

# The Transport of Marine Life Across the Ocean on Tsunami Marine Debris

東日本大震災による津波にともなう漂着瓦礫がもたらした  
海洋無脊椎動物の越境移動について

Saturday, May 20, 2017

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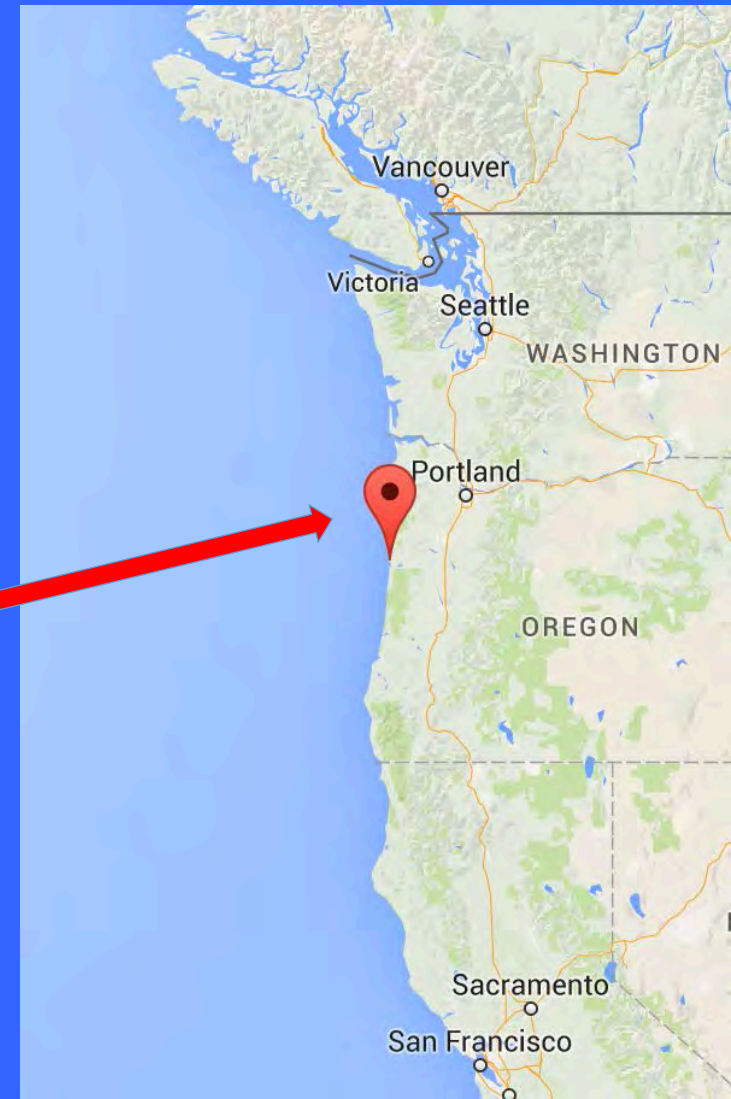
Gregory Ruiz

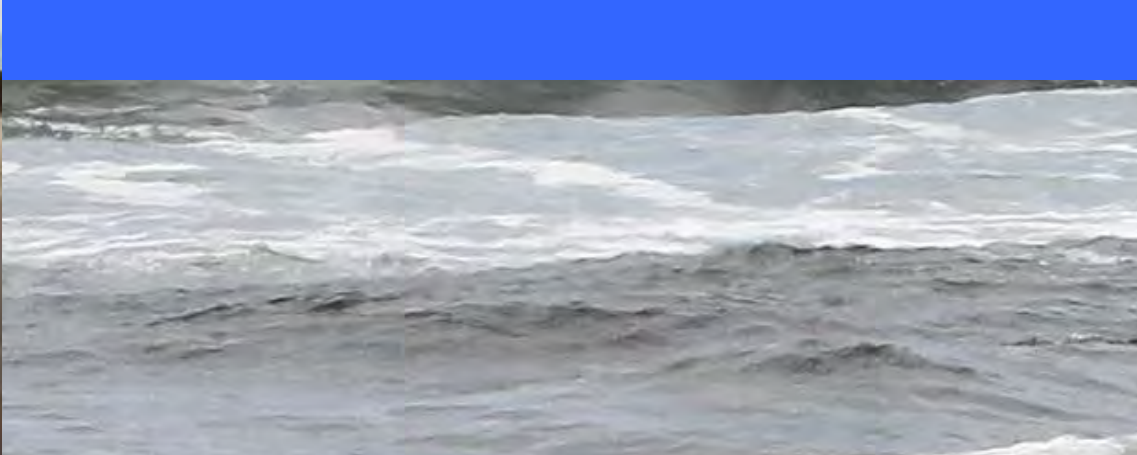
Smithsonian Environmental Research Center



