



COMPASS – A Survey Toolkit for Marine Species Data Collection: 2016 Annual Progress Report

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Cetacean Observation and Marine Protected Animal Survey Software



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Cover Photo Credit:

Humpback whale flukes (*Megaptera novaeangliae*). Photo taken by Michael Richlen under National Marine Fisheries Service permit no. 16239.

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Acronyms and Abbreviations

MSM	Navy Marine Species Monitoring
QC	Quality Control
U.S.	United States

1. Background

The United States (U.S.) Navy identified the need for development of a survey data-collection system that fully meets U.S. Navy Marine Species Monitoring (MSM) data standards. The objectives were to streamline data-collection procedures, minimize manual data-management requirements, and increase the standardization and repeatability of data-collection efforts. In response to this need, HDR developed a survey toolkit called COMPASS (*Cetacean Observation and Marine Protected Animal Survey Software*). COMPASS is designed to be an integrated survey data-collection and data-management system to facilitate work conducted during MSM surveys. HDR's *fin* survey toolkit integrates current mobile and web technologies to allow efficient real-time collection, processing, reporting, and delivery of marine species data. The final product will include a mobile platform for data collection in the field; a web portal to design, plan, and execute surveys and access data products; and a server-hosted database-management system for quality control (QC), team collaboration, and preliminary data processing/reporting.

The surveys conducted within the MSM program include a variety of data-collection scenarios and technologies. The preliminary version of the *fin* system addresses the needs for the most common survey types: shore-based (theodolite), vessel-based, and aerial-based. The data-collection routines for each survey type are designed to maintain consistency with the U.S. Navy's Data Standard (developed by NAVFAC LANT and HDR, Inc.), which specifies field names, aliases, data types, measurement units, and descriptions for data that are collected in the field. Each data-collection scenario will use some subset of fields specified in the Data Standard.

2. COMPASS Overview

2.1 Mobile Application

The mobile application ("app") runs on the Apple® iPad platform and is the primary interface for the collection of field data (example data collection screenshot is seen in **Figure 1**). The mobile app includes mapping capabilities for navigation and data collection, and functions in areas without network or cellular connectivity. It has the ability to display the data stream (e.g., sightings and tracklines [**Figure 2**]), relevant auxiliary data (e.g., range complex boundaries, exclusion zones, passive acoustic monitoring stations, pinnacles, etc.), and customizable base-map layers (e.g., bathymetry, ortho-imagery). Users can pan and zoom on the map, and control the visibility of data layers on the map. Users are able to search the attributes of collected data and auxiliary data, and easily reference the search results.

Customizable data fields allow users to collect data relevant to each of the survey types, including ancillary tasks (e.g., focal-follow studies, biopsy collection, satellite tagging, etc.). All data collected are stored in relational databases adhering to the U.S. Navy Data Standard.

Data collected with the mobile app are synchronized with a central database server via Wi-Fi, cellular data connection, or USB. Transmitting collected data as soon as possible after a survey

ensures that information is archived and protected, while allowing for collaborative QC review and editing through a web-based user interface. Alternatively, data can be backed up, edited, and managed locally via direct connection with a laptop when web connectivity is unavailable.

2.2 Web-based Application

The web-based application is the central interface for the management of marine species surveys and data. It allows access from any Internet-connected computer, allowing field crews, biologists, and program managers from multiple locations to collaborate on active surveys. New users can be added easily, and authorization control will be implemented in order to designate specified users able to access different aspects of the surveys and data management.

Field crews can use the web application to perform QC checks on data uploaded from the mobile app. Accessing these data via the internet allows field crews to verify that collected data have been transmitted successfully to the server and also provides an opportunity to review as well as annotate field data from laptop computers. If Internet access is unavailable, QC checks in the field can be conducted in the mobile app.

