

# Data Management Plan

The goal of the CARMMHA Data Management Plan is to promote and facilitate a culture of timely and responsible sharing of research and analysis within our consortium and with the greater scientific community/general public.

## Section 1: Research Consortium Information

### Lead Principal Investigator

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### Data Manager

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## Data Manager Roles and Responsibilities

The CARMMHA Data Manager will be responsible for the identifying, organizing, documenting, and storing of CARMMHA-related data to facilitate data submission to the Gulf of Mexico Research Initiative (GoMRI) Information and Data Cooperative (GRIIDC). The Data Manager will coordinate all data management activities across the CARMMHA team, working closely with the co-Principal Investigators (co-PIs) to develop data management practices tailored to GRIIDC's requirements, CARMMHA's needs, and our respective institutional needs (Table 1). The Data Manager will also be responsible for updating this Data Management Plan as needed, and then will serve as the primary CARMMHA point of contact for GRIIDC.

The CARMMHA Data Manager will devote 25-50% effort to the responsibilities described in this document. They will be familiar with GRIIDC data management practices (including attending required GRIIDC training sessions); chemical, physical, and biological research data collection and analysis practices; veterinary clinical data collection and analysis practices; and biological statistical modeling practices. The Data Manager will also be familiar with and have experience developing and implementing quality assurance and quality control (QA/QC) practices.

## Data Submission to GRIIDC

The Data Manager will coordinate all Dataset Information Form (DIFs) and dataset submissions to GRIIDC. The Data Manager will work with the technical team members responsible for generating each type of data to prepare, review, and respond to requests for DIF/dataset revisions to ensure that the selected formats and metadata (using the GRIIDC ISO 19115-2 Metadata Editor) accurately represent the actual data, especially for potential non-CARMMHA users. The Data Manager will be responsible for submitting DIFs and datasets to the GRIIDC data portal and will work with selected co-PIs and the GRIIDC team for QA/QC. The Data Manager and co-PIs will work together to perform standard QA/QC based on the best practices

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in their field of study, and GRIIDC will support the team with high-level QA/QC of the dataset files and descriptions.

As a reminder, all data sets with environmental sampling field data (e.g., water salinity and temperature) must be provided to GRIIDC with minimal delay. All other data (e.g., analysis of field-collected organismal samples, laboratory data) must be submitted to GRIIDC within 12 months of data collection or synchronously with manuscript submission. If, during the process of preparing presentations or manuscripts, consortium members update datasets or generate new datasets, they will contact and work with the Data Manager to ensure that we upload the new datasets to GRIIDC.

<https://data.gulfresearchinitiative.org/RB-data-compliance>

Table 1: CARMMHA data management check-in activities. Co-PIs are responsible for contacting the Data Manager for each of the check in points. They will then work together to fulfill the corresponding activities. Check marks and question marks denote activities that will usually be mandatory or optional, respectively.

| Check in point               | Share w/in CARMMHA | Archive data set | QA/QC | Metadata review | Outreach activities | CARMMHA review | GRIIDC Upload    |
|------------------------------|--------------------|------------------|-------|-----------------|---------------------|----------------|------------------|
| Data collection              | ✓                  | ✓                | ?     | ✓               |                     |                | ✓<br>(Env. data) |
| CARMMHA update               | ✓                  | ✓                | ?     |                 |                     |                |                  |
| Final data set               | ✓                  | ✓                |       | ✓               | ?                   |                | ✓                |
| Data supporting draft ms/ppt |                    |                  | ✓     |                 |                     | ✓              |                  |
| Data supporting final ms/ppt |                    | ✓                |       | ✓               | ✓                   |                | ✓                |

## Data Management Training

All members of the CARMMHA Steering Committee will attend the 3-part GRIIDC training series, either as part of the CARMMHA in-person Steering Committee meeting in February 2018 or remotely via the GRIIDC conference call/webinar training series (see link below). The Data Manager will then work with each co-PI to identify other members of each research team that may require some or all of the GRIIDC training, and to provide CARMMHA-specific training on adhering to this Data Management Plan and QA/QC protocols (e.g., a 30 minute conference call/webinar session).

<https://data.gulfresearchinitiative.org/video-tutorials>

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Other data management resources that CARMMHA will rely upon include:

[https://www.nap.edu/resource/12017/data\\_at\\_noaa\\_final.pdf](https://www.nap.edu/resource/12017/data_at_noaa_final.pdf)

[https://www.dataone.org/sites/all/documents/DataONE\\_BP\\_Primer\\_020212.pdf](https://www.dataone.org/sites/all/documents/DataONE_BP_Primer_020212.pdf)

<https://www.axiomdatascience.com/best-practices/index.html>

<http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1004525>

## Communicating Data Submission Requirements

Upon GRIIDC approval of this CARMMHA Data Management Plan, the Data Manager will disseminate the CARMMHA Data Management Plan and a link to the GRIIDC User Guides (see below) via Google Groups, email, and post them on the CARMMHA website. All CARMMHA co-PIs must identify and be familiar with the specific user guides relevant to the data they are generating. The Data Manager will work closely with each co-PI to ensure that all requirements are met for each data set according to the check in points in Table 1.

