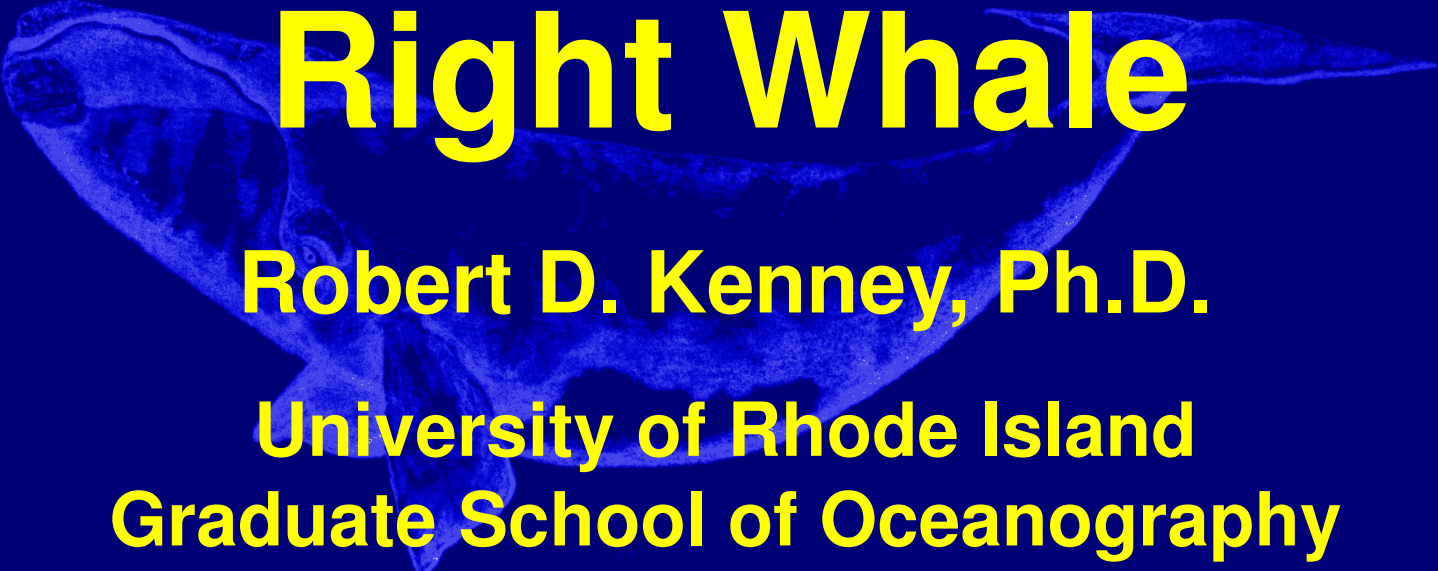


Introduction to the North Atlantic Right Whale



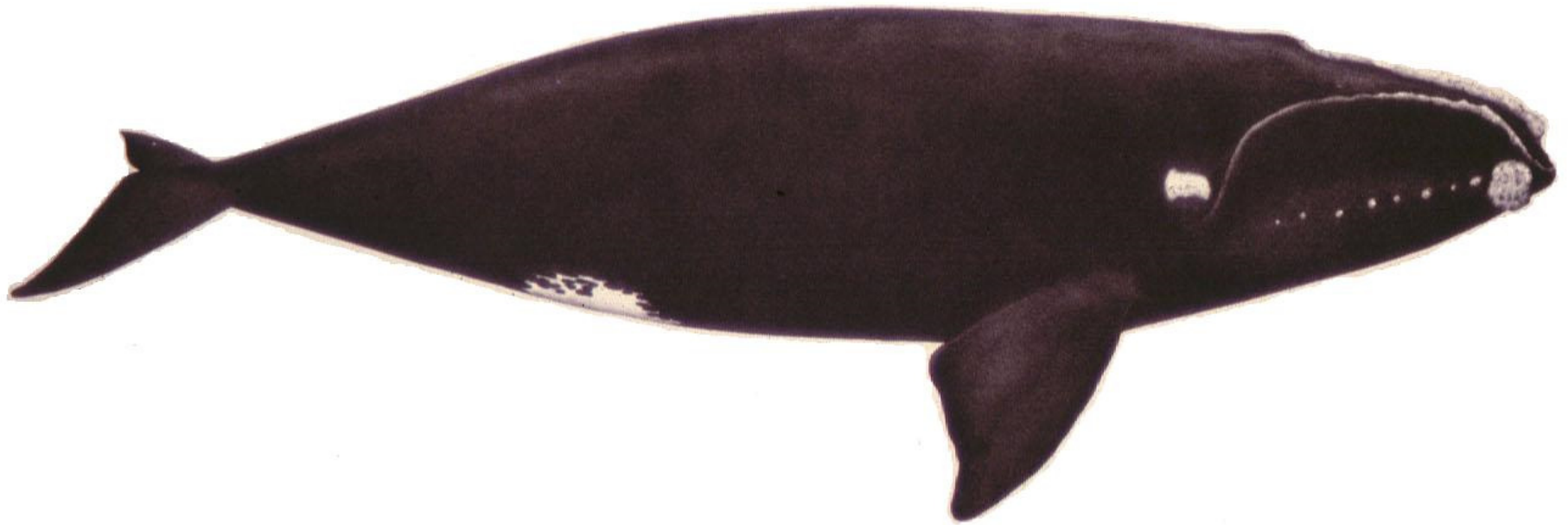
Robert D. Kenney, Ph.D.

**University of Rhode Island
Graduate School of Oceanography
&**

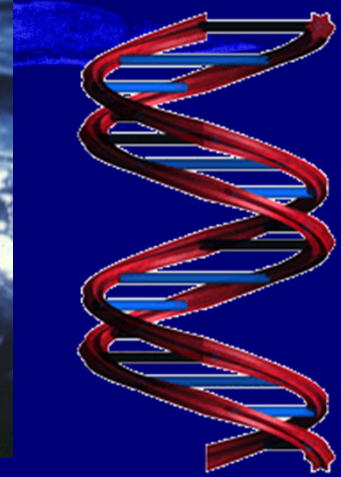
North Atlantic Right Whale Consortium (NARWC)

[Drawing in the slide backgrounds by Don Sineti]

North Atlantic Right Whale (*Eubalaena glacialis*)



- Adults are 35–55 feet long; newborns are 14–15 feet and grow fast, reaching 29–30 feet by weaning at about age 1.
- The top conservation priority, but only one of some three dozen marine mammal species from our region.



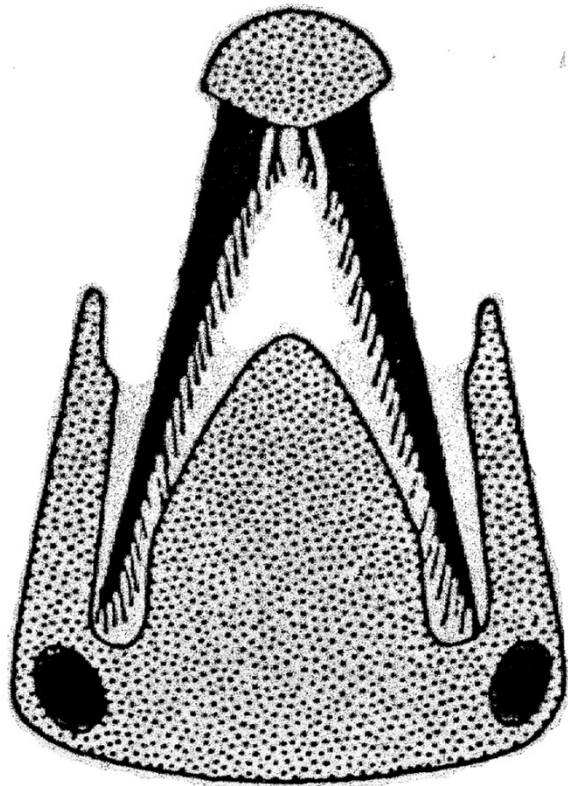
- Ability to identify each whale from photos (& DNA) gives us the means to understand the population's biology in great detail.
- “Callosity” patterns on the head are unique, like fingerprints.
- Black centers are thick, warty skin surrounded by thousands of white whale lice (inset is one, magnified).

