

Nearshore seabed habitats and benthic biodiversity, Arctic Bay, Nunavut.

Michelle Brandt, Ashley Beckett, and Robin Steeg, Biology, University of Saskatchewan;
Malina Garner and Alec Aitken, Geography and Planning, University of Saskatchewan;
Evan Edinger and Trevor Bell, Geography, Memorial University of Newfoundland and Labrador



Introduction

Recent pan-arctic inventories of benthic macrofauna diversity identified the waters bordering the Canadian Arctic Archipelago as some of the most poorly explored marine habitats in the circumpolar North^{1,2,3}. This is especially true for hard substrate habitats and the soft sediments surrounding them. Much of our current knowledge of shallow water (depths < 100 m) benthic community structure along the coastline of Baffin Island is derived from short-term (less than 3 years) studies^{4,5,6}. Benthic community diversity varies over both spatial and temporal scales. Small-scale (i.e., 10's-100's metres) and short-term (i.e., seasonal, annual) variations in benthic community structure are related to factors operating on a local scale, including seabed sediment characteristics.

Objectives

An exploration of the diversity of seabed habitats, derived from information about seabed topography, sediment texture, and the diversity of benthic biota, observed in the coastal environments of Arctic Bay, Nunavut (Figures 1 and 2). This information is compared with similar data acquired near the communities of Gjoa Haven and Igloolik, Nunavut^{4,5}.

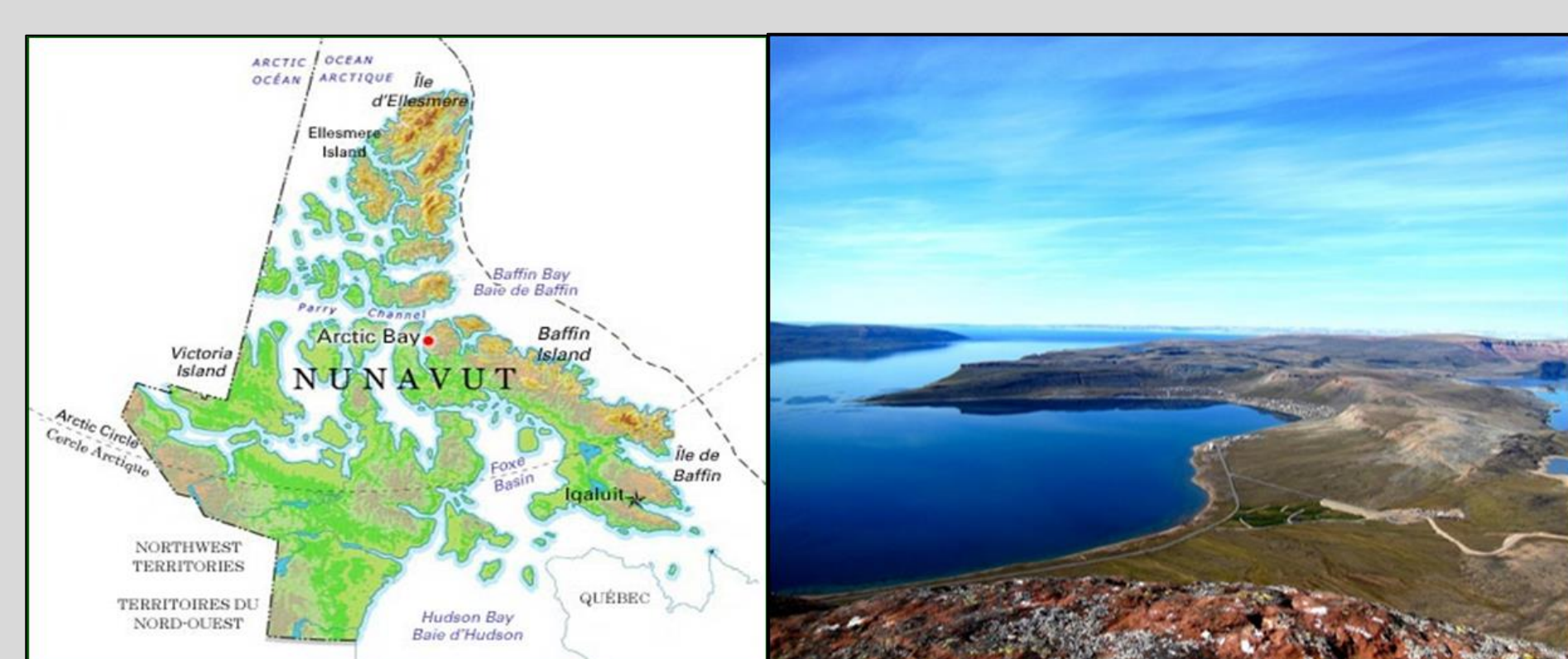


Figure 1. Location of Arctic Bay, Nunavut (image at left) and a panoramic view of the bay (image at right).

