Risk to Alaska Communities from Ocean Acidification

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Ocean acidification risk assessment for Alaska's fishery sector

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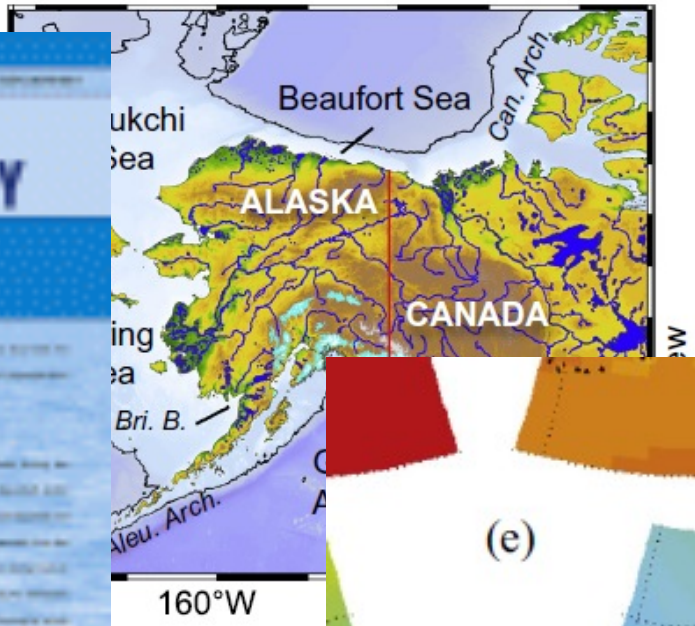
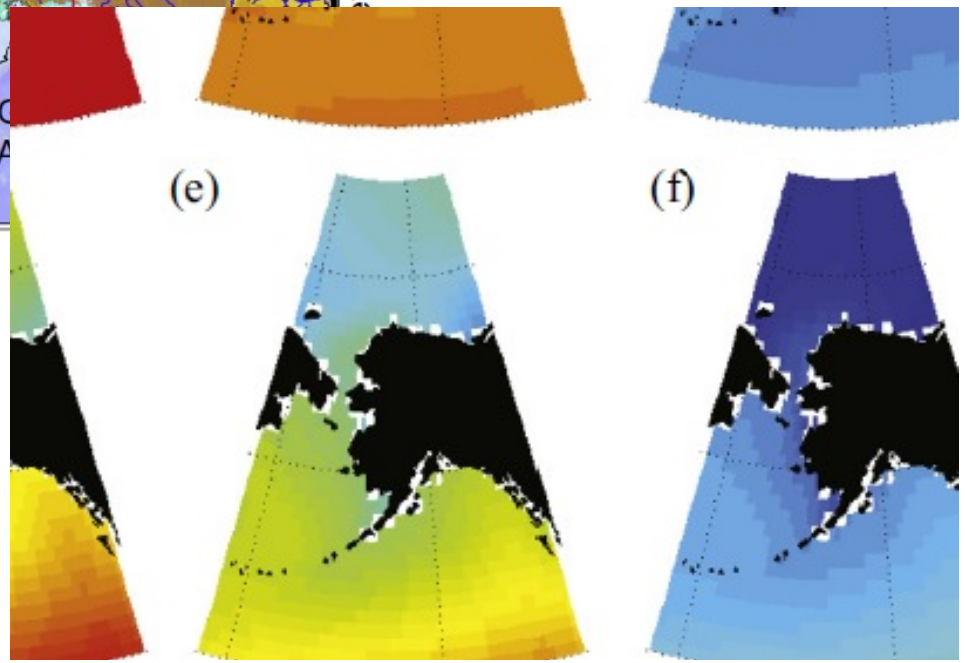
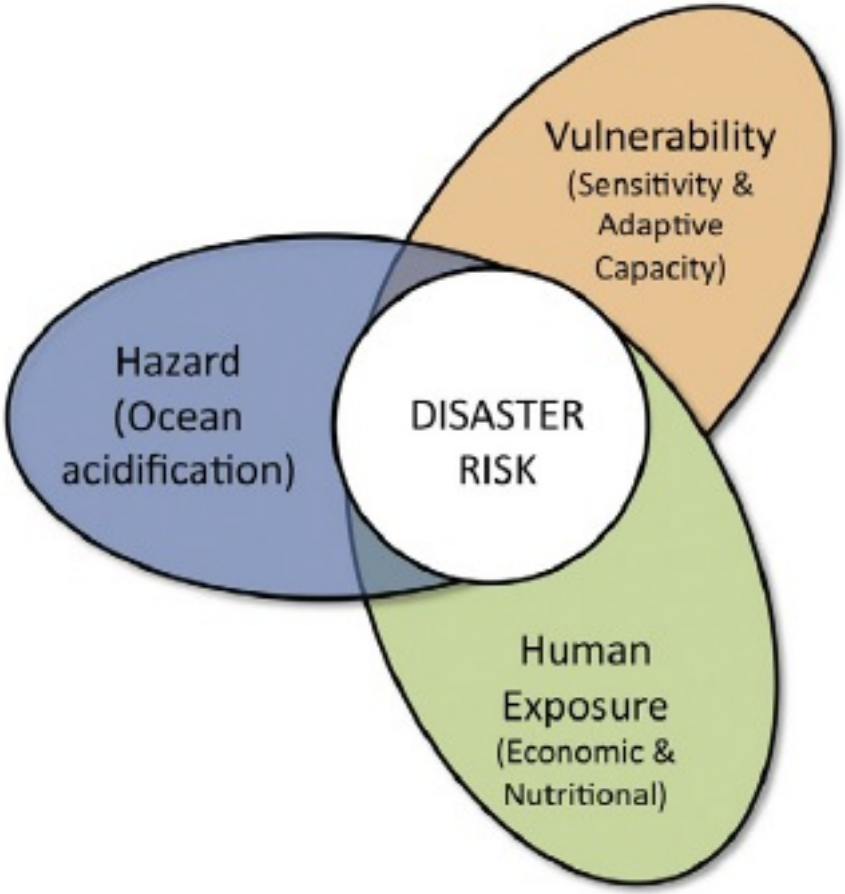