NARWC PhotoID Catalog Summary

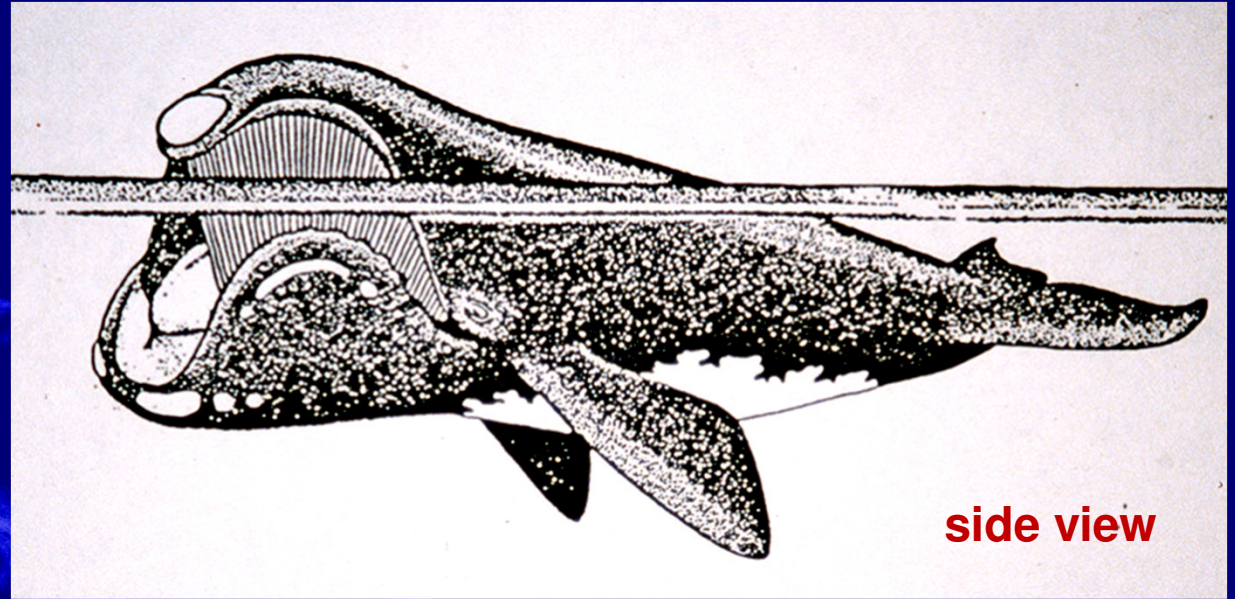
- ~90,000 sightings of identified whales (as of Aug. 2022)
- >2,000,000 photos (+ DNA profiles)
- 782 different whales (as of Mar. 23, 2023)
- 368 males, 323 female, 75 unknown sex (as of early 2021): sex ratio at birth is 50:50; females have significantly higher mortality rates than males. Of females reaching age 2, half will be dead in 20 years; for males that time is 35 years.
- 184 of the 323 females have given birth to at least one calf (up to 8 or more)

Accessible on-line at <http://rwcatalog.neaq.org>

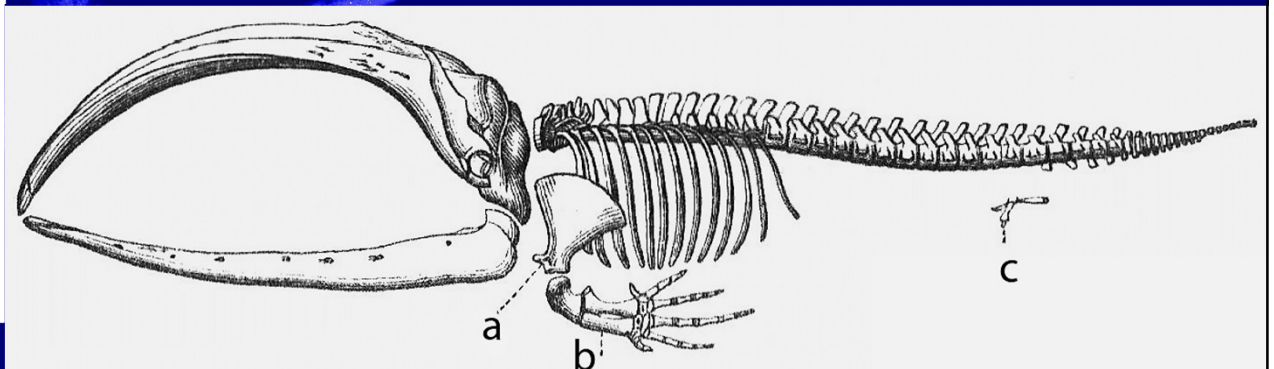
“Skim-feeder” – feed by swimming ahead with the mouth open. Water flows in between the two rows of baleen plates and out through the plates, filtering prey on the inside fringes.



x-section through head

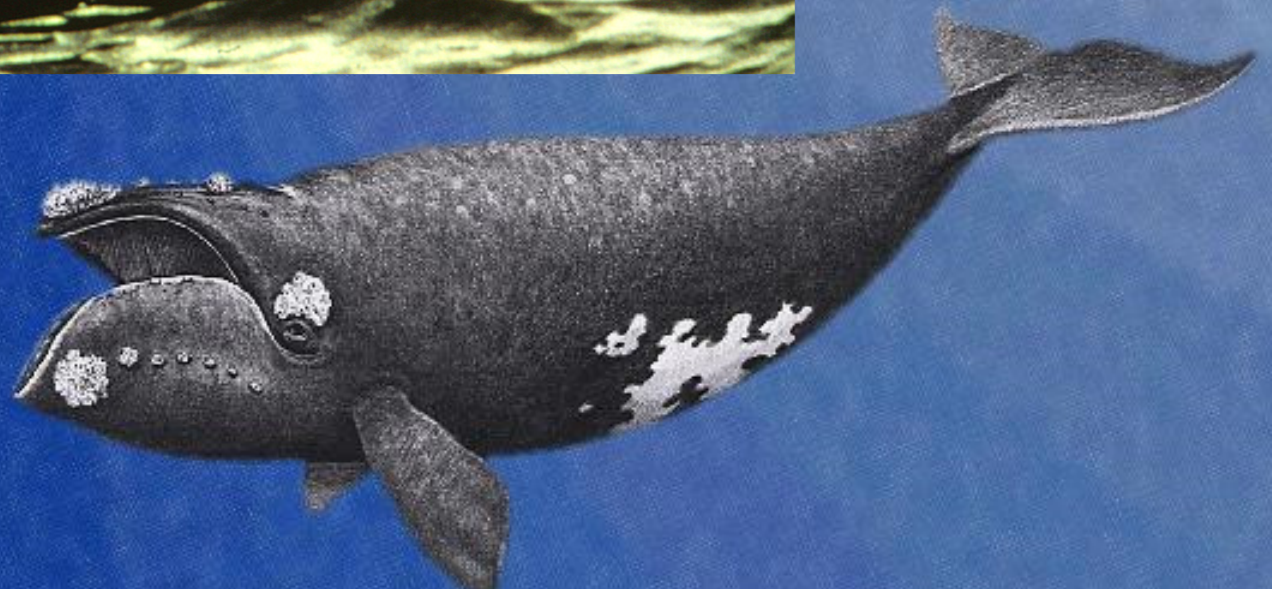
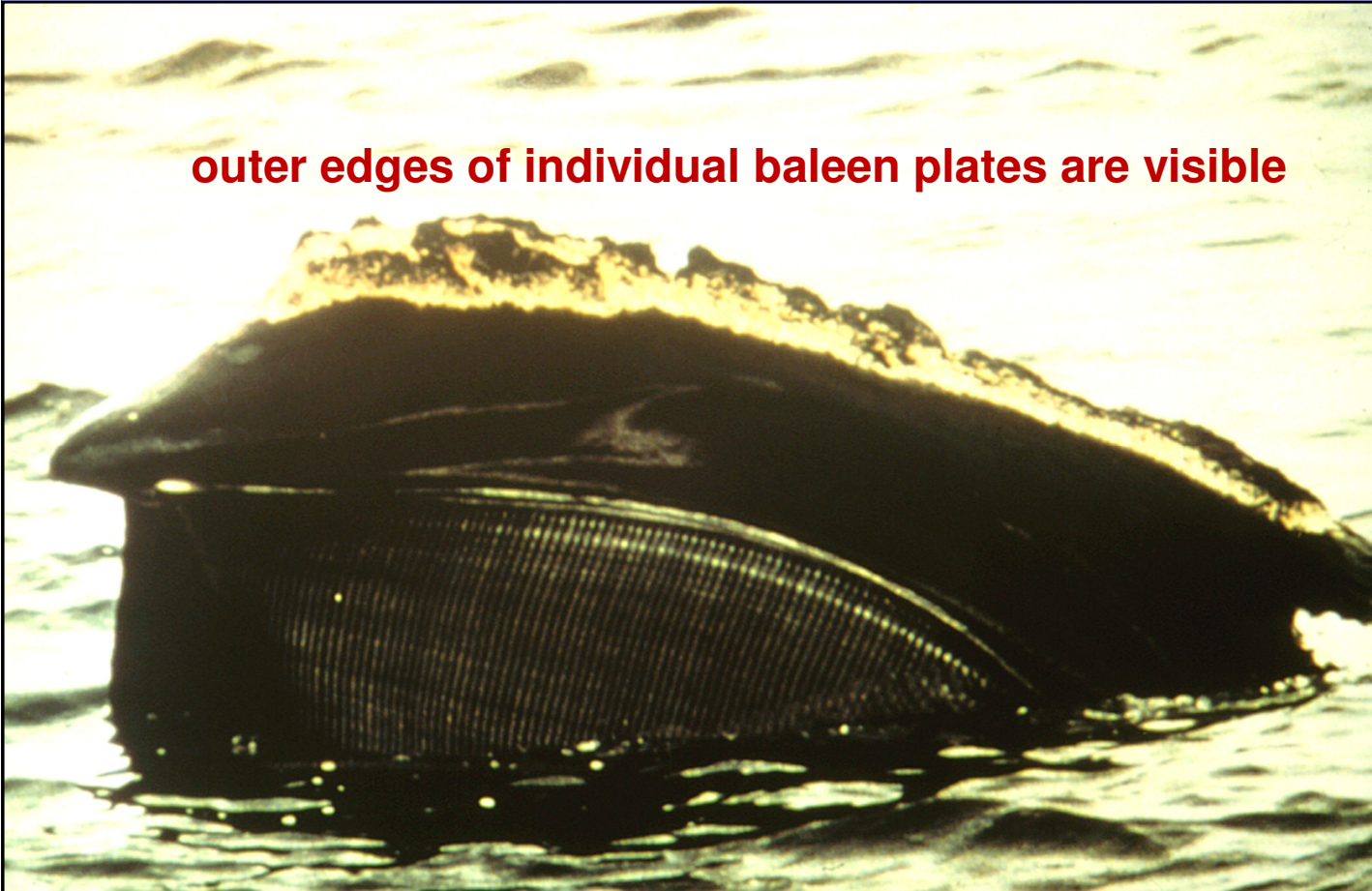


