

Cruise Report:
Aerial abundance survey during December 2014 – January 2015

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SUMMARY

During 5 December 2014 – 14 January 2015, the Northeast Fisheries Science Center (NEFSC) conducted aerial abundance surveys targeting marine mammals and sea turtles. The southwestern extent was New Jersey and the northeastern extent was the southern tip of Nova Scotia, Canada. This survey covered waters from the coast line to about the 2000 m depth contour with a higher coverage over the New York State Offshore Planning Area. Track lines were flown 183 m (600 ft) above the water surface, at about 200 kph (110 knots). The two-independent team methodology was used to collect the data. In Beaufort sea states of six and less, about 5670 km of on-effort track lines were surveyed. About 1900 individuals within 84 groups of 17 species (or species groups) of live cetaceans, seals and large fish were detected by one or both teams. Short-beaked common dolphins (*Delphinus delphis*) were the most commonly detected species: including six groups that had more than 40 animals per group, of which one group had about 1200 individuals. The most common large whale was the right whale (*Eubalaena glacialis*), where 4 groups of 9 individuals were detected. One loggerhead turtle (*Caretta caretta*) was detected. In addition, harbor seals (*Phoca vitulina*), gray seals (*Halichoerus grypus*), basking sharks (*Cetorhinus maximus*) and ocean sunfish (*Mola mola*) were also detected.

OBJECTIVES

The objectives of these aerial flights were to collect the data needed to estimate abundance of cetaceans and turtles in the study area, and to investigate how the animal's distribution and abundance relate to their physical and biological ecosystem.

CRUISE PERIOD AND AREA

This survey was conducted during 5 December 2014 – 14 January 2015. The study area extended from New Jersey to the southern tip of Nova Scotia, Canada, from the coast line to about the 2000 m depth contour (Figure 1).

The proposed track lines cover the entire region using a broad scale strategy providing an overall spatial coverage. In addition, higher resolution track lines covered the New York State Offshore Planning Area (<http://www.dos.ny.gov/opd/programs/offshoreResources/>) providing higher coverage within this Area.

METHODS

The aerial surveys were conducted on a DeHavilland Twin Otter DHC-6 aircraft over Atlantic Ocean waters off the east coast of the U.S. and Canada. Track lines were flown 183 m (600 ft) above the water surface, at about 200 kph (110 knots), when Beaufort sea state conditions were six and below, and when there was at least two miles of visibility.

When a cetacean, seal, turtle, sunfish, or basking shark was observed the following data were collected:

- Time animal passed perpendicular to the observer;
- Species identification;
- Species identification confidence level (certain, probable, not sure);

- Best estimate of the group size;
- Angle of declination between the track line and location of the animal group when it passed abeam (measured to the nearest one degree by inclinometers or marks on the windows, where 0° is straight down);
- Cue (animal, splash, blow, footprint, birds, vessel/gear, windrows, disturbance, or other);
- Swim direction (0° indicates animal was swimming parallel to the track line in the same direction the plane was flying, 90° indicates animal was swimming perpendicular to the track line and towards the right, etc.);
- If the animal appeared to react to the plane (yes or no);
- If a turtle was initially detected above or below the surface, and;
- Comments, if any.

Other fish species were also recorded opportunistically. Species identifications were recorded to the lowest taxonomic level possible.

At the beginning of each leg, and when conditions changed the following effort data were collected:

- Initials of person in the pilot seats and observation stations;
- Beaufort sea state (recorded to one decimal place);
- Water turbidity (clear, moderately clear, turbid very turbid, and unknown);
- Percent cloud cover (0-100%);
- Angle glare swath started and ended at (0-359°), where 0° was the track line in the direction of flight and 90° was directly abeam to the right side of the track line;
- Magnitude of glare (none, slight, moderate, and excessive); and
- Subjective overall quality of viewing conditions (excellent, good, moderate, fair, and poor).

In addition, the location of the plane was recorded every two seconds with a GPS that was attached to the data entry program. Sightings and effort data were collected by a computer program called VOR.exe, version 8.75 originally created by Phil Lovell and Lex Hiby.

