

North Atlantic Right Whale Consortium 2015 Annual Report Card

NORTH ATLANTIC RIGHT WHALE CONSORTIUM BACKGROUND

The North Atlantic right whale (*Eubalaena glacialis*) remains one of the most endangered large whales in the world. The interest in addressing the problems hampering the recovery of North Atlantic right whales using innovative research techniques, new technologies, analyses of existing databases, and enhanced conservation and education strategies has increased significantly over the past sixteen years. This increased interest necessitated better coordination and collaboration among all stakeholders to ensure that there was improved access to data, research efforts were not duplicative, and that findings are shared with all interested parties. The North Atlantic Right Whale Consortium, initially formed in 1986 by five research institutions to share data among themselves, was expanded in 1997 to address these greater needs. Currently, the Consortium membership is comprised of representatives from more than 100 entities including: research, academic, and conservation organizations; shipping and fishing industries; whale watching companies; technical experts; U.S. and Canadian Government agencies; and state authorities.

The Consortium membership is committed to long-term research and management efforts and to coordinating and integrating the wide variety of databases and research efforts related to right whales to provide the relevant management, academic and conservation groups with the best scientific advice and recommendations on right whale conservation. The Consortium is also committed to incorporating new and updated methods with its membership, providing up-to-date information on right whale biology and conservation to the public, and maintaining effective communication with U.S. and Canadian Government agencies, state authorities, the Canadian Right Whale Network, the U.S. Southeast Right Whale Implementation Team, the Atlantic Large Whale Take Reduction Team, the Atlantic Scientific Review Group, and members of Congress. The Consortium membership supports the maintenance and long-term continuity of the separate research programs under its umbrella, and serves as executor for database archives that include right whale sightings and photo-identification data contributed by private institutions, government scientists and agencies, and individuals. Lastly, the Consortium is interested in maximizing the effectiveness of management measures to protect right whales, including using management models from other fields.

The Consortium is governed by an Executive Committee and Board members who are elected by the general Consortium Membership at the Annual Meeting.

2015 ANNUAL NORTH ATLANTIC RIGHT WHALE REPORT CARD

North Atlantic Right Whale Consortium members agreed in 2004 that an annual “report card” on the status of right whales would be useful. This report card includes updates on the status of the cataloged population, mortalities and entanglement events, and a summary of current management and research efforts that have occurred over the previous 12 months. The Board’s goal is to make public a summary of current research and management activities, as well as provide detailed recommendations for future activities. The Board views this report as a valuable asset in assessing the effects of research and management over time. The 2015 annual report card includes information from 01 November 2014 – 31 October 2015.

Essential Population Monitoring and Priorities

In the 2009 Report Card to the International Whaling Commission (IWC) the Consortium Board identified key monitoring efforts that must be continued and maintained in order to identify trends in the population as well as assess the factors behind any changes in these trends (Pettis, 2009). The key efforts are: (1) Photographic Identification and cataloging of right whales in high use habitats and migratory corridors, including, but not limited to, the southeast United States, Cape Cod Bay, Great South Channel, Bay of Fundy, Scotian Shelf, and Jeffreys Ledge, (2) Monitoring of scarring and visual health assessment from

photographic data, (3) Examination of all mortalities, and (4) Continue using photo-ID and genetic profiling to monitor population structure and how this changes over time.

Over the last several years, surveys in areas listed above have indicated that right whale distribution and patterns of habitat use have shifted, in some cases dramatically from expectations based on previous studies. These shifts have been observed throughout the range of North Atlantic right whales and have direct implications on research and management activities, as well as on each of the key efforts identified above. As such, the Board believes that identifying potential extralimital and new critical habitats and developing alternative survey effort strategies to respond to the distributional changes should be a priority.

Entanglement in fixed fishing gear continues to pose a significant threat to this population. Recent publications have shown reduced survival following entanglement and that moderate and severe injuries from entanglement are increasing (Robbins et al. 2015; Knowlton et al. 2015). Additionally, current research projects underway suggest that 1) relatively minor declines in health can inhibit reproduction; 2) post entanglement health continues to decline after a severe injury from entanglement for at least a year and often leads to death; and 3) mortality from entanglements has been significantly underestimated. The recent shifts in distribution and movements of right whales may be contributing to the entanglement problem while simultaneously decreasing our ability to document those entanglements, but more importantly, it calls into question the co-occurrence model for large whale take reduction (in the US), since the model was based on historical distributions that no longer apply. There is an urgent need to mitigate entanglements in this population; this must be a priority in future research and management plans in both Canada and the United States.