Outline

- What do we mean by risk?
- How are we measuring risk?
- Components of the OA Risk Index
- Results
- Two surprises

What do we mean by risk?



Consistent with IPCC SREX (2012)

How are we measuring risk?

Construct an index:

Hazard x *Exposure* x *Vulnerability*

where,

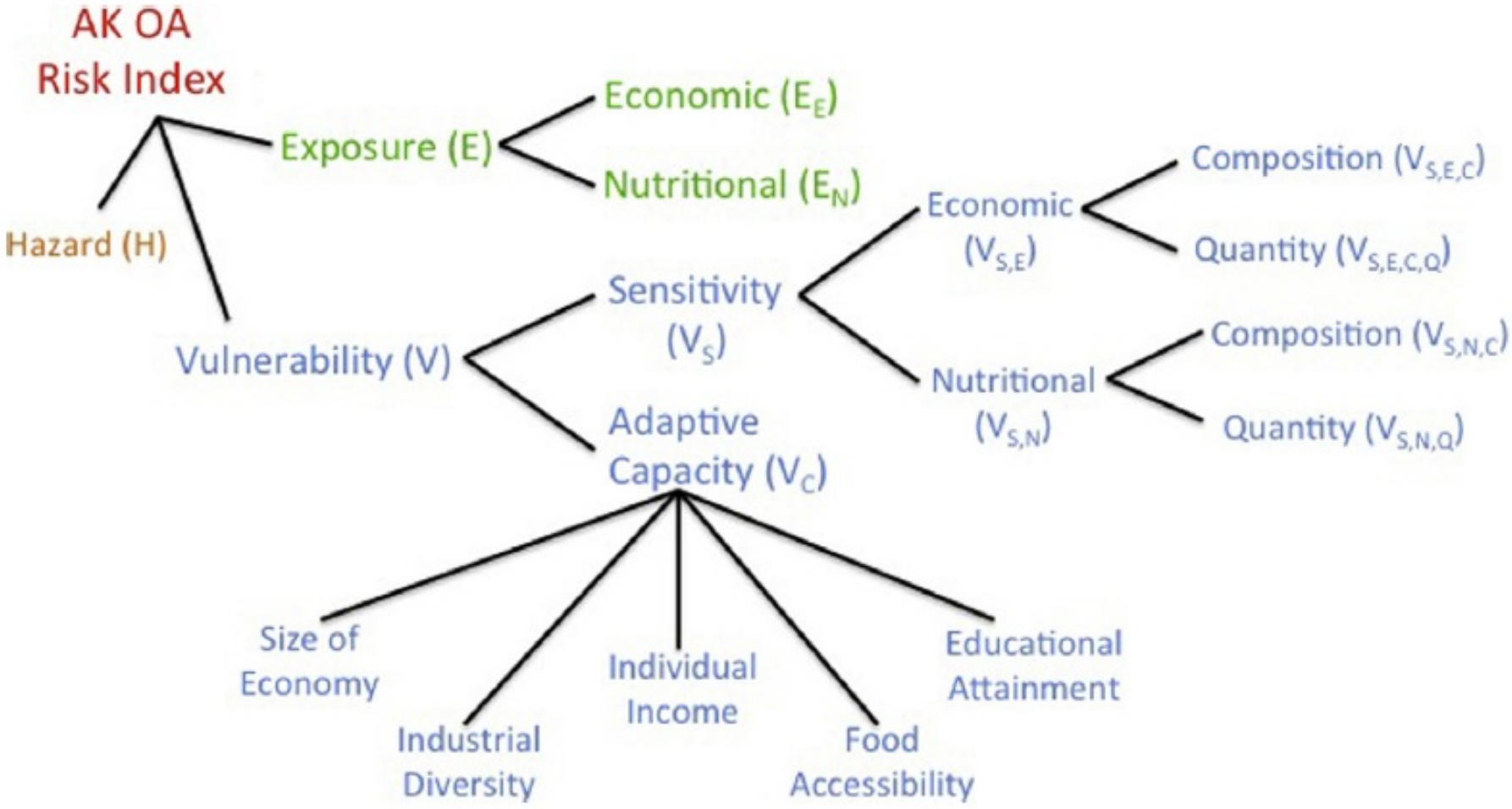
