

Data Management Plan. This plan provides for the preservation, documentation, and sharing of data collections, modeling results, and other related research and education products. It follows the guidance provided in NSF 17-037 Division of Ocean Sciences Data and Sample Policy. All data and metadata will be submitted to the Biological & Chemical Oceanography Data Management Office (BCO-DMO) within two years of collection or generation. Project information and metadata will be submitted to BCO-DMO within the first three months of project initiation as outlined in NSF 17-037.

1. *Types of data and other materials produced in the course of the project.* During the proposed project we will collect oceanographic data (water temperature, salinity, DO, pH, flow velocity and structure), ecological data (abalone juvenile recruitment, adult and sub-adult abundances and size structure, demographic rates – growth and mortality - and physiological condition of experimental animals). Spatial data will be geo-referenced to coordinate with GIS and remote sensing data formats. We will also use existing data in analyses and modeling. Existing data include Sea Surface Temperature, SSH, QuickScat winds, chlorophyll (color) from satellite imagery (available from NOAA CoastWatch, coastwatch.noaa.gov), fisheries catch, effort, and catch per unit effort time series, published and unpublished data on focal species (e.g., past estimates of invertebrate abundance), and their vital rates (e.g., growth, mortality). R, Matlab, and Python scripts for data analyses and for models simulating population demography and management will be also produced during the project.

2. *The standards to be used for data and metadata format.* All raw data and metadata will be submitted to the Biological & Chemical Oceanography Data Management Office (BCO-DMO) in the preferred format at the time of submission. Copies of the biological data and model parameters and results will also be housed and managed on a server in the Micheli and De Leo labs, while oceanographic data will be housed on a server in Micheli's and Woodson's labs and at Stanford's EFML. Data on the servers will be stored in appropriate formats, including Microsoft Access, Excel/CSV, and Rich Text Format according to good practice for data management¹. Spatial analyses will be saved as coverages, shapefiles, rasters, and accompanying metadata. An HTML interface will be also created for easy access to the relevant information. Metadata will include a description of how the data were collected, where, when, and who collected them, where they are stored and how they can be accessed. We will also provide an explanation of variables measured, data analyses, and details on who has worked on the project and performed each task. Metadata for spatial datasets will include geographic extent, projections used, file formats, and other relevant information. In the case of biological samples, we will provide a description of how samples were collected, processed, stored and analyzed. For existing/historical data, we will provide and make accessible a full description of the source of the information, the type of data, ownership, geographical coverage, format, and accessibility. Where possible, narrative metadata will be gleaned from relevant, currently existing or multi-purpose sources, such as progress reports and publications that are generated through this project. Metadata will be stored along with the data in the same folder file structure. We will use the Ecological Metadata Language (EML) as our metadata standard. EML is based on work conducted by the Ecological Society of America and the aforementioned KNB and uses Extensible Markup Language (XML) schema documents that allow for the structural expression of metadata and encodes documents in a format that is both human-readable and machine-readable. We will use the freeware Morpho (<http://knb.ecoinformatics.org/morphoportal.jsp>) to generate the metadata in EML format.

3. *Policies for access and sharing.* New raw data generated by this project will be provided to BCO-DMO within two years of collection. Depending on the types of data (see above), requests for data prior to publication will be made to one or more of the PIs and senior participants in the

¹Borer ET, Seabloom EW, Jones MB and M Schildhauer 2009, "Some Simple Guidelines for Effective Data Management," Bulletin of the Ecological Society of America 90(2):205-214

project: Drs. Fiorenza Micheli (email: micheli@stanford.edu), Stephen Monismith (monismith@stanford.edu), Giulio De Leo (deleo@stanford.edu), Arnaldo Valle-Levinson (arnaldo@coastal.ufl.edu), and C. Brock Woodson (bwoodson@uga.edu). Access to the data will not be chargeable. For data sharing, standard policies for access, e.g., obtaining permission from dataset owner(s), will be used as appropriate.

4. *Policies for re-use of data.* We envisage that the data and analyses generated by this project will be of wide benefit and interest to a variety of government agencies, NGOs, and the general public (see Project Significance). Measures of seawater oxygen content, temperature and other physical and chemical parameters, and abundance and projected dynamics of monitored populations have a wide range of applications, especially when analyzed over the long-term at various temporal resolutions. Environmental management decisions are often based upon the state of the environment. Understanding of the impacts of climate and oceanographic variability with respect to the persistence of marine resources may prompt recommendations and actions to be taken at various societal levels including local organizations and government (local, state, federal). Results might shed some light in understanding coastal societies resilience around the world and might be re-used in other geographic contexts.

5. *Plans for archiving data.* For the oceanographic, modeling, and ecological data, we will use three primary repositories that will be managed by Micheli at Hopkins Marine Station, and by Woodson at University of Georgia. Biological data and model parameters and results will be housed and managed on servers in the Micheli lab, while oceanographic data will be housed on a server at the UGA. Backup copies on GitHub will be regularly made so as to preserve the data in the case of server failure. Biological and oceanographic data will be replicated and made available through secure FTP servers. Access to the raw data for this project will be provided to PIs, senior participants, and all researchers, students, and technicians involved in the project via a secure logon. Within 2 years of data collection, data, model code, and metadata will be archived at BCO-DMO. Published materials will be available through searchable online databases commonly accessed through research university libraries. Data will be further available upon request to the PIs (see above).

6. *Preservation of access to data, samples, and other research products.* Citation of published materials will be dependent upon the location of publication but will likely be provided a Digital Object Identifier (DOI). Links to published materials will further be available on homepages and websites of the PIs.