

Species Risk Assessment

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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?

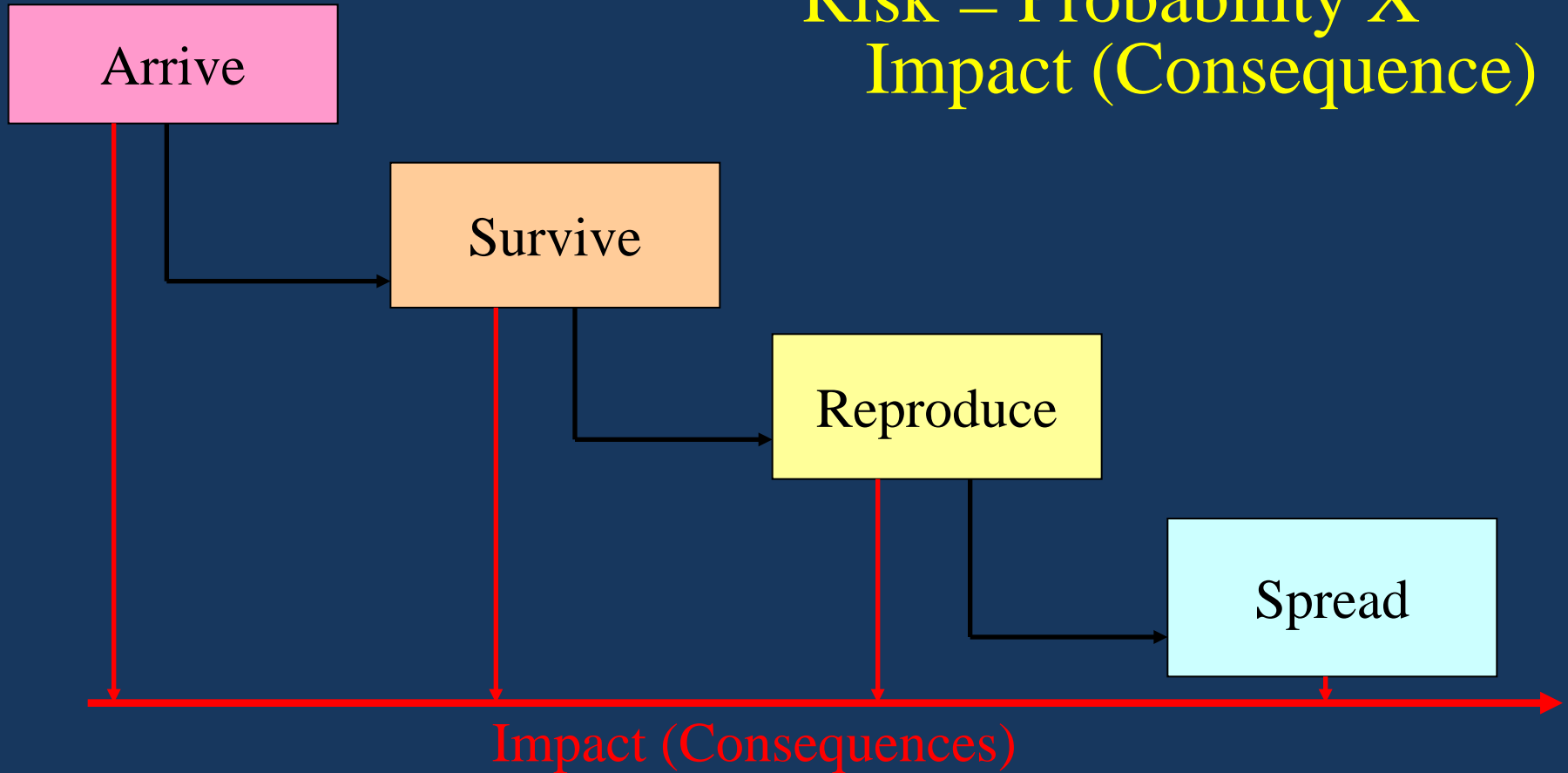
- Different species pose different risks to new ecosystems
- Screening Level Risk Assessment Tools can be applied quickly with available data (which may be limited)
- Score-based tools can prioritize species based on rank scores
- Prioritized species lists for monitoring
- Public species watch lists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

