

VECTOR RISK ASSESSMENT: HOW DOES TSUNAMI DEBRIS COMPARE?

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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



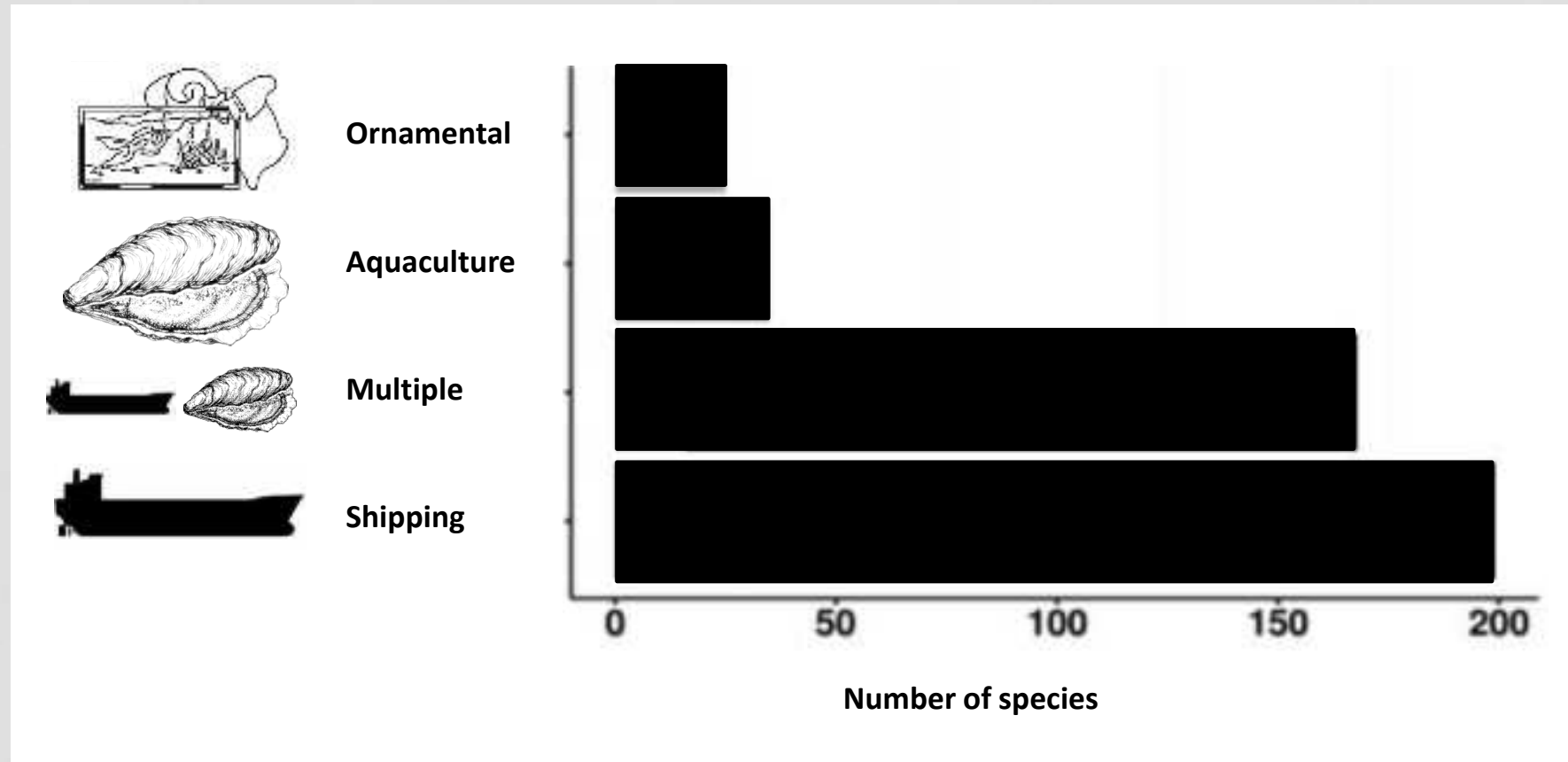
AQUACULTURE



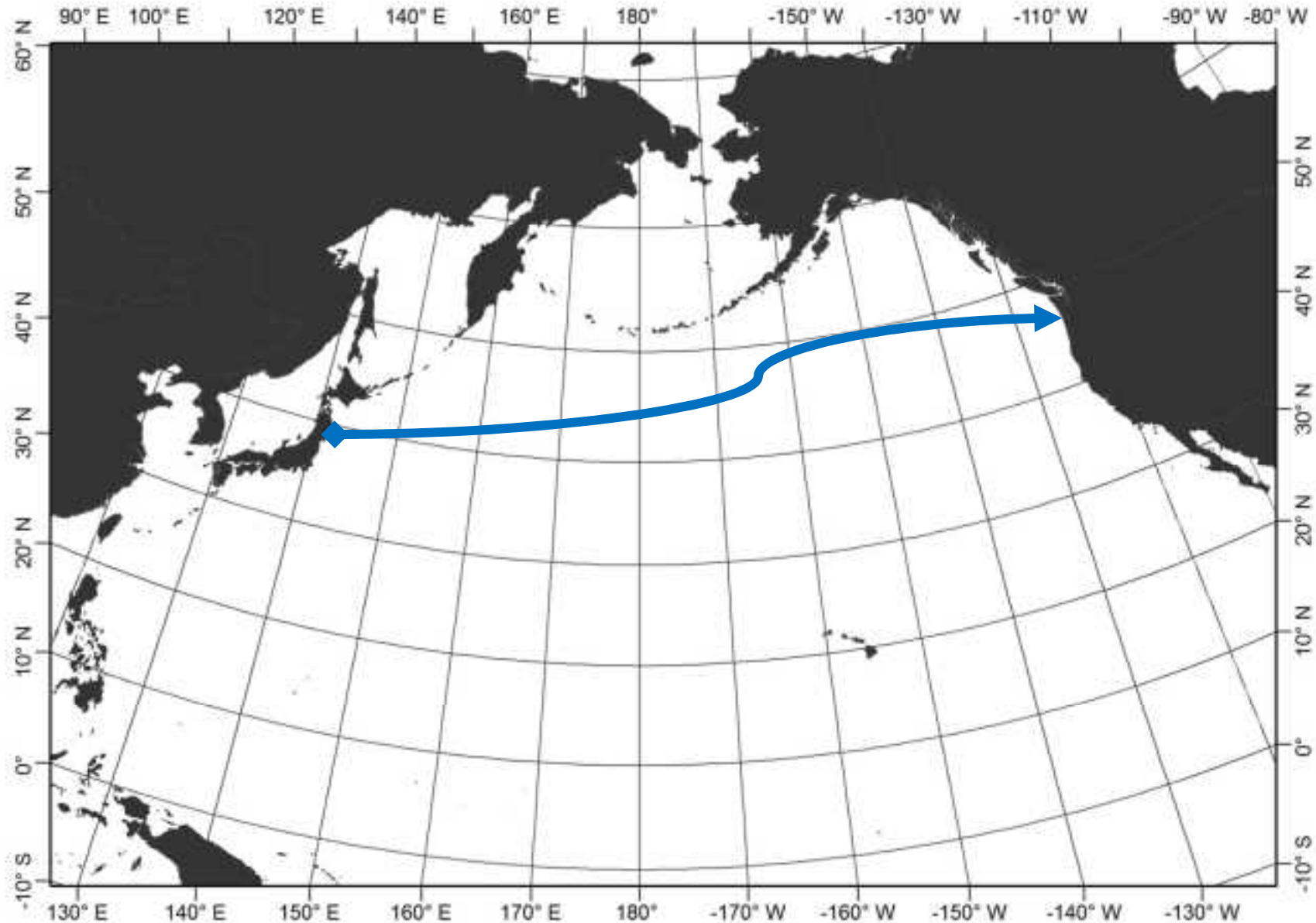
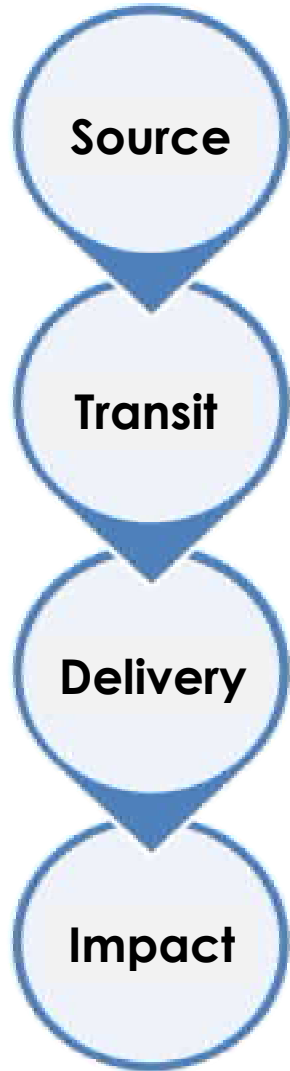
ORNAMENTAL TRADE



