	❍	❍	❍	❍	❍	❍	●	❍

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DETECTION AND WARNING	9n)	Does the organisation have the capability of analysing real-time seismic and sea-level data for potential tsunami threat?	●	●	❍	❍	●	●	❍	●	●	●	❍	❍	●	●	●	●	❍	●	❍	❍	●
	9o)	Does the organisation have capability for tsunami modelling to support generation of	●	❍	❍	❍	●	●	●	●	●	●	❍	❍	❍	●	●	●	❍	●	●	●	●
	9p)	Does the organisation responsible for identifying a potential tsunami threat also issue national tsunami watches, advisories, alerts and/or warnings?	●	●	❍		●	❍	●	●	●	●	●	●	●	●	❍	●	●	●	●	●	●
	9s)	Did your country's NTWC and/or TWFP participate in the 6-monthly communications tests conducted by the IOTWMS TSPs?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍
	9t)	Did your country's NTWC and/or TWFP participate in the Tsunami Drill (eg. IOWave) conducted in the inter-sessional period?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●	●
	9u)	After the December 26 2004 tsunami and until now, was your country impacted by any	●	❍	❍	❍	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍
DISSEMINATION	10a)	How is the tsunami information (warning, public safety action, etc) disseminated within country? (select all that apply)																					
		Email	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		SMS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍	●	●
		Telephone	●	●	●	❍	●	❍	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●
		Fax	●	●	●	❍	●	●	●	❍	●	●	●	●	●	●	●	●	❍	●	●	●	❍
		Webpage	●	●	●	❍	●	●	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	❍
		Radio	●	●	●	●	●	●	❍	●	●	●	●	❍	●	●	●	●	●	●	●	●	❍
		WhatsApp / Facebook / Other social media	●	●	●	❍	●	●	●	●	❍	●	❍	❍	●	●	❍	❍	❍	●	❍	●	●
		Door-to-door	●	❍	❍	❍	●	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
		Sirens	●	●	❍	❍	●	●	●	●	●	●	●	❍	❍	❍	●	❍	❍	●	❍	●	●
		Television	●	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		Warning towers	●	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	●	●
		Megaphone	●	❍	●	●	●	❍	❍	●	●	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	●
		Police/military	●	❍	❍	❍	●	●	❍	●	●	❍	●	❍	❍	●	❍	❍	❍	●	●	❍	●
		Public alert system	●	❍	❍	❍	●	❍	❍	●	●	❍	❍	●	❍	●	❍	●	❍	●	●	●	●
		VHF radio	●	●	❍	❍	●	❍	❍	●	●	❍	●	❍	❍	❍	❍	❍	❍	●	❍	●	❍
		VPN	●	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍
		Other	●	❍	❍	❍	❍	●	❍	❍	❍	●	❍	●	❍	❍	❍	❍	●	❍	❍	●	●

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STANDARD OPERATING PROCEDURES	11a)	**For each of the (upstream) emergency response issues listed below (in rows), consider the four questions (in columns). Select a yes/no response using the drop down menus.**																					
		24/7 EOC - Does your SOP address this aspect of tsunami emergency response?	●	●	●	●	●	●		●	●	●	●		●	●	●	●	❍	●	●	●	●
		24/7 EOC - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	❍	●	●	❍	❍	●		●	●	●	❍		●	●	●	❍	●	●	●	●	●
		24/7 EOC - Is support required to develop Human Resources in this aspect of tsunami emergency response?	❍	●	❍	❍	●	●		●	●	●	●		●	●	●	❍	●	●	●	●	●
		24/7 EOC - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●	●	●	●	●		●	●	●	●		●	❍	●	❍	●	●	●	●	●
		Receiving information from the NTWC - Does your SOP address this aspect of tsunami emergency response?	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●
		Receiving information from the NTWC - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	❍	●	●	❍	❍	●		●	●	●	❍		●	❍	●	❍	❍	●	●	●	●
		Receiving information from the NTWC - Is support required to develop Human Resources in this aspect	❍	●	❍	❍	❍	●		●	●	●	❍		●	❍	●	❍	❍	●	●	●	●
		Receiving information from the NTWC - Is support required to develop infrastructure for this aspect of	❍	●	●	●	❍	●		●	●	●	●		●	❍	●	❍	❍	●	●	●	●
		Does your SOP address this aspect of tsunami emergency response?	●	●	❍	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●
		Response Criteria / decision making - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●	●	●	❍	●		●	●	●	●		❍	●	❍	❍	●	●	●	●	●
		Response Criteria / decision making - Is support required to develop Human Resources in this aspect	❍	●	●	●	❍	●		●	●	●	●		●	●	❍	❍	●	●	●	●	●
		Response Criteria / decision making - Is support required to develop infrastructure for this aspect of	❍	●	❍	●	❍	●		●	●	●	●		●	❍	●	❍	●	●	●	●	●
	11b)	**For each of the (downstream) emergency response issues listed below (in rows), consider the four questions (in columns). Select a yes/no response using the drop down menus.**																					
		Warning dissemination - Does your SOP address this aspect of tsunami emergency response?	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●
		Warning dissemination - Is support required to develop/improve this aspect of tsunami emergency	●	●	●	●	❍	●		●	●	●	❍		●	●	●	❍	❍	●	●	●	●
		Warning dissemination - Is support required to develop Human Resources in this aspect of tsunami	●	●	●	❍	❍	●		●	●	●	●		●	●	❍	❍	❍	●	●	●	●
		Warning dissemination - Is support required to develop infrastructure for this aspect of tsunami	❍	●	●	●	❍	●		●	●	●	●		●	●	●	❍	❍	●	●	●	●
		Evacuation call procedures - Does your SOP address this aspect of tsunami emergency	●	●	●	●	●	●		●	●	●			●	●	●	❍	❍	●	●	●	●
		Evacuation call procedures - Is support required to develop/improve this aspect of tsunami emergency	●	●	●	●	❍	●		●	●	●			●	●	●	❍	●	●	●	●	●
		Evacuation call procedures - Is support required to develop Human Resources in this aspect of tsunami	●	●	●	❍	●	●		●	●	●			●	●	❍	❍	●	●	●	●	●

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STANDARD OPERATING PROCEDURES	**11b)**	**For each of the (downstream) emergency response issues listed below (in rows), consider the four questions (in columns). Select a yes/no response using the drop down menus.**																					
		Evacuation call procedures - Is support required to develop infrastructure for this aspect of tsunami	❍	●	❍	●	●	●		●	●	●			●	●	●	❍	●	●	●	●	●
		Community evacuation procedures - Does your SOP address this aspect of tsunami emergency response?	●	●	❍	❍	●	●		●	●	●			❍	●	❍	❍	❍	●	●	●	●
		Community evacuation procedures - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●	●	●	❍	●		●	●	●			❍	●	●	❍	●	●	●	●	●
		Community evacuation procedures - Is support required to develop Human Resources in this aspect	●	●	●	❍	●	●		●	●	●			●	●	❍	❍	●	●	●	●	●
		Community evacuation procedures - Is support required to develop infrastructure for this aspect of	❍	●	❍	●	●	●		●	●	●			●	●	●	❍	●	●	●	●	●
		Communication with NTWC - Does your SOP address this aspect of tsunami emergency	●	●	●	●	●	●		●	●	●			●	●	●	●	●	●	●	●	●
		Communication with NTWC - Is support required to develop/improve this aspect of tsunami emergency	●	●	●	●	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
		Communication with NTWC - Is support required to develop Human Resources in this aspect of tsunami	●	●	●	●	❍	●		●	●	●			●	●	❍	❍	❍	●	●	●	●
		Communication with NTWC - Is support required to develop infrastructure for this aspect of tsunami	●	●	●	❍	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
		Communication with Local Government - Does your SOP address this aspect of tsunami	●	●	●	●	●	●		●	●	●			●	●	●	❍	●	●	●	●	●
		Communication with Local Government - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●	❍	❍	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
		Communication with Local Government - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●	❍	❍	❍	●		●	●	●			●	●	❍	❍	❍	●	●	●	●
		Communication with Local Government - Is support required to develop infrastructure for this aspect of	❍	●	●	❍	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
		Media arrangements - Does your SOP address this aspect of tsunami emergency response?	●	●	❍	●	●	●		●	●	●			●	●	●	●	❍	●	●	●	●
		Media arrangements - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●	●	❍	❍	●		●	●	●			●	●	●	❍	●	●	●	●	●
		Media arrangements - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●	●	❍	❍	●		●	●	●			●	●	❍	❍	●	●	●	●	●
		Media arrangements - Is support required to develop infrastructure for this aspect of tsunami emergency	❍	●	❍	❍	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
		Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Does your SOP address this	●	●	●	●	●	●		●	●	●			●	●	●	●	❍	●	●	●	●

STANDARD OPERATING PROCEDURES

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11b)	**For each of the (downstream) emergency response issues listed below (in rows), consider the four questions (in columns). Select a yes/no response using the drop down menus.**																					
	Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●	●	❍	❍	●		●	●	●			●	●	❍	❍	●	●	●	●	●
	Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●	●	❍	❍	●		●	●	●			●	●	❍	❍	●	●	●	●	●
	Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●	●	❍	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
11c)	**Would your country be willing to share your SOPs with the IOTIC and other countries?**	●	●	●	●	●	●		●	●	●	●	●	●	●	●	❍	●	●	●	●	●
11d)	**For each emergency response organisation listed below, which communication methods for emergency response are available? (select all that apply)**																					
	National DMOs - Telephone	●	❍	●	●	●	❍		●	●	●	●	●	●	●	●	●	●	●	●	●	●
	National DMOs - Fax	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	❍
	National DMOs - Email	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
	National DMOs - SMS	●	❍	●	●	●	●		●	●	●	●	❍	●	●	●	●	●	❍	❍	●	●
	National DMOs - Siren	❍	❍	❍	●	●	❍		●	❍	❍	❍	❍	❍	❍	●	●	❍	❍	❍	●	●
	National DMOs - Other	●	❍	❍	❍	●	❍		❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍
	Local DMOs - Telephone	●	❍	●	●	●	❍		●	●	●	❍	●	●	●	●	●	●	●	●	●	●
	Local DMOs - Fax	●	●	●	●	●	●		❍	❍	●	❍	●	●	●	●	●	●	●	●	●	❍
	Local DMOs - Email	●	●	●	●	●	●		●	❍	●	❍	●	●	●	❍	●	●	●	●	●	●
	Local DMOs - SMS	●	❍	●	●	●	●		●	●	●	❍	❍	●	❍	●	●	●	❍	❍	●	●
	Local DMOs - Siren	●	❍	❍	❍	●	●		●	●	❍	❍	❍	❍	❍	●	●	❍	❍	❍	●	❍
	Local DMOs - Other	●	❍	❍	❍	●	●		❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍
	General public - Telephone	●	❍	❍	❍	●	❍		●	❍	●	❍	❍	●	❍	●	●	❍	❍	●	❍	●
	General public - Fax	●	❍	❍	❍	❍	❍		❍	❍	●	❍	❍	●	❍	❍	●	❍	❍	●	❍	❍
	General public - Email	●	❍	❍	❍	●	❍		❍	❍	●	❍	❍	●	❍	❍	●	❍	❍	●	❍	●
	General public - SMS	●	●	●	❍	●	❍		●	●	❍	●	❍	●	●	●	●	●	●	❍	❍	●
	General public - Siren	●	●	❍	❍	❍	❍		●	●	●	●	❍	❍	●	●	●	❍	●	❍	●	❍
	General public - Other	●	❍	●	●	●	●		❍	❍	●	❍	❍	❍	●	❍	❍	❍	●	❍	●	❍

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
STANDARD OPERATING PROCEDURES	11b)	**For each of the (downstream) emergency response issues listed below (in rows), consider the four questions (in columns). Select a yes/no response using the drop down menus.**																					
		Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●	●	❍	❍	●		●	●	●			●	●	❍	❍	●	●	●	●	●
		Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●	●	❍	❍	●		●	●	●			●	●	❍	❍	●	●	●	●	●
		Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●	●	❍	❍	●		●	●	●			●	●	●	❍	❍	●	●	●	●
	11c)	**Would your country be willing to share your SOPs with the IOTIC and other countries?**	●	●	●	●	●	●		●	●	●	●	●	●	●	●	❍	●	●	●	●	●
	11d)	**For each emergency response organisation listed below, which communication methods for emergency response are available? (select all that apply)**																					
		National DMOs - Telephone	●	❍	●	●	●	❍		●	●	●	●	●	●	●	●	●	●	●	●	●	●
		National DMOs - Fax	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	❍
		National DMOs - Email	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
		National DMOs - SMS	●	❍	●	●	●	●		●	●	●	●	❍	●	●	●	●	●	❍	❍	●	●
		National DMOs - Siren	❍	❍	❍	●	●	❍		●	❍	❍	❍	❍	❍	❍	●	●	❍	❍	❍	●	●
		National DMOs - Other	●	❍	❍	❍	●	❍		❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍
		Local DMOs - Telephone	●	❍	●	●	●	❍		●	●	●	❍	●	●	●	●	●	●	●	●	●	●
		Local DMOs - Fax	●	●	●	●	●	●		❍	❍	●	❍	●	●	●	●	●	●	●	●	●	❍
		Local DMOs - Email	●	●	●	●	●	●		●	❍	●	❍	●	●	●	❍	●	●	●	●	●	●
		Local DMOs - SMS	●	❍	●	●	●	●		●	●	●	❍	❍	●	❍	❍	●	●	●	❍	●	●
		Local DMOs - Siren	●	❍	❍	❍	●	●		●	●	❍	❍	❍	❍	❍	❍	●	●	❍	❍	●	❍
		Local DMOs - Other	●	❍	❍	❍	●	●		❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍
		General public - Telephone	●	❍	❍	❍	●	❍		●	❍	●	❍	❍	●	❍	●	●	●	❍	●	❍	●
		General public - Fax	●	❍	❍	❍	❍	❍		❍	❍	●	❍	❍	●	❍	❍	●	❍	❍	●	❍	❍
		General public - Email	●	❍	❍	❍	●	❍		❍	❍	●	❍	❍	●	❍	❍	●	❍	❍	●	❍	●
		General public - SMS	●	●	●	❍	●	❍		●	●	❍	●	❍	●	●	●	●	●	●	❍	❍	●
		General public - Siren	●	●	❍	❍	❍	❍		●	●	●	●	❍	❍	●	●	●	❍	●	❍	●	❍
		General public - Other	●	❍	●	●	●	●		❍	❍	●	❍	❍	❍	●	❍	❍	❍	●	❍	●	❍
		Coastal communities - Telephone	●	❍	●	●	●	❍		●	●	●	❍	●	●	❍	●	●	●	❍	●	❍	●
		Coastal communities - Fax	●	❍	❍	●	❍	❍		❍	❍	●	❍	●	●	❍	❍	●	❍	❍	❍	❍	❍
		Coastal communities - Email	●	❍	❍	●	●	❍		❍	❍	●	❍	●	●	❍	❍	●	●	❍	❍	❍	●
		Coastal communities - SMS	●	●	●	●	●	❍		●	●	❍	●	❍	●	●	●	●	●	●	❍	❍	●
		Coastal communities - Siren	●	●	❍	❍	❍	❍		●	●	●	●	❍	❍	●	●	●	❍	●	●	●	❍
		Coastal communities - Other	❍	❍	●	❍	●	●		❍	❍	●	❍	❍	❍	●	❍	❍	❍	●	❍	●	❍

