WhaleMap

A system for collating and displaying whale survey results to inform conservation

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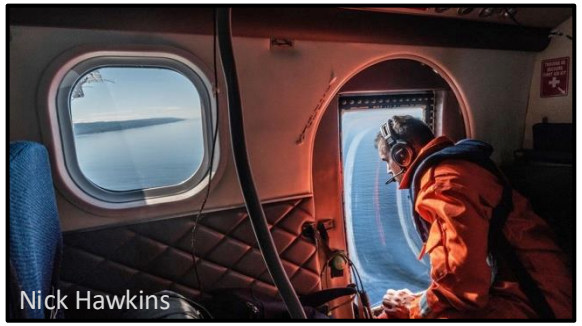
Photo: NEAq under NOAA permit #655-1652-01

Motivation

- North Atlantic right whales are critically endangered: 372 (+12/-11) remain
- Main threats are entanglement and vessel strike
- Risk mitigation relies on whale distribution
  - Slowing or diverting vessels
  - Fisheries closures or gear regulations
- Climate-driven shifts in their prey have made their movement patterns less predictable

Right whale monitoring



Visual - aerial

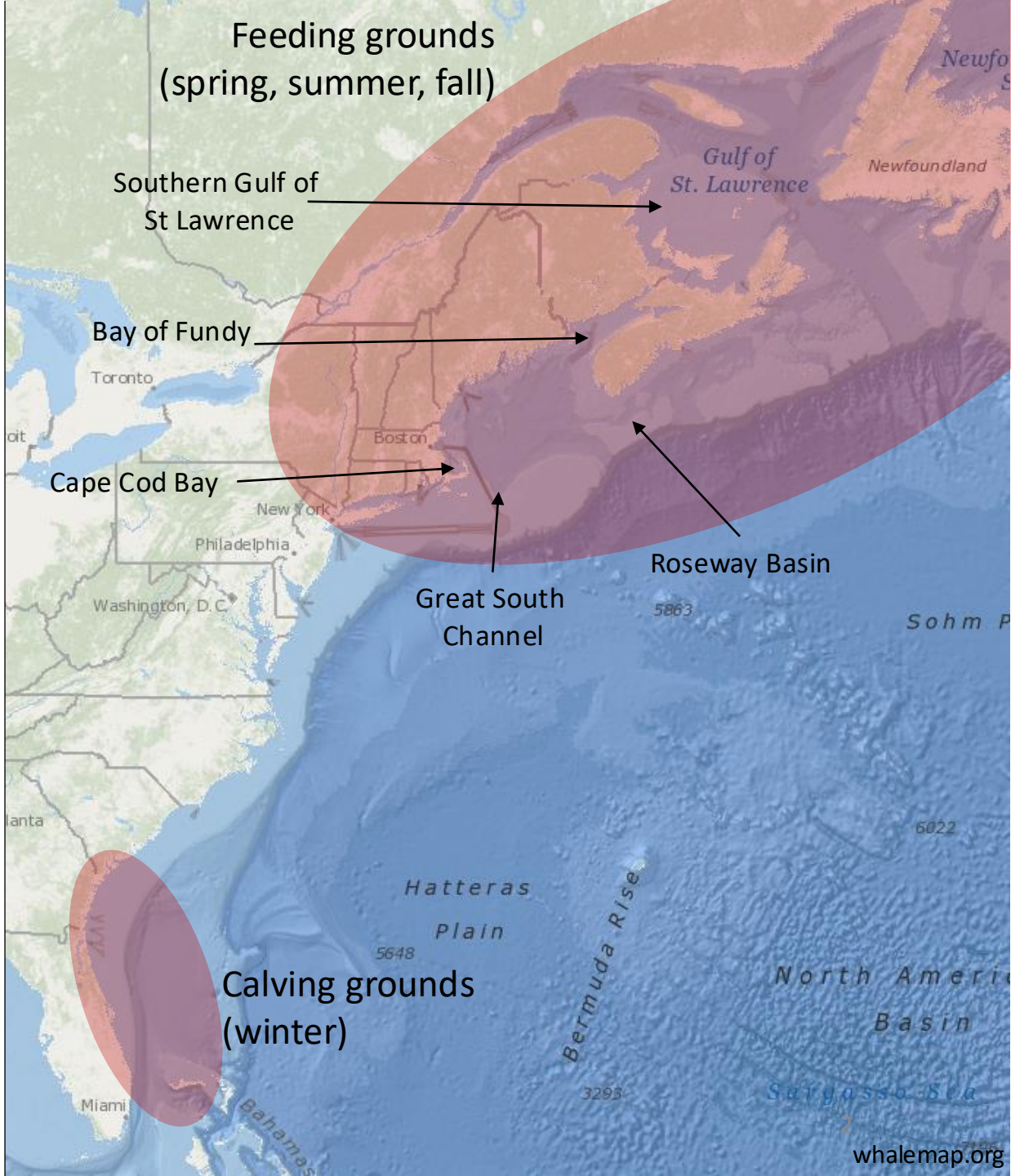
