

VECTOR RISK ASSESSMENT: HOW DOES TSUNAMI DEBRIS COMPARE?

Dr. Cathryn Clarke Murray
PICES Project Scientist

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JAPANESE TSUNAMI MARINE DEBRIS

A new transport vector of marine species in the North Pacific



Photo credit: U.S. Navy



Photo credit: Robin Loznak

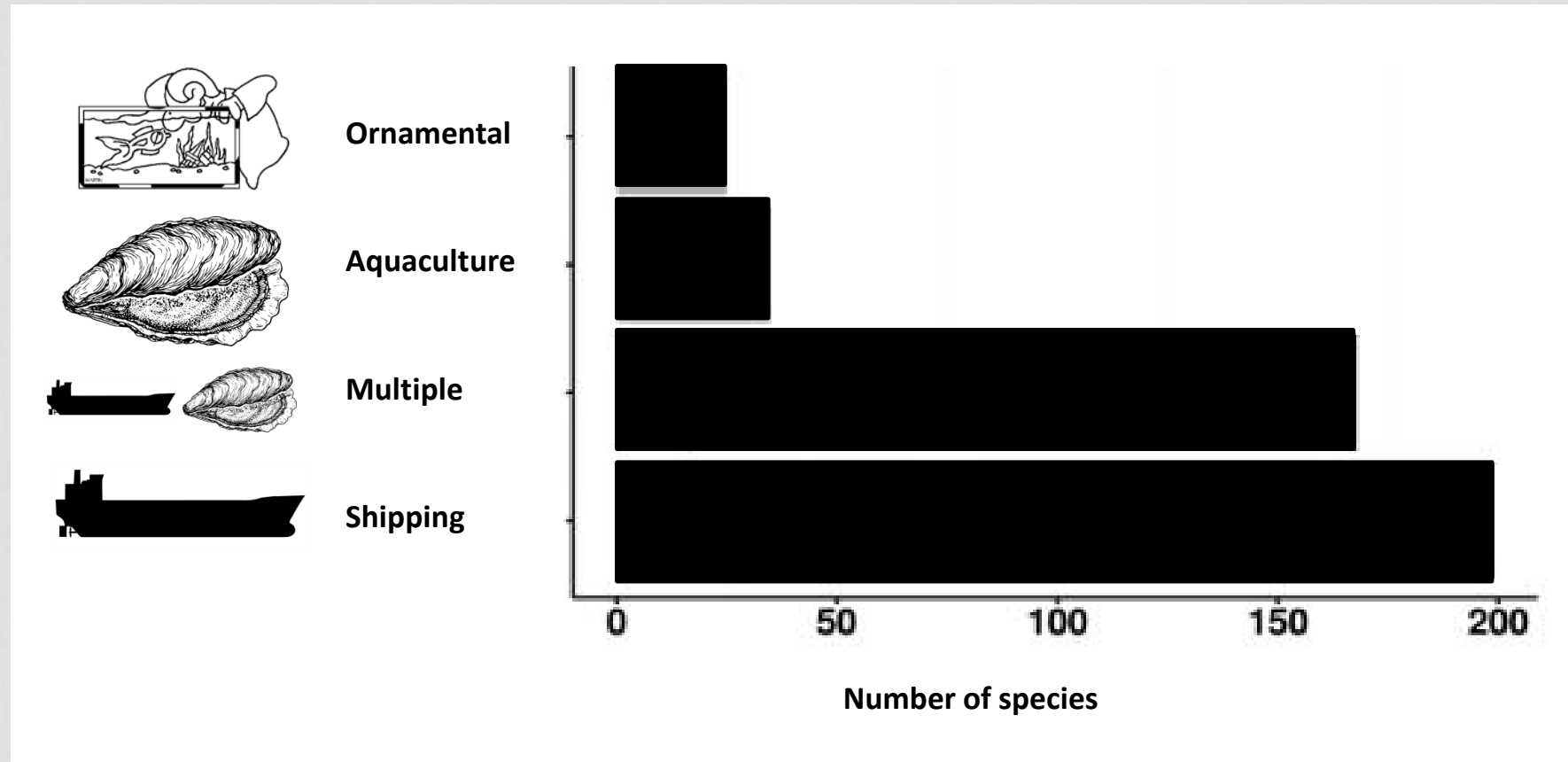
COMMERCIAL SHIPPING



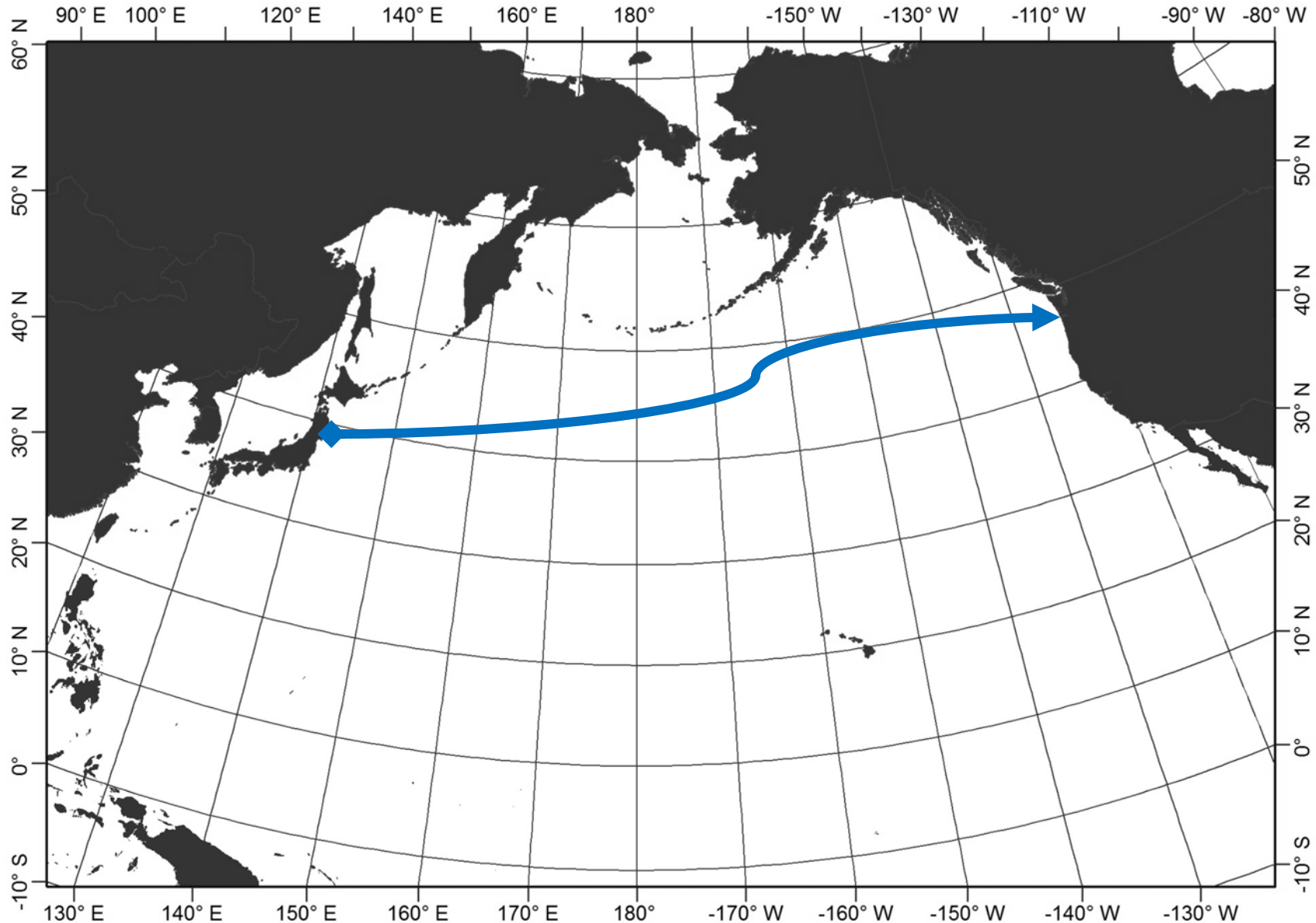
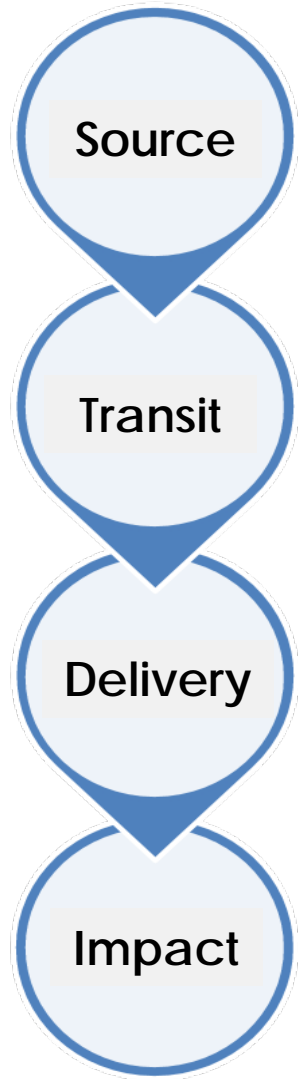
AQUACULTURE



