1-1-2021

Observation of marine mammal and bird interactions focused around a commercial fishing vessel in central baffin bay, nunavut

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NRC Research Press

COMMUNICATION

Observation of marine mammal and bird interactions focused around a commercial fishing vessel in central Baffin Bay, Nunavut[1]

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Abstract: A detailed account of a variety of species foraging on Greenland halibut (*Reinhardtius hippoglossoides* (Walbaum, 1792)) fisheries discards associated with a commercial fishing vessel in central Baffin Bay, Nunavut, Canada is presented. Species observed included three marine mammals: northern bottlenose whales (*Hyperoodon ampullatus* (Forster, 1770)), sperm whales (*Physeter macrocephalus* Linnaeus, 1758), and a hooded seal (*Cystophora cristata* (Erxleben, 1777)), and two marine bird species: northern fulmars (*Fulmarus glacialis* (Linnaeus, 1761)) and glaucous gulls (*Larus hyperboreus* Gunnerus, 1767). Interspecies and intraspecies interactions were observed while species were in close proximity to the stern and starboard of a commercial fishing vessel confirming anecdotal reports from boat captains. Improved understanding of marine mammal and bird interactions with fisheries in the Arctic is required to accurately assess financial and ecological (i.e., bycatch) losses, potential for entanglement and to predict the likely impact on energy flow and transport of these resource subsidies throughout the Arctic marine ecosystem.

Key words: fisheries, bycatch, discards, entanglement, northern bottlenose whale.

Résumé : Un compte rendu détaillé d'une variété d'espèces se nourrissants des rejets de la pêche au flétan du Groenland (*Reinhardtius hippoglossoides* (Walbaum, 1792)) associés à un bateau de pêche commerciale dans le centre de la baie de Baffin, au Nunavut, au Canada, est présenté. Les espèces observées comprenaient trois mammifères marins : la baleine-à-bec commune (*Hyperoodon ampullatus* (Forster, 1770)), le grand cachalot (*Physeter macrocephalus* Linnaeus, 1758), le phoque à capuchon (*Cystophora cristata* (Erxleben, 1777)) et deux espèces d'oiseaux marins : le fulmar boréal (*Fulmarus glacialis* (Linnaeus, 1761)) et le goéland bourgmestre (*Larus hyperboreus* Gunnerus, 1767). Des interactions interspécifiques et intraspéscifiques ont été observées alors que les espèces se trouvaient à proximité immédiate de la poupe et du côté de tribord d'un bateau de pêche commerciale, confirmant les rapports anecdotiques des capitaines de bateau. Une meilleure compréhension des interactions des mammifères et des oiseaux marins avec les pêches dans l'Arctique est nécessaire pour évaluer avec précision les pertes financières et écologiques (c.-à-d. les prises accessoires), le risque d'enchevêtrement et l'incidence probable sur le flux d'énergie et le transport de ces octrois à l'ensemble de l'écosystème marin de l'Arctique. [Traduit par la Rédaction]

Mots-clés : pêches, prises accessoires, rejets, enchevêtrement, baleine-à-bec commune.

Received 7 May 2020. Accepted 15 October 2020.

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[1]This paper is part of a Special Issue entitled: Emerging Fisheries in a Changing Arctic. This Special Issue was financially supported by Fisheries and Oceans Canada.

Introduction

Fisheries can provide food resources that would normally not be available to predators through discards, including bycatch and offal, and via depredation of fishing gear, such as long lines (Read 2008). For marine birds, fisheries discards are well documented as supplementary food, influencing foraging behaviour, diet, and distribution across fisheries and oceans (Tasker et al. 2000; Renner et al. 2013; Sommerfeld et al. 2016; Sherley et al. 2020). In many instances, these discards provide a resource (e.g., occurring at great depths or benthic species) that would otherwise be inaccessible to predators limited by diving capabilities (Schreer and Kovacs 1997). Although the occurrence and impacts of fisheries providing supplementary food sources for birds are well documented (Blaber and Wassenberg 1989; Oro 1996; Cury et al. 2011; Votier et al. 2013), fewer studies exist for marine mammals (Read 2008) and our understanding of the type and scale of interactions between marine mammals and fisheries in the Canadian Arctic is limited. Furthermore, depredation of longlines and gill nets poses a serious threat to many marine birds and mammals, in the form of entanglement. Consequently, data on the occurrence of net depredation is required for informed consideration for management (Croxall et al. 2012; Reeves et al. 2013; Žydelis et al. 2013).

