North Atlantic Right Whale *(Eubalaena glacialis)* Mortality Event in the Gulf of St. Lawrence, 2017

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[3] *Zoo de Granby, Granby, QC, J2G 5P3, Canada*
[4] *Marine Animal Response Society, Halifax, NS, B3H 3A6, Canada*
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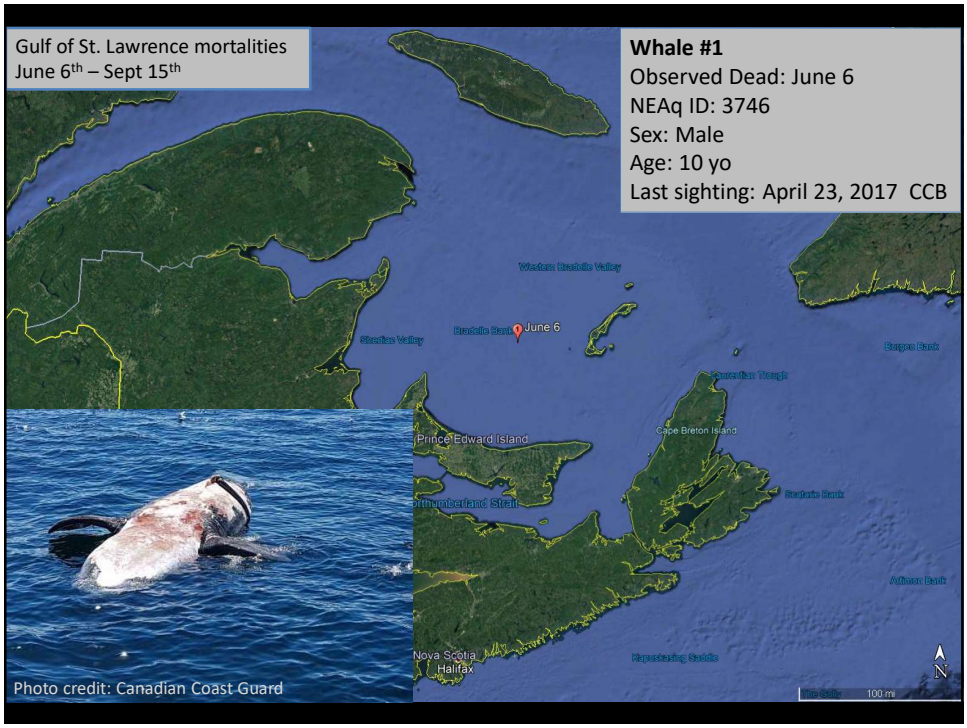
twimmer@marineanimals.ca

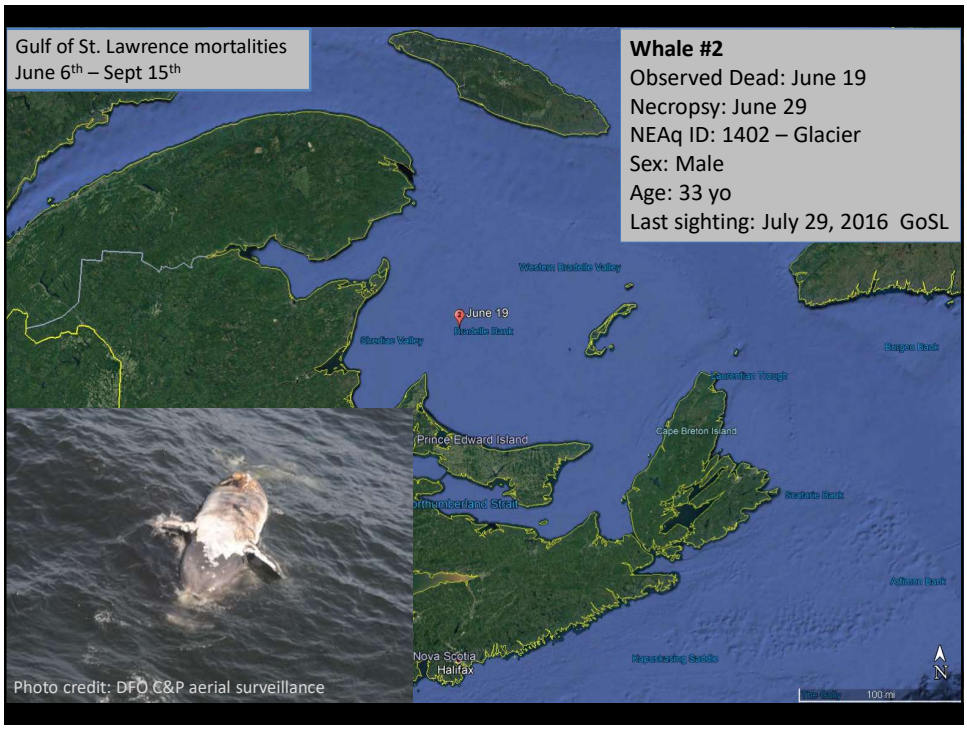
In 2017, an unprecedented mortality event occurred in the Gulf of St. Lawrence. Between June 6 – Sept 15, 2017, twelve endangered North Atlantic right whales were found dead at sea or along the shores of western Newfoundland. During the same period, five live, entangled right whales were also observed. Two of these animals were disentangled and a re-sighting of another animal indicated it had shed the gear on its own. The fate of the remaining two animals is unknown. Seven necropsies were performed on whales brought to shore in Norway PEI, the Magdalen Islands, Québec, and Miscou Island, New Brunswick. Based on necropsy findings, four animals were considered to have died acutely as a result of trauma likely caused by vessel collisions. One animal was confirmed to have died from a chronic entanglement in fishing gear. Changes observed in the carcasses on which these conclusions were based were interpreted as antemortem. The cause of death of one animal could not be determined because of advanced post mortem decomposition, but some observations in this animal suggested blunt trauma. The necropsy results of the entangled animal necropsied on September 19, 2017 are not yet available as analyses are pending, although the nature of the entanglement and the animal's body condition suggest that entanglement was the cause of death. An eighth animal was sampled at-sea on June 22 and although cause of death could not be determined without a necropsy, limited samples obtained from this carcass suggested an acute death. No evidence was found to support the involvement of biotoxins, infectious diseases, or starvation as the primary causes of mortality in this investigation. Samples for genetic analysis were obtained from all the necropsied and sampled animals, including the four carcasses which came ashore in western Newfoundland. Genetic and photographic analyses conducted confirmed there were 12 individual whales involved in this incident to date. Necropsy findings of blunt force trauma and entanglement coincide with high levels of fisheries activity and maritime traffic in the Gulf of St. Lawrence. The investigations confirm that vessel strikes and entanglement in fishing gear continue to be the key threats to the recovery of North Atlantic right whales. These results also indicate that these threats are present in the Gulf of St. Lawrence, an area not previously focused on for the protection and recovery of this endangered species. More work is urgently needed to understand right whale habitat use in the Gulf of St. Lawrence, as well as the human activities in these waters and their risk to right whales, to prevent further deaths.