# Our first “meeting” (encounter) in North America with Japanese Tsunami Marine Debris (JTMD): **June 5, 2012, in Oregon**

- On the morning of Tuesday,  
**June 5, 2012**
- 451 days (14 1/2 months) after  
March 11, 2011 .....
- Morning beach walkers reported  
that a “large dock” had floated  
ashore near **Newport, Oregon**



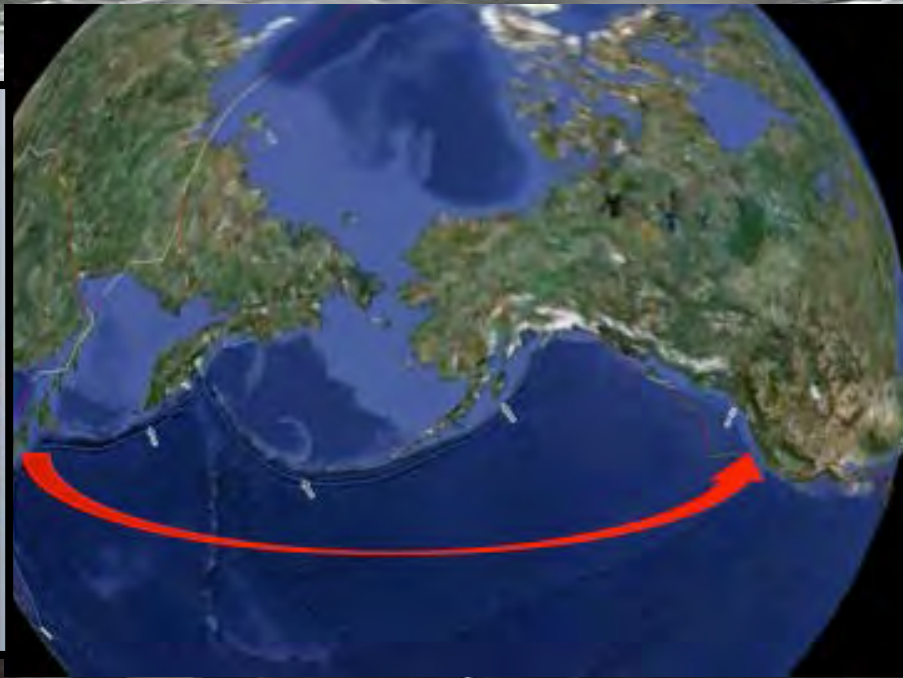


