



**SOPAC Member Countries
National Capacity Assessments:
Tsunami Warning and Mitigation Systems**

Republic of Palau



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SOPAC

5. Assessment Results

5.1. Status of Key System Components

The Tsunami Capacity Assessment Workshop results are summarised below in Table 4 in which the status of key components of Palau's tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in August 2009. Updates between then and the publication of this report are as marked).

Table 4: Summary of current status of key components of Palau's tsunami warning and mitigation system as at August 2009.

Rating

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Comment
Authority, Coordination and NGO Role		
Legislation in place for tsunami warnings and response	No	A National Disaster Plan (1998, D1) exists and is in the final stages of being reviewed (draft NDRMF (D2)). The current 1998 plan is legislated by Executive Order No. 166-99. However, tsunami warning roles and responsibilities are not clearly articulated in the 1998 plan and therefore not legislated.
Tsunami coordination committee or effort at a National and local level	No	There is a national governance structure consisting of the Crisis Leadership Team (CLT) comprised of the President and Cabinet, NEC of 22 members including State Governors the Vice President as Chair and Chief of Staff as Vice Chair, the National Emergency Operations Centre (NEOC), and Incident Command Post (ICP) (a tactical location near the incident) to manage response during an event. The NEC could benefit from meeting regularly outside of disaster events and incorporating mitigation and preparedness through the development of active Working Groups under this structure.
Agency responsibilities clearly defined	Partially	DRM Plans exist in Palau at a National (refer to 5.3.1) and State Government level (for example, Kayangel State Government, State Disaster Plan (D29)). A tsunami response, evacuation and recovery plan does not exist

Key Component	Rating	Comment
NGOs and Red Cross Society have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response	Partially	Engagement of NGOs is primarily in emergency response and recovery and community awareness (for example Cardio Pulmonary Resuscitation (CPR) training). These include the Red Cross, traditional State level men, women and youth groups, religious groups, the Belau Tourism Association and multicultural community clubs (such as the Filipino Community in Palau Group).
International and Regional Cooperation		
Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts	Partially	<p>Strong linkages with international agencies and donors to assist in DRM, including technical assistance and emergency response. These include SOPAC, South Pacific Regional Environmental Programme (SPREP), Pacific Island Forum (PIF), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), PTWC, Comprehensive (Nuclear) Test Ban Treaty Organisation (CTBTO), International Federation of Red Cross and Red Crescent Societies (IFRC), United Nations Development Programme (UNDP), International missions and aid agencies and various USA agencies.</p> <p>Could benefit from further involvement in international tsunami forums and the IOC.</p>
Priorities		
Priorities established for implementation of tsunami warning and mitigation system at a National level	Yes (through this process)	<p>Not specifically completed for tsunami, except through the Tsunami Capacity Assessment Workshop in August 2009. See below the priorities identified during this process.</p> <ul style="list-style-type: none"> • Emergency Response Planning <ul style="list-style-type: none"> ○ Enhancement of National tsunami planning. ○ Plans at the community level, particularly for small flat islands such as Tobi. ○ Identify evacuation requirements. ○ Drills and exercises (preceded by education). • Community Awareness <ul style="list-style-type: none"> ○ A public education program is needed similar to that run for typhoons. ○ Focused awareness training for specific groups and special interest groups (such as non-English speaking).

Key Component	Rating	Comment
Priorities (Continued...)		
<p><i>Continued...</i></p> <p>Priorities established for implementation of tsunami warning and mitigation system at a National level</p>	<p><i>Continued...</i></p> <p>Yes (through this process)</p>	<ul style="list-style-type: none"> • Risk Assessment & Warning Dissemination <ul style="list-style-type: none"> ○ Development of a better understanding of the tsunami risk. ○ Identify low-lying coastal areas, public and tourist areas and areas with key utilities, essential services and industry. ○ Install more bull horns for warning. ○ Radio and TV for dissemination of warning information. ○ Informing Governors to pass the information onto the community. ○ Use of the emergency service networks and communications channels. • Interagency Cooperation <ul style="list-style-type: none"> ○ Further coordination for receipt and dissemination of tsunami warnings, public education and evacuation. ○ Activating agencies required.
Multi-hazard Approach		
<p>Tsunami warning capabilities are being established within a multi-hazard framework</p>	<p>Yes</p>	<p>Palau is working within a multi-hazard framework for DRM. This will be enhanced further after the adoption of the draft NDRMF (D2) and associated legislation as well as the DRM National Action Planning process due to begin in 2010-12.</p>
Research Expertise		
<p>Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system</p>	<p>No</p>	<p>There is no research into tsunami being undertaken in Palau. There is a limited research skill base in Palau to support analysis and preparedness at a technical level in country (for example, PALARIS appears to have good skill in Information Technology (IT), GIS and capacity to undertake modelling application work). Some cooperation with external technical (regional and international) agencies currently exists and could be further enhanced.</p> <p>Scientific research capability exists with in-country organisations such as the Coral Reef Research Foundation, and Palau International Coral Reef Center. These are not tsunami related at present.</p>
Tsunami monitoring infrastructure		
<p>Existence of seismograph stations and integration of real-time data from these stations into the tsunami warning process</p>	<p>Partially</p>	<p>There is one seismic station at PCC in Koror. The station is part of the JMASTEC network. PCC has access to the seismic data collected on site and eight PCC employees have been trained to use the instrumentation. Operational agencies do not have access to the seismic data in real-time for operational use.</p>

