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
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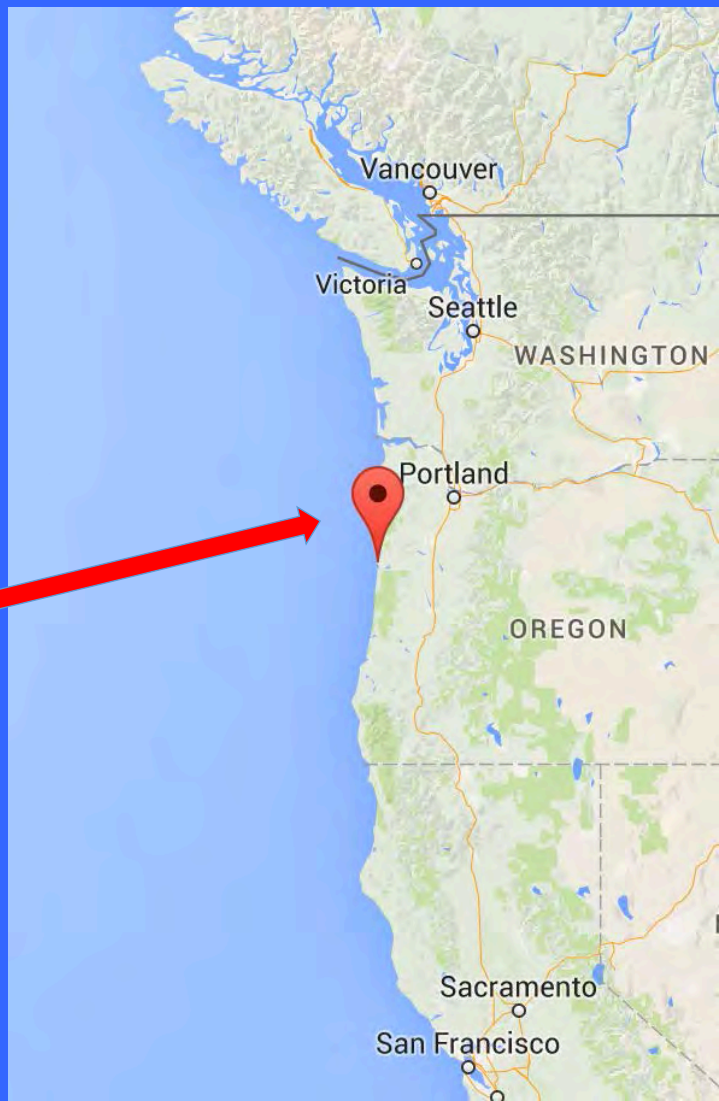
James T. Carlton (Williams College)

John Chapman — Oregon State University
Jonathan Geller — Moss Landing Marine Laboratories
Jessica Miller — Oregon State University
Gregory Ruiz — Smithsonian Environmental Research Center

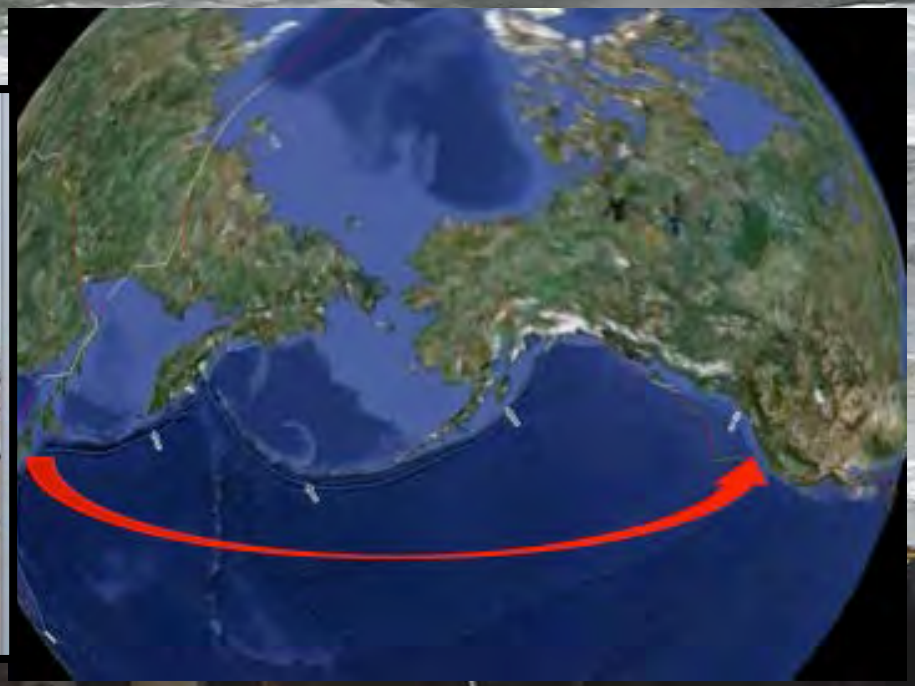
NSF
PICES
環境省 Ministry of the Environment
Sea Grant Oregon

