OSU Hatfield Marine Sciences Center, E. Bachus

Japanese tsunami debris and invasive species: lessons being learned in Oregon and Applications for the Region

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- **Thanks to contributions by Jessica Miller, Jim Carlton, Gayle Hanson, John Chapman, E. Bachus, Jennifer Lam, Jean Wan-Lee, Jack Barth, NOAA MDP, Chris Belter, Teresa Hall**

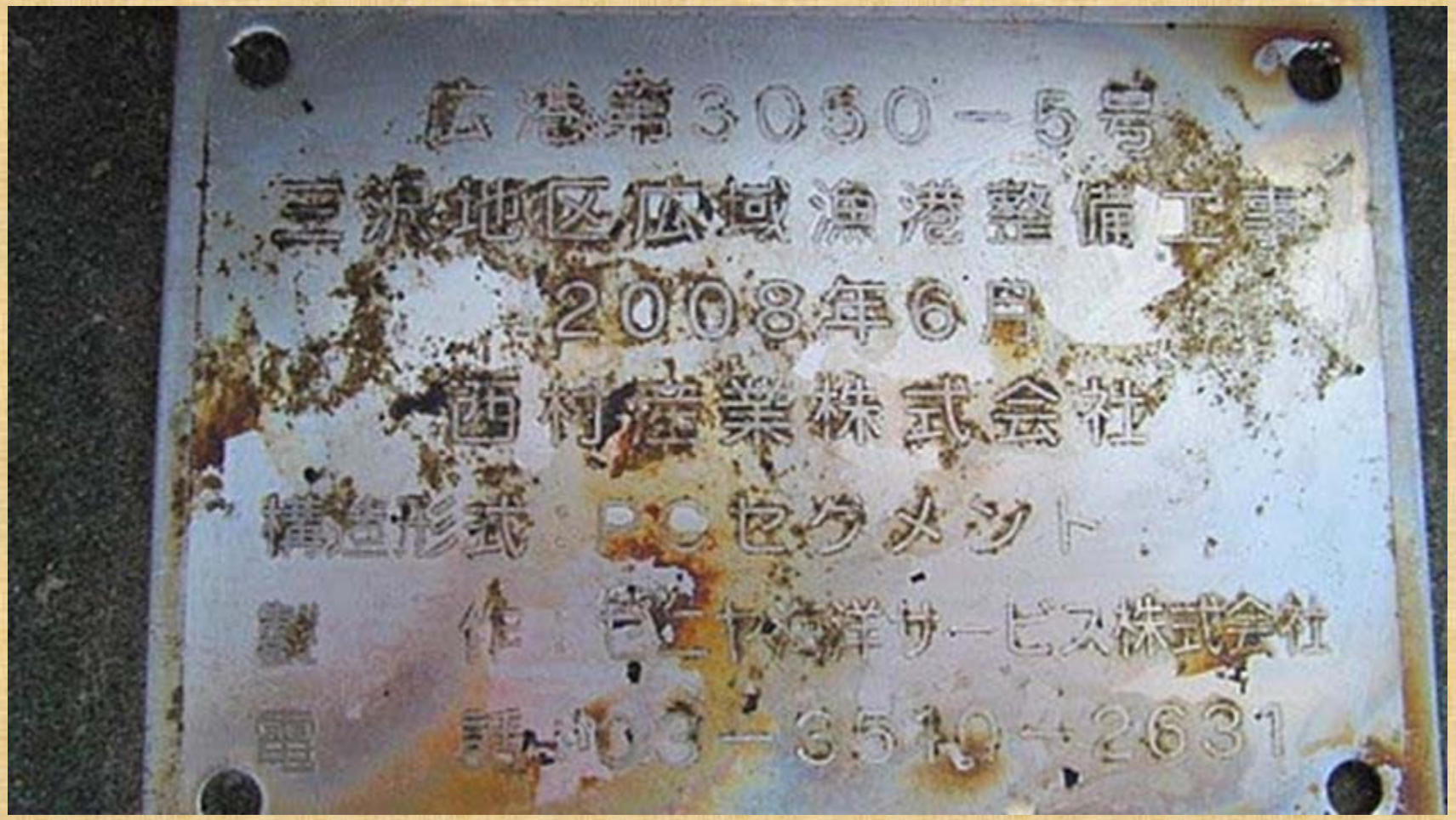
Proposed Presentation Overview

- When, where and what with update from NOAA MDP.
- Biofouling and invasive species on tsunami debris.
- Organisms that arrived with the dock. So what?
- Potential Impacts?
- Need for guidelines, protocols and consistent communication.
- What should agencies and people anticipate and the public be prepared for?
- Workshop Coordination to enhance preparedness and response in Oregon and the region
- Brief summary from briefings with Oregon's Congressional staff.
- Discussion

