

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

Tohoku University, Sendai
May 19, 2017

James T. Carlton (Williams College)

John Chapman

Oregon State University

Jonathan Geller

Moss Landing Marine Laboratories

Jessica Miller

Oregon State University

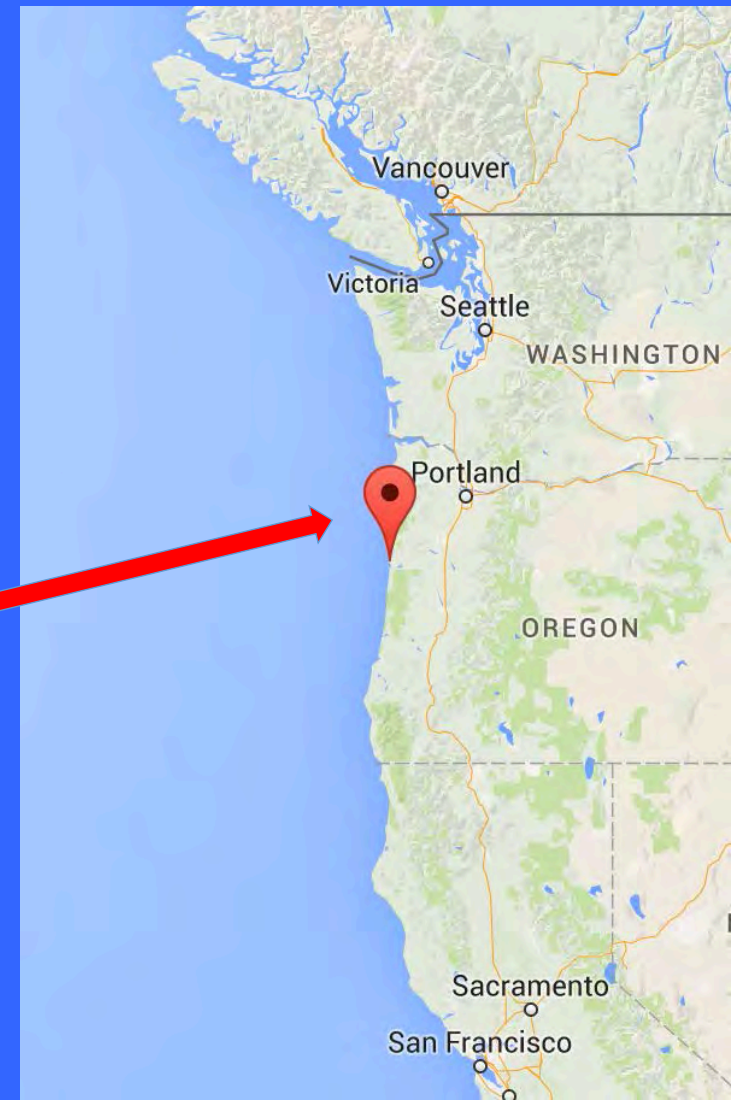
Gregory Ruiz

Smithsonian Environmental Research Center



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

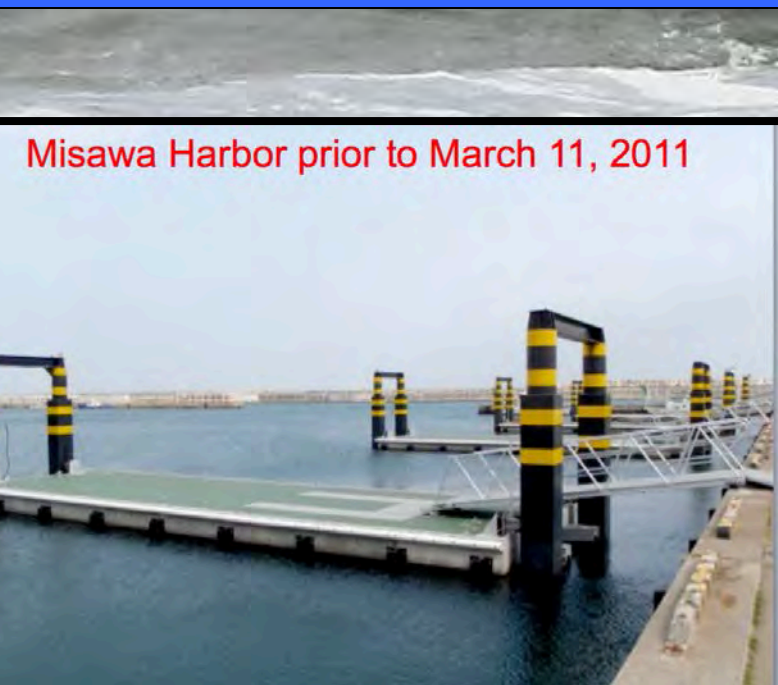
- On the morning of Tuesday,
June 5, 2012
- 451 days (14.5 months) after
March 11, 2011
- Morning beach walkers reported
that a “large dock” had floated
ashore just north of,
Newport, Oregon