Lastly, the Consortium Board regards the Consortium databases as essential to recovery efforts for the North Atlantic right whale population. In a review of the federal recovery program for North Atlantic right whales, the Marine Mammal Commission agreed with the Board's sentiment, stating that "both databases play critical roles in right whale conservation" and that the Identification Catalog "is the cornerstone of right whale research and monitoring" (Reeves et al. 2007). The review went on to recommend that both databases ("both" here and above refers to the Identification and Sightings databases; there are several Consortium databases available) be fully funded on a stable basis.

Population Status

Estimate of Cataloged North Atlantic Right Whales: 2014

The ability to monitor North Atlantic right whale vital rates is entirely dependent on the right whale identification database. Curated by the New England Aquarium, the database consists of over 700,000 slides, prints, and digital images collected during the 65,976 sightings of 685 individual right whales photographed since 1935. Each year, 3,000 to 5,000 sightings consisting of 20-30,000 images are added to the identification database. Due to the lag time in processing data (data are currently completely processed through 2013) the most recent estimate of the cataloged population available is for 2014.

In 2014, the best estimate of catalogued North Atlantic right whales was 526 individuals (database exported 16 October 2015). Low and high estimates were also calculated (Table 1 below). This "best estimate" is based upon the number of photographed whales, but it excludes potential unphotographed whales, and therefore should **not** be considered a "population estimate". This photo-identification estimate includes 496 cataloged whales that were presumed to be alive in 2014 because they were seen in that year, or any time in the prior five years (Knowlton et al. 1994). The estimate also includes 11 calves from 2013 or 2014 that were considered suitable for eventual inclusion in the catalog and 19 other whales that did not match the catalog, but were re-identified in at least one subsequent year (excluding sightings in field seasons that spanned the calendar year). A detailed explanation of these calculations is included at the end of this report.

Table 1. Estimates of the number of cataloged whales in the North Atlantic Right Whale Identification Catalog. A detailed explanation of calculations can be found at the end of this report. Analysis completed 10/16/15.

Low: 333 individuals
333 Cataloged whales seen in 2014
Middle: 526 individuals
496 Cataloged whales presumed alive in 2014
19 Intermatch whales likely to be added to Catalog
11 Calves from 2013 and 2014 likely to be added to Catalog
High: 703 individuals
658 All Cataloged whales in 2013 minus those known dead
24 All active intermatch codes without 2012 & 2013 calves
21 All uncataloged 2013 and 2014 calves minus dead

Population Over Time

Below are assessments of the number of photo-identified right whales within the population over time based on three available methods (Figure 1). The presumed alive counts whales that have been seen at least once in the last six years. It is a consistently measurable and easily available value, but is not an accurate estimate of recent cataloged population size due to delays in data processing. The Minimum Number Alive (MNA) is the number used in the NMFS stock assessment reports and counts whales seen in a given year, plus any whale not seen that year- but seen both before *and* after. The MNA number is also not accurate for recent years for the same reason as the presumed alive, plus the fact that there have been fewer “after” years to detect a whale. The report card number is the only number that assesses animals that are not yet cataloged and is the best number for the previous year.

In the figure below, the numbers for presumed alive and MNA for all years were recalculated using data from October 16, 2015; only the numbers from past report cards were not regenerated. The report card numbers are always higher than the other two methods for the last two years. However, the fact that the old report card numbers for 2009 and 2010 are now close but below the regenerated presumed alive numbers indicates that the report card method provides a conservative, relatively accurate count, and is able to do so several years in advance of the other analyses. The report card also helps capture recent calves that have not yet been cataloged largely due to the shift in right whale distribution; this shift has resulted in fewer calves seen on the feeding grounds with their mothers, and fewer sightings of juveniles anywhere- both of which make cataloging recent calves challenging.

