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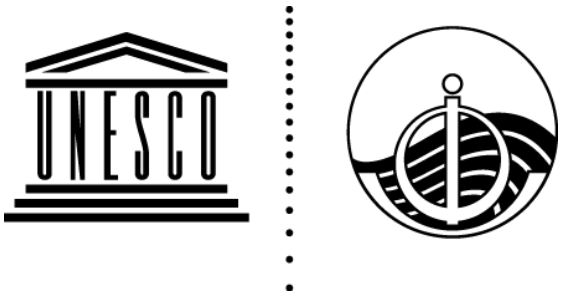

Capacity Assessment of Tsunami Preparedness in the Indian Ocean

Status Report, 2024

UNESCO

Intergovernmental Oceanographic Commission
Technical Series
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Capacity Assessment of Tsunami Preparedness in the Indian Ocean

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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 assessing the status of tsunami preparedness in the Indian Ocean region twenty years after the 2004 Indian Ocean (Aceh) tsunami, the ICG/IOTWMS at its 13th session (Bali, Indonesia, November-December 2022) decided to undertake the 2024 Capacity Assessment of Tsunami Preparedness in the Indian Ocean. The 2024 capacity assessment is a follow up to a similar assessment conducted in 2018, with the addition of a new section on the UNESCO-IOC Tsunami Ready Recognition Programme.

With 22 ICG/IOTWMS Member States and Territories responding, the 2024 assessment provides 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.

In general, much progress has been made between 2005 and 2018 to develop robust and state-of-the-art regional and national tsunami warning and mitigation systems. Examination of the 2024 survey results indicate that there has been significant progress in downstream community awareness and preparedness initiatives while the upstream warning and detection system has plateaued. While efforts have been increasing with regards to preparedness at the community level, this needs to be accelerated. Capacity development is now required to enhance the timeliness and accuracy of the existing warning systems and greatly improve preparedness of at-risk communities.

UNESCO-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 UN Decade of Ocean Science for Sustainable Development (2021–2030) offers a great opportunity to build collaborations and pursue activities that will lead to transformative enhancements of tsunami and multi-hazard early warning systems. I warmly congratulate the ICG/IOTWMS, all Member States and experts who contributed to this important assessment.

Vidar Helgesen
Executive Secretary of IOC
Assistant Director-General of UNESCO

EXECUTIVE SUMMARY

The Indian Ocean (Aceh) tsunami of 26 December 2004 was associated with a magnitude 9.1 earthquake located 160 km off 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 (UNESCO-IOC), 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 UNESCO-IOC, 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 Office in support of UNESCO-IOC 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 provided timely inputs to the assessment.

Recognising the importance of assessing the status of tsunami preparedness in the Indian Ocean region twenty years after the 2004 Indian Ocean (Aceh) tsunami, the ICG/IOTWMS at its 13th session (Bali, Indonesia, November-December 2022) decided to undertake the 2024 Capacity Assessment of Tsunami Preparedness in the Indian Ocean. The 2024 capacity assessment survey questions were similar to those of the 2018 Capacity Assessment Survey with the addition of a new section on the UNESCO-IOC Tsunami Ready Recognition Programme.

The 2024 capacity assessment provides the current status of tsunami preparedness capacity in the region based on the survey responses from twenty-one (21) Member States and one (1) territory including Australia, Bangladesh, Comoros, France (Indian Ocean Territories), India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Singapore, South Africa, Sri Lanka, Thailand and United Arab Emirates.

This publication provides an update 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 timeframe between the 2018 and 2024 capacity assessments. Both capacity assessment reviews the high-level strategic documents and progress in end-to-end tsunami warning and mitigation in Indian Ocean Member States enabling progress to be tracked over a six-year period. 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.

An assessment of the survey indicates that, much progress has been made between 2005 and 2018 to develop robust and state-of-the-art regional and national tsunami warning and mitigation systems. Examination of the 2018 and 2024 survey results indicate that tsunami policies, plans and guidelines have increased or remained at a similar level between the surveys. All to nearly-all countries have reported undertaking tsunami hazard assessments in both surveys while the percentage of countries undertaking tsunami risk assessments has increased with time. The results show that the upstream tsunami warning system components of detection, warning and dissemination have plateaued since 2018. During the same timeframe, efforts have been increasing in community preparedness. For example, considerable growth has been measured in the areas of standard operating procedures for community evacuation, and tsunami exercises conducted in cities and schools. Countries have reported an increase in tsunami information boards and signage reflecting greater community awareness and preparedness. The observed increase in community tsunami activities between 2018 and 2024 may be attributed to the adoption and growth of the UNESCO-IOC Tsunami Ready Recognition Programme.

The capacity gaps and support requirements that have emerged from the 2024 Indian Ocean capacity assessment of tsunami preparedness are intended to provide recommendations for future capacity development activities in the Indian Ocean region (section 5).

1. INTRODUCTION

1.1 2004 INDIAN OCEAN (ACEH) TSUNAMI

The devastating Indian Ocean (Aceh) Tsunami of 26 December 2004 resulted in over 230,000 people losing their lives and more than a million people displaced from their homes (Figures 1 and 2). At that time there was no regional tsunami warning system in the India Ocean. Only a few countries had a capability to provide very basic national alerts to their communities.

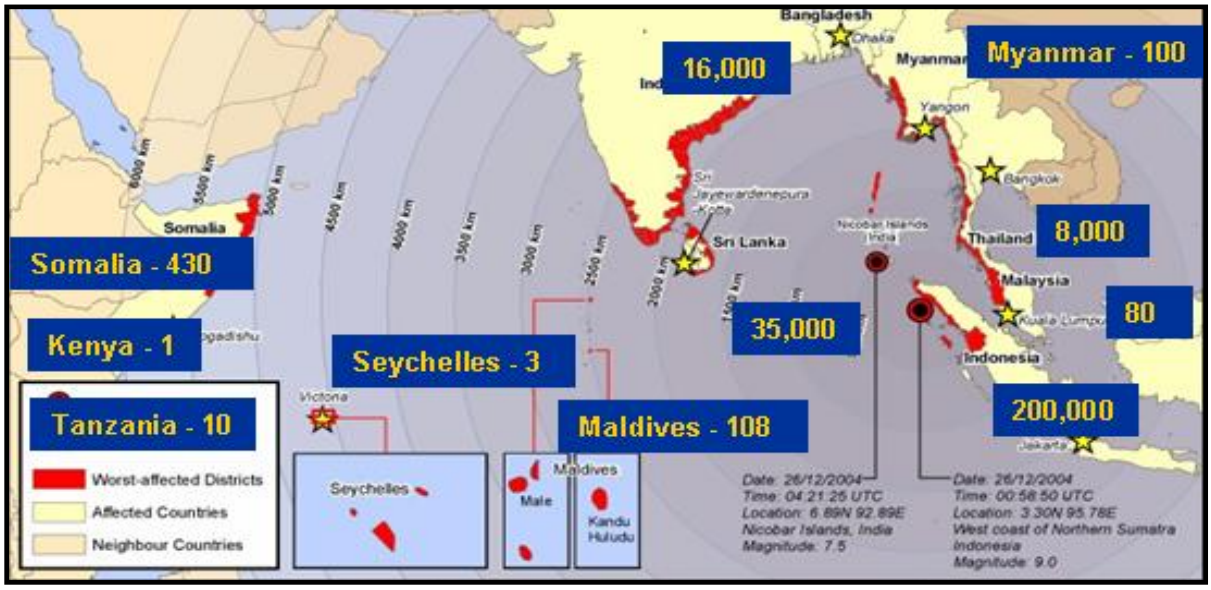

Figure 1. Approximate deaths and damage caused by Indian Ocean (Aceh) Tsunami on 26 December 2004 (UN OCHA 2005).

Figure 2. Devastation in Banda Aceh, Indonesia following the 2004 Indian Ocean Tsunami of 26 December 2004. ©David Dare Parker °SOUTH - OnAsia Images.

1.2 TSUNAMI IN THE INDIAN OCEAN

There are two main sources of tsunami threat in the Indian Ocean (Figure 3). While the 2004 Indian Ocean tsunami and most tsunamis are generated along the Andaman-Sumatra-Java subduction zone (i.e., Sunda Arc) in the eastern Indian Ocean, there is a similar threat from the Makran subduction zone in the North-West Indian Ocean. The 1945 Makran earthquake and tsunami resulted in an estimated lives lost of a few hundred to 4,000 people due to the combined effects.

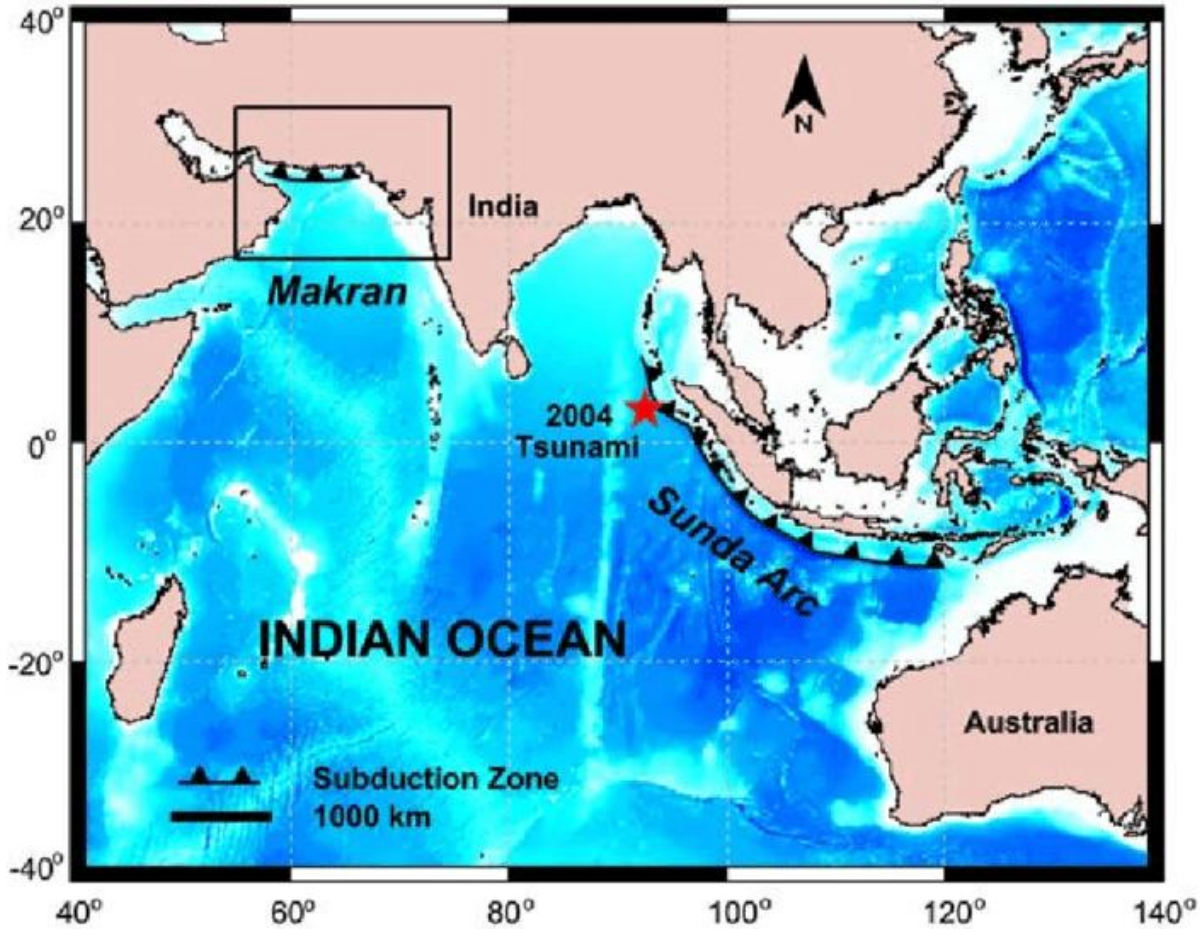

Figure 3. Two main subduction earthquake zones for generating tsunamis in the Indian Ocean (Heidarzadeh et al. 2009).

The Indian Ocean region has experienced thirty-three (33) tsunami events since 2004, of which seven have taken lives (Table 1). While most of the tsunami events across the Indian Ocean have been due to subduction earthquakes, the two devastating events in 2018 in Sulawesi and Anak Krakatau in Indonesia were due to submarine landslides and a volcano flank collapse, respectively. This highlights the risk from tsunamis generated by non-seismic and complex sources, which is a current focus of further development of tsunami hazard assessment, warning, and mitigation globally.

Table 1. Tsunami events in Indian Ocean since 2004 (Source: NOAA NCEI, USA).

#	Date	Location	Cause	Countries impacted	Deaths (estimate)
1	26/12/2004	Off W. Coast of Sumatra	Mag. 9.1 earthquake	Indian Ocean	227,899
2	28/03/2005	W. Coast N. Sumatra, Indonesia	Mag. 8.6 earthquake	Indonesia	16
3	04/10/2005	Kepulauan, Mentawai, Indonesia	Mag. 6.7 earthquake	Indonesia	
4	14/03/2006	Seram Island, Indonesia	Mag. 6.7 earthquake	Indonesia	4
5	17/07/2006	South of Java, Indonesia	Mag. 7.7 earthquake	Indonesia	802
6	12/09/2007	Sumatra, Indonesia	Mag. 8.4 earthquake	Indonesia	
7	25/02/2008	Sumatra, Indonesia	Mag. 6.5 earthquake	Indonesia	
8	16/11/2008	Sulawesi, Indonesia	Mag. 6.5 earthquake	Indonesia	
9	03/01/2009	Near N. Coast of Indonesia	Mag. 7.6 earthquake	Indonesia	
10	03/01/2009	Near N. Coast of Indonesia	Mag. 7.3 earthquake	Indonesia	
11	11/02/2009	Celebes Sea, Indonesia	Mag. 7.3 earthquake	Indonesia	
12	02/09/2009	Java Sea, Indonesia	Mag. 7.3 earthquake	Indonesia	
13	30/09/2009	Sumatra, Indonesia	Mag. 7.5 earthquake	Indonesia	
14	06/04/2010	Sumatra, Indonesia	Mag. 7.8 earthquake	Indonesia	
15	12/06/2010	Little Nicobar Island, India	Mag. 7.5 earthquake	India	
16	25/10/2010	Mentawai, Sumatra, Indonesia	Mag. 7.8 earthquake	Indonesia	431
17	11/04/2012	Off W. Coast N. Sumatra, Indonesia	Mag. 8.6 earthquake	Indonesia	
18	11/04/2012	Off W. Coast N. Sumatra, Indonesia	Mag. 8.2 earthquake	Indonesia	
19	24/09/2013	Off Coast Gwadar, Pakistan	Following Mag. 7.7 earthquake (inland Balochistan) an island appeared near Gwardar and produced a small tsunami	Pakistan, Iran	
20	15/11/2014	N. Moluccas Islands, Indonesia	Mag. 7.1 earthquake	Indonesia	
21	02/03/2016	SW Sumatra, Indonesia	Mag. 7.8 earthquake	Indonesia	
22	28/07/2018	Bali Sea, Indonesia	Mag. 6.4 earthquake	Indonesia	
23	05/08/2018	Bali Sea, Indonesia	Mag. 6.9 earthquake	Indonesia	
24	19/08/2018	Bali Sea, Indonesia	Mag. 6.3 earthquake	Indonesia	
25	28/09/2018	Sulawesi, Indonesia	Mag. 7.5 earthquake/ submarine landslide	Indonesia	4,340 tsunami + earthquake
26	22/12/2018	Anak Krakatau Volcano, Indonesia	Volcanic eruption	Indonesia	437
27	02/08/2019	W. Java, Indonesia	Mag. 6.9 earthquake	Indonesia	
28	14/11/2019	N. Moluccas Islands, Indonesia	Mag. 7.1 earthquake	Indonesia	
29	29/05/2020	Lesser Sunda: Bali: Ijen Volcano, Indonesia	Volcanic eruption	Indonesia	
30	16/06/2021	Banda Sea, Indonesia	Mag. 5.8 earthquake	Indonesia	
31	14/12/2021	Flores Sea, Indonesia	Mag. 7.3 earthquake	Indonesia	

#	Date	Location	Cause	Countries impacted	Deaths (estimate)
32	09/01/2023	S. Maluku, Indonesia	Mag. 7.3 earthquake	Indonesia	
33	24/04/2023	SW. Sumatra, Indonesia	Mag. 7.3 earthquake	Indonesia	

1.3 INDIAN OCEAN TSUNAMI WARNING AND MITIGATION SYSTEM

In 2005, the 2nd United Nations (UN) World Conference on Disaster Risk Reduction (WDCRR) – held in Kobe, Japan – and the Ministerial Meeting on Regional Cooperation on Tsunami Early Warning Arrangements – held in Phuket, Thailand – garnered increased international attention following the 2004 Indian Ocean Tsunami. Over 130 countries and territories globally joined forces to better mitigate tsunami risks and prepare communities in the face of these otherwise unpredictable events. UNESCO's Intergovernmental Oceanographic Commission (IOC) was subsequently given the mandate by the United Nations General Assembly (UNGA) to coordinate the establishment of a global tsunami warning and mitigation system.

Resolutions XXIII-12, XXIII-13, and XXIII-14 of the 23rd Session of the UNESCO-IOC General Assembly created the UNESCO-IOC Tsunami Programme (https://tsunami.ioc.unesco.org), which includes tsunami warning and mitigation systems in the Indian Ocean, Pacific Ocean, Caribbean and adjacent regions, and the North-Eastern Atlantic, Mediterranean and connected seas (Figure 4, next page).

As one of the initial steps, UNESCO-IOC in 2005 facilitated an assessment of capacity development requirements to build an effective and durable tsunami warning and mitigation system in the Indian Ocean. This was facilitated by Expert Missions to sixteen (16) of the twenty-five (25) Member States identified as requiring capacity development. The UNESCO-IOC Pacific Tsunami Warning and Mitigation System (PTWS) was used to identify the basic requirements.

In August 2005, UNESCO-IOC established the Intergovernmental Coordination Group (ICG) for the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS). Its primary role was to coordinate the efforts of Member States around the Indian Ocean to build the IOTWMS and support its ongoing implementation. The ICG/IOTWMS meets at least every two years and is supported by the ICG/IOTWMS Secretariat (funded by the Government of Australia). It is organised according to three strategic pillars: 1) Hazard and Risk; 2) Detection, Warning, and Dissemination; and 3) Community Awareness and Preparedness.

The UNESCO-IOC IOTWMS was quickly established, with the main objective to alert countries all around the Indian Ocean of any future threats. It was initially based on the PTWS, which had been established by UNESCO's IOC in 1965 following the tsunami generated by the 1960 Chile earthquake and tsunami that devastated many countries around the Pacific Ocean. One of the first tasks of the ICG/IOTWMS was to establish an Interim Advisory Service (IAS), which was implemented in 2005 by the Government of United States of America and the Government of Japan, utilising their expertise in the PTWS. National Tsunami Warning Centres (NTWCs) were established by each country.

By 2011 the independent regional tsunami threat forecasting capability of the IOTWMS was fully implemented. Designated UNESCO-IOC Tsunami Service Providers (TSPs) were established by Australia, India, and Indonesia to provide tsunami threat information to the NTWCs. The NTWCs review the interoperable information provided by each TSP for the entire Indian Ocean region and decide and issue warnings to their at-risk communities.

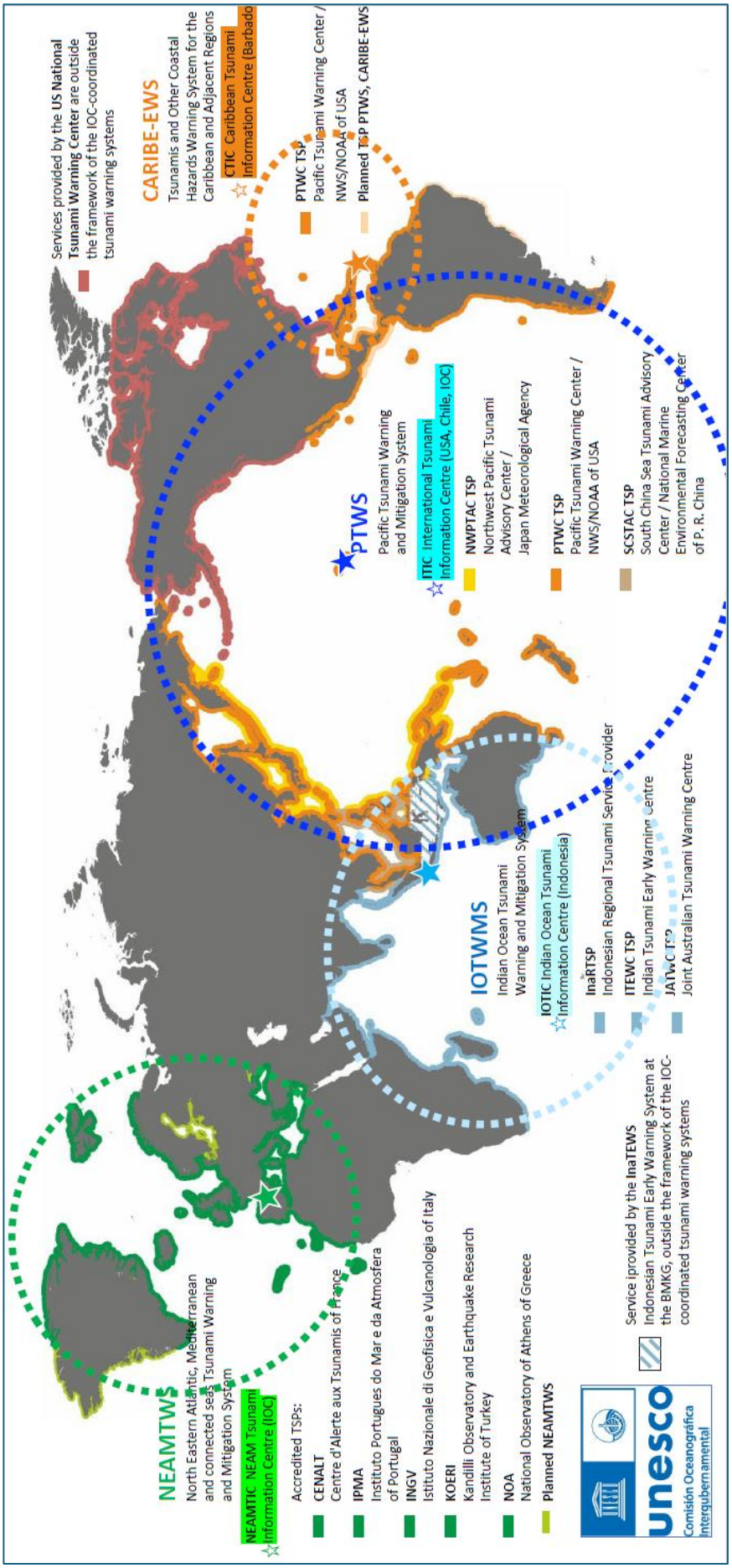

Figure 4. UNESCO-IOC Global Tsunami Warning and Mitigation System.

After a period of parallel operation and cross-evaluation of the new system, the IAS ceased operation in 2013. The IOTWMS is now extensively exercised every two years (2009, 2011, 2014, 2016, 2018, 2020, 2023) in IOWave Exercises coordinated by the UNESCO-IOC ICG/IOTWMS and supported by its Secretariat. Member States are also encouraged to conduct national exercises during the in-between years.

At its 10th Session (Muscat, August 2015), the ICG/IOTWMS identified the need to conduct a reassessment of the state of tsunami preparedness of the Indian Ocean Member States. This was to help evaluate progress since the 2004 Indian Ocean Tsunami, as well as identify remaining gaps and prioritise capacity development requirements at both the regional and national levels for strengthening the end-to-end tsunami warning and mitigation system.

At its 11th Session (Putrajaya, April 2017) the ICG/IOTWMS established the inter-sessional "Task Team on Capacity Assessment of Tsunami Preparedness" (TT-CATP) to oversee the 2018 capacity assessment of tsunami preparedness in the Indian Ocean. The TT-CATP designed an extensive online survey covering all pillars and aspects of the end-to-end tsunami warning and mitigation system. A total of 20 ICG/IOTWMS Member States responded to the reassessment survey.

The 2018 results provided a new baseline of the status of tsunami preparedness capacity in the region, including capacity development requirements at both regional and national levels. The results clearly indicated that there had been considerable improvement across all components of the IOTWMS since the previous assessment in 2005, but much work was still required, especially with regards to preparedness at the vulnerable community level. The recommendations from the 2018 assessment provided core input into the development of the work programmes of the ICG Working Groups and Task Teams.

During 2022 to 2024 intersessional period, the work programmes related to the three pillars of the ICG/IOTWMS were managed by the following bodies, with members elected by the ICG:

- *Steering Group*
- *Working Group 1 – Tsunami Risk, Community Awareness and Preparedness*
- *Working Group 2 – Tsunami Detection, Warning, and Dissemination*
- *Working Group 3 – Tsunami Ready Implementation*
- *Regional Working Group - North-West Indian Ocean*
- *Task Team on Exercise Indian Ocean Wave 2023 (IOWave23).*

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.

The ICG/IOTWMS has facilitated dialogue by organising 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. Notable events include:

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

- *Advances in Tsunami Warning to Enhance Community Response (Paris, France, 12–14 February 2018)*
- *Scientific Tsunami Hazard Assessment of the Makran Subduction Zone (Kish Island, Islamic Republic of Iran, 8 March 2019)*
- *Strengthening Tsunami Early Warning in the North-West Indian Ocean Region through Regional Cooperation (Muscat, Oman, 1–6 September 2019)*
- *Lessons Learnt from the 2018 Tsunamis in Palu and Sunda Strait. (Jakarta, Indonesia, 26–28 September 2019)*
- *2nd UNESCO-IOC Global Tsunami Symposium: Reflection and the Way Forward (Banda Aceh, Indonesia, 11-14 November 2024)*

As 2024 marks the 20th anniversary of the 2004 Indian Ocean Tsunami, the UNESCO-IOC ICG/IOTWMS at its 13th Session (Bali, November 2022) (Figure 5) decided it was timely to conduct the next reassessment of the state of tsunami preparedness in ICG/IOTWMS Member States. The outcomes from the assessment informed the 2nd UNESCO-IOC Global Tsunami Symposium (Banda Aceh, November 2024) on progress since the Indian Ocean Tsunami of 2004. The results were also considered by Member States at the 14th Session of the ICG/IOTWMS (Jakarta, November 2024) to develop work programmes to address remaining gaps, and for potential donors to support the identified capacity building needs. Additionally, this assessment will inform the development of the ICG/IOTWMS Medium-Term Strategy for 2025-30.

Figure 5. 13th Session ICG/IOTWMS, Bali, Indonesia. 28 November–1 December 2022

1.4 GLOBAL FRAMEWORKS

The overall UNESCO-IOC Tsunami Programme contributes to several global frameworks within a Multi-Hazard Early Warning System (MHEWS) context. Of relevance is the UN “Early Warnings for All” (EW4ALL) initiative, which was launched in 2022 by the UN Secretary-General, Antonio Guterres. This initiative aims to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.

While tsunami warning and mitigation systems relate to a geophysical hazard, the core warning and mitigation elements within countries are similar and often the responsibility of the same agencies who respond to other hazards. Improvements to tsunami warning and mitigation systems will therefore contribute to the EW4ALL initiative. The EW4ALL initiative utilises four pillars to undertake a coordinated effort to evaluate the status of warning systems and develop roadmaps to address any issues preventing warnings getting to all in the community (see Figure 6).

Figure 6. Related Global Initiatives.

In June 2021, UNESCO-IOC launched the Ocean Decade Tsunami Programme (ODTP) as part of the Decade of Ocean Science for Sustainable Development (2021–2030) (https://oceandecade.org) – an effort to further bolster the global tsunami warning system by greatly enhancing response times and community readiness. Its main objectives are to:

- Enhance systems' capacity to issue actionable and timely warnings for tsunamis from all identified sources to 100% of coasts at-risk;
- Guarantee that 100% of communities at-risk are prepared and resilient to tsunamis by 2030 through efforts like the UNESCO-IOC Tsunami Ready Recognition Programme (TRRP)

The UNESCO-IOC Tsunami Programme makes significant contributions to the implementation of all the Sustainable Development Goals (SDGs) of the UN 2030 Agenda for Sustainable Development, in particular SDG #11 (Sustainable Cities and Communities) and SDG #14 (Life Below Water).

Within the overarching Sendai Framework for Disaster Risk Reduction, the UNESCO-IOC Tsunami Programme supports all targets: Global Target A (Substantially reduce global disaster mortality by 2030); Global Target B (Substantially reduce the number of affected people globally by 2030); Global Target C (Reduce direct economic loss in relation to global domestic product (GDP) by 2030); Global target D (Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030); Global target E (Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020); Global Target F: Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030); and Global target G (Substantially increase the availability of, and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030).

2. METHODOLOGY

The 2024 Capacity Assessment of Tsunami Preparedness in the Indian Ocean 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 2024 Member State Survey was based on the survey undertaken for the 2018 Capacity Assessment of Tsunami Preparedness of Member States of the ICG/IOTWMS, thereby also facilitating a comparison of results between 2018 and 2024.

The assessment was conducted through an online survey questionnaire covering all aspects of the end-to-end tsunami warning and mitigation system. The survey consisted of six main parts: basic information; risk assessment and reduction; detection, warning and dissemination; public awareness, preparedness and response; Tsunami Ready Recognition Programme, 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.

The underpinning survey questions were similar to those of the 2018 Capacity Assessment Survey with the addition of a new section on the UNESCO-IOC Tsunami Ready Recognition Programme. The 2018 questionnaire assimilated and built upon the existing ICG/IOTWMS National Reports, Post-IOWave Surveys and UNESCO-IOC 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 in May 2024. 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.

Submission of responses was timed to coincide with Member States' formal reporting to the fourteenth session of the ICG/IOTWMS (Banten, Republic of Indonesia, 17–19 November 2024) eliminating the need for countries to submit a separate national report.

A total of 22 of the 25 active Member States and Territories responded, including: Australia, Bangladesh, Comoros, France Indian Ocean Territories, India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Singapore, South Africa, Sri Lanka, Thailand, and United Arab Emirates. This is an increase in the response rate from the 2018 survey, when 20 countries completed the survey. However, two countries that completed the 2018 survey did not respond to the 2024 survey (i.e., Tanzania and Timor Leste) and four Member States responded that did not respond to the 2018 survey (i.e., Maldives, Seychelles, South Africa, and United Arab Emirates) resulting in discrepancies between the sample sets. Therefore, variations between the 2018 and 2024 results are partially attributed to the difference in respondents and partially attributed to changes in capacity. Deriving temporal trends from the results should take both factors into consideration.

To assess the accuracy of the trends observed between the two surveys, an independent analysis of only Member States responding to both 2018 and 2024 surveys was conducted. The results showed that the same trends were observed with the subset of common Member States and full suite of respondents thus providing validity to the overall trends observed in the comparison of the 2018 and 2024 assessments. Therefore, the observed trends are considered accurate and not artifacts of the variance in Member State responses between the two surveys.

The University of Huddersfield of the United Kingdom again assisted with the analysis and compilation of the survey data, which was reviewed by the Expert Team during the 2024 ICG/IOTWMS Capacity Assessment of Tsunami Preparedness Validation Workshop, Bangkok, 4-6 September. The overall assessment was also based on further information on capacity and gaps identified by the work of the ICG/IOTWMS Working Groups and Exercise

IOWave23 Task Team, and an ongoing assessment of national tsunami warning chains and associated Standard Operating Procedures (SOPs).

