A note on the entanglement of large whales in marine debris

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ABSTRACT

The incidence of entanglement of large whales in marine debris is poorly understood. Recent entanglement records from some areas indicate that a significant number of animals are reported to be entangled in rope and net of undetermined origin, (20% along the Atlantic coast of the U.S. and Canada). However, it is extremely rare that "marine debris" is determined to be the cause of the original entanglement. In this note several confirmed reports are discussed, indicating a possible mechanism by which certain species may become entangled in marine debris. While there are new efforts to gather data relevant to this issue, the extent to which large whale entanglement in marine debris is a problem remains unknown.

KEYWORDS: DEBRIS, INCIDENTAL CATCHES

INTRODUCTION

There are many definitions of "marine debris", but most broadly define it as all manmade objects that are lost, abandoned or discarded in the Oceans of the world. While marine mammals can die from ingesting small manmade objects, the major threat that marine debris poses to large whales appears to be entanglement (Laist, 1996a). Therefore, we focus here on debris that might cause a lethal entanglement for large whales, such as derelict ropes, nets and buoys. While some of this can come from a variety of sources (moorings, research, commercial transport) the vast majority comes from the world's fisheries, but is no longer being fished, and may even have drifted far from where it was originally deployed. Most authors refer to this as "derelict" or "ghost" gear. Since the term "ghost fishing" is also used to describe the process by which this lost, abandoned or discarded gear continues to catch both its targeted species and incidental catch, we will use the term ghost gear. The amount of ghost gear currently existing in the world's Oceans, and the rate at which it is produced, is not known, but likely varies considerably depending on the type of fishery and its associated regulations, the cost and materials used to manufacture the gear, and the environment and manner in which it is deployed. Because virtually all fishing gear is currently made from long-lasting synthetic materials, Laist (1996b) reports that in some areas ghost gear may outnumber actively fished gear and its associated catch of the target species alone can range from 5-30% of the officially landed catch. The level of incidental catch is less well documented.

The percentage of overall marine debris that is made up of ghost gear is not well known for most areas, but has been reported (mostly from beach surveys) to be 29% on Macquarie Island in the Southern Ocean (Slip and Burton, 1991), 2-41% in Australia (Jones, 1994) and 38-46% of dedicated benthic trawls in Alaska (Hess et. al., 1999). In a dedicated removal program, the U.S. NOAA Fisheries and partners removed 35 metric tonnes of ghost gear (primarily trawl and drift net) from the beaches and shallow reefs of the Northwest Hawaiian Islands between 1996 and 1999 (Brainard et. al., 2000).

Further complicating any attempt to estimate entanglement risk to large whales is that some ghost gear, especially bottom set gear like traps, will likely remain relatively close to where it was set, while mid-water or floating gear, including fragments of bottom gear which break away and float (e.g. buoy systems), may be carried off by currents to concentrate in ocean gyres hundreds or thousands of miles from its point of origin. Therefore, when trying to determine the risk of large whale entanglement, some ghost gear may be considered a subset of the actively fished gear in a given whale habitat. However, gear that is carried away may pose an entirely unexpected risk in other aggregation areas (e.g. bottom trawl fragments in the Northwest Hawaiian Islands), and along oceanic migratory routes (Matsumura and Nasu, 1997).

In his review of entanglements of marine wildlife in marine debris Laist (1996a) determined that at least 135 species have been reported entangled in marine debris and ghost gear. He includes records of bowhead, northern and southern right, humpback, gray, minke and sperm whales. However, he recognizes that it is difficult to determine if the gear entangling the whale was ghost gear or actively fished gear when the whale encountered it. He assumes that some unknown percentage of what was recorded as "undetermined" ropes and nets was indeed ghost gear. In a recent more detailed review of gear removed from whales along the east coast of the U. S. and Nova Scotia, Johnson et. al. (2005) found that even when the gear removed was examined carefully by fisheries specialists they could not determine the origin of 20% of it. The authors did not report on any attempt to

determine if any of the gear was ghost gear, but the implicit assumption throughout is that it was actively fished gear, and that the percentage that could not be identified was due to the loss of any identifying buoys or tags.

The full extent to which large whales can become seriously entangled in manmade ropes and nets, whether actively fished or ghost, is not well known. However, for some populations and locations entanglement represents a significant anthropogenic risk (Lien et al., 1989; Robbins and Mattila, 2004 and Felix et al., 2005). In some cases it may even seriously impair a population's ability to recover (Knowlton et al, 2001; Caswell, 1999).

METHODS

Large whale entanglement records for the United States over the past decade were reviewed for documented evidence of entanglement in ghost gear. These records are kept by the NOAA Fisheries, which divides U.S. waters into (currently) six regional offices. Each regional office has a staff member designated to coordinate the investigation and documentation of any reports of entangled large whales. In Hawaii the authors assisted in the examination of gear from entangled whales reported, as they coordinate the whale disentanglement network there. In addition the individual who coordinates disentanglement effort along the coast of Western Australia was interviewed.

