

Pre-print

Rebuttal to published article “A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs” by M. Stelfox, J. Hudgins, and M. Sweet.

Dear Dr. Sheppard, as per our earlier email communications:

We reviewed the findings of the recently published article by Stelfox et al. (2016): “A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs” published in this journal (Volume 111, pp 6–17) and found that they are both flawed and misleading as they do not accurately reflect the prevalence of “ghost gear” cases reported in the literature. While we commend the authors for recognizing the importance of attempting to quantify the threat and for recommending more comprehensive databases, the methods, results and conclusions of this review have not advanced the understanding of the issue. As authors of the papers on whale entanglements in the North Atlantic that were reviewed by Stelfox et al. (2016) and others who are knowledgeable about the topic, we provide specific comments regarding misrepresentations of both the source of entanglement (e.g., actively fished gear versus “ghost gear”) and the number of reported entanglements for whale species included in the North Atlantic.

1. Differentiating between “ghost gear” and active gear

The first significant issue is that this review does not differentiate cases of “ghost gear” entanglement from entanglement in fishing gear that was actively in use at the time the entanglement occurred. We contend that none of the 1,453 North Atlantic whale entanglement cases described as “ghost gear” or abandoned, lost, or otherwise discarded fishing gear (ALDFG), in this review were reported as such by the original

cited source, nor was there adequate information presented to assign them to that category.

Table 1 in Stelfox et al. (2016) is said to provide the “number of marine mammals recorded entangled in ghost gear since Laist (1997).” However, that table consistently lists studies that did not specifically report on the type or status (ALDFG, actively fished gear, or something else) of the entangling gear. In fact, many of the cited papers did not specifically analyze or otherwise report upon this aspect of the gear. Only one of the papers cited for whales in the North Atlantic was a systematic study of the type of materials involved in whale entanglement events (Johnson et al. 2005). This paper did not conclude that any of the gear was necessarily, or even likely, ALDFG. In fact, there are many cases included in our studies in which the gear owner either reported the entangled whale or was interviewed when the gear was retrieved or identified, confirming that the gear was being actively fished when the entanglement occurred. Yet, Stelfox et al. (2016) listed all of these cases in the cited literature linked to a specific type of active fishing gear (e.g., pot gear, gillnet gear) as “ghost gear” in Table 1. Other whale studies cited from the North Atlantic focused on the frequency and impact of documented entanglements on individuals and populations, not the nature of the gear itself (Cassoff et al., 2011; Cole et al., 2006; Glass et al., 2009; Henry et al., 2012; Henry et al., 2014; Knowlton et al., 2012; Knowlton and Kraus, 2001; Nelson et al., 2007; Robbins, 2009; Robbins and Mattila, 2001, 2004; van der Hoop et al., 2013). Rarely did these sources mention the specific type or status of gear involved in reported events beyond the fact that it was fishing-related.

“Ghost gear” assignment errors also appear to extend beyond the North Atlantic literature. The review also attributed all fishing-related gear events in a North Pacific study (Moore et al. 2009) to ALDFG, despite the conclusion by the study authors that “fishing gear involved in entanglements in this study could be either active gear or discarded gear.” Two North Pacific studies that focused only on entanglement injuries were also included despite the fact that no gear information was presented by the

original sources (Bradford et al., 2009; Neilson et al., 2009). We did not assess the degree to which gear mischaracterization occurred in other cases.

2. The total number of entanglement cases reported

The total number of whale entanglement cases reported in Stelfox et al. (2016) is grossly inaccurate and individual cases were often counted multiple times. The counts in Table 1 for North Atlantic whales are not consistent with the total number of entanglement cases reported, the number of cases in which gear was actually recovered, or the number of cases in which gear was studied and specifically categorized as ALDFG. For some papers, it was difficult for us to ascertain what the counts in Stelfox et al. (2016) were based on. It appears that the authors merely summed cases across the cited studies without recognizing that these studies reviewed different aspects of the same entanglement cases. For example, van der Hoop et al. (2013) summarized all reported entanglement cases from 1970 through 2009; the same events had previously been studied in the other cited North Atlantic whale entanglement papers published prior to that date. A number of papers cited in this review were annually-produced evaluations of entanglement reports occurring over consecutive five-year blocks of time (Cole et al., 2006; Nelson et al., 2007; Glass et al., 2008; Glass et al., 2009, 2010; Henry et al., 2012; Cole and Henry, 2013; Henry et al., 2014). These evaluations clearly and intentionally reported on many of the same entanglement cases, but it does not appear that Stelfox et al. (2016) recognized nor accounted for this in their totals. As another example, Johnson et al. (2005) summarized the gear involved in North Atlantic right and humpback whale entanglements documented between 1993 and 2002, while other aspects of these events were studied in other listed papers (e.g., Cole et al., 2006; Glass et al., 2008; Knowlton et al., 2012; Knowlton and Kraus, 2001; Nelson et al., 2007; van der Hoop et al., 2013). The cases from each published study were treated as unique events by Stelfox et al. (2016), and their results are therefore patently incorrect and often counted multiple times.

