



Review

Mercury in the marine environment of the Canadian Arctic: Review of recent findings



Birgit Braune^{a,*}, John Chételat^a, Marc Amyot^b, Tanya Brown^{c,d}, Meredith Clayden^{e,1}, Marlene Evans^f, Aaron Fisk^g, Ashley Gaden^h, Catherine Girard^b, Alex Hare^h, Jane Kirkⁱ, Igor Lehnher^{j,2}, Robert Letcher^a, Lisa Loseto^k, Robie Macdonald^c, Erin Mann^l, Bailey McMeans^{g,3}, Derek Muirⁱ, Nelson O'Driscoll^l, Alexandre Poulain^m, Ken Reimer^d, Gary Stern^{h,k}

^a Environment Canada, National Wildlife Research Centre, Carleton University, Raven Road, Ottawa, Ontario, Canada K1A 0H3

^b Département de sciences biologiques, Université de Montréal, CP 6128, Succ. Centre-Ville Pavillon Marie-Victorin, Montreal, Quebec, Canada H3C 3J7

^c Fisheries and Oceans Canada, Institute of Ocean Sciences, 9860 West Saanich Road, PO Box 6000, Sidney, British Columbia, Canada V8L 4B2

^d Royal Military College of Canada, PO Box 17000, Station Forces, Kingston, Ontario, Canada K7K 7B4

^e Canadian Rivers Institute and Biology Department, University of New Brunswick, Saint John, New Brunswick, Canada E2L 4L5

^f Environment Canada, National Water Research Institute, 11 Innovation Blvd., Saskatoon, Saskatchewan, Canada S7N 3H5

^g Great Lakes Institute for Environmental Research, University of Windsor, 401 Sunset Ave., Windsor, Ontario, Canada N9B 3P4

^h Centre for Earth Observation Science, 497 Wallace Bldg., University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2

ⁱ Environment Canada, Canada Centre for Inland Waters, 867 Lakeshore Road, Burlington, Ontario, Canada L7R 4A6

^j Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E9

^k Fisheries and Oceans Canada, Freshwater Institute, 501 University Crescent, Winnipeg, Manitoba, Canada R3T 2N6

^l Department of Environmental Science, Acadia University, Wolfville, Nova Scotia, Canada B4P 2R6

^m Department of Biology, University of Ottawa, 30 Marie Curie, Ottawa, Ontario, Canada K1N 6N5

HIGHLIGHTS

- The water column in Arctic marine waters is important for mercury methylation.
- Mercury deposited on marine snow pack is rapidly re-emitted to the atmosphere.
- Rates of mercury biomagnification were similar across Arctic marine food webs.
- Mercury is higher in Beaufort Sea biota than in other Canadian Arctic areas.
- Mercury in some marine biota has increased in recent decades.

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ABSTRACT

This review summarizes data and information which have been generated on mercury (Hg) in the marine environment of the Canadian Arctic since the previous Canadian Arctic Contaminants Assessment Report (CACAR) was released in 2003. Much new information has been collected on Hg concentrations in marine water, snow and ice in the Canadian Arctic. The first measurements of methylation rates in Arctic seawater indicate that the water column is an important site for Hg methylation. Arctic marine waters were also found to be a substantial source of gaseous Hg to the atmosphere during the ice-free season. High Hg concentrations have been found in marine snow as a result of deposition following atmospheric mercury depletion events, although much of this Hg is photoreduced and re-emitted back to the atmosphere. The most extensive sampling of marine sediments in the Canadian Arctic was carried out in Hudson Bay where sediment total Hg (THg) concentrations were low compared with other marine regions in the circumpolar Arctic. Mass balance models have been developed to provide quantitative estimates of THg fluxes into and out of the Arctic Ocean and Hudson Bay. Several recent studies on Hg biomagnification have improved our understanding of trophic transfer of Hg through marine food webs. Over the past several decades, Hg concentrations have increased in some marine biota, while other populations showed no temporal change. Marine biota also exhibited considerable geographic

* Corresponding author. Tel.: +1 613 998 6694; fax: +1 613 998 0458.