3. CAPACITY ASSESSMENT RESULTS

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 7).

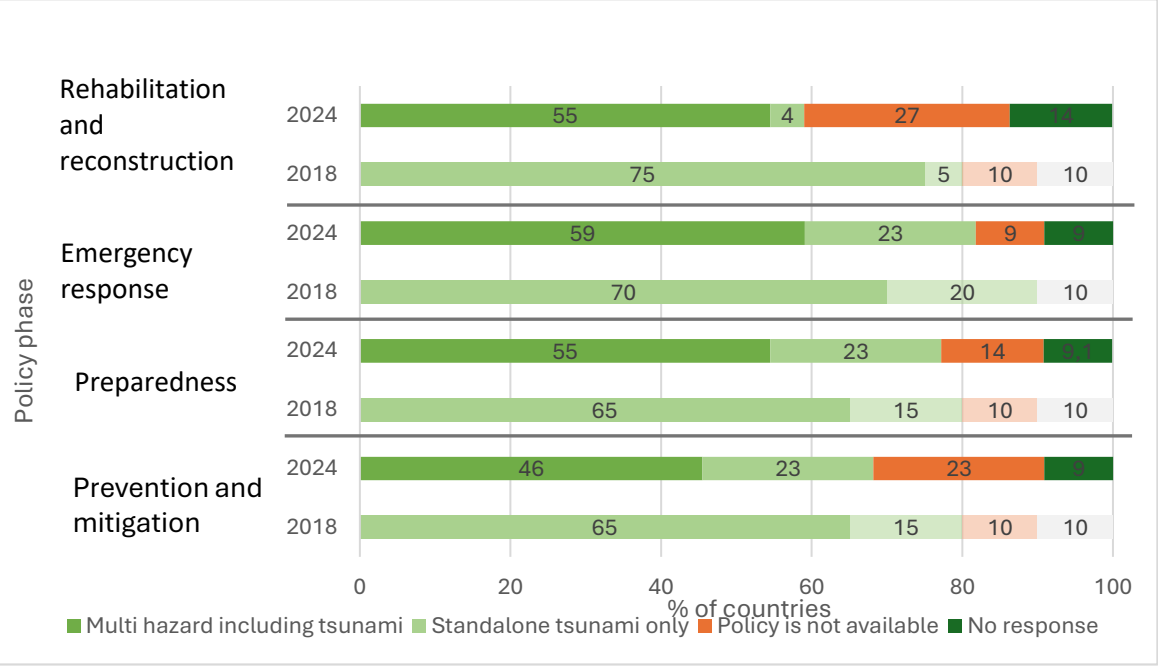

Figure 7. Types and phases of national tsunami policy.

The responses indicate that 20 of the 22 countries (91%) have some form of national tsunami policy. A majority address tsunami as a part of a multi-hazard policy. Over 80% of countries have a national policy have addresses the emergency response phase and over 75% that addresses the preparedness phase. However, less than 60% of countries have a policy that addresses the rehabilitation and reconstruction phase.

Overall, the results show a similar proportion of countries reporting the availability of national policies when compared to the reporting countries in the 2018 survey.

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 8).

The responses indicate that 14 of the 22 countries (64%) have some form of local tsunami policy. A majority of those address tsunami as a part of a multi-hazard policy. Over 60% of countries have a policy have addresses the emergency response and preparedness phases, and over 50% have a policy that addresses the prevention and mitigation & rehabilitation and reconstruction phases.

Overall, the results show a similar proportion of countries reporting the availability of local policies when compared to the reporting countries in the 2018 survey.

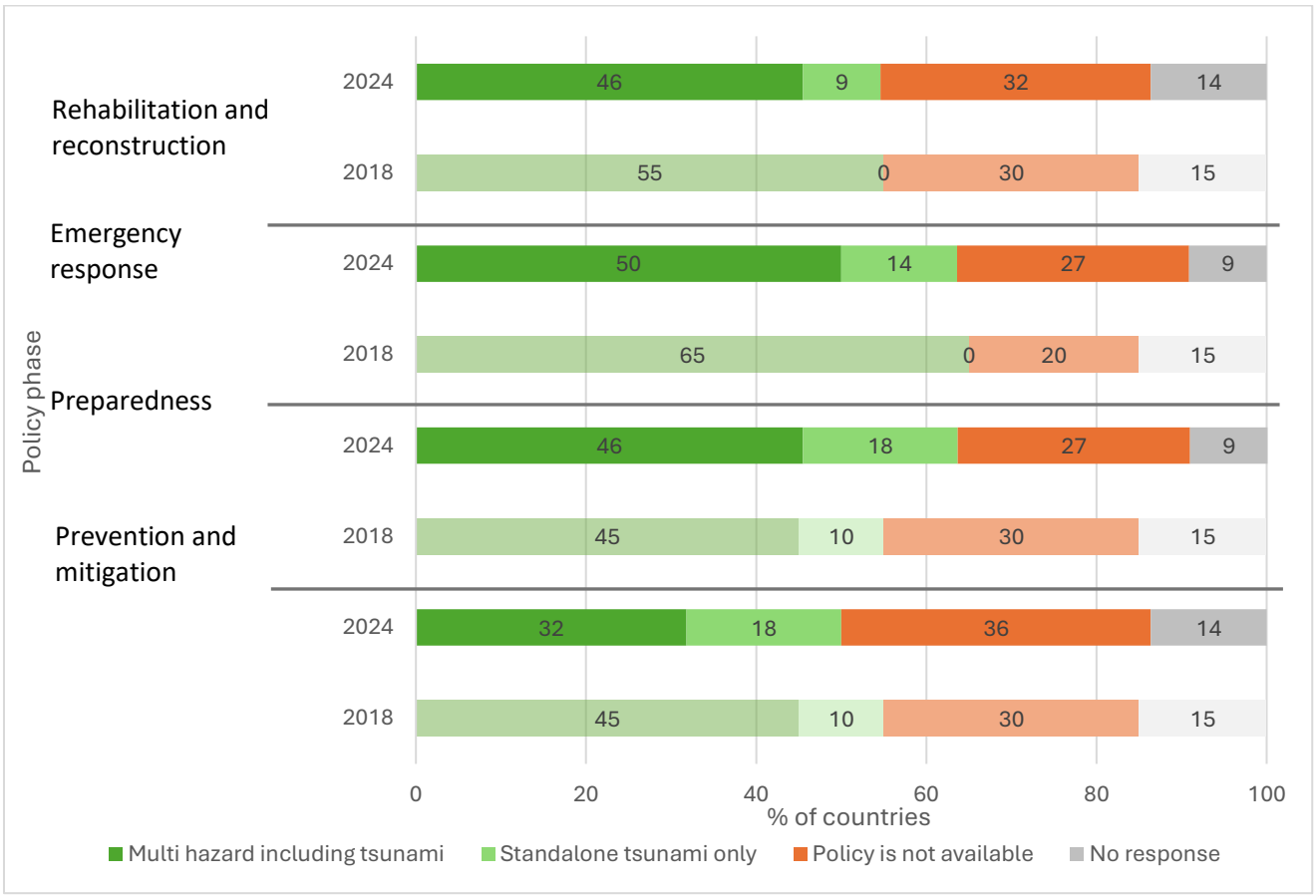

Figure 8. Types and phases of local tsunami policy.

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 9), through to preparedness (Figure 10), emergency response (Figure 11), and rehabilitation and reconstruction phases (Figure 12).

The responses indicate that all 22 (100%) of the respondent countries have some form of tsunami disaster risk reduction plan. Eighty-six percent (86%) have a national tsunami plan, 59% have a local tsunami plan, and 50% have a community/neighbourhood tsunami plan.

A significant majority of countries address 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 is significantly higher at the national level, followed by the local level. There is least availability at the community level. This pattern is similar in all phases of disaster management. Overall, 86% of countries have national level plans, while 59% have local and 50% have community level plans.

Availability of tsunami plans is highest during the preparedness and emergency phases. For example, the 86% of countries with national plans at the emergency response phase exceeds those during the prevention and mitigation phase (64%) and the rehabilitation and reconstruction phase (55%). This pattern is replicated at the local and community levels, with availability at the emergency response and preparedness phases exceeding other phases.

Nineteen (19) countries (86%) reported that their tsunami disaster risk reduction plans are based on hazard and/or risk assessments.

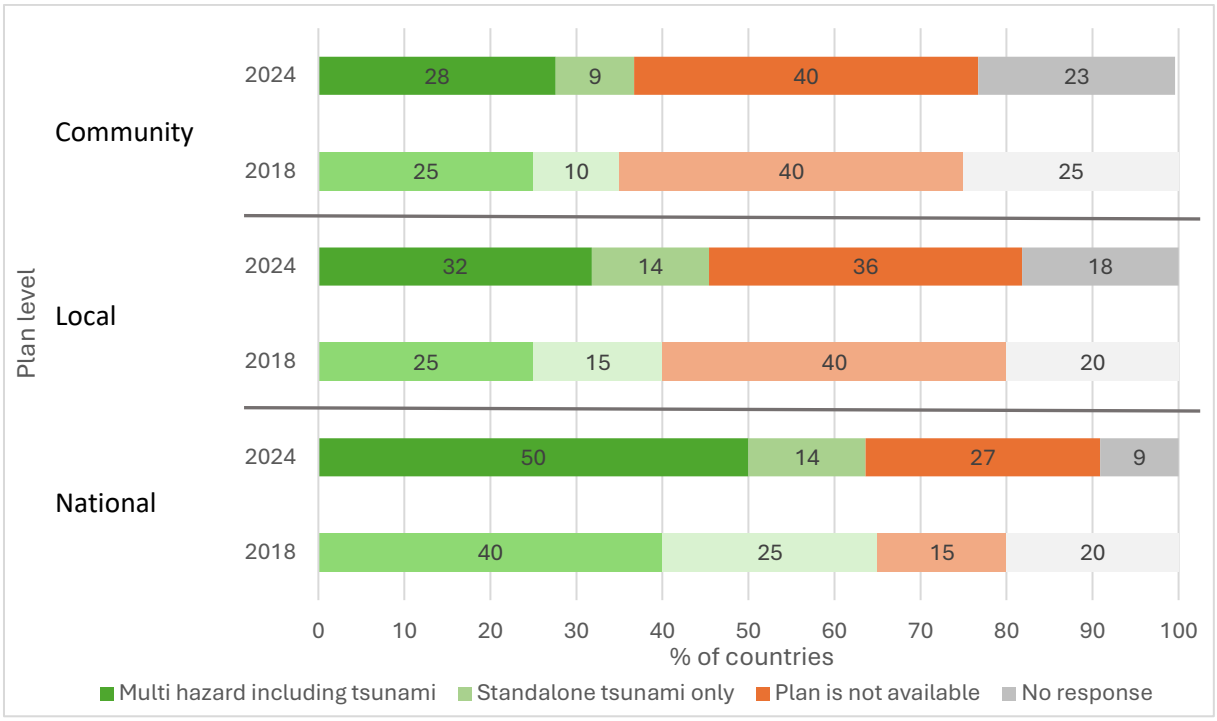

Figure 9. Availability of national, local and community level tsunami disaster risk reduction plans during prevention and mitigation phase.

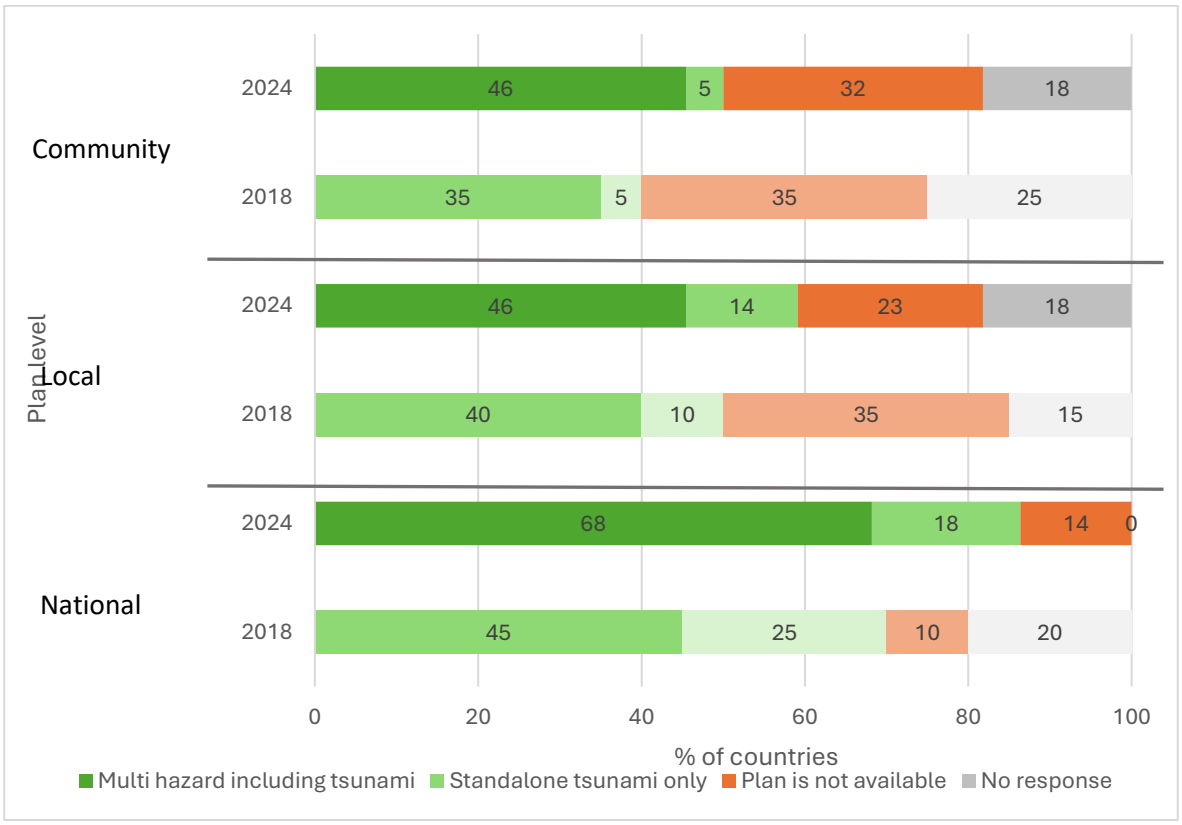

Figure 10. Availability of national, local and community level tsunami disaster risk reduction plans during preparedness phase.

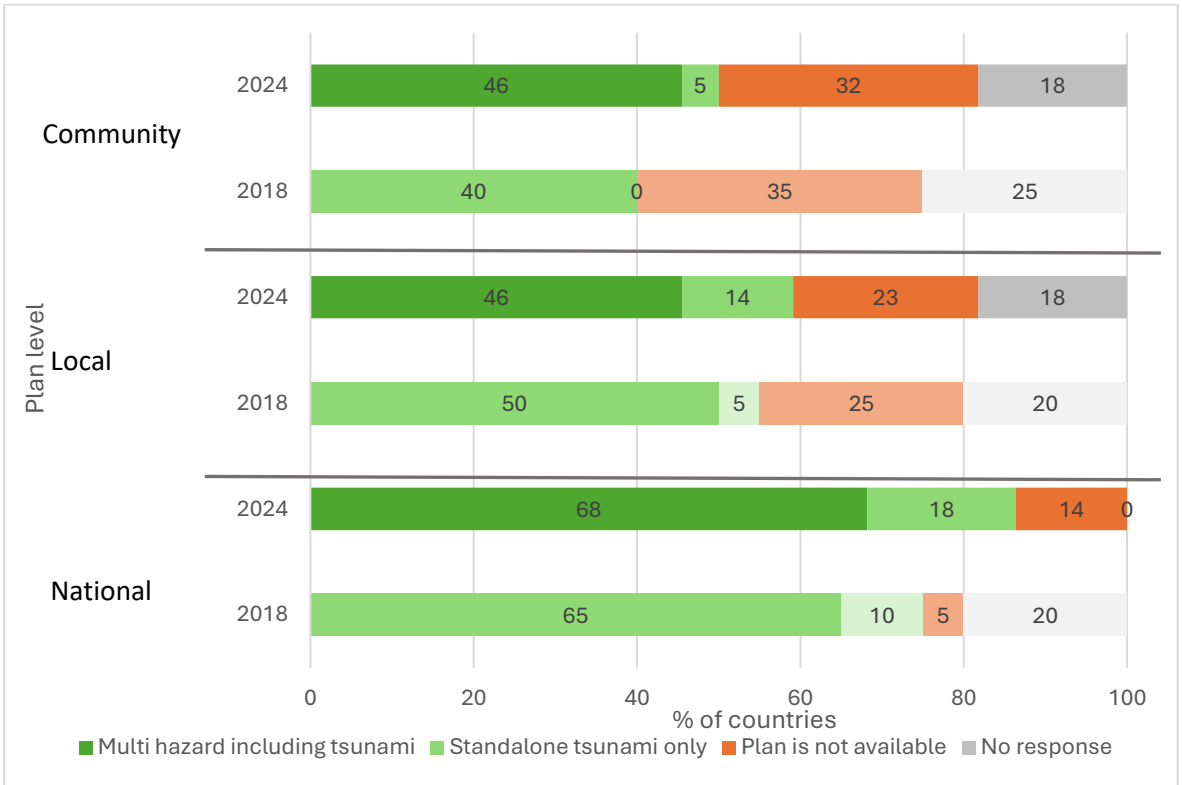

Figure 11. Availability of national, local and community level tsunami disaster risk reduction plans during emergency response phase.

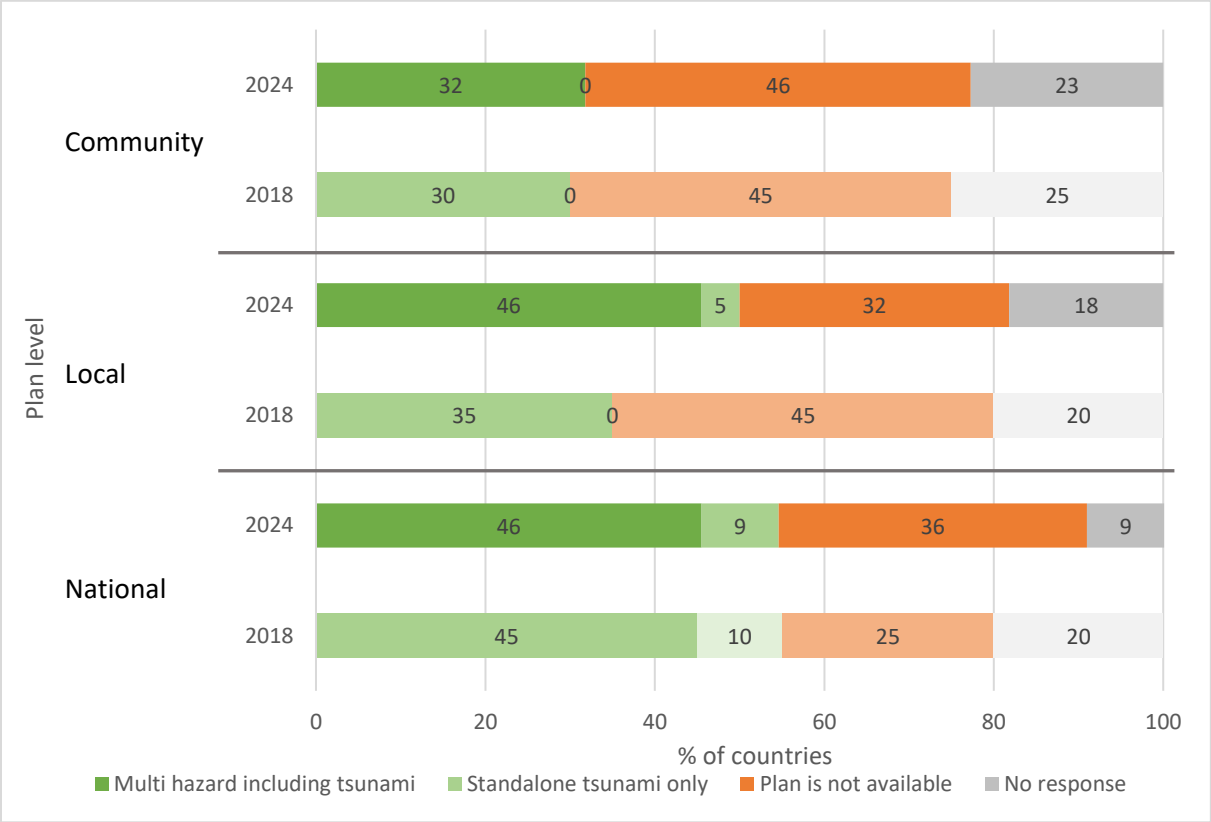

Figure 12. Availability of national, local and community level tsunami disaster risk reduction plans during rehabilitation and reconstruction phase.

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 13).

The responses indicate that all 22 of the respondent countries (100%) have some form of national tsunami guidelines. At the prevention and mitigation phase there is a mix of standalone guidelines and those that address tsunami as a part of a multi-hazard guideline. In the other phases, they predominantly address tsunami as a part of national multi-hazard guidelines.

The results show that most countries (>60%) have national tsunami guidelines that address all phases. However, there is least availability in the rehabilitation and reconstruction phase.

Overall, the results show a higher proportion of countries reporting the availability of national tsunami guidelines in all phases, when compared to those countries responding to the 2018 survey.

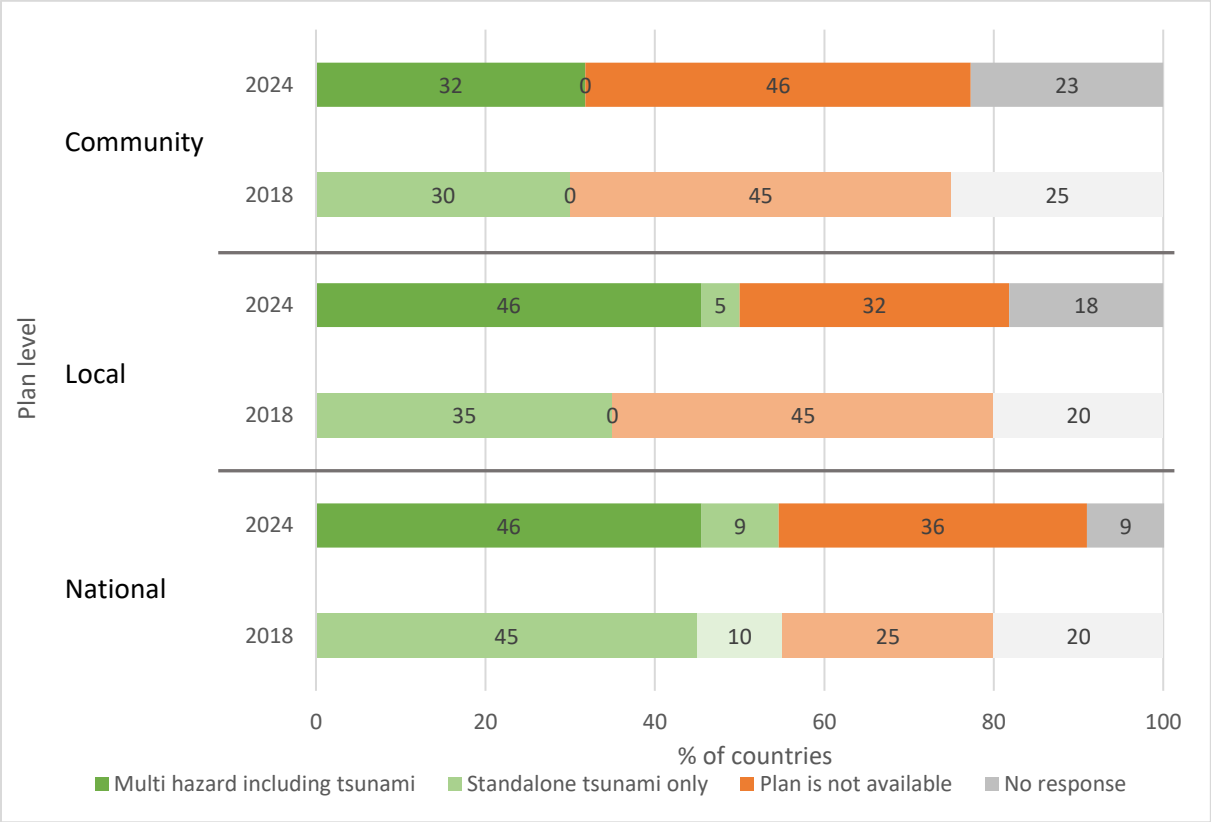

Figure 13. Types and phases of national tsunami guidelines.

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 14).

The responses indicate that 17 of the 22 countries (77%) have some form of local tsunami guidelines. Across the disaster management phases, the majority address tsunami as a part of multi-hazard guidelines. Half (50%) of countries have local tsunami guidelines that address the preparedness phase. They are not as commonly found in other phases, including emergency response (41%), prevention and mitigation (46%), and rehabilitation and reconstruction (36%).

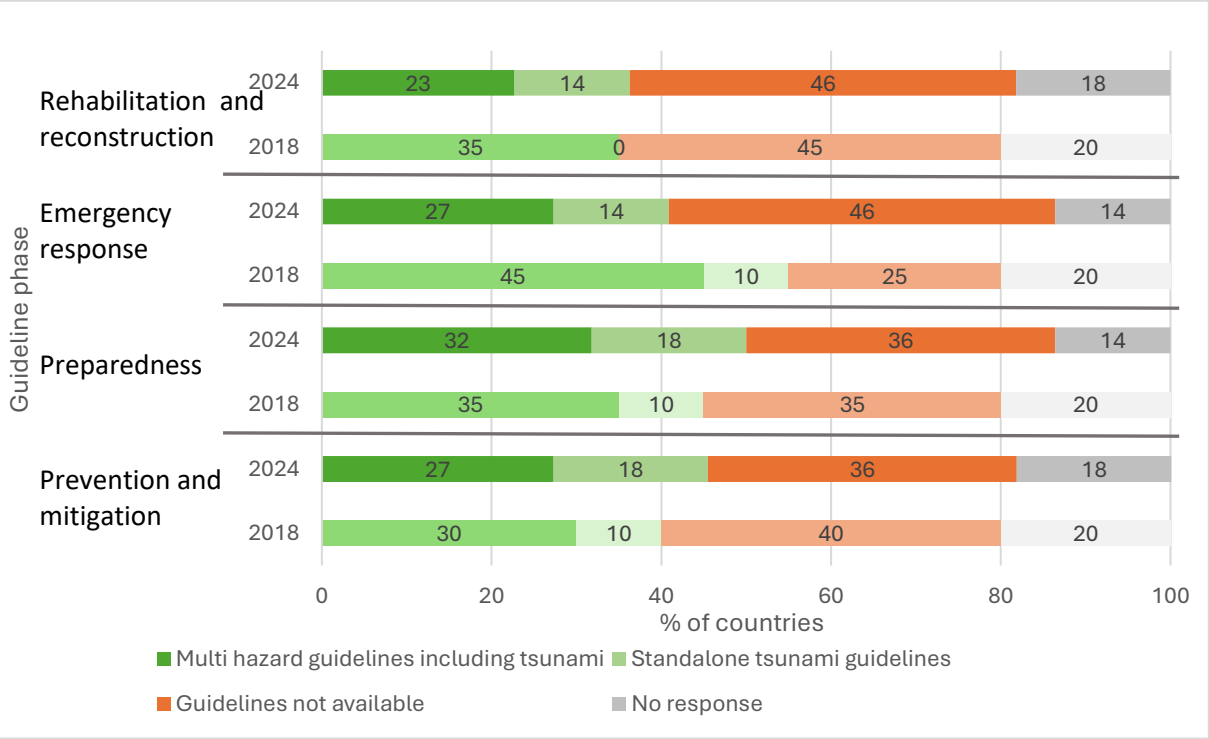

Figure 14. Types and phases of local tsunami guidelines.

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 21 of the 22 countries participating in this survey (96%) conduct hazard assessments to understand the hazard threats to their territory. This compares to all 20 countries (100%) that responded in 2018. The Seychelles, which did not respond to the 2018 survey, was the only country not to carry out a tsunami hazard assessment.

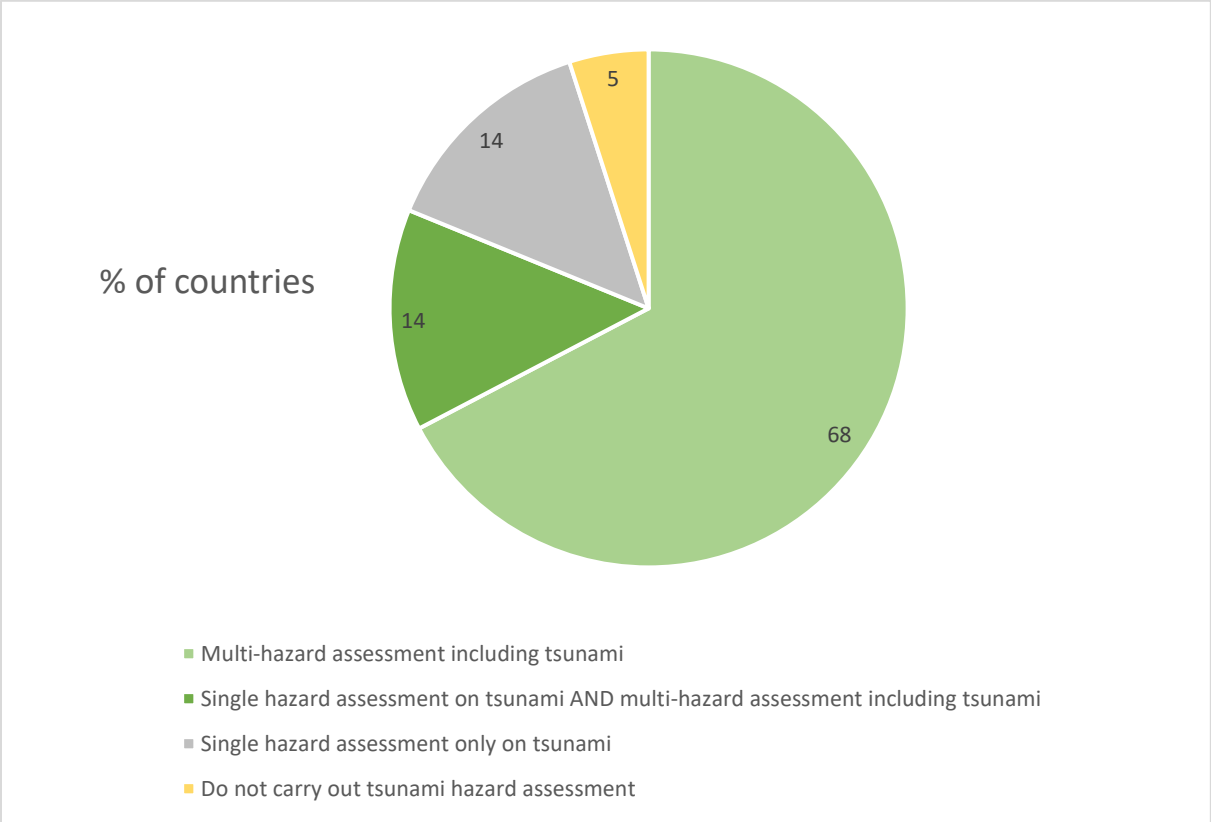

Figure 15. Type of hazard assessment.