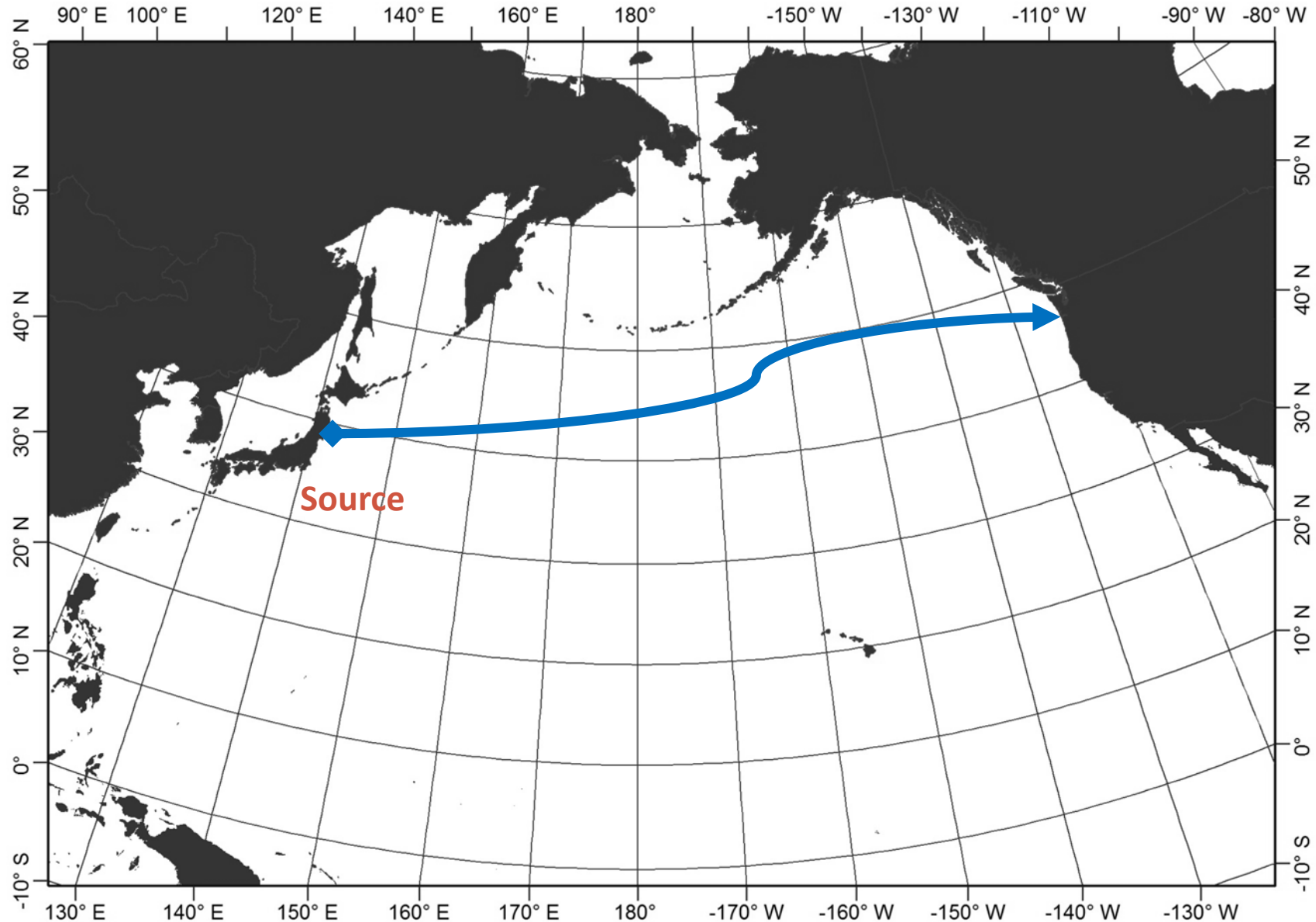
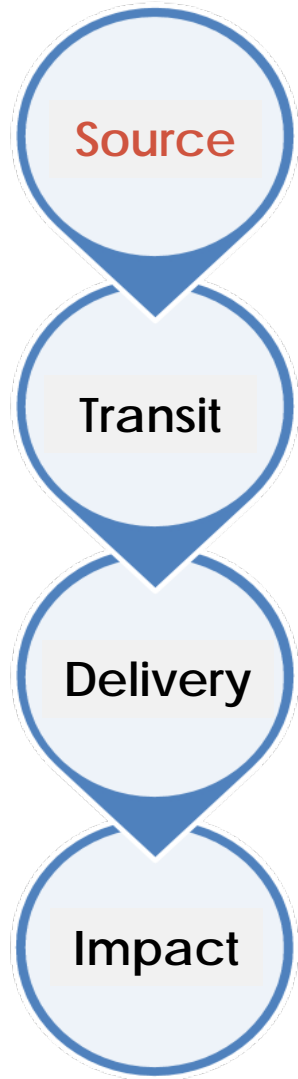
MORE THAN 200 SPECIES HAVE ALREADY BEEN INTRODUCED BY OTHER ACTIVITIES