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
STANDARD OPERATING PROCEDURES	11d)	**For each emergency response organisation listed below, which communication methods for emergency response are available? (select all that apply)**																					
		Coastal communities - Other	❍	❍	●	❍	●	●		❍	❍	●	❍	❍	❍	●	❍	❍	❍	●	❍	●	❍
		Media - Telephone	●	●	●	●	●	❍		●	●	●	●	●	●	●	●	●	●	●	●	●	●
		Media - Fax	●	●	●	❍	●	❍		●	●	●	●	●	●	❍	●	●	❍	●	●	●	❍
		Media - Email	●	❍	●	●	●	●		●	●	●	●	●	●	●	❍	●	●	●	●	●	●
		Media - SMS	●	●	❍	●	●	❍		●	●	❍	❍	❍	●	●	●	❍	●	❍	❍	●	●
		Media - Siren	❍	❍	❍	❍	❍	❍		●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
		Media - Other	●	❍	❍	❍	●	●		●	❍	●	❍	❍	❍	❍	❍	❍	❍	●	❍	●	❍
TSUNAMI EXERCISES	12a)	**Does your country have the following evacuation infrastructure? (select all that apply and detail specific areas).**																					
		Evacuation shelter	❍	●	❍	❍	●	●	❍	●	●	❍	●	●	❍	●	❍	❍	❍	●	❍	●	●
		Vertical evacuation structure	❍	●	❍	❍	●	●	❍	❍	❍	❍	❍	●	❍	❍	❍	❍	●	●	❍	●	●
		Natural or artifical hill for vertical evacuation	●	●	●	●	●	●	●	❍	●	●	❍	❍	❍	❍	●	❍	●	●	❍	●	●
		Evacuation signage	●	●	❍	❍	●	●	❍	●	❍	❍	❍	❍	❍	❍	●	❍	❍	●	❍	●	●
		Other	❍	❍	❍	❍	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	12b)	**Is your evacuation infrastructure integrated in the evacuation plan?**	❍	●	❍	❍	●	●	●	●	●	●	●	●	●	●		❍	❍	●		●	●
	12a)	**Are tsunami exercises incorporated within national policies and guidelines? (select all that apply)**																					
		National policy	❍	❍	●	❍	●	●	❍	●	●	●	●	❍	❍	●	●	●	❍	❍	●	●	●
		National guidelines	●	●	❍	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	❍	●	❍
	12b)	**At what levels were the exercises conducted during the inter-sessional (between ICG Meetings) period? (select all that apply)**																					
		National level	●	●	●	❍	●	●	❍	●	●	❍	●	❍	●	●	❍	●	●	●	❍	●	●
		Regional level	●	❍	●	●	●	●	❍	●	●	❍	❍	❍	●	●	❍	❍	❍	❍	❍	●	●
		City level	●	❍	❍	❍	●	❍	❍	❍	●	❍	●	●	●	❍	❍	❍	❍	❍	●	❍	❍
		Village level	●	❍	●	❍	●	❍	●	❍	❍	●	●	❍	●	●	●	❍	❍	●	❍	❍	❍
		Community/Neighbourhood level	❍	❍	●	❍	●	❍	❍	❍	❍	●	●	❍	●	●	●	❍	❍	●	❍	●	●
		School level	❍	❍	❍	❍	●	❍	❍	❍	❍	●	●	❍	❍	●	❍	❍	❍	●	❍	❍	●
	12c)	**What kind of tsunami exercise activities have been undertaken in your country and how many times during the inter-sessional (between ICG Meetings) period?**																					
		Organisation table top exercises	●	●	●	❍	●	●	❍	●	❍	●	●	●	●	●	❍	●	●	●	●	●	●
		Inter-organisation table top exercises	●	●	●	❍	●	●	❍	●	❍	●	❍	●	●	●	❍	●	●	●	●	❍	●
		National.tsunami drill/exercise	●	●	❍	❍	●	●	❍	●	❍	●	❍	❍	●	❍	●	❍	❍	●	❍	●	●
		Indian Ocean Wave exercise	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●	●
		Local tsunami exercise		●	❍	❍	●	●	❍	●	❍	●	●	❍	●	❍	●	●	❍	●		●	●
		Other	●		●	❍		●	❍	❍	❍			❍								❍	
PUBLIC AWARENESS	13a)	**Who is responsible for tsunami public awareness programmes in your country?**	LDMO	NDMO	NDMO	NDMO	NDMO	NTWC	NTWC	NDMO	NDMO	NDMO	NTWC	NDMO	NTWC	NDMO	NDMO	NTWC	NDMO	NDMO	NDMO	MO	NDMO
	13b)	**What tsunami related education and awareness materials do you have? (select all that apply)**																					
		Leaflets or flyers	●	❍	●	❍	●	●	❍	●	❍	●	●	❍	❍	●	●	❍	●	●	●	●	●
		Posters	●	❍	❍	❍	●	●	●	●	●	●	●	●	●	●	●	❍	❍	●	❍	●	●
		Booklets	●	❍	●	❍	●	●	●	●	●	●	❍	●	❍	●	❍	❍	❍	●	❍	●	●
		Information boards	●	●	❍	●	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	●	❍
		Tsunami Signage	●	❍	❍	❍	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	●	❍
		Video, or other visual or oral media	●	❍	❍	❍	●	●	❍	●	❍	●	●	●	●	●	❍	❍	❍	●	●	●	●

			AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MAU	MZ	MM	OM	PK	SIN	SA	SLK	TAN	THA	TL
PUBLIC AWARENESS	13b)	**What tsunami related education and awareness materials do you have? (select all that apply)**																					
		Leaflets or flyers	●	❍	●	❍	●	●	❍	●	❍	●	●	❍	❍	●	●	❍	●	●	●	●	●
		Posters	●	❍	❍	❍	●	●	●	●	●	●	●	●	●	●	●	❍	❍	●	❍	●	●
		Booklets	●	❍	●	❍	●	●	●	●	●	●	❍	●	❍	●	❍	❍	❍	●	❍	●	●
		Information boards	●	●	❍	●	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	●	❍
		Tsunami Signage	●	❍	❍	❍	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	●	❍
		Video, or other visual or oral media	●	❍	❍	❍	●	●	❍	●	❍	●	●	●	●	●	❍	❍	❍	●	●	●	●
		Indigenous knowledge, folklore, or oral history accounts or compilations	❍	❍	❍	❍	●	●	❍	●	❍	❍	❍	❍	❍	❍	❍	❍	●	●	❍	●	●
		Teaching kits on tsunamis	●	❍	●	❍	●	●	❍	●	●	❍	●	❍	●	❍	❍	❍	❍	●	❍		●
		School curricula	●	❍	●	❍	❍	❍	●	●	❍	❍	●	❍	❍	●	❍	❍	❍	●	❍	●	●
		Public evacuation map	●	❍	❍	❍	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	●	❍	❍	●
	13c)	**Would your country be willing to share these education and awareness materials with the Indian Ocean Tsunami Information Centre**	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●
	13d)	**Do you undertake the following tsunami awareness activities?**																					
		World Tsunami Awareness Day	●	●	●	❍	●	❍	●	●	❍	●	●	❍	●	●	●	❍	❍	●		●	❍
		Global Disaster Risk Reduction Day	●	●	●	❍	❍	❍		●	❍	❍	●	❍		●	❍	❍	●	❍	●	●	●
		Public tsunami preparedness outreach	●	●	❍	❍	●	●	●	●	●	❍	●	❍		●	❍	❍	❍	●		●	❍
		School.and/or children's awareness		●	●	❍	●	●	●	●	●	●	●	●	●	●	●	❍	❍	●	❍	●	●
		Exhibitions	❍	●	●	❍	●	●	❍	●	❍	●	●	❍		●	❍	❍	❍	●		●	●
		Competitions or other ways of highlighting tsunami safety	❍	●	❍	❍	●	❍	❍	❍	❍	●		❍		❍	❍	❍	❍	●		❍	❍
		Tsunami exercise	●	●	❍	❍	●	●	●	●	●	●	●	❍	●	●	●	❍	●	●		●	●
		Other			❍	❍		❍	❍	❍								❍				❍	
	13e)	**Use the boxes below to indicate any areas in which you require support from the IOTIC to develop or enhance public awareness in your country. If you do not require support, please leave blank.**																					
		Provision of general tsunami awareness materials	❍	●	❍	●	●	●	●	●	●	●	❍	●	●	●	●	❍	●	❍	●	●	●
		Customization of general materials to country or community	❍	●	●	❍	●	❍	●	●	●	●	●	❍	●	●	●	❍	●	●	❍	●	●
		Development of tsunami awareness programmes, activities or campaigns	●	●	●	❍	●	❍	●	●	●	●	●	●	●	●	●	❍	❍	●	●	●	●
		Participation/support by international agencies or experts to your country's activities	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	❍	❍	❍	●	●	●	●
	13f)	**Can your country offer support to other Member States to develop or enhance public awareness in their country?**	●	●	❍	❍	●	●	❍	●	●	❍	❍	❍	●	❍	❍	❍	❍	●	●	●	❍
	13g)	**Are any communities in your country piloting the Indian Ocean Tsunami Ready (IOTR) initiative?**	●	●	❍	❍	●	●	❍	●	●	❍	❍	❍	❍	●	❍	❍	❍		❍	❍	❍

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PUBLIC AWARENESS	13h)	**For those communities that participated in the IOTR initiative, please provide a general ranking of their performance against the IOTR indicators, using the scale 1 (very poor) to 5 (very good)**																					
		Have a community tsunami risk reduction plan	3	4			4	3		3	2			3	3	3				2	3		
		Have designated and mapped tsunami hazard zones	3	4			4	4		4	2			4	3	4				3	3		
		Have a public display of tsunami information	2	4			4	5		3	2			2	3	4				3	3		
		Produce easily understood tsunami evacuation maps as determined appropriate by local authorities in collaboration with communities	3	4			4	3		3	2			2	3	4				3	3		
		Develop and distribute outreach and public education	3	4			5	4		3	2			2	3	5				3	4		
		Hold at least three outreach or educational activities annually	2	4			5	5		3	2			2	3	4				4	4		
		Conduct an annual tsunami community exercise	2	4			5	5		3	2			1	3	4				4	4		
		Address tsunami hazards in the community's Emergency Operations Plan (EOP)	3	5			5	4		4	2			1	3	4				3	4		
		Commit to support the Emergency Operations Centre (EOC) during a tsunami incident, if an EOC is open and activated	5	5			5	4		4	2			4	3	4				1			
		Have redundant and reliable means for a 24-hour warning point (and EOC if activated) to receive official tsunami threats / information	3	5			5	5		3	2			4	3	5				4			
		Have redundant and reliable means for a 24-hour warning point and/or EOC to receive official tsunami alerts to the public	3	5			4	5		3	2			4	3	5				4			

ANNEX IV

COUNTRY SUMMARY REPORTS

AUSTRALIA

	Status				Notes/Requirements
Policies	**Phase**	**National**	**Local**		**Notes:** National Strategy for Disaster Resilience (Feb 2011); National Disaster Risk Reduction Framework (draft); Australian Emergency Management Arrangements Handbook
	Prevention & Mitigation	Multi-hazard inc.Tsunami	Not available		
	Preparedness	Multi-hazard inc.Tsunami	Not available		
	Emergency Response	Multi-hazard inc.Tsunami	Not available		
	Rehabilitation & Reconstruction	Multi-hazard inc.Tsunami	Not available		
Plans	**Phase**	**National**	**Local**	**Community**	**Notes:** Australian Government Disaster Response Plan stipulates when and how to seek Federal Government assistance in a major disaster; Tsunami subplan in each State/Territory Emergency Service; Multi-hazard plan in each State/Territory and local government area
	Prevention & Mitigation	Multi-hazard inc.Tsunami	Standalone tsunami	Multi-hazard inc.Tsunami	
	Preparedness	Multi-hazard inc.Tsunami	Standalone tsunami	Multi-hazard inc.Tsunami	
	Emergency Response	Multi-hazard inc.Tsunami	Standalone tsunami	Multi-hazard inc.Tsunami	
	Rehabilitation & Reconstruction	Not available	Multi-hazard inc.Tsunami	Multi-hazard inc.Tsunami	
	Country's tsunami disaster risk reduction plans based on hazards and risk assessment: **Yes**				
Guidelines	**Phase**	**National**	**Local**		**Notes:** Tsunami Emergency Planning in Australia Handbook.
	Prevention & Mitigation	Standalone tsunami	Standalone tsunami		
	Preparedness	Standalone tsunami	Standalone tsunami		
	Emergency Response	Standalone tsunami	Standalone tsunami		
	Rehabilitation & Reconstruction	Not available	Not available		
Hazard Assessment	• Single hazard assessment on tsunami undertaken: **No** • Multi-hazard assessment including **tsunami, cyclone, earthquakes and flooding**. • Tsunami hazard assessment at **national, regional and city levels** • Products available: **PTHA, field studies on tsunami impact, hazard maps and inundation maps, guidelines on tsunami hazard modelling** • Capacity to undertake tsunami hazard assessment: **Good** • Capacity to train other countries: **Good** (PTHA, DTHA, hazard, inundation and evacuation maps) to **Moderate** (field studies)				**Notes:** Tsunami Hazard Modelling Guidelines available. Most mapping used the 2008 PTHA since updated with the 2018 PTHA. State governments to assess need to update mapping given the significant changes to the PTHA product.

AUSTRALIA			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment including **tsunami, cyclone, earthquakes, epidemics, flooding and landslides** • Tsunami risk assessment at **regional level** • Products available: **National Emergency Risk Assessment Guidelines (NERAG)** • Capacity to undertake tsunami risk assessment: **Very Good** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Good**		**Notes**: PTHA shows that offshore hazard varies around the country. However, there is not necessarily a direct relationship between high offshore hazard and high onshore hazard due to the nature of the nearshore environment and the source of the event itself.
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Joint Australian Tsunami Warning Centre (JATWC)** • Use IOTWMS TSP data to determine national threats? **Use own threat assessments** • 24x7 operations? **Yes** (see notes) • Level of tsunami threat forecast information produced: **Ocean-wide, national and local** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (seenotes) • Other national observing networks used for tsunami early warning: **GNSS/GPS** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** • Capability for tsunami modelling to support threat forecasts: **Yes** • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes**: 24x7 staffed earthquake monitoring at Geoscience Australia, Canberra and sea-level monitoring at Bureau of Meteorology's National Operations Centre, Melbourne; redundant infrastructure and communications services; direct GA-BOM video conferencing facility. Real-time seismic data available from GA's seismic monitoring network, the International Monitoring System (IMS) of the Comprehensive Nuclear- Test-Ban Treaty (CTBT) and from other international seismic monitoring networks via IRIS and other public SEEDlink server. Real-time data from Australian operated 43 coastal sea level stations and Australian network of 6 tsunameters.
Dissemination	How is tsunami information disseminated within country?	Email SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media Door-to-door, Sirens, Television, Warning towers, Megaphone, Police/military, Public alert system, VHF radio, VPN.	**Notes:** Other: Emergency Alert; Phone trees; 1300 TSUNAMI telephone services
	How is warning terminated?	JATWC will issue a warning cancellation when it assesses that either no tsunami has eventuated or the tsunami threat has passed. In the latter case, the observed wave amplitudes must be below the Marine Threat threshold for at least two hours, although abnormal sea level changes and currents may persist for many hours.	**Notes**: All Clear advice s not issued by the JATWC, but by the State/Territory emergency management authorities who have jurisdictional responsibility for public safety and response to any tsunami impacts.