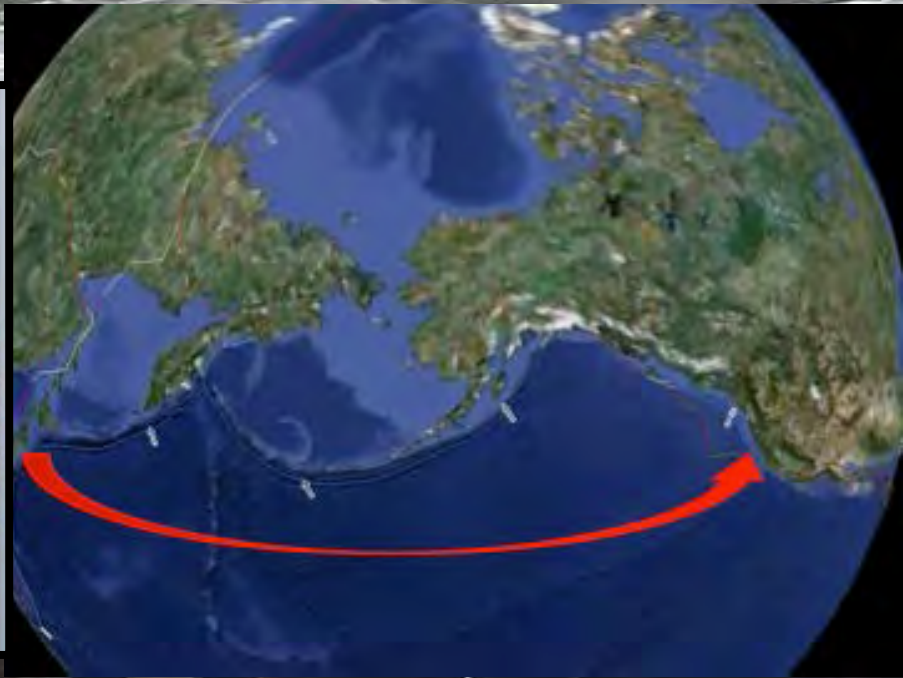


Port of Misawa,
built 2008

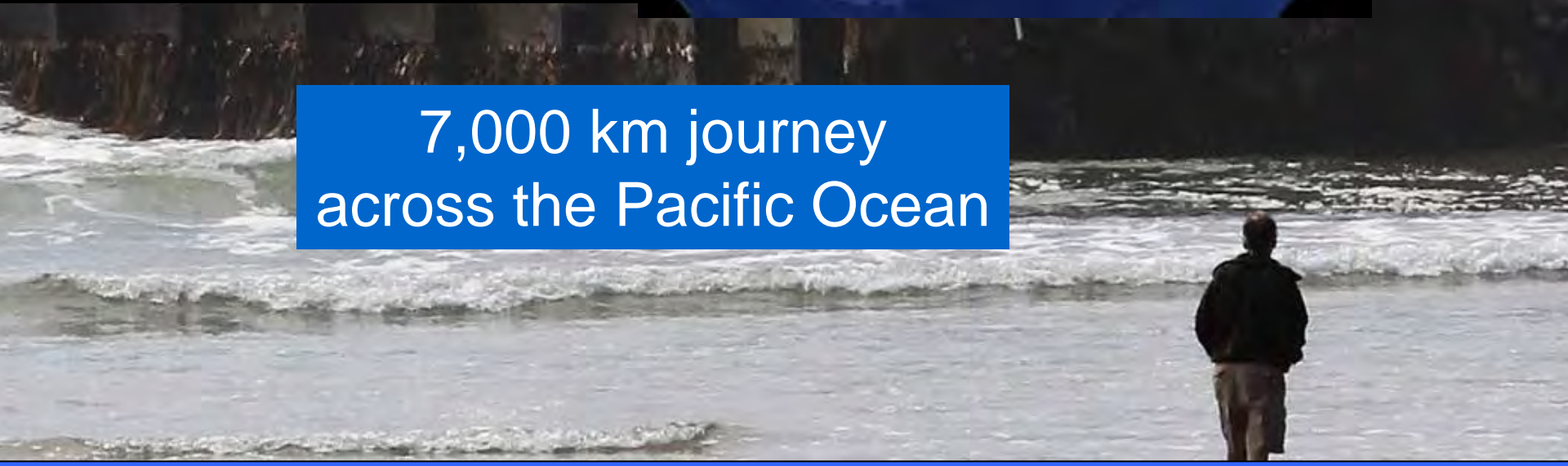


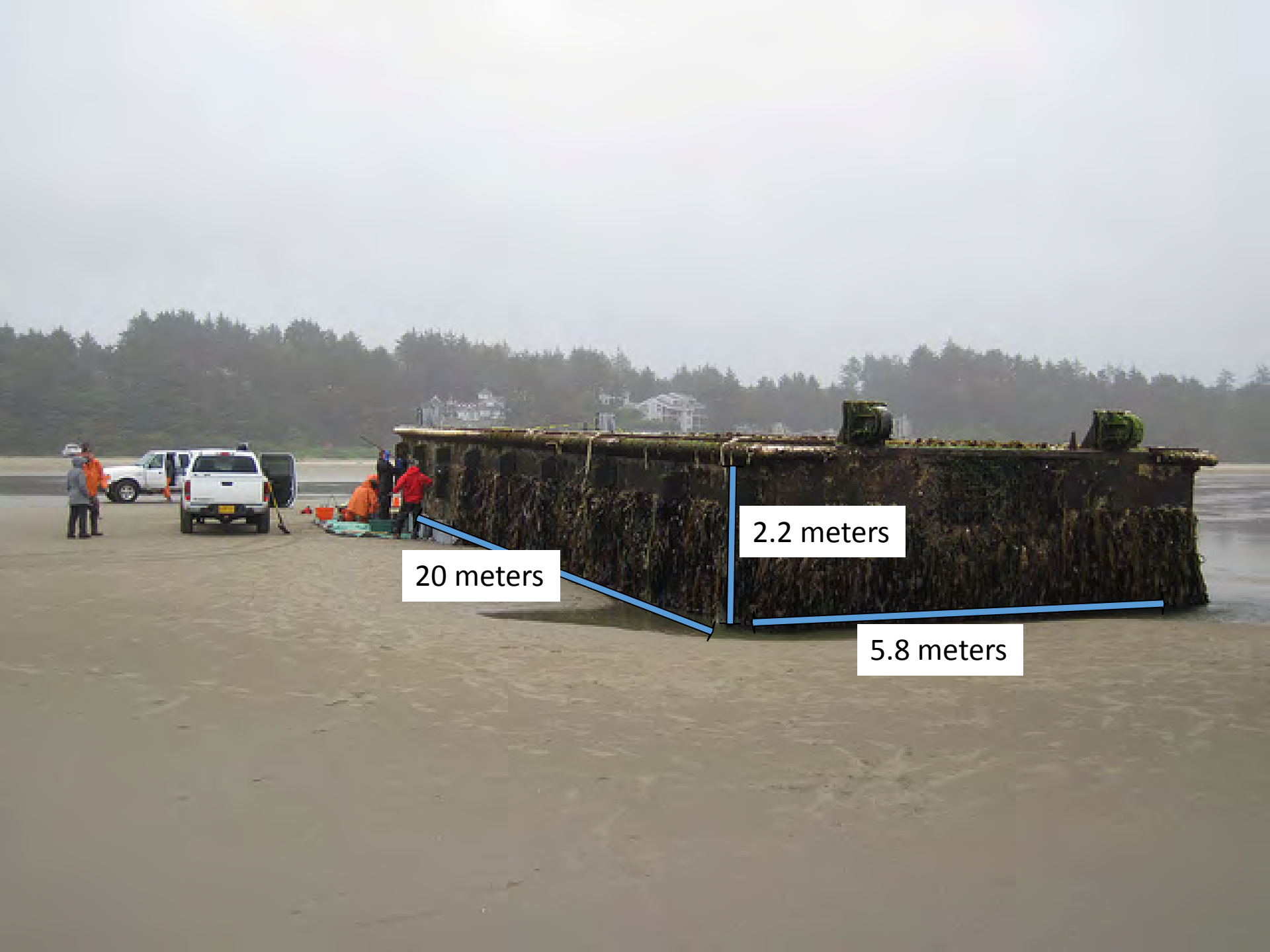


Misawa Harbor prior to March 11, 2011



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



Sea squirts
Styela



BARNACLES

*Jassa marmorata,
Ampithoe valida,
Caprella spp.*

AMPHIPODS

BRYOZOANS:

*Tricellaria,
Cryptosula
spp.,
Watersipora*

**125 species arrived
on Misawa 1**



Jingle shell
