

Long-Distance Transoceanic Rafting Communities  
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

TUMSAT, Shinagawa Campus  
May 18, 2017

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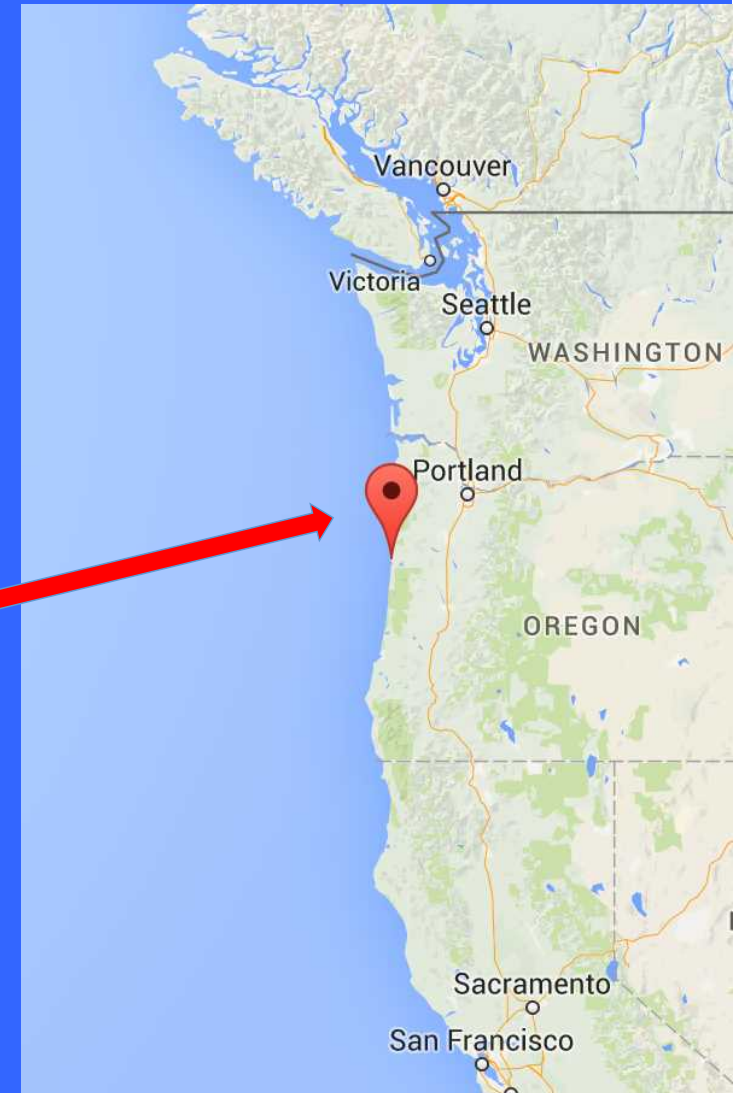
Gregory Ruiz

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 (14.5 months) after  
March 11, 2011 .....
- Morning beach walkers reported  
that a “large dock” had floated  
ashore just north of,  
**Newport, Oregon**