Acoustic - mobile

Visual - vessel

Acoustic - stationary

> 25 organizations conducting surveys in the US and Canada using different methods

Problem: no common place for all survey results



Design

WhaleMap is designed to:

- Incorporate whale detection and survey effort from all survey methods in near real-time
- Allow survey teams to easily contribute and retain complete control over their data
- Provide the latest data in an accurate, user-friendly, and publicly accessible format
- Operate transparently using open-source tools and with limited supervision

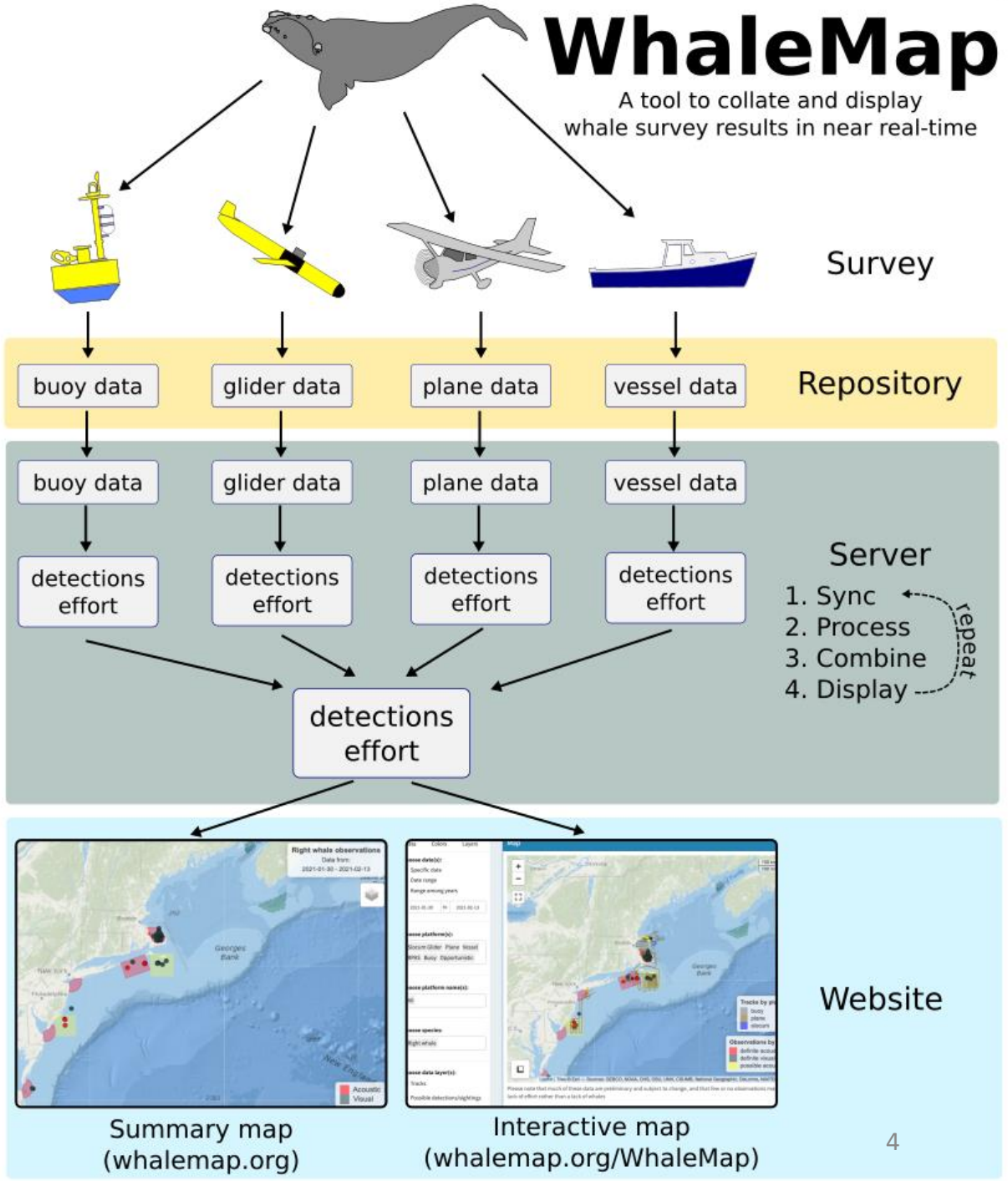
WhaleMap does **NOT**:

- Perform significant quality-control, or take responsibility for verifying contributions
- Provide a long-term database for survey results
- Allow access to raw or processed data without appropriate permission

How it Works

1. Survey data are uploaded to a remote repository (e.g., Google Drive)
2. Data are copied to the WhaleMap server
3. Custom code extracts detections and effort
4. Data are combined, displayed online, and made available for management

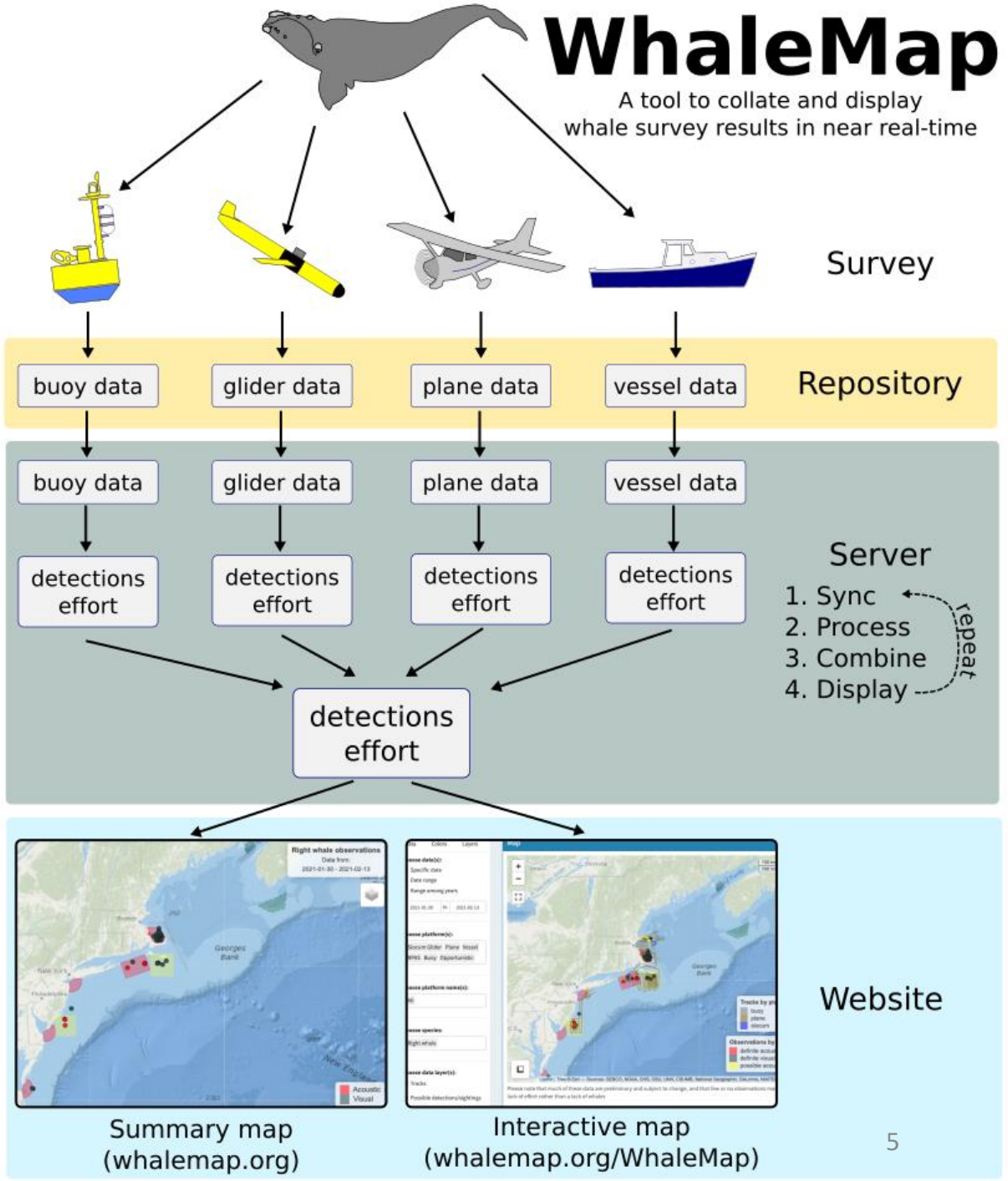
Entire process repeats every 15 minutes



Johnson H, Morrison D, Taggart C (2021) WhaleMap: a tool to collate and display whale survey results in near real-time. Journal of Open Source Software 6:3094.

How it Works

- **WhaleMap** processes data from US
- **Whale Insight** processes data from Canada
- The two exchange data to facilitate coast-wide coverage



