



REPORT

Chapter 4.0 Benthic Infauna

2024 Milne Port Marine Environmental Effects Monitoring Program (MEEMP) and Non-Indigenous Species/Aquatic Invasive Species (NIS/AIS) Monitoring Program

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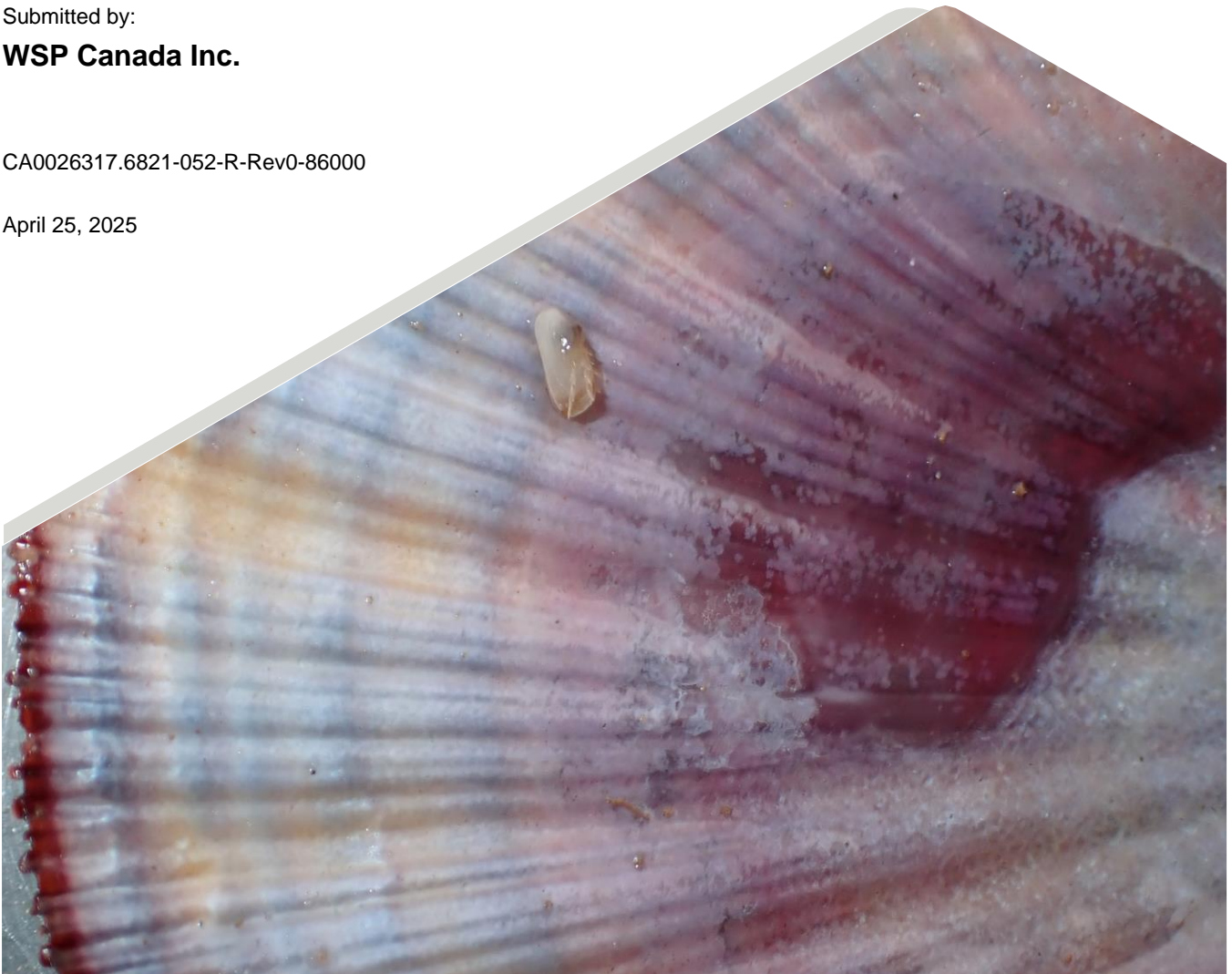


Table of Contents

4.0 BENTHIC INFAUNA 1

4.1 Introduction..... 1

4.1.1 Objectives 1

4.2 Study Design..... 1

4.2.1 Background 1

4.2.2 Indicators..... 2

4.3 Materials and Methods..... 1

4.3.1 Field Methodology..... 1

4.3.2 Data Analysis 2

4.3.2.1 Data Screening 2

4.3.2.2 Benthic Infauna Community Indicators 2

4.3.2.3 Statistical Analysis 3

4.3.3 Quality Management..... 4

4.3.3.1 Field QA/QC..... 4

4.3.3.2 Laboratory and Data Analysis QA/QC 4

4.4 Results 5

4.4.1 2024 Benthic Infauna Community Indicators 6

4.4.2 2024 Relative Densities of Major Benthic Invertebrate Taxonomic Groups 8

4.4.3 Statistical Comparisons of Community Indicators (2019 to 2024) 9

4.4.3.1 Total Density 9

4.4.3.2 Richness 10

4.4.3.3 Simpson’s Diversity Index..... 12

4.4.3.4 Simpson’s Evenness Index..... 14

4.5 Discussion..... 15

4.5.1 Benthic Community Composition..... 15

4.5.2 Density and Richness 16

4.5.3 Diversity and Evenness 16

4.6	Conclusions and Recommendations	17
4.7	Closure	18
4.8	References	19

TABLES

Table 4-1: MEEMP Benthic Infauna and Sediment Quality Capesize Sampling Stations at Milne Port (2024)	1
Table 4-2: Marine Environment TARP Framework for Benthic Infauna ¹	5

FIGURES

Figure 4-1: Capesize Vessel Sediment Quality and Benthic Infauna Sampling Stations, 2024.	4
Figure 4-2: Community Endpoints of Benthic Infauna from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2024.....	7
Figure 4-3: Relative Density of Major Benthic Infauna Taxonomic Groups from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2024.	8
Figure 4-4: Observed Values of Benthic Infauna Total Density at Capesize Sampling Stations, 2019–2024.....	10
Figure 4-5: Observed Values of Benthic Infauna Richness at Capesize Sampling Stations, 2019–2024.	11
Figure 4-7: Simpson's Evenness Index Values for Benthic Infauna at Capesize Sampling Stations, 2019–2024.....	14

APPENDICES

Appendix 4A

Photographs

Appendix 4B

Biologica Environmental Services Ltd. Methods

Appendix 4C

Biologica Environmental Services Ltd. Raw Data

Appendix 4D

Summary Statistics

Appendix 4E

2023-2024 Benthic Community Indicator Plots

Appendix 4F

Power Analysis

ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Definitions
AIC	Akaike information criterion
Biologica	Biologica Environmental Services Ltd.
CD	Chart datum
cm	Centimetre
FEIS	Final Environmental Impact Statement
HDPE	High-density polyethylene
L	Litre
mm	Millimetre
m ²	Square metres
MEEMP	Marine Environmental Effects Monitoring Program
MMP	Marine Monitoring Plan
NIRB	Nunavut Impact Review Board
NIS/AIS	Non-Indigenous and Aquatic Invasive Species
No.	Number
Org/m ²	Organisms per square meter
PC	Project Certificate
p _i	Proportion of the i th taxon
%	Percent
QA/QC	Quality Assurance/Quality Control
QIA	Qikiqtani Inuit Association
S	Total number of taxa
SDI	Simpson's Diversity Index
SEI	Simpson's Evenness Index
SW	West Transect
TARP	Trigger Action Response Plan
UTM	Universal Transverse Mercator
x	Magnification factor

4.0 BENTHIC INFAUNA

4.1 Introduction

This chapter presents the results of the benthic infaunal monitoring program, a component of the larger Marine Environmental Effects Monitoring Program (MEEMP) conducted within the vicinity of Milne Port in Milne Inlet, during the 2024 open-water season. The 2024 MEEMP benthic infaunal sampling program was focused on the eight Capesize sampling stations introduced during the 2023 MEEMP to assess potential change in benthic infaunal communities associated with potential impacts of large ore carriers utilizing the Ore Dock. The 60-station joint radial transect benthic and sediment sampling program, with a monitoring frequency of every three years, was last conducted in 2023 and is scheduled for monitoring in 2026.

The Capesize sampling program was developed in consideration of the additional commitment for monitoring for potential effects of the increased use of larger ore carriers (i.e., Capesize and Baby Cape) in 2023 under Amendment 5 of Nunavut Impact Review Board (NIRB) Project Certificate (PC) 005. Conditions are described in Chapter 1.0, Table 1-2, PC No. 005 Conditions related to the monitoring include PC Conditions No. 76, 87, 99(a), 99(c), and 126.

4.1.1 Objectives

The MEEMP objectives are outlined in Section 1.3 of Chapter 1.0 (Program Overview). The objectives specific to the 2024 benthic infaunal sampling program are:

- Characterize and interpret benthic infauna communities at eight stations established in Milne Port for the purpose of identifying Project-related effects due to the use of larger ore vessels (Baby Cape and Capesize) at Milne Port.
- Verify predictions made in the Final Environmental Impact Statement (FEIS; Baffinland 2012, 2013) and subsequent addenda to the NIRB regarding effects on benthic infauna communities, as applicable.
- Recommend any necessary and appropriate changes to the benthic infauna component of the MEEMP for future years.
- Involve Inuit in the marine benthic infaunal monitoring program and include protocols that are responsive to Inuit concerns.

4.2 Study Design

4.2.1 Background

In 2023, NIRB accepted the Sustaining Operations Proposal and issued Amendment 5 of Project Certificate 005. Under Amendment 5, Term and Condition 83(a) required Baffinland to update the marine sediment quality program to reflect the increased use of larger ore vessels at Milne Port. Baffinland committed that stations SW-1 through SW-4, SE18-1, SNW-1, and two new stations (SCV-1 and SCV-2) added in 2023 would be monitored for scouring effects on sediment and benthic infauna for three years after the initial use of large (Baby Cape and Capesize) ore carriers in fall 2023 (Commitment 10, SOP Technical Comment QIA ME-7(3); NIRB, 2023).

Following this three-year period, Baffinland will consider a reduced frequency in sampling at these locations (once every three years) if sediment and benthic conditions at these sites are shown to be stable and within the limits of impact predictions. As the initial Capesize ore carrier use in Milne Port was planned to take place in the late ice-free period of 2023 (29 August 2023), initial sampling for Capesize vessel effects monitoring commenced in August 2023 (August 4-19, 2023), with the intention of documenting existing conditions for benthic infauna prior to the use of the larger vessels. In total, there were five Capesize (3 Newcastlemax and 2 Baby Cape) ore carrier arrivals to Milne Port during the 2023 shipping season.

In 2024, benthic infauna sampling was conducted at the eight Capesize sampling stations mentioned above that were established for the Capesize Vessel Existing Conditions Sampling Program and represents Year 1 of the Capesize program. The full joint transect radial sampling program was not conducted in 2024 based on the adjusted monitoring frequency of every three years, 2023 being the last year the program was sampled. Existing conditions for the Capesize sampling stations were also documented as part of the 2023 MEEMP.

In 2020, station SW-2 stood out as an outlier with substantially reduced benthic infaunal community indicators (e.g., density, diversity) and a coarser sediment composition relative to other stations along the West Transect and compared to previous years. While it is plausible that this result may have reflected variability inherent in a dynamic shoreline environment, the findings may also have reflected localized physical disturbance at station SW-2 in 2020, resulting from propeller-generated currents (propeller wash) from Project vessels. To determine whether Project activities contributed to these differences, targeted benthic infauna and sediment quality sampling was performed at station SW-2 in 2021 and 2022, with the addition of sampling at adjacent West Transect stations SW-1, SW-3, and SW-4 in 2022. The additional stations were added to continue monitoring for signs of recovery and to better characterize variability in benthic infauna. The 2022 and 2023 results suggested that the benthic community at SW-2 appeared to have rebounded from the apparent anomalous results in 2020, with benthic indicators returning to levels more comparable to those found in the 2019 MEEMP program (WSP 2024).

4.2.2 Indicators

Indicators and thresholds for the MEEMP program are described in Chapter 1.0, Section 1.4.2. Performance indicators selected to evaluate potential Project-induced changes in benthic infauna communities include total invertebrate density, taxa richness (number of unique¹ taxa present), Simpson's Diversity Index (SDI), and Simpson's Evenness Index (SEI). These indicators are calculated from data collected for the Capesize sampling stations and analyzed statistically to evaluate Project-related effects within the Milne Inlet study area. The overall trend in benthic communities is compared spatially and temporally examining changes in density, richness, diversity and evenness. These indicators are described in detail in Section 4.3.2.2.

Along with several other components of the MEEMP, the benthic infauna monitoring program has indicators, thresholds and risk categories that are part of Baffinland's Trigger Action Response Plan (TARP), an adaptive management process. The TARP uses effect indicators that are measured against a series of tiered thresholds (i.e., low, moderate and high-risk thresholds) that are designed to guide short-term and long-term adaptive management strategies as outlined in Baffinland (2023). Baffinland has updated the TARP as part of the revised draft Marine Monitoring Plan (MMP) (Baffinland 2023). The pre-defined actions identified in the TARP describe

¹ Did not include higher order taxa for which there exists a lower order identification. For example, does not include *Ophiura* sp. if *Ophiura robusta* is found in the same sample.

the responses that Baffinland would implement should the corresponding threshold levels be exceeded and assuming there is some degree of certainty that the measured change is Project-related. As adaptive management is beyond the scope of the present report, only the indicators, risk categories and thresholds are presented here (Section 4.3.4).

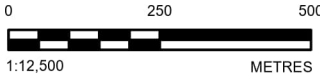


LEGEND

- BATHYMETRIC CONTOUR (5 m INTERVAL)
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- SEDIMENT AND BENTHIC INFAUNA STATIONS
- CAPE SIZE STATION

REFERENCE(S)

BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. MILNE PORT IMAGERY CAPTURED AUGUST 2020 © 2020 DIGITAL GLOBE, INC. ADDITIONAL IMAGERY COPYRIGHT © 20240718 ESRI AND ITS LICENSORS. SOURCE: MAXAR VIVID. USED UNDER LICENSE, ALL RIGHTS RESERVED. PROJECTION: UTM ZONE 17 DATUM: NAD 83



CLIENT

BAFFINLAND IRON MINES CORPORATION

PROJECT

MARY RIVER PROJECT

TITLE

CAPE SIZE VESSEL SEDIMENT QUALITY AND BENTHIC INFAUNA SAMPLING STATIONS 2024

CONSULTANT



YYYY-MM-DD	2025-04-23
DESIGNED	TT
PREPARED	AA
REVIEWED	TT
APPROVED	TT

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4.3 Materials and Methods

4.3.1 Field Methodology

The 2024 sampling program involved the collection of benthic infauna samples from eight stations in support of Capesize vessel monitoring for propeller-wash effects (Figure 4-1; Table 4-1). Each benthic sample was collected as a composite of three individual grabs using a standard Van Veen sampler with a surface area of 0.1 m². Grab samples were examined for acceptability using the criteria outlined in Section 3.3.1 in Chapter 3.0 and, upon acceptance, the three individual grab samples were split using a field splitter purpose-built for this program due to the large volume of the Van Veen sampler.

The composite material was gently rinsed with filtered seawater through a 1 cm mesh sieve to initially remove larger organisms that could otherwise become damaged when the composite material was subsequently filtered through a 0.5 mm mesh sieve. The 1 cm sieved sample was retained as a whole sample. Large debris, such as gravel and cobble, were checked for encrusting fauna and included in the sample jar if potential encrusting epifauna were observed. The 1 cm mesh sieved composited material was further split in half, totalling a ¼ field split.