Photo: US Navy

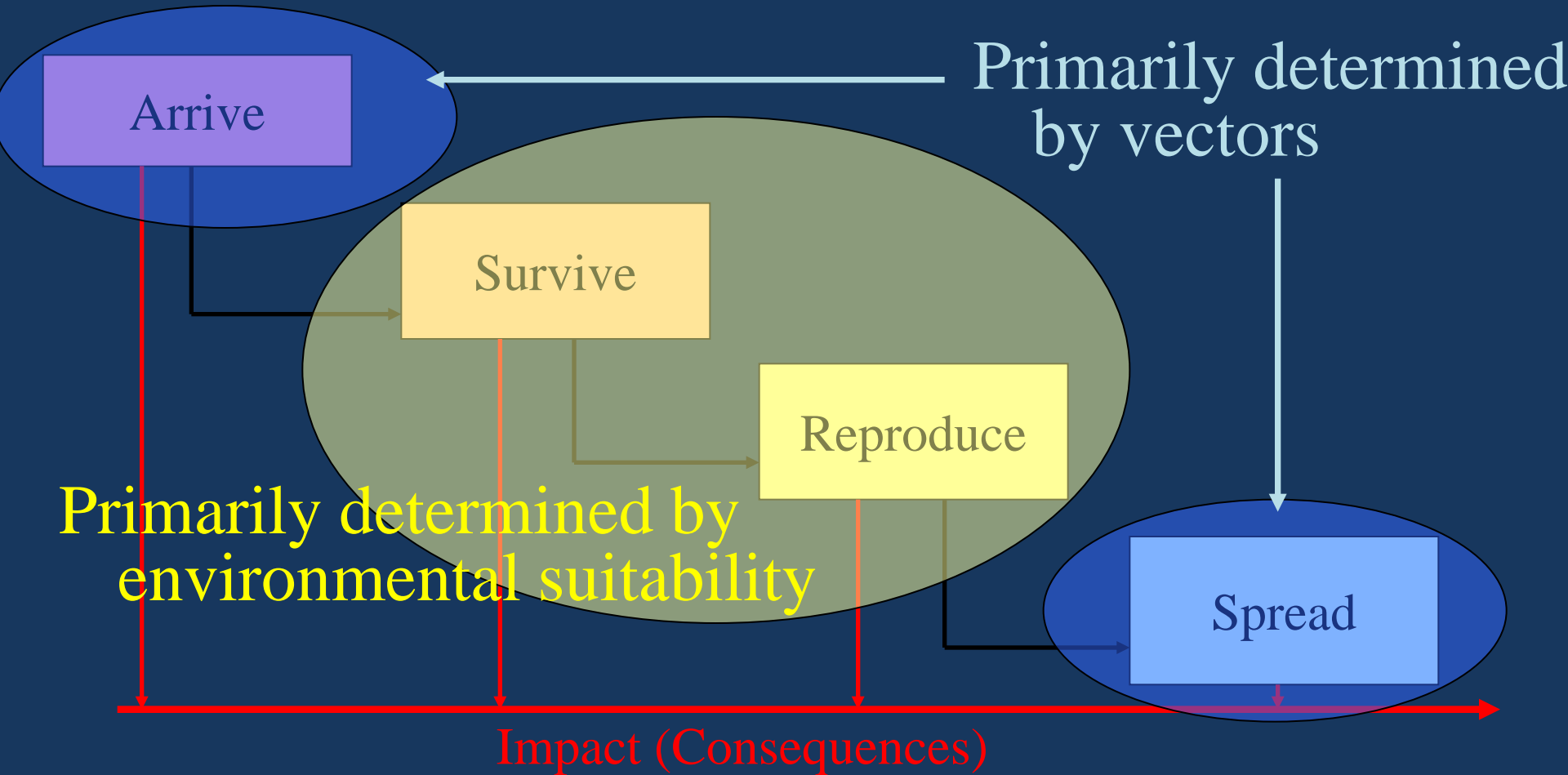


The General Invasion Process

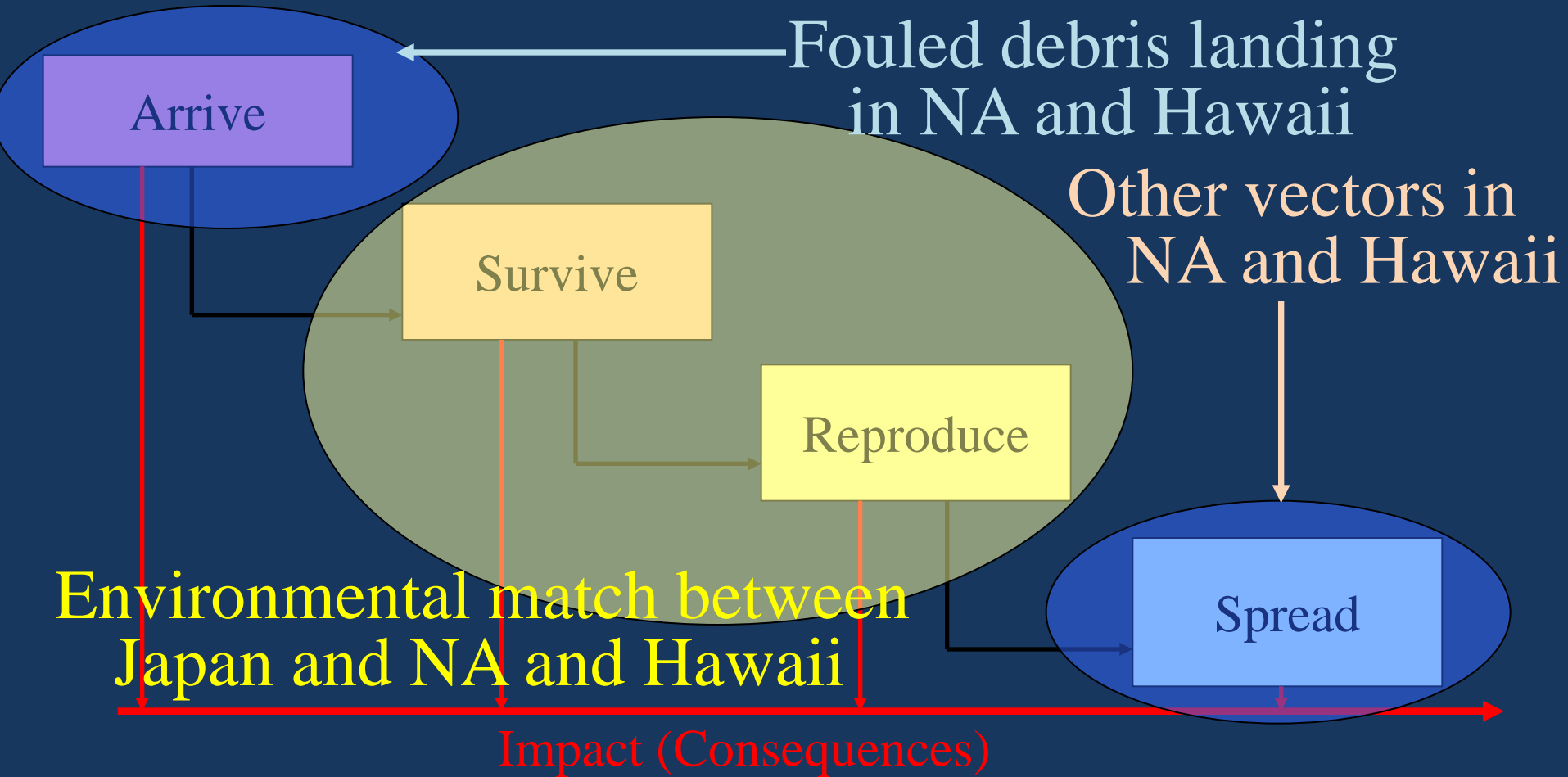
Risk = Probability X
Impact (Consequence)