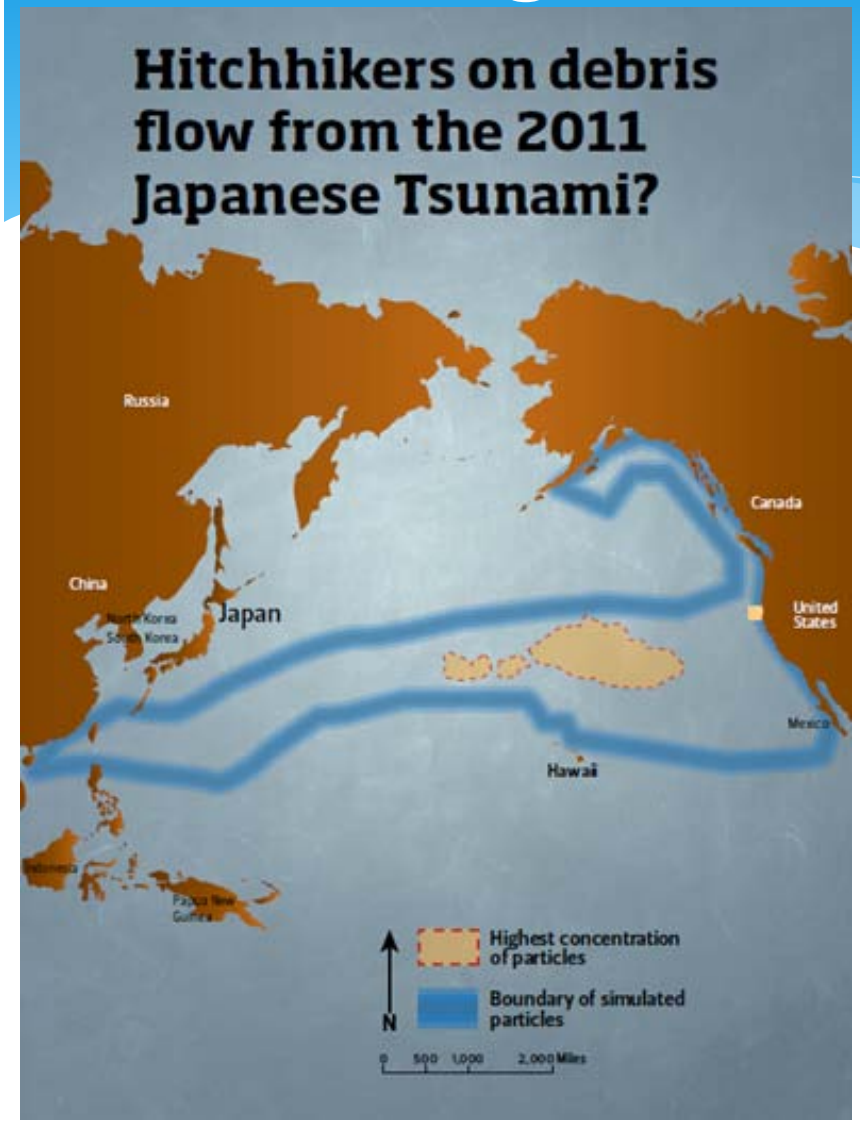
Agate Beach, Yaquina Head, Oregon

Japanese dock , Agate Beach, OR June 5

Dock Dedicated June 2008 in the Fishing Port of Misawa, Japan