Prior to initiating a survey, the web portal is used by survey leads to “create” a new survey, assign authorized users to a survey, and configure survey-specific information including species lists, equipment descriptions, survey ranges and platform specifics. The web portal will provide instructions for the loading of pre-built base-maps, which will be created for the most common survey areas. Pre-built base-maps will cover the instrumented U.S. Navy training ranges and other areas of interest. The web portal will also provide instructions to load any additional feature data required for the survey, including tidal data, track lines, waypoints of interest, passive acoustic mooring positions, etc.

After the survey is completed (daily or at the end of a project) and the data are synchronized with a central database server, primary access to the survey data will occur through a web-based interface. This user interface allows access to the centralized database, and facilitates QC review and editing. It allows a broader set of specified users (e.g., field crews, biologists, program managers, external clients) access to the data, while controlling access through the use of user accounts and permissions. Project managers will use the web application interface to monitor data collection and QC activity, and to export data.

3. Progress to Date

3.1 Application Development

A document outlining *fin* development, specifications, functional requirements, user stories, and overall capabilities was completed. The next step was completing design and development of the basic software for the field app and the web-based portal. Desktop testing confirmed basic functionality and prompted follow-on development of the mobile app. The underlying data framework for the three classes of survey platform (theodolite, vessel, and aerial surveys) was similar, and the aerial survey functionality was the first to be deployed and tested for field use.

3.2 Initial Field Testing (Aerial Surveys)

HDR completed four months of aerial surveys to monitor the U.S. Navy's Full Ship Shock Trials that were conducted off the Atlantic coast of Florida during the summer of 2016. *COMPASS* was used for the primary survey aircraft's field observations and data management. A significant amount of field testing and trials were conducted prior to the start of the ship shock surveys. *COMPASS* developers were able to create a stable field app capable of sampling platform positions at 1-second intervals (required for precise position tracking at higher speeds), streamline popup windows for ease of quick data entry, and debug many of the other capabilities of the integrated *fin* system.

The surveys were successfully conducted using *COMPASS* and, in order to meet other expectations of the project, additional functionality was added, primarily the capability to produce daily reports. This particular functionality included the ability to generate maps with user-selected attributes and summary statistics for the survey, observations, effort, and environmental variables. Observers returned to shore, synchronized the iPad, and efficiently conducted a QC of the data prior to generating and submitting daily reports. Additionally, the project manager (not based locally) also was able to remotely access the data via the web portal and provide additional reporting elements to the U.S. Navy Technical Representative while the observers were back in the air surveying.

The HDR MSM data-management leads and geographic information system personnel were able to verify that the data collected, and output, by *COMPASS* were aligned with the MSM Data Standard.

3.3 Ongoing Development

While the primary development of both the data-collection app for field survey types and the web portal is complete, the user functionality continues to be improved. Currently, the vessel-survey app is being prepared for rigorous field testing with continual input from HDR field researchers. The theodolite-survey app also is being updated and prepared for field trials.

iPad ② 11:39 97% 

[Back](#) Existing Observation [Edit](#)

SIGHTING LOCATION

 Platform Position -79.586143, 30.175190

 Tap to enter bearing, distance, heading and calculate sighting location

FOCAL FOLLOW OBSERVATIONS

 Add Focal Follow Point >

SIGHTING DETAILS

Sighting Number	3
DateTime	09/04/2016 16:51:57
Scientific Name	Globicephala macrorhynchus
SpesNmCom	Short-finned pilot whale
Cue	
Birds	
Mixed Group Sighting	
Species Confidence	Medium
Animal Heading	1
Behavior	
Max Body Lengths to Neighbor	
Min Body Lengths to Neighbor	
Sighting Notes	Probable pilot whales seen two times. Brief looks. No apparent injury .
Effort Status: on-effort (systematic)	09/04/2016 16:00:13
Environment Observation: (null)	09/04/2016 16:01:07

Figure1. Screenshot of the COMPASS field app showing data entry fields for an observation.