<table>
<tr><th colspan="6">AUSTRALIA</th></tr>
<tr><th></th><th colspan="3">Status</th><th colspan="2">Notes/ Requirements</th></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="3"></td><td colspan="2">Support Required to Develop</td></tr>
<tr><td colspan="3">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td colspan="2">SOPs ✗
✗
✓

Human Resources ✗
✗
✗

Infrastructure ✗
✗
✗</td></tr>
<tr><td colspan="3">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: Yes
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: Yes</td><td colspan="2">✓ ✓ ✗
✓ ✓ ✗
✓ ✓ ✗
✓ ✓ ✓
✓ ✓ ✗
✓ ✓ ✗
✓ ✓ ✗</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="3">• Evacuation shelters: No
• Vertical evacuation shelter: No
• Natural or artificial hill for vertical evacuation: Yes (No definitive percentage)
• Evacuation signage: Yes
• Evacuation infrastructure integrated in evacuation plan: No</td><td colspan="2">Notes:
Shelters available but not specifically for tsunami. Evacuation signage is limited to some coastal cities such as Manly Beach</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="3">• Tsunami exercises incorporated in national policy No
• Tsunami exercises incorporated in national guidelines Yes</td><td colspan="2"></td></tr>
<tr><td colspan="3">Level at which exercises are conducted:
• National: Yes
• Regional: Yes
• City: Yes
• Village: Yes
• Community/neighbourhood: No
• School: No</td><td colspan="2">Notes:
• Organisation table top (5-10)
• Inter-organisation table top (5-10)
• National tsunami drill/exercise (2, leveraging IOWave18 and PacWave18)
• Indian Ocean Wave Exercise (1?)</td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="3">• Responsibility for tsunami public awareness programmes: LDMO</td><td colspan="2"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: Yes</td><td colspan="2">Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: Yes</td><td colspan="2">Notes:
A tailored-to-Australia online tsunami education resource called "Tsunami: The Ultimate Guide" at</td></tr>
</table>

<table>
<tr><th colspan="4">AUSTRALIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/ Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">Posters: Yes
Booklets: Yes
Information boards: Yes
Tsunami signage: Yes
Video or other visual or oral media: Yes
Indigenous knowledge, folklore etc: No
Teaching kits: Yes
Schools curricula: Yes
Public evacuation maps: Yes</td><td>Global Disaster Risk Reduction Day: Yes
Public tsunami preparedness outreach: Yes
School and/or children’s awareness: No
Exhibitions: No
Competitions/other ways of highlighting tsunami safety: No</td><td>https://knowledge.aidr.org.au/resources/the-ultimate-guide- tsunami/#
Keen to work with IOTIC to enhance tsunami preparedness</td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness:</td><td colspan="2">Provision of general tsunami awareness materials ✗
Customization of general materials to country or community ✗
Development of tsunami awareness programmes, activities or campaigns ✓
Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">Willing to support other countries to develop or enhance public awareness: Yes
Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes</td><td>Notes: IOTR pilot communities: Christmas Island and Cocos (Keeling) Islands</td></tr>
<tr><td>General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
Australian Tsunami Advisory Group (ATAG) has updated the national Tsunami Emergency Planning Handbook and developed national Tsunami Hazard Modelling Guidelines. Both documents were released on World Tsunami Awareness Day on 5 Nov 2018.
Geoscience Australia (GA) upgraded the National Earthquake Alert Centre in June 2018 which is a key component of the JATWC
GA released a new version of the PTHA on World Tsunami Awareness Day. Reviewed at EGU and journal publications are progressing)
GA have provided options to the IOTWMS to leverage the PTHA for Indian Ocean nations
GA has trained scientists in the Pacific to develop tsunami inundation maps and to integrate into disaster management plans using the open-source PacSAFE software tool.
Bureau of Meteorology performed a major upgrade to its tsunami Decision Support Tool.
Bureau of Meteorology published a real-time tsunami warning status page for the Indian Ocean which was successfully tested during the IOWave18 exercise
University of Newcastle completed a study into the potential for submarine landslide inundation off the NSW coast</td></tr>
</table>

AUSTRALIA		
	Status	**Notes/ Requirements**
	Future Plans • Develop local tsunami hazard information using the 2018 PTHA and the Tsunami Hazard Modelling Guidelines • Collect elevation data in priority areas and support national initiatives in this regard • Develop nationally consistent storm surge services • Continue to collaborate on science improvements to the warning system (e.g. upgrade the JATWC T2 scenario database based on new data in the PTHA18) • Develop and/or refine tsunami evacuation maps • More inundation modelling and mapping • Increase tsunami awareness for coastal communities and marine users	

<table>
<tr><th colspan="6">BANGLADESH</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td colspan="2">Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard +Tsunami</td><td>Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard +Tsunami</td><td>Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard +Tsunami</td><td>Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard +Tsunami</td><td>Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard +Tsunami</td><td colspan="2">Multi-hazard +Tsunami</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including tsunami, cyclone, droughts, earthquakes, flooding, landslides
Tsunami hazard assessment undertaken at national level
Products available: PTHA, DTHA, hazard maps and inundation maps.
Capacity to undertake tsunami hazard assessment: Poor
Capacity to train other countries: Poor (all categories)</td><td>Notes:
0.5% coastal areas of total Khulna, Barishal, Chattogram division have been mapped for tsunami hazard.
Requirements:
Priority to improve capacity in all areas of tsunami hazard assessment is rated as Essential.</td></tr>
</table>

<table>
<tr><th colspan="4">BANGLADESH</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Risk Assessment</td><td colspan="2">• Single risk assessment on tsunami undertaken: No
• Multi-hazard risk assessment undertaken including tsunami, cyclone, drought, earthquakes, flooding and landslides
• Tsunami risk assessment undertaken at national level
• Products available: risk map
• Capacity to undertake tsunami risk assessment: Poor
• Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: Poor (all categories)</td><td>Notes:
0.5% coastal areas of total Khulna, Barishal, Chattogram division have been mapped for tsunami risk. More than 5 important cities are at risk from tsunami.
Requirements:
Priority to improve capacity in all areas of tsunami risk assessment is rated as Essential.</td></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Bangladesh Meteorological Department
• Use IOTWMS TSP data to determine national threats? Use TSP data
• 24x7 operations? Yes
• Level of tsunami threat forecast information produced: national
• Access to national or international seismic networks: Yes (see notes)
• Access to national or international sea level networks: Yes
• Other national observing networks used for tsunami early warning: None
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: Yes
• Capability for tsunami modelling to support threat forecasts: No
• Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
• Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td>Notes:
National seismic data through national communication infrastructure, mobile telecommunications etc)</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social, media, Sirens, Television, VHF radio</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>Based on the updated information on tsunami warning from IOTWMS TSPs the warning situation in terminated</td><td></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>Support Required to Develop</td></tr>
<tr><td>
<table>
<tr><th>SOPs</th><th>Human Resources</th><th>Infrastructure</th></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
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BANGLADESH				
	Status		**Notes/Requirements**	
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **Yes** • Vertical evacuation shelter: **Yes** • Natural or artificial hill for vertical evacuation: **Yes** (2% or risk prone areas) • Evacuation signage: **Yes** • Evacuation infrastructure integrated in evacuation plan: **Yes**		**Notes**: Evacuation infrastructure and signage is considered insufficient	
Tsunami Exercises	• Tsunami exercises incorporated in national policy **No** • Tsunami exercises incorporated in national guidelines **Yes**			
	Level at which exercises are conducted: • National: **Yes** • Regional: **No** • City: **No** • Village: **No** • Community/neighbourhood: **No** • School: **No**		**Notes:** • Organisation tabletop (10 times) • Inter-organisation tabletop (10 times) • National tsunami drill/exercise (once) • Indian Ocean Wave Exercise (3 times) • Local tsunami exercise (3-4 times) • DREE by Armed Forces Division (for earthquakes)	
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**		**Notes**: Department of Disaster Management	
	Tsunami related education and awareness material available: • Leaflets or flyers: **No** • Posters: **No** • Booklets: **No** • Information boards: **Yes** • Tsunami signage: **No** • Video or other visual or oral media: **No** • Indigenous knowledge, folklore etc: **No** • Teaching kits: **No** • Schools curricula: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **Yes** (annually) • Global Disaster Risk Reduction Day: **Yes** (annually) • Public tsunami preparedness outreach: **Yes** (1 day per year) • School and/or children's awareness: **Yes** (1 day per year) • Exhibitions: **Yes** (3 days per year) • Competitions/other ways of highlighting tsunami safety: **Yes** (1 day per year)		

<table>
<tr><th colspan="4">BANGLADESH</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Public evacuation maps: No</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: Yes
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
Bangladesh Meteorological Department, Dhaka is involved with tsunami exercise. But we have lack of knowledge of tsunami modelling and tsunami risk assessment documentation.</td></tr>
<tr><td colspan="3"><u>Future Plans</u>
Bangladesh Meteorological Department has an interest on developing the computed tsunami modeling system as well as tsunami inundation map with evacuation route, training the emergency personnel, supporting to build sufficient evacuation centers, coastal wall of particular height as a part for future tsunami warning and mitigation system improvements.</td></tr>
</table>

<table>
<tr><th colspan="5">COMOROS</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td>Standalone Tsunami only</td><td colspan="2">Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Preparedness</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Emergency Response</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: Yes
Multi-hazard assessment undertaken including tsunami, cyclone, flooding, volcanic eruptions
Tsunami hazard assessment undertaken at national level
Products available: Hazard map, inundation map, evacuation map, guidelines (SOP) for national level stakeholders.
Capacity to undertake tsunami hazard assessment: Fair
Capacity to train other countries: Poor</td><td></td></tr>
</table>

<table>
<tr><th colspan="5">COMOROS</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td>Risk Assessment</td><td colspan="2">• Single risk assessment on tsunami undertaken: Yes
• Multi-hazard risk assessment undertaken including tsunami, cyclone, earthquakes, epidemics and flooding
• Tsunami risk assessment undertaken at national level
• Products available: risk map, evacuation map, guidelines
• Capacity to undertake tsunami risk assessment: Fair
• Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: Poor</td><td colspan="2"></td></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Agence National de l’Aviation Civile et de la Météorologie Direction Technique de la Météorologie
• Use IOTWMS TSP data to determine national threats? Use TSP data
• 24x7 operations? No
• Level of tsunami threat forecast information produced: National, local
• Access to national or international seismic networks: No
• Access to national or international sea level networks: Yes
• Other national observing networks used for tsunami early warning: Buoy
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: No
• Capability for tsunami modelling to support threat forecasts: No
• Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? No
• Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td colspan="2">Note: Not completely 24x7. Operations are 15 or 12x7 depending on weekend days

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IOTWMS TSPs provide tsunami products</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media, Television, Megaphone</td><td colspan="2"></td></tr>
<tr><td>How is warning terminated?</td><td>By a message confirm the no threat in our coastal area</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: No</td><td colspan="2">Support Required to Develop</td></tr>
<tr><td>SOPs

✓
✓
✓</td><td>Human Resources

✗
✗
✓</td><td>Infrastructure

✓
✓
✗</td></tr>
</table>

COMOROS				
	Status		**Notes/Requirements**	
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **No** • Communication with other stakeholders: **Yes**		✓ ✓ ✓ ✓ ✗ ✓ ✓	✓ ✓ ✓ ✓ ✗ ✓ ✓	✓ ✗ ✗ ✓ ✓ ✗ ✓
Evacuation Infrastructure	• Evacuation shelters: **No** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **No**			
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **No** • Tsunami exercises incorporated in national guidelines: **Yes**			
	Level at which exercises are conducted: • National: **Yes** • Regional: **Yes** • City: **No** • Village: **Yes** • Community/neighbourhood: **Yes** • School: **No**			
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**			
	Tsunami related education and awareness material available: • Leaflets or flyers: **Yes** • Posters: **No** • Booklets: **Yes** • Information boards: **No** • Tsunami signage: **No** • Video or other visual or oral media: **No** • Indigenous knowledge, folklore etc: **No** • Teaching kits: **Yes** • Schools curricula: **Yes** • Public evacuation maps: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **Yes** (once) • Global Disaster Risk Reduction Day: **Yes** (more than 3 times) • Public tsunami preparedness outreach: **No** • School and/or children's awareness: **Yes** (occasionally) • Exhibitions: **Yes** • Competitions/other ways of highlighting tsunami safety: **No**		

<table>
<tr><th colspan="4">COMOROS</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="2"></td><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials ✗
• Customization of general materials to country or community ✗
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u> None provided</td></tr>
<tr><td colspan="3"><u>Future Plans:</u> None provided</td></tr>
</table>

<table>
<tr><th colspan="6">FRANCE INDIAN OCEAN TERRITORIES</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td>Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td><td>Not available</td></tr>
<tr><td colspan="5">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Preparedness</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Emergency Response</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, earthquakes, flooding, landslide, volcanic eruptions
Tsunami hazard assessment undertaken at regional level
Products available: inundation map
Capacity to undertake tsunami hazard assessment: Fair
Capacity to train other countries: Poor (PTHA, DTHA, field studies) to Moderate (hazard, inundation, evacuation maps)</td><td>Notes:
Eastern and northern costs (Saint Benoit - Saint André - Sainte Suzanne - Sainte Marie - Saint Denis - Saint Paul) mapped for tsunami hazard</td></tr>
</table>

FRANCE INDIAN OCEAN TERRITORIES			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including **tsunami, cyclone, flooding, landslides and volcanic eruptions** • Tsunami risk assessment undertaken at **regional level** • Products available: **risk map** • Capacity to undertake tsunami risk assessment: **Good** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Poor** (city, village, community level) **to moderate** (national to regional level)		
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Météo-France** • Use IOTWMS TSP data or own assessments to determine national threats: **Use TSP data** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **Ocean-wide** • Access to national or international seismic networks: **No** • Access to national or international sea level networks: **Yes** • Other national observing networks used for tsunami early warning: **None** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **No** • Capability for tsunami modelling to support threat forecasts: **No** • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? (*No response*) • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Radio, Television, Megaphone	
	How is warning terminated?	Media info and official communication (email - sms)	

FRANCE INDIAN OCEAN TERRITORIES					
	Status		**Notes/Requirements**		
Standard Operating Procedures			**Support Required to Develop**		
			SOPs	**Human Resources**	**Infrastructure**
	SOPs for **upstream** emergency response: • 24/7 Emergency Response Centre: **Yes** • Receiving information from NTWC: **Yes** • Response criteria/decision making: **Yes**		✗ ✗ ✓	✗ ✗ ✓	✓ ✓ ✓
	SOPs for **downstream** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		✓ ✓ ✗ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✗ ✗ ✗	✓ ✓ ✓ ✗ ✗ ✗ ✗
Evacuation Infrastructure	• Evacuation shelters: **No** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **No**				
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **No** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **No** • Regional: **Yes** • City: **No** • Village: **No** • Community/neighbourhood: **No** • School: **No**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **No** • Posters: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **No** • Global Disaster Risk Reduction Day:			

<table>
<tr><th colspan="4">FRANCE INDIAN OCEAN TERRITORIES</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Booklets: No
• Information boards: Yes
• Tsunami signage: No
• Video or other visual or oral media: No
• Indigenous knowledge, folklore etc: No
• Teaching kits: No
• Schools curricula: No
• Public evacuation maps: No</td><td>• No
• Public tsunami preparedness outreach: No
• School and/or children’s awareness: No
• Exhibitions: No
• Competitions/other ways of highlighting tsunami safety: No</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials
• Customization of general materials to country or community
• Development of tsunami awareness programmes, activities or campaigns
• Participation/support by international agencies or experts to your country’s activities</td><td>✓
✗
✗
✗</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u> None provided</td></tr>
<tr><td colspan="3"><u>Future Plans:</u> None provided</td></tr>
</table>

<table>
<tr><th colspan="5">INDIA</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5">Notes: National Disaster Management Guidelines-Management of Tsunamis by National Disaster Management Authority (NDMA)

Multi Hazard Policies are available at Provinces level</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Standalone tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Standalone tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5">Notes: National Disaster Management Guidelines-Management of Tsunamis by National Disaster Management Authority (NDMA)

Multi Hazard Policies are available at Provinces level</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">• Single hazard assessment on tsunami undertaken: No
• Multi-hazard assessment undertaken including: Tsunami, cyclone, flooding
• Tsunami hazard assessment undertaken at national and regional level
• Products available: DTHA, field studies, hazard and inundation map
• Capacity to undertake tsunami hazard assessment: Very good
• Capacity to train other countries: Good (PTHA, field studies, evacuation maps) to very good (DTHA, hazard and inundation maps)</td><td>Notes: Ministry of Environment and Forest (MoEF), Government of India is the nodal agency to implement coastal zone management plan and policy. As part of national policy MoEF is generating the coastal hazard zones. National Centre for Coastal Research (NCCR) and INCOIS are also involved in generation of coastal hazard maps.</td></tr>
</table>

INDIA			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including **tsunami, cyclone, flooding** • Tsunami risk assessment undertaken at **national, regional and city levels** • Products available: **risk map, guidelines** • Capacity to undertake tsunami risk assessment: **Very good** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Good** (at all levels)		**Notes:** Entire coastline of India except Andaman and Nicobar Islands Province has been mapped. Coastal cities of 9 provinces are at risk from tsunami. Indian National Centre for Ocean Information Services (INCOIS); National Centre for Coastal Research (NCCR) can provide training/consultancy
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Indian Tsunami Early Warning Centre (ITEWC) at INCOIS** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data and own threat assessment** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **Ocean-wide, national and local** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **GNSS/GPS, Coastal radars** (see notes) • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** National Seismic Network (RTSMN & ISGN) through VSAT connectivity 2. International seismic data from GSN & IRIS servers through Internet (seedlink) National sea level data through INSAT, GPRS & Iridium connectivity. International sea level data from NOAA- NDBC & IOC sea level station monitoring facility servers through internet. 35 Nos of GNSS stations & 10 Nos of HF Radars operated by INCOIS In-house developed application which uses TUNAMI-N2 and ADCIRC models
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media, Door-to-door, Sirens, Television, Warning towers, Megaphone, Police/military, VHF radio, VPN	
	How is warning terminated?	After receiving the final bulletin from INCOIS, local DMOs are taking decision on termination of warning situation.	
Standard			**Support Required to: Develop**

