

## DATA MANGEMENT PLAN

### I. Products of Research

NSF Guideline: *What kind of data will be collected, standards employed, and for how long will data be retained?*

We will collect biological, chemical and physical data on ocean acidification related issues around a remote Pacific atoll. The data types will be a combination of experimental measures, qualitative raw in situ data for monitoring purposes, and processed chemical fluxes. In particular we will measure the growth and physiological responses of a number of benthic reef taxa to elevated pCO<sub>2</sub> including net calcification standardized to initial size (mg mg<sup>-1</sup> CaCO<sub>3</sub> d<sup>-1</sup>), net productivity (mg cm<sup>-2</sup> AFDW d<sup>-1</sup> or μmol O<sub>2</sub> mg<sup>-1</sup> d<sup>-1</sup>, depending on methodology), pigment content (μg g<sup>-1</sup>), and carbonic anhydrase enzyme activity (activity units standardized to biomass). We will also measure a number of physical variables including current speed (cm s<sup>-1</sup>) and direction that will be collected using autonomous instrumentation and standard techniques. A variety of chemical parameters will also be measured using autonomous sensors including temperature (T), salinity (S), pH<sub>SW</sub>, pCO<sub>2</sub> (μatm), and dissolved O<sub>2</sub> at a number of reef sites around Palmyra atoll. Discrete water samples for total alkalinity (A<sub>T</sub> μmol kg<sup>-1</sup> SW) and total dissolved inorganic carbon (C<sub>T</sub> μmol kg<sup>-1</sup> SW) will be collected following standard operating procedures as described by Dickson et al. (2007). Quality control will be assessed using certified reference materials to calibrate sensors and lab instrumentation as per Dickson et al. (2007). These data will be processed, along with T, S, and depth, to calculate the remaining carbonate chemistry parameters using CO2SYS: ρ (kg m<sup>-3</sup>), CO<sub>2</sub> (μmol kg<sup>-1</sup> SW), HCO<sub>3</sub><sup>-</sup> (μmol kg<sup>-1</sup> SW), CO<sub>3</sub><sup>2-</sup> (μmol kg<sup>-1</sup> SW), Ω-Calcite, & Ω-Aragonite. We have a track record of collecting similar data as evidenced by the publication record of the PIs. The data collected will be retained by the PIs indefinitely.

### II. Data Storage and Preservation

NSF Guideline: *What physical and/or cyber resources and facilities (including third party resources) will be used to store and preserve the data?*

All biological, physical and chemical data sets and metadata describing species, experimental conditions and measurement locations will be archived at the Biological and Chemical Oceanography Data Management Office (BCO-DMO; <http://www.bco-dmo.org/>). No data transformations will be necessary to prepare data for preservation or data sharing and data will be structured in EML (see below) with associated 'read me' files to make readily usable.

### III. Data Formats and Metadata

NSF Guideline: *Describe standards to be used for data and metadata format and content.*

Our data will be submitted as a clean matrix and will be stored in a comma separated files (.csv) with an associated metadata file. The biological and ecological data will be structured in Ecological Metadata Language (EML). We will also include a "readme file" that will explain variables, structure of the files, etc. for each of the independent data sets. All physical and chemical time series data will be stored in ascii or MatLab formats with associated metadata and readme files. Data will be formatted to follow the standard operating procedures for ocean acidification research and data sharing as described by Riebesell et al. (2010).

### IV. Data Dissemination & Policies for Data Sharing and Public Access

NSF Guideline: *What will be the policies for data sharing and public access (including provisions for protection of privacy, confidentiality, security, intellectual property rights and other rights as appropriate)?*

A subset of the data generated during this project will be accessible in real time on the project's web page. The majority of the remaining data will be available via email request or on the open access repository at the World Data Center for Marine Environmental Sciences (WDC-MARE; <http://www.wdc-mare.org/>), specifically through the EPOCA (European Project on Ocean

Acidification; <http://www.epoca-project.eu/>) and PANGAEA (data publisher for earth & environmental science; <http://www.pangaea.de/>). Data will remain with the PIs for 2 years after the completion of the project to allow adequate time for publication. Foreseeable users of the data are managers associated with the US Fish and Wildlife Service as the waters and coral reefs surrounding Palmyra were recently designated (2009) as part of the new Pacific Island Remote Area (PRIA) National Marine Monument. Additionally, the NOAA Coral Reef Ecosystem Division and Coral Reef Conservation Programs anticipate using the data for monitoring purposes. Finally, Roger Nisbet and Eric Mueller anticipate incorporating biological rates quantified in experiments into an unassociated but collaborative effort to create a mathematical theoretical dynamic energy budget model for coral reef organisms: these data will be supplied to them in appropriate formats.

## V. Roles and Responsibilities

NSF Guideline: *What are the rights and obligations of all parties with respect to their roles in and responsibilities for the management and retention of research data (including contingency plans for the departure of key personnel from the project)?*

All personnel funded through this project will be responsible for maintaining and updating individual data sets and for writing detailed metadata and read me files that outline all components of how, when and where a particular data set was collected. A fraction of the salaries requested will be used for data management activities, in particular data entry, QA/QC, calibration, meta data management, and conversion to standard formats.

## Citations

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to best practices for ocean CO<sub>2</sub> measurements. PICES Special Publication 3, 191 pp.

Riebesell U., Fabry V. J., Hansson L. & Gattuso J.-P. (Eds.), 2010. Guide to best practices for ocean acidification research and data reporting, 260 p. Luxembourg: Publications Office of the European Union.