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

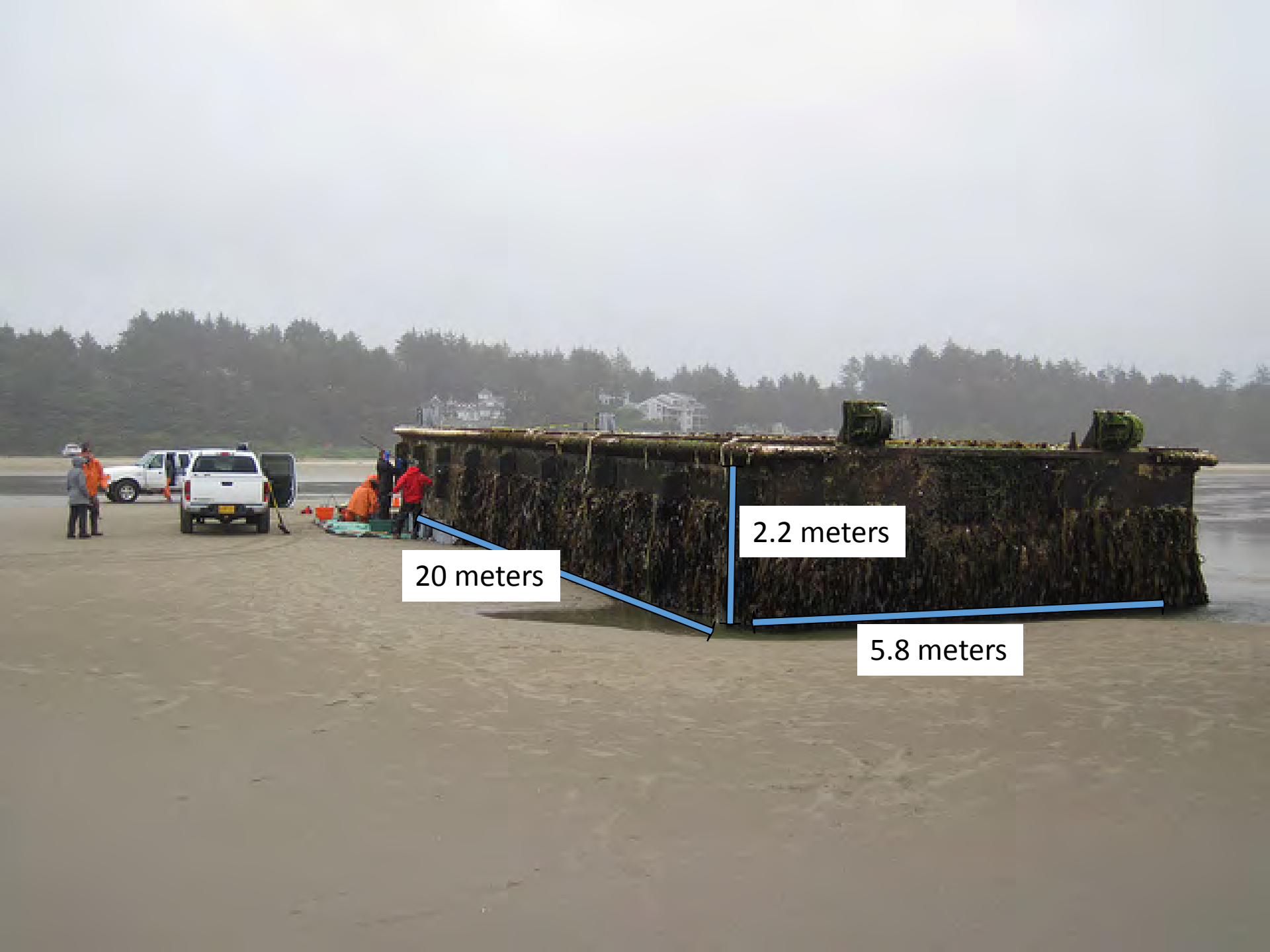
- On the morning of Tuesday, **June 5, 2012**
- 451 days (14.5 months) after March 11, 2011 ……..
- Morning beach walkers reported that a “large dock” had floated ashore just north of, **Newport, Oregon**