The General Invasion Process



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



CMIST: Likelihood of Invasion

Table 1 Questions of CMIST and description of potential scores

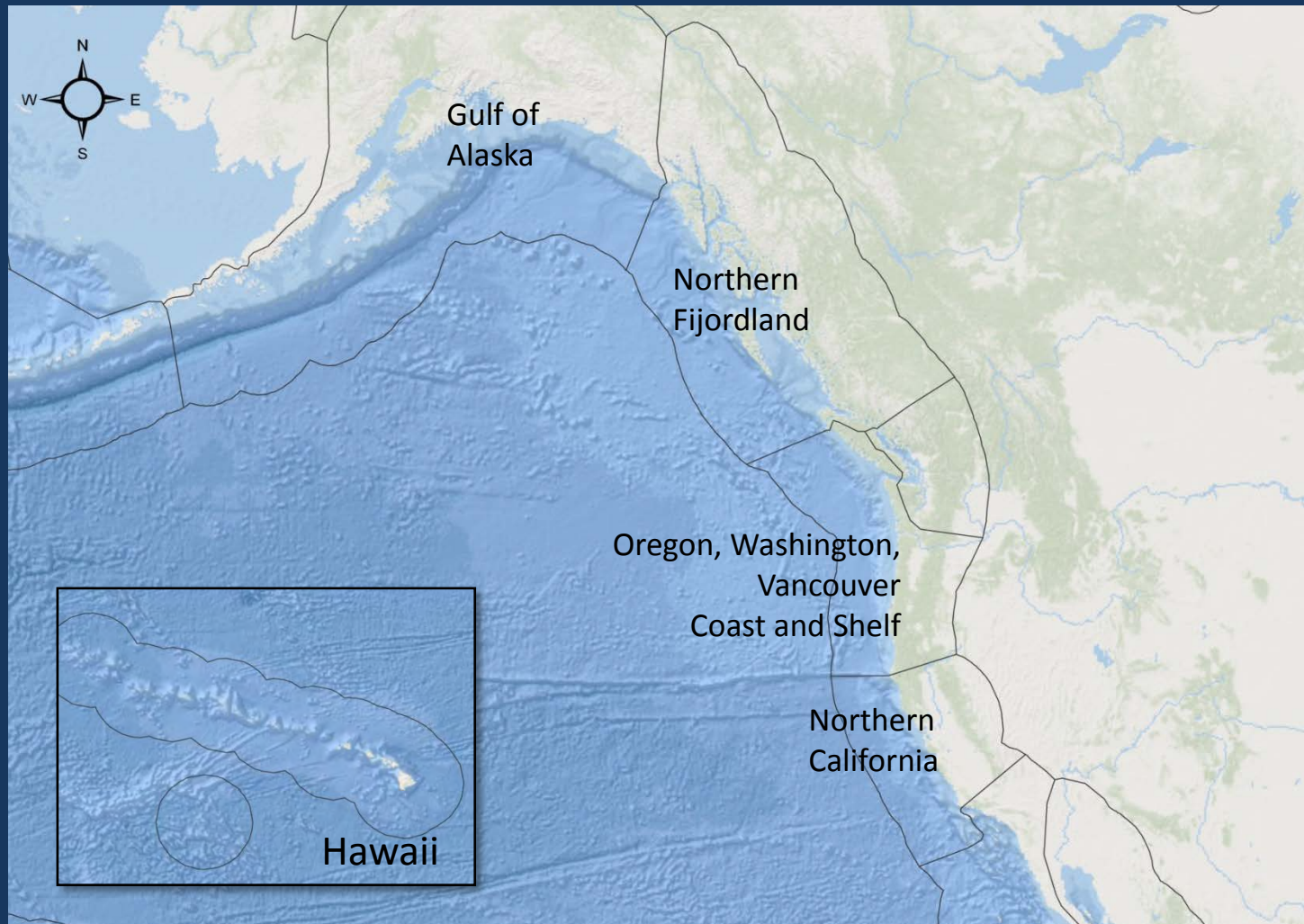
Question	Score		
	1 (Low)	2 (Moderate)	3 (High)
<i>Present status</i>			
1 Is the species established in the assessment area?	No	Observed but not reported as established	Yes
<i>Rate of introduction</i>			
2 How frequently and in what numbers is the species expected to arrive into the assessment area?	Infrequently in low numbers of individuals	Frequently in low numbers or infrequently in high numbers	Frequently in high numbers
<i>Survival</i>			
3 How much of the assessment area offers suitable habitat for the species?	Negligible proportion of the assessment area	Moderate proportion of the assessment area	Most of the assessment area
4 How much of the assessment area offers suitable environmental conditions for the species to survive?	Negligible proportion of the assessment area	Moderate proportion of the assessment area	Most of the assessment area
<i>Establishment</i>			
5 Are the species' reproductive requirements available in the assessment area?	Almost never	Sometimes	Almost always
6 To what extent could natural control agents slow the species' population growth in the assessment area?	Likely to severely restrict population growth	Could slow population growth	Unlikely to affect population growth
<i>Spread</i>			
7 What is the range of the species' potential natural dispersal in the assessment area?	Very limited range	Moderate range	Wide range
8 What is the range of the species' potential dispersal in the assessment area from anthropogenic mechanisms?	Very limited range	Moderate range	Wide range