<table>
<tr><th colspan="6">INDIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="3">Notes/Requirements</th></tr>
<tr><td rowspan="2">Operating Procedures</td><td colspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>SOPs

✓
✓
✓</td><td>Human Resources

✓
✗
✗</td><td>Infrastructure

✓
✗
✗</td></tr>
<tr><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: Yes
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: Yes</td><td>
✗
✗
✗
✗
✗
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✓
✓
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✗
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✗</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters: Yes
• Vertical evacuation shelter: Yes
• Natural or artificial hill for vertical evacuation: Yes
• Evacuation signage: Yes
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="3">Notes:
Evacuation shelters are available at Province Level.
Around 60% of risk prone areas covered
Natural hills are available in few coastal provinces
Evacuation signage is available in few places</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: Yes
• Tsunami exercises incorporated in national guidelines: Yes</td><td colspan="3"></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: Yes
• Regional: Yes
• City: Yes
• Village: Yes
• Community/neighbourhood: Yes
• School: Yes</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NDMO</td><td colspan="3"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: Yes
• Posters: Yes
• Booklets: Yes</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: Yes (2 times)
• Global Disaster Risk Reduction Day:</td><td colspan="3"></td></tr>
</table>

<table>
<tr><th colspan="4">INDIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Information boards: No
• Tsunami signage: Yes
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: Yes
• Teaching kits: Yes
• Schools curricula: No
• Public evacuation maps: Yes</td><td>No
• Public tsunami preparedness outreach: Yes (4 times)
• School and/or children’s awareness: Yes (>50 times))
• Exhibitions: Yes (4 times)
• Competitions/other ways of highlighting tsunami safety: Yes (1 time)
• Tsunami exercise: Yes (3 times)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness:</td><td colspan="2">• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: Yes

• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes</td><td>Notes: Training on preparing SOPs, GIS maps, tsunami modelling, Seismic & Sea level analysis, preparation of education material etc

In Odisha Province, 6 communities are piloting the IOTR programme. Community Names: 1) Jayadevkasaba Pahi 2) Podhuan 3) Tantiapal Sasan 4) Noliasahi 5) Keutajanga 6) Venkatraipur</td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
INCOIS has initiated preliminary work on cutting edge research areas such as:
• Multi-hazard Vulnerability Mapping has been done for most vulnerable areas
• Real-time tsunami inundation modelling using ADCIRC has been evaluated and ready for operational usage
• 3D GIS Mapping has been completed for around 5000 sq.km area
• Conducted National SOP workshops, Mock exercise, WTAD, Open days, Exhibitions, etc.</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
• Enhance observational network by deployment of additional stations
• Enhancements in Tsunami Modelling and Sea-level Inversion
• Utilization of real-time GNSS & SMA data for rupture characterization of the tsunamigenic earthquakes
• Implementation of Service Level 3 inundation modelling for Indian Ocean coastal zones
• Development of webpage to calculate performance indicators of all TSPs automatically</td></tr>
</table>

INDIA		
	Status	**Notes/Requirements**
	• Continuing technical enhancements as part of the new IOTWMS Service Definition from time to time • Contribute to training and capacity building activities as per the requirements of the ICG/IOTWMS • Contribute to the planning and conduct of ongoing 6-monthly IOTWMS COMMs Tests	

<table>
<tr><th colspan="5">INDONESIA</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
UU No. 24 tahun 2007 (for general policy)</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
NDMO (BNPB) and UNDP</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone Tsunami only</td><td>Standalone Tsunami</td><td>Standalone Tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone Tsunami only</td><td>Standalone Tsunami</td><td>Standalone Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
SNI rambu evakuasi Tsunami (sign evacuation), SNI Jalur Evakuasi Tsunami (Evacuation route), SNI Sirine Peringatan Dini Tsunami (Siren of Early Warning System), SNI Manajemen Pelatihan menghadapi bencana tsunami (Manajemen Training for Tsunami Disaster)</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone Tsunami</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Standalone Tsunami</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, flooding, earthquakes, epidemics, landslide, volcanic eruptions, forest and land fires
Tsunami hazard assessment undertaken at national, regional, city and village levels
Products available: PTHA, field studies, hazard, inundation map and evacuation maps, guidelines
Capacity to undertake tsunami hazard assessment: Fair
Capacity to train other countries: No response</td><td>Notes:
Guidelines on tsunami evacuation and tsunami warning signs.

Nearly 100% Indonesia has a basic map in Inarisk, which can be used as a calculation for tsunami hazards with a modified scenario.</td></tr>
</table>

INDONESIA			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including **tsunami, drought, earthquake, flooding, landslides, volcanic eruptions** • Tsunami risk assessment undertaken at **national, regional, city and village levels** • Products available: **risk map and evacuation maps, action plan, evacuation signs, information boards** • Capacity to undertake tsunami risk assessment: **Good** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Good** (national level) to **Moderate** (regional, city, village, community levels)		**Notes:** 26 provinces are included in the tsunami risk areas
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **BMKG, BNPB, BPBD, BASARNAS** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data and own threat assessment** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **Ocean-wide, national and local** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **None** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **No** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** BMKG = NTWC BNPB = NDMO BPBD = LDMO BASARNAS = National Search and Rescue Agency The list of seismic and sea level stations operated by Indonesia collated by IOTWMS Secretariat as many seismic stations have been added and some sea level stations have been decommissioned. BMKG is the agency responsible for providing tsunami products
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Fax, Webpage, Radio, WhatsApp / Facebook / Other social, media, Sirens, Television, Police/military, DVB-WRS	
	How is warning terminated?	Based on: sea level observation and monitoring; Modelling Tsunami on the last ETA +2 hours	

INDONESIA				
	Status		**Notes/Requirements**	
Standard Operating Procedures			**Support Required to Develop**	
			SOPs	**Human Resources**	**Infrastructure**
	SOPs for **<u>upstream</u>** emergency response: • 24/7 Emergency Response Centre: **Yes** • Receiving information from NTWC: **Yes** • Response **criteria**/decision making: **Yes**		✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • **Communication** with other stakeholders: **Yes**		✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **Yes** • Vertical evacuation shelter: **Yes** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **Yes** • Evacuation infrastructure integrated in evacuation plan: **Yes**		**Notes**: • Many areas such as at Padang, Pacitan, Bali • Many areas • Due to limit area, we had explored for Pandeglang • All evacuation areas given the signage		
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **Yes** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **Yes** • Regional: **Yes** • City: **No** • Village: **No** • Community/neighbourhood: **No** • School: **No**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NTWC**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **Yes** • Posters: **Yes**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **No** • Global Disaster Risk Reduction Day:			

<table>
<tr><th colspan="4">INDONESIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">Booklets: Yes
Information boards: Yes
Tsunami signage: Yes
Video or other visual or oral media: Yes
Indigenous knowledge, folklore etc: Yes
Teaching kits: Yes
Schools curricula: No
Public evacuation maps: Yes</td><td>No
Public tsunami preparedness outreach: Yes (1 time)
School and/or children’s awareness: Yes (>5 times))
Exhibitions: Yes (>3 times/year)
Competitions/other ways of highlighting tsunami safety: No
Tsunami exercise: Yes (2 times/year)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">Provision of general tsunami awareness materials ✓
Customization of general materials to country or community ✗
Development of tsunami awareness programmes, activities or campaigns ✗
Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">Willing to support other countries to develop or enhance public awareness: Yes
Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes</td><td>Notes: BMKG has cooperated with IOTIC for 5 (five) consecutive years since 2017 until 2021

NDMO (BNPB) has developed Destana (Disaster Resllience Village) at several villages spreading in Indonesia</td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
BMKG as NTWC currently focusing on Tsunami Early Warning caused by the volcano eruption, we realized that we need to establish our system, capacity building and public awareness to deal with Tsunami in Indonesia. This establishing might implicate the NDMO, Media and many stakeholders to educate the society about awareness of vulnerability hazard of the tsunami and its cause not only from earthquake.</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
BMKG and many stakeholders make some cooperation for preparing the Standard Operating Procedure for each institute in order to make synergy tsunami evacuation, then the output will be the regulation for tsunami evacuation</td></tr>
</table>

<table>
<tr><th colspan="6">IRAN</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5">Notes:
National and local tsunami policies are undergoing preparation</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Preparedness</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Emergency Response</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
Plans are under development</td></tr>
<tr><td>Prevention & Mitigation</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Preparedness</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Emergency Response</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Preparedness</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Emergency Response</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">No response</td><td colspan="2">No response</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslides
Tsunami hazard assessment undertaken at regional and village levels
Products available: DTHA, tsunami hazard analysis, hazard map, inundation map, evacuation map, guidelines
Capacity to undertake tsunami hazard assessment: Good
Capacity to train other countries: Moderate (IPTHA and field studies) to Very Good (hazard, inundation and evacuation mapping)</td><td>Notes:
100% of Chabahar and 20% of Jask region have been mapped for tsunami hazard.

Guidelines provided in Educational Brochure</td></tr>
</table>

<table>
<tr><th colspan="4">IRAN</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Risk Assessment</td><td colspan="2">• Single risk assessment on tsunami undertaken: No
• Multi-hazard risk assessment undertaken including No response
• Tsunami risk assessment undertaken at [level]: No response
• Products available: No response
• Capacity to undertake tsunami risk assessment: No response
• Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: No response</td><td></td></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Iranian National Institute for Oceanography and Atmospheric Science
• Use IOTWMS TSP data or own assessment to determine national threats? Use TSP data and own threat assessment
• 24x7 operations? No
• Level of tsunami threat forecast information produced: National and local level
• Access to national or international seismic networks: Yes (see notes)
• Access to national or international sea level networks: Yes (see notes)
• Other national observing networks used for tsunami early warning: None
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: No
• Capability for tsunami modelling to support threat forecasts: Yes (see notes)
• Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
• Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td>Notes:

• Institute of Geophysics University of Tehran (IGUT)
• Ioc-sealevelmonitoring.org

• Use ComMIT</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, WhatsApp / Facebook / Other social media, Sirens</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>When sea level would be less than 0.5 meters according to observation and model results</td><td></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: No response
• Receiving information from NTWC: No response
• Response criteria/decision making: No response</td><td>Support Required to Develop</td></tr>
<tr><td>
<table>
<tr><th>SOPs</th><th>Human Resources</th><th>Infrastructure</th></tr>
<tr><td>No response</td><td>No response</td><td>No response</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th colspan="5">IRAN</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td></td><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: No response
• Evacuation call procedures: No response
• Community evacuation procedures: No response
• Communication with NTWC: No response
• Communication with local government: No response
• Media arrangements: No response
• Communication with other stakeholders: No response</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters: No
• Vertical evacuation shelter: No
• Natural or artificial hill for vertical evacuation: Yes
• Evacuation signage: No
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: No response
• Tsunami exercises incorporated in national guidelines: No response</td><td colspan="3"></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: No
• Regional: No
• City: No
• Village: Yes
• Community/neighbourhood: No
• School: No</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NTWC</td><td colspan="3"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: No
• Posters: Yes
• Booklets: Yes
• Information boards: No
• Tsunami signage: No
• Video or other visual or oral media: No
• Indigenous knowledge, folklore etc: No
• Teaching kits: No
• Schools curricula: Yes
• Public evacuation maps: No</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: Yes (1 time – 2018)
• Global Disaster Risk Reduction Day: No response
• Public tsunami preparedness outreach: Yes
• School and/or children’s awareness: Yes
• Exhibitions: No
• Competitions/other ways of</td><td colspan="3"></td></tr>
</table>

<table>
<tr><th colspan="4">IRAN</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2"></td><td>highlighting tsunami safety: No
• Tsunami exercise: Yes</td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
Developing inundation and evacuation maps for Chabahar and Jask Building a dedicated website for tsunami warnings and bulletins Setting up SMS and Fax panels for issuing warnings and bulletins.</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
Iranian National Center for Ocean Hazards has planned its future improvements as follows:
• Make the warning dissemination process automated.
• Develop and integrate NTWC, NDMO, and LDMO tsunami Standard Operating Procedures. Cooperate with more organizations to improve their involvement in tsunami exercises.
• Continue numerical Modeling for different parts of Iranian coastline. Produce inundation and evacuation maps.
• Set up inter-organizational tsunami exercises. Improve education and public awareness.</td></tr>
</table>

<table>
<tr><th colspan="6">KENYA</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5">Notes:
National Disaster Management Policy</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
National Disaster Response Plan</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Not Available</td><td>Not Available</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Not Available</td><td>Not Available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Not Available</td><td>Not Available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Not Available</td><td>Not Available</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5">Notes:
Standard Operating Procedures</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">• Single hazard assessment on tsunami undertaken: No
• Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslides, volcanic eruptions, lightning
• Tsunami hazard assessment undertaken at national level
• Products available: Guidelines, historic data
• Capacity to undertake tsunami hazard assessment: Fair
• Capacity to train other countries: No capacity</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">KENYA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Risk Assessment</td><td colspan="2">Single risk assessment on tsunami undertaken: No
Multi-hazard risk assessment undertaken including tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslides, volcanic eruptions, lightning
Tsunami risk assessment undertaken at national level
Products available: None
Capacity to undertake tsunami risk assessment: Very poor
Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: Poor (at all levels)</td><td></td></tr>
<tr><td>Detection and Warning</td><td colspan="2">National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Kenya Meteorological Department NTWC
Use IOTWMS TSP data or own assessment to determine national threats? Use TSP data
24x7 operations? Yes
Level of tsunami threat forecast information produced: Ocean-wide
Access to national or international seismic networks: Yes
Access to national or international sea level networks: Yes (see notes)
Other national observing networks used for tsunami early warning: None
Capability to analyse real-time seismic and sea-level data for potential tsunami threat: Yes (see notes)
Capability for tsunami modelling to support threat forecasts: Yes (see notes)
Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td>Notes:
National sea level networks currently out of service but can be accessed through GTS
Capability to analyse seismic and seal level data and tsunami modelling exists but is not adequate</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media, Door-to-door, Sirens, Television, Warning towers, Megaphone, Police/military, VHF radio, VPN</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>After receiving the final bulletin from INCOIS, local DMOs are taking decision on termination of warning situation.</td><td></td></tr>
</table>

<table>
<tr><th colspan="5">KENYA</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2"></td><td colspan="2">Support Required to Develop</td></tr>
<tr><td colspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td colspan="2">SOPs ✓ ✓ ✓
Human Resources ✓ ✓ ✓
Infrastructure ✓ ✓ ✓</td></tr>
<tr><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: Yes
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: Yes</td><td colspan="2">✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters: Yes
• Vertical evacuation shelter: No
• Natural or artificial hill for vertical evacuation: No
• Evacuation signage: Yes
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="2">Notes:
• All coastal towns use tents as evacuation shelters
• Signage in limited places where known or common knowledge to the communities</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: Yes
• Tsunami exercises incorporated in national guidelines: Yes</td><td colspan="2"></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: Yes
• Regional: Yes
• City: No
• Village: No
• Community/neighbourhood: No
• School: No</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NDMO</td><td colspan="2"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: Yes
• Posters: Yes</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: Yes (Annual)
• Global Disaster Risk Reduction Day: Yes</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th colspan="4">KENYA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Booklets: Yes
• Information boards: No
• Tsunami signage: Yes
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: Yes
• Teaching kits: Yes
• Schools curricula: Yes
• Public evacuation maps: Yes</td><td>((Annual)
• Public tsunami preparedness outreach: Yes (Annual)
• School and/or children’s awareness: Yes (Annual)
• Exhibitions: Yes (Annual)
• Competitions/other ways of highlighting tsunami safety: No
• Tsunami exercise: Yes (biennial IOWave)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: Yes

• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes</td><td>Notes:
• Skills on SOP development, public awareness, advocacy, material development

• Kilifi Blue Beach area</td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
The NTWC has been collaborating with many stakeholders in IOWAVE and IOTR activities. In these events, we have raised the capacity of the stakeholders and affected communities. We have carried out Tsunami Drills in different coastal locations all of which has utilised community participation as well as key stakeholders. Majority of the stakeholders are now aware of their roles in tsunami warning operations. We have also upscaled our communication systems to be more alert and responsive. Our staff at the NTWC are 24/7 alert.</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
Other innovations include planned seismic and tidal gauge stations enhancement, buoys and other sea level measurements instruments and equipment</td></tr>
</table>