side view



bizarre skull to accommodate long baleen & feeding mode

outer edges of individual baleen plates are visible



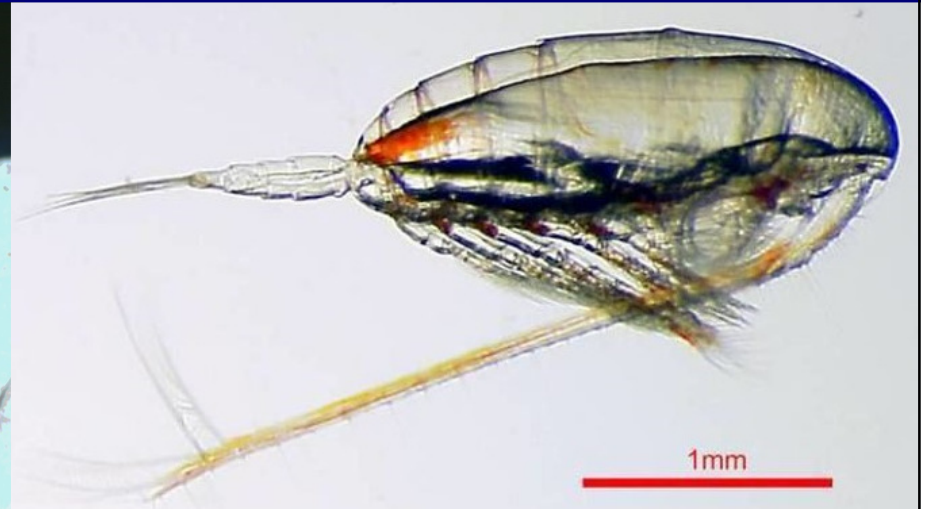


- Principal prey are large copepods, mainly *Calanus finmarchicus* – about the size of short-grain rice.
- A right whale is 50 billion times larger than its prey (like humans feeding on bacteria).

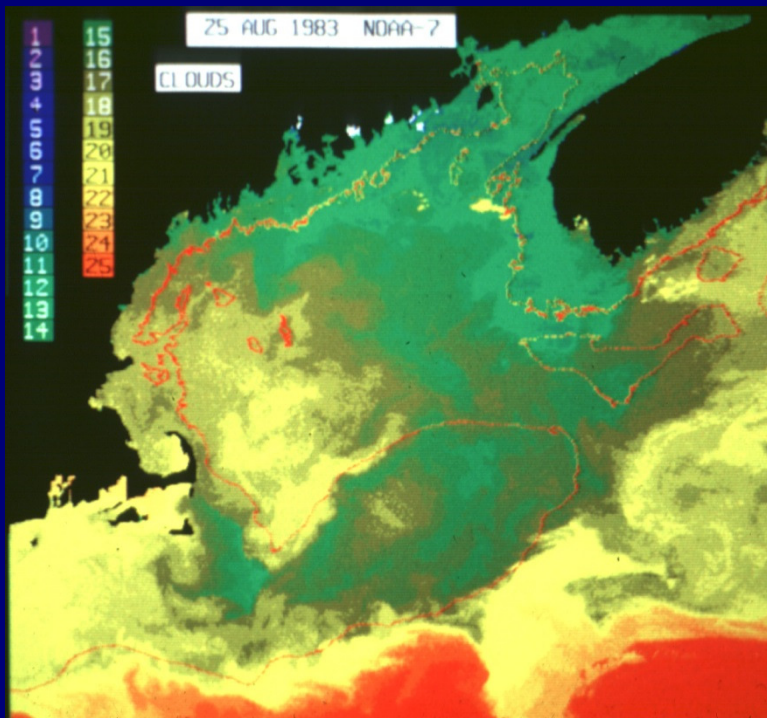
Right whales must find very dense zooplankton patches simply to break even on energy, even denser to successfully reproduce.



Sampling near feeding right whales finds the highest concentrations ever, which are 95–98% *Calanus*.



