National Marine Manufacturers Association

May 15, 2024

VIA ELECTRONIC MAIL

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Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
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Re: Proposed Amendments to the North Atlantic Right Whale Vessel Strike Reduction Rule (Docket ID No. NOAA-NMFS-2022-0022)

Dear Dr. Good:

On behalf of the National Marine Manufacturers Association ("NMMA"), I am writing to request that the National Marine Fisheries Service ("NMFS") conduct further analysis and reopen the docket for additional public comment on technological options to achieve a performance-based vessel strike reduction rule that can reduce whale strike risk without the significant safety, economic, and privacy consequences that are recorded in the public's response to the proposed amendments to the North Atlantic right whale ("NARW") vessel speed regulations at 50 C.F.R. Part 224 (the "Vessel Speed Rule" or "Rulemaking"). We understand that the final Vessel Speed Rule is under review at the Office of Management and Budget ("OMB") and that NMFS plans to issue the final rule after this review is complete. The purpose of this letter is to reiterate certain technical and procedural shortcomings of the Rulemaking, highlight information about technological solutions that has been solicited by NMFS during the pendency of the Rulemaking, and urge NMFS to reconsider its flawed approach that will not withstand judicial scrutiny.

At this time, the NMMA is firmly opposed to the rule as drafted. The Rulemaking is ill-conceived and does not represent a proven regulatory approach that is designed to successfully protect this critically endangered mammal. The NMMA has consistently demonstrated a good faith effort to educate NMFS on the consequences of the proposed Vessel Speed Rule and strongly believes that alternative management strategies to protect the NARW—including various technology alternatives—must be further pursued, as evidence shows that existing systems can be utilized to detect and warn mariners when a NARW is present in a specific area, without sacrificing critical safety and marine operational considerations.

As explained further below, the proposed Vessel Speed Rule failed to consider currently available technology as a potential alternative approach to reducing the risk of vessel strikes on the NARW. The NMMA and other stakeholders raised this concern in comments on the proposed

Vessel Speed Rule and, since the close of the comment period, NMFS has solicited and collected information on technological options. Yet, to our knowledge, NMFS is not considering this information as part of its Rulemaking process, even though the information would significantly impact the agency's analysis of options to address risks from vessel strike on the NARW. Rather than inappropriately siloing the Vessel Speed Rule from the agency's work on technological solutions, the agency must incorporate and consider these technological solutions *as part* of the ongoing Rulemaking. This is the exact type of significant information that necessitates reopening the rulemaking process. The NMMA will be meeting with OMB on May 17th to discuss these and other matters involving the Rulemaking. We welcome NMFS's engagement on these issues and support an opportunity to discuss them with the agency.

Background

On August 1, 2022, NMFS issued a notice of proposed rulemaking to significantly expand the existing NARW vessel speed rule regulations.[1] The NMMA submitted comments on the Vessel Speed Rule highlighting the many technical and procedural flaws. In particular, the NMMA explained that NMFS had failed to consider technology-based alternatives that would achieve the same (or superior) results with regard to protecting the NARW, without the drastic adverse economic and safety impacts.[2]

Since the close of the comment period, the NMMA and other stakeholders have been actively involved in educating policymakers within NMFS and the National Oceanic and Atmospheric Administration ("NOAA") regarding the benefits of technology solutions over NMFS's current approach. NMFS has welcomed this engagement and hosted a NARW Vessel Strike Risk Reduction Technology Workshop on March 5-6, 2024 (the "Technology Workshop").[3] In addition, the Whale and Vessel Safety ("WAVS") Task Force, a coalition of marine industry stakeholders and experts in various disciplines, sent a white paper to NMFS in advance of the Technology Workshop which set the stage to discuss many available and developing technologies ("WAVS White Paper").[4] The Technology Workshop made clear to all stakeholders that NMFS is now well aware of the technologies currently available that can be utilized alone or on a layered basis to reduce NARW vessel strike risk.[5]

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[1] Proposed Amendments to the North Atlantic Right Whale Vessel Strike Reduction Rule, 87 Fed. Reg. 46921 (Aug. 1, 2022).

[2] *See* Comments of NMMA on the Vessel Speed Rule at 11-12, available at https://www.regulations.gov/comment/NOAA-NMFS-2022-0022-20629.

[3] *See generally* NOAA Fisheries, North Atlantic Right Whale Vessel Strike Risk Reduction Technology Workshop, available at https://web.cvent.com/event/7467a542-8d8d-4020-82d8-7cef9482a3d2/websitePage:b2fe19ef-3416-4fa1-a7a6-1df5a28b9242. In addition to the presentations and materials included on the Technology Workshop website, all presentations and information developed and/or received in connection with the Technology Workshop should be part of the docket for, and considered as part of, the Rulemaking.

[4] Letter from WAVS Taskforce to Mary Colligan, NOAA Fisheries, dated October 30, 2023 (attached hereto as Exhibit A).

[5] For example, NMFS created a table to consolidate the categories of various technologies that can be utilized to reduce the risk of NARW strikes. *See*

Unfortunately, NMFS did not seek to solicit any recreational boating, fishing, or marine industry input as it devised the proposed Vessel Speed Rule in response to pressure from certain stakeholders, and to our knowledge the agency is still refusing to consider any of these technologies as part of the Rulemaking. In fact, the Vessel Speed Rule is based on an archaic premise that the recreational boating, fishing, and marine industry are not technology- or innovation-driven. The WAVS Task Force effort proves otherwise and was developed based off a greater need to demonstrate innovation leadership in this sector, especially as it relates to conservation and marine mammal management. Some of these materials are provided as an attachment to this letter and should be incorporated into the Rulemaking record; to the extent NMFS has compiled any other materials related to technological options that have not been made public (for example, materials developed or received as part of the Technology Workshop), those materials also should be added to the rulemaking record.

Even if NMFS was not aware of these technologies at the time the Vessel Speed Rule was issued,[6] its current knowledge requires that the agency go back and reconsider its decision-making in light of such information. Under the Administrative Procedure Act, it is incumbent on the NMFS to reopen the rulemaking process to consider new information that significantly affects the Rulemaking.[7] Similarly, under the National Environmental Policy Act ("NEPA"):

> an agency must prepare a supplement to an [environmental assessment] when there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts… [I]f the new information shows that the remaining action will affect the quality of the environment in a significant manner or to a significant extent not already considered, a supplemental must be prepared.

Loper Bright Enterprises, Inc. v. Raimondo, 544 F. Supp. 3d 82, 122 (D. D.C. 2021) (internal citation and quotation omitted).

As discussed below, there are several technological alternatives available today that, if deployed properly, would likely be more effective at reducing NARW strike risk than expansive speed and routing restrictions and avoid the severe negative impacts that would be caused by the Vessel Speed Rule. NMFS is aware of these technological solutions—indeed, it has actively solicited this information from stakeholders. The agency cannot simply turn a blind eye to this information as it undertakes this Rulemaking. Further, the agency is well-suited to create a collaborative structure with all stakeholders, including the marine industry, to implement technology solutions that can successfully reduce risks of NARW vessel strikes. As contemplated

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https://custom.cvent.com/8D2B15A58CD6472E897351F27F2DF309/files/5cdb90075da041c894d0a21b32eed916.pdf.

[6] To be clear, information on such technologies was available at that time and should have been sought by NMFS prior to development of the Vessel Speed Rule.

[7] *See* 5 U.S.C. § 706(2)(A). *See also* ACUS Recommendation 76-3 (explaining that agencies should provide an opportunity for additional comment in any proceeding when comments filed in the proceeding, or the agency's response to such comments, present new and important issues or serious conflicts of data).

throughout the public comments submitted, recreational boating, fishing, and marine industries support the protection of endangered species but find serious fault with the data used to justify the Rulemaking and the unrealistic approaches that would be required to achieve compliance with the Vessel Speed Rule.

In addition, NMFS's failure to consider these viable technology alternatives—including those that were highlighted during the Technology Workshop—would be found by a court to be arbitrary and capricious under the Administrative Procedures Act. For example, in *Motor Vehicle Manufacturers Association v. State Farm Mutual Automobile Insurance Company*, the Supreme Court overturned the National Highway Transportation Safety Administration's ("NHTSA") safety-related actions because the agency "gave no consideration whatever" to an alternative of requiring "airbag technology" as part of a safety-related rulemaking. 463 U.S. 29, 46 (1983) (requiring NHTSA to reconduct its rulemaking and consider airbag technology as a viable alternative to achieve the agency's safety goals); *see also Yakima Valley Cablevision, Inc. v. FCC*, 794 F.2d 737, 746 n. 36 (D.C. 1986) ("The failure of an agency to consider obvious alternatives has led uniformly to reversal"); *California v. Bernhardt*, 472 F. Supp. 3d 573, 608 n. 22 (N.D. Cal. 2020) (collecting cases).

NMFS's analysis related to the Vessel Speed Rule (as documented in the Environmental Assessment, Draft Regulatory Review and Initial Regulatory Flexibility Analysis) examined different variations of vessel speed reduction requirements and implementation of management areas. The agency did not examine whether technology alternatives could achieve the same or superior results without imposing serious negative socioeconomic impacts. Below is a short summary of the technology alternatives that NMFS should have considered as part of this Rulemaking:

Summary of Technology Alternatives

As discussed in more detail below, technology holds significant advantages over other forms of risk reduction tools such as speed reduction and re-routing. And because collision avoidance (with any objects in the water, including marine mammals) has been a priority for recreational boat and supply manufacturers for decades, this technology is well-developed as the private sector is incentivized to constantly improve and innovate. Each of the technology alternatives discussed below—either alone or layered together—provide a better alternative for reducing risks to NARW from vessel strikes that NMFS must consider as part of the ongoing Rulemaking. Thus, we urge the agency to issue a supplemental proposal to reengage the public and allow for comment on how these technological solutions can be used to effectively reduce the risk of vessel strikes on NARW.

1. Detection Technologies

A variety of detection technologies are readily available and can be utilized, alone or in combination with other methods, to reduce NARW strikes. These technologies include acoustic detection, visual detection, satellite and drone imagery, infrared cameras, forward-looking sonar, and heat signature technology. These instruments generally can connect to the on-board Multi-

Function Display ("MFD") to provide real-time information regarding the boat's surroundings and thereby reduce the risk of NARW strikes.

One readily available example already used for species protection is vessel-mounted navigational radar that utilizes S and X band radar for vessel avoidance and navigations. X-band radars are used for a sharper image and better resolution, while S-band radar is used during rain or fog and for identification. As recently noted in the WAVS White Paper:

> Radar has been used in biological research and to monitor wildlife. Radar has been successfully used to monitor birds within the vicinity of airports. Radar has also been used to detect single birds and large swarms of insects. Previous work demonstrated the feasibility of detecting and tracking fin whales and smaller mammals up to 5.5km or more at lower sea states. Additional work found that conventional radar holds potential for detection of marine mammals in optimal sea state at short range (<lkm) using automated algorithms. Vessel operators have indicated that spouts from marine mammals can be detected by radar under ideal conditions and when the unit is tuned specifically to detect the presence of water vapor. The limitations of radar detection may prevent this tool from being a complete detection solution. However, when coupled with other technology, radar may provide additional advancement towards providing real-time monitoring of NARW and other marine mammals.[8]

Other countries recognize the importance of these technologies to address NARW strikes. For example, the Tethys Research Institute conducted a study in the Mediterranean Cetacean Sanctuary (located along the Italian and French coast) that analyzed how best to deal with threatened whale populations and high levels of maritime traffic and nautical activities. Their approach includes, among other things, drones and other detection devices that notify vessels that they are likely to encounter a cetacean on their route.[9]

2. Automatic Identification System ("AIS") and On-Board Electronics

As detailed at the recent Technology Workshop, AIS is already used by the Coast Guard for security and coastal management purposes. This same technology is already widely utilized among recreational boaters as it is commercially available and included on many new boats for

[8] WAVS White Paper at 6.

[9] As discussed in the WAVS White Paper, visual and infrared images can be analyzed by artificial intelligence ("AI") to detect and classify objects in the water such as NARWs:

> The benefit of AI is that it allows for immediate analysis of information even in adverse conditions more effectively than can be done by human observers, thereby allowing vessel operators to have better situational awareness and to make better informed decisions for the vessel and the whale. Whale Seeker, Space Whale, Awarion, Sea AI, Sea Machines, and Avikus are but a few examples of companies that have developed AI tools to scan images for the presence of whales. These products are currently being trained with the intent of deployment for field verification in the coming months.

WAVS White Paper at 3.

safety purposes. AIS technology is a viable alternative for distributing real-time (or near real-time) monitoring information to boaters regarding factors that are relevant to NARW strike risk.

