Marine Policy 81 (2017) 160–166

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

A timely opportunity to protect North Atlantic right whales in Canada

Sean W. Brillant[a,b,c,*], Tonya Wimmer[b,1], Robert W. Rangeley[b,2], Christopher T. Taggart[c]

[a] Canadian Wildlife Federation, 350 Michael Cowpland Dr., Kanata, ON, Canada K2M 2W1
[b] WWF-Canada, Atlantic, 5251 Duke Street, Duke Tower Suite 1202, Halifax, NS, Canada B3J 1P3
[c] Oceanography Department, Dalhousie University, PO Box 15000, Halifax, NS, Canada B3H 4R2

ARTICLE INFO

Keywords:
Bycatch
Canada
Entanglement
Fishing
Right whales

ABSTRACT

The survival of federally protected North Atlantic right whales (*Eubalaena glacialis*) requires an immediate reduction in the risk of entanglement in commercial fishing gear. This paper argues that at least a 30% reduction in risk is needed to meaningfully contribute to the conservation of right whales. The argument follows from risk estimates calculated using time and space intersections of right whales and fishing gear in Canadian waters. Almost all the risk occurs during July, August and September (12%, 50%, 37% respectively) and the groundfish fishery contributed the greatest proportion (86%) of annual risk. Given that efforts in the USA to reduce entanglement risk through modified fishing gear have been unsuccessful to date, we address the alternative option of restricting certain fishing gear at times and locations where entanglement risk is elevated. There are many options that Canada could employ to achieve the above risk reduction and our results clearly point to the most effective and efficient action being seasonally restricted fishing in two relatively small regions; the Grand Manan Basin and the Roseway Basin. Fully a third (34% ± 4%) of the annual risk is associated with these two basins, though fishery catch estimates in the basins are relatively small and declining.

1. Introduction

Entanglement in commercial fishing gear measurably and negatively impacts the conservation of cetaceans globally [18,4]. From 1970 through 2009, the leading cause of death for whales in the Northwest Atlantic Ocean was entanglement in fishing gear, followed by natural causes and vessel strikes, though this ranking varies markedly among species [23].

The North Atlantic right whale (*Eubalaena glacialis*; hereafter, right whale) is an endangered species that is federally protected in Canada and in the United States of America (USA). Recovery planning by each nation specifies the need to reduce or eliminate deaths caused by human activity; particularly those due to fishing gear entanglement and vessel strikes [12,2,20,8]. Gear entanglement of right whales is real and measureable. Knowlton et al. [10] document that at least 16%, and as many as 26%, of all right whales show new entanglement scars annually. For the current population estimate of 522 (± 164) individuals [17], this equates to 109 ± 27 right whales potentially becoming entangled annually. From a mortality perspective, the best estimates are that between 1.2% ± 0.5 [25] and 4% [11] of all entanglements are lethal. This equates to between 2 and 5 right whales killed annually as a result of entanglement; an estimate that has yet to be refuted in recent assessments. For example, Waring et al. [26] estimate 3.4 fishery entanglement mortalities annually. Entanglements and other anthropogenic causes of death are the primary reasons for the species growth rate being less than expected and the viability of the species remains in jeopardy [12,13].

In an attempt to reduce lethal entanglements, the USA enacted laws that required changes to fishing practices, including mandating the use of sinking groundlines. Although changing the configurations and operations of fisheries seems to have potential to reduce risk, risk assessments [27], and other recent preliminary studies [16] suggests that these efforts are not successful. Alternatively, the simplest and most sound solution to reducing lethal entanglements is to minimize the probability that a whale will encounter fishing gear. Reducing the probability of encounters by at least 30% will prevent the deaths of at least 2 right whales every 3 years and as many as 32 fewer entanglements annually. This recommended risk reduction is enough to make the difference between the long-term recovery and extinction of right whales [5]. As right whales spend nearly equal parts of the year in Canadian and USA waters [1], achieving the above level of risk reduction requires action by both nations.

Previously, the Canadian government adopted policies that successfully reduced the probability of vessel strikes to right whales [24] and subsequently identified their known habitats as "critical habitats" ([2]; Fig. 1) deserving of protection. However, the Canadian government has

* Correspondence to: Canadian Wildlife Federation, Dalhousie University, Dept Oceanography, 1355 Oxford St, PO Box 15000, Halifax, NS, Canada B3H 4R2.
E-mail addresses: seanb@cwf-fcf.org (S.W. Brillant), twimmer@dal.ca (T. Wimmer), rrangeley@oceana.ca (R.W. Rangeley), Chris.Taggart@phys.ocean.dal.ca (C.T. Taggart).
[1] Current address: Marine Animal Response Society, NS Museum, 1747 Summer St., Halifax, NS, Canada B3H 3A6.
[2] Current address: Oceana Canada, 1701 Hollis St. Suite 800, Halifax, NS, Canada B3J 3M9.

http://dx.doi.org/10.1016/j.marpol.2017.03.030
Received 12 December 2016; Received in revised form 3 March 2017; Accepted 22 March 2017
Available online 02 April 2017

