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PROJECT DESCRIPTION

Scientists from the United States and Canada collaborated on aerial surveys for North Atlantic right whales (*Eubalaena glacialis*) along the Scotian Shelf and in the Gulf of St. Lawrence during the summer of 2015. Contributors included researchers from the National Oceanic and Atmospheric Administration (NOAA), Fisheries and Oceans Canada (DFO), Dalhousie University, the Canadian Whale Institute, and the New England Aquarium. The surveys were directed over bathymetric features potentially attractive to right whales and areas being monitored by passive acoustic gliders. The survey platform was a de Havilland Twin Otter (DHC-6). Two observers scanned the ocean surface for right whales while flying at 230m and 100 knots. Sighting locations of all whales, dolphins, basking sharks, and sea turtles were recorded along with sighting conditions including Beaufort sea state, visibility, and glare.

Observers were on watch for a total of 38.1 hours over the course of 8 survey flights along the Scotian Shelf and 5 flights in the Gulf of St. Lawrence between July 23 and August 22. Flights on August 8 and August 20 were directed to right whale aggregations discovered east of the Gaspé Peninsula. A total of 40 different right whales were photographed for individual identification, 25 of which we matched to known individuals in the North Atlantic Right Whale Catalog. Two of these whales were previously injured, and their health status is being monitored (Catalog #3140 and #4057). Another identified whale (#2503) appeared to be in poor health. Two other whales, which we have yet to match to the catalog, had moderate to severe entanglement injuries although no gear was present. We also saw 2 calves with known mothers and 3 calves whose mothers were not identified on scene.

Figures 1 and 2 show completed aerial survey track lines and the locations of sightings for each species. Tables 1 and 2 summarize the survey effort and species sighting tallies of each flight. Table 3 contains the flight log notes. Table 4 lists survey participants. The Appendix lists our preliminary identifications of the right whales we photographed during this project.

The right whale images we collected have been submitted to the North Atlantic Right Whale Catalog at the New England Aquarium in Boston, MA. Copies of the survey data and right whale images are available from Tim Cole at NOAA's Northeast Fisheries Science Center.

ACKNOWLEDGEMENTS

NOAA Aircraft Operations Center and Peter Corkeron for supporting this work; Cathy Merriman and Hilary Moors-Murphy for assistance at all stages; Moira Brown, Kim Davies, Phillip Hamilton, and Chris Taggart for help designing the surveys; Stéphane Plourde and Catherine Johnson for copepod biomass plots; and Gary Pardy and Marty King for detailed bathymetry data and local knowledge.

Table 1. Summary of aerial survey effort and species sighting tallies for the NOAA flights on the Scotian Shelf in 2015.

Date	23-Jul	26-Jul	30-Jul	02-Aug	03-Aug	06-Aug	15-Aug	16-Aug
Area	Georges Basin	Central Scotian Shelf	North margin LeHave Basin	Lehave Bank and Channel	Eastern Scotian Shelf	Lehave Basin and Channel	Eastern Scotian Shelf	Emerald Basin and Channel
Beaufort sea state	2-4	2-3	1-3	3-5	2-5	4-6	4-6	2-4
Time on watch (h:mm)	1:23	2:54	3:13	2:58	4:30	2:38	0:59	4:01
Sightings								
(probable)right whale ¹			1					
humpback whale ²	4	3		2	2			1
fin whale ³	5	2	6	2	6			6
fin or sei ⁴	1							
minke whale ⁵	6	4	1	9	30	2	2	3
blue whale ⁶					1			
sperm whale ⁷								4
pilot whale ⁸			37	16	18	3		42
whale spp	3	3	2	4	1	1		5
Risso's dolphin ⁹								11
common dolphin ¹⁰	706			38	19	261	57	12
white-sided dolphin ¹¹	89	257		24	1169	53	90	
common or white-sided dolphin spp	607		17	69	47			
harbor porpoise ¹²	98	25		7	88	15		5
basking shark ¹³		8	31	10	10	7		8
leatherback turtle ¹⁴			2	4	7	1		1
loggerhead turtle ¹⁵	1							