<https://data.gulfresearchinitiative.org/training-user-guides>

## Data Storage Backup

All CARMMHA co-PIs will be responsible for storing the data generated by their research groups and maintaining a regularly updated backup system (e.g., a cloud drive that automatically backs up your project directory each night). The Data Manager will work with each co-PI to develop a system that is reasonable based on the types of data and the research group's resources. Each co-PI will be responsible for ensuring that members of their research groups also adhere to their data storage and backup system requirements. For each check in point, co-PIs will contact the Data Manager to coordinate the transfer of the dataset to a central CARMMHA repository for archiving. The Data Manager will coordinate all archiving activities in the CARMMHA repository, using a standard file naming convention and data management practices. The repository will be stored synchronously on two different cloud servers. All CARMMHA Co-PIs will have access to the data repository, but the Data Manager will oversee the stewardship activities.

## Ethics and Compliance Information

CARMMHA does not have any research components involving human research that would require Institutional Review Board approval nor Health Insurance Portability and Accountability Act issues. All marine mammal-related field data collection activities will be conducted under Marine Mammal Protection Act (MMPA) and NMFS Permits held by project co-PIs or key collaborators. For all other animal-based research, each co-PI has obtained the appropriate Institutional Animal Care and Use Committee (IACUC) approval from their respective institution.

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### Section 2: Methods Information

CARMMHA will incorporate data from three types of projects:

1. Thematic projects, including technique development and sample processing in research laboratories and at animal husbandry facilities;
2. Field assessments, including capturing, assessing, and releasing wild animals in the field, as well as boat surveys; and
3. Integrative modeling, including aggregating data from disparate sources and producing models to summarize and predict biological parameters.

Here, we provide general summaries of the types of data we expect from each of these research components. Table 2 lists the types of data we do not anticipate collecting, however, we will update this Data Management Plan as appropriate.

Table 2: The types of data CARMMHA does not plan to collect.

| Excluded data types  |                |
|----------------------|----------------|
| Research cruises     | Aerial imagery |
| Microcosms/mesocosms | Economics      |
| Mapping              | Images/video   |

### Non-Cruise Field Work

CARMMHA will include three types of non-cruise field work: wild dolphin capture/release in waters less than 10 m deep; coastal dolphin remote biopsy sampling; and dolphin prey collections. We will collect environmental data while in the field, including intermittent salinity, temperature, and depth measurements with hand-held YSI probes. During the capture/release health assessments, we will collect some combination of the following tissues (depending on conditions in the field, the age/sex of the animals, and the safety of our personnel and the animals): blood, urine, feces, mucus, skin, blubber, teeth, milk, and lung biopsies. Remote biopsy sampling includes only collection of skin and blubber. Prey collections will be conducted using 16 foot trawls, and we will collect whole animals (fish and crustaceans) wherever possible. Accompanying those trawls, we will collect some water and sediment samples for stable isotope analysis.

Specific techniques for cardiac assessments (ultrasound and electrocardiography) will be determined based on methods development with managed animals (see Pure Lab-Based Studies section).

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### Remote Sensing

Satellite tags (SPOT-299B from Wildlife Computers, Redmond, WA, USA) will be attached to a subset of animals during capture-release health assessments according to the specifications of MMPA and IACUC permits (see Mullin et al., 2017<sup>1</sup> for a similar study and Balmer et al., 2014<sup>2</sup> for a review of cetacean telemetry techniques). The Argos Data Collection and Location System will receive and process satellite-linked locations. Then CARMMA scientists will use GIS software and R to conduct spatio-temporal analysis of the dolphin locations.

### Environmental Sample Lab Analysis

Laboratory analysis of field samples may include (but is not limited to) the following: endocrinology, serum chemistry and electrophoresis, hematology, fibrinogen, osmolality, immune cell activity and proliferation, cytokines, cardiac biomarkers, infectious diseases, fatty acids, stable isotopes, urinalysis, cytology, age determination, microsatellites, and histology/immunohistochemistry. The Steering Committee will determine the final analyses for each animal.

### Pure Lab-Based Studies

The immune response research component of CARMMA will include pure lab-based exposure studies using bottlenose dolphin cell cultures and mouse (6-7 week old female B6C3F1) models to investigate whether the immunomodulation of DWH oil is dose-dependent. A variety of immunolabeling techniques will be used to measure cell proliferation and activity, as well as cytokine levels in either exposed cell culture or from blood and spleen tissue collected from gavaged mice. In addition, to assess oil's effect on reproductive success, we will mate exposed and unexposed female mice with unexposed male mice and count the number of live pups delivered and the number that survive through weaning.

Laboratory-based methods development will include testing a variety of commercially available immunolabeling kits and reagents from the scientific community to identify antibodies that will cross-react with proteins of interest (especially markers of regulatory T cells) in archived dolphin blood samples. Analytical techniques for which the antibodies may be tested include flow cytometry, enzyme-linked immunosorbent assays (ELISAs), and the Luminex multiplex platform.