Vulnerability = *Sensitivity* x *Adaptive Capacity*

Hazard ~= chemistry

Exposure ~= OA susceptible share of fishery

Vulnerability ~= fishery share of economy and "ability to cope"

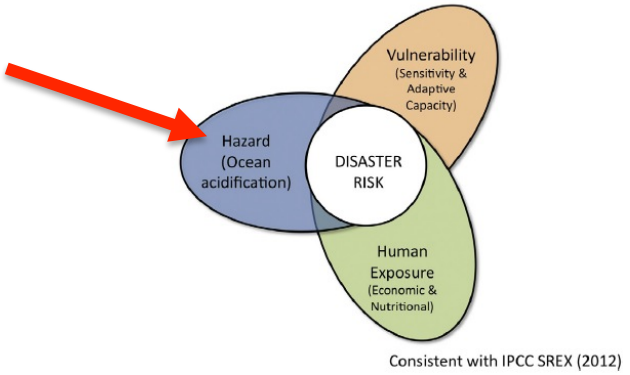
How are we measuring risk?



Heavy use of quartiles

Everybody

Got it?



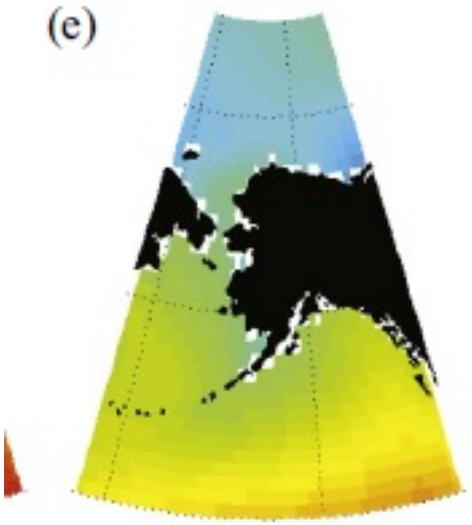
Consistent with IPCC SREX (2012)

