

Do organisms on debris pose a risk to North American ecosystems?

**Thomas W. Therriault¹, Jocelyn C. Nelson², James T. Carlton³,
Michio Otani⁴, Gregory M. Ruiz⁵, and Cathryn Clarke Murray²**



¹ Department of Fisheries & Oceans Canada

² North Pacific Marine Science Organization (PICES)

³ Williams College - Mystic Seaport

⁴ Osaka Museum of Natural History

⁵ Smithsonian Environmental Research Center



Why be Concerned?

- Non-native species can result in the loss of native biodiversity
- They also pose significant socio-economic risks, including significant risks to sustainable fisheries and aquaculture and human health
- Impacts may be exacerbated by climate change
- Globally, introductions continue
- But we need to understand the risks ...



Why risk assessments?

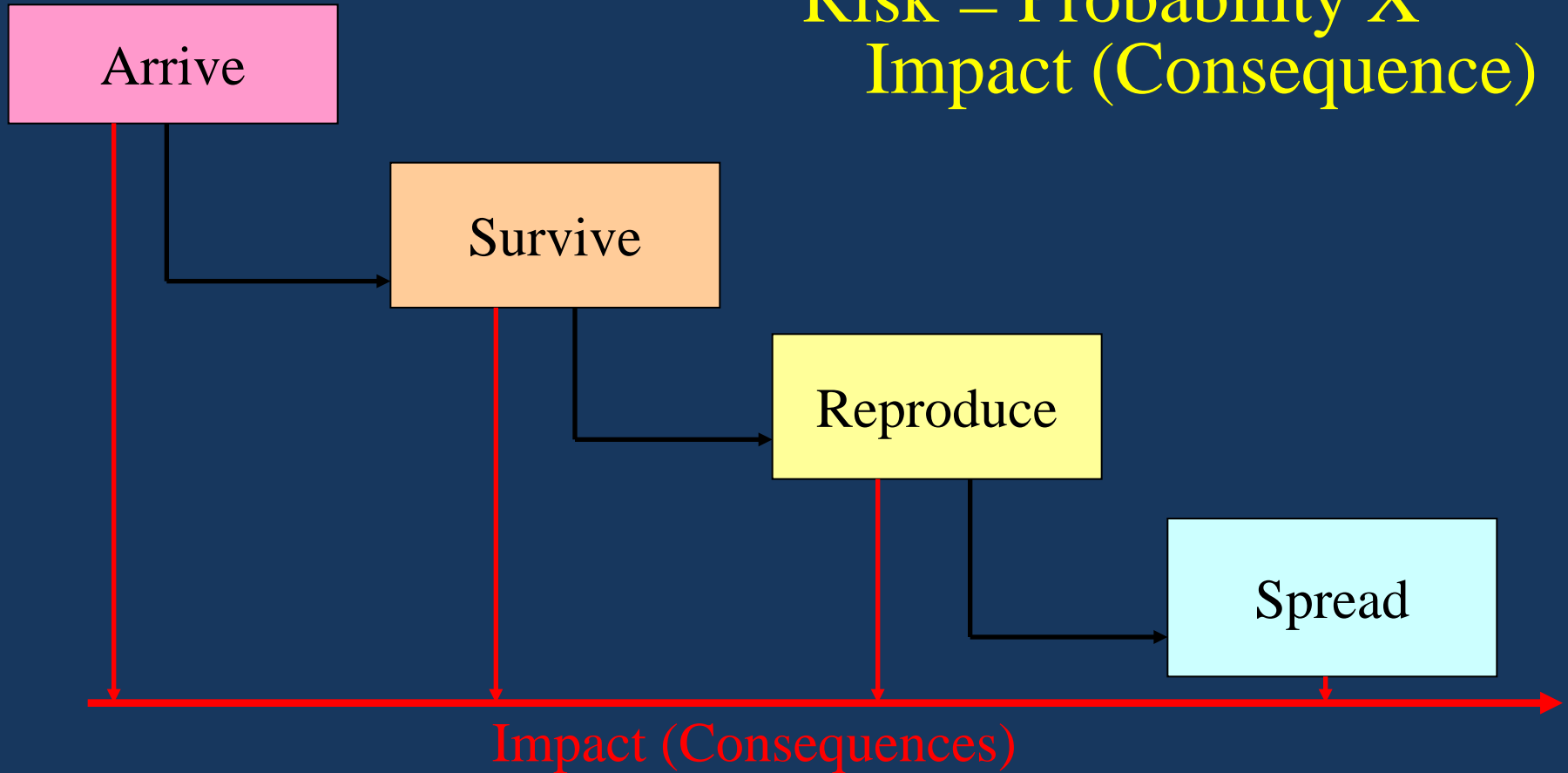
- Different species pose different risks to new ecosystems
- Screening Level Risk Assessment Tools can be applied quickly with available data (which may be limited)
- Score-based tools can prioritize species based on rank scores
- Prioritized species lists for monitoring
- Public species watch lists per ecoregion