Figure 15 shows the type of hazard assessment carried out by those countries. 15 countries (68%) reported conducting a multi-hazard assessment that includes tsunami, three countries (14%) a single hazard assessment on tsunami AND a multi-hazard assessment including tsunami, and three countries (14%) a single hazard assessment on tsunami only.

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

Figure 16 shows the number of hazards included in the multi-hazard assessments conducted by each country. Out of the 19 countries that conducted a multi-hazard assessment, one country included seven, and seven countries included six hazards from Tsunami, Cyclone, Drought, Earthquakes, Epidemics, Flooding, Landslide, and Volcanic eruptions. Three countries included five hazards, and four countries included four hazards.

As shown in Figure 15 and Figure 17, while 21 of the respondent countries include tsunami in their hazard assessment. 15 of the countries who do multi-hazard assessments also include flooding (68% of total), 14 include cyclones (64% of total) and 13 (59% of total) include earthquakes (Figure 17). Less common hazards to be included are drought and landslides (46%), epidemics (27%) and volcanic eruptions (18%).

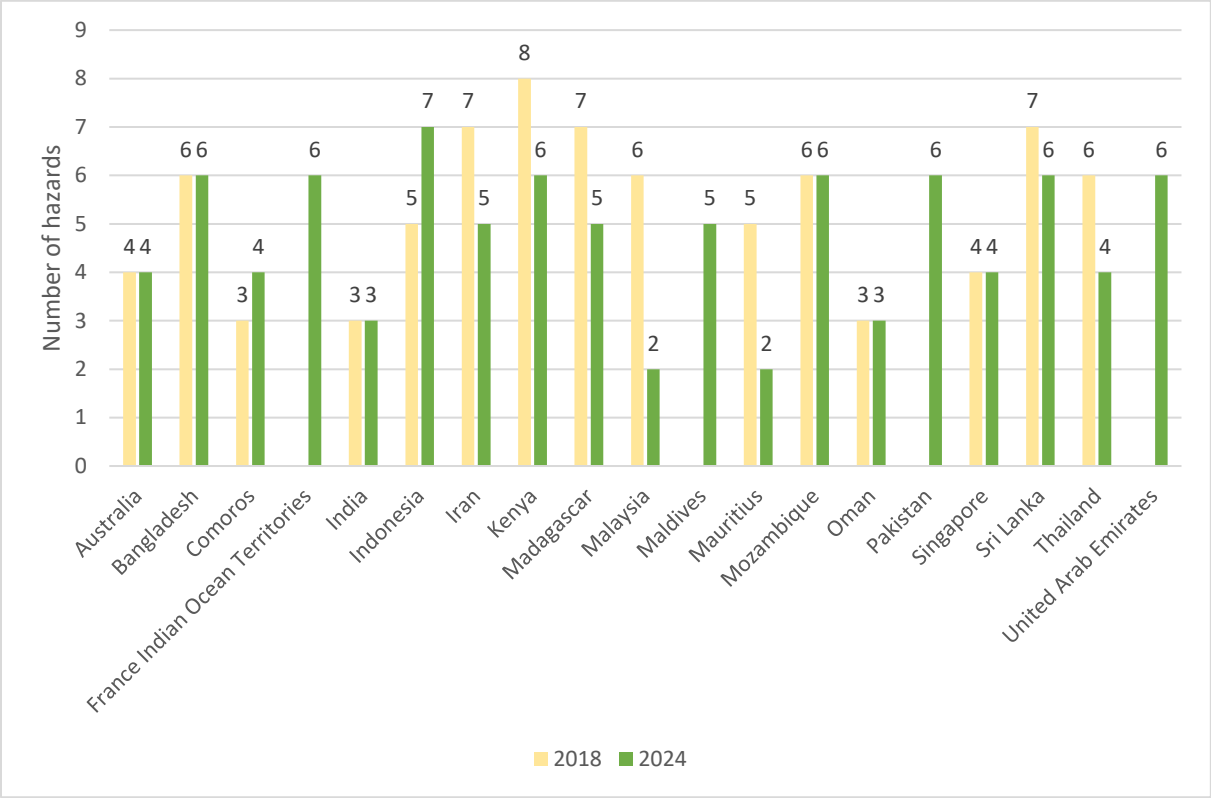

Figure 16. Number of hazards included in a multi-hazard assessment.

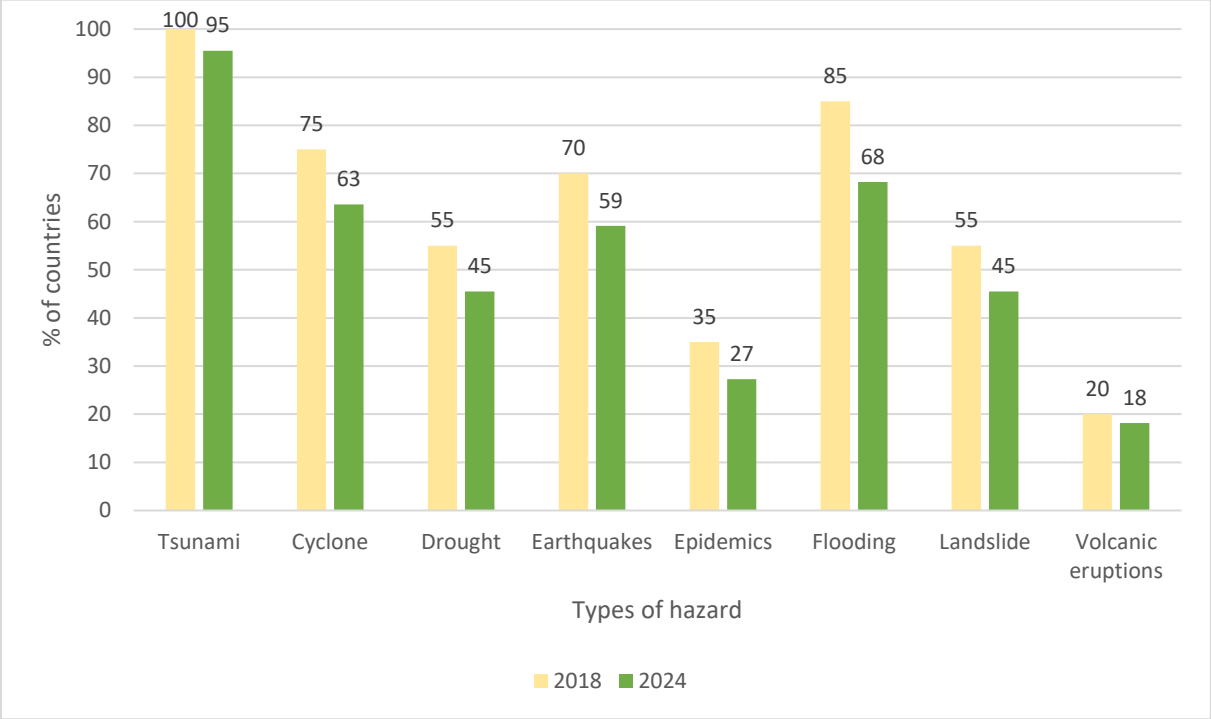

Figure 17. Type of hazard(s) included in multi-hazard assessment.

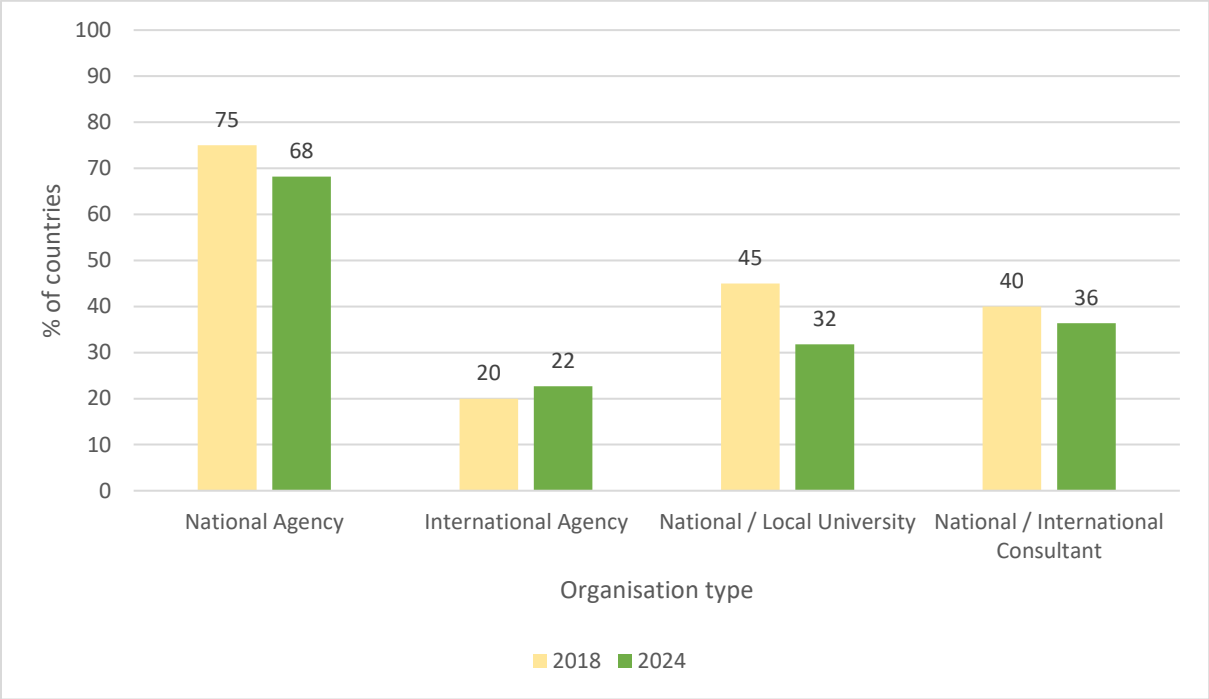

Figure 18. Organisation(s) responsible for the tsunami hazard assessment.

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

Sixty-eight percent (68%) of tsunami hazard assessments carried out by countries involve a national agency, 32% a national or local university, 23% a national or international consultant, and 36% an international agency (Figure 18). Forty-one percent (41%) of tsunami hazard assessments involved multiple organisations.

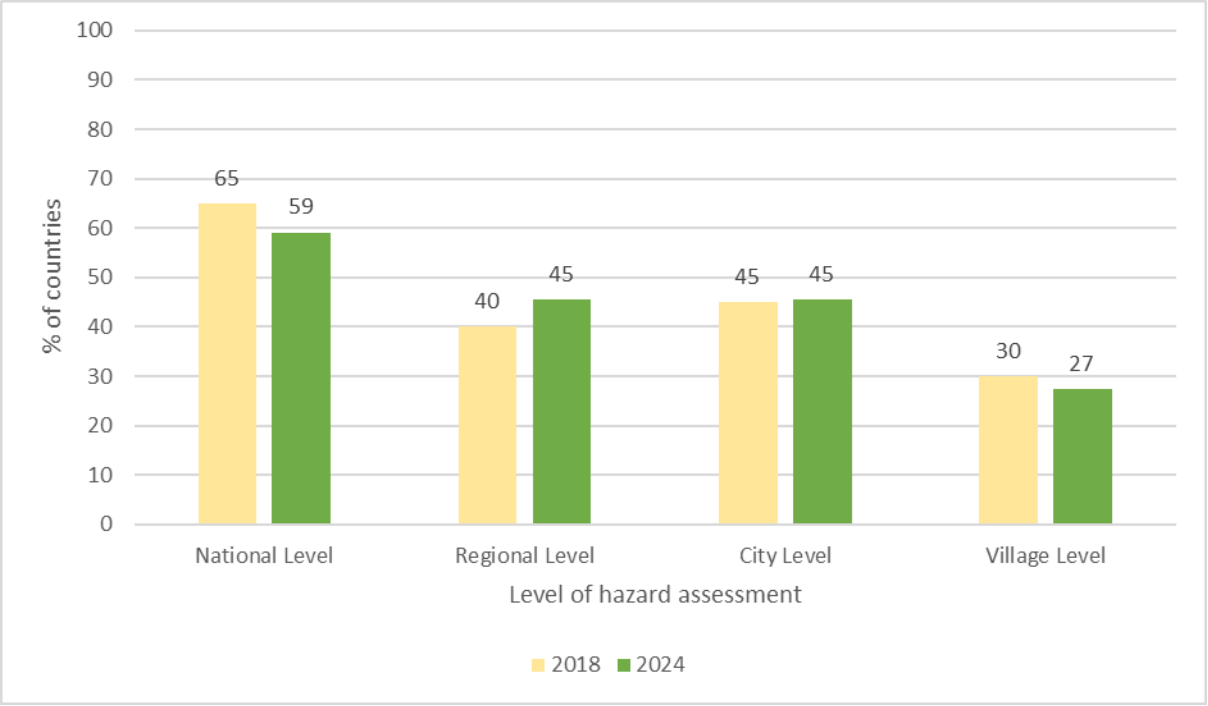

Figure 19: Level at which tsunami hazard assessment is carried out.

Fifty-nine percent (59%) of countries carry out the tsunami hazard assessment at a national level, 46% at the regional level, 46% at the city level and 27% at the village level (Figure 19). Fifty percent (50%) of countries carry out hazard assessments at multiple levels.

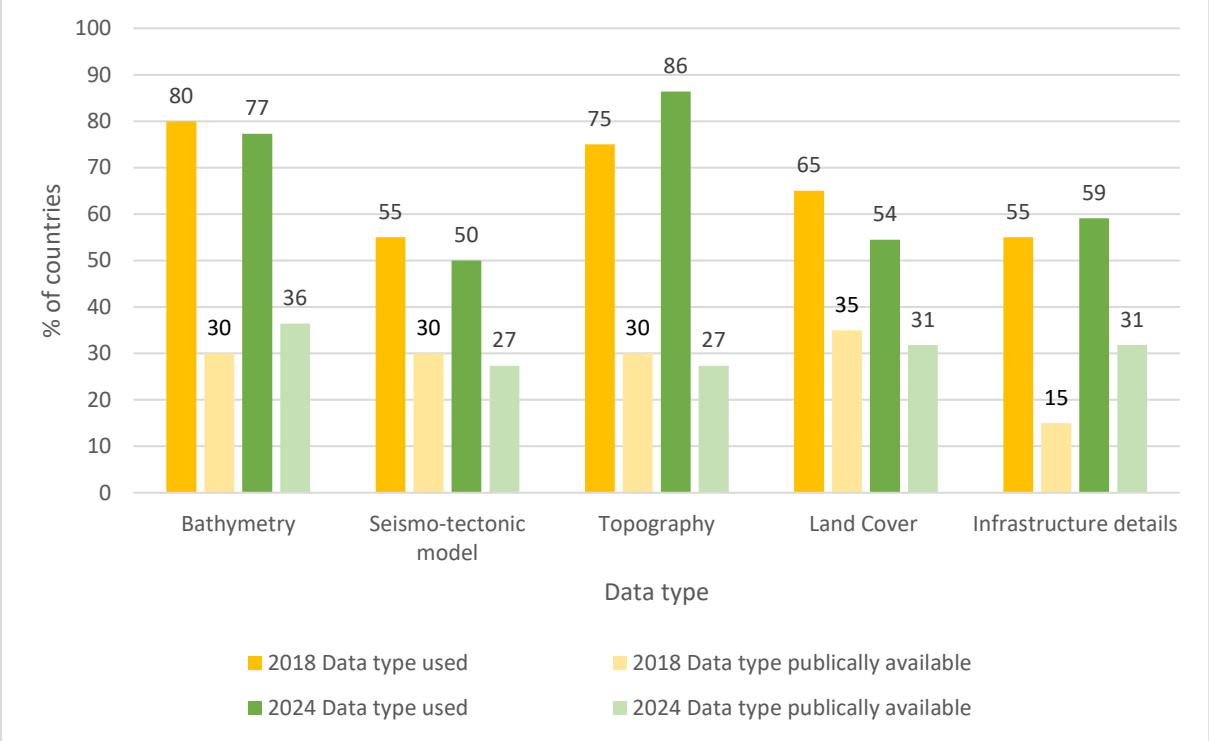

Figure 20. Data types used for tsunami hazard assessment.

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

Sixteen (16) countries (73%) identify two or more data types used to support their tsunami hazard assessment. Bathymetry and topography are the most widely used data to inform tsunami hazard assessment (Figure 20). 50% or more of the countries also use seismo-tectonic models, infrastructure details and/or land cover data. However, none of the data sources are widely available to the public (<40% of countries).

The number and type of products to emerge from the tsunami hazard assessment varies greatly across the 22 respondent countries. The most common products (Figure 21) are inundation maps (77%), hazard maps (59%) and evacuation maps (50%). The other products are developed by less than 50% of countries.

One country, Thailand, produces all seven products, while a majority of countries produce three products or less (Figure 22).

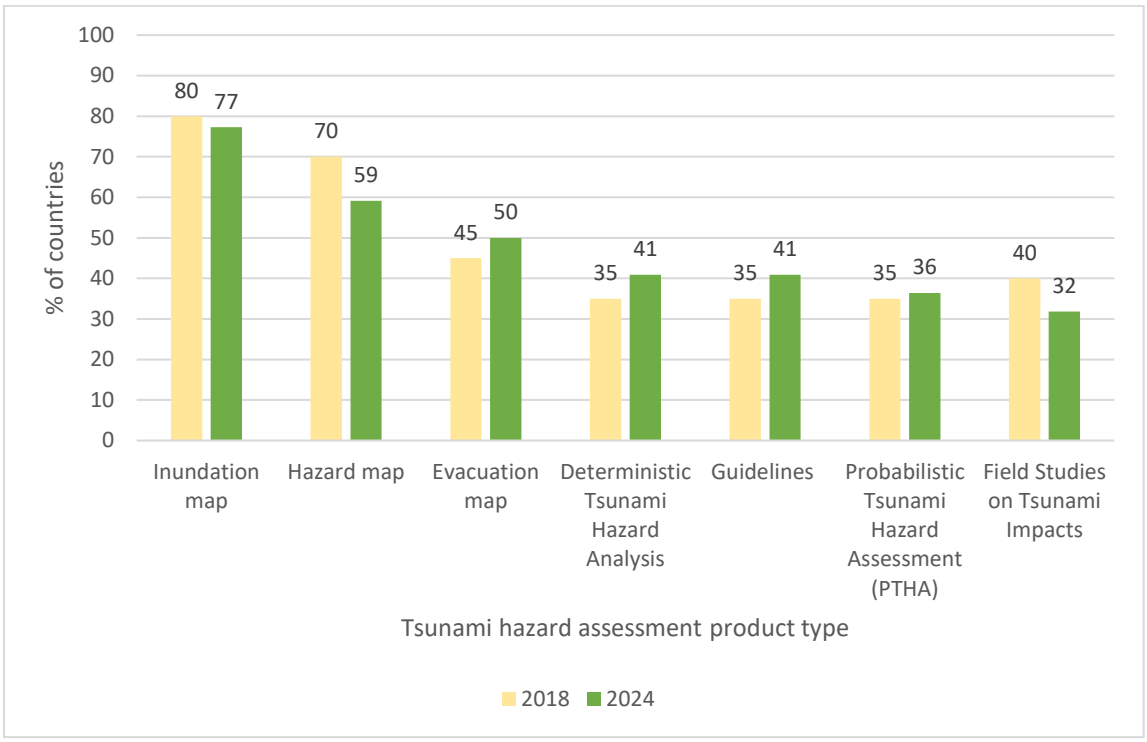

Figure 21. Products from tsunami hazard assessment.

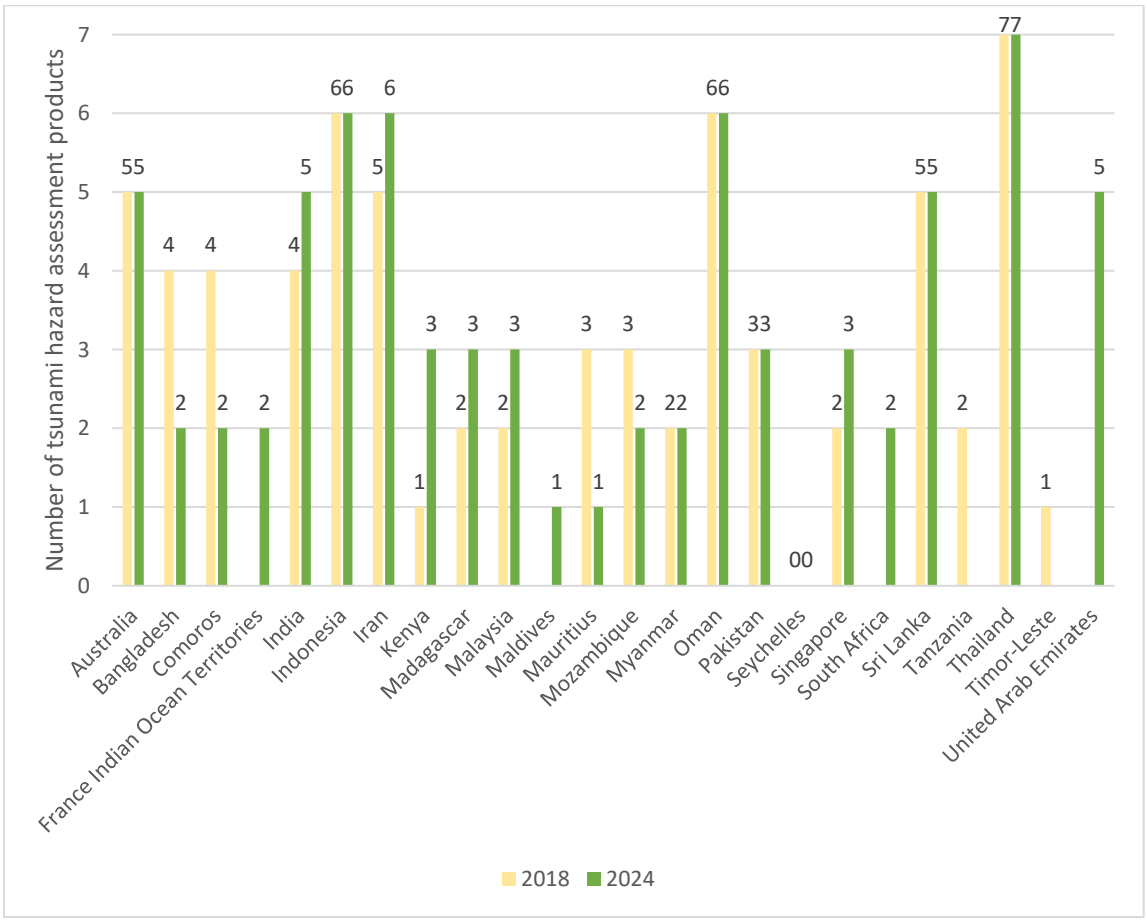

Figure 22. Number of tsunami hazard assessment products.

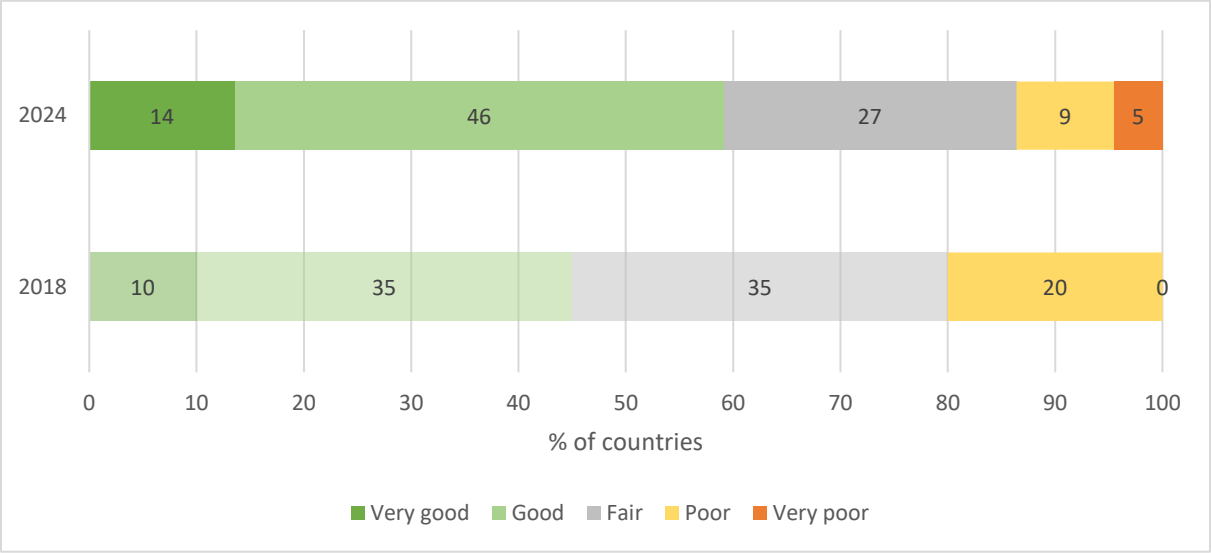

Figure 23: Capacity to undertake tsunami hazard assessments.

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 23). The responses indicate wide ranging capacity across the 22 respondent countries. 13 countries (59%) rate themselves as having very good or good capacity to undertake tsunami hazard assessments, while six countries (27%) rate themselves as having fair capacity. Three countries (14%) rate themselves as having poor or very poor capacity.

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. The responses indicate that all areas require capacity improvement in at least some countries but using a weighted response across the twenty-two respondent countries, evacuation mapping was ranked as the highest priority for capacity improvement, followed by hazard mapping and inundation mapping (Table 2). The ranking for the 2018 survey results is indicated in brackets.

Areas of tsunami hazard assessment	RII	2024 Rank (2018 Rank)
Evacuation map	0.85	1 (1)
Hazard map	0.81	2 (2)
Inundation map	0.81	2 (3)
Deterministic tsunami hazard analysis	0.76	4 (4)
Probabilistic tsunami hazard assessment (PTHA)	0.75	5 (6)
Field studies on tsunami impacts	0.67	6 (5)

Table 2. Ranking of priority areas for capacity improvement in tsunami hazard assessment.
RII (Relative Importance Index) = WAxN (0≤R≤1) where W is the weightage given to each factor, A is the highest weight, and N is the number of respondents.

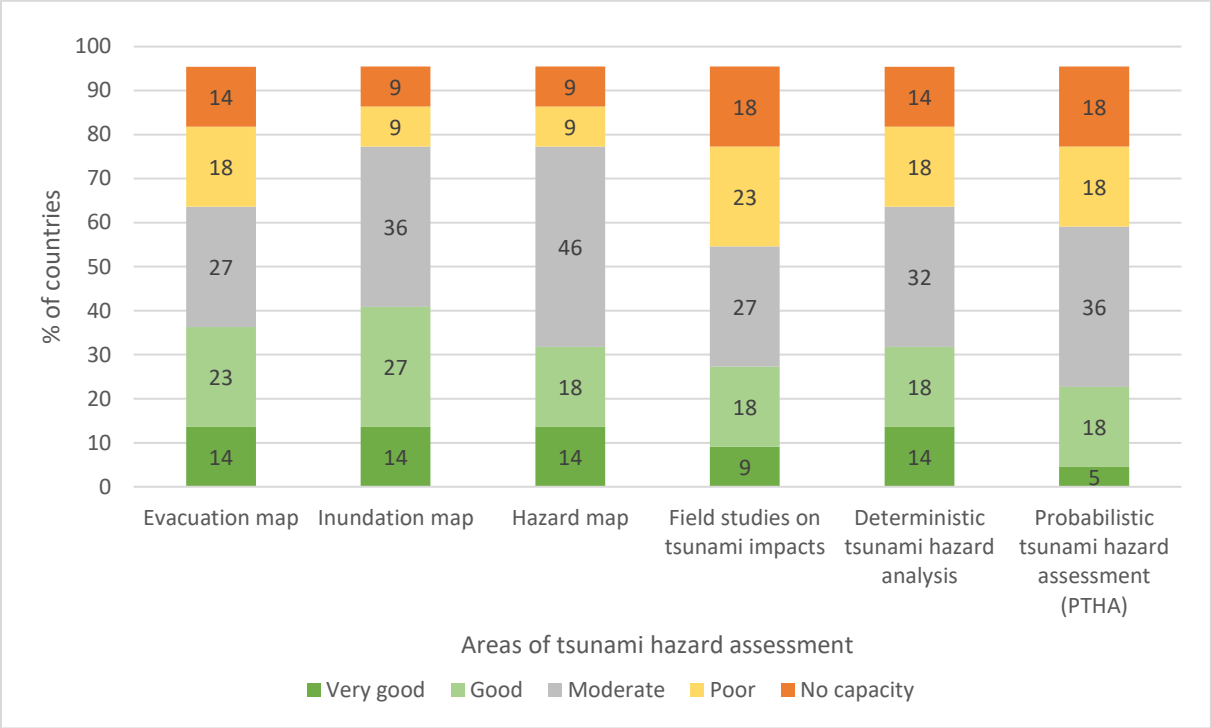

Figure 24: Capacity to give training and/or consultancy on tsunami hazard assessment to other countries.

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 24).

The results indicate that there is capacity among the respondent countries to deliver training and/or consultancy in all six areas of tsunami hazard assessment. It is highest for inundation mapping (>40% of countries) and lowest for PTHA and field studies on tsunami impacts (<30% of 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 19 of the 22 countries participating in this survey (86%) conduct tsunami risk assessments.

Figure 25 shows the type of risk assessment carried out by each country. 12 countries (55%) report conducting a multi-hazard risk assessment that includes tsunami, five countries (23%) a single hazard assessment on tsunami AND a multi-hazard assessment including tsunami, and two countries (9%) a single hazard assessment on tsunami only.

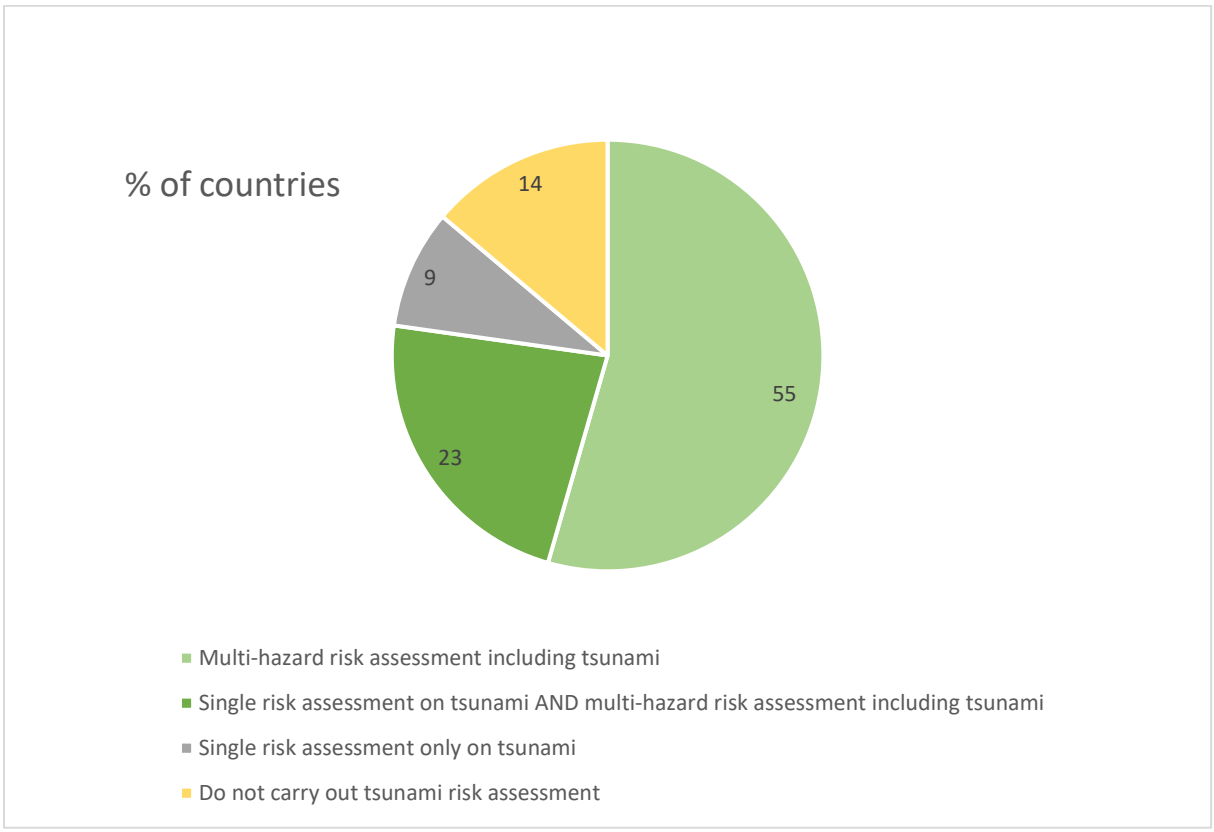

Figure 25. Types of risk assessment.

