

CLIMATE CHANGE & INVASION RISKS IN ALASKA & THE ARCTIC



AFE 2011

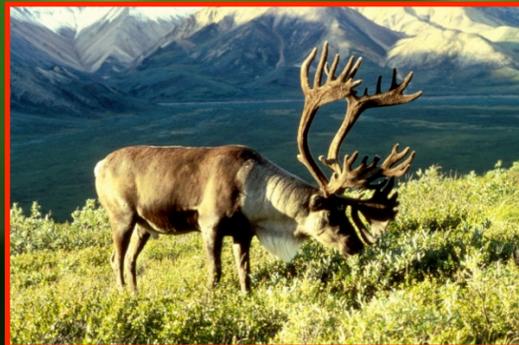
Denny Lassuy

U.S. Fish and Wildlife Service





ALASKA & the ARCTIC: Worth Protecting



“With the inevitable expansion of international trade in the coming decades, the threat of invasions looms ominously over the past century’s work to preserve native biological diversity.”

(UCS 2001)

Invasions can alter ecosystems ...



Alaska is home to ~70% of total U.S. intertidal mudflats – which provide a smorgasbord of food for birds (at low tide) and fish (at high tide).

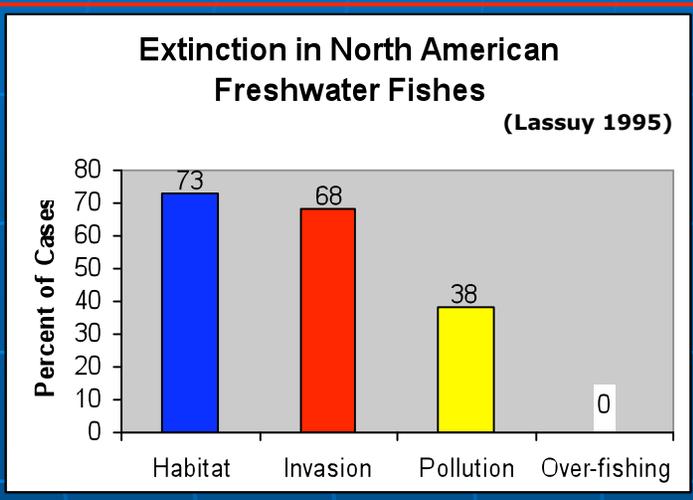
Spartina cordgrass growing like a cancer, eating up the mudflats of Willapa Bay, WA



We do not want to imagine Alaska's Bays and Deltas without shorebirds - & - shorebird festivals!\$!

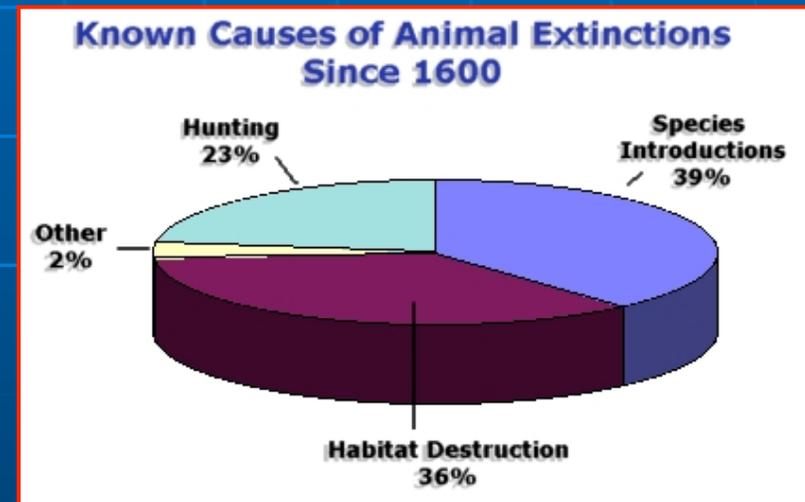


... and dramatically impact native species: introduced species are the second* leading factor in the endangerment & extinction of North American fishes



* In southwest U.S., invasive species were recently noted to be an even more pervasive factor than habitat alteration.

