Capability, Expertise and Skill Sets Required For Deployment and Field Estimation Lander-Based Denitrification

The personnel deploying the lander should have expertise with boating, a boat with sufficient space and a sturdy davit , the physical capability to move a heavy lander, expertise with operation of a water quality sonde, and water quality sampling expertise for rapid sampling of the gas and nutrient samples.

Deployment/Field Operation

- The paramount skill the assessment team needed for operation of the lander is expertise with boat operations and anchoring. The ability to deploy 3 anchors to secure the boat in a relatively small area can be acquired through trial and error with repeated deployments and should not exclude less-experienced boat operators. Basic navigation skills are needed to use a GPS to locate the sampling site.
- Having a properly equipped boat is also a necessity. The lander, as currently constructed with thick PVC walls is quite heavy, requiring 2 individuals comfortable moving the large, heavy lander . The boat must have sufficient deck space for the lander and room in the lander's periphery for scientists to attach the various sampling, sonde and 12v circulator supply lines. A davit with sufficient strength to lift the lander is necessary, deployment and retrieval without the davit it not likely to be feasible. While we used a hand crank on the davit to lower and raise the lander, a small electric winch set up would be optimal.

Sampling

The skills required for taking samples from the lander require mostly generic water quality expertise. The dissolved nutrient and bromide samples are syringe filtered and are relatively straightforward. Proper nutrient handling includes ensuring the water makes no contact with hands and that they are kept on ice until they are returned to the laboratory and frozen until analysis. The samples for dissolved gas analysis are more sensitive to error. The sample vials are filled by insertion of the sampling tubing into the bottom of the vial and overfilling the tube, removing it as it continues to flow. Proper sampling protocol for the denitrification and nutrient samples is shown in Owens and Cornwell (2016). UMCES uses 10 μL of 50% saturated mercuric chloride to inhibit microbial degradation of the sample and experience with pipetting is useful. Proper preservation includes both the preservative as well as proper handling of the samples, generally including submersion in water to keep temperatures from changing excessively and eliminating evaporation. Experience handling samples for mass spectrometric analysis of dissolved gases is helpful, particularly when analytical results are hard to interpret, but proper training makes sampling handling a minimal concern.

Field Observations to Guide Flux Experiments

Diligence in assuring the lander is not dragged from its footprint is essential, while analytical results may still appear useful, they may result from changing rates of dilution/leakage or a change in bottom characteristics, including oyster abundance. Field personnel need to have the ability to monitor dissolved oxygen over time, preferably by recording the oxygen time course from a water quality sonde, or by recording values in a notebook. At UMCES, we did both and used the notebook data to decide when the oxygen decreases were getting small, suggesting termination of the experiment. In practice, taking 8-10 samples every 5 minutes makes monitoring oxygen less necessary, though it is possible that with low oyster biomass or sampling in low temperatures/low metabolism conditions may require longer time courses. With high rates of leakage, oxygen changes are minimal and operators should recognize that changes in oxygen are insufficient to provide rates, and be ready to "abandon" the time course.

Owens, M. S., and J. C. Cornwell. 2016. The Benthic Exchange of O-2, N-2 and Dissolved Nutrients Using Small Core Incubations. Jove-Journal of Visualized Experiments.