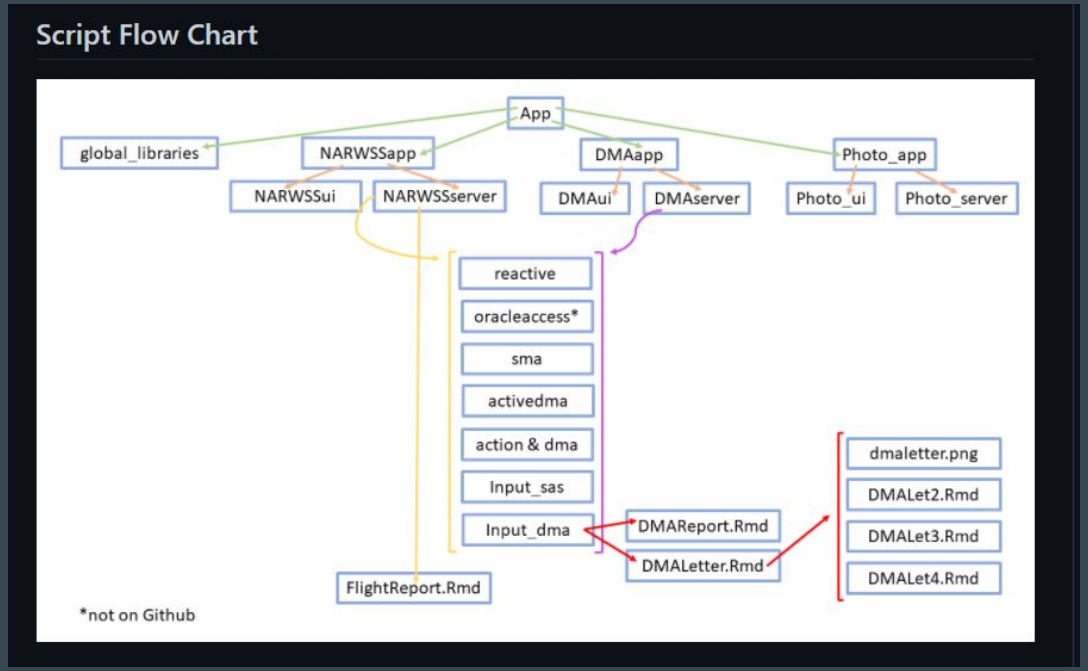
Shiny right whales

RShiny tools to help streamline the processing of survey data and evaluate for dynamic management zones

Leah Crowe

Apps in apps

https://github.com/NEFSC/READ-PSB-LWT-narwss_rwsas_apps



From our eyes to action

Collect data in the airplane

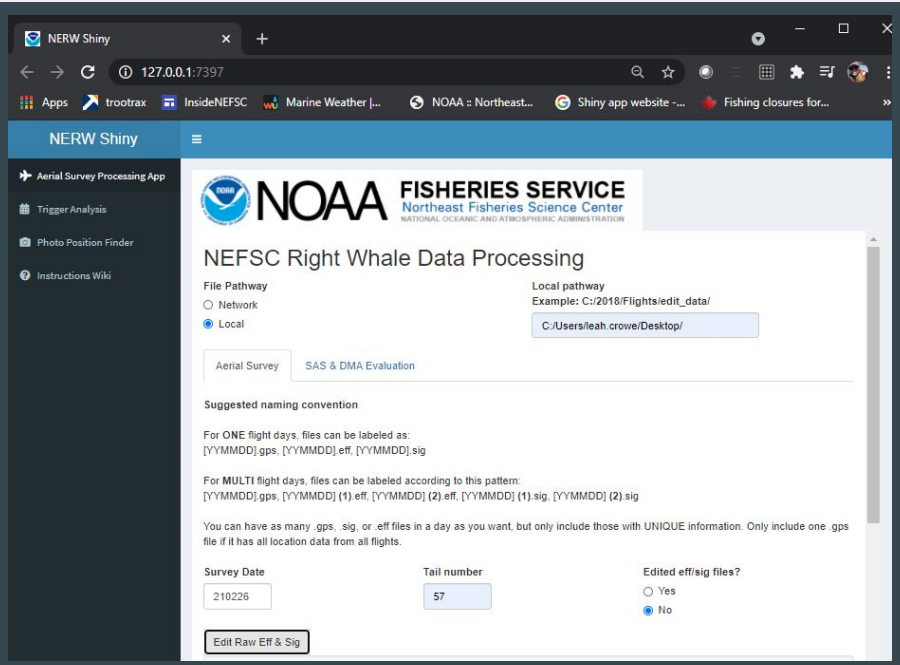
- Sightings (.sig)
- Effort (.eff)
- Trackline (.gps)

