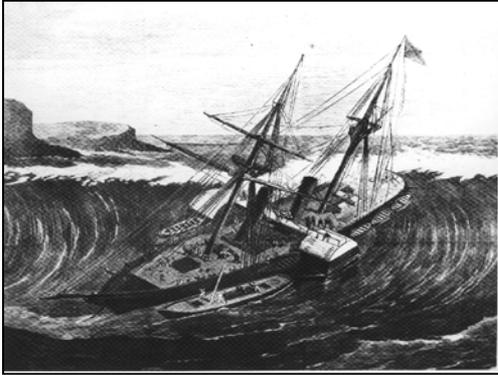


Preparedness & Outreach Goals For Maritime Tsunami Guidance

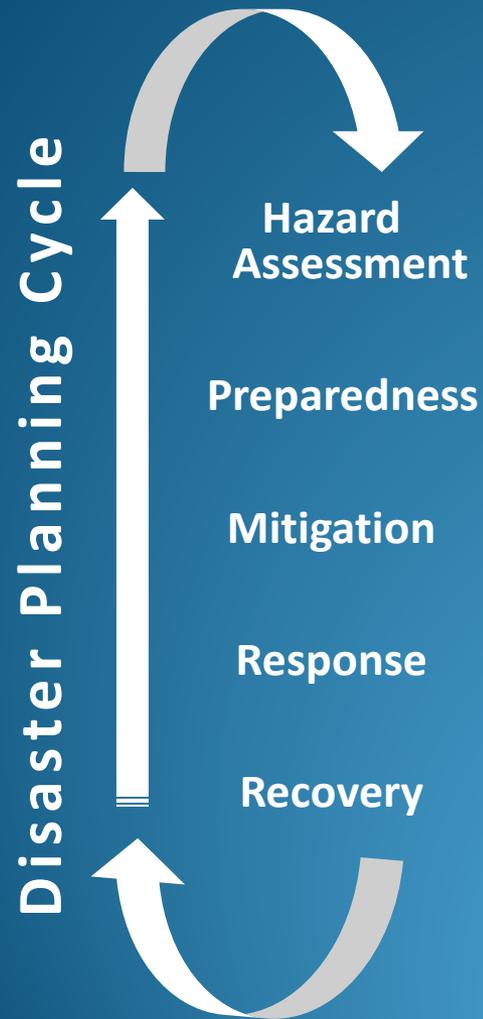


**Kevin Miller, CA Governor's Office of Emergency Services
Members of the National Tsunami Hazard Mitigation Program
and Research Partners:**



Rick Wilson, California Geological Survey; Amanda Admire, Humboldt State University; Jose Borrero, University of Southern California; Ed Curtis, Federal Emergency Management Agency; Lori Dengler, Humboldt State University; Martin Eskijian, California State Lands Commission; Laurie Johnson, Laurie Johnson Consulting; Patrick Lynett, University of Southern California; Dmitry Nicolosky, University of Alaska, Fairbanks; Cindy Pridmore, California Geological Survey; Jeri Siegel, CA Governor's Office of Emergency Services; Hong Kie Thio, URS Corporation

Maritime Community Support Goals



- Promote accurate, consistent decision-making products
- Facilitate emergency harbor response planning activities
- Depict areas in danger and safe from tsunamis
- Create map, products, & coordination through accurate assessment of local risks



Issues and Lessons Learned from Recent Real and Scenario Tsunamis

▪ **Evacuation Issues**

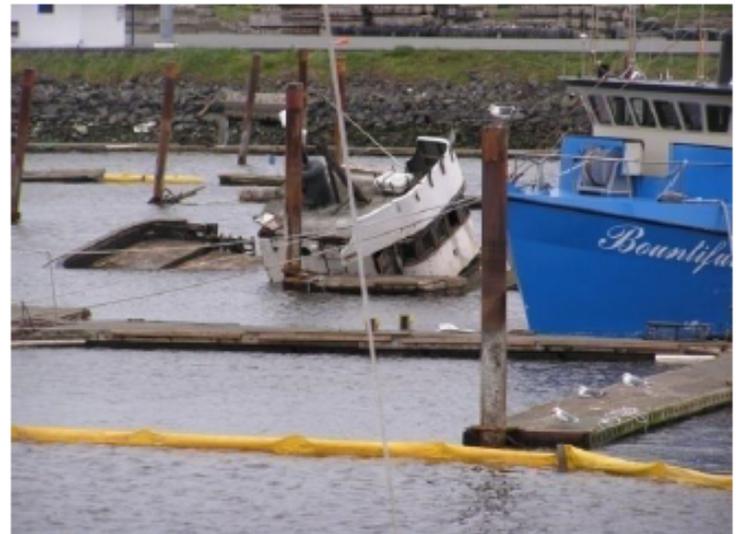
- Inconsistent response activities statewide
- What evacuation, if any, in a minor or moderate “Warning” alert at high/low tide?

▪ **Maritime Community Response Issues**

- If/When/Where to move or evacuate boats?
- Educate boat owners about tsunami hazards
- Long-term recovery issues
- What can be done to improve resiliency (mitigation and recovery)?