E-mail address: birgit.braune@ec.gc.ca (B. Braune).

¹ Current address: 5568 Falkland Street, Halifax, Nova Scotia, Canada B3K 1A5.

² Current address: Earth and Environmental Sciences, University of Waterloo, 200 University Ave. W, Waterloo, Ontario, Canada N2L 3G1.

³ Current address: Department of Integrative Biology, University of Guelph, Science Complex, Guelph, Ontario, Canada N1G 2W1.

variation in Hg concentrations with ringed seals, beluga and polar bears from the Beaufort Sea region having higher Hg concentrations compared with other parts of the Canadian Arctic. The drivers of these variable patterns of Hg bioaccumulation, both regionally and temporally, within the Canadian Arctic remain unclear. Further research is needed to identify the underlying processes including the interplay between biogeochemical and food web processes and climate change.

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Contents

1.	Introduction	68
2.	Overview of the mercury cycle in the Arctic marine environment	69
3.	Speciation of mercury in Arctic marine waters	70
4.	Sea ice and snowpack	70
4.1.	Mercury in Arctic marine snow	70
4.2.	Rapid re-emission of mercury from snow following Atmospheric Mercury Depletion Events (AMDEs)	71
4.3.	Distribution of mercury in Arctic sea ice	71
5.	Marine sediments	72
6.	Mass balance models	72
6.1.	Mass balance estimates of mercury for the Arctic Ocean	72
6.2.	Mercury budget for Hudson Bay	73
7.	Biogeochemical cycling of mercury	73
7.1.	Methylation and demethylation	73
7.2.	Reduction and oxidation	74
7.2.1.	Microbial redox processes	74
7.2.2.	Photochemical redox processes	75
8.	Bioaccumulation and biomagnification of mercury	75
9.	Food webs	75
9.1.	Trophic transfer of mercury through marine food webs in the Canadian Arctic	75
9.1.1.	Cumberland Sound	75
9.1.2.	Hudson Bay	75
9.1.3.	Queens Channel	76
9.1.4.	Eastern Beaufort Sea and Amundsen Gulf	76
10.	Marine fish	77
10.1.	Sea-run Arctic char	77
10.1.1.	Spatial patterns	77
10.1.2.	Temporal trends	77
10.2.	Other marine fish	78
11.	Marine birds	78
11.1.	Interspecies comparisons	78
11.2.	Spatial patterns	79
11.3.	Temporal trends	80
12.	Marine mammals	80
12.1.	Historical trends of mercury in marine mammals	80
12.2.	Ringed seal	80
12.2.1.	Tissue selection and data adjustment	80
12.2.2.	Spatial patterns	81
12.2.3.	Comparison of mercury concentrations in ringed seal with other seal species	82
12.2.4.	Temporal trends	82
12.3.	Beluga	83
12.3.1.	Beluga in Hudson Bay	83
12.3.2.	Beluga in the western Arctic	83
12.4.	Walrus	84
12.5.	Narwhal	84
12.6.	Polar bear	84
12.6.1.	Spatial patterns	84
12.6.2.	Temporal trends	85
13.	Summary	86
	Acknowledgments	87
	References	87

1. Introduction

The marine environment in the Canadian Arctic is truly vast and diverse. It includes deep basins and large shelves of the Arctic Ocean, many fjords, channels and straits in the Arctic Archipelago, Hudson Bay (the largest northern inland sea) and large, productive polynyas such as the North Water Polynya in Baffin Bay and the Bathurst Polynya

in the Beaufort Sea. Over the last two decades, investigations of mercury (Hg) in these marine ecosystems have largely focussed on marine mammals and birds because of their dietary and cultural importance for northern Aboriginal peoples and the presence of elevated Hg concentrations in some animals. Marine mammals such as seals, beluga (*Delphinapterus leucas*), and polar bears (*Ursus maritimus*) generally have higher concentrations of Hg than terrestrial mammals and

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