¹ *Eubalaena glacialis*

² *Megaptera novaeangliae*

³ *Balaenoptera physalus*

⁴ *B. borealis*

⁵ *B. acutorostrata*

⁶ *B. musculus*

⁷ *Physeter macrocephalus*

⁸ *Globicephala spp.*

⁹ *Grampus griseus*

¹⁰ *Delphinus delphis*

¹¹ *Lagenorhynchus acutus*

¹² *Phocoena phocoena*

¹³ *Cetorhinus maximus*

¹⁴ *Dermochelys coriacea*

¹⁵ *Caretta caretta*

Table 2. Summary of aerial survey effort and species sighting tallies for the NOAA flights in the Gulf of St. Lawrence in 2015.

Date	07-Aug	08-Aug	10-Aug	11-Aug	20-Aug
Area	West of Banc de l'Orphelin	West of Banc de l'Orphelin	Shediac Valley	West side Cape Breton Island to St Paul Island	Northern Shediac Valley
Beaufort sea state	2-4	5-6	1-4	2-5	3-5
Time on watch (h:mm)	3:52	3:14	2:58	3:44	1:44
Sightings					
right whale ¹	25	26	22		14
fin whale ²	24				18
minke whale ³	6		4		3
pilot whale ⁴				3	
whale spp	2	1	2	6	3
white-sided dolphin ⁵				262	29
dolphin spp	18	2	16	13	20
harbor porpoise ⁶	65	5	148		8
basking shark ⁷	4		2	1	1
leatherback turtle ⁸				1	

¹ (*Eubalaena glacialis*)

² (*Balaenoptera physalus*)

³ (*B. acutorostrata*)

⁴ (*Globicephala spp*)

⁵ (*Lagenorhynchus acutus*)

⁶ (*Phocoena phocoena*)

⁷ (*Caretta caretta*)

⁸ (*Dermochelys coriacea*)

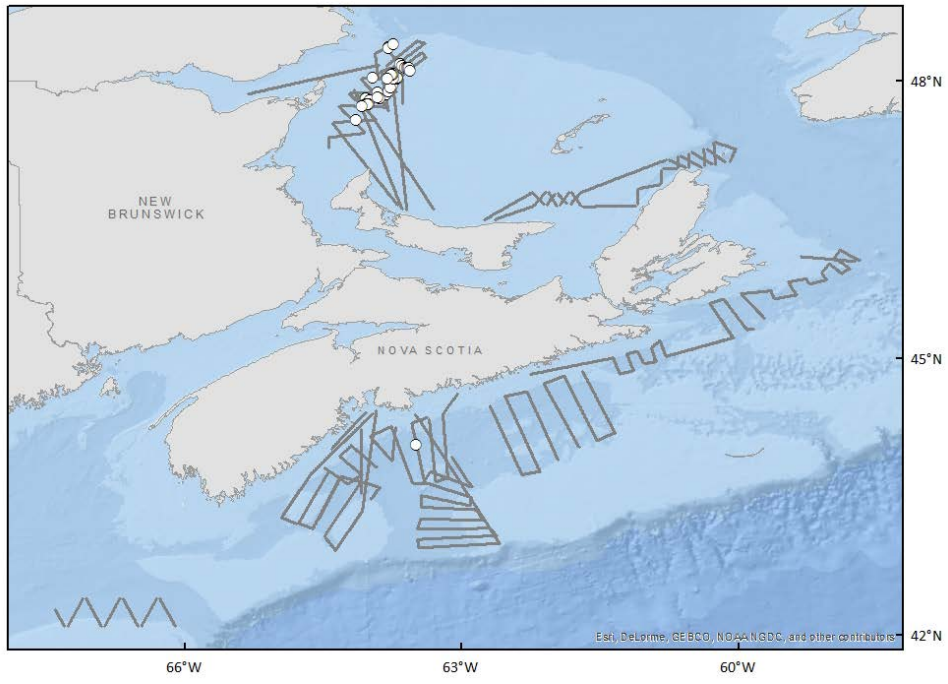
Table 3. Flight notes from the NOAA surveys of the Scotian Shelf and Gulf of St. Lawrence in 2015. Participants named here are further identified in Table 4.