* Light, T. and M. Marchetti. 2007
Distinguishing between Invasions
and Habitat Changes as Drivers of
Diversity Loss ... Conservation
Biology 21(2):434-446



*“Dithering and endangering
are often linked.”*

(Soulé 1986)

Fewer Known Invasions in Alaska & the Arctic

- **but, High Latitudes are not immune:**
 - **Arctic Canada: growing # of invasive plants**
 - **Arctic Alaska: 7% (39 sp) non-native plants**
 - **Svalbard: 15% of plants non-native**



**White Sweetclover
(roadside Alaska)**



**Chinese Mitten Crab
(Barents/White Sea)**

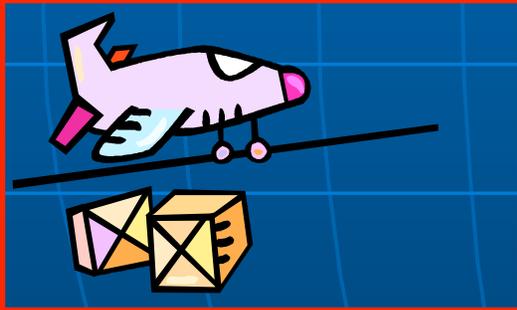


**Prostrate Knotweed
(Svalbard)**

- **and Invasion Opportunity is Increasing**

“Strategically located at the air-and-sea nexus between Asia and North America, and straddling key polar sea routes, Alaska serves as a major international hub for air and marine transportation and shipping.”

(Fritts 2006)



Arctic Biodiversity Trends - 2010: Selected Indicators of Change

“Biological invasion is now widely recognized as second only to habitat alteration ... and is arguably the less reversible of the two.

... many consider invasive species, together with climate change, to be among the most important ecological challenges facing global ecosystems today.”

<http://www.arcticbiodiversity.is>

Climate Change: It's Real; It's Not Going Away Soon & It Makes A Difference

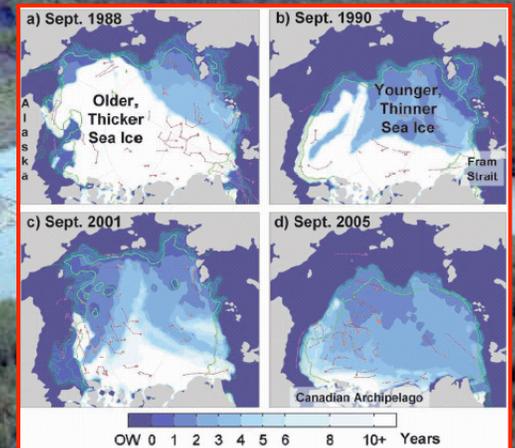
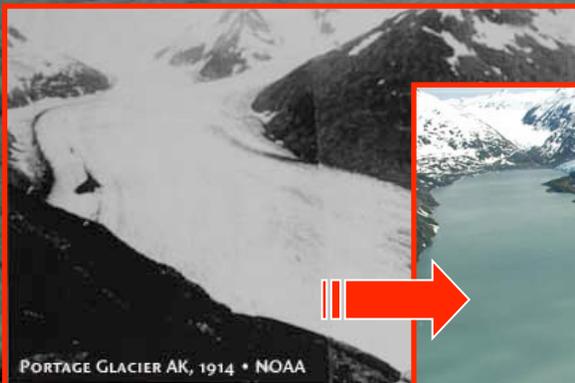
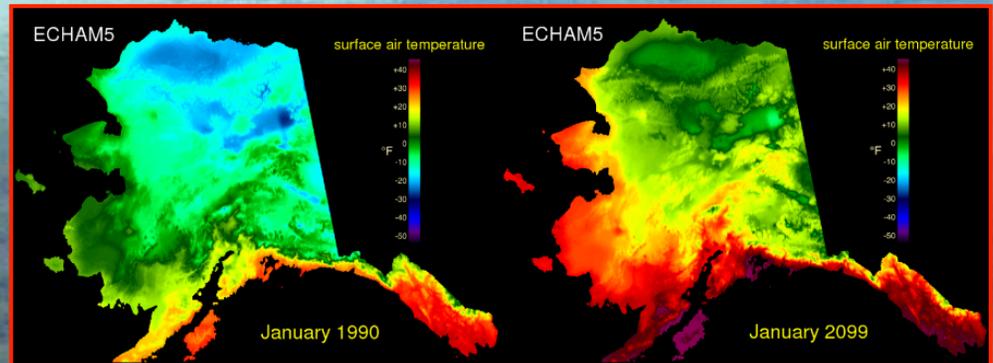
from
Bangladesh



to
Shismaref



Winter Temperatures



“We expect most aspects of global change to favor invasive alien species & thus exacerbate the impacts of invasions on ecosystems.”

