



HOKKAIDO UNIVERSITY

Title	Marine mammals in a warming Arctic : Connections with ecosystem, environment and Inuit in Inglefield Bredning, northwest Greenland [an abstract of dissertation and a summary of dissertation review]
Author(s)	小川, 萌日香
Degree Grantor	北海道大学
Degree Name	博士(環境科学)
Dissertation Number	甲第16229号
Issue Date	2025-03-25
Doc URL	https://hdl.handle.net/2115/95270
Rights(URL)	https://creativecommons.org/licenses/by/4.0/
Type	doctoral thesis
File Information	OGAWA_Monica_abstract.pdf, 論文内容の要旨



学 位 論 文 内 容 の 要 旨/Dissertation Abstract

博士（環境科学）

氏 名/Applicant 小川 萌日香

学 位 論 文 題 名/Title of Dissertation

Marine mammals in a warming Arctic: Connections with ecosystem, environment and Inuit in
Inglefield Bredning, northwest Greenland

（温暖化する北極域の海棲哺乳類：北西グリーンランドにおける海洋生態系、環境、
イヌイトとのつながり）

The Arctic is one of the most rapidly warming regions on Earth, raising concerns about cascading effects on the interconnected relationships among the environment, marine ecosystem, and its apex predator – marine mammals – as well as the Inuit, who depend on them as vital resources. To be able to assess and predict the impacts of climate change across this entire network, we peered into these connections in Inglefield Bredning, home to Greenland's northernmost Inuit communities, by combining analyses of marine mammal biological samples with interviews with Inuit who possess deep knowledge of the local nature and animals. My target species was all marine mammals that visit this area during summer, including the ringed seal (*Pusa hispida*), bearded seal (*Erignathus barbatus*), harp seal (*Pagophilus groenlandicus*) and narwhal (*Monodon monoceros*), all marine mammals coming to this area during summer.

In chapter 2, we report on the feeding ecology and niche overlap among marine mammals revealed by stomach contents collected between 2022 and 2024 to provide detailed insights into the relationships between marine mammals and their prey. Polar cod (*Boreogadus saida*), the most abundant fish in the Arctic, was the dominant prey for marine mammals. Redfish (*Sebastes fasciatus*), an Atlantic fish typically found in more southern waters, was found from the stomachs for the first time in this region, and the composition of zooplankton showed a shift toward Atlantic species compared to previous studies, suggesting that climate change is driving changes in the marine ecosystem in this area. When comparing the four marine mammals, it was suggested that the narwhal has the narrowest dietary niche, making it the most vulnerable to environmental changes.

In chapter 3, we combined the stomach contents revealed in chapter 2 with location data of where each animal was hunted to conduct a spatial analysis of stomach contents to investigate the relationship between marine mammals and environment in terms of foraging. To provide insights into how sympatric species partition foraging areas, we predicted foraging areas for each species using Maxent. The results of the model indicated that the relationship with glaciers is an important parameter in the selection of foraging sites, with this area being particularly important for ringed seals as foraging grounds. Therefore, if glacier retreat continues due to climate

change, it could deprive marine mammals of these crucial foraging sites, potentially leading to changes in their diet and habitat use.

In chapter 4, I focused on the foraging ecology of ringed seals, which particularly use glacier front as foraging ground. By comparing stomach contents data collected in 2003 – before glacier retreat accelerated – with the results of this study, I investigated changes in foraging areas over the past two decades to clarify the impact of climate change on their feeding ecology. My results showed that the importance of glaciers as their feeding grounds has increased, which is likely due to enhanced marine productivity around glacier fronts driven by increased glacial discharge.

In chapter 5, we reported the results of stable isotope values, which reflects long-term dietary patterns that cannot be captured by stomach contents. The trophic levels of organisms in the food web, from zooplankton to marine mammals, were analyzed, and the results regarding contaminant levels in the marine mammals, accumulated through the food web were presented. Although marine mammals belong to similar trophic levels, harp seals showed relatively high levels of contaminants, which is likely due to feeding on more contaminated prey in their southern wintering grounds. If warming leads southern prey species to expand their distribution into this region, it could result in increased impacts of pollutants on marine mammals, and the local people who rely on them as vital food.

In chapter 6, we conducted interviews with local Inuit people to gather information about the region that could not be reflected in the analysis of animal samples, including their deep knowledge built from lived experiences over the past decades, as well as intergenerational knowledge passed down through generations, which finally allowed us to uncover the structure of the interconnected relationships between environmental, ecosystem, and cultural changes in this area. The most significant changes which have been recognized by people were the melting glaciers, sea ice, and icebergs, which have particularly impacted dog sled hunting, making it increasingly difficult to carry out traditional marine mammal hunting methods. Moreover, through listening to their stories, it became clear is that global societal changes may have indirectly, yet significant impacts on their culture and marine ecosystems – Inuit people in this area are struggling in the midst of two changes, a changing environment and societal transformations.

This study comprehensively reveals the connections between the marine ecosystem, environment, and people in the region for the first time with a focus on marine mammals, and provides crucial insights for evaluating and predicting potential impacts of climate change. Results of the study clearly revealed that for both marine mammals and the Inuit people who rely on them as vital resources, climate change is indeed a threat, and there is an urgent need to strengthen resilience to environmental changes in the region. As the impacts of climate change on the environment, marine ecosystems, marine mammals, and local communities are interconnected, multifaceted, and complex, it is essential to approach the issue from multiple perspectives and interdisciplinary ways in devising effective strategies. Furthermore, it is important to emphasize that, in order to achieve social sustainability, it is crucial to conduct research not only by researchers but also in collaboration with local people.