Port of Misawa,  
built 2008

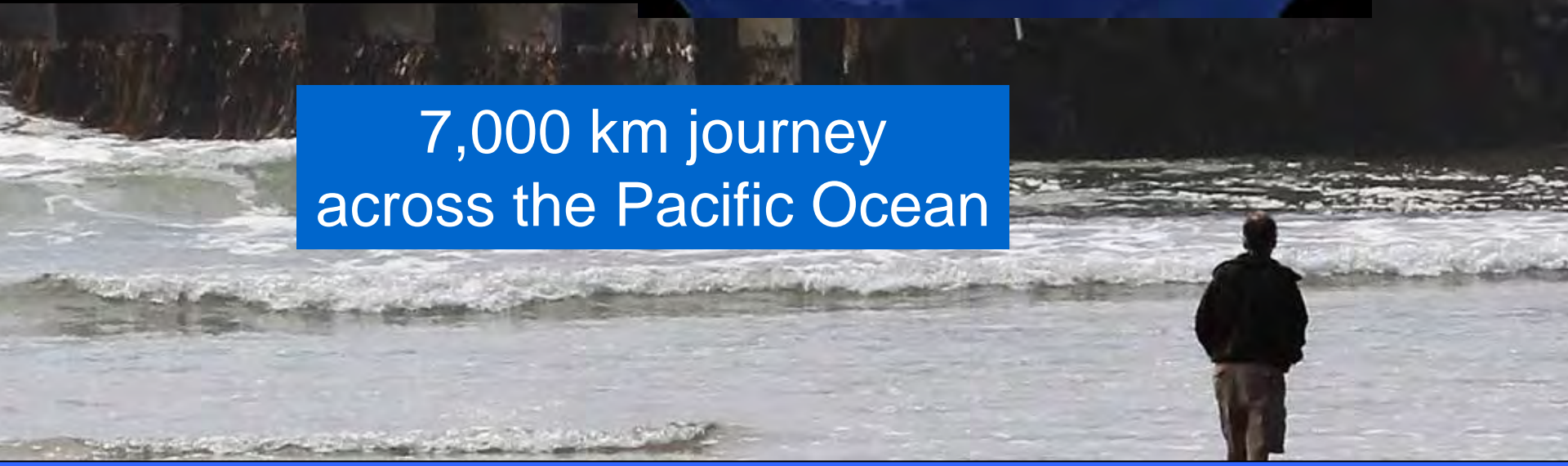


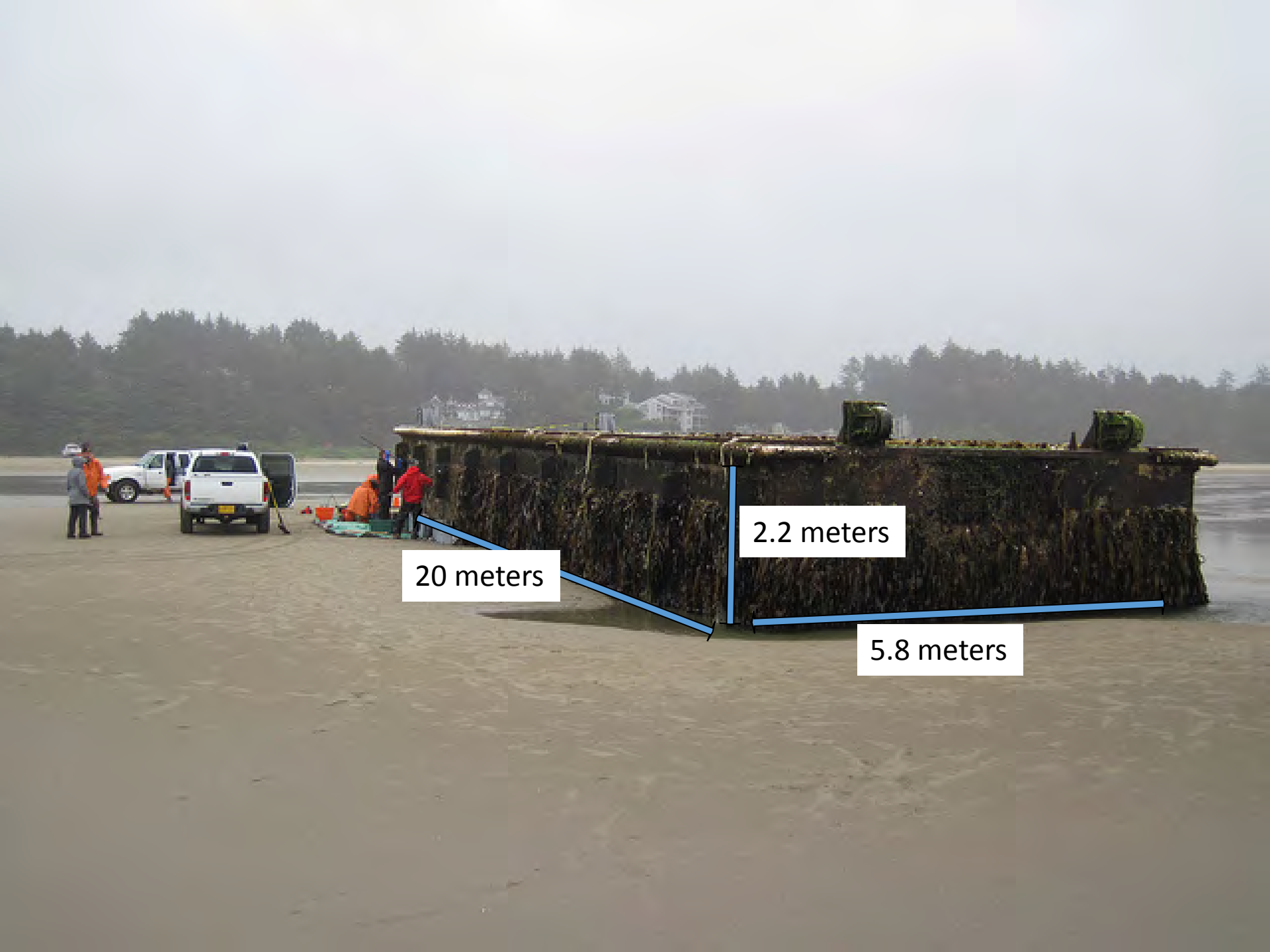


Misawa Harbor prior to March 11, 2011



7,000 km journey  
across the Pacific Ocean





20 meters

2.2 meters

5.8 meters



The dock attracted much public attention, with more than 20,000 visitors in the summer of 2012