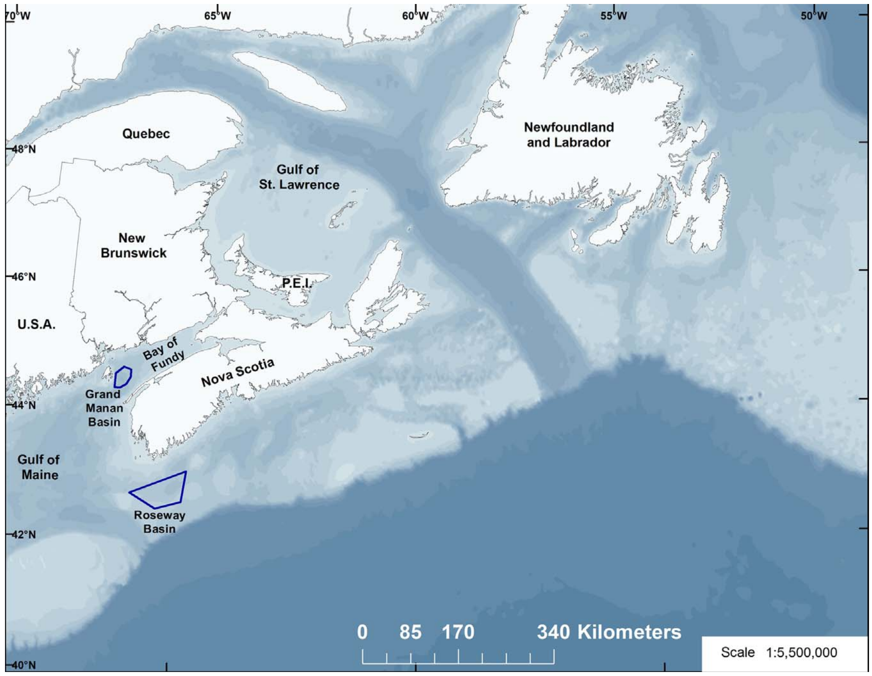

Fig. 1. Map of the domain for this research showing the two Canadian Species at Risk Act Critical Habitats: Grand Manan Basin and Roseway Basin.

yet to adopt any policies designed to reduce the risk of death due to fishing gear entanglement. Therefore, the goal of this research was to first, quantitatively determine where and when right whales are most exposed to entanglement risk in Canada, and second, provide options for policies that would serve to effectively and efficiently reduce the risk presented by commercial fisheries while at the same time minimizing economic consequences to the fisheries wherever and whenever possible.

2. Materials and methods

The domain for this research was the NW Atlantic Ocean between 40° and 51°N latitude and 48° and 71°W longitude subdivided into 3-min (0.05°N and W) grid-cells (76,620 grid-cells excluding land, rivers and lakes; Fig. 1). A monthly probabilistic spatial distribution of right whales was estimated using the Brownian bridge method described in Brillant et al. [1] based on 30 years of data (1978 through 2007). Probabilities for the occurrence of right whales were estimated for each grid-cell (*i*) within the domain; *P(Whale)i*, standardized (to 1) over the year and categorized by month. Unreasonably small probabilities were removed in the manner used in Brillant et al. [1] that maintained comparability among months.

The distribution of commercial fisheries in Atlantic Canada was estimated using data provided by Fisheries and Oceans Canada for thirteen fixed-gear fisheries from 1999 through 2012 (Table 1). The inshore lobster fishery was not included in this analysis because data for that fishery are collected at a large spatial scale that is incomparable with the other fixed-gear fisheries. The distribution of fishing was expressed as an annual probability for a set of a particular fishery (*j*) to occur in each grid cell (*i*), for each calendar month, and relative to the other fisheries in each year examined.

$$P(Set_j)_i = \frac{Set_{ij}}{\sum_i \sum_j Set_{ij}}.$$

A set is an amount of gear placed in the water for the purpose of capturing specific species. Sets can consist of different components among fisheries. For example, a set for the crab trap fishery may be a

Table 1
Annual average sets, annual relative risk to lethally entangle North Atlantic right whales, and relative risk per 1 000 sets of gear from 1999 through 2012 with the study area for thirteen types Canadian fishing gear examined in this study.

Fishing Gear	Average annual sets (SE)		Average % relative risk (SE)		Relative risk (%) per 1 000 sets
Groundfish longline	21 650	(1 726)	55.41	(3.9)	2.6
Groundfish gillnet	16 897	(668)	30.58	(4.2)	1.8
Crab trap	38 101	(2 085)	7.45	(1.0)	0.2
Lobster trap (LFA 38b, 41)	945	(121)	3.52	(0.8)	3.7
Herring gillnet	2 260	(277)	2.19	(0.8)	2.3
Shark pelagic longline	360	(24)	0.39	(0.2)	1.1
Hagfish trap	225	(29)	0.36	(0.1)	1.6
Swordfish pelagic longline	229	(70)	0.02	(< 0.1)	0.1
Tuna pelagic longline	215	(85)	0.02	(< 0.1)	0.1
Unsp. gear and Trap net	8	(3)	0.01	(< 0.1)	0.6
Mahimahi pelagic longline	175	(45)		0	0
Shrimp trap	28	(19)		0	0
Whelk trap	2 908	(462)		0	0

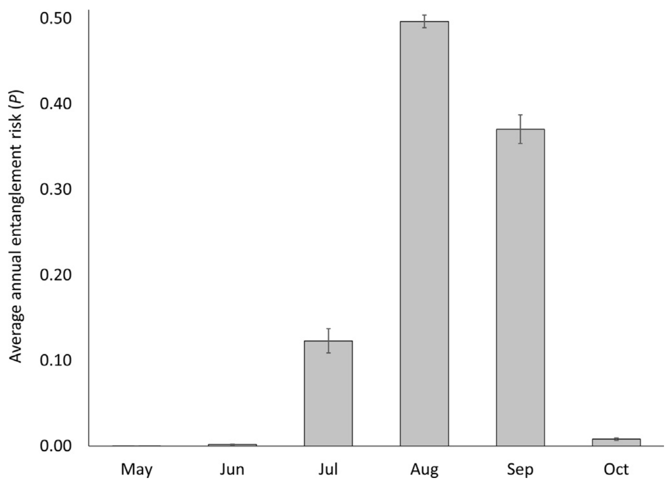

Fig. 2. Monthly proportions of the average annual relative risk ($P \pm$ SE) from 1999 through 2012, for North Atlantic right whales to lethally encounter fishing gear from Canadian fisheries listed in Table 1.

