DATA MANGEMENT PLAN

Data management will be coordinated by the Principal Investigator and carried out by all project participants. The plan encompasses three areas: use policies, standards, and data and sample preservation and archival. The PI will leverage existing systems wherever possible. All data will be communicated in a timely fashion following the NSF policy.

I.   **Products of Research**

Three main data types will be generated in the proposed activities: chemical oceanographic data (in American Samoa) and biological data on the biogeographic variation in the physiology and mineralogy of tropical crustose coralline algae (CCA) in the Pacific and Atlantic. The data will be a combination of quantitative experimental measures, qualitative raw in situ data for monitoring purposes, and processed seawater chemical metrics, all geo-referenced. In particular the PI will measure the growth and physiological responses of a number of coralline algal species to natural variation in seawater pCO_2 and temperature including: relative abundance of early successional benthic reef taxa on settlement plates (% cover), net calcification of assemblages and of individual thalli standardized to final surface area (g $CaCO_3$ cm^{-2} yr^{-1}), net productivity of assemblages and individual thalli (g AFDW cm^{-2} yr^{-1}), and pigment content (µg g^{-1}), vertical accretion rate (mm $CaCO_3$ yr^{-1}), recruitment rate (no. individual thalli m^{-2} yr^{-1}), and lateral expansion (cm^2 yr^{-1}) of individuals. Mineralogical data of CCA skeletons will be collected using two techniques (pXRD and LA-ICP-MS) and reported as wt% $MgCO_3$ in calcite, $MgCO_3$ mol%, and Mg/Ca$_C$. A variety of chemical parameters will also be measured using autonomous sensors including temperature (T), salinity (S), pH$_{SW}$ and/or pCO_2 (µatm) at each reef study site; the PI is responsible for these data only at the sites on Tutuila where the ongoing monitoring research does not include this instrumentation. Discrete water samples for total alkalinity (A$_T$ µmol kg^{-1} SW) and total dissolved inorganic carbon (C$_T$ µmol kg^{-1} 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^{-3}), CO_2 (µmol kg^{-1} SW), HCO_3^- (µmol kg^{-1} SW), CO_3^{2-} (µmol kg^{-1} SW), Ω-Calcite, Ω-Aragonite, & Ω-Mg Calcite (mole fraction TBD from CCA mineralogy). The PI has a track record of collecting similar data as evidenced by her publication record. The data collected will be retained by the PI indefinitely. In addition, the chemical data are stored and made accessible by the established "open-access" sites (e.g. CRED, BATS, HOTS, and MCR-LTER).

II.   **Data and Sample Storage and Preservation**

All biological and chemical data sets and metadata describing species, field site conditions and geo-referenced measurement locations will be uploaded to networked servers maintained at Bigelow Laboratory. These servers are backed up weekly, and can be made available to collaborators needing access to the data. Data will be transferred and archived at the Biological and Chemical Oceanography Data Management Office (BCO-DMO; http://www.bco-dmo.org/) following processing. 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.

Coralline algae carbonate skeletons will be archived, with affiliated collection site metadata, in the National Institute of Standards and Technology (NIST) Archive of Coral Ecosystem Specimens program, a new component of NIST's cryogenic biorepository at the Hollings Marine Laboratory called the Marine Environmental Specimen Bank (ESB) (http://www.nist.gov/mml/csd/marineesb.cfm). All available CCA carbonate will be aliquoted and archived in the Marine ESB. In the future, these samples will be made available by request for external researchers and used in planned collaborative activities between NIST and Bigelow Labs exploring the utility of stable isotopes (e.g. boron isotope [δ^{11}B] ratios) as environmental tracers of seawater pH (http://www.nist.gov/mml/csd/esbisotopes.cfm). All associated metadata will be housed in the Marine ESB database, supported by NIST internal funding.

III.   Data Formats and Metadata

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 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

Data will remain with the PI 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. 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. The lead PIs of the Moorea Coral Reef-LTER and of the Coral Reef Instrumented Monitoring Platform also anticipate using the data for monitoring purposes.

V.   Roles and Responsibilities

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, metadata 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_2 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.