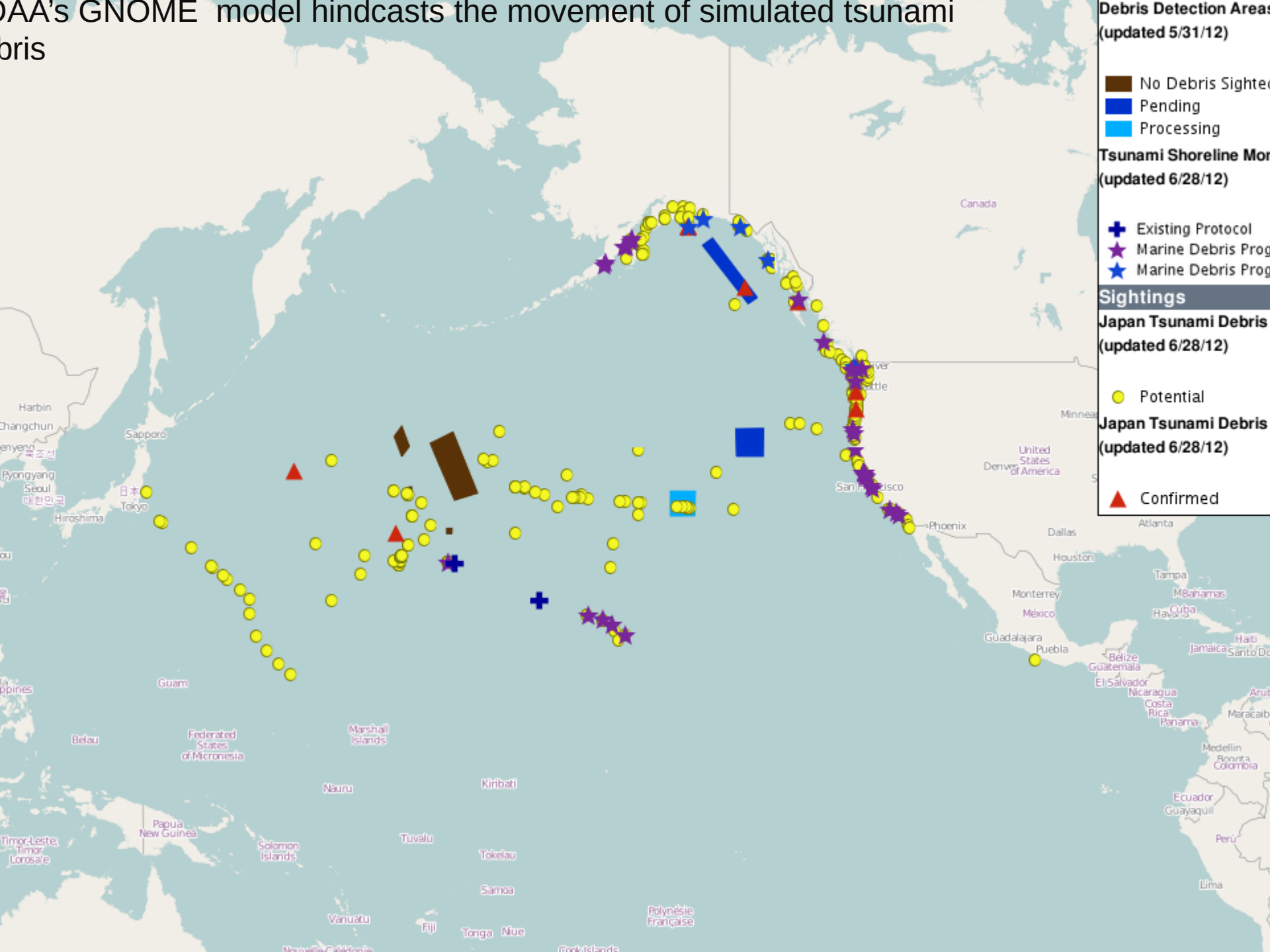
Timing and location of debris

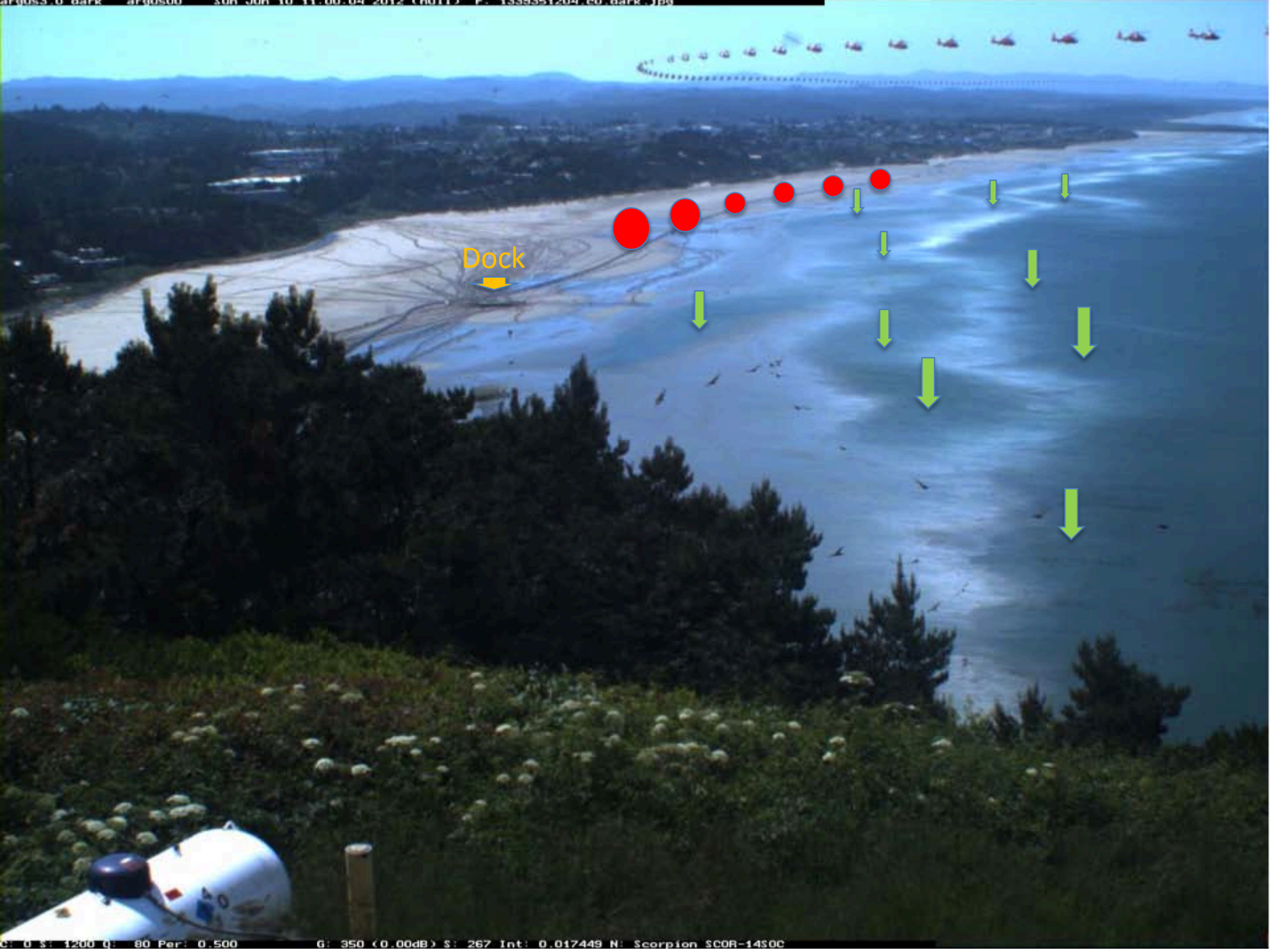


Tan square represents Japanese floating dock at Agate Beach, OR. Source Jack Barth, OSU and NOAA MDP