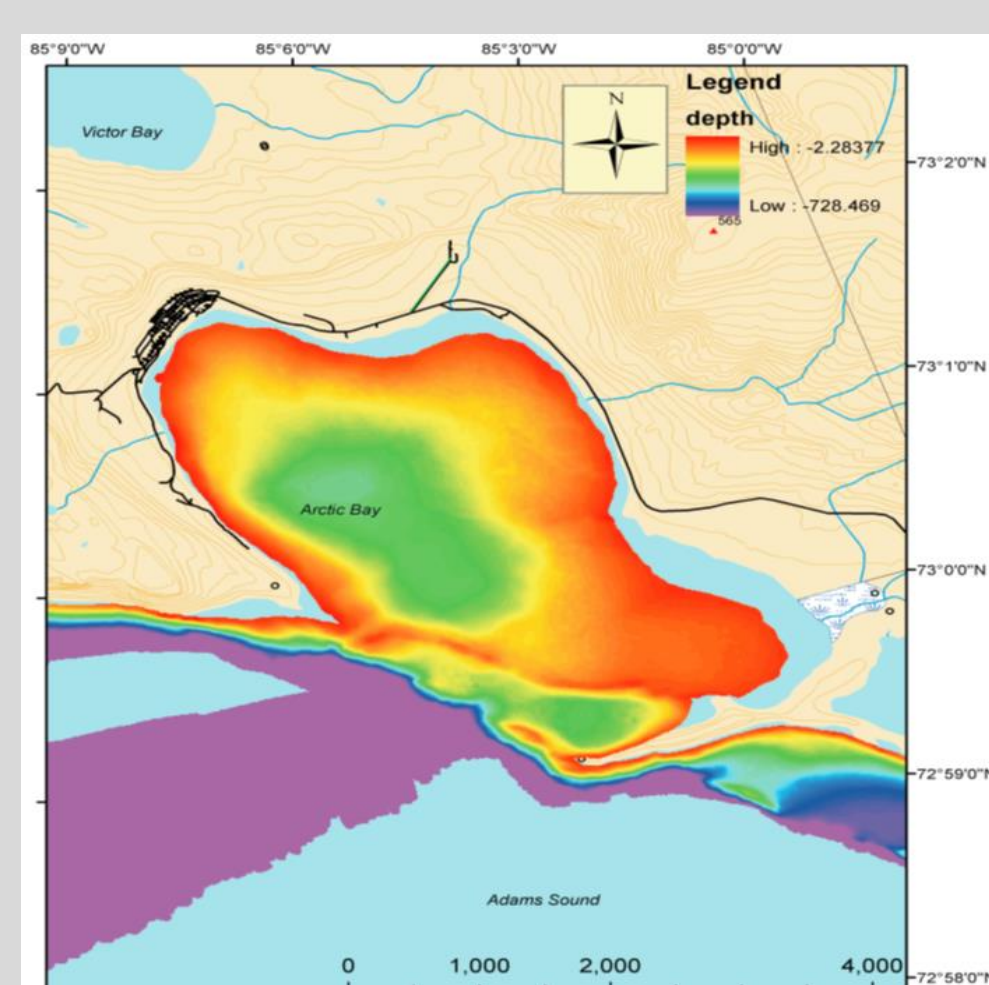


Figure 2. Bathymetry of Arctic Bay. Shallow water indicated in red, orange, and yellow tones; deep water indicated by green, blue and violet tones.

Methods and Materials

Seabed imagery was acquired with a diving camera suspended in an aluminum crash cage. A total of 10.5 hours of video imagery were recorded over 111 transects distributed throughout the bay in July and August, 2009. Thirty-nine video transects were selected for detailed study based on the quality of image resolution and spatial coverage, based on water depth, within the bay. Observations of seabed substrates and the presence of benthic macrofauna were recorded for each video transect.

Frame capture at 20 second intervals was performed on each video transect; a minimum of 20 images were acquired for each of the 39 transects. From these data, 5 images were selected for each transect with priority given to those images with the highest resolution. A 24 point grid was superimposed on each of the 195 images (Figure 3).



Figure 3. A 24 point grid superimposed on a seabed photograph.