*Anomia
Cytaeum
(chinensis)*



Snail
*Mitrella
moleculina*

Chiton
*Mopalia
seta*



**MOLLUSKS
(12 species)**

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



Limpets:
Lottia sp.;
*Nipponacmea
habei*



Sea anemone
*Metridium
senile*



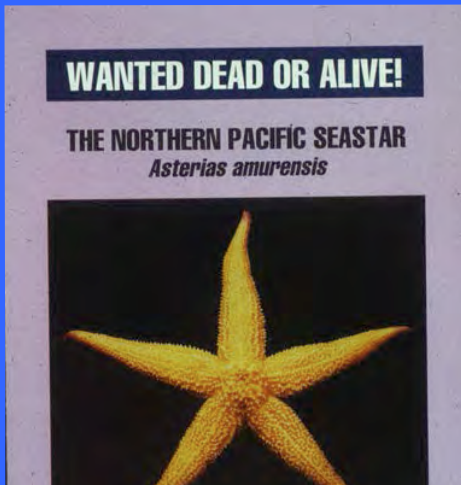
Polynoidae



Syllidae

**POLYCHAETE WORMS
(28 species)**

On the Misawa Ark:



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

Shore Crab
Hemigrapsus sanguineus

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

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



Skeleton Shrimp
Caprella mutica

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

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

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

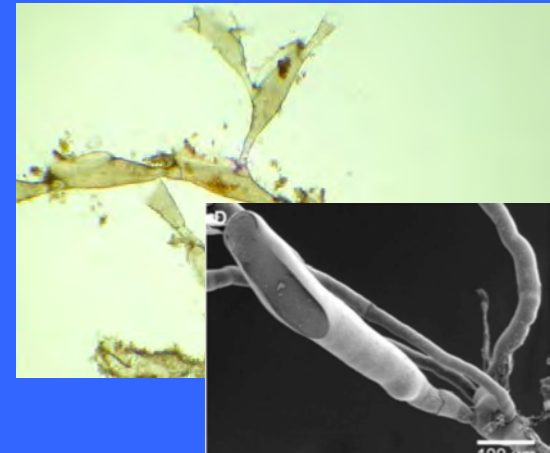
Examples of some of the most common Japanese species arriving in North America and Hawaii on tsunami rafts