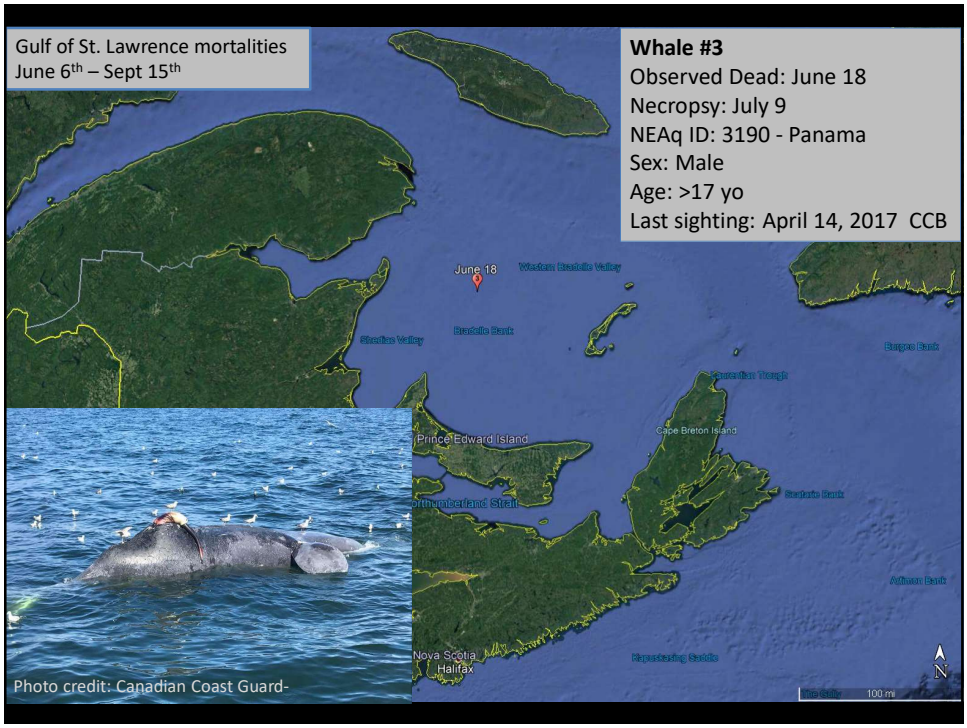
Incident Report for the North Atlantic Right Whale Mortality Event in the Gulf of St. Lawrence, 2017

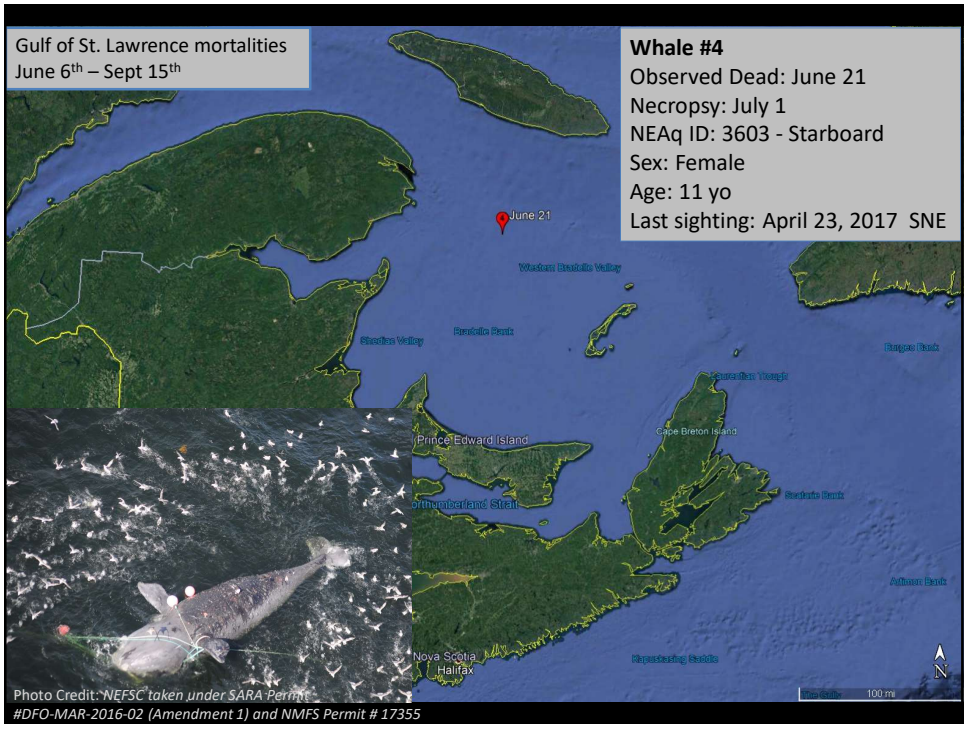

CANADIAN WILDLIFE HEALTH COOPERATIVE
RÉSEAU CANADIEN POUR LA SANTÉ DE LA FAUNE
Pêches et Océans Canada
Fisheries and Oceans Canada
North Atlantic Right Whale (Eubalaena glacialis)
Mortality Event in the Gulf of St. Lawrence, 2017
Pierre-Yves Daoust, Émilie Couture,
Tonya Wimmer, Laura Bourque,
Stephanie Ratelle and Matt Hardy

