

UNITED STATES DISTRICT COURT  
DISTRICT OF MASSACHUSETTS

RICHARD MAXIMUS STRAHAN,

Plaintiff,

v.

SECRETARY, MASSACHUSETTS OFFICE  
OF ENERGY AND ENVIRONMENTAL  
AFFAIRS (“MEOEEA”), et al.

Defendants.

CIVIL ACTION 1:19-cv-10639-IT

DEFENDANTS’ CROSS-QUESTIONS TO DEPONENT DR. MICHAEL MOORE

Pursuant to Fed. R. Civ. P. 31 and 32, and the deposition notice dated July 8, 2020, defendants Secretary of Massachusetts Executive Office of Energy and Environmental Affairs and Director of Massachusetts Division of Marine Fisheries object to the taking of a deposition by written question, and without waiving that objection, submit the following Cross-Questions to Dr. Michael Moore and further Objections:

DEPOSITION OF DR. MICHAEL MOORE: (*answers in italics*)

1. Please answer the following questions fully and completely to the best of your ability.

If you have partial knowledge but not absolute certainty or complete knowledge, please indicate that and provide your partial knowledge. If you need to reference a document in order to be certain of an answer please state so and identify the document. Do you understand that this is a deposition and that you are answering these questions under oath?

*Yes*

Cross-Question: Which of the questions answered in this deposition are based on your personal knowledge?

Exhibit 1 to Declaration of Adam Keats

*All - where I have provided an annotated source, this is to point to supporting information for the statement.*

Please state your job title and experience relevant to Northern Right Whales.

*NOTE – Throughout this document I will respond to the questions as if they were posed concerning the North Atlantic right whale – Eubalaena glacialis. There is no such whale as a Northern right whale. As posed the document is irreconcilably ambiguous. The questions could equally refer to the North Pacific right whale - Eubaleana japonica, however, given this is a court action in the Commonwealth of Massachusetts, it is reasonable to assume the questions refer to E. glacialis. I will abbreviate this to NARW.*

*My job title is Senior Scientist, Biology Department and Director, Marine Mammal Center, at the Woods Hole Oceanographic Institution, Woods Hole, Mass.*

*My relevant experience as a scientist and veterinarian since 1978 has focused on the biology, pathology, health, and anthropogenic trauma, of live and dead whales, dolphins and seals.*

*These studies have been undertaken in the UK, Iceland, Canada, US, Argentina, New Zealand, and Antarctica. Most specifically, since 1996 I have examined many dead NARW to diagnose cause of death. These diagnoses have included entanglement in fishing gear and vessel trauma.*

*I have also studied live NARW, focusing especially on their body condition, and the impacts off sublethal entanglement trauma thereon. I am a current member of the NOAA NMFS Atlantic Scientific Review Group that provides peer review for annual Stock Assessment Reports for NARW inter alia, and a past member of the NMFS Working Group for Unusual Marine Mammal Mortality Events, and was its most recent past Chair.*

a. *Please provide a copy of your most recent resume or CV. Please see below.*  
*Exhibit 1 to Declaration of Adam Keats*

Cross-Question: [none]

2. What is your understanding of the term “vertical buoy ropes”?

*Any rope or line that connects a surface marker buoy to a trap or traps on the ocean floor. Their role is to enable communication of the presence of a bottom trap or traps to surface vessels through its connection to the trap or traps and the marker buoy, and for retrieval of trap or traps for the purposes of examining the harvest, retention of legal catch, and replenishment of bait.*

Cross-Question: Objection. Without waiving the objection, are all vertical buoy ropes the same? If not, what differences might be found among the types of vertical buoy ropes?

*They vary in diameter, material, lay (can be twisted or braided in various ways), and color. A single vertical buoy rope can comprise more than one rope type depending on the requirements of the location, the fisherman and relevant regulations. They may carry markings as specified by regulations. There is also an idea to insert braided sleeves at given intervals in the vertical buoy line, to reduce the effective breaking strength of the line to 1700 lbs, a limit that has been suggested as safer for adult NARW. However, if the sleeves are buried in one or more wraps around a whale or one or more appendages, their weakening effect will be negated.*

3. Can vertical buoy ropes kill Northern Right Whales?

*Yes – any rope in the water column is a mortality risk for a NARW.*

Cross-Question: Objection. Without waiving the objection, can (a) ship strikes, (b) climatic shifts, or (c) other human activity cause death to right whales? What are the other human activities?

*(a) Ships and smaller vessels can kill whales.*

*(b) A climatic shift per se cannot kill a whale. I presume the question is alluding to recent climatic changes that have resulted in shifts in timing and location of suitable prey aggregations that trigger NARW foraging. Such as the increase in*

*NARW in the Gulf of St Lawrence since ~ 2013. This has resulted in increased risk of vessel and entanglement mortality for the NARW in other areas. However, the cause of poor health and or death remains anthropogenic trauma.*

*(c) Other human activities that can cause death to NARW include:*

- 1) Ground lines between traps.*
- 2) Gillnets*
- 3) Trawl nets, although rare for NARW, being a greater problem for whales that eat fish.*
- 4) Directed harvests. They have been harpooned for at least 1000 years. Most recently in Madeira in the 1970's.*
- 5) Not recorded as causes of death to NARW to my knowledge, but the following are certainly potential causes of death to a NARW*
  - a. oil spills*
  - b. other toxicants*
  - c. if spent nuclear fuel storage tanks at the closed Pilgrim power plant in Plymouth Mass were to have a catastrophic event and discharge into Cape Cod Bay*
  - d. strike by munitions in a live military exercise*

4. Can vertical buoy ropes cause sublethal harm to Northern Right Whales? a. If so, please describe the types of sublethal harm.

*I have not undertaken an exhaustive analysis of NOAA's data in regards to the gear type, and specific gear part, of line taken off NARW, but for instance, see Report E36-16, a surface system, and vertical / End Line, taken off a live NARW on 9/22/2016, a non-serious injury – i.e. sublethal. See page 7 of:*

<https://www.greateratlantic.fisheries.noaa.gov/policyseries/index.php/GARPS/article/view/16/13> . Any kind of rope, including vertical buoy rope, can damage baleen (bilateral, hairy-fringed, horny, row of plates suspended from the upper jaw that provide a filter for NARW food), encircle the upper jaw, flippers, and peduncle (the narrow waist prior to the tail flukes). If the whale cannot shed the rope, or it is not removed by humans, and the animal swims, and locomotes, flexing and extending its body, flippers and flukes, the rope tends to tangle and tighten, resulting in a slow but inexorable constriction. The baleen feeding apparatus can be displaced, and at times broken, hindering feeding efficiency. This impairs caloric intake, locomotion, growth and reproduction. Rope can become embedded in flippers, lips, blubber, muscle and bone <sup>1-3</sup>. Large whales are well supplied with sensory nerves in their skin. Thus, pain has to be a consequence for the duration of the entanglement. There are cases that remain alive, entangled for years. The harm includes increased drag from towing rope, buoys and traps. The average drag has been equated to the energetic cost of pregnancy <sup>4</sup>. We have recently modelled an energy budget for a typical female NARW, looking at the caloric relationship between food intake and entanglement drag. Food is the dominant factor, but entanglement can seriously impact a NARW's capacity to reproduce successfully. Our model which is in preparation for publication was able to show how a combination of food and drag stress can extend the inter-calving interval (years between calves) from a norm of 3 years to greater than 10, as has been observed in reality in recent years for NARW.

Cross-Question: Objection. Without waiving the objection, can (a) ship strikes, (b) climatic shifts, or (c) other human activity cause sublethal harm to right whales? If so, how?