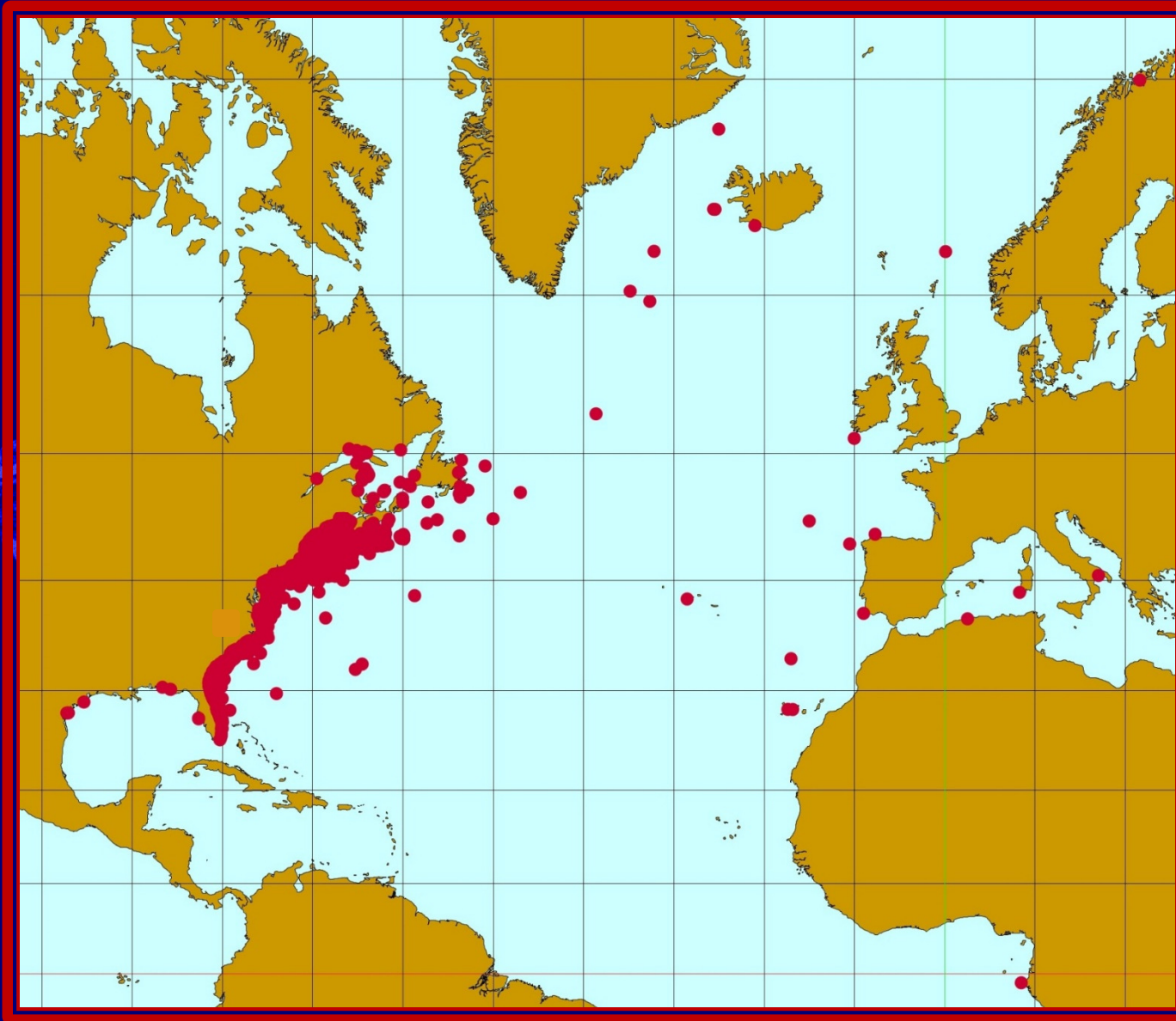
The whales are even pickier eaters, since they prefer the last of five juvenile stages: just the right size for filtering and filled with a big drop of rich oil that will be used to make eggs after molting to the adult stage.



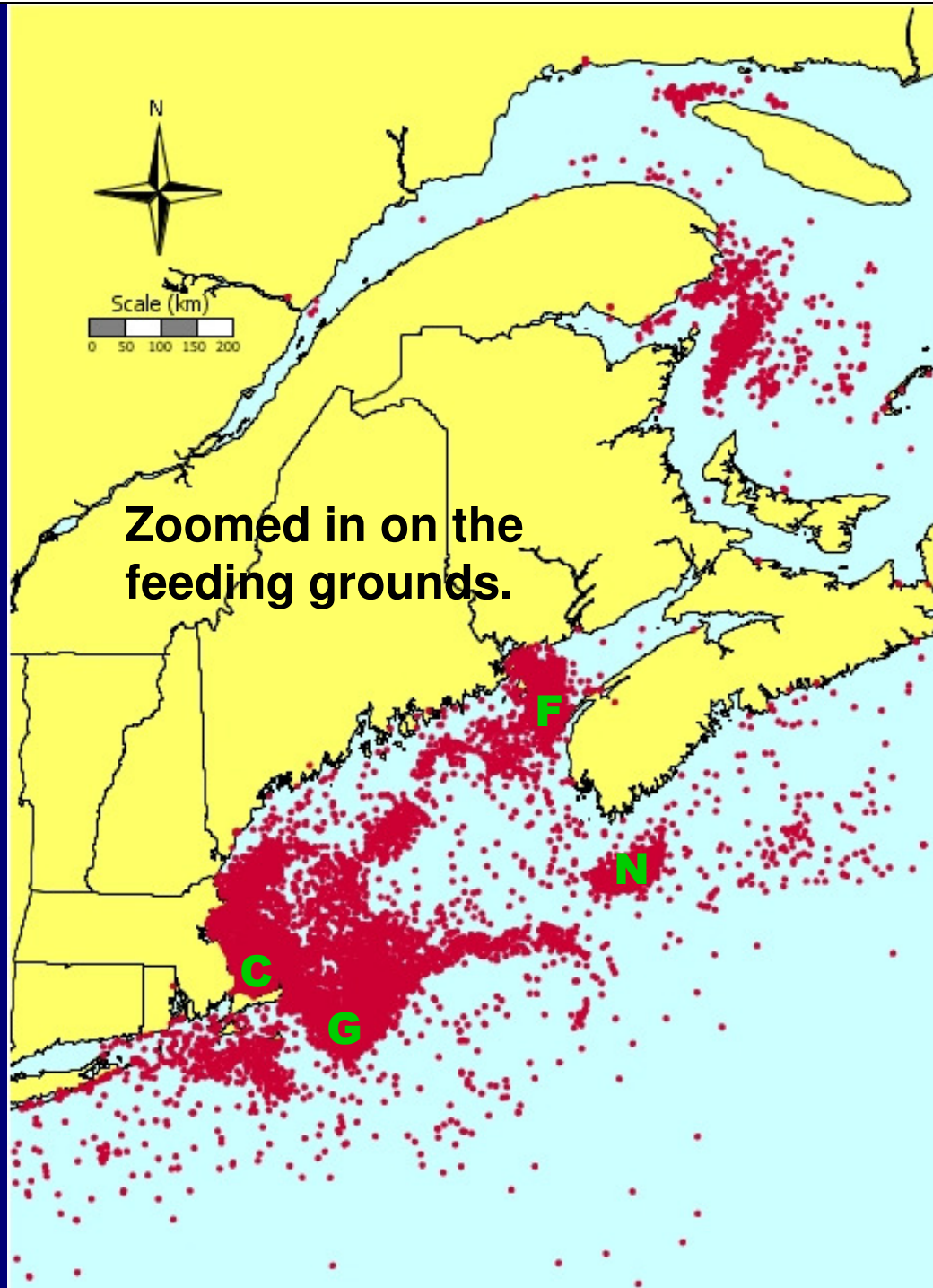
The processes that result in dense copepod patches in predictable feeding grounds are not the expected local food chain of nutrients—phytoplankton—zooplankton. Prey are concentrated mainly by physics in a very dynamic system: just the right combinations of currents, bottom topography, temperature, stratification, etc. working on widespread zooplankton populations.

The original range of the species prior to the beginning of commercial whaling in the Bay of Biscay (X) about 1,000 years ago.





The current range of sightings. Where good photos are available, whales on the eastern side are from the western population.