(Dukes & Mooney 1999)

Will Climate Change Put Alaska and the Arctic at Greater Risk of Invasion?

Maybe? Probably? Yes?

MAYBE?

Not Yet (in AK)

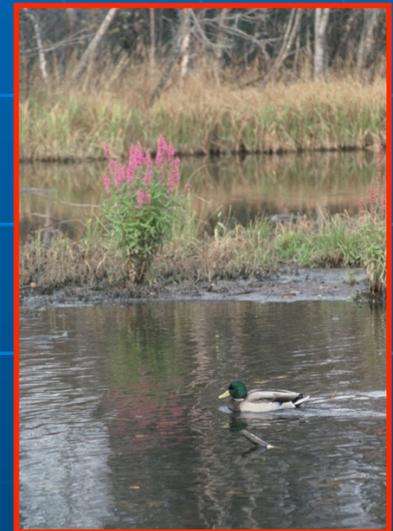


Mitten Crab

Here (in AK)



Whirling Disease



Purple Loosestrife

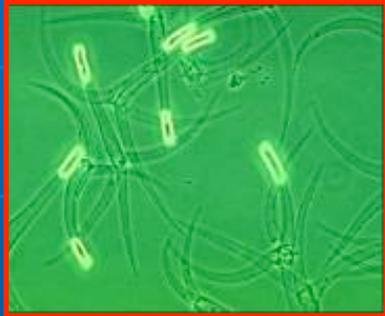
Mitten Crab



“If water temperatures rise due to climate change, many Alaska estuaries would be at risk.” (Hanson 2007)

“New invasive crab found in Russian Arctic” (Utronews.ru 2010)

Whirling Disease



"The risk of parasite dissemination in Alaska is an evolving process and will vary with changes to environmental or physical conditions that affect parasite proliferation and development, such as climate change..."

Arsan (2006)



Myxobolus cerebralis
detected at Elmendorf
State Fish Hatchery

ADFG (2007)



Purple Loosestrife: Purple Peril!



- 1990's: "not invasive, too cold, can't set seed"
- 2005: escaped, set seed, established in wild
- 2007: labeled noxious, banned from sale
- 2009: handful of plants left
- 2011: eradicated? (no dithering!)



PROBABLY?

Not Yet



European Green Crab

Here



Norway Rat

EUROPEAN GREEN CRAB



“Where you find large populations of green crabs, you won't find native crabs at all.”

***(Dr. Ron Thresher,
CRIMP, Australia)***

•Locations in Gulf of Alaska already at risk

(Ruiz 04)

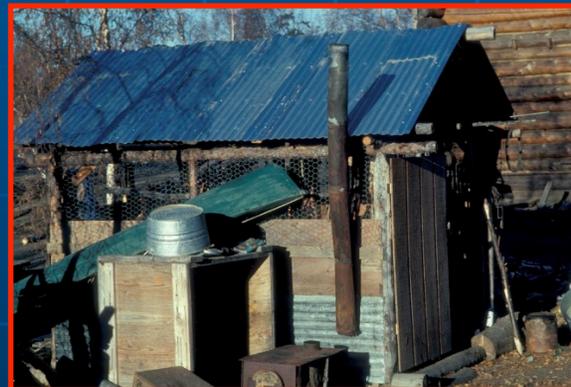
•Warmer water will increase risk & range

(de Rivera et al. 06)

RATS!

“Whether rats arrive by **sea**, air or land transport ..., a warming climate increases the likelihood of their becoming successfully established.”

(Fritts 2006)



YES?

Tunicates (Sea Squirts)

Not Yet(?)