The Greenland halibut (*Reinhardtius hippoglossoides* (Walbaum, 1792)) fishery in Baffin Bay is one of the largest fisheries in Canadian Arctic waters that has continued to grow since its establishment in 1999 (Treble and Bowering 2002; Jørgensen and Arboe 2013; Fisheries and Oceans Canada (DFO) 2020). The fishery primarily runs from May to December correlated with ice conditions, although there are no formal management measures (Fisheries and Oceans Canada (DFO) 2020). The fishery predominantly uses trawls and gillnets, with the latter sometimes baited with squid or grenadier (Woll et al. 2001; Bayse and Grant 2020; Fisheries and Oceans Canada (DFO) 2020). When nets are brought to the surface, Greenland halibut are processed immediately and bycatch, remaining bait and halibut viscera (offal) are thrown overboard. Large numbers of northern fulmars (*Fulmarus glacialis* (Linnaeus, 1761)), as well as some gull species (*Larus* spp.) are reportedly caught as bycatch by gillnets in the fishery (Hedd et al. 2016). There are, however, few anecdotal data available and no formal documentation on the interactions of marine mammals with commercial fishing vessels, specifically two Arctic transient species, northern bottlenose whales (*Hyperoodon ampullatus* (Forster, 1770)) and sperm whales (*Physeter macrocephalus* Linnaeus, 1758) (MacDonald 2005; Fisheries and Oceans Canada (DFO) 2020). Although the Davis Strait–Baffin Bay–Labrador Sea northern bottlenose whale population is poorly studied, entanglement is considered one of the main threats for this population (COSEWIC 2011). Furthermore, entanglement of sperm whales is reported in other fisheries (Hucke-Gaete et al. 2004). This potential for negative interactions highlights the need to document the diversity of species associated with the Greenland halibut fishery in the Arctic and their relative abundance and behaviour while in close proximity to fishing vessels. Therefore, the objective of this paper is to report on a one day observation period of five different medium to large-bodied vertebrate species foraging on discards around a commercial fishing vessel in the remote offshore central region of Baffin Bay. In addition, this paper formally documents sightings of northern bottlenose whales in a region for which very limited data are available.

Methods

On 20 September 2018, we observed bird and mammal species aggregating around a commercial Greenland halibut fishing boat (M.V. Arluk II — vessel length ~30 m). All observations were made as the fishers were pulling in gill nets and simultaneously discarding

Fig. 1. Birds aggregating on the starboard side of the commercial fishing vessel.

Fig. 2. Sperm whale spy hopping at the stern of the commercial fishing vessel.

bycatch off the starboard and offal off the starboard-stern of the vessel during fisheries processing (Figs. 1 and 2). Observations were made ad hoc while conducting focused whale research (deploying satellite tags, collecting biopsy samples, and undertaking photo ID) from a zodiac at the stern of the fishing boat from 1530 to 1930; starting at 68.56 N, 59.67 W and ending at 68.55 N, 59.65 W. Numbers of whales were determined by unique identification of individual northern bottlenose whales based on photographs and by counting sperm whales resting at the surface.

Results/discussion

Observed bird species included adult northern fulmars, both light and dark morphs were present, and both adult and juvenile glaucous gulls (*Larus hyperboreus* Gunnerus, 1767),

Fig. 3. Northern fulmars and glaucous gull (with wings spread) competing for discards.

with the northern fulmar the dominant bird species by number. Mammal species included northern bottlenose whales, sperm whales, and a hooded seal (*Cystophora cristata* (Erxleben, 1777)). The most abundant marine mammal, northern bottlenose whales, were commonly observed in groups of 2–6 individuals, composed mainly of subadults and adults; however, one group was observed with a calf. A total of 15 individuals were identified based on dorsal fin shape and markings; however, this is a conservative estimate given an unknown number of individuals were likely not photographed. Sperm whales, the largest predator by size, were observed alone or in groups of two. We estimated that 12 individuals were present in the area based on the number observed resting at the surface. Birds were principally aggregated along the starboard of the vessel where the net was being hauled in and bait/bycatch discards were being thrown, but they were also present at the starboard-stern where offal was disposed (Fig. 1). Both cetacean species were located at the stern and starboard of the vessel and were typically within 5–15 m from the vessel itself. Northern bottlenose whales would approach the vessel from the stern and leave the area after a brief feeding period near the vessel (5–20 min). Sperm whales were observed around the vessel 50–200 m away logging at the surface between feeding bouts at the stern of the vessel. The hooded seal was observed for a short period of time, approaching the vessel from the stern and stayed on the starboard side among the aggregation of birds.

Behaviours observed included direct interspecies and intraspecies competition among birds, which included individuals fighting over discards and offal (Fig. 3). Northern bottlenose whales were also observed to "move" birds with their melon and beak in competition for discards and offal at the surface (Fig. 4). Sperm whales were seen spy-hopping at the stern and starboard side of the vessel and "finning", whereby individuals would rotate on their side with half of the fluke raised out of the water (Fig. 2). Both behaviours were likely to locate food at the ocean surface or as it sank. Northern bottlenose whales and sperm whales were observed in close vicinity to each other (<5 m apart) at the stern of the vessel, but no direct interactions between the two species were detected (Fig. 5). Northern bottlenose whales were also observed to submerge for a few minutes before surfacing near the stern of the vessel, a behaviour that could potentially be linked to depredation of the net. A single hooded seal was observed eating and playing with discards/offal (whipping the food back and forth in its mouth; Fig. 6). All bird species kept their distance from the hooded seal.