- a) *Ships and smaller vessels can cause propeller cuts and blunt trauma to NARW. Propellers can cause serial 'bread slices' across the head, back or tail. The degree of morbidity can depend of depth of cut and degree to which a vital organ or organs are involved. Cuts to the tail flukes are quite common. Their lethality increases if the cuts involve the midline of the flukes as that is where the blood vessels are largest in that area. Blunt trauma is often more cryptic, especially if under dark skin pigment, but bleeding, bruises, swelling, bone fractures and organ dysfunction are common.*
- b) *A climatic shift per se cannot cause sublethal harm to a NARW. I presume the question is alluding to recent climatic changes that have resulted in shifts in timing and location of suitable prey aggregations that trigger NARW foraging. Such as the increase in NARW in the Gulf of St Lawrence since ~ 2013 <sup>5</sup>. This has resulted in increased risk of vessel and entanglement sublethal harm for the NARW in new areas. However, the cause of sublethal harm remains anthropogenic trauma.*
- c) *Other human activities that can cause sublethal harm to NARW include:*
- 1) *Ground lines between traps.*
  - 2) *Gillnets.*
  - 3) *Trawl nets, although rare for NARW, being a greater problem for whales that eat fish.*
  - 4) *Directed harvests. They have been harpooned for at least 1000 years. Most recently in Madeira in the 1970's. Not all harpoon strikes are lethal.*
  - 5) *Not recorded as causes sublethal harm to NARW to my knowledge, but the following are certainly potential causes of sublethal harm to a NARW:*
    - a. *oil spills*
    - b. *other toxicants*

- c. if spent nuclear fuel storage tanks at the closed Pilgrim power plant in Plymouth Mass were to have a catastrophic event and discharge into Cape Cod Bay*
- d. strike by munitions in a live military exercise*

Do vertical buoy ropes affect the ability of female Northern Right Whales to bear young?

a. If so, please describe how.

*Any rope entanglement is an incremental cost that reduces a female NARW's ability to bear young. This is a result of energy drain from drag, ill health from the constriction and organ damage, and impaired feeding and locomotion, all described above. Any dairy farmer would agree, that a stressed, ill fed cow will not get pregnant and hence no milk. They take great care to feed them well and avoid stress. We do not do this for NARW. We know that sublethal entanglements reduce reproductive success.*

Cross-Question: Objection. Without waiving the objection, do (a) ship strikes, (b) climatic shifts, or (3) other human activity affect the ability of female right whales to bear young? What is the other human activity?

- a) I am not aware of studies that have addressed the effect of sublethal ship or vessel strikes on NARW reproductive success. But again, ill-health, and the stress of recovering from such trauma would likely reduce fecundity.*
- b) As above, climatic shifts have moved NARW optimal foraging in time and space. To the extent that has led to reduced caloric intake, then the calf production will suffer.*
- c) The sublethal effects listed in 5c above would also have knock on effects on calf productivity.*

5. Would eliminating the use of vertical buoy ropes lead to any increase in the number of newborn baby Northern Right Whales?

*Yes – directly.*

Cross-Question: Objection. Without waiving the objection, would eliminating (a) the use of ships to transport people and goods or (b) green house gas emissions from human activity lead to any increase in the number of livebirths of right whales?

*a) To the extent that noise and sublethal and lethal trauma from ships and smaller vessels affects calf production, as described above, calf production would increase in the absence of such stressors.*

*b) To the extent, which is unknown, that green house gas emissions affect NARW distribution and behavior, foraging success, and prevalence of other trauma, consequently increased reproductive success would be expected.*

6. In the past five years, have incidents of harm to Northern Right Whales caused by vertical buoy ropes increased, decreased, or stayed the same?

*August 3<sup>rd</sup> 2020 the 2019 Stock Assessment Reports (SAR) were released by NMFS. <https://www.fisheries.noaa.gov/action/2019-marine-mammal-stock-assessment-reports>. The 2019 SAR for the NARW carries data up to the end of 2017. Thus, the question cannot be answered for the past 5 years, as without the details in that report for years 2018, 2019 and 2020 to date, the relevant data are not publicly available. The general trend in recent years has been for rope entanglements for NARW to have increased, relative to ship and vessel trauma. Although both in of themselves, are sufficient to independently push the species above allowable mortality rates as defined by the Marine Mammal Protection Act 1972 as Potential Biological Removal (PBR) in US waters.*



Cross-Question: Objection. Without waiving the objection, in the past five years, have incidents of harm to right whales caused by (a) ship strikes, (b) climatic shifts or (c) other human activity increased, decreased, or stayed the same? If you refer to other human activity, which activities are they?

- a) *Absence of the data detailed in section 7 creates the same problem, but relative to rope entanglement, ship and smaller vessel strike rates have decreased in recent years, but remain a substantial problem in spite of this.*
- b) *We do not have sufficient data to understand the indirect effects of climatic shifts on this time scale, even if the NARW data were available.*
- c) *Again, insufficient data to comment.*

7. Do you expect incidents of harm to Northern Right Whales caused by vertical buoy ropes in the next five years to increase, decrease, or stay the same?

*This entirely depends on whether state and federal governments are politically enabled to do their job, and finally effectively enforce existing protections under the Marine Mammal Protection Act 1972 and the Endangered Species Act 1973 while also enabling relevant stake holder industries, such as lobster harvests to prosper. Were they to do so, given that in US waters used by NARW, vertical buoy lines are the dominant source of rope in the water column, the answer would be yes. If status quo continues, then no. Technologies exist to remove rope from the water column, but the political and economic wherewithal to do so are currently lacking.*

Cross-Question: Objection. Without waiving the objection, do you expect incidents of harm to right whales caused by (a) ship strikes, (b) climatic shifts or (c) other human activity in the next five years to increase, decrease or stay the same? If you refer to other human activities, what are those activities?

- a) *In light of my response to section 8 above, similarly, if ship and smaller vessel speeds were to be limited to 10 knots or less in areas where right whales go, which is essentially the waters of the continental shelf, then ship and smaller vessel trauma would reduce substantially.*
- b) *If the other sources of trauma listed in 5c above were to be substantially reduced, this would also substantially reduce NARW harm.*

8. Is the current Northern Right Whale population declining?

*Yes. To quote the US Government: “The endangered North Atlantic right whale population has been steadily declining for nearly the past decade. Today, researchers estimate that only about 400 right whales are left.”*

<https://www.fisheries.noaa.gov/feature-story/10-things-you-should-know-about-north-atlantic-right-whales>

Cross-Question: Objection.

9. Does Northern Right Whale entanglement in vertical buoy ropes significantly contributing to the species’ current decline in numbers?

*Rope entanglement is the leading cause of lethal and sublethal trauma in the NARW<sup>1</sup>. Vertical buoy ropes are the commonest type of rope in the water column both in the US (overwhelmingly lobster) and Canada (lobster and snow crab primarily).*

*Thus, the lethal entanglements kill whales directly – an expense. The sublethal entanglements reduce the number of calves produced (through adult female ill health) – a reduced income. Less income, more expense sums to a decline in numbers.*

Cross-Question: Objection. Without waiving the objection, do (a) ship strikes, (b) climatic shifts, or (c) other human activity significantly contribute to the decline? If there are other human activities, what are they? What is your definition of “significantly” in the context of answering these questions?

*Every dead or unborn (through reproductive failure) NARW contributes to the decline as stated above. a) Ships kill whales. b) As discussed in 5b above, climatic change is not a direct cause of death, but where such change invalidates successful conservation measures, such as shipping lane movements to reduce collision risk, then indirectly, climatic change can result in failure of conservation measures, and the need for new response based on where the risk is now greatest. c) other human activities as defined above have the potential of reducing NARW numbers. My definition of significant is the death of one right whale, as is the limit for PBR required by the Marine Mammal Protection Act 1972.*

Is the use of vertical buoy ropes interfering with the recovery of the Northern Right Whale as a species?

*Given all of the above, yes.*

Cross-Question: Objection. Without waiving the objection, do (a) ship strikes, (b) climatic shifts, or (c) other human activities interfere with the recovery of the right whale as a species? If you've answered yes with respect to other human activities, what are they?