The ¼ field split sample was retained and transferred to an aluminum sieving table. The sample was gently rinsed through a 0.5 mm mesh sieve with filtered seawater. A representative photograph was taken of the sieved sample, including a visible sample label (Appendix 4A). Remaining material on the sieve was placed in pre-labeled 1-L wide-mouth high-density polyethylene (HDPE) sample jars and preserved in a 10% buffered formalin solution. Containers were then sealed and inverted several times to promote mixing with the formalin. Containers were labeled internally and externally with water-resistant labels. The benthic samples were sent to Biologica Environmental Services Ltd. (Biologica) for sorting and taxonomic identifications, as per the previous MEEMP programs. Details on laboratory methods are provided in Appendix 4B.

Table 4-1: MEEMP Benthic Infauna and Sediment Quality Capesize Sampling Stations at Milne Port (2024)

Station Name	UTM Coordinates (Zone 17W)		Approximate Lateral Distance from Centre of Ore Dock (m)	Water Depth (-m) below Chart Datum ¹
	Easting	Northing		
Capesize Vessel Stations				
SCV-1	503120	7976660	148.1	34.2
SCV-2	503087	7976586	181.7	26.0
SE18-1	503433	7976699	183.8	15.7
SW-1	503162	7976554	125.2	9.6
SW-2	503052	7976533	231.8	16.9
SW-3	502970	7976468	334.1	14.5
SW-4	502867	7976434	441.3	15.6
SNW-1	503301	7976745	124.2	32.6

Notes:

m = metres; UTM = Universal Transverse Mercator

¹ Sample depth was converted to meters chart datum (CD), estimated using tide table for Milne Inlet, Nunavut (<https://tides.gc.ca/en/stations/05791> [accessed March 2025]). The negative (-) numbers indicate 'below' CD.

4.3.2 Data Analysis

4.3.2.1 Data Screening

Detailed sorting methods are provided in Appendix 4B. Taxonomic data provided by Biologica were screened for incidental organisms not considered to be part of the marine benthic infauna community, such as freshwater, terrestrial, planktonic, and parasitic taxa. Meiofauna, such as nematodes, were removed from benthic analysis because these species often fall through the 0.5 mm mesh sieve used to separate benthic infauna from sediments in the field. Nematode species counts would thus not represent true population numbers at each station and could bias station comparisons of total abundance and species diversity. Taxa not expected to have significant direct exposure to sediments were also removed, which included Ostracoda (planktonic taxa) and Copepoda (parasitic and planktonic). Removed and incidental taxa were included in the taxonomic review as part of the non-indigenous species and aquatic invasive species monitoring described in Chapter 8.0.

4.3.2.2 Benthic Infauna Community Indicators

A description of performance indicators (invertebrate density, taxa richness, Simpson's Diversity Index, Simpson's Evenness Index) selected to evaluate potential Project-induced changes in benthic infauna communities is provided below.

Invertebrate Density

Total invertebrate density was calculated as the number of organisms per square metre (organism/m²) for each station. The surface area of the Van Veen (0.1 m²) was multiplied by three to account for the three composite grab samples using the following equation:

$$\text{Density} = \frac{\text{number of organisms (org) per station}}{(\text{grab sampler area} * 3 \text{ composites})}$$

Taxa Richness

Taxa richness is the total number of unique taxa per station and provides an indication of the diversity of benthic invertebrates in an area; a higher richness value typically indicates a healthier and balanced community.

Simpson's Diversity Index (SDI)

Simpson's Diversity Index (SDI) measures the proportional distribution of organisms in the community. The SDI considers the abundance patterns and taxonomic richness of the community. Certain conditions may favour one taxon over another, resulting in the community being dominated by a few taxa, which is reflected in decreased diversity (Simpson 1949). The SDI value ranges between zero and one, where lower values indicate a less diverse community, and higher values indicate a more diverse community. The SDI was calculated using the formula provided by Krebs (1999):

$$SDI = 1 - \sum_{i=1}^S (p_i)^2$$

Where:

- SDI = Simpson's diversity index
- S = the total number of taxa
- p_i = the proportion of the ith taxon

Simpson's Evenness Index (SEI)

Simpson's Evenness Index (SEI) is a measure of the relative abundance of the different taxa contributing to richness, or in other words, how evenly the total invertebrate density is distributed among the taxa present at the station. SEI compares the observed community to a hypothetical community, which consists of the same number of taxa that are equally abundant. The SEI is included along with the SDI to provide context as to whether richness or the distribution of total density among taxa is driving the SDI values. The SEI is also expressed as a value between one and zero, with one representing high evenness (i.e., equal numbers of all taxa present in a sample) and zero representing low evenness (i.e., a high degree of dominance by one or a few taxa).

Communities with a high degree of dominance by one or a few taxa are often referred to as "stressed" and may indicate the influence of natural and/or anthropogenic stressors.

The SEI values were calculated using the following formula (Smith and Wilson 1996):

$$SEI = 1 / \sum_{i=1}^S (p_i)^2 / S$$

Where:

- SEI = Simpson's evenness index
- S = the total number of taxa
- p_i = the proportion of the i^{th} taxon

4.3.2.3 Statistical Analysis

Benthic infauna data collected during the 2023 (existing conditions before Capesize vessel use) and 2024 (Year 1 for Capesize vessel use) sampling programs were analyzed to assess potential effects of propeller wash in the study area. For each Capesize sampling station, temporal trends were evaluated visually using time series plots for each parameter. The analyses of benthic fauna total density, richness, SDI, and SEI were performed in the statistical environment R v.4.4.2 (R 2024) using the package "glmmTMB" (Brooks et al. 2017). To account for potential effects of habitat, each analysis considered three models – one with only fixed effect of year, one with the fixed effects of year but also a covariate of depth (as a nonlinear effect), and one with the fixed effects of year but also a covariate of fines content (as a nonlinear effect). These candidate models were compared using Akaike's Information Criterion corrected for small sample size (AIC_c), where the model with the lowest AIC_c was considered as the best supported by the data and was selected for interpretation (Burnham and Anderson 2002).

The change in benthic density between 2023 (existing conditions) and 2024 (Year 1) was assessed using a mixed-effect negative binomial regression. The response variable was infauna abundance, and an offset of grab surface area was used to account for difference in grab sizes. The fixed effects were the categorical effect of year and a nonlinear effect of fines content (used to account for the effect of habitat); the random effect was an intercept of station.

The change in benthic richness between 2023 and 2024 was assessed using a mixed-effect Poisson regression. The fixed effects were the categorical effect of year and a nonlinear effect of fines content (used to account for the effect of habitat); the random effect was an intercept of station.

The change in Simpson's Diversity Index of benthic infauna between 2023 and 2024 was assessed using a mixed-effect beta regression. The fixed effects were the categorical effect of year and a nonlinear effect of depth content (used to account for the effect of habitat); the random effect was an intercept of station. The change in Simpson's Evenness Index was assessed in the same way, except that habitat effects were accounted for using fines rather than depth.

4.3.3 Quality Management

Quality assurance and quality control (QA/QC) procedures were applied to the field collection, data analysis, and reporting tasks within the benthic infauna component to verify that the data presented were valid and of acceptable quality to address objectives stated in Section 4.1.1.

4.3.3.1 Field QA/QC

QA measures undertaken to confirm benthic infauna sample integrity are the same as those described for sediment quality as noted in Section 3.3.1. Each grab sample was examined for acceptability based on the following criteria:

- The sampler was fully closed.
- There was adequate penetration depth (i.e., sediment volume greater than 25% full).
- The sample did not appear overfilled or disturbed, and the sample did not appear to have been collected at an angle.
- The sampler did not appear to be leaking sediment at a substantial rate (i.e., the top of the sediment profile did not appear to be sloping inwards).

4.3.3.2 Laboratory and Data Analysis QA/QC

Biologica's laboratory QA/QC measures included an assessment of sorting recovery, identification error, and precision/accuracy of sub-sampling. Laboratory procedures included sample sorting measures, spot-checks of portions of samples by a second sorter to ensure all organisms have been removed from the sample, preliminary counting of major groups, and collaborative identification to accurately identify species to their lowest practicable level. Further detailed discussion of the laboratory QA/QC procedures used by Biologica and the findings of their QA/QC assessment are provided in their laboratory reports in Appendix 4B and 4C.

Benthic data received from Biologica were reviewed upon receipt to verify that specified laboratory data quality objectives were met. No inconsistencies were noted that required follow up with the laboratory. Screening of the benthic data and calculation of the benthic indicators were reviewed by a second biologist for accuracy.

4.3.4 TARP Assessment

As part of applying the Trigger Action Response Plan benthic infauna performance indicators were screened against condition status/thresholds in 2024, in order to assess risk levels for each performance indicator (Table 4-2).

Table 4-2: Marine Environment TARP Framework for Benthic Infauna¹

Component	Performance Indicators	Condition Status/Threshold		
		Low Risk	Moderate Risk	High Risk
Benthic Infauna	<ul style="list-style-type: none"> Density Taxa Richness Simpson's Diversity Index Simpson's Evenness Index 	<ul style="list-style-type: none"> Spatial and temporal trend analysis for density or taxa richness suggest a pattern indicative of Port-related effects beyond FEIS² predictions. AND Low Risk Status/Threshold is triggered for sediment. 	<ul style="list-style-type: none"> Spatial and temporal trend analysis for density and taxa richness suggest a pattern indicative of Port-related effects beyond FEIS² predictions. AND Moderate Risk Status/Threshold is triggered for sediment. 	<ul style="list-style-type: none"> To be determined based on outcome of moderate response investigations.

¹ TARP criteria were applied for the Capesize Vessel Sampling Program however there is a 2-year limitation in the data available for analysis (2023 [existing conditions] vs 2024 [Year 1]).

² Predictions made in the Final Environmental Impact Statement (FEIS; Baffinland 2012, 2013) and other submissions to the Nunavut Impact Review Board (NIRB) regarding effects on benthic infauna, as applicable.

4.4 Results

Benthic invertebrate community samples were collected from eight stations located in close proximity to the Ore Dock at Milne Port to monitor potential impacts from the use of the larger Capesize vessels within the study area (Figure -1). Sampling of Capesize vessel stations occurred between 10 and 18 August 2024. Nine Capesize vessels (including Baby Cape) utilized the Ore Dock during the 2024 open water shipping season, with the first vessel arriving in the area on 01 August 2024 and the last vessel arriving on 24 September 2024. Three of the nine Capesize carriers arrived in Milne Port during the sediment sampling program and the remaining 5 vessels arrived once the program had been completed. Five Capesize vessels (including Baby Cape) had arrived in Milne Port during 2023, following completion of the 2023 sampling to document existing conditions before the arrival of the larger Capesize vessels.

Photographs of each sample are provided in Appendix 4A. The laboratory methods report from Biologica and results provided by Biologica are located in Appendices 4B and 4C, respectively. Summary results of the taxonomic analysis of benthic infauna are available in Appendix 4D. The benthic community indicator plots for 2023 and 2024 are available at Appendix 4E.

4.4.1 2024 Benthic Infauna Community Indicators

Benthic invertebrate community indicators calculated from infaunal data collected at the eight Capesize sampling stations are summarized in Figure 4-2 and described below.

- **Total Density**—Density was variable between stations, ranging from 1,073 org/m² (SW-1) to 20,121 org/m² (SW-4). The density range was lower than in 2023, which varied between 6,224 org/m² (SW-3) and 23,756 org/m² (SW-4). Station SW-2 saw the largest change in density between 2023 and 2024, dropping from 23,756 org/m² in 2023 to 2,389 org/m² in 2024 (Appendix 4E – Figures 1-2). However, other stations such as SW-4 decreased by a much smaller amount, and some stations such as SNW-1 had a higher density in 2024 compared to 2023.
- **Richness**— Richness was highest at station SW-4 (71 unique taxa) and lowest at SW-1 (9 unique taxa). The same observation was previously made in 2023, with 61 taxa and 38 taxa, respectively. The most pronounced decrease in richness was observed at SW-1 between the two years, which went from 38 taxa in 2023 to 9 taxa in 2024.
- **Simpson's Diversity Index**—All stations had diverse communities, with SDI values ranging from 0.81 to 0.94, with the highest values observed at station SNW-1. The lowest value was observed at station SW-1.
- **Simpson's Evenness Index**—SEI ranged from 0.10 to 0.59 with the highest value at station SW-1 and the lowest at SW-4, suggesting that distribution of organisms across taxa in SW-4 was generally uneven compared to SW-1. This low evenness indicates that only a few taxa made up the majority of organisms in the community (e.g. *Philomedes* sp., *Chaetozone* spp., *Nereimyra aphroditoides*). A similar low evenness was observed at all stations in 2023.

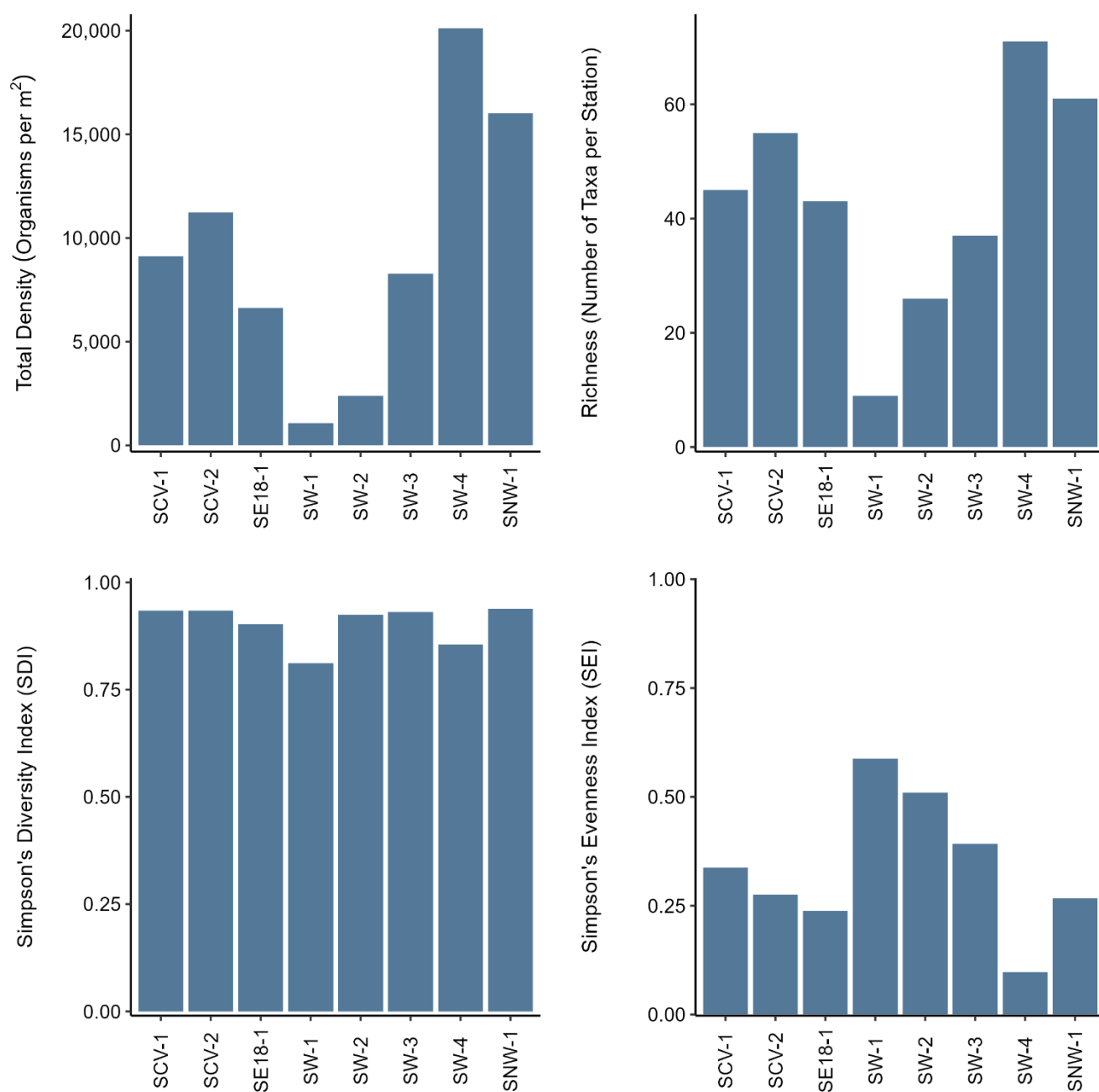


Figure 4-2: Community Endpoints of Benthic Infauna from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2024.