MADAGASCAR

Policies

Status			Notes/Requirements
Phase	**National**	**Local**	**Notes:** National Policy of Disaster and Risk Management (Law no.2015-031) taking into account of multi hazard and multi-risk approach. One policy for the four disaster management phases. In addition to the policy, we also have the National Strategy of Disaster and Risk Management
Prevention & Mitigation	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Preparedness	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Emergency Response	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Rehabilitation & Reconstruction	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	

Plans

Status				Notes/Requirements
Phase	**National**	**Local**	**Community**	**Notes:** 1) National Contingency Plan with multi-hazard approach 2) Regional Contingency Plans with multi-hazard approach: - Vatovavy Fitovinany Regional Contingency Plan including tsunami - Atsimo Atsinanana Regional Contingency Plan including tsunami 3) Contingency Plan of Sainte Marie Island including tsunami
Prevention & Mitigation	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Preparedness	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Emergency Response	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Rehabilitation & Reconstruction	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Country's tsunami disaster risk reduction plans based on hazards and risk assessment: **Yes**				

Guidelines

Status		Notes/Requirements
Phase	**National**	**Local**	**Notes:** National Rapid Reaction Matrix on Tsunami Regional / local Rapid Reaction Matrix on Tsunami
Prevention & Mitigation	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Preparedness	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Emergency Response	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	
Rehabilitation & Reconstruction	Multi-hazard inc. Tsunami	Multi-hazard inc. Tsunami	

Hazard Assessment

Status	Notes/Requirements
• Single hazard assessment on tsunami undertaken: **No** • Multi-hazard assessment undertaken including: **Tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslides** • Tsunami hazard assessment undertaken at **national, regional and city levels** • Products available: **Inundation and evacuation maps** • Capacity to undertake tsunami hazard assessment: **Poor** • Capacity to train other countries: **Poor**	**Notes:** Conducted by Institute and Observatory of Geophysics of Antananarivo (IOGA), Bureau National de Gestion des Risque et des Catastrophes (BNGRC) Manakara (eastern coast of Madagascar, map still in improvement) The other cities on going

MADAGASCAR			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including **tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslides** • Tsunami risk assessment undertaken at **national, regional and city levels** • Products available: **Evacuation map** • Capacity to undertake tsunami risk assessment: **Poor** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Poor** (at all levels)		**Notes**: Conducted by Institute and Observatory of Geophysics of Antananarivo (IOGA) / Bureau National de Gestion des Risques et des Catastrophes (BNGRC) Manakara (eastern coast of Madagascar, map still in improvement) The other cities on going
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Institute and Observatory of Geophysics of Antananarivo (I.O.G.A.)** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data and own assessment** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **Ocean-wide and national** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **No** • Other national observing networks used for tsunami early warning: **None** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** (see notes) • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** • National seismic network, seedlink, internet • Use SeisComp3 • Use ComMIT
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, Door-to-door, Sirens, Television, Megaphone, Police/military, Public alert , system, VHF radio	
	How is warning terminated?	The warning will end few hours after the TSPs "all clear " message	

MADAGASCAR				
	Status		**Notes/Requirements**	
Standard Operating Procedures	SOPs for **<u>upstream</u>** emergency response: • 24/7 Emergency Response Centre: **Yes** • Receiving information from NTWC: **Yes** • Response criteria/decision making: **Yes**		**Support Required to Develop** **SOPs** ✓ ✓ ✓	**Human Resources** ✓ ✓ ✓	**Infrastructure** ✓ ✓ ✓
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **Yes** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **Yes**		**Notes**: • Coastal regions, especially in eastern part of country • Almost all of the coastal regions		
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **Yes** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **Yes** • Regional: **Yes** • City: **Yes** • Village: **No** • Community/neighbourhood: **No** • School: **No**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **No** • Posters: **Yes**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **No** • Global Disaster Risk Reduction Day: **No**			

<table>
<tr><th colspan="4">MADAGASCAR</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="4"></td><td colspan="2">• Booklets: Yes
• Information boards: No
• Tsunami signage: No
• Video or other visual or oral media: No
• Indigenous knowledge, folklore etc: No
• Teaching kits: Yes
• Schools curricula: No
• Public evacuation maps: No</td><td>• Public tsunami preparedness outreach: Yes (1 time/year)
• School and/or children’s awareness: Yes (1 time/year)
• Exhibitions: No
• Competitions/other ways of highlighting tsunami safety: No
• Tsunami exercise: Yes (1 time/year)</td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: Yes
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes (?)</td><td>Notes:
• Sensitisation
• Response unclear</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
We are starting to make people and authorities to be conscious of the existence of the tsunami. Not all of the communities are aware of this disaster and not all of the people know yet its existence. Most of the coastal part of the country are still vulnerable face to the tsunami. We make a policy to be prepared and reduce its impact for each region but it is not yet finished for all the country</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
Exercises are needed for the regions which are already visited and have a knowledge of tsunami Many regions don't have yet SOP and don't know yet about tsunami</td></tr>
</table>

<table>
<tr><th colspan="6">MALAYSIA</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5">Notes:
MKN Directive 20</td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
Tsunami Emergency Response Plan</td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5">Notes:
Tsunami Emergency Response Plan</td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td>Not available</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">• Single hazard assessment on tsunami undertaken: No
• Multi-hazard assessment undertaken including: Tsunami, drought, earthquakes, epidemics, flooding, landslides
• Tsunami hazard assessment undertaken at national level
• Products available: Hazard map, field studies
• Capacity to undertake tsunami hazard assessment: Good
• Capacity to train other countries: Moderate (PTHA, DTHA) to Good (field studies, hazard, inundation and evacuation mapping)</td><td>Notes:
Hazard assessment of Malaysian coastline conducted by Malaysian Meteorological Department and Akademik Sains Malaysia</td></tr>
</table>

MALAYSIA			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including *No response* • Tsunami risk assessment undertaken at *No response* • Products available: *No response* • Capacity to undertake tsunami risk assessment: **Fair** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Moderate** (national, regional and city levels) to **Good** (village and community levels)		
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Malaysian Meteorological Department** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data and own assessment** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National and local level** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **None** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** (see notes) • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** • Seedlink, internet • National sea level stations: Pulau Perhentian Kudat, Sabah Lahad Datu, Sabah Pulau Perak Kerachut, Penang Porto Malai, Langkawi • Use Antelope, SeisComp3, Tide Tool • Use Tunami, COMCOT and ComMIT
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media, Sirens, Television, mobile application (myCuaca)	
	How is warning terminated?	When no significant wave heights is observed from the national tide gauge station	
Standard			**Support Required to Develop**

MALAYSIA				
	Status		**Notes/Requirements**	
Operating Procedures			**SOPs**	**Human Resources**	**Infrastructure**
	SOPs for **upstream** emergency response: • 24/7 Emergency Response Centre: **Yes** • Receiving information from NTWC: **Yes** • Response criteria/decision making: **Yes**		✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
	SOPs for **downstream** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **No** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **Yes**		**Notes**: • Along Malaysian coastal waters		
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **Yes** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **No** • Regional: **No** • City: **No** • Village: **No** • Community/neighbourhood: **Yes** • School: **Yes**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **Yes** • Posters: **Yes** • Booklets: **Yes**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **Yes** (1 time) • Global Disaster Risk Reduction Day:			

<table>
<tr><th colspan="4">MALAYSIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Information boards: No
• Tsunami signage: No
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: No
• Teaching kits: No
• Schools curricula: No
• Public evacuation maps: No</td><td>No
• Public tsunami preparedness outreach: No
• School and/or children’s awareness: Yes (2 times)
• Exhibitions: Yes (3 times)
• Competitions/other ways of highlighting tsunami safety: Yes (2 times)
• Tsunami exercise: Yes (2 times)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="3">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
In 2019, MMD will be conducting public awareness’s campaigns and drills on the extreme weather, earthquake & tsunami for the aiming as follow: -
• Preparing the publics for all hazards through awareness and education programmes;
• Communicate hazard risk assessment information to the communities, NADMA, local authorities and disaster response team;
• Educating the public with warnings, alerting system and evacuation arrangements; and
• Involvement of communities in mitigation activities (drills & evacuation plan).</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
MMD will develop Location-Based SMS alert to warn people in vulnerable areas of impending disasters. Under the system, an SMS would be sent to those living near disaster-prone areas when events like earthquake, tsunami, typhoon and heavy thunderstorm are likely to take place</td></tr>
</table>

<table>
<tr><th colspan="5">MAURITIUS</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
National: National Disaster Scheme

Local: Tsunami Emergency Scheme</td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td>Not available</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
National Disaster Scheme/Tsunami Emergency Scheme</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
National Disaster Scheme/Tsunami Emergency Scheme</td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Standalone tsunami guidelines</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, flooding, landslides
Tsunami hazard assessment undertaken at national, city and village level
Products available: Hazard, inundation and evacuation maps
Capacity to undertake tsunami hazard assessment: Good
Capacity to train other countries: Moderate (PTHA, DTHA) to Good (hazard, inundation and evacuation mapping)</td><td>Notes:
Whole island mapped for tsunami hazard.</td></tr>
</table>

MAURITIUS			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including: **Tsunami, cyclone, drought, flooding, landslide** • Tsunami risk assessment undertaken at: **National level** • Products available: **Risk map, action plan** • Capacity to undertake tsunami risk assessment: **Poor** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Good** (national and regional levels). **No capacity** (city, village and community levels)		**Notes:** A Tsunami Emergency Scheme has been put into place which elaborates the roles, responsibilities and actions of stakeholders concerned under general preparedness, issue of tsunami watch, warning and termination. This scheme is at national level. Six district councils (Pamplemousses, Riviere du Rempart, Flacq, Black River, Savanne, Grand Port) and one City Council (Port-Louis) are at risk from tsunami The tsunami risk mapped areas for Mauritius is kept for restricted use/application pending policy decision as to their access for general public attention.
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Director, Meteorological Services** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National level** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **None** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **No** • Capability for tsunami modelling to support threat forecasts: **No** • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** • Seismic: Internet • Sea level: GTS and internet
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, Sirens, Television, Police/military, VHF radio	
	How is warning terminated?	2 hours after the passage of last high wave and also from observation of tide gauge and visual from police	

<table>
<tr><th colspan="6">MAURITIUS</th></tr>
<tr><th></th><th colspan="3">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="3" rowspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td colspan="2">Support Required to Develop</td></tr>
<tr><td>SOPs

✗
✗
✓</td><td>Human Resources

✓
✗
✓</td><td>Infrastructure

✓
✓
✓</td></tr>
<tr><td></td><td colspan="3">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: N/R
• Community evacuation procedures: N/R
• Communication with NTWC: N/R
• Communication with local government: N/R
• Media arrangements: N/R
• Communication with other stakeholders: N/R</td><td>✓
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-</td><td>✗
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-</td><td>✓
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-</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="3">• Evacuation shelters: Yes
• Vertical evacuation shelter: N/R
• Natural or artificial hill for vertical evacuation: No
• Evacuation signage: No
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="2">Notes:
• The existing national system of emergency shelters for cyclones is extended for cases of tsunami as far as applicable</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="3">• Tsunami exercises incorporated in national policies: Yes
• Tsunami exercises incorporated in national guidelines: Yes</td><td colspan="2"></td></tr>
<tr><td colspan="3">Level at which exercises are conducted:
• National: Yes
• Regional: No
• City: Yes
• Village: Yes
• Community/neighbourhood: Yes
• School: Yes</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="3">• Responsibility for tsunami public awareness programmes: NTWC</td><td colspan="2"></td></tr>
<tr><td colspan="2">Tsunami related education and awareness material available:
• Leaflets or flyers: Yes
• Posters: Yes</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: Yes
• Global Disaster Risk Reduction Day:</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th colspan="4">MAURITIUS</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Booklets: No
• Information boards: No
• Tsunami signage: No
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: No
• Teaching kits: Yes
• Schools curricula: Yes
• Public evacuation maps: No</td><td>Yes
• Public tsunami preparedness outreach: Yes
• School and/or children’s awareness: Yes
• Exhibitions: Yes
• Competitions/other ways of highlighting tsunami safety: N/R
• Tsunami exercise: Yes</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">• Provision of general tsunami awareness materials ✗
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td>General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u> No Response</td></tr>
<tr><td></td><td colspan="3"><u>Future Plans:</u> No Response</td></tr>
</table>

<table>
<tr><th colspan="5">MOZAMBIQUE</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
The country has only the Policy of Natural Hazards that includes all kind of disasters that challenge the country including tsunami. But considering the low risk of tsunami hazard more priority is given to cyclones, floods, drought and epidemics</td></tr>
<tr><td>Prevention & Mitigation</td><td>No response</td><td>No response</td></tr>
<tr><td>Preparedness</td><td>No response</td><td>No response</td></tr>
<tr><td>Emergency Response</td><td>No response</td><td>No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>No response</td><td>No response</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
As above, the country has risk reduction plans taking into consideration the challenging hazards</td></tr>
<tr><td>Prevention & Mitigation</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Preparedness</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Emergency Response</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>No response</td><td>No response</td><td>No response</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td>No response</td><td>No response</td></tr>
<tr><td>Preparedness</td><td>No response</td><td>No response</td></tr>
<tr><td>Emergency Response</td><td>No response</td><td>No response</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>No response</td><td>No response</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">• Single hazard assessment on tsunami undertaken: No
• Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, earthquakes, epidemics, flooding
• Tsunami hazard assessment undertaken at city level
• Products available: Hazard, inundation and evacuation maps
• Capacity to undertake tsunami hazard assessment: Fair
• Capacity to train other countries: Poor (PTHA, DTHA, field studies) to Moderate (hazard, inundation and evacuation mapping)</td><td>Notes:
Hazard assessment conducted by: National Institute of Disaster Management/NMHS/Healthy/Agriculture/UN Agencies/UNESCO IOC/NGO/University Eduardo Mondlane

Under the tsunami pilot project sponsored by UNDP three coastal cities were mapped on tsunami inundation and evacuation routes. The cities are Beira, Nacala and Pemba.</td></tr>
</table>

MOZAMBIQUE		
	Status	**Notes/Requirements**
		RIMES and INCOIS have also sponsored a case study for tsunami hazard and risk assessment and evacuation planning for Beira city in September 2018. **Requirements:** There is a need for capacity building on tsunami hazard but at the moment no institution in the country capable of doing it without international collaboration
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including: **Tsunami, cyclone, drought, earthquakes, epidemics, flooding** • Tsunami risk assessment undertaken at: **City level** • Products available: **Risk map, evacuation map** • Capacity to undertake tsunami risk assessment: **Fair** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Moderate** (national and regional levels) to **Good** (city, village and community levels)	**Notes:** The results of the case studies for Beira, Nacala and Pemba showed that none of cities are at risk from tsunami. Only in case of tsunami from earthquake of magnitude above 8 can cause impacts but the risk is very low

<table>
<tr><th colspan="5">MOZAMBIQUE</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td>Detection and Warning</td><td colspan="2">National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: No response
Use IOTWMS TSP data or own assessment to determine national threats? No response
24x7 operations? Yes
Level of tsunami threat forecast information produced: National level
Access to national or international seismic networks: Yes
Access to national or international sea level networks: No
Other national observing networks used for tsunami early warning: None
Capability to analyse real-time seismic and sea-level data for potential tsunami threat: No
Capability for tsunami modelling to support threat forecasts: No
Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Fax, Television, Public alert system, radio</td><td colspan="2"></td></tr>
<tr><td>How is warning terminated?</td><td>Cancellation based on the information received from tsunami warnings centres</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2">SOPs for <u>upstream</u> emergency response:
24/7 Emergency Response Centre: No response
Receiving information from NTWC: No response
Response criteria/decision making: No response</td><td colspan="2">Support Required to Develop</td></tr>
<tr><td>SOPs

No response</td><td>Human Resources

No response</td><td>Infrastructure

No response</td></tr>
</table>

<table>
<tr><th colspan="4">MOZAMBIQUE</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td></td><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: No response
• Evacuation call procedures: No response
• Community evacuation procedures: No response
• Communication with NTWC: No response
• Communication with local government: No response
• Media arrangements: No response
• Communication with other stakeholders: No response</td><td>No response