▪ **Land-Use and Recovery Planning**

- Japanese experience pre- and post-tsunami development and tsunami recovery
- Recovery issues experienced in 2011



Boats sunk; recovery efforts in Crescent City Harbor after 2011 Japan tsunami

Players/Stakeholders (and Audience for this Guidance document)

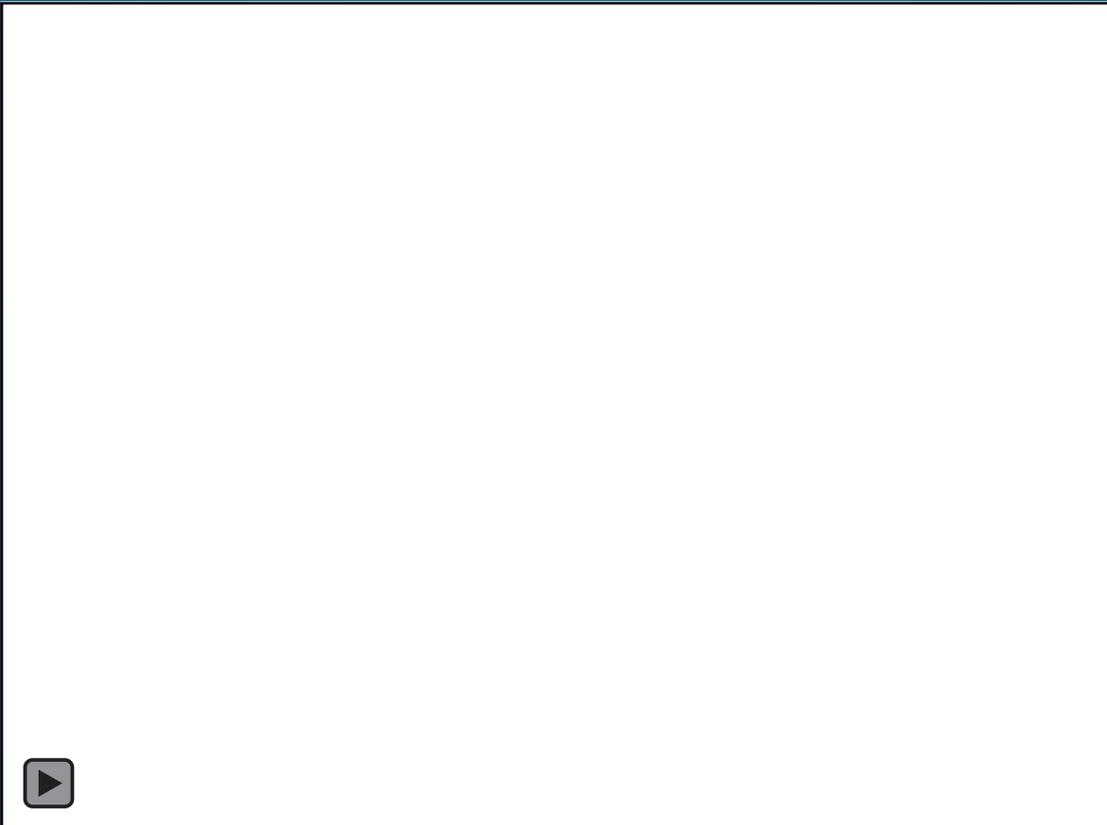
- Harbormasters (manage vessels and private assets)
- State/Local Emergency Managers
- Scientific/Academic Research community (provide knowledge)
- US Coast Guard (authority to close waters)

BENEFICIARIES

- US Shipping interests
- Public Maritime Community (ultimately; not directly)

Tsunami Maritime Safety Planning

1. Create in-harbor current hazard maps
2. Create offshore safe depth evacuation zone
3. Provide guidance and outreach
4. Consistent national policy for maritime evacuation



Maritime Response Playbooks

****Draft Maritime Playbook for Santa Cruz Harbor now available****

DRAFT 03/20/2015

California Maritime Tsunami Response Playbook And Mitigation Guidance

Santa Cruz Harbor – Santa Cruz County

Maritime Tsunami Response Playbook (MTRP) No. 2015-SCruz-01

DURING AN EMERGENCY, USE THE "QUICK REFERENCE" SHEET ON THE BACK PAGE (PAGE 22).

(For the expanded Playbook format, use directions on page 7)

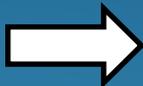


California Maritime Tsunami Response Playbook No. 2015-SCruz-01

California Geological Survey
California Governor's Office of Emergency Services
University of Southern California
Humboldt State University
National Oceanic and Atmospheric Administration



Funded by the Federal Emergency Management Agency and the National Tsunami Hazard Mitigation Program



APPENDIX
Quick Reference Page for Determining Real-Time Maritime Tsunami Response Activities

Step 1: Obtain basic information about the earthquake and tsunami from National Tsunami Warning Center in Alaska, regional National Weather Service office, and/or county emergency manager. **NOTE:** Tsunami Alert Level may change in first couple hours after the earthquake; WATCH may be upgraded to ADVISORY or WARNING.

Earthquake location _____
Earthquake magnitude _____
Tsunami Alert level (circle one) WATCH ADVISORY WARNING
Closest forecasted tsunami amplitude/wave height _____
Forecasted tsunami arrival time _____

