

Data Management Plan

Products of Research: This proposed research will generate both raw and processed data. These data will consist of: 1) baseline environmental and biological parameters measured at each of our 15 sites (light, temperature, seagrass nutrient content, and grazer community structure), and 2) seagrass response metrics to fixed treatments at each site (areal biomass, productivity, sediment and seagrass nutrient content, epiphyte loading, carbohydrate storage). Data will be used for the generation of annual and final reports to NSF as well as peer-reviewed articles and presentations. Implementation, status, and any changes to original data management plan will be reported in annual and final reports to NSF. PI Campbell and co-PI Paul will be responsible for implementing and using the data management plan. Data will also be shared in a variety of ways. We will follow the Division of Ocean Sciences Sample and Data Policy and utilize the Biological and Chemical Oceanography Data Management Office (BCO-DMO) for all data management and data and sample storage for this project. Additionally, the Smithsonian Institution's IT infrastructure and organization will be used to support data sharing and archiving. Below are examples of the kinds of data to be collected in our research project:

Environmental metrics: Temperature ($^{\circ}\text{C}$), salinity (ppt), irradiance ($\mu\text{mol photons m}^{-2} \text{ s}^{-1}$),

Biological metrics: Seagrass biomass (g m^{-2}), productivity ($\text{g g}^{-1} \text{ d}^{-1}$), nutrient content (% nitrogen, % phosphorus), epiphyte loading ($\text{chl } a \text{ cm}^{-2}$), carbohydrate content ($\text{mg C g}^{-1} \text{ dry wt}$), grazer community structure (abundance / richness)

Data will be interpreted with the aid of statistical software (e.g., SPSS, Sigmaplot, and R). Interpreted data products will be incorporated primarily into peer-reviewed journal articles, and in Supplemental Information to journal articles, but will also appear in conference presentations. In the case of journal articles, we will endeavor to make arrangements with the publishers to allow us to post PDF versions to public archives such as Smithsonian Research Online (<http://research.si.edu/>, a tool available to the public for accessing products from Smithsonian scholars) or other similar sites after an appropriate embargo period, but will in all cases abide by whatever the publisher's terms and conditions require. All raw experimental and biological data and metadata from this project will be archived via the BCO-DMO and the Smithsonian Research Information Repository Initiative in consultation with the NSF Program Officer. The Smithsonian Research Information Repository Initiative will provide a centralized preservation, storage and access environment for the digitized data of current and future research activities. Data products will be shared according to established policies and archived for long term storage. All raw data and data products will be made available for public use according to NSF guidelines.

Data Storage and Preservation According to Smithsonian Directive 610 (Digitization and Digital Asset Management Policy), all Smithsonian units must create digital asset management plans for any project they embark on. The Smithsonian Office of the Chief Information Officer is responsible for maintaining the IT infrastructure that supports digitization and digital asset management. The Smithsonian's Data Center in Herndon as part of a research information service will house an enterprise digital repository for scientific data including both near-line and archival storage, provide the staff to care for it, develop mirrored sites and traditional offsite storage, and provide methods to securely access and disseminate the data sets. Additionally, the BCO-DMO has software and procedures for data storage and preservation, and we will work with BCO-DMO staff to ensure all data storage meets with the specifications of the Biological Oceanography program at NSF.

Data Formats and Metadata Data processing and analysis will occur primarily in spreadsheets (e.g., MS Excel) and statistical programs (e.g., SPSS, SigmaPlot, and R). We will maintain metadata for all data types and data files associated with this project. Metadata will describe and document our datasets. For

example, metadata include definitions of all environmental metrics (temperature, salinity, irradiance) conducted during our networked experiment. All biological metrics will be specified and units designated within metadata files. Metadata will also describe the experimental manipulations that we impose. Data and metadata (calibration information) associated with the analytical instruments used to assess water quality variables will be additionally collected and stored. All methods used for data collection, processing, QC/QA, and analysis will be described, as well as the title, creator, file format, file structure, geographic location, and timestamp. Access rights and access information regarding where the public can access data will be included as part of metadata. Excel files and appropriate project metadata and dataset metadata forms will be submitted to the BCO-DMO.

Data Dissemination & Policies for Data Sharing and Public Access Data will be disseminated in a variety of ways but only in accordance with ethical and legal terms and conditions as outlined by applicable Smithsonian guidelines and federal regulations. 1) Data will be made available in response to individual requests via e-mail with attached files. 2) When appropriate, some data will be disseminated through journals that enable online posting of Supplementary data. 3) Data will be archived, and made available via the Smithsonian Research Information Repository Initiative and through the dissemination capabilities of the BCO-DMO. Additionally, dissemination of research products such as peer-reviewed journal articles will be made available via Smithsonian Research Online.

Roles and Responsibilities All members of our research team will be responsible for preserving data quality through standardized field and lab practices; however, the postdoc and PI Campbell will work with site managers and help oversee interns to ensure accuracy of manual data entry, data file uploads, and subsequent proofing. PI Campbell and co-PI Paul will also supervise data quality measures; file naming, data documentation and metadata creation. Campbell and Paul will be the point of contact for long term archiving by the BCO-DMO and the Smithsonian Research Information Repository Initiative, which operates in concert with the Smithsonian's Data Center in Herndon, VA, which houses an enterprise digital repository for scientific data including both near-line and archival storage, provide the staff to care for it, develop mirrored sites and traditional offsite storage, and provide methods to securely access and disseminate the data sets.