*Recovery consists of two factors, reduced mortality and increased calf production. Given all that has been said above, to repeat it here would be redundant and repetitive.*

10. Can the Northern Right Whale species sustain the death of one or more Northern Right Whales each year?

*If there were to be substantive reproductive success and recruitment of reproductively active animals into the species that exceeded the mortality rate then the income would exceed the expenses and the species would grow. However as has been shown above, lethal and sublethal trauma (and its impacts on reproductive success) are tightly linked. Thus, unless and until significant lethal and sublethal trauma from entanglement and ship and vessel collisions, are reduced, neither will*

*expense decrease nor income increase.*

Cross-Question: Objection.

11. Are you familiar with the 2015 Northern Right Whale Take Reduction Plan?

*Yes*

Cross-Question: [none]

12. Do you believe the 2015 Take Reduction Plan contributed to a decline in the number of incidents of harm to Northern Right Whales caused by vertical buoyropes?

*To attempt to answer this question, I consulted the ALWTRT Outreach Guide for Trap/ Pot Northeast. <https://www.fisheries.noaa.gov/webdam/download/94698537> The requirements (page 11): no surface line, wet storage, sinking groundlines, only one endline for short trawls, weak links at the buoy, marked buoys and ropes, etc. As long as substantive amounts of rope remain in the water column, lethal and sublethal harm from vertical buoy ropes will continue wherever NARW go. Assessing the impact of this plan must await analysis on changing incidences of entanglement scar, calving, and mortality, in the context of both the US and Canadian management changes. We will never really know, given the relatively small proportion of entanglement events that can be traced to specific regions. Gear marking will never provide enough data from gear taken off whales to be helpful. The only plan of value will be a widespread, transboundary reduction in rope and vessel risks. The gear tweaks and marking, as outlined in the 2015 plan, are a continuation of decades of similar deck chair shuffling while the NARW ship goes down.*

Cross-Question: Objection.

13. What is your understanding of the term “jurisdictional waters of Massachusetts”?

Cross-Question: [none]

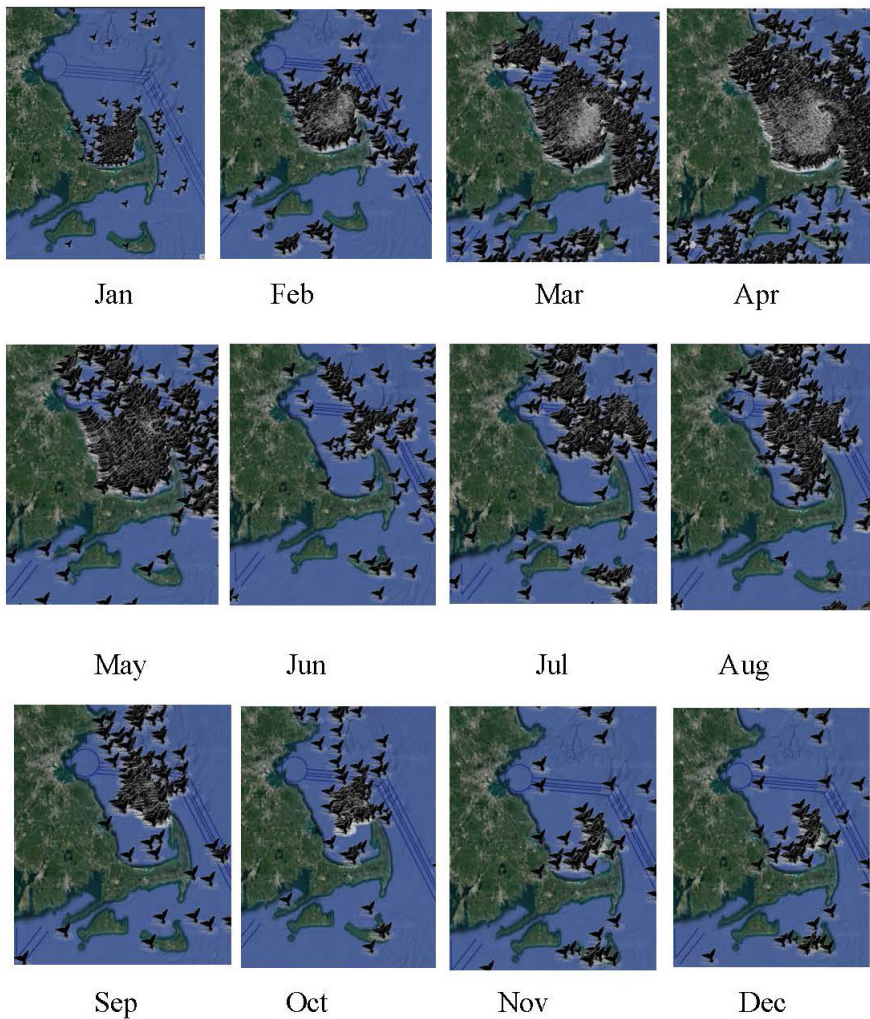
*Waters over which the Commonwealth regulates and enforces such activities as the American lobster*

fishery. They are depicted in that context on page 17 of

<https://www.fisheries.noaa.gov/webdam/download/94698537>

14. In what months of the year can Northern Right Whales be found within jurisdictional waters of Massachusetts?

*All months. See below.*



*Right whale sightings around Massachusetts for each month, all years (not defined)*

<https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html>

Cross-Question: Objection. Without waiving the objection, does the number of whales found vary in different months or seasons of the year? What are the differences?

Exhibit 1 to Declaration of Adam Keats

*They are most prevalent between February and May, and least in November and December. See above.*

15. Are there any specific areas or regions within the jurisdictional waters of Massachusetts that Northern Right Whales can with certainty not be found? a. If so, please describe these areas.

*They are typically not found up rivers, but they have been known to venture up rivers, but mostly in Florida.*

Cross-Question: Objection.

16. Can vertical buoy ropes be found in jurisdictional waters of Massachusetts when Northern Right Whales may be present?

*Yes, but for instance there is a closed area February through April for Cape Cod Bay and some surrounding waters with possible extensions into May.*

Cross-Question: Objection.

17. Are you aware of any reports since 2010 of Northern Right Whales being harmed or killed by vertical buoy ropes deployed in jurisdictional waters of Massachusetts? a. Please describe each of these reports of harm or death.

*Yes – see for instance Report E36-16 in my response in 5 above. I have not undertaken a thorough analysis. I am sure the Mass Division of Marine Fisheries can supply a full accounting.*

Cross-Question: Objection.

18. Do you believe that the reported (or known) incidents of harm or death of Northern Right Whales caused by vertical buoy ropes deployed in jurisdictional waters of Massachusetts constitute all of the harm to Northern Right Whales caused by vertical buoy ropes deployed in  
Exhibit 1 to Declaration of Adam Keats

jurisdictional waters of Massachusetts that have occurred in the same time period?

*No*

a. Do you agree that the reported incidents of harm to Northern Right Whales caused by vertical buoy ropes deployed in jurisdictional waters of Massachusetts vastly understate or underestimate the actual number of incidents of harm?

*Yes. The degree of understatement is hard to clarify. See my response in 13 above.*

b. If you believe that there have been more incidents of harm than have been reported, how would you best describe the relationship between those numbers?

*See my response in 19a above*

Cross-Question: Objection.

19. If vertical buoy ropes continue to be deployed in jurisdictional waters of Massachusetts, will Northern Right Whales be harmed and/or killed?

*Yes. It is statistically inconceivable that as long as NARW and rope in the water column coexist in any area, morbidity and mortality is not a significant risk for NARW, including the jurisdictional waters of Massachusetts.*

Cross-Question: Objection.

20. Would the elimination of vertical buoy ropes in Massachusetts waters benefit the recovery and survival of the Northern Right Whale species?

*Yes*

Cross-Question: Objection. Without waiving the objection, would the elimination of ships in Massachusetts waters benefit the recovery and survival of the North Atlantic right whale species?

*Yes, but NARW, lobstering and shipping can all prosper in those waters if ships were slowed and rope removed.*

21. Can the Northern Right Whale species sustain further incidents of sublethal harm caused by vertical buoy rope deployed in jurisdictional waters of Massachusetts?