To help correct for perception bias, data were collected to estimate the parameter $g(0)$, the probability of detecting a group on the track line. This was accomplished by using the two independent team data collection method (Laake and Borchers 2004). In addition, the approximate area that a species can be detected was determined, when possible by the front team. This was accomplished by recording the time a group was initially seen and then also collected the time and angle of declination of that same group when it was perpendicular to the observers position. The initial time a group was seen was identified in the sightings data by a species identification of "FRST".

Onboard, in addition to two pilots, were six scientists who were divided into two teams. One team, the primary forward team, consisted of a recorder and two observers viewing through the two forward right and left bubble windows. The other team, the independent back team, consisted of one observer viewing through the back belly window, one observer viewing from the right back visa window, and a recorder. The two observer teams operated on independent intercom channels so that they were not able to cue one another to sightings.

The belly window observer was limited to approximately a 30° view on both sides of the track line. The bubble window and back side visa window observers searched from straight down to the horizon, with a concentration on waters between straight down (0°) and about 50° up from straight down.

When at the end of track lines or about every 30-40 minutes, scientists rotated between the observations positions. When both teams could not identify the species of a group that was

within about 60° of the track line and there was a high chance that the group could be relocated or the species was thought to have been a North Atlantic right whale then sighting effort was broke off, and the plane returned to the group to confirm the species identification and group size. The marine mammal and turtle data were reviewed after the flights to identify duplicate sightings that were made by the two teams based upon time, location, and position relative to the track line.

RESULTS

The observers and pilots who collected these data are listed in Table 1.

Fourteen of the 39 days had sufficiently good weather and a working plane to conduct the survey. There were about 5670 km of “on-effort” track lines, where 72% of the track lines were surveyed in Beaufort 2 and 3 (Table 2).

On the on-effort portions of the track lines, 1569 and 517 individual cetaceans within 34 and 36 groups were detected by the back and front teams, respectively (Table 3). The locations of sightings seen on the on-effort transect legs, by species, are displayed in Figures 2 – 5, where dolphins are in Figure 2 – 3, whales in Figures 4, while seals, turtles and other species are in Figure 5. The sightings included nine species of identifiable cetaceans: common bottlenose dolphins (*Tursiops truncatus*), short-beaked common dolphins, striped dolphins (*Stenella coeruleoalba*), Risso’s dolphins (*Grampus griseus*), white-sided dolphins (*Lagenorhynchus acutus*), harbor porpoise (*Phocoena phocoena*), fin whales (*Balaenoptera physalus*), humpback whales (*Megaptera novaeangliae*) and right whales. In addition, one loggerhead turtle (*Caretta caretta*) and one dead turtle were seen; harbor seals (*Phoca vitulina*) and gray seals (*Halichoerus grypus*), along with basking sharks (*Cetorhinus maximus*) and ocean sunfish (*Mola mola*) were also detected.

Short-beaked common dolphins were the most commonly detected species: including six groups that had more than 40 animals per group, of which one group had about 1200 individuals. The most common large whale was the North Atlantic right whale, where 4 groups of 9 individuals were detected. Harbor and gray seals were only seen close to shore, while basking sharks and ocean sunfish were in deeper offshore waters.

DISPOSITION OF DATA

All data collected during this survey will be maintained by the Protected Species Branch at NEFSC in Woods Hole, MA and are available from the NEFSC’s Oracle database.

PERMITS

NEFSC was authorized to conduct these research activities during this survey under US Permit No. 17355 issued to the NEFSC by the NMFS Office of Protected Resources. The NOAA aircraft was granted diplomatic overflight clearance in Canadian airspace with the Overflight Clearance number 0790-US-2014-12. The Species at Risk Management Division of the Canadian Fisheries and Oceans concluded a permit under SARA was not needed.