The biotic and abiotic elements observed at 20 randomly selected grid points were recorded for each image; these observations were aggregated for each of the 39 transects. This procedure generated a data set of 3900 observations incorporating both biotic and abiotic elements of the sampled seabed habitats. Histograms derived from these observations were generated for each of the 39 sampled video transects (see Figure 4 for examples).

Five transects were selected to illustrate the diversity of seabed habitats represented in the bay (Figure 5): Stations 14 (muddy gravel), 43 (gravelly mud), 67 (mud-draped cobbles), 93 (gravel and coralline algae), and 139 (gravel and coralline algae).

Results

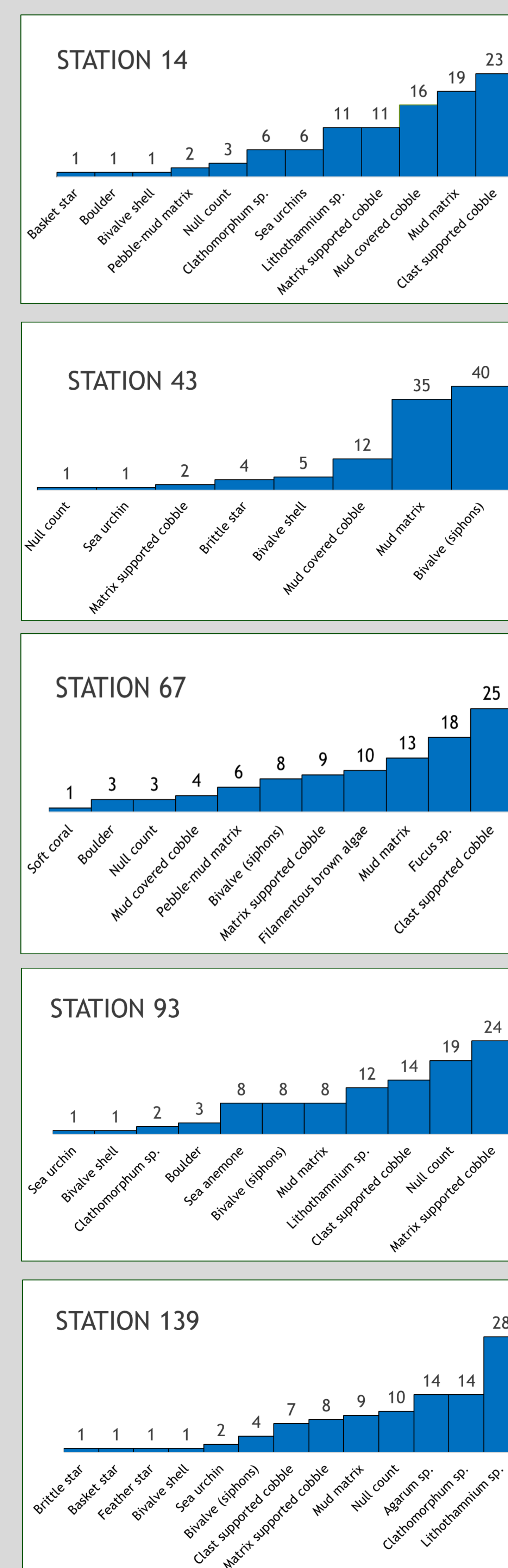


Figure 4. Histograms for grid point data for 5 selected video transect stations.