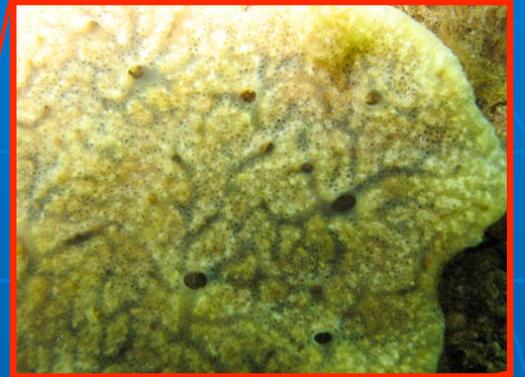
**Marine Vomit
(Didemnum)**

Here



**Botrylloides
violaceus**

Marine Vomit



Didemnum vexillum



Not a Laughing Matter!



Global change variables that may affect invasive plants

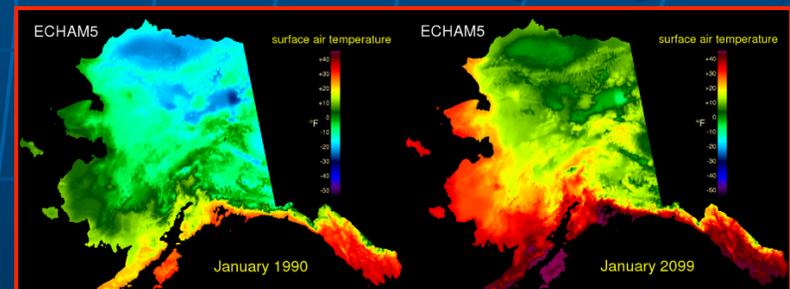
🌡️ Temperature (min./max./mean/season)

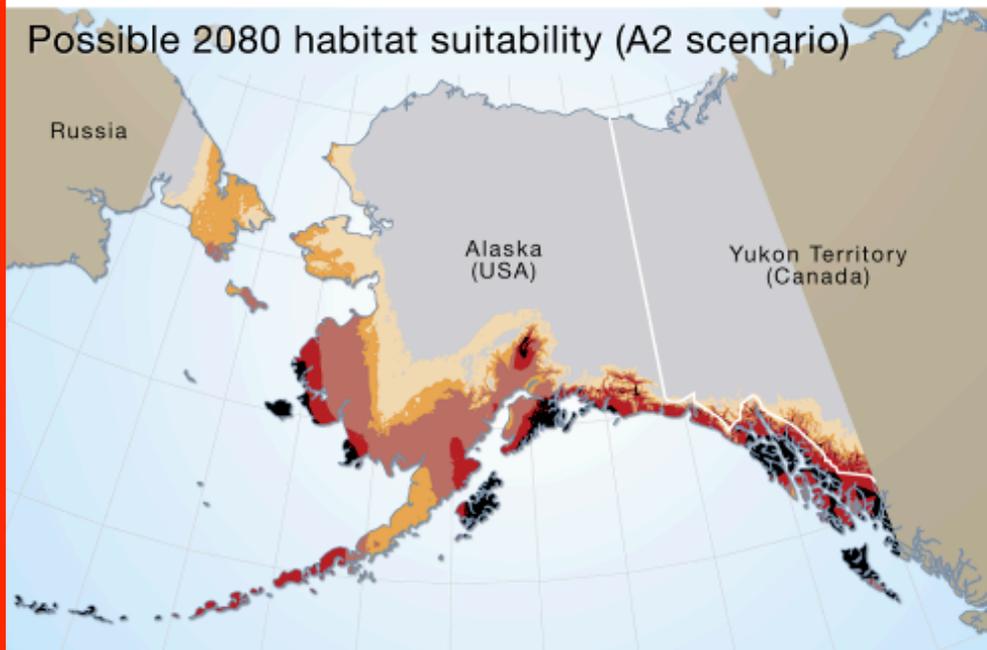
☁️ Precipitation (quantity and timing)

❄️ Snow (quality, quantity, and timing)

● CO₂ concentrations

⚡ Frequency/intensity of extreme events (fire)





Physical “DRIVERS” of Invasion

Ports (new & expansions)?

Natural Gas (Tankers/Pipeline?)

Offshore Oil & Gas?