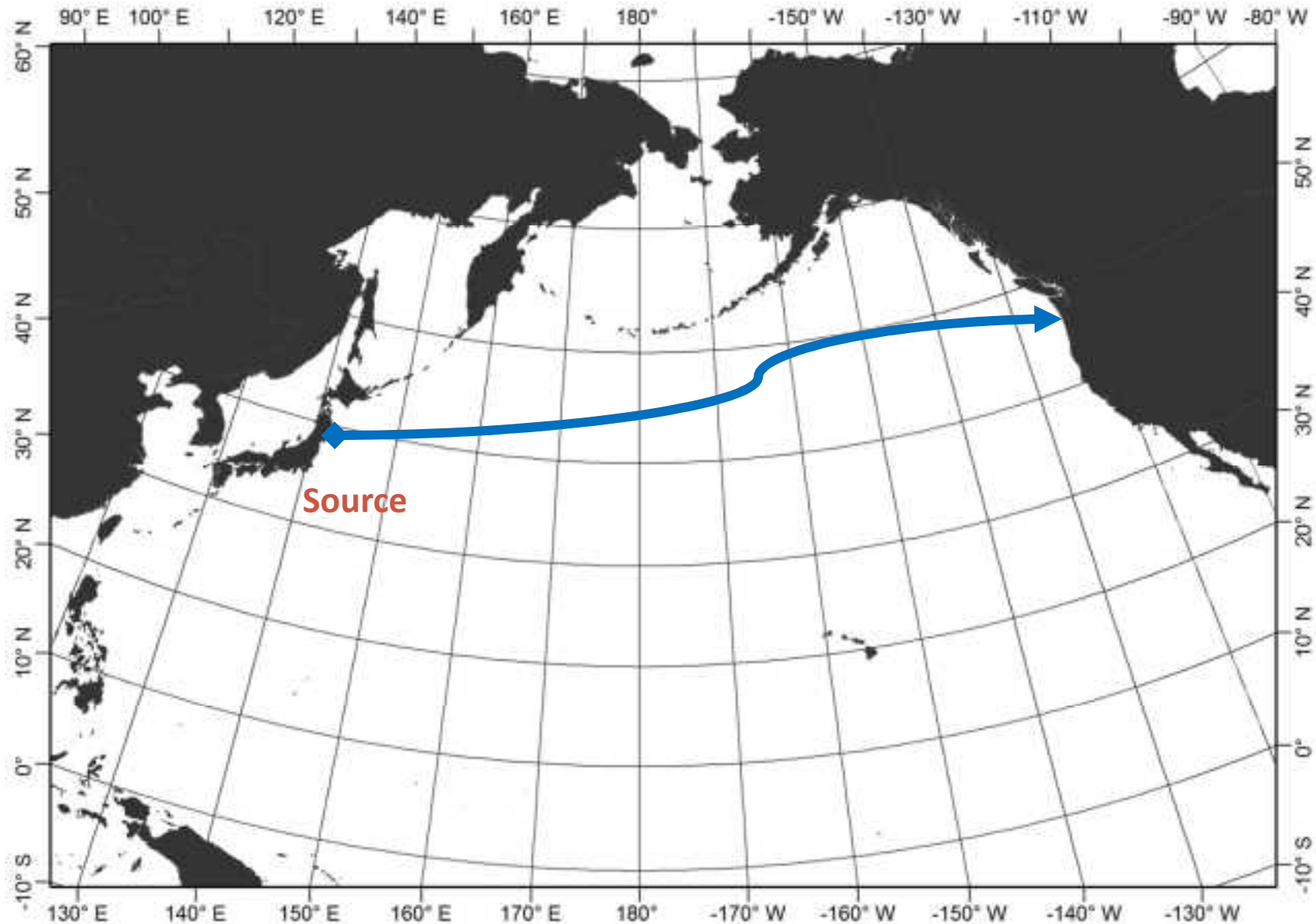
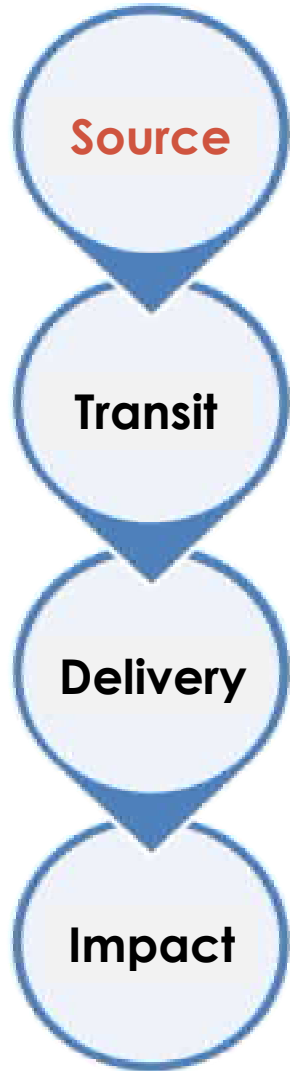
MORE THAN 200 SPECIES HAVE ALREADY BEEN INTRODUCED