CMIST: Impacts

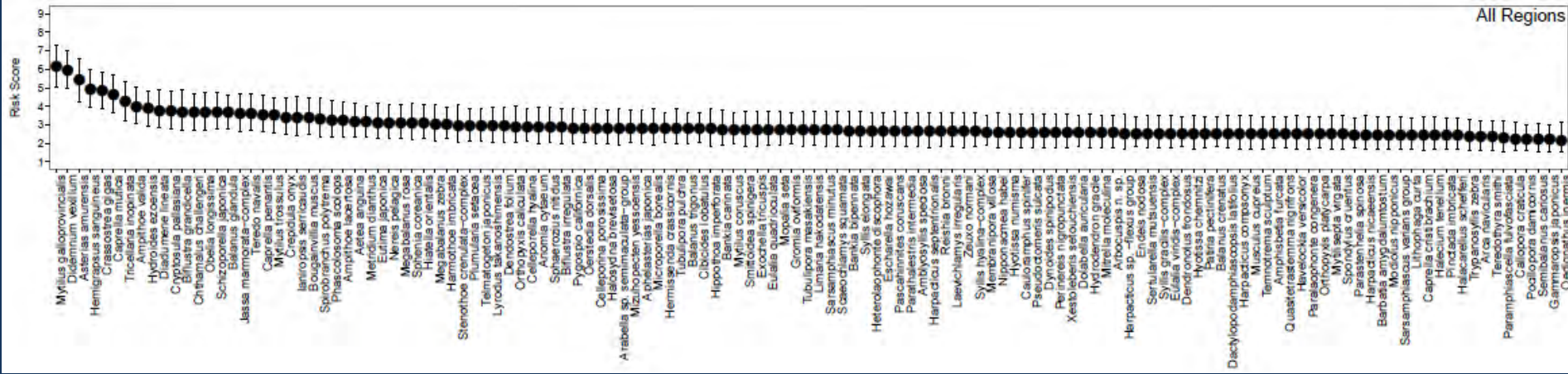
Table 1 Questions of CMIST and description of potential scores

Question	Score		
	1 (Low)	2 (Moderate)	3 (High)
9 What level of impact could the species have on population growth of other species in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
10 What level of impact could the species have on communities in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
11 What level of impact could the species have on habitat in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
12 What level of impact could the species have on ecosystem function in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
13 What level of impact could the species' associated diseases, parasites, or travellers have on other species in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
14 What level of genetic impact could the species have on other species in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
15 What level of impact could the species have on at-risk or depleted species in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
16 What level of impact could the species have on aquaculture and commercially fished species in the assessment area?	Low or no impact	High impact in few areas or moderate impact in many areas	High impact in many areas
17 Is the species known or generally considered to be invasive anywhere in the world?	No	No, but has traits related to invasiveness	Yes

