

Project update – Integration of Traditional Knowledge and western science using a Bayesian approach for fully informed models

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Project Goals & Objectives

Our overall goal is to combine Traditional Knowledge (TK) with satellite telemetry data of seal movement to get a better understanding of seal habitat use and behavior. To do this we are focusing on three seal species: ringed, bearded, and spotted seals.

Our specific objectives are to:

1. Document TK on the habitat use and behavior of ringed, bearded, and spotted seals.
2. Convert the TK into a form that can be use in species habitat and movement models.
3. Include both TK and satellite telemetry data into the same model using a Bayesian framework.

Methods

1. TK interviews – We will conduct interviews with knowledge holders using a semi-directed approach, which allows for the interviews to be more like a conversation. We will focus on topics around seal habitat use (e.g., if they are associated with specific ice concentrations) and behavior (e.g., if seals are feeding in specific areas).
2. Conversion of TK – We will convert the TK into a form that can be included in our seal habitat and behavior models.
3. Combination of TK and telemetry data – We will combine the converted TK with satellite telemetry data from the North Slope Borough Department of Wildlife. We will use Bayesian modeling because this approach lets us combine different type of data and information into the same model.
4. Comparison – We will compare models that include TK with those that do not.

Throughout this project we will go back to the hunters we have interviewed to confirm our interpretation of the TK and get feedback on our approach and results.

Progress & Results

- TK Interviews
 - Utqiagvik, AK – We interviewed 9 hunters in November 2018 and conducted follow up interviews to review our interpretation of the TK in September 2019. Billy Adams and Andy Vonduyke identified hunters to be interviewed.
 - Kotzebue, AK – We interviewed 10 hunters in November 2019, with the assistance of Alex Whiting. We attempted to conduct follow-up interviews in May 2023 but were not able to due to limited availability of the hunters. Alex Whiting has assisted with review of the documented TK.
 - Point Hope, AK – We interviewed 7 hunters in November 2019, with the assistance of Michael Tuzroyluck. We conducted follow up interviews in May 2023 to review interpretation of the TK.
- Documentation of TK
 - We have published a manuscript summarizing the TK of ringed, bearded, and spotted seals in Utqiagvik, AK to the journal Arctic Science.

Gryba R, HP Huntington, AL Von Duyke, B Adams, B Frantz, J Gatten, Q Harcharek, H Olemaun, R Sarren, J Skin, G Henry, M Auger-Méthé. 2021. Indigenous Knowledge of bearded seal (*Erignathus barbatus*), ringed seal (*Pusa hispida*), and spotted seal (*Phoca largha*) behaviour and habitat use near Utqiagvik, Alaska, USA. *Arctic Science* 7: 832–858 dx.doi.org/10.1139/as-2020-0052
 - We have prepared a manuscript summarizing the TK of ringed, bearded, and spotted seals in Kotzebue and Point Hope, AK and plan to submit to Arctic in April 2024.
- Seal habitat and behavior modeling
 - We have developed a method to convert TK of seal habitat use into a form that can be mapped as a probability of observing a seal.
 - The probabilities are then included in a statistical model that can be used to predict the habitat use of seals using only TK as a data source.
 - We applied the method to ringed seal habitat use in summer in the waters near Utqiagvik, Alaska
 - All of the maps and predictions have been reviewed and corrected by the hunters we interviewed in Utqiagvik, Alaska
 - A manuscript has been prepared (available as a pre-print on bioRxiv) and we are submitting to a peer-review journal in March 2024
 - This work was presented to the Ice Seal Committee Feb. 2023
- TK and animal movement data modelling
 - We have developed a method to include both TK and animal movement data (e.g., satellite location data) in the same statistical model.
 - These models can be used to predict habitat use of an animal that includes both sources of information.

- We applied the method to ringed seal habitat use in summer in the waters near Utqiagvik, Alaska and compared models that use only TK, TK and animal movement data, and animal movement data only models (Figure 1)
- All of the maps and predictions have been reviewed and corrected by the hunters we interviewed in Utqiagvik, Alaska
- A manuscript has been prepared and will be submitted April 2024

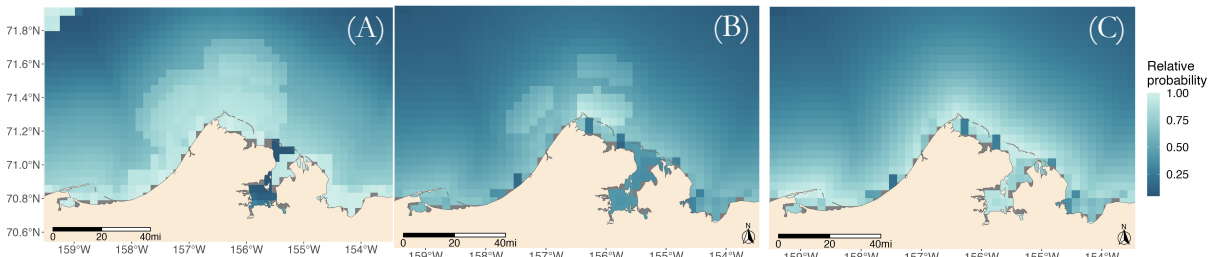


Figure 1. Prediction of the probability of ringed seal presence based on (A) Indigenous Knowledge (IK) only, (B) IK and satellite movement data, and (C) satellite data only in the waters around Utqiagvik, Alaska, August 15, 2016. Areas in light green show high probability of ringed seal presence, dark green show low probability of ringed seal presence.

Conclusion

Our goal is to develop a method for TK to be included in habitat and behavior models. Our approach should improve models of, and the identification of, important habitat because it can include all of the information that is contained within TK, not just ‘western’ science data. Although we are currently focused on ringed, bearded, and spotted seals in the waters near Utqiagvik, Alaska, our method can be applied to other species and in other regions in the future.