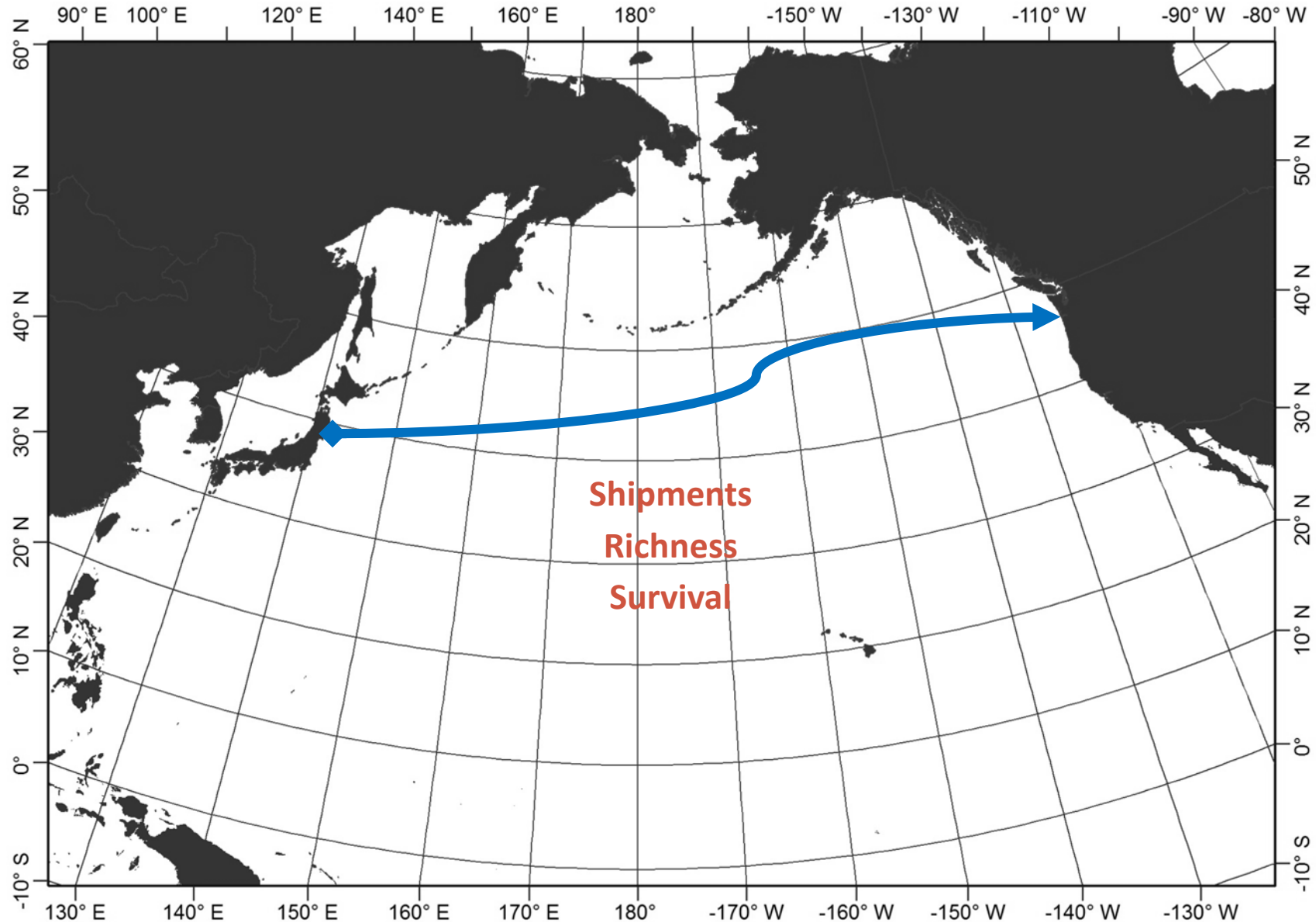
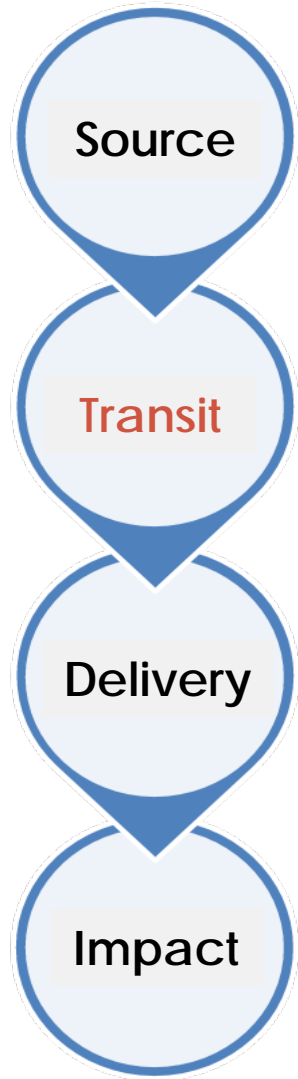
THE INVASION PROCESS