Photo: US Navy

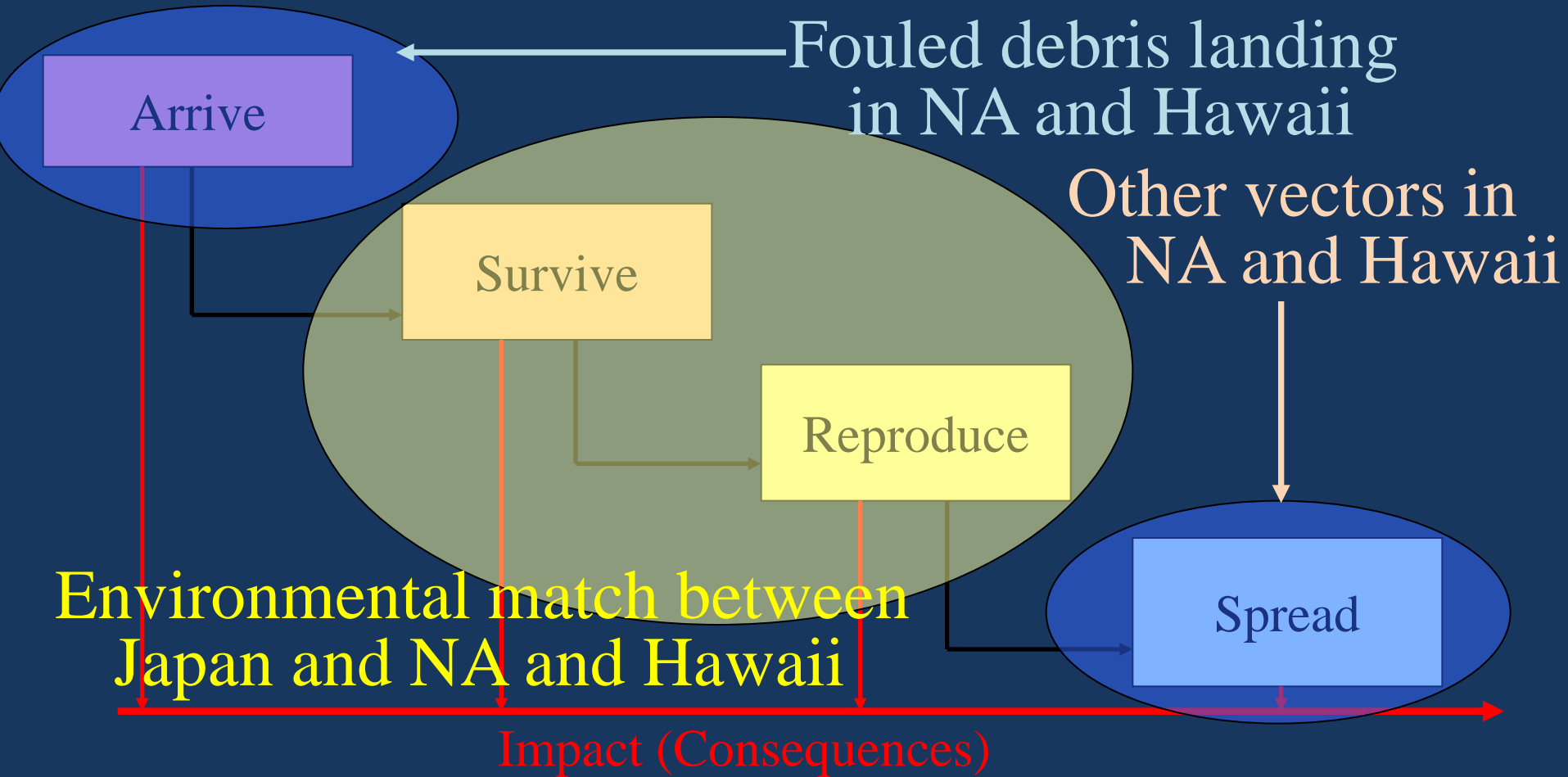


The General Invasion Process

Risk = Probability X
Impact (Consequence)