ACKNOWLEDGEMENTS

Funds for this project came from the Bureau of Ocean Energy Management (BOEM) and the US Navy through the respective Interagency Agreements for the AMAPPS project. Flight time and other aircraft costs were funded by NOAA Aircraft Operations Center (AOC). Staff time was also provided by the NOAA Fisheries Service, Northeast Fisheries Science Center (NEFSC) and NOAA AOC. We would like to thank the pilots and observers involved in collecting these data for their efforts and dedication to this project.

REFERENCES CITED

Laake JL, Borchers DL. 2004. Methods for incomplete detection at distance zero, In: Advanced distance sampling, edited by S. T. Buckland, D. R. Andersen, K. P. Burnham, J. L. Laake, and L. Thomas, pp. 108–189, Oxford University Press, New York.

Table 1. List of observers and pilots, along with their affiliations, that participated in the winter 2014/15 Northeast AMAPPS aerial survey.

Name	Affiliation
OBSERVERS	
Allison Chaillet	Integrated Statistics, Inc, Woods Hole, MA
Leah Crowe	Integrated Statistics, Inc, Woods Hole, MA
Robert DiGiovanni	Integrated Statistics, Inc, Woods Hole, MA
Marjorie Foster	Integrated Statistics, Inc, Woods Hole, MA
Rachel Hardee	Integrated Statistics, Inc, Woods Hole, MA
Richard Holt	Integrated Statistics, Inc, Woods Hole, MA
Val Sherlock	Integrated Statistics, Inc, Woods Hole, MA
PILOTS	
Kevin Doremus	NOAA Aircraft Operations Center, Tampa, FL
Kerryn Schneider	NOAA Aircraft Operations Center, Tampa, FL
Mattrew Nardi	NOAA Aircraft Operations Center, Tampa, FL
Phillip Eastman	NOAA Aircraft Operations Center, Tampa, FL

Table 2. Length of on-effort track lines (in km) surveyed by Beaufort sea state.

	Beaufort sea state						Total
	1	2	3	4	5	6	
track length (km)	213.6	1272.7	2817.5	1026.1	310.4	30.6	5670.9
% of total	4	22	50	18	5	1	100

Table 3. Winter 2014/15 Northeast AMAPPS aerial survey: Number of groups and individuals of species detected while on-effort by the front and back teams. Some of the groups seen by the back team were also seen by the front team.

Species		Number of groups		Number of individuals	
		Back	Front	Back	Front
Common bottlenose dolphin	<i>Tursiops truncatus</i>	1	1	9	4
Short-beaked common dolphin	<i>Delphinus delphis</i>	19	18	1511	420
Common or white-sided dolphin	-	0	4	0	7
Striped dolphin	<i>Stenella coeruleoalba</i>	7	2	36	29
Risso's dolphin	<i>Grampus griseus</i>	0	1	0	10
White-sided dolphin	<i>Lagenorhynchus acutus</i>	0	1	0	30
Harbor porpoise	<i>Phocoena phocoena</i>	0	1	0	3
Fin whale	<i>Balaenoptera physalus</i>	1	0	1	0
Humpback whale	<i>Megaptera novaeangliae</i>	2	2	2	2
North Atlantic right whale	<i>Eubalaena glacialis</i>	1	4	2	9
Unid dolphin	<i>Delphinidae</i>	1	1	6	2
Unid large whale	<i>Mysticeti</i>	2	1	2	1
Total cetaceans		34	36	1569	517
Loggerhead turtle	<i>Caretta caretta</i>	1	1	1	1
dead turtle	-	0	1	0	1
Basking shark	<i>Cetorhinus maximus</i>	5	2	5	2
Ocean sunfish	<i>Mola mola</i>	2	1	2	1
Harbor seal	<i>Phoca vitulina</i>	0	1	0	1
Gray seal	<i>Halichoerus grypus</i>	5	3	6	5
Unid seal	<i>Pinnipedia</i>	4	2	4	36
Total all species		51	47	1587	564

Figure 1. Winter 2014/15 Northeast AMAPPS aerial survey (5 December 2014 – 14 January 2015): completed on-effort track lines by Beaufort sea state. The 100 m, 1000 m and 2000 m depth contours (colored dotted lines) and the New York State Offshore Planning Area (gray shading) are shown.