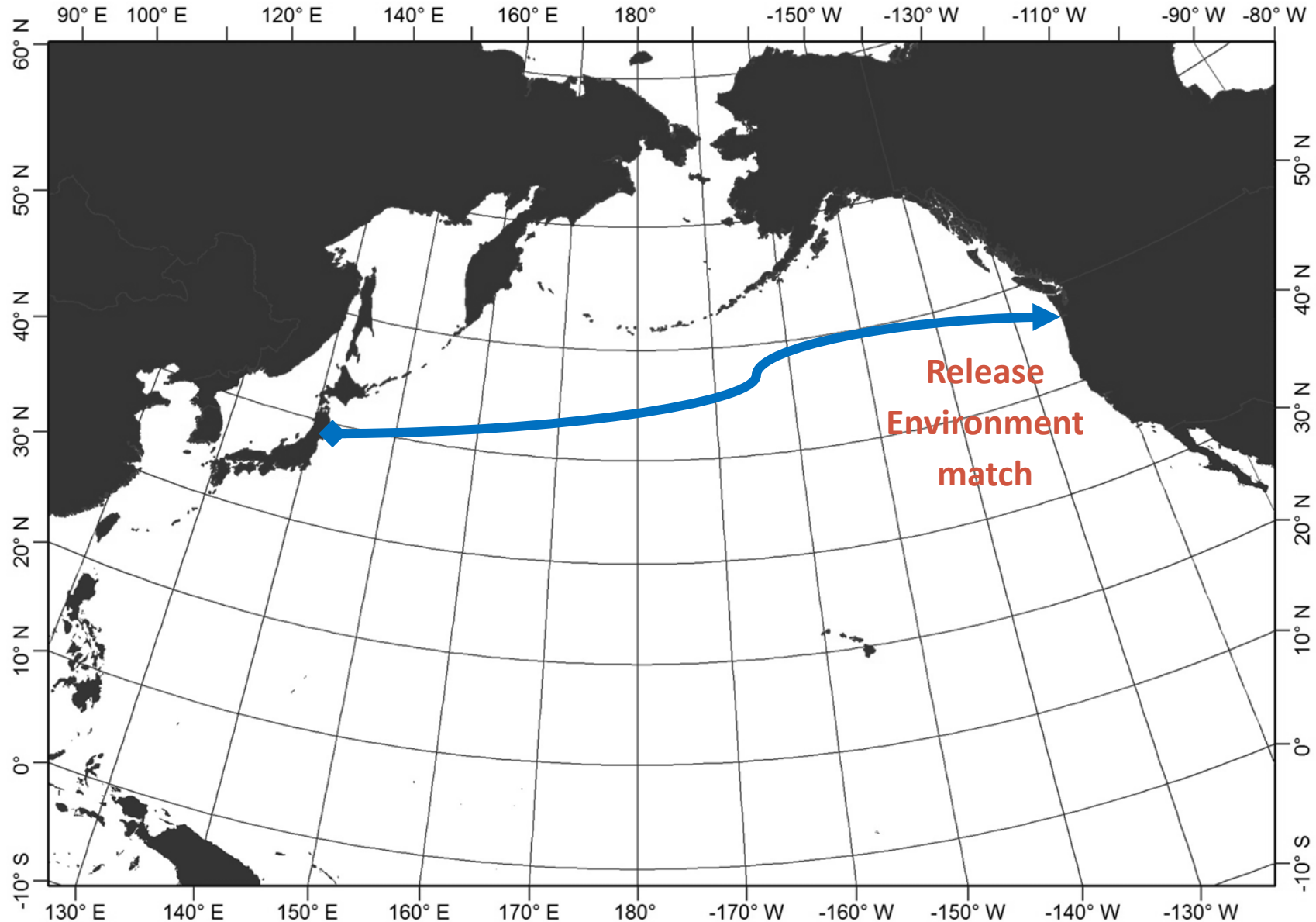
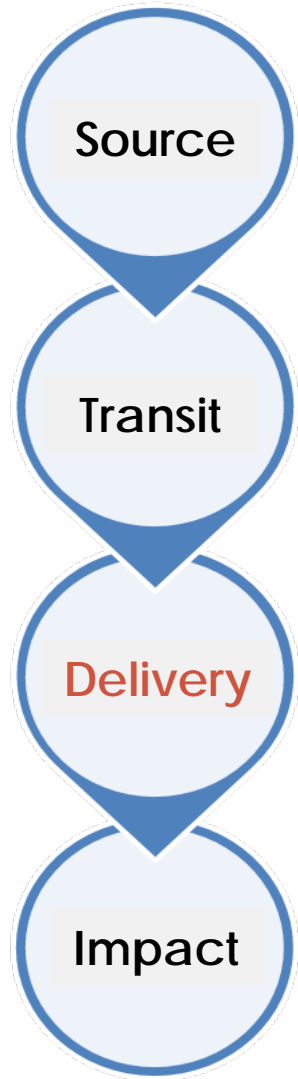
THE INVASION PROCESS



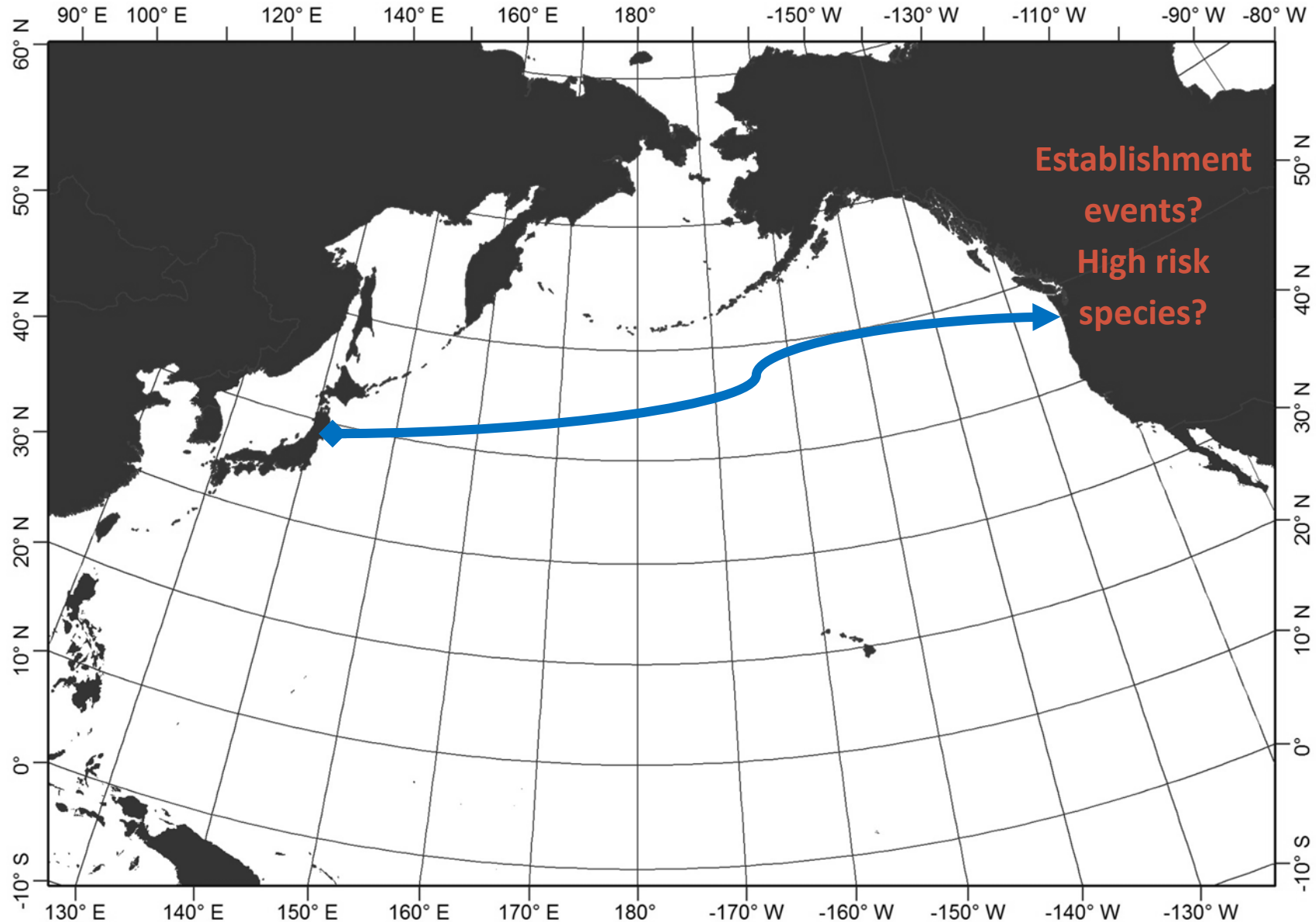
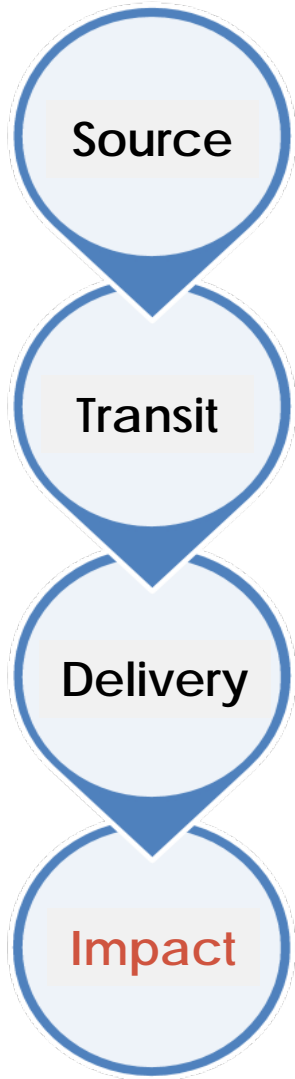
THE INVASION PROCESS