4.4.2 2024 Relative Densities of Major Benthic Invertebrate Taxonomic Groups

Overall, benthic communities were dominated by Polychaeta (42 to 84% of relative abundance), followed by ostracods, bivalves and Malacostraca (Figure 4-3). The most abundant polychaetes were *Nereimyra aphroditoides* (SE18-1 and SW-1), *Chaetozone* sp. (SCV-2, SE18-1, SNW-1, SW-2, SW-3 and SW-4), *Prionospio* sp. (SCV-1 and SCV-2), *Pygospio elegans* (SCV-2) and *Cossura longocirrata* (SCV-1 and SNW-3). Ostracods (*Philomedes* sp.) were present at higher densities in stations SW-4, SNW-1 and SCV-1. A higher proportion of malacostracans, predominantly amphipods and cumaceans, were found at West Transect stations SW-3 and SW-4, whereas bivalves presented a higher proportion at stations not along this transect (i.e., SCV-1, SCV-2, SE18-1 and SNW-1) (Figure 4-3).

The most common bivalve species were *Hiatella arctica*, which accounted for 0% to 10% of total density across the stations, with the lowest relative density at SCV-1 and the highest relative density at SW-1, and *Ennucula tenuis*, which accounted for approximately 6% to 8% at SNW-1 and at SCV-1, respectively. The proportion of other taxa were low across all stations, except at station SW-1, which had a relative density of 16% (dominated by unidentified balanomorphans and the brittle star *Ophiura sarsii*).

A higher proportion of bivalves was observed in 2024 compared to 2023 at stations SCV-2, SE18-1, SW-1, SW-2 and SW-3 (Appendix 4E – Figures 3-4). On the contrary, a drop in ostracod and malacostracan relative densities occurred at stations SCV-2, SE18-1, SNW-1, SW-1 and SW-3 (Appendix 4D). These differences likely reflect the natural variation in the benthic infaunal community.

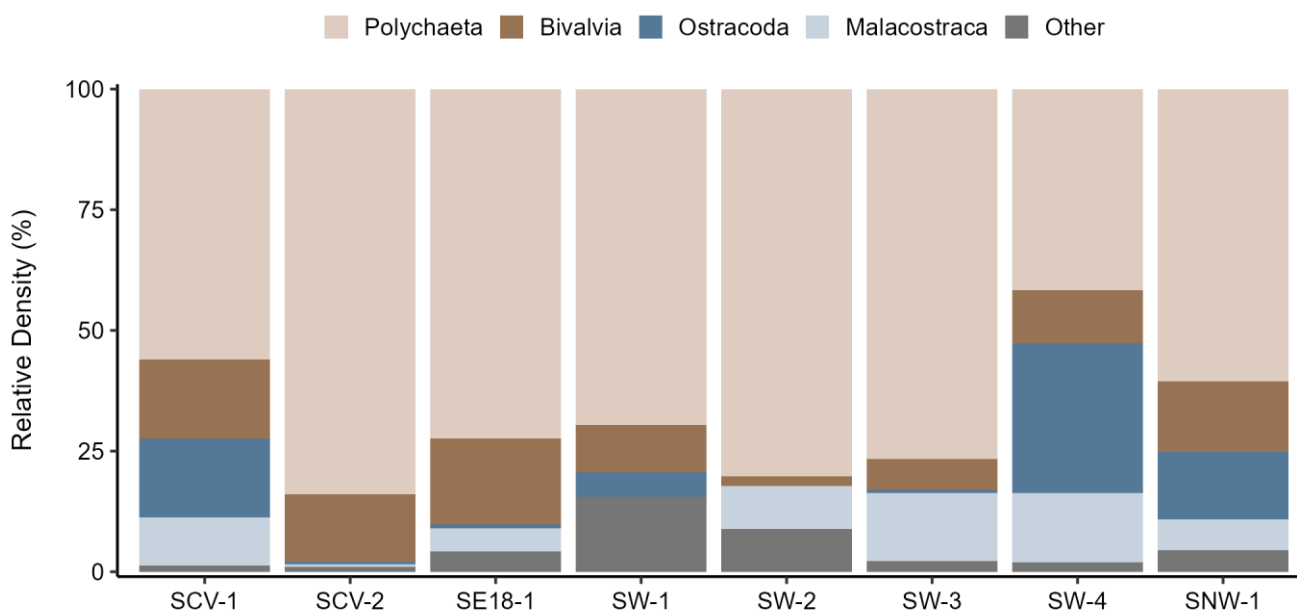


Figure 4-3: Relative Density of Major Benthic Infauna Taxonomic Groups from CapeSize Vessel Stations Near the Ore Dock Area, Milne Port, 2024.

4.4.3 Statistical Comparisons of Community Indicators (2019 to 2024)

Generalized linear models were used to evaluate the significance of changes in community indicators (i.e., total density, richness, SDI, and SEI) between 2023 and 2024, using data collected at Capesize sampling stations. The main effect of each model included the categorical effect of year. Additionally, a main effect of percent fines or depth was used to account for the ecological relationship between total density and habitat variation. Both percent fines and depth were modelled using non-linear terms (i.e., natural splines) to account for non-linearity in trends of indicators relative to habitat variability.

4.4.3.1 Total Density

Total density was highly variable between years within stations (Figure 4-4). At station SNW-1, total density increased over time, whereas total density at SW-3 decreased between 2019 and 2020 and has remained relatively stable since. Total density at stations SW-1 and SW-2 fluctuated between 2019 and 2023, followed by a large decrease between 2023 and 2024. At stations SCV-1 and SE18-1, total density decreased slightly between 2023 and 2024.

The change in total density between 2023 and 2024 was not statistically significant ($P=0.059$), with an effect size of -34%. That is, total density was on average 34% lower in 2024 when compared to 2023 (on the ratio scale). The lack of significance is likely due to the high variability in the data – while 90% decreases in density were recorded for SW-1 and SW-2, SNW-1 and SW-3 showed 33–49% increases in density, and SW-4 and SCV-2 had changes of -15 to +5%. This variability and the small sample size resulted in the lack of statistical significance. The statistical power to detect the observed difference between 2023 and 2024 values was low (power = 0.5; Appendix 4F).

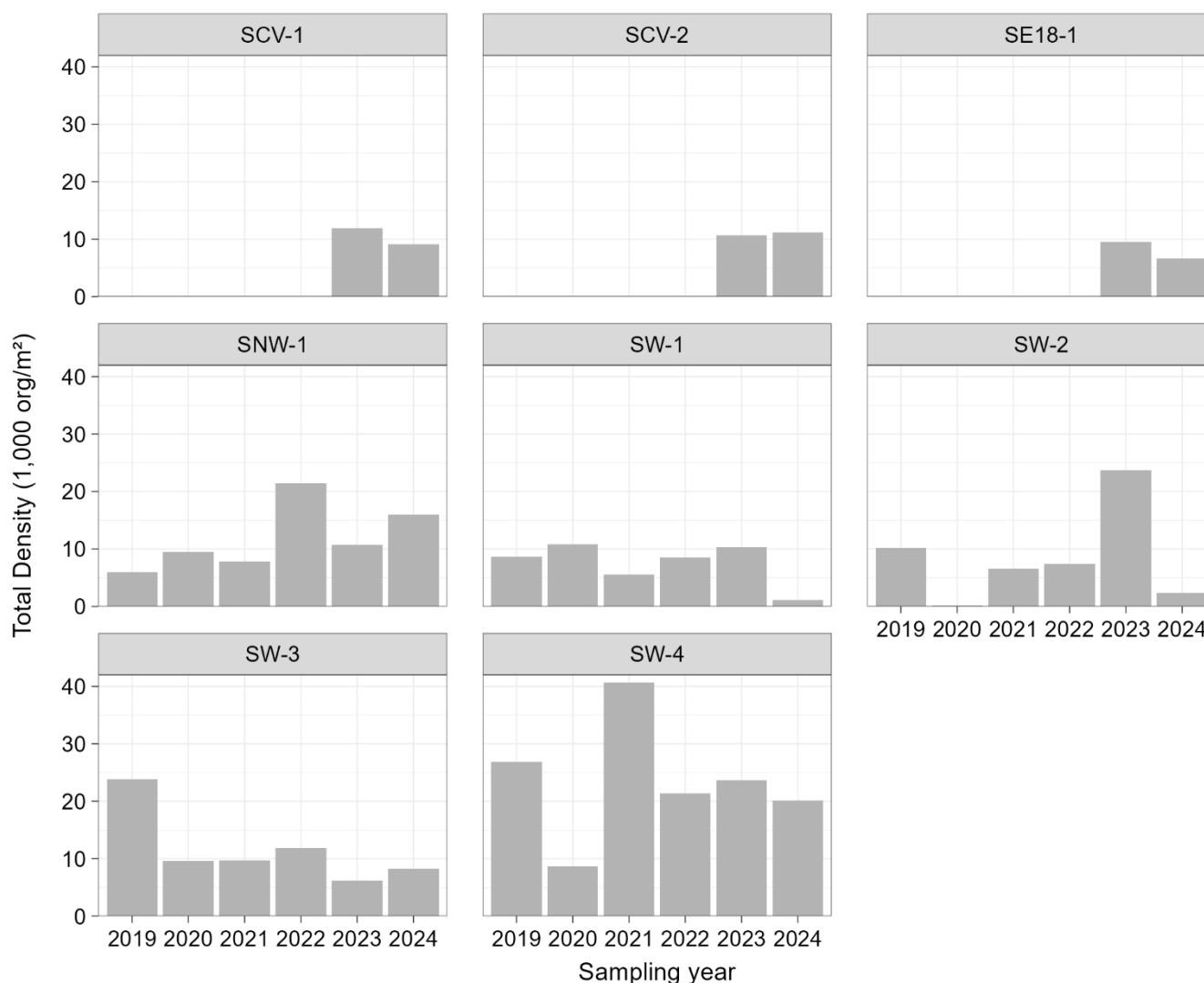


Figure 4-4: Observed Values of Benthic Infauna Total Density at Capesize Sampling Stations, 2019–2024.

4.4.3.2 *Richness*

At the station scale, benthic infauna richness differed between years (Figure 4-5). Richness stayed relatively stable over the years at SNW-1, SW-4, and SE18-1. At SW-3, there was a decrease in richness between 2019 and 2020, however, richness has remained consistent at this station since 2020 with a -5% decrease in 2024. Richness at SW-2 has varied considerably with a large decrease observed in 2020 before rebounding in 2021, 2022, and 2023, and then decreasing again in 2024, but not by the magnitude observed in 2020.

Between 2023 and 2024, changes in richness differed between stations. At four stations (i.e., SCV-1, SW-1, SW-2 and SW-3), richness declined between 2023 and 2024, with effect sizes ranging from -76% (SW-1) to -5% (SW-3). At the remaining four stations, richness increased, with effect sizes ranging from +7% (at SNW-1) to

+20% (at SCV-2). Overall, the change in richness between 2023 and 2024 was not statistically significant ($P=0.19$), with an effect size of -10%. That is, richness was on average 10% lower in 2024 when compared to 2023 (on the ratio scale). The statistical power to detect the observed difference between 2023 and 2024 values was low (power = 0.3; Appendix 4F), as to be expected given the small effect size and high data variability.

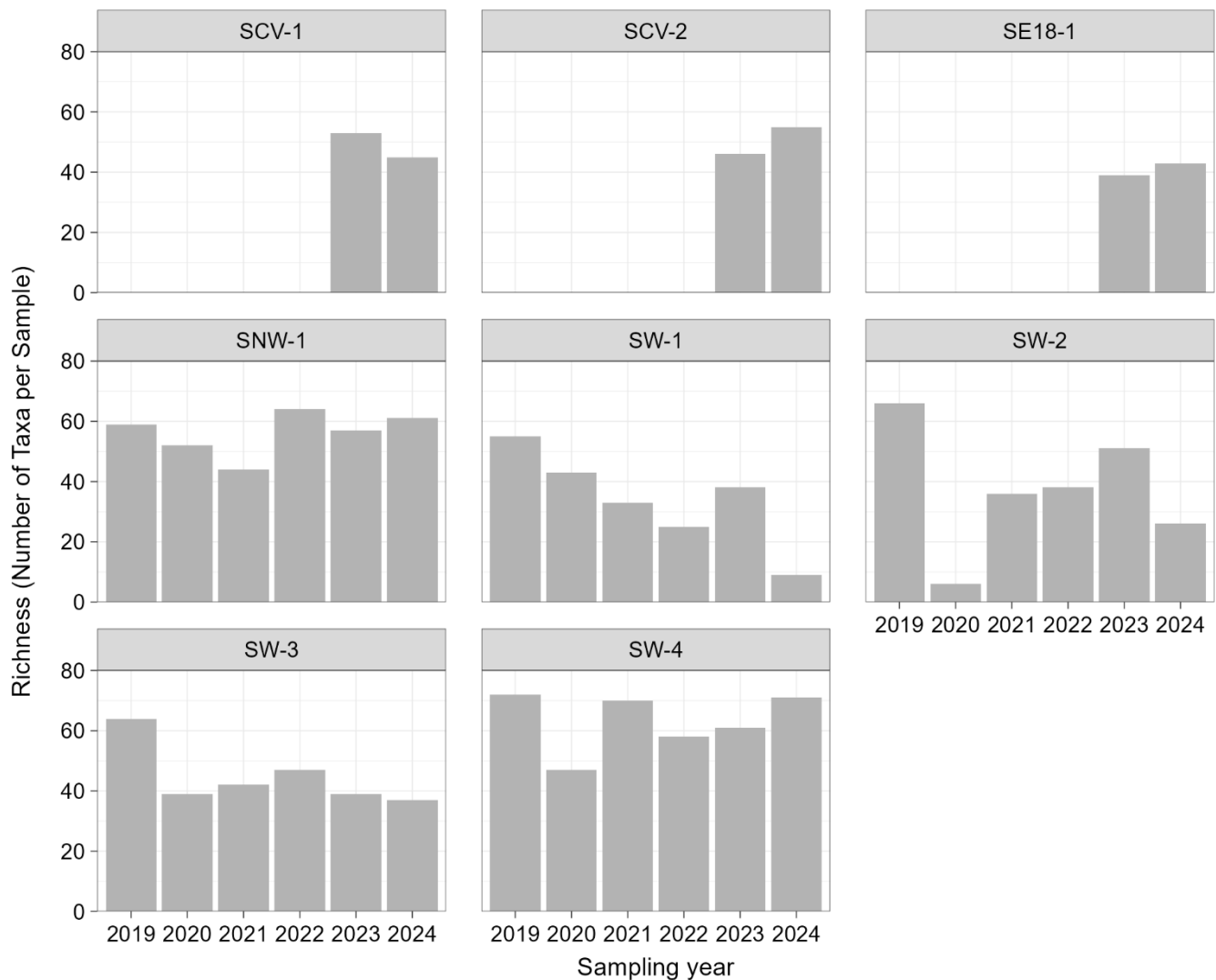


Figure 4-5: Observed Values of Benthic Infauna Richness at Capesize Sampling Stations, 2019–2024.