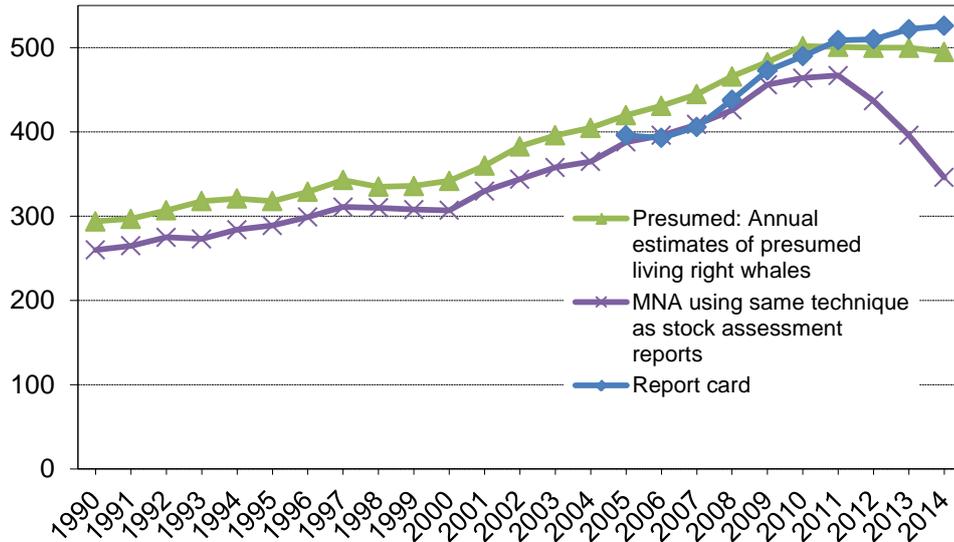


Figure 1. Assessments of the North Atlantic right whale population based on three available assessment methods.

How Well Are We Monitoring?

Below is a count of sightings, unique individuals, and whales presumed alive by year from 2000-2014. Evident from the table is that the shift in whale distribution has reduced both the number of sightings contributed to the Catalog and the percent of the population seen annually in recent years.

Table 2. Annual counts of sightings, unique individuals, presumed living whales, and the percentage of the population seen. Survey effort from dedicated surveys only; opportunistic sightings do not record or report effort. Data as of October 16, 2015. * Data are not yet fully processed for 2014.

Year	Sightings	Unique IDs	Presumed Living Population	Survey Effort (1,000 km)	% of population seen
2000	3085	245	342	125	72%
2001	3848	285	360	127	79%
2002	2715	315	383	217	82%
2003	2402	315	396	180	80%
2004	1805	298	405	259	74%
2005	3398	360	420	340	86%
2006	2800	345	431	316	80%
2007	3740	383	445	267	86%
2008	4149	405	466	254	87%
2009	4636	425	483	246	88%
2010	3224	428	502	263	85%
2011	3461	438	501	223	87%
2012	2126	370	500	256	74%
2013	1906	280	500	212	56%
2014*	2388	335	495	199	68%

Reproduction

There were 17 documented calves born in 2015 (Table 3). The average calving interval of 2015 moms was 5.54 years and there were four first time moms in 2015.

Table 3. Summary of calving events and associated interval times for North Atlantic right whales 2006-2015.

Year	Calf Count	Average Interval	Median Interval	First time Moms
2006	19	3.21	3	5
2007	23	4.54	3	10
2008	23	3.19	3	7
2009	39	3.97	4	8
2010	19	3.33	3	4
2011	22	3.74	3	3
2012	7	5.4	4	2
2013	20	4.62	4	7
2014	11	4.4	4.5	1
2015	17	5.54	6	4

Mortalities

Between 01 November 2014 and 31 October 2015, three right whale mortalities were documented (Table 4). The Consortium Board recognizes necropsies as significant data collection events that provide valuable information on which management and conservation measures can be (and have been) made. The Board views consistent necropsy response and support (both financial and personnel) as critical to monitor both right whale recovery and the efficacy of management actions.

There was an update made to 2013/2014 mortalities reported in the 2013 NARWC Report Card. A carcass sampled on 08/26/14 was hypothesized to be that of Eg #3966, found floating dead on 07/12/2014 and subsequently necropsied. Both carcasses were listed as mortalities in the 2014 Report Card. Genetic samples confirmed that both carcasses were indeed Eg #3966. Therefore, the number of mortalities reported in the 2014 Report Card was corrected from four to three whales and can be accessed at http://www.narwc.org/pdf/2014_Report_Card.pdf.