THE INVASION PROCESS



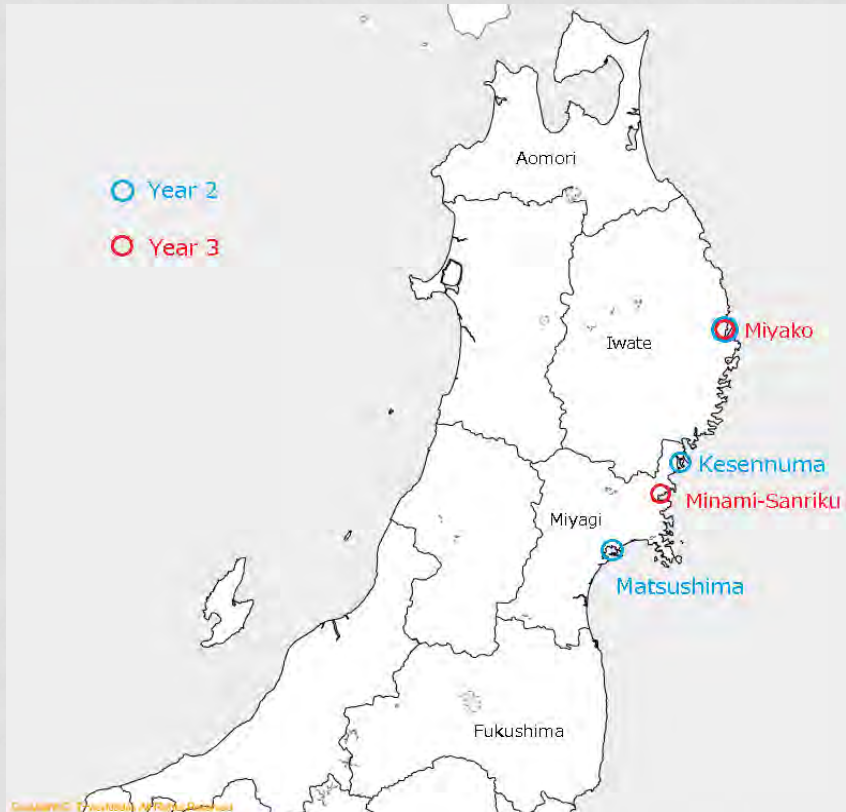
THE INVASION PROCESS



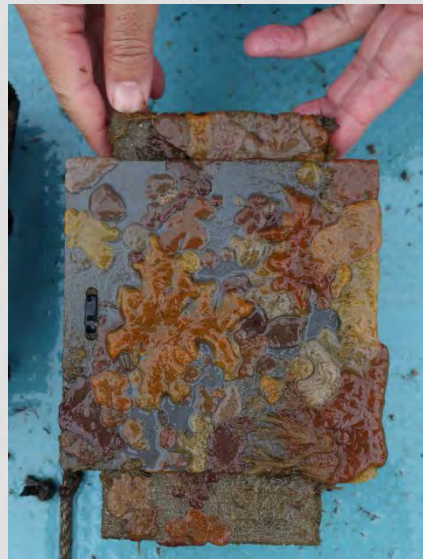
<u>VECTOR</u>	<u>SOURCE</u>	<u>TRANSIT</u>			<u>DELIVERY</u>	
	Source	Richness	Number	Survival	Release	Environment Match
Tsunami Debris						
 Hull fouling						
 Ballast Water						
 Ornamental						
 Aquaculture					Framework: Williams et al 2013; California Ocean Science Trust 2013	