4.4.3.3 *Simpson's Diversity Index*

The temporal distribution of SDI values differed between stations (Figure 4-6). Similar to richness (Figure 4-5), SDI stayed relatively stable over the years at SNW-1, SW-3 and SW-4 but some decline has been observed over time at SW-1, and fluctuations observed at SW-2. Stations SCV-1 and SCV-2 stayed stable between 2023 and 2024, whereas SDI values at SE18-1 showed an increase.

Between 2023 and 2024, seven out of eight stations had an increase in SDI, with increases that ranged from 0.7% (SW-1) to 266% (SW-2) (on the odds scale as explained in Appendix 4F). At SW-4, the only station where a decrease in SDI was recorded, SDI values decreased by 42% (on the odds scale) between 2023 and 2024. The change in SDI between 2023 and 2024 was statistically significant ($P=0.048$), with an effect size of +45%. That is, SDI was on average 45% higher in 2024 when compared to 2023 (on the odds scale). The statistical power to detect the observed difference between 2023 and 2024 values was low (power = 0.65; Appendix 4F). The large effect sizes required to obtain sufficient power for increasing SDI were due to the high SDI values estimated in 2023 (which were used as the baseline).

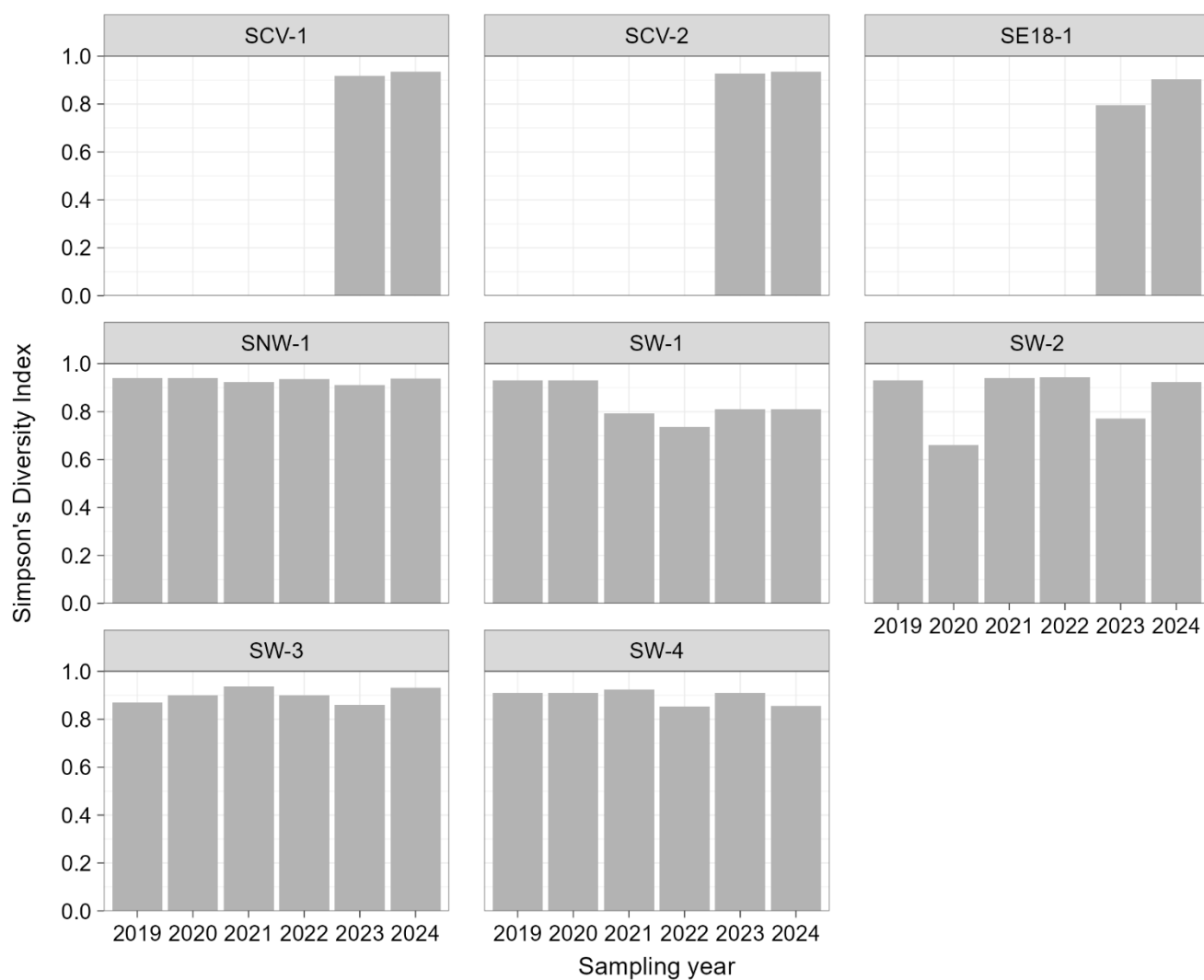


Figure 4-6: Simpson's Diversity Index Values for Benthic Infauna at Capesize Sampling Stations, 2019–2024.

4.4.3.4 Simpson's Evenness Index

The temporal distribution of SEI values differed between stations (Figure 4-7). Stations SCV-1 and SE18-1 showed an increase in SEI between 2023 and 2024, whereas values in SCV-2 remained similar. SEI stayed relatively stable over the years at SNW-1 and SW-4 but varied strongly at SW-1, SW-2 and SW-3.

Between 2023 and 2024, two stations had a decrease in SEI, ranging from -51% (SW-4) to -12% (SCV-2). The remaining five stations all had increases in SEI between 2023 and 2024, ranging from +46% (SNW-1) to 953% (SW-2) (on the odds scale as explained in Appendix 4F). The change in SEI between 2023 and 2024 was statistically significant ($P=0.001$), with an effect size of +143%. That is, SEI was on average 143% higher in 2024 when compared to 2023 (on the odds scale). The statistical power to detect the observed difference between 2023 and 2024 values was high (power = 0.95; Appendix 4F).

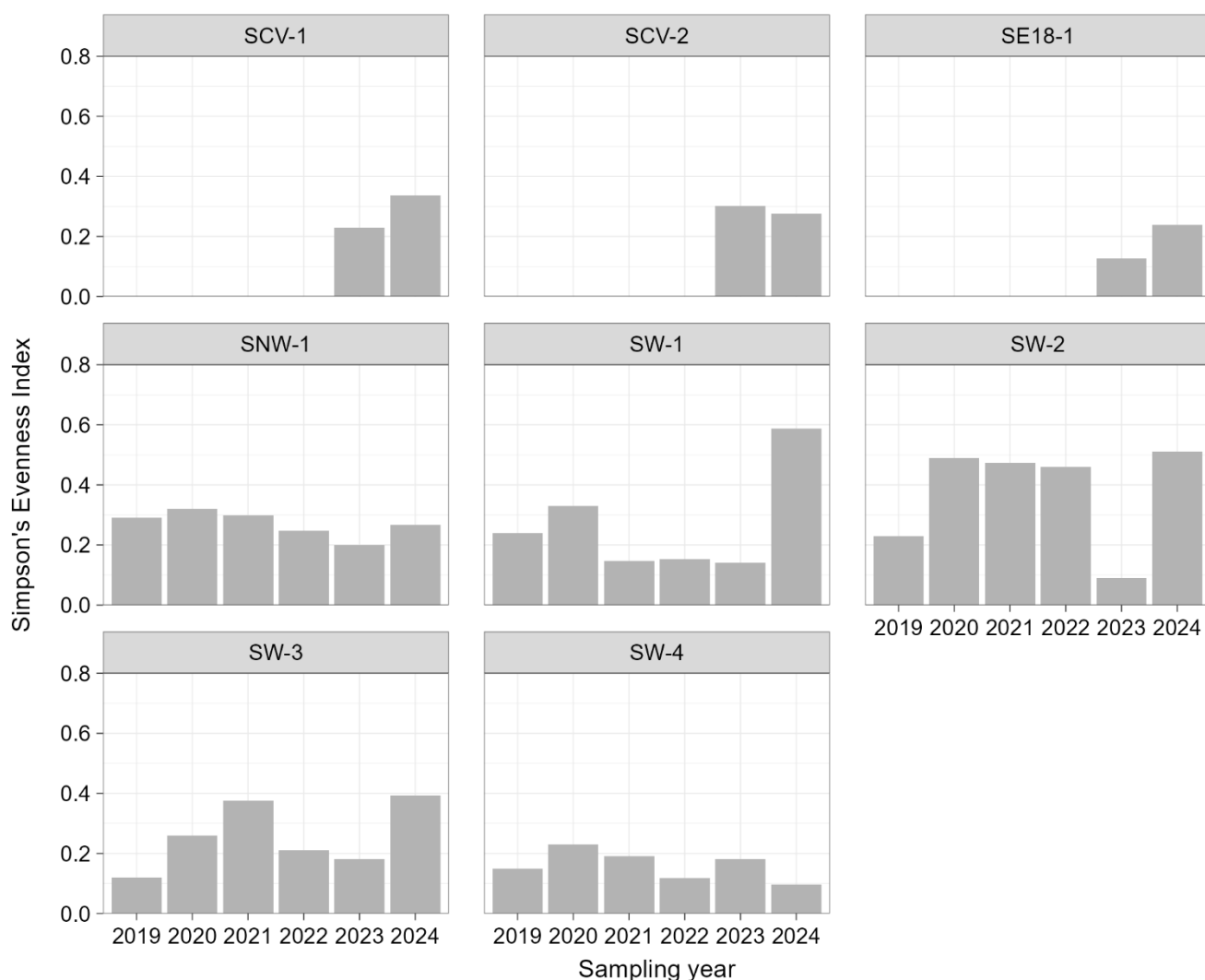


Figure 4-7: Simpson's Evenness Index Values for Benthic Infauna at Capesize Sampling Stations, 2019–2024.

4.4.4 2024 TARP Assessment

Results of the benthic infauna assessment above were screened against the TARP criteria (Table 4-2). The 'Low Risk' threshold was not triggered for benthic infauna in the 2024 MEEMP which was focussed on comparing the Year 1 Capesize sampling station results with the 2023 existing conditions results for these stations.

There were no statistically significant changes in the benthic performance indicators density and richness between 2023 and 2024, although variability was noted in the datasets. With respect to individual stations, there were noticeable decreases in benthic densities and richness at SW-1 and SW-2. As discussed in Chapter 3.0, these stations experienced some level of scouring before 2023 and the proportion of fines remained low in 2024 with no observed rebound. Scouring of sediments was predicted down to 5 cm at SW-2 and down to 50 cm at SW-1 by the Ship Wake and Propeller Wash Assessment for the Capesize vessels (WSP 2023) as shown in Figure 3-9. Given that benthic performance indicators were not significantly different in Year 1 (2024) compared to existing conditions in 2023, and any visual decreases in benthic indicators appeared to be within Port-related effects predicted by FEIS and subsequent addenda, a 'Low Risk' threshold was not triggered in 2024 for the Capesize assessment.

4.5 Discussion

The 2024 MEEMP benthic infauna sampling program was focused on the eight Capesize sampling stations implemented in 2023 to assess potential changes in marine sediment and benthic infaunal community indices associated with potential impacts of Baby Cape and Capesize ore carriers utilizing the Ore Dock. Overall, monitoring results have remained within original FEIS predictions and subsequent addenda (Baffinland 2012, 2013). The FEIS predictions forecasted no significant residual effects on sediment quality but indicated the potential for minor localized sediment disturbance associated with propeller wash, which is expected to stabilize over time, as well as the potential for minor localized increases in nutrients, metal, or hydrocarbon concentrations that could impact benthic invertebrate communities. Subsequent to the FEIS, WSP conducted a Ship Wake and Propeller Wash Assessment to address possible project effects on the marine physical environment related to shipping activities associated with increased large vessel traffic (WSP 2023). This assessment predicted some scour to occur over most of the berthing area for Capesize vessels to depths ranging from 5 cm over the broader berthing area to 50 cm in a more localized area adjacent to the Ore dock. The 2024 sediment quality assessment evaluated sediment quality down to 5 cm sediment depth consistent with the MEEMP and sampling at the Capesize stations in 2023. This sediment depth is also the most relevant to the assessment of benthic infauna communities.

4.5.1 Benthic Community Composition

In 2024, benthic communities were largely dominated by polychaetes followed by ostracods, bivalves and malacostracans. Overall, the relative abundances of major taxa observed in 2024 were similar to 2023 for the eight Capesize sampling stations. At most stations, tubicolous polychaetes (the spionids, *Prionospio* sp. and *Pygospio elegans*) dominated the benthic community. These taxa are known to be tolerant to disturbance and are generally the first to colonise disturbed habitats such as ice scours (Conlan et al. 1998). The ostracods *Philomedes* spp. are also rapid colonizers after ice scouring (Kim and Collins, 2021) and were abundant at stations SW-4, SCV-1, SNW-1 and SW-1. A lower proportion of bivalves were observed at stations SW-2 and SW-3 compared to other stations sampled in 2024, which may be a result of the low proportion of fines observed

at these two stations. Marine coastal benthic infaunal communities are influenced by abiotic factors, such as sediment grain size and organic carbon content, water depth, inundation time, and salinity (Eckman 1996; Ricciardi and Bourget 1999; Hyland et al. 2005).

4.5.2 Density and Richness

There was no statistically significant change in either density and richness between Year 1 (2024) for the Capesize monitoring program and existing conditions in 2023, although variability was noted in the datasets. With respect to individual stations, there were noticeable decreases in benthic densities and richness at stations SW-1 and SW-2 on the Western Transect. Density at both of these nearshore stations fluctuated from 2019 to 2023, before notable decreases in 2024 compared to 2023 and previous years, except for 2020 at SW-2 where density was close to zero. Station SW-1 showed a decline in richness every year since 2019, until an increase was observed in 2023, followed by a more prominent decline in 2024. As discussed in Chapter 3.0, SW-1 and SW-2 experienced some level of scouring before 2023 and the proportion of fines remained low in 2024, with no observed rebound. Scouring of sediments was predicted down to 5 cm at SW-2 and down to 50 cm at SW-1 by the Ship Wake and Propeller Wash Assessment for the Capesize vessels (WSP 2023) and as shown in Figure 3-9. The nearshore stations SW-1 and SW-2 are in close proximity to the Ore Dock and are likely impacted by scouring of sediments as predicted by the modelling and FEIS predictions and subsequent addenda. Sediment scouring can potentially lead to changes in benthic composition and assemblages.

Further away from the Ore Dock along the Western Transect and outside of the zone of influence for potential scouring predicted by WSP (2023), a decrease in percent fines at Stations SW-4 (in 2024) and SW-3 (in 2023 and continued to remain low in 2024) go beyond what was predicted in the Ship Wake and Propeller Wash Assessment (WSP 2023). Despite this, the drop in density and richness observed at SW-1 and SW-2 between 2023 and 2024 was not observed at SW-3 and SW-4. Between 2023 and 2024, SW-3 showed a small increase in density and marginal decrease in richness, while station SW-4 showed the inverse with a small decline in density and increase in richness. Benthic communities at stations SW-3 and SW-4 appeared to be more stable than those closer to the Ore Dock along the nearshore transect.