Recent appearance of large marine debris on the west coast is the vanguard of the tsunami debris field stretching thousands of miles, the majority currently north of Hawaii and expected to begin arriving after the fall storms of 2012 and estimated to continue circulating for years through 2015

OAA's GNOME model hindcasts the movement of simulated tsunami
bris

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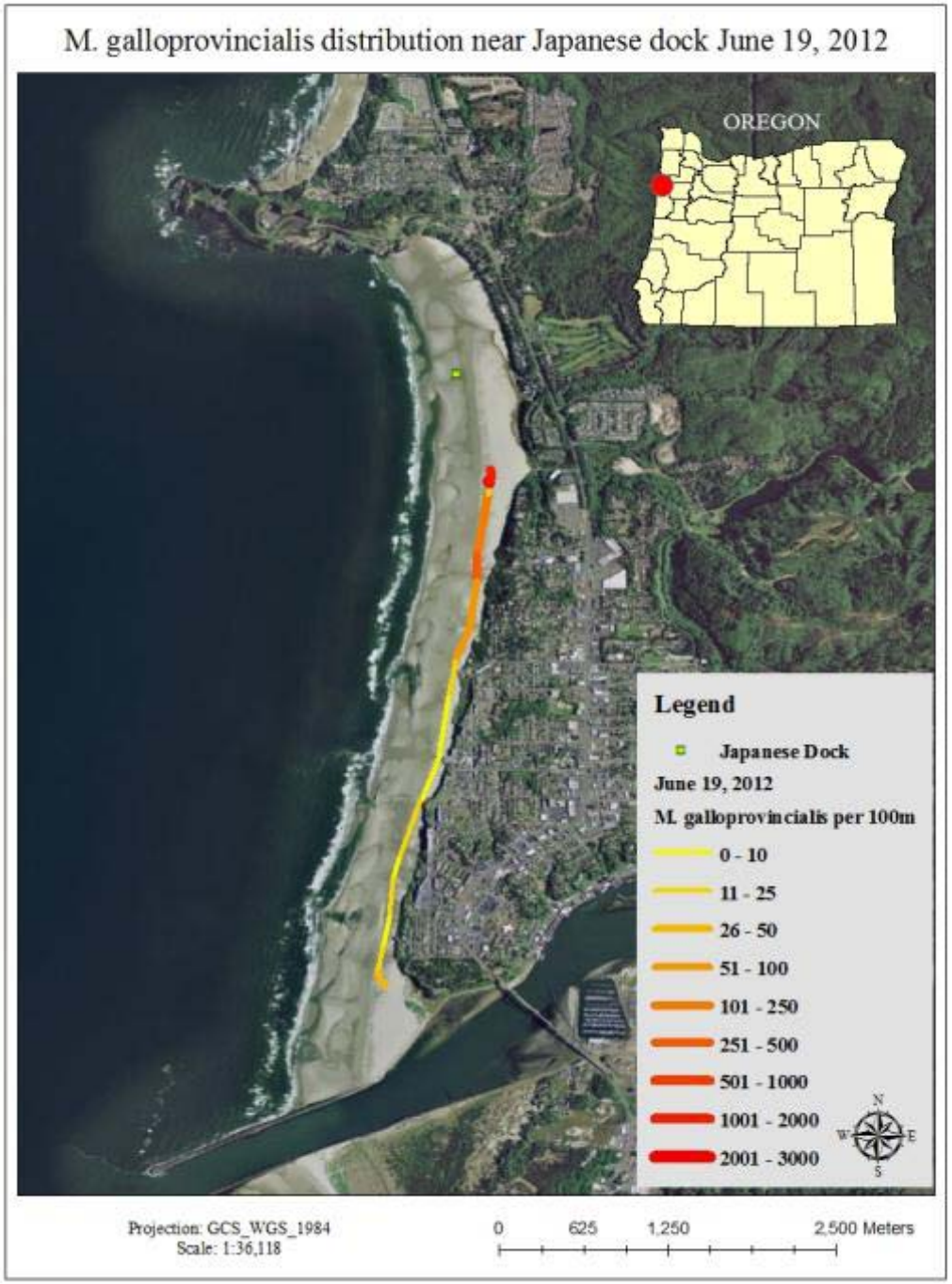
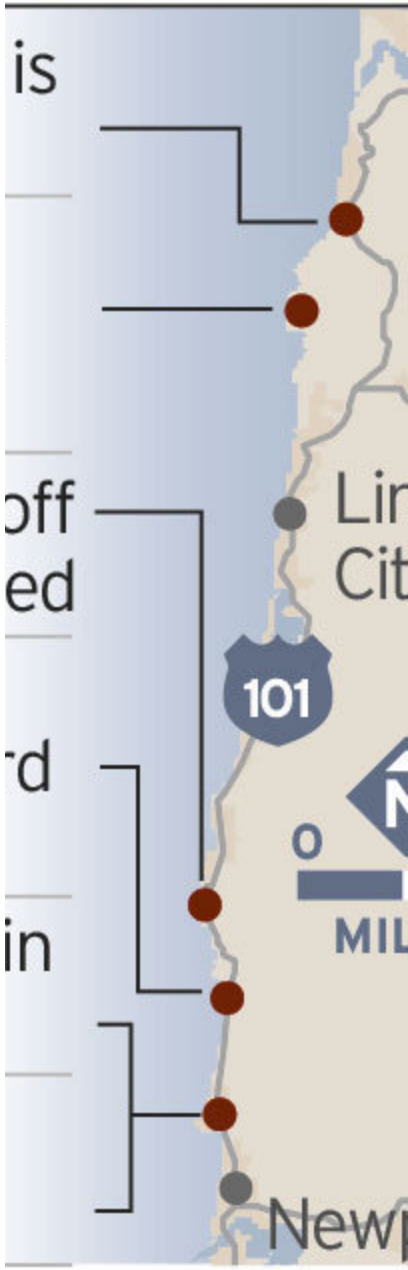
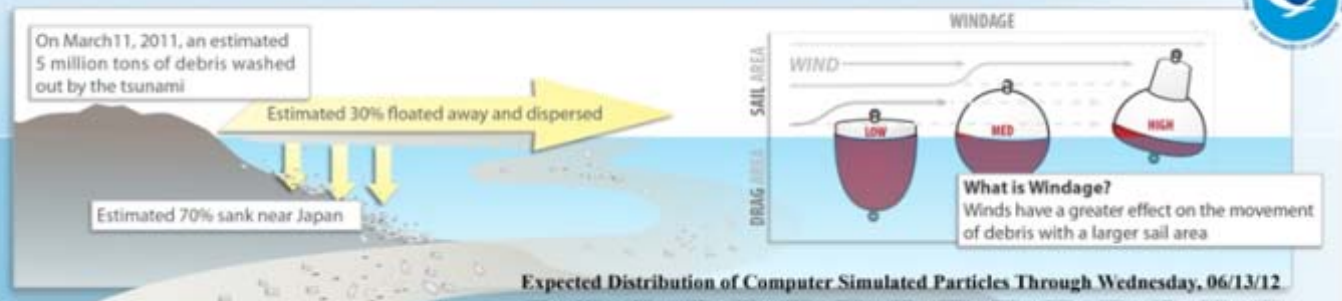