BY OTHER ACTIVITIES



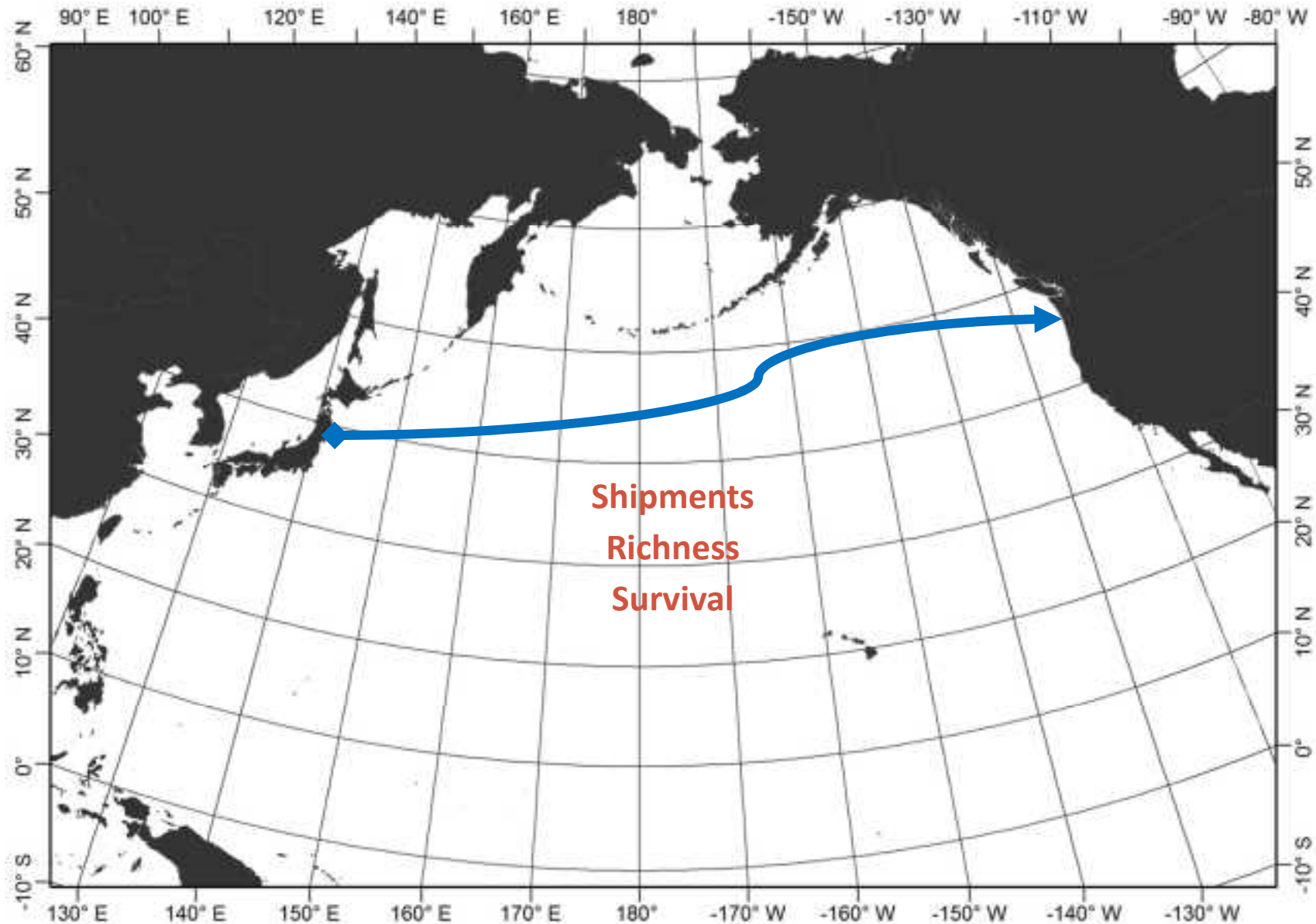
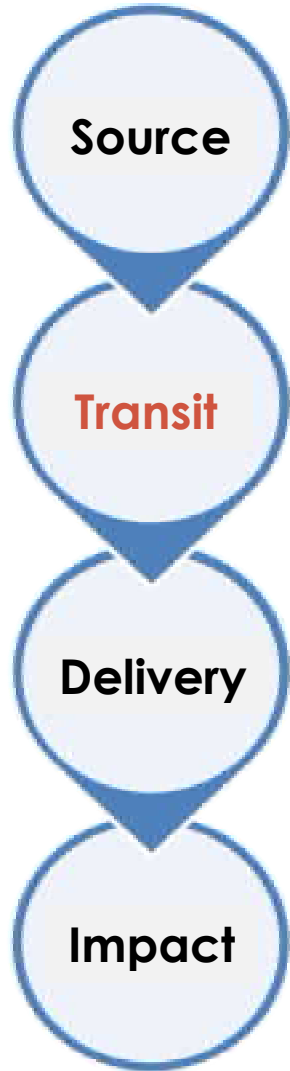
THE INVASION PROCESS