Key Component	Rating	Comment
Tsunami monitoring infrastructure (Continued...)		
Existence of sea level stations and integration of real-time data from these stations into the tsunami warning process	Partially	There is one sea level gauge at Malakal, Koror Harbour. This is owned and maintained by the University of Hawaii and first in maintenance support is provided by the NWS.
Sharing of seismic and sea level data internationally to facilitate improvement of PTWC tsunami messages for the region	Partially	The one sea level gauge at Malakal, Koror Harbour transmits data via satellite to University of Hawaii and internationally on the GTS. The one seismic station at PCC in Koror distributes the data is distributed internationally for inclusion in seismic evaluation.
Warnings		
Nation receives PTWC messages	Yes	NWS receives international tsunami messages (PTWC, JMA, ATWC (Alaska)) through e-mail, fax, EMWIN and AISR with audio alert through internet via PNCC links.
24/7 operational staff at warning receipt and dissemination location	Yes	NWS operates 24/7 and has support from on-call staff.
Disseminate national tsunami warnings as guided by a Standard Operating Procedure	Partially	Procedures currently exist for dissemination of tsunami warnings nationally. However, the process from receiving the international tsunami message to issuing advice to the community is too lengthy and convoluted to effectively warn the Palauan public. Currently, national warnings are issued by NEMO (who are not 24/7), after receiving advice from the NWS. NEMO's actions must first be approved by the NEC Chairman or deputy. Dissemination mechanisms to the community require improvement.
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	Partially	NWS has multiple paths for incoming PTWC alerts via the PNCC Intelsat supplied Internet or phone/fax lines with Iridium backup and EMWIN backup. A second 24/7 agency does not receive tsunami messages at present. There is currently no back-up agency identified to disseminate tsunami warnings if the NEMO is unable to do so.

Key Component	Rating	Comment
Warnings (Continued...)		
<p>Redundant 24/7 methods available for dissemination of warnings to community (for example, public radio, sirens)</p>	<p>Partially</p>	<p>Mechanisms that would currently be used to disseminate tsunami warnings include:</p> <ul style="list-style-type: none"> • Activating the Koror emergency siren (slow wailing alert tone three to five minutes). • Contacting the following by phone: <ul style="list-style-type: none"> ○ The most vulnerable State first and other States. ○ Hotels on the coastline. ○ Bureau of Education (and schools if during the day). ○ Prepare official warning to radio stations. ○ Police. • Koror Police Office to Southwest Islands (HF or Iridium). • Remote northern areas via Police car top siren, bull horn or church bells through State Governors. • Resorts which have their own alarms, public address systems and procedures. • Media – radio and television. <p>Current problems include:</p> <ul style="list-style-type: none"> • Radio stations are manned from 6am to 12 midnight, and are pre-recorded over night. The station manager is available for emergency call-outs. • Palau is not currently using the EAS or SMS to disseminate warnings. EAS is in store at the Balau National Hospital. • Siren limited to Koror at present. • Bullhorns are limited (on 3 Police cars on the north island to cover 10 northern States). • Marine users (boats etc.) require adequate communications to receive tsunami and other warnings. <p>(Refer below for remote communities)</p>
<p>Effective warning dissemination to remote communities</p>	<p>Partially</p>	<p>Island communication systems are not 24/7 to receive messages. None of the three broadcast stations dependably cover the southwest islands or all the villages in the north. A 24/7 communication link to the remote Southwest Islands is required to disseminate emergency warnings (for example, Chatty Beetle).</p> <p>Update March 2010: Small Ku Band dishes have been installed in the Southwest. Training and configuration of systems required.</p>