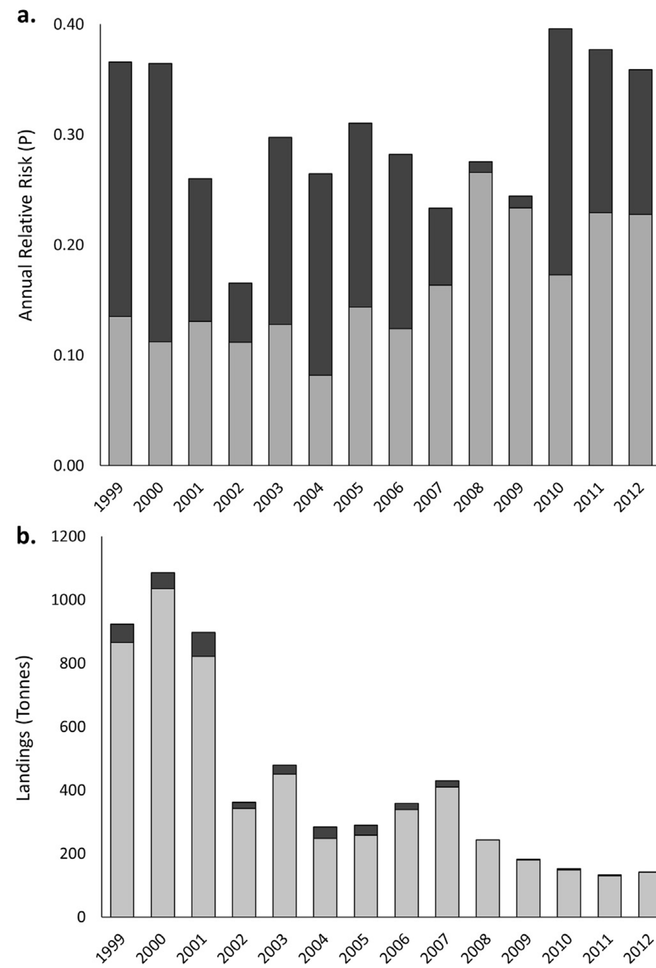

Fig. 3. Proportion of the average annual relative risk (P) for North Atlantic right whales to lethally encounter fishing gear within the boundaries of each Canadian Species at Risk Act Critical Habitat for right whales (a), and the reported landings (tonnes) for all fisheries within each Critical Habitat (b); Roseway Basin (light bars), and Grand Manan Basin (dark bars).

single crab-trap, a groundfish longline set may be a kilometre or more of line near the sea floor with hundreds of hooks along its length, and a set of offshore lobster trap set may be a line hundreds of meters in length with 20 or more traps distributed along it. Despite their differences, all sets consist of one or two buoylines, each connecting the gear in the water with a buoy at the surface. Currently, there is insufficient knowledge to determine other attributes of fishing gear that contribute to the probability of entanglement [8] or entanglement lethality [25]. Consequently, sets were used as the comparable unit among fisheries and the probability of right whales becoming entangled in fishing gear each calendar month was directly related to the probability of whales and sets (j) to occur in each grid-cell (i).

$$P(Entangle)_{ij} \;=\; P(Encounter)_{ij} = P(Whale)_i \;\times\; P(Set_j)_i.$$

As the probability of lethality due to an entanglement has been estimated as a constant [11], though with uncertainties [25], ***P (Entangle)ij*** is the estimate of the annual risk for a lethal encounter with fishing gear, relative to the grid cell, month and fishery for each year. This was the simplest method to compare risk among fisheries, without introducing assumptions that have yet to be validated concerning the features among fishing gear sets (e.g., water depth, number of traps) that may influence the probability of lethal entanglement.

3. Results

The commercial fishery data consisted of an average of 86 000 sets of fishing gear within the domain, each year, from 1999 through 2012. Crab traps, groundfish longline and groundfish gillnets were the largest fisheries comprising 89% of the total annual sets on average (44%, 25%, and 20% respectively; Table 1). The other fisheries each averaged less than 3.5% of the total sets annually; each consisted of fewer than 4 000 sets annually.

Right whales occur in Canadian waters from May through November [1], but the annual relative probability that right whales encountered fishing gear in Canada consistently occurred almost entirely during July (12%), August (50%), and September (37%; Fig. 2). Two fisheries contributed the majority (86%) of the average annual relative risk during the study period: groundfish longlines (55% ± 4% SE) and groundfish gillnets (31% ± 4% SE; Table 1). Four fisheries, with relatively small fishing effort (LFA 38b, 41 lobster traps, herring gillnets, shark pelagic longline, and hagfish trap) contributed a small but disproportionate amount of annual risk to right whales due to the location and timing of fishing effort. Three fisheries (swordfish pelagic longline, tuna pelagic longline, unspecified gear and trap nets) contributed relatively little to the annual risk, and three fisheries posed no measureable risk to right whales within the study period and domain (mahimahi pelagic longline, shrimp traps, and whelk traps; Table 1).