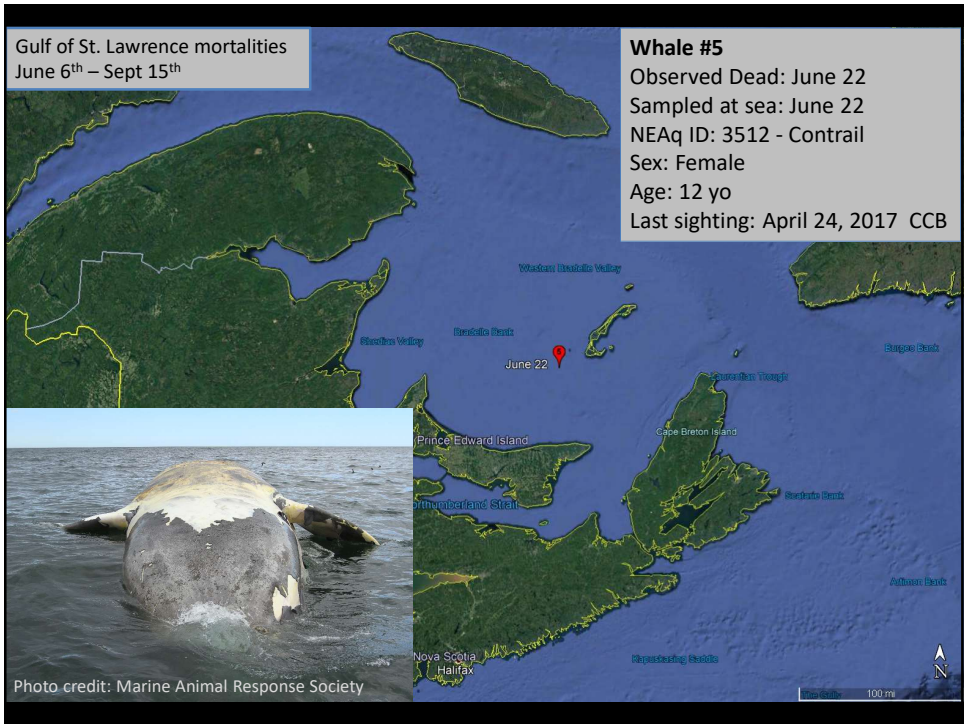

Quebec
Gulf of
St. Lawrence
Newfoundland
Magdalen
Islands
New Brunswick
Prince Edward
Island
Maine
Grand
Banks
Bay of Fundy
Nova Scotia
Scotian Shelf

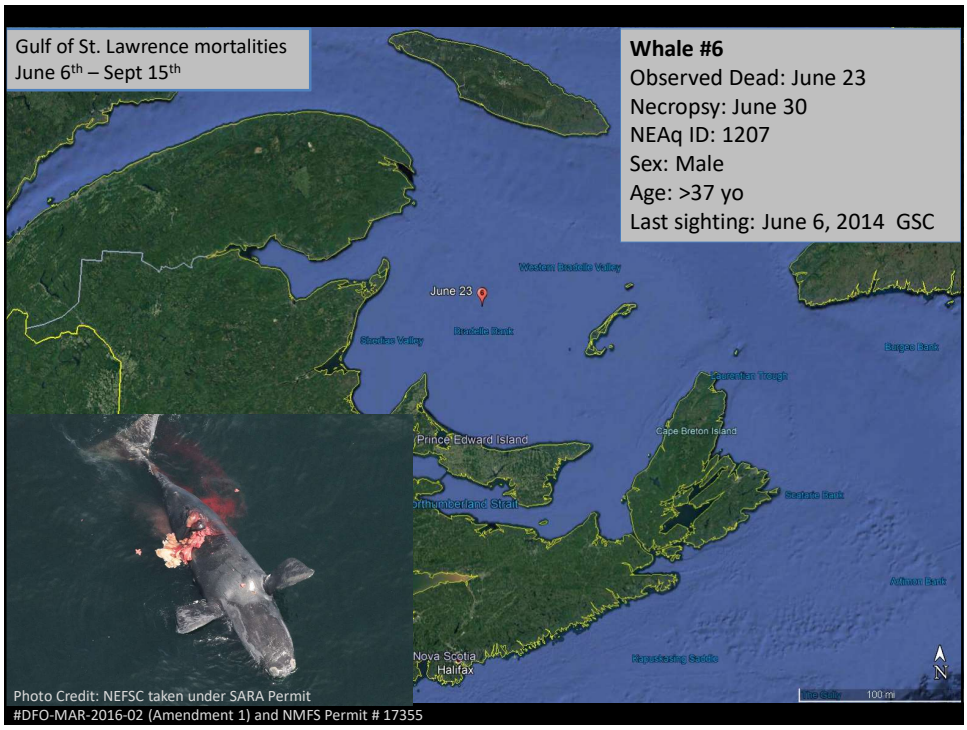

Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #1
Observed Dead: June 6
NEAq ID: 3746
Sex: Male
Age: 10 yo
Last sighting: April 23, 2017 CCB
June 6
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo credit: Canadian Coast Guard

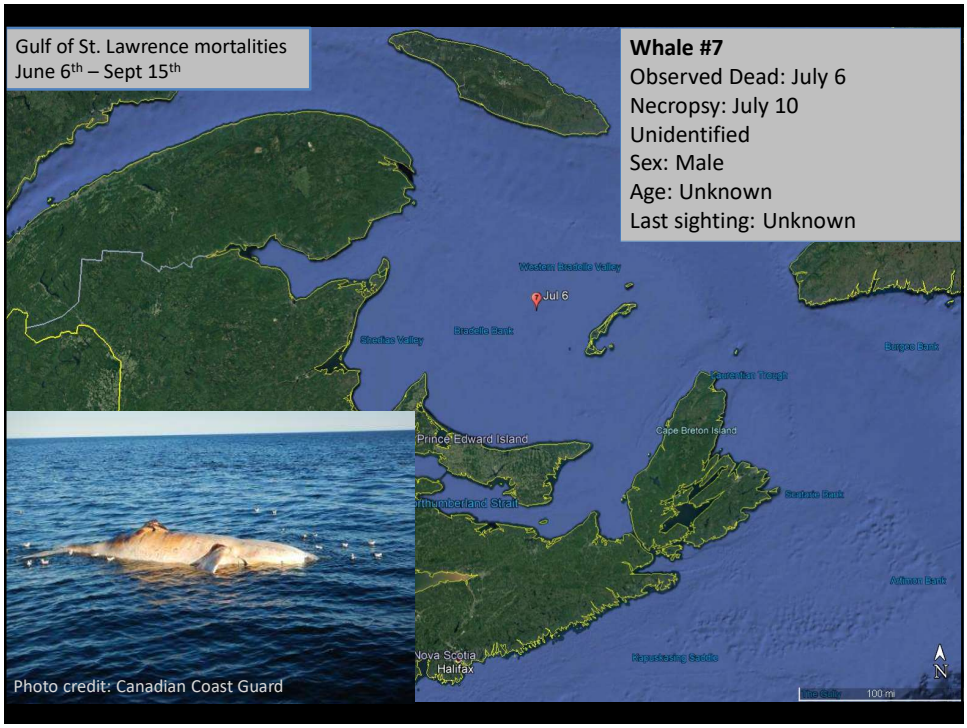

Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #2
Observed Dead: June 19
Necropsy: June 29
NEAq ID: 1402 – Glacier
Sex: Male
Age: 33 yo
Last sighting: July 29, 2016 GoSL
June 19
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo credit: DFO C&P aerial surveillance