*Assuming each NARW habitat has a proportional responsibility to ensure that the species prospers, and given the extremely significant role Mass waters play in the survival of the species, every effort should be made to avoid further sublethal harm to NARW.*

Cross-Question: Objection. Without waiving the objection, (a) can the species sustain further incidents of sublethal harm caused by ship strikes; and (b) can the species sustain further climatic shifts?

*Every effort should be made to avoid further sublethal harm to NARW.*

22. Do vertical buoy ropes deployed in jurisdictional waters of Massachusetts entangle, kill and/or injure sea turtles and/or any other endangered whale species?

*Yes*

Cross-Question: Objection.

23. If Massachusetts no longer required the use of vertical buoy ropes, could fishermen still fish for lobster in jurisdictional waters of Massachusetts using alternative means? a. If yes, what alternative means would be available?

*Yes. There are technological solutions to retrieve and deploy traps that do not require persistent vertical buoy ropes.*



Cross-Question: Objection. Without waiving the objection, if yes, how is: (a) gear conflict, and (b) affordability addressed by the alternative means you've described?

- a) *Currently the surface marking system attempts to avoid gear conflict by providing a visual indication of the approximate bottom location of the trap or traps. Intra and inter fishing industry sector conflict, and gear loss, using this system is significant. Without vertical buoy endlines, acoustic release and retrieval of bottom systems is commonplace in research, defense and other industrial applications. This has been used in trap fisheries commercially in Australia and is under trial in US east and west coasts, Canada and the UK. The location is recorded as a surface position, and can be updated with acoustic ranging in some systems.*
- b) *Affordability depends upon cost and benefit. Where such technology affords access to an otherwise closed area, the incentive is significant. Government subsidies can and should enable development and commercialization of technology that avoids rope in the water column. Were the over-capitalization of the trap fisheries in right whale habitat to be addressed by a significant reduction in effort resulting in a greater catch per unit effort, this technology would also become more affordable.*

*August 7, 2020.*

*Michael J Moore Vet MB, PhD.*

Respectfully submitted,

MASSACHUSETTS EXECUTIVE OFFICE  
OF ENERGY AND ENVIRONMENTAL  
AFFAIRS and MASSACHUSETTS DIVISION  
OF MARINE FISHERIES,

By their attorney,

MAURA HEALEY  
ATTORNEY GENERAL

Dated: July 22, 2020

**Declaration of Dr. Michael Moore Regarding Deposition By Written Question**

1. My name is Dr. Michael Moore. I am above the age of 18. I reside in the State of Massachusetts.

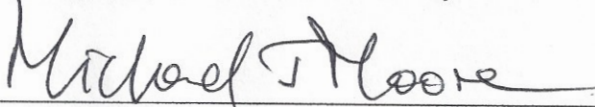
2. I received a Notice of Deposition By Written Question pursuant to Federal Rules of Civil Procedure 31 and 45 that contained direct examination questions posed by the Plaintiff and cross-examination questions posed by the Defendants in the case titled *Man Against Xtinction a/k/a "Max" v. Secretary, Massachusetts Executive Office of Energy and Environmental Affairs ("MEOEEA"), et al.*, Civil Action No. 19-cv-10639-IT (D. Mass.).

3. The Notice stated that "in lieu of the procedures set forth under Rule 31(b), the Deponent will respond to the deposition questions in writing outside the presence of an Officer, the Deponent will sign the written answers under pains of perjury, and the Deponent's signature will be notarized, per prior agreement between Plaintiff and counsel for Deponent and based on the need for proportionality of burdens, particularly for a non-party, and for the deposition to be conducted remotely (pursuant to applicable Massachusetts rules and laws) due to the coronavirus pandemic."

4. I converted the pdf document that I received containing the direct and cross-examination questions into a word document and inserted my responses in *italics*. In addition to typing my responses to the direct and cross-examination questions in *italics*, I also added endnotes and my cv to the end of the document. The responses in *italics*, the endnotes, and cv are my own additions (hereinafter "Additions"); the remainder of the document contains content provided to me by the parties to the above-captioned case.

5. I declare, under penalty of perjury, that, to the best of my current knowledge and belief, the Additions are true.

Aug 8<sup>th</sup> 2020  
Date

  
\_\_\_\_\_  
Dr. Michael Moore

/s/Maryanne Reynolds

Maryanne Reynolds, BBO # 627127 Assistant Attorney General  
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*Cited Sources*

1. Sharp, S.M., W.A. McLellan, D.S. Rotstein, A.M. Costidis, S.G. Barco, K. Durham, T.D. Pitchford, K.A. Jackson, P.-Y. Daoust, and T. Wimmer, *Gross and histopathologic diagnoses from North Atlantic right whale Eubalaena glacialis mortalities between 2003 and 2018* <https://doi.org/10.3354/dao03376>. *Diseases of Aquatic Organisms*, 2019. **135**(1): p. 1-31.
2. Cassoff, R.M., K.M. Moore, W.A. McLellan, S.G. Barco, D.S. Rotstein, and M.J. Moore, *Lethal entanglement in baleen whales*. *Diseases of Aquatic Organisms* <https://www.int-res.com/abstracts/dao/v96/n3/p175-185/>, 2011. **96**(3): p. 175-185.
3. Moore, M., A. Knowlton, S. Kraus, W. McLellan, and R. Bonde, *Morphometry, gross morphology and available histopathology in Northwest Atlantic right whale (Eubalaena glacialis) mortalities (1970 to 2002)*. *Journal Cetacean Research and Management*, 2004. **6**: p. 199-214.
4. van der Hoop, J., P. Corkeron, and M. Moore, *Entanglement is a costly life-history stage in large whales*. *Ecology and Evolution* <https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.2615>, 2017. **7**(1): p. 92-106.
5. Record, N., J. Runge, D. Pendleton, W. Balch, K. Davies, A. Pershing, C. Johnson, K. Stamieszkin, R. Ji, and Z. Feng, *Rapid Climate-Driven Circulation Changes Threaten Conservation of Endangered North Atlantic Right Whales*. *Oceanography*, 2019. **32**(2): p. 162-169.

## MICHAEL MOORE

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### EXPERIENCE

1991 to present **Senior Scientist** (2016 to present), **Director** Marine Mammal Center (2011 to present), Senior Research Specialist (2006 to 2016), Research Specialist (1995 to 2006), Visiting Investigator (1993 to 1995), Postdoctoral Investigator, (1991 to 1993): Biology Department, Woods Hole Oceanographic Institution.

1998 to present **Program Director** (1998 to 2000), **Veterinarian** (2001 to 2005), Cape Cod Stranding Network. Now International Fund for Animal Welfare, Marine Mammal Rescue Research (2005 to present).

1997 to 2006 Lecturer, Boston University Marine Program.

1985 to 1986 **Veterinarian**, Laboratory for Marine Animal Health (Marine Biological Laboratory), Dept. Avian & Aquatic Animal Medicine, N.Y.S. College Veterinary Medicine.

1983 to 1985 **Associate Veterinarian**, 1983 to 1985, Bulger Animal Hospital, N. Andover, MA Veterinarian.

1983 International Whaling Commission, Hvalfjordur, Iceland.

1979 to 1980 **Assistant Scientist**, Ocean Research and Education Society (R/V Regina Maris).

1979 to 1982 Field Research Assistant, Zoology Department, University of Cambridge, England.

### DEGREES

1986 to 1991 PhD WHOI/MIT Joint Program in Biological Oceanography.

1979 to 1983 Vet MB Department of Clinical Veterinary Medicine, University of Cambridge, England.

1975 to 1979 B.A. Pembroke College, University of Cambridge, England.

### ACADEMIC AND PROFESSIONAL HONORS

2018 Stanley Watson Chair (WHOI)

2006 Fellow – WHOI Ocean Life Institute

2003 Outstanding Service Award, Cape Cod Stranding Network.

1983 Sismey Prize in Medicine & Surgery.

1981 Glaxovet Parasitology Prize.

1977 University of Cambridge, Foundation Scholar.

1976 Foundress Memorial Prize, Pembroke College, University of Cambridge.

1975 Exhibition - Pembroke College, University of Cambridge.

**LICENSURE**

National: Certified A.V.M.A. Educational Commission for Foreign Veterinary Graduates.

