

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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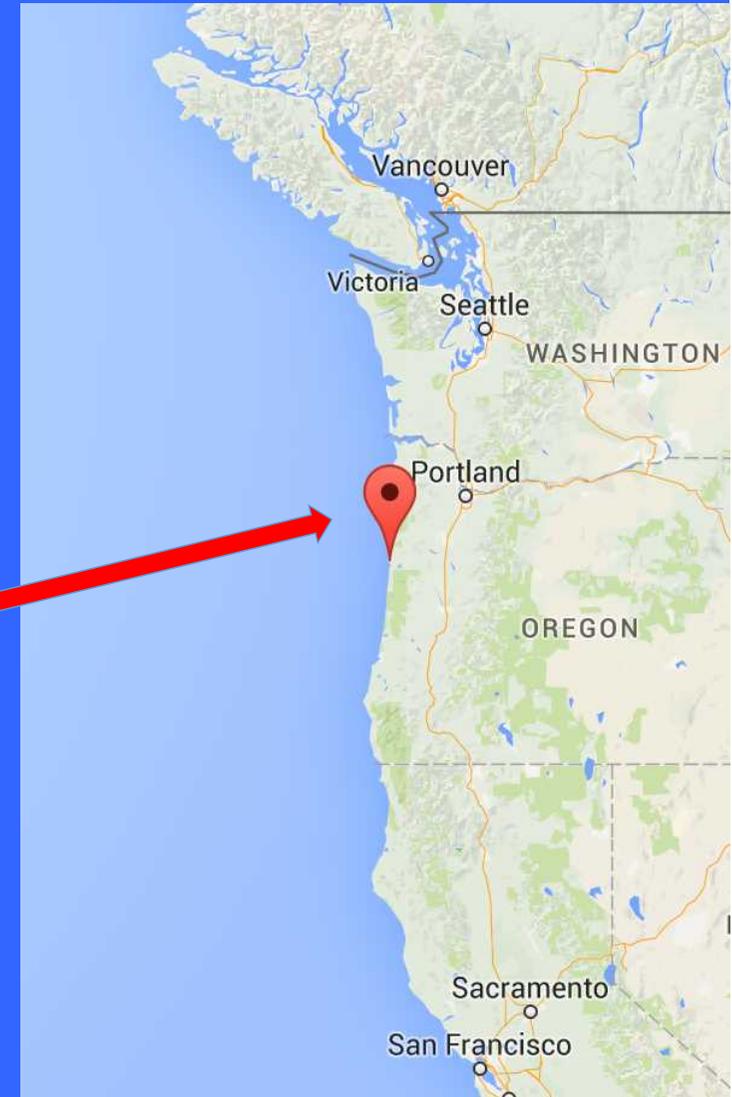
Gregory Ruiz