Mytilus galloprovincialis
Mediterranean Mussel



Megabalanus rosa
Rosy Barnacle



Scruparia ambigua
Bryozoan
("Moss animal")



Jassa marmorata
Fouling Amphipod



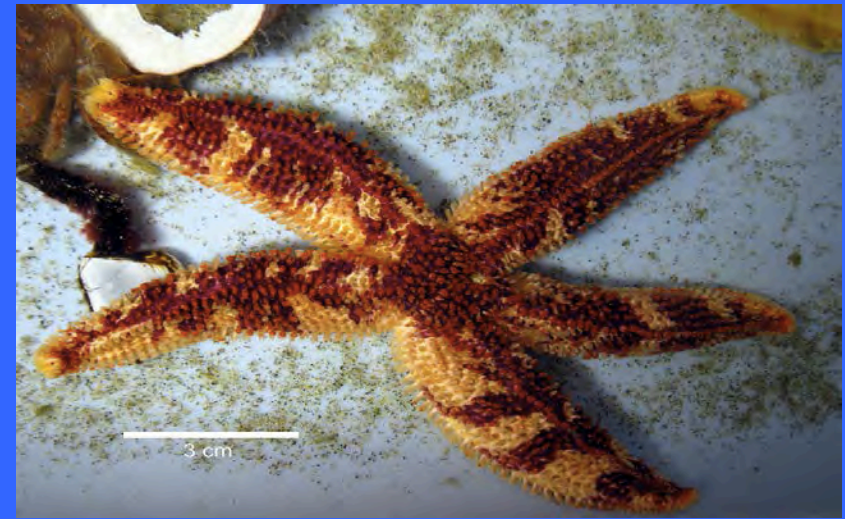
Ianiropsis serricaudis
Isopod crustacean

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



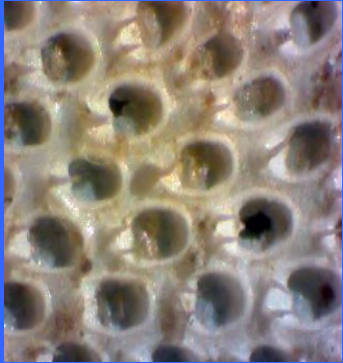
Patiria pectinifera

JTMD-BF: Carter Lake Skiff
Landed in Oregon

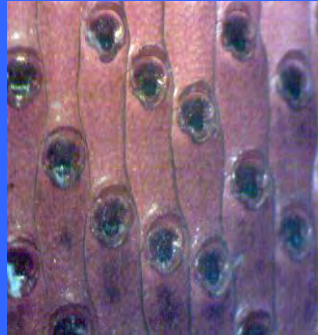


Bryozoan Biofouling

Japanese Species



Arbocuspis bellula



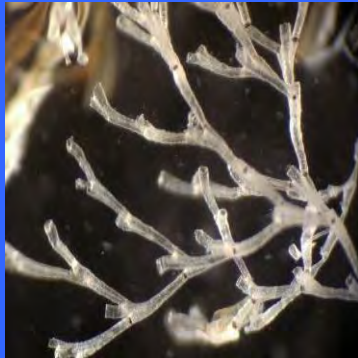
Watersipora sp.



Lichenopora radiata



Exochella sp.



Filicrisia sp.



