Introduction

The Western stock of Steller sea lions (Eumetopias jubatus) around the Aleutian Islands and Southeast Alaska have declined over 80% in the past 50 years. At the same time, the Eastern stock of Steller sea lions have been rising.[1] It is unknown what factors may affect this decline, however, research suggests that the four main theories for the decline are: dietary changes of sea lions due to overfishing, increased predation, climate change, or disease. We investigated the effects transient killer whales (Orcinus orca) predation has on Steller sea lion populations.

Methods

Our Model:

\[
\frac{dx}{dt} = bx(1 - \frac{x}{k}) - \frac{axy}{1 + hx} - jx \quad (1)
\]

\[
\frac{dy}{dt} = \frac{caxy}{1 + hx} - ly \quad (2)
\]

Equation 1: Change in sea lion population = growth rate - death rate due to orcas - death rate due to other factors

Equation 2: Change in orca population = growth rate due to killing sea lions - death rate due to other factors

Results

Our model with reasonable parameters resulted in the rapid decline of Steller sea lions as seen by the data. We found that, over time, the two populations can achieve coexistence under these conditions. More Western Steller sea lion and transient orca stock data is needed to refine our ODE model to truly assess the impact of transient killer whale predation on Steller sea lion populations.

Further Research

Our work provides one scenario that our model can produce. We can extend this research by solving our model analytically, providing further analysis on different end-behaviors.