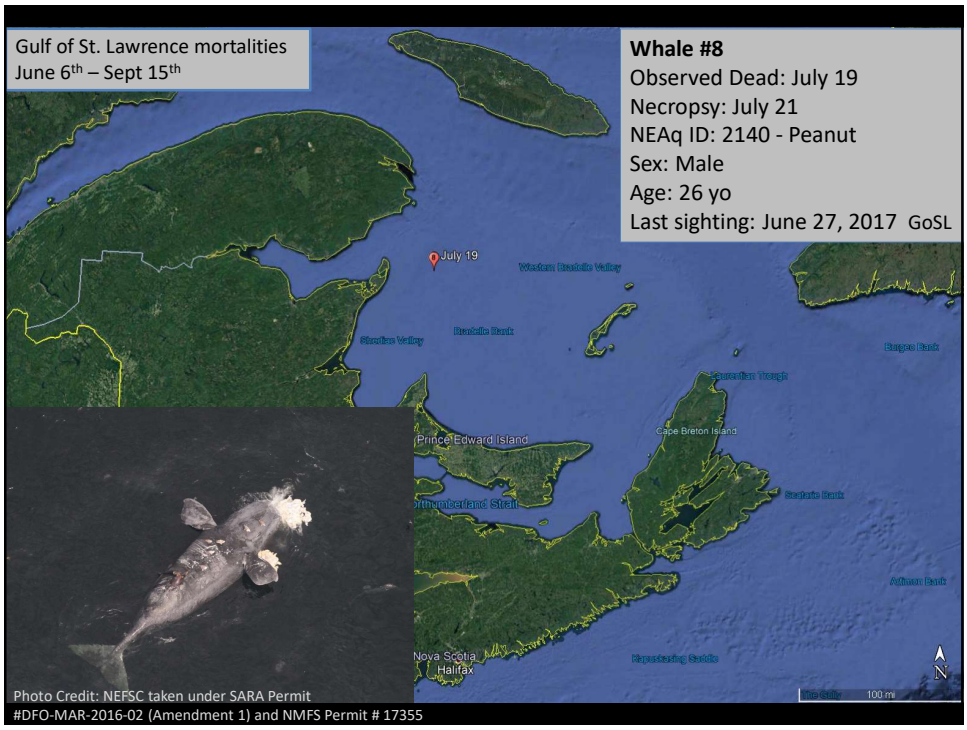

Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #3
Observed Dead: June 18
Necropsy: July 9
NEAq ID: 3190 - Panama
Sex: Male
Age: >17 yo
Last sighting: April 14, 2017 CCB
June 18
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo credit: Canadian Coast Guard-

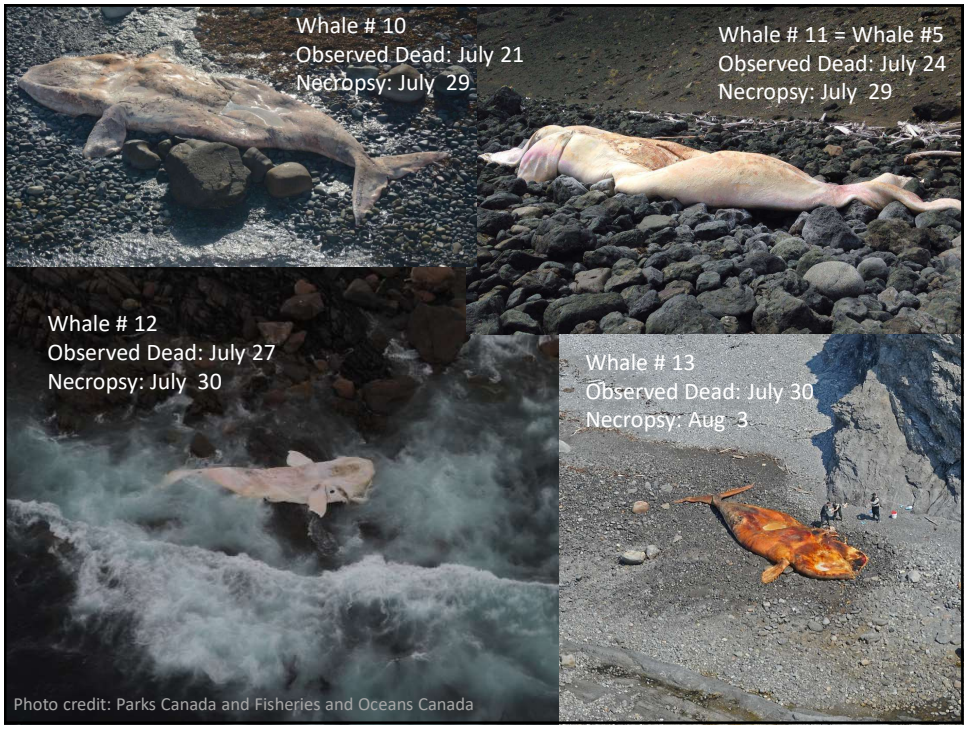

Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #4
Observed Dead: June 21
Necropsy: July 1
NEAq ID: 3603 - Starboard
Sex: Female
Age: 11 yo
Last sighting: April 23, 2017 SNE
June 21
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo Credit: NEFSC taken under SARA Permit
#DFO-MAR-2016-02 (Amendment 1) and NMFS Permit # 17355


Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #5
Observed Dead: June 22
Sampled at sea: June 22
NEAq ID: 3512 - Contrail
Sex: Female
Age: 12 yo
Last sighting: April 24, 2017 CCB
June 22
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo credit: Marine Animal Response Society