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**





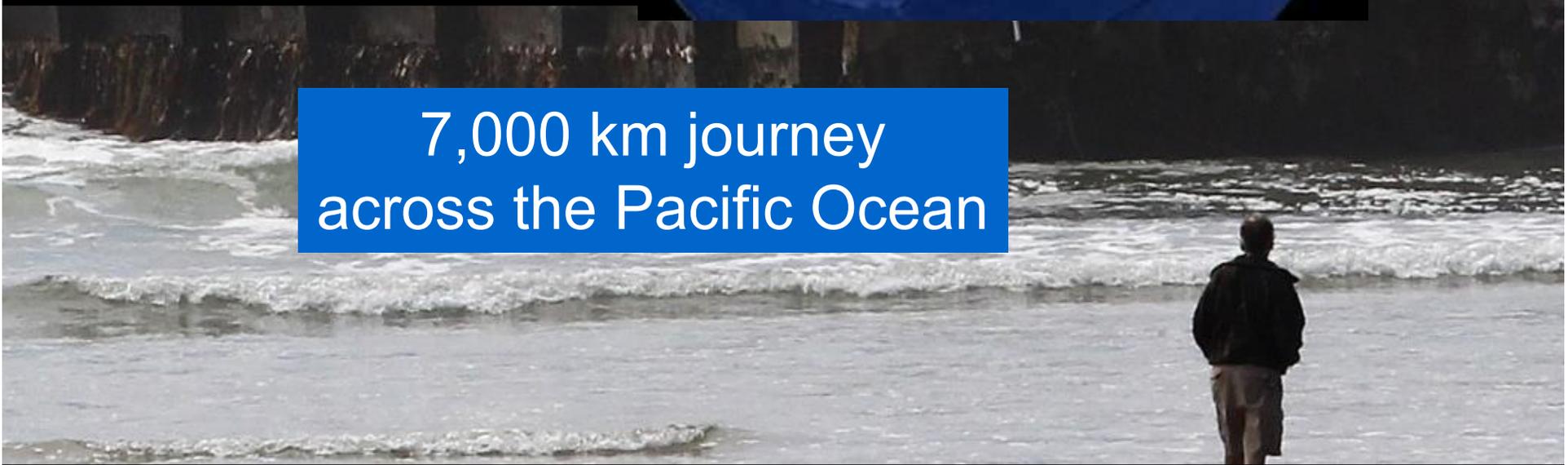
Port of Misawa,
built 2008

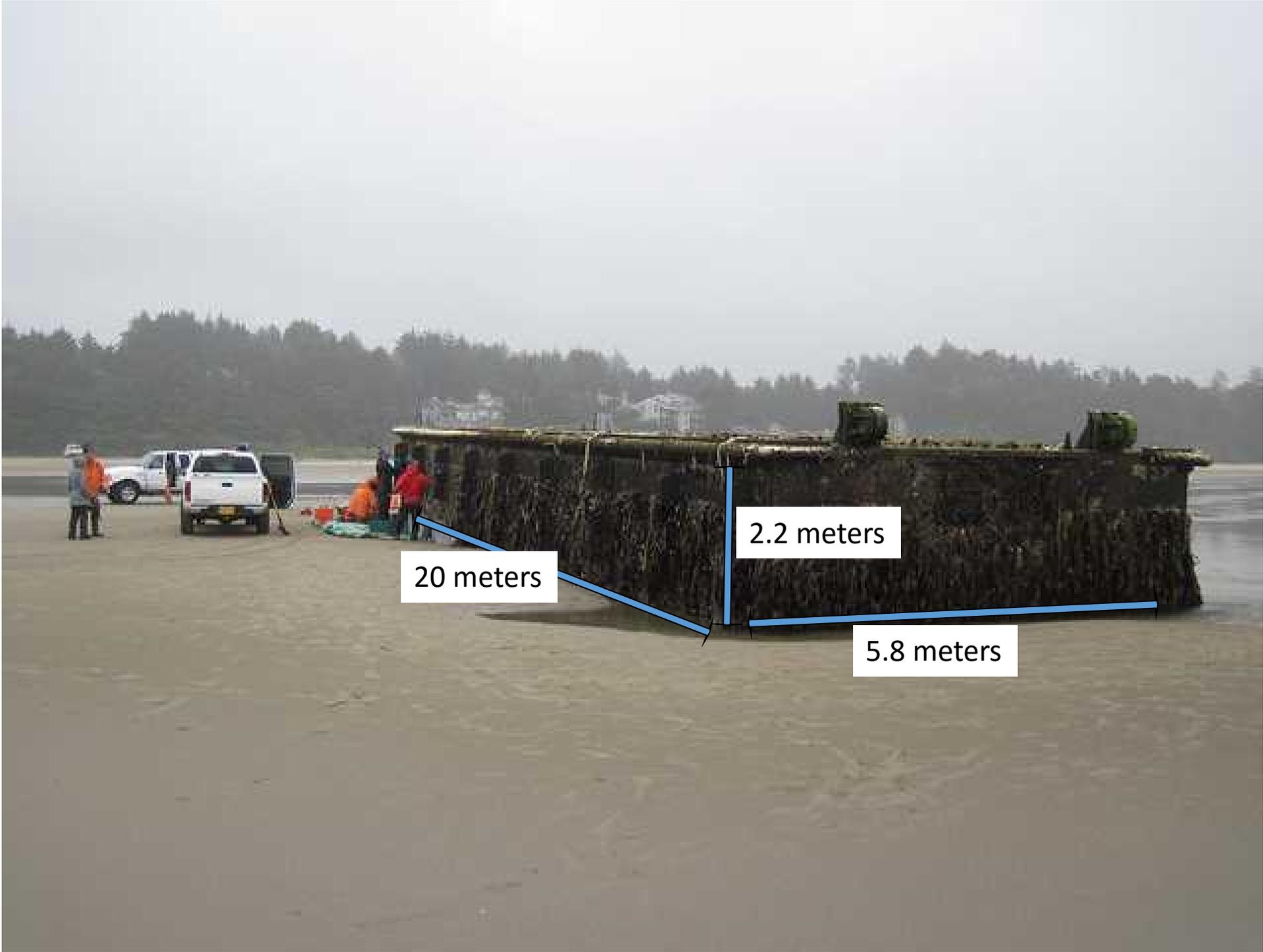


Misawa Harbor prior to March 11, 2011



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

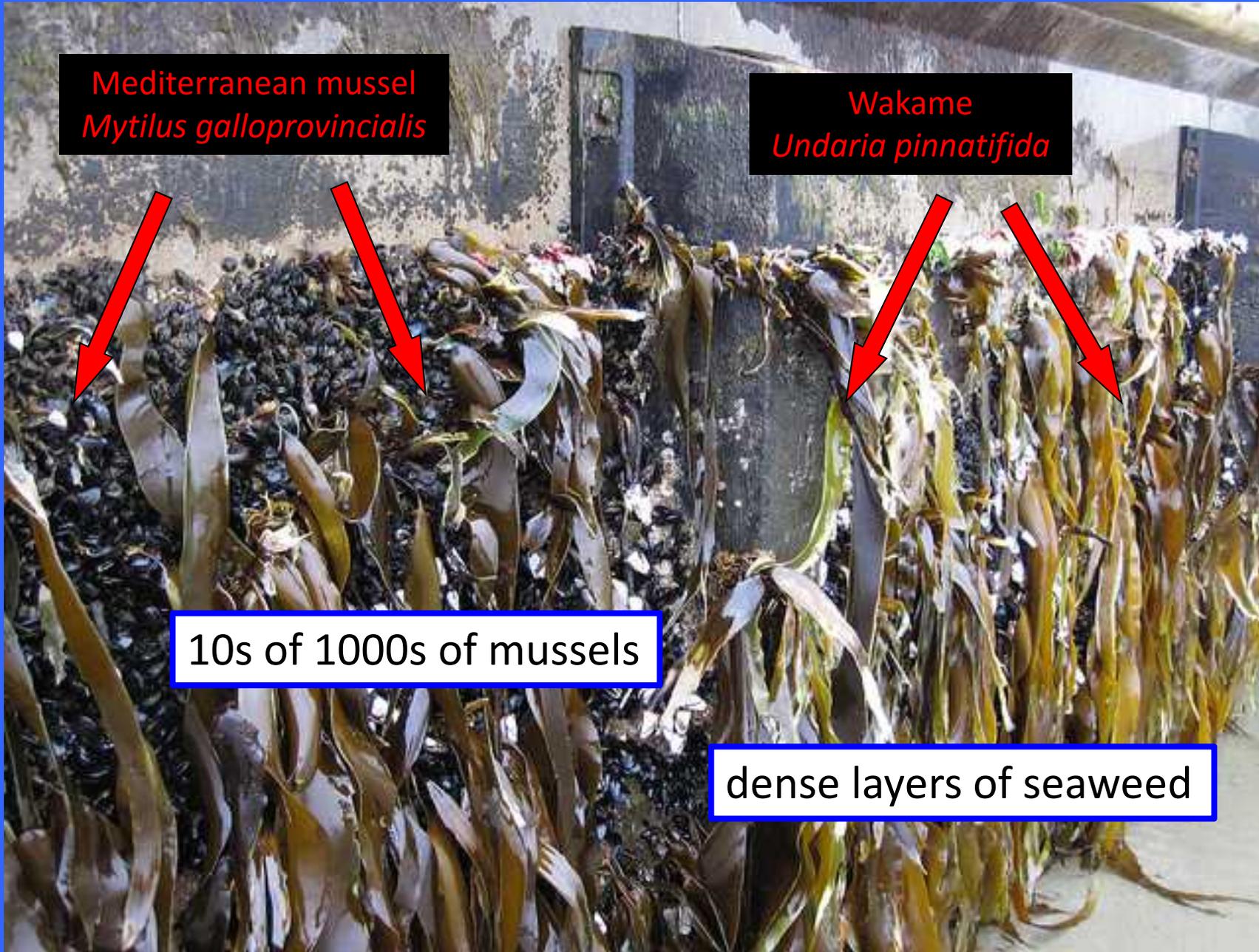


Mediterranean mussel
Mytilus galloprovincialis

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

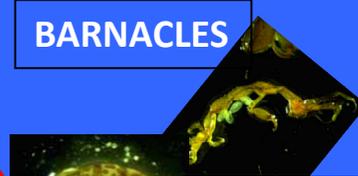


Sea squirts
Styela



Jingle shell
*Anomia
Cytaeum
(chinensis)*

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



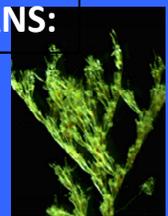
BARNACLES

*Jassa marmorata,
Ampithoe valida,
Caprella spp.*

AMPHIPODS

BRYOZOANS:

*Tricellaria,
Cryptosula
spp.,
Watersipora*



Chiton
*Mopalia
seta*



Snail
*Mitrella
moleculina*

