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Managing U.S. Atlantic large whale entanglements: Four guiding principles

Diane L. Borggaard[a,*], David M. Gouveia[a], Mary A. Colligan[a,1], Richard Merrick[b], Kathryn S. Swails[a], Michael J. Asaro[a], John Kenney[a], Glenn Salvador[a], John Higgins[a]

[a] National Marine Fisheries Service, Greater Atlantic Region, 55 Great Republic Drive, Gloucester, MA, USA
[b] National Marine Fisheries Service, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA, USA

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ABSTRACT

Fatal entanglements in fishing gear threaten marine mammal populations worldwide. The management of entanglements of large whales, such as the North Atlantic right whale (*Eubalaena glacialis*), with commercial fisheries, is a challenge given the species' small population size, economic consequences of regulations, and the general lack of data on entanglements. The U.S. Marine Mammal Protection Act (MMPA) requires development of programs to limit marine mammal entanglement in commercial fishing gear. Following a retrospective look at implementing aspects of the MMPA, a set of guiding principles were developed with associated best practices useful in reducing fatal large whale entanglement in fishing gear. Among these are: 1) involve stakeholders early in the decision making process; 2) establish a transparent management strategy that includes critical needs to guide research; 3) use a variety of tools such as an established process for receiving new information and ideas; and 4) incorporate adaptive management which considers the constraints of dynamic (rapid) changes to some fixed fishing gear. Efforts to reduce worldwide marine mammal bycatch will typically occur in a data-limited environment as experienced with U.S. Atlantic large whale entanglements. The guiding principles will remain as key tools for reducing large whale bycatch in fisheries as they build upon common practices. These insights developed over two decades of management can potentially help others to address similar bycatch problems.

1. Introduction

Bycatch of marine mammals is a global problem [1]. For large whale stocks, the problem of modern fisheries bycatch impedes the recovery from centuries of commercial whaling around the world. To address the complex social and ecological challenges facing large whale recovery, fisheries management has embraced multi-party stakeholder negotiation as a method to incorporate diverse local knowledge and expertise into the policy process. In the United States, this process has been undertaken as take reduction planning under the Marine Mammal Protection of 1972 (MMPA) [2,3].

The recovery of the North Atlantic right whale (*Eubalaena glacialis*) is slowed by deaths resulting from ship strikes and entanglement in fishing gear [4]. The United States and Canada are involved in efforts to reduce the number of ship strike impacts on right whales [5–7], and the United States is also focused on efforts to reduce fishing gear entanglement on other large whale species [2,8]. The MMPA requires processes and timelines that enhance the recovery or prevent the depletion of vulnerable stocks of marine mammals (16 U.S.C. 1387).

The U.S. National Marine Fisheries Service (NMFS) is required under the 1994 amendments to the MMPA to establish and convene stakeholder groups (Take Reduction Teams; TRTs) to develop and implement plans (Take Reduction Plans; TRPs) in specific cases to reduce fatal marine mammal entanglements [2] (16 U.S.C. 1387). TRPs target fisheries with frequent or occasional levels of fatal bycatch of vulnerable stocks of marine mammals [9]. NMFS monitors fisheries where possible through observer programs to determine the level of marine mammal bycatch which facilitates the development of TRPs [9]. The goals of a TRP are to: 1) within six months of its implementation, reduce the fatal bycatch in U.S. commercial fishing operations to below the established acceptable levels (the Potential Biological Removal (PBR) level); and 2) within five years of its implementation, reduce bycatch to insignificant levels approaching a zero fatal bycatch rate (known as the zero mortality rate goal or ZMRG), taking into account

* Corresponding author.
E-mail addresses: diane.borggaard@noaa.gov (D.L. Borggaard), david.gouveia@noaa.gov (D.M. Gouveia), mary_colligan@fws.gov (M.A. Colligan), richard.merrick@noaa.gov (R. Merrick), kate.swails@noaa.gov (K.S. Swails), michael.asaro@noaa.gov (M.J. Asaro), johnk2035@gmail.com (J. Kenney), glenn.salvador@noaa.gov (G. Salvador), john.higgins@noaa.gov (J. Higgins).
[1] Present address: U.S. Fish and Wildlife Service, Alaska Region, 1011 E. Tudor Road, MS-361, Anchorage, AK, USA.

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the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans [2,10] (16 U.S.C. 1387).

The Atlantic Large Whale Take Reduction Team (Team) was established to help NMFS develop and modify the Atlantic Large Whale TRP (Plan) [11,12]. The Plan focuses on the North Atlantic right, humpback (*Megaptera novaeangliae*) and fin (*Balaenoptera physalus*) whales, and also benefits minke whales (*Balaenoptera acutorostrata*) [10,12] (50 CFR 229.32). Right and fin whales are listed as endangered species under the Endangered Species Act (ESA), and are, therefore, considered strategic stocks under the MMPA [10,13]. Humpback whales in the North Atlantic were removed from the endangered species list on October 11, 2016 [14], but remain protected under the MMPA. Because these large whale stocks interact with commercial fisheries at unacceptable levels, the MMPA requires a TRP to assist in their recovery [10,13,15]. The Plan also assists in the conservation and recovery of these endangered species under the ESA [4,13,16,17] (16 U.S.C. 1531 et seq.).

