



The Effects of Dredged Material Placement on Benthic Assemblages at Woodland Islands

May 30, 2023

**Nikki Sather, Kailan Mackereth,
Narmadha Meenu Mohankumar**
Pacific Northwest National Laboratory



PNNL is operated by Battelle for the U.S. Department of Energy



Photo credit: USACE

Outline

- Overview; study area, design, timeline
- Environmental conditions
- Benthic assemblage
- Before-After comparison
- Summary and next steps

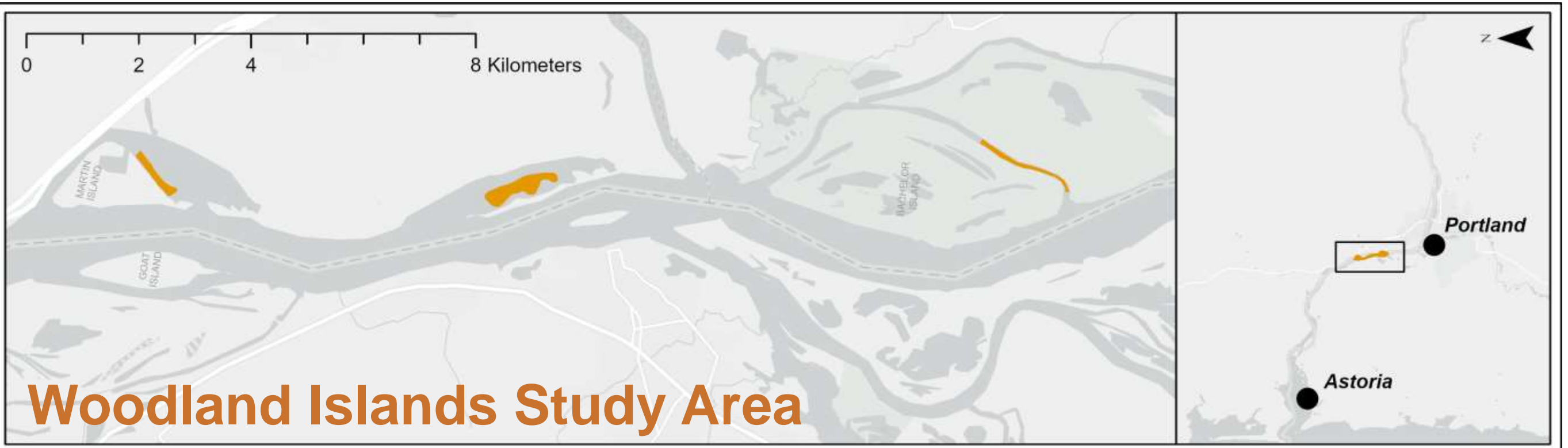


Purpose and Rationale

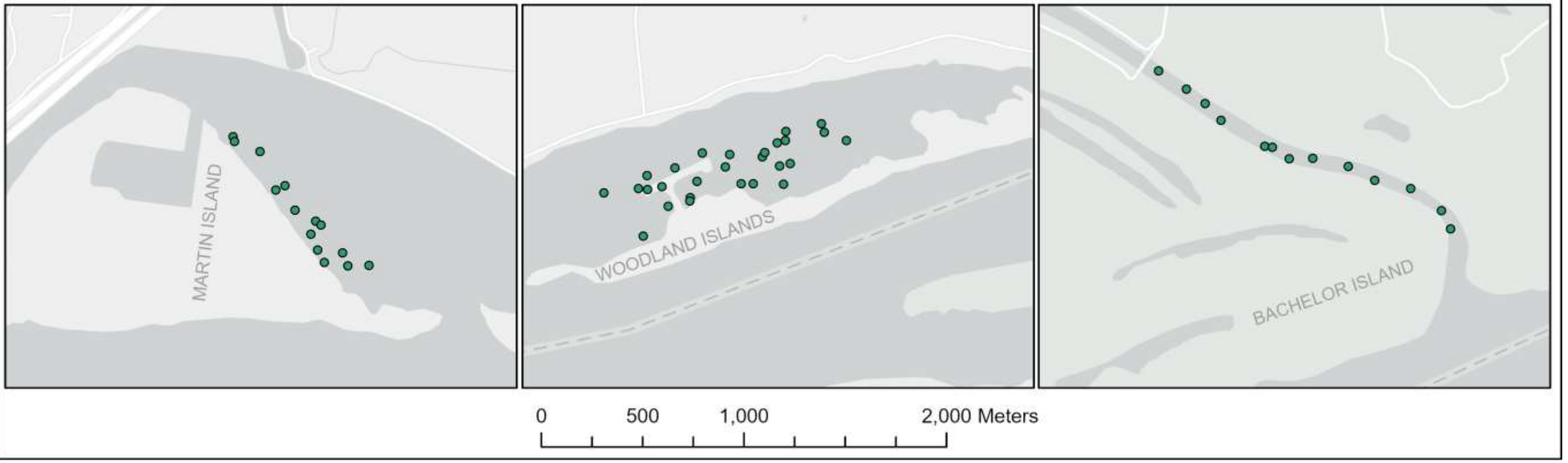
- Evaluate the effects of dredge material placement at Woodland Islands
- Macroinvertebrates provide critical functions in aquatic ecosystems