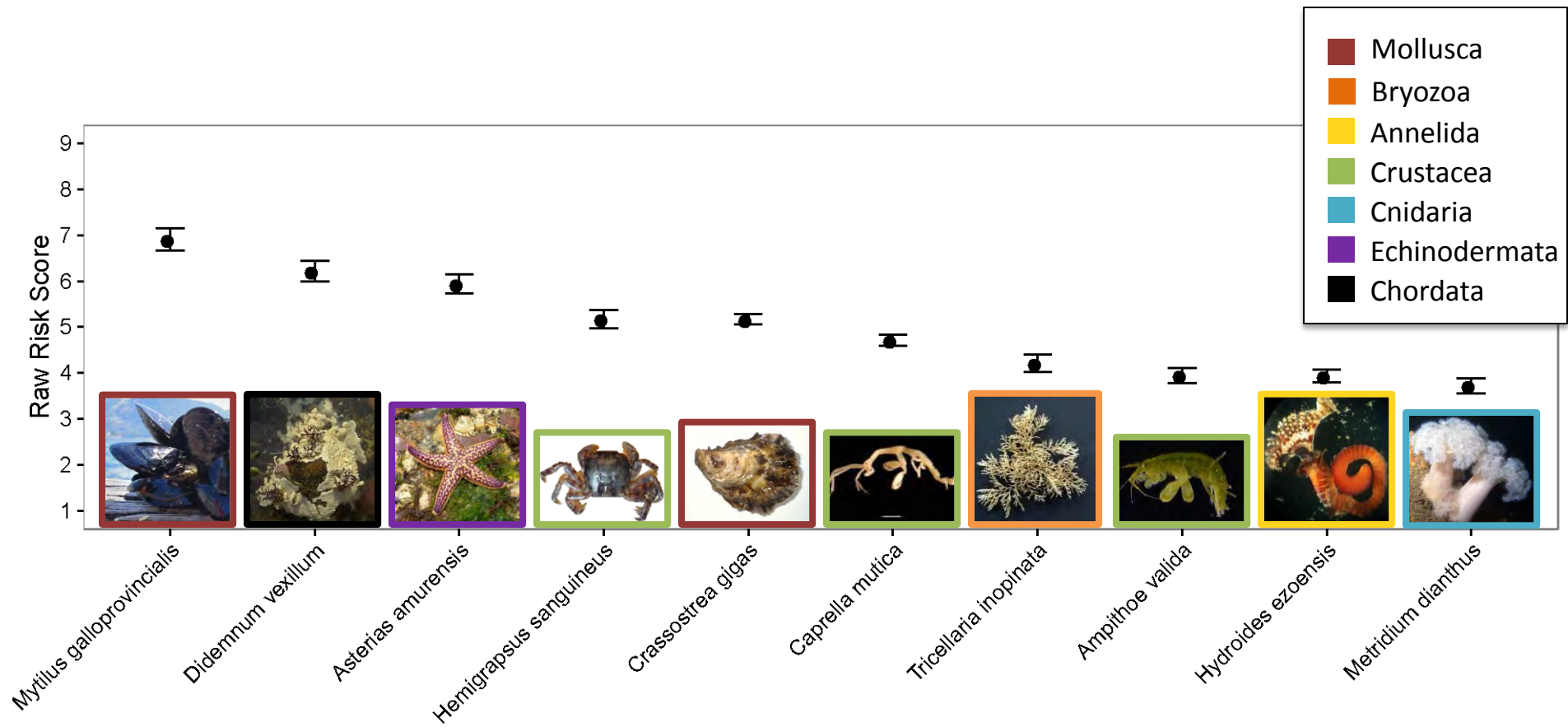
Spatial Scale for Assessments



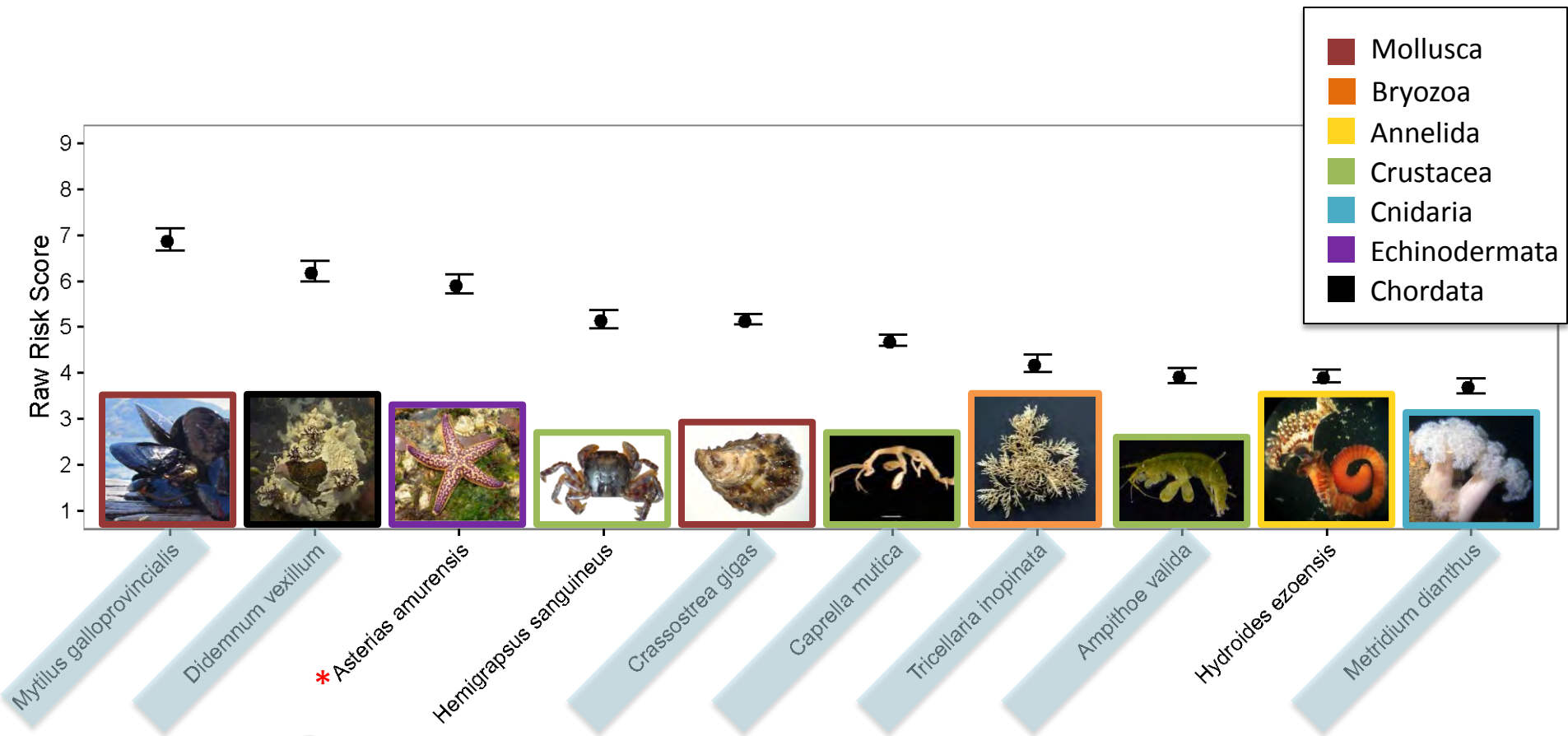
CMIST Results – All Species and Regions



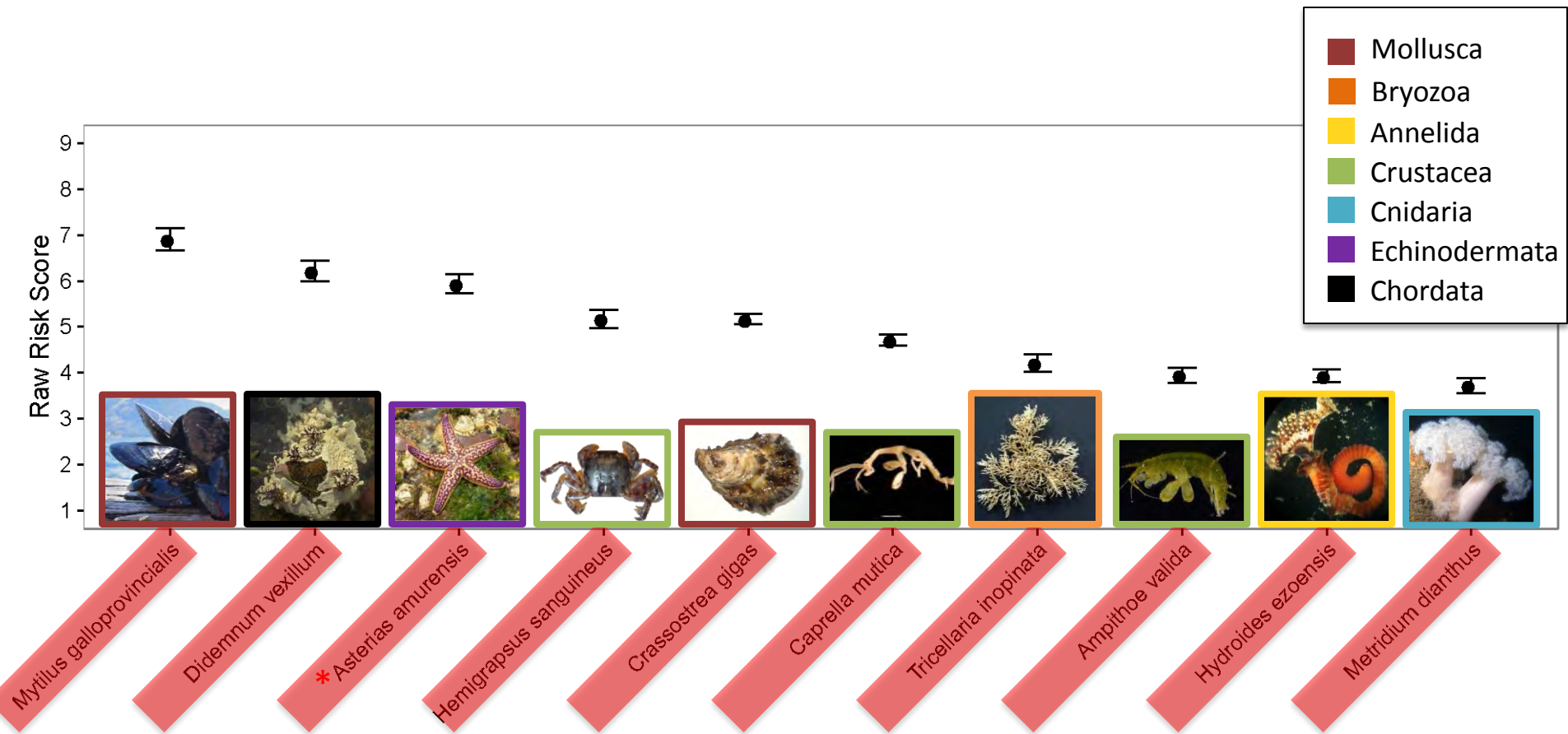
Ten highest risk species



