COMPASS – A Survey Toolkit for Marine Species Data Collection: 2017 Annual Progress Report

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COMPASS

Cetacean Observation and Marine Protected Animal Survey Software

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Cover Photo Credit:

COMPASS website screenshot.

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Acronyms and Abbreviations

MSM   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 data-collection and management system to facilitate work conducted during visual surveys for protected marine species. The 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 U.S. Navy's MSM program include a variety of data-collection scenarios and technologies. The initial build of the *COMPASS* 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 Naval Facilities Engineering Command Atlantic 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 is built on this 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 ancillary 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 associated 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.

Figure1. Screenshot of the *COMPASS* field app showing data entry fields for an observation.
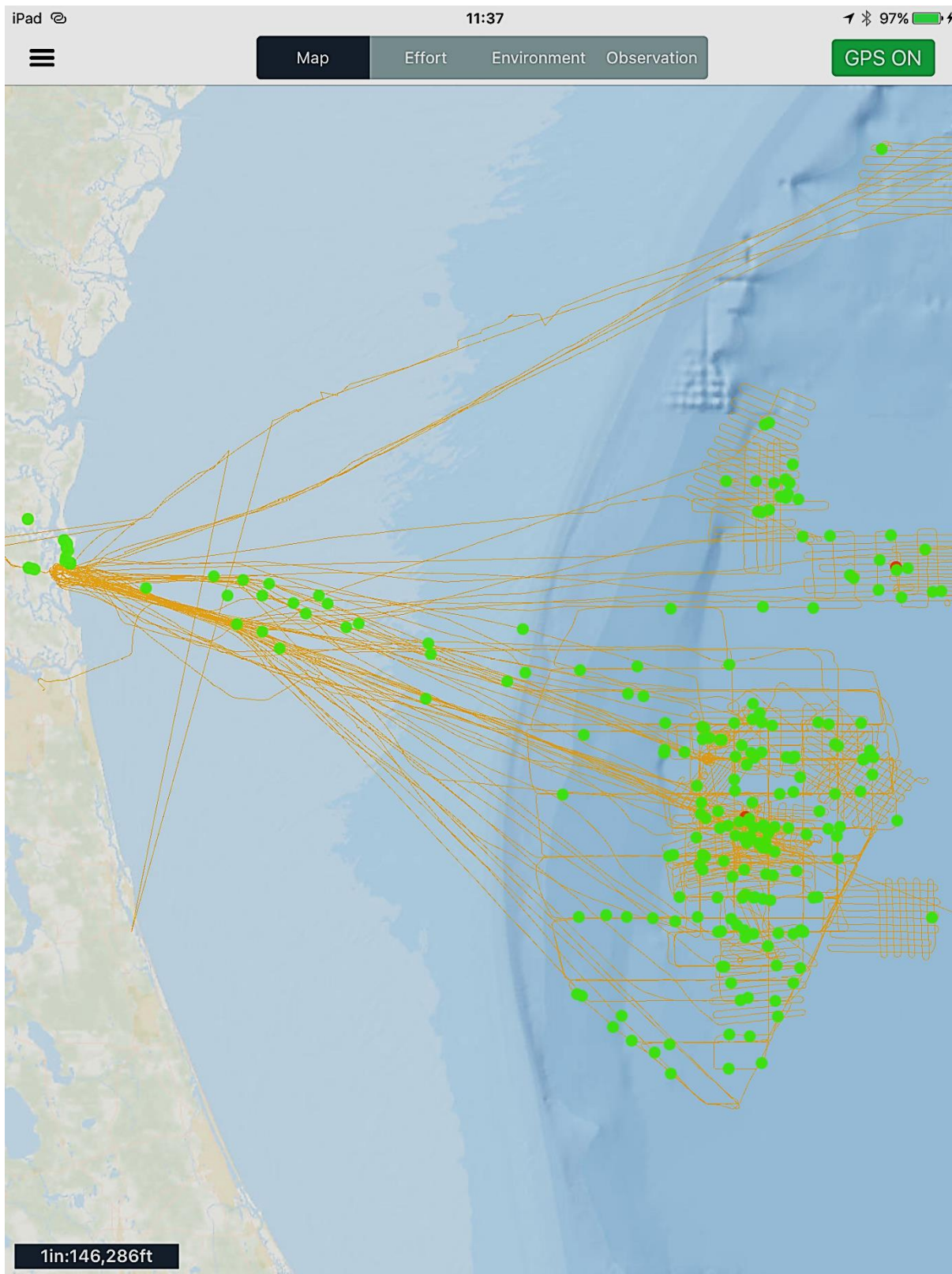
Figure 2. Screenshot from *COMPASS* **field app showing the tracklines and sightings made during the Full Ship Shock Trial aerial survey efforts in summer 2016. Green dots indicate cetacean and sea turtle sightings, red dots indicate re-sightings, and orange lines are the survey tracklines flown.**