Woodland Island - Sept. 2022  0 125 250 500 Feet  



Woodland Islands Study Area





Pre-construction Research

April - July



2019

2020



Pre-construction Research

April - July

Dredged Material Placement

Sept - Oct



2020

2021

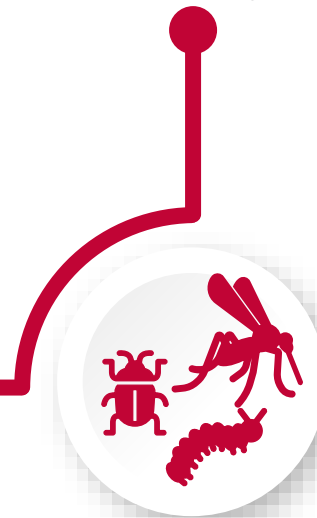


Post-construction Research

April - July

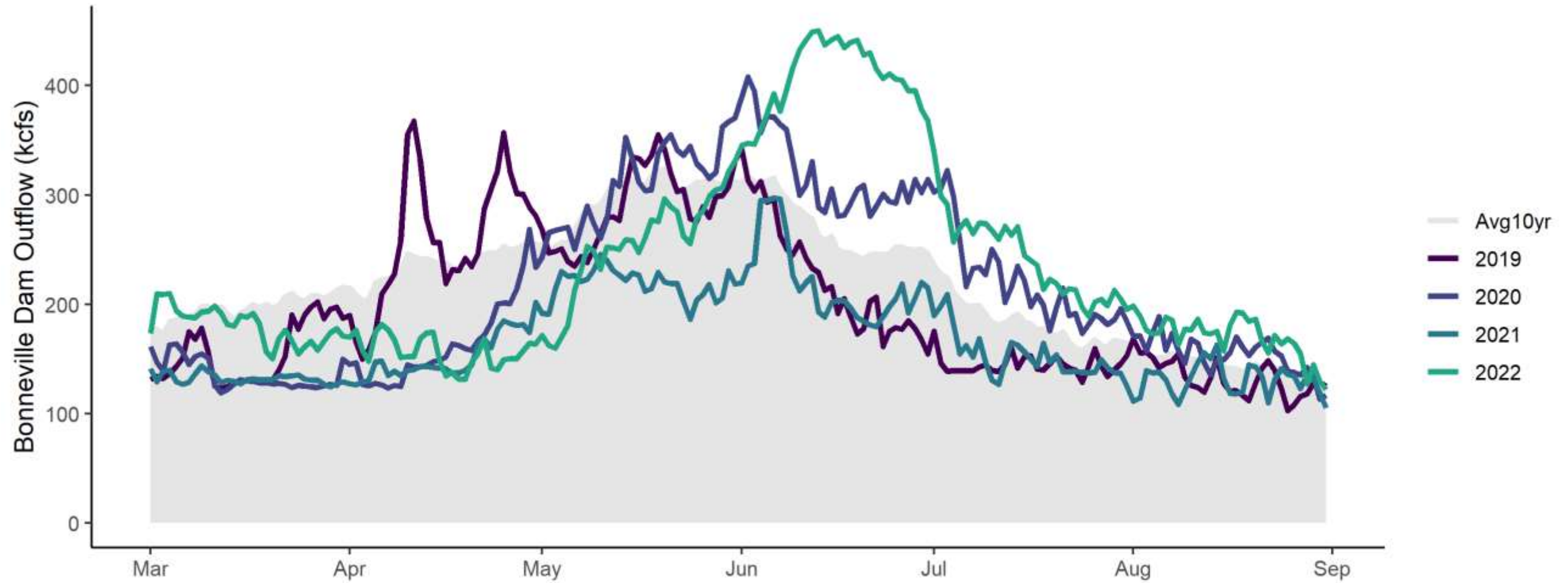