The distribution of the annual entanglement risk was relatively consistent and coincided with the two known right whale Critical Habitats designated by the Canadian Species at Risk Act (SARA; Brown et al., 2005; Fig. 1). The average annual risk of entanglement within Grand Manan Basin was 16% (± 2.3% SE) and 18% (± 1.9% SE) within Roseway Basin (Fig. 3a). The groundfish longline fishery contributed the greatest proportion of this risk among gear types within these basins and it was the only fishery that was active every year throughout the study period. The landings recorded for all fisheries within these basins have declined over time (Fig. 3b), and since 2008, average landings from Grand Manan Basin amounted to 2 tonnes.

An examination of data from 2012 demonstrated the most recent situation for which data are available. The spatial distribution of annual relative risk for 2012 (Fig. 4a) predominantly comprised the relative risk contributed by groundfish longline and groundfish gillnet for July, August and September (78.9% overall; Fig. 4b-g). Other fisheries that contributed to the 2012 annual relative risk included herring gillnet, lobster trap, crab trap and pelagic longline; (SUPPLEMENTAL Table 1). Not all risk occurred within the Critical Habitats in 2012. For example, although groundfish gillnet contributed 12.7% of the annual relative risk (Supplemental Table 1), the groundfish gillnet risk occurred outside the Critical Habitats (Fig. 4b-d). Groundfish longline sets were, however, present within the Critical Habitats, as well as in surrounding areas (Fig. 4e-g). In previous years, other fisheries occurred within the Critical Habitats, including crab traps, hagfish traps and lobster traps (SUPPLEMENTAL Table 3).

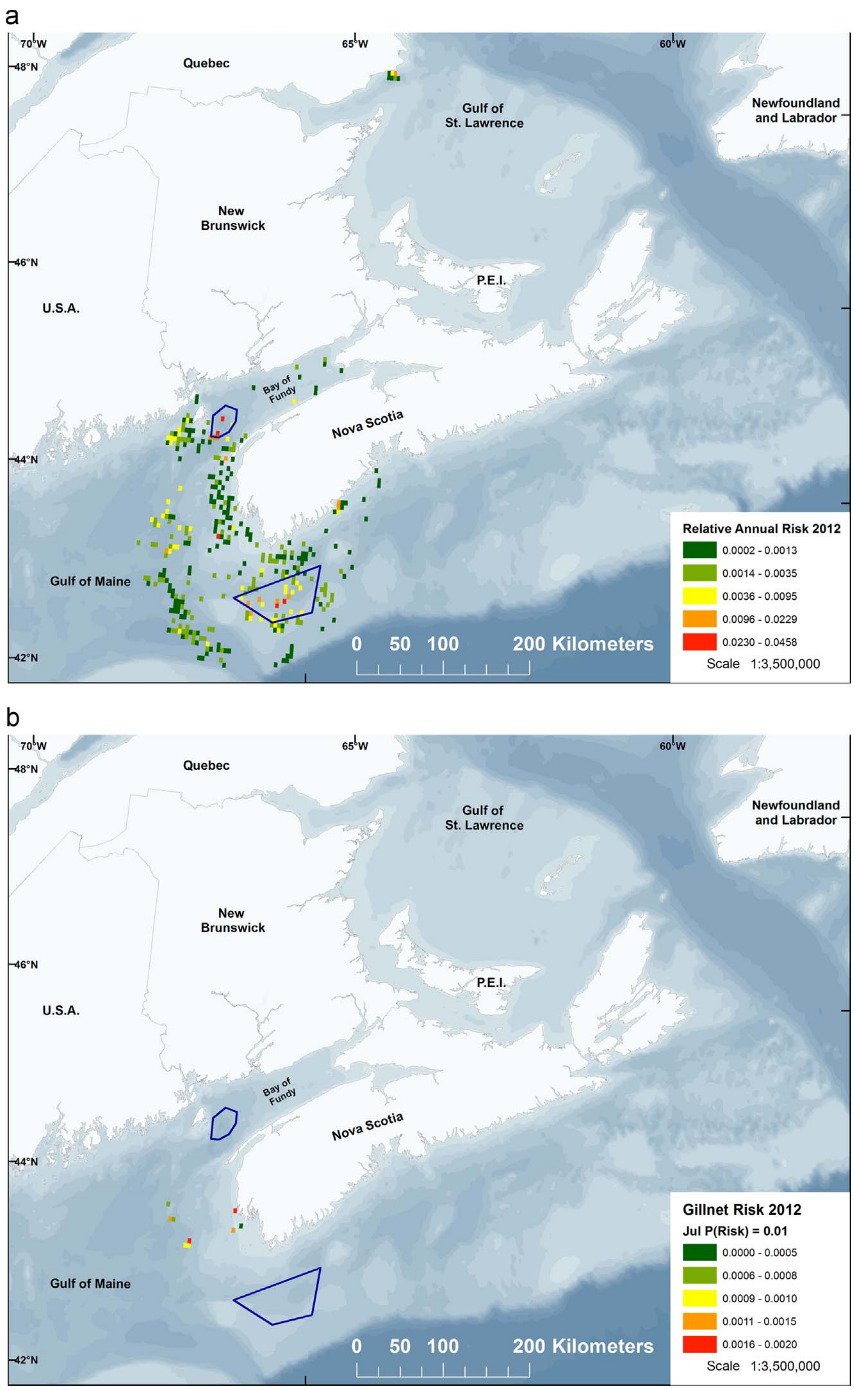

Fig. 4. Spatial distribution of the annual relative risk for North Atlantic right whales to lethally encounter fishing gear for all fisheries listed in Table 1 during 2012 (a), the risk from groundfish gillnet during July (b), August (c) and September (d) of 2012, and the risk from groundfish longline during July (e), August (f) and September (g) of 2012. The proportion of the annual relative risk is shown in the legend for figures (b) through (g).