For example, utilizing existing technology, NOAA could issue an acutely focused dynamic management area and a vessel's on-board cartography would be updated in near real-time to reflect that new zone. "Dynamic regulatory polygons could be broadcast using AIS and chartplotters on vessels of all sizes, and can be taught to receive, display, and alarm based on those dynamic polygons."[10] Similarly:

> devices broadcasting virtual aids to navigation (vAtoN) exist today and can be deployed to distribute not only regulatory polygons but real-time positions of monitoring programs. Garmin Guardian is one example where the likes of tow operations, telecom, or offshore wind…utilize AIS to broadcast AtoNs alerting nearby vessel traffic of subsea assets. These devices are cloud based connected systems so that real-time observation, or real-time deployment of AtoN and polygon information is achievable as these devices are placed in strategic broadcasting locations. Receiving vessels can then make informed navigation decisions based on real-time information just as they would respond to the alert of a nearby vessel utilizing AIS.[11]

In addition, existing on-board technology allows users to share their own data points in real time. Crowdsource infrastructure and communities such as ActiveCaptain, Community, and Navionics Community Edits allow a user's point-based data to be distributed in real-time and loaded to a chartplotter through a mobile application. As a result, NARW positions "reported by real-time monitoring programs and technology…can be distributed to on-board marine electronics and displayed and alarmed on screen in near real-time." [12] Input of such data would also enable NOAA and other research entities to augment the volume of the agency's monitoring data.

3. Technology for Aggregating & Disseminating Information

As boaters collect data through detection devices or other instruments, technology exists to aggregate this information and share it in near real-time with NOAA and other boaters. For example, the WhaleReport Alert System ("WRAS") aggregates whale detection data from multiple sources and sends out alerts. In fact, the U.S. Coast Guard recently launched a Cetacean Desk in the Puget Sound region that utilizes WRAS to aggregate data and disseminate notices to mariners.[13]

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[10] *Id.* at 5.

[11] *Id.*

[12] *Id.*

[13] U.S. Coast Guard News, "Press Release: U.S. Coast Guard introduces cetacean desk, enhancing cetacean safety in Salish Sea," available at https://www.news.uscg.mil/Press-Releases/Article/3681963/us-coast-guard-introduces-cetacean-desk-enhancing-cetacean-safety-in-salish-sea/.

The Coast Guard's pilot project is just one example of how technology is being used to aggregate relevant information and provide it to mariners to improve situational awareness. This pilot program should serve as a national model to create publicly accessible repositories of data points that can be shared with the marine community in real time.

4. Modeling/Predicting/Forecasting Whales

Data aggregation enables existing programs to create predictive models that can be utilized for avoidance purposes. One example is Risk Terrain Modeling ("RTM") which is a tool used to "diagnose environmental conditions that connect with spatial patterns of whale-vessel strikes. RTM can help us identify and prioritize the areas where these collisions are significantly most likely to happen at the micro-level" so that boaters can take steps to prevent such strikes.[14]

Similar predictive modeling was recently highlighted by Fathom Science at a recent presentation to the bipartisan Congressional Boating Caucus.[15]

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As discussed above, technology serves as an opportunity to reduce NARW strike risk without imposing the serious negative socioeconomic impacts of the Vessel Speed Rule. The NMMA urges NMFS to reconsider its approach to this issue, reopen the Rulemaking, and conduct an appropriate analysis of technology alternatives capable of achieving the agency's policy goals. The NMMA believes that all stakeholders with an interest in this rule should fully embrace a modern, outcome-oriented strategy to protect the NARW, human lives, and our nation's economy—a strategy that embraces current technology, quality data, and collaboration with public- and private-sector partners. This reasonable middle ground approach is far more likely to be effective at reducing strike risk than the expansive and unenforceable Vessel Speed Rule.

We would be happy to discuss these issues with the agency or provide additional information upon request.

Sincerely,

Frank Hugelmeyer
President & CEO
National Marine Manufacturers Association

cc: Janet Coit, Assistant Administrator for Fisheries, NOAA
Brenda Mallory, Chair, Council of Environmental Quality
Richard Revesz, Administrator, Office of Information and Regulatory Affairs
Shalanda Young, Director, Office of Management and Budget

[14] WAVS White Paper at 5.

[15] WAVS Taskforce presentation to Congressional Boating Caucus (April 11, 2024), attached hereto as Exhibit B.

Exhibit A

WAVS Taskforce
Whale and Vessel Safety Taskforce

October 30, 2023

Mary Colligan
NOAA Fisheries
1315 East West Highway
Silver Spring, MD 20910
mary.colligan@noaa.gov

RE: Whale and Vessel Safety (WAVS) Task Force Recommendations for NOAA Technology Workshop

Dear Ms. Colligan:

Management of the North Atlantic Right Whale (NARW) presents a challenge for resource managers and those who operate vessels. NOAA estimates fewer than 350 individual NARW remain, and below average reproductive output makes for a dire long-term outlook for the species. NARWs face many threats, including the threat of vessel strikes. NOAA Fisheries, under authority of the Marine Mammal Protection Act and the Endangered Species Act, has sought to reduce the risk of vessel strike mortality through seasonal speed restrictions and dynamic speed restriction zones based on spatial and temporal occurrence of NARWs.

However, other approaches that leverage technology could be equally or perhaps more effective for reducing strike risk of NARW – and all marine mammals. By engaging the private sector and the marine industry, NOAA managers would be equipped with a more robust set of management tools that can also permit more nuanced management options.

In response to the threats facing NARWs, a panel of marine industry stakeholders and experts in various disciplines have been convened to carry out the following mission: *Identify, develop, and implement technology and monitoring tools in the marine industry and boating community with the goal of mitigating risk of vessel strike to all marine mammals with special attention for North Atlantic Right Whales.* The group is called the Whale and Vessel Safety Task Force (WAVS).

WAVS members have backgrounds in marine mammal monitoring and detection, spatial risk analysis, marine electronics, and telemetry. The group is currently working quickly to inventory existing assets to monitor and detect NARW positional information and to evaluate if other management tools can be created to assist in this management problem. The group is exploring available platforms to analyze detection data and develop pathways to push information in a format compatible and most useful for vessel operators. In addition, the group is working with experts in spatial risk modeling to identify areas where management measures are most needed and evaluate the performance of mitigation efforts. Results from pilot projects and other exercises will be shared with the public, policy makers, and resource managers.

Numerous programs exist that focus on monitoring and tracking marine mammals with specific attention focused on NARW. It is not the intention of WAVS to compete in that space. While this field is mature, there is interest in expanding real-time detection and monitoring and

developing pathways to move information directly to vessel operators' onboard marine electronics. A key goal of WAVS is to explore all viable options to bridge that gap between monitoring equipment and boat owners and operators. With the decline of NARW and the increased presence of other marine mammals, such as humpback whales, leveraging all available technology and utilizing expertise in the marine electronics industry is the most practical and effective approach moving forward.

WAVS is encouraged by the release announcement by NOAA to allocate $82 million in funding from the Inflation Reduction Act, a portion of which will be aimed at detection, modeling, avoidance technology, and enforcement specific to the critically endangered NARW. WAVS foresees this funding as an important opportunity towards exploring and developing tools that will help meet long-term conservation goals for this species while accommodating the concerns of the marine industry. While the focus and subsequent work is directed towards the NARW, we foresee the products of this effort having measurable impacts for other species too. Among the items identified as funding priorities, we are encouraged to learn of the scheduling of a workshop to focus on the topic of technology and how it will play a role in risk reduction and the overall management of this species.

WAVS has a particular interest in the workshop not only for the anticipated content to be covered at the event but also for the opportunity to foster greater collaboration with NOAA and other entities with expertise in this space. Furthermore, we see the workshop as an opportunity to engage stakeholders on this issue who have not been previously consulted. The collaboration of various sectors will accelerate information sharing and generate prospects for cross-sector work. WAVS believes the marine industry will play a key role in achieving risk reduction.

The scheduling of the workshop is a critical first step. WAVS encourages NOAA to steer the workshop toward evaluating potential solutions that are quantifiable and scalable. Any technology tools pursued through this effort must be able to calculate the amount of risk reduction they provide. Furthermore, alternatives must offer benefits to a majority segment of the marine fleet. In addition, where possible, efforts should prioritize options that offer the potential for as close to real-time monitoring as possible.

Detection - The detection and ongoing monitoring programs that seek to track individual whales produce a large dataset of dynamic targets that are moving in space and have context in time. This can also include predictive analysis and modeling exercises. These data points can be captured through numerous approaches including vessels that carry detection capabilities.

Aggregation - Data points specific to large marine mammal positions should be warehoused in a publicly accessible repository(s). Data should be analyzed to reduce noise, duplication, and other artifacts and prepared in formats that can be utilized by the broadest range of marine electronics manufacturers.

Dissemination - Sending the data to the boating community in an efficient and timely manner. The goal of information sharing should be to provide and make available aggregated data to the broadest range of products, manufacturers, brands, and price points.

Integration - Leveraging disseminated data to create an on-board experience aimed to influence on-board operation decision making. Further treatment of information so it is accessible by the broadest array of manufacturers, brands, and product price points.

Risk Reduction - Vessel response will be varied and depend on the vessel's class, size, location, and capabilities. The response will (should) result in risk reduction. Response may vary based on the specifications of the vessel or the activity it is engaged. Other factors will also play a role such as sea state and vessel traffic.

Once solutions are developed and their risk reduction capabilities defined, it is critical to deploy these products to stakeholders and users. Adoption can be a mix of outreach and incentives such as insurance reductions and exemptions from rules or other regulatory incentives. The implementation and use of these solutions implies some way of declaring, identifying, and tracking compliance, an essential element in calculating risk reduction.

Each step in this flow of events demands technical discussion and policy decisions regarding treatment of data, sharing data and appropriate responses by vessels. Further referencing this theoretical progression, WAVS can identify several steps where the boating and marine industry will play a necessary role towards completion.

It is our desire to see the following themes included in the NOAA Technology Workshop agenda and scope of discussion. These themes are consistent with the progression of information and action as outlined above and based on the efforts being undertaken by WAVS.

WAVS is investigating four key areas as described below. We are interested in providing an update on this work at the NOAA Technology workshop.

1) Evaluation of Artificial Intelligence Detection

Evaluating the use of artificial intelligence (AI) to analyze visual, infrared and very high-resolution images to detect the presence of marine mammals. Developments in artificial intelligence and marine image equipment can detect and classify objects in the water, including marine mammals.

The benefit of AI is that it allows for immediate analysis of information even in adverse conditions more effectively than can be done by human observers, thereby allowing vessel operators to have better situational awareness and to make better informed decisions for the vessel and the whale. Whale Seeker,[1] Space Whale,[2] Awarion,[3] Sea AI,[4] Sea Machines,[4] and Avikus[5] are but a few examples of companies that have developed AI tools to scan images for the presence of whales. These products are currently being trained with the intent of deployment for field verification in the coming months.

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[1] https://www.whaleseeker.com/
[2] https://www.spacewhales.de/
[3] https://cra.com/awarion-autonomous-lookout-system/
[4] https://sea.ai/
[5] https://avikus.ai/eng/about/main

AI software can be trained to work with images captured by various manufacturers. This approach has the potential for broad application in the industry.

Additionally, WAVS is interested in working with NOAA and others to develop a validation process for AI software for the detection of large marine mammals. Once developed and 'approved' by the various providers, these systems can begin to provide additional data that feeds into the various detection databases. AI has the benefits of standardizing data analysis and reducing the time to validate a sighting. This has the potential to produce a positive feedback loop that improves the quality and timeliness of the data and provides more real-time information to vessel operators.

2) Marine Electronics Integration

There is a critical need to develop ways of sharing the output obtained through monitoring efforts and from derivative speed zone information with marine electronics. Information in the form of marine mammal detection is of most value when presented to vessel operators in a visual or graphic representation on a real-time basis through their suite of marine electronics. This includes not only alerting the boater by display but also by audible alarm which afford the vessel operator the opportunity to make informed decisions and reduce the risk of collision with marine mammals. In addition, this effort will explore ways of sending management notices, such as dynamic management areas through the Automatic Identification System (AIS). WAVS foresees this work to be a lynch pin in risk reduction by bridging the gap between policy and practical, impactful, on-the-water, real-time implementation.

Marine Cartography and Rapid Updates

Most Chart plotters on the market today display marine protected area and speed limit zone polygons. This information provided by NOAA is found in both Garmin cartography brands (who serve most of the market) and other third-party marine cartography manufacturers. Most modern cartography manufacturers publish updates on some regular cadence. Often those updates are distributed by way of updated memory cards or more rapidly via download or mobile applications serving as companions to on-board electronics.

As an example, Garmin branded cartography is capable of "Daily Updates"[6] which essentially means Garmin can ingest updated data sets and publish updates as fast as within a 24-hour period that can then be distributed to on-board marine electronics via download or companion mobile application. The idea that NOAA could issue an acutely focused dynamic management area and a concerned vessel could have on-board cartography updated to reflect that new zone in a 24-hour period (so long as they have internet connectivity while in port or at sea) is **not only realistic but exists today**.

