

SUCCESSFUL BENTHIC MONITORING PLAN ELEMENTS:

- Mindful site selection based on geophysical and geotechnical (G&G) seafloor characterization and sensitive habitat presence.
- Statistical power analysis to determine appropriate sample size.
- Defined indicators, standardized classification standards (i.e., Coastal and Marine Ecological Classification Standards [CMECS]), and indices to describe changes in benthic habitat and recovery of communities.
- Consideration of the advantages and disadvantages of a Before-After-Control-Impact (BACI) versus a Before-After-Gradient (BAG) sampling design to assess the spatial and temporal changes in defined indicators in the designated survey area.

BACI SURVEY DESIGN

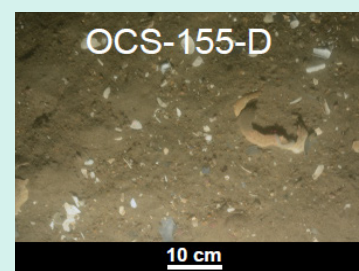
Employs sampling at control and impact sites both before and after an impact occurs.

- ◇ Advantages: Allows for statistical analysis of hypotheses.
- ◇ Challenges/Drawbacks (Stewart-Oaten et al. 1986; Methratta 2020)
 - » Locate control site statistically similar to-and independent of the impact site.
 - » Assumes habitat areas within control and impact sites are homogeneous.
 - » Assumes the spatial scale of the impact is correctly estimated and sampled.
 - » Proper survey design and appropriate application can mitigate these drawbacks.

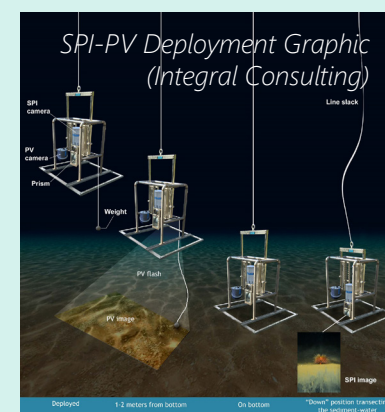
BAG SURVEY DESIGN

- ◇ Measures environmental variables before/after an impact along a spatial gradient.
- ◇ Sampling based on distance from impact source rather than impact/control sites.
- ◇ Regression techniques can be used to assess potential distance-associated changes.

- Standardized methodology, gear, and monitoring areas to compare results. Types of surveys could include:



- ◇ Acoustic imaging of the seafloor (i.e., multibeam, side scan sonar).
- ◇ Grab sampling for sediment grain size and macroinvertebrate community analyses.
- ◇ Underwater imagery such as Sediment Profile Imaging and Plan View Imaging (SPI/PV) sampling, drop camera, towed video camera, or remotely operated vehicle (ROV) transects.



Main Objectives of Benthic and Fisheries Monitoring Surveys for Offshore Wind Projects

- Document baseline environmental conditions relevant to benthic and fisheries resources in the Lease Area and along submarine export cable routes.
- Measure and assess potential changes post-construction and during Project operation.
- Assess and measure the disturbance and recovery of marine benthic habitats and fisheries resources.

SUCCESSFUL FISHERIES MONITORING PLAN ELEMENTS:

- Survey design that follows Bureau of Offshore Energy Management (BOEM) 2019 Fisheries Survey Guidelines and Responsible Offshore Science Alliance (ROSA) 2021 Offshore Wind Project Monitoring Framework and Guidelines.
- Comprehensive review of pre-existing data to identify key fisheries and resources of interest in the project area.
- Identification of objectives for the surveys with input from state and federal agencies and other stakeholders.
- Methods to conduct comprehensive baseline conditions assessment for fisheries of interest in the Project area and to monitor conditions during and after Project construction.
- Methods to determine the appropriate sample size for sufficient statistical power to detect potential effects.
- Identification of appropriate gear and survey techniques for the project based on regulator and stakeholder input. Fisheries surveys could include:
 - ◇ Demersal trawl surveys
 - ◇ Clam dredge surveys
 - ◇ Trap and pot surveys
 - ◇ Rod and reel surveys
 - ◇ Gill net surveys
 - ◇ Environmental DNA (eDNA) surveys
 - ◇ Acoustic telemetry and tagging surveys
 - ◇ Remote underwater video surveys
 - ◇ ROV glider surveys

Example of survey vessel used for bottom trawl surveys (www.vims.edu)



Challenges

- Balancing the input and needs of federal, state, and other fisheries stakeholders which can sometimes be contradictory. For example:

Site-specific sampling is required by Lease stipulations; however, regional sampling is often requested by stakeholders.

Evolving equipment and methods including more non-extractive techniques are encouraged by some stakeholders, but not embraced by others since there is not a historic baseline for comparison.

- Developing best sampling design (BACI vs BAG) and obtaining agency agreement.
 - ◇ Determining the appropriate survey design and size can be difficult if there is not enough existing data to conduct a statistical power analysis.
- Agency guidelines and recommendations often change during the life of a project.
- Agencies and stakeholders have differing guidelines and views related to appropriate scope and duration of pre- and post-construction monitoring.
- In certain locations, obtaining Endangered Species Act (ESA) take coverage permits for surveys has been difficult, time consuming, and has resulted in project delays.

Recommendations

- Begin planning early and collaborate with state and federal resource agencies, academic institutions, commercial and recreational fishermen, and other stakeholders prior to conducting surveys.
- Have clear hypotheses and focal species groups for each monitoring survey. Set indicators and define thresholds that are appropriate and measurable. Adjust designs as needed to achieve monitoring objectives.
- Choose sampling gear with lower risk to ESA species where the presence of ESA species is a factor (e.g., avoid trawls and fixed gear such as gillnets or traps with lines). Work with agencies to design and implement non-extractive surveys (eDNA, video, autonomous vehicle sampling).
- Hire commercial and/or recreational fishing vessels/captains to assist with survey implementation.
- To address stakeholder requests for regional sampling, state and federal agencies should consider developing and funding a programmatic, regional approach to fisheries surveys so data can be consistent among offshore wind lease areas. This should also include data management guidelines and storage/display solutions.