So for Japanese Tsunami Debris

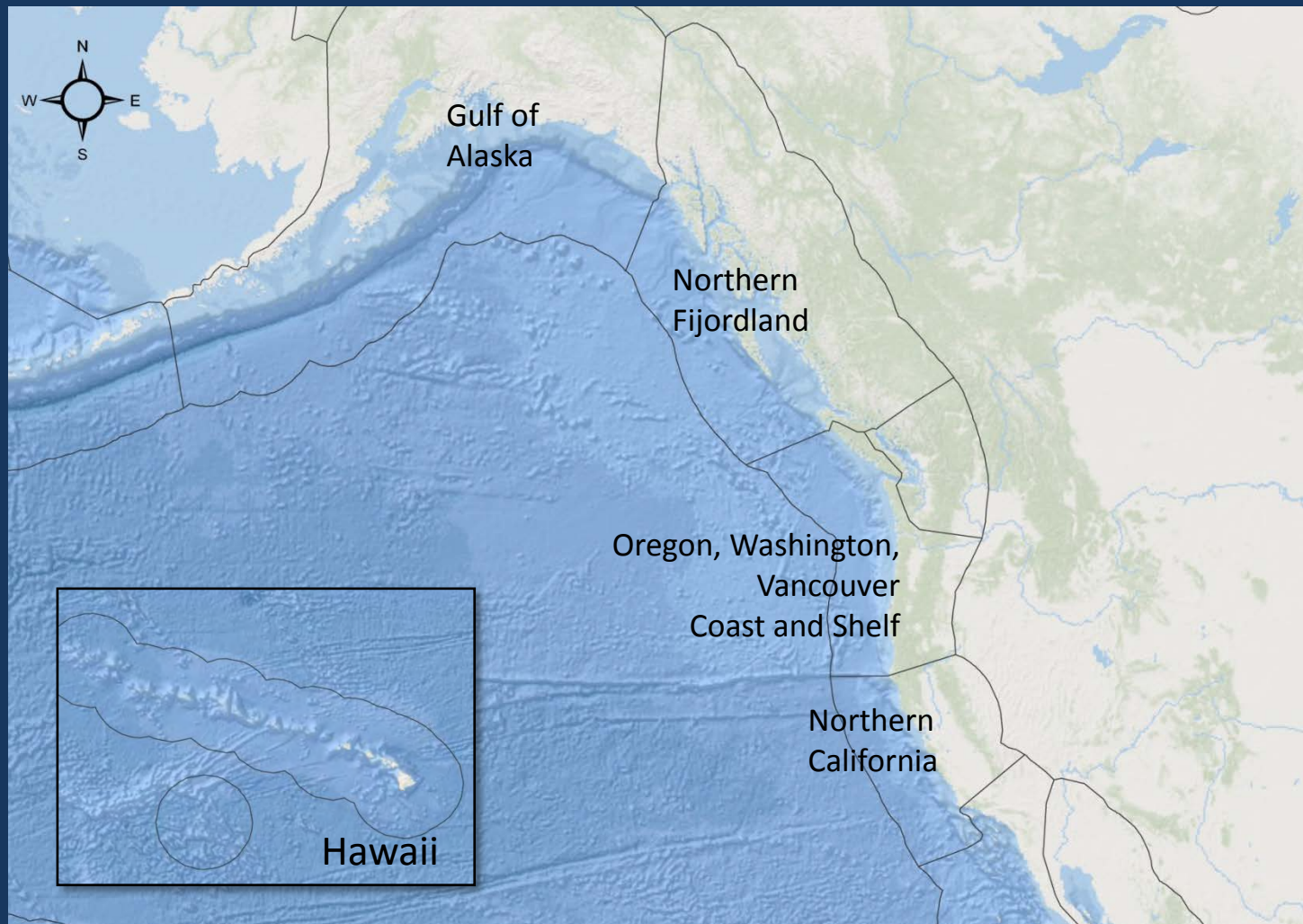


Canadian Marine Invasive Screening Tool (CMIST)