Post-construction Research

April - July



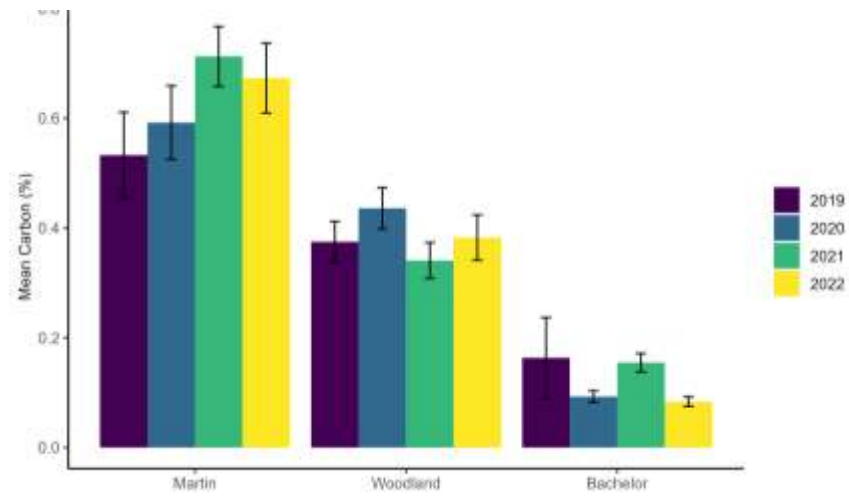
2022

Bonneville dam outflow

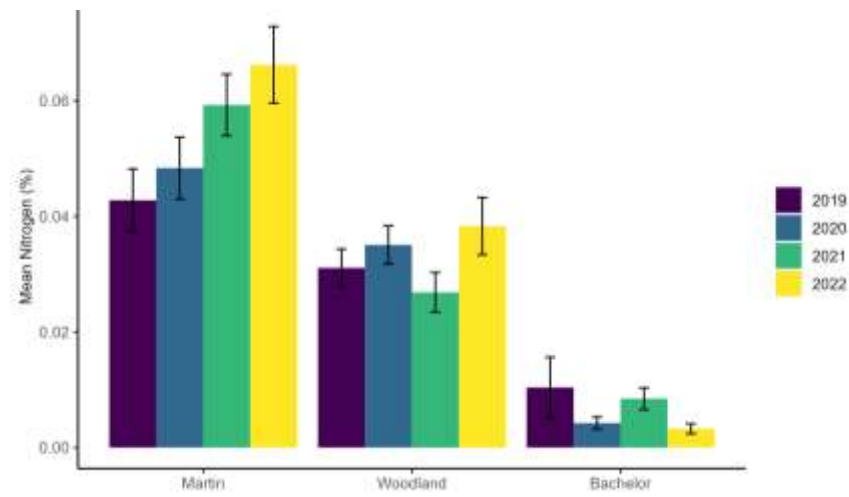


Sediment Conditions

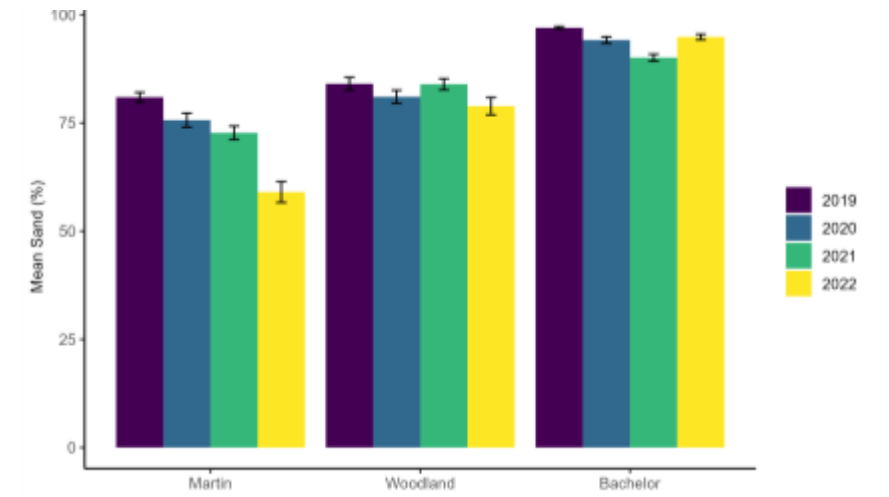
Carbon



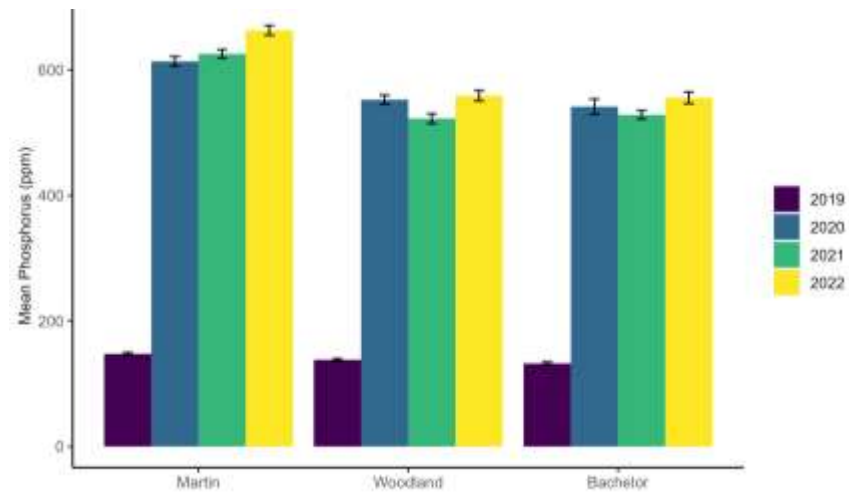
Nitrogen



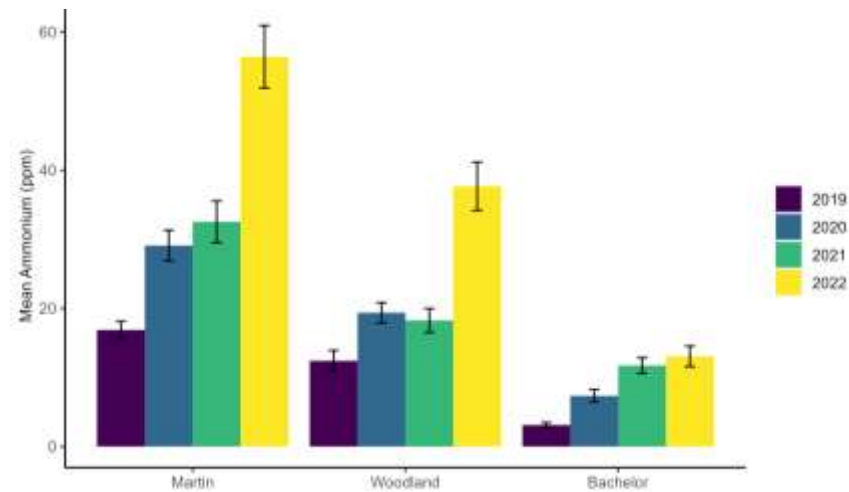
Sand