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



**MOLLUSKS
(12 species)**



Limpets:
*Lottia sp.;
Nipponacmea
habei*



Sea anemone
*Metridium
senile*



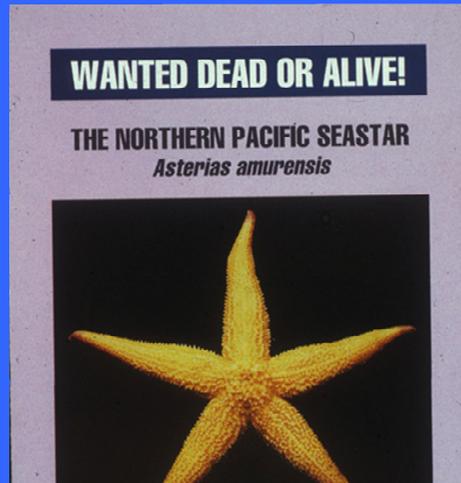
Polynoidae



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 is a ship ballast species from North Carolina. It is 35mm across, brown. Grows in non 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

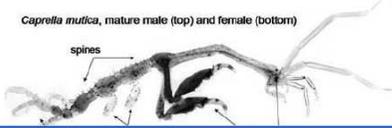
Caprella mutica
spiny red Caprellid amphipod, skeleton shrimp

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



Caprella mutica, mature male (top) and female (bottom)



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

**Skeleton Shrimp
*Caprella mutica***

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

Takuma Haga	National Museum	Bivalve mollusks
Toshio Furota	Toho University	General invertebrates