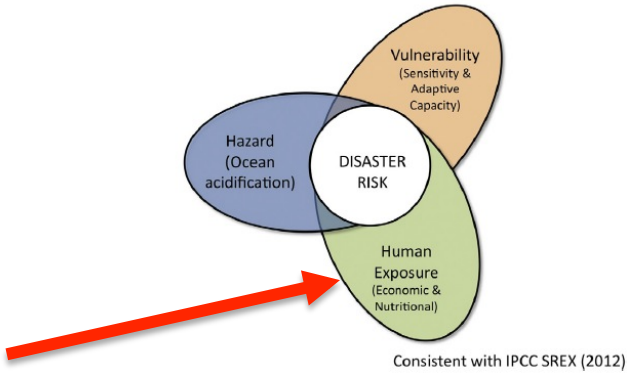
Hazard

For four ocean regions (Gulf of AK, East Bering Sea/Aleutians, Chukchi, Beaufort),

Projected decrease in decadal mean aragonite saturation state ($\Delta\ \Omega_{arag}$),

Between 2003-2012 and 2090-2099





Exposure

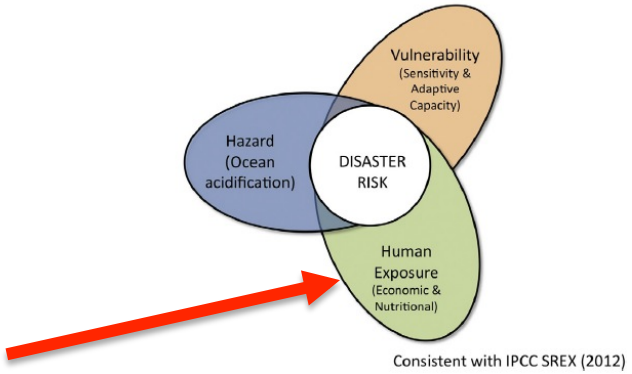
Economic exposure (E_E)

= 2 x (shellfish share of commfish revenue)

+ 1 x (salmon share of commfish revenue)

Example: Bristol Bay Borough:

2 x (0) + 1 x (.96) = 0.96



Consistent with IPCC SREX (2012)

Exposure

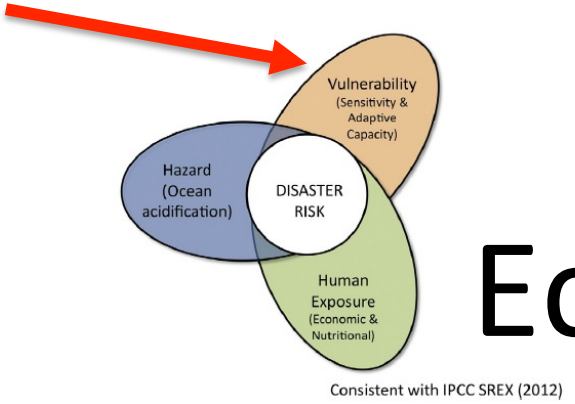
Nutritional exposure (E_N)

= 2 x (shellfish share of subsistence fish weight)

+ 1 x (salmon share of subsistence fish weight)

Example: Kodiak:

2 x (.09) + 1 x (.44) = 0.42



Consistent with IPCC SREX (2012)

Vulnerability: Economic Sensitivity

Economic Sensitivity (V_{SE})

= 50% x quartiled (!)

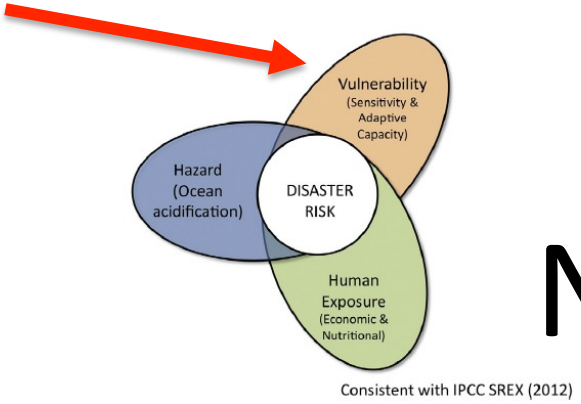
Average revenue per worker in the [harvesting plus processing] fish "industry"

+ 50% x quartiled (!)