Use Aerial Survey Processing App to process data and create report

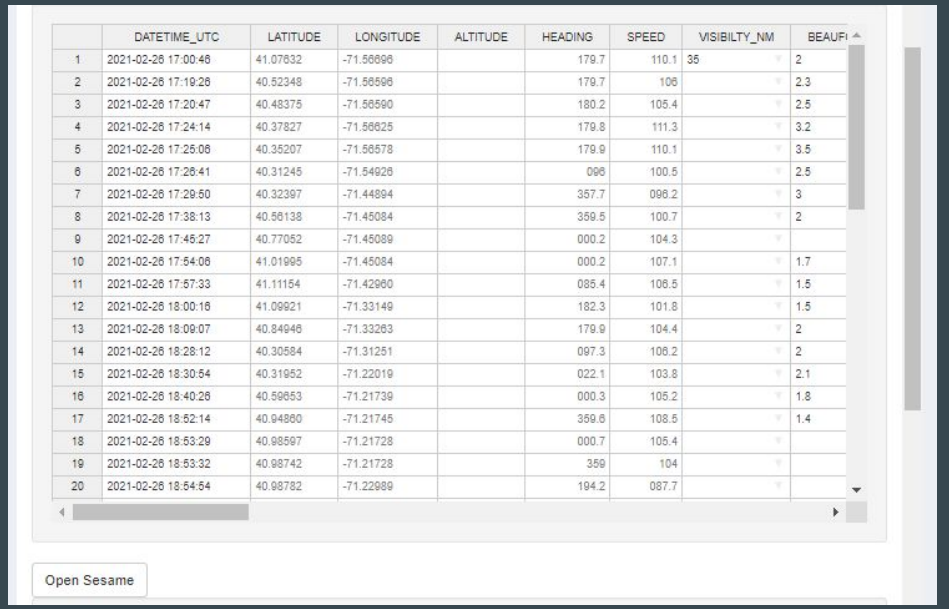
- Changes to effort/sightings data (effsig_YYMMDD.csv) to use in the app later
- Final/synthesized data (f_YYMMDD.csv)
- Survey report (DDMonYYY_NOAA_NERW_Aerial_Report.pdf)
- Upload sightings to the Right Whale Sighting Advisory System database (Oracle)

Aerial Survey Processing App

1. “Edit raw Eff & Sig” = edit raw data w/o trackline



2. “Open Sesame” = confirm/save edits

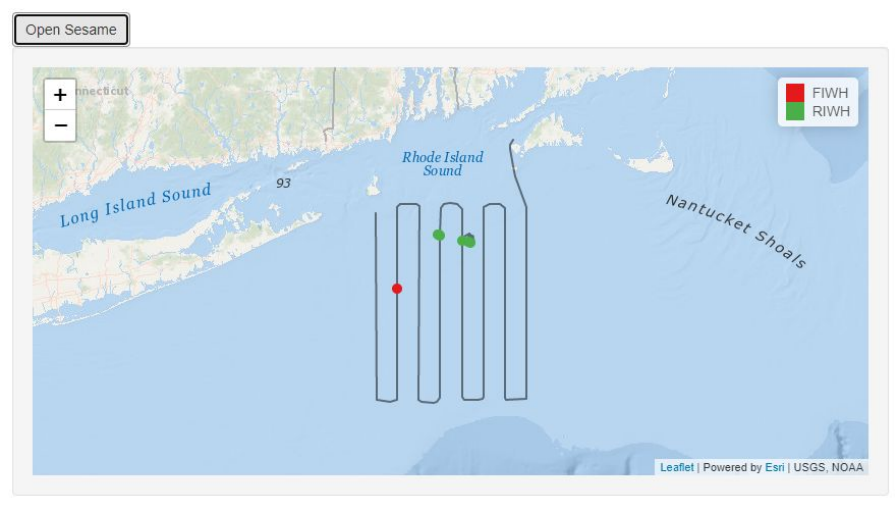


	DATETIME_UTC	LATITUDE	LONGITUDE	ALTITUDE	HEADING	SPEED	VISIBILTY_NM	BEAUF
1	2021-02-26 17:00:46	41.07632	-71.56696		179.7	110.1	35	2
2	2021-02-26 17:19:26	40.52348	-71.56596		179.7	106		2.3
3	2021-02-26 17:20:47	40.48375	-71.56590		180.2	105.4		2.5
4	2021-02-26 17:24:14	40.37827	-71.56625		179.8	111.3		3.2
5	2021-02-26 17:25:06	40.35207	-71.56578		179.9	110.1		3.5
6	2021-02-26 17:26:41	40.31245	-71.54926		096	100.5		2.5
7	2021-02-26 17:29:50	40.32397	-71.44894		357.7	096.2		3
8	2021-02-26 17:38:13	40.56138	-71.45084		359.5	100.7		2
9	2021-02-26 17:45:27	40.77052	-71.45089		000.2	104.3		
10	2021-02-26 17:54:06	41.01995	-71.45084		000.2	107.1		1.7
11	2021-02-26 17:57:33	41.11154	-71.42960		085.4	106.5		1.5
12	2021-02-26 18:00:16	41.09921	-71.33149		182.3	101.8		1.5
13	2021-02-26 18:09:07	40.84946	-71.33263		179.9	104.4		2
14	2021-02-26 18:28:12	40.30584	-71.31251		097.3	106.2		2
15	2021-02-26 18:30:54	40.31952	-71.22019		022.1	103.8		2.1
16	2021-02-26 18:40:26	40.59653	-71.21739		000.3	105.2		1.8
17	2021-02-26 18:52:14	40.94860	-71.21745		359.6	108.5		1.4
18	2021-02-26 18:53:29	40.98597	-71.21728		000.7	105.4		
19	2021-02-26 18:53:32	40.98742	-71.21728		359	104		
20	2021-02-26 18:54:54	40.98782	-71.22989		194.2	087.7		