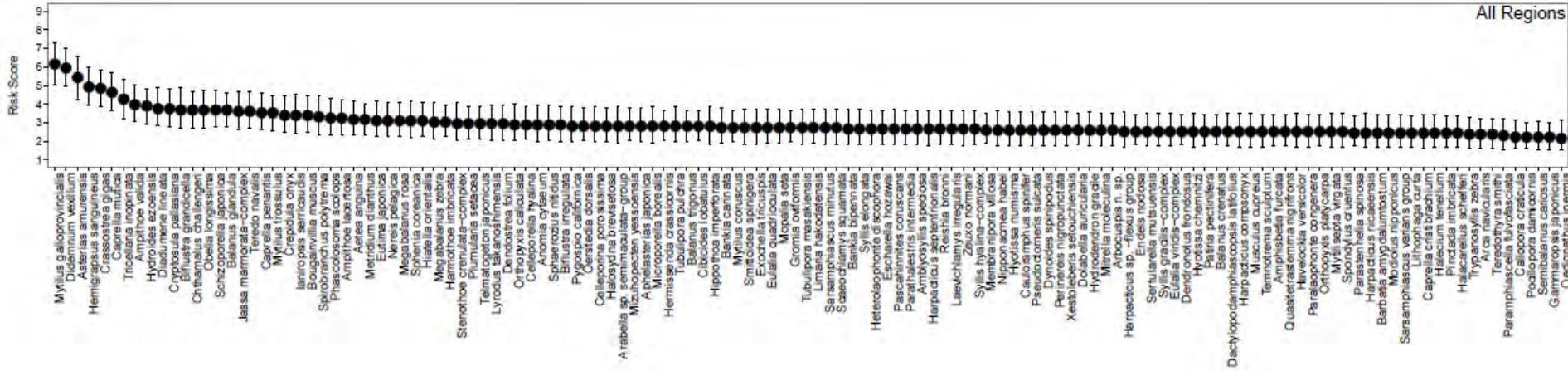
- Screening tool that evaluates risk based on invasion likelihood and impacts
- 17 Questions scored from low (1) to high risk (3):
 - Present status in the area
 - Rate of introduction
 - Survival
 - Establishment
 - Spread
 - Impact
- Captures assessor uncertainty
- We applied to 132 invertebrates on debris