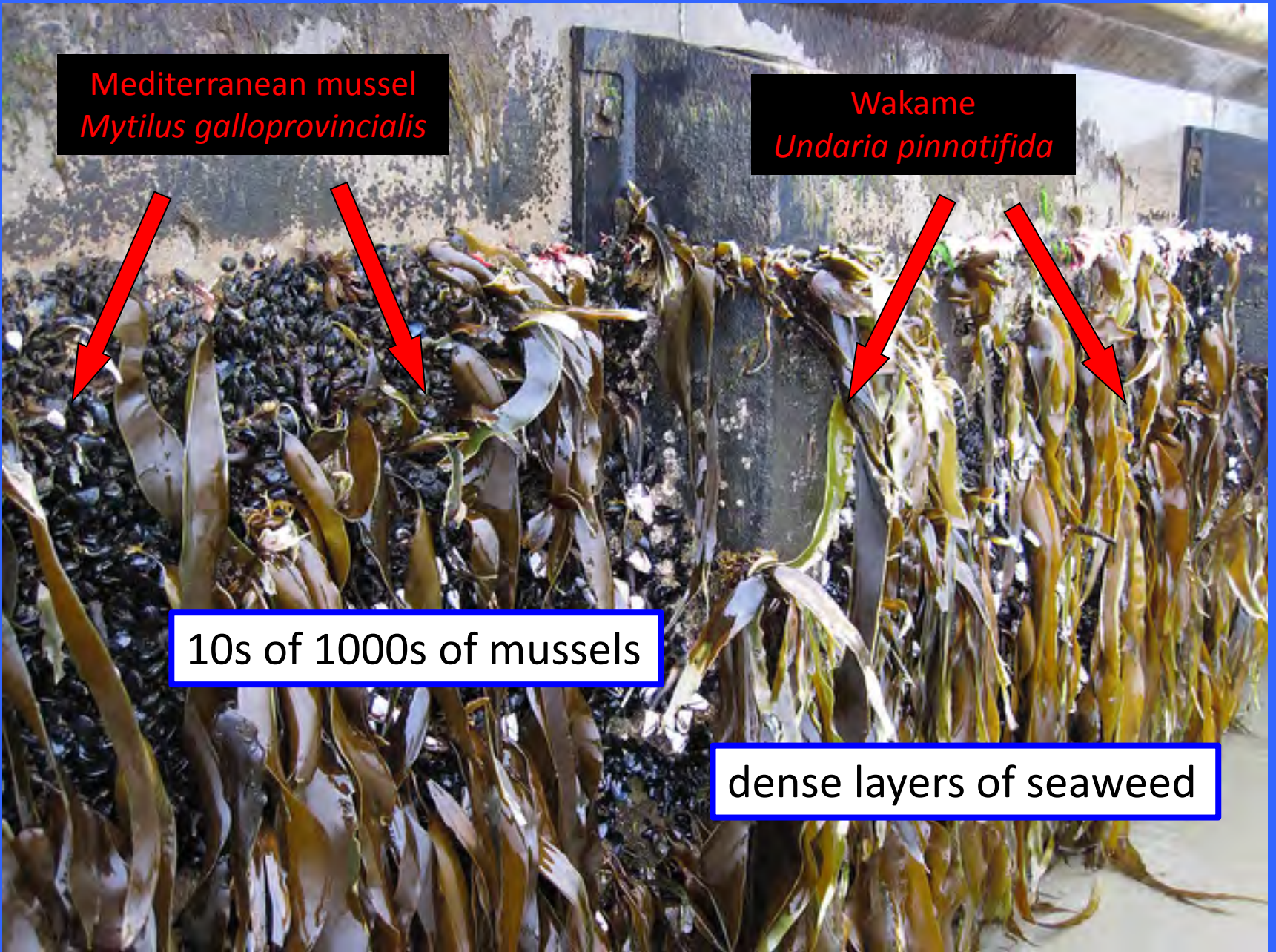


Mediterranean mussel  
*Mytilus galloprovincialis*

Wakame  
*Undaria pinnatifida*

10s of 1000s of mussels

dense layers of seaweed







Inside the dock: the Japanese seastar (starfish)  
*Asterias amurensis*

# Examples of coastal organisms on "Misawa 1": Landed Agate Beach, Oregon, June 4, 2012

Sea urchin  
*Temnotrema  
sculptum*



Sea cucumber  
*Havelockia  
versicolor*



Seastar  
*Asterias  
amurensis*



Shore crab  
*Hemigrapsus*



*Semibalanus  
cariosus*

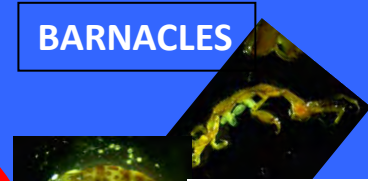


*Megabalanus  
rosa*

## ECHINODERMS



Sea squirts  
*Styela*



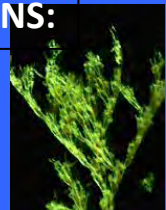
## BARNACLES

*Jassa marmorata,  
Ampithoe valida,  
Caprella spp.*

## AMPHIPODS

## BRYOZOANS:

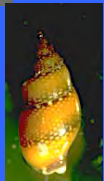
*Tricellaria,  
Cryptosula  
spp.,  
Watersipora*



128 different species of  
Japanese animals and plants  
crossed the ocean to  
North America  
on "Misawa 1"



Jingle shell  
*Anomia  
Cytaea  
(chinensis)*



Snail

Chiton  
*Mopalia  
seta*



Mollusk  
*Mitrella  
moleculina*

## MOLLUSKS (12 species)

Mussels:  
*Mytilus galloprovincialis,  
M. coruscus, M.  
trossulus, Musculus  
cupreus*



Limpets:  
*Lottia sp.;*  
*Nipponacmea  
habei*



Sea anemone  
*Metridium  
senile*



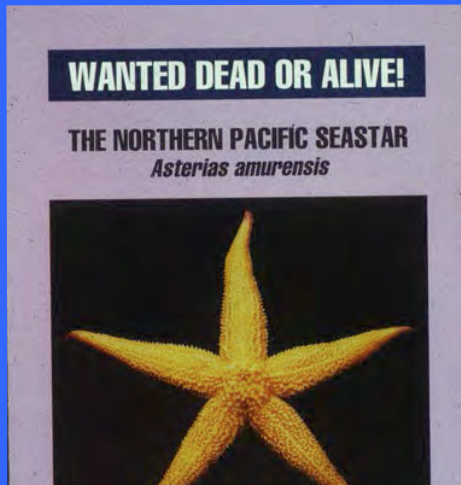
Polynoidae



Syllidae