4. Discussion

Groundfish fisheries (longline and gillnet) contributed the most risk of gear entanglement to right whales in Atlantic Canada over the study period. Although there are relatively few reports of right whales being entangled in groundfish longline or gillnets, relatively few samples of gear from entangled right whales have been examined [20]. In one study, more than half the samples of gear removed from entangled right whales (n =31) could not be associated with a specific fishery [8]. Furthermore, generally fewer than 12 entangled right whales are observed and reported each year (e.g., Pettis et al., 2014 [17]), and fewer of these are examined sufficiently to associate the gear with a particular fishery. Given that actually observed entanglements are far less frequent than entanglement scaring would indicate, it follows that opportunities to sufficiently examine and to determine the origin of the gear is even less frequent; i.e., associating the prevalence of gear type with entanglement will remain n-limited for some time to come.

The fine-scale distribution of the Canadian inshore lobster fishery is not readily (legally) available through Fisheries and Oceans Canada, nor in the same manner as other commercial fisheries, so this fishery could not be included in our study. However, the inshore lobster fishery does have a very small co-occurrence with rights whales in Atlantic Canada based on our current knowledge of right whale distribution in time and space, and previous research concluded that the inshore lobster fishery presents a relatively small risk due to limited temporal coincidence [25]. Data were, however, available for two other lobster fisheries that were active at times

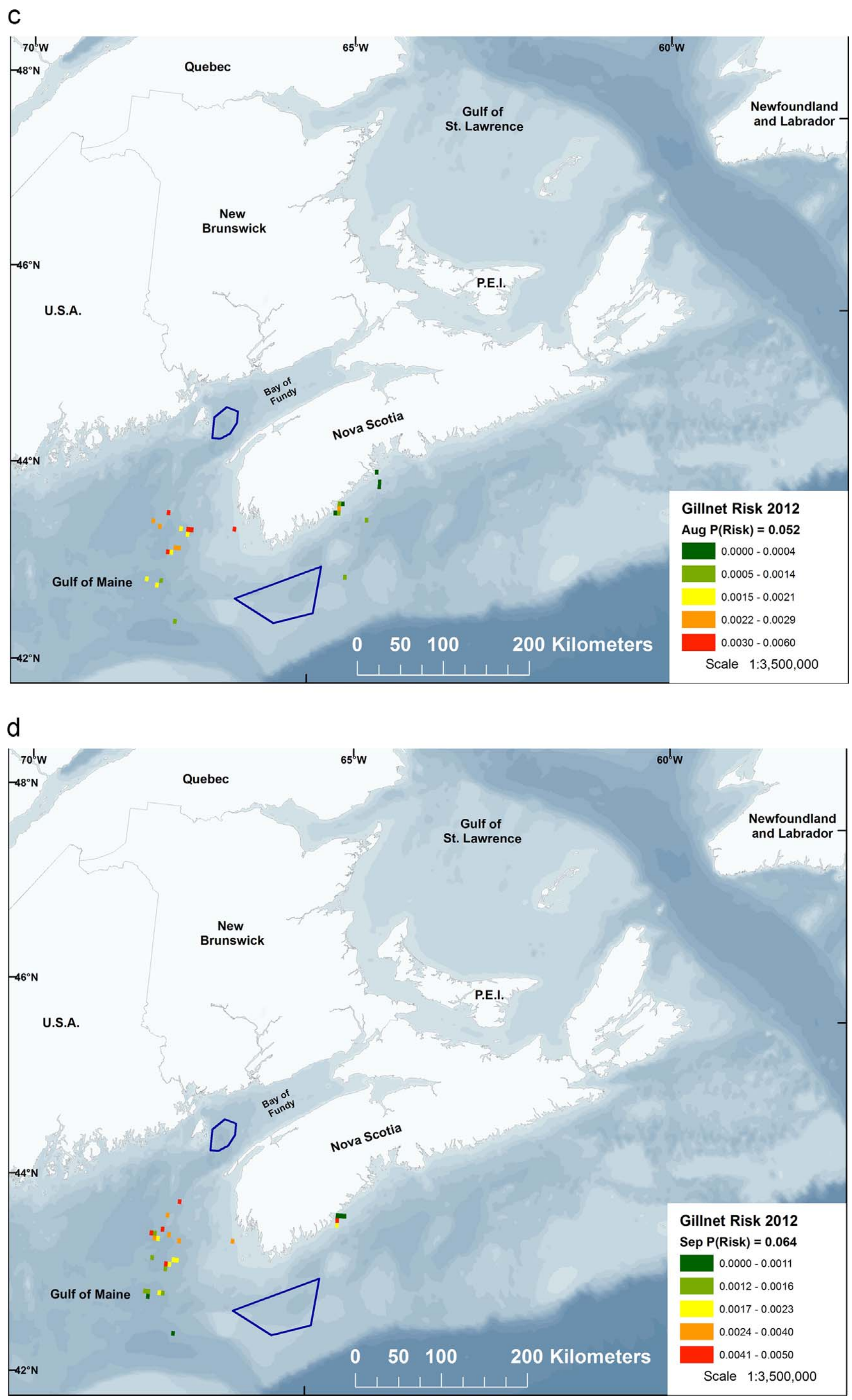

Fig. 4. (*continued*)

and near areas that right whales are known to frequent; Lobster Fishing Area (LFA) 38b and LFA 41, and these fisheries were included in our analyses. Although they use relatively few sets (< 700 in 2012), their contribution to the annual risk was not negligible (7% in 2012) due to their proximity to known locations frequented by right whales. Nevertheless the contributions of inshore lobster to the entanglement risk of right whales will need to be reevaluated when gear-set data might be made available and as our knowledge of right whale distribution improves.