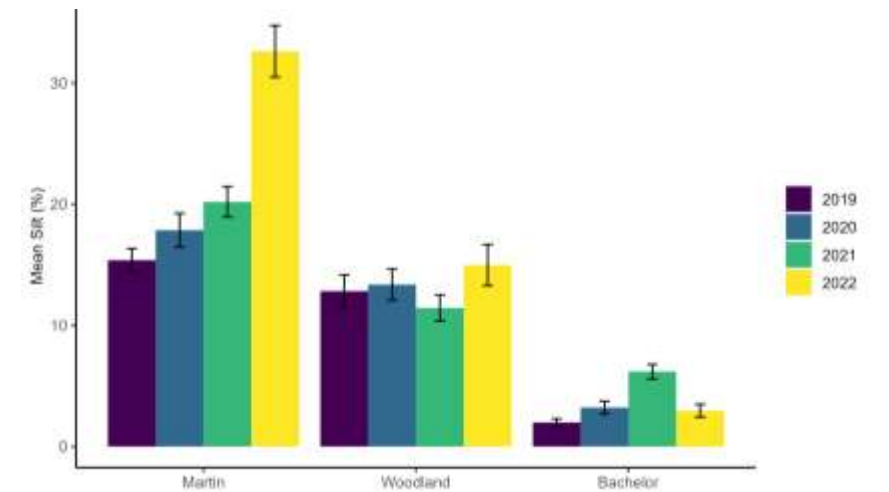
Phosphorous



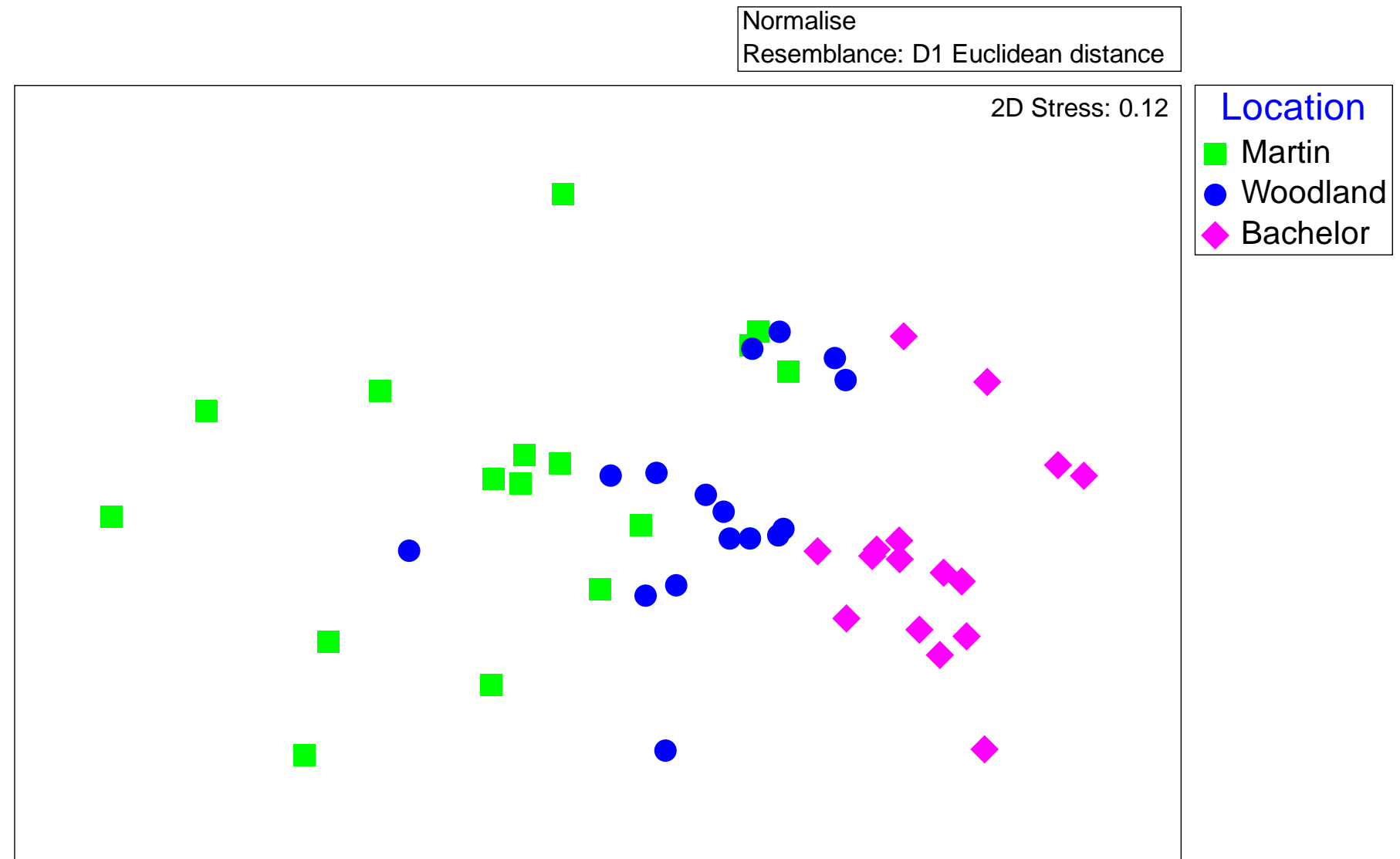
Ammonium



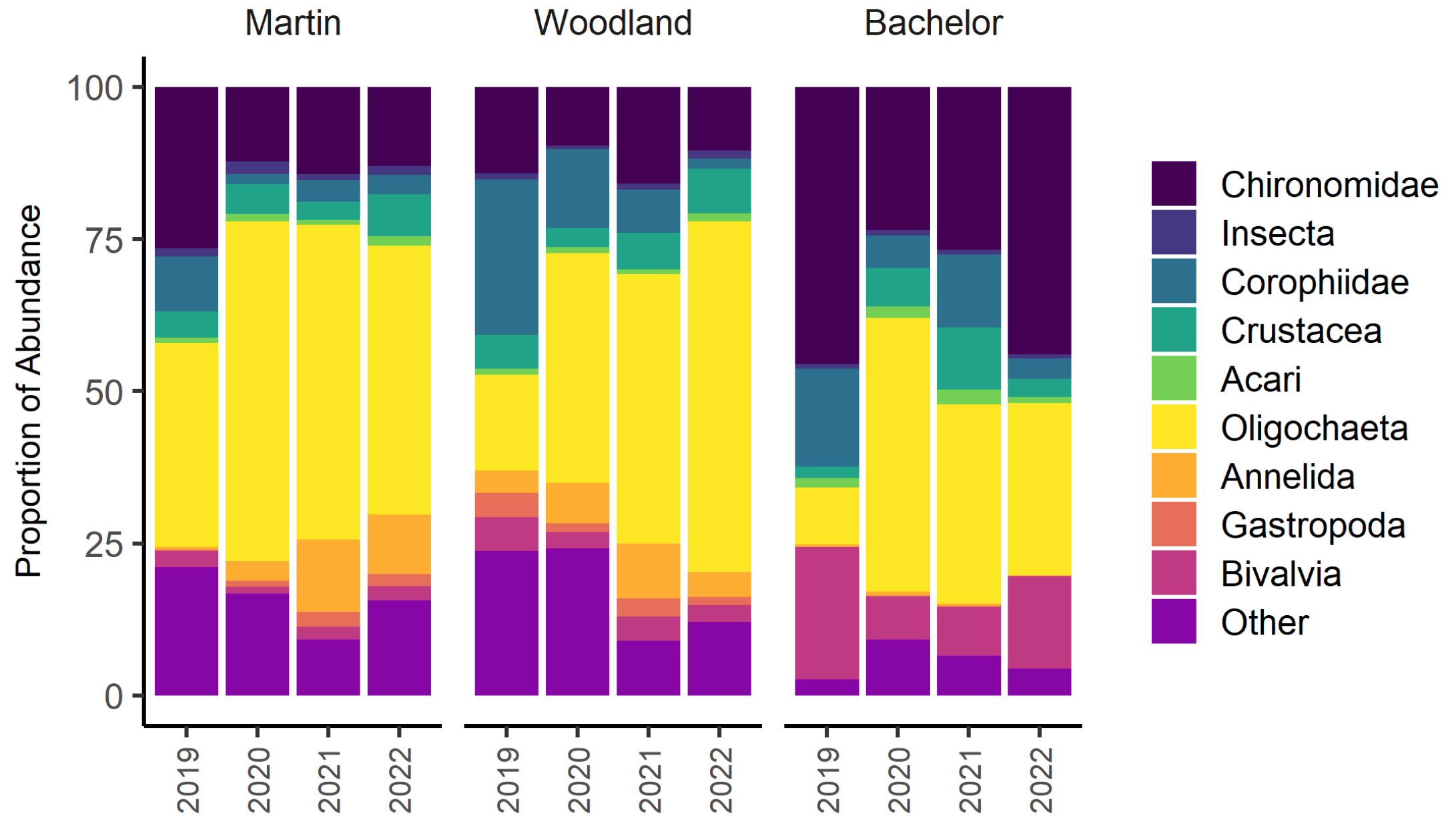
Silt



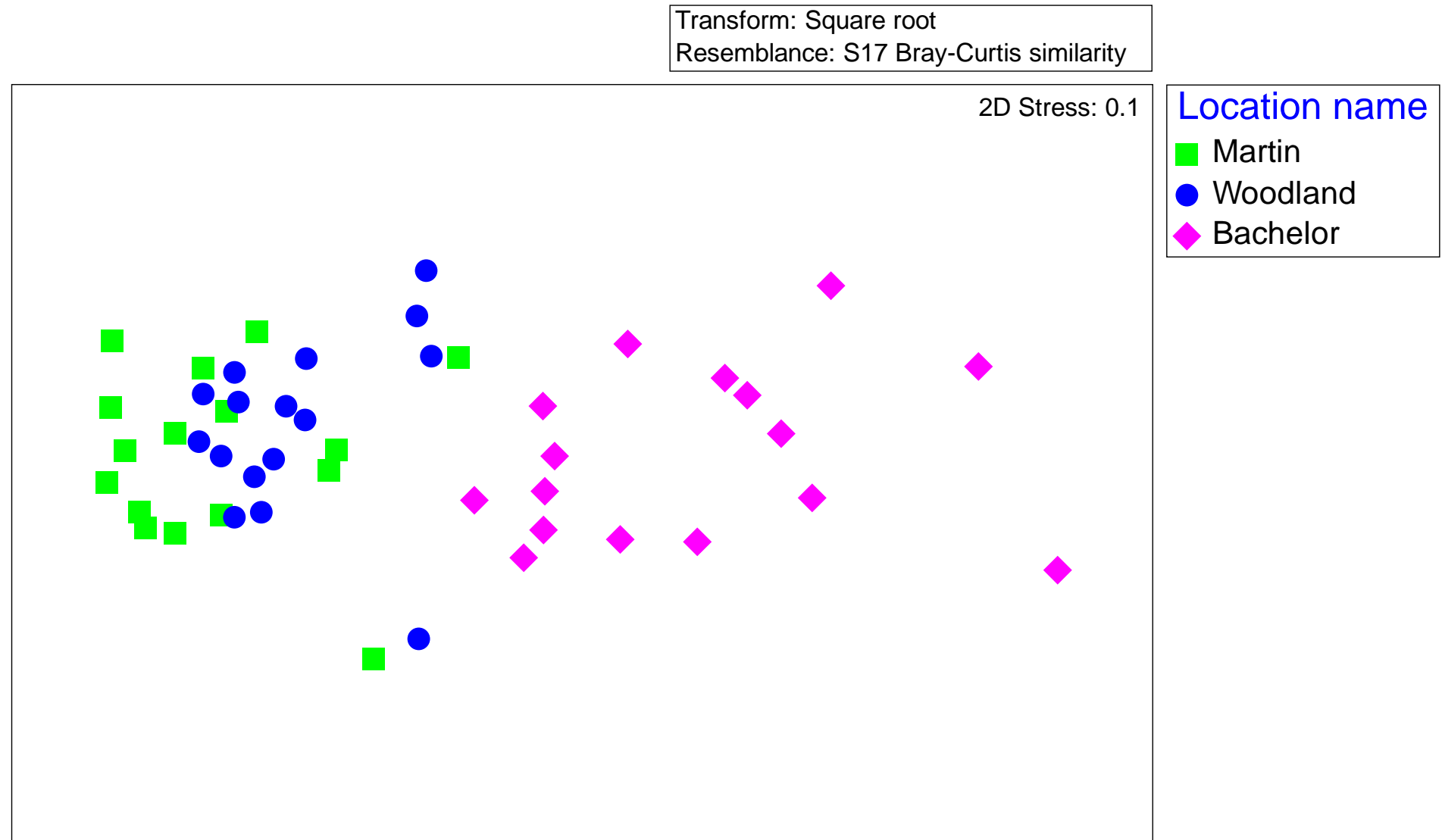
Environmental Conditions



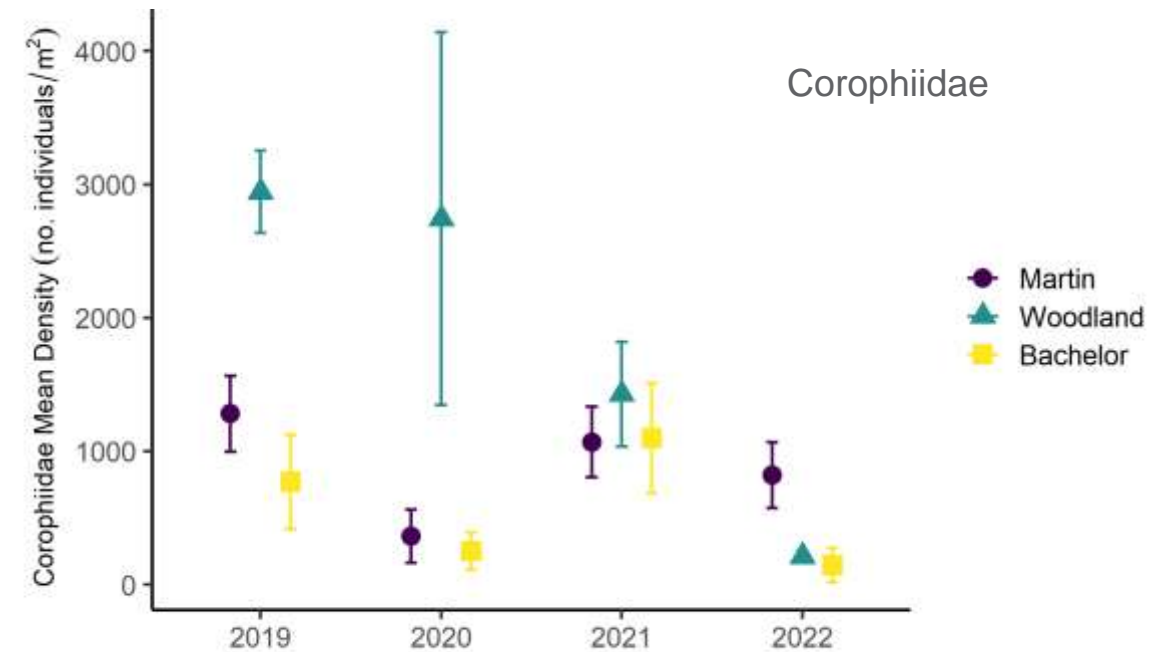
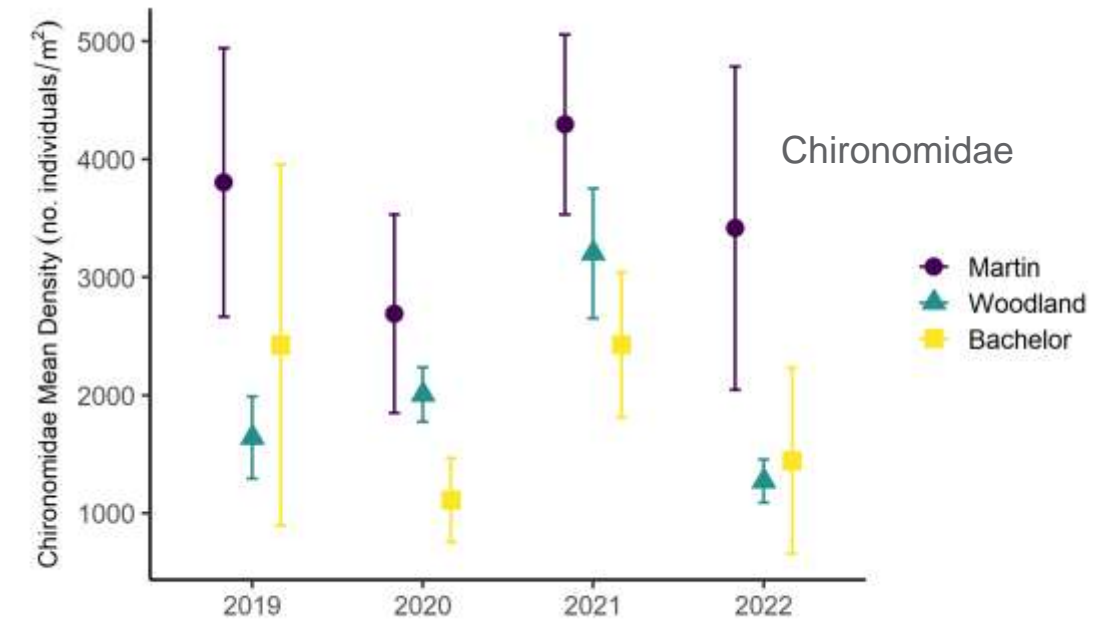
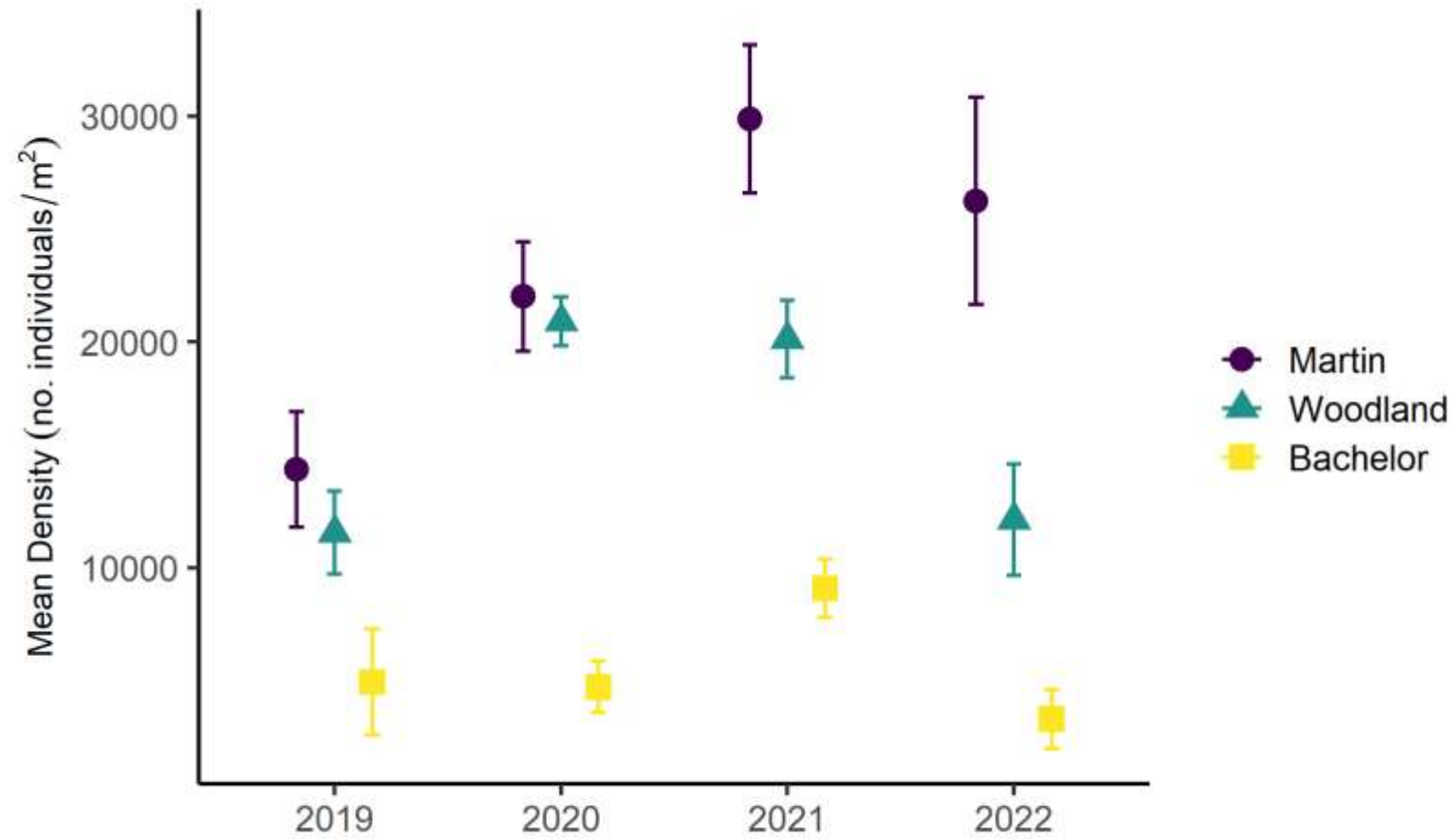
Benthic Assemblage