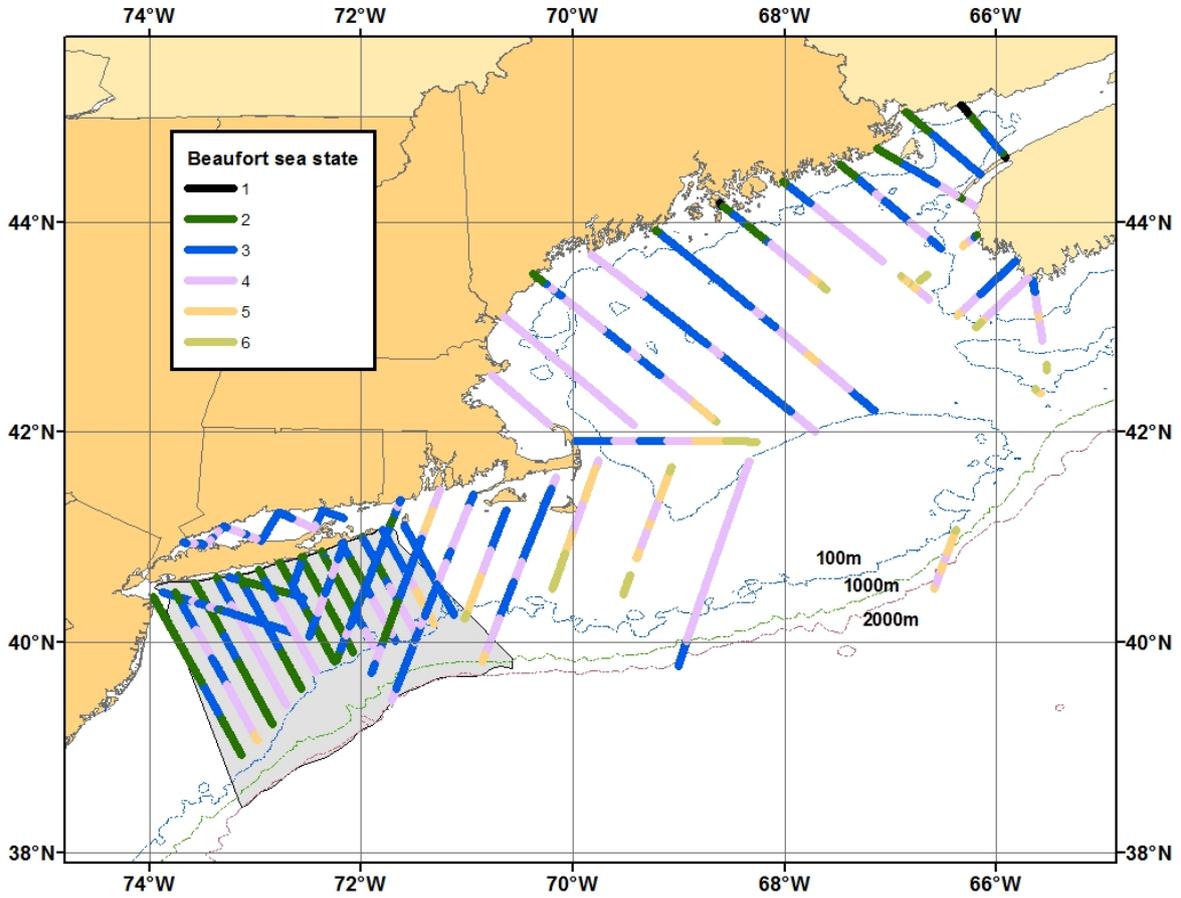


Figure 2. Winter 2014/15 Northeast AMAPPS aerial survey (5 December 2014 – 14 January 2015): Locations of short-beaked common (*Delphinus delphis*) and white-sided dolphins (*Lagenorhynchus acutus*) detected by one or both of the teams. The 100 m, 1000 m and 2000 m depth contours (colored dotted lines) and the New York State Offshore Planning Area (gray shading) are shown.