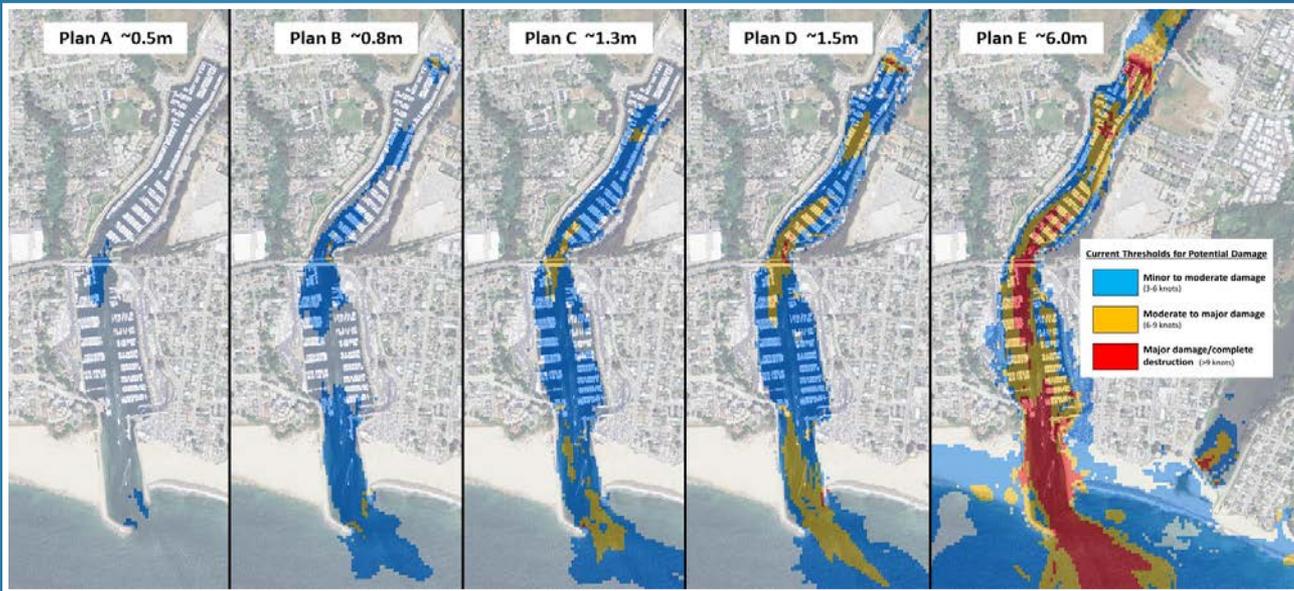
Step 2: Tsunami evacuation and response will depend on the amount of time before the tsunami arrival. Four (4) hours is considered the threshold time needed for evacuation. As a quick reference, we offer the following guidance:

1) **If less than four hours before tsunami arrival, we recommend the following:**

- ADVISORY – evacuate beaches, harbor docks, and piers
- WARNING – evacuate entire maximum on-land evacuation zone, or follow guidance provided by local emergency manager

Reference Pages for Details in Maritime Playbook	Scenario Playbook Plan Letter	Peak Amplitude/wave height (in meters above existing conditions at harbor entrance)
	(No action)	0.2
Page 8-9	A	0.5
Page 10-11	B	0.8
Page 12-13	C	1.3
Page 14-15	D	1.5
Page 16-17	E	6

2) **If greater than four hours before tsunami arrival, and your harbor has fully developed its tsunami response Playbook plans, the harbor can utilize the FORECAST AMPLITUDE from Step 1 on the table on the right to identify the appropriate response plan to use.**



Duration of Damaging Currents

Playbook Plan D (based on M9.4 North Chile Scenario)

Background Information:

Alert level = Warning

Peak Amplitude = 1.2 meters (modeled)

Peak Velocity = 7 knots

Projected duration of strong currents (see location map below):

3-6 knots = 30 hrs; 6-9 knots = 10 hrs; 9 knots = 0 hrs

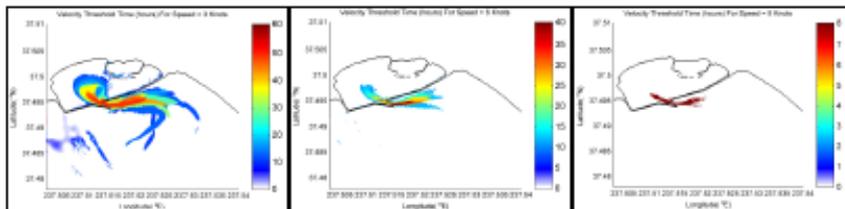
Specific Instructions:

- Follow general guidance for Warning-level tsunamis (Page 5)
- Inundation of dry land around the bay may occur in this scenario
- Strong currents and potential scour are expected in areas identified in blue-yellow-red on the map to the right. Consider relocating vessels 100 meters (300 feet) away from these areas.
- Specific areas where vessels should be relocated and docks secured:
 - (completed with maritime community input)

Safe areas for repositioning vessels within Pillar Point Harbor:

..... (completed with maritime community input)

Time thresholds for currents >3 knots.....>6 knots.....>9 knots
(Colors represent HOURS of potential activity)



Playbook Plan E (based on M9.2 Eastern Aleutian-Alaska Scenario)

Background Information:

Alert level = Warning

Peak Amplitude = 5+ meters (modeled)

Peak Velocity = 9+ knots

Projected duration of strong currents (see location map below):

3-6 knots = 40 hrs; 6-9 knots = 15 hrs; 9 knots = 5 hrs

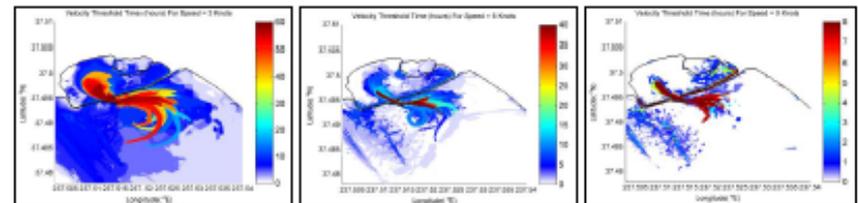
Specific Instructions:

- Follow general guidance for Warning-level tsunamis (Page 5)
- Inundation of dry land around the bay will occur in this scenario
- Strong currents and potential scour are expected in areas identified in blue-yellow-red on the map to the right. Consider relocating vessels 100 meters (300 feet) away from these areas.
- Specific areas where vessels should be relocated and docks secured:
 - (completed with maritime community input)

Safe areas for repositioning vessels within Pillar Point Harbor:

..... (completed with maritime community input)

Time thresholds for currents >3 knots.....>6 knots.....>9 knots
(Colors represent HOURS of potential activity)





Maritime Guidance for Distant Source Tsunami Events

Ports of Newport and Toledo Lincoln County, Oregon

Oregon Maritime Tsunami Response Guidance (MTRG) No. 2015-OR-01

Maritime response guidance in this document is based on anticipated effects of a **maximum-considered distant tsunami event**, scenario **AKmax** of the Oregon Department of Geology and Mineral Industries (see www.oregontsunami.org for more information on this scenario). Smaller distant source tsunamis will occur more commonly and are likely to cause significantly less damage than this maximum considered scenario. Check with local authorities for more specific guidance that may be appropriate for smaller distant tsunami events.