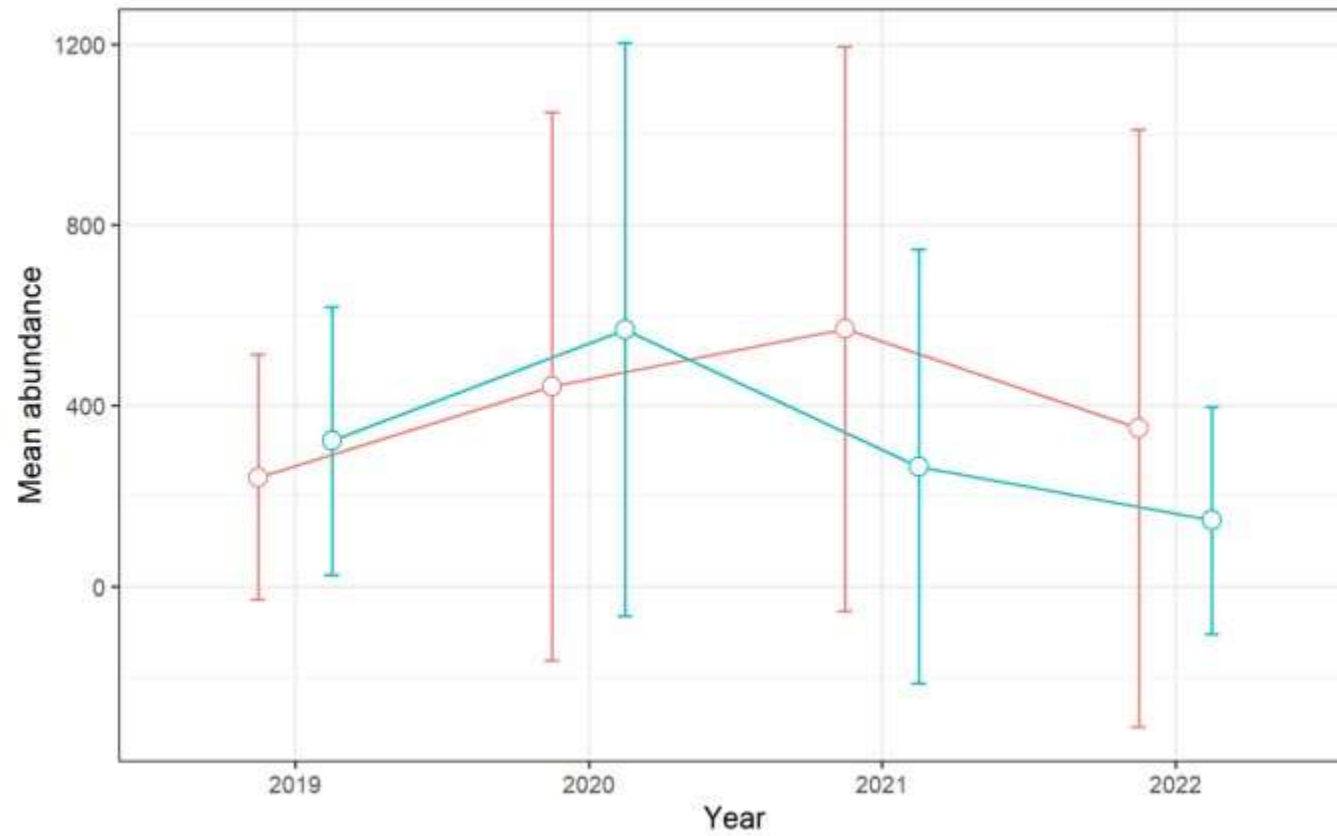
Benthic Assemblage



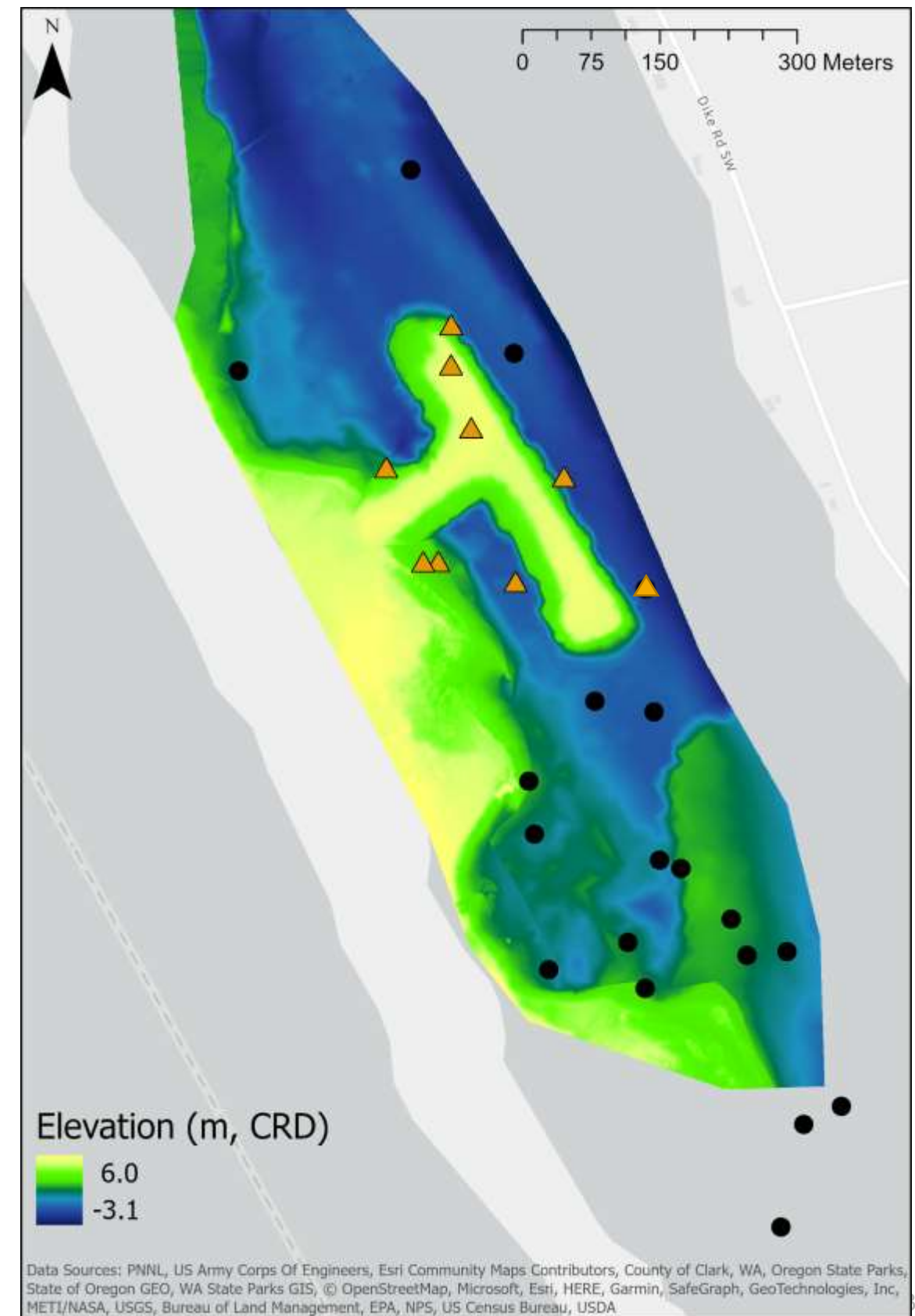
Invertebrate abundance



Woodland Island



Impact
 - No
 - Yes



Woodland Island Benthic Assemblage

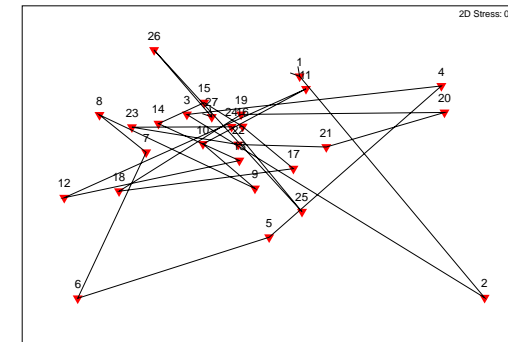
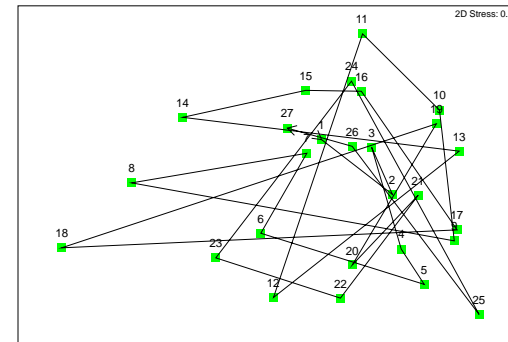
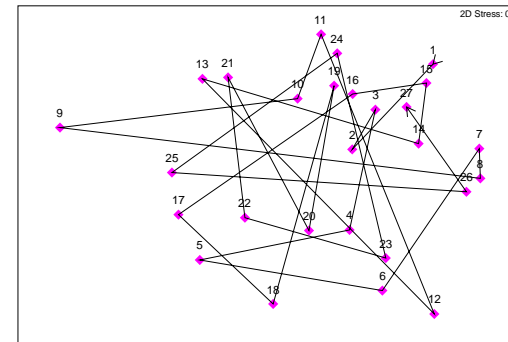
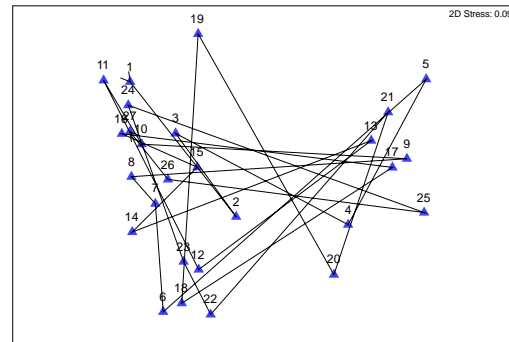
April

May

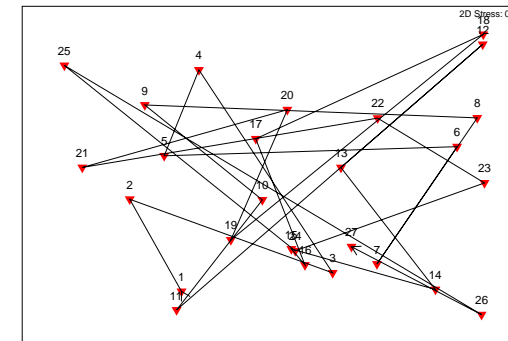
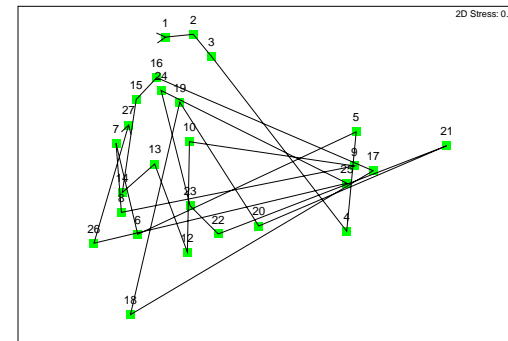
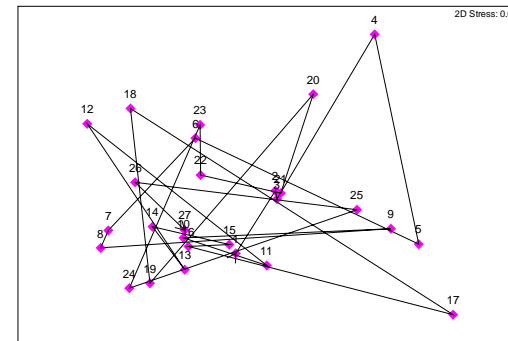
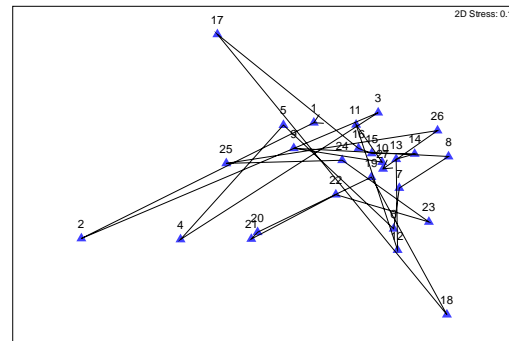
June