No response

No response</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters: Yes
• Vertical evacuation shelter: Yes
• Natural or artificial hill for vertical evacuation: No
• Evacuation signage: No
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td>Notes:
• Coastal areas but low risk
• Coastal areas but low risk</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: No
• Tsunami exercises incorporated in national guidelines: Yes</td><td></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: No
• Regional: No
• City: Yes
• Village: No
• Community/neighbourhood: No
• School: No</td><td></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NDMO</td><td></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: No
• Posters: Yes
• Booklets: Yes
• Information boards: No
• Tsunami signage: No
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: No
• Teaching kits: No
• Schools curricula: No</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: No
• Global Disaster Risk Reduction Day: No
• Public tsunami preparedness outreach: No
• School and/or children’s awareness: Yes (not often)
• Exhibitions: No
• Competitions/other ways of</td><td></td></tr>
</table>

<table>
<tr><th colspan="5">MOZAMBIQUE</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="3">• Public evacuation maps: No
highlighting tsunami safety: No
• Tsunami exercise: No</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials
• Customization of general materials to country or community
• Development of tsunami awareness programmes, activities or campaigns
• Participation/support by international agencies or experts to your country’s activities</td><td>✓
✗
✓
✓</td><td></td></tr>
<tr><td colspan="3">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="4"><u>General Comments:</u>
With INCOIS and RIMES in 2018 the country had opportunity to implement the pilot project on tsunami hazard risk assessment and evacuation mapping using INSPIRE and ESCAPE systems.
Two technicians participated on the TEMPP-3 training in Indonesia.
These were good for the country in order to strengthen the local capacity on tsunami risk assessment and evacuation mapping.</td></tr>
<tr><td colspan="4"><u>Future Plans:</u>
We hope to continue our collaboration and coordination with UNESCO IOC to improve many aspects related to tsunami as stated in different previous questions</td></tr>
</table>

<table>
<tr><th colspan="5">MYANMAR</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
National: Myanmar Action Plan of Disaster Risk Reduction

Local: Community Based Disaster Risk Reduction</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
Tsunami exercise guidelines</td></tr>
<tr><td>Prevention & Mitigation</td><td>-</td><td>-</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Emergency Response</td><td>-</td><td>-</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>-</td><td>-</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">Single hazard assessment on tsunami undertaken: Yes
Multi-hazard assessment undertaken including: No response
Tsunami hazard assessment undertaken at village level
Products available: Inundation and evacuation maps
Capacity to undertake tsunami hazard assessment: Poor
Capacity to train other countries: Moderate (PTHA, DTHA, hazard and inundation mapping) to Poor (field studies, evacuation mapping)</td><td>Notes:
Hazard assessment conducted by Department of Meteorology and Hydrology was cooperated with RIMES-Regional Integrated Multi-hazard Early Warning System

One village mapped: Aung Hlaing Village, Labutta Township, Ayeyarwady Region</td></tr>
<tr><td>Risk Assessment</td><td colspan="3">Single risk assessment on tsunami undertaken: Yes
Multi-hazard risk assessment undertaken including: tsunami only
Tsunami risk assessment undertaken at village level
Products available: evacuation map
Capacity to undertake tsunami risk assessment: Poor
Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: Poor (at all levels)</td><td>Notes:
Risk assessment conducted by Department of Meteorology and Hydrology with Regional Integrated Multi-hazard Early Warning System-RIMES

One village mapped: Aung Hlaing Village, Labutta Township, Ayeyarwady Region</td></tr>
</table>

<table>
<tr><th colspan="4">MYANMAR</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Department of Meteorology and Hydrology
• Use IOTWMS TSP data or own assessment to determine national threats? Use TSP data
• 24x7 operations? Yes
• Level of tsunami threat forecast information produced: National and local level
• Access to national or international seismic networks: Yes (see notes)
• Access to national or international sea level networks: Yes (see notes)
• Other national observing networks used for tsunami early warning: None
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: Yes (see notes)
• Capability for tsunami modelling to support threat forecasts: No
• Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
• Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td>Notes:

• Local Seismic Network, Regional Seismic Network, Global Seismic Network
• National seal level stations: Sittwe, Moulmein, Haing Gyi Kyun
• Seismic software: Use Antelope, SeisComp3, SeisAn
• Sea level data: GTS, internet, Tide Tool software</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media, Television</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>When tsunami disaster is clear or cannot effect to our coastal areas, we issue the tsunami cancellation</td><td></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>Support Required to Develop</td></tr>
<tr><td><table><tr><th>SOPs</th><th>Human Resources</th><th>Infrastructure</th></tr><tr><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>✗</td><td>✓</td><td>✓</td></tr></table></td></tr>
</table>

MYANMAR					
	Status		**Notes/Requirements**		
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		✓ ✓ ✗ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **Yes** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **No** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **Yes**		**Notes**: Just have evacuation shelter for Multi-hazard, not only for Tsunami		
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **No** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **Yes** • Regional: **Yes** • City: **Yes** • Village: **Yes** • Community/neighbourhood: **Yes** • School: **No**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NTWC**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **No** • Posters: **Yes** • Booklets: **No** • Information boards: **No** • Tsunami signage: **No** • Video or other visual or oral media: **Yes** • Indigenous knowledge, folklore etc: **No** • Teaching kits: **Yes**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **Yes** (2 time) • Global Disaster Risk Reduction Day: *No response* • Public tsunami preparedness outreach: *No response* • School and/or children's awareness: **Yes** (2 times) • Exhibitions: *No response*			

<table>
<tr><th colspan="4">MYANMAR</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Schools curricula: No
• Public evacuation maps: No</td><td>• Competitions/other ways of highlighting tsunami safety: No response
• Tsunami exercise: Yes (3 times)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: Yes
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td>Notes:
• Knowledge sharing to develop the hazard and risk assessment maps for Tsunami</td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
Should do more research of tsunami and need to conduct more training and workshop for the tsunami risk reduction</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
Need to share more data and upgrade the existing communication systems</td></tr>
</table>

<table>
<tr><th colspan="6">OMAN</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>-</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>-</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>-</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>-</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, earthquakes
Tsunami hazard assessment undertaken at national and city level
Products available: PTHA, DTHA, field studies, hazard map and inundation maps, guidelines
Capacity to undertake tsunami hazard assessment: Good
Capacity to train other countries: Moderate (PTHA, DTHA, inundation mapping) to Poor (field studies, hazard and evacuation mapping)</td><td>Notes:
Hazard assessment conducted by national and international consultants.

All coastline mapped with more detail for 9 cities

Evacuation maps under process with the National Committee for Civil Defense. Guide lines are available such as SOP</td></tr>
</table>

OMAN			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including **Tsunami, cyclone, earthquakes** • Tsunami risk assessment undertaken at **National and city levels** • Products available: **Risk map, guidelines and action plan** • Capacity to undertake tsunami risk assessment: **Good** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Moderate** (national, city, village and community levels). **Poor** (regional level)		**Notes:** Risk assessment conducted by national and international consultants. All coastline mapped with more detail for 9 cities 4 districts are at high risk from local tsunami
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **National Multi Hazard Early Warning Center (NMHEWC)** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data and own assessment** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National and local level** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **Yes** (see notes) • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** (see notes) • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** • National seismic network, seedlink and internet • National sea level network, GTS, IOC website • GNSS/GPS, coastal radars • Use TOAST, SeisComp3, Antelope • Use Easywave, MHRAS
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social media, Television, Police/military, Public alert , system, VPN	
	How is warning terminated?	Cancellation message	
Standard			**Support Required to Develop**

OMAN				
	Status		**Notes/Requirements**	
Operating Procedures	SOPs for **upstream** emergency response: • 24/7 Emergency Response Centre: **Yes** • Receiving information from NTWC: **Yes** • Response criteria/decision making: **Yes**		**SOPs** ✓ ✗ ✓	**Human Resources** ✓ ✗ ✓	**Infrastructure** ✓ ✗ ✓
	SOPs for **downstream** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		 ✓ ✓ ✓ ✓ ✓ ✓ ✓	 ✓ ✓ ✓ ✓ ✓ ✓ ✓	 ✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **Yes** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **No** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **Yes**				
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **Yes** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **Yes** • Regional: **Yes** • City: **Yes** • Village: **Yes** • Community/neighbourhood: **Yes** • School: **Yes**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **Yes** • Posters: **Yes** • Booklets: **Yes** • Information boards: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **Yes** (2 times) • Global Disaster Risk Reduction Day: **Yes** (2 times)			

<table>
<tr><th colspan="4">OMAN</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Tsunami signage: No
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: No
• Teaching kits: No
• Schools curricula: Yes
• Public evacuation maps: No</td><td>• Public tsunami preparedness outreach: Yes (2 times)
• School and/or children’s awareness: Yes (many times)
• Exhibitions: Yes (1 time)
• Competitions/other ways of highlighting tsunami safety: No
• Tsunami exercise: Yes (2 times)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: Yes</td><td>Notes:
• Al Sawadi area</td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u> No Response</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
Expanding observation network, improve and add Hazard and risk assessment for more cities level and implementing CBS using CAPs protocol</td></tr>
</table>

<table>
<tr><th colspan="5">PAKISTAN</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
National Earthquake & Tsunami Framework</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
National Earthquake & Tsunami Framework</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">• Single hazard assessment on tsunami undertaken: Yes
• Multi-hazard assessment undertaken including: Single hazard assessment on tsunami
• Tsunami hazard assessment undertaken at city level
• Products available: PTHA, hazard and inundation maps
• Capacity to undertake tsunami hazard assessment: Very Good
• Capacity to train other countries: Very Good (PTHA, hazard and inundation mapping)</td><td>Notes:
Hazard assessment conducted by Pakistan Meteorological Department

Gwadar and Karachi Cities mapped</td></tr>
</table>

<table>
<tr><th colspan="4">PAKISTAN</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Risk Assessment</td><td colspan="2">• Single risk assessment on tsunami undertaken: No
• Multi-hazard risk assessment undertaken including No risk assessment undertaken
• Tsunami risk assessment undertaken at N/A
• Products available: N/A
• Capacity to undertake tsunami risk assessment: Very poor
• Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: No capacity (all levels)</td><td></td></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Pakistan Meteorological Department
• Use IOTWMS TSP data or own assessment to determine national threats? Use TSP data and own assessment
• 24x7 operations? No
• Level of tsunami threat forecast information produced: National and local level
• Access to national or international seismic networks: Yes (see notes)
• Access to national or international sea level networks: No
• Other national observing networks used for tsunami early warning: None
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: Yes (see notes)
• Capability for tsunami modelling to support threat forecasts: Yes (see notes)
• Does organisation responsible for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? No (?)
• Has the NTWC and/or TWFP participated in tsunami drills? No (?)</td><td>Notes:
• National seismic network, seedlink and internet
• Use SeisComp3
• Use MOST, ComMIT</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, Radio, Sirens, Television</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>After confirmation of no threat by second Bulletin</td><td></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>Support Required to: Develop</td></tr>
<tr><td>
<table>
<tr><th>SOPs</th><th>Human Resources</th><th>Infrastructure</th></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>✗</td><td>✗</td><td>✓</td></tr>
</table>
</td></tr>
</table>

PAKISTAN					
	Status		**Notes/Requirements**		
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **Yes** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		✓ ✓ ✓ ✓ ✓ ✓ ✗	✗ ✗ ✗ ✗ ✗ ✗ ✗	✓ ✓ ✓ ✓ ✓ ✓ ✓
Evacuation Infrastructure	• Evacuation shelters: **No** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **Yes** • Evacuation infrastructure integrated in evacuation plan: *No response*		**Notes:** • Gwadar area		
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **Yes** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **No** • Regional: **No** • City: **No** • Village: **Yes** • Community/neighbourhood: **Yes** • School: **No**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **NDMO**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **Yes** • Posters: **Yes** • Booklets: **No** • Information boards: **No** • Tsunami signage: **No** • Video or other visual or oral media: **No** • Indigenous knowledge, folklore etc: **No** • Teaching kits: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **Yes** (every year) • Global Disaster Risk Reduction Day: **No** • Public tsunami preparedness outreach: **No** • School and/or children's awareness: **Yes** (occasionally) • Exhibitions: **No**			

<table>
<tr><th colspan="4">PAKISTAN</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Schools curricula: Yes
• Public evacuation maps: No</td><td>• Competitions/other ways of highlighting tsunami safety: No
• Tsunami exercise: Yes (3 times)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">• Provision of general tsunami awareness materials ✓
• Customization of general materials to country or community ✓
• Development of tsunami awareness programmes, activities or campaigns ✓
• Participation/support by international agencies or experts to your country’s activities ✗</td><td></td></tr>
<tr><td colspan="3">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="4"><u>General Comments:</u>
Research is needed to investigate the potential of Makran Subduction zone.</td></tr>
<tr><td colspan="4"><u>Future Plans:</u>
PMD is currently working installation of equipment for better understanding of the Arabian Sea.
PMD is developing mechanism for data sharing with neighbouring countries like Oman and UAE for better location and fast information</td></tr>
</table>

<table>
<tr><th colspan="6">SINGAPORE</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td>Local</td><td rowspan="5">Notes:
National Tsunami Response Plan (also applies locally)</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Standalone tsunami</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td colspan="2">Standalone tsunami</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Standalone tsunami</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Not available</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
National policy applies at local and community level</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Standalone tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Not available</td><td>Not available</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td>Local</td><td rowspan="5">Notes:
National guidelines apply locally</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Standalone tsunami</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td colspan="2">Standalone tsunami</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Standalone tsunami</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">• Single hazard assessment on tsunami undertaken: Yes
• Multi-hazard assessment undertaken including: tsunami, earthquakes, flooding
• Tsunami hazard assessment undertaken at national level
• Products available: DTHA and inundation map
• Capacity to undertake tsunami hazard assessment: Good
• Capacity to train other countries: Moderate (DTHA, hazard and inundation mapping)</td><td>Notes:
Hazard assessment conducted by Meteorological Service Singapore and national university

Whole of Singapore is assessed, including offshore islands</td></tr>
<tr><td>Risk Assessment</td><td colspan="4">• Single risk assessment on tsunami undertaken: Yes
• Multi-hazard risk assessment undertaken including: tsunami, flooding
• Tsunami risk assessment undertaken at national level
• Products available: Risk map, action plan (see notes)
• Capacity to undertake tsunami risk assessment: Good
• Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: Good (national level)</td><td>Notes:
• Risk assessed for all Singapore coastline including offshore islands

• Guidelines: National Tsunami Response Plan</td></tr>
</table>

<table>
<tr><th colspan="4">SINGAPORE</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: Meteorological Service Singapore
• Use IOTWMS TSP data or own assessment to determine national threats? Use TSP data and own assessment
• 24x7 operations? Yes
• Level of tsunami threat forecast information produced: National and local level
• Access to national or international seismic networks: Yes (see notes)
• Access to national or international sea level networks: Yes (see notes)
• Other national observing networks used for tsunami early warning: None
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: Yes (see notes)
• Capability for tsunami modelling to support threat forecasts: Yes (see notes)
• Does organisation responsible for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
• Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td>Notes:

• National seismic network, seedlink, internet, GSM
• National sea level network, GTS

• Use Operational Tsunami Prediction and Assessment System (OPTAS)
• Use OPTAS</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Fax, Webpage, Radio, Television, Public alert system</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>Via the same modes used for dissemination of alerts/warnings</td><td></td></tr>
<tr><td>Standard Operating Procedures</td><td colspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>Support Required to Develop
SOPs | Human Resources | Infrastructure
✗ ✗ ✗
✗ ✗ ✗
✗ ✗ ✗</td></tr>
</table>

SINGAPORE				
	Status		**Notes/Requirements**	
	SOPs for **downstream** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **No** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **No** • Media arrangements: **Yes** • Communication with other stakeholders: **Yes**		X X X X X X X	X X X X X X X	X X X X X X X
Evacuation Infrastructure	• Evacuation shelters: **No** • Vertical evacuation shelter: **No** • Natural or artificial hill for vertical evacuation: **No** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **No**			
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **Yes** • Tsunami exercises incorporated in national guidelines: **Yes**			
	Level at which exercises are conducted: • National: **Yes** • Regional: **No** • City: **No** • Village: **No** • Community/neighbourhood: **No** • School: **No**			
Public Awareness	• Responsibility for tsunami public awareness programmes: **NTWC**			
	Tsunami related education and awareness material available: • Leaflets or flyers: **No** • Posters: **No** • Booklets: **No** • Information boards: **No** • Tsunami signage: **No** • Video or other visual or oral media: **No** • Indigenous knowledge, folklore etc: **No** • Teaching kits: **No** • Schools curricula: **Yes** • Public evacuation maps: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **No** • Global Disaster Risk Reduction Day: **No** • Public tsunami preparedness outreach: **No** • School and/or children's awareness: **No** • Exhibitions: **No** • Competitions/other ways of highlighting tsunami safety: **No**		