Share of population working in fish x share of shellfish & salmon in total fish weight

Example: Anchorage: ($66,131 and .001180)

.5 x (4) + .5 x (2) = 3



Consistent with IPCC SREX (2012)

Vulnerability: Nutritional Sensitivity

Nutritional Sensitivity (V_{SN})

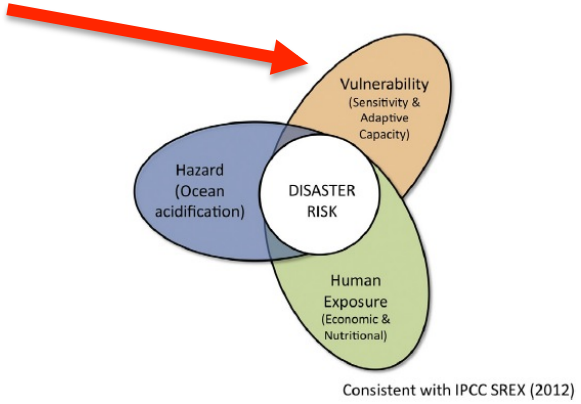
= 50% x quartiled:

2 x (shellfish share of per capita subsistence fish weight)

+ 1 x (salmon share of subsistence fish weight)

+ 50% x quartiled:

Total subsistence fish pounds per capita



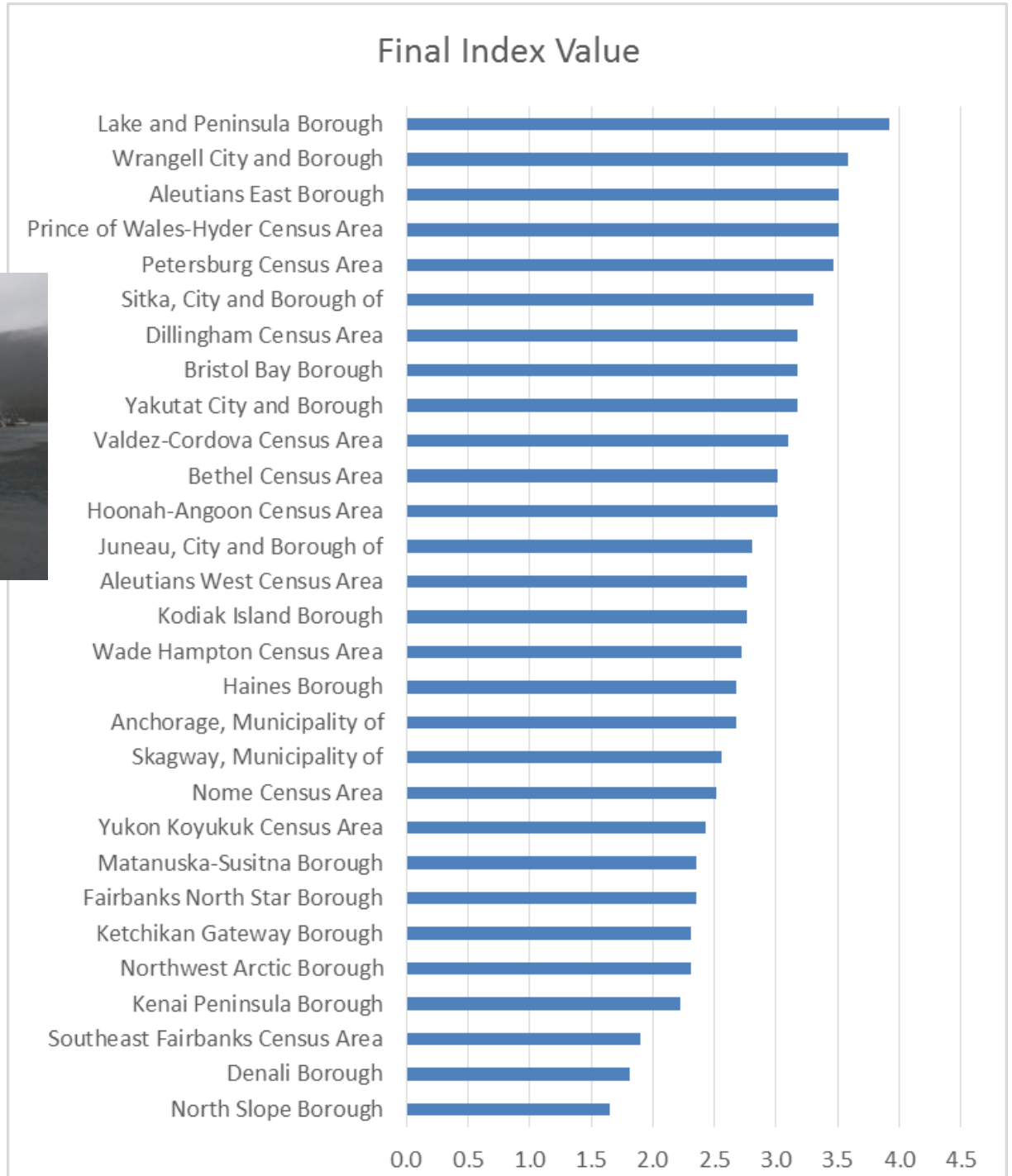
Consistent with IPCC SREX (2012)