Table 4. Documented right whale mortalities, 01 November 2014 - 31 October 2015

Whale #	Date	Location	Sex	Age	Necropsy Field #	Cause	Comments
2320	06/24/2015	Gulf of St. Lawrence	Female	Adult		Undetermined	Necropsy performed. No signs of recent trauma or entanglement. Whale last sighted alive on 04/02/2014 in Cape Cod Bay.
	07/09/2015	Gulf of St. Lawrence	Unk	Unk		Undetermined	Not retrieved, not sampled.
3923	07/13/2015	Gulf of St. Lawrence	Female	6		Undetermined	Not retrieved, not sampled. Last sighted alive on 12/27/2014 in Southern New England

Entanglements, Entrapments, and Vessel Strikes

Entanglement and Entrapments

There were eight active entanglement/entrapment cases reported between 01 November 2014 and 31 October 2015. Of these, five were new cases. Table 5 includes newly reported cases as well as pertinent updates to previously reported cases.

Table 5. Right whale entanglements and status updates 01 November 2014 – 31 October 2015. Newly reported entanglements (carrying gear) are bolded.

Whale#	Date of First Entanglement Sighting	First location	Sex	Age (current)	Comments
3346	3/17/2004	2 miles E Anastasia Island, FL	Male	11	Gear remains on right flipper, resighted 04/26/2015 (Southern New England)
4057	2/16/2014	40 mile east Jacksonville, FL	Male	4	Partially disentangled. Line remains in mouth. Resighted 4/12/2014 in CCB, still entangled. Whale was sighted gear free on 4/18 and 4/19/2015 in Cape Cod Bay. Resighted in the Gulf of St. Lawrence on 8/20/2015 and again in the Grand Manan Channel on 10/7/2015.
1131	6/29/2014	100 miles south of Yarmouth, Nova Scotia	Male	Unk, Adult	The entanglement is extensive and appears to involve rope only. There is at least one wrap of the rostrum, but likely two. Line exiting the left mouthline are two lengths of line, one ending at a bitter end about 20feet aft of the flukes, the other at depth, ending in a large mass of what appears to be line. Exiting the right mouthline is a loop of line cleating the right flipper. Whale in very poor condition: thin, pale, and extensive cyamid coverage. This whale was identified as Eg #1131 in March 2015. Whale likely died as a result of this entanglement.
WR-2015-05	6/13/2015	10miles NE of Brier Island	Unk	Unk	Free swimming whale with line through mouth, 300-400m trailing to buoys. Whale reported to be struggling at the surface and then traveling at a high rate of speed with buoys in tow. No additional sightings.
4140	7/5/2015	East of Cape Breton	Male	4	Whale entrapped in fishing weir. Fisherman responded following day, dropped one section and whale rushed out. No obvious injuries observed. No additional sightings.
3160	7/18/2015	East of Ingonish, Cape Breton	Male	14	Peduncle wrap with attached snow crab pot gear and buoys. Disentangled.
1306	9/13/2015	Roseway Basin	Male	Unk, Adult	Green line exiting the left side of the mouth, possibly going to the flipper. No additional sightings.
WR-2015-28	9/28/2015	17 nm south of Boothbay Harbor, ME	Unk	Unk	Whale observed with a large diameter line draped over the flukes. It was unclear how the gear was attached and how far behind the whale the line trails; the observing crew speculated that the line may be attached to something weighted below the surface. No additional sightings.

Vessel Strikes:

There were three right whales sighted with new vessel strike wounds between 01 November 2014 – 31 October 2015 (Table 6). None of these whales have been resighted since injury.

Table 6. Vessel strike wounds reported between 01 November 2014 – 31 October 2015.

Whale#	Date of First Sighting with Strike	First location	Sex	Age (current)	Comments
3999	5/6/2015	Cape Cod Bay	Female	6	Propeller cuts that span from behind right blowhole, across both right and left blowholes, and forward of left blowhole. Significant damage to both blowholes. The impact of these wounds on the whale's health is unclear as the whale has not been resighted. There are concerns about the functionality of both blowholes. Seen without strike wounds on 5/2/2015 in Cape Cod Bay.
2015 Calf of 2145	5/11/2015	Cape Cod Bay	Unk	Calf	Wound on back that appears to be vessel strike related. Likely not prop but possibly keel. Severity of wound is unknown. Seen without strike wound on 5/6/2015 in Cape Cod Bay. No additional sightings.
BK01MB15	9/2/2015	Cape Cod Bay	Unk	Calf	Calf of the year was seen alone in Cape Cod Bay on 8/30/2015 without strike injuries. Whale was resighted on 9/2/2015 in Cape Cod Bay with prop and skeg cuts on the back/right side. Mother is unknown. Whale has not been resighted since the initial injury sighting.