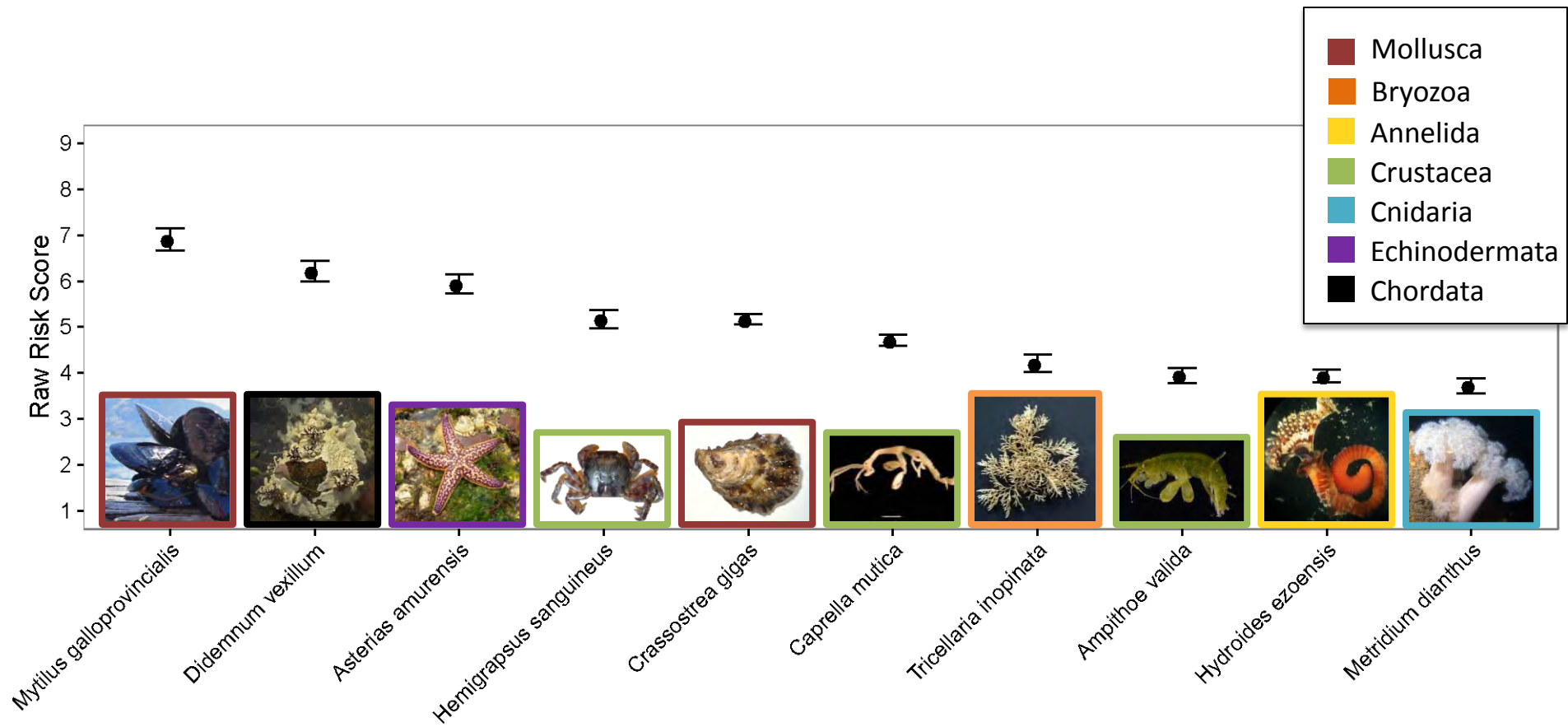
Spatial Scale for Assessments



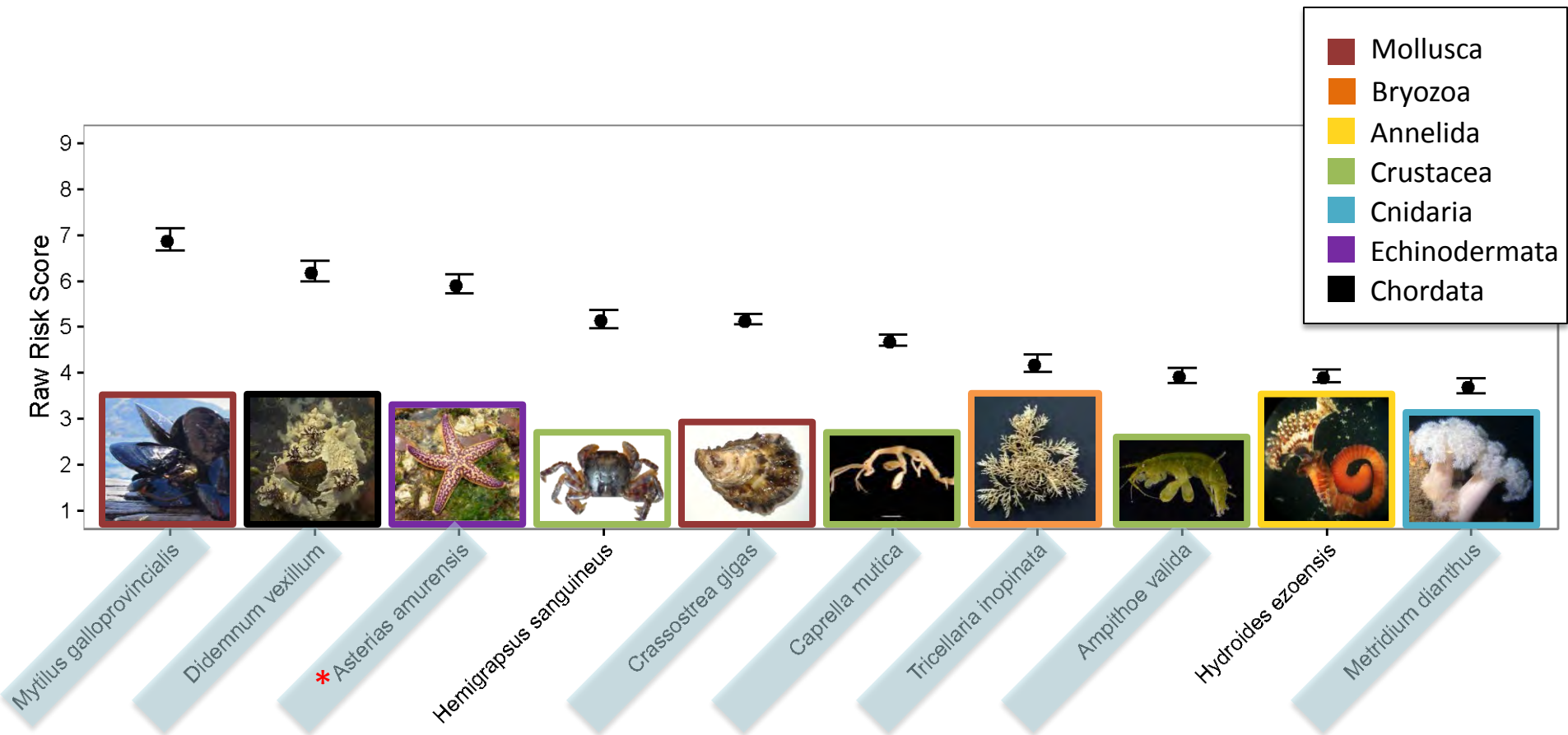
CMIST Results – All Species and Regions



Ten highest risk species



Many of these are already present