## POLYCHAETE WORMS (28 species)

# Some of these species were well-known “invasive” species



Seastar  
*Asterias amurensis*



**WATCH FOR THE INVASIVE KELP**  
**UNDARIA PINNATIFIDA (WAKAME)**

This brown seaweed, native to Asia, has spread around the world to Australia, New Zealand, Europe, South America and California's harbors!

Its blade is thin, deeply lobed, and has a prominent midrib. It can be 1-6' long. There are tiny dots - tufts of hairs - scattered on the surface of the blade.

The reproductive structure develops below the blade, just above the holdfast. It is deeply folded and frilled; it looks like ribbon candy or a pinecone.




If you find *Undaria*, take a picture and contact:

Seaweed  
*Undaria pinnatifida*

**Wanted dead, not alive**  
**INVADING SPECIES**

Asian shore crab *Hemigrapsus sanguineus*



Aliases: Japanese shore crab, Pacific shore crab

**DESCRIPTION**

Native to the western North Pacific Ocean, this crab ship ballast North Carolina. (35mm) across, brown. Grows in on native

**Clawed and considered aggressive. Could displace existing crab population. May outcompete lobsters, mussels and crabs. Report crab sightings here.**

Shore Crab  
*Hemigrapsus sanguineus*

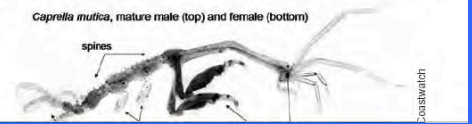
**GUIDE TO MARINE INVADERS IN THE GULF OF MAINE** *Caprella mutica*  
spiny red Caprellid amphipod, skeleton shrimp