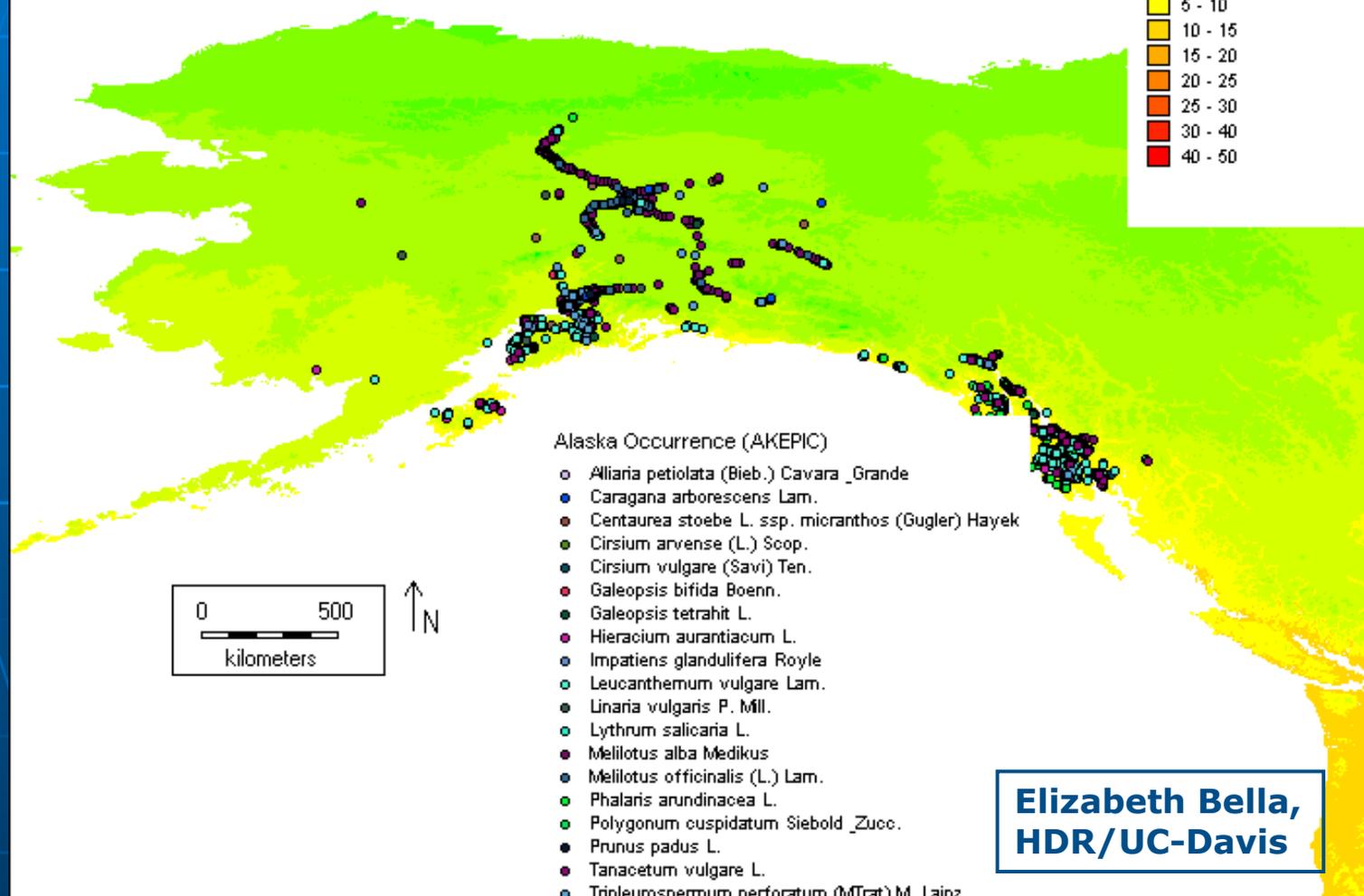
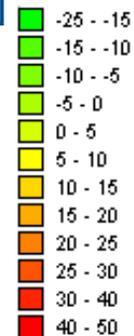
Roads, roads, roads, ...

Mines, mines, ...



Current State Distribution Data of Study Species (AKEPIC)

Mean Annual Temperature



**Elizabeth Bella,
HDR/UC-Davis**

INVASIVES >> 1 species, 1 vector (as #2* threat, it needs to be a mindset)

MINES as Sources of Invasion Risks:

Equipment

- Source (AK or outside?)
- Transport (**barge** or truck?)
 - If truck, greater traffic on current road – or --
 - new road? If so, what's the gravel source?

Site Revegetation (**wetland** plant species? seed source?)