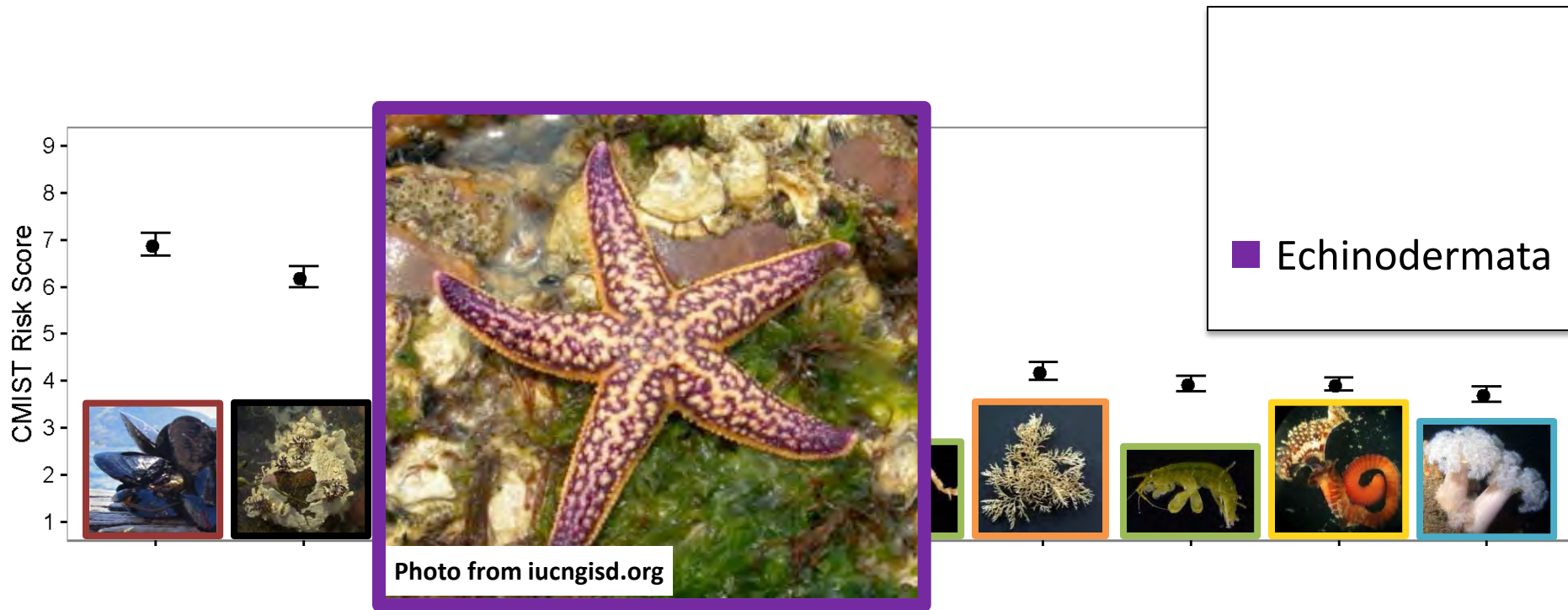
But all have a history of invasion

Ten highest risk species



Mytilus galloprovincialis

Ten highest risk species



* *Asterias amurensis*

* Native to parts of Gulf of Alaska

So still risky if already here?