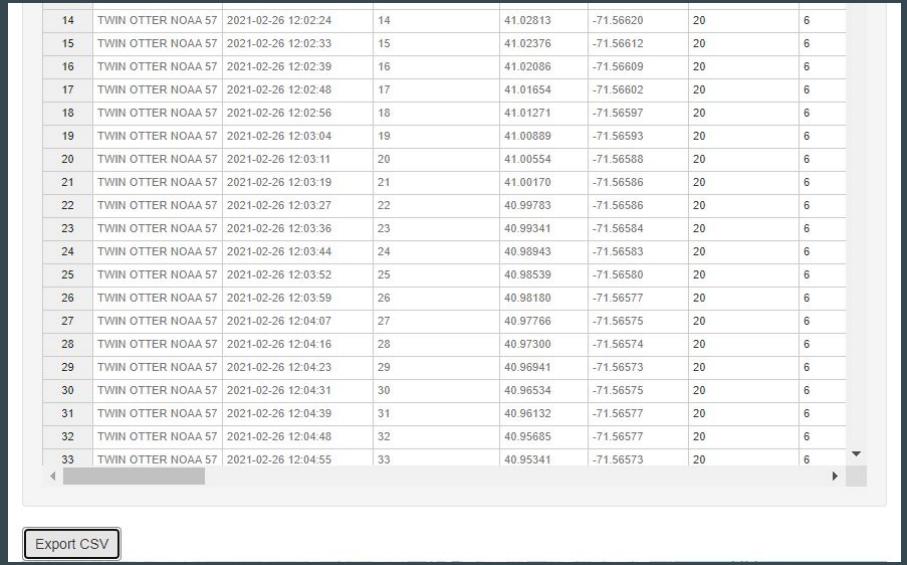
Open Sesame

Aerial Survey Processing App

2. “Open Sesame” continued:



3. “Export CSV” = creates csv of final version of survey data in folder and summarises for report



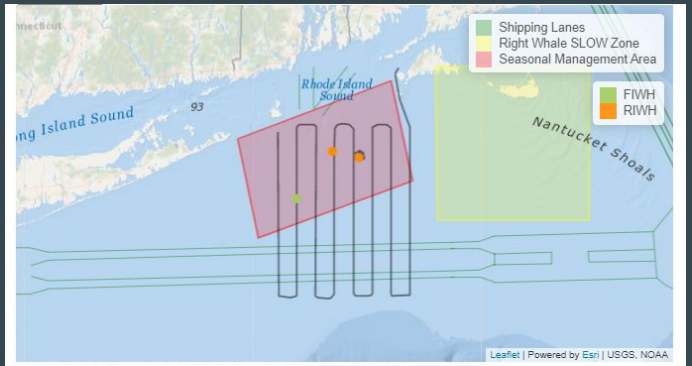
14	TWIN OTTER NOAA 57	2021-02-26 12:02:24	14	41.02813	-71.56620	20	6
15	TWIN OTTER NOAA 57	2021-02-26 12:02:33	15	41.02376	-71.56612	20	6
16	TWIN OTTER NOAA 57	2021-02-26 12:02:39	16	41.02086	-71.56609	20	6
17	TWIN OTTER NOAA 57	2021-02-26 12:02:48	17	41.01654	-71.56602	20	6
18	TWIN OTTER NOAA 57	2021-02-26 12:02:56	18	41.01271	-71.56597	20	6
19	TWIN OTTER NOAA 57	2021-02-26 12:03:04	19	41.00889	-71.56593	20	6
20	TWIN OTTER NOAA 57	2021-02-26 12:03:11	20	41.00554	-71.56588	20	6
21	TWIN OTTER NOAA 57	2021-02-26 12:03:19	21	41.00170	-71.56586	20	6
22	TWIN OTTER NOAA 57	2021-02-26 12:03:27	22	40.99783	-71.56586	20	6
23	TWIN OTTER NOAA 57	2021-02-26 12:03:36	23	40.99341	-71.56584	20	6
24	TWIN OTTER NOAA 57	2021-02-26 12:03:44	24	40.98943	-71.56583	20	6
25	TWIN OTTER NOAA 57	2021-02-26 12:03:52	25	40.98539	-71.56580	20	6
26	TWIN OTTER NOAA 57	2021-02-26 12:03:59	26	40.98180	-71.56577	20	6
27	TWIN OTTER NOAA 57	2021-02-26 12:04:07	27	40.97766	-71.56575	20	6
28	TWIN OTTER NOAA 57	2021-02-26 12:04:16	28	40.97300	-71.56574	20	6
29	TWIN OTTER NOAA 57	2021-02-26 12:04:23	29	40.96941	-71.56573	20	6
30	TWIN OTTER NOAA 57	2021-02-26 12:04:31	30	40.96534	-71.56575	20	6
31	TWIN OTTER NOAA 57	2021-02-26 12:04:39	31	40.96132	-71.56577	20	6
32	TWIN OTTER NOAA 57	2021-02-26 12:04:48	32	40.95685	-71.56577	20	6
33	TWIN OTTER NOAA 57	2021-02-26 12:04:55	33	40.95341	-71.56573	20	6

Some magic happens, map and final data preview

Aerial Survey Processing App

3. “Export CSV” continued

Report version of map (complete with active SLOW zones), summary tables, and input box for relevant survey comments



Date/Time (ET)	Latitude	Longitude	Number	Calves	Behavior
2021-02-26 13:54:54	40.99	-71.23	6		SAG
2021-02-26 14:30:57	40.96	-71.06	3		SAG

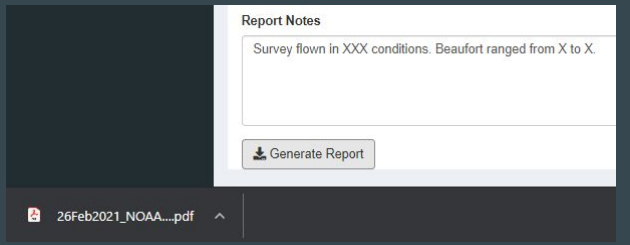
Species	Total number
Fin Whale	1
Right Whale	9

Report Notes

Survey flown in XXX conditions. Beaufort ranged from X to X.