- PHYSICAL DESCRIPTION**
- Slender crustacean with a skeletal appearance, long robust antennae and large claws
  - Distinct ridges of small spines visible on the main body segments that begin at base of neck where the clawed forelegs join the body
  - Found at all sizes, but full-grown males reach over 2" (5+ cm) in length, nearly twice as long as adult females
  - Males have much longer neck segments and larger claws than females
  - Body is often mottled red in color, particularly on full-grown adults
  - Highly mobile, animated in appearance, seen "waving" back and forth on substrate, often in large groups; attached to substrate using small posterior legs

Skeleton Shrimp  
*Caprella mutica*

ropes, as well as on many living substrates, particularly hydroids and macroalgae



Over the **next five years**, many objects with Japanese marine animals and seaweed landed in North America and the Hawaiian Islands



## Japanese Scientists Helping to Identify Marine Animals on Tsunami Rafts

<b>Takuma Haga</b>	National Museum	Bivalve mollusks
<b>Toshio Furota</b>	Toho University	General invertebrates
<b>Gyo Itani</b>	Kochi University	Crabs
<b>Hiroshi Kajihara</b>	Hokkaido University	Ribbon worms (Nemertea)
<b>Eijiroh Nishi</b>	Yokohoma Nat'l University	Marine worms
<b>Teruaki Nishikawa</b>	Nagoya University	Peanut worms (Sipuncula)
<b>Atsushi Nishimoto</b>	Nat'l Res. Inst. Fish. Sci	Shipworms (Teredinidae)
<b>Michio Otani</b>	Osaka Museum	Barnacles (Cirripedia) and general invertebrates
<b>Ichiro Takeuchi</b>	Ehime University	Caprellids (Amphipods)
<b>Hayato Tanaka</b>	Hiroshima University	Ostracods

Some common Japanese species  
arriving in North America and Hawaii on tsunami rafts

**Mediterranean Mussel**

*Mytilus galloprovincialis*



**Rosy Barnacle**

*Megabalanus rosa*



**Fouling Amphipod  
(crustacean)**

*Jassa marmorata*



# Japanese Seastars ("Starfish")



*Asterias amurensis*

JTMD-BF: floating pier  
from Misawa, Japan  
Landed in Oregon



*Aphelasterias japonica*

JTMD-BF: Horsfall Skiff  
The "Third" Thriving  
(第三隆昌丸 [Dai-San-Ryu-Sho-Maru])  
Landed in Oregon



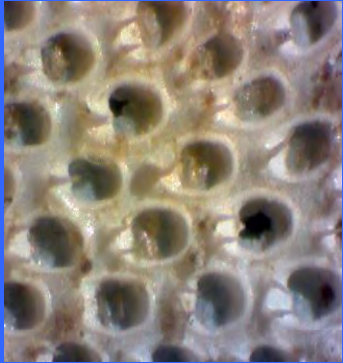
*Patiria pectinifera*

JTMD-BF: Carter Lake Skiff  
Landed in Oregon

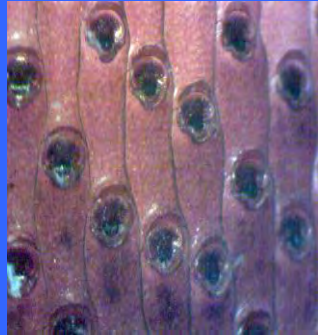


# Bryozoans (“Moss Animals”)

## Japanese Species



*Arbocuspis bellula*



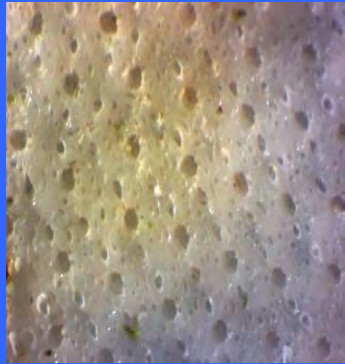
*Watersipora* sp.



*Lichenopora radiata*



Colony of bryozoan  
*Biflustra*  
on a 30-cm diameter  
buoy (float)



*Exochella* sp.