NOTABLE HISTORICAL TSUNAMIS IN NEWPORT AREA

The table provides basic information about historical tsunami events; very minor tsunamis are not shown. The largest, most damaging distant-source tsunamis in Newport area have come from large earthquakes in the Alaska-Aleutian Islands region. The peak amplitude and damage information may help provide port authorities background for comparing future Advisory and Warning level tsunamis in the area. For example, the 2011 Japan tsunami may provide a threshold for no damage occurring below a forecast amplitude (wave height) of 0.43 m (1.4 ft).

Location	Event	Peak Amplitude Observed		NTWC Tsunami Alert Level Assigned	Tides During First 5 Hours	Damage Summary
		(m)	(ft)			
Newport area	1964 M9.2 Alaska	3.5	11.5	Warning	High	light damage to ships and docks**
South Beach	2009 M8.0 Samoa	0.08	0.3	Advisory***	High	no damage reported
South Beach	2010 M8.8 Chile	0.16	0.5	Advisory***	Low	no damage reported
South Beach	2006 M8.3 Kuril	0.17	0.6	—	Low	no damage reported
South Beach	2011 M9.0 Japan	0.43	1.4	Warning***	Low	no damage reported

* Alaska 1964 arrival on PNW coast was at mean high water flood tide.

** 1964 observation by ship captain Terry Thompson communicated February 19, 2015 to George Priest.

*** Alert assigned by forecast OUTSIDE of bay.

le:

ria

ide

on B

zan

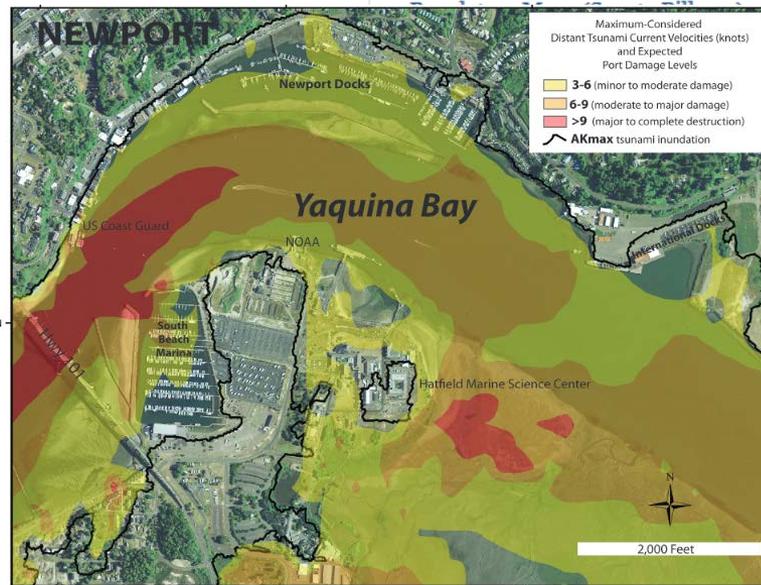
law

llan

fic C

in C

in C

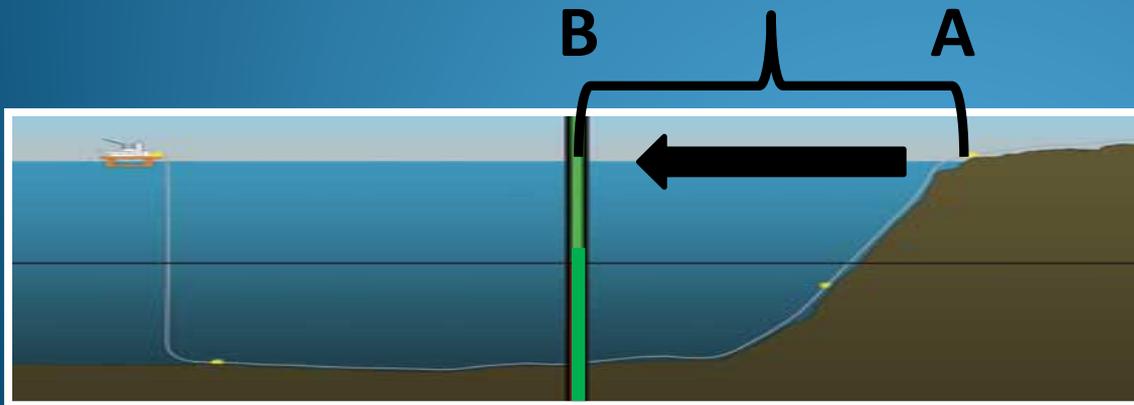
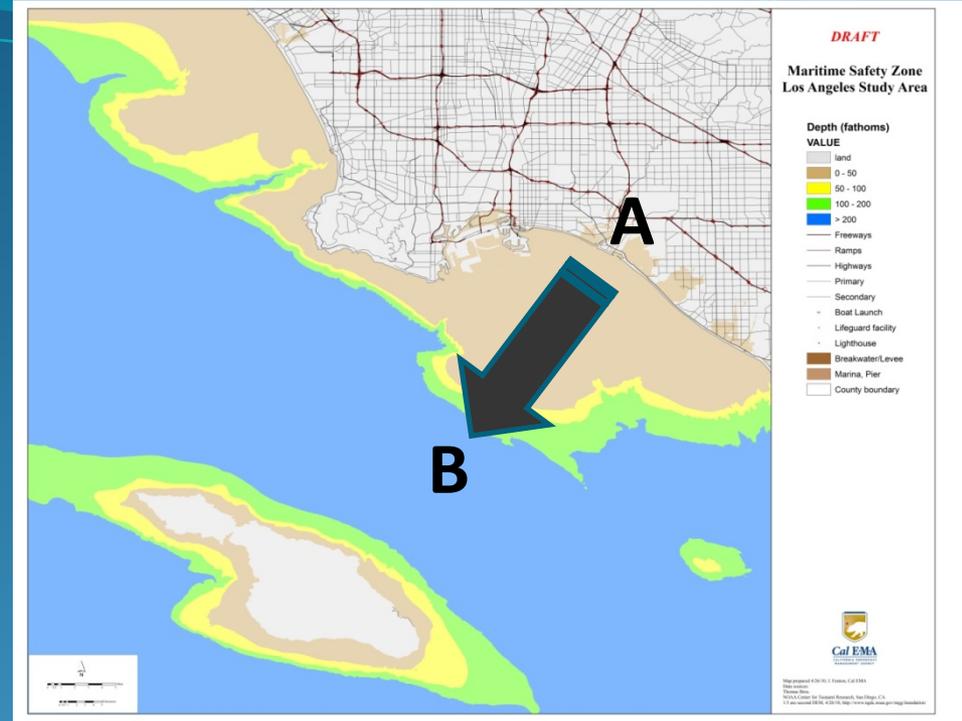