All 17 countries that carry out multi-hazard risk assessments include tsunami, while flooding, cyclones and earthquakes considered by 60% or more of countries (Figure 26).

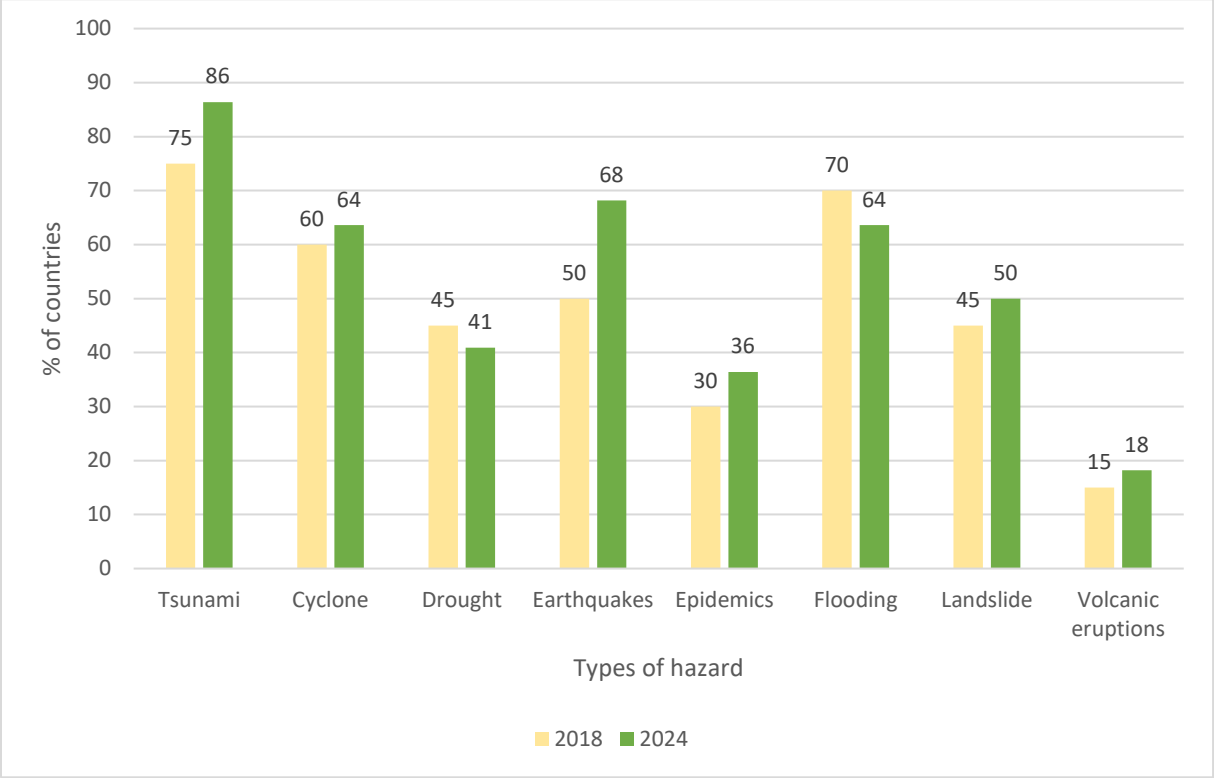

Figure 26. Types of hazards included in the multi-hazard risk assessment.

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 27). However, in 68% of countries a national agency is fully or partially responsible. Other organisations include an international agency, national or local university or international consultant, although each in less than 20% countries. In six countries (27%), the tsunami risk assessment is the responsibility of multiple actors.

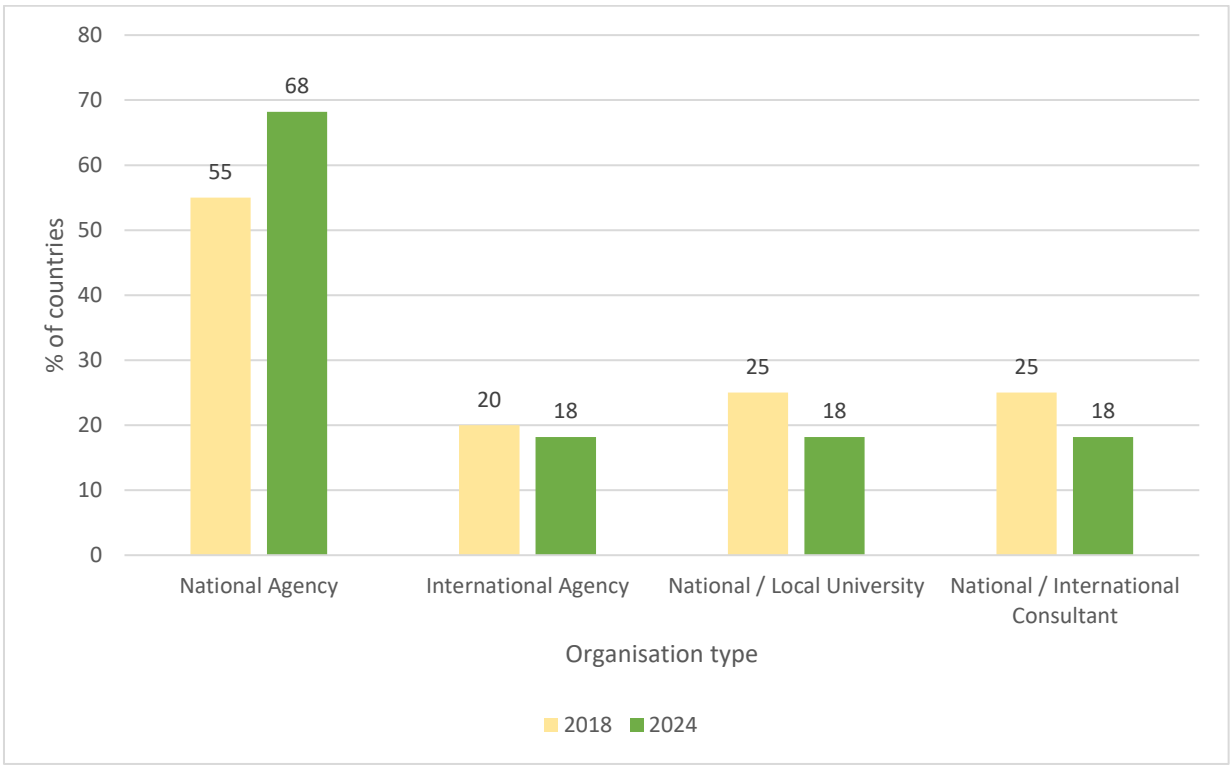

Figure 27. Organisation(s) responsible for the tsunami risk assessment.

Of the countries that carry out tsunami risk assessments, 11 conduct them at the national level, and eight at a regional and or city level (Figure 28). Village (seven) and/or community (four) level assessments are less common. Nine countries carry out risk assessment at multiple levels.

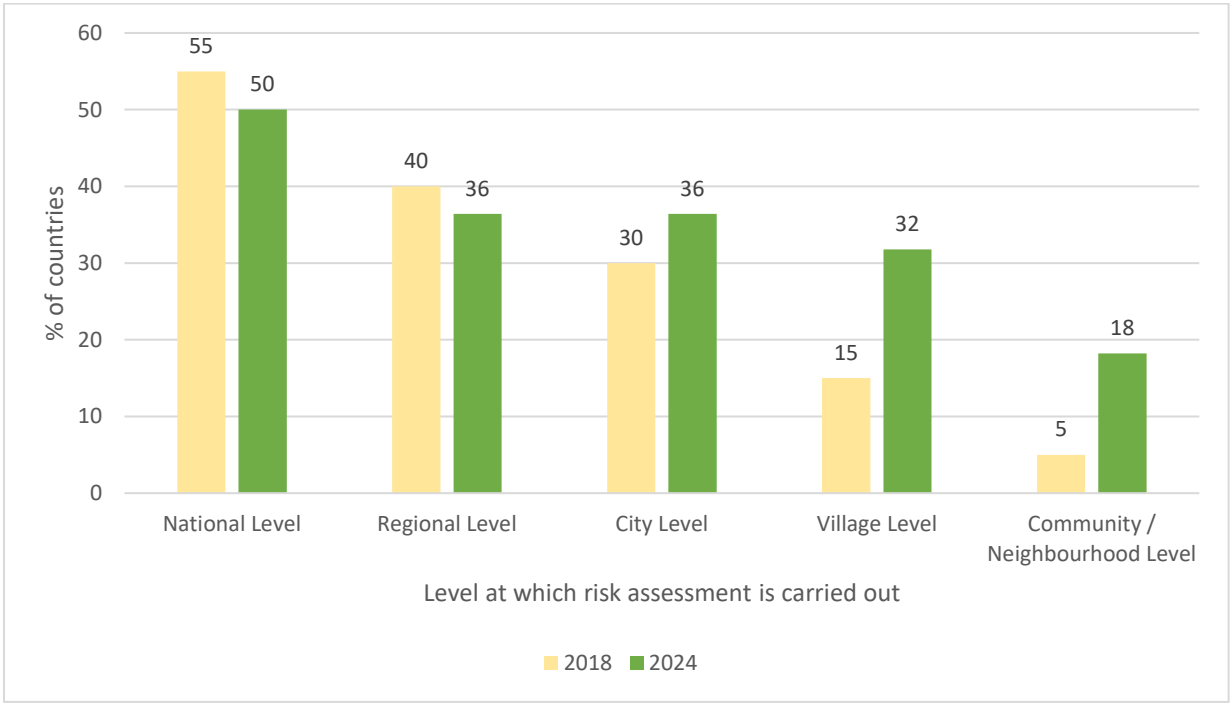

Figure 28. Levels at which the tsunami risk assessment is carried out.

Countries were then asked to identify the type of products that emerge from the tsunami risk assessment.

The number and type of products developed from the tsunami risk assessment varies across the respondent countries (Figure 29). A risk map is produced by 17 of the countries (77% of all countries) that conduct tsunami risk assessments. 50% or more countries also produce evacuation maps and/or guidelines from the risk assessments. Action plans remain a less common output, with just 32% countries producing them. 15 countries develop two products or more.

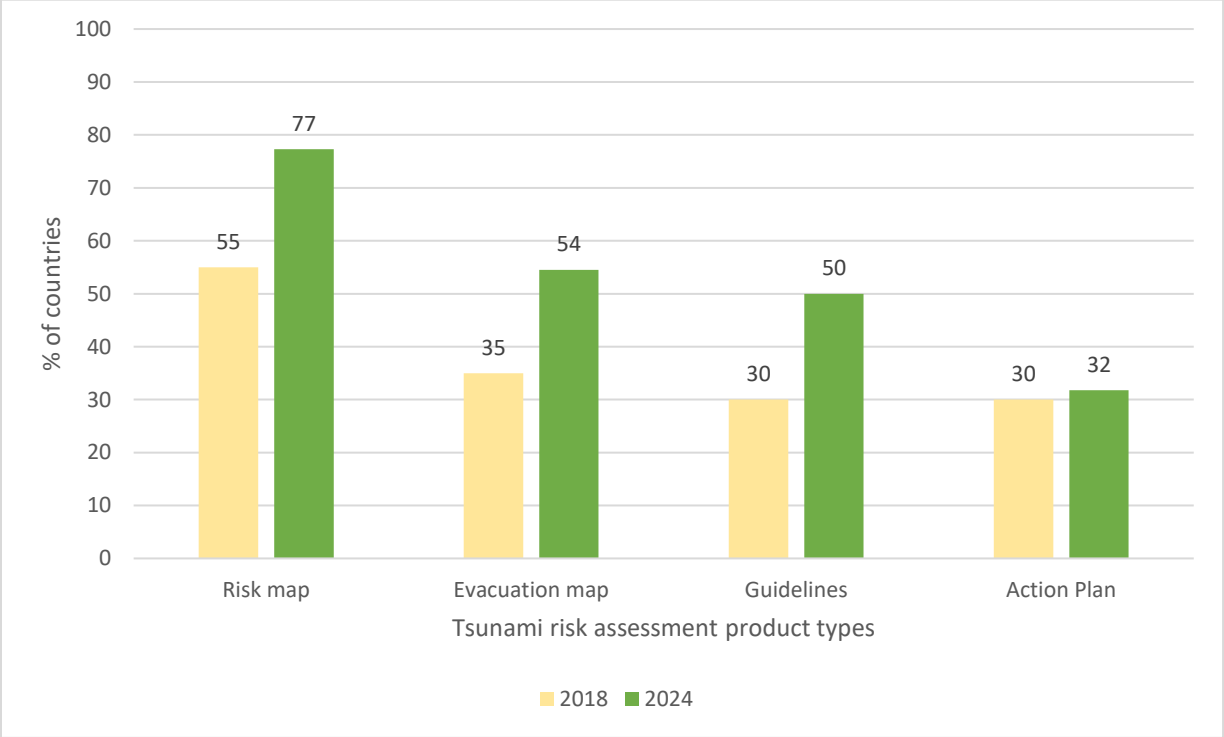

Figure 29: Types of products to emerge from the tsunami risk assessment.

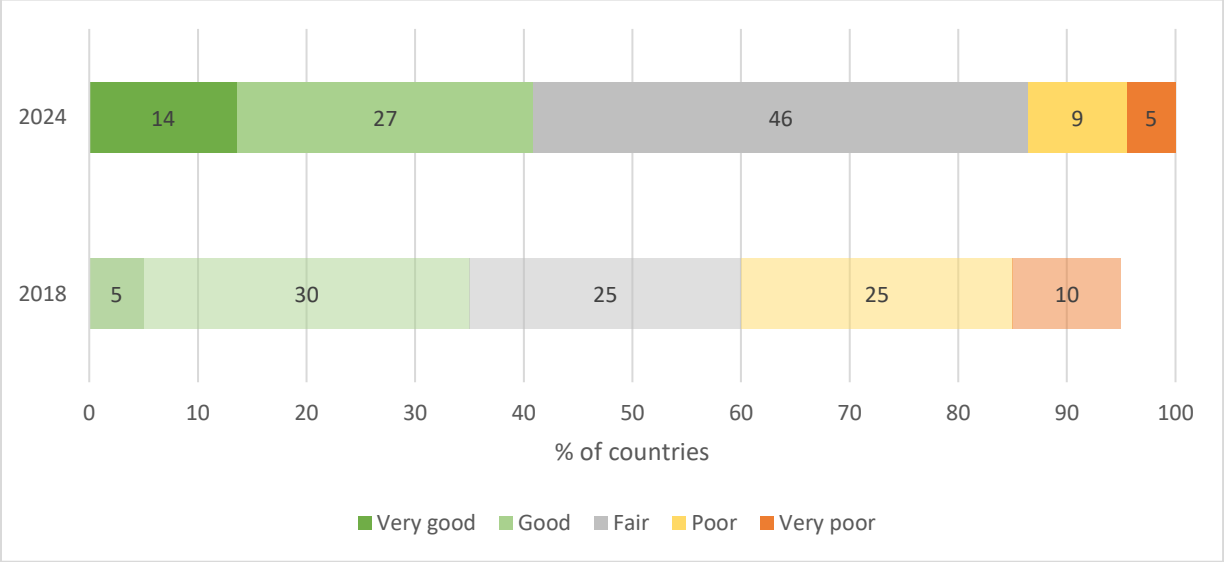

Figure 30: Capacity to undertake tsunami risk assessment.

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 indicate wide ranging capacity across the 22 respondent countries (Figure 30). Over 85% of countries rates their capacity as fair or better, with over 40% of countries rating their capacity as very good or good. However, three countries (14%) still rate themselves as having poor or very poor capacity.

Using a similar approach, each country was then asked to rate their priorities for capacity improvement across five levels of tsunami risk assessment, using a five-point scale, from not a priority to essential. The responses indicate that all areas require capacity improvement in at least some countries (rated as essential priorities), but using a weighted response across the twenty respondent countries, city level risk assessment is ranked as the highest priority for capacity improvement, followed by national and regional levels (Table 3).

Priority level	RII	2024 Rank (2018 Rank)
Tsunami risk assessment at city level	0.82	1 (1)
Tsunami risk assessment at national level	0.79	2 (4)
Tsunami risk assessment at regional level	0.78	3 (5)
Tsunami risk assessment at village level	0.75	4 (2)
Tsunami risk assessment at community / neighbourhood level	0.74	5 (3)

Table 3. Priorities for capacity improvement in tsunami risk assessment.
RII (Relative Importance Index) = WAxN (0≤R≤1) where W is the weightage given to each factor, A is the highest weight, and N is the number of respondents.

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 31). The results suggest that for each level of risk assessment, 50% or more countries have at least moderate capacity to give training and/or consultancy to other countries, with several countries also reporting good or very good capacity at each level.

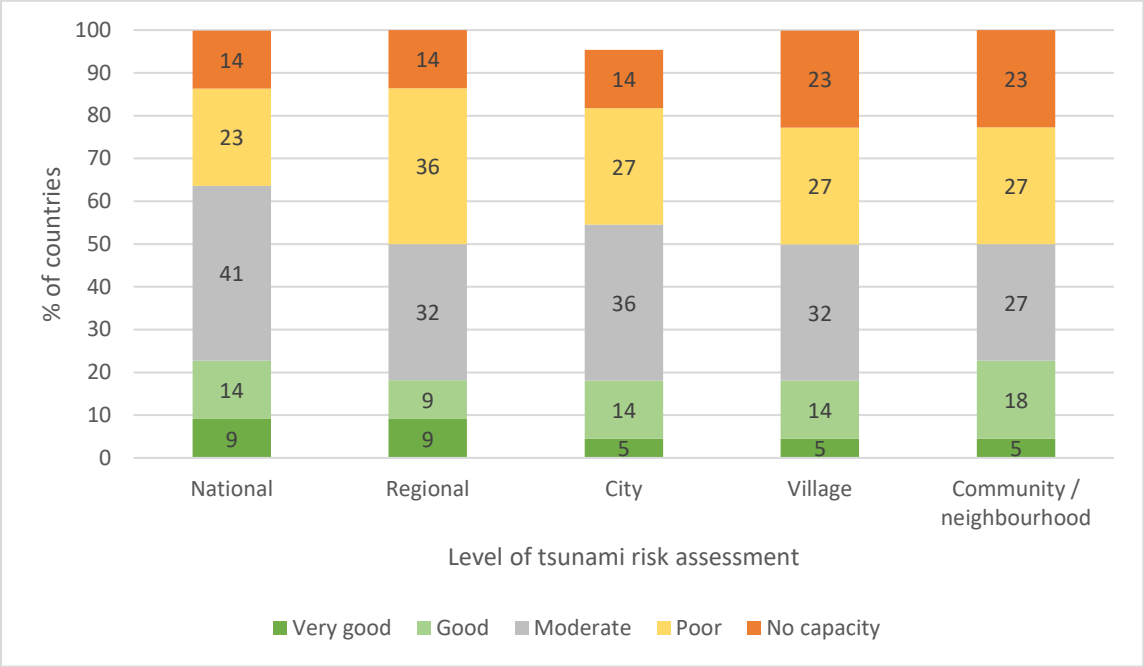

Figure 31. Capacity to give training on tsunami risk assessment.

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 32). Nine countries (41%) rely solely on the data provided by the IOTWMS Tsunami Service Providers (TSPs) to identify CFZs, while 12 (55%) countries use TSP data and their own threat assessment data. One country relies solely on their own threat assessment data.

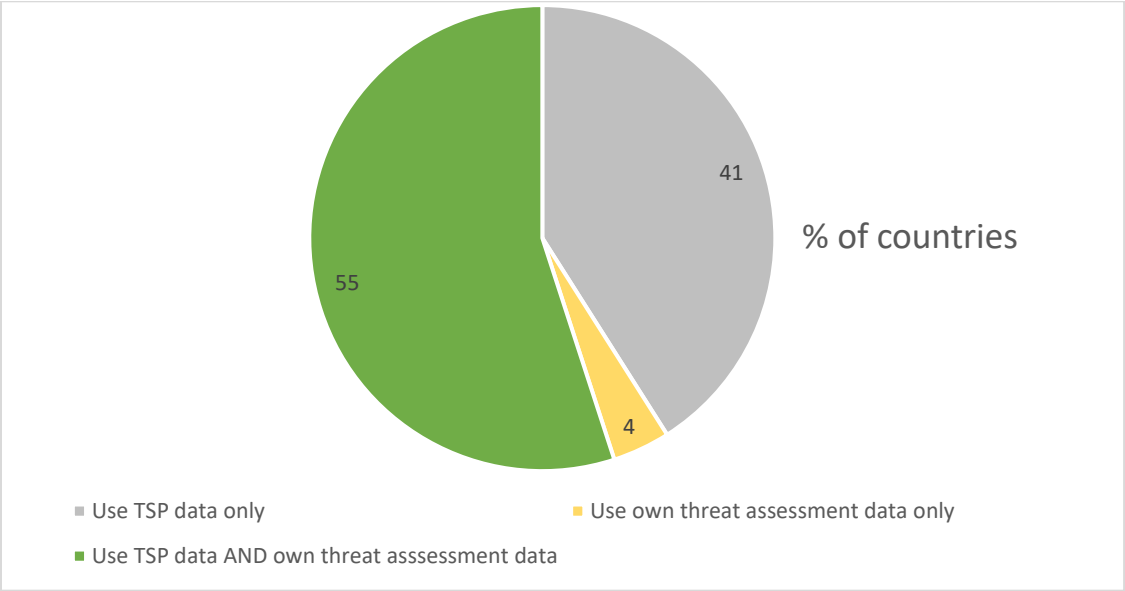

Figure 32. Data use for the Coastal Forecast Zones (CFZ) of a country's coastline to determine national threats.

Twenty (20) of the 22 respondent countries (91%) reported that the organisation responsible for assessing and/or receiving potential tsunami threat information operates 24x7. Comoros and Iran reported operating weekdays and daytime only due to a lack of resources.

Countries were also asked to confirm what type of infrastructure is available to enable 24x7 operations (Figure 33). Computers and the internet were reported by 100% of respondents, while mobile phones or cell phones were reported by 21 of the 22 countries (96%). Landline, GTS and UPS were also widely reported (over 75%). Fax is also available in a majority of countries, while Satellite phones and VSAT were reported by 32% of respondents or less.

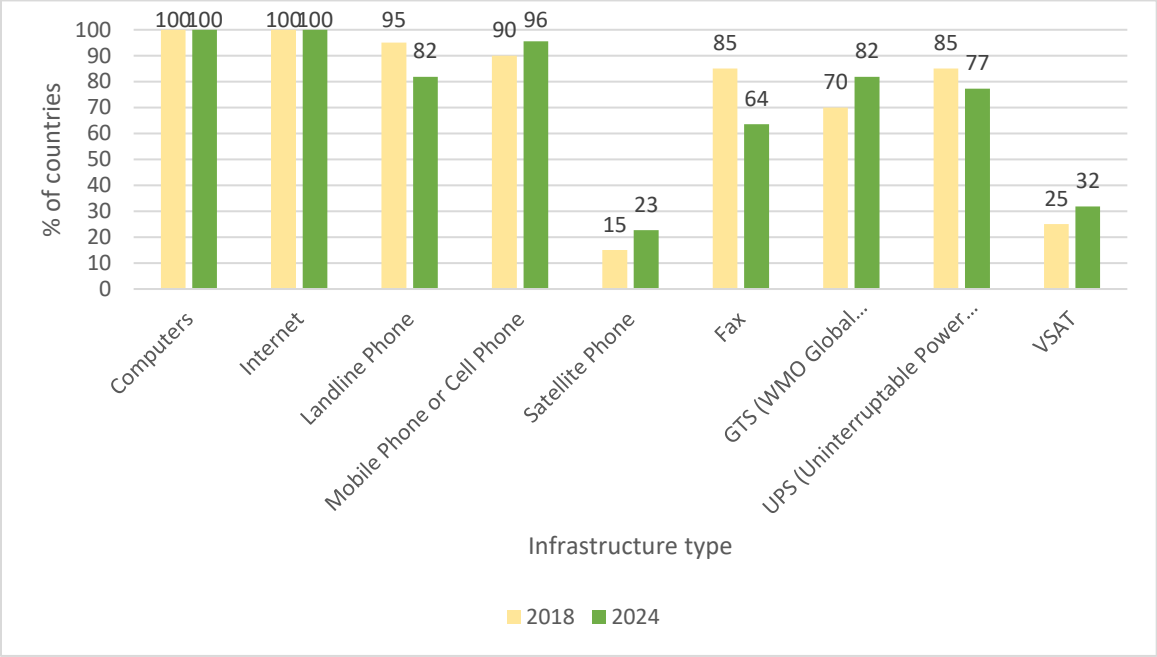

Figure 33. Infrastructure availability to support 24x7 operations.

Countries were asked to report the level of tsunami threat forecast information produced by the responsible organisation (Figure 34). Eighty-two percent (82%) of countries reported producing national level threat forecast information, while 73% of countries produce local level information. Six countries (32%) reported producing ocean-wide information. Seventy-three percent (73%) of countries reported producing multiple levels of tsunami threat forecast information.

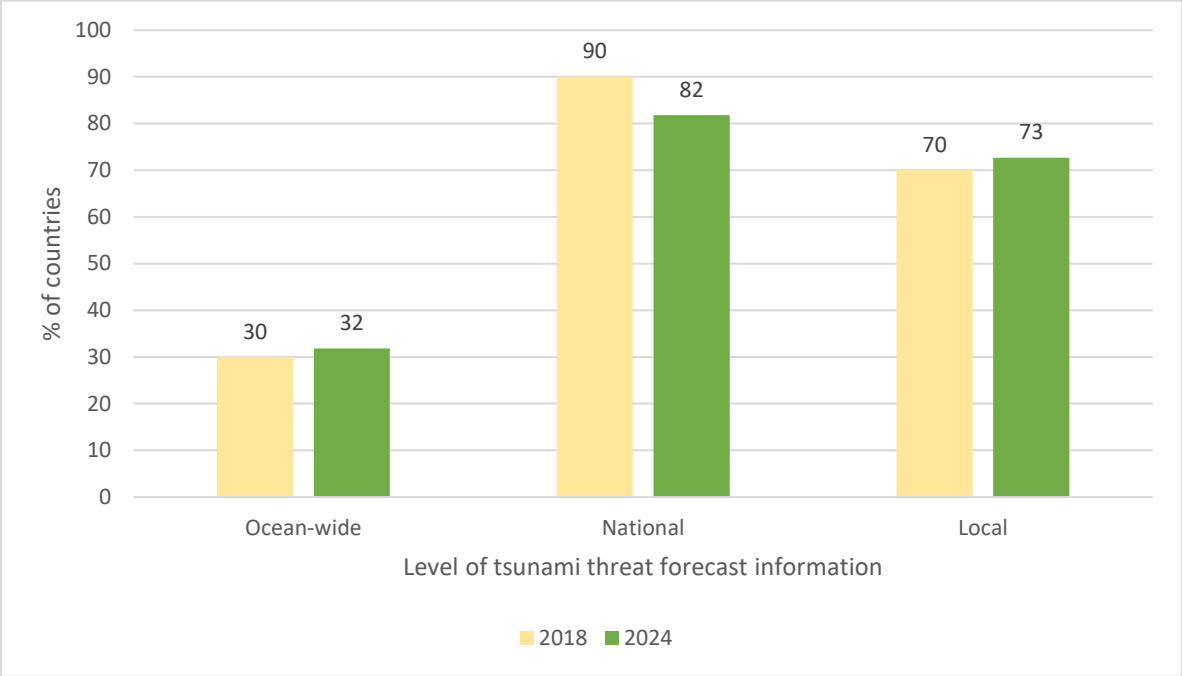

Figure 34. Level of tsunami threat forecast information is produced by the responsible organisation.

Countries were also asked about their access to national or international seismic networks, and access to national or international sea-level networks.

Twenty (20) of the respondent countries (91%) reported that the responsible organisation has access to national or international seismic networks, with 19 having access to both national and international networks.

Nine (9) of the respondent countries (41%) reported that all national seismic data is shared in real time, while ten (46%) countries reported that some national seismic data is shared in real time.

Fifty percent (50%) of respondent countries reported having access to GNSS data.

Fifty-nine percent (59%) of respondent countries reported that the list of broadband seismometers operated by their country is listed accurately in the IOTWMS seismic database. Seven countries reported that stations had been added to their network when compared to the database listing, while one reported that some stations have been decommissioned.

Sixty-eight percent (68%) of respondent countries reported that they have access to national or international sea level networks, with most of those having access to both national and international. Eight (36%) countries share all their national sea level data in real time, while four (18%) countries share some sea level data in real time.

Sixty-eight percent (68%) of respondent countries reported that the list of sea level stations operated by their country is listed accurately in the IOTWMS sea level database. One country reported that stations had been added to their network when compared to the database listing, while two reported that some stations have been decommissioned.

Countries were also asked about other national observing networks used for tsunami early warning (Figure 35). 12 (55%) countries reported that they operated no other observing networks, and one country did not provide a response. Four (18%) respondent countries

reported operating GNSS/GPS, and three (14%) reported operating coastal radars. Three (14%) identified other observing networks they operate, including Wave Radar and Tidal Wave.