Near Real-Time Updates

Leveraging existing crowd source infrastructure and communities such as ActiveCaptain,[7] Community,[8] or Navionics Community Edits,[9] point-based data input can be distributed in near

[6] https://www.navionics.com/usa/charts/features/daily-updates
[7] https://activecaptain.garmin.com/en-US/Map
[8] https://activecaptain.garmin.com
[9] https://www.navionics.com/usa/charts/features/community-edits

real-time (seconds to minutes) and loaded to a chartplotter via a mobile application. This means that cetacean positions reported by real-time monitoring programs and technology (such as AI based identification reporting) can be distributed to on-board marine electronics and displayed and alarmed on screen in near real-time. This is technology that is **not only realistic but exists today,** sharing tens of thousands of cartography edits annually at speed other cartography sources are unlikely to match.

Taking that concept a step further, boaters can be empowered to input their own observations via the same crowd-sourced tools that can be shared across the boating community as well as back to NOAA or other research entities to help augment the volume of monitoring observations used to drive dynamic regulatory efforts. The ActiveCaptain community also has a third-party Application Programming Interface (API) allowing other apps or web sites to bring in community Points Of Interest (POI) aimed to widen the efficacy of that program.

Other On-board Systems

Marine electronics integrate with class A and B AIS. -Today, the AIS standard supports distribution of polygons although adoption by most marine electronics companies has been low considering there are few if any sources broadcasting that type of information using AIS. Most utilize the aforementioned cartography distribution method. Dynamic regulatory polygons could be broadcasted using AIS and chartplotters on vessels of all sizes, and can be taught to receive, display, and alarm based on those dynamic polygons. Similarly, devices broadcasting virtual aids to navigation (vAtoN) exist today and can be deployed to distribute not only regulatory polygons but real-time positions of monitoring programs. Garmin Guardian[10] is one example where the likes of tow operations, telecom, or offshore wind (a shared stakeholder in cetacean vessel strike risk mitigation) utilize AIS to broadcast AtoNs alerting nearby vessel traffic of subsea assets. These devices are cloud based connected systems so that real-time observation, or real-time deployment of AtoN and polygon information is achievable as these devices are placed in strategic broadcasting locations. Receiving vessels can then make informed navigation decisions based on real-time information just as they would respond to the alert of a nearby vessel utilizing AIS.

3) Development of a Risk Terrain Model

Whale-vessel strikes are a serious problem that can harm marine life, people and property. Risk Terrain Modeling (RTM) is a tool used to diagnose environmental conditions that connect with spatial patterns of whale-vessel strikes. RTM can help us identify and prioritize the areas where these collisions are significantly most likely to happen at the micro-level, so we can take reasonable steps to prevent them. This process is similar to how RTM is used to identify high-risk locations for traffic crashes.

RTM can analyze available land and sea datasets, and the resulting products can be used to guide policy decisions, optimize sensors/AI/ML technologies, allocate resources, and prioritize surveillance and monitoring activities (including for new data collection efforts). Modelers can create maps that show the risk of whale-vessel strikes at different times of the year throughout the Atlantic Seaboard or elsewhere. These maps can be incorporated into nautical charts and

[10] https://www.vesperguardian.com/how-guardian-works/

global position satellite (GPS) technologies to help vessel operators mitigate risk and prevent harm.

RTM can assess the spatial risks of whale-vessel strikes in a similar way. These models can analyze features of landscapes and seascapes that influence boater and whale behaviors to determine how they co-locate and interact to create risky places for strikes. Multiple physical and structural elements of land and water environments can be analyzed. From these inputs, only the most significant influences will be identified, and the highest-risk areas will be mapped.

According to availability, data sets from reliable data sources such as voluntarily reported sightings (Whale Map[11]) and AI surveillance of whale surfacing (Whale Seeker and Space Whales) has the potential to be incorporated into the RTM. Additionally, modelers can readily obtain data on land and sea features that attract or influence whale or boater behaviors to run an RTM analysis. Results will show statistically significant micro areas where strike risks are higher and lower throughout the entire Atlantic Seaboard.

4) Marine Radar

Marine radar is an established tool to improve navigational and safety at sea. There are numerous products that can be utilized to monitor and detect large marine mammals. One off-the-shelf product is vessel-mounted navigational radar that utilizes S and X band radar for vessel avoidance and navigation. The wide-scale use of radar on vessels, both commercial and recreational, can gather a significant amount of information from on-water operators.

Radar has been used in biological research and to monitor wildlife. -Radar has been successfully used to monitor birds within the vicinity of airports[12]. Radar has also been used to detect single birds and large swarms of insects. -Previous work demonstrated the feasibility of detecting and tracking fin whales and smaller mammals up to 5.5km or more at lower sea states. Additional work found that conventional radar holds potential for detection of marine mammals in optimal sea state at short range (<1km) using automated algorithms[13]. Vessel operators have indicated that spouts from marine mammals can be detected by radar under ideal conditions and when the unit is tuned specifically to detect the presence of water vapor. The limitations of radar detection may prevent this tool from being a complete detection solution. However, when coupled with other technology, radar may provide additional advancement towards providing real-time monitoring of NARW and other marine mammals.

The objectives for this project include evaluating the feasibility of using vessel mounted and stationary radar to detect whale breath, evaluating the rate at which radar can distinguish marine mammals from other maritime targets, evaluating the weather constraints associated with using radar to detect whale breath, developing an algorithm to identify whale breath observed in near real-time radar data, and comparing whale detection by radar to baseline detection via acoustic detection, visual detection, satellite images or through other detection methods.

---

[11] https://whale-alert.io/

[12] "Radar-Based Detection, Tracking and Speciation of Marine Mammals from Ships. DeProspo, Douglas F., J, Mobley, W. Hom, and M. Carron," Award Number: N00014-04-1-0729 2005.

[13] "Comparing methods suitable for monitoring marine mammals in low visibility conditions during seismic surveys," Verfuss, U., D. Gillespie, J. Gordon and L. Thomas. Marine Pollution Bulletin, January 2018.

The development of marine radar for NARW detection may hold promise in areas and during times of year when detection is challenging due to the whales' behavior.

In addition to the topics outlined above, WAVS suggests the inclusion of two additional points of discussion for the Technology Workshop.

a. **Quantifying Risk Reduction:** A thorough discussion on the methodology that will be employed to quantify the amount of risk reduction achieved through technology innovation, outreach, education, enhanced compliance, and other actions taken by the marine industry and federal agencies. Discussion should also include how techniques can be qualified in situations where risk reduction calculations prove to be difficult. It will also be important to discuss how qualifications will play a role in assessing risk reduction for the work.

b. **Data Aggregation:** As more information on marine mammal movements and real-time location becomes available, it will be necessary to have consistency between data aggregators. Having standards on format and accessibility are critical. Furthermore, it would be valuable to discuss possibilities of a collaboration with NOAA and potential third-party data aggregators.

In closing, WAVS requests that NOAA consider our suggestions as the scope and agenda for the technology workshop are developed. We outlined several efforts undertaken by WAVS that can mitigate risk of vessel strike through advanced technology. We hope these themes are included in the technology workshop. We have also suggested additional issues that should be discussed at the workshop. In addition, WAVS members are interested in providing an update on this work at the workshop and would appreciate the opportunity to present on these important topics.

We look forward to having further discussions with you and the steering committee during the planning of the NOAA Tech Workshop.

Sincerely,

John DePersenaire, Chair
Whale and Vessel Safety Task Force (wavstaskforce.com)

WAVS Taskforce
Whale and Vessel Safety Taskforce

Attachment 1.

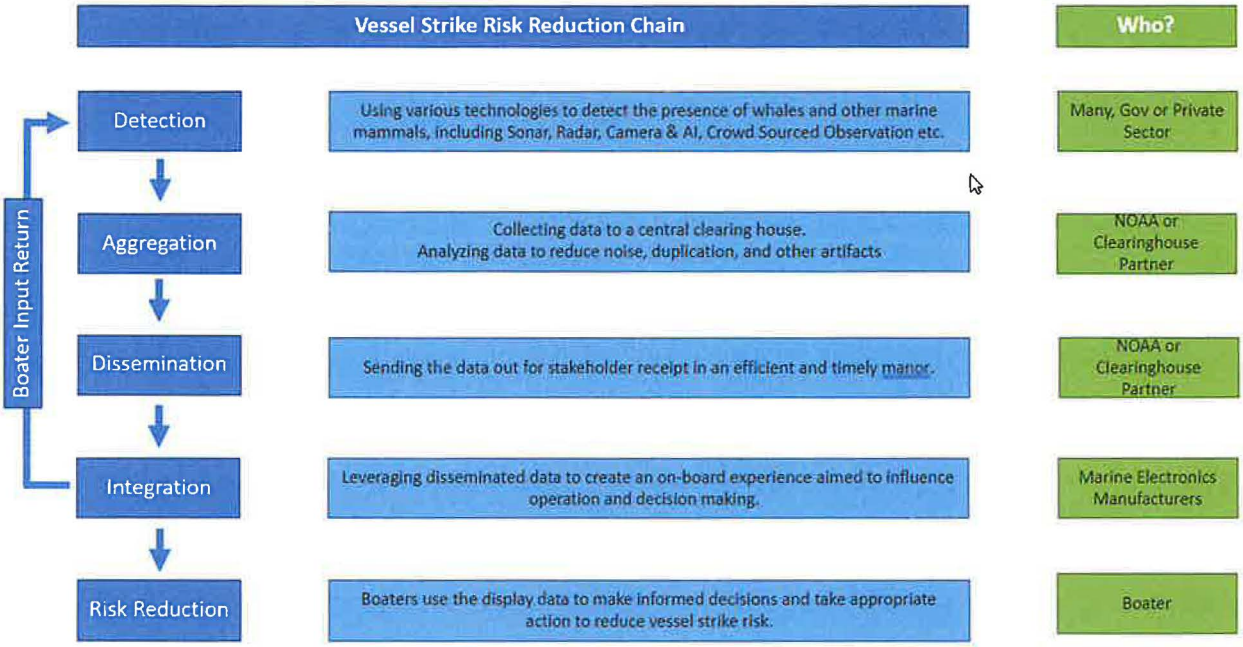

Exhibit B

Leveraging Marine Technologies to Safeguard Marine Life and Boater Safety

Congressional Boating Caucus

JOHN DEPERSENAIRE
DIRECTOR OF GOVERNMENT AFFAIRS &
SUSTAINABILITY @ VIKING YACHT COMPANY

Leveraging Marine Technologies To Safeguard Marine Life And Boater Safety

Congressional Boating Caucus | April 11, 2024

WAVS Taskforce
Whale and Vessel Safety Taskfor

Management of the North Atlantic Right Whale Represents a Significant Conservation Challenge

- Population Size is low
- NARW More Susceptible to Anthropogenetic Sources of Mortality than Other Large Cetaceans
- Habitat Overlaps With Areas Used for Commerce and Recreation
- Occurrences of Mortality are Rare and Spread Out a large Spatial and Temporal Scales
- Multiple Tools are Needed

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> It is not possible to establish a direct casual link between speed reduction efforts and the relative decline in observed right whale serious injury and mortality events following implementation of the speed rule.

Draft Regulatory Impact Review and Initial Regulatory Flexibility Analysis
Amendments to the North Atlantic Right Whale Vessel Strike Reduction Rule

Risk Reduction Tools

- Two tools currently used to reduce Vessel Strike Mortality: Vessel Speed and Re-Routing
- Vessel Speed remains the primary tool but fails to address the whale/vessel interaction
- Vessel Speed is not linked to risk reduction

We are interested in looking at all tools, including technology, to reduce risk and the whale/vessel interaction!

Why Technology Holds Significant Advantages

Safety is a fundamental area of continuing improvement for all vessels

- Collision avoidance is part of building safer boats and product development
- Significant desire to avoid hitting anything in the water, including marine mammals
- Not starting from zero, avoiding objects in the water has been a focus of the marine industry for decades

Technology Is Constantly Improving

Progress continues to be made towards risk reduction every day continues to expand to a great proportion of the fleet.

Technology has distinct advantages in reducing risk

- Technology addresses the whale/vessel interaction
- Current management tools for NARW are not linked to risk reduction
- Improves Boat/Passenger Safety
- Not limited by time or space
- Current Focus on NARW but benefits extend to other species

WAVS Taskforce
Whale and Vessel Safety Taskfor

NOAA Recognition of Technology in Vessel Strike Reduction!

NMFS also recognizes the role whale avoidance technologies may play in preventing vessel collisions and remains open to the future application of these technologies, if proven safe and effective.

NMFS solicits comments on options for alternative speed reduction programs specifically within port entrance areas that best maintain navigational safety while providing comparable vessel strike protections to right whales. Alternative programs would be conducted and resourced by external partners, include comprehensive monitoring of right whale presence, and provide a level of vessel strike risk reduction equivalent to that achieved through the measures described in this rule."