The cardiac research component of CARMMA will require some methods development before we can implement the techniques in the field. Board-certified veterinary cardiologists will work with bottlenose dolphins ( $n > 8$ ) from a managed population to test the feasible and optimal options for performing transthoracic and transesophageal electrocardiography, including the position/orientation of the animal, the type of electrocardiography equipment, and the metrics for quantification.

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<sup>1</sup> <https://doi.org/10.1371/journal.pone.0186265>

<sup>2</sup> <https://doi.org/10.1111/mms.12072>

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### Modeling

CARMMHA will conduct modeling activities, including:

- Determining the relative contribution of different prey species to the isotope signature in cetaceans.
- Obtaining predictions of population trajectory, with robust measures of uncertainty, for inshore, coastal and offshore bottlenose dolphin populations, using an age- and sex-structured population dynamics model that includes effects of environmental stochasticity and uses the demographic information generated under previous objectives.
- Obtaining predictions of population trajectory, with robust measures of uncertainty, for other key offshore species (beaked whale species, sperm whale, Bryde's whale, Risso's dolphin, pantropical spotted dolphin), using a stage-structured population dynamics model that includes effects of environmental stochasticity and uses the demographic information generated under previous objectives.

All modeling efforts will rely primarily on the publicly available R programming language for statistical computing and graphics, but other options may be pursued as the project progresses. CARMMHA researchers will produce the necessary scripts and make their code publicly available at the end of the project, including the parameters and the random number seed(s) used for the final runs.

### Social Surveys and Interviews

CARMMHA will use expert elicitation, a formal process to survey/interview a panel of subject experts (in this case, dolphin veterinarians and biologists), to estimate currently unmeasurable biological parameters that are required to develop population models. The outcomes will be probability distributions for a variety of parameters.

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### Section 3: Dataset Information Forms

CARMMHA's anticipated datasets are listed in Table 3. The Data Management team has submitted DIFs for all anticipated datasets. Currently, the Data Manager (Ryan Takeshita; RT) will serve as the primary point of contact for all DIFs.

| Unique Dataset Identifier | Dataset Title  | Primary Point of Contact |
|---------------------------|--|--------------------------|
| R6.x809.000:0001          | Cardiac measurements: methods development  | RT                       |
| R6.x809.000:0002          | Cardiac histopathology evaluations on stranded animals   | RT                       |
| R6.x809.000:0003          | Immune function measurements: methods development  | RT                       |
| R6.x809.000:0004          | Immune function of peripheral blood mononuclear cells exposed to Deepwater Horizon oil in laboratory experiments   | RT                       |
| R6.x809.000:0005          | Immune function of laboratory strain mice exposed to Deepwater Horizon oil   | RT                       |
| R6.x809.000:0006          | Environmental sampling information associated with trawls for fish and crustacean dolphin prey   | RT                       |
| R6.x809.000:0007          | Modeling results from Stable Isotope Analysis in R (SIAR) mixing model analysis of dolphin and prey tissue samples   | RT                       |
| R6.x809.000:0008          | Environmental sampling data associated with field dolphin health assessments   | RT                       |
| R6.x809.000:0009          | Wild common bottlenose dolphin health assessment parameters: Field measurements  | RT                       |
| R6.x809.000:0010          | Environmental sampling information associated with remote biopsy surveys of common bottlenose dolphins ( <i>Tursiops truncatus</i> ) near Dauphin Island, AL in 2018 | RT                       |
| R6.x809.000:0011          | Satellite telemetry of common bottlenose dolphins captured, tagged, and released near Dauphin Island, AL in September 2018   | RT                       |
| R6.x809.000:0012          | Microsatellite genotyping of remote biopsies from common bottlenose dolphins ( <i>Tursiops truncatus</i> ) near Dauphin Island, AL in 2018                           | RT                       |
| R6.x809.000:0013          | Statistical distributions of model parameters generated by expert elicitation to inform cetacean population recovery trajectory models                               | RT                       |
| R6.x809.000:0014          | Updated northern Gulf of Mexico cetacean population recovery trajectories following the Deepwater Horizon oil spill  | RT                       |
| R6.x809.000:0015          | Reproductive success of laboratory strain mice exposed to Deepwater Horizon oil  | RT                       |
| R6.x809.000:0016          | Wild common bottlenose dolphin health assessment parameters: Laboratory measurements   | RT                       |
| R6.x809.000:0017          | Wild common bottlenose dolphin health assessment parameters: Cardiac measurements  | RT                       |
| R6.x809.000:0018          | Wild common bottlenose dolphin health assessment parameters: Immune function measurements  | RT                       |
| R6.x809.000:0019          | Wild common bottlenose dolphin health assessment parameters: Fatty acid measurements   | RT                       |
| R6.x809.000:0020          | Stable isotope ratios from northern Gulf of Mexico bottlenose dolphins (stranded and capture-release animals) and their prey (fish and crustaceans) from 2011-2018   | RT                       |
| R6.x809.000:0021          | Updated northern Gulf of Mexico bottlenose dolphin population recovery trajectories following the Deepwater Horizon oil spill  | RT                       |