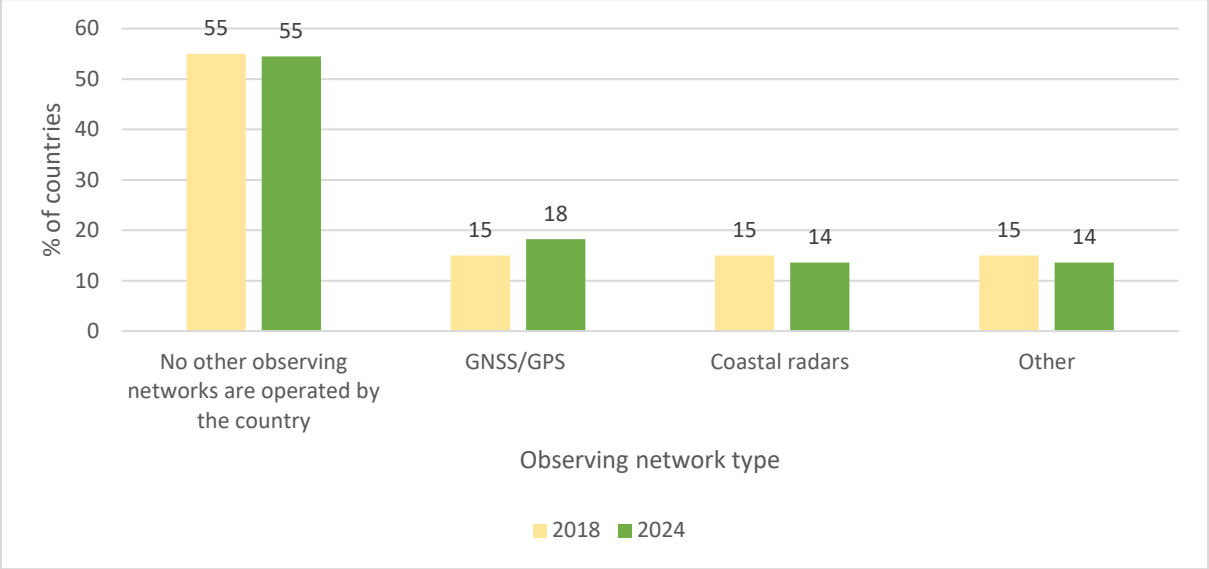

Figure 35. Other observing networks operated and used for tsunami early warning.

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.

Twelve (12) or 55% of respondent countries reported having the capability of analysing real-time seismic and sea-level data for potential tsunami threat. Software tools used for this purpose vary greatly across the countries. Examples include: SeisComP3, JISView, Linuh, OTPAS (Operational Tsunami Prediction and Assessment System), Toast, Antelope, SeisAn, CSDP-IAS (Seismic data Analysis), Tide tool, Bulletin Hydra, and in-house developed applications for analysis of sea-level data.

Ten (10) or 46% of respondent countries also reported having the capability for tsunami modelling to support generation of threat forecasts. A range of software tools are used across the countries. Examples include: 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.

Seventeen (17) or 77% 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. Twenty (20) or 91% of the respondent countries reported that their country's NTWC and/or TWFP participated in the six-monthly communications tests conducted by the IOTWMS TSPs. France Indian Ocean Territories reported that it did not participate due to a lack of time.

Twenty-one (21) of the respondent countries (96%) reported that their country's NTWC and/or TWFP participated in the Tsunami Drill (e.g. IOWave) conducted in the inter-sessional period. Mozambique reported that it did not participate.

Countries were also asked to report on any recent experiences of tsunami, specifically those that occurred after 2004, and the national response to those events. Four countries reported tsunami events.

France Indian Ocean Territories reported that in 2004 and 2007, Mayotte experienced two tsunamis following earthquakes that occurred in Indonesia, in the northeastern area of the Indian Ocean. No damage was noted.

Indonesia reported its standard response to tsunami events.

Australia reported several events. For HTHH Volcanic eruption of 15 January 2022, a Marine Warning issued for Norfolk Island, three hours after the eruption, later upgraded to Land Warning, Marine Warning also issued for Lord Howe Island and later upgraded to Land Warning with local emergency service ordered evacuation which took place overnight. Marine Warning was also issued for most of the Australian east coast. These warnings were verified well against many sea level observations. M7.9 Kermadec Islands of 05 March 2021. Timely Marine Warning issued for Norfolk Island and verified well by observations. Below threat waves also observed along east coast of Australia. M7.6 Loyalty Islands of 11 February 2021. Timely Marine Warning issued for Lord Howe Island and verified well with observations. No evacuation required but communities self-evacuated on the island. Below threat waves also observed along east coast of Australia. For the 11 Mar 2011 Japan event, JATWC issued a National No Threat Bulletin to Australia for this event. A few tide gauges in Australia recorded tsunami waves up to 55cm. Unusual currents and waves were noted at Port Kembla and Sydney Harbour. Several swimmers were washed into a lagoon at Merimbula NSW although inconclusive whether due to tsunami. Overall, the impact to Australia was minor. On 17 Jul 2006, the Java event generated a very localised impact to Steep Point of Western Australia (WA) where a camp site was destroyed and evidence of inundation to 200m inland. No tsunami warning was issued with the JATWC still being built. A field impact assessment survey was subsequently conducted. Tide gauge observations along the WA coasts provided little clue to this very localised impact.

India reported that there was no event which generated a major tsunami that impacted the country after December 2004. However, on 11 April 2012 twin events (M 8.5 & M 8.2) generated a minor tsunami, NTWC-India issued appropriate bulletins for those events.

Seventeen (17) countries also reported enhancements to their national warning SOPs and alerting since 2018. A wide range of enhancements were reported, including implementation of a cell broadcast system to broadcast alerts, review of national warning SOPs and/or response plans, quality management certification, changes to threat levels and mandates, and monitoring of non-seismic tsunami such as due to volcanic activity and landslide

3.3.2 Dissemination

Countries were asked to report on how their tsunami information (warning, public safety action, etc.) is disseminated (Figure 36). Email, SMS, Radio and Television remain in widespread use (>90% of countries). There are however notable changes in the reporting from the results in the 2018 survey, including a reduction in the number of responding countries that report using of Fax (85% to 50%) and an increase in the proportion of responding countries that report using social media (65% to 96%).

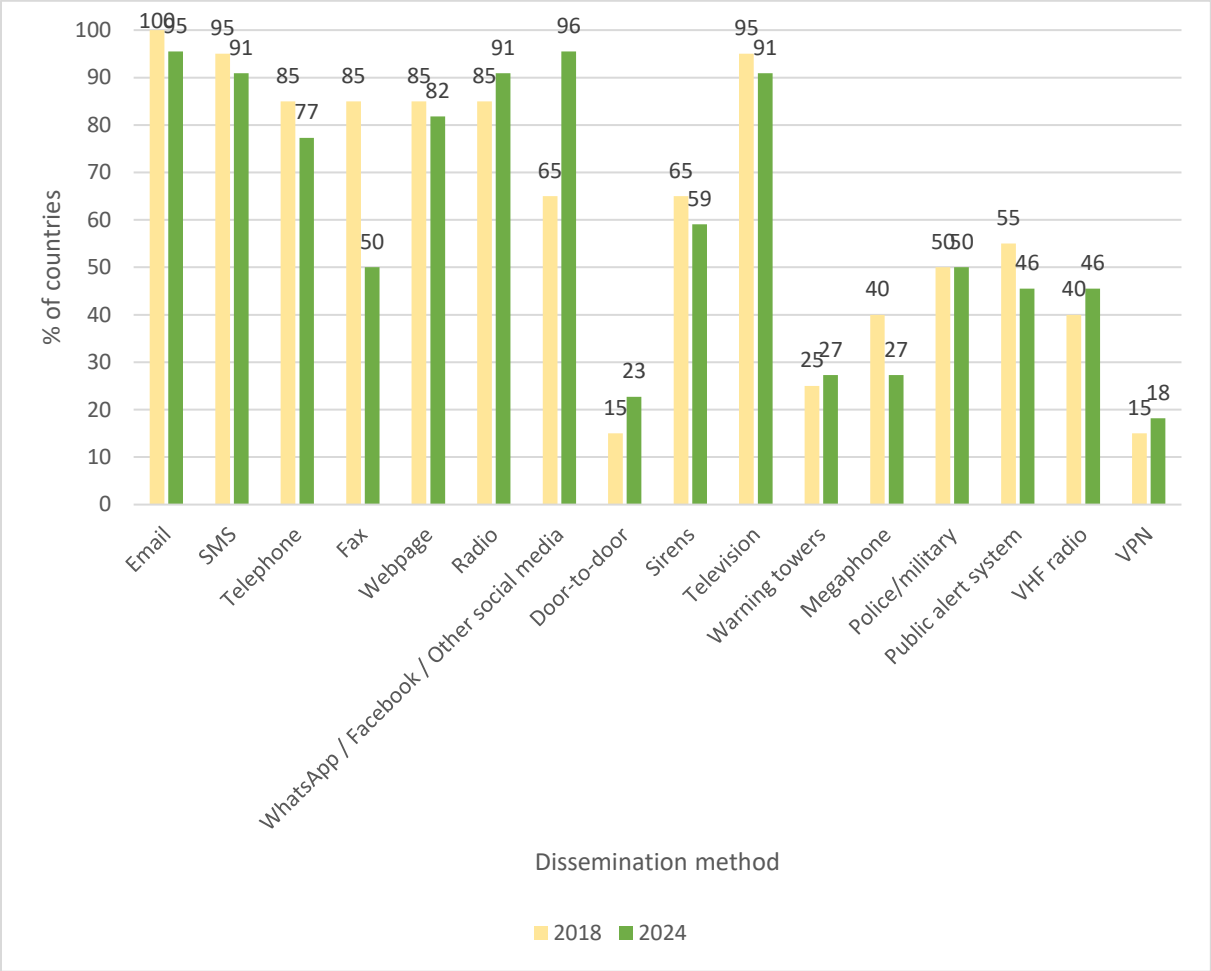

Figure 36. How tsunami information is disseminated.

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 37).

The responses indicate that most countries have SOPs that address the operation of a 24/7 emergency operation centre (86%), receiving information from the NTWC (96%) and response criteria and decision making (91%). However, these results also indicate that many countries still require support to develop SOPs in all three aspects (55 – 68%). They also require support to develop human resources in these areas, especially 24/7 emergency operations and response criteria / decision making (64 – 68%). Support to develop infrastructure across all three aspects is also required in many countries (55 – 64%).

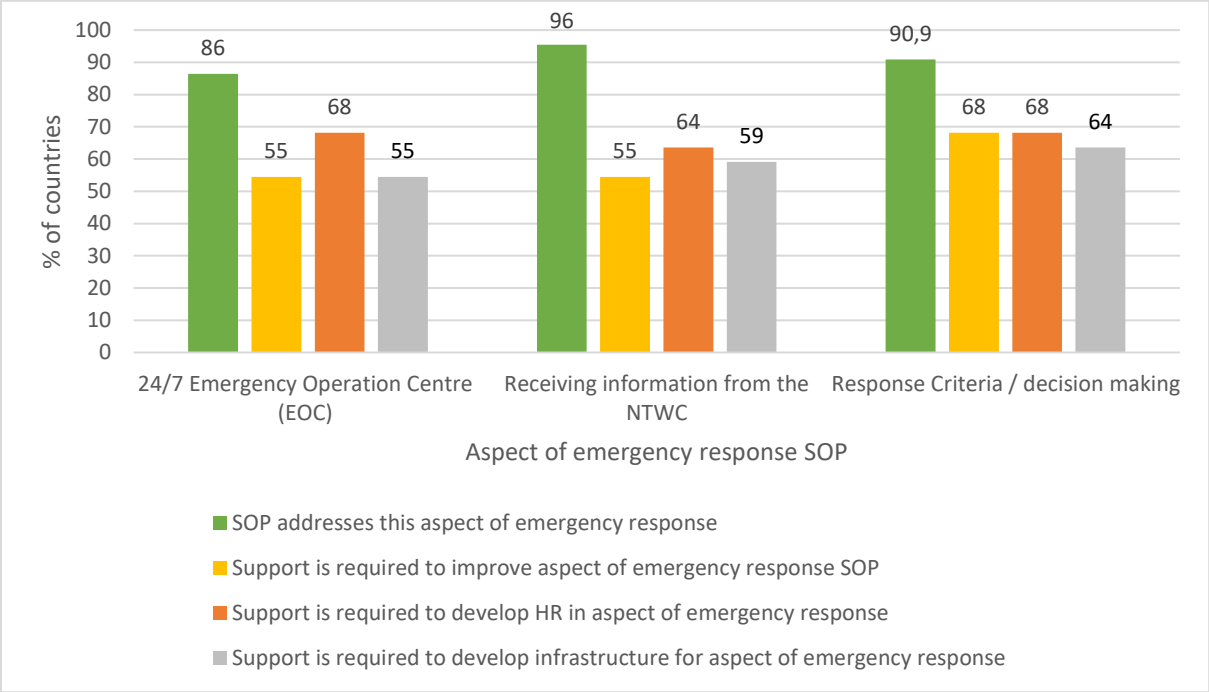

Figure 37. Support required to develop upstream emergency response SOP.

Using the same structure, countries reported on the availability of SOPs for emergency response during the downstream stages of tsunami early warning (Figure 38).

The responses indicate that more than 90% of countries have SOPs that address warning dissemination and communication with the NTWC, while more than 70% of countries have SOPs that address all aspects of emergency response.

However, despite widespread availability, a majority of countries still require support to develop SOPs (55 – 68%), support to develop human resources (59 - 68%) and support to develop infrastructure across all seven aspects (50 – 68%).

Twenty (20) of the countries indicated their willing to share SOPs with IOTIC and other countries.

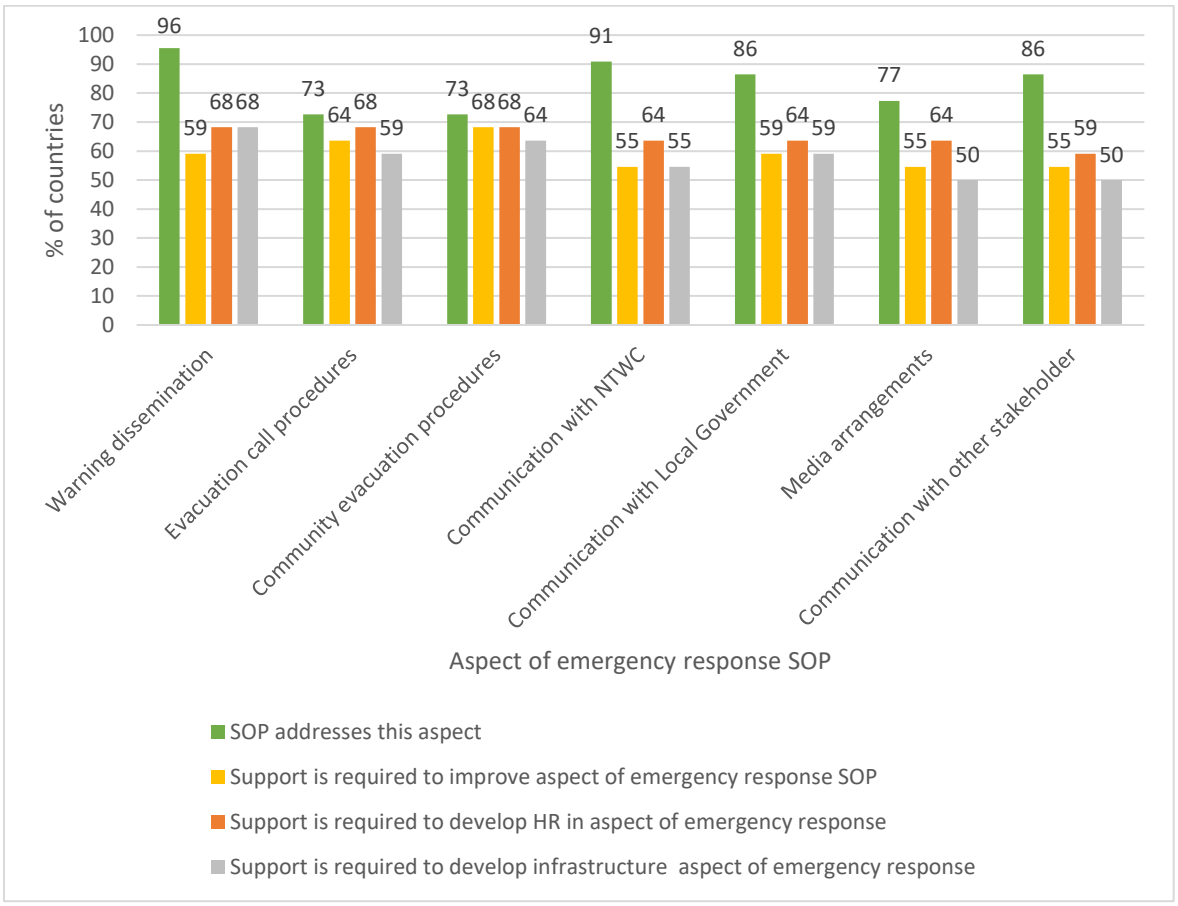

Figure 38. Support required to develop downstream emergency response SOP.

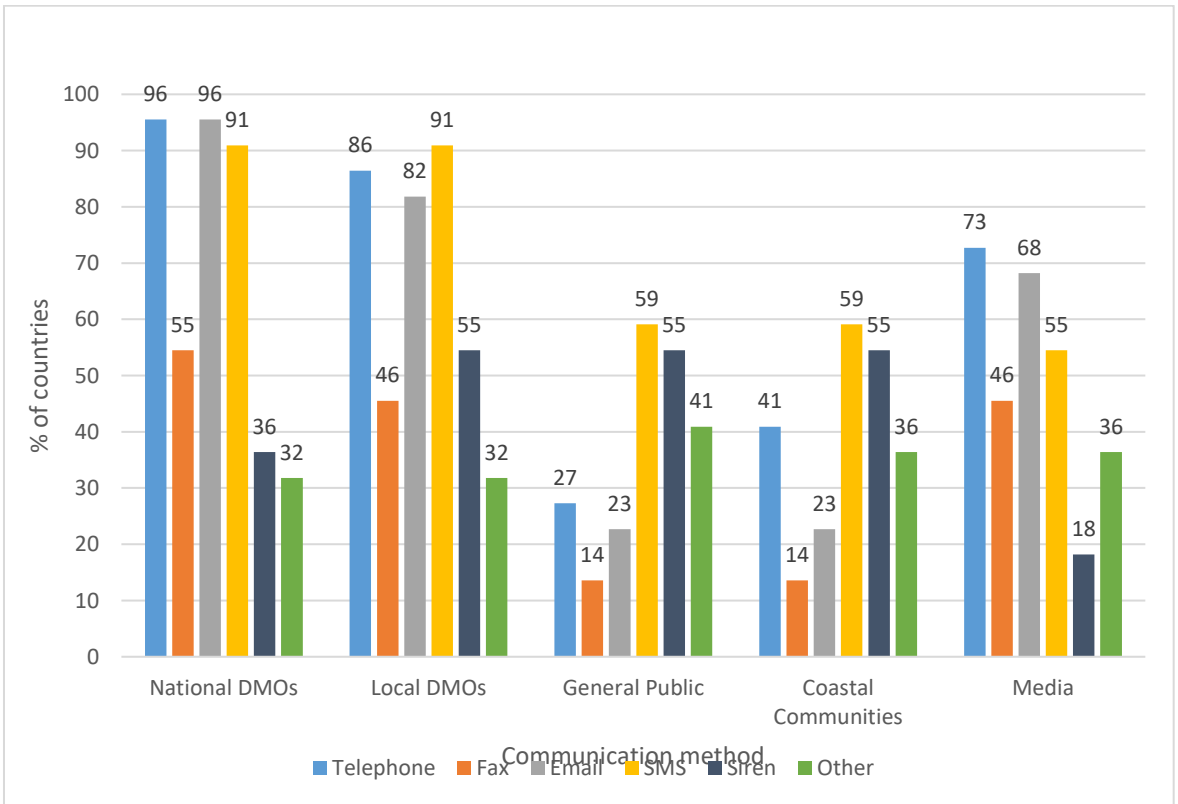

Figure 39. Communication methods for emergency response.

Respondents were asked to confirm the communication methods used in communicating and responding to emergency situations (Figure 39).

For National DMOs, telephones, email and SMS are all widely used in many countries (90% or more). The situation is similar for Local DMOs (80% or more). When compared to the group of countries responding in 2018, notably fewer countries reported using fax for National DMOs (90% to 55%) and Local DMOs (75% to 45%).

For communicating with the media, the telephone and email remain the most widely used methods, but again, use of the Fax is less than those countries who reported in 2018 (75% to 45%).

Unsurprisingly, the pattern of responses for the general public and coastal communities is similar, and more than 50% of countries use to some extent SMS and sirens to reach these groups.

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

3.4.2 Evacuation Infrastructure

Respondents were asked to indicate the availability of four different types of evacuation infrastructure in their country (Figure 40).

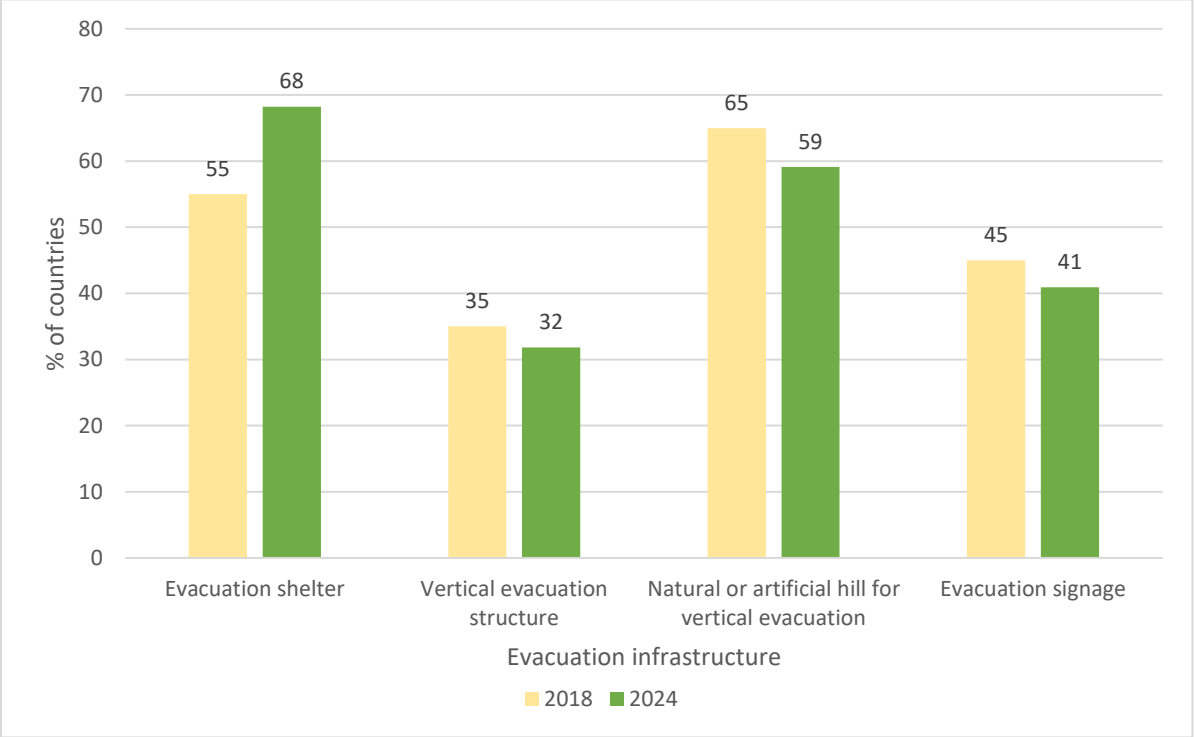

Figure 40. Evacuation infrastructure.

The results reveal more provision of evacuation shelters within countries when compared to the 2018 survey (55% to 68%), while Natural or artificial hills for vertical evacuation also remain widely reported and identified by 59% of countries. Evacuation signage (41%) and vertical evacuation structures (32%) remain less common.

Fourteen (14) countries (64%) also reported that evacuation infrastructure is incorporated into the evacuation plans.

3.4.3 Tsunami Exercises

Fourteen (14) or 64% of the respondent countries reported that they have tsunami exercises incorporated within their national policies and fourteen (14) or 64% have tsunami exercises incorporated within national guidelines. Six countries incorporated them within national policies and guidelines.

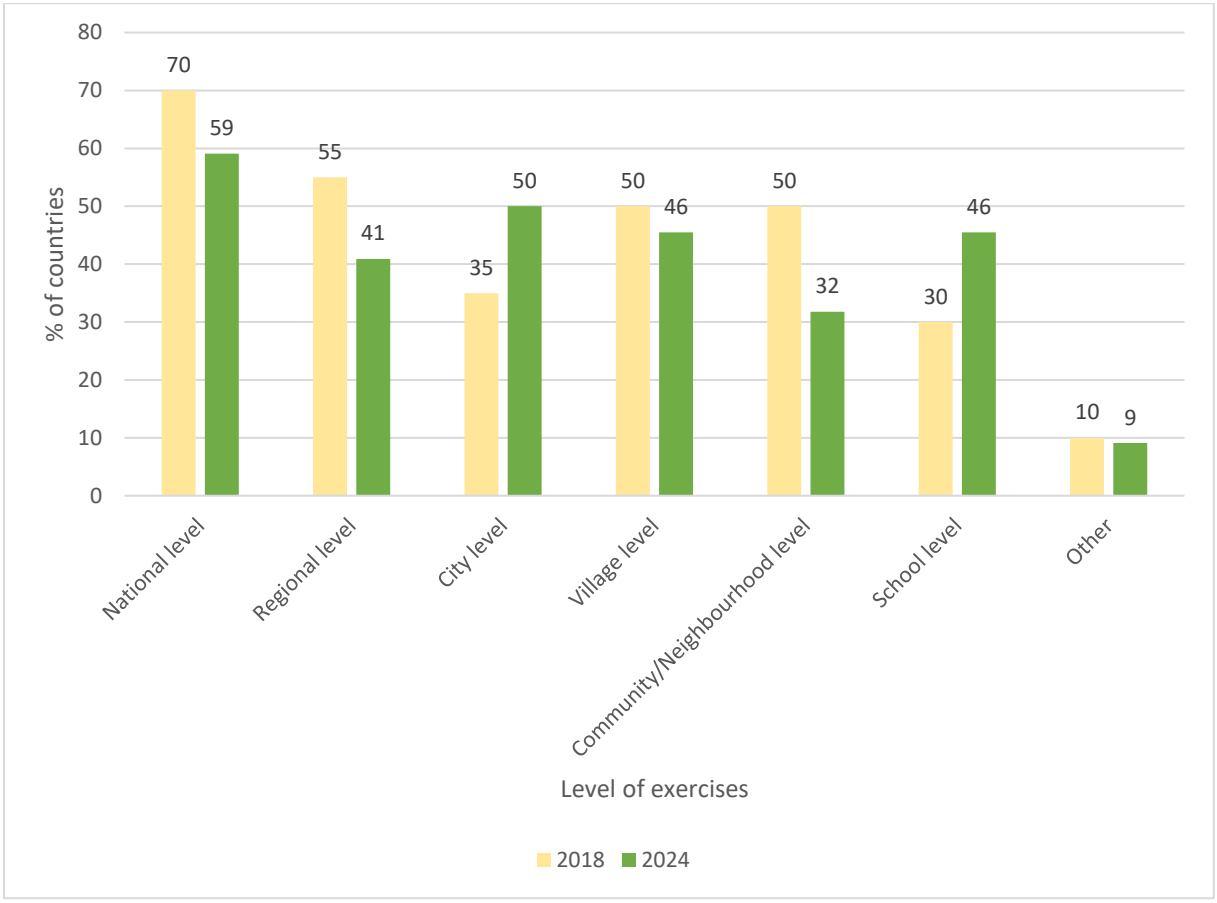

Figure 41. Levels of tsunami exercise conducted.

Twenty-one (21) respondent countries (96%) reported conducting tsunami exercises at one or more levels during the inter-sessional period (Figure 41).

Exercises were conducted at the national level within 59% of countries and at the regional, city, village and school levels in more than 40% of countries.

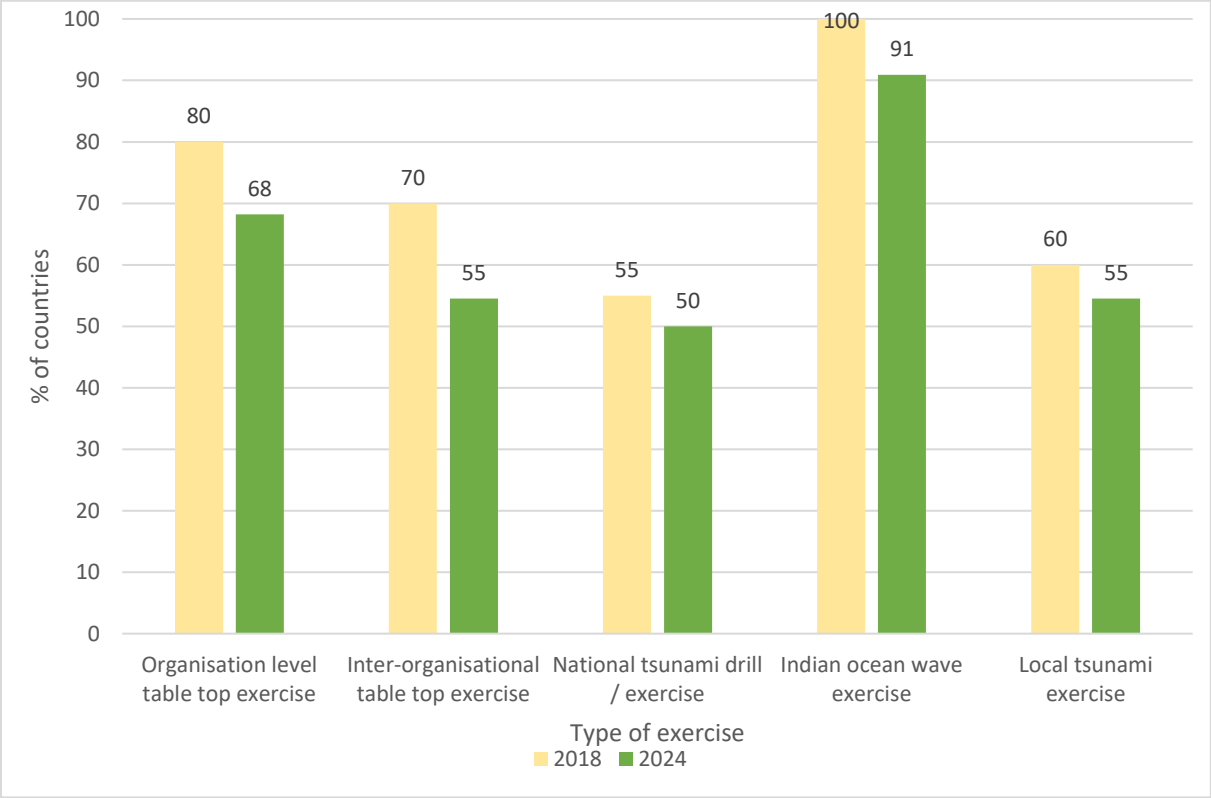

Figure 42: Types of tsunami exercise conducted.

Respondents were asked to report on the type of tsunami exercise activities that have been undertaken in their countries (Figure 42) during the inter-sessional period (between ICG Meetings).

Twenty (20) or (91%) of respondent countries reported that they took part in the Indian Ocean Wave exercise. Tabletop exercises (intra- and inter-organisational), as well as national and local tsunami exercises were all undertaken by 50% of respondent countries or more.

Despite this, the results show a smaller proportion of countries that reported conducting exercises when compared to those countries responding to the 2018 survey.

3.4.4 Public Awareness

Respondents were asked to identify the organisation responsible for tsunami public awareness programmes in their countries (Figure 43). In many countries the National Disaster Management Office takes responsibility (46%), but the National Tsunami Warning Centre (23%) and Local Disaster Management Office (9%) were identified by some countries. Several countries reported that is the responsibility of multiple organisations, including the NDMO, LDMO, NTWC and international organisations.