In summary, while we do not discount that ALDFG is a serious concern, it is not the only, nor likely the most significant, source of marine animal entanglement in fishing gear. Entanglement is a significant conservation and welfare issue which is limiting the recovery of a number of marine species, including marine mammals (e.g., Reeves et al., 2013; Rojas-Bracho and Reeves, 2013; van der Hoop et al., 2013). It is therefore important to reliably identify the causes of these events, including the nature of the entangling gear, in order to reduce or prevent them in the future.

The implication by Stelfox et al. (2016) that all fishery-related entanglements are attributable to ALDFG, and the authors' failure to consider risk from actively fished gear, has the potential to hamper efforts to address the very real threat posed by the latter. It has strong public and policy implications because it could misdirect resource managers from addressing the appropriate issues. It also contributes to an increasing public misperception that ALDFG is the primary marine mammal entanglement problem. A variety of efforts are currently underway, involving many stakeholders, to manage and reduce the risk associated with active fishing gear on marine mammals and other marine species, such as sea turtles. The misleading conclusions of Stelfox et al. (2016) may inadvertently undermine these efforts.

References

Bradford, A.L., Weller, D.W., Ivashchenko, Y.V., Burdin, A.M., Brownell, R.L., 2009. Anthropogenic scarring of western gray whales (*Eschrichtius robustus*). *Mar. Mamm. Sci.* 25, 161-175.

Cassoff, R.M., Moore, K.M., McLellan, W.A., Barco, S.G., Rotstein, D.S., Moore, M.J., 2011. Lethal entanglement in baleen whales. *Diseases of Aquatic Organisms* 96, 175-185.

Cole, T.V.N., Hartley, D., Garron, M., 2006. Mortality and serious injury determinations for baleen whale stocks along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2000-2004. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 06-04. p. 18.

Cole, T.V.N., Henry, A.H., 2013. Serious Injury Determinations for Baleen Whale Stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2007-2011. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-24. 14p.

Glass, A.H., Cole, T.V.N., Garron, M., 2009. Mortality and serious injury determinations for baleen whale stocks along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2003-2007 (Second Edition). US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-04. 19p.

Glass, A.H., Cole, T.V.N., Garron, M., 2010. Mortality and serious injury determinations for baleen whale stocks along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2004-2008. NOAA Technical Memorandum NMFS NE 214. 19 p.

Glass, A.H., Cole, T.V.N., Garron, M., Merrick, R.L., Pace III, R.M., 2008. Mortality and serious injury determinations for baleen whale stocks along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2002-2006. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 08-04. 18p.

Henry, A.H., Cole, T.V.N., Garron, M., Hall, L., Ledwell, W., Reid, A., 2012. Mortality and serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2006-2010. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-1. 24p.

Henry, A.H., Cole, T.V.N., Hall, L., Ledwell, W., Morin, D., Reid, A., 2014. Mortality and serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2008-2012. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-10. 17 p.

Johnson, A., Salvador, G., Kenney, J., Robbins, J., Kraus, S., Landry, S., Clapham, P., 2005. Analysis of fishing gear involved in entanglements of right and humpback whales. Mar. Mamm. Sci. 21, 635-645.

Knowlton, A.R., Hamilton, P.K., Marx, M.M., Pettis, H.M., Kraus, S.D., 2012. Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: a 30 yr retrospective. Mar. Ecol. Prog. Ser. 466, 293-302.

Knowlton, A.R., Kraus, S.D., 2001. Mortality and serious injury of northern right whales (*Eubalaena glacialis*) in the western North Atlantic ocean. J. Cetacean Res. Manage. (special issue) 2, 193-208.