Ore Transport (**new port = new route & more ships**)

Any **rivers** run through mine site? (= pathways for spread)



Shipping Pathway

“As economic activity and population size continue to increase, so too will the numbers of ships arriving in the state ... and the likelihood that non-native species will become established. This potential may further increase with now documented increases in sea water temperature.”

McGee et al. (2006)
Marine Pollution Bulletin



New shipping routes = new spread?

Arctic shipping coming soon, U.S. expert says

CBC News

"Melting ice may create shipping shortcut"

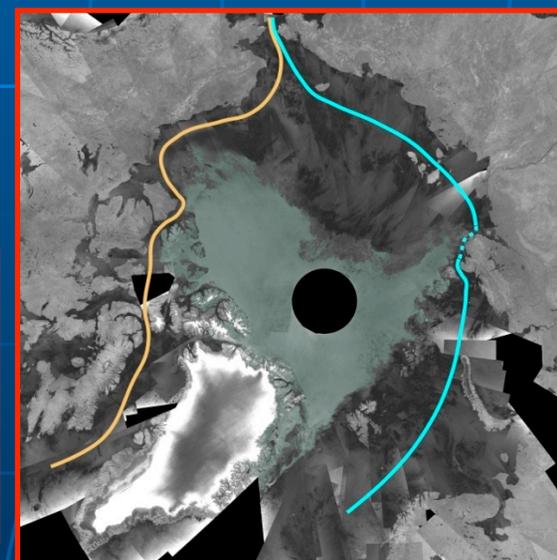
Seattle Times

"Thaw could deliver new shipping route"