July

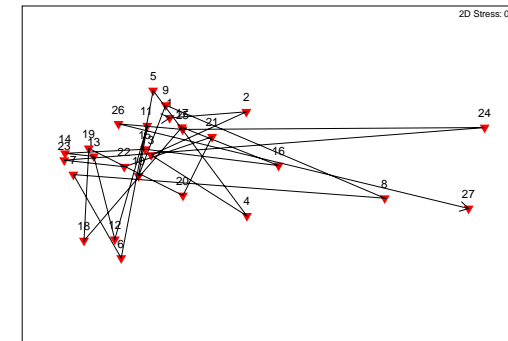
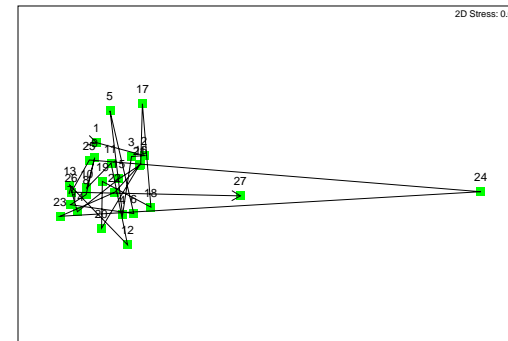
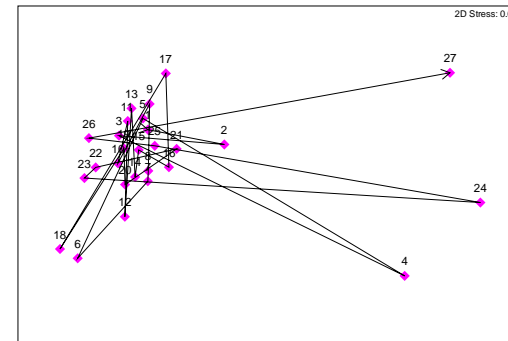
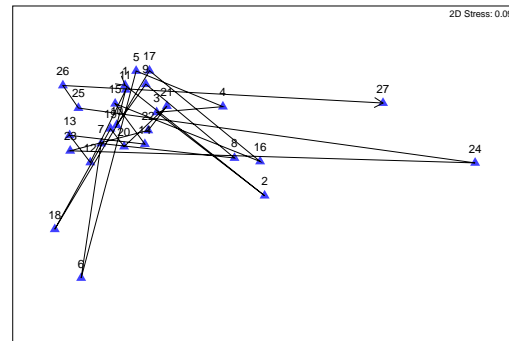
2019



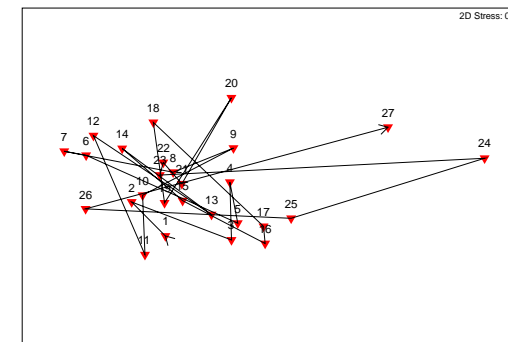
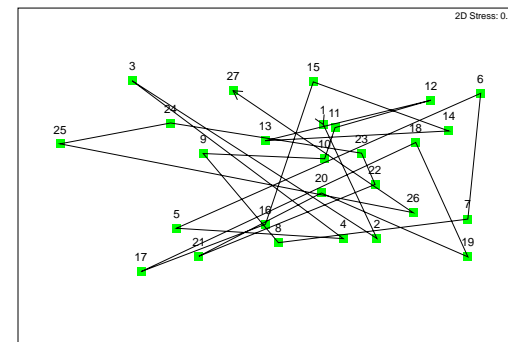
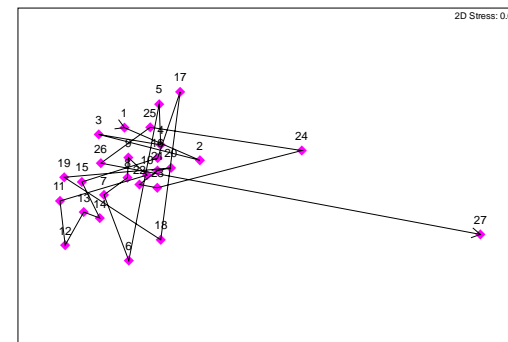
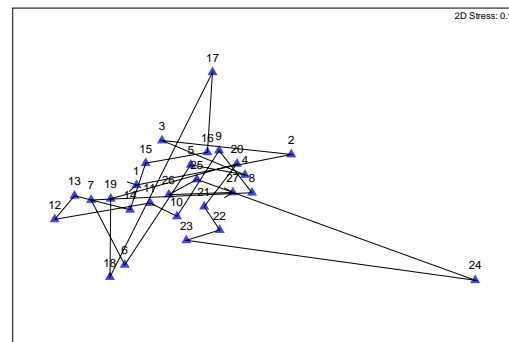
2021



2020

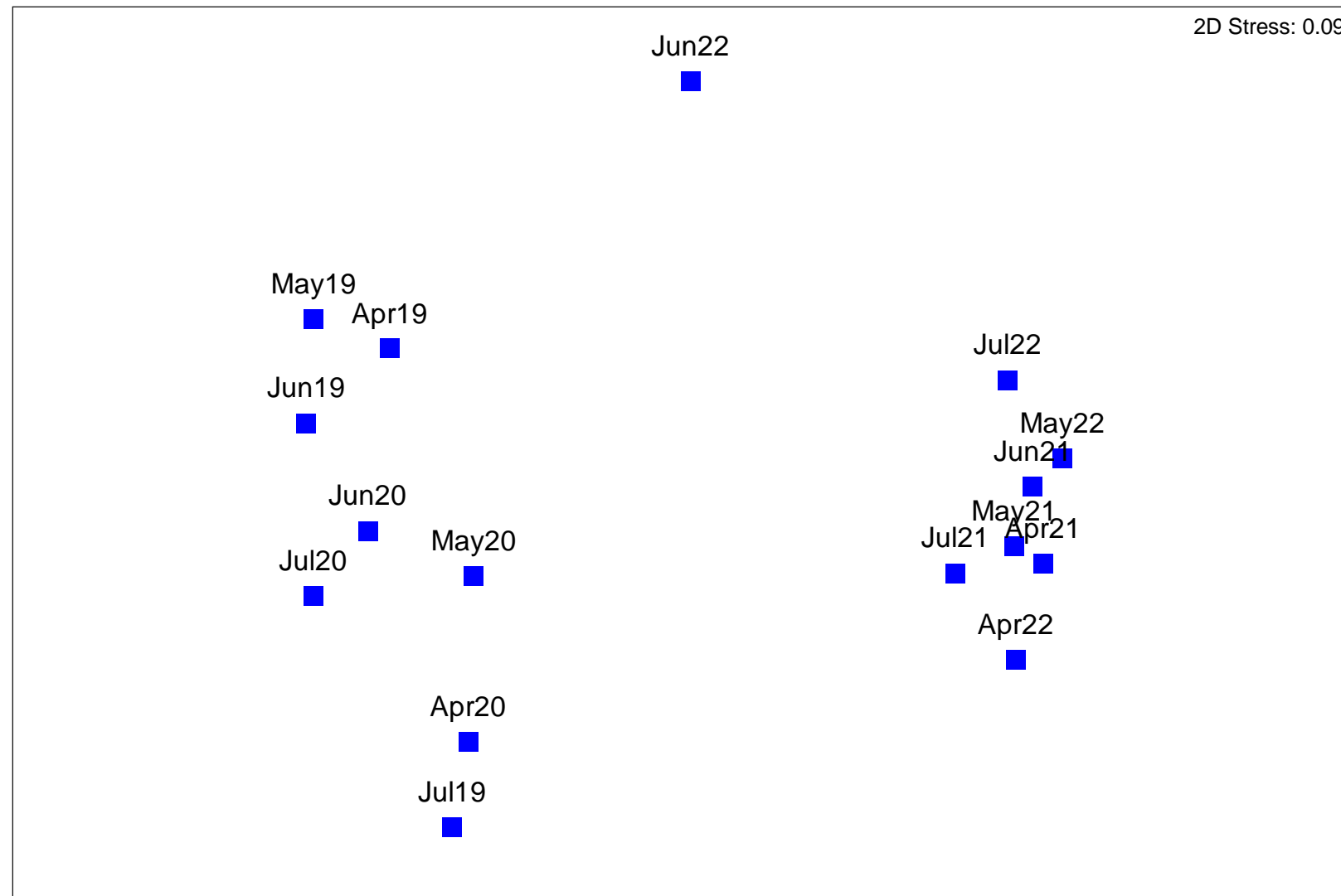


2022



Benthic assemblage

Non-metric MDS



Summary and Next Steps

- New insights into benthic assemblages in off-channel habitats:
 - provide key food resources for juvenile salmon
 - Inform future study designs
- Relationship between environmental conditions and benthic invertebrates
 - high sand, low nutrients correspond to low invertebrate density and high variability
- Before vs. After
 - Total mean density: control sites decreased in 2022, impact site decreased 2021-2022
 - Individual taxa responded differently across space and time
 - Benthic assemblage at Woodland differed before vs after placement