State Veterinary License: Massachusetts.

Northeast Region, National Marine Fisheries Service Authorization to maintain tissue parts from stranded marine mammals.

**EDUCATION**

**GRADUATE STUDENTS**

**ADVISED**

WHOI/ MIT Joint PhD Program in Biological Oceanography

Julie van der Hoop 2011 to 2016 - PhD

Regina Campbell-Malone – 2001 to 2007 - PhD

Boston University Marine Program

Nadine Lysiak 2003 to 2008 – PhD

Carolyn Miller 1998 to 2005 - PhD

Melinda Sweeny 2000 to 2003 – MA

Stefani Valentini 1997 to 1998 – MA

University of Massachusetts Dartmouth

Michael Morss 1996 to 1998 – MA

College of the Atlantic

Colby Moore – MA 2007 to 2009

Royal Veterinary College

Ashley Barratclough – MS 2013

European University Institute of Sea, Brest France

Perrine LeFaou – MS 2007 to 2008

University College London

Maria Martins – MS 2018 to 2019

**COMMITTEE**

WHOI/ MIT Joint PhD Program in Biological Oceanography

Nicholas MacFarlane 2010 to 2015 –PhD

Max Kaplan 2014 to Present PhD

University of Connecticut

Andrea Bogomolni to 2009 to 2014 – PhD

Duke University Marine Lab

Rachel Cassoff 2013 to 2017 – PhD

U Maine Orono

Becky Woodward 2005 to 2009 – PhD

Jeremy Winn 2009 to 2011 – MA

**DEFENSE CHAIR (WHOI/ MIT)**

Susan Parks 2003 PhD

Maya Yamato 2013 PhD

Camryn Braun 2018 PhD

**POST DOCTORAL SCHOLAR**

Becky Woodward 2010 to 2012

**POST DOCTORAL INVESTIGATORS**

Yara Bernaldo de Quiros 2013 to 2015

Alex Shorter 2001 to 2013

Julie van der Hoop 2016 to 2017

**GUEST STUDENTS**

Univeristy College London

Maria Martins 2018-2019

Kansas State University, College of Veterinary Medicine

Michael Denk 2018-2019

University of Cambridge

Hannah Cubaynes 2018

University College London

Maria Martins 2018-2019

Wentworth Institute of Technology

Bailey Avila 2017

Duke University Marine Lab

Samantha Emmert – 2014 Summer Fellow Undergraduate

Jessica Richardson – 2011 to 2012 Duke/ WHOI Fellow

Smith College

Caroline Kerouack – 2012 Undergraduate

U Pennsylvania

Rachel Cassoff 2010 DVM candidate

College of Charleston

Carmen Wiegandt 2013 Undergraduate

Tufts University School of Vet Med

Melissa Joblon 2014 – DVM candidate

Stephanie Levesque 2014 – MA

Meghan Hartwick 2011 to 2012 - MA

UCLA

Eden Maloney – 2010 Undergraduate

Cornell University

Karen Tracy – 2010 Undergraduate

University of Tolima, Colombia

Carolina Gutierrez – 2007 Summer Fellow

**COURSES TAUGHT**

WHOI/MIT Joint PhD Program in Biological Oceanography

Fall 1999 – Topics in Behavior - Marine Mammal Anatomy

Spring 2003 – Topics in Behavior – Comparative Anatomy of Air-Breathing Marine  
Vertebrates

Spring 2004 – Marine Mammal Toxicology

Spring 2010 - Gast JP topics course - Ocean and Human Health

Boston University Marine Program

Oct 1997 - Marine Mammals – Anatomy section

Oct 1998 - Marine Mammals – Anatomy section

Feb 1999 – Marine Mammal Anatomy

U Penn/ Cornell Aquavet Program 1989 to present  
U Chicago – Whales course 2015

### **OTHER MENTORING**

As Director of the WHOI Marine Mammal Center, I have used that position to support WHOI colleagues in that discipline, including Aran Mooney, Amy Apprill, Gareth Lawson, Mark Baumgartner and Laela Sayigh, both fiscally and for some in terms of career development. National and international role as mentor and consultant for large whale trauma investigations.

### **MAJOR CRUISES**

Winter flounder survey for Massachusetts Water Resources Authority – annual April cruise, 1990 to present (**Chief Scientist**)  
Large whale survey and biopsy – RV Abel J. Falkland Islands to South Georgia 4 weeks Jan Feb 1997 (**Chief Scientist**)  
Right whale body condition surveys – Bay of Fundy – August 1995 to 2002 (**Chief Scientist**)  
North Atlantic historic right whaling habitat survey 15 months, 18,000 miles, 2001/2002 (Skipper)  
Survey of Basque whaling sites in Labrador Straits July 2004 and Lower N Shore Quebec July 2005 (Skipper)  
Field studies, Dolphin Quest, Honolulu 2014  
Field studies, Chicago Zoological Society dolphin health assessments, Sarasota, FL 2011 to present  
Field studies, UBC open water facility, Vancouver, BC (**PI**) 2012, 2013  
Acoustic behavioral studies Bay of Fundy August 2004 (Skipper)  
Sperm whale physiology – RV Alucia, Kaikoura New Zealand, March 2013 (**Chief scientist**).  
Blue whale photogrammetry, Gulf of Corcovado, Chile RV Centinella, Feb/ Mar 2015 (**PI**)  
Humpback whale photogrammetry and blow sampling – Stelwagen Bank – July 2015 (**PI**)  
Right whale photogrammetry and blow sampling – East of Amelia Island, FL Feb 2016 & 2017 (**PI**)  
Right whale photogrammetry and blow sampling – Cape Cod Bay, MA Feb 2016 to present (**PI**)

### **NECROPSIES UNDERTAKEN**

42 right whales, 12 humpback whales, 6 minke whales, 1 fin whale, 1 blue whale, 1 sperm whale, and numerous smaller species. With substantial local student involvement (FL to Quebec, and Argentina).

### **SOCIETY MEMBERSHIP**

Society for Marine Mammalogy  
American Veterinary Medical Association

### **COMMITTEE/ PANEL/ TASKFORCE MEMBERSHIP**

**WHOI**

Marine Mammal Center **Director** since 2011  
Staff Committee 2006 to 2008  
Sea Water Users Committee 1988 to present, **Chair** since 2011.  
Information Systems Council 1995 to 1997  
Institutional Animal Care and Use Committee Veterinarian 1987 to present

#### **EXTERNAL**

Ropeless Consortium Chair 2018 to 2019, Vice Chair 2019 to present  
NOAA Working Group Marine Mammal Unusual Mortality Events  
2012 to 2019, **Chair** 2015-2019  
NOAA Atlantic Scientific Review Group 2012 to present  
NOAA Right whale/fishery gear interaction workshops 2008 to 2014  
MWRA Outfall Monitoring Science Assessment Panel – Periodically in past decade  
South Georgia Heritage Trust Trustee 2005 to 2015  
National Institute of Environmental Health Sciences Site Review Team 6/98, 6/03  
New Bedford Whaling Museum – Trustee 2005 to 2011, 2015 to present.  
Right Whale Consortium – Board Member 1999 to present,  
**Vice President** 2002 to 2004, **President** 2004 to 2007  
Barnstable County MMR Scientific Advisory Panel 1996 to 1997  
Various regional panel discussions on MWRA issues 1993 to 1995  
Sippican Lands Trust: Trustee 1993 to 2003  
Mass Water Resources Authority Outfall Monitoring Taskforce 1992 to 1993  
Annual presentations to MWRA Science Review meetings 1992 to present.  
Island Foundation Inc: Corporator 1984 to present. **President** 2003 to 2007

#### **JOURNAL REVIEW**

##### **EDITOR**

Diseases of Aquatic Organisms (Aquatic Mammals **Subject Editor** - 2006 to 2015,  
2017 to present)  
Endangered Species Research **Special Issue Editor** 2016

##### **REVIEWER**

Marine Pollution Bulletin, ICES Journal of Marine Science, Marine Environmental  
Research, Aquatic Toxicology, Science, Nature, Marine Mammal Science, J  
Mammalogy, J Cetacean Research and Management, J Mammalogy,  
Endangered Species Research, Aquatic Mammals, J Wildlife Disease, Marine  
Ecology Progress Series, Frontiers J. Marine Science.