Generate Report

4. “Generate Report”

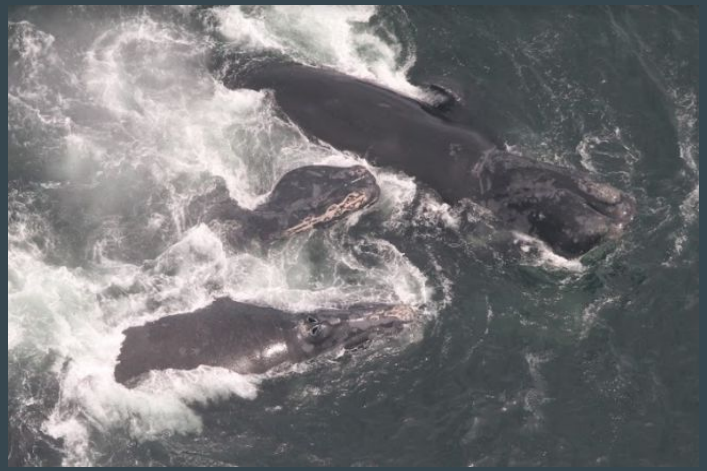


The user then emails the report to stakeholders via our survey email account. This could be automated in the future.

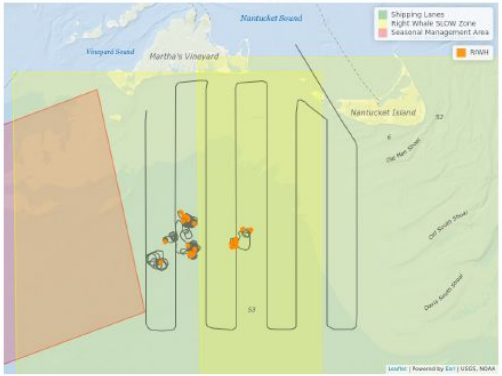
Aerial Survey Processing App

4. “Generate Report” continued

Rmd includes snapshot of leaflet map and two kable tables



NOAA Northeast Region
Right Whale Aerial Survey Report
08 Mar 2021



Survey flown in moderate to excellent conditions. Beaufort ranged from 1 to 4.

Active right whale SLOW zone(s): 46nm SE Atlantic City NJ expires on 09 March 2021, 30nm E Boston MA expires on 15 March 2021, 20nm SE Atlantic City NJ expires on 15 March 2021, 34nm E Virginia Beach VA expires on 19 March 2021, 23nm S Martha's Vineyard MA expires on 23 March 2021, 15nm S Nantucket MA expires on 23 March 2021.

Only large whale sightings were recorded on this survey.

Table 1: Species Sighted

Species	Total number
Right Whale	24

Table 2: Right Whale Sighting(s) Details

Date/Time (ET)	Latitude	Longitude	Number	Calves	Behavior
2021-03-08 12:31:06	40.95554	-70.69125	1		
2021-03-08 13:06:21	41.04499	-70.61580	1		
2021-03-08 13:07:15	41.04722	-70.61554	1		
2021-03-08 13:18:00	41.05265	-70.62894	1		
2021-03-08 13:24:17	41.03690	-70.59967	1		
2021-03-08 13:30:05	41.05920	-70.63528	1		

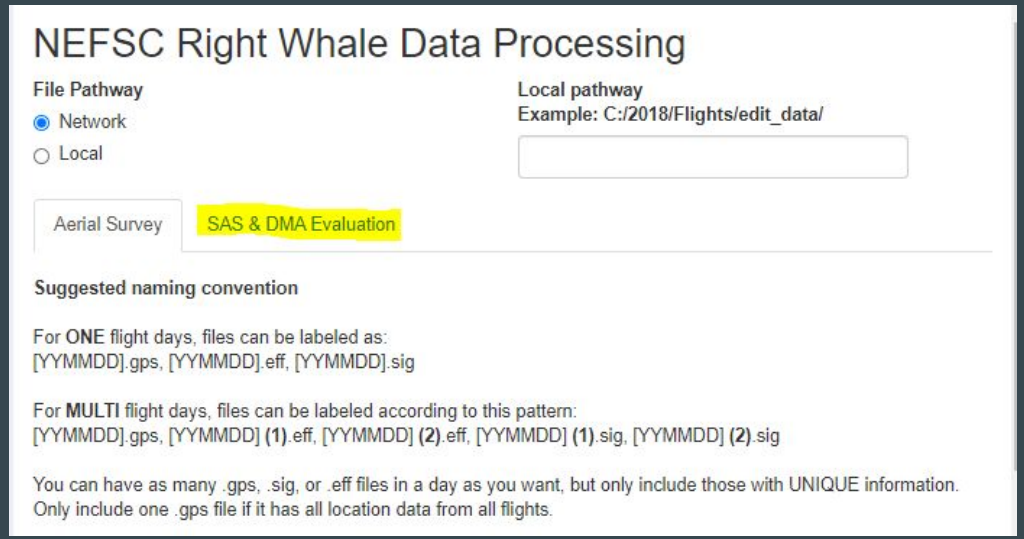
Aerial Survey Processing App

Did you see right whales on survey?

Nope → You're done!