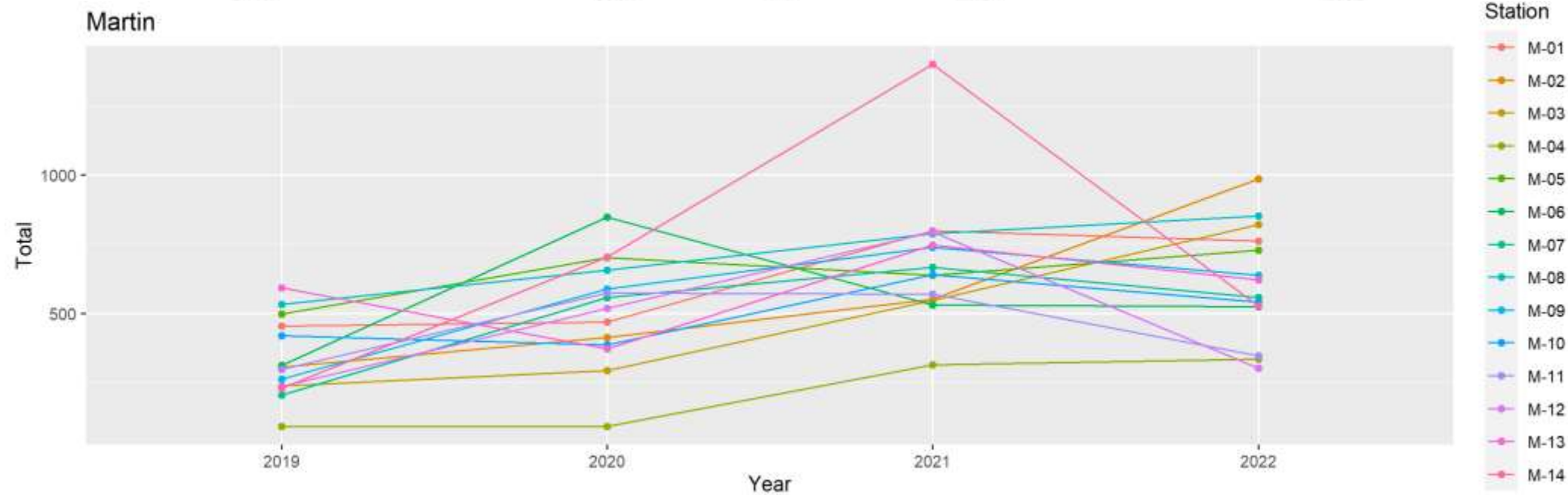
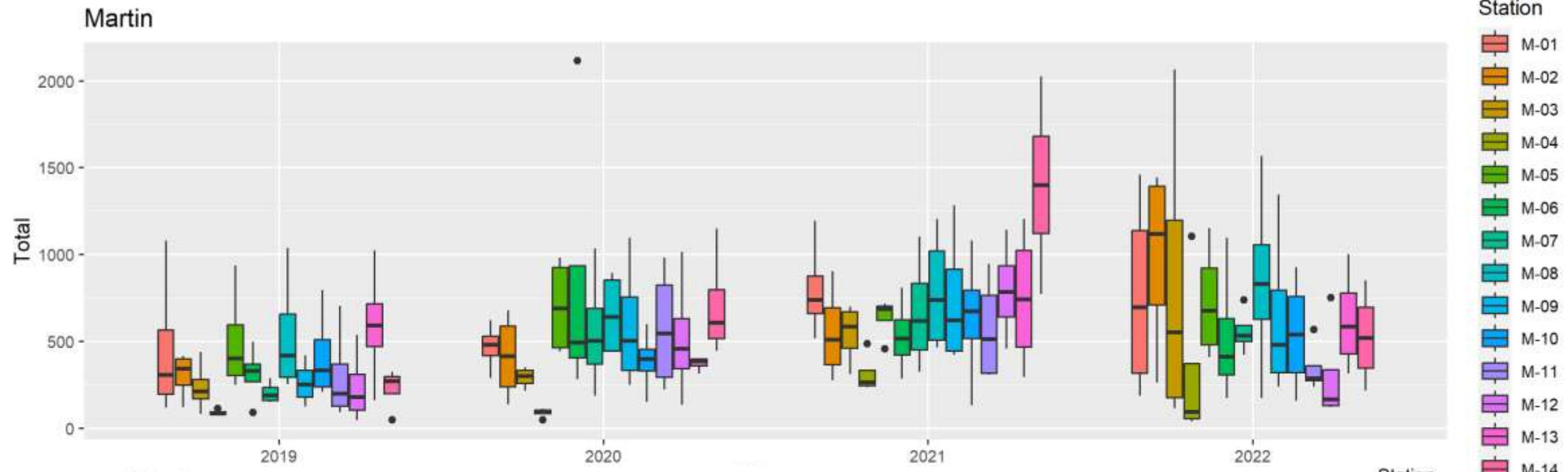


Acknowledgements

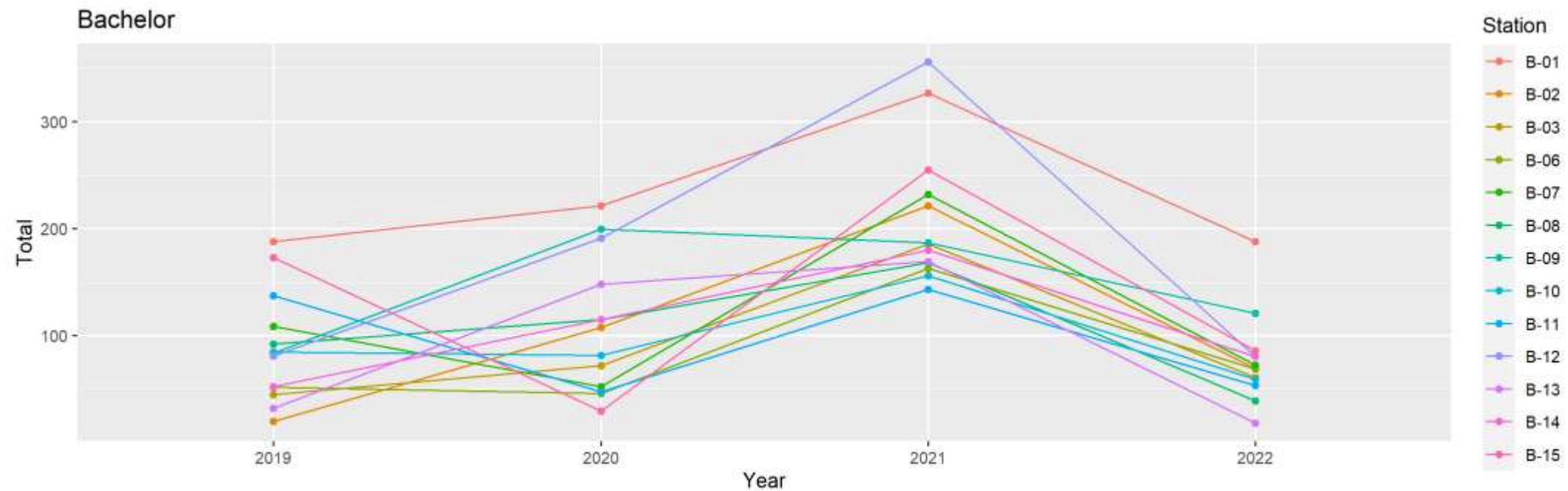
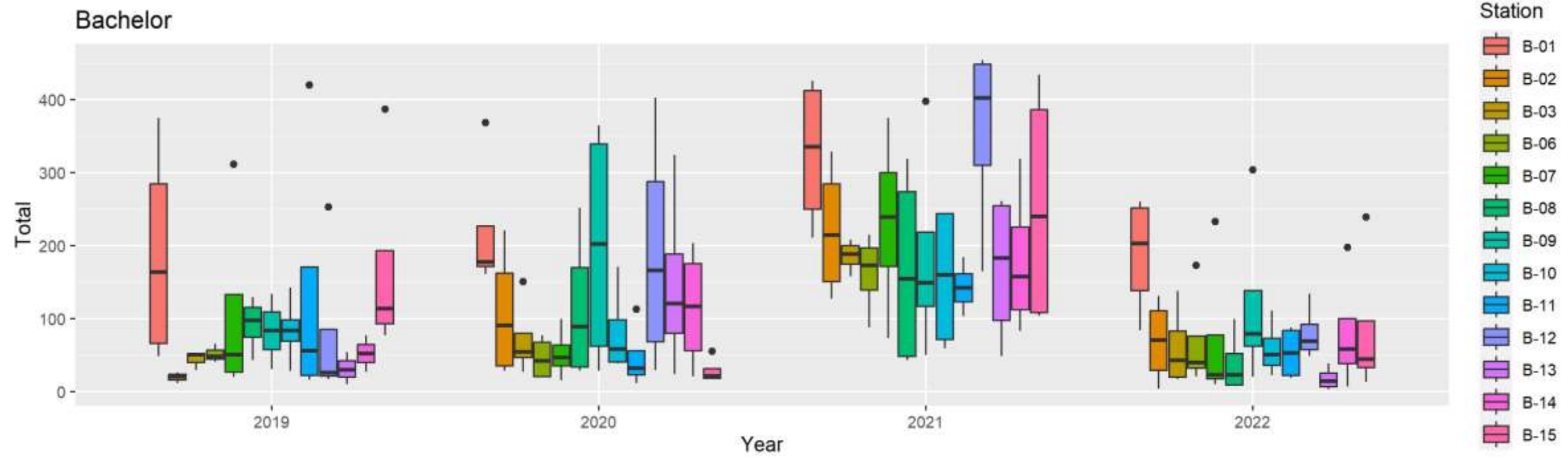
- USACE
 - Ida Royer, Chanda Littles, Mark Bierman
- PNNL
 - Eric Fischer
 - Madison Bowe
 - Shon Zimmerman
- EcoAnalysts
- OSU Central Analytical Lab