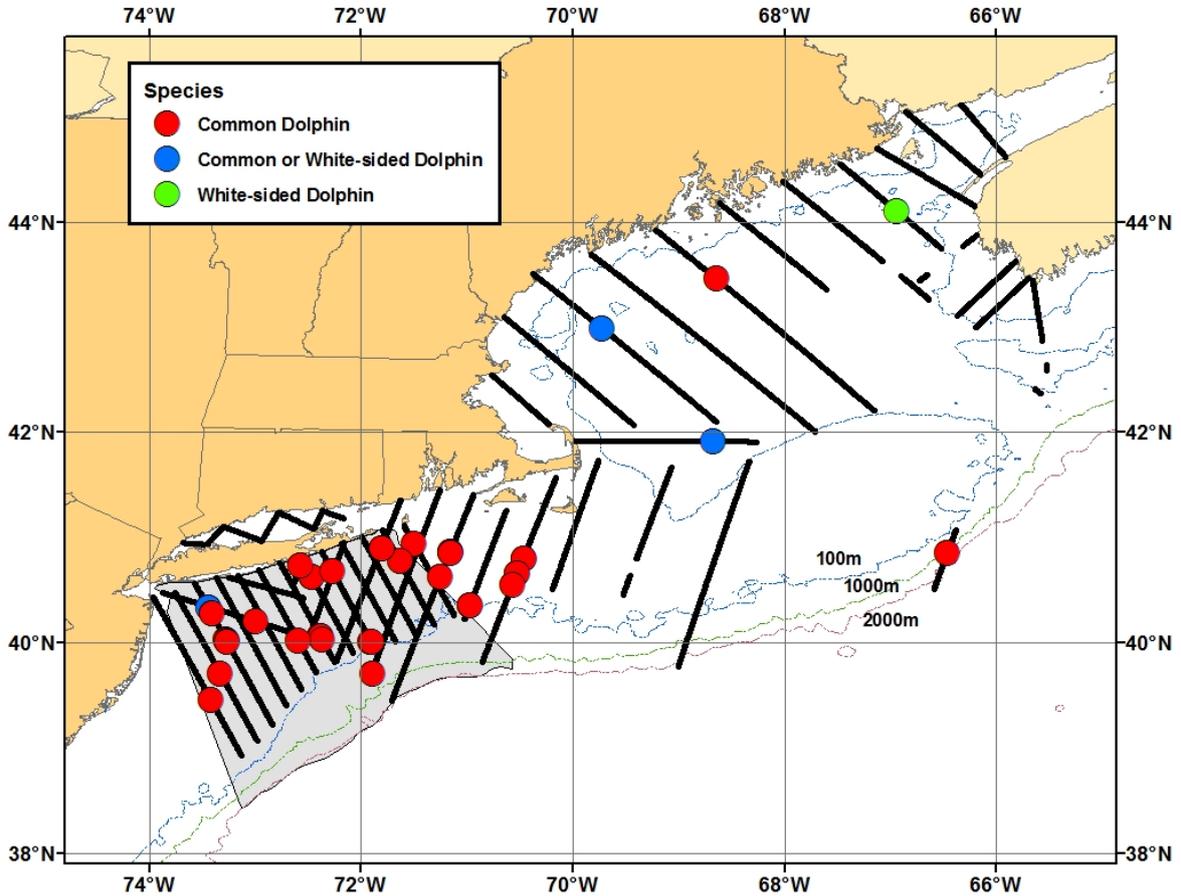


Figure 3. Winter 2014/15 Northeast AMAPPS aerial survey (5 December 2014 – 14 January 2015): Locations of common bottlenose dolphins (*Tursiops truncatus*), harbor porpoises (*Phocoena phocoena*), Risso’s dolphins (*Grampus griseus*), striped dolphins (*Stenella coeruleoalba*) and unidentified dolphins detected by one or both of the teams. The 100 m, 1000 m and 2000 m depth contours (colored dotted lines) and the New York State Offshore Planning Area (gray shading) are shown.