#### **WORKSHOPS and PRESENTATIONS (Recent)**

##### **INVITED PRESENTATIONS**

Animal Welfare in Practice: Marine Mammal Stranding. Atlantic Veterinary College, Prince  
Edward Island, Canada Sept 2018  
TEDx Provincetown June 2018  
ONR Diving Physiology Workshop, Santa Cruz, CA, Presenter  
IWC/ONR/NOAA Tagging Workshop Silver Spring DC Steering Committee and invited  
presenter  
National Stranding Conference, Sept 2016. Plenary talks on Unmanned Aerial System  
applications, documentation of case reports and definitions, and diagnosing vessel trauma.



Biennial Marine Mammal Society Meeting San Francisco Unmanned Aerial Systems workshop - **Invited** presenter 2015  
U Mass Dartmouth Art Department, **Invited** Lecture Feb 2015 Woods Hole Film Festival, Aug 2015 **Invited** Panel discussion of Chasing Bayla (Boston Globe)  
Global Whale Entanglement Response Network Workshop, Provincetown, MA **invited** presenter 2015  
Marion Natural History Society, **Invited** Lecture, Feb 2015 Feb 2016  
NOAA Serious Injury Workshop, Seattle, **Invited** participant 2014  
Taught a day long workshop by **invitation** for International Whaling Commission (IWC) on large whale necropsy technique in La Paz Mexico 2013 and then in St Maarten in 2014  
Biennial Marine Mammal Society Meeting Dunedin, NZ, Right whale workshop **invited** - Dec 2013  
Marine mammal forensics **invited** lecture at Tufts Vet School. 2013  
IWC Large Whale Euthanasia Workshop in London. **Invited participant** 2013  
Stelwagen Bank National Marine Sanctuary Advisory Council - Science Alternate 2013  
**Invited** seminar, Sea Mammals Research Unit, St Andrew's University, Scotland 2013  
WSPA Marine Debris Workshop - Miami FL **Invited participant 2013**  
IWC Marine Debris Workshop, **Invited participant**, Hosted at WHOI 2013  
Population Consequences of Disturbance Workshop - New England Aquarium **Invited** participant 2013  
WHOI Summer Student Fellow Orientation on IACUC, Annually 2010 to present  
Marine mammal forensics **invited** lecture Aquavet 2 at WHOI 2013 to present  
**Invited** talk on Marine Mammal Forensics to IWC Scientific Committee in Jeju Korea. 2013  
**Convended and chaired** workshop in Anchorage, Alaska. Implications of Arctic industrial growth and strategies to mitigate future vessel and fishing gear impacts  
NOAA CINAR workshop - Defining criteria for diagnosing human interaction in marine mammals. **Convended, chaired and lead** resulting monograph publication. Woods Hole. 2012  
**Invited** Lecture on right whale conservation via Skype to Huntsman Aquarium in St Andrews NB, Canada 2012  
NOAA Marine Mammal Breath Analysis Workshop SWFSC La Jolla, CA **Invited** participant 2012  
**Invited** Presentation at NOAA Large whale euthanasia workshop in Virginia Beach. 2011  
**Invited** presentation at workshop on large whale disentanglement – Provincetown 2011  
**Invited** seminar at UBC, Vancouver: 'Large Whale Forensics: A Management Tool' 2011  
NEAq Reverse Engineering Workshop, **Invited Participant**, hosted at WHOI. 2011  
**Invited speaker** World Society Protection of Animals Conference in UK 2011  
IWC Southern right whale die off workshop - Puerto Madryn, Argentina **Invited paper** 2010  
IWC Large Whale Entanglement Workshop, Maui, HI **Invited paper** 2010  
National Stranding Conference, Shepherdstown, WV April 5-9 2010 **Invited paper** Forensics Workshop  
Gas Kinetics Workshop WHOI **Invited** participant 2010  
**Convended and chaired** 3 workshops on large whale medical intervention at sea – Woods Hole 2000, 2002, 2007.

## **WORKSHOPS AND MEETING PRESENTATIONS**

Ropeless Consortium 2019, Portland Maine, 2019 Chair

N Atlantic Seal Research Consortium, U Mass Dartmouth 2019  
Ropeless Consortium, New Bedford 2018 co-chair  
Ropeless Workshop, WHOI, 2018 co-chair  
Right Whale Consortium, New Bedford, MA 2018  
Right Whale Consortium, Halifax, NS 2017  
Biennial Marine Mammal Society Meeting Halifax, NS 2017  
Biennial Marine Mammal Society Meeting San Francisco 2015  
N Atlantic Seal Research Consortium, Salem State U, participant, May 2015  
NOAA Unmanned Aerial Systems Workshop, Pittsburgh, PA as part of Wildlife Society Annual Meeting. Participant, 2014  
Biennial Marine Mammal Society Meeting Dunedin, NZ, spoken presentation, Dec 2013  
Right Whale Consortium, New Bedford, Nov 2013  
Right Whale Consortium New Bedford 2011  
Workshop on the impact of gillnets on marine mammals – WHOI 2010  
NOAA Gear Innovations Workshop - New Bedford 2010  
Right Whale Consortium- New Bedford 2010  
NOAA National Working Group on Unusual Marine Mammal Mortalities 2011  
PCAD workshop, Boston 2010  
Right Whale Consortium New Bedford 2010  
Right Whale Consortium, New Bedford MA 2009 Presentation  
Marine Mammal Society Biennial Meeting, Quebec City, Two talks 2009  
Ocean Human Health Gordon Conference, Biddeford ME Talk 2010

## **Publications (151 total)**

### **2020**

1. Myers, H. and M. **Moore**. Reducing effort in the U.S. American lobster (*Homarus americanus*) fishery to prevent North Atlantic right whale (*Eubalaena glacialis*) entanglements may support higher profits and long-term sustainability", Myers, Hannah J., and Michael J. Moore. "Reducing effort in the US American lobster (*Homarus americanus*) fishery to prevent North Atlantic right whale (*Eubalaena glacialis*) entanglements may support higher profits and long-term sustainability." *Marine Policy* 118 (2020): 104017.
2. Relvas, C., Moore, M., and L. Millman. Blowhole anomaly in pantropical spotted dolphin (*Delphinidae: Stenella attenuata*). *Marine Mammal Science*. DOI: 10.1111/mms.12708
3. **Moore**, M., G. Mitchell, T. Rowles and G. Early. Dead Cetacean? Beach, Bloat, Float, Sink. *Frontiers in Marine Science* 7, 333 doi: 10.3389/fmars.2020.00333.
4. Martins, M., C. Miller, P. Hamilton, J. Robbins, D. Zitterbart and M. **Moore**. Respiration cycle duration and seawater flux through open blowholes of humpback (*Megaptera novaeangliae*) and North Atlantic right (*Eubalaena glacialis*) whales. *Marine Mammal Science*.
5. Denk, M.A., A. Fahlman, S. Dennison-Gibby, Z. Song, M.J. **Moore**, Hyperbaric Tracheobronchial Compression in Cetaceans and Pinnipeds. *J. Exp. Biol.* 223, jeb217885. doi:10.1242/jeb.217885

6. Carroll, E. L., P. H. Ott, L. F. McMillan, B. Galletti Vernazzani, P. Neveceralova, E. Vermeulen, O. E. Gaggiotti, A. Andriolo, C. S. Baker, C. Bamford, M. **Moore** et al. 2020. Genetic diversity and connectivity of southern right whales (*Eubalaena australis*) found in the Brazil and Chile-Peru wintering grounds and the South Georgia (Islas Georgias del Sur) feeding ground. *Journal of Heredity*. 111(3), 263-276.
7. Christiansen, F., S. M. Dawson, J. W. Durban, H. Fearnbach, C. A. Miller, L. Bejder, M. Uhart, M. Sironi, P. Corkeron, W. Rayment, E. Leunissen, E. Haria, R. Ward, H. A. Warick, I. Kerr, M. S. Lynn, H. M. Pettis and M. J. **Moore**. 2020. Population comparison of right whale body condition reveals poor state of the North Atlantic right whale. *Marine Ecology Progress Series* 640:1-16.
8. Cubaynes, H.C., W.G. Rees, J.A. Jackson, M. Moore, T.L. Sformo, W.A. McLellan, M.E. Niemeyer, J.C. George, J. van der Hoop, and J. Forcada, *Spectral reflectance of whale skin above the sea surface: a proposed measurement protocol* *Remote Sensing in Ecology and Conservation* doi: 10.1002/rse2.155, 2020.