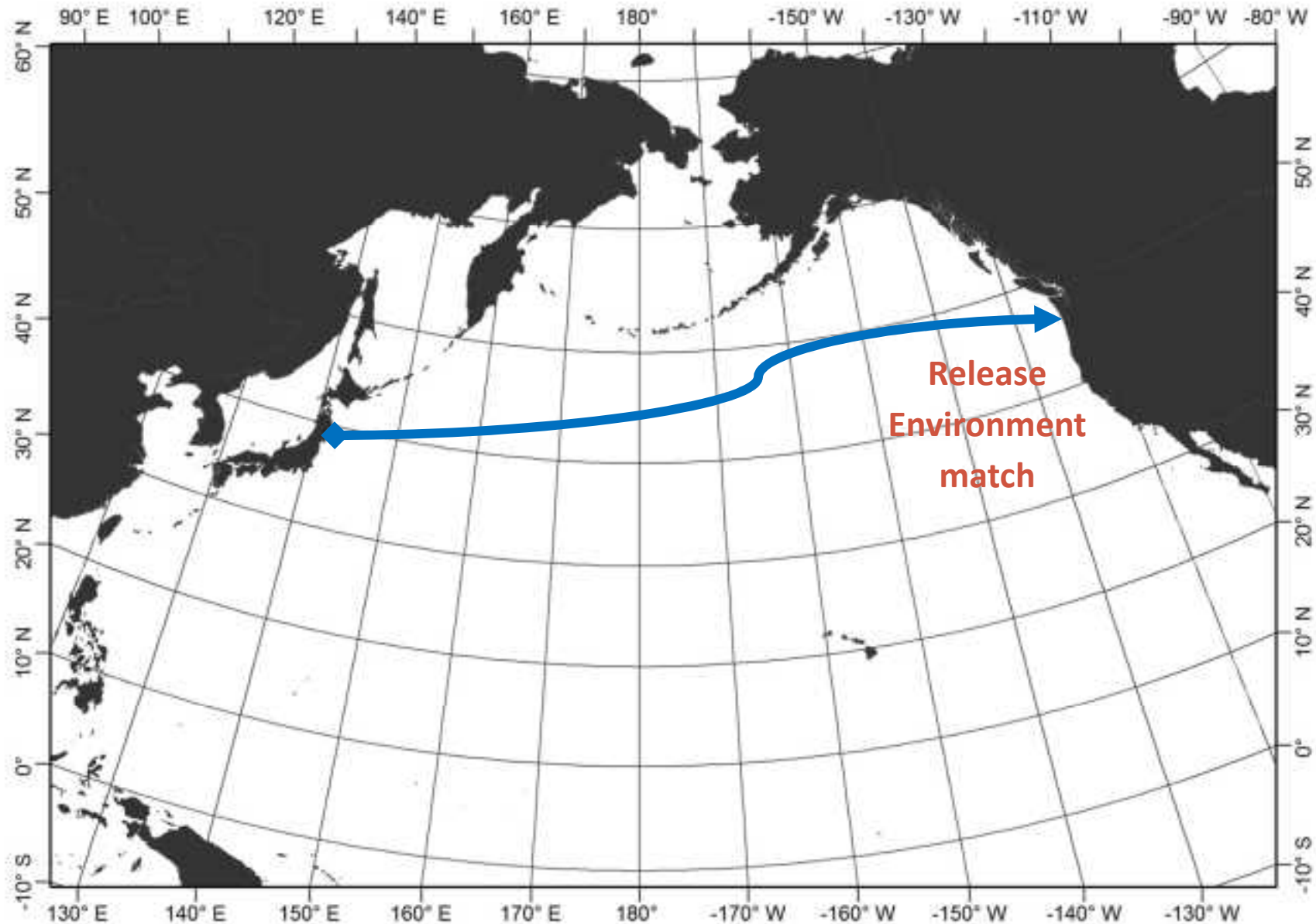
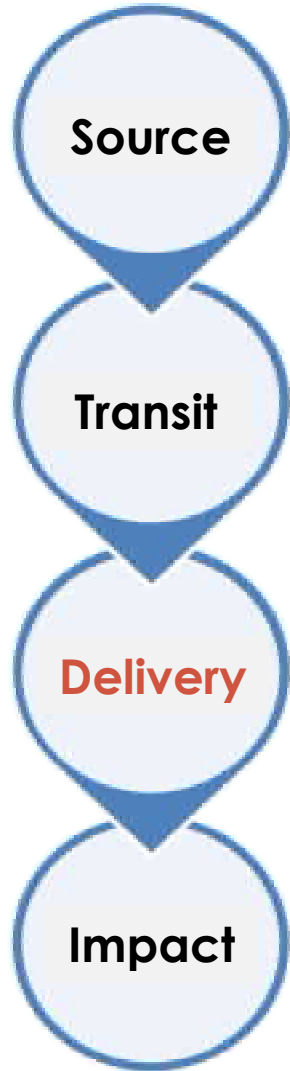
THE INVASION PROCESS