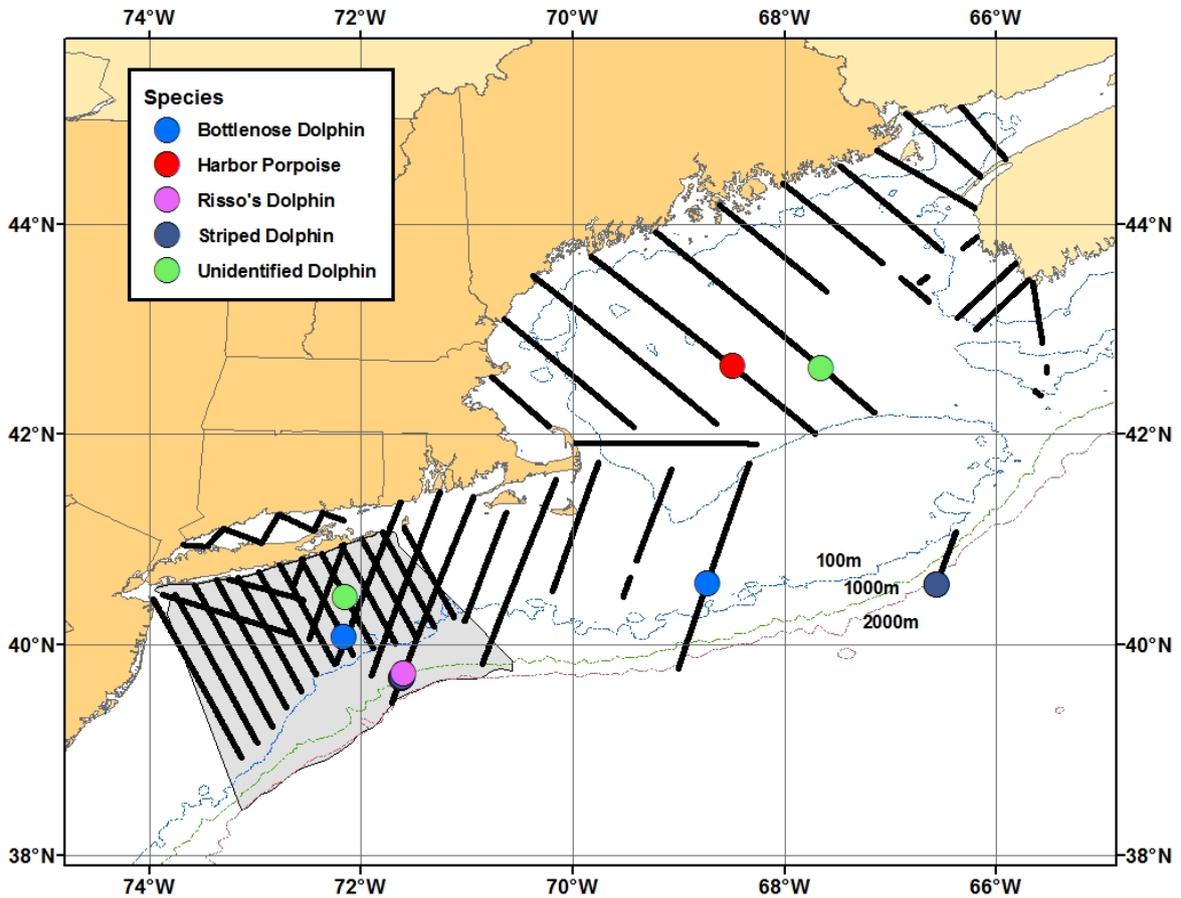


Figure 4. Winter 2014/15 Northeast AMAPPS aerial survey (5 December 2014 – 14 January 2015): Locations of fin (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), North Atlantic right (*Eubalaena glacialis*) and unidentified whales detected by one or both of the teams. The 100 m, 1000 m and 2000 m depth contours (colored dotted lines) and the New York State Offshore Planning Area (gray shading) are shown.