4.5.3 Diversity and Evenness

There were statistically significant increases in both diversity and evenness from 2023 to 2024 for the overall dataset and stations continued to support diverse benthic invertebrate communities. Although the trend at individual stations was inconsistent between years, particularly for evenness, which ranged from increasing more than threefold at stations SW-1 and SW-2 between 2023 and 2024, to decreasing slightly at SW-4 and SCV-2 and increasing at SNW-1 and SW-4. Diversity was variable at individual stations but remained relatively stable at SNW-1 and SW-1 between 2023 and 2024. Station SW-2 and SW-3 showed a small increase in diversity between 2023 and 2024, while SW-4 showed a small decrease. Increased evenness is often associated with a drop in density and may also indicate an adverse effect on the local benthic infaunal community. The variability observed in the benthic composition as well as the performance indicators as seen in previous MEEMP monitoring years may be due to a combination of the existing influence of scouring due to propeller wash from the smaller carriers and natural coastal processes and variations in morphology.

4.6 Conclusions and Recommendations

The 2024 results remain within predictions of the FEIS and subsequent addenda, which forecasted the potential for localized sediment disturbance associated with propeller wash and temporary effects on benthic infaunal community indicators. In 2024 the eight Capesize stations continued to support diverse benthic invertebrate communities, with dominant polychaete taxa but also bivalves and crustaceans. Overall density and richness were not significantly different between Year 1 (2024) and under existing conditions in 2023; however, the benthic infaunal community continued to show variability between stations in 2024 with observed decreases in density and richness from 2023 to 2024 at stations in close proximity to the Ore Dock. These observations are partly supported by changes in the proportion of fines content in the area over time as well as natural variability seen within benthic communities. Scouring effects were previously observed in 2020 at station SW-2 due to propeller wash from smaller ore carriers and tugs. Subsequent monitoring years indicated that the benthic infaunal community at that station later recovered, and that the effects were temporary and localized.

Given that use of larger ore carriers (Baby Cape and Capesize) is expected to continue at Milne Port, Baffinland has committed to a frequency of annual sampling of the Capesize monitoring stations, for a minimum of three years after the initial use of large (Baby Cape and Capesize) ore carriers in fall 2023. As noted for sediment quality in Chapter 3.0, in order to gain a better understanding of potential scouring effects outside of the predicted zone of influence for the Capesize vessels versus influence from natural coastal processes, a consideration would be to extend the 2025 Capesize Vessel sampling program along the West Transect to include SW-5 and SW-6, for a total of ten stations for sediment quality and benthic infauna sampling.

4.7 Closure

We trust this information is sufficient for your needs at this time. Should you have any questions or concerns, please do not hesitate to contact Phil Rouget, on behalf of the undersigned, at +1 250 419 4945.

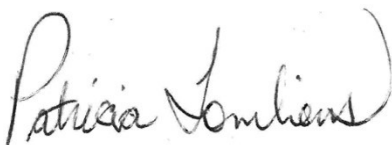
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APPENDIX 4A

Photographs



Photo 1: Benthic sample on 1.0 cm sieve, collected at station SCV-1 on 12 August 2024.



Photo 2: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SCV-1 on 12 August 2024.



Photo 3: Benthic sample on 1.0 cm sieve, collected at station SCV-2 on 17 August 2024.



Photo 4: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SCV-2 on 17 August 2024.



Photo 5: Benthic sample on 1.0 cm sieve, collected at station SE18-1 on 17 August 2024.



Photo 6: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SE18-1 on 17 August 2024.



Photo 7: Benthic sample on 1.0 cm sieve, collected at station SNW-1 on 17 August 2024.



Photo 8: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SNW-1 on 17 August 2024.



Photo 9: Benthic sample on 1.0 cm sieve, collected at station SW-1 on 18 August 2024.



Photo 10: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SW-1 on 18 August 2024.



Photo 11: Benthic sample on 1.0 cm sieve, collected at station SW-2 on 12 August 2024.



Photo 12: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SW-2 on 12 August 2024.



Photo 13: Benthic sample on 1.0 cm sieve, collected at station SW-3 on 10 August 2024.



Photo 14: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SW-3 on 10 August 2024.



Photo 15: Benthic sample on 1.0 cm sieve, collected at station SW-4 on 18 August 2024.



Photo 16: Benthic sample (1/4 field split) on 0.5 mm sieve, collected at station SW-4 on 18 August 2024.



Photo 17: Bivalve (*Astarte* sp.) collected at station SCV-1 on 12 August 2024.

APPENDIX 4B

**Biologica Environmental Services
Ltd. Methods**



Marine Benthic Enumeration and Identification Methods

Client: WSP

Project: Baffinland MEEMP

Protocol: EEM

Sample Inventory

Sample arrival: 30-Aug-24

Number of samples: 8

Number of jars: 15

Screen size: 500 µm and 1.0 cm

Biologica project number: mb24-033

The chain of custody documents were checked and approved with the client. Samples were transferred from formalin into 70% ethanol and stained with Rose Bengal to aid in sorting. Each sample was provided a unique identification number and placed in the queue for analysis.

Table 1. Summary of benthic samples processed for WSP Baffinland MEEMP, 2024.

Client Sample ID	Date Sampled	Biologica Sample ID	# of Jars	Field Split	Lab Split	Final Split	Organisms Counted
SCV-1	12-Aug-24	mb24-033-001	1	1/4	1/4A	1/16	167
			1	Whole	Whole	Whole	68
SCV-2	17-Aug-24	mb24-033-002	1	1/4	1/4A	1/16	201
			2	Whole	Whole	Whole	153
SE18-1	17-Aug-24	mb24-033-003	1	1/4	1/4A	1/16	119
			1	Whole	Whole	Whole	90
SNW-1	17-Aug-24	mb24-033-004	1	1/4	1/4A	1/16	295
			1	Whole	Whole	Whole	70
SW-1	18-Aug-24	mb24-033-005	8	1/4	1/4A	1/16	20
			1	Whole	Whole	Whole	2
SW-2	12-Aug-24	mb24-033-006	1	1/4	1/4A	1/16	44
			1	Whole	Whole	Whole	14
SW-3	10-Aug-24	mb24-033-007	1	1/4	1/4A	1/16	152
			1	Whole	Whole	Whole	53
SW-4	18-Aug-24	mb24-033-008	1	1/4	1/4A	1/16	368
			2	Whole	Whole	Whole	151

Sample Processing

Sorting and Subsampling:

All samples were sorted using dissecting microscopes at 10–40x magnification by trained personnel. Microscopic sorting is the only way to ensure >90% of organisms are removed from the debris, which is required by EEM (Environment Canada; Environmental Effects Monitoring) guidelines for marine benthic analyses. To minimize potential sorter bias,

samples were distributed among technicians such that no one person sorted all the replicates of a given sample.

Due to historically the large volumes and high abundances in the samples, samples were fractioned in the field into a 1.0 cm macro fraction and 500 µm fine fraction. This strategy was developed to maximize the detection of large and rare individuals in the macro fraction while accurately enumerating smaller organisms in the fine fraction. The macro 1.0 cm fraction was analyzed whole, with all large organisms (>1.0 cm) removed from the sample, as was done in previous years for this project. In addition, all large debris in this fraction were checked microscopically, including rocks and other large debris to ensure encrusting organisms were accurately enumerated.

Biologica subsampled the fine 500 µm fraction. The 500 µm fraction was split in the field to 1/4. Biologica subsequently split this fraction by a second 1/4 split, for a final 1/16 split. Subsampling was done with a Caton tray (Caton, 1991). The sample was spread evenly over a Caton grid, and sequential random quadrats were selected and sorted until the minimum 1/4 lab split was reached.

Sub-sampling accuracy was assessed by sorting the remaining sample for 10% (n= 4) of all sub-sampled samples and comparing the fractions to one another. Refer to Table 2 for sub-sampling accuracy results.

Sorting QA/QC:

To ensure sorting efficiency was >95%, whole and/or partial sub-samples were re-sorted. Sorting efficiency was calculated using the following equation (where total count = final total number of organisms in sample):

$$\text{Sorting efficiency} = [1 - (\# \text{ of organisms in spot check or re-sort} / \text{total organisms})] \times 100$$

*Total organisms includes the original count and the number found from the re-sort

All samples checked must meet or exceed 95% sorting efficiency. Any samples falling below 95% sorting efficiency are re-sorted in their entirety, and additional checks are undertaken as necessary. For quality assurance, QA re-sorts were performed on 10% of samples. Four samples were randomly selected and re-sorted in their entirety. Refer to Table 2 for sorting efficiency results.

Table 2. Summary of sorting QA/QC results for WSP Baffinland MEEMP, 2024.

Client Sample ID	Biologica Sample ID	Sorting Efficiency QA Whole Re-sorts	Sub-sampling accuracy
SCV-1	mb24-033-001		
SCV-2	mb24-033-002	98.54%	
SE18-1	mb24-033-003		
SNW-1	mb24-033-004		
SW-1	mb24-033-005		
SW-2	mb24-033-006		93.12%
SW-3	mb24-033-007		
SW-4	mb24-033-008		

Identification and Invasive Species Detection:

All organisms were identified using a combination of dissecting (10–40x) and compound microscopes (100–1000x) and standard taxonomic keys (see methodological and taxonomic references) to the lowest practicable level (species whenever possible). All specimens were archived in air-tight glass vials with glycerin and 70% ethanol for long-term storage. Taxonomic data were recorded in Biologica's custom database.

During the identification process, taxonomists recorded if any identified taxa were beyond their recorded range and/or potentially introduced (originating from another location) or invasive (both introduced and appearing to proliferate with possible detrimental effects to the ecosystem and/or industry). **No taxa observed were identified as putative invasive taxa.** One genus of interest over the past several years of sampling has been *Marenzelleria*. Multiple specimens were externally verified by DNA analysis by Dr. Vasily Radashevsky from the National Scientific Center of Marine Biology and were confirmed to be *Marenzelleria wireni*. Historical identifications can all be taken to this species identification.

One new taxa to the project was identified and has been referenced if needed for verification.

Reference Collection:

Biologica houses a reference collection of all taxa that have been observed in the Baffinland MEEMP project thus far. Taxa are added to this reference collection yearly. These may be new taxa and/or new stages. Taxa new to the project are sent for external verification. This collection consists of a minimum of one specimen representing each taxon and stage, with five specimens per taxon/stage wherever possible. These specimens were labelled, given a location code, and placed in evaporation-resistant shell dram vials. Approximately 1 mL of glycerin was added to each vial to prevent desiccation.

Data Management and Analysis

All data were recorded in Biologica's custom database. Total abundances were extrapolated for samples split in the field and the lab to represent the abundance from the whole sample. Organism densities were calculated by dividing the total organism abundance (extrapolated if the sample was split) using the area of a Van Veen grab (0.1 m²), with three composite Van Veen grabs (3 x 0.1m²) for each sample.

Results were provided to the WSP project manager in Excel spreadsheets via email.

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APPENDIX 4C

**Biologica Environmental Services
Ltd. Raw Data**



Abbreviations & Definitions

Worksheets:

- | | |
|--------------------------------|--|
| 1. Abbreviations & Definitions | Glossary of terms and outline of report. |
| 2. Data-Matrix | Total abundance data in matrix format, including total taxa count per sample and total abundance per sample. |
| 3. Data-Long | Raw abundance data in long format. |
| 4. QC-QA Report | Results of sorting efficiency. |
| 5. Subsampling Accuracy | Raw subsampling accuracy data based on preliminary abundance counts. |
| 6. Provisional Taxa | Description of unique taxa that are undescribed and assigned internal numbers (e.g., sp. 1, sp.2 etc.) |
| 7. Taxonomic Updates | Taxonomic updates for historical data considerations and verification purposes. |

Life Stages:

A	Adult
Int	Intermediate - has adult features but not of typical reproductive size
J	Juvenile
L	Larvae
N	Nymph
P	Pupa
Col	Colony
Deut	Deutonymph
MEMO	Incidental taxa/fragments not included in data, or whose abundance is not generally captured accurately by 1.0mm screen.
MEIO	Meiofauna
Total Number of Taxa	Number of unique taxa (=species richness), not including higher-order taxa for which there exists a lower-order identification (e.g. not including <i>Lumbrineris</i> sp. if there exists <i>Lumbrineris cruzensis</i> in the data).
Total Number of Organisms	Total Abundance, not including incidental taxa
URL	Unique, rare, large (>1.0 cm) taxa removed from the whole sample
BDL	Below detection limit. Used for biomass measurements for weights less than 0.00001g.

Biologica Coding

Major Taxonomic Groups:

Taxa Group	Group Code	Taxonomic Group
Annelida	ANHI	Annelida Hirudinea
Annelida	ANOL	Annelida Oligochaeta
Annelida	ANXX	Annelida
Annelida	POER	Polychaeta Errantia
Annelida	POSE	Polychaeta Sedentaria
Annelida	POXX	Polychaeta
Arthropoda	CHAR	Chelicerata Arachnida (Acar)
Arthropoda	CHPY	Chelicerata Pycnogonida
Arthropoda	CHXX	Chelicerata
Arthropoda	CRAM	Crustacea Amphipoda
Arthropoda	CRCI	Crustacea Cirripedia
Arthropoda	CRCL	Crustacea Cladocera
Arthropoda	CRCO	Crustacea Copepoda
Arthropoda	CRCU	Crustacea Cumacea
Arthropoda	CRDE	Crustacea Decapoda
Arthropoda	CRDI	Crustacea Diplostraca
Arthropoda	CREU	Crustacea Euphausiacea
Arthropoda	CRIS	Crustacea Isopoda
Arthropoda	CRLE	Crustacea Leptostraca
Arthropoda	CRMY	Crustacea Mysidacea
Arthropoda	CROS	Crustacea Ostracoda
Arthropoda	CRTA	Crustacea Tanaidacea
Arthropoda	CRXX	Crustacea
Arthropoda	INCM	Insecta Collembola
Arthropoda	INCO	Insecta Coleoptera
Arthropoda	INDI	Insecta Diptera
Arthropoda	INEP	Insecta Ephemeroptera
Arthropoda	INHM	Insecta Hemiptera
Arthropoda	INHY	Insecta Hymenoptera
Arthropoda	INLE	Insecta Lepidoptera
Arthropoda	INMG	Insecta Megaloptera
Arthropoda	INNE	Insecta Neuroptera
Arthropoda	INOD	Insecta Odonata
Arthropoda	INPL	Insecta Plecoptera
Arthropoda	INTH	Insecta Thysanoptera
Arthropoda	INTR	Insecta Tricoptera
Arthropoda	INXX	Insecta
Arthropoda	MYCH	Chilopoda
Arthropoda	MYDI	Diplopoda
Echinodermata	ECAS	Echinodermata Asteroidea
Echinodermata	ECCR	Echinodermata Crinoidea
Echinodermata	ECEC	Echinodermata Echinoidea
Echinodermata	ECHO	Echinodermata Holothuroidea
Echinodermata	ECOP	Echinodermata Ophiuroidea
Miscellaneous	ACAN	Acanthocephala
Miscellaneous	AMPH	Amphibia
Miscellaneous	BRAC	Brachiopoda
Miscellaneous	BRYO	Bryozoa
Miscellaneous	CHAE	Chaetognatha
Miscellaneous	CILI	Ciliophora Ciliophora
Miscellaneous	CNAN	Cnidaria Anthozoa
Miscellaneous	CNHY	Cnidaria Hydrozoa
Miscellaneous	CNSC	Cnidaria Scyphozoa
Miscellaneous	CNOX	Cnidaria
Miscellaneous	CTEN	Ctenophora
Miscellaneous	ENTO	Entoprocta
Miscellaneous	EURA	Echiura
Miscellaneous	FORA	Foraminifera
Miscellaneous	HEMI	Hemichordata
Miscellaneous	KINO	Kinorhyncha
Miscellaneous	NODA	Nemata
Miscellaneous	NTEA	Nemertea
Miscellaneous	PHOR	Phoronida
Miscellaneous	PIXX	Pisces
Miscellaneous	PLTY	Platyhelminthes
Miscellaneous	PORI	Porifera
Miscellaneous	PRIA	Priapulida
Miscellaneous	ROTI	Rotifera
Miscellaneous	SIPN	Sipuncula
Miscellaneous	TARD	Tardigrada
Miscellaneous	URAP	Appendicularia
Miscellaneous	URAS	Ascidacea
Miscellaneous	URTH	Thaliacea
Mollusca	MOAP	Mollusca Aplousobranchia
Mollusca	MOBI	Mollusca Bivalvia
Mollusca	MOCE	Mollusca Cephalopoda
Mollusca	MOGA	Mollusca Gastropoda
Mollusca	MOPO	Mollusca Polyplacophora
Mollusca	MOSC	Mollusca Scaphopoda
Mollusca	MOXX	Mollusca



Total abundance data in matrix format, including total taxa (species richness) for WSP Baffinland MEEMP Benthos, 2024.