Data collected with the mobile app are synchronized with a central database server via Wi-Fi, cellular data connection, or USB. Transmitting 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 (**Figure 3**). 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 is 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

All of the initial development has been completed for each of the survey platform types and additional functionality has been added including customized species lists, customized symbology for map production, and many specific user requests to help facilitate ease of use in the field (e.g., heads-up map orientation; user-selected units for distance, horizontal angle, and depth). Additional development has been completed for data outputs into multiple formats (daily

summary reports, ArcGIS Map Package files, and flat table database file). The basic functionality is complete and follow-on efforts will build off the existing structure and development efforts to further enhance the interface, capabilities, and outputs, and to add customized functionality to facilitate ease of use for data input and output.

3.2   Field Testing and Progress in 2017

HDR completed four months of aerial surveys to monitor the U.S. Navy's Full Ship Shock Trials off the Atlantic coast of Florida during the summer of 2016 using *COMPASS* as the primary platform for logging field observations and data management. In 2017 *COMPASS* has been used on a number of other field projects for testing and validation purposes. HDR has been using *COMPASS* for multiple small vessel surveys offshore of Virginia Beach, Virginia focusing on photographic identification, biopsy sampling, and satellite tagging of large whales. In addition to overall software stability, these efforts have been particularly useful for testing the functionality of related data for the specific field activities beyond visual detection and counting of marine species. For example, each biopsy and tagging attempt includes logging of position and time stamp information and other ancillary information that is essential for permit reporting.

We were also able to trial *COMPASS* on the 2017 National Oceanic and Atmospheric Administration Pacific Islands Fisheries Science Center Hawaiian Islands Cetacean and Ecology Assessment Survey (HICEAS). This is a large-scale ship survey to determine the abundance and density of cetaceans and seabirds around the Hawaii Exclusive Economic Zone. This opportunity was beneficial for validating the ability of *COMPASS* to plot big-eye sightings and collect sighting information alongside *WinCruz*, a proven survey software. *COMPASS* performed as expected and a number of suggested upgrades and updates were noted for future development and improved applicability for large-scale ship surveys.

Additionally, Naval Facilities Engineering Command Atlantic used *COMPASS* for a short monitoring project around a mine neutralization exercise in 2017. Two vessels conducted simultaneous focal-follow surveys of bottlenose dolphins (*Tursiops truncatus*) before, during, and after an underwater detonation off of Virginia Beach, Virginia.

3.3   Future Development

While the primary development of both the data-collection app for field surveys and the web-based application is complete, user functionality and upgrades are being documented for future modifications and updates. Future versions of *COMPASS* will aim to support a networked version that enables multiple platforms and survey types (shore station, vessel, and aerial) to collect simultaneous data that can be synchronized via a mesh network. This will be useful for monitoring large-scale events requiring data to be distributed automatically precluding the need to share information via VHF radio communications.