Many of these are already present



But all have a history of invasion

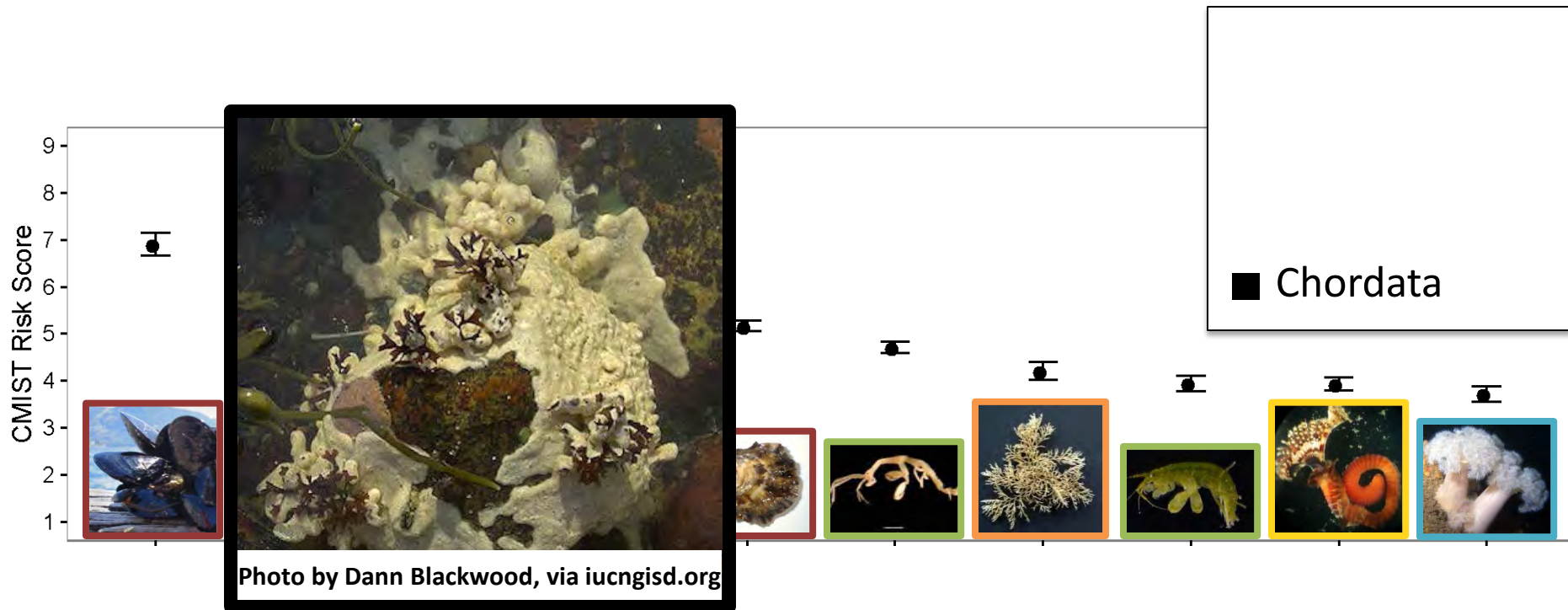


Ten highest risk species



Mytilus galloprovincialis

Ten highest risk species



Didemnum vexillum

Ten highest risk species