Aerial and Vessel-based Sightings November 2014 – October 2015

Cataloged sighting information through 31 October 2015 is summarized below and includes survey, research, and opportunistic sightings. Months with sightings and major contributing organizations (>10% total sightings for region) are listed after total number of sightings. Summaries of survey type (if available) are listed below each region. Not all data have been received and/or entered. Survey platforms and sighting totals may change.

Major Contributing Organizations:

BHWW: Bar Harbor Whale Watch
BIWSC: Brier Island Whale and Seabird Cruises
BOS: Blue Ocean Society
CCS: Center for Coastal Studies
CFWW: Cap'n Fishes Whale Watch
CWI: Canadian Whale Institute
DFO: Department Fisheries and Oceans Canada
FWRI: Fish and Wildlife Research Institute

GDNR: Georgia Department of Natural Resources
LM: Laurie Murrison
MICS: Mingan Island Cetacean Society
NEAq: New England Aquarium
NEFSC: Northeast Fisheries Science Center
QLM: Quoddy Link Marine
S2S: Sea to Shore Alliance

Southeast United States (sightings: 256, December - March; FWRI, GDNR, S2S)

- Aerial surveys, biopsy darting, acoustic studies and vessel based photo-ID

Mid-Atlantic (includes south of Cape Cod) (sightings: 98, December, January - April; NEAq, NEFSC; CCS)

- Aerial surveys

Great South Channel (sightings: 54, January - May, August; NEFSC, CCS)

- Aerial surveys

Massachusetts Bay/Cape Cod Bay (sightings: 1122, December – May; CCS, NEAq)

- Aerial and vessel surveys and habitat sampling

Jeffreys Ledge (sightings: 3, June, September; BOS)

- There were no systematic surveys on Jeffreys Ledge

Gulf of Maine (sightings: 8, March, May, July, September; CCS, NEAq, NEFSC, BHWW, CFWW)

- Aerial surveys

Bay of Fundy (sightings: 41, June – October; BIWSC, QLM, LM, NEAq)

- Vessel surveys

Roseway Basin (sightings: 14, September; CWI)

- Vessel surveys

North (sightings: 86, November, June - September; NEFSC, DFO, MICS)

- Aerial and vessel surveys

Partial Listing of Research Analyses Underway in 2015

- Seasonal occurrence, distribution, and demographics of North Atlantic Right Whales in the Gulf of St. Lawrence and around Newfoundland and implications for management.
- Using immunoassays to detect a variety of steroid and thyroid hormones in right whale blow samples.
- Assessing characteristics of right whale vision
- Passive acoustic detection of right whales
- Modeling right whale habitat
- Estimating health and survival of right whales
- Assessing role of anthropogenic injury on right whale visual health
- Evaluating vessel strike risk in the Bay of Fundy
- Assessment of the Methods Used to Monitor the Abundance and Distribution of North Atlantic Right Whales
- Passive Acoustic Monitoring of North Atlantic Right Whales off Cape Hatteras
- Assessing use of right whale vocalizations to discern between individuals
- The effect of entanglement severity on health in North Atlantic right whales
- Investigation into calving right whale habitat use in the Southeast U.S
- Estimating the health of individual right whales using a combination of Visual Health Assessment data, sightings and location data, and effort data.
- Analysis of movement through the mid-Atlantic corridor
- Integrating oceanographic data, CPR data, right whale sightings, and survey effort data to investigate linkages between the dramatic distributional shifts, regional oceanographic changes, and broad-scale oceanic trends.
- Estimating the nutritional requirements of North Atlantic right whales with a generalized bioenergetics model.
- Probability and location of right whale calving
- Investigating right whale habitat in a wind farm development area
- Investigating changes in right whale distribution in Cape Cod Bay 1998 – 2013
- Out of habitat sightings of Bowhead in Gulf of Maine
- Distribution, relative density, habitat use patterns and movements of right whales in the mid-Atlantic region