Managing human activities to minimize harm to right whales (or other non-target species) requires knowing the distribution of the various fisheries and of right whales (or others). Changes in the spatial distribution, seasonal timing and effort in fisheries can have important effects (positive or negative) on the risk they present to right whales. Similarly, the distribution of right whales in Canadian waters must continue to be monitored. Current knowledge of the movement and distribution of these whales is incomplete. Fewer than half of the population can be accounted for in any given year [6] and a variety of unmonitored factors (e.g., ecological changes, population demography and growth) could cause this population to change their distribution [14,15,19,22,7,9]. These limitations are discussed by Brillant et al. [1], but we use their estimate of spatial distribution because it is the current, best available information. Recent surveys indicate that right whales may use parts of the Northwest Atlantic more frequently than previously known (e.g., Gulf of St. Lawrence), so new right whale feeding habitats may be discovered that will change current estimates of whale distribution, and therefore, the risk presented by some fisheries, particularly those with large effort (e.g., inshore lobster, crab trap).

Reducing the risk of right whale entanglement requires immediate

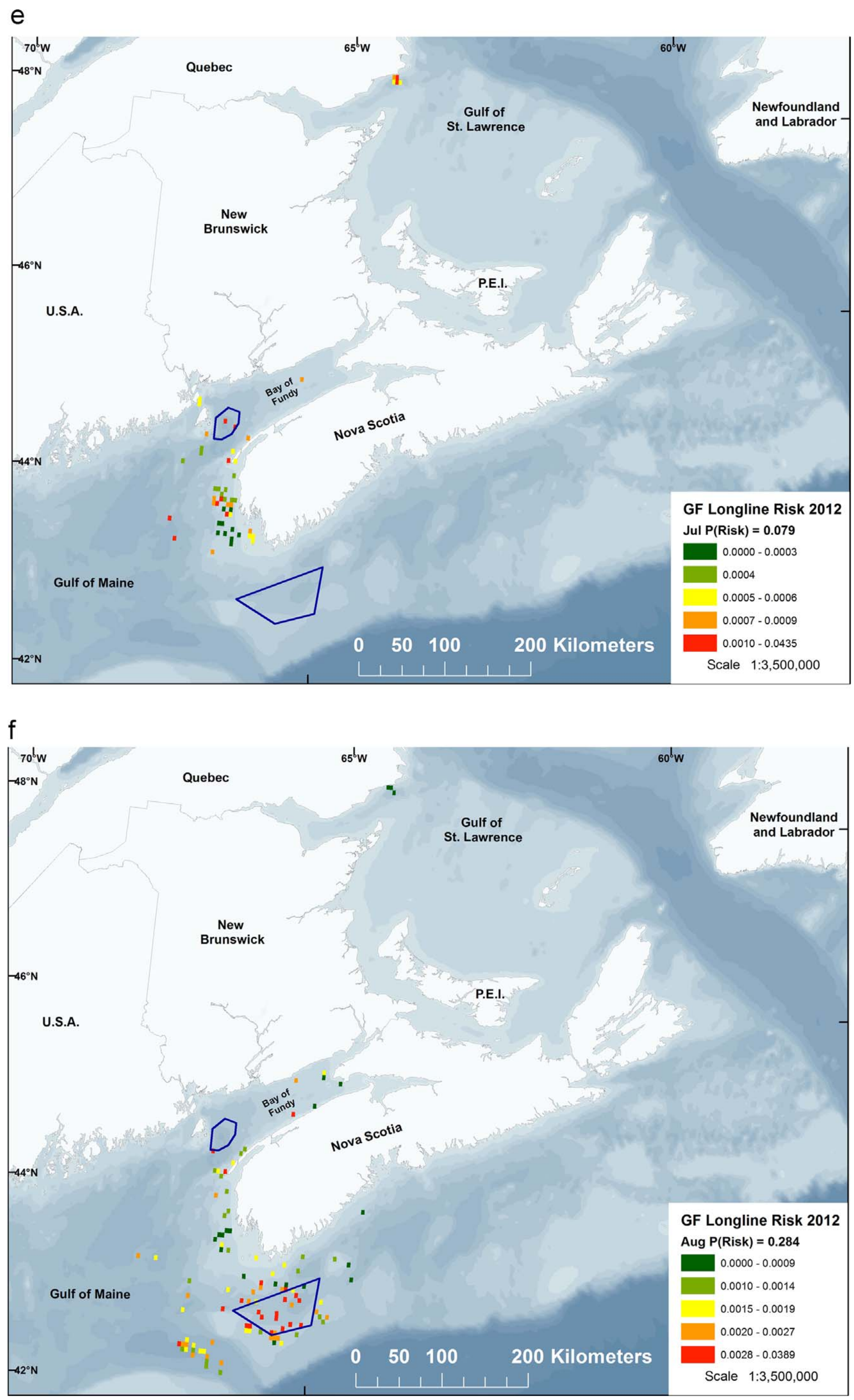

Fig. 4. (*continued*)

changes to fisheries that cause the greatest risk (i.e., groundfish longline, groundfish gillnet) and those that present a disproportionately large risk (e.g., summer lobster trap). All fisheries, however, contribute to the risk if they are active where and when right whales are present. The conservation of right whales is a shared national interest and their conservation is a legal requirement of these federally licensed fisheries. As such, all fisheries have a responsibility to reduce their entanglement risk in an equitable manner.