Gyo Itani	Kochi University	Crabs
Hiroshi Kajihara	Hokkaido University	Ribbon worms (Nemertea)
Eijiroh Nishi	Yokohoma Nat'l University	Marine worms
Teruaki Nishikawa	Nagoya University	Peanut worms (Sipuncula)
Atsushi Nishimoto	Nat'l Res. Inst. Fish. Sci	Shipworms (Teredinidae)
Michio Otani	Osaka Museum	Barnacles (Cirripedia) and general invertebrates
Ichiro Takeuchi	Ehime University	Caprellids (Amphipods)
Hayato Tanaka	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" Throwing
(第三隆昌丸 [Dai-San-Ryu-Sho-Maru])
Landed in Oregon



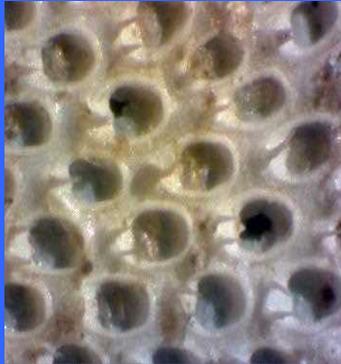
Patiria pectinifera

JTMD-BF: Carter Lake Skiff
Landed in Oregon

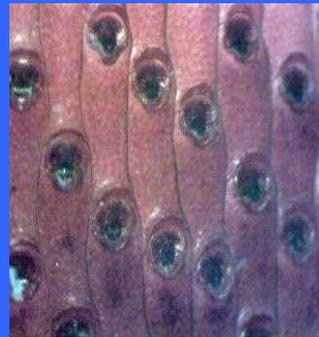


Bryozoans (“Moss Animals”)

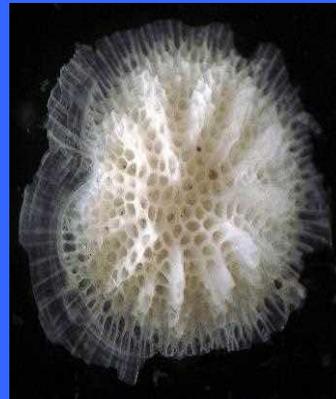
Japanese Species



Arbocuspis bellula



Watersipora sp.