Biologica Sample ID									mb24-033-001	mb24-033-002	mb24-033-003	mb24-033-004	mb24-033-005	mb24-033-006	mb24-033-007	mb24-033-008	
Client Sample ID									SCV-1	SCV-2	SE18-1	SNW-1	SW-1	SW-2	SW-3	SW-4	
Date Sampled									12-Aug-24	17-Aug-24	17-Aug-24	17-Aug-24	18-Aug-24	12-Aug-24	10-Aug-24	18-Aug-24	
									Total	Total	Total	Total	Total	Total	Total	Total	
									Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	
taxcode	grpcode	Phylum	Class	Order	Family	Subfamily	Taxon Name	Grand Total	Unique Taxa	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	
ANNE	ANHI	Annelida	Citellata				Hirudinea indet.	1	16							16	
ANNE	POER	Annelida	Polychaeta	Eunicida	Dorvilleidae		Ophryotrocha sp.	1	48					16	32		
ANNE	POER	Annelida	Polychaeta	Eunicida	Lumbrineridae		Lumbrineridae indet.		16							16	
ANNE	POER	Annelida	Polychaeta	Eunicida	Lumbrineridae		Scoletoma fragilis	1	16	16							
ANNE	POER	Annelida	Polychaeta	Eunicida	Lumbrineridae		Scoletoma laurentiana	1	16		16						
ANNE	POER	Annelida	Polychaeta	Eunicida	Lumbrineridae		Scoletoma sp.		97				48			49	
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Hesionidae		Nereimyra aphroditoides	1	995		115	432	144	96	16	144	48
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Microphthalmidae		Microphthalmus sp.	1	16					16			
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Nephtyidae		Micronephthys cornuta	1	272	64	32		96			80	
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Nephtyidae		Nephtys ciliata	1	2				1			1	
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Nereididae	Nereidinae	Nereis zonata	1	2		2						
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eteoninae	Eteone sp.	1	80				16		32	32	
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Phyllodocinae	Phyllodoce groenlandica	1	33		1	16		16			
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Polynoidae	Polynoinae	Bylgides promamme	1	16				16				
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Polynoidae	Polynoinae	Gattyana cirrhosa	1	18		2						16
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Polynoidae	Polynoinae	Harmothoe sp.	1	1		1						
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Pholoinae	Phloe longa	1	532		36	64				240	192
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Pholoinae	Phloe minuta	1	576				48			208	320
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Sigalionidae	Pholoinae	Phloe sp.	1	64				48		16		
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Sphaerodoridae		Sphaerodoridium minutum	1	16	16							
ANNE	POER	Annelida	Polychaeta	Syllidae	Syllidae	Anoplosyllinae	Streptospinigera niuqtuut	1	16			16					
ANNE	POER	Annelida	Polychaeta	Phyllodocida	Syllidae	Exogoninae	Exogone sp.	1	32	16							16
ANNE	POSE	Annelida	Polychaeta	Sabellida	Fabriciidae		Pseudofabricia sp. nr. aberrans	1	16		16						
ANNE	POSE	Annelida	Polychaeta	Sabellida	Owenidae		Galathowenia oculata	1	257	48	129		64				16
ANNE	POSE	Annelida	Polychaeta	Sabellida	Owenidae		Myriochele heeri	1	48	32			16				
ANNE	POSE	Annelida	Polychaeta	Sabellida	Owenidae		Owenia fusiformis	1	157	112	29		16				
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae	Myxicolinae	Dialychone sp.		2		2						
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae	Myxicolinae	Dialychone sp. 1	1	48	16	32				32		
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae	Myxicolinae	Dialychone sp. 3	1	32								
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae	Myxicolinae	Euchone incolor	1	416	32	112	16	96			48	112
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae	Sabellinae	Bispira sp.	1	1								1
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae		Branchiomma sp.	1	1		1						
ANNE	POSE	Annelida	Polychaeta	Sabellida	Sabellidae		Sabellidae indet.	1	64		16		16			32	
ANNE	POSE	Annelida	Polychaeta	Spionida	Apistobranchidae		Apistobranchus sp.	1	32				16		16		
ANNE	POSE	Annelida	Polychaeta	Spionida	Spionidae		Prionospio sp.	1	818	208	338	240		16	16		16
ANNE	POSE	Annelida	Polychaeta	Spionida	Spionidae		Pygospio elegans	1	512	368	16					48	80
ANNE	POSE	Annelida	Polychaeta	Spionida	Spionidae		Spio sp.	1	48					48			
ANNE	POSE	Annelida	Polychaeta	Spionida	Spionidae		Spionidae indet.	1	16					16			
ANNE	POSE	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetinae	Ampharete petersenae	1	112		48	16	32				16
ANNE	POSE	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetinae	Ampharete sp.	1	16			16					
ANNE	POSE	Annelida	Polychaeta	Terebellida	Ampharetidae	Ampharetinae	Lysippe labiata	1	32		32						
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Apheleochaeta sp.	1	416	144	32	32	192			16	
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Chaetozone bathyala	1,264	48	448	240	240	16	16	64	192	
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Chaetozone careyi	1	496		48	64		112	256	16	
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Chaetozone pigmentata	1	48		16					32	
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Chaetozone setosa complex	1	273	80	32	16		16	48	1	
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Chaetozone sp.	1	1,856	112	288	64	496	32	32	432	400
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Chaetozone anasima	1	32	32							
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Cirratulidae indet.	1	496	48		128	208			16	96
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Kirkegaardia sp.	1	32							32	
ANNE	POSE	Annelida	Polychaeta	Terebellida	Cirratulidae		Tharyx sp.	1	176	16	32	96					32
ANNE	POSE	Annelida	Polychaeta	Terebellida	Melinnidae		Melinna sp.	1	16		16						
ANNE	POSE	Annelida	Polychaeta	Terebellida	Pectinariidae		Cistenides granulata	1	69		26	3				33	7
ANNE	POSE	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellinae	Laphania boeckii	1	112	16	16	16	48		16		
ANNE	POSE	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellinae	Paramphitrite birulai	1	32		16		16				
ANNE	POSE	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellinae	Pista maculata	1	8		1						
ANNE	POSE	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellinae	Polycirrus sp. complex	1	96		48						48
ANNE	POSE	Annelida	Polychaeta	Terebellida	Trichobranchidae		Terebellides sp.	1	243	64	33	1	112	16		17	
ANNE	POSE	Annelida	Polychaeta	Capitellidae			Capitella capitata complex	1	112					48	16	32	16
ANNE	POSE	Annelida	Polychaeta	Capitellidae			Mediomastus sp.	1	416	16	80	80	48	16	80	48	48
ANNE	POSE	Annelida	Polychaeta	Capitellidae			Notomastus sp.	1	16		16						
ANNE	POSE	Annelida	Polychaeta	Cossuridae			Cossura longocirrata	1	768	208		304		16	64	176	
ANNE	POSE	Annelida	Polychaeta	Maldanidae	Euclymeninae		Clymenura										

WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	ANNE	POSE	Annelida	Polychaeta	Cossuridae	Cossura longicoma	1	1	16	16	1	In historical benthic data	
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	ANNE	POSE	Annelida	Polychaeta	Scalpellinidae	Scalpellum inflatum	1	1	1	16	16	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	ANNE	POSE	Annelida	Polychaeta	Polychaetidae	Polydora sp.	1	1	1	16	16	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	ARTH	CHAM	Arthropoda	Malacostraca	Amphipoda	Uca	1	1	1	16	16	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	ARTH	CHAM	Arthropoda	Malacostraca	Amphipoda	Uca	1	2	2	16	32	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	ARTH	CHAM	Arthropoda	Malacostraca	Amphipoda	Uca	1	2	2	16	32	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	MEMO	MEMO	Mollusca	Artemiozozoa	Cumacea	Onchocaris idet. (Inefualis)	1	1	1	16	16	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	MEMO	MEMO	Mollusca	Artemiozozoa	Cumacea	Onchocaris idet. (Inefualis)	1	1	1	16	16	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	MEMO	MEMO	Mollusca	Artemiozozoa	Cumacea	Onchocaris idet. (Inefualis)	2	2	2	16	32	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	500	1/4	1/4	1/36	MISC	NETA	Nemertea	Nemertea	Caprellidae	Caprellia sp.	1	3	3	16	48	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	11	11	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole	MOLL	MOB	Mollusca	Bivalvia	Carditidae	Cardinia	1	1	1	1	1	1	In historical benthic data
WSP	Baffinland MEEMP	2024	m24-03-026	SW-2	12-June-24	Van Veen	10,000	Whole	Whole	Whole													



Benthic report of sorting efficiency quality control/quality assurance and subsampling accuracy for WSP Baffinland MEEEMP Benthos, 2024.

Biologica Sample ID	Client Sample ID	Sorting Efficiency QA: Random whole re-sorts	Subsampling Accuracy
mb24-033-001	SCV-1		
mb24-033-002	SCV-2	98.54%	
mb24-033-003	SE18-1		
mb24-033-004	SNW-1		
mb24-033-005	SW-1		
mb24-033-006	SW-2		93.12%
mb24-033-007	SW-3		
mb24-033-008	SW-4		
Average		98.54%	93.12%

Quality Assurance/Control

Sorting efficiency: [(total count – organisms recovered in spot check and/or re-sort) / total count] x 100%



Benthic report of raw subsampling accuracy data based on preliminary abundance counts for WSP Baffinland MEEMP Benthos, 2024.

Client Sample ID	Biologica Sample ID	Subsample	Split	Ann	Arth	Echi	Moll	Other	Total	Predicted #	Predicted - Actual	% Difference from Actual	Absolute Difference	Mean Error	Subsampling Accuracy
SCV-2	mb24-033-002	Whole	1/4A	166	2		25	10	203	812	56	7.4	7.4		
			1/4B	156	8		28	6	198	792	36	4.8	4.8		
			1/4C	109	7		42	5	163	652	-104	-13.8	13.8		
			1/4D	157	9		15	11	192	768	12	1.6	1.6		
			Total	588	26	0	110	32	756					6.88	93.12



Description of unique taxa that are undescribed and assigned internal numbers (e.g., sp. 1, sp. 2 etc.) for WSP Baffinland MEEMP Benthos, 2024.

taxcode	grpcode	TaxonName	Morphological Description	Note
ANNE	POSE	Dialychone sp. 1	Methyl Green staining pattern is similar to Paradiachyone harrisae observed in California, but has ventral cleft present on collar which is lacking in California specimens.	Present historically
ANNE	POSE	Dialychone sp. 2	There is a well-defined circular unstained area in the middle of the ventral collar. There is no ventral cleft present. Likely not described.	Present historically
ANNE	POSE	Dialychone sp. 3	Similar to Chone duneri, with a simple depression on posterior. Thoracic chaetae with long macron, prostomium not covered, with oval shaped unstained area on collar. Posterior segments with a reddish brown pigmentation in a striped pattern.	Present historically
ANNE	POSE	Sabellidae sp. 2	Specimens do not have companion chaetae. Eyespots present from setiger 4. Collar similar to Parasabella pallida.	Present historically
ANNE	POSE	Sabellidae sp. 3	cf Chone, but has only capillary setae on the thorax. There is a semicircular unstained section on the collar (Methyl Green). Does not appear to be described in literature.	Present historically
ANNE	POSE	Sabellidae sp. 4	Specimens with rectangular staining pattern on the ventral collar. Thorax has long handled setae, with no white glandular ring, ventral cleft present, and a lateral and dorsal incision on collar.	Present historically
ANNE	POSE	Euchone sp. 1	Staining pattern on abdominal segments similar to Euchone analis and with a rectangular glandular area on each side and on the anterior and posterior portion of each segment. Both dorsal and ventral sides of the collar have a large divergent lobe, and there is narrow white glandular area beneath collar on the ventral side.	Present historically
ANNE	POSE	Chaetozone anasima	Taxa out of documented geographical range. Verification needed. Initially identified in 2024 as Chaetozone sp. 1.	New in 2024

Taxonomic updates for historical data considerations and verification purposes for WSP Baffinland MEEMP Benthos, 2024.

Year	Taxon	Biologica Comment	Referenced specimens
2021	Marenzelleria sp.	Identification updated to Marenzelleria wireni (Vasily Radashevsky (2021))	Specimens referenced
2020	Marenzelleria viridis	Verified and agreed in 2019 by U. Laval. - Identification updated to Marenzelleria wireni (Vasily Radashevsky (2021))	Additional specimens referenced in 2020
2020	Caudofoveata indet.	Name change. Previously Aplacophora indet.	
2020	Amphitrite cirrata	ID corrected from historical ID of Neoamphitrite affinis	Specimens referenced
2020	Sosane wireni	Historically Sosane sp. nr. wireni. Verified and agreed to Sosane wireni by the University of Laval in 2019.	
2020	Pholoe longa	Historically Pholoe minuta. Pholoe longa - With facial tubercles, bare middorsum, unpigmented elytra, relatively large species. Located along the west coast of Greenland; Canada, in Bay of Fundy, Hudson Bay, and Resolute Bay, based on molecular data (MEIßNER).	Specimens referenced from 2017, 2018, 2019 and 2020
2020	Pholoe minuta	Historically Pholoe tecta. Pholoe minuta - No facial tubercles, dorsum covered, pigmented elytra, smaller species than Pholoe longa.	Specimens referenced from 2017, 2018, 2019 and 2020
2023	Aricidea (Aricidea) minuta	Previously Aricidea minuta	
2023	Golfingia sp.	Taxcode change from MISC to ANNE	
2023	Nephasoma sp.	Taxcode change from MISC to ANNE	
2023	Golfingiidae indet.	Taxcode change from MISC to ANNE	
2023	Proclea graffii	Previously misspelled as Proclea grafi	
2023	Scoletoma laurentiana	Previously Scoletoma impatiens	
2023	Sphaerodoridium minutum	Previously Sphaerodoropsis minutum and Sphaerodoropsis minuta	