SOURCE OF SPECIES

A single source country



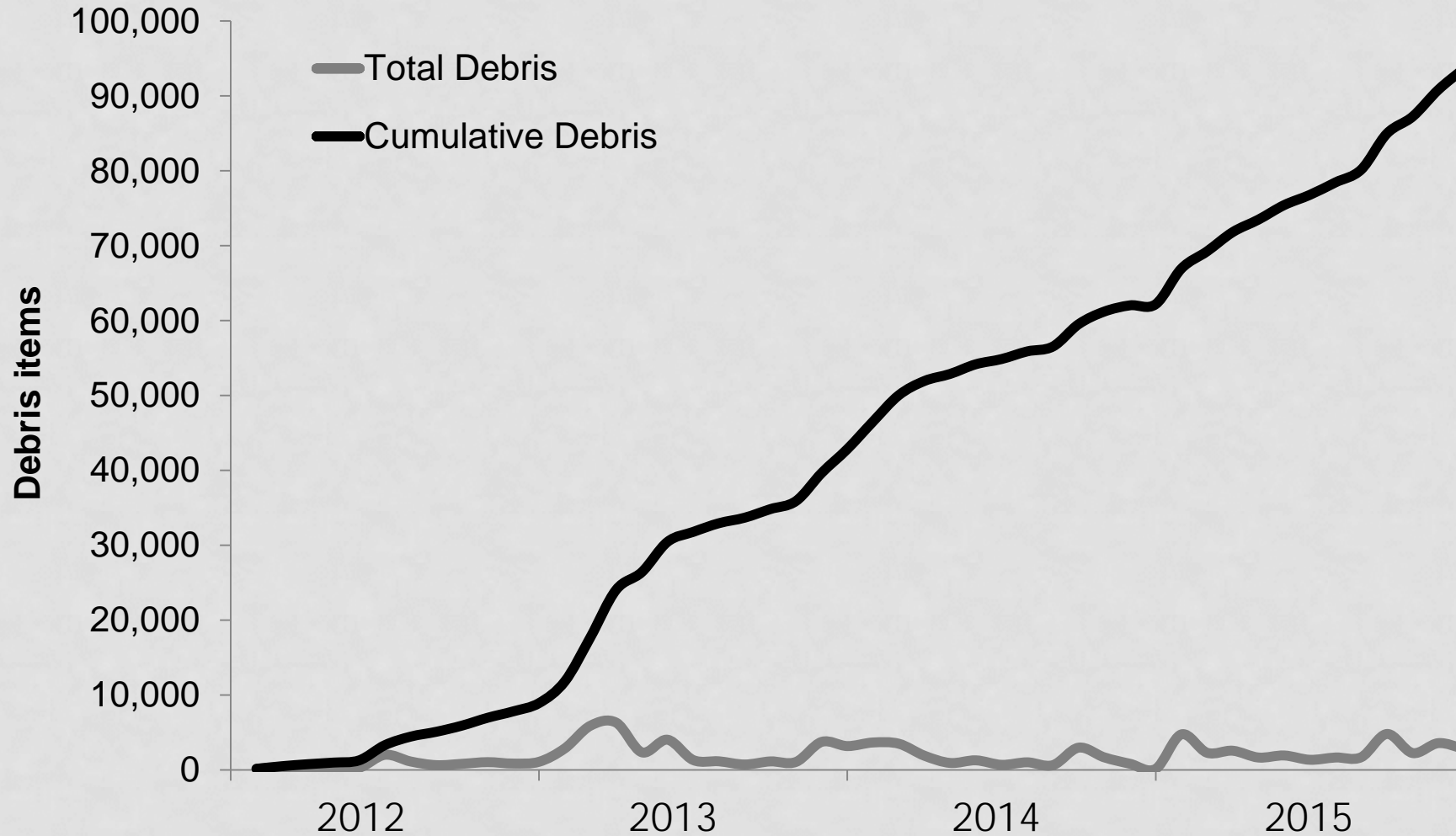
Japan NUS CO Ltd



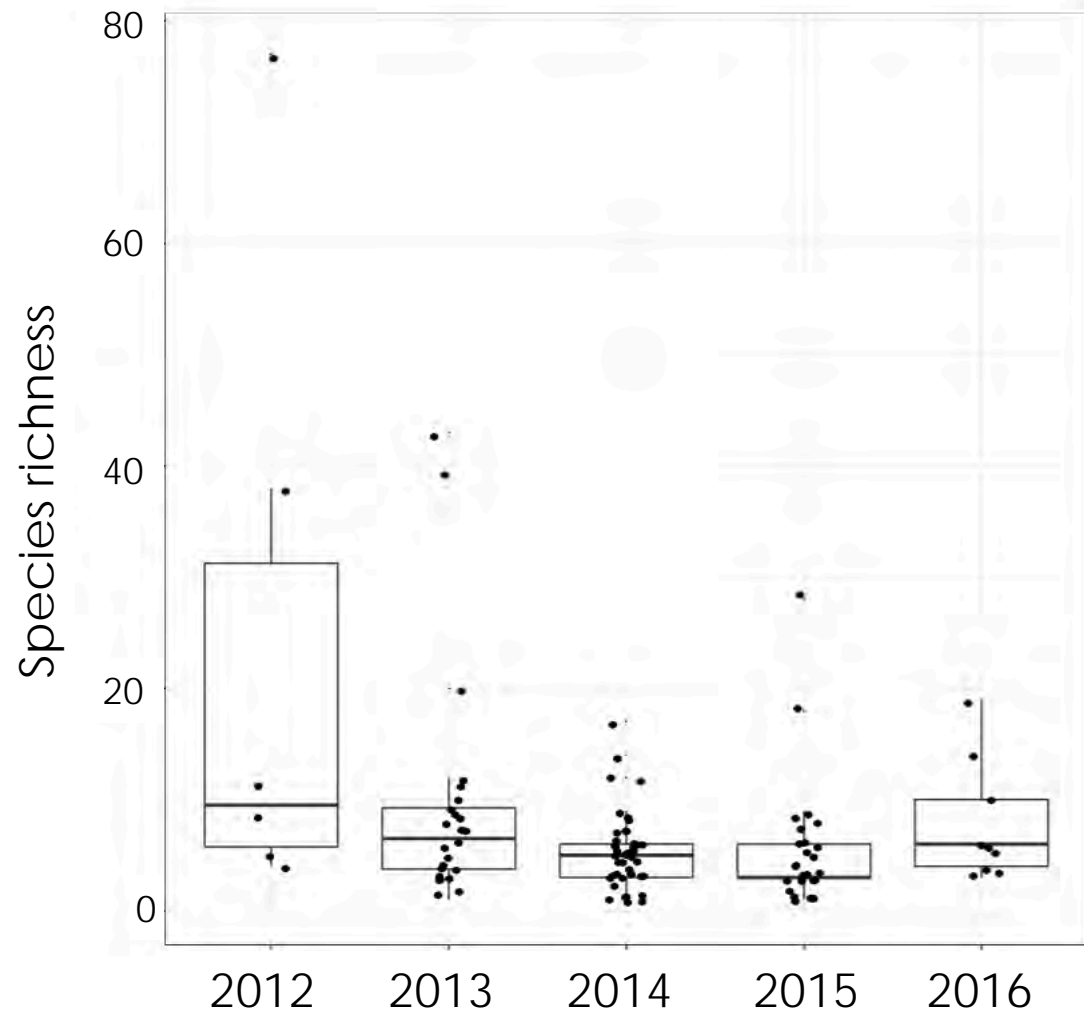
Tohoku coast surveys and documented species richness

Survey Site	Species richness
Kesenuma	14 - 24
Matsushima	13 - 35
Minamisanriku	12 - 21
Miyako	8 - 27
Overall	8 - 35