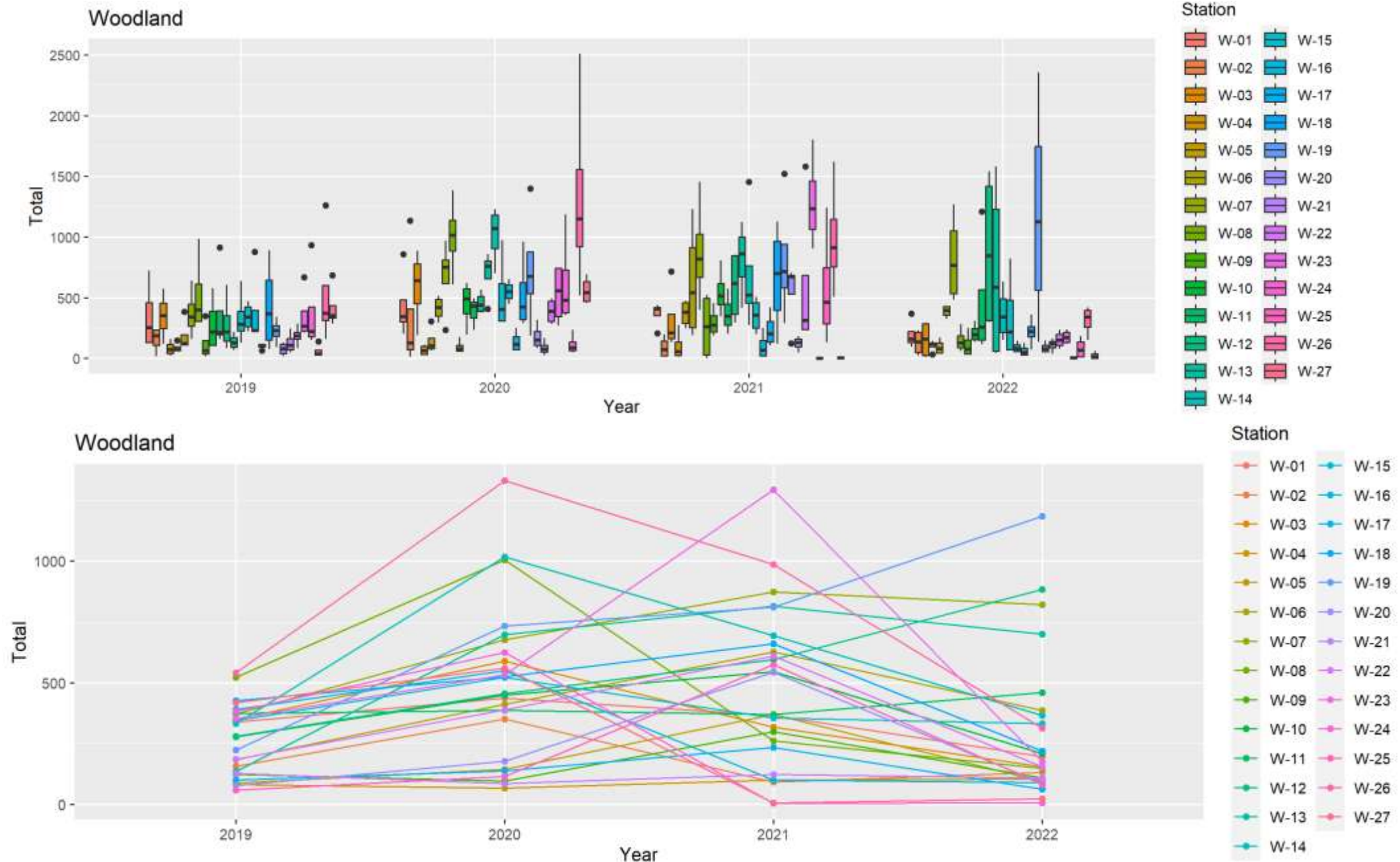
Variation of abundance by station in Martin



Variation of abundance by station in Bachelor



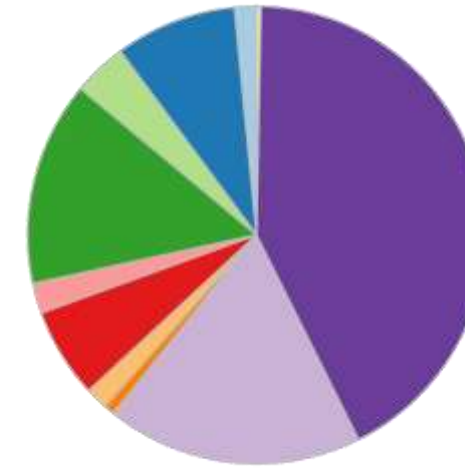
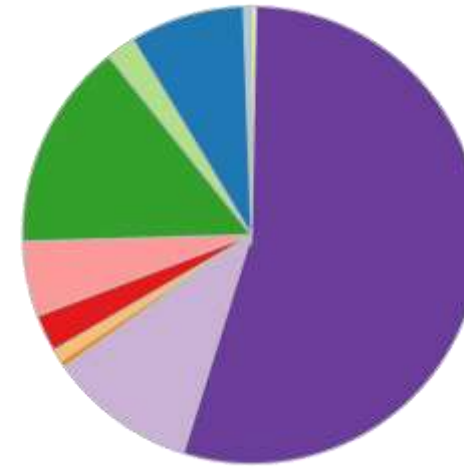
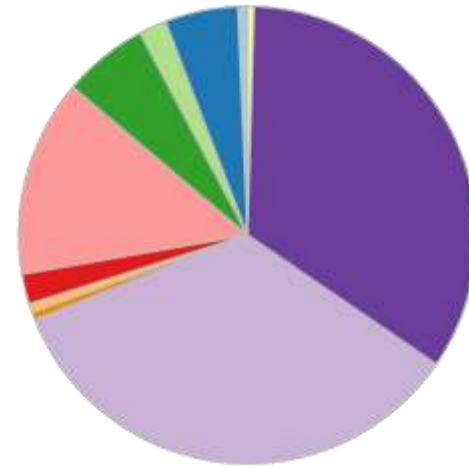
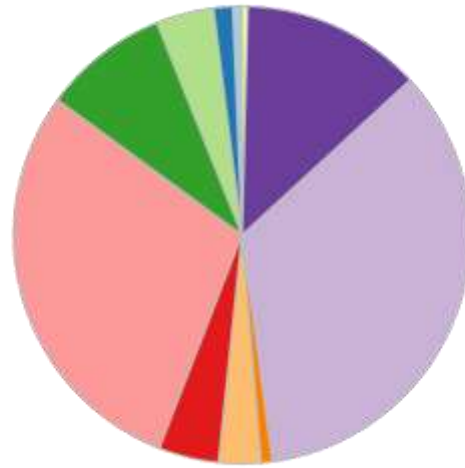
Variation of abundance by station in Woodland



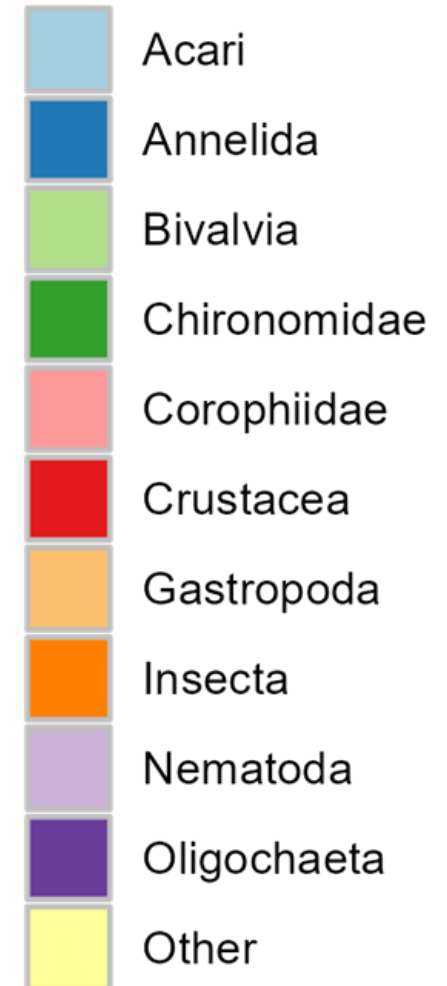
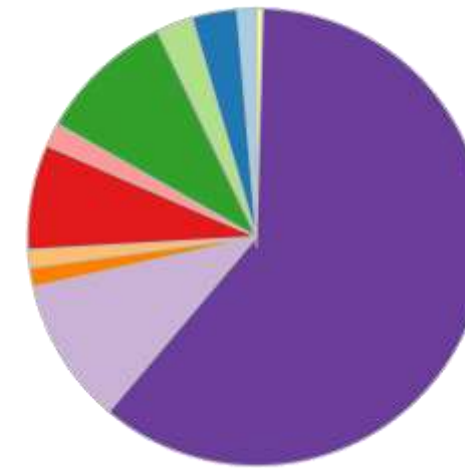
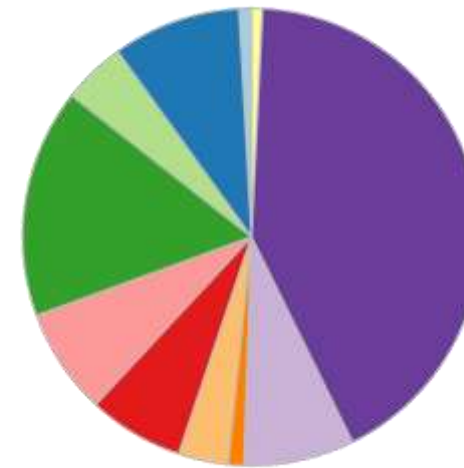
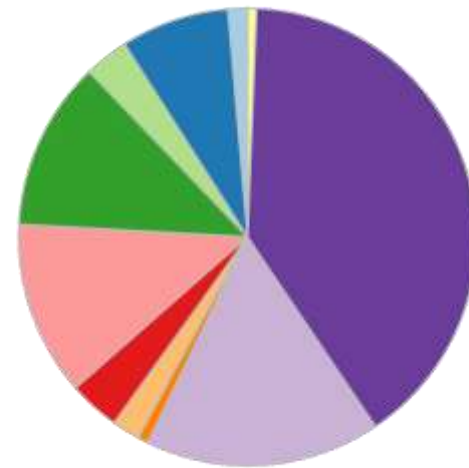
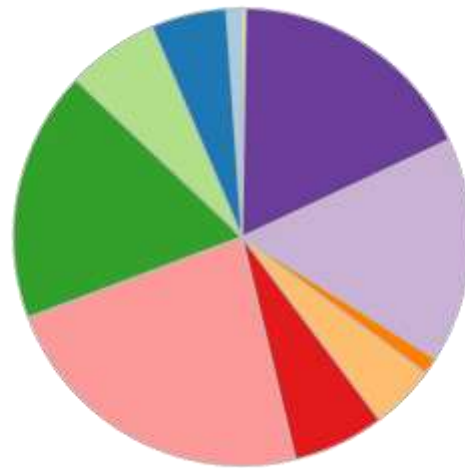
Before

After

Dredged
placement
sites



Non-
dredged
placement
sites



2019

2020

2021

2022