APPENDIX 4D

Summary Statistics

Year	Station	Total Density (org/m ²)	Richness (taxa/station)	Simpson's Diversity Index	Simpson's Evenness Index	Relative abundance (%)				
						Polychaeta	Bivalvia	Ostracoda	Malacostraca	Other
2024	SCV-1	9,130	45	0.93	0.34	56	16	16	10	1
	SCV-2	11,228	55	0.93	0.28	84	14	0	0	1
	SE18-1	6,640	43	0.90	0.24	72	18	1	5	4
	SNW-1	16,013	61	0.94	0.27	61	15	14	6	4
	SW-1	1,073	9	0.81	0.59	70	10	5	0	16
	SW-2	2,389	26	0.92	0.51	80	2	0	9	9
	SW-3	8,279	37	0.93	0.39	77	6	1	14	2
	SW-4	20,121	71	0.86	0.10	42	11	31	14	2
	Mean	9,359	43	0.90	0.34	68	11	9	7	5
	Median	8,705	44	0.93	0.31	71	13	3	8	3
	Minimum	1,073	9	0.81	0.10	42	2	0	0	1
	Maximum	20,121	71	0.94	0.59	84	18	31	14	16
	Count	8	8	8	8	8	8	8	8	8
2023	SCV-1	11,865	53	0.92	0.23	55	16	14	13	2
	SCV-2	10,687	46	0.93	0.3	76	4	6	12	1
	SE18-1	9,562	39	0.8	0.13	78	2	6	11	4
	SNW-1	10,723	57	0.91	0.20	45	19	18	12	6
	SW-1	10,255	38	0.81	0.14	78	0	5	10	7
	SW-2	23,756	51	0.77	0.09	90	0	2	2	4
	SW-3	6,224	39	0.86	0.18	84	0	4	9	3
	SW-4	23,622	61	0.91	0.18	56	20	13	9	2
	Mean	13,337	48	0.86	0.18	70	8	9	10	4
	Median	10,705	49	0.88	0.18	77	3	6	11	4
	Minimum	6,224	38	0.77	0.09	45	0	2	2	1
	Maximum	23,756	61	0.93	0.30	90	20	18	13	7
	Count	8	8	8	8	8	8	8	8	8
	SD	6,598	9	0.06	0.07	16	9	6	3	2
	SE	2,333	3	0.02	0.02	6	3	2	1	1

APPENDIX 4E

**2023-2024 Benthic Community
Indicator Plots**

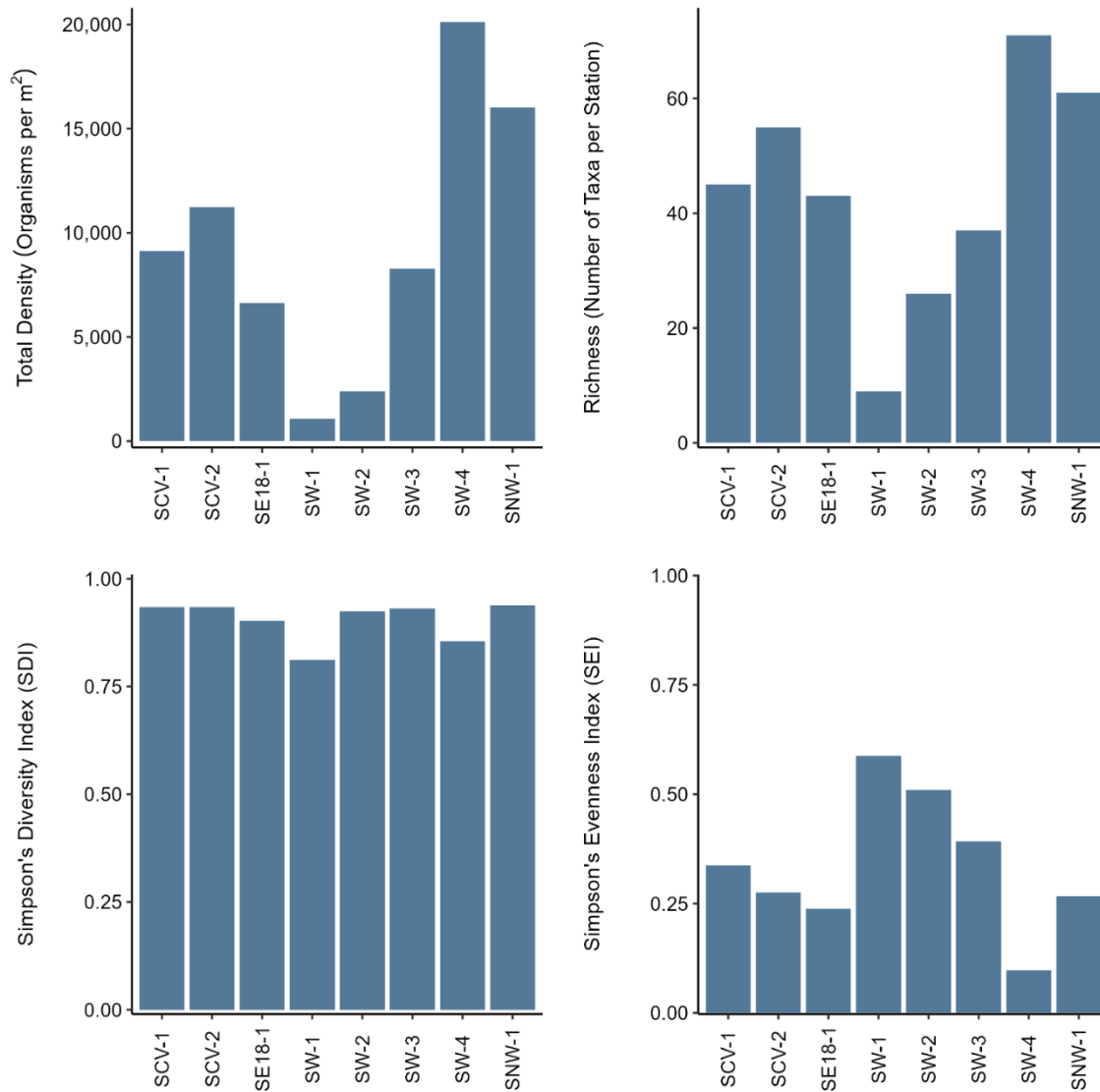


Figure 1: Community Endpoints of Benthic Infauna from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2024.

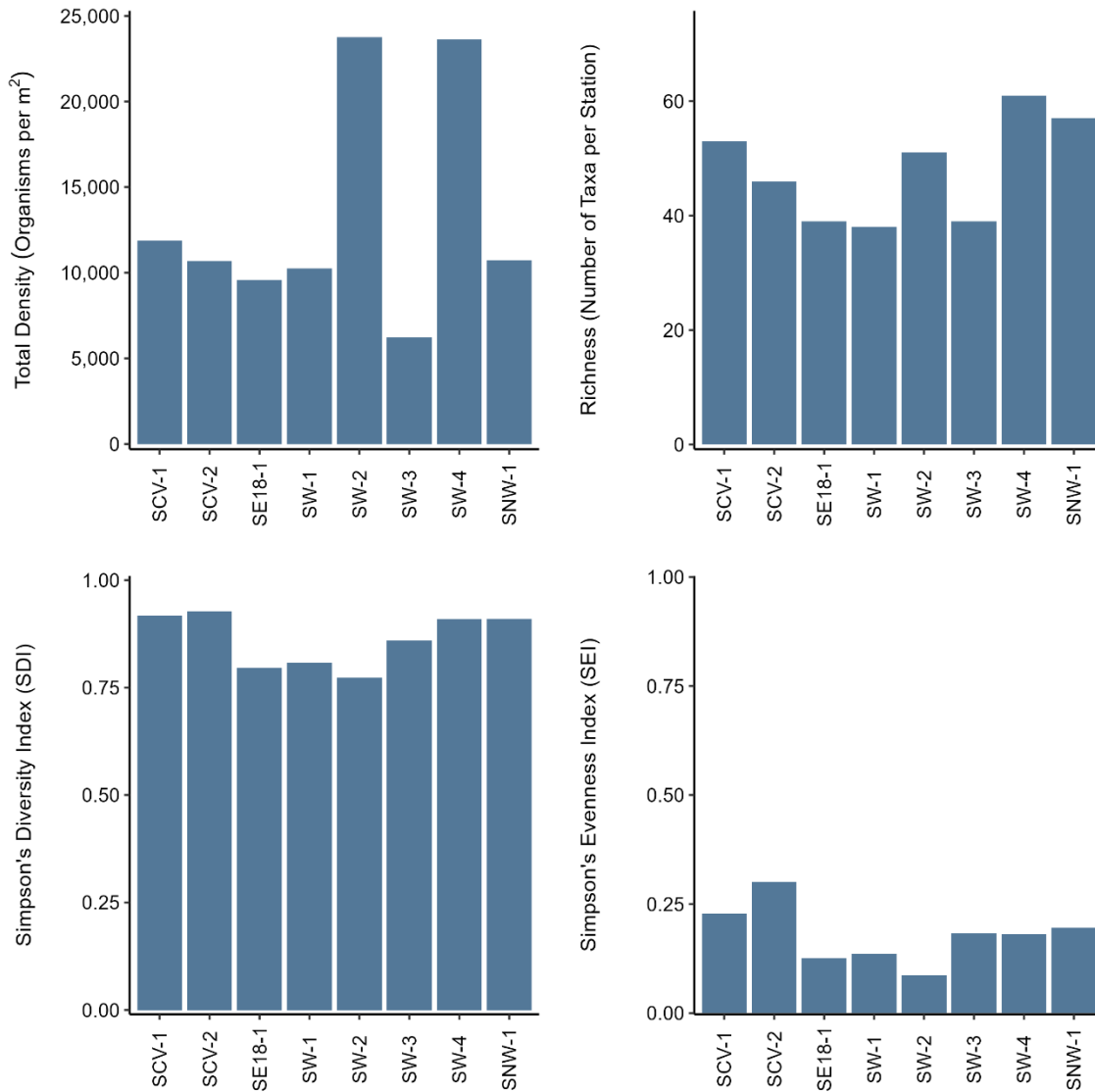


Figure 2: Community Endpoints of Benthic Infauna from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2023.

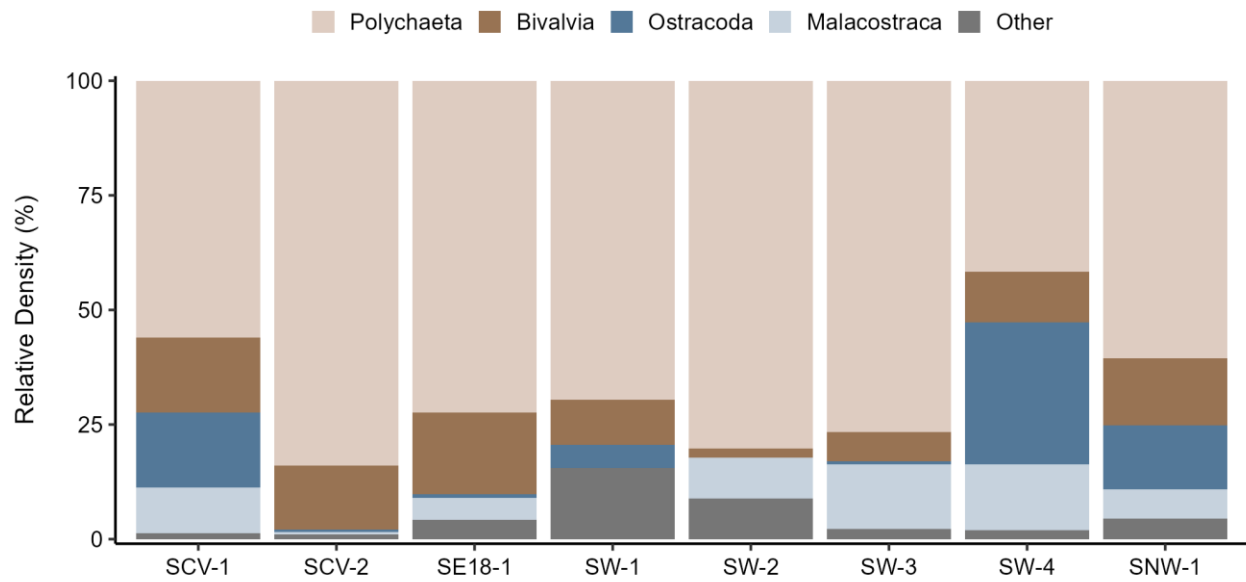


Figure 3: Relative Density of Major Benthic Infauna Taxonomic Groups from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2024.

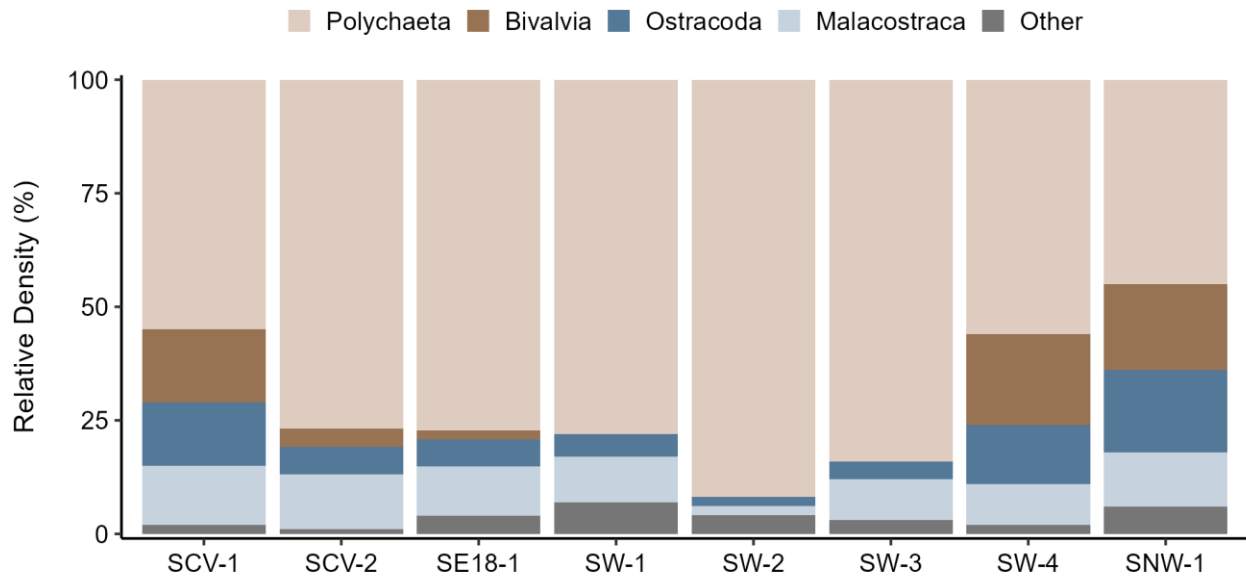


Figure 4: Relative Density of Major Benthic Infauna Taxonomic Groups from Capesize Vessel Stations Near the Ore Dock Area, Milne Port, 2023.

APPENDIX 4F

Power Analysis

POWER ANALYSIS - METHODS

A Type I error is concluding there is a significant effect when none exists (i.e., a false positive). Alpha (α) is the probability of committing a Type I error. A Type II error is the probability of concluding there is no significant effect when there is a real effect of some specified magnitude (i.e., a false negative). Beta (β) is the probability of committing a Type II error. The power of a statistical test ($1 - \beta$) is the probability of detecting a real effect. In this analysis, the Type I error-rate (α), also referred to as the significance level, was set to 0.05. The desired minimum statistical power was 80%, which corresponds to a type II error-rate of 0.2. Power analyses were conducted to assess the power of statistical tests under multiple effect sizes. For each model, a set of effect sizes was created, based on preliminary power analyses, so that power >80% was achieved at the largest absolute values of effect sizes, but also so that power is assessed at a range of effect sizes. Both negative and positive effect sizes were used, to assess the power of detecting either a reduction or an increase in values of the response variables. Since the analysis focused on assessment of changes to statistical power at different effect sizes, the power analysis used the observed samples sizes from the collected data.