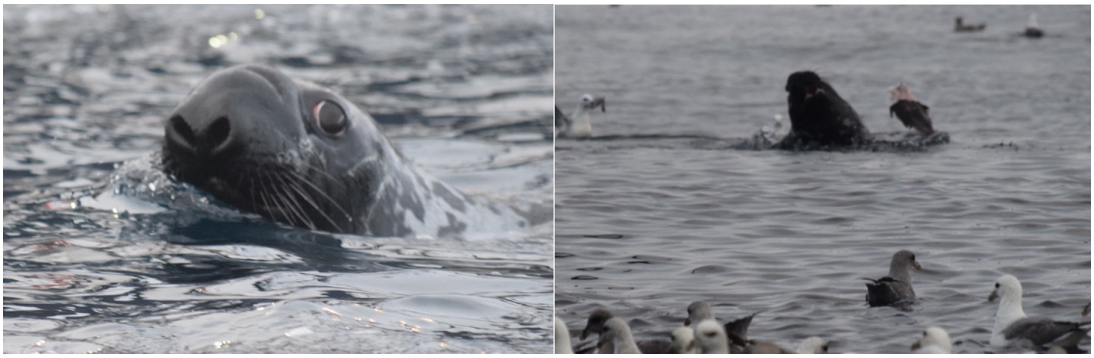
How fisheries and fisheries discards impact predator behaviour, energy flow through the ecosystem and modify intraspecific and interspecific interactions in the Arctic has, to date, received limited attention. The northern bottlenose and sperm whales may have been

Fig. 4. Northern bottlenose whale approaching a group of northern fulmars foraging on discards.

Fig. 5. Northern bottlenose whale (in background) and sperm whale (in foreground) surfacing in close proximity to the commercial fishing vessel.

depredating the gillnets at depth and while being hauled in, but direct observations were not possible. It appears that the whales were present to feed on offal/discards and hence their occurrence in surface waters at the stern of the vessel. Whale behavior, however, may have switched when gear was actually set and soaking. Although depredation of gillnets by marine mammals is poorly documented, removing fish from commercial longlines is a well-known issue involving several whale species including sperm whales and orcas (*Orcinus orca* (Linnaeus, 1758); Purves et al. 2004; Sigler et al. 2008). Consequently, depredation of set gill nets in this fishery is certainly possible (Purves et al. 2004; Sigler et al. 2008). Similarly, although net depredation by the hooded seal was not observed, seals have

Fig. 6. (Left) hooded seal, and (right) hooded seal foraging on discards from the commercial fishing vessel.



been documented to depredate nets in other fisheries (Rafferty et al. 2012; Cosgrove et al. 2015). Nevertheless, marine mammals feeding on discards at the surface is a contentious issue in global fisheries given the potential for negative species interactions (i.e., capture or injury) that contrast the direct benefits of scavenging and indirect benefits for the entire food web (i.e., nutrient recycling; Heath et al. 2014). Certainly, entanglement continues to be one of the leading causes of marine bird population decline, and has been documented in the northern fulmar population in the Arctic (Anderson et al. 2018).

The near continuous availability of fisheries discards throughout the fishing season in central Baffin Bay has consequences for the behaviour and distribution of the five observed species that partially or fully overlap with the Greenland halibut fishing season (Reeves et al. 1993; Mallory 2006; Andersen et al. 2013; Petersen et al. 2015; Frouin-Mouy et al. 2017). It is important to note that while this was a single day of observation, boat captains report that the association of birds, northern bottlenose whales, and sperm whales is a common occurrence during fishing operations that has been ongoing for several years. This is further confirmed by the authors of this study while conducting field operations in central Baffin Bay since 2015 and observations during a halibut survey (MacDonald 2005). Future research is, therefore, required to quantify individual and species interactions (i.e., competitive or facilitative behaviours); assess the influence of different types of fishing discards on behaviour (i.e., offal vs. bycatch); estimate the potential for and frequency and extent of entanglement, especially for northern bottlenose whales; determine the energetic consequences of fisheries subsidies relative to predator condition and fitness; and determine ecosystem effects (negative and (or) positive) of altered energy flow (e.g., use of benthic energy available at the ocean surface; bottom up and top down effects; Le Bot et al. 2018). Ultimately, research is needed to quantify how expanding fisheries in the Arctic that simultaneously remove a key benthic species (Greenland halibut) and subsidize food to surface predators (marine mammals and birds), may alter the transfer of energy through the pelagic and broader Arctic/Atlantic marine ecosystems.

Acknowledgements

We thank the Arluk II and captain Mark Letto for letting us work beside them for the day and the crew of the Kiviuq I. This manuscript was improved as a result of extensive reviews by Margaret Treble and two anonymous reviewers. Funding was provided by Fisheries and Oceans Canada, Crown-Indigenous Relations and Northern Affairs Canada, Government of Nunavut, Nunavut Fisheries Association, Canadian Northern Economic Development

Agency, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) and Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery.

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