“Entrance manhole” to compartment in the dock and weights

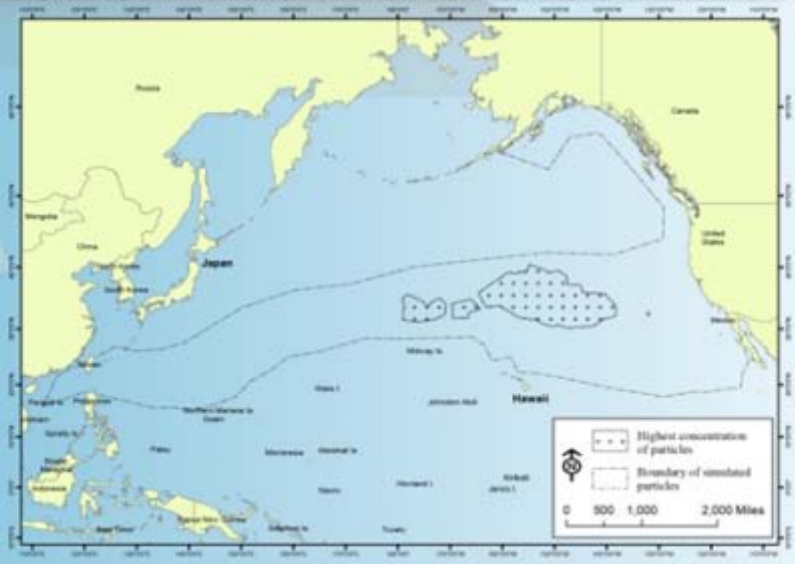
Known invasive species found on the dock

Modeled Movement of the Marine Debris Generated by the March 2011 Japan Tsunami



- Japan Ministry of the Environment estimates that 5 million tons of debris washed into the ocean.
- They further estimated that 70% of that debris sank near the coast of Japan soon after the event.
- Model Results: High windage items may have reached the Pacific Northwest coast as early as winter 2011-2012.
- Majority of modeled particles are still dispersed north and east of the Hawaiian Archipelago.
- NOAA expects widely scattered debris may show up intermittently along shorelines for a long period of time, over the next year, or longer.

Expected Distribution of Computer Simulated Particles Through Wednesday, 06/13/12



NOAA used a computer model to simulate the movement of tsunami debris from March 11, 2011, to the present day. This GNOME model (General NOAA Operational Modeling Environment) simulation is based on ocean surface currents from the US Navy (the Hybrid Coordinate Ocean Model) and winds from NOAA (the NOAA blended wind product). The computer model simultaneously released 1,000 simulated particles from each of 8 locations on the Japan coastline where tsunami wave heights were 3.5 meters or greater. Particles were randomly assigned windage values from 1-5%, meaning that they were moved not only by ocean currents, but were also moved by 1-5% of wind speed in the down-wind direction. The dotted black line contains 95% of all simulated particles. The cross-hatched area indicates the region of the highest concentration of simulated debris with 1% windage at the end of the simulation. For more details on this model, please visit **marinedebris.noaa.gov**. Have you seen tsunami debris? Report it to: **DisasterDebris@noaa.gov**