Data Simulation following Effect Size Application

The power to detect statistically significant effects was estimated using residual bootstrapping in R v. 4.4.2 (R 2024), following the approach of Fox and Weisberg (2018). The general approach was to simulate data based on the model selected for interpretation, the observed sample size, and the residuals, and re-run the models that were used for the original analysis using the simulated data. The data simulation and analysis were repeated 5,000 times, and the proportion of repetitions where the *P*-values of interest were significant ($P < 0.05$) was interpreted as the statistical power of the test.

To produce simulated data, the original model was used to predict values of the response variable. The predicted values were then adjusted according to the effect size, depending on the analysis (see below for details). The simulated data were then analyzed using the same model structure as the original analysis. Effect sizes and statistical tests were applied differently to different models, as detailed below.

Effect Sizes

The power to detect statistically significant effects was estimated using residual bootstrapping in R v. 4.4.2 (R 2024), following the approach of Fox and Weisberg (2018). The general approach was to simulate data based on the model selected for interpretation, the observed sample size, and the residuals, and re-run the models that were used for the original analysis using the simulated data. The data simulation and analysis were repeated 5,000 times, and the proportion of repetitions where the *P*-values of interest were significant ($P < 0.05$) was interpreted as the statistical power of the test.

To produce simulated data, the original model was used to predict values of the response variable. The predicted values were then adjusted according to the effect size, depending on the analysis (see below for details). The simulated data were then analyzed using the same model structure as the original analysis. Effect sizes and statistical tests were applied differently to different models, as detailed below.

In this power analysis, the question of interest was the models' power to detect a difference between 2023 and 2024, across all sampled stations. To assess the power to detect between-year differences, the effect size was applied relative to 2023 data estimated values. This allowed assessing what effect size, relative to the previous sampling year, the model would be able to identify. This simulated dataset was analyzed using the models from the original analysis in the main report. The application of the effect sizes was performed on the odds scale for SDI and SEI data and as proportion for density (i.e., abundance)

and richness data. The application of the effect sizes in this manner was required to avoid impossible values (such as negative values for all the response variables or values >1 for SDI and SEI). The application of the effect sizes on the odds scale (or the proportion scale for density and richness) means that the result of the applied effect size depends on both the effect size and the baseline (2023) values. For example, the baseline (2023) SDI value (holding the covariate of depth at mean value) was high (0.89; Figure 3F-1) and close to the maximum possible value of 1.0. Therefore, even a large increase (effect size of 100%) only resulted in a change of 0.052 in SDI value, while a 50% decrease resulted in a change of -0.88.

The significance of the year effect was assessed and the *P*-value for the model was retained. For each effect size, the proportion of repetitions with *P*-values less than 0.05 at each transect was interpreted as the statistical power to detect a year effect. This analysis assessed how much higher or lower the 2024 values would have to be to detect a significant difference relative to 2023.

Power curves were produced, showing statistical power as a function of effect size in percentages. Horizontal lines were added to visualize statistical power values of 0.8 (hereafter sufficient power) and 0.9 (hereafter high power), and a vertical line was added to visualize the magnitude of difference that was observed in the original analysis.

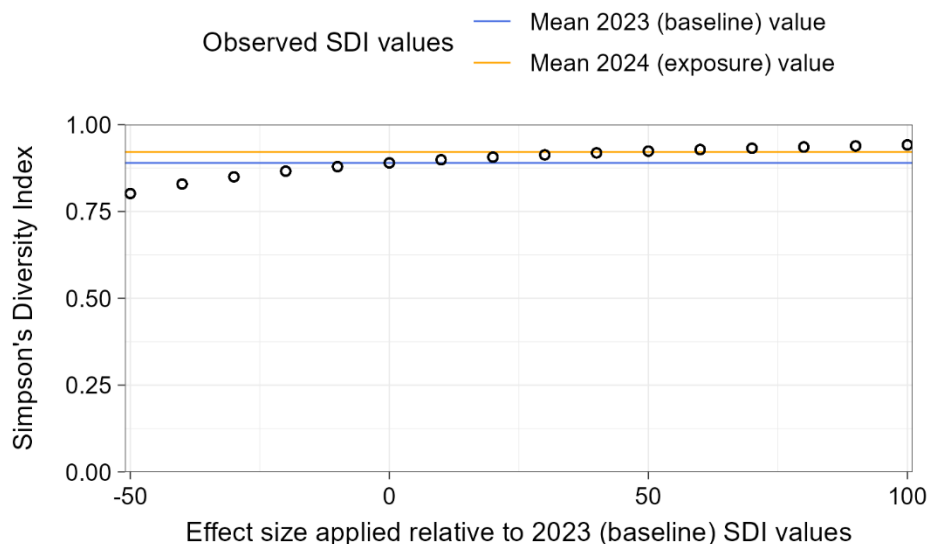


Figure 3F-1: Simulated SDI values (points) and observed 2023 and 2024 SDI values (lines) as an example of applying the effect size on the odds scale.

POWER ANALYSIS – RESULTS

Total Density

The model of total density data collected in 2023 and 2024 at the Capesize stations had sufficient power (>0.8) to detect a 47% decrease or an 82% increase in benthic infauna density (Figure 3F-2). The observed effect size was -34% and the effect of year was not found to be significant in the original model ($P=0.059$; Section 4.4.3.1 in the 2024 MEEMP main report [WSP 2025]). Statistical power to detect the observed effect size was 0.5.

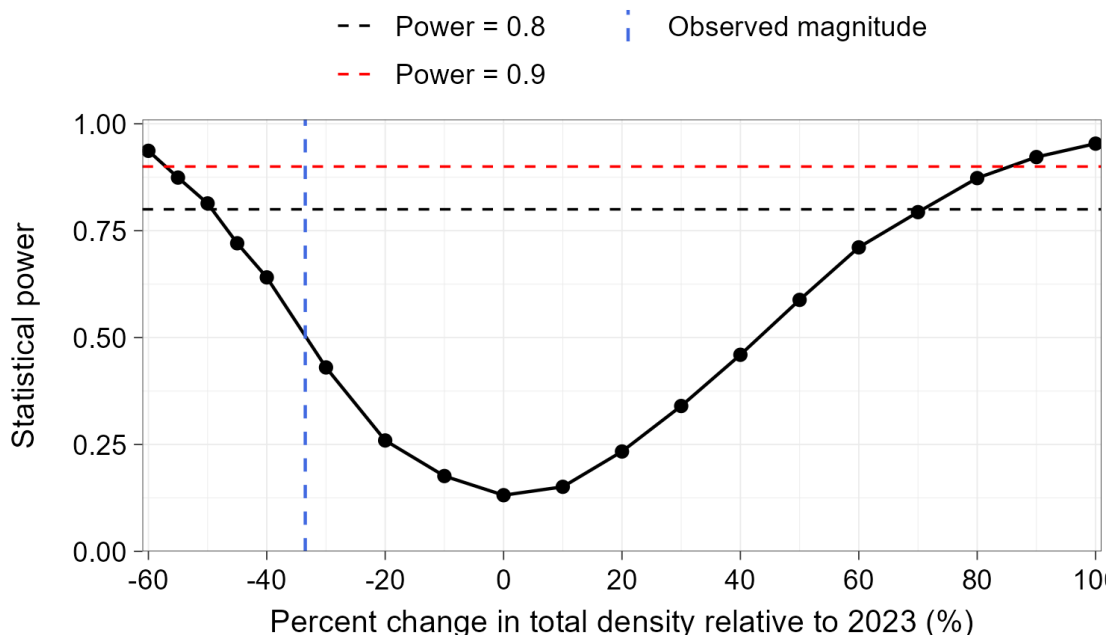


Figure 3F-2: Statistical power to detect a significant difference between total density at the Capesize stations sampled in 2023 and 2024.

Richness

The model of species richness data collected in 2023 and 2024 at the Capesize stations had sufficient power (>0.8) to detect a 22% decrease or increase in benthic infauna richness (Figure 3F-3). The observed effect size was -10% and the effect of year was not found to be significant in the original model ($P=0.19$; Section 4.4.3.2 in the 2024 MEEMP main report [WSP 2025]). Statistical power to detect the observed effect size was 0.27.

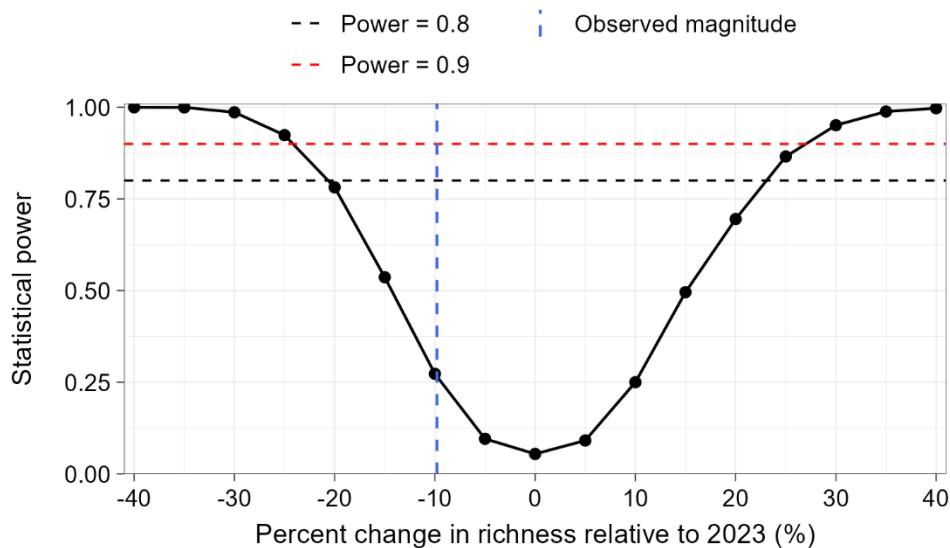


Figure 3F-3: Statistical power to detect a significant difference between species richness at the Capesize stations sampled in 2023 and 2024.

Simpson's Diversity Index

The model of Simpson's Diversity Index values estimated for benthic infauna data collected in 2023 and 2024 at the Capesize stations had sufficient power (>0.8) to detect a 33% decrease or 61% increase in SDI (on the odds scale; Figure 3F-4). The observed effect size was +45%, however the effect of year was found to be significant in the original model ($P=0.048$; Section 4.4.3.4 in the 2024 MEEMP main report [WSP 2025]). Statistical power to detect the observed effect size was 0.65.

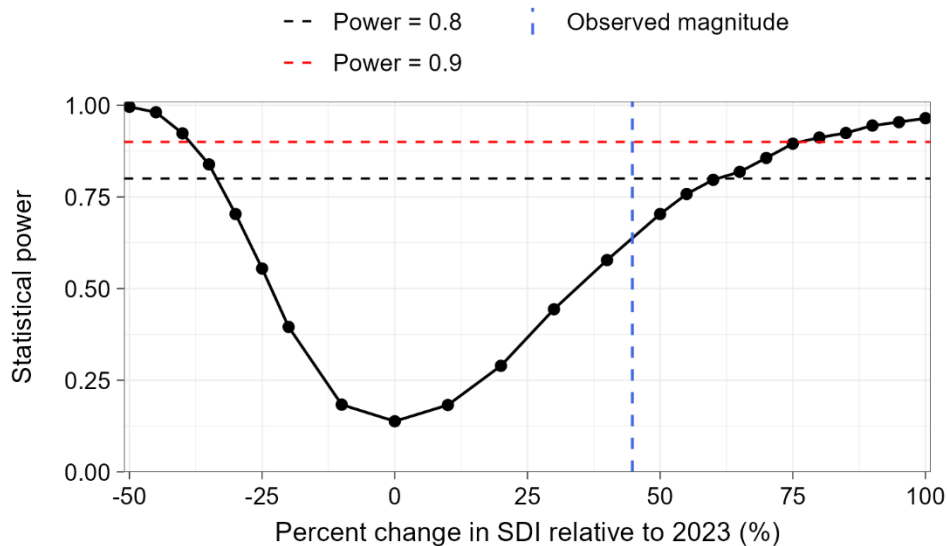


Figure 3F-4: Statistical power to detect a significant difference between Simpson's Diversity Index values at the Capesize stations sampled in 2023 and 2024.

Simpson's Evenness Index

The model of Simpson's Evenness Index values estimated for benthic infauna data collected in 2023 and 2024 at the Capesize stations had sufficient power (>0.8) to detect a 56% decrease or 95% increase in SEI (on the odds scale; Figure 3F-5). The observed effect size was +143% and the effect of year was found to be significant in the original model ($P=0.001$; Section 4.4.3.4 in the 2024 MEEMP main report [WSP 2025]). Statistical power to detect the observed effect size was 0.95.

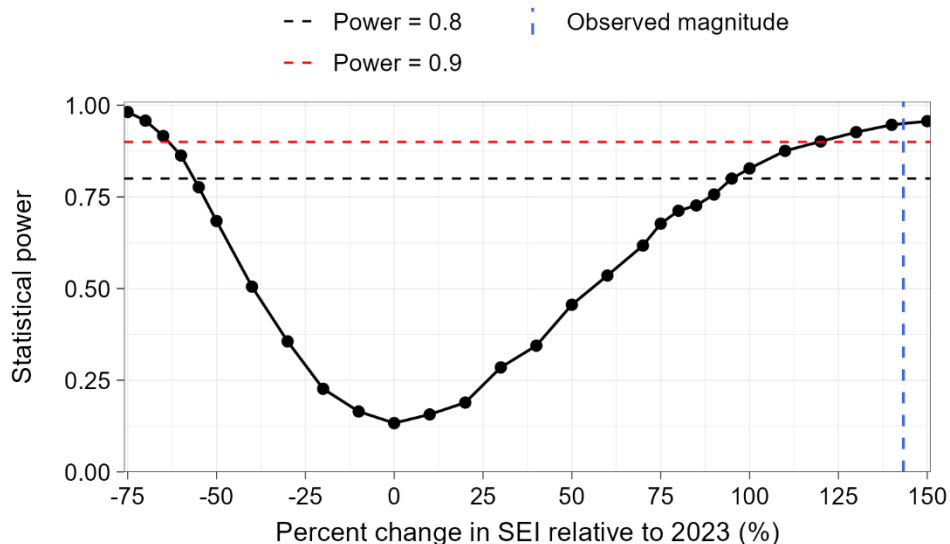


Figure 3F-5: Statistical power to detect a significant difference between Simpson’s Evenness Index values at the Capesize stations sampled in 2023 and 2024.

POWER ANALYSIS – SUMMARY

Summary of Findings

In the analysis of density, there was sufficient power to detect a 47% decrease in density or an 82% increase in density values relative to 2023. The observed effect size (34% decrease in density relative to 2023) had low statistical power. In the analysis of richness, there was sufficient power to detect a 22% decrease or increase in richness relative to 2023. The observed effect size (10% decrease in richness relative to 2023) had low statistical power. In the analysis of SDI, there was sufficient power to detect a 33% decrease in SDI or a 61% increase in SDI relative to 2023. The observed effect size (45% increase in SDI relative to 2023) had low statistical power. In the analysis of SEI, there was sufficient power to detect a 56% decrease in SEI or a 95% increase in SEI relative to 2023. The observed effect size (143% increase in SEI relative to 2023) had high statistical power. Generally, analyses of benthic infauna had higher statistical power to detect decreases, rather than increases, in values. Since reductions in benthic infauna indices are of more concern than increases, the statistical power to detect reductions was considered to be more relevant.

Given the low statistical power to detect effect sizes that may be of biological relevance, going forward, it is recommended that conclusions are not made based on strict adherence to statistical significance. Instead, effect size, uncertainty, and statistical significance and power should be considered together before ruling out spatial and temporal changes in benthic infauna.

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