National Oceanic and Atmospheric Administration
August 1, 2022, Docket No. 220722-0162

WAVS Taskforce
Whale and Vessel Safety Taskfor

Peer Reviewed Acceptance of Technology in Vessel Strike Reduction

WAVS Taskforce
Whale and Vessel Safety Taskfor


ENDANGERED SPECIES RESEARCH
Endang Species Res

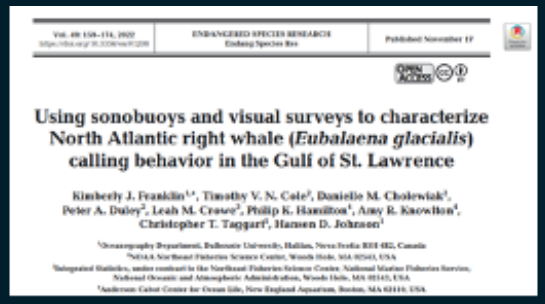
Published September 29

OPEN ACCESS

Effectiveness of surface-based detection methods for vessel strike mitigation of North Atlantic right whales

Loïcka M. R. Baille[1,*], Daniel P. Zitterbart[2]

[1]MIT-WHOI Joint Program in Oceanography/Applied Ocean Science & Engineering, 266 Woods Hole Rd, Woods Hole, MA 02543, MA, USA
[2]Applied Ocean Physics and Engineering, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA


ENDANGERED SPECIES RESEARCH
Endang Species Res

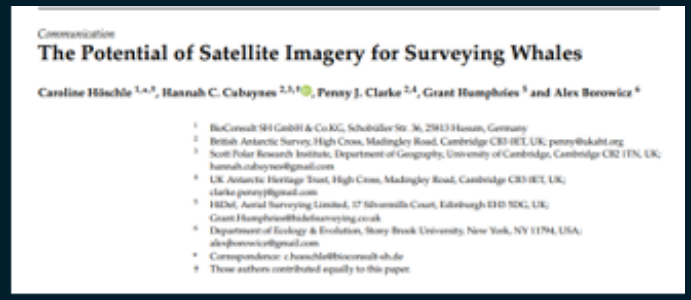
Published November 17

OPEN ACCESS

Using sonobuoys and visual surveys to characterize North Atlantic right whale (*Eubalaena glacialis*) calling behavior in the Gulf of St. Lawrence

Kimberly J. Franklin[1,*], Timothy V. N. Cole[2], Danielle M. Cholewiak[2], Peter A. Duley[2], Leah M. Crowe[2], Philip K. Hamilton[3], Amy R. Knowlton[4], Christopher T. Taggart[5], Hansen D. Johnson[1]

[1]Oceanography Department, Dalhousie University, Halifax, Nova Scotia B3H 4R2, Canada
[2]NOAA Northeast Fisheries Science Center, Woods Hole, MA 02543, USA
[3]Integrated Statistics, under contract to the Northeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Woods Hole, MA 02543, USA
[4]Anderson Cabot Center for Ocean Life, New England Aquarium, Boston, MA 02110, USA


Communication

The Potential of Satellite Imagery for Surveying Whales

Caroline Höschle[1,*,†], Hannah C. Cubaynes[2,3,†], Penny J. Clarke[2,4], Grant Humphries[5] and Alex Borowicz[6]

[1] BioConsult SH GmbH & Co.KG, Schobüller Str. 36, 25813 Husum, Germany
[2] British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK; penny@ukabt.org
[3] Scott Polar Research Institute, Department of Geography, University of Cambridge, Cambridge CB2 1TN, UK; hannah.cubaynes@gmail.com
[4] UK Antarctic Heritage Trust, High Cross, Madingley Road, Cambridge CB3 0ET, UK; clarke.penny@gmail.com
[5] HiDef Aerial Surveying Limited, 17 Silvermills Court, Edinburgh EH3 5DG, UK; Grant.Humphries@hidefsurveying.co.uk
[6] Department of Ecology & Evolution, Stony Brook University, New York, NY 11794, USA; alex@borowicz@gmail.com
* Correspondence: c.hoeschle@bioconsult-sh.de
† These authors contributed equally to this paper.

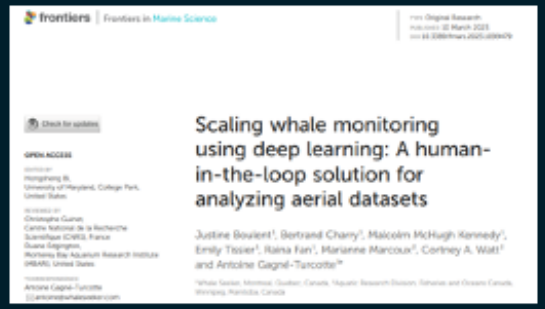

RESEARCH ARTICLE

Aerial-trained deep learning networks for surveying cetaceans from satellite imagery

Alex Borowicz[1,2]*, Hieu Le[3,4], Grant Humphries[4], Georg Nehls[5], Caroline Höschle[5], Vladislav Kosarev[6], Heather J. Lynch[1,2]

1 Department of Ecology & Evolution, Stony Brook University, Stony Brook, New York, United States of America, 2 Institute for Advanced Computational Science, Stony Brook University, Stony Brook, New York, United States of America, 3 Department of Computer Science, Stony Brook University, Stony Brook, New York, United States of America, 4 HiDef Aerial Surveying Ltd., Cleator Moor, Cumbria, United Kingdom, 5 BioConsult SH GmbH & Co. KG, Husum, Germany

* aborowicz@cisa.edu


frontiers | Frontiers in Marine Science

Scaling whale monitoring using deep learning: A human-in-the-loop solution for analyzing aerial datasets

Justine Boulent[1], Bertrand Charry[1], Malcolm McHugh Kennedy[1], Emily Tissier[1], Raina Fan[1], Marianne Marcoux[2], Cortney A. Watt[1] and Antoine Gagné-Turcotte[3]*


Mapping Arctic cetaceans from space: A case study for beluga and narwhal

Bertrand Charry, Emily Tissier, John Iacozza, Marianne Marcoux, Cortney A. Watt

Published August 4, 2021 • https://doi.org/10.1371/journal.pone.0254380

Article | Authors | Metrics | Comments | Media Coverage

Correction
Abstract
Introduction
Materials and methods
Results

Correction

30 Sep 2021: The PLOS ONE Staff (2021) Correction: Mapping Arctic cetaceans from space: A case study for beluga and narwhal. PLOS ONE 16(9): e0268238. https://doi.org/10.1371/journal.pone.0268238 | View correction

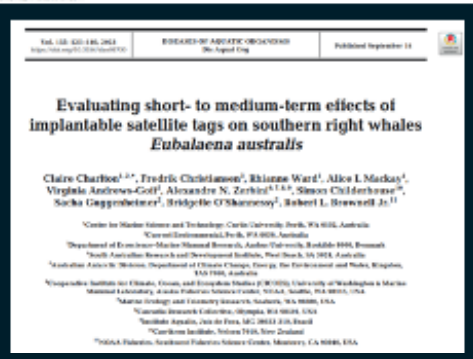

Remote sensing techniques for automated marine mammals detection: a review of methods and current challenges

Literature review | Conservation Biology | Ecology | Marine Biology | Zoology

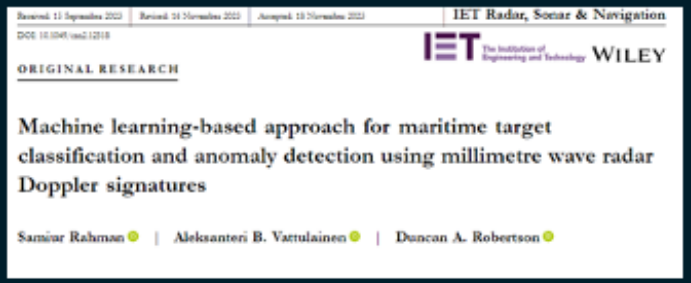
Spatial and Geographic Information Science

Esteban N. Rodofili[1], Vincent Lecours[1,2], Michelle LaRue[3,4]

Published June 20, 2022


Evaluating short- to medium-term effects of implantable satellite tags on southern right whales *Eubalaena australis*

Claire Charlton[1,2*], Fredrik Christiansen[3], Rhianne Ward[1], Alice L Mackay[1], Virginia Andrews-Goff[1], Alexandre N. Zerbini[4,5,6], Simon Childerhouse[7], Sacha Gaggenheimer[1], Bridgette O'Shaunessy[1], Robert L. Brownell Jr.[11]


IET Radar, Sonar & Navigation

IET The Institution of Engineering and Technology | WILEY

ORIGINAL RESEARCH

Machine learning-based approach for maritime target classification and anomaly detection using millimetre wave radar Doppler signatures

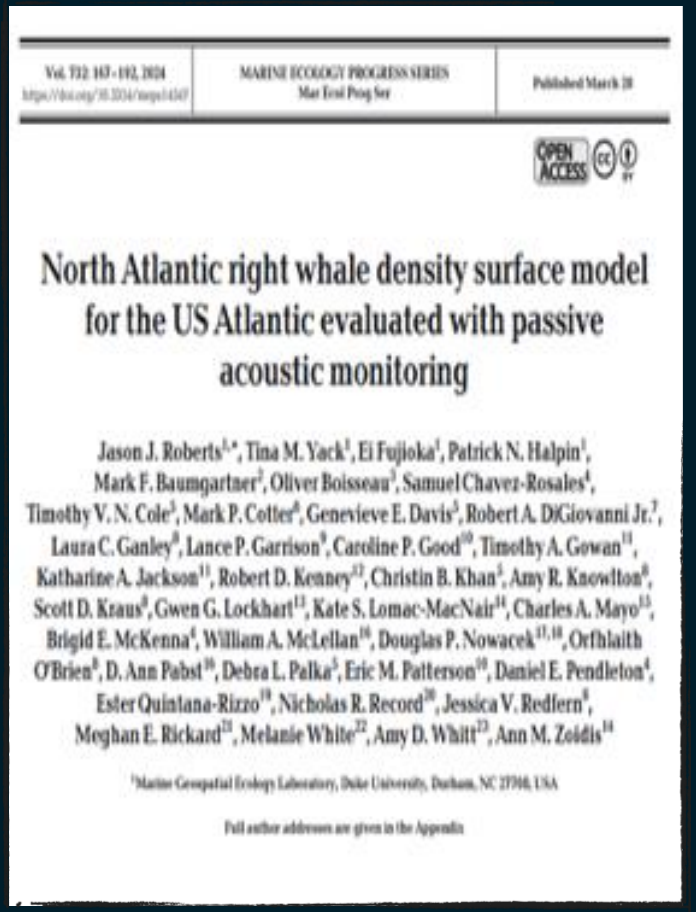
Samiur Rahman | Aleksanteri B. Vattulainen | Duncan A. Robertson

Recent Paper Highlights the Need for Multipronged Approach

In the face of high uncertainty and variability in where right whales are, the most effective mitigations may be those that apply very broadly, or do not have a spatiotemporal component at all

Consideration should be given to multiple data sources, models, perspectives, sources of expertise, and possible solutions, rather than to a single model output or approach to mitigation.

Roberts et al.
North Atlantic right whale density model, Marine Ecology Progressive Series, Vol. 732: 167–192, 2024



Vol. 732: 167–192, 2024 | MARINE ECOLOGY PROGRESS SERIES Mar Ecol Prog Ser | Published March 28

OPEN ACCESS

North Atlantic right whale density surface model for the US Atlantic evaluated with passive acoustic monitoring

Jason J. Roberts[1,*], Tina M. Yack[1], Ei Fujioka[1], Patrick N. Halpin[1], Mark F. Baumgartner[2], Oliver Boisseau[3], Samuel Chavez-Rosales[4], Timothy V. N. Cole[5], Mark P. Cotter[6], Genevieve E. Davis[5], Robert A. DiGiovanni Jr.[7], Laura C. Ganley[8], Lance P. Garrison[9], Caroline P. Good[10], Timothy A. Gowan[11], Katharine A. Jackson[11], Robert D. Kenney[12], Christin B. Khan[5], Amy R. Knowlton[6], Scott D. Kraus[6], Gwen G. Lockhart[13], Kate S. Lomac-MacNair[14], Charles A. Mayo[15], Brigid E. McKenna[4], William A. McLellan[16], Douglas P. Nowacek[17,18], Orfhlaith O'Brien[6], D. Ann Pabst[16], Debra L. Palka[5], Eric M. Patterson[19], Daniel E. Pendleton[4], Ester Quintana-Rizzo[19], Nicholas R. Record[20], Jessica V. Redfern[6], Meghan E. Rickard[21], Melanie White[22], Amy D. Whitt[23], Ann M. Zoidis[14]