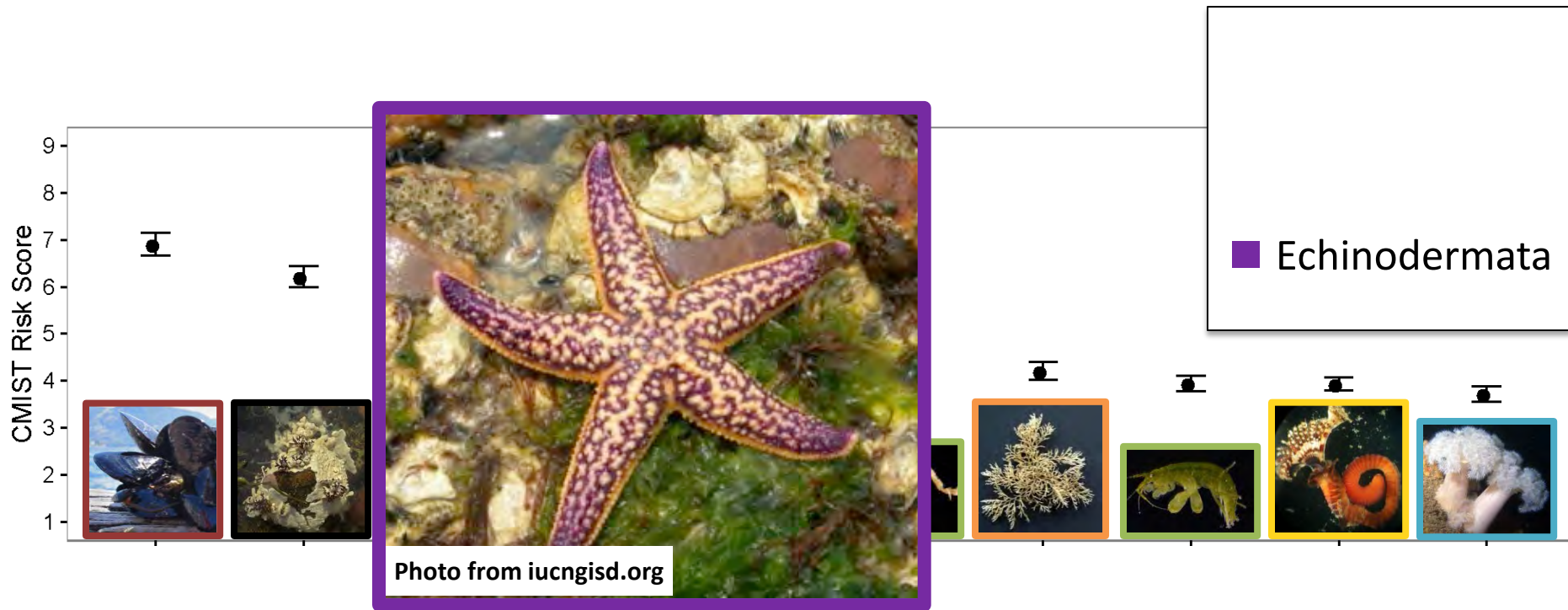


Photo from iucngisd.org

* *Asterias amurensis*

* Native to parts of Gulf of Alaska

Ten highest risk species



Hemigrapsus sanguinensis

Ten highest risk species



Crassostrea gigas

So still risky if already here?