Management and Mitigation Activities

United States

- Site assessment and characterization for the wind lease area off New York
 - Investigation into calving right whale habitat use in the Southeast U.S
 - Development of amendment to the Snapper Grouper Fishery Management Plan
 - Investigating patterns of North Atlantic right whale distribution in and around Stellwagen NMS and the relationship to vessel traffic and ship-strikes
- In February 2015 NOAA Fisheries issued a proposal to expand the designated critical habitat for endangered North Atlantic right whales in the northwestern Atlantic Ocean, including areas that will support calving and nursing. The proposed rule would expand the critical habitat to roughly 29,945 square nautical miles, and include northeast feeding areas in the Gulf of Maine/Georges Bank region and calving grounds from southern North Carolina to northern Florida.
- Amendment to the Atlantic Large Whale Take Reduction Plan (79 FR 36586) to address large whale entanglement risks associated with vertical line (or buoy lines) from commercial trap/pot fisheries effective beginning June 1, 2015. This amendment included gear modifications, gear setting requirements, a seasonal closure (Massachusetts Restricted Area) and gear marking for both the trap/pot and the gillnet fisheries.
- NMFS proposed to revise its regulations to implement the import provisions of the Marine Mammal Protection Act (MMPA). These proposed regulations would establish conditions for evaluating a harvesting nation's regulatory program for reducing marine mammal incidental mortality and serious injury in fisheries that export fish and fish products to the United States. Under this proposed rule, harvesting nations must apply for and receive a comparability finding for each fishery identified by the Assistant Administrator in the List of Foreign Fisheries in order to import fish and fish products into the United States. The proposed rule establishes procedures that a harvesting nation must follow, and conditions to meet, to receive a comparability finding for a fishery. The proposed rule also establishes procedures for intermediary nations to certify that exports from those nations to the United States do not contain fish or fish products subject to an import prohibition. Agency actions and recommendations under this rule will be in accordance with U.S. obligations under applicable international trade law, including the World Trade Organization (WTO) Agreement.
- NMFS received a petition to exclude federally-maintained dredged channels and pilot boarding areas (and the immediately adjacent waters) for ports from New York to Jacksonville from the vessel speed restrictions that were established to reduce the threat of vessel collisions with North Atlantic right whales. After reviewing the information in the petition and public comments thereon, NMFS found that the petition did not present substantial information indicating that that exclusion of these areas is necessary to address the concerns, and denies the petition. NMFS will review and revise existing compliance guide to provide clarifying information about the navigational safety exception (*i.e.*, the October 10, 2008, final rule's deviation provision) for the speed restrictions.
- NMFS issues this final rule to amend the regulations implementing the Atlantic Large Whale Take Reduction Plan. This action will change the minimum number of traps per trawl to allow fishing with a single trap in certain Massachusetts and Rhode Island state waters; and modifies the requirement to use one endline on trawls within certain areas in Massachusetts state waters. Also, this rule creates a 1/4 mile buffer in waters surrounding certain islands in Maine to allow fishing with a single trap. In addition, this rule includes additional gear marking requirements for those waters allowing single traps as well as two new high use areas for humpback whales (*Megaptera novaeangliae*) and North Atlantic right whales (*Eubalaena glacialis*).

-NOAA called for 14 Dynamic Management Area (DMA) voluntary speed reduction zones between 01 November 2014 and 31 October 2015:

12/13/2014	Southeast of Nantucket	04/1/2015	RI Sound
12/22/2014	Cape Cod Bay	04/16/2015	Southwest of Nantucket
12/27/2014	Southeast of Nantucket	05/5/2015	120 Nautical Miles Northeast of Boston
01/17/2015	Southeast of Delaware Bay		
01/21/2015	South of Nantucket	05/15/2015	85 Nautical Miles ENE of Boston
02/24/2015	Southwest of Nantucket	05/28/2015	35 Nautical Miles ESE of Nantucket
03/13/2015	South of Martha's Vineyard	08/1/2015	13 Nautical Miles ESE of Boston
03/29/2015	East of New York, NY		

Canada

Through its Fisheries Resource Management Branch, Fisheries and Oceans Canada (DFO) coordinates a national Marine Mammal Response Program (MMRP) that supports the work of organizations and networks involved in marine mammal incident responses on all Canadian coasts. The MMRP works with partners to:

- Track and respond to incidents including entanglements, breachings or strandings, and vessel strikes
- Seek to quantify and understand threats affecting marine mammal species, especially at-risk species, through sightings, necropsies and sampling.
- Support Species at Risk recovery planning, mitigation activities, and policy development.
- Collaborate with the appropriate authorities on enforcement cases.