Calving ground:
GA/FL: Dec–Feb
(off this map)

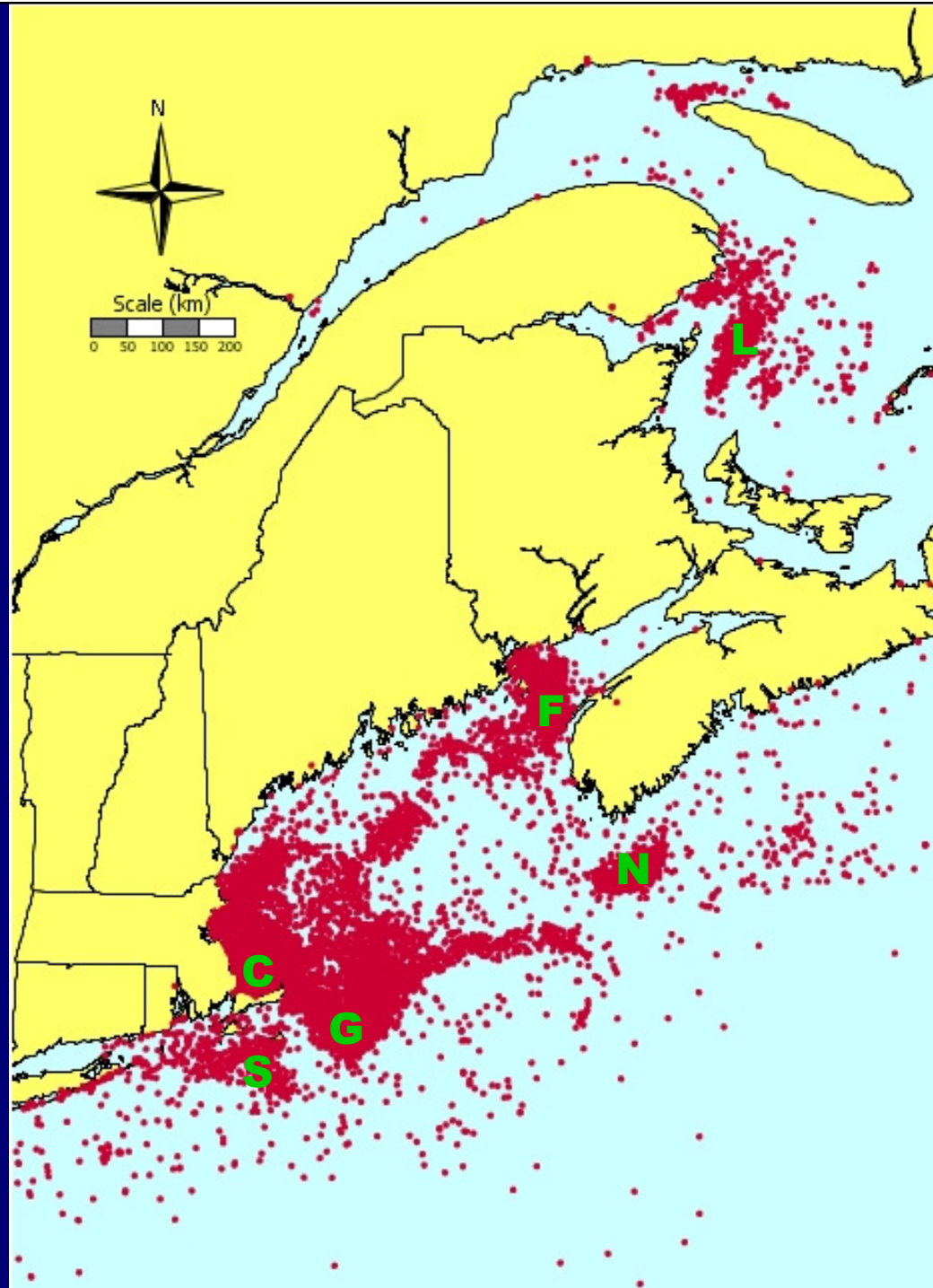
Feeding grounds
(1970s to 2010):

Cape Cod Bay:
Jan–Apr

Great South Chan-
nel: Apr–Jun

Bay of Fundy:
Jul–Oct

Nova Scotia Shelf:
Jun–Nov



Changes in feeding grounds from ~2010:

Cape Cod Bay:
more whales

Great South Channel:
fewer

Bay of Fundy:
almost none

Nova Scotia Shelf:
almost none

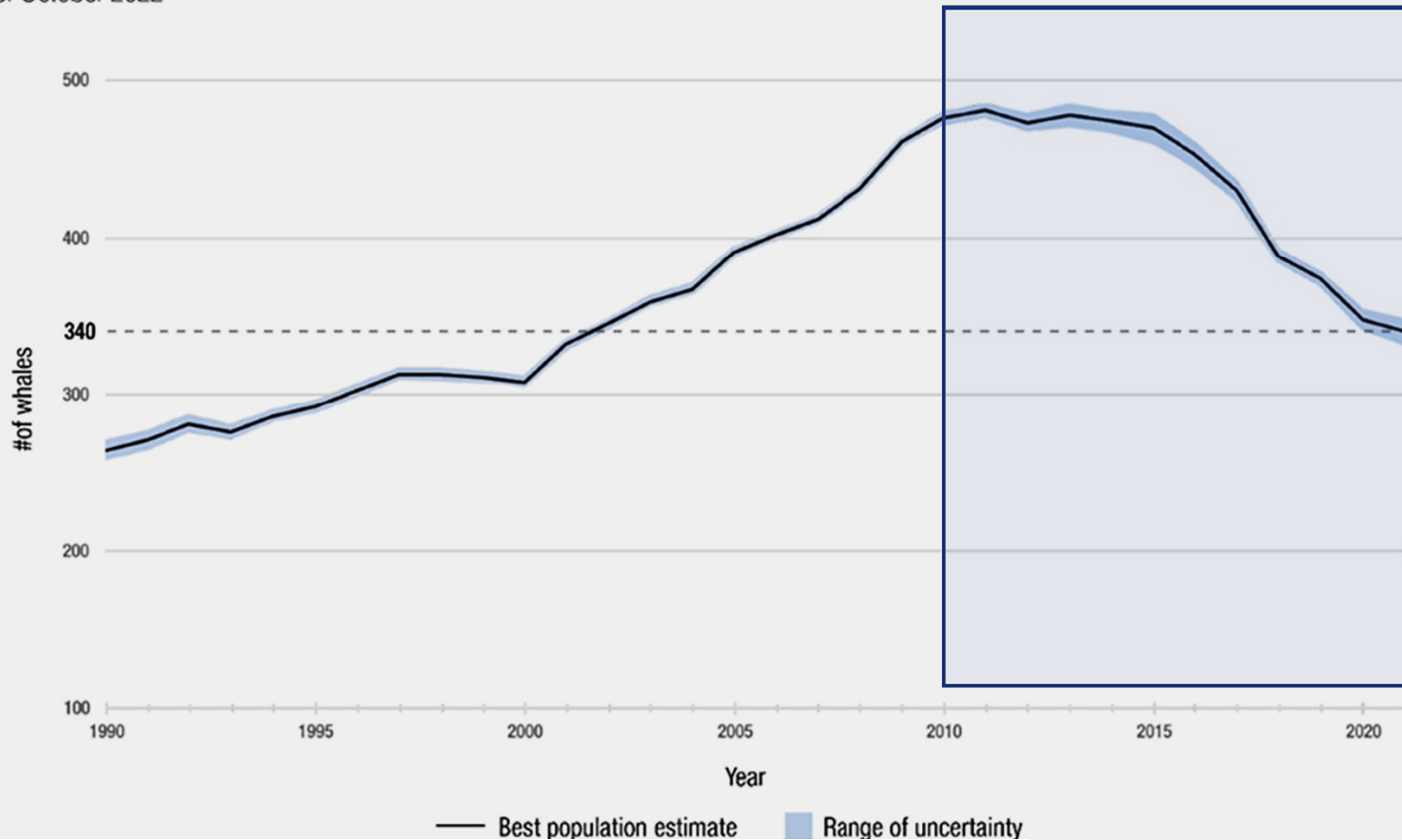
Gulf of St. Lawrence:
new, Jun–Nov

Southern New England:
new, Dec–
May but expanding

A population model based on the photoID catalog, updated every year, generates very precise estimates of the population size (for whales 2 years and older). The latest estimate, for 2021, is 340 ± 7 .

North Atlantic Right Whales 1990-2021

as of October 2022



Pace, Corkeron, & Kraus, 2017, State-space mark-recapture estimates reveal a recent decline in abundance of North Atlantic right whales, *Ecology & Evolution*.

Why did the population trajectory reverse after 2010 from a long-term increasing trend to a significant decline? A big part of the answer is completely obvious: excessive human-caused Mortality and Serious Injury (M&SI).



Right whales have to share some of the busiest seas in the world with many large, fast ships, and vessel collisions are a major source of mortality.