Yep

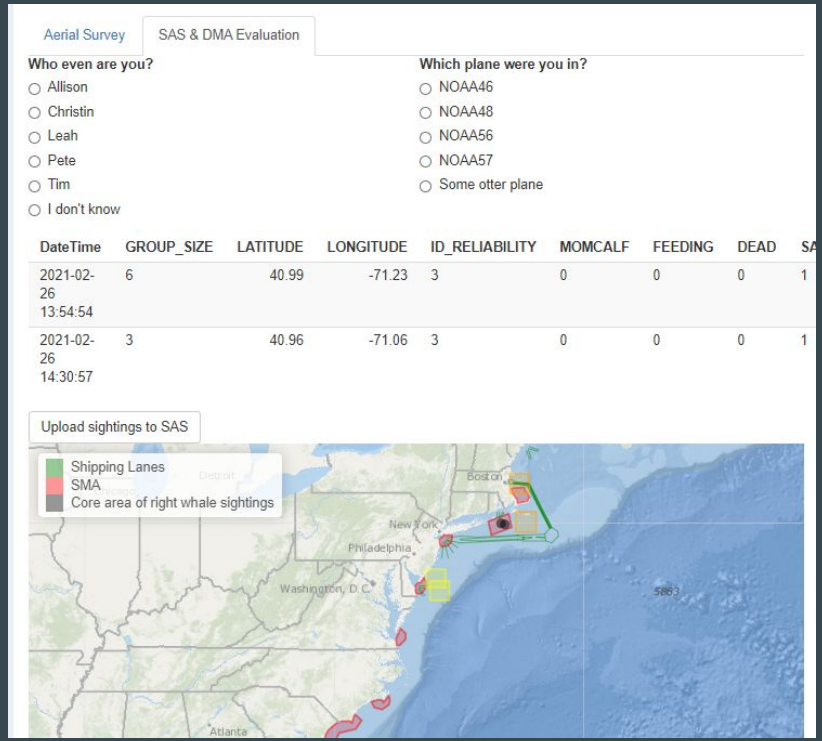
5. Check out the "SAS & DMA Evaluation" tab



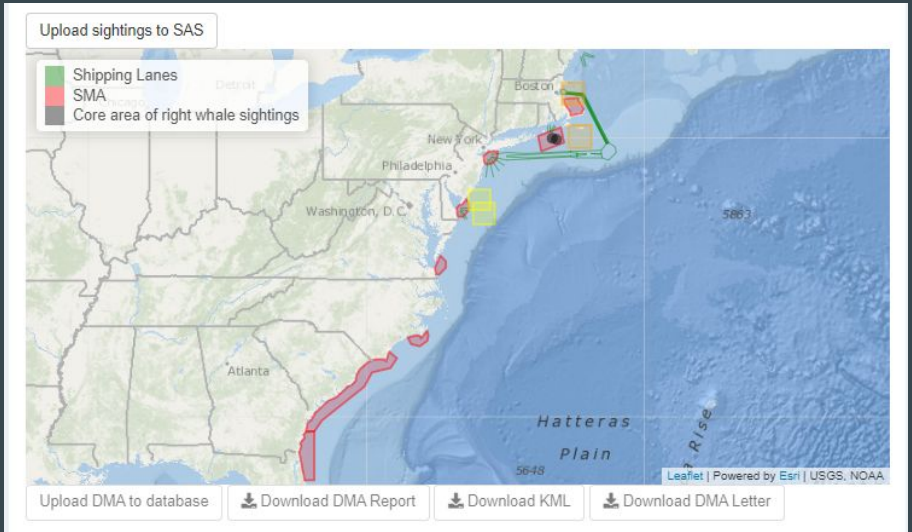
This tab offers features of the "Trigger Analysis app" so that the whole process is at your fingertips after a survey, but once sightings are in the RWSAS database, they can also be accessed via the "Trigger Analysis" app