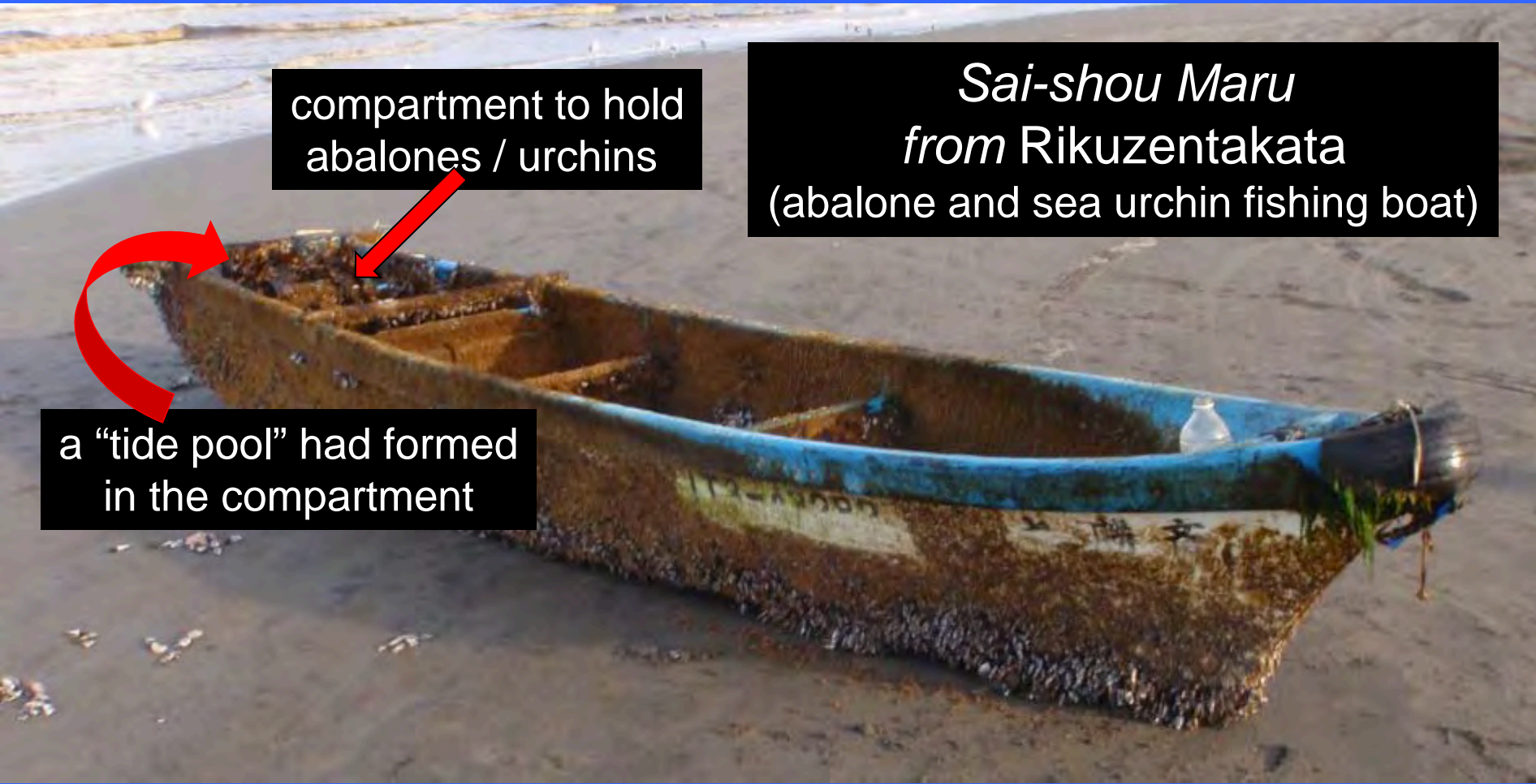
*Filicrisia* sp.



*Aetea truncata*  
... and many others



Long Beach, Washington: March 22, 2013



compartment to hold  
abalones / urchins

*Sai-shou Maru*  
from Rikuzentakata  
(abalone and sea urchin fishing boat)

a "tide pool" had formed  
in the compartment

Most vessels from the Tohoku coast  
floated across the ocean upside down (bottom up)  
but the *Sai-shou Maru* floated right side up (bottom down)



Lived in a local aquarium until February 2016

Barred knifejaw

イシダイ (Ishidai)



April 9, 2015



***Front half of a vessel likely from Iwate Prefecture***





*Seriola lalandi*  
“Yellowtail amber jack”  
鰺 (buri, hamachi)