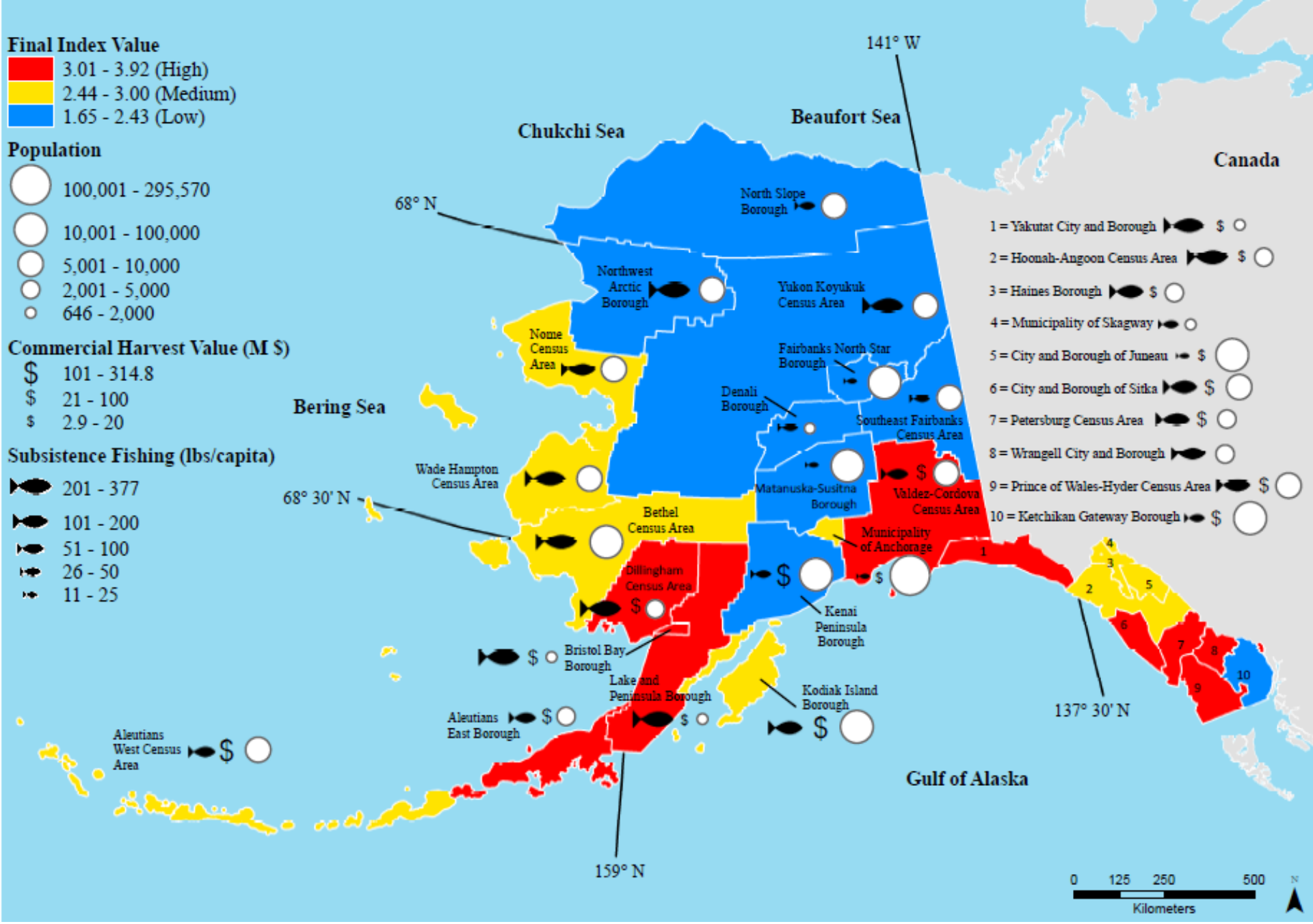
Vulnerability: Adaptive Capacity

Weighted sum of normalized (0-1):

- per capita personal income
- poverty rate (.33)
- unemployment rate (.33)
- % HH income from AK Permanent Fund Dividend (.33)
- industrial diversity
- food accessibility

Results


Final Index Value
Lake and Peninsula Borough
Wrangell City and Borough
Aleutians East Borough
Prince of Wales-Hyder Census Area
Petersburg Census Area
Sitka, City and Borough of
Dillingham Census Area
Bristol Bay Borough
Yakutat City and Borough
Valdez-Cordova Census Area
Bethel Census Area
Hoonah-Angoon Census Area
Juneau, City and Borough of
Aleutians West Census Area
Kodiak Island Borough
Wade Hampton Census Area
Haines Borough
Anchorage, Municipality of
Skagway, Municipality of
Nome Census Area
Yukon Koyukuk Census Area
Matanuska-Susitna Borough
Fairbanks North Star Borough
Ketchikan Gateway Borough
Northwest Arctic Borough
Kenai Peninsula Borough
Southeast Fairbanks Census Area
Denali Borough
North Slope Borough
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5


Final Index Value
3.01 - 3.92 (High)
2.44 - 3.00 (Medium)
1.65 - 2.43 (Low)
Population
100,001 - 295,570
10,001 - 100,000
5,001 - 10,000
2,001 - 5,000
646 - 2,000
Commercial Harvest Value (M $)
$ 101 - 314.8
$ 21 - 100
$ 2.9 - 20
Subsistence Fishing (lbs/capita)
201 - 377
101 - 200
51 - 100
26 - 50
11 - 25
Chukchi Sea
Beaufort Sea