Jul-23	Georges Basin	Completed zig only in excellent conditions. No fish being recorded during this Canada project.
Jul-26	Central Scotian Shelf	Camera and GPS display time set to Atlantic Daylight Time (ADT). Westernmost line altered due to military area. Counting basking sharks today and for the rest of the project.
Jul-30	North margin LaHave Basin	Excellent conditions. Flight directed over basin. <i>Land and Sea</i> film crew onboard. Delphine Morin in training.
Aug-02	LaHave Bank and Channel	Excellent to moderate conditions. Southern parts of some lines cut off by fog. Taggart and Morin aboard.
Aug-03	Eastern Scotian Shelf	Excellent conditions in west, good to moderate in east survey area. Some lines cut short by fog banks. Morin aboard.
Aug-06	LaHave Basin and Channel	Completed 4 lines in moderate conditions. Military area cut east part of southern line off. Morin and Merriman aboard.
Aug-07	Basins west of Banc d'Orphelin	Right whales sighted during transit to first point. Morin, Foster and Duley rotated observer positions during tracklines. More right whales likely present but we ran out of time.
Aug-08	West of Banc D'Orphelin	Marginal conditions during tracklines. Flew to yesterday's right whale aggregation. Moors-Murphy and Morin observers.
Aug-10	Shediac Valley, Gulf of St Lawrence	Southern part of Shediac Valley quiet. Northern lines back in area of previous days' aggregations. Did not break for last 4 right whale sightings due to time. Two moms (one maybe 3646). Morin observing back right.
Aug-11	West side Cape Breton Island	Sighting conditions highly variable.
Aug-15	Eastern Scotian Shelf	Partial survey of western lines between fog to west and high winds to east.
Aug-16	Emerald Basin and channel	No circle time to investigate unidentified whales. Three observer rotation (Duley, Foster, Morin for last couple weeks).
Aug-20	East of Chaleur Bay	Flew directly to last location of Aug 7 & 8 aggregations and boxed the area. Whales located to NE. Ran out of time to photograph whales. Extent of aggregation not documented. Eg 4057 seen. Duley back right.

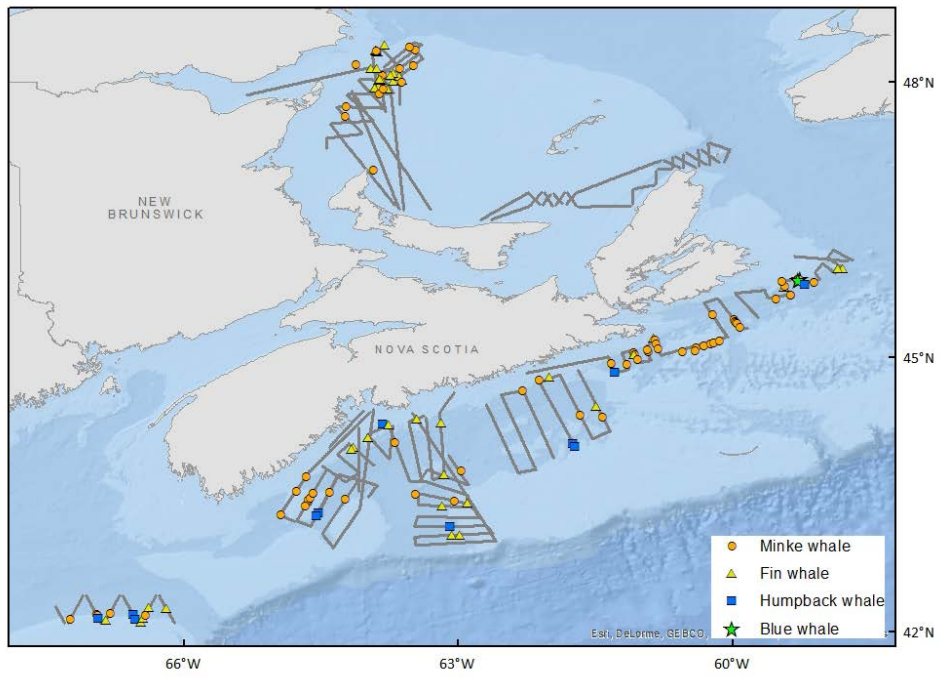
Table 4. Participants of the NOAA aerial surveys of the Scotian Shelf and Gulf of St. Lawrence in 2015.