The relative statutory benchmarks to monitor success of the Plan in meeting its goals cannot simply be used to assess the efficacy of the management measures [8,18,19]. Fatalities are monitored and compared to PBR and ZMRG (available in stock assessments such as Waring et al. [15]) to indicate whether the MMPA goals are exceeded. However, the total level of human-caused fatal bycatch for large whales is unknown [15,19]. Scarification studies have indicated that more entanglement events and entanglement mortalities are occurring than is reported/detected [20–22]. It is often not possible to link a specific entanglement event to the specific fishery due to the data limitations involved in large whale entanglement [13,23]. Therefore, it is challenging to identify the expected impact of a specific fishery on large whales and equally challenging to monitor the impacts of that fishery [13,24–26].

Data are lacking to quantify the amount of gear reduction or modification needed to achieve required reduction in large whale bycatch [13,27]. The likelihood of observing an entanglement through a fisheries observer program is low [15]. Therefore, it is difficult to assess bycatch rates in terms of fishing practices, gear characteristics, area and/or environmental factors as can be determined for other Plans due to lack of information [28–31]. Entanglements of large whales in gear are difficult to monitor as entangled whales often carry the gear away [32–34]. Even when entangled whales are discovered, specifics on the entanglement event such as gear part, fishery type, fishing location, recreational or commercial, and country of origin (e.g., United States or Canada) are not available for the majority of events [15,23]. Therefore, there can be gaps in entanglement information needed to develop and execute new actions aimed at minimizing the number of by-caught large whales [15,24,33,35].

The evolution of the Plan has involved more modifications than other take reduction plans due to the expanding knowledge about large whale entanglements, NMFS' attempts to manage to zero or a near zero PBR level, the need to meet both MMPA and ESA requirements, and challenges in quantifying certain aspects of the Plan's metrics. The stakeholders on the Team and the process to provide input into the Plan have changed since the Plan was first developed. The Plan has also evolved to accommodate new information and/or meet needed mandates (Table 1). This study examined specific highlights in more detail, and four guiding principles arose including involving stakeholders in the decision making process and incorporating adaptive management. These guiding principles include important aspects of resource management [36–38] and are articulated here for take reduction planning. The purpose is to explore and build upon these to synthesize specific best practices for managing U.S. large whale bycatch to inform this process going forward and assist those addressing similar bycatch challenges.

2. Four guiding principles

2.1. Involve stakeholders early in decision making

Although required to form a stakeholder Team to reduce the level of fatal bycatch in Atlantic commercial fisheries, NMFS was free to develop this partnership process. By looking at the history of the Team, specific best practices emerged on how to identify stakeholders, structure the team, and establish a framework for feedback to ensure a more productive Team process.

2.1.1. Identify team members and scope

The Team provides a consensus forum for the exchange of information on Atlantic large whale and commercial trap/pot and gillnet fisheries bycatch in the United States (16 U.S.C. 1387). The MMPA specifies composition of TRTs (Section 118f; 16 U.S.C. 1387). Members of the Team should have expertise regarding the conservation/biology of large whales, or fishing practices that result in the bycatch of large whales [11]. The appropriate state and federal officials are often determined by which fisheries are being considered. Determining the scope of the Team is an evolving process which is reflected in the size of the Team which started with thirty-five members in 1996 [11] and has grown to approximately sixty members in recent years [39]. This growth has been due to an increase in the number of fisheries and associated geographic areas being managed [13,24].

NMFS established the Team in 1996 to discuss lobster trap/pot and various gillnet fisheries, which had documented or suspected interactions with large whales [11], but membership has extended to additional fisheries over time (Table 1) [40]. The following information can help determine which specific fishery may be involved in an interaction: 1) location where the gear was set; 2) gear determination from gear experts (e.g., commercial or recreational, gear type); and 3) country of origin of gear for transboundary considerations. However, this information is typically not available for each entanglement event [15,23,33]. NMFS broadened the regulated fisheries based on uncertainties such as the lack of observer information, combined with the numerous cases of recovered gear that cannot be identified back to a specific fishery or gear type [13,24,41].

The Team addresses the fisheries (gillnet and trap/pot) in the U.S. geographical range of large whales (Maine through Florida). The majority of fisheries the Plan regulates have documented entanglement events with large whales, while some gillnet and trap/pot fisheries are regulated based solely on analogy with other gear types [13,24,41]. Therefore, NMFS has determined that these fisheries are similar enough in gear configuration and operation to also entangle large whales. This is supported by Johnson et al. [23] who found that 89% of the gear from examined cases of right and humpback whale entanglements was identified as or consistent with pot and gillnet gear. Although the broad management approach may be considered too cautious, it accounts for various uncertainties in the data, extends the discussions to additional fisheries to ensure that the regulatory burden is not inappropriately put on only one fishing sector, and increases the chances of success of the Plan [13,24,41].

2.1.2. Consider team structure

There are various evaluations of the take reduction team process [2,42–44] which highlight the importance of continually assessing the appropriate Team structure. NMFS discussed alternative structures with the Team due to the large size, including regional teams that do not have to pass ideas up to a larger group, but the preference was to keep the original coastwide structure [45,46]. Although a large team can make reaching consensus challenging given the data limited nature and broad views/interests represented, it has ensured that a coastwide perspective is considered [46]. NMFS utilizes working groups by area, fishery, or topic to enable focused discussions and relay information back to the larger team [47,48]. Discussions with the Team have also