Canada
Bering Sea
Gulf of Alaska
141° W
68° N
68° 30' N
137° 30' N
159° N
North Slope Borough
Northwest Arctic Borough
Yukon Koyukuk Census Area
Nome Census Area
Fairbanks North Star Borough
Denali Borough
Southeast Fairbanks Census Area
Wade Hampton Census Area
Matanuska-Susitna Borough
Valdez-Cordova Census Area
Bethel Census Area
Municipality of Anchorage
Dillingham Census Area
Kenai Peninsula Borough
Bristol Bay Borough
Lake and Peninsula Borough
Kodiak Island Borough
Aleutians East Borough
Aleutians West Census Area
1 = Yakutat City and Borough
2 = Hoonah-Angoon Census Area
3 = Haines Borough
4 = Municipality of Skagway
5 = City and Borough of Juneau
6 = City and Borough of Sitka
7 = Petersburg Census Area
8 = Wrangell City and Borough
9 = Prince of Wales-Hyder Census Area
10 = Ketchikan Gateway Borough
0 125 250 500
Kilometers
N

Surprise: Anchorage

Ranked 17 of 29

Why so high?

High fish income per fish worker

And,

High share of OA-susceptible fish

And, ?

Surprise: Kodiak

Ranked 14 of 29

Why?

Low share of OA-susceptible fish in both commercial and subsistence fisheries.

…..Halibut?

References

Mathis, J.T.; Cooley, S.R.; Lucey, N.; Colt, S.; Ekstrom, J.; Hurst, T.; Hauri, C.; Evans, W.; Cross, J.N.; Feely, R.A. 2014. Ocean Acidification Risk Assessment for Alaska's Fishery Sector. *Progress in Oceanography* (2014), doi: http://dx.doi.org/10.1016/j.pocean.2014.07.001