[1]Marine Geospatial Ecology Laboratory, Duke University, Durham, NC 27708, USA

Full author addresses are given in the Appendix

Presentations to Cover Various Tools to Reduce Risk

Prediction Modeling
Dr. Taylor Shropshire

Data Collection/Aggregation
Eliot Horowitz

Dissemination
Moses Calouro

Detection
Arnaud Pourchez

Hernando Giraldo

Integration
Shaun Ruge

Stephen Thomas

WAVS Taskforce
Whale and Vessel Safety Taskfor

Summary

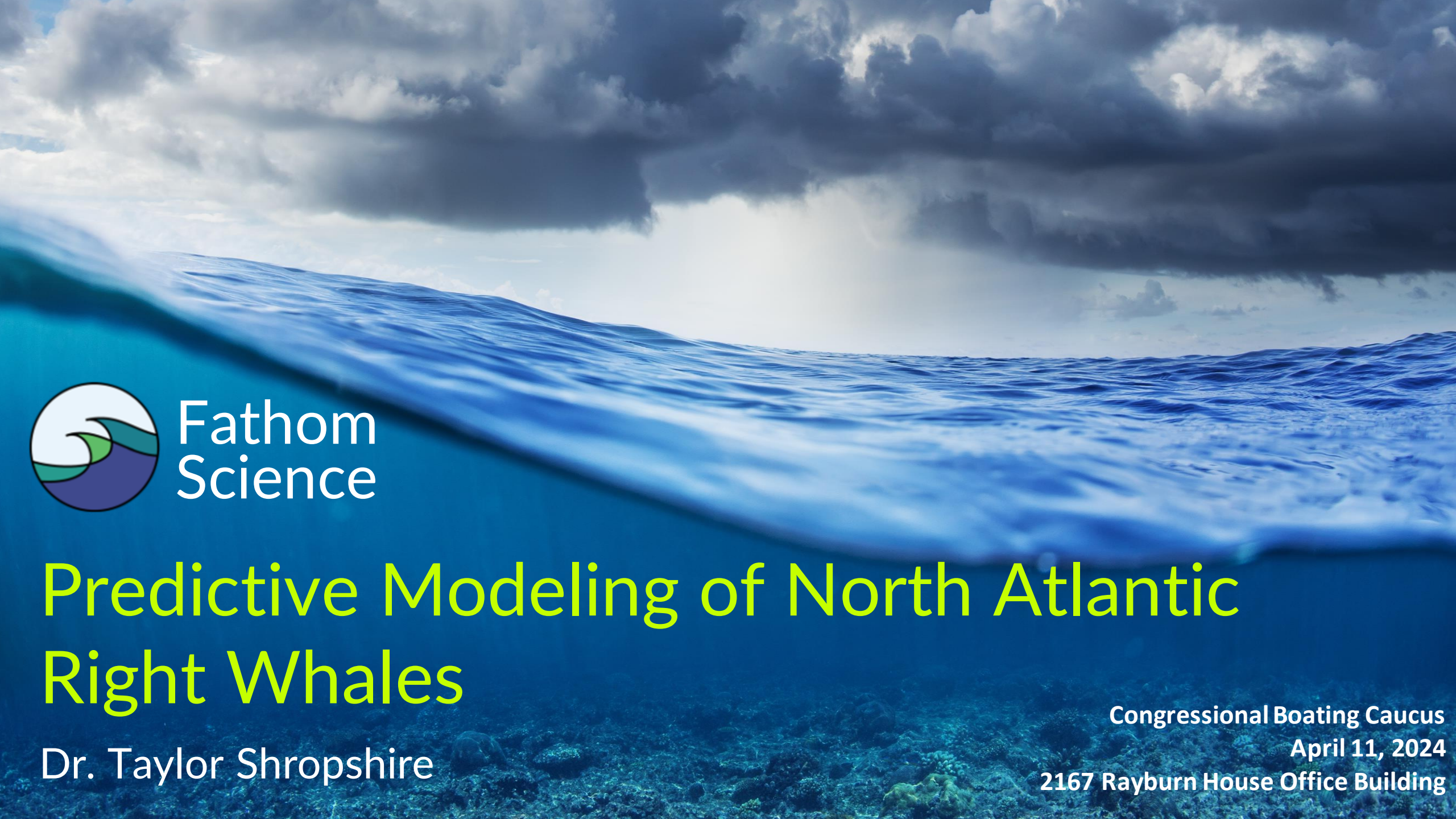
- Technology is available today to detect objects in the water, including NARW
- Work over the last few years has accelerated the focus towards marine mammals
- Technology holds the greatest potential to minimize the whale/vessel interaction
- Risk reduction is an on-going process, not an end point
- Simple improvements with communications/detection address scalability of these tools
- Providing relevant information to vessel operators is key to reducing risk
- Greater coordination with research institutes, NOAA and USCG can speed the pace of development, commercialization and adoption of these tools

WAVS Taskforce
Whale and Vessel Safety Taskforce

Thank you!

JOHN DEPERSENAIRE

Director of Government Affairs & Sustainability @ Viking Yacht Company



Fathom Science

Predictive Modeling of North Atlantic Right Whales

Dr. Taylor Shropshire

Congressional Boating Caucus
April 11, 2024
2167 Rayburn House Office Building

0.7

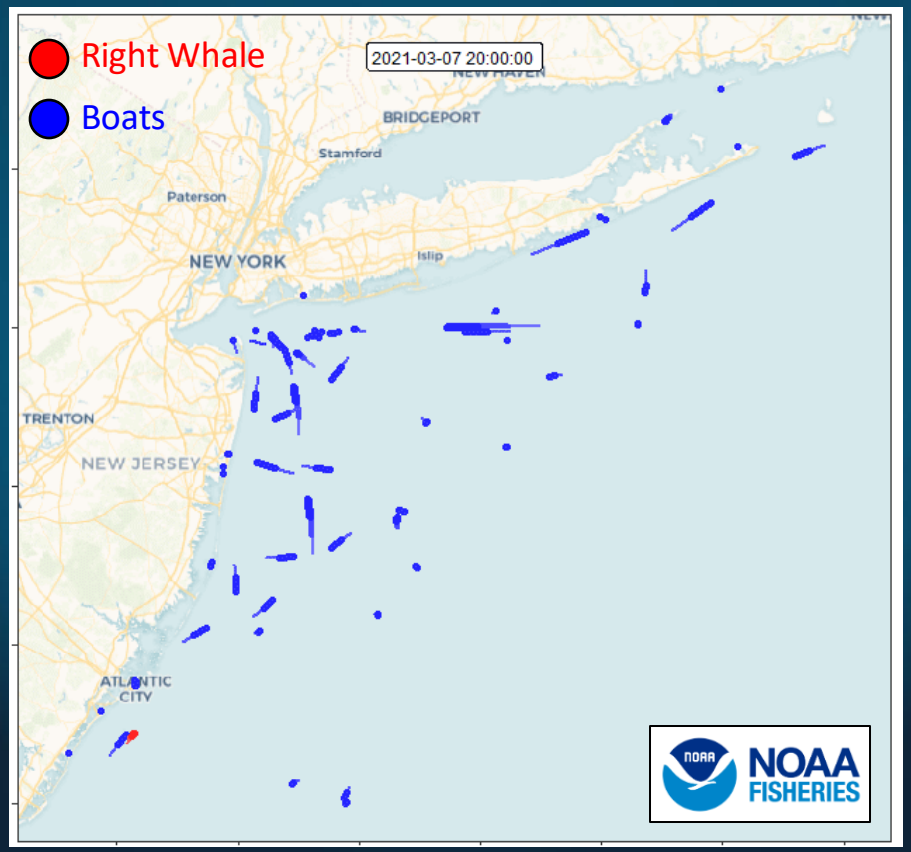
Maximum number of whales killed per year with population recovery.

Source: NOAA U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2022

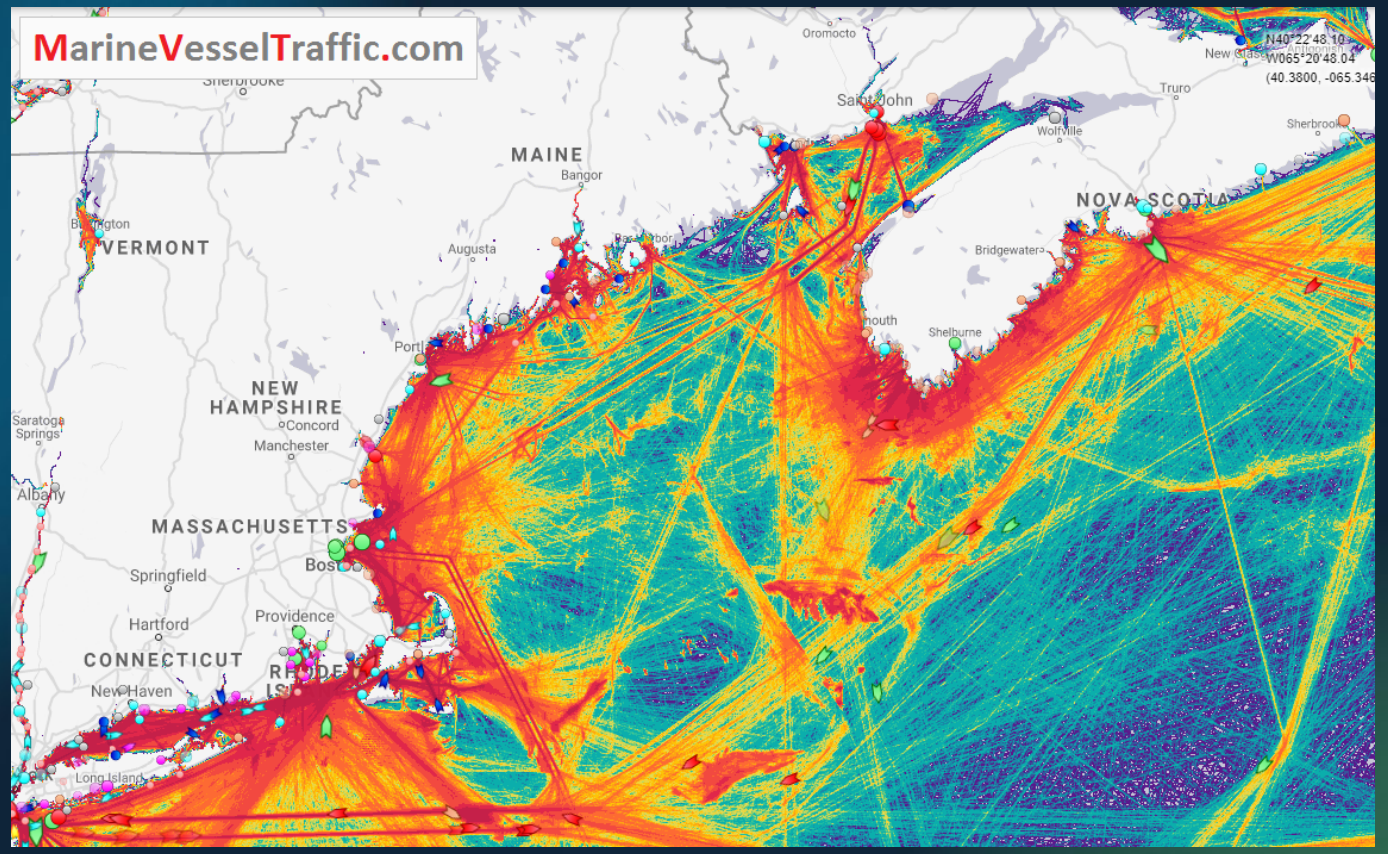
Fathom
Science

The challenge: Conservation with growth

Tagged Right Whale (6 days)



Boat Traffic

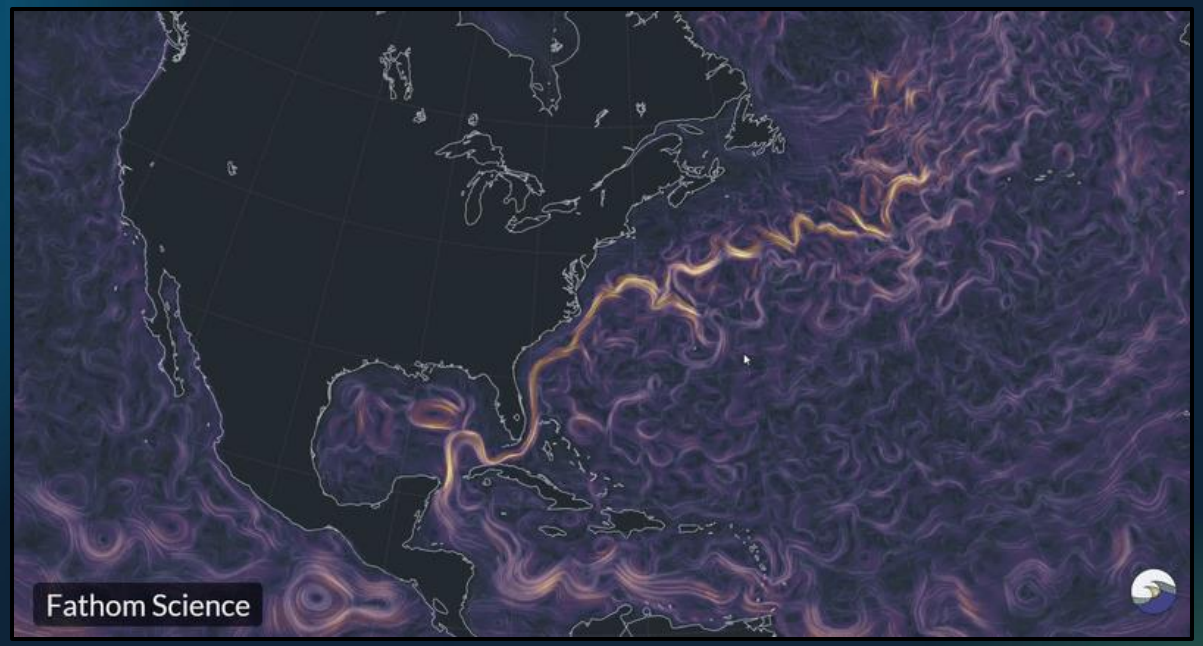


Fathom Science

Fathom Science

Sectors

Global ocean data, at your fingertips

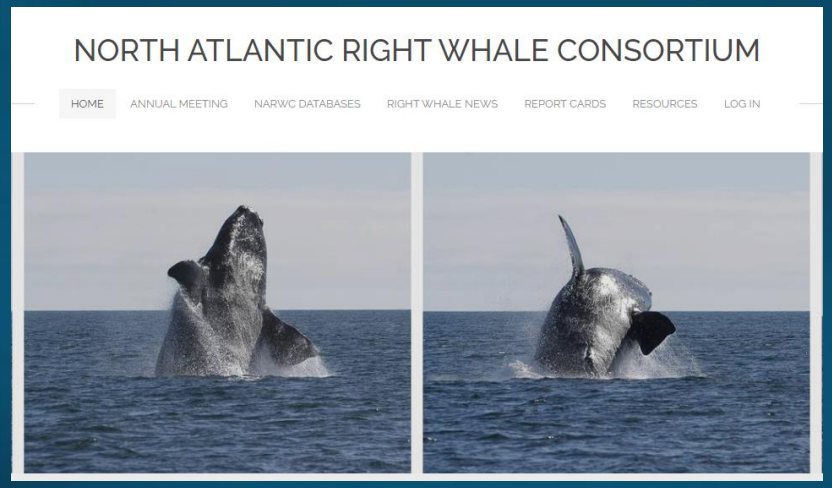


Serving the Blue Economy across multiple sectors
Providing a range of data scales
Using data for good