YES

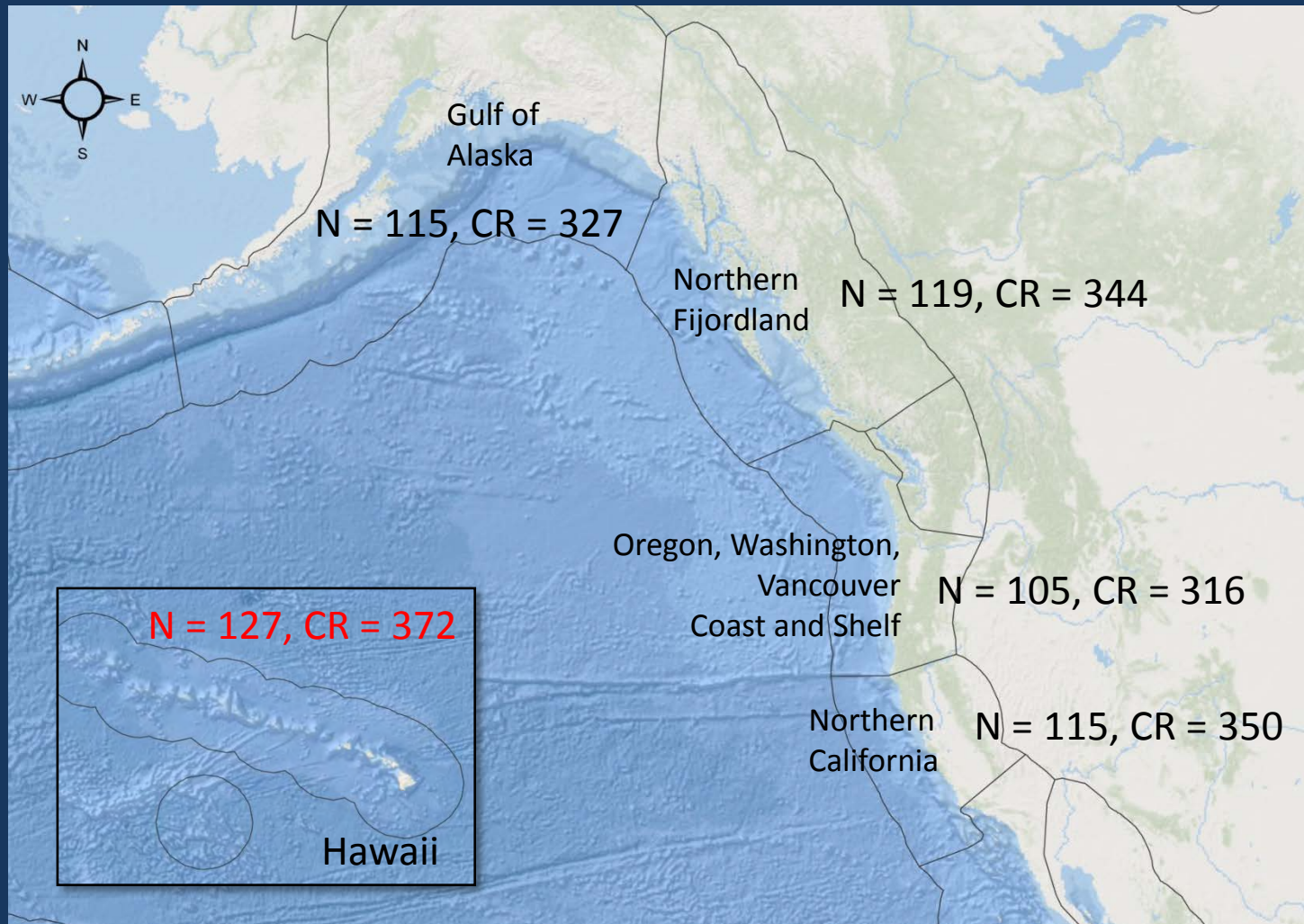
- New genetic material can increase invasiveness in NA/Hawaii
 - Greater impacts
 - Increased range

BUT

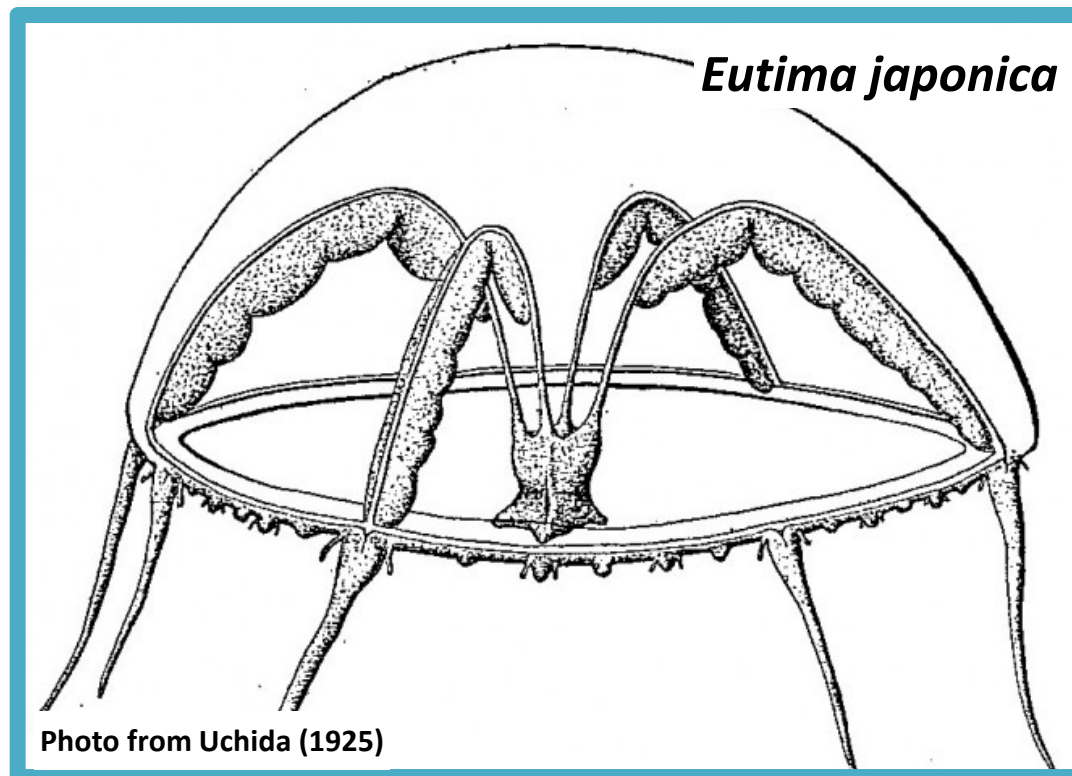
- Shows other vectors still important
- Invasions are complex