HDR will continue to host projects on its server as well as support project setup and troubleshooting. Upon completion, *COMPASS* source code can be made available to interested users both within and outside of Navy that prefer to manage, host, and store their projects and databases on their own servers. Distribution of the COMPASS source code will be at the discretion of the Navy COR, but generally will be made available to anyone interested in using COMPASS for non-commercial purposes.
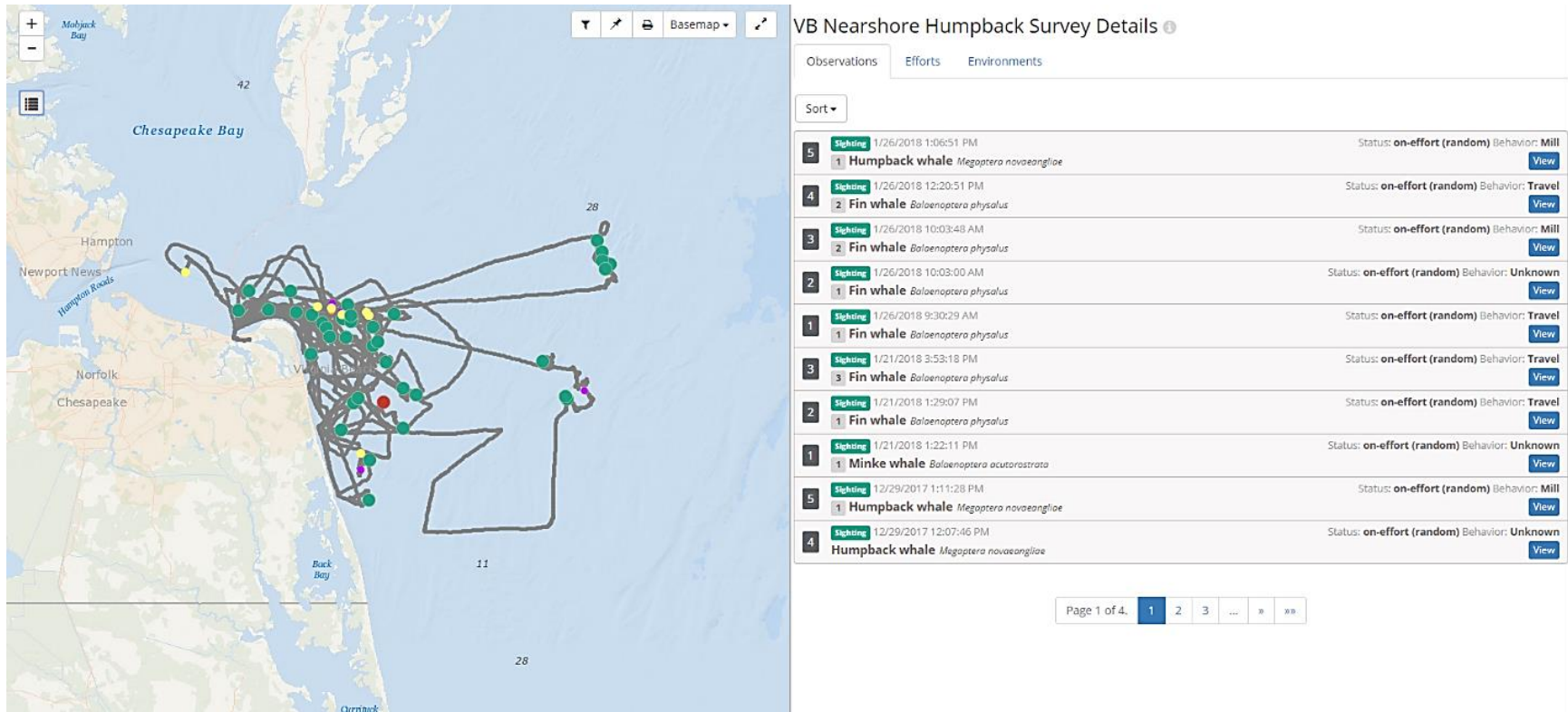
Figure 3. Screenshot from *COMPASS* web portal. The window on the left shows survey track and sighing data from a coastal vessel survey and the window on the left shows sighting details for QA and QC of data. Colored dots indicate protected species sightings and re-sighting information and the gray lines are the survey tracklines.