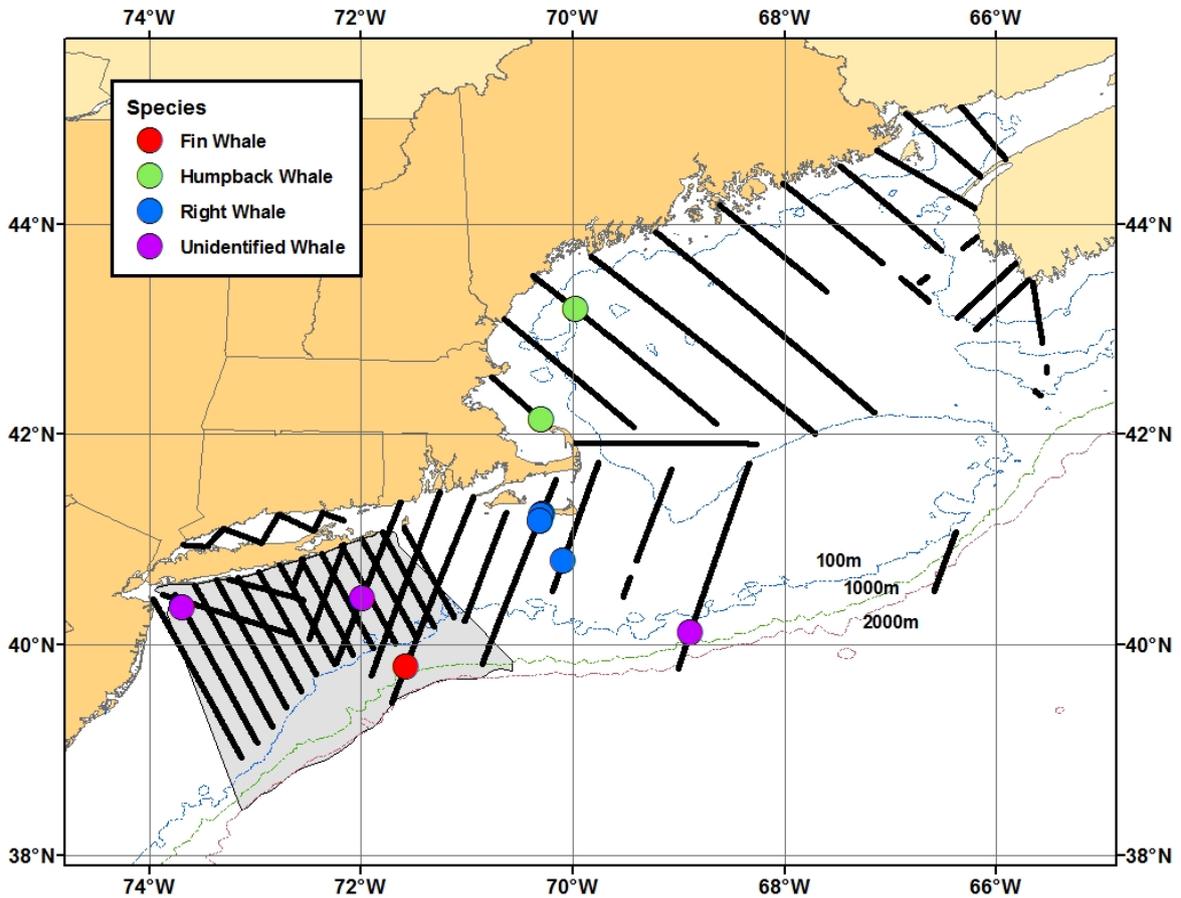


Figure 5. Winter 2014/15 Northeast AMAPPS aerial survey (5 December 2014 – 14 January 2015): Locations of gray (*Halichoerus grypus*), harbor (*Phoca vitulina*) and unidentified seals, loggerhead turtles (*Caretta caretta*), a dead turtle, basking sharks (*Cetorhinus maximus*), and ocean sunfish (*Mola mola*) that were detected by one or both of the teams. The 100 m, 1000 m and 2000 m depth contours (colored dotted lines) and the New York State Offshore Planning Area (gray shading) are shown.