Fathom
Science

Predictive Modeling

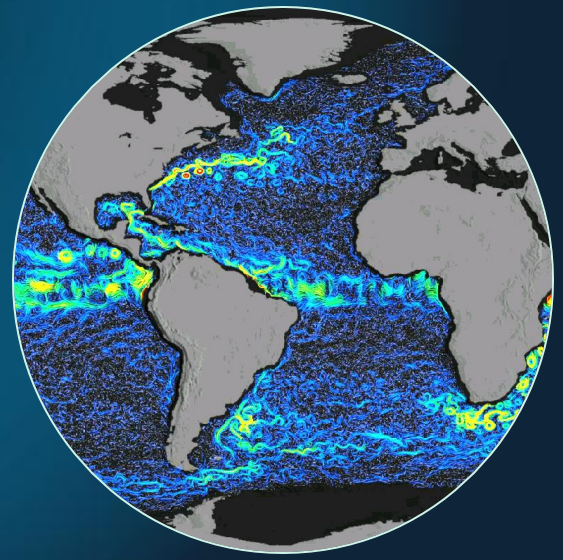
Historical Sightings



1993-2023 >50,000 sightings

+

Fathom's Historical Ocean Data



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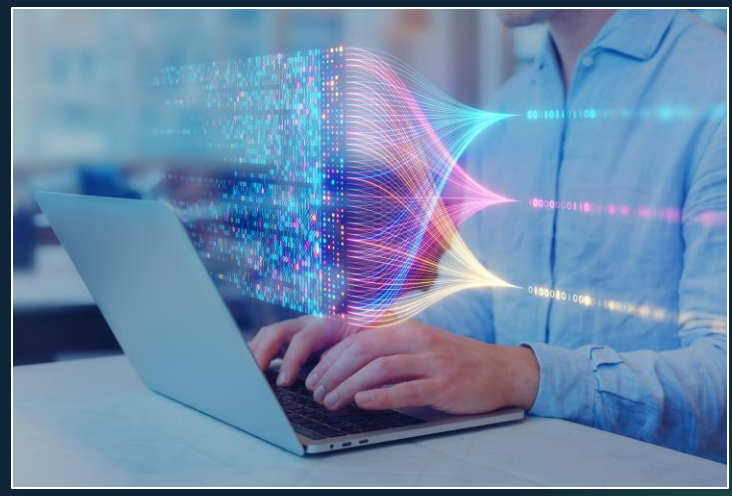
Statistics and Machine Learning



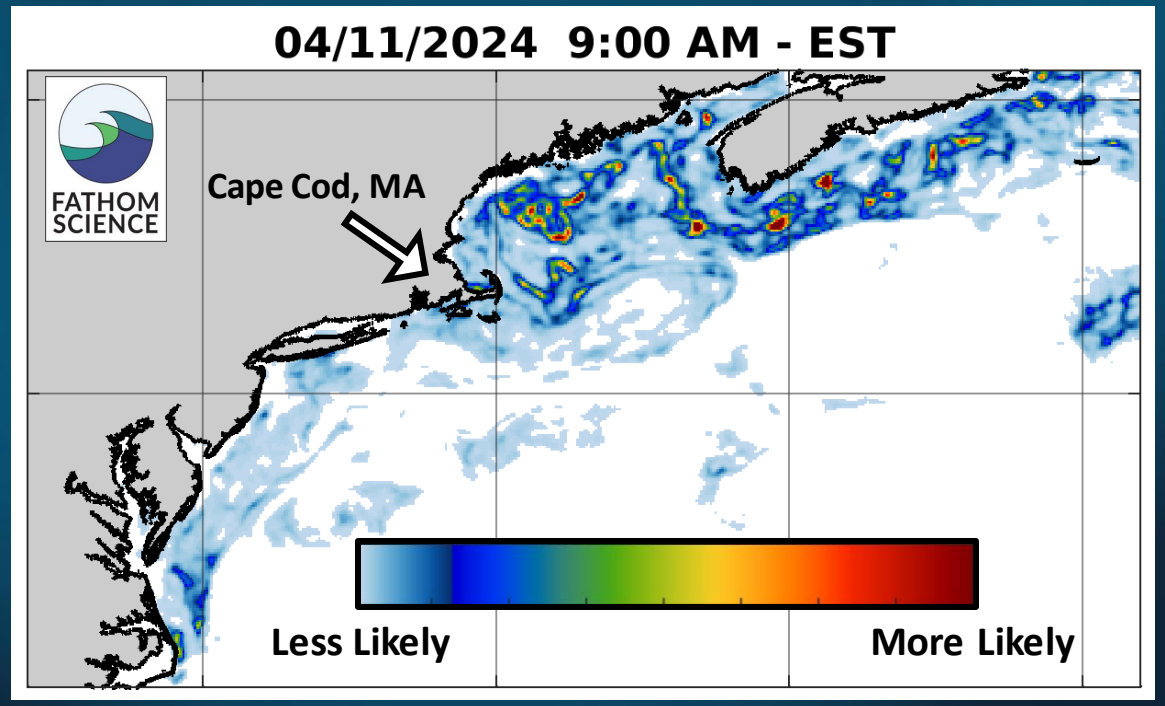
Approach:

1. Use historical ocean model to gather environmental information for each sighting
2. Develop algorithm from statistics and machine learning
3. Use Fathom's ocean forecast to identify daily whale hotspots

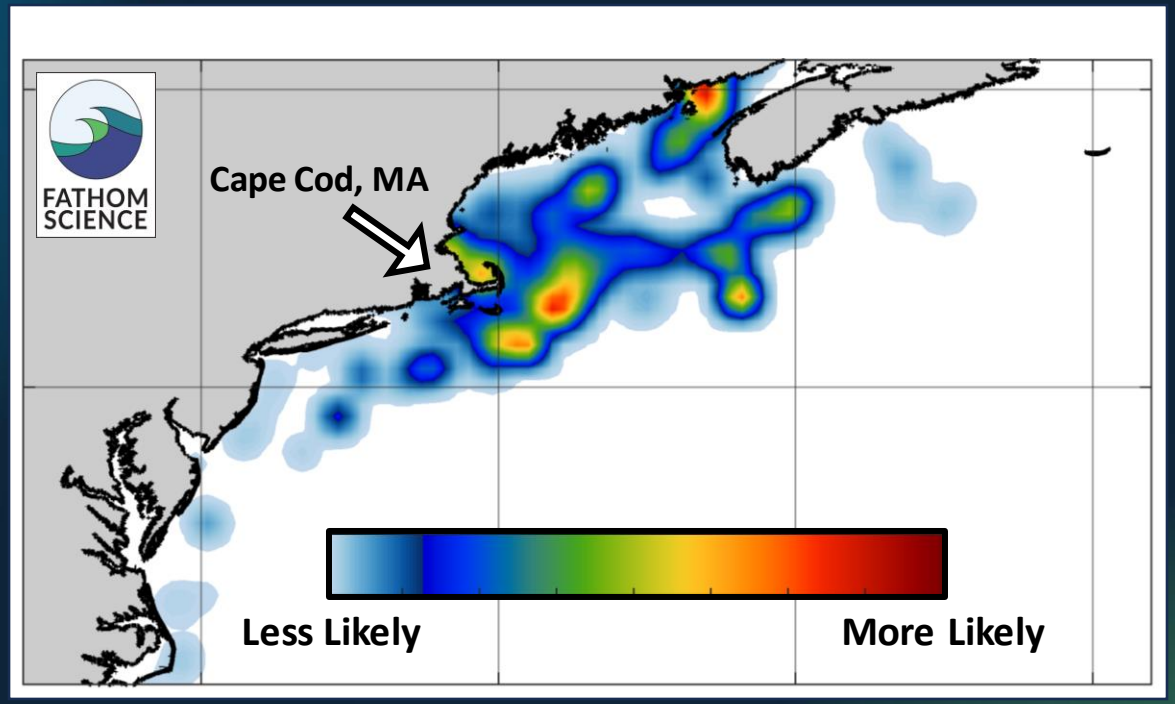
Fathom Science

Right Whale Hotspot Predictions

Today's hotspots



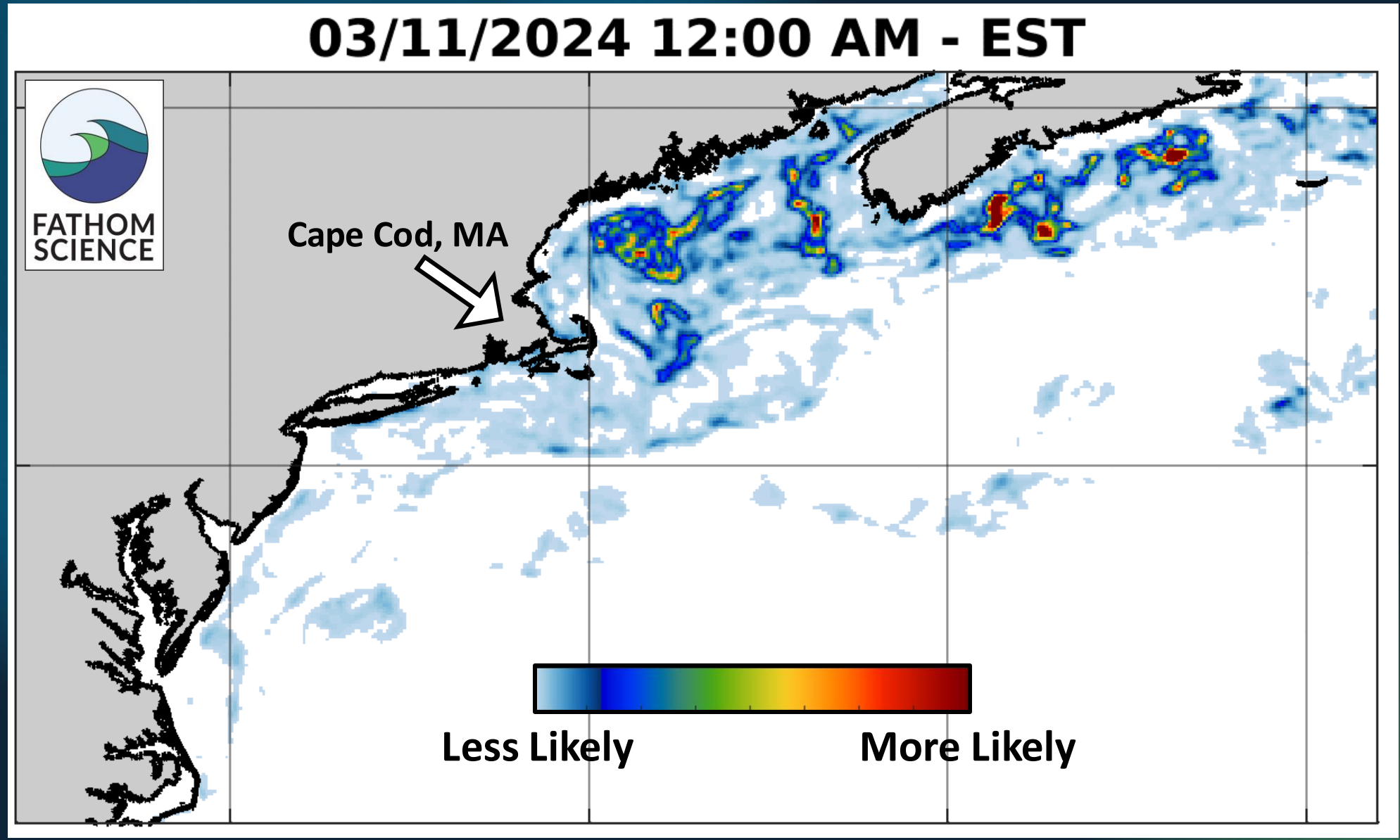
Historical Average



Does not provide exact whale locations, rather how likely that whales are present