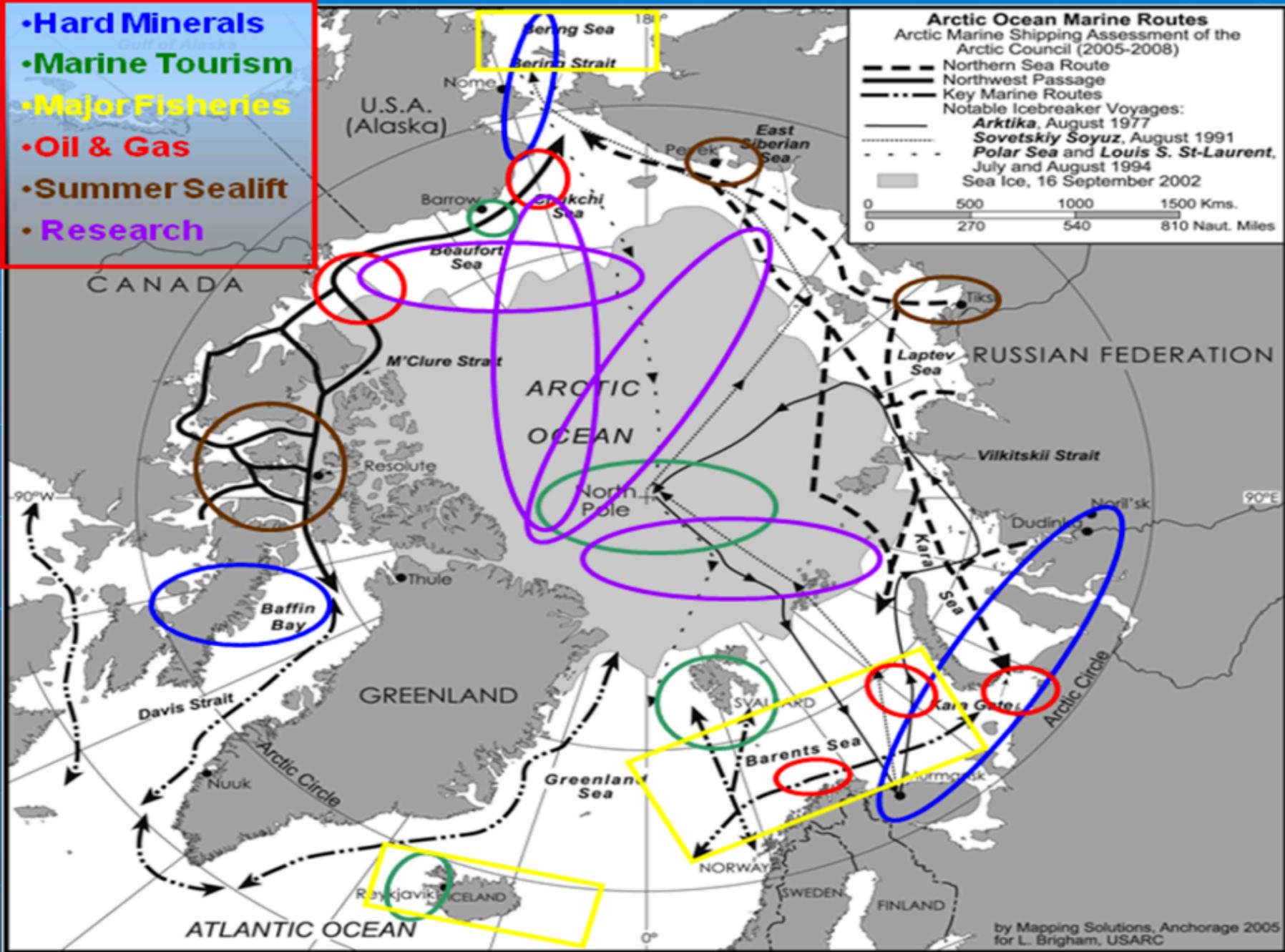
Marketplace NPR



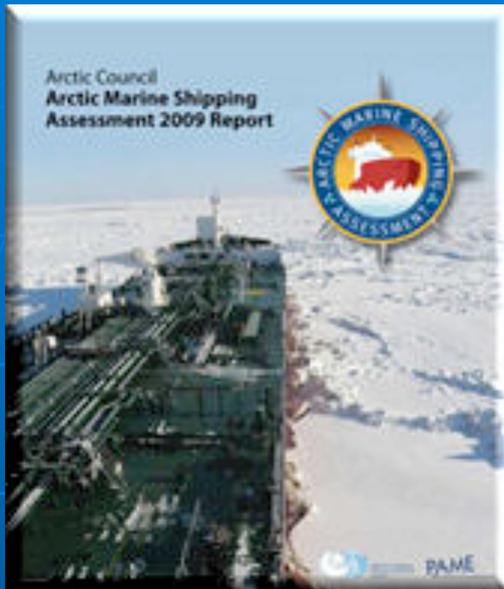
- Ballast water
- Hull fouling
- Riders (rats, moths)



- Hard Minerals
- Marine Tourism
- Major Fisheries
- Oil & Gas
- Summer Sealift
- Research



by Mapping Solutions, Anchorage 2005 for L. Brigham, USARC



Arctic Marine Shipping Assessment (Arctic Council 2009)

<http://www.pame.is/amsa/amsa-2009-report>

High Priority Arctic Policy issues Related to AMSA:

“Identification of specific ballast water / invasive species issues and prevention strategies related to Arctic marine operations.”

<http://www.snap.uaf.edu/news/report-details-next-steps-arctic-shipping-policies>

Ballast-mediated Introductions

Prevention Options



Ballast Exchange?



Shore-based Treatment?



Treat Onboard?

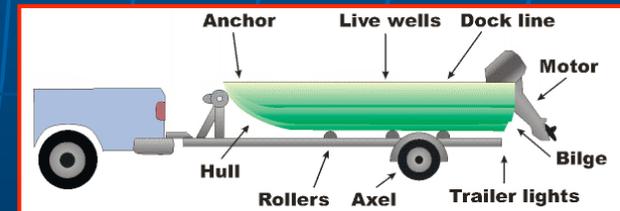
Bio-fouling

Less Ice = More Platforms? = More Risk?