Port of Misawa,  
built 2008

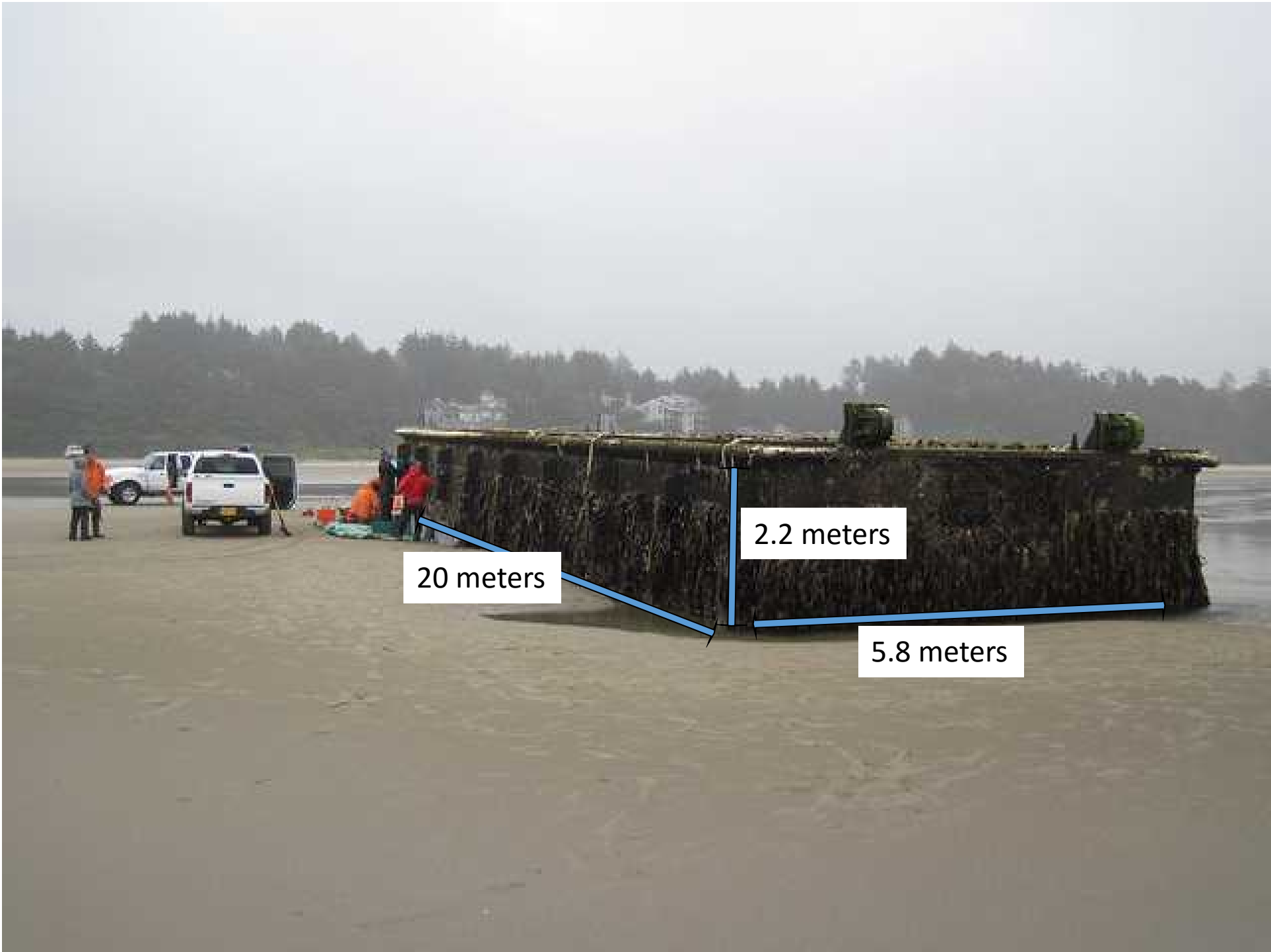


Misawa Harbor prior to March 11, 2011



7,000 km journey  
across the Pacific Ocean





20 meters

2.2 meters

5.8 meters

Mediterranean mussel  
*Mytilus galloprovincialis*

Wakame  
*Undaria pinnatifida*





Inside the dock: Seastar *Asterias amurensis*



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

Sea urchin  
*Temnotrema sculptum*



Sea cucumber  
*Havelockia versicolor*



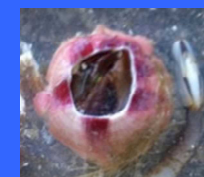
Seastar  
*Asterias amurensis*



Shore crab  
*Hemigrapsus*



*Semibalanus cariosus*



*Megabalanus rosa*

**ECHINODERMS**

**BARNACLES**



Sea squirts  
*Styela*

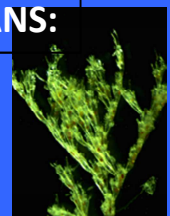


*Jassa marmorata*,  
*Ampithoe valida*,  
*Caprella* spp.