## 2019

9. Christiansen, F., M. Sironi, M. J. **Moore**, M. Di Martino, M. Ricciardi, H. A. Warick, D. J. Irschick, R. Gutierrez and M. M. Uhart. Estimating body mass of free-living whales using aerial photogrammetry and 3D volumetrics. *Methods in Ecology and Evolution* 10:2034-2044.
10. Myers, H.J., M.J. **Moore**, M.F. Baumgartner, S.W. Brilliant, S.K. Katona, A.R. Knowlton, L. Morissette, H.M. Pettis, G. Shester, and T.B. Werner, Ropeless fishing to prevent large whale entanglements: Ropeless Consortium report. *Marine Policy*. 107: p. 103587.
11. Hunt, K.E., N.S. Lysiak, C.J. Matthews, C. Lowe, A. Fernández Ajó, D. Dillon, C. Willing, M.P. Heide-Jørgensen, S.H. Ferguson, and M.J. **Moore**, Multi-year patterns in testosterone, cortisol and corticosterone in baleen from adult males of three whale species. *Conservation physiology*. 6(1): p. coy049.
12. **Moore**, M.J., How we can all stop killing whales: a proposal to avoid whale entanglement in fishing gear. *ICES Journal of Marine Science*. 76.4:781-786
13. Richardson, K., R. Asmutis-Silvia, J. Drinkwin, K.V. Gilardi, I. Giskes, G. Jones, K. O'Brien, H. Pragnell-Raasch, L. Ludwig, and K. Antonelis, M **Moore** et al., Building evidence around ghost gear: Global trends and analysis for sustainable solutions at scale. *Marine Pollution Bulletin*. 138: p. 222-229.
14. Martins, M. C. I., L. Sette, E. Josephson, A. Bogomolni, K. Rose, S. M. Sharp, M. Niemeyer and M. **Moore**. Unoccupied aerial system assessment of entanglement in Northwest Atlantic gray seals (*Halichoerus grypus*) <https://doi.org/10.1111/mms.12590>. *Marine Mammal Science*.
15. Sharp, S., W. McLellan, D. Rotstein, A. Costidis, S. Barco, K. Durham, T. Pitchford, P.-Y. Daoust, T. Wimmer, E. Couture, L. Bourque, T. Frasier, B. Frasier, D. Fauquier, T. Rowles, P. Hamilton and M. **Moore**. Gross and histopathologic diagnoses from North Atlantic right whale *Eubalaena glacialis* mortalities between 2003 and 2018. *Dis. Aq. Org.* 135(1), pp.1-31
16. Fahlman, A., K. McHugh, J. Allen, A. Barleycorn, A. Allen, J. Sweeney, R. Stone, G. Bedford, M. J. **Moore** and F. Jensen. "Resting metabolic rate and lung function in wild offshore common bottlenose dolphins, *Tursiops truncatus*, near Bermuda." *Frontiers in Physiology* 9: 886.

**2018**

17. van der Hoop, J., A. Fahlman, K.A. Shorter, J. Gabaldon, J. Rocho-Levine, V. Petrov, and M.J. **Moore**, Swimming energy economy in bottlenose dolphins under variable drag loading. *Frontiers in Marine Science* <https://doi.org/10.3389/fmars.2018.00465>.
18. Werth, A.J., D. Rita, M.V. Rosario, M.J. **Moore**, and T.L. Sformo, How do baleen whales stow their filter? A comparative biomechanical analysis of baleen bending. *Journal of Experimental Biology*, 2018. **221**(23): p. jeb189233.
19. **Moore** M., Pembroke A., Nestler E., Hall M., Lefkovitz L., Lambert M., Keay K. Toxics source reduction and sewage upgrades eliminated winter flounder liver neoplasia (1984-2017) from Boston Harbor, MA, U.S.A. *Diseases of Aquatic Organisms*. (2019) 131:239-243 DOI: <https://doi.org/10.3354/dao03299>
20. Norman, S. A., K. R. Flynn, A. N. Zerbini, F. Gulland, M. J. **Moore**, S. Raverty, D. S. Rotstein, B. R. Mate, C. Hayslip and D. Gendron (2018). "Assessment of wound healing of tagged gray (*Eschrichtius robustus*) and blue (*Balaenoptera musculus*) whales in the eastern North Pacific using long-term series of photographs." *Marine Mammal Science* 34(1): 27-53.
21. de Quirós, Y. B., M. Hartwick, D. S. Rotstein, M. M. Garner, A. Bogomolni, W. Greer, M. E. Niemeyer, G. Early, F. Wenzel and M. **Moore** (2018). "Discrimination between bycatch and other causes of cetacean and pinniped stranding." *Diseases of Aquatic Organisms* **127**(2): 83-95.
22. Fahlman, A., K. McHugh, J. Allen, A. Barleycorn, A. Allen, J. Sweeney, R. Stone, G. Bedford, M. J. **Moore** and F. Jensen (2018). "Resting metabolic rate and lung function in wild offshore common bottlenose dolphins, *Tursiops truncatus*, near Bermuda." *Frontiers in Physiology* **9**: 886.
23. Lysiak, N. S., S. J. Trumble, A. R. Knowlton and M. J. **Moore** (2018). "Characterizing the Duration and Severity of Fishing Gear Entanglement on a North Atlantic Right Whale (*Eubalaena glacialis*) Using Stable Isotopes, Steroid and Thyroid Hormones in Baleen." *Frontiers in Marine Science* **5**: 168.
24. Párraga, D. G., M. **Moore** and A. Fahlman (2018). "Pulmonary ventilation–perfusion mismatch: a novel hypothesis for how diving vertebrates may avoid the bends." *Proc. R. Soc. B* **285**(1877): 20180482.
25. Fahlman, A., M. Brodsky, R. Wells, K. McHugh, J. Allen, A. Barleycorn, J. Sweeney, D. Fauquier and M. **Moore** (2018). "Field energetics and lung function in wild bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay Florida." *R. Soc. Open Sci.* **5**(1): 171280.

**2017**

26. Hunt, K. E., N. S. Lysiak, M. **Moore** and R. M. Rolland (2017). "Multi-year longitudinal profiles of cortisol and corticosterone recovered from baleen of North Atlantic right whales (*Eubalaena glacialis*)." *General and Comparative Endocrinology* 254: 50-59.
27. Rolland RM, McLellan WA, **Moore** MJ, Harms CA, Burgess EA, Hunt KE (2017) Fecal glucocorticoids and anthropogenic injury and mortality in North Atlantic right whales (*Eubalaena glacialis*). *Endanger Species Res* 10:3354
28. Apprill, A, C Miller, M **Moore**, J Durban, H Fearnbach, and L Barrett-Lennard. Extensive core microbiome in drone-captured whale blow supports a framework for health monitoring *mSystems* 2 (5), e00119-17.