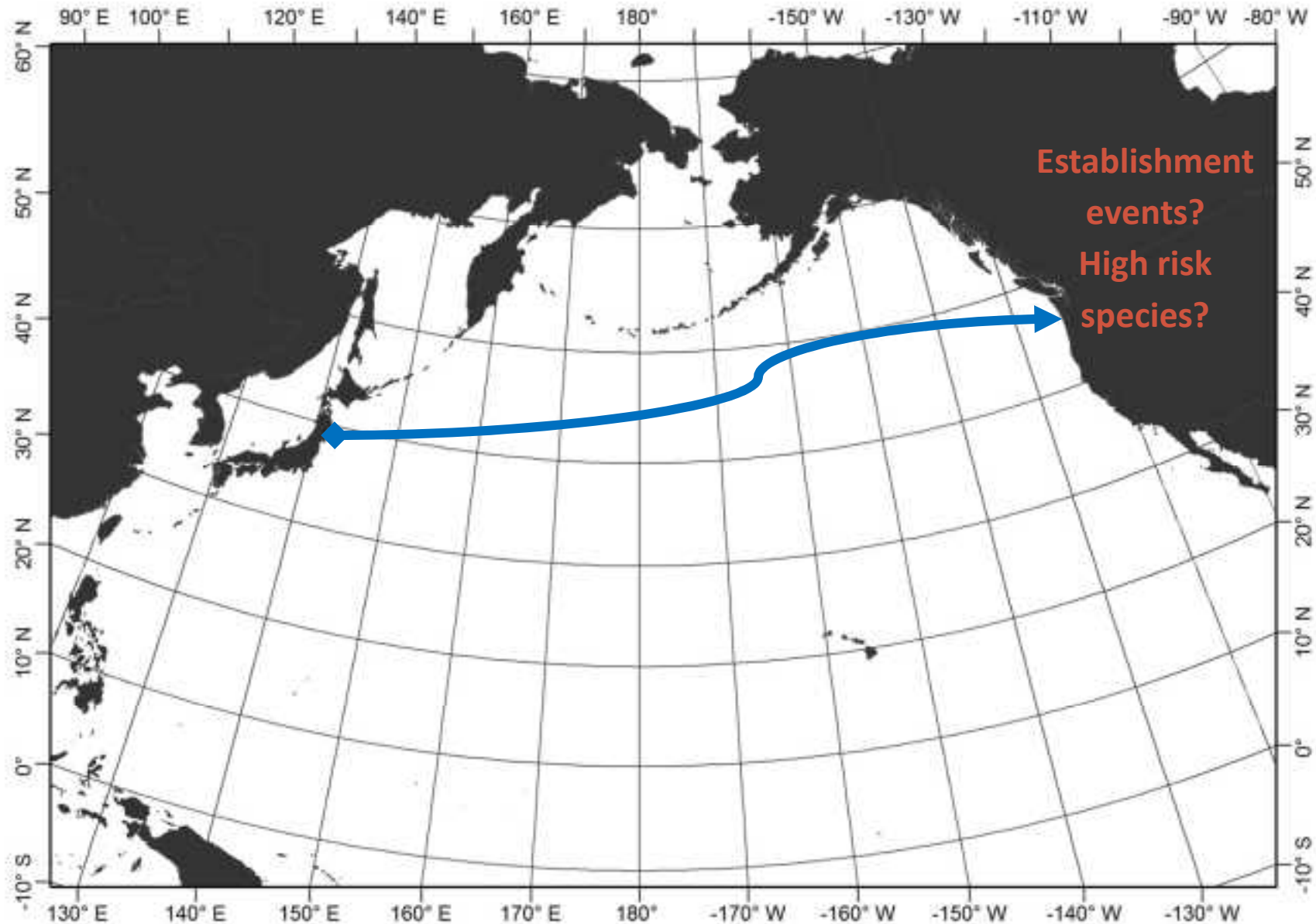
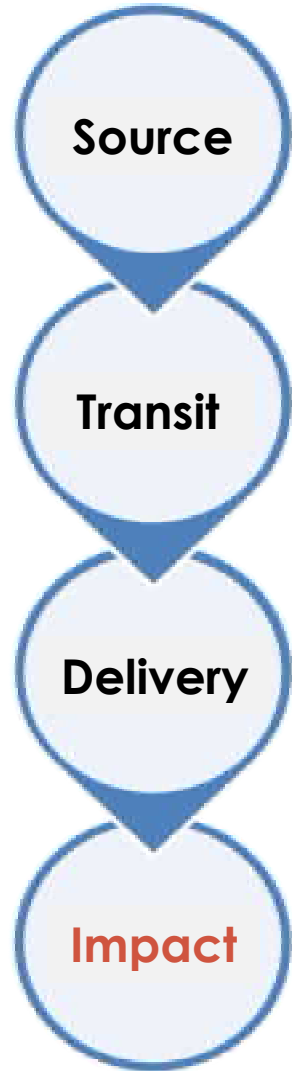
THE INVASION PROCESS