Aerial Survey Processing App

5. “SAS & DMA Evaluation” tab continued



6. “Upload sightings to SAS” = sightings beam to our database



7. If sightings trigger dynamic management, the DMA related buttons become active

From everyone's eyes to action

Right Whale Sighting Advisory System

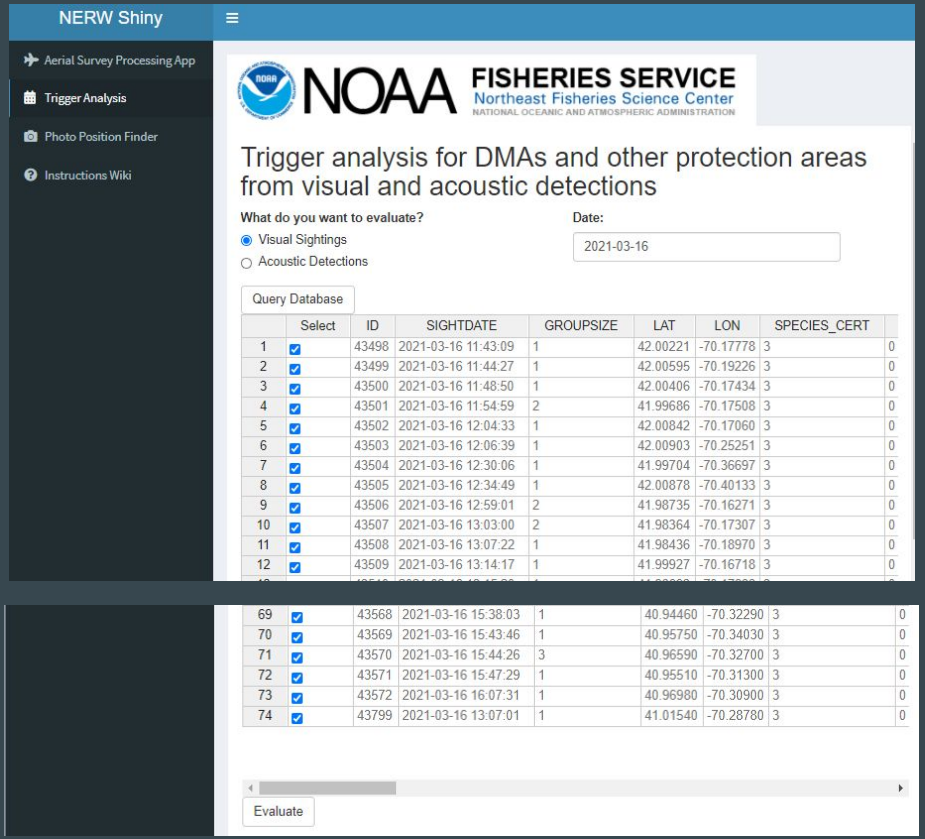
- NOAA shipboard efforts
- Dedicated survey efforts by other orgs
- Opportunistic industry, observers, fishers, Coast Guard, public, etc. via phone calls (866-755-6622) & emails (ne.rw.survey@noaa.gov)
- WhaleAlert app

Our team quality controls for species reliability; sightings stored in our Oracle database

Use Trigger Analysis App to evaluate if criteria is met and generate materials

- Declares name and bounds for Dynamic Management Area (DMA)
  - Uploads info to database
  - Generates report and letter to GARFO to request DMA
  - Generates KML (feature no longer needed due to recent developments)

Trigger Analysis App (visual sightings)



	Select	ID	SIGHTDATE	GROUPSIZE	LAT	LON	SPECIES_CERT	
1	☑	43498	2021-03-16 11:43:09	1	42.00221	-70.17778	3	0
2	☑	43499	2021-03-16 11:44:27	1	42.00595	-70.19226	3	0
3	☑	43500	2021-03-16 11:48:50	1	42.00406	-70.17434	3	0
4	☑	43501	2021-03-16 11:54:59	2	41.99686	-70.17508	3	0
5	☑	43502	2021-03-16 12:04:33	1	42.00842	-70.17060	3	0
6	☑	43503	2021-03-16 12:06:39	1	42.00903	-70.25251	3	0
7	☑	43504	2021-03-16 12:30:06	1	41.99704	-70.36697	3	0
8	☑	43505	2021-03-16 12:34:49	1	42.00878	-70.40133	3	0
9	☑	43506	2021-03-16 12:59:01	2	41.98735	-70.16271	3	0
10	☑	43507	2021-03-16 13:03:00	2	41.98364	-70.17307	3	0
11	☑	43508	2021-03-16 13:07:22	1	41.98436	-70.18970	3	0
12	☑	43509	2021-03-16 13:14:17	1	41.99927	-70.16718	3	0
69	☑	43568	2021-03-16 15:38:03	1	40.94460	-70.32290	3	0
70	☑	43569	2021-03-16 15:43:46	1	40.95750	-70.34030	3	0
71	☑	43570	2021-03-16 15:44:26	3	40.96590	-70.32700	3	0
72	☑	43571	2021-03-16 15:47:29	1	40.95510	-70.31300	3	0
73	☑	43572	2021-03-16 16:07:31	1	40.96980	-70.30900	3	0
74	☑	43799	2021-03-16 13:07:01	1	41.01540	-70.28780	3	0

1. “Evaluate” = for the selected sightings, actions are assigned and calculations are done to see if a trigger is met.

A table with adjusted “Actions” (i.e. in a protection zone or triggering a new zone) will be generated, along with a map

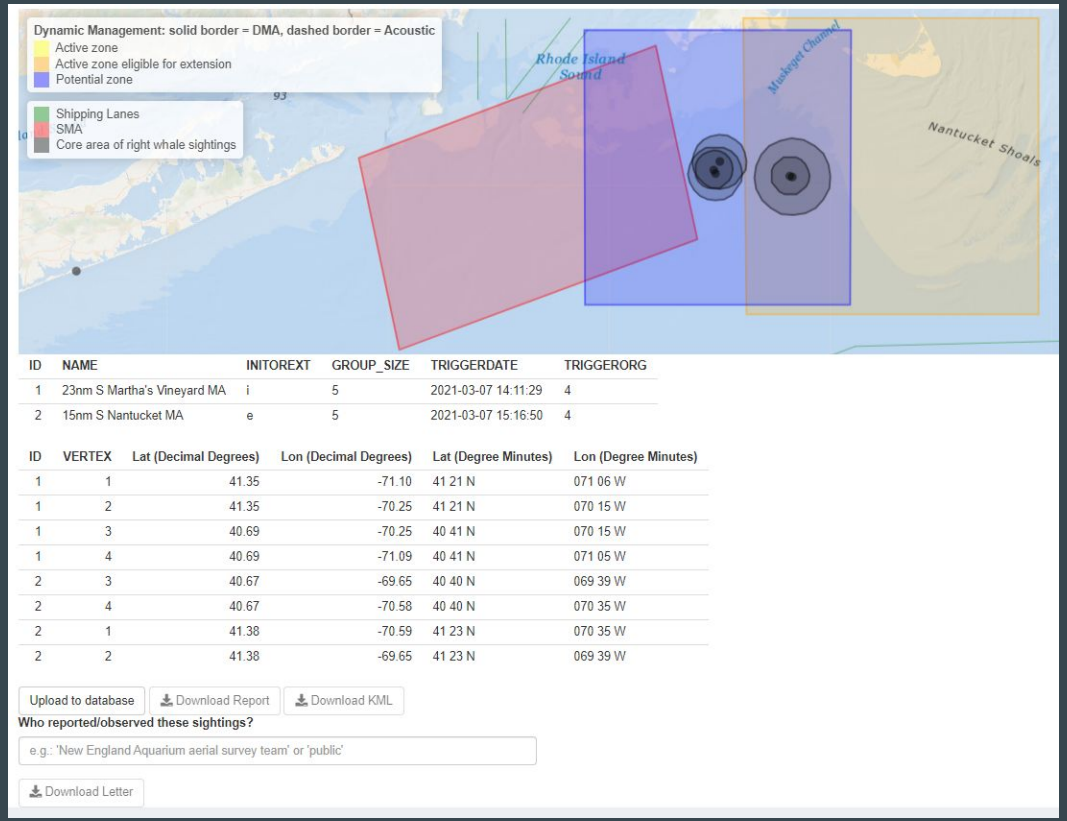
Trigger = 3+ whales that equate to a certain whale density within an area.