29. **Moore** M, Zerbini A Dolphin blubber/axial muscle shear: implications for rigid transdermal intra-muscular tracking tag trauma in whales. *J Exp Biol:jeb*. 165282
30. Guerra M, Hickmott L, van der Hoop J, Rayment W, Leunissen E, Slooten E, **Moore** M (2017) Diverse foraging strategies by a marine top predator: sperm whales exploit pelagic and demersal habitats in the Kaikōura submarine canyon. *Deep Sea Research Part I: Oceanographic Research Papers*
31. Hunt KE, Lysiak NS, Moore M, Rolland RM (2017) Multi-year longitudinal profiles of cortisol and corticosterone recovered from baleen of North Atlantic right whales (*Eubalaena glacialis*). *Gen Comp Endocrinol* 254:50-59
32. van der Hoop\*, Julie, Peter Corkeron, and Michael **Moore**. 2017. "Entanglement is a costly life-history stage in large whales." *Ecology and evolution* 7 (1):92-106
33. Fahlman, A., **Moore**, M.J. and Garcia-Parrag, D. (2017) Respiratory function and mechanics in pinnipeds and cetaceans. *J. Exp. Biol.* 220.10: 1761-1773
34. Shorter, K.A., Shao, Y., Ojeda, L., Barton, K, Rocho-Levine, J, van der Hoop, J, and **Moore**, M. (2017) A day in the life of a dolphin: Using bio-logging tags for improved animal health and well-being. *Marine Mammal Science*. 33(3): 785–802
35. Fiore, G, Anderson, E, Garborg, C, Murray, M, Johnson, M, **Moore**, M, Howle, L, Shorter, K 2017. From the track to the ocean: using flow control to improve marine bio-logging tags *PLOS One* <https://doi.org/10.1371/journal.pone.0170962>
36. Asmutis-Silvia, R., S. Barco, T. Cole, A. Henry, A. Johnson, A. Knowlton, S. Landry, D. Mattila, M. **Moore**, J. Robbins, J. van der Hoop. Rebuttal to published article "A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs" by M. Stelfox, J. Hudgins, and M. Sweet. *Marine Pollution Bulletin* 117 (1-2):554.
37. van der Hoop\*, J.M., D.P. Nowacek, M.J. **Moore**, M. Triantafyllou. (2017) Swimming kinematics and efficiency of entangled North Atlantic right whales. *Endangered Species Research* 32:1-17 doi: 10.3354/esr00781

## 2016

38. Kraus, S. D., R. D. Kenney, C. A. Mayo, W. A. McLellan, M. J. Moore and D. P. Nowacek. 2016. Recent scientific publications cast doubt on North Atlantic right whale future. *Frontiers in Marine Science* 3:137
39. van der Hoop, J.M., P. Corkeron, A.G. Henry, A.R. Knowlton and M.J. **Moore**. Predicting lethal entanglements as a consequence of drag from fishing gear. *Marine Pollution Bulletin*. 10.1016/j.marpolbul.2016.11.060
40. van der Hoop, J.M., P. Corkeron, M.J. **Moore**. Energetic impacts of entanglement in North Atlantic right whales (*Eubalaena glacialis*). *Ecology and Evolution*. DOI: 10.1002/ece3.2615
41. Wiley, D., Mayo, C, Maloney, E, and **Moore** M. (In press). Vessel Strike Mitigation Lessons from Direct Observations Involving Two Collisions between Non-Commercial Vessels and North Atlantic Right Whales (*Eubalaena glacialis*). *Marine Mammal Science*
42. Durban, J, **Moore**, M, Chiang, Ghickmott, L, Bocconcelli, A., Howes, G., Bahamonde, P.A., Perryman, W.L., LeRoi, D.J., 2016. Photogrammetry of blue whales with an

unmanned hexacopter. Marine Mammal Science DOI: 10.1111/mms.12328

43. Fahlman, A., van der Hoop, J., Moore, M.J., Levine, G., Rocho-Levine, J., Brodsky, M. In Press. Estimating energetics in cetaceans from 1 respiratory frequency: why we need to understand physiology. Open Biology. *Contribution: assisted with manuscript.*
44. Hunt, K., N. Lysiak, M. **Moore** and R. Rolland. In Press. Longitudinal progesterone profiles in baleen from female North Atlantic right whales (*Eubalaena glacialis*) match known calving history. Conservation Physiology. *Contribution: collected a major time series of right whale baleen for this study. Assisted with data interpretation and manuscript.*
45. Fahlman, A., M. **Moore**, A. Trites, D. Rosen, M. Haulena, N. Waller, T. Neale, Y Ming, S. Thom (In Press). Dive, food, and exercise effects on blood microparticles in Steller sea lions (*Eumetopias jubatus*): exploring a biomarker for decompression sickness. American Journal of Physiology. *Contribution: secured ONR support, PI, planned experiment, undertook fieldwork, contributed to data analysis and manuscript.*
46. Sharp, S. M., C. T. Harry, J. M. Hoppe, K. M. Moore, M. E. Niemeyer, I. Robinson, K. S. Rose, W. B. Sharp, S. Landry, J. Richardson and **Moore**, M. J. (2016). "A comparison of postrelease survival parameters between single and mass stranded delphinids from Cape Cod, Massachusetts, USA." Marine Mammal Science. 32: 161–180. doi: 10.1111/mms.12255 *Contribution: established the stranding network and developed the clinical protocols that enabled the study, made the clinical triage decisions, assisted with manuscript, advised the lead author during this her DVM student thesis.*

## 2015

47. van Der Hoop\*, J. M., A. S. M. Vanderlaan, T. V. N. Cole, A. G. Henry, L. Hall, B. Mase-Guthrie, T. Wimmer and M. J. **Moore**. 2015. Vessel Strikes to Large Whales Before and After the 2008 Ship Strike Rule. Conservation Letters 8:24-32. *Contribution: conceived of the study, PI of project, advised the student lead author, assisted with manuscript.*
48. van der Hoop\*, J. M., P. Corkeron, J. Kenney, S. Landry, D. Morin, J. Smith and M. J. **Moore** (2015). "Drag from fishing gear entangling North Atlantic right whales." Marine Mammal Science. *Contribution: conceived of the study, PI of project, assisted with field work, advised the PhD student lead author, assisted with manuscript.*

## 2014

49. Joblon\*, M. J., M. A. Pokras, B. Morse, C. T. Harry, K. S. Rose, S. M. Sharp, M. E. Niemeyer, K. M. Patchett, W. B. Sharp, and M. J. **Moore**. 2014. Body Condition Scoring System for Delphinids Based on Short-beaked Common Dolphins (*Delphinus delphis*). Journal of Marine Animals and Their Ecology 7:5-13. *Contribution: advised the DVM student, conceived of the project, gave veterinary oversight to the case material, assisted with the manuscript.*

50. van Der Hoop\*, J. M., A. Fahlman, T. Hurst, J. Rocho-Levine, K. A. Shorter, V. Petrov and M. J. **Moore**. 2014. Bottlenose dolphins modify behavior to reduce metabolic effect of tag attachment. *Journal of Experimental Biology* 217:4229-4236. *Contribution: PI of project, advised PhD student arranged for experimental opportunity, assisted with field work, contributed to manuscript.*
51. van Der Hoop\*, J., M. **Moore**#, A. Fahlman, A. Bocconcelli, C. George, K. Jackson, C. Miller, D. Morin, T. Pitchford, T. Rowles, J. Smith and B. Zoodsma. 2014. Behavioral impacts of disentanglement of a right whale under sedation and the energetic cost of entanglement. *Marine Mammal Science* 30:282-307. *Contribution: advised student, developed sedation system, PI of project, undertook field work and tag deployment, assisted with manuscript.*
52. Shorter\*, K. A., M. M. Murray, M. Johnson, M. Moore and L. E. Howle. 2014. Drag of suction cup tags on swimming animals: Modeling and measurement. *Marine Mammal Science* 30:726-746. *Contribution: PI of project, assisted with project design and field work, assisted with manuscript.*
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