Risk by Ecoregion



Other Higher risk species – BC, Washington, and Oregon



■ Cnidaria

Data Cautions

- Impact of invasion scoring was based on known impacts. Thus, species without known impacts, due to lack of previous invasion history or lack of study, were scored lower but they could still have impacts in new ecosystems.
- Of the almost 400 species encountered thus far, many not known from other invasion vectors like commercial shipping



Summary

- CMIST risk assessments allowed us to prioritize species for each assessed ecoregion
- Although no **NEW** invasions have been attributed to tsunami debris, higher risk species were transported to NA/Hawaii on debris
- So do organisms on debris pose a risk to North American ecosystems?
 - YES
 - But – not all are high risk and there are differences among ecoregions
- Continued monitoring is required

Photo: Dann Cutter



Acknowledgements

This research is funded by the Ministry of the Environment of Japan through the North Pacific Marine Science Organization (PICES)

Database researchers: Janson Wong and Reva Gillman

CMIST scorers: Danielle Scriven and Lauren Liggan



PICES



CMIST Questions

Is the species established in the assessment area?

- [1] No
- [2] Observed but not reported as established
- [3] Yes

How frequently and in what numbers is the species expected to arrive into the assessment area?

- [1] Infrequently in low numbers
- [2] Frequently in low numbers or infrequently in high numbers
- [3] Frequently in high numbers

How much of the assessment area offers suitable habitat for the species? [

- 1] Negligible proportion of the assessment area
- [2] Moderate proportion of the assessment area
- [3] Most of the assessment area

How much of the assessment area offers suitable environmental conditions for the species to survive?

- [1] Negligible proportion of the assessment area
- [2] Moderate proportion of the assessment area
- [3] Most of the assessment area

CMIST Questions

Are the species' reproductive requirements available in the assessment area?

- [1] Almost never
- [2] Sometimes
- [3] Almost always

To what extent could natural control agents slow the species' population growth in the assessment area?

- [1] Likely to severely restrict population growth
- [2] Could slow population growth
- [3] Unlikely to slow population growth

What is the range of the species' potential natural dispersal in the assessment area?

- [1] Very limited range
- [2] Moderate range
- [3] Wide range

What is the range of the species' potential dispersal in the assessment area from anthropogenic mechanisms?

- [1] Very limited range
- [2] Moderate range
- [3] Wide range

CMIST Questions

What level of impact could the species have on population growth of other species in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

What level of impact could the species have on communities in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

What level of impact could the species have on habitat in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

What level of impact could the species have on ecosystem function in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

CMIST Questions

What level of impact could the species' associated diseases, parasites, or travellers have on other species in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

What level of genetic impact could the species have on other species in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

What level of impact could the species have on at-risk or depleted species in the assessment area?

- [1] Low or no impact
- [2] High impact in few areas or moderate impact in many areas
- [3] High impact in many areas

CMIST Questions

What level of impact could the species have on aquaculture and commercially fished species in the assessment area?

[1] Low or no impact

[2] High impact in few areas or moderate impact in many areas

[3] High impact in many areas

Is the species known or generally considered to be invasive anywhere in the world?

[1] No

[2] No, but is noted outside of its native range

[3] Yes (noted as invasive, or noted outside of native range with impacts)