Minimum Offshore Safe Areas for Maritime Evacuation

Offshore Safety Zones for Maritime Community

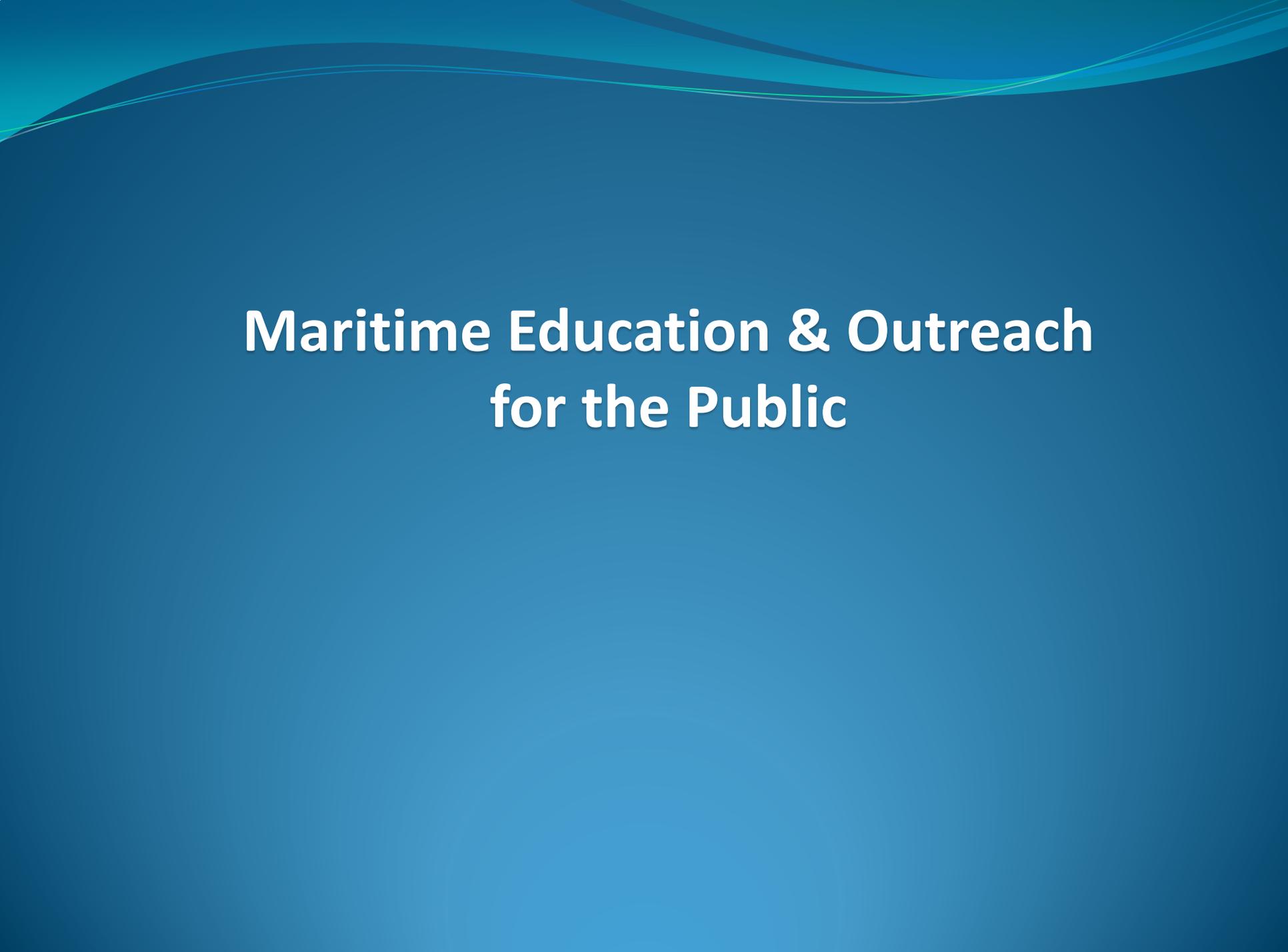
Given a tsunami Warning or Advisory, how long does it take to get from?

