Vulnerability: Can We Define it Before it is too Late for Fish?

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PROGRAM ON THE ENVIRONMENT

Background

- Fisheries are a source of food, industry, and cultural significance for billions of people.
- The first step we must take in preparing fisheries for climate change is to define fish species vulnerability.
- There are currently no universal guidelines for defining vulnerability for fish species.
- This gap in knowledge must be filled in order to properly conserve and monitor fish species.

Research Question

What are the key components that impact vulnerability to climate change in fish species?

Internship

- I interned with the National Oceanic and Atmospheric Administration at the Alaska Fisheries Science Center.


Figure 1: Map of the Gulf of Alaska

- My project focused on identifying temperature sensitivities for nine fish species in the Gulf of Alaska (Figure 1).

Methods

- A literature review was conducted consisting of peer reviewed research papers and stock assessments.
- This information was used to fill out an excel spreadsheet for each species to determine their vulnerability.
- Sources used were ranked according to relevance and reliability.

Results

Ideal Habitat
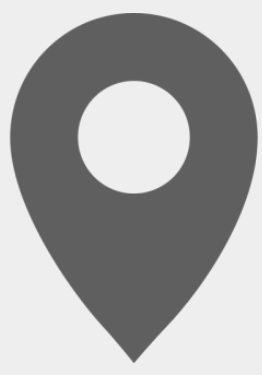
- Ideal habitat takes into consideration depth, ideal temperature, timing of key life history events, and accessibility of preferred prey.

Exposure

- Exposure is the extent to the degree that the species' ideal habitat is currently experiencing changes in temperature.

Sensitivity

- Sensitivity is a measure of how deeply a species is affected by changes in temperature.
- Sensitivity takes into consideration the ability of a population to migrate away from regions experiencing heating events.

Table 1: This table depicts the three main factors that impact vulnerability to climate change. The table contains the values for four of the nine species evaluated in the adult life history stage. These four species were chosen because they are representative of the other species investigated. Cells that contain question marks are unknown.

Species	Ideal Habitat	Exposure	Sensitivity
Arrowtooth Flounder	100-300m; 4.2-5.4 °C	Low	Low
Pacific Cod	0-500m; 4.5-6°C	Medium	Low
Sablefish	300-500m	?	Low
Northern and Southern Rock Sole	0-100m; 3.0-6.0°C	Medium	Low

Significance

Figure 2: Pacific herring is one of the least economically valuable fisheries in the Gulf of Alaska. In 2020, it was valued at $2.9 million.

- This work can be used to identify key characteristics that make fish species vulnerable to climate change.
- This project helps identify gaps in knowledge for fish species in the Gulf of Alaska in order to implement more effective management strategies (Table 1).

Next Steps

- There is a correlation between fishery value and amount of research done on species (Figure 3).
- Vulnerability can not be assessed for a species if not enough is known about them.
- More research must be performed on less economically valuable species because they still have inherent and ecological value (Figure 2).
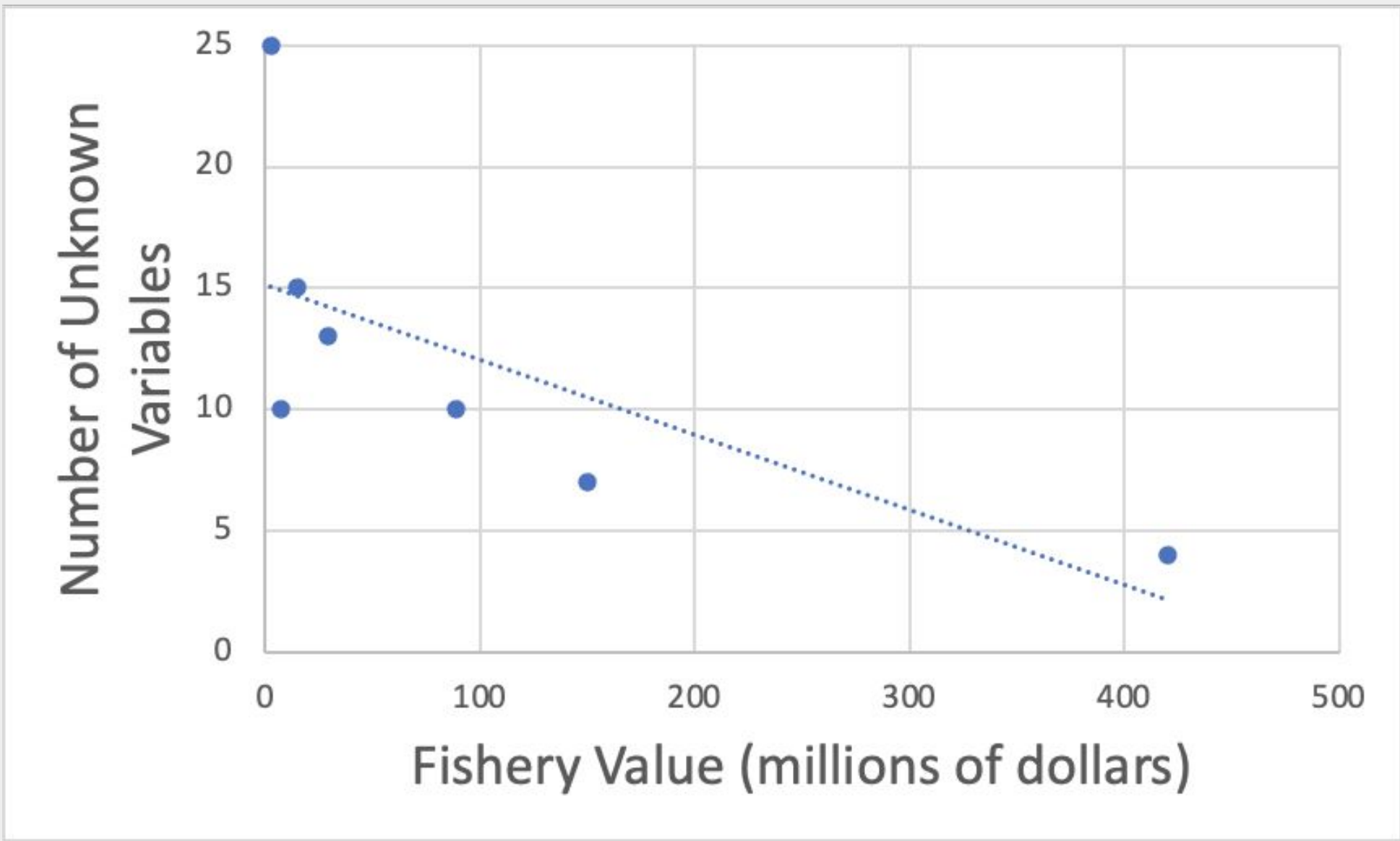

Figure 3: This graph shows the inverse correlation between fishery value and gaps in knowledge for species in the Gulf of Alaska. The less profitable a fishery is, the less research is done.

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