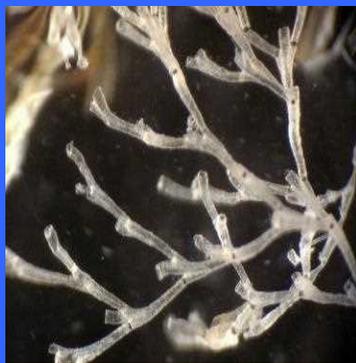
Lichenopora radiata



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



Exochella sp.

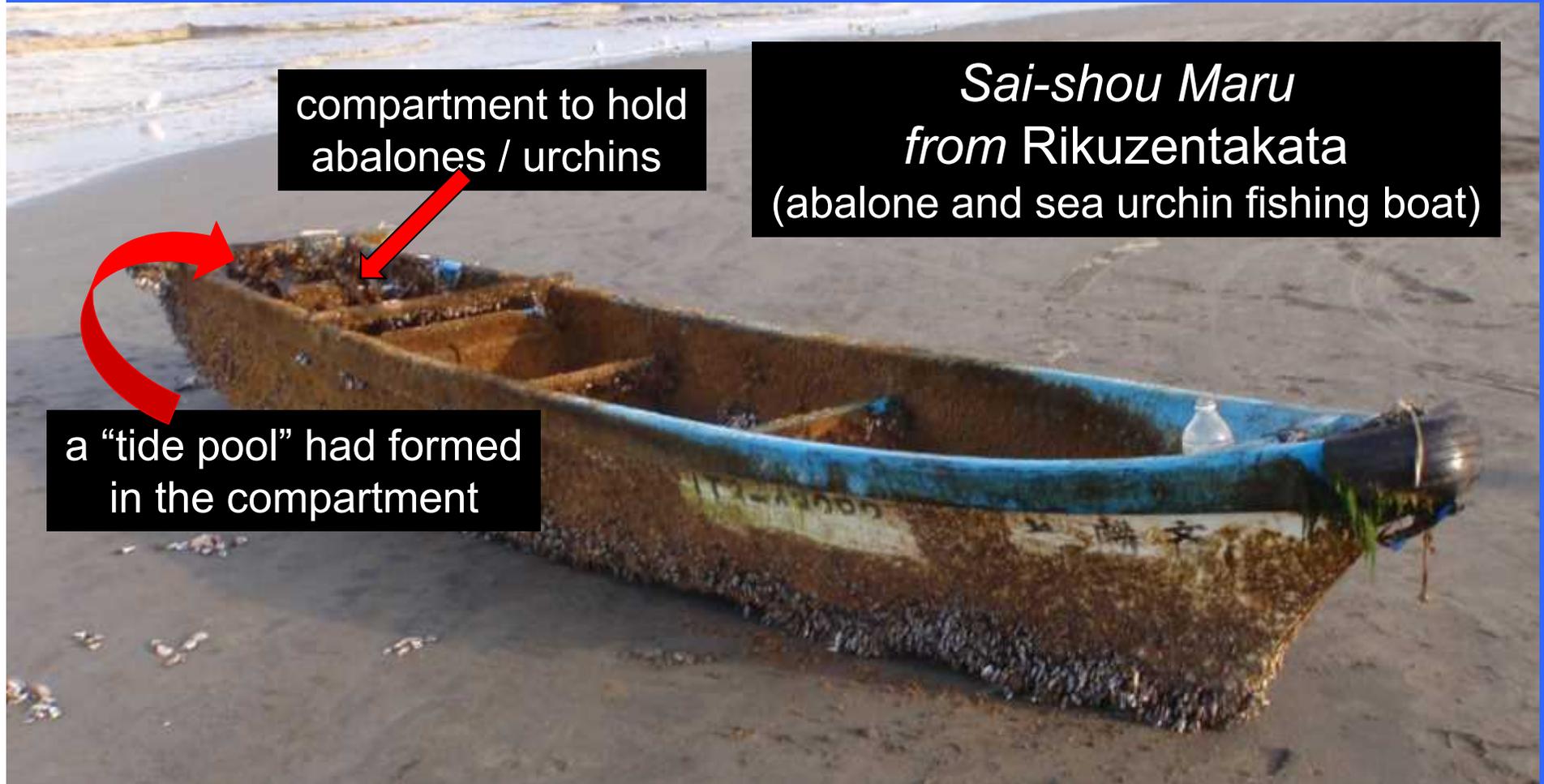


Filicrisia sp.