Fathom Science

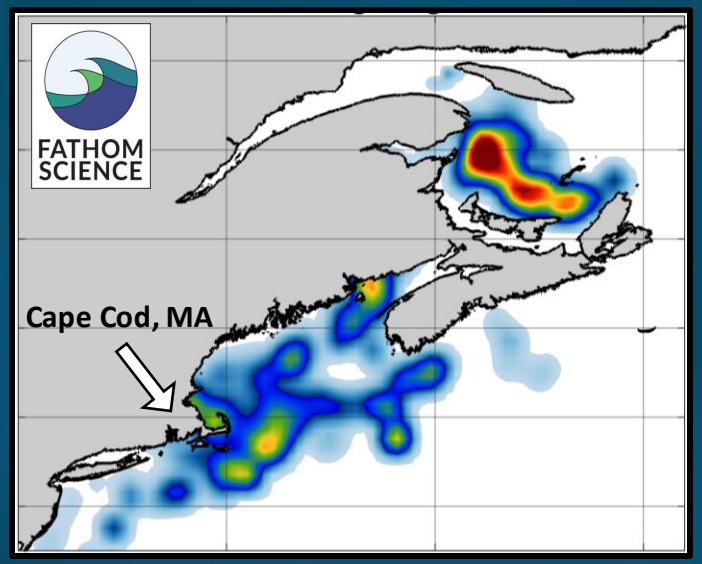
Right Whale Hotspot Predictions



Fathom Science

Integrated solutions

Locate



Modeling, shipboard detection, visual surveys, acoustic monitoring

Communicate

Display

- Communication and data visualization are just as important as locating the whales
- Layering multiple technologies reduces risk of exceeding 0.7 whales killed per year
- Federal and academic efforts are important but targeting management and moving slowly
- Critical to give mariners the ability to make decisions as soon as possible

Fathom Science

Thank you

FathomScience.com

info@fathomscience.com

Fathom
Science

ARNAUD POURCHEZ
Oceanographer and Marine Environmental Expert
Data Engineer - MLops @ Whale Seeker Inc.

Ready-to-Use Technology for Vessel Strike Mitigation

WAVS Taskforce
Whale and Vessel Safety Taskfor

WAVS Taskforce

Whale and Vessel Safety Taskforce

The Whale and Vessel Safety (WAVS) Taskforce is a group of ocean stakeholders working together to test and reduce risk within existing ocean innovations to create more sustainable boating/marine mammal ecosystems.

WHALE SEEKER

SPACE WHALE

YAMAHA

JASCO APPLIED SCIENCES

ROFFS

ATLANTIC MARINE ELECTRONICS

FATHOM SCIENCE

GARMIN

viking yachts

SIMSI

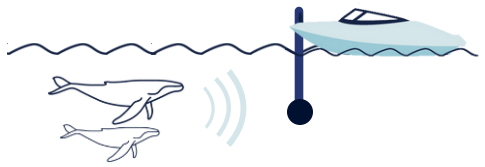
ATLANTIC SHORES offshore wind

MITRE

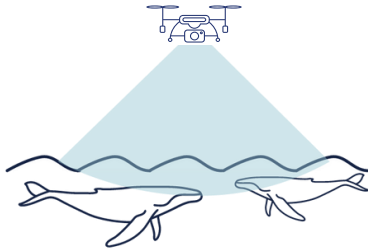
Existing Multimodal Detection Technologies and Monitoring Tools

Integrated tools for NARW conservation needs

Acoustic



Visual



Infrared (IR)

Satellite

WAVS Taskforce
Whale and Vessel Safety Taskfor

Key Takeaways

Speed reductions are a good start but
we can and need to do more.

The tools are available now.

WAVS Taskforce
Whale and Vessel Safety Taskfor

WAVS Taskforce

Whale and Vessel Safety Taskfor

www.wavstaskforce.com

Include existing technology for NARW conservation

Arnaud Pourchez

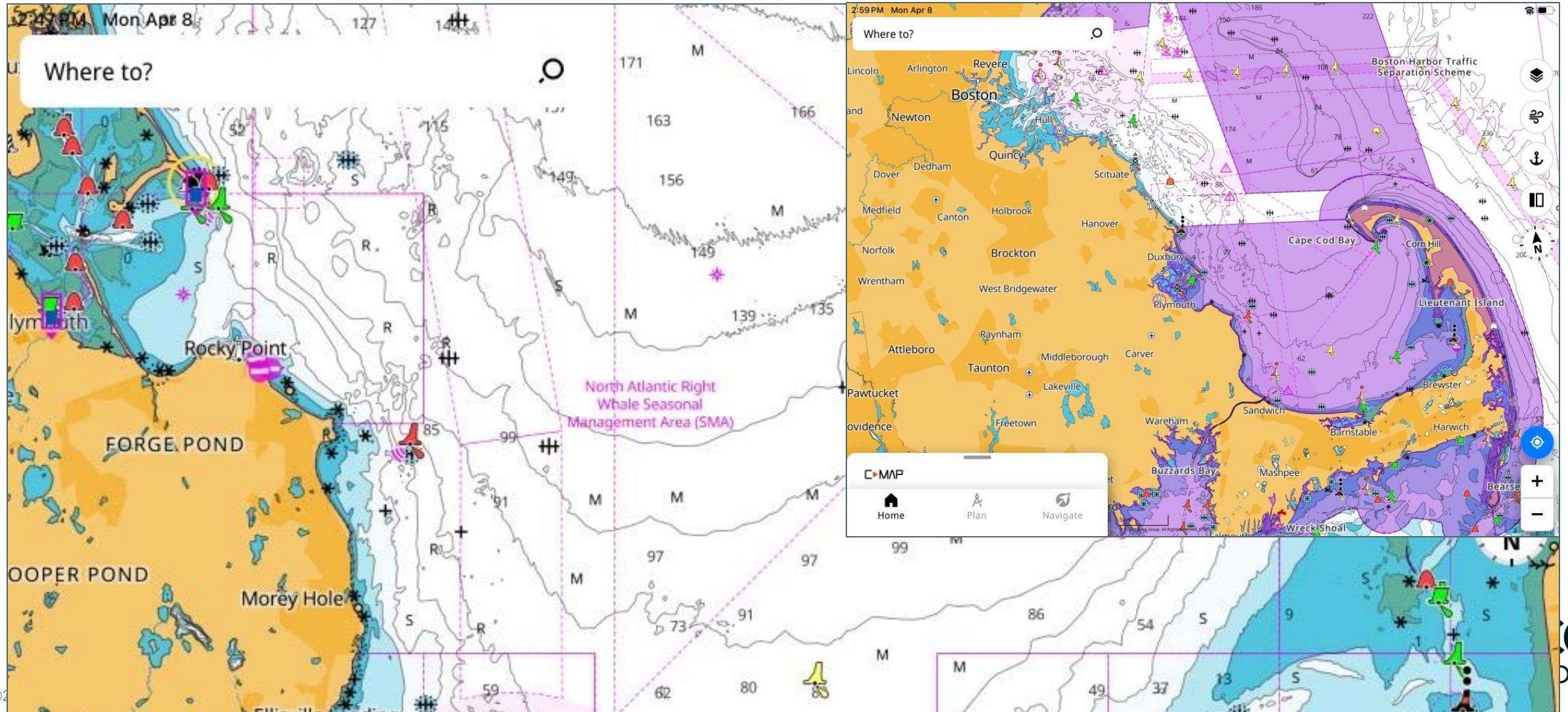
Oceanographer and Marine Environmental Expert

Data Engineer - MLops @ Whale Seeker Inc.

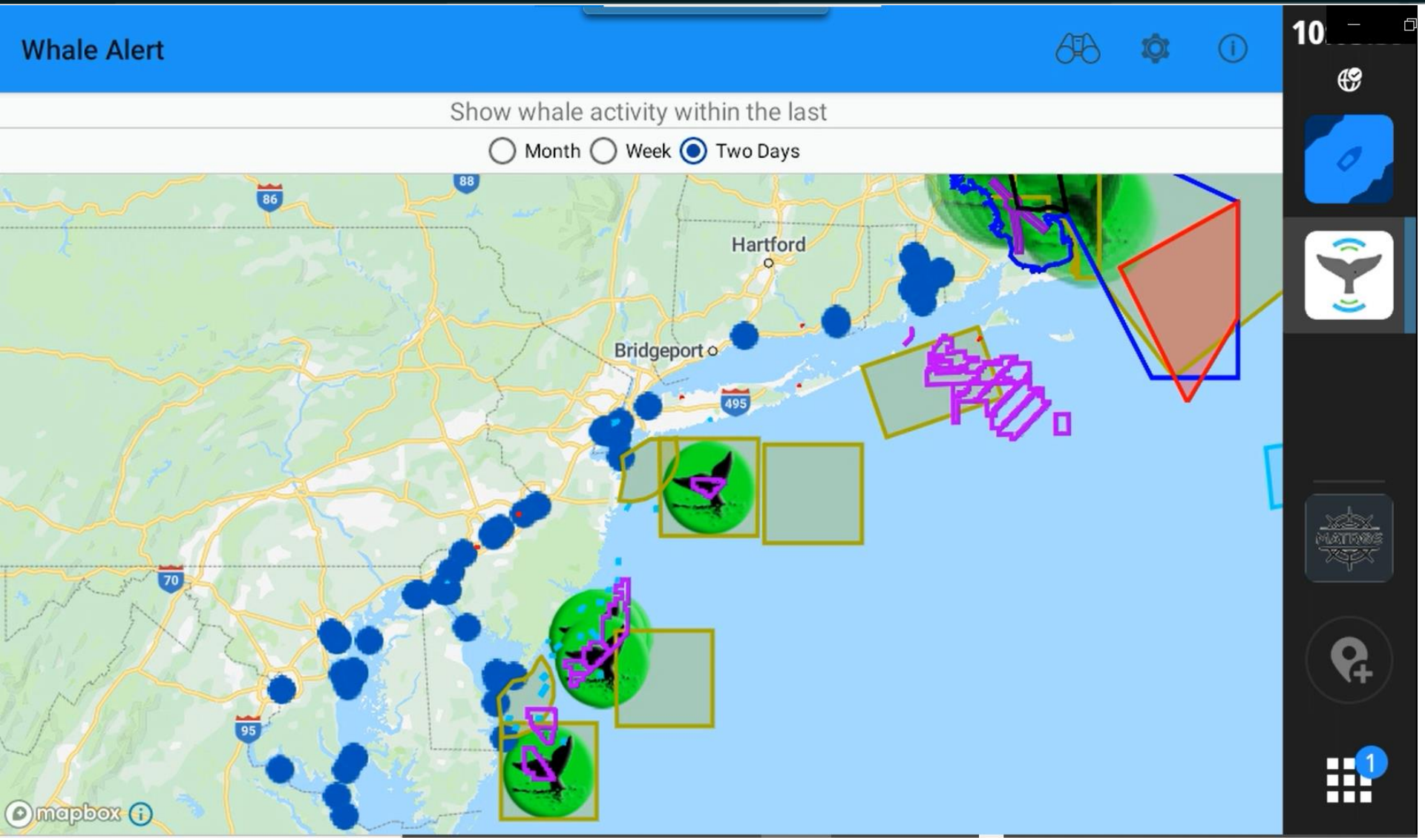
arnaud@whaleseeker.com

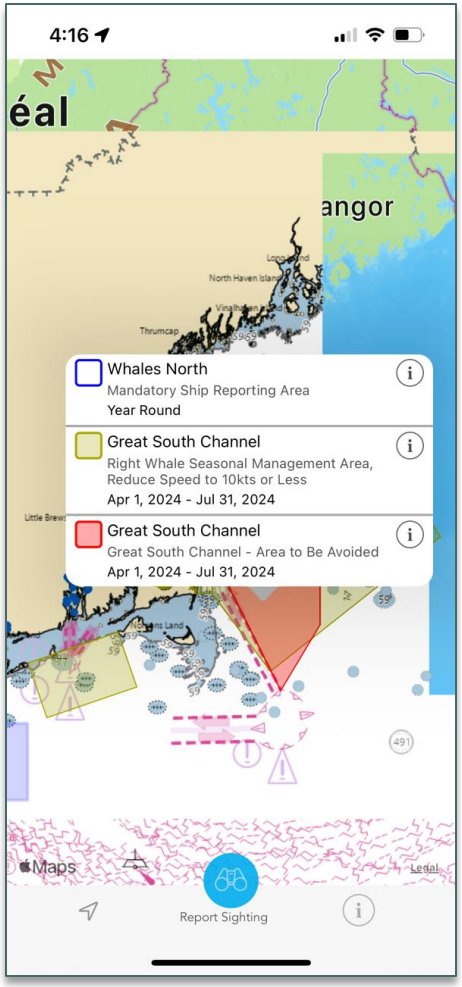
Common Technology in use today

Cartography (Charts) in use today



App Integration to MFD from Mobile App that exists today





NAVICO GROUP

Sensor Integration to MFD that exists today

NAVICO GROUP

Current Technologies that can be adapted in near term

C - Charts

A - Apps

R - Radio (VHF)