5. Conclusions

This study demonstrates there are several options through which Canada could achieve a 30% reduction in entanglement risk to right whales by seasonally restricting fisheries in certain areas. The least impactful on commercial fisheries is, however, to reduce the risk in the two areas where right whales traditionally aggregate each summer; Grand Manan Basin and Roseway Basin (Fig. 4). As approximately 34% (± 2% SE) of the annual risk to right whales occurs within these two areas (Fig. 3a), and as the landings from fisheries in these areas have been declining (Fig. 3b), excluding fishing in Grand Manan and Roseway Basins during July, August and September would be the most effective and efficient way for Canada to conserve right whales with a small effect on the commercial fisheries.

The Government of Canada will soon finalize their Species at Risk Act Action Plan entitled “Partial Action Plan for the North Atlantic Right Whale (*Eubalaena glacialis*) in Canada: Fishery Interactions” [3]. Thus, now is the time to adopt policies within the “Plan” to reduce entanglement risk. The North Atlantic right whale is recognized, publically and internationally, as an iconic and critically endangered g

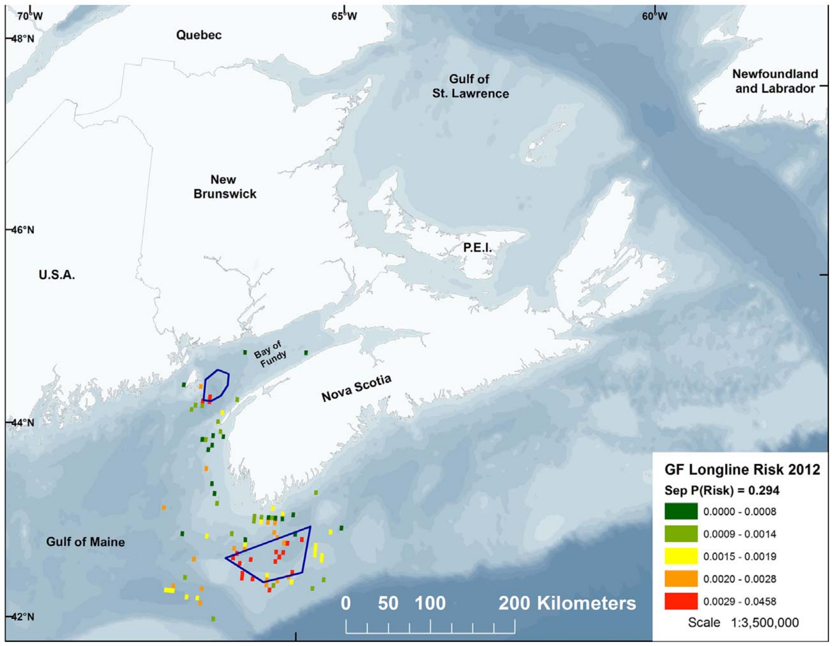

Fig. 4. (*continued*)

species in Canada. By significantly reducing the chances of right whale entanglements, Canada will: 1) show progress on the Species at Risk Act recovery goal and Action Plan for right whales; 2) directly reduce right whale mortality and injury from human activities; 3) do so at minimal disruption to fisheries with substantial benefit to conserving a federally protected species; 4) clearly demonstrate Canada's commitment to conservation of species at risk; and 5) contribute to actions that will maintain market access for Canadian seafood as other nations strengthen their laws on seafood imports [21].

Acknowledgements

This work was supported by a WWF-Canada Post-Doctoral Fellowship award to SWB through their partnerships with CSL Group Inc., Fred and Elizabeth Fountain and the Government of Canada (Habitat Stewardship Program for Species at Risk) and through an NSERC Discovery award RGPIN-2014-04036 to CTT. We thank the North Atlantic Right Whale Consortium for providing right whale photo-identification data, Fisheries and Oceans Canada for commercial fisheries data, A. Vanderlaan for valuable advice and suggestions, and G. Bondt for assistance producing the maps.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2017.03.030.