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



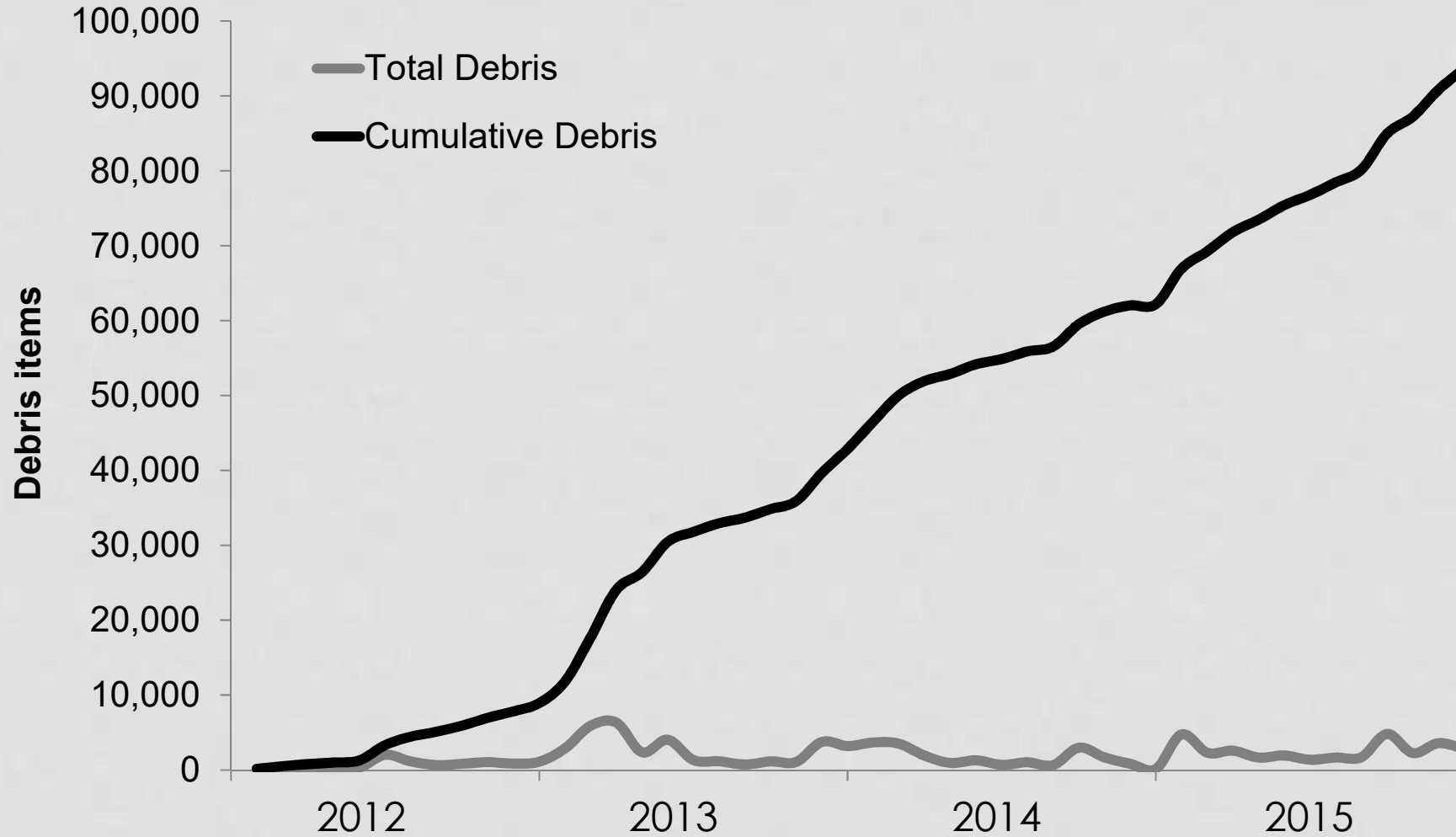
Japan NUS CO Ltd



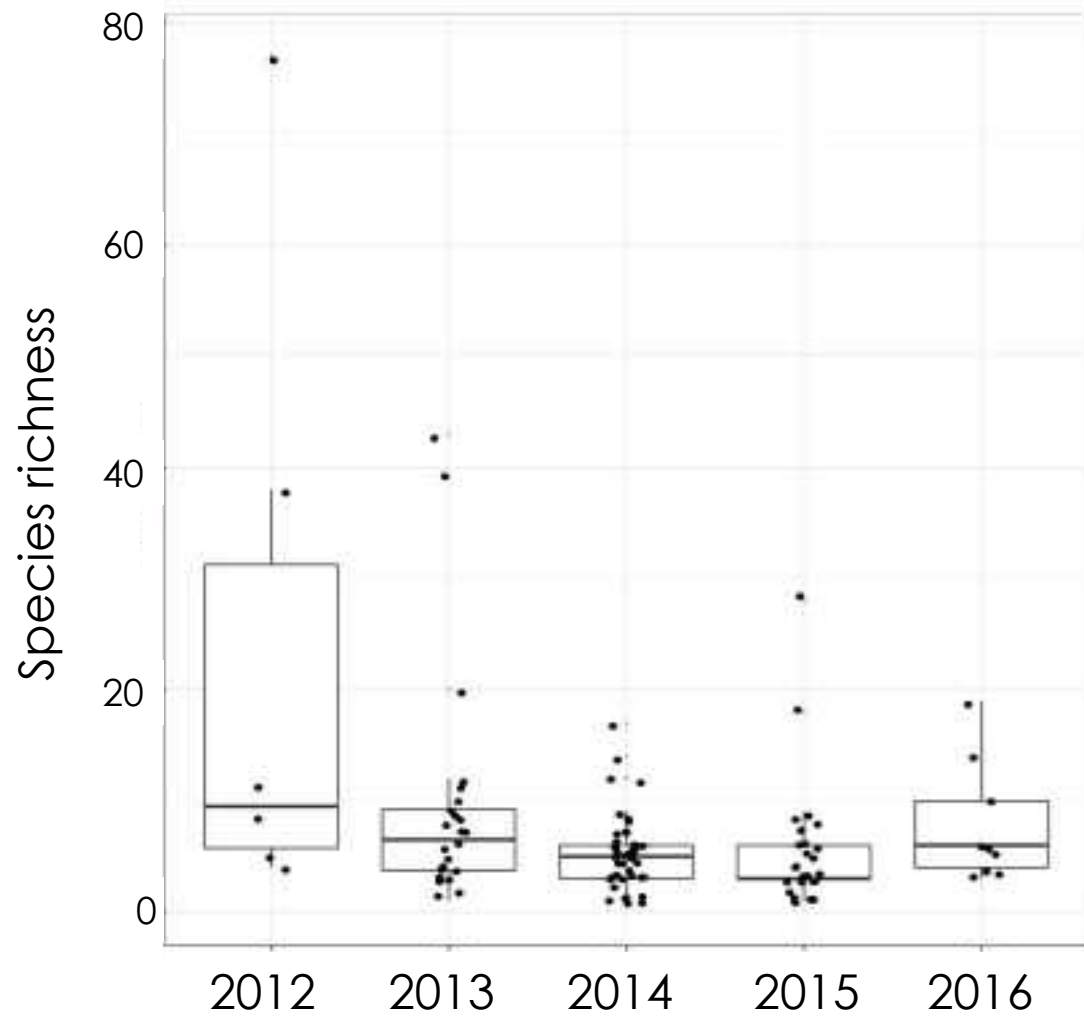
Tohoku coast surveys and documented species richness

Survey Site	Species richness
Kesennuma	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