SINGAPORE			
	Status		**Notes/Requirements**
		• Tsunami exercise**: No**	
	Support from IOTIC required to develop or enhance public awareness	*No response*	
	• Willing to support other countries to develop or enhance public awareness: **No** • Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: **No**		
General Comments and Future Plans	**General Comments:** No response		
	Future Plans: Upgrading central monitoring and processing system for collating, integrating, and assessing seismic and tsunami data		

<table>
<tr><th colspan="5">SOUTH AFRICA</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td rowspan="7">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="7">Notes:
Seasonal Contingency Plans and Seasonal Hazard Forecast</td></tr>
<tr><td>Prevention & Mitigation</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">• Single hazard assessment on tsunami undertaken: No
• Multi-hazard assessment undertaken including: Tsunami, drought, flooding, windstorms and snow
• Tsunami hazard assessment undertaken at regional level
• Products available: Hazard and inundation maps
• Capacity to undertake tsunami hazard assessment: Good
• Capacity to train other countries: Poor (PTHA, DTHA, field studies) to Moderate (hazard, inundation and evacuation mapping)</td><td>Notes:
Hazard assessment conducted by SA Weather Services and Council for Geosciences

Eastern Coastal from Richards Bay to port Elizabeth with a focus on the ports and harbour areas. The percentage mapped was between 40-90 kilometres within each of the regional centres</td></tr>
</table>

<table>
<tr><th colspan="4">SOUTH AFRICA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td>Risk Assessment</td><td colspan="2">• Single risk assessment on tsunami undertaken: No
• Multi-hazard risk assessment undertaken including No response
• Tsunami risk assessment undertaken at No response
• Products available: No response
• Capacity to undertake tsunami risk assessment: Good
• Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: Poor (at all levels)</td><td></td></tr>
<tr><td>Detection and Warning</td><td colspan="2">• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: Yes
• Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: SA Weather Services
• Use IOTWMS TSP data or own assessment to determine national threats? Use TSP data
• 24x7 operations? Yes
• Level of tsunami threat forecast information produced: National level
• Access to national or international seismic networks: Yes (see notes)
• Access to national or international sea level networks: Yes (see notes)
• Other national observing networks used for tsunami early warning: Yes (see notes)
• Capability to analyse real-time seismic and sea-level data for potential tsunami threat: No
• Capability for tsunami modelling to support threat forecasts: No
• Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? Yes
• Has the NTWC and/or TWFP participated in tsunami drills? Yes</td><td>Notes:

• Seismic Network operated by the Council for Geoscience in collaboration with other seismic monitoring networks such as NASA
• Use GTS for sea level data
• SA Weather services operates a series of coastal weather radars</td></tr>
<tr><td rowspan="2">Dissemination</td><td>How is tsunami information disseminated within country?</td><td>Email, SMS, Telephone, Webpage, Radio, National Television</td><td></td></tr>
<tr><td>How is warning terminated?</td><td>A media statement is produced</td><td></td></tr>
<tr><td rowspan="4">Standard Operating Procedures</td><td colspan="2" rowspan="4">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: No
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>Support Required to Develop</td></tr>
<tr><td><table><tr><th>SOPs</th></tr><tr><td>✓</td></tr><tr><td>✗</td></tr><tr><td>✓</td></tr></table><table><tr><th>Human Resources</th></tr><tr><td>✓</td></tr><tr><td>✗</td></tr><tr><td>✓</td></tr></table><table><tr><th>Infrastructure</th></tr><tr><td>✓</td></tr><tr><td>✗</td></tr><tr><td>✓</td></tr></table></td></tr>
</table>

SOUTH AFRICA					
	Status		**Notes/Requirements**		
	SOPs for **<u>downstream</u>** emergency response: • Warning dissemination: **Yes** • Evacuation call procedures: **No** • Community evacuation procedures: **No** • Communication with NTWC: **Yes** • Communication with local government: **Yes** • Media arrangements: **Yes** • Communication with other stakeholders: **No**		✗ ✓ ✓ ✗ ✗ ✓ ✓	✗ ✓ ✓ ✗ ✗ ✗ ✓	✗ ✓ ✓ ✗ ✗ ✓ ✗
Evacuation Infrastructure	• Evacuation shelters: **No** • Vertical evacuation shelter: **Yes** • Natural or artificial hill for vertical evacuation: **Yes** • Evacuation signage: **No** • Evacuation infrastructure integrated in evacuation plan: **No**		**Notes**: • Many coastal towns have high rise buildings that can be used to evacuate people • All 3 coastal regions have vertical evacuation based on topography although distances to these areas vary • Limited signage in each of the coastal regions		
Tsunami Exercises	• Tsunami exercises incorporated in national policies: **No** • Tsunami exercises incorporated in national guidelines: **Yes**				
	Level at which exercises are conducted: • National: **Yes** • Regional: **No** • City: **No** • Village: **No** • Community/neighbourhood: **No** • School: **No**				
Public Awareness	• Responsibility for tsunami public awareness programmes: **LDMO**				
	Tsunami related education and awareness material available: • Leaflets or flyers: **Yes** • Posters: **No** • Booklets: **No** • Information boards: **No** • Tsunami signage: **No** • Video or other visual or oral media: **No** • Indigenous knowledge, folklore etc: **Yes** • Teaching kits: **No**	Tsunami awareness activities undertaken: • World Tsunami Awareness Day: **No** • Global Disaster Risk Reduction Day: **Yes** (annually) • Public tsunami preparedness outreach: **No** • School and/or children's awareness: **No** • Exhibitions: **No**			

<table>
<tr><th colspan="4">SOUTH AFRICA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Schools curricula: No
• Public evacuation maps: No</td><td>• Competitions/other ways of highlighting tsunami safety: No
• Tsunami exercise: Yes (annually as part of TSP comms tests)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials
• Customization of general materials to country or community
• Development of tsunami awareness programmes, activities or campaigns
• Participation/support by international agencies or experts to your country’s activities</td><td>✓
✓
✗
✗</td><td></td></tr>
<tr><td colspan="3">• Willing to support other countries to develop or enhance public awareness: No
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
The NDMC, SA Weather Services and Council for Geoscience held joint meetings and briefing session post each tsunami related activity to perform three main activities that include the following:
1) Consider new implications for the regional impact of tsunami
2) factor new learnings from each exercise into the SOP to allow for improvement and clearer warnings procedures
3) Update any relevant information</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
1. Complete a full hazard mapping exercise with the relevant models that have impact for South Africa.
2. Use the hazard mapping product to compile an indicative risk assessment for the coastal regions of SA.
3. Workshop this product with other stakeholders and regional/ Provincial Disaster Management Centres (PDMC's).
4. Improve the SOP to include new information</td></tr>
</table>

<table>
<tr><th colspan="6">SRI LANKA</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5">Notes:
Disaster Management Act No 13 of 2005 and Disaster Management policy</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td>Community</td><td rowspan="6">Notes:
Disaster Management Plan</td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td colspan="2">Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td colspan="2">Not available</td><td>Not available</td></tr>
<tr><td colspan="5">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5">Notes:
Disaster preparedness plans, response plans and guidelines</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslide, coastal erosion, lightning
Tsunami hazard assessment undertaken at national, district and village level
Products available: PTHA, field studies, hazard, inundation and evacuation maps
Capacity to undertake tsunami hazard assessment: Poor
Capacity to train other countries: Poor (PTHA, DTHA, field studies, evacuation mapping) to Moderate (hazard and inundation mapping)</td><td>Notes:
Hazard assessment conducted by DMC with all the relevant technical agencies
DOM,ID,NARA,GSMB,Health Ministry, NBRO with the support of UNDP

All 14 coastal districts with the scale of high, moderate and low inundation and proximity analysis</td></tr>
</table>

SRI LANKA			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including *No response* • Tsunami risk assessment undertaken at *No response* • Products available: *No response* • Capacity to undertake tsunami risk assessment: **Poor** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Poor** (at all levels)		
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **Department of Meteorology** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National and local level** • Access to national or international seismic networks: **Yes** (see notes) • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **No** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** (see notes) • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes:** • Seismic: California Integrated Seismic Network (CISN), USGS network • Also access NDBC DART buoy network • Use SeisComp3 • Use ComMIT with local or remote databases
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social, media, Sirens, Television, Warning towers, Megaphone, Police/military, Public alert system, VHF radio	
	How is warning terminated?	Issuing tsunami threat clear message	
Standard			**Support Required to Develop**

<table>
<tr><th colspan="6">SRI LANKA</th></tr>
<tr><th></th><th colspan="3">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td rowspan="2">Operating Procedures</td><td colspan="3">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td colspan="2">SOPs ✓
✓
✓
Human Resources ✓
✓
✓
Infrastructure ✓
✓
✓</td></tr>
<tr><td colspan="3">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: No
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: No</td><td colspan="2">✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="3">• Evacuation shelters: Yes
• Vertical evacuation shelter: Yes
• Natural or artificial hill for vertical evacuation: Yes
• Evacuation signage: Yes
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="3">• Tsunami exercises incorporated in national policies: No
• Tsunami exercises incorporated in national guidelines: Yes</td><td colspan="2"></td></tr>
<tr><td colspan="3">Level at which exercises are conducted:
• National: Yes
• Regional: No
• City: No
• Village: Yes
• Community/neighbourhood: Yes
• School: Yes</td><td colspan="2">Notes:
Tsunami exercises also carried out at district, divisional and “GN” level as well as hospital and school drills</td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="3">• Responsibility for tsunami public awareness programmes: NDMO</td><td colspan="2"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: Yes
• Posters: Yes
• Booklets: Yes
• Information boards: Yes</td><td colspan="2">Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: Yes (2017)
• Global Disaster Risk Reduction Day: No</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th colspan="4">SRI LANKA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">Tsunami signage: Yes
Video or other visual or oral media: Yes
Indigenous knowledge, folklore etc: Yes
Teaching kits: Yes
Schools curricula: Yes
Public evacuation maps: Yes</td><td>Public tsunami preparedness outreach: Yes (26 December annually)
School and/or children’s awareness: Yes
Exhibitions: Yes
Competitions/other ways of highlighting tsunami safety: Yes
Tsunami exercise: Yes</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>Provision of general tsunami awareness materials ✗
Customization of general materials to country or community ✓
Development of tsunami awareness programmes, activities or campaigns ✓
Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="2">Willing to support other countries to develop or enhance public awareness: Yes
Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No response</td><td>Notes:
DMC willing to provide support</td></tr>
<tr><td>General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
DMC has developed the hazard profile of Sri Lanka and established 24/7 EOC and EW system also all the districts having Disaster Management plans and operation plans</td></tr>
<tr><td></td><td colspan="3"><u>Future Plans:</u>
EOC have their own SOPs and National Emergency Operation Plan is finalized there we have all the roles and responsibilities of Stakeholder agencies before, during and after a disaster Hazard wise and scenario wise. based on the NEOP Tsunami risk assessment have to completed and also sectoral SOPs have to be developed</td></tr>
</table>

<table>
<tr><th colspan="6">TANZANIA</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6"></td></tr>
<tr><td>Prevention & Mitigation</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Preparedness</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Emergency Response</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Not available</td><td>Not available</td><td>Not available</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5"></td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, flooding
Tsunami hazard assessment undertaken at regional level
Products available: Field studies, hazard map
Capacity to undertake tsunami hazard assessment: Good
Capacity to train other countries: Moderate (PTHA, DTHA). Good (field studies, hazard and inundation mapping). Very Good (evacuation mapping)</td><td>Notes:
Hazard assessment conducted by National/Local University</td></tr>
</table>

TANZANIA			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including: **Tsunami, drought, flooding** • Tsunami risk assessment undertaken at **regional level** • Products available: **Guidelines, Action Plan** • Capacity to undertake tsunami risk assessment: **Fair** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Good** (national, regional and city levels). **Moderate** (village and community level)		
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: *No response* • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National and local level** • Access to national or international seismic networks: **Yes** • Access to national or international sea level networks: **Yes** • Other national observing networks used for tsunami early warning: **None** • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **No** • Capability for tsunami modelling to support threat forecasts: **Yes** • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		
Dissemination	How is tsunami information disseminated within country?	Email, Telephone, Fax, Webpage, Radio, Television, Police/military, Public alert system	
	How is warning terminated?	*No response*	
Standard			**Support Required to Develop**

<table>
<tr><th colspan="5">TANZANIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td rowspan="2">Operating Procedures</td><td colspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>SOPs

✓
✓
✓</td><td>Human Resources

✓
✓
✓</td><td>Infrastructure

✓
✓
✓</td></tr>
<tr><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: No
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: No</td><td>
✓
✓
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✓</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters:
• Vertical evacuation shelter:
• Natural or artificial hill for vertical evacuation:
• Evacuation signage:
• Evacuation infrastructure integrated in evacuation plan:</td><td colspan="3">Notes
No response to this section</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: Yes
• Tsunami exercises incorporated in national guidelines: No</td><td colspan="3"></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: No
• Regional: No
• City: Yes
• Village: No
• Community/neighbourhood: No
• School: Yes</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NDMO</td><td colspan="3"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: Yes
• Posters: No
• Booklets: No
• Information boards: No</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: No
• Global Disaster Risk Reduction Day: Yes
• Public tsunami preparedness</td><td colspan="3"></td></tr>
</table>

<table>
<tr><th colspan="4">TANZANIA</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">• Tsunami signage: No
• Video or other visual or oral media: Yes
• Indigenous knowledge, folklore etc: No
• Teaching kits: No
• Schools curricula: No
• Public evacuation maps: Yes</td><td>outreach: No
• School and/or children’s awareness: Yes
• Exhibitions: No
• Competitions/other ways of highlighting tsunami safety: No
• Tsunami exercise: No</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>• Provision of general tsunami awareness materials
• Customization of general materials to country or community
• Development of tsunami awareness programmes, activities or campaigns
• Participation/support by international agencies or experts to your country’s activities</td><td>✓
✗
✓
✓</td><td></td></tr>
<tr><td colspan="3">• Willing to support other countries to develop or enhance public awareness: Yes
• Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u> No response</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
SOPs have to be developed</td></tr>
</table>

<table>
<tr><th colspan="5">THAILAND</th></tr>
<tr><th></th><th colspan="3">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
National: Tsunami Prevention and Mitigation Master Plan (2015-2019)
Local:
1.Tsunami Emergency Action Plan for local administrative; 2. Prevention and Mitigation action plan for local, administrative</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Emergency Response</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td>Local</td><td>Community</td><td rowspan="6">Notes:
1.Tsunami Risk Mitigation Strategy for Thailand
2.Disaster Risk Reduction,
3.Risk Reduction from Geo hazard : Tsunami
4.Emergency action plan and Incident Plan are in the process</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td colspan="4">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td>National</td><td>Local</td><td rowspan="5">Notes:
Guideline for Tsunami preparation</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td>Standalone tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Hazard Assessment</td><td colspan="3">Single hazard assessment on tsunami undertaken: No
Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, earthquakes, flooding and landslide
Tsunami hazard assessment undertaken at national, city, village and local level
Products available: PTHA, DTHA, field studies, hazard, inundation and evacuation mapping, guidelines
Capacity to undertake tsunami hazard assessment: Fair
Capacity to train other countries: Moderate (PTHA, DTHA, field studies, hazard, inundation and evacuation mapping).</td><td>Notes:
Hazard assessment conducted by: Department of Mineral Resources, The Thai Meteorological Department, Department of Marine and Coastal Resources, Department of Fisheries, Department of Disaster Prevention and Mitigation, Chulalongkorn University, Burapha university, Kasetsart university, Prince of Songkla University,UNISDR,ADPC
Approx 100% of coastline is mapped for tsunami hazard</td></tr>
</table>

THAILAND			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **Yes** • Multi-hazard risk assessment undertaken including: **Tsunami, cyclone, drought, earthquakes, epidemics, flooding, landslide** • Tsunami risk assessment undertaken at **national, regional, city, village, community level** • Products available: **Risk map, evacuation map, guidelines, action plan** • Capacity to undertake tsunami risk assessment: **Good** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Good** (national, regional and city levels). **Moderate** (all levels)		**Notes**: Asian Disaster Preparedness Center (ADPC) and Department of Disaster Prevention and Mitigation, Ministry of Interior Thailand can provide training/consultancy
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **National Disaster Warning Centre** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data and own assessment** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National and local level** • Access to national or international seismic networks: **Yes** • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: **Yes** (see notes) • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **No** • Capability for tsunami modelling to support threat forecasts: **Yes** (see notes) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes**		**Notes**: • Hydrographics Department, Royal Thai Navy, IOC sea level monitoring website, GTS • DART buoys and coastal radar stations • Use WINITDB, TUNAMI and TSUCAT
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, Fax, Webpage, Radio, WhatsApp / Facebook / Other social, media, Sirens, Television, Warning towers, Public alert system, VHF radio, broadcast alert system	
	How is warning terminated?	2 hours after the last tsunami wave pass or there is no longer A Destructive Tsunami threat to the coast, Thailand. Therefore, the tsunami warning for Thailand is cancelled.	