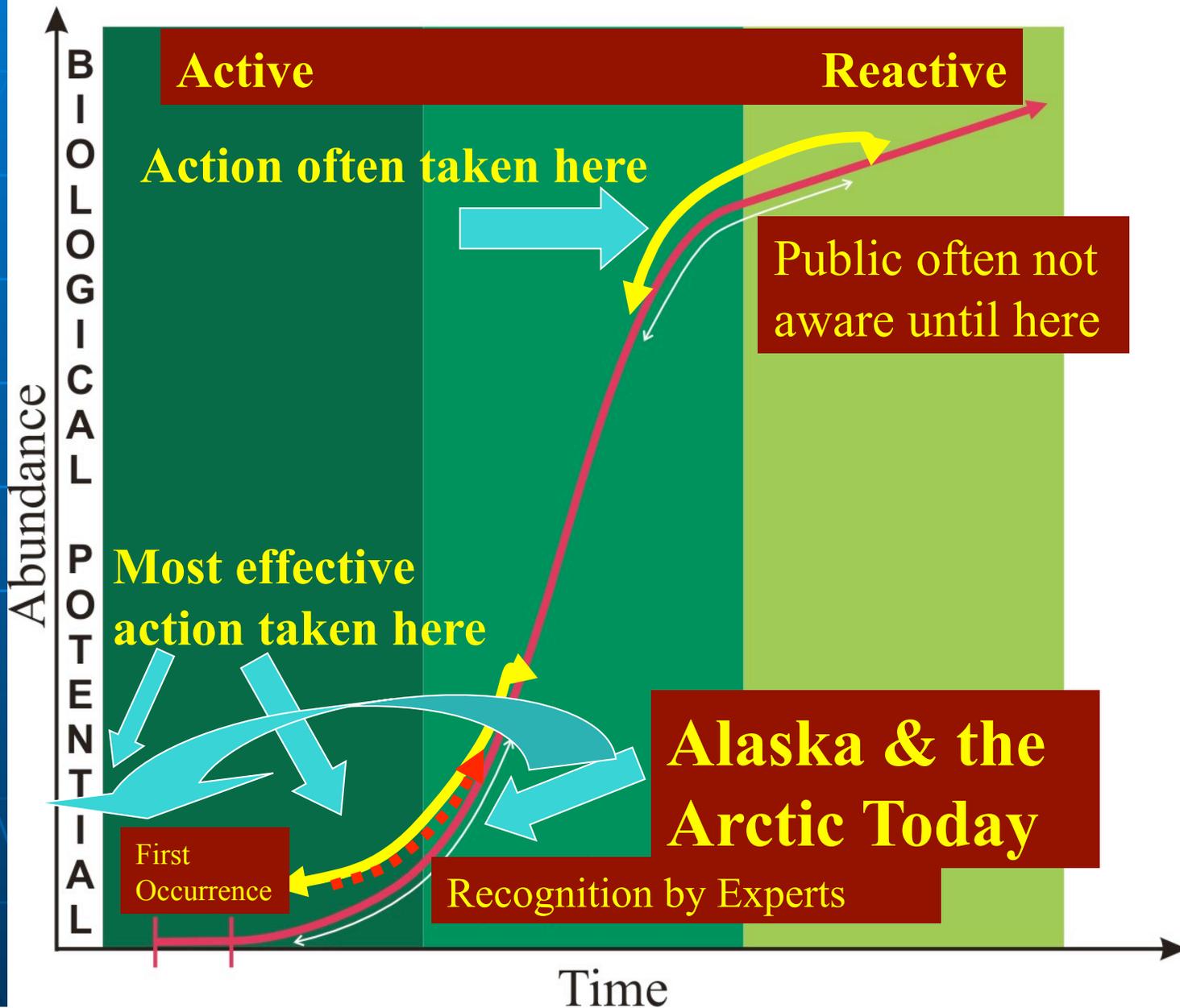
Prevention Planning

Hazard Analysis & Critical Control Points (HACCP)



**To Prevent Spreading Zebra Mussels
Inspect all parts of your boat and trailer**

Perception of an Invasive Species



If We Can't Stop the Warming (soon), We Can Slow the Tide of Invasion -- if (and only if) we work together to:

- Prevent (plan, educate, assist & do not intentionally introduce more!)



- Detect (citizen-enabled, science-driven)

- Respond (Do Not Dither!)





QUESTIONS?

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Canadian waterweed (*Elodea canadensis*)



Reed Canarygrass (*Phalaris arundinacea*)



What's the Biggest Disaster for Alaska Seabirds?



Think it was EVOS?

RAT SPILLS



Are Even Worse!!

RATS!!



Norway Rats – mostly from **ship wrecks, have invaded many Alaska islands (Unalaska, Adak, Kiska, ...)**

Did You Know?

Each year rats kill more Alaska seabirds than did the entire Exxon Valdez Oil Spill!



Rats eat eggs, chicks, and adult birds!