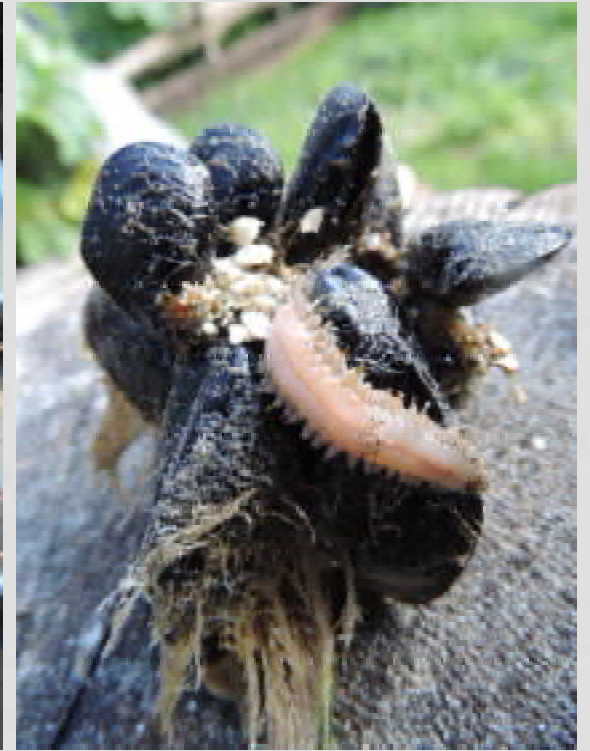


Photo: Russ Lewis


2017





DELIVERY - RELEASE



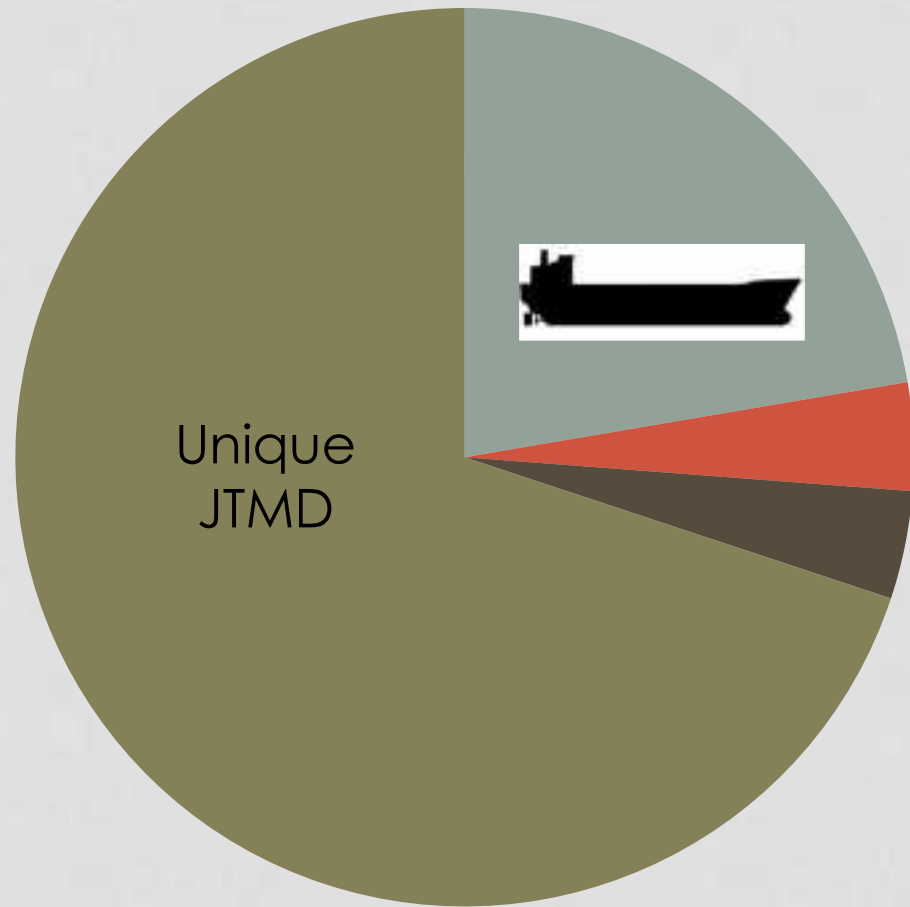
Photo: NOAA

<u>VECTOR</u>	<u>SOURCE</u>	<u>TRANSIT</u>			<u>DELIVERY</u>	
	Source	Richness	Number	Survival	Release	Environment Match
Tsunami Debris	○	○	○	○	○	○

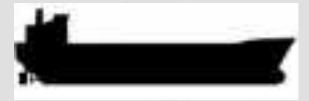
<u>VECTOR</u>	<u>SOURCE</u>	<u>TRANSIT</u>			<u>DELIVERY</u>	
	Source	Richness	Number	Survival	Release	Environment Match
Tsunami Debris	○	○	○	○	○	○
 Hull fouling	○	○	○	○	○	○

<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