TRANSIT - NUMBER OF ITEMS



TRANSIT - RICHNESS PER ITEM



TRANSIT - SURVIVAL

Photo: Robin Loznak



2012



2016

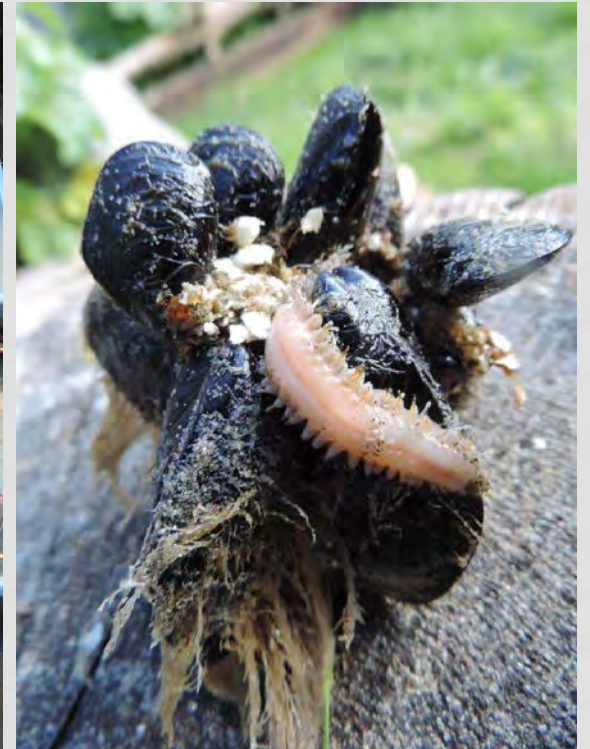


Photo: Russ Lewis

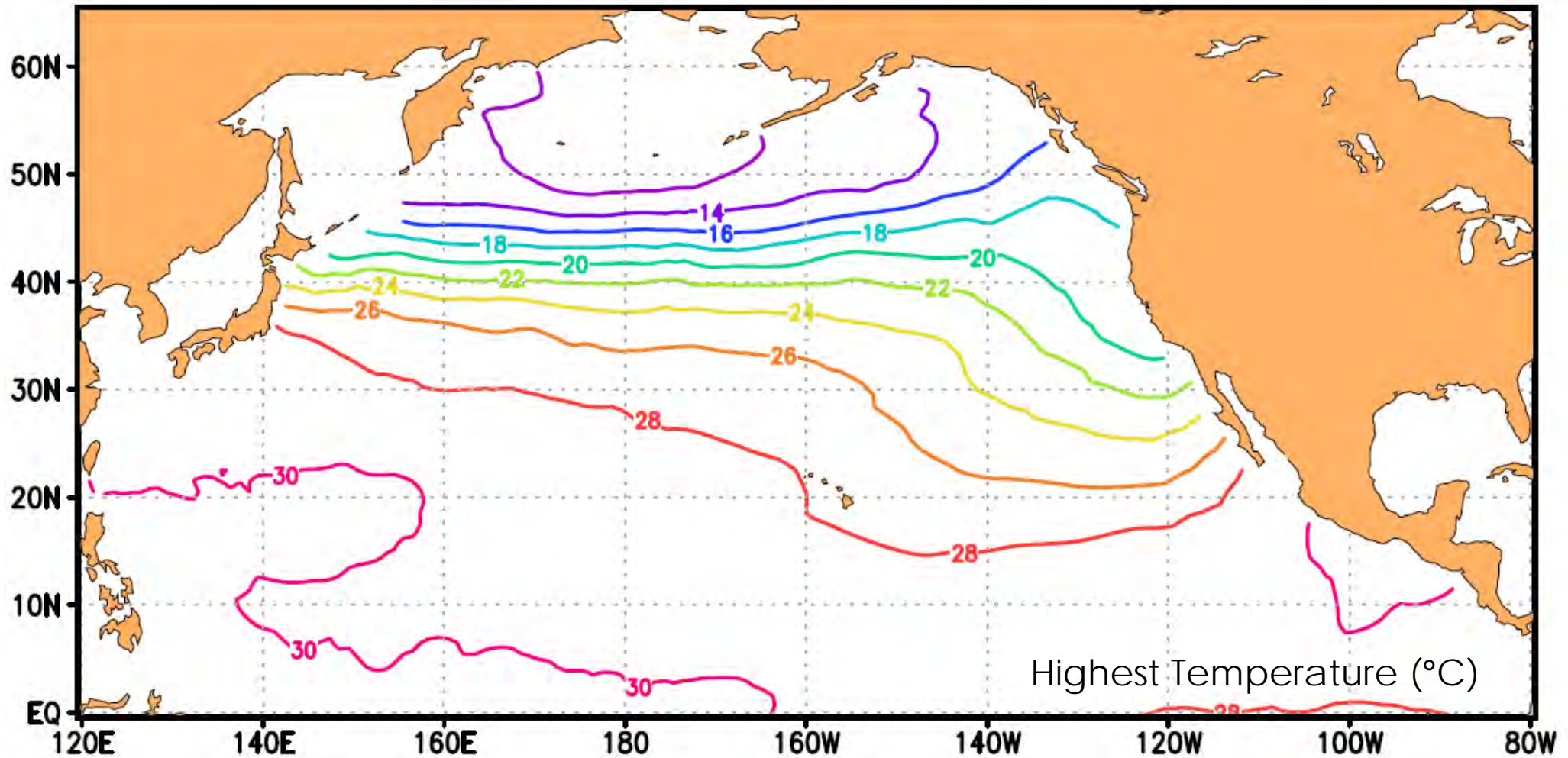
2017

DELIVERY - RELEASE



Photo: NOAA

DELIVERY - ENVIRONMENTAL MATCH



VECTOR

SOURCE

TRANSIT

DELIVERY

Source

Richness

Number

Survival

Release

Environment
Match

Tsunami Debris



VECTOR

SOURCE

TRANSIT

DELIVERY

Source

Richness

Number

Survival

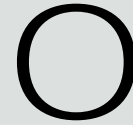
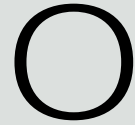
Release

Environment
Match

Tsunami Debris

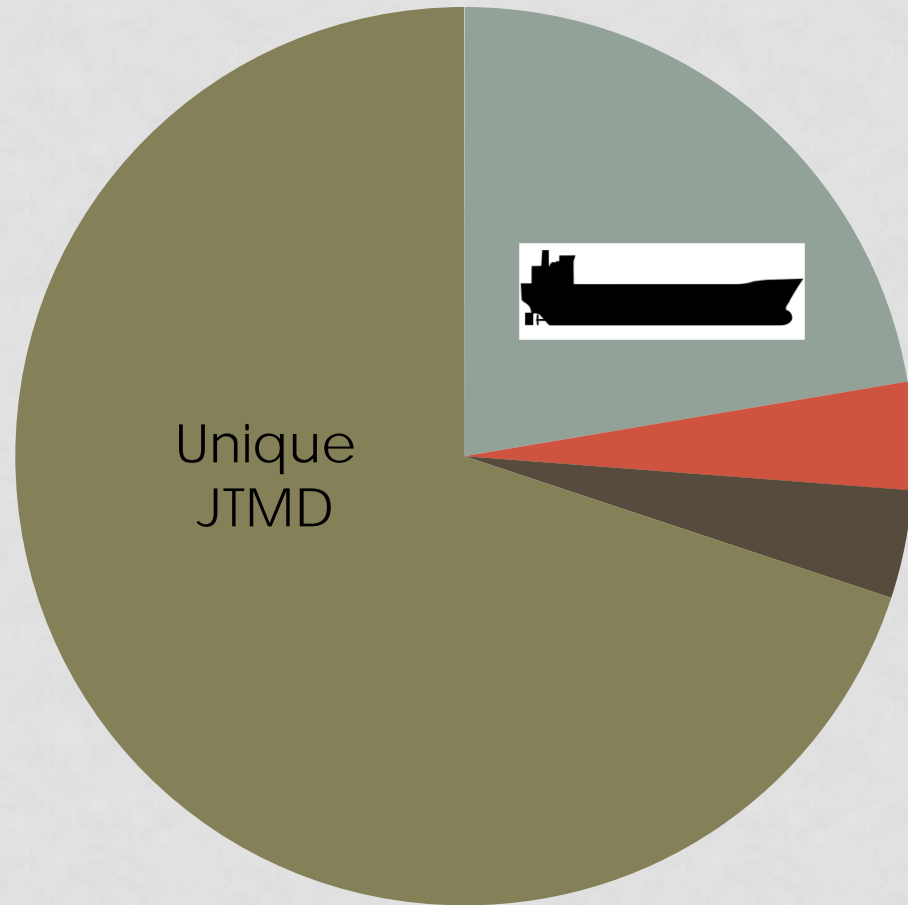


Hull
fouling



<u>VECTOR</u>		<u>SOURCE</u>	<u>TRANSIT</u>			<u>DELIVERY</u>	
		Source	Richness	Number	Survival	Release	Environment Match
Tsunami Debris		○	○	○	○	○	○
	Hull fouling	○	○	○	○	○	○
	Ballast Water	○	○	○	○	○	○
	Ornamental	○	○	○	○	○	○
	Aquaculture	○	○	○	○	○	○

SPECIES SHARED WITH OTHER VECTORS



Hull fouling & sea chest



Oyster aquaculture



Ballast water & sediment



Unique JTMD

Ornamental



WILL THERE BE AN INVASION?