**AMPHIPODS**

**BRYOZOANS:**

*Tricellaria*,  
*Cryptosula* spp.,  
*Watersipora*



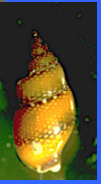
**128 species arrived on Misawa 1**



Jingle shell  
*Anomia cytaeum (chinensis)*



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*



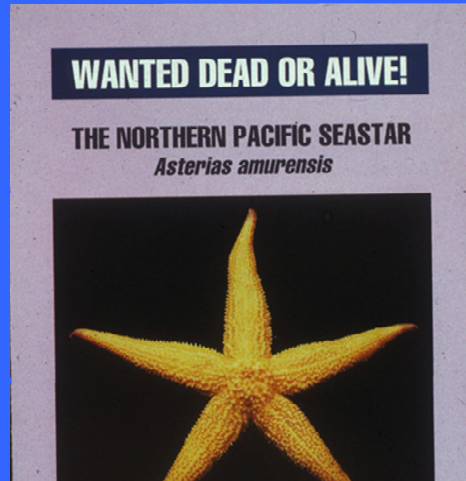
Polynoidae



Syllidae

**POLYCHAETE WORMS (28 species)**

# On the Misawa Ark:



**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**  
**INVASING 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 common ship ballast species in the Southeastern United States and North Carolina. It is 1-2 inches (25-50 mm) across, with a carapace width of 35 mm. Grows in large numbers on native shellfish.

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

**Shore Crab**  
*Hemigrapsus sanguineus*

**Help Protect Port Phillip Bay**  
Eleven-armed Seastars & Northern Pacific Seastars can be difficult to tell apart. You can help by returning the Native Seastars to the water.

**NATIVE ✓**  
Eleven-armed Seastar

- Usually has 11 arms
- Tips of arms not upturned
- All native seastars are protected under the Victorian Fisheries Act 1995
- A single arm from a Native Pacific Seastar returned to the water can grow back into a full body.

**PEST X**  
Northern Pacific Seastar

- Usually has 5 arms
- Tips of arms upturned
- All Northern Pacific Seastars are protected under the Victorian Fisheries Act 1995
- A single arm from a Northern Pacific Seastar returned to the water can grow back into a full body.

For further information contact:  
Department of Natural Resources and Environment  
138 156  
www.dnre.vic.gov.au/nar/npseastars

**Seastar**  
*Asterias amurensis*

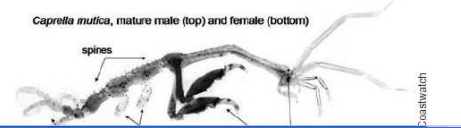
**GUIDE TO MARINE INVADERS IN THE GULF OF MAINE**  
**Caprella mutica**  
spiny red Caprellid amphipod, skeleton shrimp



**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*



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

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



## Japanese Colleagues Contributing to JTMD Biodiversity Research

<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

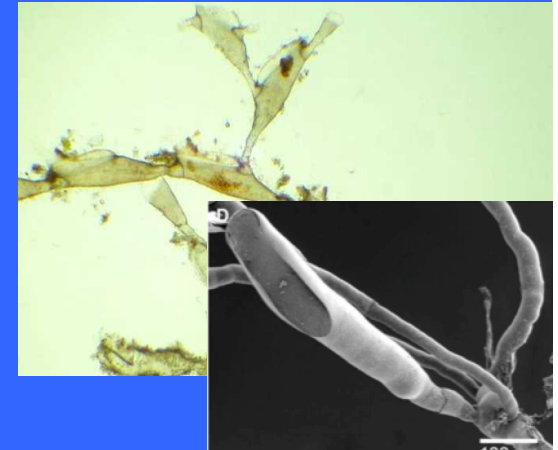
Examples of some of the most common Japanese species arriving in North America and Hawaii on tsunami rafts



*Mytilus galloprovincialis*  
Mediterranean Mussel



*Megabalanus rosa*  
Rosy Barnacle



*Scruparia ambigua*  
Bryozoan  
("Moss animal")