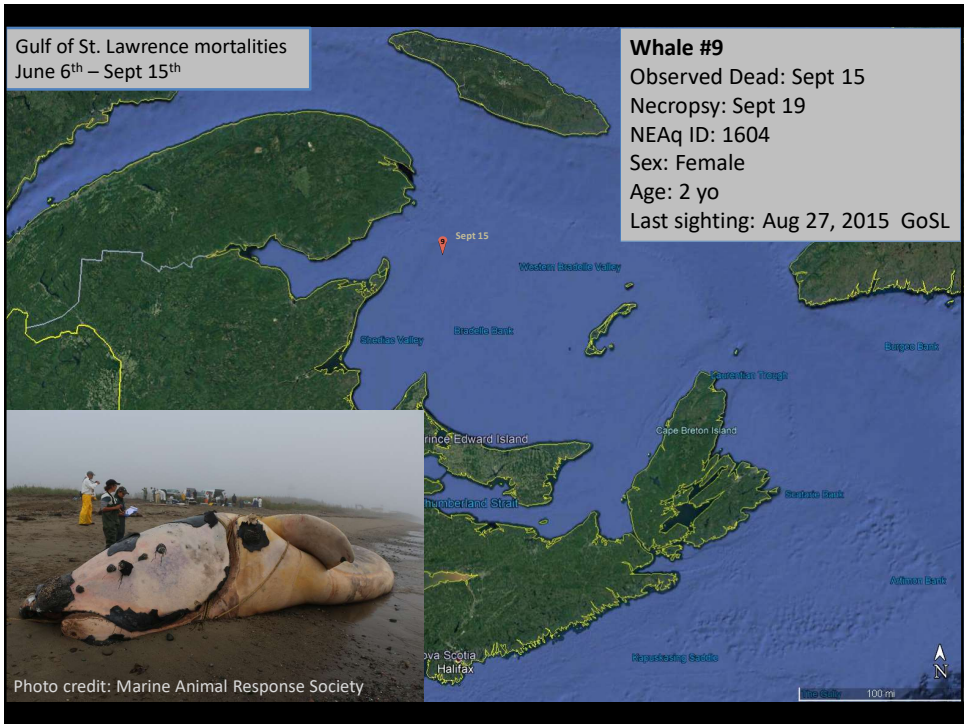

Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #6
Observed Dead: June 23
Necropsy: June 30
NEAq ID: 1207
Sex: Male
Age: >37 yo
Last sighting: June 6, 2014 GSC
June 23
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo Credit: NEFSC taken under SARA Permit
#DFO-MAR-2016-02 (Amendment 1) and NMFS Permit # 17355


Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #7
Observed Dead: July 6
Necropsy: July 10
Unidentified
Sex: Male
Age: Unknown
Last sighting: Unknown
Jul 6
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo credit: Canadian Coast Guard


Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #8
Observed Dead: July 19
Necropsy: July 21
NEAq ID: 2140 - Peanut
Sex: Male
Age: 26 yo
Last sighting: June 27, 2017 GoSL
July 19
Prince Edward Island
Cape Breton Island
Nova Scotia
Halifax
Photo Credit: NEFSC taken under SARA Permit
#DFO-MAR-2016-02 (Amendment 1) and NMFS Permit # 17355


Whale # 10
Observed Dead: July 21
Necropsy: July 29
Whale # 11 = Whale #5
Observed Dead: July 24
Necropsy: July 29
Whale # 12
Observed Dead: July 27
Necropsy: July 30
Whale # 13
Observed Dead: July 30
Necropsy: Aug 3
Photo credit: Parks Canada and Fisheries and Oceans Canada


5 Live Entangled whales
Observed: July 5 – Aug 28
2 disentangled by J. Howlett
1 shed gear
2 no response permitted
Photo credit: NEFSC taken under SARA Permit #DFO-MAR-2016-02 (Amendment 1) and NMFS Permit # 17355


Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Whale #9
Observed Dead: Sept 15
Necropsy: Sept 19
NEAq ID: 1604
Sex: Female
Age: 2 yo
Last sighting: Aug 27, 2015 GoSL
Sept 15
Prince Edward Island
Cape Breton Island
Halifax
Photo credit: Marine Animal Response Society

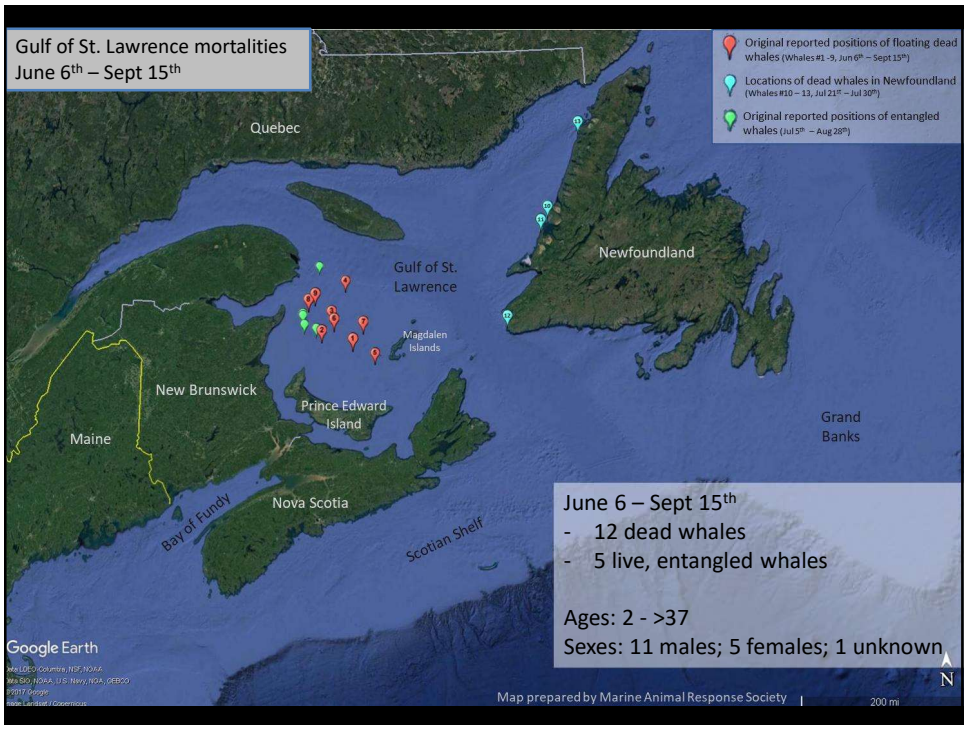

Gulf of St. Lawrence mortalities
June 6th – Sept 15th
Original reported positions of floating dead whales (Whales #1 -9, Jun 6th – Sept 15th)
Locations of dead whales in Newfoundland (Whales #10 – 13, Jul 21st – Jul 30th)
Original reported positions of entangled whales (Jul 5th – Aug 28th)
Quebec
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
New Brunswick
Prince Edward Island
Maine
Nova Scotia
Bay of Fundy
Scotian Shelf
Grand Banks
June 6 – Sept 15th
- 12 dead whales
- 5 live, entangled whales
Ages: 2 - >37
Sexes: 11 males; 5 females; 1 unknown
Google Earth
Map prepared by Marine Animal Response Society

Photo credit: Marine Animal Response Society

Attempted at sea sampling

Photo credit: Marine Animal Response Society

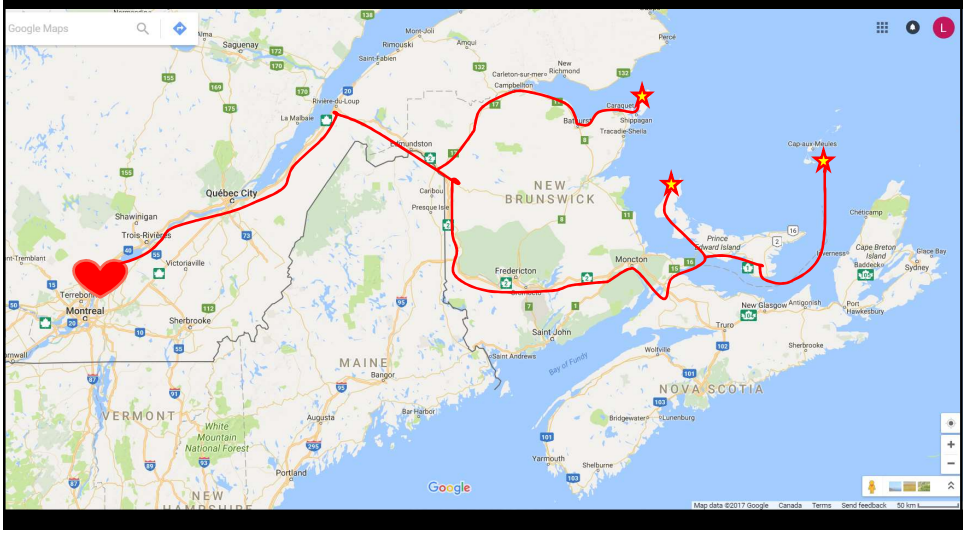
Photo credit: Marine Animal Response Society