<table>
<tr><th colspan="5">THAILAND</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2" rowspan="2"></td><td colspan="2">Support Required to Develop</td></tr>
<tr><td>SOPs</td><td>Human Resources</td><td>Infrastructure</td></tr>
<tr><td colspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td>✓
✓
✓</td><td>✓
✓
✓</td><td>✓
✓
✓</td></tr>
<tr><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: No
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: No</td><td>✓
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✓</td><td>✓
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✓</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters: Yes
• Vertical evacuation shelter: Yes
• Natural or artificial hill for vertical evacuation: Yes
• Evacuation signage: Yes
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="2">Notes
• 233 shelters in 6 provinces: Krabi, Trang, Satun, Phang Nga, Phuket, Ranong, and Satun</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: Yes
• Tsunami exercises incorporated in national guidelines: Yes</td><td colspan="2"></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: Yes
• Regional: Yes
• City: No
• Village: No
• Community/neighbourhood: Yes
• School: No</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NDMO/LDMO/NTWC</td><td colspan="2"></td></tr>
<tr><td>Tsunami related education and awareness material available:</td><td>Tsunami awareness activities undertaken:</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th colspan="4">THAILAND</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">

Leaflets or flyers: Yes
Posters: Yes
Booklets: Yes
Information boards: Yes
Tsunami signage: Yes
Video or other visual or oral media: Yes
Indigenous knowledge, folklore etc: Yes
Teaching kits: No
Schools curricula: Yes
Public evacuation maps: No

</td><td>

World Tsunami Awareness Day: Yes (2 times)
Global Disaster Risk Reduction Day: Yes (many)
Public tsunami preparedness outreach: Yes (many)
School and/or children’s awareness: Yes (many)
Exhibitions: Yes (many)
Competitions/other ways of highlighting tsunami safety: No
Tsunami exercise: Yes (many)

</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td>

Provision of general tsunami awareness materials ✓
Customization of general materials to country or community ✓
Development of tsunami awareness programmes, activities or campaigns ✓
Participation/support by international agencies or experts to your country’s activities ✓

</td><td></td></tr>
<tr><td colspan="2">

Willing to support other countries to develop or enhance public awareness: Yes
Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No

</td><td>Notes:

Can provide experts, materials, training, consultancy

</td></tr>
<tr><td>General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
NDWC is operating 24 hours under the supervision DDPM ,NDMO, Ministry of Interior. NDWC has its responsibility in planning, coordinating, controlling, implementing and preparing the national warning systems and equipment for issue tsunami early warning and evacuation in the role of warning operation part under central emergency operation center that the Director General is a commander. NDWC receives earthquake information from TMD national responsible for seismic evaluations and receives Sea level information from Hydrographic Department of the Royal Thai Navy. GTS is fully operational to TMD and NDWC. There is also provide the information from Indian Ocean and Pacific Ocean.
The SOPs of NDWC for earthquake in the sea will analyse situation within 5 minutes after the earthquake occurs. Then disseminate warning message in the risk area via fax, email, SMS, Line application, website and broadcast alert system (On Digital Television Channels and Radio Stations) including the warning tower.
TMD is operating 24 hours to monitoring seismic network in Thailand and Outside Thailand. TMD has been developing estimate time of arrival for tsunami model including generated shake map and evaluated Focal mechanism. Moreover, TMD has also increases seismic network around the country.
LDMO along Andaman Provinces have the tsunami exercised by themselves very regular with some support from NDMO. Tsunami evacuation maps, routes and signage have been installed along Andaman Provinces and will be upgrade for the smart signage (This project is in process). The education sectors have created tsunami awareness in the curriculum for schools.</td></tr>
</table>

THAILAND		
	Status	**Notes/Requirements**
	Future Plans: NDWC and TMD are cooperating together in the SOP especially with the Tsunami Modelling and Focal mechanism analysis. NDWC are improving criteria and SOP for Tsunami Warning and also improving the Tsunami model. NDMO will plan to improve master plan for Tsunami Prevention and Mitigation include Emergency Response plan.	

<table>
<tr><th colspan="6">TIMOR-LESTE</th></tr>
<tr><th></th><th colspan="4">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="5">Policies</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5">Notes:
National Disaster Management Policy 2008, currently being revised

At the Municipal level, the local tsunami policy will form part of municipal disaster management plans however these are still in development</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">-</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">-</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">-</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">-</td></tr>
<tr><td rowspan="6">Plans</td><td>Phase</td><td>National</td><td colspan="2">Local</td><td>Community</td><td rowspan="6">Notes:
Comprehensive guide to tsunami exercise at national level in Timor - Leste which would form the basis for standalone plan at sub national level planning form part of municipal disaster management plan which are currently in development</td></tr>
<tr><td>Prevention & Mitigation</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Preparedness</td><td>Standalone tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Multi-hazard inc. Tsunami</td></tr>
<tr><td>Emergency Response</td><td>Multi-hazard inc. Tsunami</td><td colspan="2">Multi-hazard inc. Tsunami</td><td>Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td>Standalone tsunami</td><td colspan="2">Not available</td><td>Not available</td></tr>
<tr><td colspan="5">Country’s tsunami disaster risk reduction plans based on hazards and risk assessment: Yes</td></tr>
<tr><td rowspan="5">Guidelines</td><td>Phase</td><td colspan="2">National</td><td colspan="2">Local</td><td rowspan="5">Notes:
National Disaster Management Policy 2008

Tsunami DRR guidelines at municipal level are the responsibilities of municipalities and these currently in development as part of multi hazard planning</td></tr>
<tr><td>Prevention & Mitigation</td><td colspan="2">Not available</td><td colspan="2">Not available</td></tr>
<tr><td>Preparedness</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Emergency Response</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Rehabilitation & Reconstruction</td><td colspan="2">Multi-hazard inc. Tsunami</td><td colspan="2">Not available</td></tr>
<tr><td>Hazard Assessment</td><td colspan="4">• Single hazard assessment on tsunami undertaken: No
• Multi-hazard assessment undertaken including: Tsunami, cyclone, drought, earthquakes, flooding, landslide, strong wind
• Tsunami hazard assessment undertaken at regional, city, sub-district level
• Products available: DTHA
• Capacity to undertake tsunami hazard assessment: Fair
• Capacity to train other countries: Poor (PTHA, DTHA, field studies, hazard, inundation and evacuation mapping).</td><td>Notes:
Hazard assessment conducted by UNDP

Areas mapped: municipalities of Ainaro, Baucau, Bobonaro, Covalima, Dili, Liquica, Lautem, Manatuto, Manufahi, Viqueque - and the Special Economic Region of Oecusse.</td></tr>
</table>

TIMOR-LESTE			
	Status		**Notes/Requirements**
Risk Assessment	• Single risk assessment on tsunami undertaken: **No** • Multi-hazard risk assessment undertaken including: **Tsunami, cyclone, drought, earthquakes, flooding, landslide, strong wind** • Tsunami risk assessment undertaken at **national, regional and sub-district level** • Products available: **Risk map, evacuation map** • Capacity to undertake tsunami risk assessment: **Fair** • Capacity to provide training and/or consultancy on tsunami risk assessment to other countries: **Poor** (all levels)		**Notes**: Risk assessment conducted by UNDP Municipalities of Ainaro, Baucau, Bobonaro, Covalima, Dili, Liquica, Lautem, Manatuto, Manufahi, Viqueque - and the Special Economic Region of Oecusse. Only major population centers mapped Risk map and evacuation map are in draft form for Dili, but yet to be finalised
Detection and Warning	• National capability to assess and/or receive potential tsunami threat information and advise/warn coastal communities: **Yes** • Name of organisation with responsibility for assessing and/or receiving potential tsunami threat information: **National Disaster Risk Management Directorate** • Use IOTWMS TSP data or own assessment to determine national threats? **Use TSP data** • 24x7 operations? **Yes** • Level of tsunami threat forecast information produced: **National and local level** • Access to national or international seismic networks: **Yes** • Access to national or international sea level networks: **Yes** (see notes) • Other national observing networks used for tsunami early warning: *No response* • Capability to analyse real-time seismic and sea-level data for potential tsunami threat: **Yes** (see notes) • Capability for tsunami modelling to support threat forecasts: **Yes** (basic level) • Does organisation for identifying potential tsunami threat issue national tsunami watches, advisories, alerts and/or warnings? **Yes** • Has the NTWC and/or TWFP participated in tsunami drills? **Yes** (see notes)		**Notes**: • Sea level via RIMES, BMKG Ocean Forecast, BOM – Australia • Use JISView and Linuh • IOWave only (not in IOTWMS Communications Tests)
Dissemination	How is tsunami information disseminated within country?	Email, SMS, Telephone, WhatsApp / Facebook / Other social, media, Sirens, Television, Warning towers, Megaphone, Police/military, Public alert system, traditional alert methods, eg. bells and gongs	
	How is warning terminated?	Email, sms, phone call, public alert system.	

<table>
<tr><th colspan="5">TIMOR-LESTE</th></tr>
<tr><th></th><th colspan="2">Status</th><th colspan="2">Notes/Requirements</th></tr>
<tr><td rowspan="2">Standard Operating Procedures</td><td colspan="2"></td><td colspan="2">Support Required to Develop</td></tr>
<tr><td colspan="2">SOPs for <u>upstream</u> emergency response:
• 24/7 Emergency Response Centre: Yes
• Receiving information from NTWC: Yes
• Response criteria/decision making: Yes</td><td colspan="2">SOPs | Human Resources | Infrastructure

✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓</td></tr>
<tr><td></td><td colspan="2">SOPs for <u>downstream</u> emergency response:
• Warning dissemination: Yes
• Evacuation call procedures: No
• Community evacuation procedures: No
• Communication with NTWC: Yes
• Communication with local government: Yes
• Media arrangements: Yes
• Communication with other stakeholders: No</td><td colspan="2">✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓
✓ ✓ ✓</td></tr>
<tr><td>Evacuation Infrastructure</td><td colspan="2">• Evacuation shelters: Yes
• Vertical evacuation shelter: Yes
• Natural or artificial hill for vertical evacuation: Yes
• Evacuation signage: Yes
• Evacuation infrastructure integrated in evacuation plan: Yes</td><td colspan="2">Notes
• 2 dedicated shelters completed in Viqueque and Covalima Municipalities
• Potential to utilise the multi story Timor Plaza shopping center but no formal agreement yet
• Limited signage is in place Viqueque and Covalima. However this is an area that urgently needs to be addressed</td></tr>
<tr><td rowspan="2">Tsunami Exercises</td><td colspan="2">• Tsunami exercises incorporated in national policies: Yes
• Tsunami exercises incorporated in national guidelines: No</td><td colspan="2"></td></tr>
<tr><td colspan="2">Level at which exercises are conducted:
• National: Yes
• Regional: Yes
• City: No
• Village: No
• Community/neighbourhood: Yes
• School: Yes</td><td colspan="2">Notes:
UNDP coordinated and Japanese Government funded School Tsunami Exercise and the awareness program conducted in 6 school in 3 municipalities during 2018</td></tr>
<tr><td rowspan="2">Public Awareness</td><td colspan="2">• Responsibility for tsunami public awareness programmes: NDMO</td><td colspan="2"></td></tr>
<tr><td>Tsunami related education and awareness material available:
• Leaflets or flyers: Yes</td><td>Tsunami awareness activities undertaken:
• World Tsunami Awareness Day: No</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th colspan="4">TIMOR-LESTE</th></tr>
<tr><th></th><th colspan="2">Status</th><th>Notes/Requirements</th></tr>
<tr><td rowspan="3"></td><td colspan="2">Posters: Yes
Booklets: Yes
Information boards: No
Tsunami signage: No
Video or other visual or oral media: Yes
Indigenous knowledge, folklore etc: Yes
Teaching kits: Yes
Schools curricula: Yes
Public evacuation maps: Yes</td><td>Global Disaster Risk Reduction Day: Yes (1 time)
Public tsunami preparedness outreach: No
School and/or children’s awareness: Yes (6 times)
Exhibitions: Yes (1 time)
Competitions/other ways of highlighting tsunami safety: No
Tsunami exercise: Yes (1 time)</td><td></td></tr>
<tr><td>Support from IOTIC required to develop or enhance public awareness</td><td colspan="2">Provision of general tsunami awareness materials ✓
Customization of general materials to country or community ✓
Development of tsunami awareness programmes, activities or campaigns ✓
Participation/support by international agencies or experts to your country’s activities ✓</td><td></td></tr>
<tr><td colspan="3">Willing to support other countries to develop or enhance public awareness: No
Communities involved in Indian Ocean Tsunami Ready (IOTR) initiative: No</td><td></td></tr>
<tr><td rowspan="2">General Comments and Future Plans</td><td colspan="3"><u>General Comments:</u>
Some material in Bahasa Indonesia been translated to Tetun language.</td></tr>
<tr><td colspan="3"><u>Future Plans:</u>
Policy Integration of the Viqueque and Covalima evacuation center in to Tsunami awareness and evacuation planning.
Integration of the BSRP (Building Safety Resilience Pacific) Project funded Tsunami warning towers in Dili in to National Early Warning System and development of Public Awareness campaign.
Integration of Tsunami hazard mapping and evacuation planning and community awareness into municipal disaster management plan and policy</td></tr>
</table>

ANNEX V

ACRONYMS

BMKG	Indonesian Agency for Meteorology, Climatology and Geophysics
BoM	Australian Bureau of Meteorology
CARIBE-EWS	Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
CATP	This Capacity Assessment of Tsunami Preparedness
CFZ	Coastal Forecast Zone
CISN	California Integrated Seismic Network
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
DART	Deep-ocean Assessment and Reporting of Tsunami Project
DMO	Disaster Management Organization
EOC	Emergency Operation Centre
EOP	Emergency Operation Plan
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GTS	Global Telecommunication System
HF	high frequency
ICG	Intergovernmental Coordination Group
ICG/IOTWMS	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System
IMS	International Monitoring System
IOC	Intergovernmental Oceanographic Commission
IOTIC	Indian Ocean Tsunami Information Center
IOTR	Indian Ocean Tsunami Ready
IOWave Exercise	Exercise Indian Ocean Wave
IRIS	Incorporated Research Institutions for Seismology
JATWC	Joint Australian Tsunami Warning Centre
JMA	Japan Meteorological Agency
LDMO	Local Disaster Management Organization
MSZ	Makran Subduction Zone

NDMO	National Disaster Management Organization
NEAMTWS	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
NTWC	National Tsunami Warning Centre
OTPAS	(Operational Tsunami Prediction and Assessment System
PTHA	Probabilistic Tsunami Hazard Assessment
PTWC	Pacific Tsunami Warning Center
RIMES	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SMS	Short Message Service
SOP	Standard Operating Procedures
TNC	Tsunami National Contact
TOAST	Tsunami Observation and Simulation Terminal
TOWS-WG	Working Group on Tsunami and Other Hazards related to Sea-Level Warning and Mitigation Systems
TSP	Tsunami Service Provider
TsuCAT	Tsunami Coastal Assessment Tool
TT-CATP	Task Team on Capacity Assessment of Tsunami Preparedness
TWFP	Tsunami Warning Focal Point
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPS	Uninterruptible Power Supply
USGS	United States Geological Survey
VHF	Very High Frequency
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal