2018

Mathematically Predicting the Aleut Tribe Population Using Archaeological Data

Jack Conrad Kiefer II
Utah State University

Paden Allen Thompson
Utah State University

Follow this and additional works at: https://digitalcommons.usu.edu/roch

Part of the Computer Engineering Commons, and the Mathematics Commons

Recommended Citation
https://digitalcommons.usu.edu/roch/89
Sanak Island, located off the southern Alaska Peninsula, was home to the native Aleut peoples for thousands of years. Their hunter-gatherer society depended heavily on the arctic and marine ecosystem for food resources.

In 2015, a team of archaeologists from Idaho State and Utah State universities went to the island and collected data about the Aleut population size and their diet. This study constructed a dynamical model to mathematically predict the Aleut population over time in order to gain insights into how food resources affected the Aleut people’s ability to survive.

Food intake parameters were fit to historic population data on two important animals in the typical Aleutian diet: salmon (family Salmonidae) and Steller sea lions (family Otariidae). Proportional calorie representations for these animals were found in order to best fit the Aleut data.

This study constructed a dynamical model to mathematically predict the Aleut population over time in order to allow for the inclusion of real data sets.

Methods

Beginning with a hunter-gatherer predictive model pioneered by theoretical biologist Gary E. Belovsky (Figure 2) the model was modified to allow for the inclusion of real data sets.

Food intake parameters were fit to historic population data on two important animals in the typical Aleutian diet: salmon (family Salmonidae) and Steller sea lions (family Otariidae). Proportional calorie representations for these animals were found in order to best fit the Aleut data.

Results

This model’s prediction is generally consistent with most of the dynamics of the archaeological data (Figure 1). However, there are certain time periods where the population is not well-accounted for by the model.

The fitted parameters were found as follows (expressed as calories per person per day):

- Calories from salmon: 0.036 kcal
- Calories from sea lions: -0.81 kcal
- Baseline caloric availability: 2566.8 kcal

Conclusions

Early results suggest that local salmon population changes seem to be a positive factor in driving the size of the Aleut population through time. Additionally, there exists the theoretical possibility that a greater numbers of Steller sea lions have a negative impact on the Aleut peoples’ ability to obtain sufficient amounts of food. We hope further research and analyses will provide additional insights into our findings.

Figure 1 – Population prediction

![Population prediction graph]

This model’s prediction is generally consistent with most dynamics of the archaeological data.

Figure 2 – The model

![Model equation]

The Belovsky model with our modifications. Shown here alongside an analogous English explanation.