Variability and uncertainty challenge human communities

Human communities need to be able integrate over variability in the aggregate social-ecological system
Variability in social-ecological systems occurs at many scales

38% of fish stocks exhibit regime shifts (Vert-pre et al. 2013)

Regime shift in salmon prices impacted Alaskan fishers
Strategies for coping with variability

**Forecasting**

difficult to predict the future

**Insurance**

transfer damages from unexpected shocks

**Diversification**

shown to benefit individual fishers from interannual variation (Kasperski and Holland 2013)

**Maintain flexibility**

adapt to changing conditions
The North Pacific ocean is notoriously variable

These regime shifts affect species differently and change the overall composition
Fishing is important to Alaskan communities

Credit: NOAA
Questions

Were fishing revenues in Alaskan communities impacted by regime shifts in the North Pacific ecosystem and in salmon prices?

Were communities with more diverse fishing opportunities buffered and better able to adapt to these regime shifts?
Alaskan fishing revenue data

Commercial Fisheries Entry Commission

Census of fishing catches and revenues for Alaska since 1975

Catch records for 64 fish stocks (species and locations)

Revenue allocated to 105 individual fishing communities

Thousands of permit holders

Socio-economic benefits at the scale of communities as fishing generates taxes and other commerce with the communities

Credit: T. Walsworth
Ocean regime changes and market shifts impact fisheries catch and revenue

Redrawn from Hare and Mantua (2000)

Variation in the diversity of fishing opportunities across Alaskan fishing communities

Cline et al. (2017), Nature Commun.
Diversification and turnover of fishing opportunities buffer against abrupt shifts

Conclusions

Ecosystems rarely collapse, but often undergo significant shifts in composition.

Diversification and turnover of fishing opportunities can buffer communities against large scale unexpected shifts.

These are tangible strategies that may ensure sustainable communities despite deep uncertainty about the future.

Credit: NOAA