*Jassa marmorata*  
Fouling Amphipod



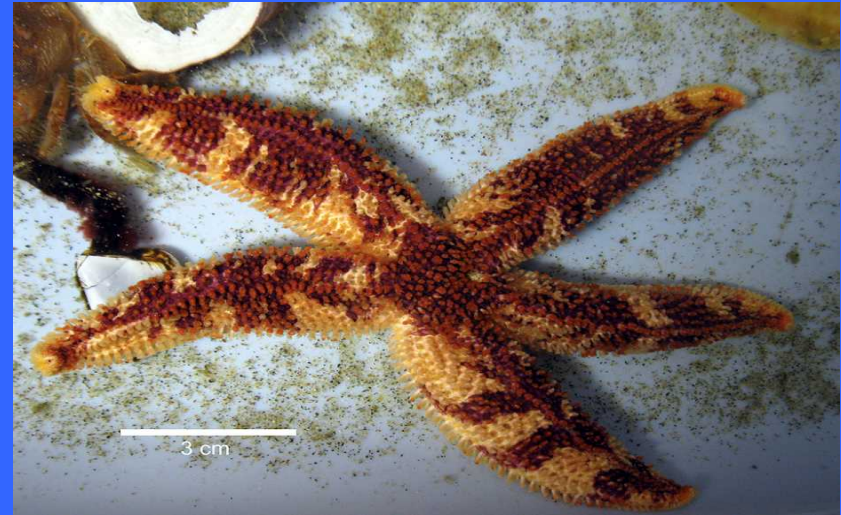
*Ianiropsis serricaudis*  
Isopod crustacean

# Japanese Seastars (Asteroidea)



*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



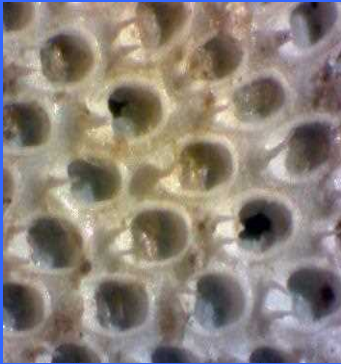
*Patiria pectinifera*

JTMD-BF : Carter Lake Skiff  
Landed in Oregon

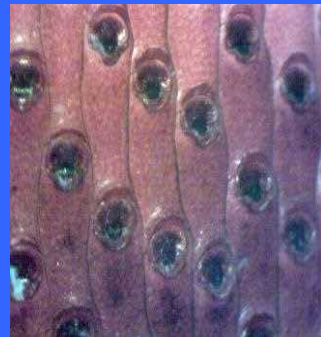


# Bryozoan Biofouling

## Japanese Species



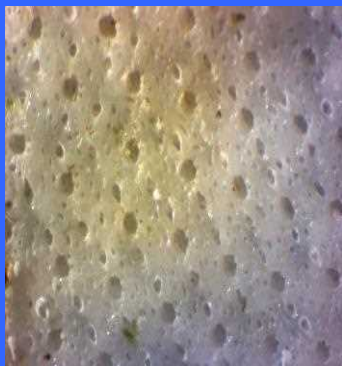
*Arbocuspis bellula*



*Watersipora* sp.



*Lichenopora radiata*



*Exochella* sp.



*Filicrisia* sp.

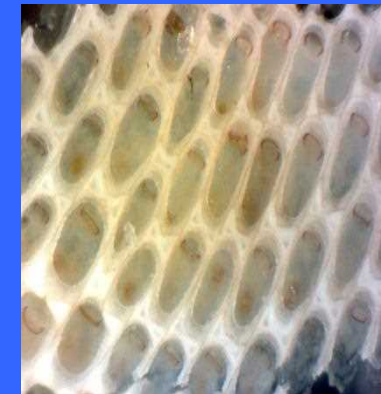


*Aetea truncata*  
... and many others

## Oceanic Species



*Jellyella eburnea*



*Jellyella tuberculata*

Long Beach, Washington: March 22, 2013



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

wet well

a "tide pool" had formed  
in the wet well

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





Lived in an aquarium until February 2016

*Oplegnathus fasciatus*  
“Barred knifejaw”

(“Striped beakperch”  
“Striped beakfish”, “False parrotfish”)



April 9, 2015



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





*Seriola lalandi*  
“Yellowtail amber jack”  
(Western Pacific)