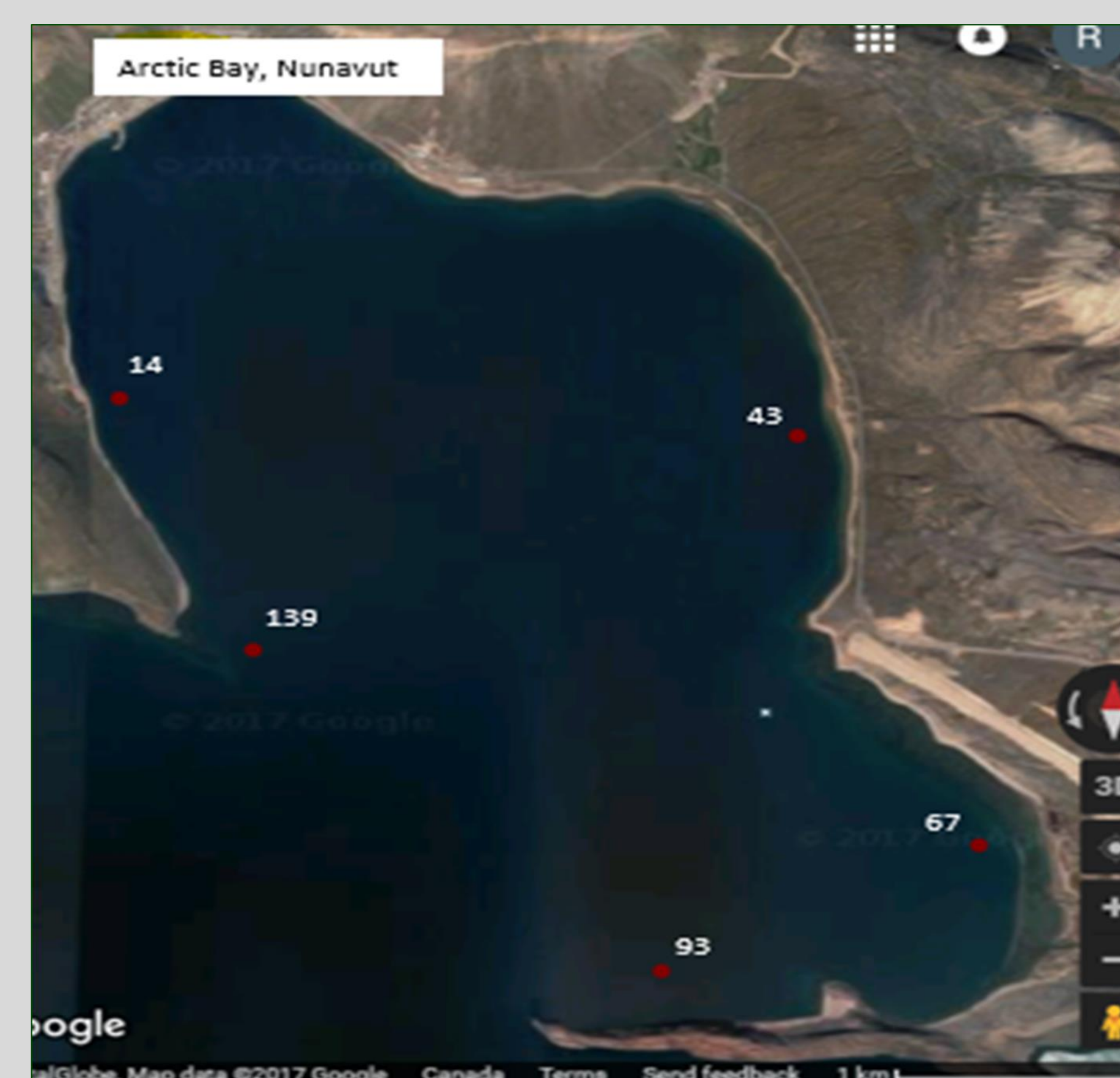


Figure 5. Location of selected video transects.

Discussion

The presence of hard substrates (gravel, cobbles, rock) contributes positively to the presence and abundance of epifaunal invertebrates, notably brittlestars, sea anemones, and sea urchins, and macroalgae. Diverse macroalgae communities dominated by *Agarum* sp., *Coccotylus* sp., *Fucus* sp. and *Laminaria* sp. are observed at Gjoa Haven, Igloolik, and Arctic Bay. What distinguishes the biota in Arctic Bay is the presence and abundance of coralline algae (*Clathromorphum* sp. and *Lithothamnium* sp.; see Stations 14, 93 and 139).

Fine-grained substrates (mud, sand) at Gjoa Haven, Igloolik and Arctic Bay are dominated by infaunal bivalves and polychaetes (see Stations 43 and 67).

References

1. Archambault, P., et al. 2010. *PLoS One*. doi.org.10.1371/journal.pone.0012182
2. Piepenberg, D., et al. 2011. *Marine Biodiversity*, 41: 51-70.
3. Roy, V., K. Iken, and P. Archambault. 2015. *Arctic*, 68: 180-192.
4. Brown, T.M., E.N. Edinger, R.G. Hooper, and K. Belliveau. 2011. *Arctic*, 64: 281-301.
5. Dale, J.E. and K. Leontowich. 2006. *Géographie physique et Quaternaire*, 60: 63-80.
6. Aitken, A.E., M.J. Risk, and J.D. Howard. 1988. *Journal of Sedimentary Research*, 58: 969-978.

Acknowledgements

The authors thank the community of Arctic Bay (Ikpiarjuk), the Nunavut Research Institute, the Natural Sciences and Engineering Research Council (NSERC), ArcticNet, the Memorial University of Newfoundland and Labrador (MUN), and the University of Saskatchewan for the financial and logistical support required to undertake this research project. Grab sampling and drift video image acquisition were undertaken by Meghan Goobie, an Environmental Science student at MUN.