- Point “A” - Feet on the dock to
- Point “B” - Safe Offshore Depth



180 FEET

Working with NOAA and NTHMP partners a “Rule of thumb” for safety has been 100 fathoms (600 feet)



Maritime Education & Outreach for the Public

Some Key Outreach Considerations (coordinated safety messaging)

Guidance needs to address appropriate groups:

- Large vessels (Military / Container)
- Mid-size vessels (Fishing Fleet)
- Small vessels (Private / Recreational)

Who do you send to sea?

- Bad weather
- Enough fuel for extended periods (12-24 hours)
- Ability to get to distant ports



Emergency Planning Considerations

- 1) Does your harbor have a **Tsunami Emergency Response Plan**?
 - a. Is it connected to the City's/County's?
 - b. Address On land evacuation (people)?
 - c. Address To Sea evacuation (vessels/people)?
 - d. Consider Tsunami Warning/Watch/Advisory/Local Earthquake?

- 2) Are tsunami mitigation measures for all participant's harbors integrated into the **Local Hazard Mitigation Plan**?

Basic Safety Message

Our fundamental recommendation is **not to evacuate vessels offshore** prior to the arrival of or during any tsunami. However, if boaters decide to evacuate a harbor/port/marina in advance of a tsunami, scientific evidence indicates navigable and non-damaging conditions offshore in California can be found beyond an ocean depths specified by Region.

Additional comments and caveats regarding boater safety include:

1. Your **personal safety** from tsunamis can only be guaranteed by getting to and staying on land, above and beyond the established evacuation zone.
2. Consider whether you have **enough time** to reach a depth of 180 feet offshore prior to tsunami arrival.
3. Consider your **navigational skill** to reach distant ports (in some cases hundreds of miles away) if your home port is too damaged to return.
4. **Consider your preparedness** in terms of having enough fuel, food, water, and clothing to remain at sea for an extended period (24 hours – 36 hours or more).
5. **The above considerations**, especially preparedness, **may be different** (better) for medium to large commercial and military vessels, including the fishing fleet, than for smaller, recreational, private vessels.

PUBLIC OUTREACH PRODUCTS

OREGON

If you are on the water and a tsunami is coming, how far offshore should you take your boat?

Minimum safe distance offshore for local tsunamis: 100 fathoms

Minimum safe distance offshore for distant tsunamis: 30 fathoms

Nautical Miles 40 20 0
Miles 40 20 0

100 fathom depth
30 fathom depth



WHAT TO DO WHEN A TSUNAMI STRIKES

What to do depends on what type of tsunami occurred and where you are

Distant Tsunamis

You generally have at least 1-2 hours after the ocean earthquake to take action.

If you are on the water

- Check with the US Coast Guard (USCG) before taking any action. If advised that offshore evacuation is an option and this option looks practical for your vessel, proceed to a staging area **greater than 30 fathoms (180 ft)**. If conditions do not permit, dock your boat and get out of the tsunami evacuation zone.

If you are on land or tied up at the dock

- Your choices are to a) evacuate out to sea beyond 30 fathoms, b) leave your vessel and evacuate out of the distant tsunami inundation zone, or c) go upriver. **DO YOUR HOMEWORK** before the event to understand how practical these options are for the largest distant tsunamis that might strike your area. Check with local authorities and www.oregontsunami.org for information.
- Check with local authorities before taking any action. Most distant tsunamis are small enough that it is safer to keep your boat docked. Congestion in the waterway or among those trying to pull boats out with trailers can create serious problems. Sea and weather conditions may be more dangerous than the tsunami! Get yourself out of the tsunami evacuation zone.

After the tsunami

- If in an offshore staging area**, check with the USCG for guidance before leaving the staging area; conserve fuel by drifting until you know what actions you need to take.
- If in an onshore assembly area**, check with local authorities for guidance before returning to the inundation zone.

BROADCASTS DURING A TSUNAMI EVENT

USCG will issue Urgent Marine Information Broadcasts on CH 16, and additional information will be available from NOAA Weather Radio.



Local Tsunamis

You have only ~10 minutes to take action, so have a plan ahead of time that includes a quick way to release commercial fishing gear so your boat is not dragged down by currents; have least 3 days of food, fuel, and water.

If you are on the water

- At less than 100 fathoms (600 ft):** (1) Stop commercial fishing operations immediately, (2) free the vessel from any bottom attachment (cut lines if necessary), and (3) if you can beach or dock your boat and evacuate on foot within 10 minutes of a natural warning, then this is your best chance. If that is not possible, head to greater than 100 fathoms, keeping in mind the following:
 - Proceed as perpendicular to shore as possible.
 - Sail directly into wind waves, keeping in mind that wind waves opposed by tsunami currents will be greatly amplified.
 - Maintain as much separation as possible from other vessels.
 - Synchronize movements with other vessels to avoid collisions.
- At greater than 100 fathoms:** If you are in deep water but not quite 100 fathoms, head to deeper water. If you are already at greater than 100 fathoms, then you are relatively safe from tsunamis, but deeper water is safer from tsunami currents and the amplification of wind waves by those currents.

If you are on land or tied up at dock

- Evacuate out of the tsunami evacuation zone.** You don't have time to save your boat and could die if you try to do so.

After the tsunami

- If in an offshore staging area**, check with the USCG for guidance before leaving the staging area; conserve fuel by drifting until you know what actions you need to take.
- If in an onshore assembly area**, check with local authorities for guidance before returning to the inundation zone.
- Do not return to local ports** until you have firm guidance from USCG and local authorities.
 - Local ports will sustain heavy damage from a local tsunami and may not be safe for days, weeks or months.
 - If at sea, check to see if you can reach an undamaged port with your current fuel supply and watch for floating debris or survivors that may have been washed out on debris.
 - If at sea, consider checking with USCG about your role in response and recovery.

