

# Data Quality Management Plan Recommendations for Quality Assurance and Quality Control

## 1. Introduction

## Background

For many years the South Atlantic Fishery Management Council (SAFMC) has grappled with the challenge of ensuring adequate and timely science to support management despite limited resources, a multitude of species to manage, and a complex and highly diverse ecosystem. Discussions of data shortcomings and the resulting scientific uncertainties often lead to offers from fishermen to provide their vessels as research platforms, collect samples and record their own observations to help increase scientific knowledge and 'fill the gaps'. The SAFMC recognizes the desire of constituents to get involved and the need to have a well-designed program and accompanying sampling protocols to ensure that information collected through such efforts is useful. To meet this growing need, the SAFMC has initiated a Citizen Science Advisory Panel to coordinate, develop, and assist citizen science (CS) projects in the South Atlantic.

## Purpose

This document describes the recommended sections and content of Data Quality Management Plans (DQMP) to be developed by each CS project conducted in conjunction with the CS program at SAFMC. CS projects requiring a DQMP can be conducted by the SAFMC CS program or external entities. The DQMPs are recognized by the Data Management Action Team as the backbone to ensuring high quality data is collected by CS projects and the quality of the data is maintained over time. Recommendations provided in this document are based on similar documents utilized by the Environmental Protection Agency (EPA 2001), the Atlantic Coastal Cooperative Statistics Program (ACCSP 2012), and the DataONE CS workgroup (Wiggins et al. 2013).

## 2. Management and Organization

DQMPs should include information pertaining to overall scope, applicability, and management responsibilities for the project and specific to data quality. DQMPs should, when applicable, document:

- Standard operating procedures, including volunteer training
- Generation of measurement data
- Verification and reproducibility of data
- Known quality of data (accuracy, precision, completeness, etc.)
- Research and analyses, chains-of-custody (where appropriate), derivations of analytic approaches and results
- Software used
- Resources used
- Mechanism by which data errors identified through assessment, audit, or other means are corrected
- DQMPs can be based on quality documents required by other programs such as the ACCSP Data Requirements documents or the EPA Quality Assurance Project and Quality Management Plans

Recommended Personnel Involved in Data Quality





- Citizen Science Program Manager: SAFMC staff member that facilitates CS projects conducted in conjunction with the mission of SAFMC. Provides advice for development of DMQP.
- Project Manager (i.e. Principle Investigator): overall management of the project. Oversees collaboration with CS Coordinator. Develops DMQP and other project documents.
- Data Quality Lead: overall data management for the project. Oversees adherence to DMQP, data collection and entry training, data checks or audits. Coordinates data corrections, archiving, and delivery to users.
- Data Specialists: project personnel involved in any data management aspect.
- Data Reviewer: CS Program Manager may assign a data reviewer to conduct data audits as needed or on advice of the CS Committee. Evaluates collection, accuracy, precision, and validity of data, adherence to the DMQP, and proper archiving of data.
- *Note:* one person may serve multiple roles, depending on the type and scope of a project.

# 3. DQMP Documentation, Reviews, and Revisions

Each project must develop specific quality procedures, training, and documentation systems in their DQMP. All project participants are responsible for knowing and understanding the quality system for a given project and other supplemental project documentation. DQMPs should be developed prior to a CS project enlisting volunteers and beginning data collection. As part of the documentation and archiving process, the CS Program Manager will maintain both archived and updated versions the DQMP, the records of deliberations and decisions on all subsequent updates and revisions, and copies of change control memoranda (i.e. changes to the DQMP). The Project Manager, in collaboration with the Data Quality Lead, is responsible for overseeing the implementation of changes, documentation of changes, maintaining and numbering new DQMP versions, and distributing copies of updated DQMPs to the CS Program Manager and project personnel.