References

[1] S.W. Brillant, A.S.M. Vanderlaan, R.W. Rangeley, C.T. Taggart, Quantitative estimates of the movement and distribution of North Atlantic right whales along the northeast coast of North America, Endanger. Species Res. 27 (2015) 141–154.
[2] M.W. Brown, D. Fenton, R.K. Smedbol, C. Merriman, K. Robichaud-Leblanc, J.D. Conway, Recovery strategy for the North Atlantic right whale (*Eubalaena glacialis*) in Atlantic Canadian waters [Final], Fish. Oceans Can. (2009) (vi +66p).
[3] Fisheries and Oceans Canada, Action Plan for the North Atlantic Right Whale (*Eubalaena glacialis*) in Canada: fishery Interactions [Proposed]. In: Species at Risk Act Action Plan Series, Fisheries and Oceans Canada, Ottawa, 2016(v+35).
[4] P.J. Clapham, S.B. Young, R.L. Brownell, Baleen whales: conservation issues and the status of the most endangered populations, Mammal. Rev. 29 (1999) 35–60.
[5] M. Fujiwara, H. Caswell, Demography of the endangered North Atlantic right whale, Nature 414 (2001) 537–541.
[6] P.K. Hamilton, A.R. Knowlton, M.K. Marx, Right whales tell their own stories: the photo-identification catalog, in: S.D. Kraus, R.M. Rolland (Eds.), The Urban Whale: North Atlantic Right Whales at the Crossroads, Mass.: Harvard University Press, Cambridge, 2007, pp. 73–102.
[7] J. Harwood, Marine mammals and their environment in the twenty-first century, J. Mammal. 82 (2001) 630–640.
[8] A. Johnson, G. Salvador, J. Kenney, J. Robbins, S. Landry, P. Clapham, Fishing gear involved in entanglements of right and humpback whales, Mar. Mammal. Sci. 21 (2005) 635–645.
[9] C.A. Keiper, D.G. Ainley, S.G. Allen, J.T. Harvey, Marine mammal occurrence and ocean climate off central California, 1986 to 1994 and 1997 to 1999, Mar. Ecol.-Prog. Ser. 289 (2005) 285–306.
[10] A.R. Knowlton, P.K. Hamilton, M.K. Marx, H.M. Pettis, S.D. Kraus, Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: a 30 yr retrospective, Mar. Ecol.-Prog. Ser. 466 (2012) 293–302.
[11] S.D. Kraus, Rates and potential causes of mortality in North-Atlantic right whales (*Eubalaena glacialis*), Mar. Mammal. Sci. 6 (1990) 278–291.
[12] S.D. Kraus, R.D. Kenney, C.A. Mayo, W.A. McLellan, M.J. Moore, D.P. Nowacek, Recent scientific publications cast doubt on north atlantic right whale future, Front. Mar. Sci. 3 (2016) 137.
[13] S.D. Kraus, M.W. Brown, H. Caswell, C.W. Clark, M. Fujiwara, P.K. Hamilton, R.D. Kenney, A.R. Knowlton, S. Landry, C.A. Mayo, W.A. McLellan, M.J. Moore, D.P. Nowacek, D.A. Pabst, A.J. Read, R.M. Rolland, North Atlantic right whales in crisis, Science 309 (2005) 561–562.
[14] J. Michaud, C.T. Taggart, Lipid and gross energy content of North Atlantic right whale food, *Calanus finmarchicus*, in the Bay of Fundy, Endanger. Species Res. 3 (2007) 77–94.
[15] T.J. O'Shea, D.K. Odell, Large-scale marine ecosystem change and the conservation of marine mammals, J. Mammal. 89 (2008) 529–533.
[16] R.M. Pace, T.V.N. Cole, A.G. Henry, Incremental fishing gear modifications fail to significantly reduce large whale serious injury rates, Endanger. Species Res. 26 (2014) 115–126.
[17] H.M. Pettis, P.K. Hamilton, North Atlantic Right Whale Consortium 2014 annual report card. Available from ⟨http://www.narwc.org/pdf/2014_Report_Card.pdf⟩. (Accessed 30 September 2016), 2014.
[18] R.R. Reeves, B.D. Smith, E.A. Crespo, G. Notarbartolo di Sciara, Dolphins, Whales and Porpoises: 2002–2010 Conservation Action Plan for the World's Cetaceans, IUCN, Gland, Switzerland, 2003, p. 139.
[19] D.J. Rugh, K.E.W. Shelden, A. Schulman-Janiger, Timing of the gray whale southbound migration, J. Cetacea. Res. Manag. 3 (2001) 31–39.
[20] NMFS, National Marine Fisheries Service. In: Recovery plan for the North Atlantic right whale (*Eubalaena glacialis*), Silver Spring, MD, 2005.
[21] NMFS, National Marine Fisheries Service. Fish and Fish Product Import Provisions of the Marine Mammal Protection Act, Fed. Regist. 81 (2016) 54390–54419.
[22] C.T. Tynan, Cetacean populations on the SE Bering Sea shelf during the late 1990s: implications for decadal changes in ecosystem structure and carbon flow, Mar. Ecol.-Prog. Ser. 272 (2004) 281–300.
[23] J.M. van der Hoop, M.J. Moore, S.G. Barco, T.V.N. Cole, P.-Y. Daoust, A.G. Henry, D.F. McAlpine, W.A. McLellan, T. Wimmer, A.R. Solow, Assessment of management to mitigate anthropogenic effects on large whales, Conserv. Biol. 27 (2013) 121–131.
[24] A.S.M. Vanderlaan, C.T. Taggart, Efficacy of a voluntary area to be avoided to reduce risk of lethal vessel strikes to endangered whales, Conserv. Biol. 23 (2009) 1467–1474.
[25] A.S.M. Vanderlaan, R.K. Smedbol, C.T. Taggart, Fishing-gear threat to right whales (Eubalaena glacialis) in Canadian waters and the risk of lethal entanglement, Can. J. Fish. Aquat. Sci. 68 (2011) 2174–2193.
[26] G.T. Waring, E. Josephson, K. Maze-Foley, P.E. Rosel, US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2015, Woods Hole, MA, 2016, p. 512.
[27] S.W. Brillant, E.A. Trippel, Elevations of lobster fishery groundlines in relation to their potential to entangle endangered North Atlantic right whales in the Bay of Fundy, Canada, ICES J. Mar.Sci. 67 (2010) 355–364.