YES

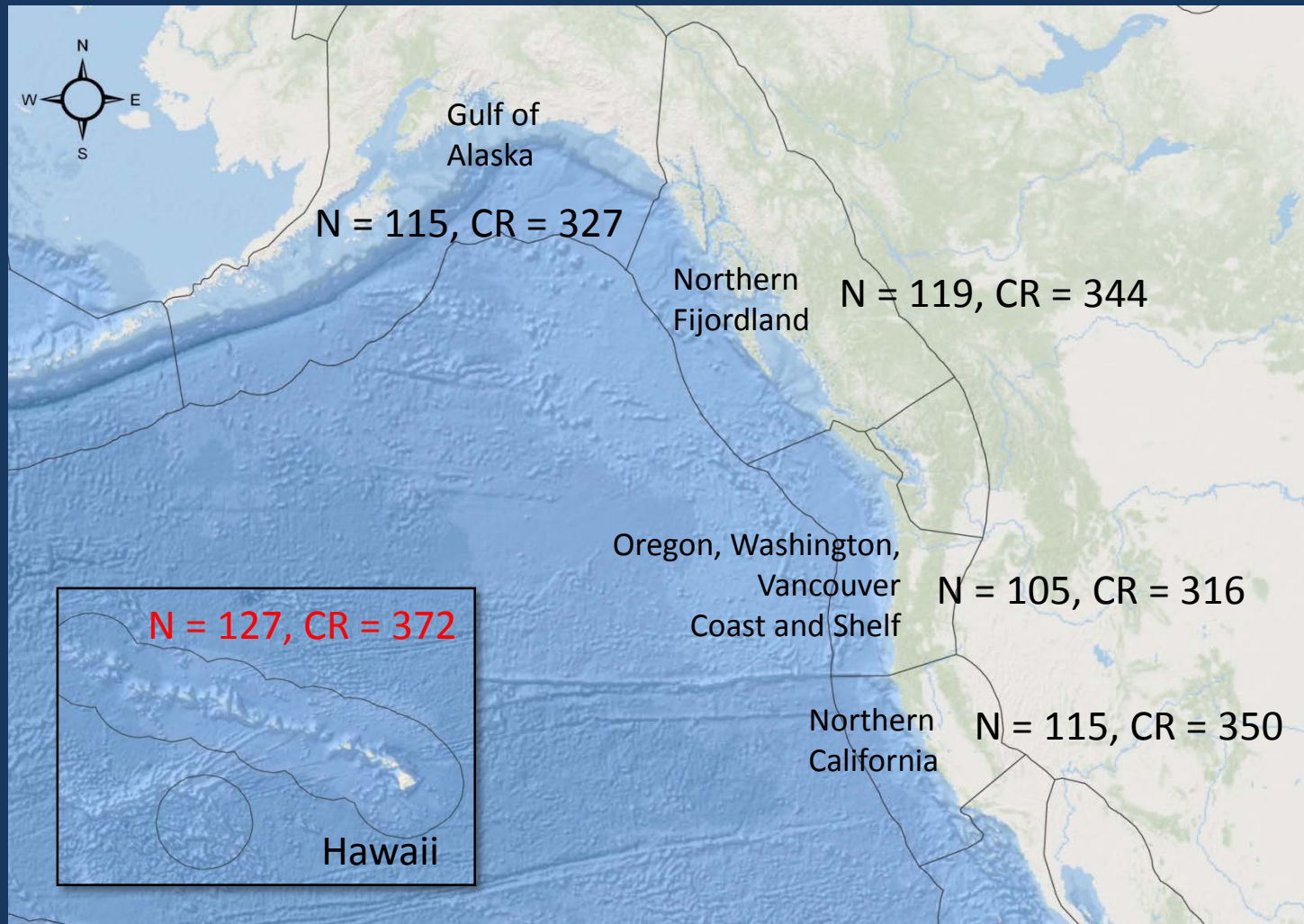
- New genetic material can increase invasiveness in NA/Hawaii
 - Greater impacts
 - Increased range

BUT

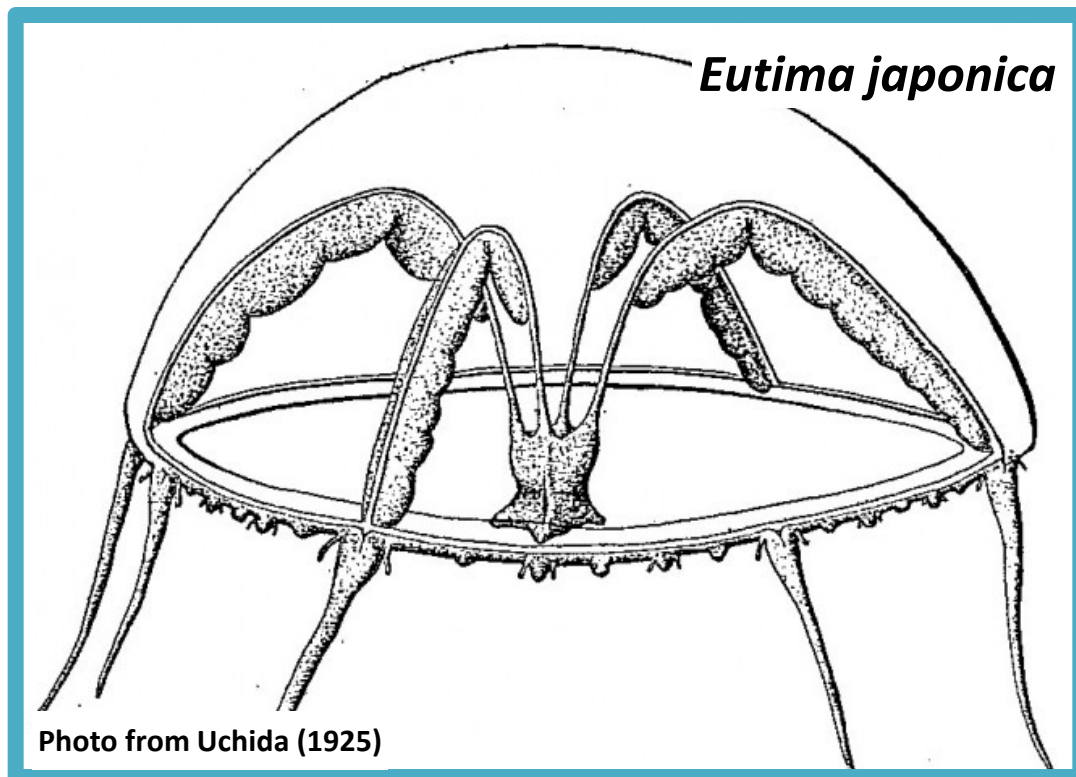
- Shows other vectors still important
- Invasions are complex



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.
- There was some variability in highest risk species among ecoregions.



Summary

- Risk assessments, via CMIST, allowed us to prioritize species for each assessed ecoregion
 - Results can inform monitoring and management options
- Although no **NEW** invasions have been attributed to tsunami debris, higher risk species were transported to NA/Hawaii on debris
- Continued monitoring is recommended due to invasion lag times
- Also are scoring algal species
 - *Undaria pinnatifida* is higher risk



Photo: Dann Cutter

Acknowledgements

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

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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
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- [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
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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)