Aetea truncata
... and many others

Oceanic Species



Jellyella eburnea



Jellyella tuberculata

Long Beach, Washington: March 22, 2013



wet well

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

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”)

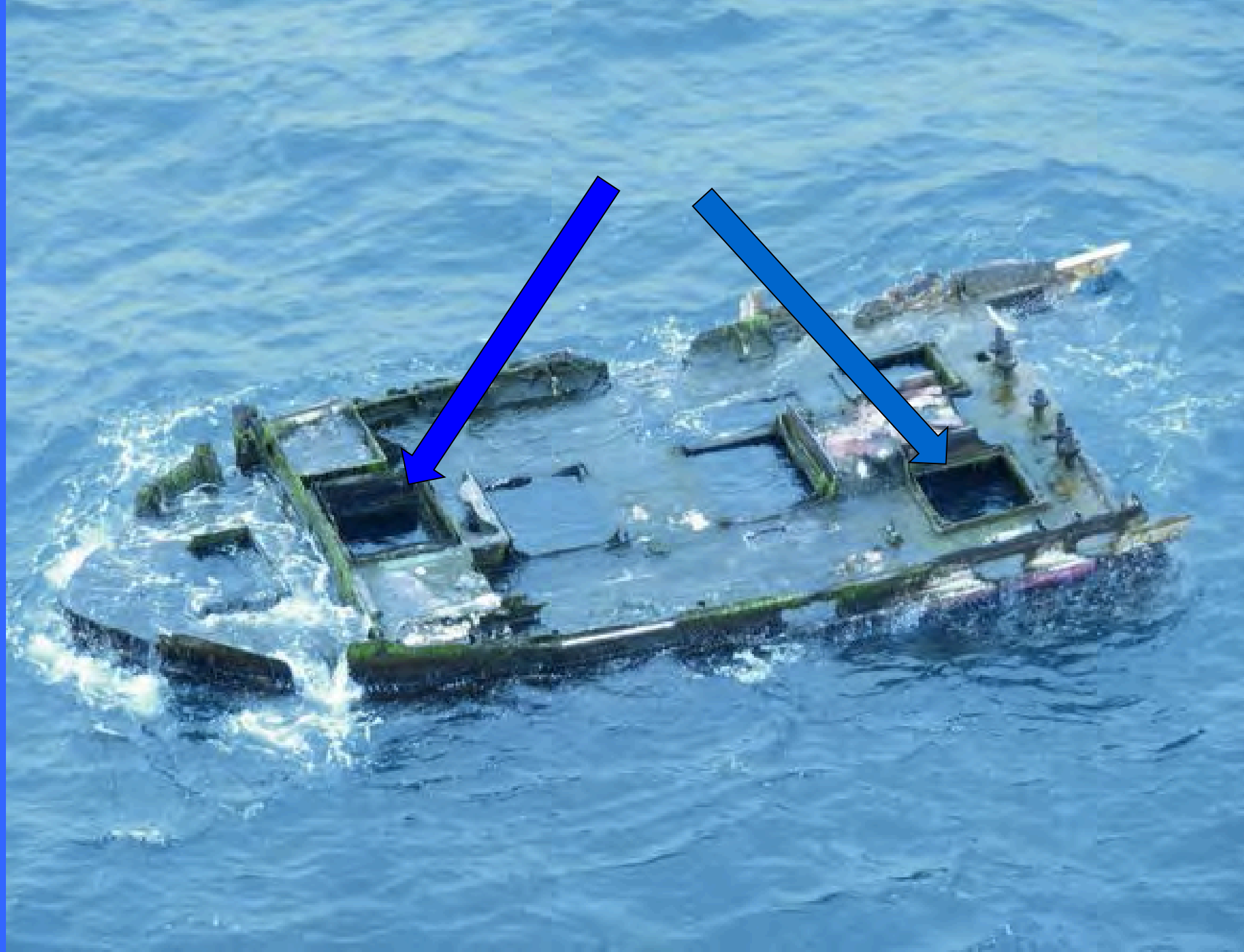


April 9, 2015



Front half of a vessel likely from Iwate Prefecture





Seriola lalandi
“Yellowtail amber jack”
(Western Pacific)