BASELINE DETECTION



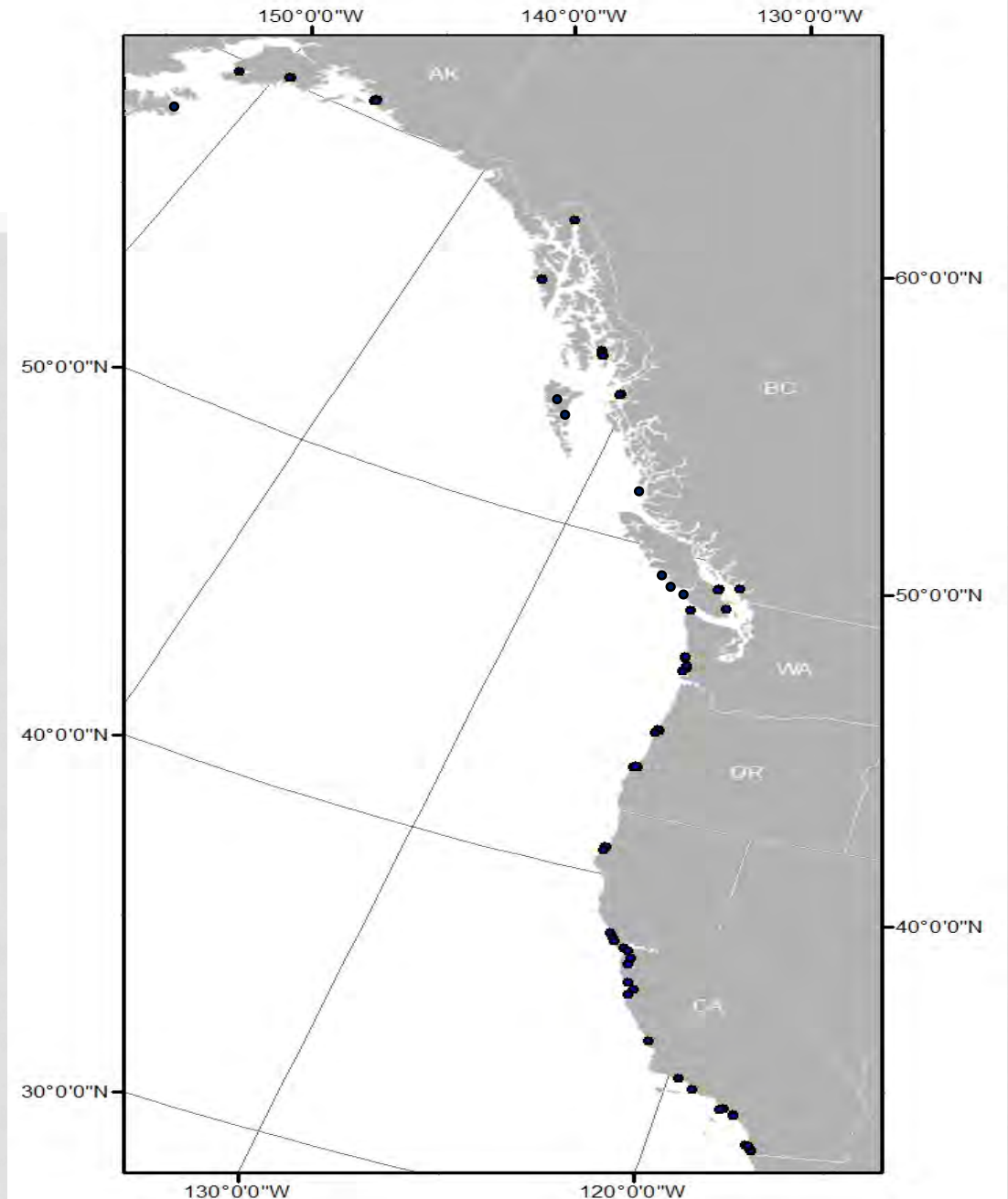
Invertebrate surveys
- 600 panels at 73 sites



Seaweed surveys
- 30 sites



Mussel parasite surveys
- 4000 mussels at 30 sites



ONE POSSIBLE INTRODUCTION

Striped beakfish (*Opelgnathus fasciatus*)



Photo: Travis Haring



Photo: Oregon State University

JTMD COMPARATIVELY LOWER RISK

However... potential to introduce high risk species will require monitoring



KEY AQUATIC INVASIVE SPECIES WATCH

Japanese Tsunami Marine Debris in the Eastern Pacific



WAKAME KELP—**INVADER!** (*Undaria pinnatifida*)

An edible kelp species native to Japan, *U. pinnatifida* can be highly invasive and disruptive to native kelp ecosystems. In addition to its occurrence on larger tsunami debris, it may recruit in the natural environment on existing docks, pier pilings, or rock in newly disturbed areas. *Undaria* has lobes or finger-like projections on its blade margin and two highly ruffled sporophylls at its base. (Gayle Hansen, OSU)

- Size range: blades can grow to 3 m long (see image on page 9 of the long blades of *Undaria pinnatifida* attached to the dock that washed ashore at Agate Beach, Oregon, 15 months after being washed out to sea by the 2011 Japanese tsunami)



NORTHERN PACIFIC SEASTAR—**INVADER!** (*Asterias amurensis*)

This species of sea star is predominantly light purple in color, and is often seen with purple or red detail on its upper surface. There are numerous small spines with sharp edges on the upper body surface. On the underside of the body, these spines line the groove in which the tube feet lie, and join up at the mouth in a fan-like shape. The underside is a uniform yellow in color. It is normally found in shallow water, but it can also be found from the intertidal area through to the subtidal as deep as 200 m. (New Zealand Ministry for Primary Industries)

- Size range: can reach 40 to 50 cm in diameter



RESEARCH TEAM

- Thomas Therriault, Canada
- Nancy Wallace, USA
- Hideaki Maki, Japan
- Atsuhiko Isobe, Japan
- James Carlton, USA
- Amy MacFadyen, USA
- Hiroshi Kawai, Japan
- Masafumi Kamachi, Japan
- Toshio Furota, Japan
- Shin-ichiro Kako, Japan
- Gregory Ruiz, USA,
- Gayle Hansen, USA
- Tomoya Kataoka, Japan
- Janson Wong, Canada
- Jonathan Geller, USA
- Hideki Takami, Japan
- Nikolai Maximenko, USA
- Jessica Miller, USA
- Yoichi Ishikawa, Japan
- Hirofumi Hinata, Japan
- John Chapman, USA
- Jocelyn Nelson, Canada
- Sandra Lindstrom, Canada
- Danielle Scriven, Canada
- Lauran Liggan, Canada
- Reva Gillman, USA
- Karin Baba, Japan
- Sonia Gorgola, USA
- Michio Otani, Japan
- Brian Neilson, USA
- Kirsten Moy, USA
- Sherry Lippiatt, USA
- Stephen Ambagis, USA
- Kristine Davidson, USA
- Nancy Treneman, USA
- Cathryn Murray, Canada



The PICES ADRIFT project has been a rare and exciting interdisciplinary study and we are extremely grateful to the Ministry of Environment and the people of Japan for their vision and support.

どうもありがとうございます

Thank you very much