Latest (draft) 5-yr mean annual M&SI from vessel strikes = 2.5 from observed cases (“body counts”), 9.6 estimated from the population model.



Whales can sometimes survive collisions, but usually not.

SELECTED EXAMPLES:



Adult female, catalog #1014, “Staccato,” Mother to 6 known calves. At least 32 years old and probably more; the largest ever measured in modern times (they should live up to 100+ years). In Apr 1999 , seen in Cape Cod Bay alive in the morning, floating dead hours later. No visible external injuries, but necropsy found broken bones and internal injuries from ship collision (“blunt force trauma”).

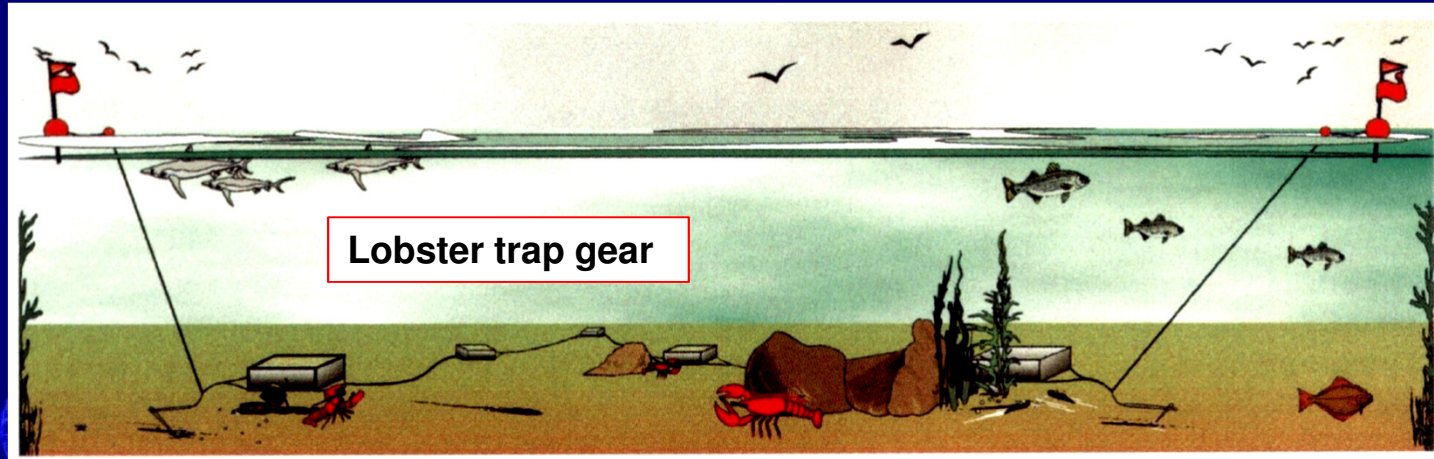


#323, “Infinity,” female born in 2002 (her page in the catalog will tell you who her mother and father were). Her first calf was born in 2021 when she was 19. On Feb 12, a 54-foot sport-fishing boat, heading into port in Florida at 24 knots, hit both mother and calf. The calf was necropsied on the beach on the 13th; the mother was last seen on the 16th, with serious injuries, and has not been seen since. The \$1.2-million boat was a total loss.

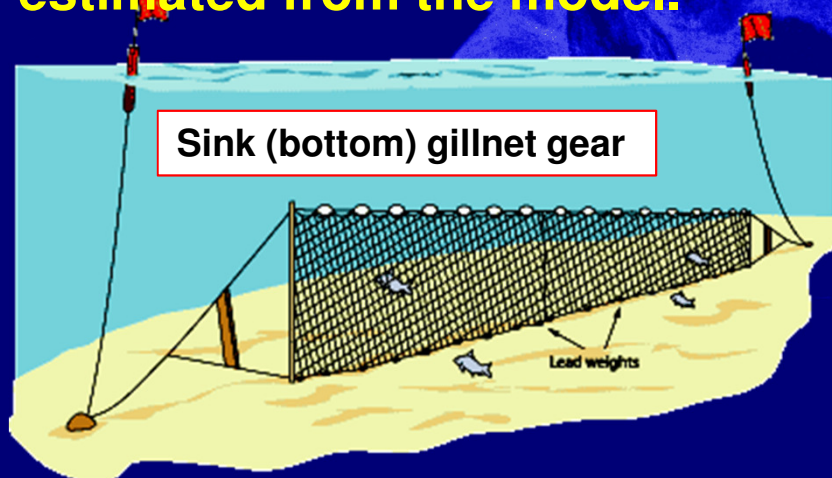


#2143, a female born in 1991. She was struck by a ship as a calf, but survived with some significant propeller scars ... earning the name "Lucky." She was pregnant with her first calf in 2005 at age 14. Pressure from the growing fetus popped open her old scars, and she died a gruesome death.

Entanglement in fixed (not towed or mobile) fishing gear is the largest source of human-related M&SI.



Latest (draft) 5-yr mean annual M&SI from entanglement = 5.7 from observed cases, 17.6 estimated from the model.



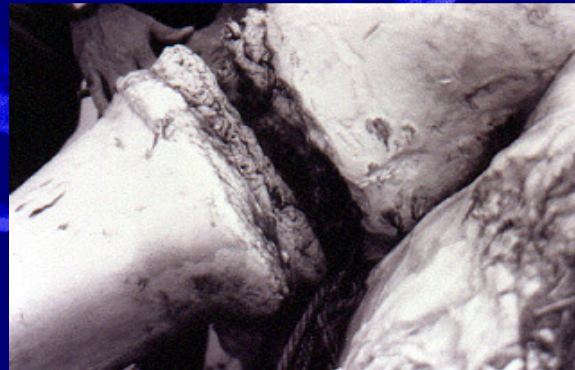
Entanglement leaves scars that can be tracked. >80% of all whales have been entangled at least once, up to 8 times for one whale.

SELECTED EXAMPLES: #2366, male calf born in 1993

Calf with mom, Aug 1993



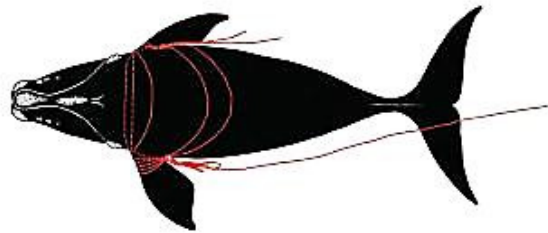
Sep 1994, rope coming out of the mouth



July 1995, dead on Second Beach in Middletown. The rope didn't stretch or weaken while the whale kept growing, causing a constricting injury with the rope embedded deeply into the bone (far right), and death from systemic infection.

**#2030, female, >9 years old;
first seen entangled May 1999**

Species: Right Whale		Whale ID: Eg #2030	
Date first observed/entangled: 10 May 1999 (date seen/first without gear) (11 Sep 1999)	Case study ID: P025	ABB #:	SIAB #:
Sex: Female	18th year: Unknown	Age at entanglement: 5	Case sample collected: Yes
			Case type: Size: print