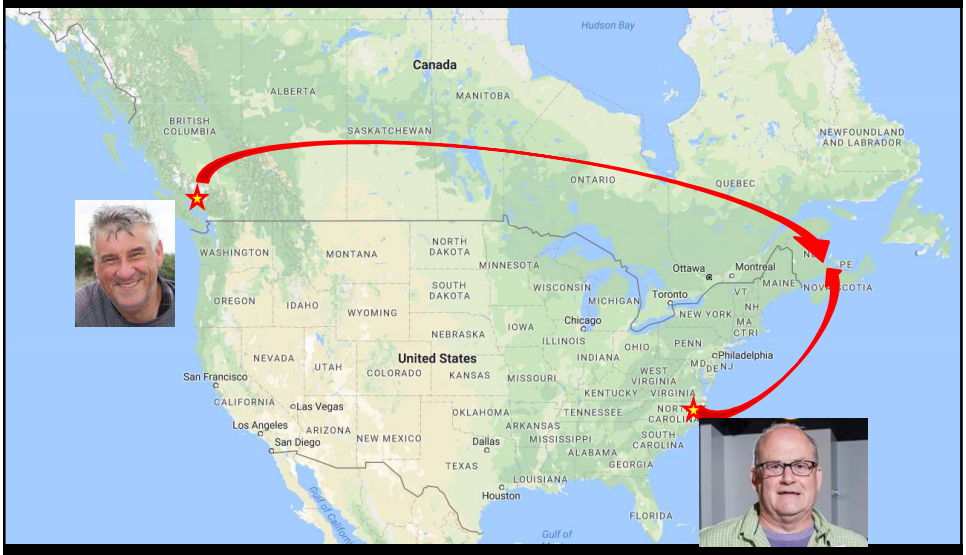
Photo credit: Marine Animal Response

How to attempt 7 NARW necropsies?

7 necropsies
3 months
3 provinces

Locations of necropsy sites





Sampling and Tests

- Complete necropsy for each NARW
- Limited sampling at times do to decomposition
- Extensive photo documentation

Sampling for:

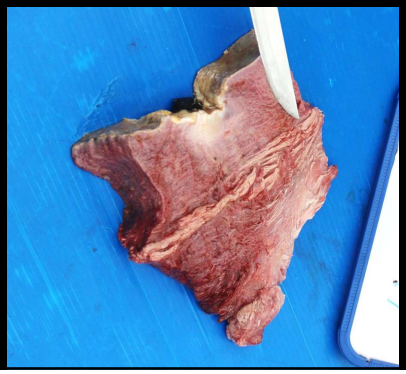
- Fecal glucocorticoids
- Biotoxins
- Histology (limited)
- Genetics
- Research samples

Results

- 2 entanglements
  - One confirmed as chronic entanglement
  - One report pending
- 4 blunt trauma
- 1 undetermined cause of death (decomposition)
  - Some observations suggestive of blunt trauma

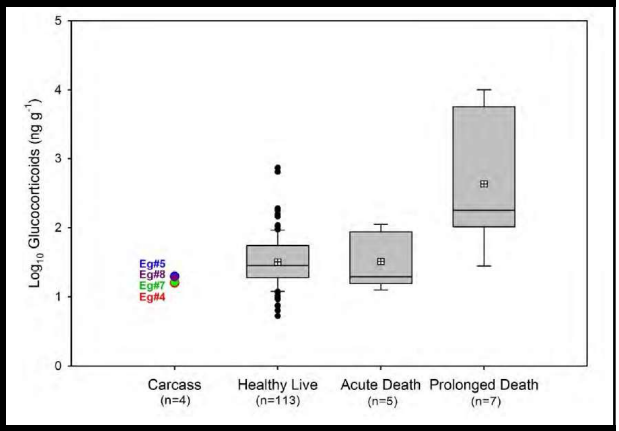
Main observations: Entanglement NARW #4

- Thin body condition
- Scar tissue
- Fishing gear
- Erosions



Fecal Glucocorticoids

Fecal Glucocorticoids were low in NARW #4
- Poor sample?

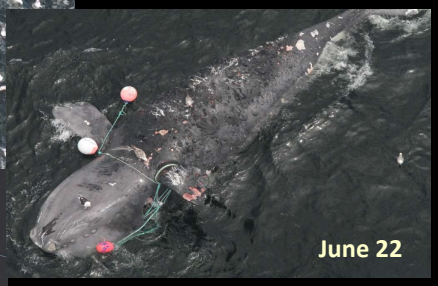


Roland et al. 2017, annex 8

Samples are pending for NARW #9 (also entangled) → Elevated?

Gear Entanglement – Whale #4

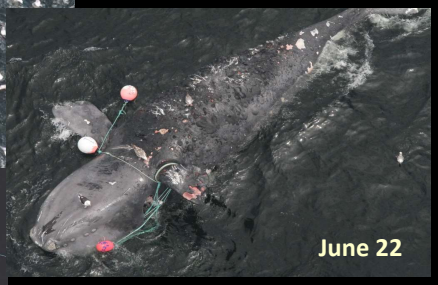
GEAR: SNOW CRAB



GEAR REMOVED AT TOWING:
- **Two snow crab traps** removed by C&P at towing (fisherman reported 4 traps on animal earlier)
- **Two buoys:** large, white, spherical shaped poly buoy (estimated size= A4) and a large, orange, spherical shaped poly buoy (estimated size=A3)

Gear Entanglement – Whale #4

GEAR: SNOW CRAB



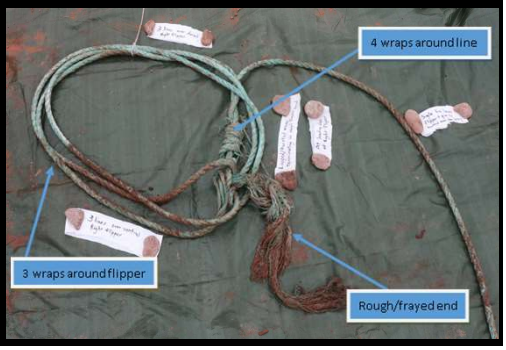
TIMELINE:

- June 12 – 16 : Initial known entanglement
- June 16 - 21 : traveled ~8.8nm and entangled in 2nd set of gear
- June 21 : animal first observed dead by a NOAA Fisheries, 0.12nm east of the final trap set location

Gear Entanglement – Whale #4

GEAR REMOVED AT NECROPSY:

- **30.2 m rope:**
  1) approximately 21.8m of 5/8" float rope
  2) approximately 3.7m of ¾" sink line
  3) approximately 4.5m of ½" float rope
- **2 buoys:**
  - orange, Polyform LD-2 cylindrical
  - red, hard plastic cylindrical



Gear Entanglement – Whale #9

Gear Entanglement – Whale #9

- **3 ropes spliced into 1**
- **~150m**
- **Gauge 3/4" – 7/8"**
- **Older-style trap**

Main observations
Blunt trauma – 4 whales

- Hemorrhage
  - ’Putty-like material’ – clotted / putrified blood
  - **Large amounts**
    - Thoracic cavity (Eg #6, Eg #8)
    - Vertebral canal (Eg #2)
    - Occipital foramen (Eg#2, Eg#6)

Hemorrhage – large quantity

Hemorrhage – large quantity

Hemorrhage – large quantity

Main observations
Blunt trauma – 4 whales

- Hemorrhage
  - Dark, 'putty-like material' – clotted / cooked blood
  - Large amounts
  - **Smaller amounts**
    - **Muscle masses (Eg #7)**
    - **Thoracic cavity (Eg #7)**

Hemorrhage – small quantity

Main observations
Blunt trauma – 4 whales

- Hemorrhage
  - Dark, 'putty-like material' – clotted / cooked blood
  - Large amounts
  - Smaller amounts
  - **<u>Association with fractures / luxations*</u>**
    - **Luxation vertebral column (Eg #2)**
    - **Petro-tympanic complexes (Eg #6, 7, 8)**

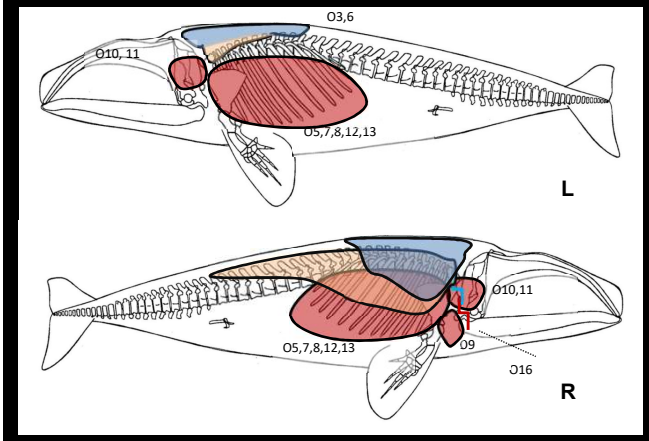
Main observations
Blunt trauma

- **<u>Contusions</u>** (Eg# 2,6,7,8)
  - Gelatinous hemorrhagic tissue between blubber and muscle
  - Blubber

Main observations
Blunt trauma

- External evidence (Eg #7)
  - Lesions to rostrum (more fragile)
    - Oral lacerations
      - Probable implication of the oral *rete*, with massive external hemorrhage
    - Maxilla, premaxilla fracture

Distribution of observations suggestive of blunt trauma
Field # EG2017-06 Date 2017-06-30



Dislocation
O11: luxation of right atlanto-occipital joint on the right

Fracture
O16: right tympano-periotic complex, associated with putty material

Putty-like material
O5,7,8,12,13: whole thoracic region, liver and lung
O9: associated with rupture of right jugular vein
O10,11: occipital surface, foramen magnum, cranial cavity

Red-tinged gelatinous fluid
O6: right lateral wall, extends to level of prepuce

Blubber contusion
O3,6: right lateral wall

Main observations
Undetermined cause of death- Eg#3

- Lesions suggestive of blunt trauma
- BUT
  - Carcass beached and beat by the surf
  - Impossible to clearly determine the origin of changes

Underlying issues investigated
Emaciation / starvation

- Body condition
  - Relation with time of year
    (W.A. McLellan, UNC, *pers. comm.)*
  - 3 whales – robust condition
  - 2 whales – relatively thin
    - One – advanced decomposition
  - Entangled whale - emaciated

Whale	Blubber, mid-dorsal region (cm)	Blubber, mid-ventral region (cm)
EG#2		23
EG#3	12	15.5
EG#4	7.5	
EG#6		20.5
EG#7	17	12
EG#8	20	20.5

- **Not considered as a primary cause of death**

Underlying issues investigated
Biotoxin

- No unusual deaths in other species than right whales
- Phytoplankton /zooplankton
  - Phytoplankton
    - *Alexandrium* spp., *Dinophysis* spp., *Prorocentrum* spp., *Pseudo-nitzschia* spp
    - low abundance, at some stations only
  - Zooplankton
    - Tested negative for PSP (except trace concentration in a 8/34 samples)
- Animal samples
  - No toxins detected, in any specimen submitted
- Chronic exposure to sub-lethal levels – unlikely

- **Primary implication in mortality event unlikely**

Underlying issues investigated
Infectious disease

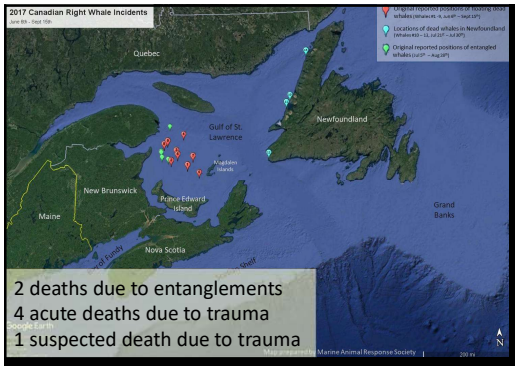
- Internal organs
  - Decomposition
  - Absent
- No gross lesion suggestive of an infectious – inflammatory process