Aetea truncata
... and many others

Long Beach, Washington: March 22, 2013



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

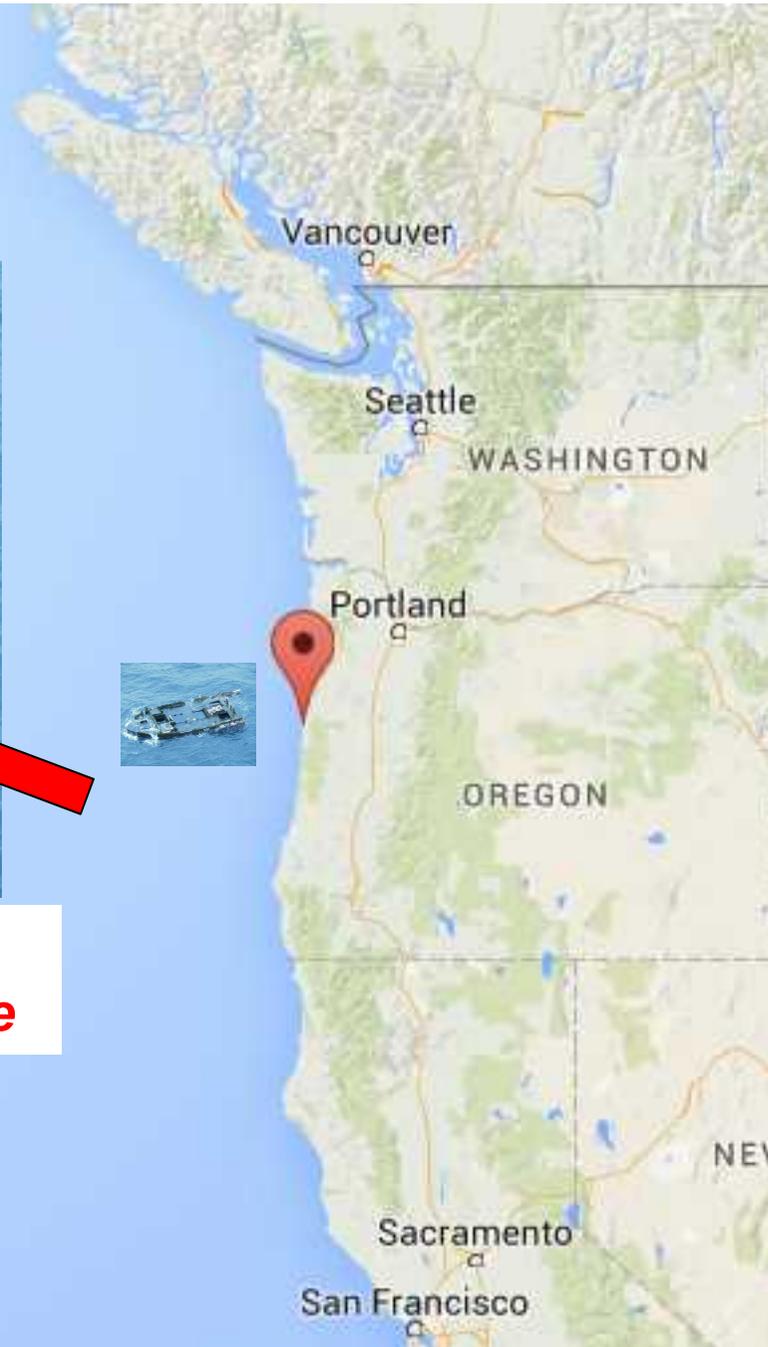
イシダイ (Ishidai)



April 9, 2015



Front half of a vessel likely from Iwate Prefecture





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