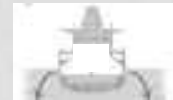
Hull fouling & sea chest



Oyster aquaculture



Ballast water & sediment



Unique JTMD

Ornamental



WILL THERE BE AN INVASION?

BASELINE DETECTION



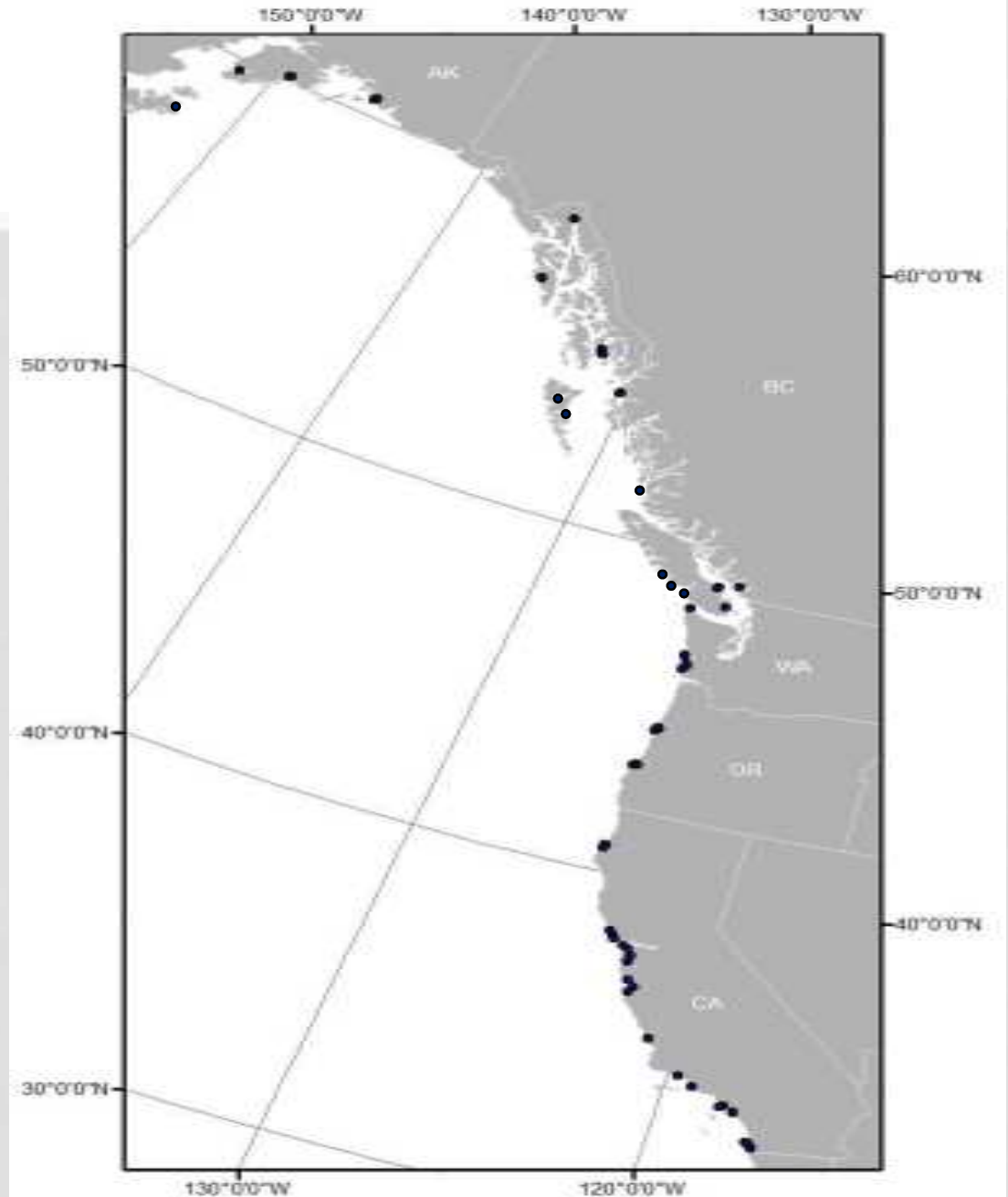
Invertebrate surveys
- 600 panels at 73 sites



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



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- Nancy Treneman, USA
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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