Kerryn Schneider	Pilot (AC)	NOAA Aircraft Operations Center
BJ Bonner	Pilot	NOAA Aircraft Operations Center
Rick de Triquet	Pilot	NOAA Aircraft Operations Center
Tim Cole	Observer	Northeast Fisheries Science Center
Peter Duley	Observer	Northeast Fisheries Science Center
Marjorie Foster	Observer	Integrated Statistics
Delphine Durette Morin	Observer	Dalhousie University
Chris Taggart	Observer	Dalhousie University
Catherine Merriman	Observer	Department of Fisheries and Oceans Canada
Hillary Moors-Murphy	Observer	Department of Fisheries and Oceans Canada
Rachel Bower	Film Crew	Canadian Broadcasting Corporation (CBC) Television
Scott Berrington	Film crew	Canadian Broadcasting Corporation (CBC) Television

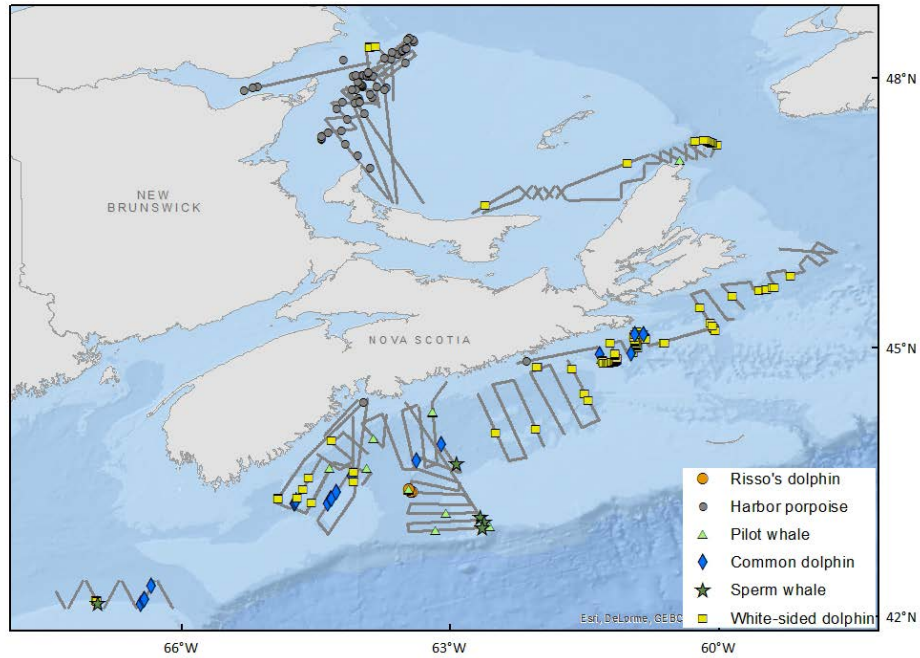
A



B



C



D

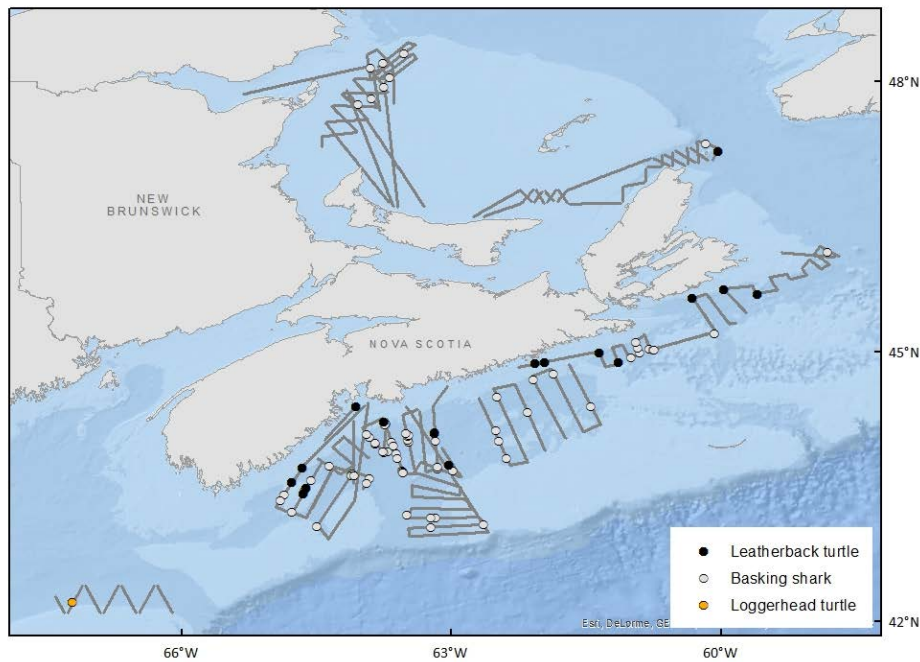


Figure 1. Completed aerial survey lines and sighting locations of (A) right whales (*Eubalaena glacialis*); (B) rorqual whales: minke (*Balaenoptera acutorostrata*), fin (*B. physalus*), humpback (*Megaptera novaeangliae*), and blue (*B. musculus*); (C) odontoceti: Risso's dolphin (*Grampus griseus*), Harbor porpoise (*Phocoena phocoena*), Pilot whale (*Globicephala* spp), Common dolphin (*Delphinus delphis*), Sperm whale (*Physeter macrocephalus*), and white-sided dolphin (*Lagenorhynchus acutus*); and (D) Leatherback turtle (*Dermochelys coriacea*), Loggerhead turtle (*Caretta caretta*), and basking sharks (*Cetorhinus maximus*) during the NOAA surveys, July 23-August 22, 2015.