RESULTS

While there is a concerted effort to standardize record keeping in the U.S., it became clear that the detail in the records and the level of investigation in each region varied widely due to a combination of the complexity of this task and the resources available. The former was exacerbated by the remoteness of some regions (e.g. Alaska) and the latter was influenced by the perceived priority of the problem. For instance, along the Atlantic coast of U.S. the urgency of the right whale situation has leveraged the resources to establish a trained, well-equipped and staffed disentanglement network, and gear they remove from whales is examined in detail. While along the Pacific coast there are individual teams in some locations, but the gear is not documented or examined at the same level everywhere. Therefore we concluded that a detailed comparison would be of little or no value at this time. But, where records allowed, the findings were consistent with those from Johnson et. al. (2005) in that approximately 20% (or more) of the reported entanglements were in undetermined rope and net. However, with the exception of Hawaii, no one from any of the regions reported an entanglement where the gear was positively identified as ghost gear. In Hawaii between 1995 and 2005 there was strong circumstantial evidence suggesting that two animals (both yearlings) had become entangled in ghost gear as calves. Interestingly, although not a part of the reports reviewed here, one of us (Mattila) removed ghost gear and marine debris (packing straps) from a calf of the year on a breeding ground in the North Atlantic (Silver Bank, Dominican Republic) in 1993, suggesting that young animals may be more likely to become entangled in ghost gear. In 2005 on the Hawaii breeding grounds we removed a life-threatening entanglement made up of over 21 different types of rope and netting from a juvenile whale.

In addition, examination of the reports from Hawaii indicated that humpback whales can become entangled during daylight in areas with clear water where they are not feeding. This finding is further supported by reports of entanglements in gear along the west coast of Australia where 23 of 33 entanglements between 1990 and 2004 were in local rock lobster gear, which whales encounter as they migrate along that coast (Anon. 2005).

Finally, several observers reported humpback whales playing with rope and buoys at the surface in Hawaii. A naturalist on a whale watch boat in Nova Scotia (Barnaby, pers. com.) watched a humpback calf play in a patch of floating derelict rope, in which it became entangled, but subsequently freed itself by violent thrashing. We have seen humpback whales routinely roll and play in patches of seaweed in the Gulf of Maine, and researchers from the Provincetown Center for Coastal Studies witnessed a young right whale do the same in a patch of seaweed that included small pieces of manmade debris. How often this type of behavior results in a serious entanglement is unknown.

DISCUSSION

Investigating the incidence of large whale entanglements in manmade rope and nets is extremely difficult. These cryptic events are rarely witnessed by observer programs as these large animals frequently break the gear swimming off with what may still be a lethal entanglement. Entanglements in ghost gear are even less likely to be witnessed, and yet certain areas of the world's Oceans are accumulating large quantities of this persistent threat. These are not necessarily feeding grounds, as several areas of high concentration have been found in mid-Ocean areas through which humpback whales (and possibly others) migrate (Brainard et. al., 2000). In

addition, some fishing gear which is not considered an entanglement threat to large whales while fishing (e.g. bottom trawls), can become as much a threat as other passive gear when lost or discarded.

Laist (1996a) suggests three behaviors that put animals at greatest risk to become entangled in ghost gear and other marine debris: that is feeding, play and nest building (for seabirds). While he noted that some marine mammals (e.g. pinnipeds) were known to become entangled while playing, he assumed that feeding is the behavior that puts large whales at risk of entanglement. The documented reports of whales becoming entangled in gear in Hawaii and along the migratory route off Australia suggest that at least humpback whales can become seriously entangled while not engaged in feeding or foraging. The confirmed reports presented here, along with observations of play behaviour, suggests one possible mechanism by which migrating and non-feeding whales may become entangled in ghost gear and other debris.

In the case of ghost gear that is still "ghost fishing" it is easy to envision that a whale may become entangled in it in much the same manner that it would if it were actively fished gear. In such cases it is also easy to assume that the severity of the entanglement and subsequent impact on the animal would be similar in both instances. While we have suggested a mechanism by which a large whale may become entangled in floating ghost gear or fragments of gear, it may not be as easy to understand how this may become life-threatening. However, in the case of the two yearlings documented off of Hawaii, each was entangled in a single wrap of approximately 2.2 cm diameter synthetic rope. In each case the rope was just ahead of the flippers but not in the mouth, and the young whales had grown into the wrap to the extent that the rope was embedded approximately 10 cm into the body. Both were clearly lethal if not removed. In addition, ghost gear can complicate an existing entanglement, no matter what type of gear entangled the whale originally. This occurred in a case in New England where one of us (Mattila) removed entangling gear from a humpback whale which included several derelict lobster traps which had become ensnared in the net entangling the whale.

While we are beginning to understand the enormity of the marine debris problem, we know very little of its true impact on large whales. Its potential effects must be factored into the equation of incidental catches for local fishing efforts. However, it may also cross entire Oceans and entangle whales in completely different habitats. As such it is an international issue that needs collaboration, standardized terminology and definitions and more thorough investigation. In Hawaii, we are attempting to document entanglements more thoroughly, retrieve gear, and, if the gear does not have an identifying buoy or tag, we hand it over to the NOAA Fisheries marine debris team, as they are attempting to identify and track ghost gear throughout the North Pacific.

ACKNOWLEDGEMENTS

We would like to thank the NOAA Fisheries Regional stranding coordinators, especially Joe Cordaro, Brent Norberg, Aleria Jensen and David Schofield. We also appreciate the time and effort put into "collecting" entangling gear, by the Atlantic large whale disentanglement network, in particular the team from the Provincetown Center for Coastal Studies. Finally, we appreciate the enthusiasm and effort of Doug Coughran of the Department of Conservation and Land Management, Western Australia.

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