Key Component	Rating	Comment
Warnings (Continued...)		
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	Partially	PNCC, the robust local government run telecom, supports the majority of the Palau voice, data and video traffic over Intelsat. A number of warning dissemination tools are available to disseminate warnings to the community. Further utilisation and coordination is required for the issue of tsunami warnings (refer above).
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	Partially	Further consideration needs to be given to incorporating the Port Authority into tsunami warning plans to ensure effective and timely instructions are given to the ports and vessels. Port authority only monitors the VHF during working hours (8am-5pm daily). Currently there is a 24/7 hour watch at the patrol boat dock, but the watchstander has no access to VHF or HF radio at night. A marine warning hazard flag (different colours) can be flown at the port.
Emergency Response and Evacuation		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	Partially	A National Disaster Plan (1998, D1) exists and is in the final stages of being reviewed (draft National Disaster Risk Management Framework (2009, D2)). The Disaster Risk Management National Action Planning is due to begin in 2010-12.
Tsunami emergency response, evacuation and recovery plan exists	No	A tsunami response, evacuation and recovery plan does not exist. When developed, this would most likely be a Sub-Plan to the reviewed NDRMF (D2).
The designated agency for evacuation is identified and have authority by law	Partially	The workshop stated that NEMO is the designated agency for issuing public evacuations. However, this is not clear in the National Disaster Plan (1998, D1). The workshop expressed that once the NEC is activated, authority can be given to the State Officers to complete public evacuations on behalf of NEMO.
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	No	No tsunami evacuation plans have been developed for Palau communities to date.
Procedures are tested and exercised to improve the response through better planning and preparedness	Partially	Exercise Pacific Wave 2006 was conducted down to the community level by Palau (including pre-exercise education and an evacuation drill). Palau participated in Exercise Pacific Wave 2008 but this stopped at NEMO. Aside from this, no national tsunami exercises have been conducted. Some other exercises (aviation, pandemic) are conducted and lessons learned completed but more on an agency basis.

Key Component	Rating	Comment
Emergency Response and Evacuation (Continued...)		
Land use policies and building codes are in place to mitigate against the tsunami hazard	Partially	While building permits are required, there are no formal building code requirements for Palau excepting for loans involving building insurance through the bank. Land management planning is largely centered on environmental and land right considerations. It would be beneficial if natural disaster hazard, risk and vulnerability was incorporated into this planning.
Tsunami hazard, vulnerability and risk		
Completion of studies to assess the tsunami hazard in the country or Region	Yes	Geoscience Australia has completed a Preliminary and Probabilistic Tsunami Hazard for the Southwest Pacific, including Palau (refer D27, D28).
Local risk assessments have been completed for at risk communities	No	No risk assessments have been completed at a community level for tsunamis. This has been completed for climate change related sea-level rise in a few locations. Consideration of critical infrastructure has not been factored into disaster management planning.
Adequate data exists and local inundation modelling has been completed for population centres	Partially	There is a general lack of good quality topographic and bathymetric data to facilitate production of reliable inundation maps. The bathymetric data is based on 1930 Japanese surveys and has a high associated uncertainty greater than 10 metres. Some high resolution scans of the western channel to Koror have also been undertaken (USA Military 2007) but this data is not held in-country. The only land survey data has a resolution of 10 metres.
Public and Stakeholder Awareness, Education and Training		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	Partially	Some tsunami community awareness programs have been undertaken (see below) but these have generally included the science of tsunami and natural warning signs. Information regarding tsunami warnings and required response has been missing to date.
Community level education and preparedness programs exist for tsunami	Partially	NEMO have been coordinating and facilitating public town hall meetings in each State every two years on emergency preparedness. These meetings include education about moving to high ground if you feel an earthquake. Some tsunami community awareness on the Northern Atoll was completed before Pacific Wave 2006 in the form of town hall meetings. Draft natural hazard education materials (for example, typhoon, drought, earthquake, landslides and tsunami) have been developed for school grades Year 6 to 8. This material is currently under review with the Ministry of Education with the aim of this being incorporated into the science curriculum (some natural hazards curriculum exists but is not comprehensive).

Key Component	Rating	Comment
Public and Stakeholder Awareness, Education and Training (Continued...)		
Training programs for the National media exist for natural hazard and tsunami	No	Limited media training is undertaken on natural hazards. During an event, media is managed through the Palau Broadcasting Commission as well as a senior person speaking to the media based on prepared information. NWS has some media templates.
Public and Stakeholder Awareness, Education and Training		
Training programs exist for officials involved in tsunami warning and response	Partially	In general, agencies are responsible for identifying and meeting their own DRM training needs. NEMO has some disaster management training modules and has done an Introduction to Disaster Management workshops with some States. NWS staff are comprehensively trained through NOAA channels. No tsunami specific training was identified. Training needs analysis needs to be completed and a national training framework developed. A training database would also be beneficial. This is an identified need in-country. Current plans are to complete this as the second phase of the DRM National Action Plan process (due for completion 2010 - 2012).