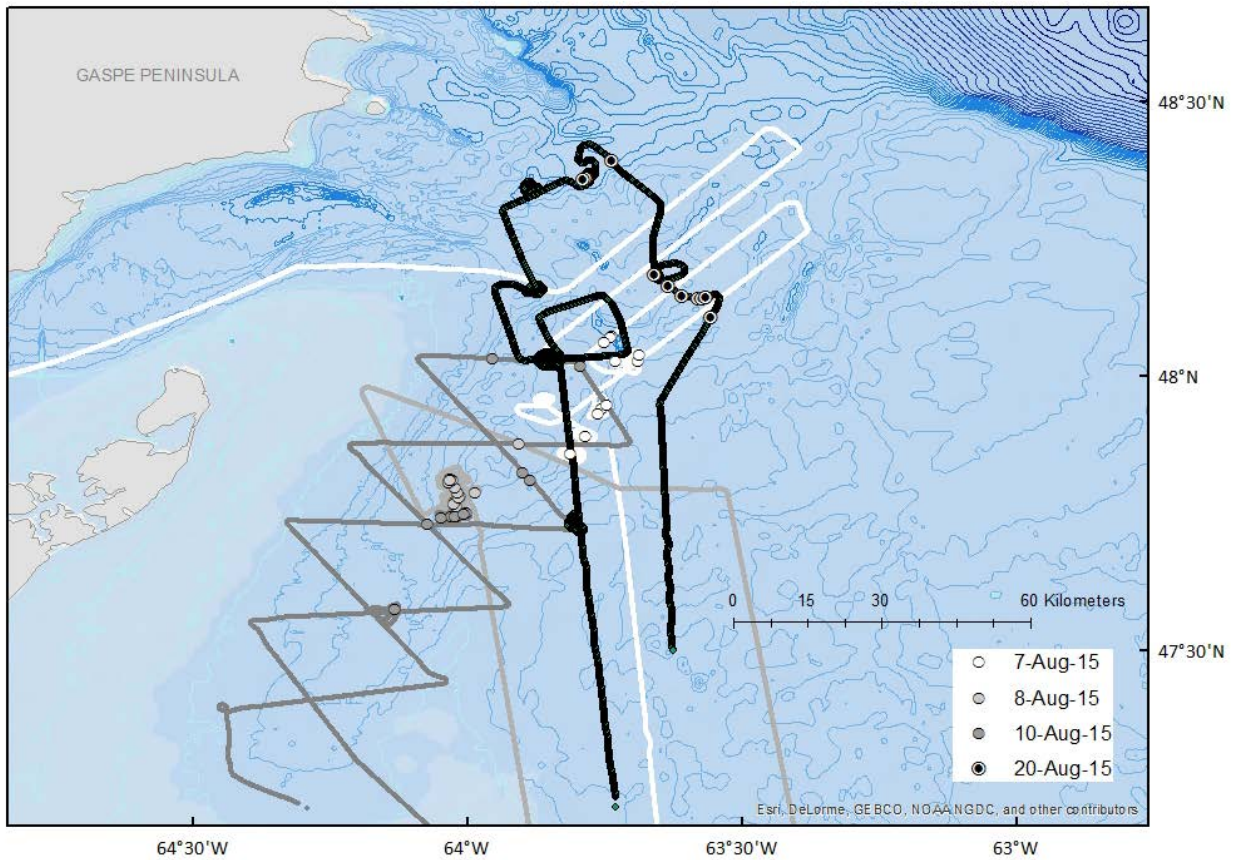


Figure 2. Detail of the NOAA aircraft's flight paths and right whale (*Eubalaena glacialis*) sighting locations in the Gulf of St. Lawrence in 2015. The white, light gray, dark gray, and black lines and dots represent the flight paths and right whale sighting locations on August 7, 8, 10 and 20, respectively. 10 meter bathymetry contours provided by the Atlantic Bathymetric Compilation, Canadian Hydrographic Service, Bedford Institute of Oceanography, Dartmouth, N.S. Canada.

APPENDIX. Preliminary identifications (Catalog number) of photographed right whales (*Eubalaena glacialis*), from the NOAA aerial surveys in the Gulf of St. Lawrence in 2015. The first right whale photographed each day was lettered A, the second B, etc. Lettering was reset each day, e.g., whale “K” on August 7 is not the same whale as “K” on August 8 or 10. Subsequent review of photographs identified several individual whales that were given multiple letters in a day. Photographs have been submitted to the New England Aquarium for confirmation of catalog numbers.

Unique photo IDs		7-Aug	8-Aug	10-Aug	20-Aug	
Total number seen		13	15	11	6	