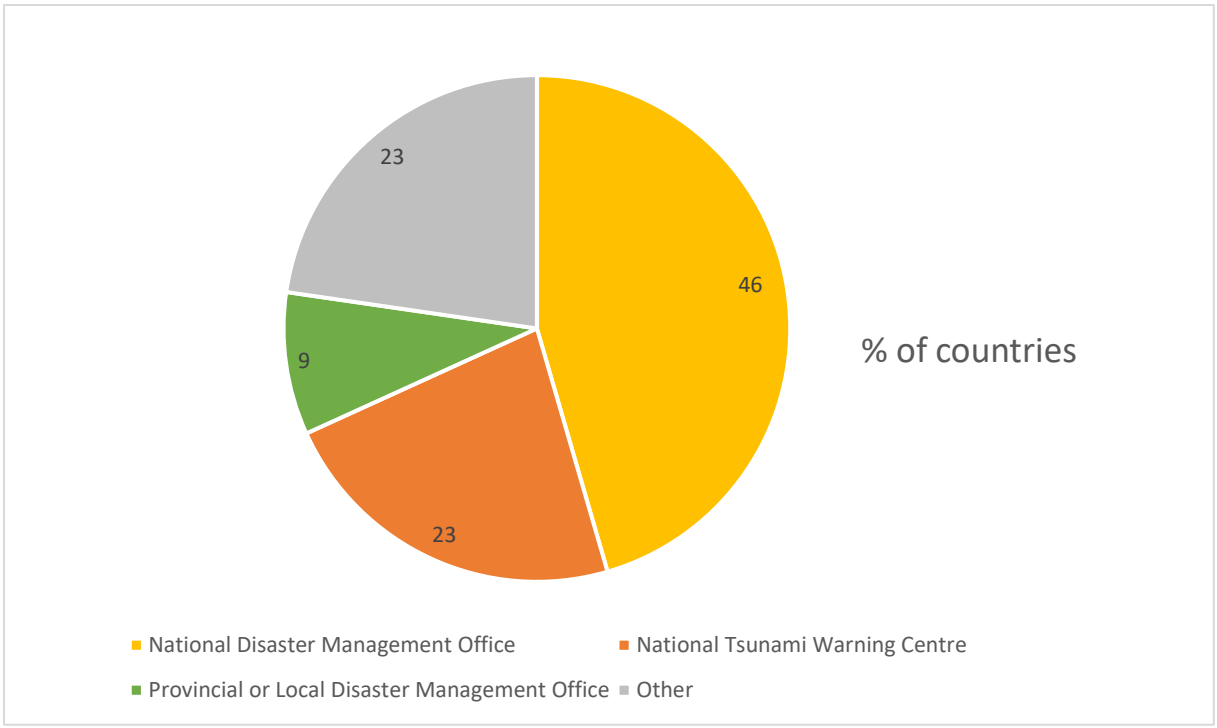

Figure 43. Organisation responsible for tsunami public awareness programmes.

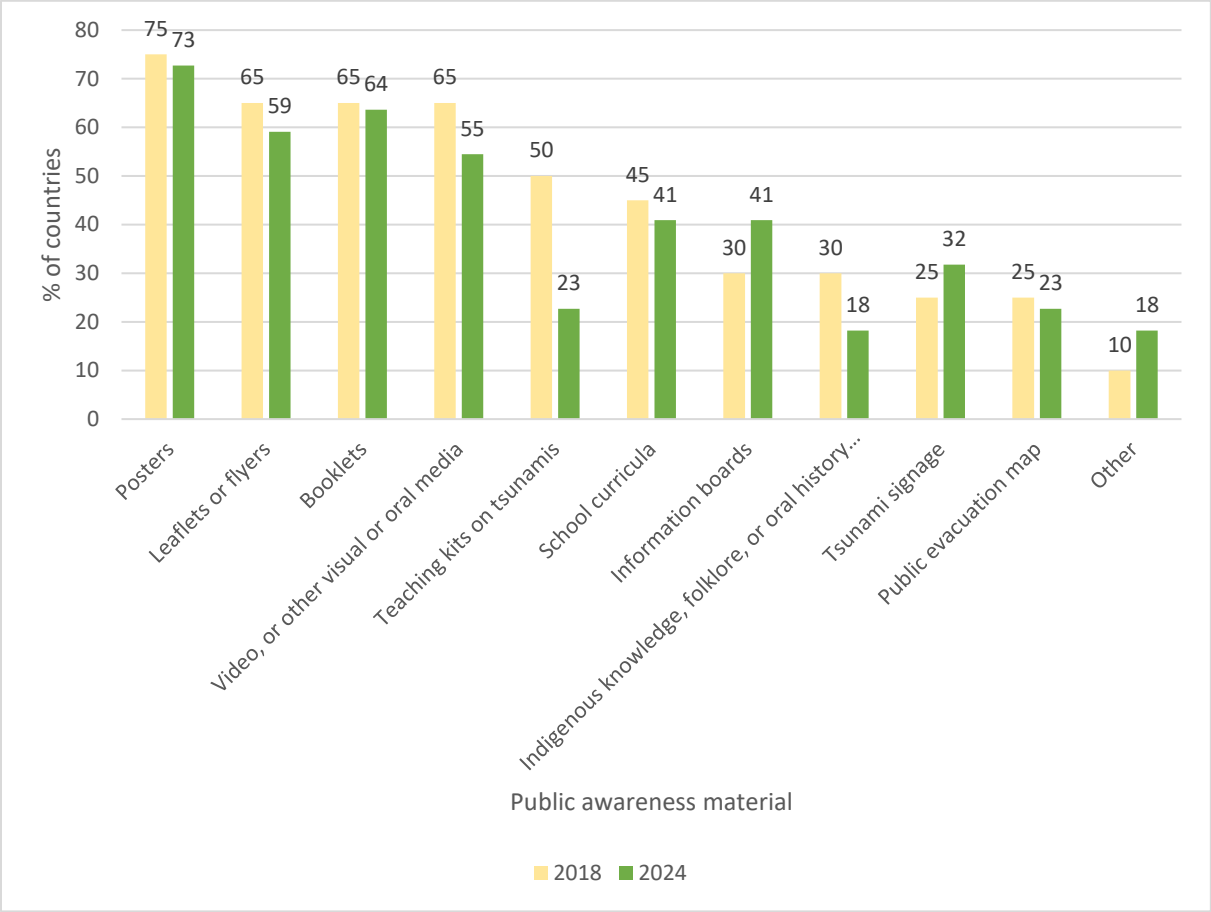

Figure 44: Types of public awareness materials.

Countries were asked to identify what tsunami-related education and awareness materials they have developed and used (Figure 44). In a similar outcome to 2018, posters, leaflets and flyers, booklets and video/oral media were identified by the majority of countries. Education materials such as information boards and school curricular (40%) were also used in many countries. Less common were the use of teaching kits, indigenous knowledge, signage and public evacuation maps. Among other responses, were a tailored-to-Australia online tsunami education resource called "Tsunami: The Ultimate Guide" and a sensitisation campaign.

Nineteen (19) of the respondent countries (86%) confirmed that they are willing to share these 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 45). The responses varied greatly across countries. School and child related awareness activities and tsunami exercises, as well as global awareness raising days were the most widely carried out across respondent countries. In particular, a greater proportion of countries reported activities linked to the Global Disaster Risk Reduction Day when compared to the countries responding to the 2018 survey (45% to 73%).

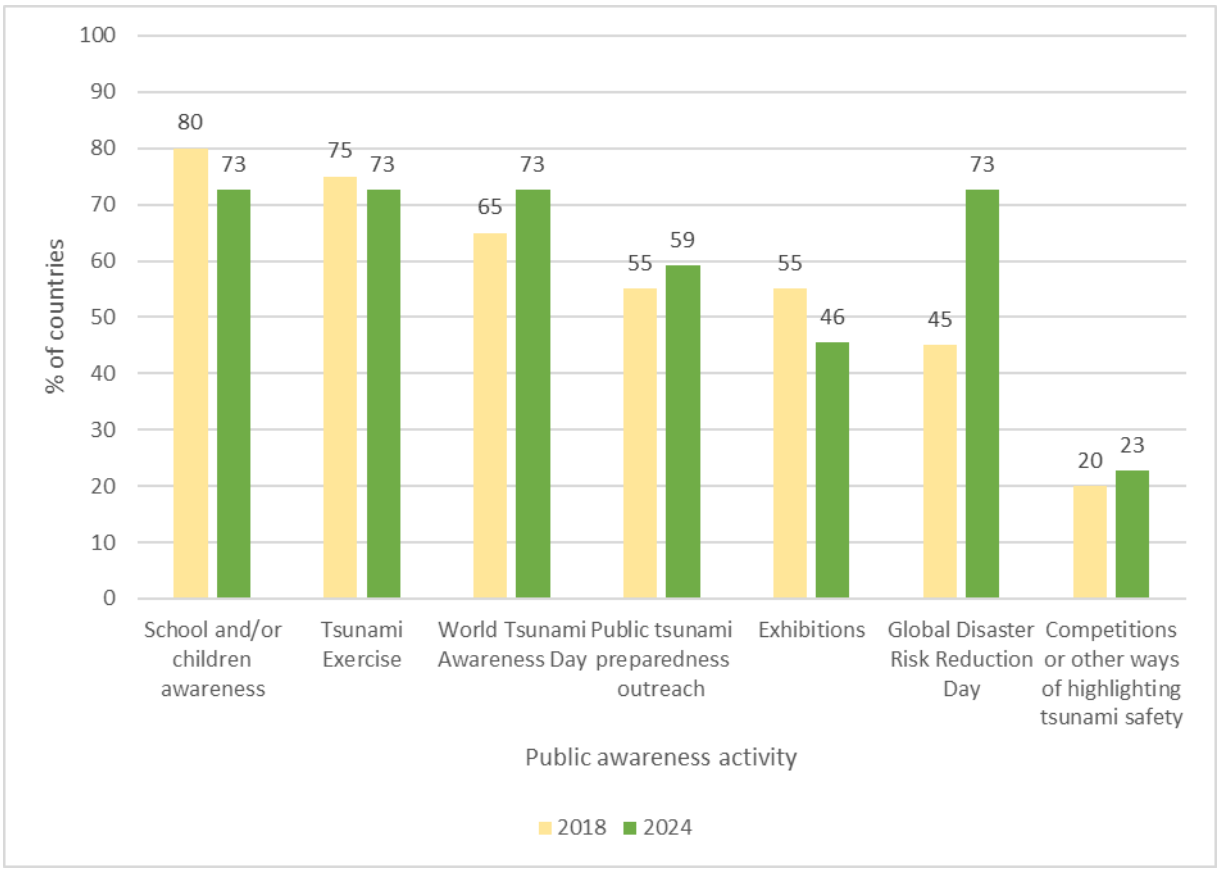

Figure 45. Types of public awareness activity.

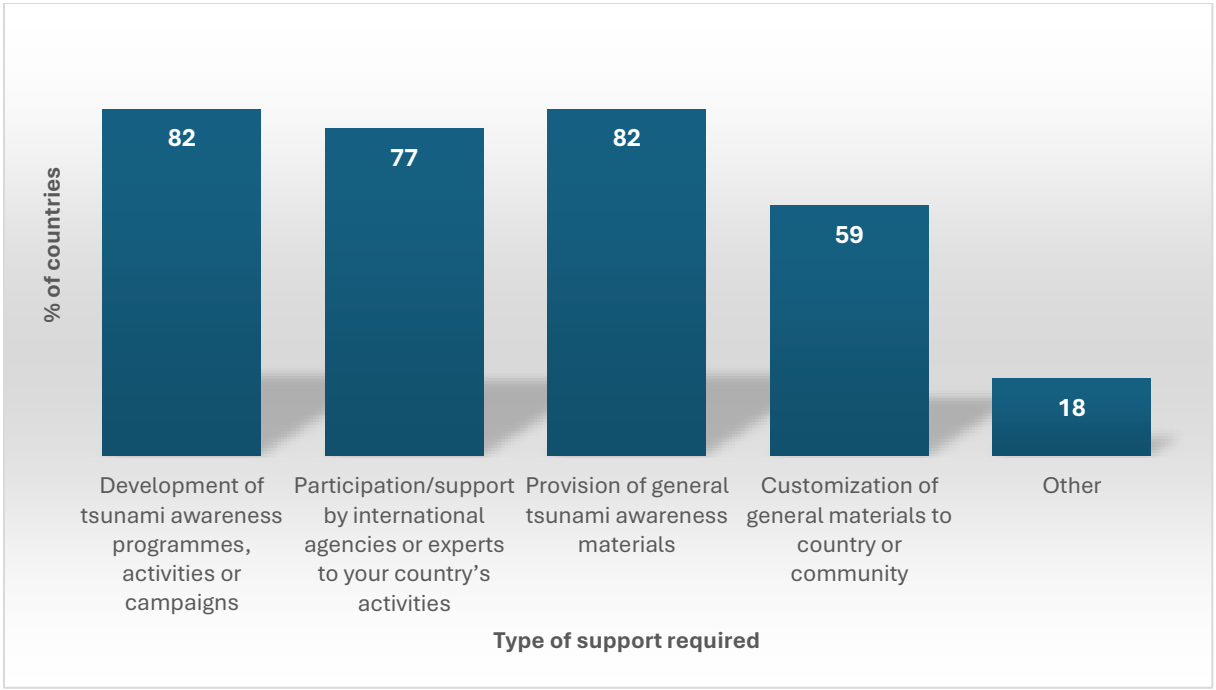

Figure 46. Support required for public awareness activity.

Respondents were asked to indicate any areas in which they required support from the IOTIC to develop or enhance public awareness in their country (Figure 46). 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, participation by international agencies or experts, and the provision of general tsunami awareness materials were the most widely requested by countries (more than 75%).

Thirty-six percent (36%) of the respondents also 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 activity.

3.4.5 UNESCO-IOC Tsunami Ready Recognition Programme

Countries were asked a series of questions about their involvement in the UNESCO-IOC Tsunami Ready Recognition Programme (TRRP) and other tsunami resilience and preparedness related initiatives or programmes. The TRRP is implemented as a voluntary, performance-based community recognition programme that promotes an understanding of the concept of readiness as an active collaboration among national and local warning and emergency management agencies and government authorities, scientists, community leaders, and the public. These questions differed significantly from 2018 and therefore comparable data is not available.

Firstly, countries were asked to confirm whether they have an interest to participate in the UNESCO-IOC TRRP. 13 countries (59%) confirmed that they are already participating in TRRP, while eight responded that they are not currently doing so. Of those that are not currently participating, six responded that they have plans to do so in the near future, while two do not.

Countries were then asked whether they are currently implementing any other tsunami resilience and preparedness related initiatives or programmes. Six countries (27%) responded that they are currently implementing other initiatives and programmes. Examples included the village disaster resilient programme (DESTANA), as well as a range of national level campaigns and exercises, such as tabletop exercises, training of trainers, awareness raising workshops, and as part of multi-hazard workshops. The other 14 countries (63%) responded to confirm they are not currently implementing any other programmes or initiatives.

Countries were then asked to estimate what number of villages, cities/districts and provinces/state levels are at risk to tsunami. While it is difficult to make meaningful comparisons across such a diverse group of countries with different governance structures, population sizes, and varying levels of tsunami hazard exposure, it is notable that 19 countries are collecting this data for at least one administrative level, while half of the respondent countries are providing estimates to the village level.

Five countries (23%) reported having a National Tsunami Ready Board (NTRB), which is responsible for guiding the community on the steps for Tsunami Ready recognition and for the review and approval of the community's Tsunami Ready application. Of the countries that reported not having a NTRB, nine reported an existing coordination mechanism that can fulfil this role. These included a range of National Councils, Committees and Advisory Groups.

When asked which institution(s) should be involved in the implementation of TRRP or similar national initiative, country responses varied greatly. They ranged from an individual institution (such as the NTWC), to a variety of national and local disaster management agencies, national and local government agencies, armed forces and emergency services, and humanitarian agencies.

Twelve countries (55%) reported that communities (for example, villages, cities, districts, provinces or states) are currently working towards implementing or are interested in implementing the UNESCO-IOC TRRP or similar national initiative. However, only two countries (India and Indonesia) reported having achieved recognition through UNESCO-IOC TRRP or a similar national initiative.

Countries were then asked a series of questions about their national capacity to implement different aspects of TRRP, including the extent to which each aspect can be achieved entirely or partially through mobilising national experts and funding, or whether there is a strong need for international technical expertise.

Analysis across the country responses (Figure 47) reveals that national capacity is highest for the following aspects (85%+ countries report that they can at least partially done through mobilising national experts and funding):

- Working with the community to develop local context outreach and public education materials
- Training and building capacity of community to be able to organise and implement outreach and education activity
- Training and building capacity of community to be able to organise and implement tsunami exercises
- Working with the communities to develop mechanisms (means and procedures) to receive 24/7 warning
- Working with the communities to develop mechanisms (means and procedures) to disseminate 24/7 warning to the community

Those aspects indicating the most countries (more than 25%) that have a strong need for international technical support include:

- Training the community on identifying and estimating the number of people that live in the tsunami hazard zone
- Training the community on the inventory of available economic, infrastructural, political, and social resources to reduce tsunami risk at the community level
- Work with the community to develop tsunami evacuation maps, plans and procedures at the community level
- Training and building capacity of communities to be able to develop their community Emergency Operation Plan

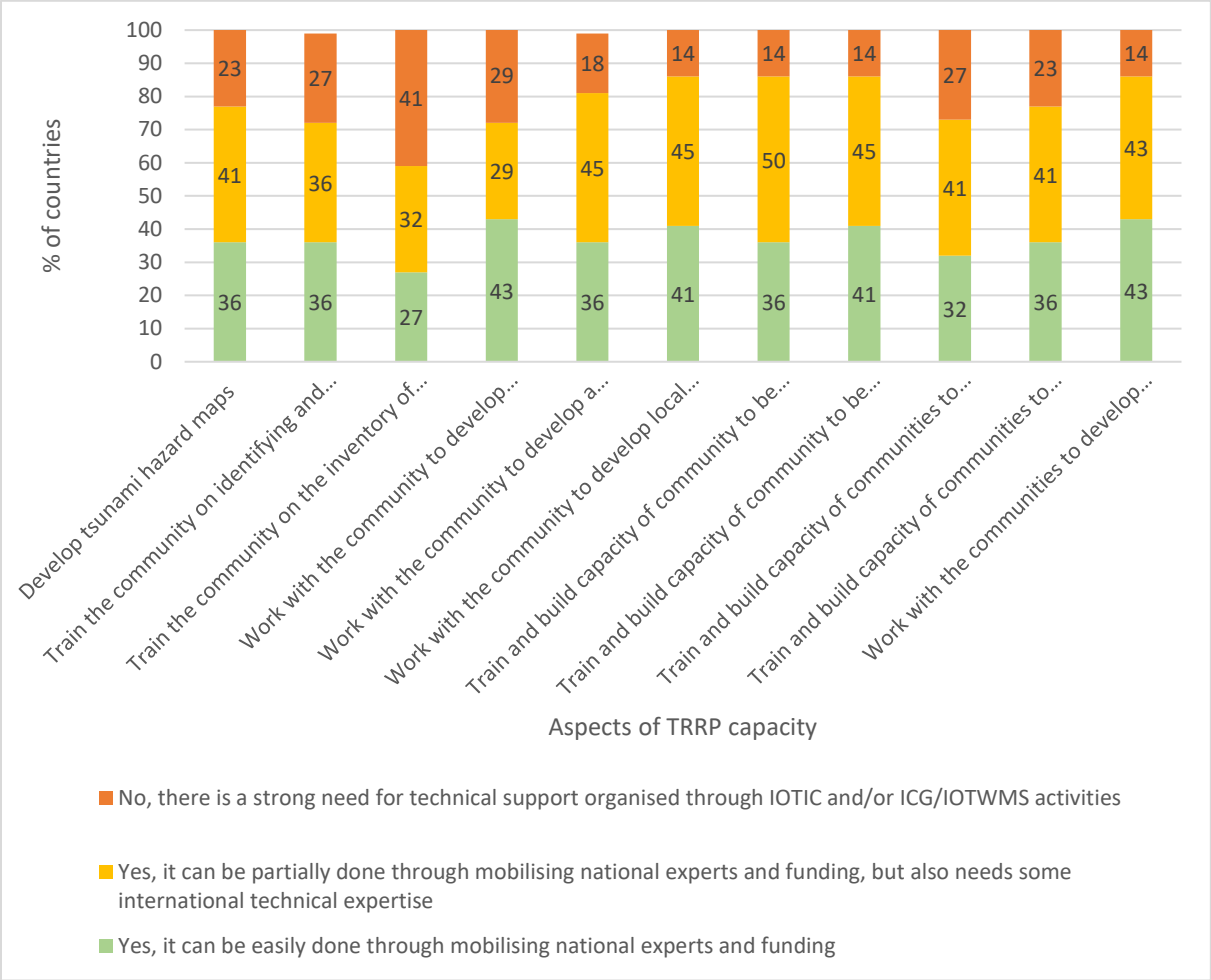

Figure 47. Summary of national capacity according to different aspects of the TRRP.

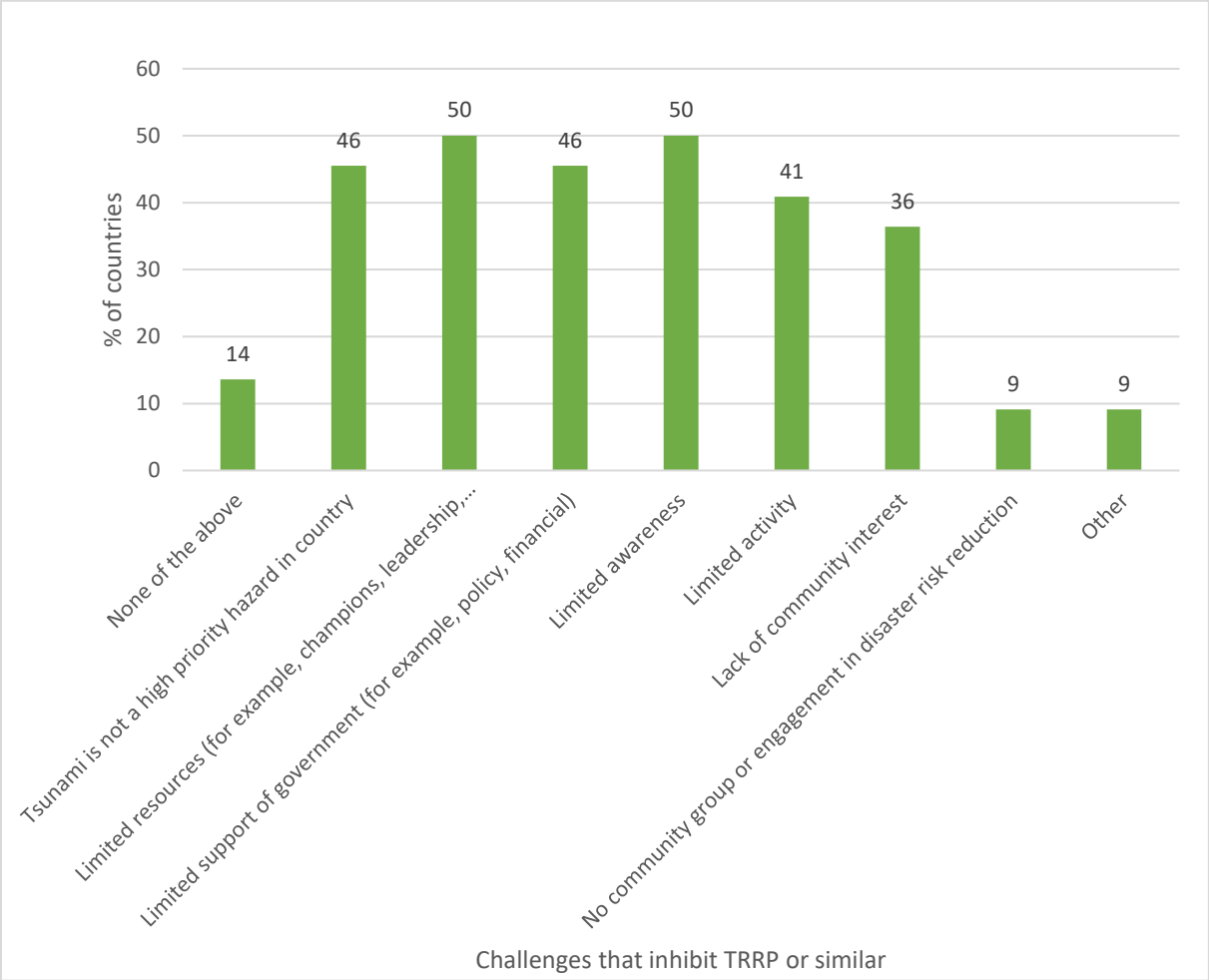

Figure 48. Challenges that inhibit the implementation of TRRP or similar national initiatives.

Countries were asked to consider what challenges inhibit the implementation of TRRP or similar national initiatives (Figure 48). The most significant challenges were limited resources and limited awareness, each reported by 11 countries (50%). Other significant challenges included that tsunami is not a high priority (46%), there is limited support from government (46%), there is limited activity (41%), and a lack of community interest (36%). Only three countries (14%) reported that none of the identified challenges inhibited implementation. The other challenges identified by at least one country included the infrequent nature of tsunami hazard events and the lack of tangible benefits of TRRP.

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 22 countries that completed the online survey. Given the similar questions in the 2018 and 2024 surveys the results can be directly compared. However, two countries that completed the 2018 survey did not respond to the 2024 survey (i.e., Tanzania and Timor Leste) and four Member States responded that did not respond to the 2018 survey (i.e., Maldives, Seychelles, South Africa, and United Arab Emirates) resulting in discrepancies between the sample sets.

To address the differences in the composition of countries between the surveys an independent analysis was conducted, which showed that the same overall trends were observed with the subset of common Member States. Although variations between the 2018 and 2024 results are not attributed to the difference in respondents, there remain other limitation including the small sample size, any changes to personnel completing the survey, and a lack of validation. Therefore, caution should be used when attempting to draw conclusions based on any trends, especially (what tend to be only small) changes between 2018 and 2024. Despite this, collectively the results do provide some useful insights on where the greatest needs are for future capacity development.

The 2005 assessment is not directly comparable with the 2018 and 2024 assessments as the earlier assessment was a baseline survey that focused mainly on capacity building requirements in the countries affected by the 26 December 2004 whereas the 2018 and 2024 surveys are a wider assessment of the current capacity that has been developed in terms of policies, systems, and technological and human capacity. Given the differences between the 2005 and later assessments, Table 4 is intended to provide a broad comparison only to indicate the scale of capacity improvement in the IOTWMS since 2005.

In general, much progress has been made between 2005 and 2018 to develop robust and state-of-the-art regional and national tsunami warning and mitigation systems. Examination of the 2018 and 2024 survey results indicate that tsunami policies, plans and guidelines have increased or remained at a similar level between the surveys. All to nearly-all countries have reported undertaking tsunami hazard assessments in both surveys while the percentage of countries undertaking tsunami risk assessments has increased with time. The results show that the upstream tsunami warning system components of detection, warning and dissemination have plateaued since 2018. During the same timeframe, efforts have been increasing in community preparedness. For example, considerable growth has been measured in the areas of standard operating procedures for community evacuation, and tsunami exercises conducted in cities and schools. Countries have reported an increase in tsunami information boards and signage reflecting greater community awareness and preparedness. The observed increase in community tsunami activities between 2018 and 2024 may be attributed to the adoption and growth of the UNESCO-IOC Tsunami Ready Recognition Programme.

Table 4 (below) provides a comparison of the status of the IOTWMS in 2005, 2018 and 2024. Given the differences between the 2005 and later assessments, Table 4 is intended to provide a broad comparison only to indicate the scale of capacity improvement in the IOTWMS since 2005. Given the similar questions in the 2018 and 2024 surveys the results can be directly compared. However, two countries that completed the 2018 survey did not respond to the 2024 survey (i.e., Tanzania and Timor Leste) and four Member States responded that did not respond to the 2018 survey (i.e., Maldives, Seychelles, South Africa, and United Arab Emirates) resulting in discrepancies between the sample sets. Variations between the 2018 and 2024 results are partially attributed to the difference in respondents and partially attributed to changes in capacity. Thus, care should be taken in data interpretation.

	Capacity Criteria	2005	Capacity Criteria	2018	2024
Policies, Plans and Guidelines	• Legal framework in place for disaster warning formulation, dissemination and response	59%	• National tsunami policy in place	90%	91%
	• National platform or other mechanism in place for guiding disaster risk reduction in general	94%	• Local tsunami policy in place	60%	64%
	• National Tsunami Warning and Mitigation and Coordination Committee or some other coordination mechanism in place	59%	• National tsunami disaster risk reduction plan in place	75%	86%
	• Disaster coordination mechanisms at community level established	75%	• Local tsunami disaster risk reduction plan in place	55%	59%
	• Tsunami emergency plans, tsunami evacuation plans and/or signage exist indicating routes to safety or higher ground	19%	• Community tsunami disaster risk reduction in place	40%	50%
			• National tsunami guidelines established	70%	100%
			• Local tsunami guidelines established	60%	77%
Risk Assessment and Reduction	• Tsunami hazard evaluation conducted prior to 26 December 2004	44%	• Tsunami hazard assessment conducted	100%	96%
	• Historical record of past earthquakes and tsunamis documented	37%			
	• Tsunami vulnerability assessment conducted	22%	• Tsunami risk assessment conducted	75%	86%
	• Numerical modelling studies conducted to calculate inundation from tsunamis	22%	• Numerical modelling conducted for hazard assessment (PTHA and/or DTHA)	35%	41%
	• Accurate bathymetry and topography data exist for the coastlines	25%	• Bathymetry used for tsunami hazard assessment	85%	77%
			• Topography used for hazard assessment	80%	86%

	Capacity Criteria	2005	Capacity Criteria	2018	2024
Detection, Warning and Dissemination	• International tsunami warnings received for teletsunamis from PTWC and/or JMA • Agency receiving warnings staffed 24x7 • National or regional tsunami warning centre to monitor and warn of regionally or locally generated tsunami in operation • Warning centre staffed 24x7 • Real-time seismic data received • Sea level data available real-time to the central monitoring site, or available in near real-time	94% 94% 28% 31% 41% 41%	• National capability to assess and/or receive potential tsunami threat information and advise and/or warn coastal communities • Warning centre staffed 24x7 • Access to national or international seismic networks • Access to national or international sea level networks	100% 90% 90% 85%	100% 91% 91% 68%
Standard Operating Procedures **Tsunami Exercises**	• Local government disaster preparedness and emergency response assessed • Community and ordinary citizen disaster preparedness and emergency response assessed • Response procedures for regional or locally generated tsunami in place • Response procedures have been tested or exercised	59% 25% 19% 19%	• Warning dissemination SOPs in place • Evacuation call SOPs in place • Community evacuation SOPs in place • Media arrangement SOPs in place • Tsunami exercises conducted at national level • Tsunami exercises conducted at regional level • Tsunami exercises conducted at city level • Tsunami exercises conducted at village level • Tsunami exercises conducted at community level • Tsunami exercises conducted at school level	90% 80% 60% 80% 70% 55% 35% 50% 50% 30%	96% 73% 73% 77% 59% 41% 50% 46% 32% 46%

	Capacity Criteria	2005	Capacity Criteria	2018	2024
Awareness, Preparedness and Response	• Public is aware of what a tsunami is and how to respond to both locally generated and distant tsunamis	37%	• Tsunami related education and awareness material		
	• Community level education and preparedness programmes for national hazards or tsunami exist	47%	- Leaflets or flyers	65%	59%
	• Tsunami education and public outreach programme in place	6%	- Posters	70%	73%
	• Earthquake and tsunami hazards and preparedness is incorporated into educational curricula for school children	12%	- Booklets	60%	64%
	• Training programmes for the media on tsunami hazards, mitigation, warning and preparedness exist	22%	- Information Boards	30%	41%
			- Tsunami signage	25%	32%
			- Video or other visual/oral media	65%	55%
			- Indigenous knowledge	35%	18%
			- Teaching kits	50%	23%
			- School curricula	45%	41%
			- Public evacuation maps	25%	23%

Table 4. Comparison of status of IOTWMS in 2005, 2018 and 2024. 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 to 2005). The 2024 responses are based on 22 countries (with 14 countries in common to 2005 and 18 countries in common to 2018). Given the differences between the assessments, the table is intended to provide a broad comparison only to indicate the scale of capacity improvement in the IOTWMS since 2005.