DMA bounds = edge of radius of whale density (core area) + 15nm

Trigger Analysis App (visual sightings)

2. If DMAs are triggered, the buttons will become available as you move through the steps.

DMA extensions are treated differently



ID	NAME	INITOREXT	GROUP_SIZE	TRIGGERDATE	TRIGGERORG
1	23nm S Martha's Vineyard MA	i	5	2021-03-07 14:11:29	4
2	15nm S Nantucket MA	e	5	2021-03-07 15:16:50	4

ID	VERTEX	Lat (Decimal Degrees)	Lon (Decimal Degrees)	Lat (Degree Minutes)	Lon (Degree Minutes)
1	1	41.35	-71.10	41 21 N	071 06 W
1	2	41.35	-70.25	41 21 N	070 15 W
1	3	40.69	-70.25	40 41 N	070 15 W
1	4	40.69	-71.09	40 41 N	071 05 W
2	3	40.67	-69.65	40 40 N	069 39 W
2	4	40.67	-70.58	40 40 N	070 35 W
2	1	41.38	-70.59	41 23 N	070 35 W
2	2	41.38	-69.65	41 23 N	069 39 W

Upload to database | Download Report | Download KML

Who reported/observed these sightings?

e.g.: 'New England Aquarium aerial survey team' or 'public'

Download Letter

Trigger Analysis App (visual sightings)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Protected Species Branch
166 Water Street
Woods Hole, MA 02543

(508) 495-2087 FAX: (508) 495-2033

March 08, 2021 F/NEC: S. Hayes

MEMORANDUM FOR: Peter Kelliher
Shipping Liaison, GARFO

FROM: Tim Cole
Protected Species Branch, NEFSC

SUBJECT: Materials documenting 07 Mar 2021 North Atlantic right whale sightings

On March 07, 2021, five and five North Atlantic right whales were detected south of Martha's Vineyard MA and Nantucket MA by the New England Aquarium aerial survey team. Since whales were detected both in a region where there are no protections in place, as well as within a region where the protections are due to expire in a week or less, we recommend a Dynamic Management Area be initiated/extended at the following bounds:

23nm S Martha's Vineyard MA

1. 41 21 N
2. 40 41 N
3. 070 15 **W**
4. 071 06 **W**

15nm S Nantucket MA

1. 41 23 N
2. 40 40 N
3. 069 39 **W**
4. 070 35 **W**

Expiration – 00:00:01 EDT March 23, 2021

Please contact me with any questions about sightings or area calculations.

Potential SLOW Zone Report

23nm S Martha's Vineyard MA and 15nm S Nantucket MA

Trigger date: 07 Mar 2021

Expiration: 00:00:01 EDT March 23, 2021

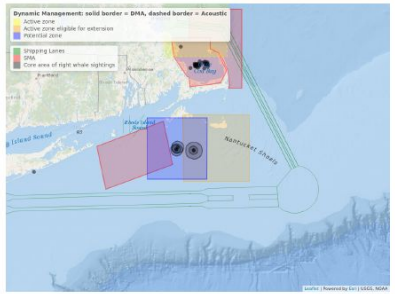


Table 1: Dynamic Management Area Name(s)

ID	NAME	INITOREXT	GROUP_SIZE	TRIGGERDATE	TRIGGERORG
1	23nm S Martha's Vineyard MA	i	5	2021-03-07 14:11:29	4
2	15nm S Nantucket MA	e	5	2021-03-07 15:16:50	4