## 4. Personnel Qualification and Training



CS projects are required to implement data entry training as part of their overall volunteer training efforts. In addition, volunteers or others collecting data, should be trained in species identification and measuring protocols, as appropriate. Project-specific data management personnel (Quality Lead and Specialists) should be trained in procedures outlined in the DQMP. In addition, Project Managers in conjunction with the Quality Officer must ensure that data management personnel and volunteers are adhering to the project's DQMP. Methods to determine adherence can be developed to best fit a project, but must be outlined in the DQMP. One example is a quarterly data audit. Adherence checks should be documented in a project's progress and final reports.

## 5. Documents and Records

SAFMC CS projects are required to provide electronic documentation of the project's objectives, methods, and results throughout the project's life span. This documentation should be done in adherence with funding sources, such as progress and final reports, but also can and should include detailed procedural documentation for data collections, management, and analysis. Electronic copies of all reports and procedural documents will be submitted to the CS Program Manager and stored at the SAFMC headquarters.

## 6. Electronic Equipment and Software

DQMPs must identify all electronic equipment and software used for data collection, management, and analysis. Details to consider may include:

- accuracy and precision of instruments used,
- training procedures for using instruments, and
- calibration or servicing of instruments.

DQMPs also should include methods by which electronic data collected by a project (including volunteer data) is secured and remains private as appropriate. For projects that are developing new software, the DQMP must include user requirements and the methods employed to test/troubleshoot the new software. For electronically captured data, DQMPs must include verification and validation procedures. Without compromising the integrity or security of software or web applications, software code used to capture, manage, or analyze data should be included the supplemental documentation submitted to the CS Program Manager.

## 7. Generation, Acquisition, and Use of Data

DQMPs should consider including details on the accuracy and precision of collected data. This section should address:

- How the intended measurement is appropriate for achieving project objectives. Whether the project involves the application of known methods or the development of new methods.
- How the quality control procedures are sufficient for obtaining data of known and adequate quality.
- To what degree data will be defensible if challenged technically or legally.
- Limits to the use of data.

## Measurement and Data Acquisition

Each project's DQMP must address the design and implementation of measurement systems to ensure that appropriate methods for collection, handling, and analysis is done.

- Sampling process design (experimental design)
- Sampling methods requirements



- Sample handling and custody requirements
- Quality control requirements
- Data acquisition requirements (non-direct measurements)
- Data management

## Data Quality Steps

Projects should outline the process by which they assure data quality. These processes can be general and apply to a range of projects or be specific to each project, tailored as appropriate to the data types to be collected. ACCSP (2012) provides detailed steps that projects submitting data to them should follow; we provide a summary of these steps here to assist projects for developing their own processes.

- Data are collected on paper should be reviewed for legibility, completeness, reasonable values, and accuracy prior to electronic entry.
- All data should be available electronically and data entry protocols to minimize errors or identify errors should be in place.
  - Exs. Spot checks, outlier checks, double entry.
- Computer audits are highly recommended to automate data checks for errors less easy to identify.
  - Exs. Species' length and weight ranges, license numbers, dates, blanks.
- Data review at any of the steps above should occur in a reasonably short time frame after collection provide the greatest chance that errors can be corrected by contacting the person who recorded the data.
- Consistent errors should be addressed with data recorders to prevent future errors.

## Assessment, Validation, and Usability

Each project's DQMP must address the methods by which data correctness (and therefore usefulness) is ascertained. DQMPs should detail:

- How are data assessed and response actions for corrections
- How are data corrections tracked
- How are data validated and verified
- Degree of precision (measure of agreement among repeated measurements)
- Required accuracy (measure of overall agreement to a known value)
- Degree of completeness (amount of data obtained in comparison to amount expected to be collected)
- Representativeness (degree to which the data represent the population from which they are drawn)
- Comparability (confidence with which data set can be compared to another)

## References

ACCSP. 2012. Atlantic Coast Fisheries Data Collection Standards.

EPA. 2001. Guidance for Quality Assurance Project Plans. EPA QA/G-5.

Wiggins, A., R. Bonney, E. Graham, S. Henderson, S. Kelling, G. LeBuhn, R. Littauer, K. Lotts, W. Michener, G. Newman, E. Russell, R. Stevenson & J. Weltzin. 2013. Data Management Guide for Public Participation in Scientific Research.