4.1 POLICIES, PLANS AND GUIDELINES

The adoption of policies, plans and guidelines at national and local levels can help countries to focus their efforts on tsunami warning and mitigation by incorporating the tsunami hazard into legislation thus increasing stakeholder engagement and potentially assisting in securing funding for tsunami capacity development activities.

The potential impacts of tsunamis are very challenging to prepare for, as they are a relatively low risk, but with major consequences and impacts should they occur. They may best be managed and supported through expansion of a multi-hazard approach, whereby observations, warning systems, community education and preparedness activities are integrated and contribute to multi-hazard national initiatives, noting the economies of scale and to ensure the tsunami threat remains centre of mind in well prepared at-risk communities, especially where the tsunami may arrive in minutes.

4.1.1 Policies

When compared to the results of the 2018 survey, the 2024 results show a similar proportion of countries reporting the availability of national and local policies. The 2024 responses indicate 91% of countries have a national tsunami policy (compared to 90% in 2018) and 64% of countries have a local tsunami policy (compared to 60% in 2018). In both cases, the majority of countries address tsunami within a multi-hazard policy.

Member State training in the development of integrated national multi-hazard and stand-alone tsunami policies for authorities and stakeholders at all levels (community through to national) is recommended. ***(Recommendations TPP 1 - 3)***

4.1.2 Plans

The results show a similar or greater level of tsunami plans in 2024 when compared to 2018. All 2024 respondent countries (22) have some form of tsunami disaster reduction plan with a significant majority addressing tsunami risk reduction as part of a multi-hazard plan. Across all four phases of the disaster management lifecycle, availability of plans is significantly higher at the national level, followed by the local level with the least availability at community level. Most countries (>60%) have national tsunami guidelines that address all phases. Overall, more countries reported plans are incorporated within a multi-hazard framework.

Member State training in the development of integrated national multi-hazard and stand-alone tsunami plans for authorities and stakeholders at all levels (community through to national) is recommended. ***(Recommendations TPP 1 - 3)***

4.1.3 Guidelines

The results show a higher proportion of countries reporting the availability of national tsunami guidelines in all phases, when compared to those countries responding to the 2018 survey. The 2024 responses indicate that all respondent countries (22) have some form of tsunami guidelines. At the prevention and mitigation phase there is a mix of standalone guidelines and those that address tsunami as a part of a multi-hazard guideline. In the other phases, they predominantly address tsunami as a part of national multi-hazard guidelines.

It is recommended to provide training to Member States in the development of specific tsunami guidelines within a multi-hazard framework. ***(Recommendations TPP 1 - 3)***

4.2 RISK ASSESSMENT AND REDUCTION

All countries around the Indian Ocean are at some level of risk of being impacted by tsunamis. Even relatively small tsunamis of 1 metre in amplitude can create dangerous currents and

possible inundation of areas close to the foreshore, leading to loss of life and impacts on livelihoods, such as ports, fishing and tourist industries.

4.2.1 Hazard Assessment

The results show that 21 of the 22 countries participating in this survey (96%) conduct hazard assessments to understand the tsunami threats to their territories. This compares to all 20 countries (100%) that responded in 2018. The Seychelles, which did not respond to the 2018 survey, was the only country not to carry out a tsunami hazard assessment. As observed in the 2018 results, evacuation mapping was ranked as the highest priority for capacity improvement, followed by hazard mapping and inundation mapping.

The UNESCAP funded project “Strengthening Early Tsunami Warning in the North-West Indian Ocean through Regional Collaboration” has further examined the seismic characteristics and prepared a Probabilistic Tsunami Hazard Assessment (PTHA) for the Makran region.

Member States and at-risk communities should be further sensitized to the Indian Ocean tsunami hazard by developing and updating tsunami hazard assessments through sharing of best practices and ideally within a multi-hazard framework. The PTHA for the North-West Indian Ocean region should be expanded across the Indian Ocean. Additionally, it should incorporate tsunamis generated by non-seismic and complex sources. ***(Recommendations THRA 1 - 2)***

4.2.2 Risk Assessment

The results show that 19 of the 22 countries participating in this survey (86%) conduct tsunami risk assessments. All 17 countries that carry out multi-hazard risk assessments include tsunami, while flooding, cyclones and earthquakes considered by 60% or more of countries. As observed in the 2018 results, city level risk assessment is ranked as the highest priority for capacity improvement, followed by national and regional levels.

Risk (and hazard) assessments for tsunamis generated by subduction earthquakes continue to be updated and integrated within multi-hazard frameworks to provide awareness to governments, response authorities, and the community on any possible threat.

National capacities to undertake tsunami risk assessments down to local level and within a multi-hazard framework should be enhanced. ***(Recommendations THRA 1 - 2)***

4.3 DETECTION, WARNING AND DISSEMINATION

Following the implementation of the Interim Advisory Service (IAS; 2005) to provide basic alerts to National Tsunami Warning Centres (NTWCs) established by all countries, a well-coordinated and interoperable IOTWMS began full independent operations in 2013. The IOTWMS TSPs in Australia, India and Indonesia continue to provide National Tsunami Warning Centres (NTWCs) in each country bordering the Indian Ocean with tsunami threat information for tsunamis generated by subduction earthquakes. TSP Australia is now also providing regional threat information products for tsunamis generated by volcanoes. The NTWCs utilise the TSP products and in many cases also their own information to develop and disseminate appropriate tsunami warnings to their communities.

4.3.1 Detection and Warning

All countries (100%) reported that they have a national capability to assess and/or receive potential tsunami threat information and advise/warn their coastal communities. Twenty (20) of the 22 respondent countries (91%) reported that the organisation responsible for assessing and/or receiving potential tsunami threat information operates 24x7. Twelve (12) or 55% of

respondent countries reported having the capability of analysing real-time seismic and sea-level data for potential tsunami threat evaluation. Ten (10) or 46% of respondent countries also reported having the capability for tsunami modelling to support generation of threat forecasts.

The ICG/IOTWMS designated Tsunami Service Providers (TSPs) operated by Australia, India, and Indonesia provide detailed forecast threat information for the entire Indian Ocean. In 2024, the TSP service has been extended to provide information for tsunamis generated by non-seismic events (such as undersea volcanos) in addition to the standard service for tsunamis generated by earthquakes.

The timeliness and accuracy of tsunami threat information and warnings should be enhanced by designing the optimal seismic and sea level observing systems, adopting new technologies (such as SMART cables, GNSS networks), and exchanging all data for tsunami monitoring and detection in real-time. The development of tsunami warnings within a multi-hazard framework can help to optimise available resources and sharing of good practices among stakeholders. ***(Recommendations TDWD 1 - 3)***

4.3.2 Dissemination

Countries reported that dissemination of tsunami information (warning, public safety action, etc.) is mostly achieved by email, SMS, radio and television. Notable changes in the 2018 results include a reduction in the number of responding countries that report using of Fax (85% to 50%) and an increase in the proportion of responding countries that report using social media (65% to 96%).

Member States have the sovereign responsibility to develop and disseminate tsunami warnings to their communities at-risk. National tsunami warning chains underpinned by time sensitive standard operating procedures are critical for dissemination of tsunami information and advice from the NTWCs through to communities at-risk. Redundant modes of communication are encouraged to mitigate risks associated with communication delivery failures.

The capacity and effectiveness of NTWCs should be enhanced by ensuring 24/7 operation and providing training in tsunami threat analysis and standard operating procedure enhancements. ***(Recommendations TDWD 1 - 3)***

4.4 AWARENESS, PREPAREDNESS AND RESPONSE

For a tsunami warning to be effective once it reaches all in the community, the community must be prepared and know what to do. To meet the goal of the UN Ocean Decade Tsunami Programme 100% of at-risk communities must be prepared and resilient to the tsunami threat by 2030.

Collaboration between UNESCO-IOC and United Nations Office for Risk Reduction (UNDRR) on events, such as World Tsunami Awareness Day, is utilising major opportunities to advance community awareness and preparedness. Collaboration between UNESCO-IOC and United Nations Development Programme (UNDP) is importantly seeing the growth of education and training programmes for schools. Furthermore, efforts to enhance national tsunami warning chains will also help underpin efforts by the UN EW4ALL initiative, as there are many common elements for other hazards.

4.4.1 Standard Operating Procedures

The responses indicate that most countries have SOPs that address the operation of a 24/7 emergency operation centre (86%), receiving information from the NTWC (96%) and response criteria and decision making (91%). However, these results also indicate that many countries still require support to develop SOPs in all three aspects (55 – 68%). They also require support

to develop human resources in these areas, especially 24/7 emergency operations and response criteria / decision making (64 – 68%). Support to develop infrastructure across all three aspects is also required in many countries (55 – 64%).

To reach people at-risk to tsunamis in a timely manner, a functioning national tsunami warning chain including integrated and timeline driven standard operating procedures is essential.

Further effort is required nationally by some countries to ensure standard operating procedures underpin every link in the warning chain, especially in the downstream components, to ensure early warnings reach all in the community. ***(Recommendations TDWD 3 and CTAPR 1 to 3)***

4.4.2 Evacuation Infrastructure and Planning

The results reveal more provision of evacuation shelters within countries when compared to the 2018 survey (55% to 68%), while natural or artificial hills for vertical evacuation also remain widely reported and identified by 59% of countries. Evacuation signage (41%) and vertical evacuation structures (32%) remain less common. Fourteen (14) countries (64%) also reported that evacuation infrastructure is incorporated into the evacuation plans.

Evacuation infrastructure is an important component of the UNESCO-IOC capacity development training on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP), and contributes to the UNESCO-IOC Tsunami Ready Recognition Programme.

Enhancement of national capabilities in evacuation planning by providing regular trainings and national activities to advise best practices for evacuation sheltering options for tsunamis including vertical evacuation strategies. ***(Recommendations CTAPR 1 to 3)***

4.4.3 Tsunami Exercises

Twenty-one (21) of the respondent countries (96%) reported that their country's NTWC and/or TWFP participated in the IOWave exercises conducted in the inter-sessional period. The overall results indicate a smaller proportion of countries conducting exercises when compared to 2018. Nonetheless between 2018 and 2024, tsunami exercises have shown an increase at the city and school levels.

The interoperable system developed by the UNESCO-IOC ICG/IOTWMS is routinely tested and exercised through biennniel IOWave Exercises organised by the ICG/IOTWMS and supported by the Secretariat.

Establishing regular programmes of tsunami exercises into cities, villages, communities and schools as a key to community preparedness, through conduct of national exercises between IOWave exercises. ***(Recommendations TE 1 - 2)***

4.4.4 Public Awareness

In a similar outcome to 2018, countries reported that the most widely used public awareness materials were posters, leaflets and flyers, booklets and video/oral media. Education materials such as information boards and school curricular (40%) were also used in many countries. Less common were the use of teaching kits, indigenous knowledge, signage and public evacuation maps.

In terms of reported public awareness activities, school and child related awareness activities and tsunami exercises, as well as global awareness raising days were the most widely carried out across respondent countries. In particular, a greater proportion of countries reported activities linked to the Global Disaster Risk Reduction Day when compared to the countries responding to the 2018 survey (45% to 73%).

Awareness is the first step in the development of any warning and mitigation system. Since 2005 there has been considerable production of awareness materials and delivery of community awareness activities to help prepare at-risk communities.

The request for more support by countries most likely reflects the appreciation of the high quality, utility, and need for the services provided by IOTIC, especially as efforts by countries focus and grow with regards to the massive task of making at-risk communities prepared and resilient to the tsunami threat. As work focus more on local communities, even more effort and resources are required to translate education materials and training into local languages.

Raising community awareness of tsunami threat can be pursued through dissemination of outreach materials (i.e., IOTIC and IEC) through a range of platforms. Utilising internationally coordinated activities, such as International Day for Disaster Risk Reduction (13 October) and World Tsunami Awareness Day (5 November). Including tsunami within the national school curriculars is an effective pathway for enhancing community tsunami awareness. ***(Recommendations CTAPR 1 to 3)***

4.4.5 UNESCO-IOC Tsunami Ready Recognition Programme

Thirteen (13) countries (59%) confirmed that they have already started to participate in the UNESCO-IOC Tsunami Ready Recognition Programme (TRRP), while eight responded that they are not currently doing so. Of those that are not currently participating, six responded that they have plans to do so soon, while two do not. Furthermore, six countries (27%) responded that they are currently implementing other initiatives and programmes.

Five countries (23%) reported having a National Tsunami Ready Board, which is responsible for guiding the community on the steps for Tsunami Ready recognition and for the review and approval of the community's Tsunami Ready application.

National capacities to implement Tsunami Ready indicators were assessed. Those aspects indicating the most countries (more than 25%) that have a strong need for international technical support include: a) Training the community on identifying and estimating the number of people that live in the tsunami hazard zone; b) Training the community on the inventory of available economic, infrastructural, political, and social resources to reduce tsunami risk at the community level; c) Work with the community to develop tsunami evacuation maps, plans and procedures at the community level, d) Training and building capacity of communities to be able to develop their community Emergency Operation Plan. Countries reported that the most significant challenges in implementing Tsunami Ready were limited resources and awareness.

While India and Indonesia have begun to initiate significant national programmes, further support is required to significantly enhance efforts to implement the TRRP or similar national initiatives across the region at the at-risk community level. Significantly more resources and support nationally are required for countries to implement national programmes at the community level. The challenges in implementing the UNESCO-IOC TRRP or similar national initiatives have been identified and countries need training and support to help address these.

Facilitation of sharing of experiences among Member States in initiating and implementing the programme would add value. Community ownership of TRRP or similar national initiatives is recommended by strengthening local capacities, engagement to develop local preparedness plans, activities in line with the TRRP indicators, and commitment to sustain it. Moreover, integrating other ocean and multi-hazard approaches with the TRRP approach is beneficial. ***(Recommendations TRRP 1 to 2)***

5. RECOMMENDATIONS TO ADDRESS CAPACITY GAPS

The following is a summary of recommendations and key actions for capacity development that have emerged from the 2024 Indian Ocean capacity assessment of tsunami preparedness. They are intended to help guide the work programmes of the ICG/IOTWMS and contributions by donors.

5.1 POLICIES AND PLANS

Tsunami Policies and Plans (TPP)		
#	**Recommendation**	**Figures**
TPP.1	**Provide training in development of integrated national MHEWS and stand-alone tsunami policies and plans for authorities and stakeholders** (such as DMOs, local governments, research institutions, communities, etc) across following levels: a. National b. Provincial c. Local d. Community	# 7-12
TPP.2	**Provide training in development of specific tsunami guidelines in a multi-hazard framework** with respect to: a. Disaster Risk Reduction (DRR) based urban and spatial planning incorporating city/district level (scale 1:25,000) and detailed spatial plan for sub-district level (scale 1:5,000). b. Contingency Plan for tsunami generated by multi-sources (seismic, non-seismic, and complex sources) c. Operation Plan for tsunami generated by multi-sources (seismic, non-seismic, and complex sources) d. Prevention and Mitigation: Tsunami Building Code, Critical Facilities Tsunami Ready Guide, Hotel Ready for Tsunami e. Integration of tsunami DRR strategies into planning processes for mitigation and preparedness, e.g. zoning laws that prevent construction in tsunami high-risk areas and the development of tsunami-resistant infrastructure f. Mainstreaming of inclusivity in all aspects of tsunami-related activities, policies, and plans, including scientific research, community education and preparedness, evacuation planning, and post-disaster management. g. Sustainable grey and green coastal protection management practices that reduce vulnerability to tsunamis, such as nature-based solutions for the restoration of mangroves and coral reefs. h. Rehabilitation and Reconstruction planning and Sustainable Recovery through lessons learnt to Build Back Better	# 13-14
TPP.3	**Optimise national resources in tsunami preparedness and response planning, in areas such as tsunami hazard assessments, harmonisation of early warning systems, and joint exercises** by: a. Utilising cross-border tsunami warning and response coordination and planning for countries sharing coastlines (e.g. North-West Indian Ocean (NWIO)). b. Exchange of best-practice policies, plans and guidelines for tsunami preparedness and response planning between Member States	# 23-24

5.2 RISK ASSESSMENT AND REDUCTION

Tsunami Hazard and Risk Assessment (TRHA)		
#	**Recommendation**	**Figures**
THRA.1	**Help further sensitize, raise awareness and understanding of Member States and at-risk communities of the Indian Ocean tsunami hazard** by: a. Utilising international expertise and collaboration to provide an updated good-practice on Probabilistic Tsunami Hazard Assessment (PTHA) across the entire Indian Ocean, including tsunamis generated by non-seismic and complex sources. b. Develop and update tsunami hazard assessments through good practice sharing for the Indian Ocean in a multi-hazard framework.	# 15, 20-24
THRA.2	Enhance and strengthen the national capacity to undertake tsunami hazard and risk assessments in a multi-hazard framework down to local level where required.	# 18-19, 23-24

5.3 DETECTON, WARNING AND DISSEMINATION

Tsunami Detection, Warning, and Dissemination (TDWD)		
#	**Recommendation**	**Figures**
TDWD.1	**Support the achievement ODTP Objective #1, enhance the timeliness and accuracy of tsunami threat information and warnings** by: a. Designing the optimal seismic & sea level observing systems to guide implementation of observational networks to quantifiably improve the timeliness and accuracy of tsunami warnings b. Sustaining, fully utilising, and expanding existing seismic and sea level observational networks to implement optimal observing systems to quantifiably improve the timeliness and accuracy of tsunami warnings c. Trial and adopt new technologies (such as SMART cables, GNSS network) to implement optimal seismic and sea level observing systems to quantifiably improve the timeliness and accuracy of tsunami warnings d. Demonstrating the impact of gaps in real-time exchange of seismic and sea level data on the timeliness and accuracy of tsunami detection and warning e. Exchanging all data in real-time required for tsunami detection, warning, and monitoring by all National Tsunami Warning Centres (NTWCs) and regional Tsunami Service Providers (TSPs) to improve the timeliness and accuracy of tsunami detection and warning. f. Establishing collaboration channels and training activities for sea level network operators to create awareness understanding and increase readiness on needs for tsunami detection and warning to encourage expansion and sustainability of existing networks g. Developing guidelines and delivering training on adoption and implementation of advanced analytical platforms that utilise artificial intelligence and machine learning to integrate and analyse data from multiple sources to enhance the accuracy of tsunami models and improve warning decision-making processes	# 32, 34-35
TDWD.2	**Enhance the capacity and effectiveness of National Tsunami Warning Centres (NTWCs)** by: a. Ensuring all NTWCs operate 24/7 b. Suggesting optimal Provision of human and infrastructure resources to support NTWC operation c. Training for NTWCs in analysing and utilising real-time seismic and sea-level data and models to develop capacity to undertake own tsunami threat analysis d. Guiding the Member States to develop capabilities & Standard Operating Procedures (SOPs) for detection, warning, and monitoring of tsunamis generated by non-seismic and complex sources (e.g. IOC M&G 183) e. Developing tsunami warnings in a multi-hazard framework to optimise available resources through good practice sharing	# 32-35

TDWD.3	**Ensure People Centred national tsunami warnings reach all in the community** by: a. Ongoing forensic analysis and regular review of national tsunami warnings chains and underpinning SOPs to identify weak links and gaps b. Providing ongoing training in national tsunami warning chain and SOP development to address weak links and gaps, facilitated by training Member States from geographical regions with similar tsunami threat and warning requirements (e.g. NWIO project funded by ESCAP), with particular focus on N/P/LDMO and Media SOPs. c. Training in delivery of tsunami warnings using common terminologies and formats (e.g. Common Alerting Protocol (CAP)) to ensure more effective use and all-inclusive community responses. d. Continuous reviewing of existing (internet, GTS, SMS, satellite, radio, fax, etc) and implementation of new (social media, cell broadcast, etc) tsunami warning dissemination and communication technologies to ensure robust and timely dissemination of tsunami warnings to all-inclusive groups in the community and communications between warning and response operational staff.	# 36-38

5.4 COMMUNITY AWARENESS AND PREPAREDNESS

	Community Tsunami Awareness and Preparedness (CTAPR)	
#	**Recommendation**	**Figures**
CTAPR.1	**Raise community awareness of tsunami threat** by: a. Sharing and utilising national and Indian Ocean Tsunami Information Centre (IOTIC) Information Education & Communication (IEC) tsunami awareness materials, materials used in other oceans and developed by other Tsunami Information Centres (TICs), nationally tailored materials for individual stakeholders, translated as needed at local level and all inclusive b. Disseminating IEC tsunami awareness materials using a wide range of formats and platforms for dissemination (e.g. brochures/fliers, e-posters, booklets, e-books, YouTube, TikTok, Instagram, Facebook) c. Participation/support by international agencies or experts in national activities d. Utilising internationally coordinated activities, such as International Day for Disaster Risk Reduction (IDDRR) (13 October) and World Tsunami Awareness Day (WTAD) (5 November)	# 39, 44
CTAPR.2	**Enhance national capacities in tsunami evacuation planning** by: a. Expanding training on tsunami evacuation planning provided in NWIO to other regions and Member States, including sharing of best practices through a hands-on and collaborative learning approach. b. Providing regional training on best practices in utilising vertical infrastructure for tsunami evacuations. Engaging professional societies and experts in national activities to advise best practices and certified national criteria for evaluating shelter options in the context of tsunami vertical evacuation strategies c. Share examples of best practice in national tsunami signage, taking into consideration recommendations from the UNESCO-IOC TOWS-WG TTDMP.	# 40, 45
CTAPR.3	**Enhance tsunami awareness and preparedness in schools** by: a. Continuing the work of UNDP, in consultation with IOTIC, in the development of tsunami school community awareness IEC materials and training b. Implementing tsunami awareness and preparedness training in school national curricula.	# 44-46

5.5 TSUNAMI READY RECOGNITION PROGRAMME

Tsunami Ready Recognition Programme (TRRP)		
#	**Recommendation**	**Figures**
TRRP.1	**Train, both regionally and nationally (with priority for Small Island Developing States (SIDS), Least Developed Countries (LDCs), and African State), the implementation of UNESCO-IOC Tsunami Ready Recognition Programme (TRRP) or similar national or international initiatives (e.g. Weather Ready) to build resilience and make at-risk communities prepared and resilient against the tsunami threat** by: a. Supporting National Tsunami Ready Focal Points (TRFPs) and Tsunami National Contacts (TNCs) through training, advocacy and provision of IEC materials (e.g. UNESCO-IOC M&G 74 and IOTIC education and awareness materials), including translation to national and/or local languages where needed b. Exchanging Member State best practices and experiences on initiating, implementing, and demonstrated value of TRRP to assist other Member States to initiate. c. Assisting Member States to review their national tsunami preparedness programs with respect to the 12 Tsunami Ready Indicators.	# 47-48
TRRP.2	**Implement and expand national Tsunami Ready Recognition Programmes (TRRP) or similar national initiatives to make at-risk communities prepared and resilient against the tsunami threat** by: a. Identifying tsunami risk and educate communities and key stakeholders of the risk and value of TRRP b. Investigating if TRRP can be integrated within a similar national initiative or obtain seed funding to start the TRRP nationally (or an equivalence) to demonstrate value in a multi-hazard context. c. Establishing a National Tsunami Ready Board (NTRB) as per IOC M&G 74 or utilise similar national body d. Identifying and providing data on communities/villages in tsunami-prone areas (as described in M&G 74) to develop a prioritised plan for implementing TRRP nationally e. National authority with responsibility for TRRP or similar national initiative collaborating with at-risk communities to create education materials tailored to their local context f. Assuring local communities' ownership of TRRP or similar national initiatives by strengthening local capacities, engagement to develop local preparedness plans, activities in line with the TRRP indicators, and commitment to sustain it. g. Engage the private sector to implement and help resource implementation h. Engage Non-Government Organisations (NGOs) and other international agencies supporting national implementation i. Integrating other ocean and multi-hazard approaches with the TRRP approach	# 47-48

5.6 TSUANMI EXERCISE

Tsunami Exercises (TE)		
#	**Recommendation**	**Figures**
TE.1	**Continue to organise and enhance biennial IOWave Exercises for the Indian Ocean region to routinely test regional and national tsunami preparedness** by: a. Including scenarios of nighttime and/or weekend tsunami events to test 24/7 procedures and performance. b. Including an objective testing and validating of SOPs along national tsunami warning chains. c. Avoiding times when DMOs, etc, are busy responding to other seasonal hazards, by scheduling two different times/seasons for biennial IOWave Exercises within scheduled year. d. Nationally extending involvement at at-risk local and community levels. e. Involving international expert observers to help review and evaluate future IOWave Exercises	# 41-42
TE.2	**Increase national tsunami exercises to more frequently test national tsunami preparedness** by: a. Establishing regular programme of tsunami exercises into cities, villages, communities and schools as a key to community preparedness, through conduct of national exercises between Indian Ocean-wide exercise (IOWave exercises) b. In addition to IOC MG58 and MG86, developing further guidance on how to the conduct tabletop or similar tsunami warning exercises to routinely review and test SOPs, helping to maintain preparedness and reduce the potential for complacency among countries that have not experienced a recent tsunami event.	# 41-42

ANNEX I

CONTRIBUTORS TO THE 2024 STATUS REPORT

The Capacity Assessment of Tsunami Preparedness in the Indian Ocean region was a primary activity of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) in 2024.

The capacity assessment is based on survey responses from twenty-one (21) IOTWMS Member States and one (1) Territory. This includes Australia, Bangladesh, Comoros, France (Indian Ocean Territories), India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Singapore, South Africa, Sri Lanka, Thailand and United Arab Emirates. Compilation of the survey responses were overseen by the ICG/IOTWMS Tsunami National Contacts with inputs from national stakeholders.

Experts convened under the guidance of the ICG/IOTWMS Steering Group chaired by Prof Dwikorita Karnawati (2019–2024) to deliver the 2024 IOTWMS Status Report. The expert team included Steering Group members Ms Suci Dewi Anugrah (Indonesia), Ms Sunanda Manneela (India), Dr Yuelong Miao (Australia), Dr Mohammad Mokhtari (Iran), Mr Jijjavarapu Padmanabham (India), Dr Harkunti Rahayu (Indonesia), and Dr Weniza (Indonesia). Dr Harkunti Rahayu lead the sessional committee on the Capacity Assessment during the 14th Session of the ICG/IOTWMS (Banten, 17-19 November 2024), which further enhanced the publication.

Prof Richard Haigh and Prof Dilanthi Amaratunga, affiliates of the University of Huddersfield's Global Disaster Resilience Centre, conducted the data analysis, compilation, and interpretation as well as data trend validation by comparison of the common country responses to both 2018 and 2024 surveys.

The Trust Fund for Tsunami, Disaster and Climate Preparedness of the UN Economic and Social Commission for Asia and the Pacific (ESCAP) facilitated and provided funding for the ICG/IOTWMS Capacity Assessment of Tsunami Preparedness Validation Workshop held at their office in Bangkok, Thailand during 4-6 September 2024. Additional funding for the Bangkok workshop was provided by the Asian Development Bank and Swiss Agency for Development and Cooperation. Special thanks are extended to Ms Temily Baker, Mr Kazi Rahman and Ms Nattabhon Narongkachavana of ESCAP.

Ms Lara Bland and Dr Laura Kong of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System offered insights from a global perspective.

Mr Rick Bailey (former ICG/IOTWMS Chair and former Head of Secretariat) compiled preliminary drafts of the report and its executive summary through a consultancy funded by the Asian Development Bank.

Mr E Pattabhi Rama Rao (current ICG/IOTWMS Chair and former Vice-Chair) and Mr Harald Spahn (UNESCO consultant) provided further improvements to the report.

Overall support and management were provided by staff at the Intergovernmental Oceanographic Commission of UNESCO's Tsunami Resilience Section including Mr Bernardo Aliaga, Mr Rick Bailey, Ms Nora Gale, Mr Ardito Kodijat and Dr Srinivasa Kumar Tummala.

Figure 49: Participants at the ICG/IOTWMS Capacity Assessment of Tsunami Preparedness Validation Workshop, Bangkok, 4–6 September 2024.

ANNEX II

COMPARATIVE LISTS OF COUNTRIES SURVEYED IN THE 2005, 2018 AND 2024 ASSESSMENTS

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)	**2024** Capacity Assessment of Tsunami Preparedness in the Indian Ocean –Status Report (IOC Technical Series, 193)
	Australia	Australia
Bangladesh	Bangladesh	Bangladesh
Comoros	Comoros	Comoros
	France (Indian Ocean Territories)	France (Indian Ocean Territories)
	India	India
Indonesia	Indonesia	Indonesia
	Iran (Islamic Republic of)	Iran (Islamic Republic of)
Kenya	Kenya	Kenya
Madagascar	Madagascar	Madagascar
Malaysia	Malaysia	Malaysia
		Maldives
Mauritius	Mauritius	Mauritius
Mozambique	Mozambique	Mozambique
Myanmar	Myanmar	Myanmar
Oman	Oman	Oman
Pakistan	Pakistan	Pakistan
Seychelles		Seychelles
	Singapore	Singapore
Somalia		
	South Africa[1]	South Africa
Sri Lanka	Sri Lanka	Sri Lanka
Tanzania	Tanzania	
Thailand	Thailand	Thailand
	Timor-Leste	
		United Arab Emirates

[1] The 2018 report from South Africa was submitted after the regional analysis had already been completed and therefore their response was not included in the 2018 analysis.