Laist, D., 1997. Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records, in: Coe, J.M., Rogers, D.B. (Eds.), Marine Debris. Springer, New York, pp. 99-139.

Moore, E., Lyday, S., Roletto, J., Litle, K., Parrish, J.K., Nevins, H., Hermance, A., 2009. Entanglements of marine mammals and seabirds in central California and the north-west coast of the United States 2001–2005. Mar. Pollut. Bull. 58 (7), 1045–1051.

Neilson, J.L., Straley, J.M., Gabriele, C.M., Hills, S., 2009. Non-lethal entanglement of humpback whales (*Megaptera novaeangliae*) in fishing gear in northern Southeast Alaska. *Journal of Biogeography* 36, 452-464.

Nelson, M., Garron, M., Merrick, R.L., Pace III, R.M., Cole, T.V.N., 2007. Mortality and serious injury determinations for baleen whale stocks along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2001-2005. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 07-04. 18p

Reeves, R.R., McClellan, K., Werner, T.B., 2013. Marine mammal bycatch in gillnet and other entangling net fisheries, 1990 to 2011. *Endangered Species Research* 20, 71-97.

Robbins, J., 2009. Scar-Based inference into Gulf of Maine humpback whale entanglement: 2003-2006. Report to the National Marine Fisheries Service. Order Number EA133F04SE0998. 24p.

Robbins, J., Mattila, D.K., 2001. Monitoring entanglements of humpback whales (*Megaptera novaeangliae*) in the Gulf of Maine on the basis of caudal peduncle scarring. Unpublished report to the Scientific Committee of the International Whaling Commission: SC/53/NAH25.

Robbins, J., Mattila, D.K., 2004. Estimating humpback whale (*Megaptera novaeangliae*) entanglement rates on the basis of scar evidence. Report to the National Marine Fisheries Service. Order number 43ENNF030121. 22p.

Rojas-Bracho, L., Reeves, R.R., 2013. Vaquitas and gillnets: Mexico's ultimate cetacean conservation challenge. *Endangered Species Research* 21, 77-87.

Stelfox, M., J. Hudgins, and M. Sweet. (2016). A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs. *Marine Pollution Bulletin* Volume 111, Issues 1–2, 15 October 2016, Pages 6–17.

van der Hoop, J.M., Moore, M.J., Barco, S.G., Cole, T.V.N., Daoust, P.-Y., Henry, A.G., McAlpine, D.F., McClellan, W.A., Wimmer, T., Solow, A.R., 2013. Assessment of management to mitigate anthropogenic effects on large whales. *Conservation Biology* 27, 121-133.

Senior Biologist

Regina Asmutis-Silvia

Whale and Dolphin Conservation, USA

E-mail address: Regina.Asmutis-Silvia@whales.org

Research Coordinator & Senior Scientist

Susan Barco

Virginia Aquarium & Marine Science Center Foundation, USA

E-mail address: SGBarco@virginiaaquarium.com

Research Fishery Biologist

Tim Cole
NOAA's Northeast Fisheries Science Center, USA
E-mail address: Tim.Cole@noaa.gov

Research Fishery Biologist
Allison Henry
NOAA's Northeast Fisheries Science Center, USA
E-mail address: Allison.Henry@noaa.gov

NOAA Affiliate
Amanda Johnson
Integrated Statistics under contract to the Greater Atlantic Regional Fisheries Office,
USA
E-mail address: Amanda.Johnson@noaa.gov

Research Scientist
Amy Knowlton
New England Aquarium, USA
E-mail address: AKnowlton@neaq.org

Marine Animal Entanglement Response Director
Scott Landry
Center for Coastal Studies, USA
E-mail address: SCLandry@coastalstudies.org

Global Whale Entanglement Response Network Coordinator
David Mattila
International Whaling Commission and Center for Coastal Studies, USA
E-mail address: David.Mattila@IWC.int

Senior Research Specialist
Michael Moore
Woods Hole Oceanographic Institution, USA
E-mail address: MMoore@whoi.edu

Senior Scientist
Jooke Robbins
Center for Coastal Studies, USA
E-mail address: JRobbins@coastalstudies.org

Post-Doctoral Investigator
Julie van der Hoop
Woods Hole Oceanographic Institution, USA
E-mail address: Jvanderhoop@whoi.edu