Japanese organisms on floating dock and Agate Beach, Oregon, June 2012

1 species of urchin

Northern Pacific seastar
Asterias amurensis

Japanese shore crab
Hemigrapsus sanguineus

4+ species of barnacle

Solitary tunicate

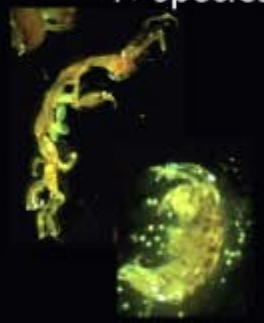
Granular claw crab

Oedignathus inermis

Oyster

Mytilus galloprovincialis

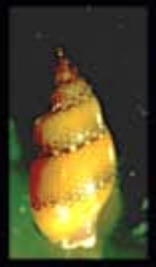
Undaria pinnatifida



3+ species of amphipod

Bryozoans

Sponge on mussel



8+ species of mollusk

Anemone

4+ species of worm

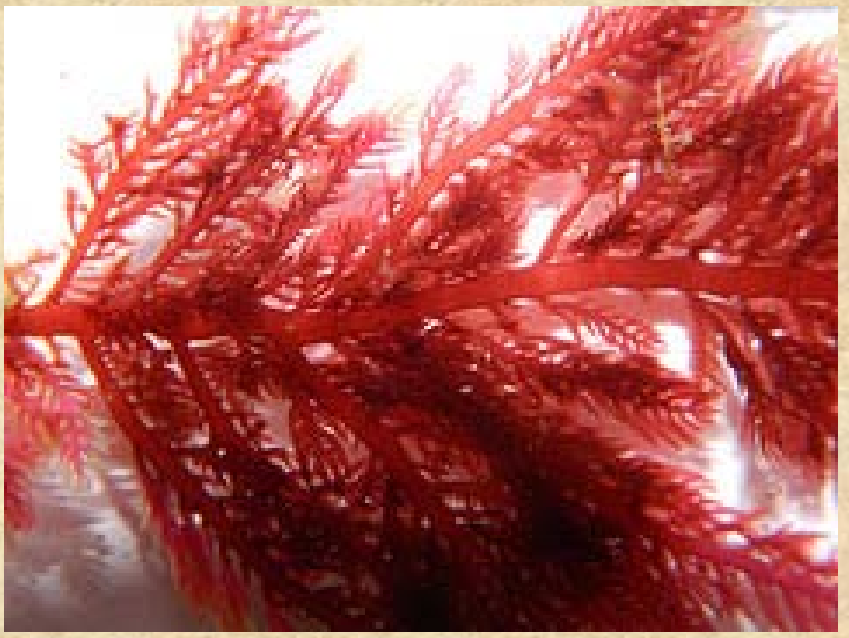
Oregon State University's Hatfield Marine Science Center & Coastal Oregon Marine Experiment Station

Over 90 different species preliminarily Identified from the Japanese Floating Dock on Agate Beach, Oregon as of July 8, 2012
(Species in bold have established outside native range)

Group	Common Name	Estimated Species	Identification	Authority for final identification
Algae	seaweeds	30+	***Undaria pinnatifida*** *(wakame)* Additional species – IP	All algae – Gayle Hansen (OSU and US EPA)
Annelida				
Polychaeta	polychaete worms	17	***Hydroides ezoensis*** Plus 16 others	All species – Leslie Harris (Natural History Museum of Los Angeles County)
Mollusca				
Gastropoda	snails	3	*Mitrella moleculina(dove snail)* *Lottia sp. (limpet) (IP)* **Pteropoda*	*Mitrella*: James T. Carlton (JTC), James H. McLean (Natural History Museum of Los Angeles County)
Bivalvia	mussels, oysters, clams	6	***Mytilus galloprovincialis*** *(mussel) (GCIP)* ***Crassostrea gigas*** *(oyster)* ***Anomia chinensis*** *(clam: jingle shell)* *Hiatella arctica (clam)* *Arca navicularis (clam)* *Musculus cupreus (mussel)*	*Mytilus*: JTC *Crassostrea:* Chris Langton (OSU), Eugene V. Coan (Palo Alto CA (EVC) *Other bivalves*: EVC
Crustacea				
Cirripedia	barnacles	4	***Megabalanus rosa*** *Semibalanus cariosus* **Lepas anatifera* **Conchoderma auritum*	*Lepas*: JTC and John W. Chapman (JWC) Other barnacles: JTC
Amphipoda	amphipods	5+	***Jassa marmorata*** Additional gammarid species (IP) Caprellis species (IP)	*All amphipods*: JWC
Decapoda	crabs	2	***Hemigrapsus sanguineus*** *Oedignathus intermis*	*Hemigrapsus*: JTC *Oedignathus*: Gyo Itani (Kochi University)
Tanaidacea	tanaids	1	*Zeuxo normani*	JTC
Copepoda	copepods	3		
Isopoda	pill bugs	1		

Group	Common Name	Estimated Species	Identification	Authority for final identification
Echinodermata	sea stars, sea urchins, sea cucumbers	3	Aterias amurensis (sea star) Echinoidea (sea urchin (IP) Holothuroidea (sea cucumber)	Asterias: Christopher Mah (Smithsonian Institution)
Protista	protozoans	3	*Gromia "oviformis"* Arenaceous forminaiferan Forminifera	Gromia: JTC
Porifera	sponges	2	IP Including very small tubular siliceous; larger encrusting white species	
Nematoda	roundworms	1		
Cnidaria				
Hydrozoa	hydroids	2	Campanulariidae: *Obelia* sp.? Species 2: IP	Dale Calder (Royal Ontario Museum)
Anthozoa	sea anemones	1+	IP	
Nemertea	ribbon worms	1+	Lineidae, unidentified Japanese species	Hiroshi Kajihara (Hokkaido University), Svetlana Maslakova (University of Oregon)
Bryozoa	bryozoans	3	Cheilostomata, arborescent, unidentified (IP) Cheilostomata: Ascophorina, unidentified (IP) *Cryptosula pallasiana*	Cryptosula: JTC
Ascidiacea	sea squirts	4	Compound (2), solitary (2) (IP)	

Total Species: 90+



About 30 species of marine algae have been preliminarily identified from the dock . At least two occur in Oregon

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Undaria pinnatifidia ("Wakame" - Brown (Kelp) Algae)
with reproductively mature ruffled sporophylls.
An invasive species of high concern.