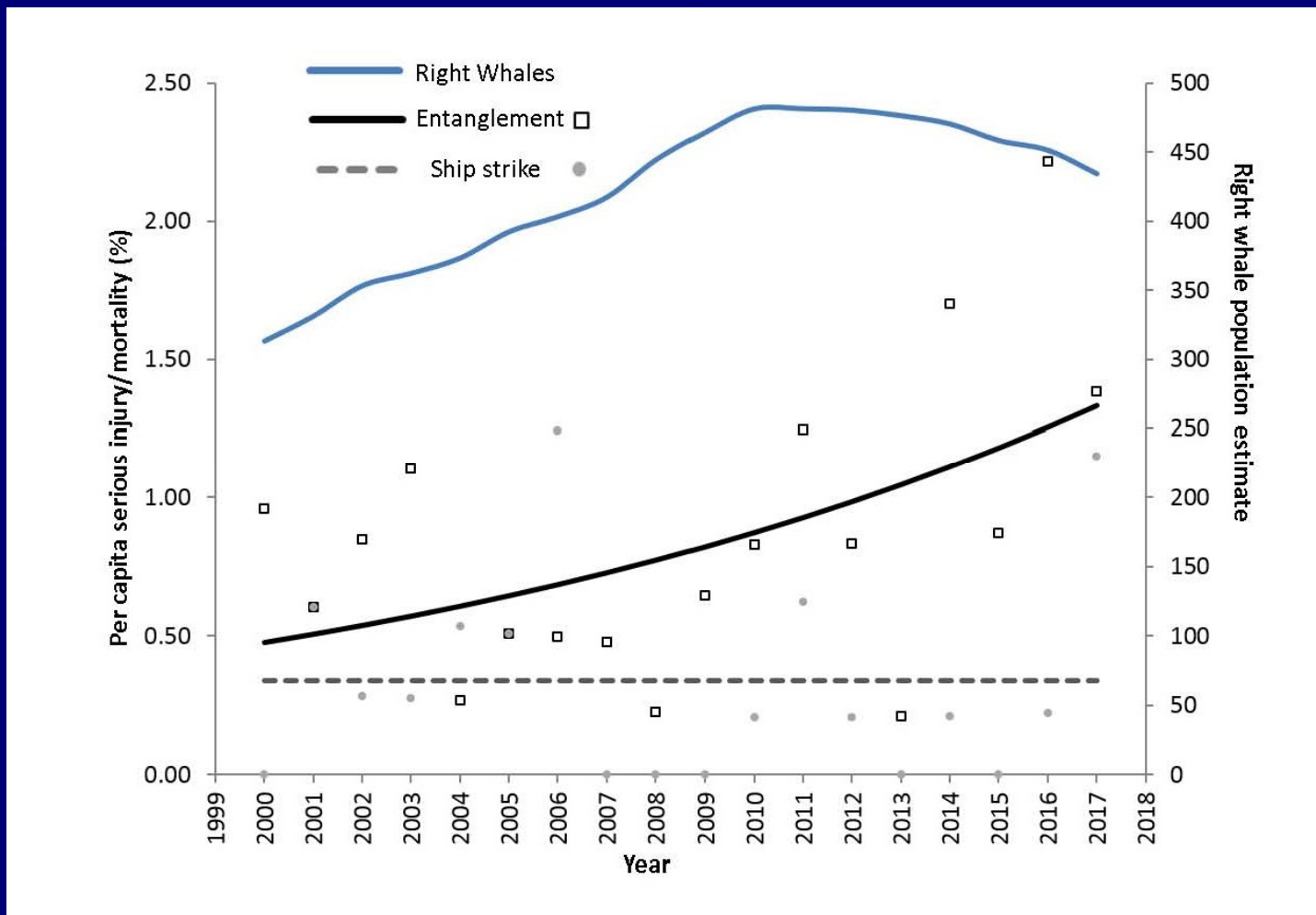
**Entanglement configuration
diagram produced by Center
for Coastal Studies to aid
disentanglement teams.**



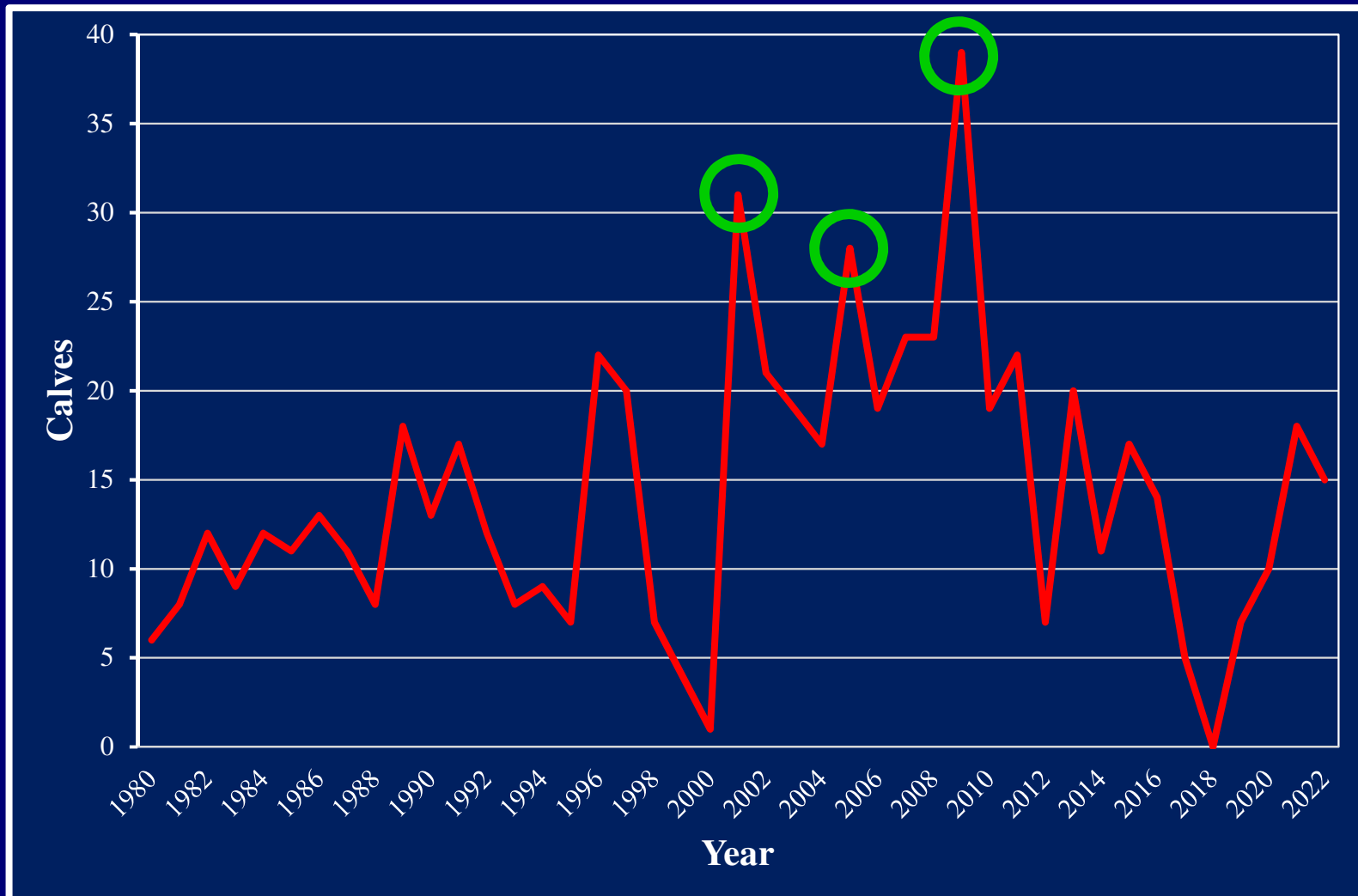
**Sep 1999, with the tight ropes
across her back slicing deeper
with each stroke of her tail.**



Oct 1999, dead on the beach in New Jersey after a painful ordeal.

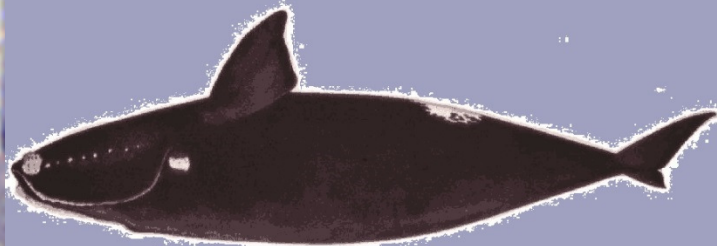


Comparing population size, 1999–2018 to per capita rates of M&SI from ship strikes (relatively stable) and fisheries entanglement (steadily increasing). (from Hayes et al., 2017, NOAA Tech. Memo. NMFS-NE-247)