ANNEX III

TABLES OF SURVEY RESPONSES

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
3a) Is your Tsunami Warning Focal Point (TWFP) agency the same as your National Tsunami Warning Centre (NTWC) agency?	●	❍	●	❍	●	●	❍	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●
3d) Has your country appointed a Tsunami Ready Focal Point (TRFP)?	❍	●	❍	❍	❍	●	●	●	●	●	❍	●	❍	❍	❍	❍	●	❍	●	●	❍	●
4a) Has your country undertaken a hazard assessment?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●
4b) What type of hazard assessment has been carried out?	MH+T	MH+T	MH+T	MH+T	MH+T	MH+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	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?	●	●	●	●	●	●	●	●	●	●	❍	?		●	●	❍		●	●	●	●	●
Bathymetry - Public?	●	❍	❍	?	❍	●	●	●	●	❍	❍	?		❍	❍	?		●	●	?	❍	●
Seismo-tectonic model - Used?	●	❍	❍	❍	●	●	●		●	●	❍	?			●	❍		●	❍	●	●	●
Seismo-tectonic model - Public?	●	❍	❍	?	❍	●	●		●	●	❍	?			●	?		❍	❍	?	❍	
Topography - Used?	●	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●		❍	●	●	●	●
Topography - Public?	●	❍	❍	?	❍	●	●	●	●	❍	❍	?	?	❍	?	?		?	●	?	❍	
Land Cover - Was this data used for tsunami hazard assessment?	●	❍	❍	●	●	●	●		●	●	❍	?		●	●	❍		❍	●	?	●	●
Land Cover - Is this data publicly available?	●	❍	❍	?	●	●	●		●	❍	❍	?		❍	?	❍		?	●	?	●	
Infrastructure details - Was this data used for tsunami hazard assessment?	●	❍	❍		●	●	●	●	❍	●	❍	?	●	●	●	❍		●	●	?	●	●
Infrastructure details - Is this data publicly available?	●	❍	❍	?	❍	●	●	●	❍	❍	❍	?	?	❍	●	?		❍	●	?	●	

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
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	4	4	3	4	5	5	4	3	4	4	1	3	2	3	4	3	3	4	4	2	4	5
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	4	4	2	5	3	5	4	4	4	5	4	2	3	2	3	4	5	3	5	4	4
Deterministic tsunami hazard analysis	3	4	4	3	4	4	3	4	4	4	5	4	2	5	2	3	4	5	3	5	4	5
Field studies on tsunami impacts	2	4	2	2	4	4	3	4	5	4	5	4	3	3	3	3	3	4	2	3	4	3
Hazard map	3	4	3	3	5	5	5	3	5	4	5	4	3	5	2	3	4	4	5	5	4	5
Inundation map	2	4	3	2	5	4	5	4	5	4	5	4	4	5	2	4	4	5	5	5	3	5
Evacuation map	3	3	5	2	5	4	5	3	5	4	5	4	4	5	5	4	4	3	5	5	5	5
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	1	2	1	4	4	3		3	3	1	4	2	3	3	2	3	3	1	2	3	5
Deterministic tsunami hazard analysis	4	2	2	1	5	5	4		3	3	1	4	2	4	3	3	1	3	1	3	3	5
Field studies on tsunami impacts	3	2	2	1	4	5	3		4	3	1	4	2	3	2	3	1	1	1	4	3	5
Hazard map	4	2	3	1	5	5	3		4	3	1	4	3	4	2	3	3	3	3	3	3	5
Inundation map	4	2	2	1	5	5	4		4	3	1	4	3	4	3	3	3	3	4	3	3	5
Evacuation map	4	2	2	1	5	5	3		4	3	1	4	3	4	2	2	3	1	4	3	3	5
5a) Has your country undertaken a tsunami risk assessment?	●	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●	❍	●	❍	●	●	●
5b) What type of risk assessment?	MR+T	MR+T	MR+T	T, MR+T	MR+T	MR+T		MR+T	T, MR+T	MR+T	MR+T	MR+T	MR+T	MR+T	MR+T	MR+T		T, MR+T		T	T, MR+T	T, MR+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		●			●	●									●							
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	●																					

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
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	4	3	3	4	5	4	3	3	2	4	1	3	2	3	4	2	2	5	2	2	4	5
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	4	4	2	5	5	4	4	5	4	5	3	2	5	2	4	5	5	3	5	5	4
Regional Level	3	4	2	2	5	5	4	5	4	4	5	3	2	5	2	4	5	5	4	5	4	4
City Level	3	4	5	2	5	5	4	5	4	4	5	3	2	5	4	4	5	5	2	5	5	4
Village Level	2	4	5	2	5	5	4	4	4	4	5	3	2	5	3	4	5	1	1	5	5	4
Community / Neighbourhood Level	2	4	4	2	5	5	4	4	4	4	5	3	2	5	3	4	5	1	1	5	5	4
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	1	4	3	1	2	2	3	1	4	2	3	3	3	3	3	3	3	3	5
Regional Level	3	2	2	1	4	3	1	2	2	3	1	4	2	2	1	3	2	3	3	3	3	5
City Level	3	2	2	1	4	3	1	2	3	3	1	4		2	3	3	2	3	2	3	3	4
Village Level	3	2	2	1	4	3	1	2	3	3	1	4	2	2	3	3	2	1	1	3	3	4
Community / Neighbourhood Level	3	2	2	1	4	3	1	2	4	3	1	4	2	2	3	3	2	1	1	3	3	4
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	T	MH+T	MH+T	MH+T	T	T	T	N/A	MH+T	MH+T	N/A	MH+T	N/A		MH+T	MH+T	N/A	MH+T	N/A	MH+T	T	MH+T
Preparedness	T	MH+T	MH+T	MH+T	T	T		MH+T	MH+T	MH+T	N/A	MH+T	N/A		MH+T	MH+T	MH+T	N/A	MH+T	T	T	MH+T
Emergency response	T	MH+T	MH+T		T	MH+T		MH+T	MH+T	MH+T	MH+T	MH+T	N/A		MH+T	MH+T	MH+T	N/A	MH+T	T	T	MH+T
Rehabilitation and reconstruction	N/A	MH+T	MH+T		T	MH+T		N/A	MH+T	MH+T	N/A	MH+T	N/A		MH+T	MH+T	N/A	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	T	MH+T	N/A	MH+T	MH+T	MH+T	T	N/A	N/A	MH+T	N/A	N/A	N/A		MH+T	T	N/A	N/A	N/A	MH+T	T	MH+T
Preparedness	T	MH+T	N/A	MH+T	MH+T	MH+T	T	N/A	N/A	MH+T	N/A	N/A	N/A		MH+T	MH+T	MH+T	N/A	MH+T	T	T	MH+T
Emergency response	T	MH+T	N/A		MH+T	MH+T	T	N/A	N/A	MH+T	N/A	N/A	N/A		MH+T	MH+T	MH+T	N/A	MH+T	T	MH+T	MH+T
Rehabilitation and reconstruction	T	MH+T	N/A		MH+T	MH+T	T	N/A	N/A	MH+T	N/A	N/A	N/A		MH+T	MH+T	N/A	N/A	MH+T	MH+T	MH+T	MH+T
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 plan / plan not available.																						
National - Prevention and mitigation	MH+T	MH+T	N/A		T	MH+T	N/A	N/A	MH+T	MH+T	N/A	MH+T	N/A		MH+T	T	N/A	MH+T	MH+T	MH+T	T	MH+T
Local - Prevention and mitigation	T	MH+T			MH+T	MH+T	T	N/A	N/A		N/A	MH+T	N/A		MH+T	MH+T	N/A	N/A	N/A	MH+T	T	
Community / Neighbourhood Level - Prevention and mitigation	MH+T	MH+T			MH+T	MH+T	N/A	N/A	N/A		N/A	MH+T	N/A			T	N/A	N/A	N/A	MH+T	T	
National - Preparedness	MH+T	MH+T	T	MH+T	T	MH+T	N/A	MH+T	MH+T	MH+T	N/A	MH+T	N/A	MH+T	MH+T	T	MH+T	MH+T	MH+T	MH+T	T	MH+T
Local - Preparedness	T	MH+T			MH+T	MH+T	T	N/A	N/A		N/A	MH+T	N/A	MH+T	MH+T	MH+T	MH+T	N/A	MH+T	MH+T	T	
Community / Neighbourhood Level - Preparedness	MH+T	MH+T		MH+T	MH+T	MH+T	N/A	N/A	N/A		N/A	MH+T	N/A	MH+T		MH+T	MH+T	N/A	N/A	MH+T	T	

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
National - Emergency response	MH+T	MH+T	T	MH+T	T	MH+T	N/A	MH+T	MH+T	MH+T	N/A	MH+T	N/A	MH+T	MH+T	T	MH+T	MH+T	MH+T	T	MH+T	MH+T
Local - Emergency response	T	MH+T			MH+T	MH+T	T	N/A	N/A		N/A	MH+T	N/A	MH+T	MH+T	MH+T	MH+T	N/A	MH+T	T	MH+T	
Community / Neighbourhood Level - Emergency response	MH+T	MH+T		MH+T	MH+T	MH+T	N/A	N/A	N/A		N/A	MH+T	N/A	MH+T		MH+T	MH+T	N/A	N/A	T	MH+T	
National - Rehabilitation and reconstruction	N/A	MH+T			T	N/A	N/A	N/A	MH+T	MH+T	N/A	N/A	N/A	MH+T	MH+T	T	N/A	MH+T	MH+T	MH+T	MH+T	MH+T
Local - Rehabilitation and reconstruction	MH+T	MH+T			MH+T	MH+T	T	N/A	N/A		N/A	N/A	N/A	MH+T	MH+T	MH+T	N/A	N/A	MH+T	MH+T	MH+T	
Community / Neighbourhood Level - Rehabilitation and reconstruction	MH+T	MH+T			MH+T	N/A	N/A	N/A	N/A		N/A	N/A	N/A	MH+T		MH+T	N/A	N/A	N/A	MH+T	MH+T	
7b) Are your country's tsunami disaster risk reduction plans based on hazards and risk assessments?	●	●	●		●	●	●	●	●	●	●	●	❍	●	●	❍	❍	●	●	●	●	●
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	MH+T	MH+T	T	T	T	N/A	MH+T	T	N/A	MH+T	N/A	T	MH+T	MH+T	N/A	T	N/A	MH+T	T	T
Preparedness	T	MH+T	MH+T	MH+T	T	T	N/A	MH+T	MH+T	MH+T	N/A	MH+T	N/A		MH+T	MH+T	MH+T	T	MH+T	MH+T	T	T
Emergency response	T	MH+T	T		T	MH+T	N/A	MH+T	MH+T	MH+T	N/A	MH+T	N/A		MH+T	MH+T	MH+T	T	MH+T	MH+T	MH+T	T
Rehabilitation and reconstruction	N/A	MH+T	MH+T		T	MH+T	N/A	N/A	MH+T	MH+T	N/A	MH+T	N/A		MH+T	MH+T	MH+T	T	N/A	MH+T	MH+T	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	MH+T	MH+T	N/A	N/A	N/A		N/A	N/A	N/A		MH+T	MH+T	N/A	T	N/A	MH+T	T	T
Preparedness	T	MH+T	N/A	MH+T	MH+T	MH+T	N/A	N/A	N/A		N/A	N/A	N/A		MH+T	MH+T	N/A	T	N/A	MH+T	T	T
Emergency response	T	MH+T	N/A		MH+T	N/A	N/A	N/A	N/A		N/A	N/A	N/A		MH+T	N/A	N/A	T	N/A	MH+T	MH+T	T
Rehabilitation and reconstruction	T	MH+T	N/A		MH+T	N/A	N/A	N/A	N/A		N/A	N/A	N/A		MH+T	N/A	N/A	T	N/A	MH+T	MH+T	T
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	●	●	●		●	●	●			●			●	●	●	●	●	●		●	●	●

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
9g) Does the organisation have access to national or international seismic networks?	●	●	❍	●	●	●	●	●	●	●	●	●	❍	●	●	●	●	●	●	●	●	●
9h) Is national seismic data shared in real time?	●	●		●	Some	Some	Some	●	Some	Some	●	●		Some	Some	Some		●	●	Some	●	Some
9i) Does your organisation have access to GNSS data?	❍	❍	●	●	●	❍	❍	●	●	❍	●	❍	❍	●	●	●		●	●		❍	❍
9j) Is the list of broadband seismometers operated by your country listed accurately in the IOTWMS seismic database?	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
9l) Does the organisation have access to national or international sea level networks?		❍	●	●	●	●	●	❍	❍	●	❍	●	❍	●	●	❍		●	●	●	●	●
9m) Is national sea level data shared in real time?	●	●	Some	●	Some	●	❍			Some		●		●	●					●	●	Some
9n) Is the list of sea level stations operated by your country listed accurately in the IOTWMS sea level database?	●	●	❍	●	●	❍	●	●	●	●		●	●	●	●	●			●	❍	❍	●
9p) 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						●		●														●
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 threat forecasts?	●	❍	❍	❍	●	●	●	❍	❍	●	❍	❍	❍	❍	●	●		●	❍	❍	●	●
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 damaging tsunami? If Yes, what was your national response to each event (please comment if warnings were issued by your NTWC in a timely manner, if public were evacuated, etc.)	●	❍	❍	●	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
9y) Since 2018, have there been any enhancements in your national warning SOPs and alerting?	●	❍	❍	●	●	●	●	●	●	●	●	●	❍	●	●	●	❍	●	●	●	❍	●
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	●	●		●	●	●	●	●	●	●						●		●		●	●	

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
Television	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●		●	●	●
Warning towers	●				●			●												●	●	●
Megaphone	●				●	●			●		●									●		
Police/military	●		●		●	●		●	●						●	●		●		●		●
Public alert system	●			●	●	●		●					●		●			●		●		●
VHF radio	●	●	●	●	●	●		●	●		●									●		
VPN	●				●										●					●		
Other	●	●			●																	
10b) 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	●	●	●	●		●									●				●		●	
Media - Telephone	●	●	●		●		●	●	●		●	●			●	●	●		●	●	●	●
Media - Fax	●				●		●			●	●	●			●	●				●	●	
Media - Email		●	●		●		●	●		●	●		●		●	●	●		●	●	●	●
Media - SMS	●	●			●		●	●				●	●		●	●		●	●		●	
Media - Siren				●		●												●			●	
Media - Other	●		●	●		●									●				●		●	●
10e) Does your country's national tsunami warning system utilise the Common Alert Protocol (CAP) for the dissemination of warnings?	●	❍	❍	●	●	●	❍	●	❍	❍	●	❍	●		●	●		❍	●	❍	●	●

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
11a) For each of the (upstream) emergency response issues listed below, select a yes/no response.																						
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	❍	●		❍	❍	●	●	●	●	❍	●	❍	●	●	●	❍	●	❍	❍	●	●	❍
Receiving information from the NTWC - Is support required to develop Human Resources in this aspect of tsunami emergency response?	❍	●		❍	❍	●	❍	●	●	●	●	❍	●	●	●	●	●	❍	●	●	●	❍
Receiving information from the NTWC - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●		❍	❍	●	❍	●	●	❍	●	❍	●	●	●	●	●	❍	●	●	●	❍
Response Criteria / decision making - 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 of tsunami emergency response?	❍	●		●	❍	●	●	●	●	●	●	❍	●		●	●	●	❍	●	●	●	❍
Response Criteria / decision making - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●		●	❍	●	●	●	●	❍	●	❍	●		●	●	●	❍	●	●	●	❍
11b) For each of the (downstream) emergency response issues listed below, select a yes/no response.																						
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 response in your SOP?	●	●		❍	❍	●	●	●	●	❍	●	❍	●	●	●	●	●	❍	❍	●	●	❍
Warning dissemination - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●		❍	❍	●	●	●	●	●	●	❍	●	●	●	●	●	❍	❍	●	●	❍
Warning dissemination - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●		❍	❍	●	●	●	●	●	●	❍	●	●	●	●	●	❍	●	●	●	❍
Evacuation call procedures - Does your SOP address this aspect of tsunami emergency response?	●	●		●	●	●	❍	●	●	●	❍	●	●		●	❍	❍	●	❍	●	●	●
Evacuation call procedures - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●		❍	❍	●	❍	●	●	❍	●	●	●		●	●	●	❍	●	●	●	❍
Evacuation call procedures - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●		❍	●	●	❍	●	●	●	●	❍	●		●	●	●	❍	●	●	●	❍
Evacuation call procedures - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●		❍	❍	●	●	●	●	❍	●	●	●		●	●	●	❍	●	●	●	❍

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
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 of tsunami emergency response?	●	●		❍	●	●	❍	●	●	●	●	❍	●		●	●	●	❍	●	●	●	❍
Community evacuation procedures - Is support required to develop infrastructure for this aspect of tsunami emergency response?	●	●		❍	❍	●	●	●	●	❍	●	●	●		●	●	●	❍	●	●	●	❍
Communication with NTWC - Does your SOP address this aspect of tsunami emergency response?	●	●		●	●	●	❍	●	●	●	●	●	●		●	●	●	●	●	●	●	●
Communication with NTWC - Is support required to develop/improve this aspect of tsunami emergency response in your SOP?	●	●		❍	❍	●	❍	●	●	❍	●	❍	●		●	●	●	❍	❍	●	●	❍
Communication with NTWC - Is support required to develop Human Resources in this aspect of tsunami emergency response?	●	●		❍	❍	●	❍	●	●	●	●	❍	●		●	●	●	❍	●	●	●	❍
Communication with NTWC - Is support required to develop infrastructure for this aspect of tsunami emergency response?	❍	●		❍	❍	●	●	●	●	❍	●	❍	●		●	●	●	❍	●	●	●	❍
Communication with Local Government - Does your SOP address this aspect of tsunami emergency response?	●	●		●	●	●	❍	●	●	●	●	●	●		●	●	●	●	❍	●	●	●
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 tsunami emergency response?	❍	●		❍	❍	●	●	●	●	❍	●	●	●		●	●	●	❍	●	●	●	❍
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 response?	❍	●		❍	❍	●	●	●	●	❍	●	❍	●		●	●	●	❍		●	●	❍
Communication with other stakeholder i.e. Red Cross, Fire Brigade, Search and Rescue, Police, Army, Navy etc. - Does your SOP address 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/improve this aspect of tsunami emergency response in your SOP?	●	●		❍	❍	●	❍	●	●	❍	●	❍	●		●	❍	●	❍	●	●	●	❍

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
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?	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍
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?	❍	●	●	●	●	●	●	●	●	●	❍	❍	●	●	❍	❍	❍	❍	❍		●	●
12c) Are tsunami exercises incorporated within national policies and guidelines? (select all that apply)																						
National policy	●	●	●	●	●	●	●		●	●	●	●			●						●	●
National guidelines	●				●			●		●		●	●	●	●	●	●	●	●	●		●
12d) 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		●			●	●					●	●			●	●	●			●	●	
12e) 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			❍			●	❍			❍							❍	❍			❍	
13a) Who is responsible for tsunami public awareness programmes in your country?	ATAG	NDMO	NTWC	NDMO	PDMO	NDMO	NTWC	NTWC	NDMO	NDMO	NDMO	NTWC	NTWC	NTWC	NDMO	PDMO	NDMO		NDMO	NDMO	All	Other
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	●			●	●	●				●			●		●	●	●			●	●	●

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
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?	●	●	●	❍	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	❍
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.																						
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?	●	●	❍	❍	●	●	❍	❍	❍	❍	❍	❍	●	❍	❍	❍	❍	❍	●	●	●	
14a) Does your country have an interest to participate in the UNESCO-IOC TRRP?	❍	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	❍	●	●	●	●
14b) Aside from UNESCO-IOC TRRP, is your country currently implementing any other tsunami resilience and preparedness related initiatives or programmes?	❍	❍	❍	❍	❍	●	❍	❍	❍	●	❍	❍	❍	❍	●	●	❍	❍	❍	●	❍	❍

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
14c) What number of villages, cities/districts and provinces/state levels in your country are at risk to tsunami?																						
Villages			50	36	15508	5744	50				172			1000	60			0			509	
Cities / Districts		14	20		89	255	6				5	6		70	23	2	27	0		14	27	
Provinces			3		13	26	2	4		3	198			5	7	2		0	3	5	6	2
14d) Does your country have a National Tsunami Ready Board (NTRB)	❍	●	❍	●	●	●	❍	❍	❍	❍	●	❍	❍	❍	❍			❍	❍	❍	❍	❍
14f) Are any communities (for example, villages, cities, districts, provinces or states) in your country currently working towards implementing or interested in implementing the UNESCO-IOC TRRP or similar national initiative?	●	●	●	❍	●	●	●	❍	❍	❍	●	●	❍		●	●		❍	❍	●	❍	●
14g) Have any communities in your country achieved recognition through UNESCO-IOC TRRP or similar national initiative?	❍	❍	❍	❍	●	●	❍	❍	❍	❍	❍	❍	❍		❍	❍		❍	❍	❍	❍	❍
15) Is there national capacity to:																						
a) develop tsunami hazard maps?	●	Partial	Partial	●	●	●	Partial	❍	●	Partial	❍	❍	Partial	❍	Partial	❍	Partial	●	●	Partial	Partial	●
b) train the community on identifying and estimating the number of people that live in the tsunami hazard zone?	❍	Partial	Partial	●	●	●	Partial	Partial	●	●	❍	❍	❍	❍	Partial	❍	Partial	●	●	Partial	Partial	●
c) train the community on the inventory of available economic, instrastructural, political, and social resources to reduce tsunami risk at the community level?	❍	Partial	❍	●	Partial	●	Partial	Partial	●	●	❍	❍	❍	❍	Partial	❍	Partial	●	❍	❍	Partial	●
d) work with the community to develop tsunami evacuation maps, plans and procedures at the community level?		Partial	●	●	●	●	Partial	❍	●	●	❍	❍	Partial	❍	Partial	❍	Partial	●	❍	Partial	●	●
e) work with the community to develop a public display of tsunami information?	●	Partial	●	●	●	●	Partial	Partial	●	●	❍	❍	Partial	❍	Partial	Partial	Partial	●	❍	Partial	Partial	●
f) work with the community to develop local context outreach and public education materials?	●	Partial	Partial	●	Partial	●	Partial	Partial	●	●	❍	❍	Partial	❍	Partial	Partial	Partial	●	Partial	●	●	●
g) train and build capacity of community to be able to organise and implement outreach and education activity?	●	Partial	Partial	●	Partial	●	Partial	Partial	●	●	Partial	❍	Partial	❍	●	❍	Partial	●	Partial	●	Partial	●
h) train and build capacity of community to be able to organise and implement tsunami exercises?	●	Partial	Partial	●	●	●	Partial	Partial	●	●	Partial	❍	Partial	❍	●	Partial	Partial	●	❍	●	Partial	●
i) train and build capacity of communities to be able to develop their community Emergency Operation Plan?	●	Partial	❍	●	Partial	●	Partial	❍	●	●	Partial	❍	Partial	❍	Partial	❍	Partial	●	❍	Partial	●	●
j) train and build capacity of communities to manage 24/7 tsunami emergency response operation?	●	Partial	❍	●	Partial	●	❍	❍	●	●	Partial	❍	Partial	❍	Partial	●	Partial	●	Partial	Partial	●	●
k) train and work with the communities to develop mechanisms (means and procedures) to receive 24/7 warning?	●	Partial	Partial	●	●	●	❍	❍	●	●	Partial		Partial	❍	●	Partial	Partial	●	Partial	Partial	●	●
l) train and work with the communities to develop mechanisms (means and procedures) to disseminate 24/7 warning to the community?	●	Partial	Partial	●	●	●	❍	Partial	●	●	Partial	❍	●	❍	●	●	Partial	●	Partial	Partial	●	●

● = Yes ❍ = No Blank = No Response ? = Don't Know	AUS	BAN	COM	FR	IN	IND	IR	KN	MAD	MAL	MD	MAU	MZ	MM	OM	PAK	SY	SIN	SA	SLK	THA	UAE
15m) Which of the following challenges inhibit the implementation of TRRP or similar national initiatives in your country? (select all that apply)																						
None		●																			●	●
Tsunami is not a high priority hazard in country	●			●	●			●	●	●		●	●			●			●			
Limited resources (for example, champions, leadership, scientific	●		●		●		●		●			●	●	●			●			●		
Limited support of government (for example, policy, financial)	●		●				●	●	●	●	●			●			●		●	●		
Limited awareness	●		●		●	●	●			●	●	●	●			●				●		
Limited activity	●		●		●					●		●	●		●	●	●					
Lack of community interest	●					●		●	●			●				●	●					
No community group or engagement in disaster risk reduction															●	●						
Other						●														●		

ANNEX IV

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
IAS	Interim Advisory Service
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
NTRB	National Tsunami Ready Board
NTWC	National Tsunami Warning Centre
OTPAS	Operational Tsunami Prediction and Assessment System
PTHA	Probabilistic Tsunami Hazard Assessment
PTWC	Pacific Tsunami Warning Center
RII	Relative Importance Index
RIMES	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
SDGs	Sustainable Development Goals

SIDS	Small Island Developing States
SMART	Science Monitoring And Reliable Telecommunications
SMS	Short Message Service
SOP	Standard Operating Procedures
TNC	Tsunami National Contact
TRRP	Tsunami Ready Recognition Programme
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

IOC Technical Series

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
5	Legal Problems Associated with Ocean Data Acquisition Systems (ODAS). 1969	(out of stock)
6	Perspectives in Oceanography, 1968	(out of stock)
7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
9	Manual on International Oceanographic Data Exchange - Third Revised Edition. 1973	(out of stock)
10	Bruun Memorial Lectures, 1971	E, F, S, R
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12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
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15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
16	Integrated Ocean Global Station System (IGOSS) General Plan and Implementation Programme 1977-1982. 1977	E, F, S, R
17	Oceanographic Components of the Global Atmospheric Research Programme (GARP) . 1977	(out of stock)
18	Global Ocean Pollution: An Overview. 1977	(out of stock)
19	Bruun Memorial Lectures - The Importance and Application of Satellite and Remotely Sensed Data to Oceanography. 1977	(out of stock)
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27	Ocean Observing System Development Programme. 1984	E, F, S, R
28	Bruun Memorial Lectures, 1982: Ocean Science for the Year 2000. 1984	E, F, S, R
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30	Time-Series of Ocean Measurements. Vol. 2. 1984	E only
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32	Summary of Radiometric Ages from the Pacific. 1987	E only
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34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only

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36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
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54	Geological Processes on the Northeast Atlantic Margin (8th training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9th training-through-research cruise, June-July 1999). 2000	E only
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63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
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67	Interdisciplinary Geoscience Research on the North East Atlantic Margin, Mediterranean Sea and Mid-Atlantic Ridge (12th training-through-research cruise, June-August 2002). 2003	E only
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70	Interdisciplinary geoscience studies of the Gulf of Cadiz and Western Mediterranean Basin (14th training-through-research cruise, July-September 2004). 2006	E only
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72	Deep-water Cold Seeps, Sedimentary Environments and Ecosystems of the Black and Tyrrhenian Seas and the Gulf of Cadiz (15th training-through-research cruise, June–August 2005). 2007	E only
73	Implementation Plan for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS), 2007–2011. 2007 *(electronic only)*	E only
74	Bruun Memorial Lectures, 2005: The Ecology and Oceanography of Harmful Algal Blooms – Multidisciplinary approaches to research and management. 2007	E only
75	National Ocean Policy. The Basic Texts from: Australia, Brazil, Canada, China, Colombia, Japan, Norway, Portugal, Russian Federation, United States of America. (Also Law of Sea Dossier 1). 2008	E only
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82	Exercise Pacific Wave 08 – A Pacific-wide Tsunami Warning and Communication Exercise, 28–30 October 2008. 2008	E only
83.	*Cancelled*	
84.	Global Open Oceans and Deep Seabed (GOODS) Bio-geographic Classification. 2009	E only
85.	Tsunami Glossary	E, F, S
86	Pacific Tsunami Warning System (PTWS) Implementation Plan	*Electronic publication*

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87.	Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) – Second Edition. 2011	E only
88.	Exercise Indian Ocean Wave 2009 (IOWave09) – An Indian Ocean-wide Tsunami Warning and Communication Exercise – 14 October 2009. 2009	E only
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92.	27 February 2010 Chile Earthquake and Tsunami Event – Post-Event Assessment of PTWS Performance (Pacific Tsunami Warning System). 2010	E only
93.	Exercise CARIBE WAVE 11 / LANTEX 11—A Caribbean Tsunami Warning Exercise, 23 March 2011	
	Vol. 1 Participant Handbook / Exercise CARIBE WAVE 11 —Exercice d'alerte au tsunami dans les Caraïbes, 23 mars 2011. Manuel du participant / Ejercicio Caribe Wave 11. Un ejercicio de alerta de tsunami en el Caribe, 23 de marzo de 2011. Manual del participante. 2010	E/F/S
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	Vol. 3 Supplement: Media Reports. 2011	E/F/S
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98.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and connected seas. First Enlarged Communication Test Exercise (ECTE1). Exercise Manual and Evaluation Report. 2011	E only
99.	Exercise INDIAN OCEAN WAVE 2011 – An Indian Ocean-wide Tsunami Warning and Communication Exercise, 12 October 2011	E only
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100.	Global Sea Level Observing System (GLOSS) Implementation Plan – 2012. 2012	E only
101.	Exercise Caribe Wave/Lantex 13. A Caribbean Tsunami Warning Exercise, 20 March 2013. Volume 1: Participant Handbook. 2012 Volume 2: Final Report	E only
102.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas — Second Enlarged Communication Test Exercise (CTE2), 22 May 2012.	E only
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	Vol. 2 Evaluation Report. 2014	
103.	Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012. Vol. 1: Exercise Manual. 2012 Vol. 2: Evaluation Report. 2013	E only
104.	Seísmo y tsunami del 27 de agosto de 2012 en la costa del Pacífico frente a El Salvador, y seísmo del 5 de septiembre de 2012 en la costa del Pacífico frente a Costa Rica. Evaluación subsiguiente sobre el funcionamiento del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico. 2012	Español solamente (resumen en inglés y francés)

105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System, August 2014. Revised Edition. 2014	E, S
106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
107.	Tsunami Public Awareness and Educations Strategy for the Caribbean and Adjacent Regions. 2013	E only
108.	Pacific Tsunami Warning and Mitigation System (PTWS) Medium-Term Strategy, 2014−2021. 2013	E only
109.	Exercise Caribe Wave/Lantex 14. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 26 March 2014. Vol. 1 Participant Handbook. 2014 Vol. 2 Evaluation Report. 2015 (English only)	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem, 3rd edition: revised and expanded. 2017	E only
111.	Integrated Regional Assessments in support of ICZM in the Mediterranean and Black Sea Basins. 2014	E only
112.	11 April 2012 West of North Sumatra Earthquake and Tsunami Event - Post-event Assessment of IOTWS Performance	E only
113.	Exercise Indian Ocean Wave 2014: An Indian Ocean-wide Tsunami Warning and Communication Exercise. Vol.1 Manual Vol. 2 Exercise Report. 2015	E only
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115.	Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem. 2015 *(revised in 2016)*	E only
116.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Third Enlarged Communication Test Exercise (CTE3), 1st October 2013. Vol. 1 Exercise Manual Vol. 2 Evaluation Report	E only
117.	Exercise Pacific Wave 15. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2–6 February 2015 Vol. 1: Exercise Manual; Vol. 2: Summary Report	E only
118.	Exercise Caribe Wave/Lantex 15. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 25 March 2015 (SW Caribbean Scenario) Vol. 1: Participant Handbook Vol. 2: Summary Report	E only
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120.	Transboundary Waters Assessment Programme (TWAP) – Status and Trends in Primary Productivity and Chlorophyll from 1996 to 2014 in Large Marine Ecosystems and the Western Pacific Warm Pool, Based on Data from Satellite Ocean Colour Sensors. 2017	E only
121.	Exercise Indian Ocean Wave 14, an Indian Ocean wide Tsunami Warning and Communications Exercise, 9–10 September 2014	*In preparation*
122.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Sixth Communication Test Exercise (CTE6), 29 July 2015. Vol. 1: Exercise Manual Vol. 2: Evaluation Report	E only

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123	Preparing for the next tsunami in the North-Eastern Atlantic, the Mediterranean and Connected Seas – Ten years of the Tsunami Warning System (NEAMTWS). 2017 —*Cancelled*	*(see IOC/INF-1340)*
124	Indicadores Marino Costeros del Pacífico Sudeste / Coastal and Marine Indicators of the Southeast Pacific (SPINCAM)	E/S
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