

GIARDIA AND CRYPTOSPORIDIUM IN PINNIPEDS
FROM THE GULF OF ST. LAWRENCE,
CANADA

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This thesis is presented for the degree of
Doctor of Philosophy of Murdoch University

Declaration

This thesis is presented for presented for the degree
of Doctor of Philosophy of Murdoch University

I declare that this thesis is my own account of my
research and contains as its main content, work that
has not been submitted for publication or degree at
any other educational institution.

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Abstract

Giardia and *Cryptosporidium* are protozoan parasites known to cause enteric disease in terrestrial mammals, reptiles and birds. Compared to the abundance of surveys that have examined *Giardia* and *Cryptosporidium* in terrestrial wildlife species, very few studies on either parasite have been undertaken on marine mammal species. Studies of shellfish, marine waters and water treatment plants clearly indicate that marine ecosystems are contaminated with *Giardia* and *Cryptosporidium*. In spite of these data the extent to which these parasites extend into the marine environment and how they may impact on marine mammal health remains largely unknown. The aim of this thesis was to expand our current knowledge of *Giardia* and *Cryptosporidium* in the marine environment and in particular, the harp and hooded seal populations of the Gulf of St. Lawrence, Canada.

A large-scale serological survey of a large cohort of serum samples clearly show that, as is the case with terrestrial mammals, *Giardia* is ubiquitous in the marine environment. Sera positive for *G. duodenalis*-specific IgG were detected in almost all cetacean and pinniped species examined, and from all regions of the St. Lawrence estuary, Gulf of St. Lawrence and from the Canadian arctic.

In the case of harp and hooded seals, they are actively infected with Assemblage A, a zoonotic strain of *G. duodenalis* and represent a previously unrecognised contributor to the overall environmental parasite burden. The discovery of this variant of *Giardia* in a phocid host, along with their susceptibility to infection with terrestrial strains of both *Giardia* and *Cryptosporidium*, highlight the potential zoonotic transmission from seals to humans through the consumption of uncooked intestines and general animal handling during research or hunting practices. The identification of this zoonotic strain of *Giardia* in seals also demonstrates the potential for anthropogenic activities such as

human sewage treatment and agriculture runoff to be a significant source of contamination for marine mammals.

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Need I say more...



Symbols and Abbreviations

Symbols

°C	degrees Celsius
°	degrees
'	minutes
<	less than
>	greater than
=	equal to
%	percent
±	plus and minus

Units of weights and measure

μL	microliter
cm	centimetre
g	gram
G	acceleration due to gravity
hr	hour
Kda	kilodalton
kg	kilogram
L	litre
m	meter
mg	milligram
min	minute
mL	millilitre
mm	millimetre
mM	millimolar

N	normal; gram molecular weight of solute divided by hydrogen equivalent of solute, per litre of solution
ppt	parts per thousand

Other abbreviations:

ANOVA	analysis of variance
Cc	hooded seal (<i>Cystophora cristata</i>)
ELISA	enzyme linked immunosorbent assay
EPA	Environmental Protection Agency
I.D.	identity
IgA	immunoglobulin A
IgG	immunoglobulin G
max	maximum
min	minimum
MLI	Maurice Lamontagne Institute, Department of Fisheries and Oceans, Québec, Canada.
N	North
n	number of samples
PBS	Phosphate buffered saline
PCR	polymerase chain reaction
Pg	harp seal (<i>Phoca groenlandica</i>)
ref.	reference
S.E.M	standard error of the mean; standard deviation divided by the square root of sample size
SSU-rRNA	small ribosomal subunit

HSP-70 70 kDa heat shock protein

W West

Publications arising directly from this thesis:

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