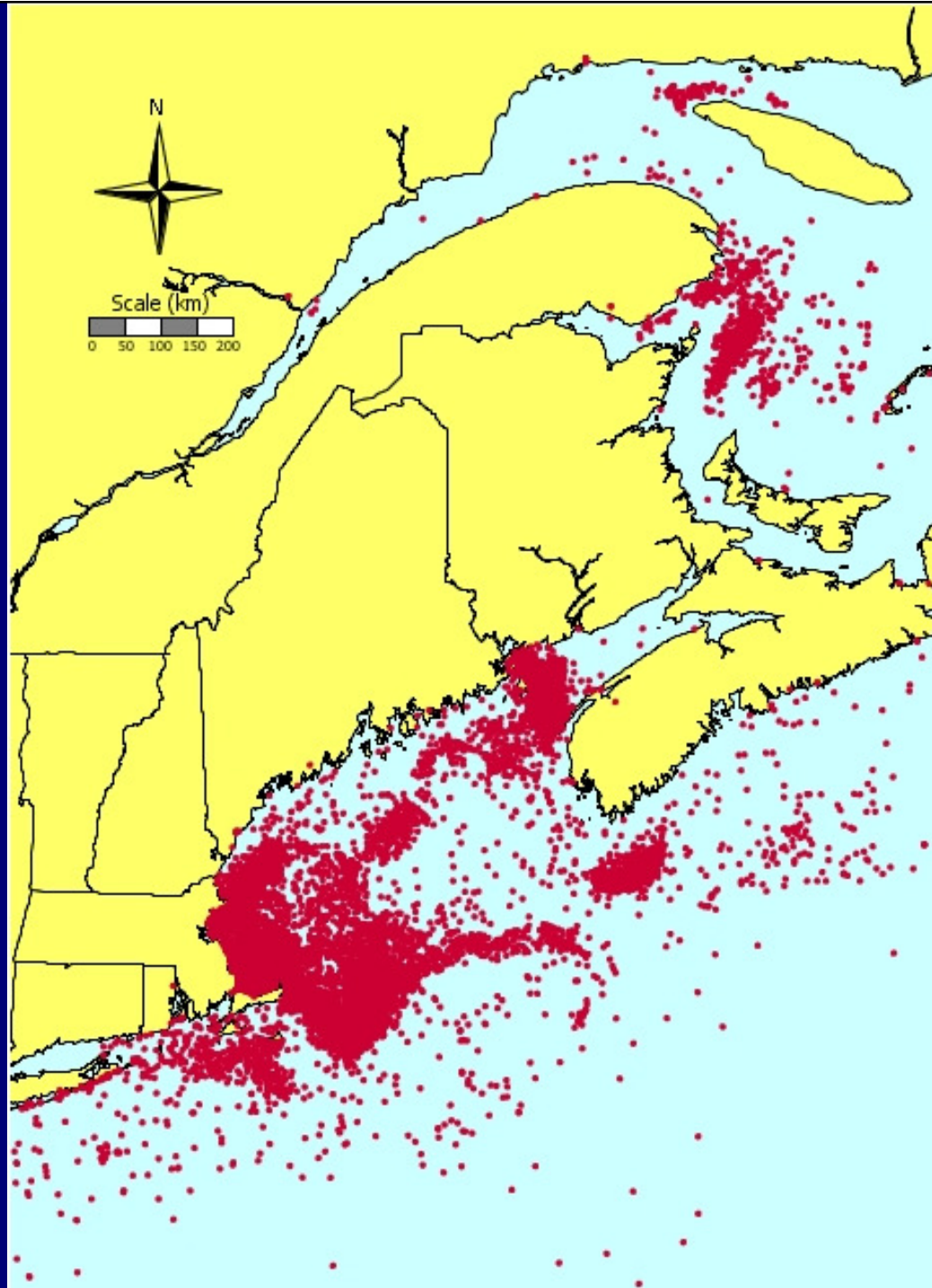
Annual calf counts, 1980–2022 (12 to date in 2023). The total estimated annual M&SI is 27.2 (17.6 fisheries + 9.6 collisions). There have only ever been three years (circled) with >27 calves, all before the changes in 2010. If more whales die than are born, the population will keep declining.

**What about climate change?
(It probably won't look like this)**



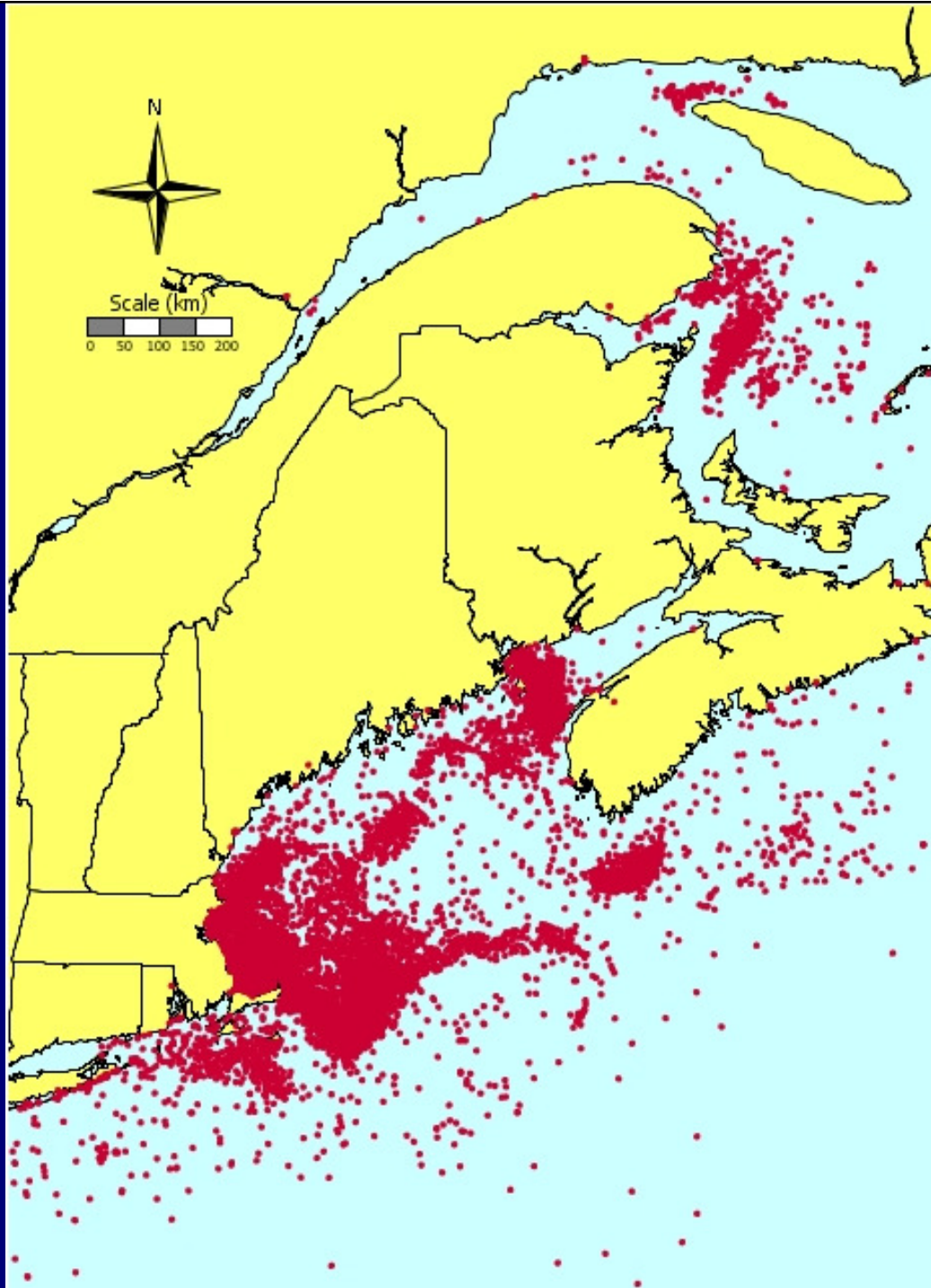
IMPACTS OF CLIMATE CHANGE #1:

Disruption of food supplies: Warmer water affects *Calanus* abundance; current patterns that concentrate prey are changing. Both impact calving success by reducing energy reserves in calving females, so calves are spaced farther apart (up to 6–10+ years instead of 3–4).



IMPACTS OF CLIMATE CHANGE #2:

Changing patterns of distribution: whales moving more in search of better feeding are at increased risk. The current UME began in 2017 in the Gulf of St. Lawrence, where whales in a new habitat encountered different fisheries, and where protective regulations were not in place.





www.narwc.org