CALIFORNIA

How should boat owners PREPARE for tsunamis?

Prior to arrival of the March 11, 2011 tsunami along the California coast, many boat owners took their boats offshore without adequate supplies or knowledge of how long they would need to stay offshore. As a result, boaters tried to re-enter harbors too early, while dangerous tsunami conditions still existed. They put themselves and harbor personnel at risk of injury and death.

Before you plan to leave safe harbor, consider the following:

- **Talk to the harbor master** or related officials to learn about your harbor's tsunami safety protocols.
- **Sign up to receive tsunami alerts** from NOAA and emergency calls from your harbor master or community emergency services office.
- **Know weather conditions** out on the ocean.
- **Know how long it takes your boat to get to deep water.** The 100-fathom line is the NOAA recommendation.
- **Have adequate supplies** (water, shelter, food) and fuel to remain at sea for 24 hrs or more.
- **Have a family plan** for tsunamis in place so you know your family will be safe.

If you do not have these essential preparedness items covered, **DO NOT attempt to raise your boat offshore.** Secure your boat to the dock and leave the dock area before the tsunami arrives.



Other resources for tsunami information in California

Information about tsunamis can come from a variety of sources, but the following sources are the most reliable:

- Harbor masters and port captains
- Local Coast Guard contact
- State and local emergency managers
- Local National Weather Service – Weather Forecast Offices

State of California Tsunami Program
(California Geological Survey website):
www.tsunami.ca.gov/

California Emergency Management Agency Earthquake and Tsunami Program:
www.calema.ca.gov/PlanningandPreparedness/Pages/Tsunami-Preparedness.aspx

NOAA tsunami website: www.tsunami.gov

NOAA – National Weather Service (NWS)

Weather Forecast Offices:

Eureka – www.weather.gov/eka/

San Francisco Bay/Monterey – www.weather.gov/mtr/

Los Angeles/Oxnard – www.weather.gov/lox/

San Diego - www.weather.gov/sdx/

Sign up for NWS alerts and updates by email:

www.weather.gov/emailupdates/index.php

Redwood Coast Tsunami Work Group/ Humboldt State University:

www.humboldt.edu/rctwg/

California Harbor Master and Port Captain Association:

www.harbormaster.org/

Marine Recreation Association:

marina.org

CA Boating Safety Officers Association:

cbsoa.org

TSUNAMIS!

What

BOATERS

should know



CARIBBEAN

Preparedness Materials Maritime Community

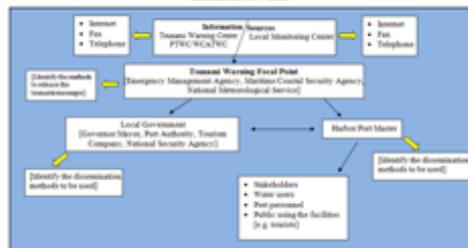
Tsunami Protocol Template for the Caribbean Port and Harbor Operators

UPRM Puerto Rico Seismic Network, NOAA NW Caribbean Tsunami
Warning Program, National Science Foundation

INTRODUCTION

Tsunami (~~tsu~~-~~nah~~-~~o~~-~~tsu~~) is a Japanese word meaning harbor wave. A tsunami is a series of waves with a long wavelength and period (time between crests) generated by a large, impulsive displacement of sea water. Time between crests of the wave can vary from a few minutes to over an hour, but generally are in the range of 15 to 25 minutes. Tsunamis are often incorrectly called tidal waves; they have no relation to the daily ocean tides, although depending on the stage of the tide, the tsunami will reach a higher or lower elevation. Tsunamis are generated by any large, impulsive displacement of the sea level. The most common cause of a tsunami is sea floor uplift associated with an earthquake. Tsunamis are also triggered by landslides into or under the water surface, and can be generated by volcanic activity and meteorite impacts.

Information Flow Chart



available at:
<http://www.srh.noaa.gov/srh/ctwp/>
and <http://prsn.uprm.edu>

WHAT TO DO?

TSUNAMI SAFETY FOR BOATERS

1. Since tsunami waves cannot be seen in the open ocean, do not return to port if you are at sea and a tsunami warning has been issued. Port facilities may become damaged and hazardous with debris. Listen to mariner radio reports when it is safe to return to port.
2. Tsunamis can cause rapid changes in water level and unpredictable dangerous currents that are magnified in ports and harbors. Damaging wave activity can continue for many hours following initial tsunami impact. Contact the harbor authority or listen to mariner radio reports. Make sure that conditions in the harbor are safe for navigation and mooring.
3. Boats are safer from tsunami damage while in the deep ocean (>200 fathoms, 1200 ft, 400 m) rather than moored in a harbor. But, do not risk your life and attempt to motor your boat into deep water if it is too close to wave arrival time. Anticipate slowdowns caused by traffic gridlock and hundreds of other boaters heading out to sea.
4. For a locally-generated tsunami, there will be no time to motor a boat into deep water because waves can come ashore within minutes. Leave your boat at the pier and physically move to higher ground.
5. For a tele-tsunami generated far away, there will be more time (one or more hours) to deploy a boat. Listen for official tsunami wave arrival time estimates and plan accordingly.
6. Most large harbors and ports are under the control of a harbor authority and/or a vessel traffic system. These authorities direct operations during periods of increased readiness, including the forced movement of vessels if deemed necessary. Keep in contact with authorities when tsunami warnings are issued.