Port of Misawa, built 2008



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 squirt *Styela*

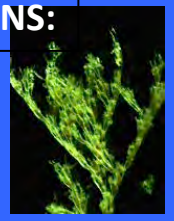
Jassa marmorata, Ampithoe valida, Caprella spp.

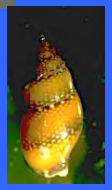
Jingle shell *Anomia Cytaeun (chinensis*

AMPHIPODS

BRYOZOANS:

Tricellaria, Cryptosula spp., *Watersipora*





Chiton *Mopalia seta*

Snail *Mitrella moleculina*

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

Polynoidae

Syllidae

Limpets: *Lottia sp.; Nipponacmea habei*

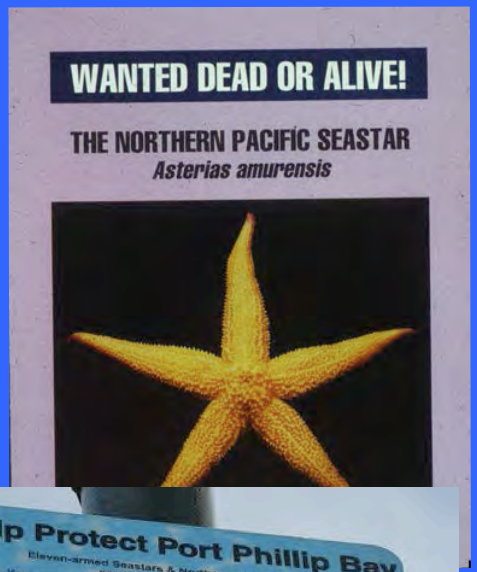
Sea anemone *Metridium senile*

MOLLUSKS (12 species)

POLYCHAETE WORMS (28 species)

125 species arrived on Misawa 1

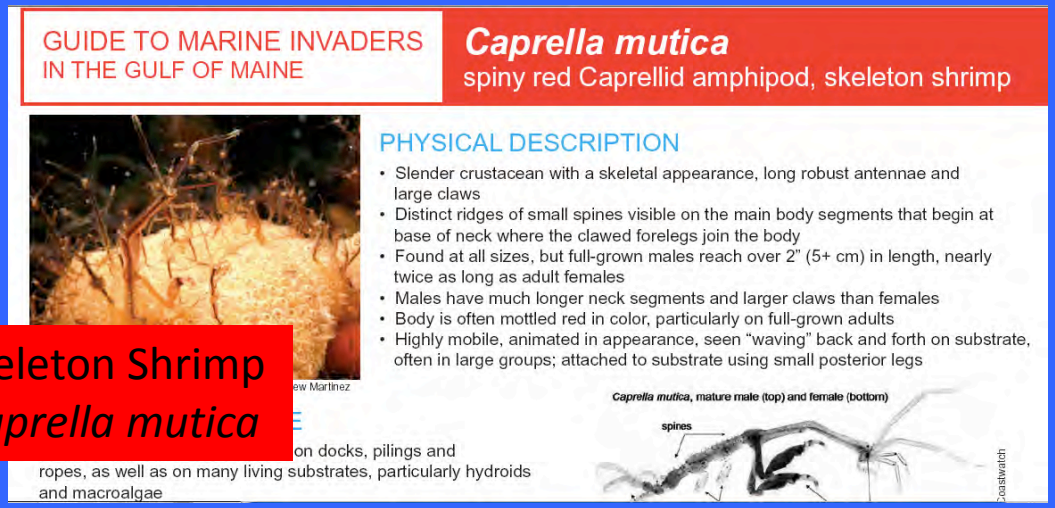
On the Misawa Ark:



Seastar
Asterias amurensis

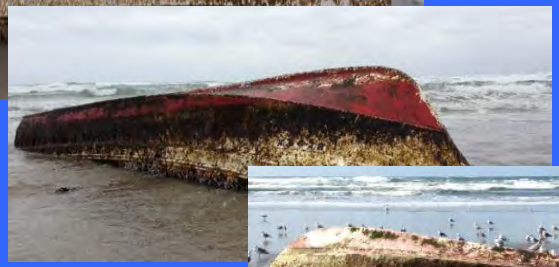
Seaweed
Undaria pinnatifida

Shore Crab
Hemigrapsus sanguineus



Skeleton Shrimp
Caprella mutica

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



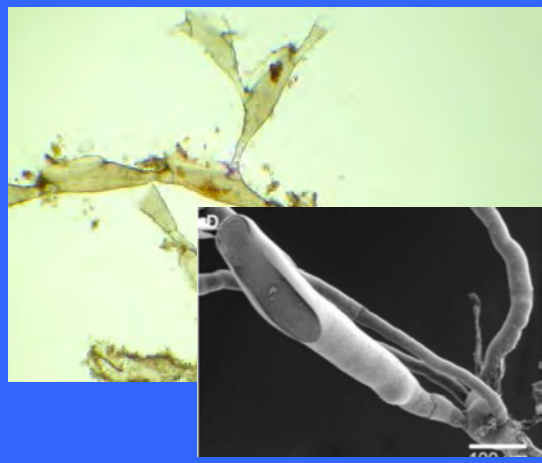
Japanese Colleagues Contributing to JTMD Biodiversity Research

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



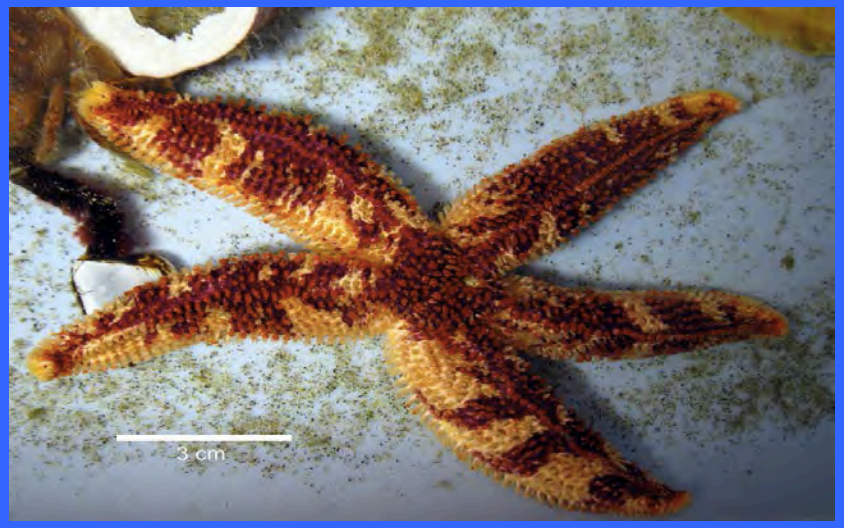
Scruparia ambigua
Bryozoan
("Moss animal")

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

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

Vancouver

Seattle

WASHINGTON

Portland

OREGON

Sacramento

San Francisco

Front half of a vessel likely from Iwate Prefecture

Seriola lalandi
"Yellowtail amber jack"
(Western Pacific)