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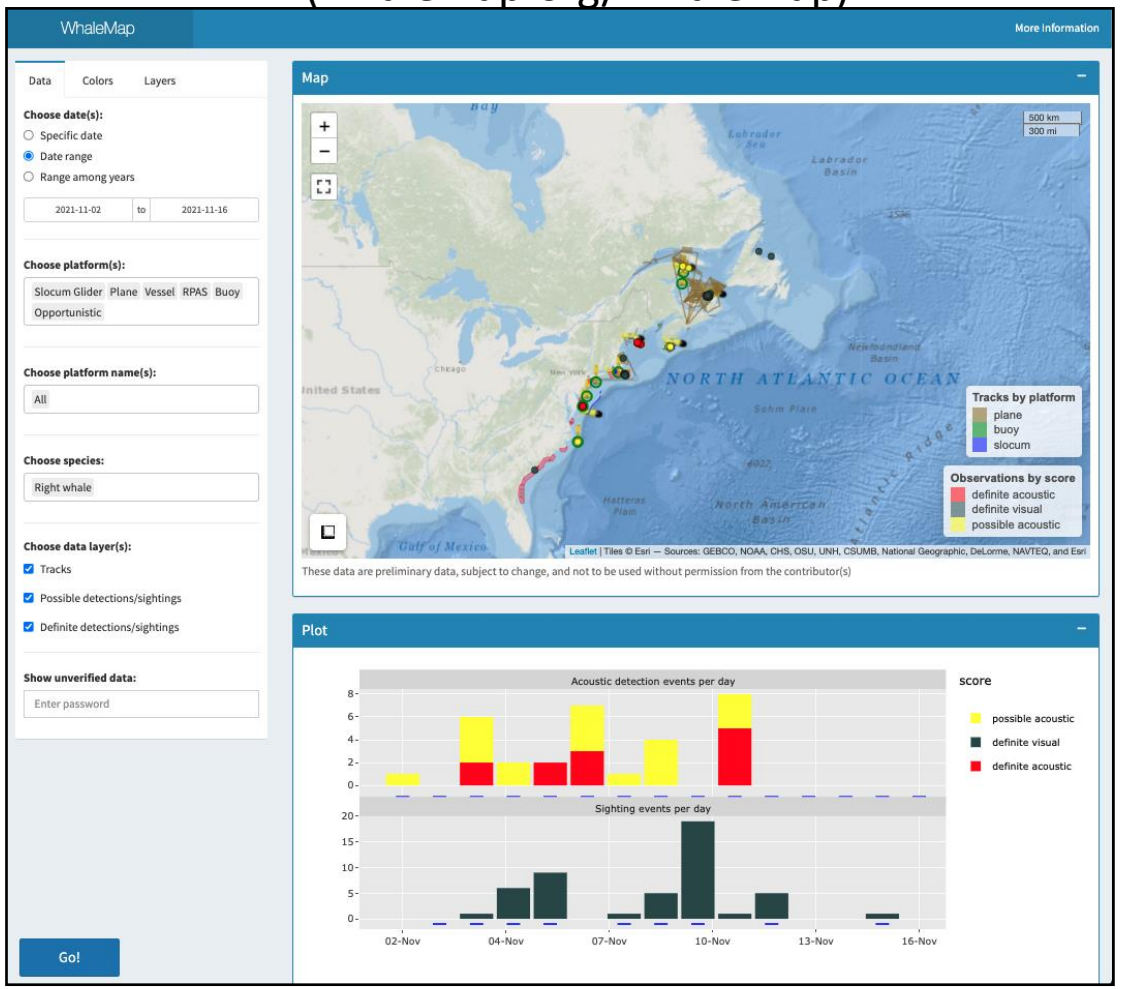
Displays

Summary map
(whalemap.org)

Dashboard
(whalemap.org/WhaleMap)



Management actions

USA

- WhaleMap sends data to NOAA
- Inform voluntary slow zones outside seasonal management areas
  - Vessel speed restrictions (<10 knots) for 15 days

Canada

- Whale Insight sends data to DFO and TC
- Inform mandatory fisheries closures and speed restrictions in dynamic management areas
  - Closure of non-tended fixed-gear fisheries for 15 days
  - Vessel speed restrictions (<10 knots) for 15 days

More details on dynamic management are available on DFO, TC, or NOAA websites, or via WhaleMap homepage

Infrastructure

- Funding from the Marine Mammal Commission to develop long term infrastructure for WhaleMap:
  - Migrated WhaleMap to New England Aquarium in 2021
  - Hosted in the cloud
  - Trained a team of curators to run the system
  - Incorporated as a North Atlantic Right Whale Consortium (NARWC) database
- Access to WhaleMap data feed is curated by the NARWC
- All code is open source and available at https://github.com/hansenjohnson/WhaleMap

Summary

- WhaleMap is an open-source software system for collating and displaying whale survey results in near real-time
- Designed to minimize workload on survey teams and allow them to retain control over their data
- Currently processes data from all US contributors, and shares data with Whale Insight to provide coast-wide coverage
- Provides real-time data required for dynamic management
- Built with a stable infrastructure that will allow it to be maintained in perpetuity

Questions?

Contact me

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More information

WhaleMap publication: https://joss.theoj.org/papers/10.21105/joss.03094

WhaleMap source code: https://github.com/hansenjohnson/whalemap

Acknowledgements

- Technical support from Daniel Morrison (Dal)
- Helpful input from many researchers, including Chris Taggart (Dal), Stephanie Ratelle (DFO), Pam Emery (DFO), Adèle Labbé (DFO), Olivia Pisano (DFO), Tim Cole (NOAA)
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- Many thanks to the survey teams doing the hard work to collect these data, and to the open-source community for making incredible tools

Thank you!