Catalog number	Gender					Notes
3510	M	A				
<i>no ID</i>		B				
3245	M	C			A	
1604	F	D				Mom. Seen multiple times in GSL, never in BOF
1604c		E				Calf of 1604
1934	F	F	Q			Nulliparous
3421	M	G				
1812	F	H				Calved 2016
<i>no ID</i>		I				
<i>no ID</i>		J				Calf
<i>no ID</i>		K				New moderate to severe entanglement injuries, no gear
<i>no ID</i>		L				Calf
<i>no ID</i>		M				
2123	F		A,K			Calved 2014
3191	M		B,J			
3140	M		C,T			Reported off Pleasant Bay, Cape Breton Aug 16.
1017	M		D			
3110	M		E,I	B,L		Seen in GSL 2010
2503	F		F,L		B	New extensive lesions, cause unknown; calved 2014
2510	M		G			Seen multiple times in GSL
<i>no ID</i>			H	K		New moderate to severe entanglement injuries, no gear
3623	M		M			
3440	F		N			Calved 2016 (calf lost)
2750	M		O			Seen in GSL 2014
1112	M		P			
3892	M		R			
<i>no ID</i>			S			
<i>no ID</i>				A		
<i>no ID</i>				C,E		Calf
1419	M			D		
3646	F			F,N,P		First time mom
3646c				G,M,Q		Calf of 3646
<i>no ID</i>				H		
3312	M			I		
3296	M			J		Seen in GSL 2002, 2014
1616	M			O		Seen in GSL 2012
<i>no ID</i>					C	
4057	M				D	
3940	F				E	Immature
<i>no ID</i>					F	

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