Centro Internacional de Información sobre Tsunami
737 Bishop St., Manka Tower Suite 2200
Honolulu, Hawaii 96813-3213 USA
Tel: <1> (808) 532-6422 Fax: <1> (808) 532-5576
Correo electrónico (e-mail): itc@tsunami.gov
Página electrónica: <http://tsunamiwave.info>
Ilustración por: Lucas Ravasi, Papua, Nueva Guinea, 1998
Traducción al español: María E. Font, UPR Sea Grant
Red Sísmica de Puerto Rico
Universidad de Puerto Rico en Mayagüez
Tel: <1> (787) 833-8433
Correo electrónico (e-mail): staff@midas.uprm.edu
Página electrónica: <http://redsisimica.uprm.edu>

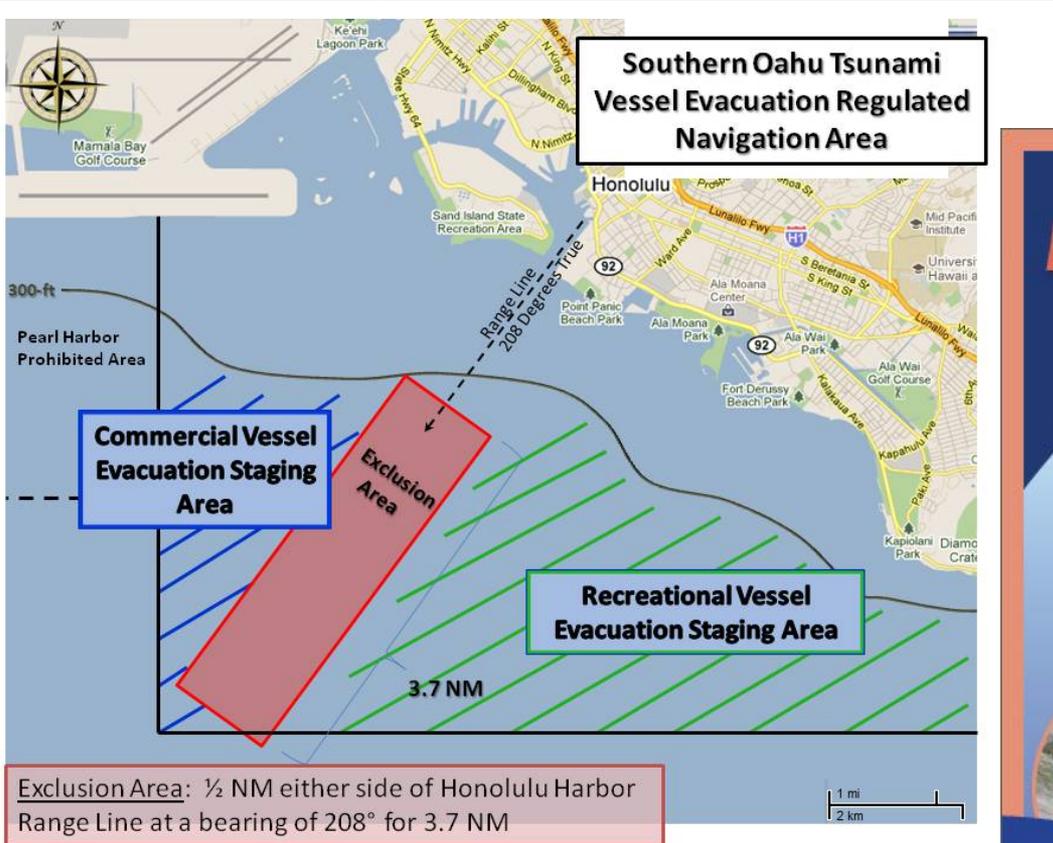


Foto: Tsunami on St. Thomas, U.S. Territory of Harper's Weekly, 23 Jan. 1866, p. 49. Private collection



HAWAII

Outreach



Hawai'i Boater's Hurricane and Tsunami Safety Manual



USCG Planning



Conclusion: Maritime Mitigation Planning, Guidance, and Implementation

To assist with:

- 1) Traffic control in and out of harbors
- 2) Minimum offshore evacuation safe depth
- 3) Port re-opening and Recovery issues
- 4) Consistent national policy for maritime evacuation



Survey Questions

for NTHMP MES Membership

1. What is your current tsunami maritime planning status? Where does your state/territory/jurisdiction see themselves in 5 years? (general overall goals/objective)
2. In Part 2 of the NTHMP “Maritime Planning and Preparedness Guidelines”, which response strategy do you use, or would you foresee developing? (e.g. Advisory-Warning, Scenario-Specific)
3. Have you developed educational materials and/or outreach capability specific to tsunami maritime preparedness? Can you list/provide examples? (e.g. brochure, workshop)
4. In Part 3, based on your experience, what mitigation planning information specific to tsunami maritime needs should be included? What recovery planning information for the maritime community should be included?

1. What is your current tsunami maritime planning status? Where does your state/territory/jurisdiction see themselves in 5 years? (general overall goals/objective)

Oregon brochure, outreach to ports. Interface with port.

Hawaii brochure to every registered boater in the state.

Mailed to anyone with a boat. How much \$?

2. In Part 2 of the NTHMP “Maritime Planning and Preparedness Guidelines”, which response strategy do you use, or would you foresee developing? (e.g. Advisory-Warning, Scenario-Specific)

Scenario-Specific: CA, American Samoa, Hawaii,

Advisory-Warning: OR, AK (for 3 harbors, assess, then await results from tsunami current workshop to assist with determining strategy), Peer-Review, cross-state/territory collaborative process to move work forward.

3. Have you developed educational materials and/or outreach capability specific to tsunami maritime preparedness? Can you list/provide examples? (e.g. brochure, workshop)

4. In Part 3, based on your experience, what mitigation planning information specific to tsunami maritime needs should be included? What recovery planning information for the maritime community should be included?

Tiger Team : Kevin, Maximilian, Kevin R., James, Althea,
Tamra, Arletta, Cindi, Manuel, Dan

USCG Doc ...