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http://www.flickr.com/photos/80098236@N07/page13/

Potential Vulnerabilities

- The estimated cost of Japanese tsunami debris removal between 2012 -2015 within just the Oregon Parks and Recreation Department will range between $1.56 – $5.65 million dollars 2012-2015 .
- Estimate does not include expenditures by other organizations for risk analysis and coordination, nor damage to habitat, visual impacts to beaches, wildlife entanglement, ingestion by wildlife, vessel damage and navigation impediment, human health and safety concerns and aquatic invasive species associated from the tsunami debris.[2]
- Need for consistent protocols and communications

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Pictures: Tsunami Dock Is "Alien Mother Ship" of Species

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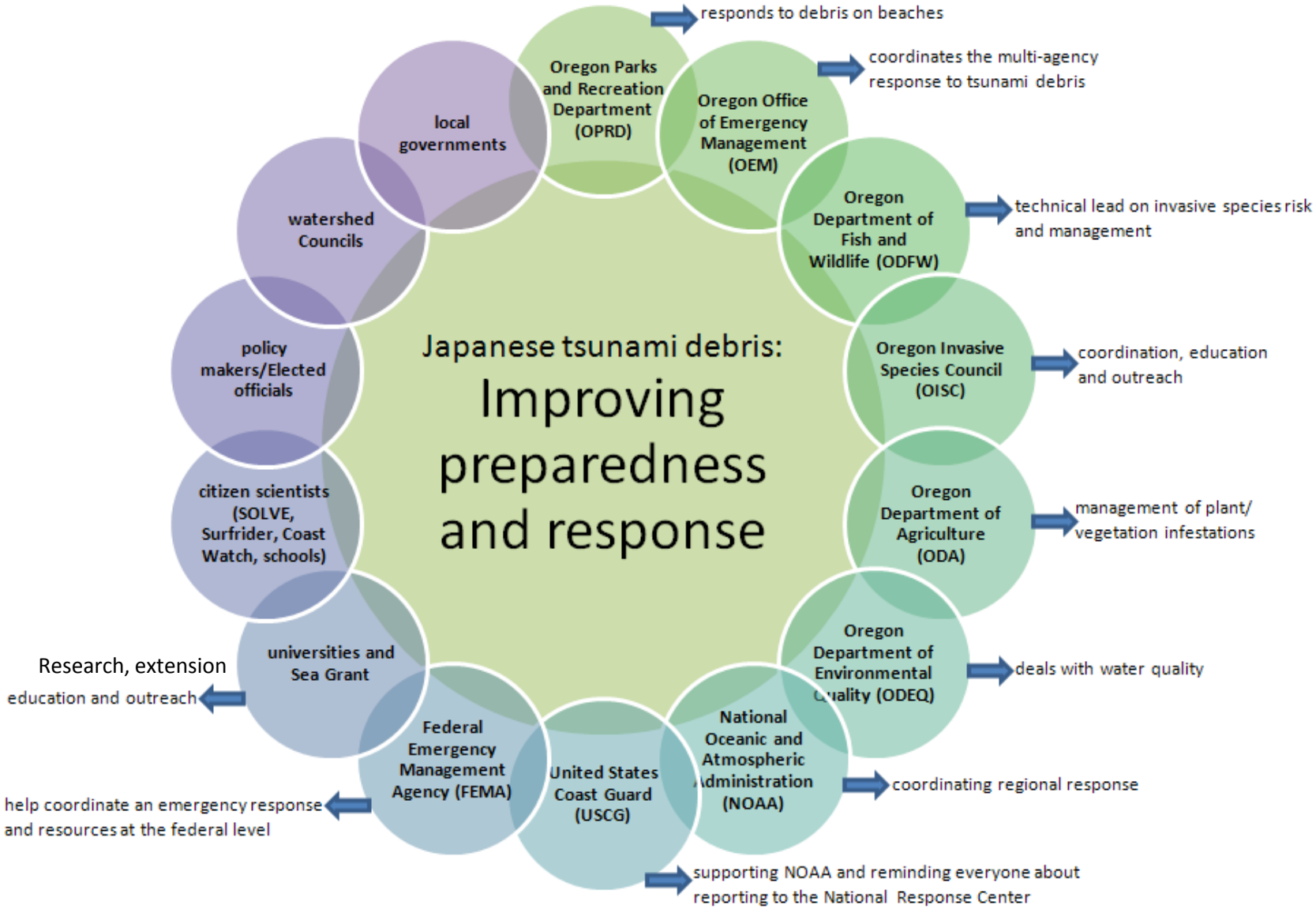
Marine life to be stripped off dock from Japan