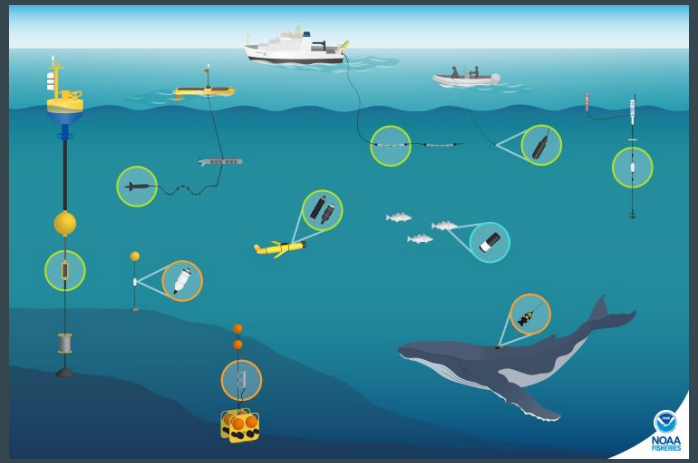
Table 2: Dynamic Management Area Bounds

ID	VERTEX	Lat (Decimal Degrees)	Lon (Decimal Degrees)	Lat (Degree Minutes)	Lon (Degree Minutes)
1	1	41.35	-71.10	41 21 N	071 06 W
1	2	41.35	-70.25	41 21 N	070 15 W
1	3	40.69	-70.25	40 41 N	070 15 W
1	4	40.69	-71.09	40 41 N	071 05 W
2	3	40.67	-69.65	40 40 N	069 39 W

From robot ears to action

Robots4Whales

- Currently: real-time monitoring efforts
- Uses upcalls to determine right whale presence



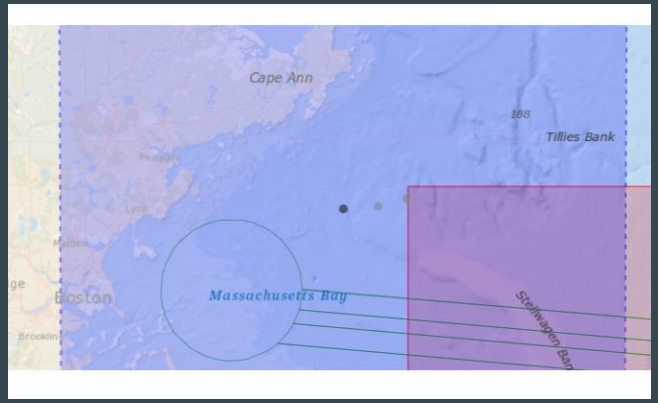
Ingest definite upcalls into Oracle table

Use Trigger Analysis App to evaluate if criteria is met and generate materials

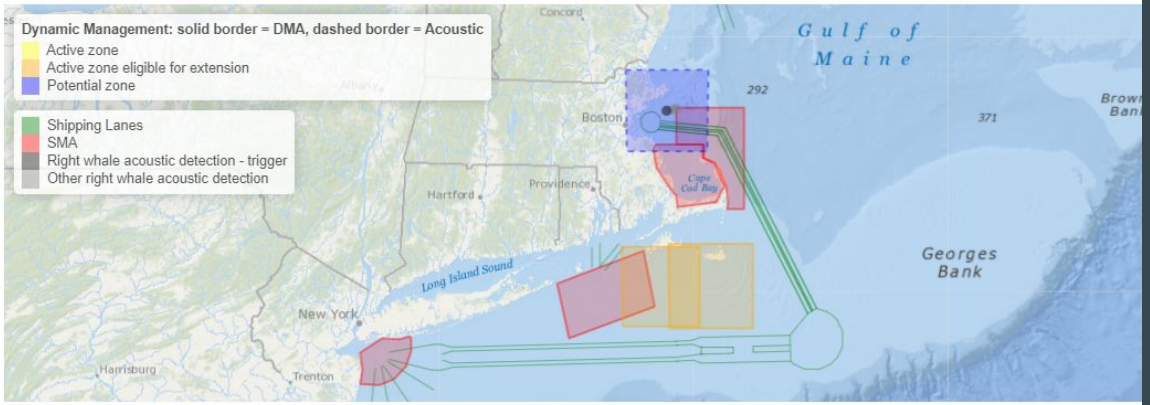
- Declares name and bounds for SLOW zone
  - Uploads info to database
  - Generates report and letter to GARFO to request SLOW zone
  - Generates KML (feature no longer needed due to recent developments)

Trigger Analysis App (acoustic detections)

- Different criteria to trigger
- Earliest detection starts the timer
- 15nm box with trigger detection at center



PLATFORM	DateTime	LATITUDE	LONGITUDE	ID_RELIABILITY	ACTION_NEW	CATEGORY	ACTION_NEW_TRANSLATION
sbnms0321	2021-03-26 09:25:11	42.47	-70.60	3	24	7	Acoustic SLOW zone
sbnms0321	2021-03-26 14:25:11	42.48	-70.55	3	22	7	Acoustic detection within existing protection zone
sbnms0321	2021-03-26 19:17:10	42.49	-70.50	3	22	7	Acoustic detection within existing protection zone



ID	NAME	INITOREXT	TRIGGERDATE	TRIGGERORG
1	23nm E Boston MA	i	2021-03-26 09:25:11	82

ID	VERTEX	Lat (Decimal Degrees)	Lon (Decimal Degrees)	Lat (Degree Minutes)	Lon (Degree Minutes)
1	1	42.81	-71.06	42 49 N	071 04 W
1	2	42.81	-70.15	42 49 N	070 09 W
1	3	42.14	-70.16	42 08 N	070 10 W
1	4	42.14	-71.05	42 08 N	071 03 W

Upload to database | Download Report | Download KML

Trigger Analysis App

Questions?

Related links

Github: https://github.com/NEFSC/READ-PSB-LWT-narwss_rwsas_apps

Github wiki: https://github.com/NEFSC/READ-PSB-LWT-narwss_rwsas_apps/wiki

NEFSC Shiny book showcase: link to section on Northeast Right Whale Shiny Apps

Right Whale Sighting Advisory System interactive map

GARFO declared dynamic Right Whale Slow Zones