-Three right whale mortalities occurred in the Gulf of St. Lawrence in Canada in June and July 2015. This is an area where historically right whale presence has been limited, and the response to those incidents has led to discussion within DFO and with partner organizations about how to improve and optimize response in all Canadian waters where right whales may be present.

-The “Wanted! North Atlantic Right Whales” outreach campaign continues in its fourth year, soliciting right whale sighting information from the public in areas outside of the known critical habitat. Posters and pamphlets have been distributed to over 300 wharves, community bulletin boards, Canadian Coast Guard (CCG) vessels, ferries, whale watch companies and DFO area offices in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, and Newfoundland. Sightings received are entered in DFO’s Maritimes Region Cetacean Sightings Database, and shared with the New England Aquarium and NOAA. DFO works with the Canadian Coast Guard (CCG) to broadcast notices to shipping, “NOTSHIPS” reminders about the two right whale CH areas. These broadcasts notify vessels to watch for right whales, to report sightings, and to avoid collisions.

-A DFO working group is beginning to identify measures to reduce injury and mortality from fishery interactions in Maritimes Region. New measures will be in addition to existing measures such as the Bay of Fundy Right Whale – Lobster Mitigation Strategy This Strategy, in place since 2007, and The Grand Manan Fishery Association’s strategy that includes a telephone hotline and a website and for reporting and mapping right whale sightings (<http://gmfa.nb.ca/right-whale-sightings/>).

-DFO researchers are collaborating on international research including the MEOPAR project, incorporating passive acoustic monitoring (PAM) for multiple whale species, including NARW, on the Scotian Shelf (Hilary Moors-Murphy). In the Gulf of St. Lawrence, DFO researchers are conducting research on copepod abundance and distribution (Yvan Simard, Stéphane Plourde) and on the presence of right whales as detectable through PAM (Y. Simard).

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Population Estimate Calculation

We have developed standardized criteria that can be applied each year to get a low, middle (best estimate) and upper number of whales in the population as determined from Catalog data. One term needs to be explained to understand these numbers. Whales are given temporary intermatch codes if 1) two or more sightings match each other, and 2) neither have been matched to a catalog whale. Some of these whales will eventually be matched to existing cataloged whales and others will be determined to be “new” to the Catalog and assigned a number. Once an intermatch whale is given a Catalog number, or matched to another intermatch code whale, the intermatch code is made inactive.

LOWER

To determine the lower bound, we simply count the number of unique cataloged whales identified the year before. Because of delays in processing data, this number is lower than the eventual total number of whales seen alive in that year.

MIDDLE

The middle bound is determined by summing three categories:

- 1) All whales presumed to be alive in that year (i.e., seen in the last six years),
- 2) Intermatch whales that are likely to be added to the Catalog. This is calculated by first finding all intermatch codes that span two or more years (both those that are active and those that were matched and made inactive), removing all calves and any SEUS whales whose sightings span two years only because they are seen in December and January of the same field season. Then, we determine which of those intermatch whales have Catalog numbers and what percent of those were new to the catalog (i.e. had not been matched to an existing cataloged whale). The remaining, unidentified intermatch whales are then multiplied by that fraction to determine how many are likely new to the Catalog (e.g., if only 20% of the matched intermatch whales were new, then 20% of the unmatched intermatched whales are likely new). That number is then added to the count of calves born more than two years earlier that are unmatched with active intermatch codes (indicating there is enough information to potentially match them in the future). Process changed Oct. 2009.
- 3) Calves from the last two years that have not been cataloged. We make an assessment of whether there is enough photographic information to match them to future sightings and thus assign them a Catalog number. We then sum those that will likely be cataloged.

UPPER

The upper bound is also the sum of three categories:

- 1) All Cataloged whales minus those whose carcasses were identified.
- 2) All active intermatch whales minus calves from the last two years.
- 3) All calves from the last two years minus those known to be dead.