By JEFF BARNARD, Associated Press | Published: Jun 7, 2012 at 9:35 AM PDT


Japanese tsunami debris:
Improving preparedness and response
Oregon Parks and Recreation Department (OPRD)
responds to debris on beaches
Oregon Office of Emergency Management (OEM)
coordinates the multi-agency response to tsunami debris
Oregon Department of Fish and Wildlife (ODFW)
technical lead on invasive species risk and management
Oregon Invasive Species Council (OISC)
coordination, education and outreach
Oregon Department of Agriculture (ODA)
management of plant/ vegetation infestations
Oregon Department of Environmental Quality (ODEQ)
deals with water quality
National Oceanic and Atmospheric Administration (NOAA)
coordinating regional response
United States Coast Guard (USCG)
supporting NOAA and reminding everyone about reporting to the National Response Center
Federal Emergency Management Agency (FEMA)
help coordinate an emergency response and resources at the federal level
universities and Sea Grant
Research, extension education and outreach
citizen scientists (SOLVE, Surfrider, Coast Watch, schools)
policy makers/Elected officials
watershed Councils
local governments

Establishment of the Oregon Tsunami Debris Task Force Incident Command

- General Mike Caldwell, Director of Oregon's Office of Emergency Management, will lead the Oregon Tsunami Debris Task Force
  - Providing one point of contact to ensure effective coordination and streamlined operations in response to marine debris cleanup and public safety.
  - Working with the states of California, Washington, Hawaii and Alaska to request federal financial support and agency assistance for tsunami debris response and cleanup.
  - Coordinating communications among stakeholders and with the general public to keep coastal communities and visitors to Oregon's beaches safe and informed
  - Launch of a "211" hotline for reporting and information

- 211 averaging 17 calls a day for the last week.
  - 14 calls have been connected to the National Response Center (for possible hazardous materials),
  - 2 calls have gone to the US Coast Guard to report possible dangers to navigation.

The infamous Oregon Exploding Whale Video

http://www.youtube.com/watch?v=8Vmnq5dBF7Y

FW 599 Student Project : Risk analysis with a human dimension

http://prezi.com/eedauergoanu/edit/?auth_key=zxvajal&follow=mrukco4woonr

Invasive Species Biofouling on the 2011 Tōhoku Tsunami Marine Debris: A Workshop Led by NOAA National and Oregon Sea Grant to Facilitate Regional Preparedness and Response

July 31 (9 am-5pm) & August 1, 201 2 (8:30 am-noon)
Portland State University, Portland OR 97201

Purpose:

1) A regional workshop to facilitate regional preparedness and response to the risk of marine invasive species.

2) Develop regional protocols and a Coordination framework to identify, detect, and respond effectively and rapidly to marine debris with invasive species.

Regional Tsunami Debris/Biofouling Protocol Team: Develop a regional science-based protocol

Regional Communication & Coordination Team: Develop a communications & coordination framework

Public Interest on the beached dock at Agate Beach, Oregon and Tsunami debris

- Over 41,000 cars have stopped at Agate Beach parking area in June since the dock was reported beached on 6/5/2012
- On a typical June, State Park pays for 3,800 gallons of water
  - this year the park paid for over 25,000 gallons.

Japanese Boat, Ilwaco, Wa,

Oregon State University Marine Council
Action Coordination Team
Japanese Tsunami Marine Debris and Invasive Species

Team Lead and Point of Contact: George Boehlert, Director, HMSC. (541 867 0211; cell 541 961 3436; george.boehlert@oregonstate.edu)

ACT Goals: With a focus on the marine debris and invasive species issues arising from the Japanese tsunami, the principal role of this action coordination team (ACT) is:

- to serve as a source of up-to-date information on these issues,
- to promote communication among involved parties at OSU, and
- to provide information on background and sources to keep abreast of new developments to others at OSU.

This ACT also identifies the leads at OSU for different components for science and research, education, and engagement at OSU and how those relate to the role of agencies and others at state, local and federal agencies.

Research opportunities and needs to aid in understanding and managing risk

1. Scientists and educators at the Hatfield Marine Science Center are leading research efforts to aid in understanding the potential risks from organisms transported by tsunami debris.
2. **"Organisms may have hitchhiked across the Pacific for centuries, so why should we be concerned?"**

   "The arrival of a living community of over 90 species of non-native marine organisms attached to large marine debris" is an undocumented process that resulted from a low-frequency, natural event that occurred in a well-developed area (in terms of human infrastructure)." —Dr. Jessica Miller, OSU Hatfield Marine Science Center.

   "… no doubt that something from a bay or estuary of Japan has floated across the Pacific and landed on the Pacific coast at some time over the past centuries or millennia—given the statistical nature and probabilities of what biogeographers call "sweepstakes dispersal"—but we have no records of any such events." — Dr. Jim Carlton, Williams College
3. How can we predict what is going to come and the risk?
4. **Improve invasion risk assessment by determining species richness of the dock fauna and assessing their origins and current distribution. This beaching of the large floating dock has provided us the (perhaps unique) opportunity to discover the suite of potential species that may be associated with the marine debris from the Japanese tsunami.**
5. Opportunity to compare the traits of those species that did make the transoceanic journey with those that did not, potentially providing additional insights into invasion risk while also contributing to understanding of dispersal and biogeography.
6. **What debris is from the tsunami and what is not?**
7. 7. Develop and standardized reporting and disposal protocols for the public.
8. **What are ways that agencies can minimize risk to the public and assist the public with reporting and disposal?**