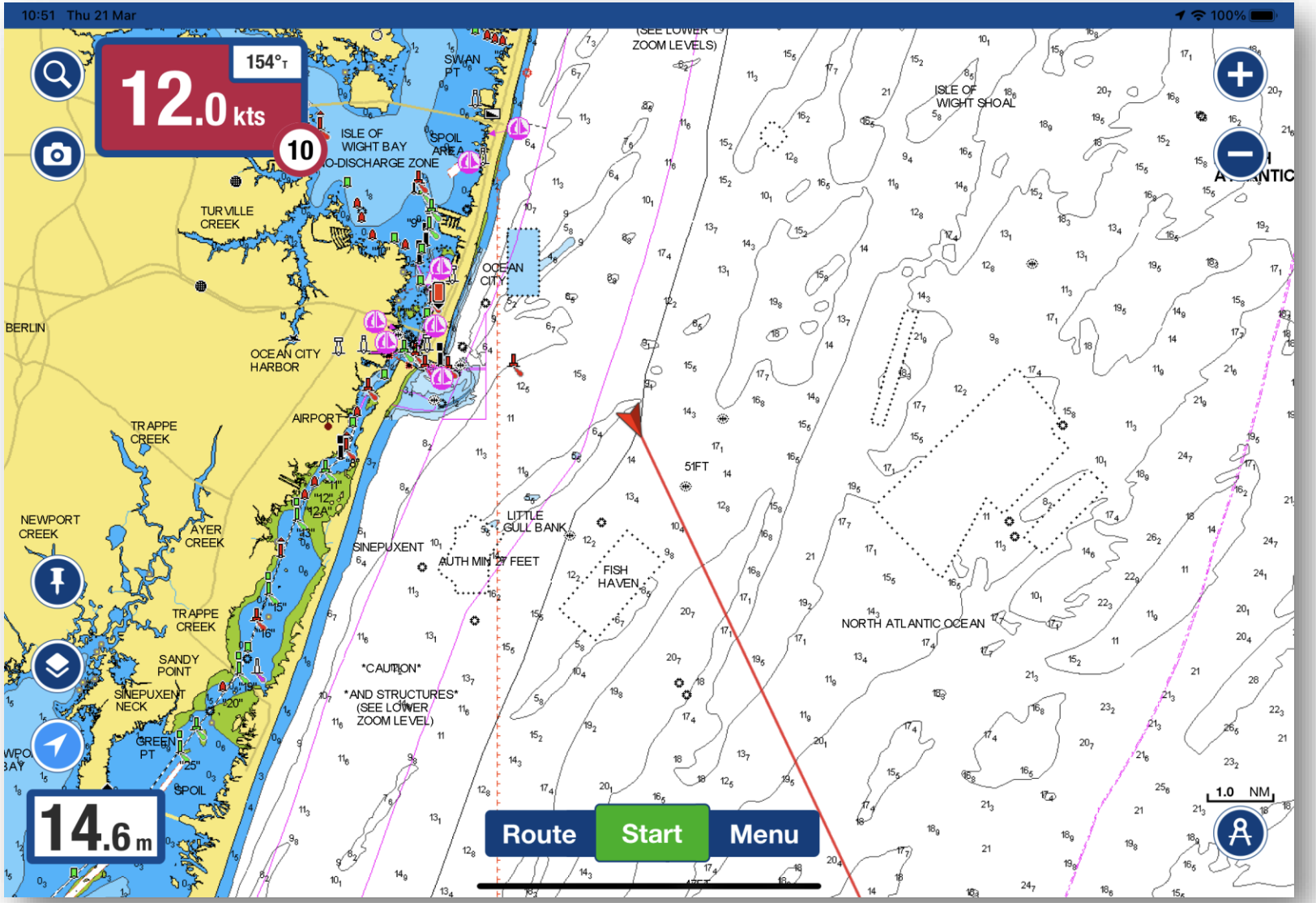
D -Displays

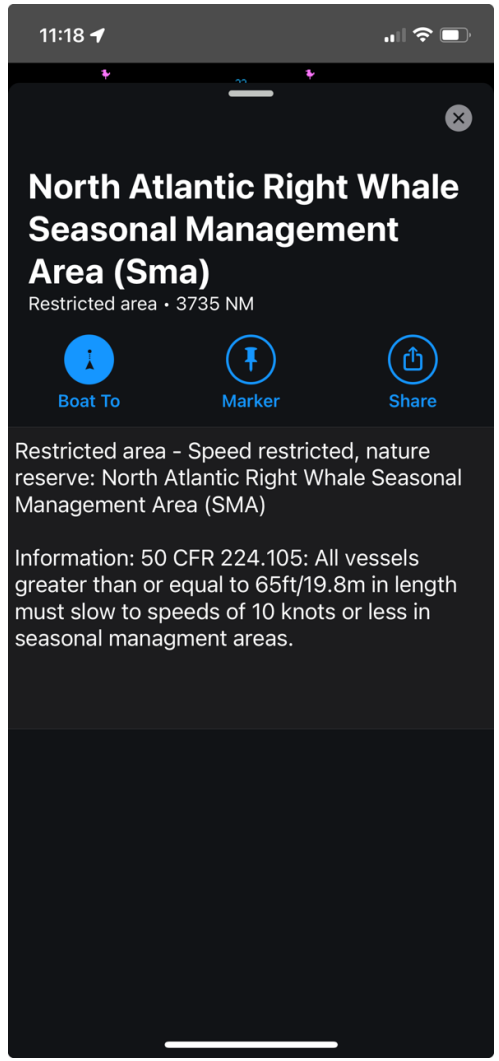
S - Sensor

NAVICO GROUP


Hearns Pond
Cow Bridge Branch
"28"
Concord Pond
Cable Ferry
Ingram Pond
Portsville Millpond
Vines Creek
Trap Pond Raccoon Pond
Auth Min 49.9FT
Nature Reserve
Delaware To Cape Henlopen Traffic Lane
Southern Mid- Atlantic Waters Closure Are
Indian Arrow
Fenwick Island
Fenwick Shoal
DELAWARE
Isle Of Wight Shoal
"WH"
Speed Limited
Discharging Prohibited
Snow Hill
Boxiron Landing
Pocomoke River
Assateague Island
Entry Restricted
Centerville
VIRGINIA
Military Practice Area
3mi
0.5mi
Offshore Safety Zone
Baltimore Canyon
Warr Canyon
Stop Panning
06:44
Mark
Where To
SOS
Toolbars
Options

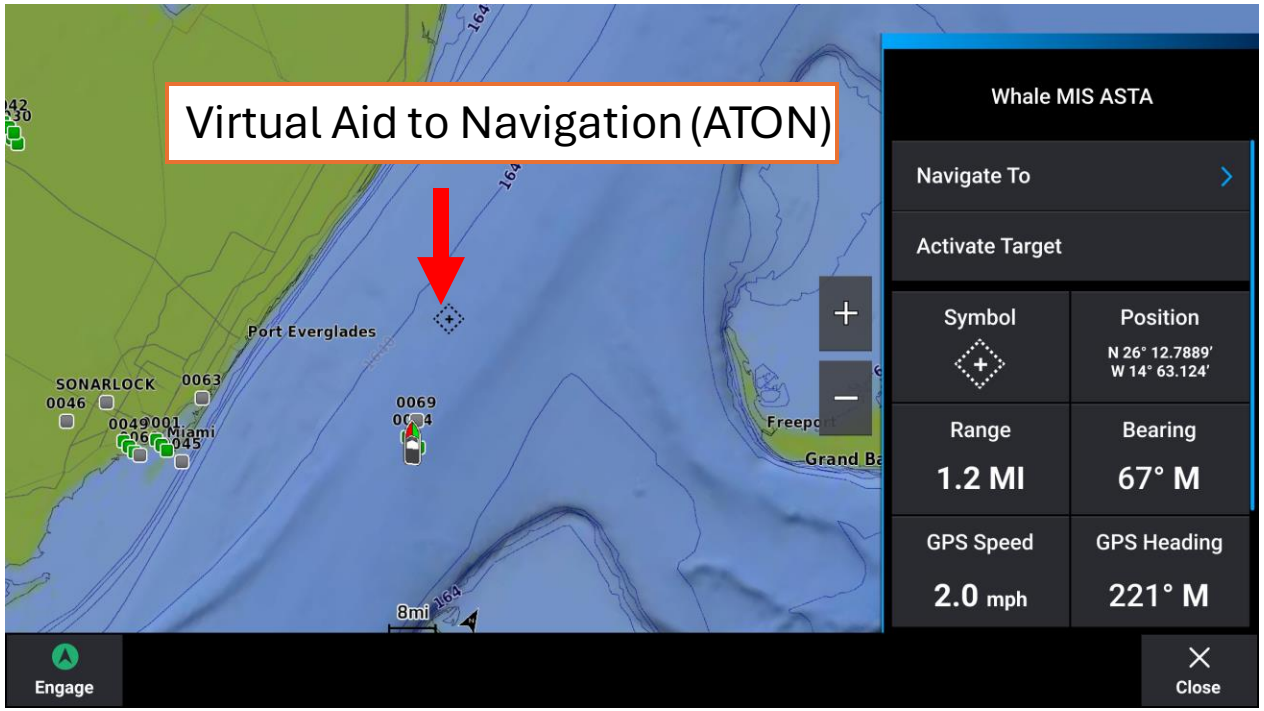
Mobile App Speed Limit Example

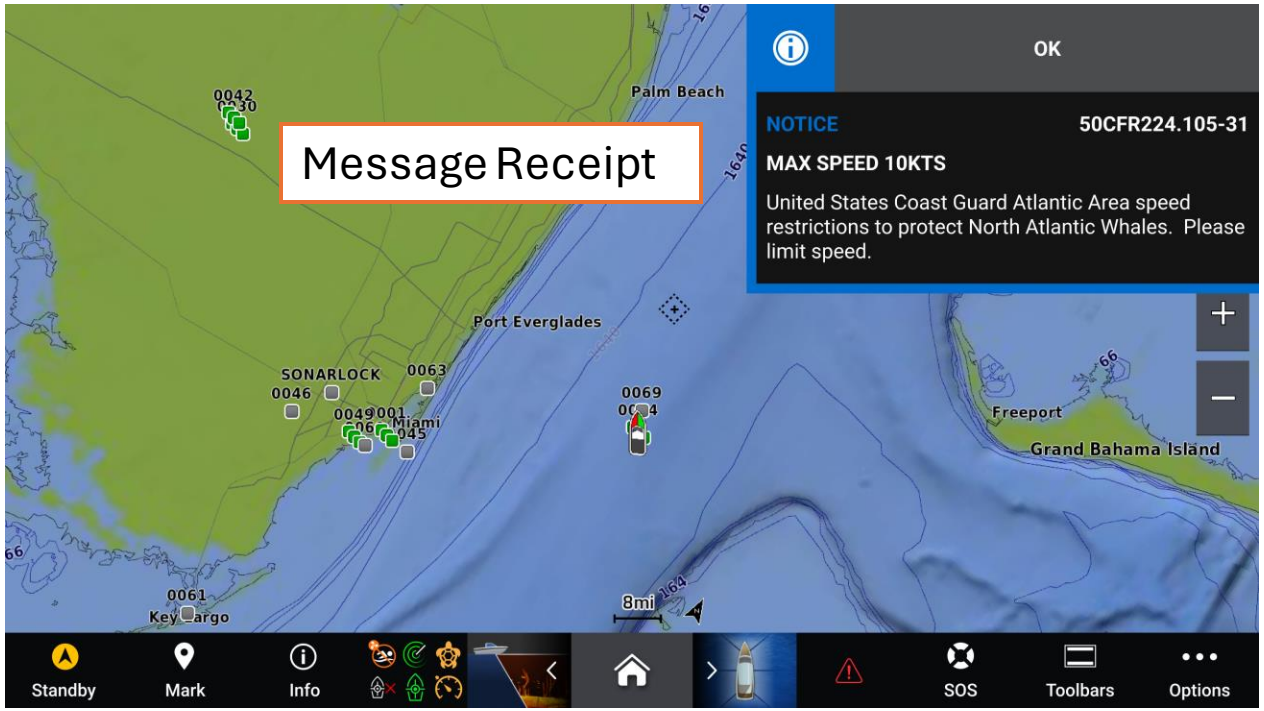




AIS example

AIS standards support movement of Points, Messages, and Polygons





AIS Polygon Example