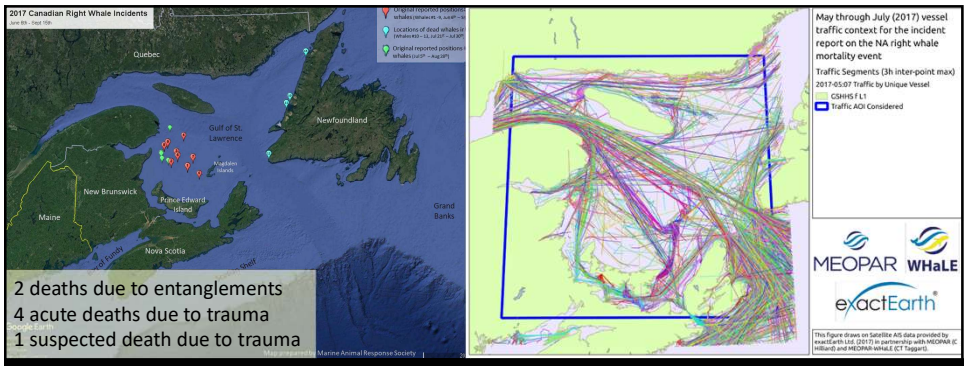
- **Cannot be ruled out, but unlikely primary cause of mortality**

Conclusion

- **Entanglement in fishing gear, blunt trauma are the cause of death for at least 6 NARW* carcasses found in the Gulf of St. Lawrence over summer 2017**

- No underlying condition identified
- **Human activity (fishing, maritime traffic) considered as primary cause of death**


2017 Canadian Right Whale Incidents
Quebec
Gulf of St. Lawrence
Newfoundland
New Brunswick
Prince Edward Island
Maine
Nova Scotia
Grand Banks
2 deaths due to entanglements
4 acute deaths due to trauma
1 suspected death due to trauma
Google Earth
Marine Animal Response Society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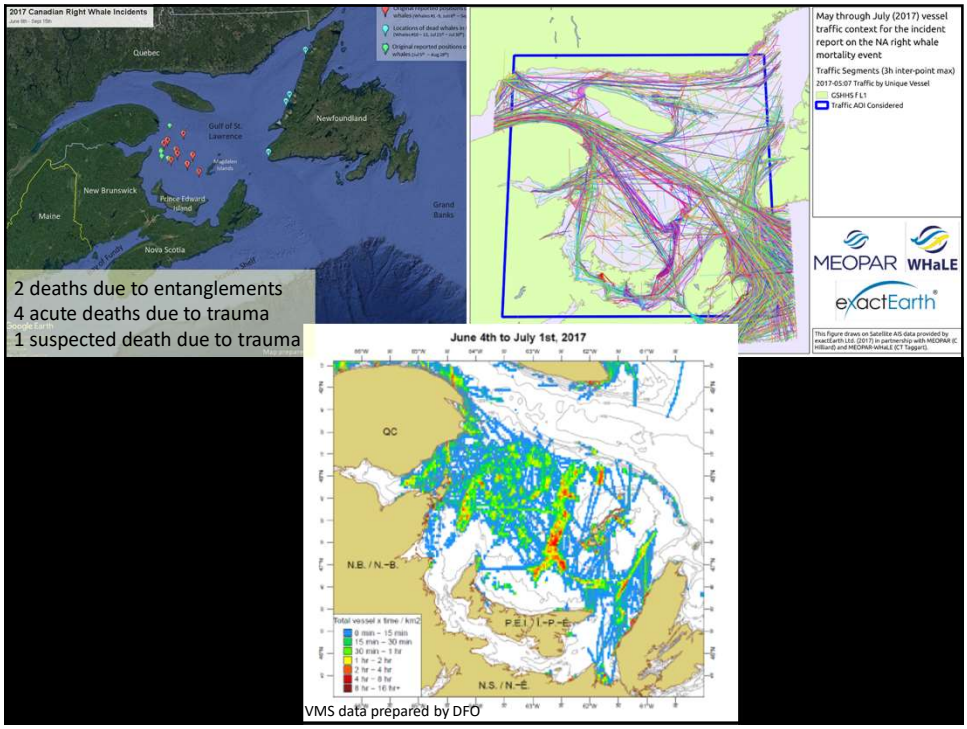
Marine Animal Response Society
May through July (2017) vessel traffic context for the incident report on the NA right whale mortality event
Traffic Segments (3h inter-point max)
2017-05:07 Traffic by Unique Vessel
GSHHS f L1
Traffic AOI Considered
MEOPAR
WHaLE
exactEarth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May through July (2017) vessel traffic context for the incident report on the NA right whale mortality event
Traffic Segments (3h inter-point max)
2017-05:07 Traffic by Unique Vessel
CSHIS F L1
Traffic AOI Considered
MEOPAR
WHaLE
exactEarth
June 4th to July 1st, 2017
QC
N.B. / N.-B.
P.E.I. / I.-P.-É.
N.S. / N.-É.
Total vessel x time / km2
0 min - 15 min
15 min - 30 min
30 min - 1 hr
1 hr - 2 hr
2 hr - 4 hr
4 hr - 8 hr
8 hr - 16 hr+
VMS data prepared by DFO


Conclusions and Path Forward
Photo credit: Marine Animal Response Society

Conclusions

- 12 right whale found dead and 5 live-entanglements in GoSL in 2017
- 2 died from entanglement in fishing gear
- 4 had findings were compatible with acute death due to trauma
- 1 COD could not be determined; some observations suggest blunt trauma

Path Forward

To maximize information which can be obtained, it is imperative a prompt identification, reporting, and response to such mortalities occurs

- A lot of challenges: logistics, communications, lack of funding = chronic problem
- Exceptional teams and a lot of support

Path Forward

- **This is not a new problem, not for right whales nor other species in Canada**
- **A very serious problem – 458 individual whales, 5 calves born, 15 deaths 2017**
- **Prevention and collaboration is required!**
- **An international working group is essential!**

Many thanks to: Lennox Island First Nation, Elsipogtog First Nation, Esgenoopetitj First Nation, University of PEI- Atlantic Veterinary College, Université de Montréal- Faculté de médecine vétérinaire, Granby Zoo, Canadian Coast Guard, British Columbia's Ministry of Agriculture and Lands, Animal Health Center/CWHC British Columbia, University of North Carolina Wilmington, Dalhousie University (Halifax and Truro campus), Trent University, New Brunswick Museum, Canadian Food Inspection Agency, Canadian Whale Institute, Marine Mammal Commission, Centre for Coastal Studies, Woods Hole Oceanographic Institution, National Oceanographic and Atmospheric Administration, Campobello Whale Rescue Team, National Air Surveillance Program (NASP)- Marine Aerial Reconnaissance Team (MART), Transport Canada, Environment and Climate Change Canada, Department of National Defense, Province of New Brunswick, Province of Prince Edward Island, Province of Québec – Magdalen Islands, Whale/MEOPAR and Dr. Christopher Taggart, Anderson Cabot Center for Ocean Life at the New England Aquarium, Mingan Island Cetacean Study, Florida Fish and Wildlife Conservation Commission, and the Nova Scotia Department of Natural Resources