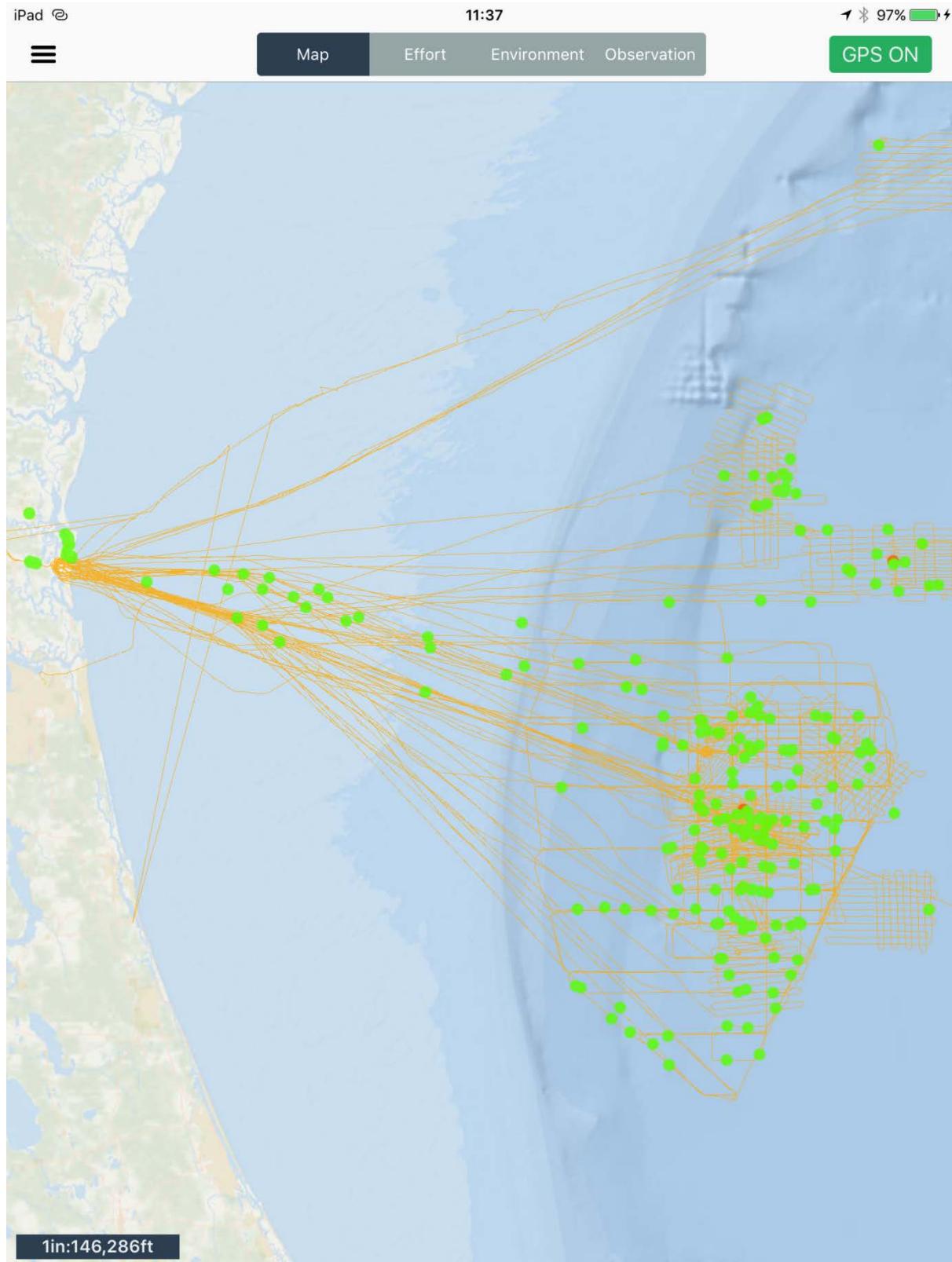


Figure 2. Screenshot from COMPASS field app showing the tracklines and sightings made during the Full Ship Shock Trial aerial survey efforts in summer 2016. Green dots indicate cetacean and sea turtle sightings, red dots indicate re-sightings, and orange lines are the survey tracklines flown.

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