

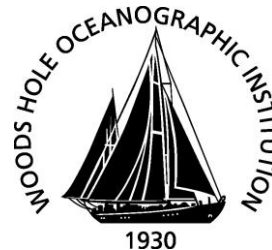
Seals and Ocean Health: Benefits, Risks and Realities

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The Northwest Atlantic
Seal Research
Consortium

Why Should We Care About (Gray) Seal Health?

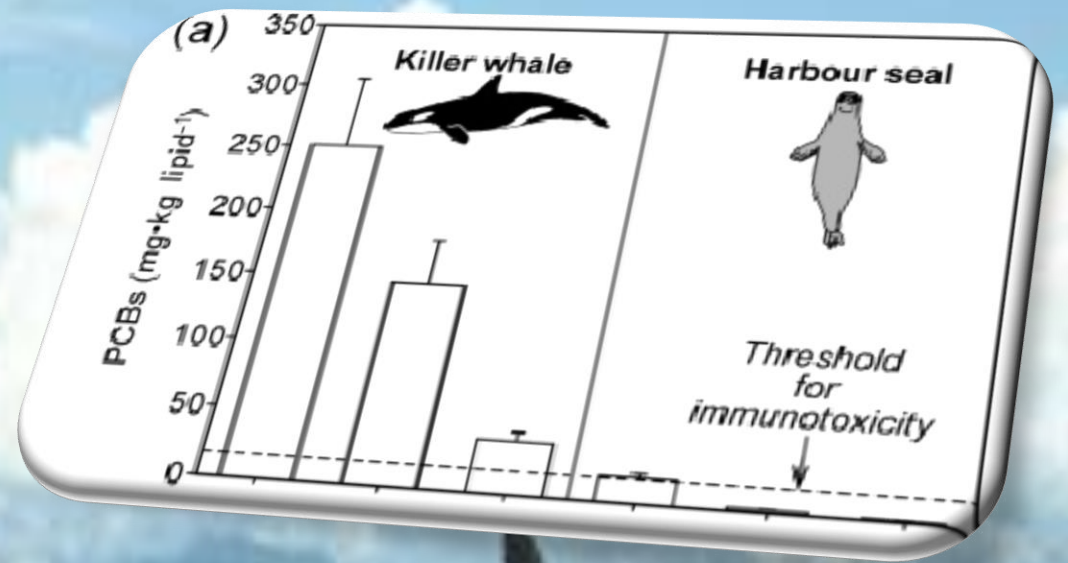




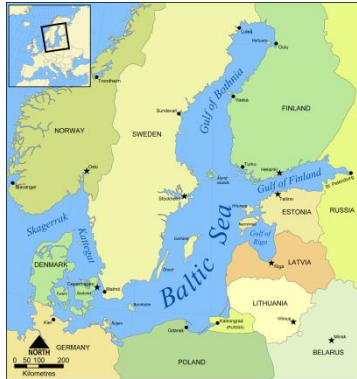
Sentinels!



Monomoy National Wildlife Refuge, Chatham



Gray Seals as Toxic Waste



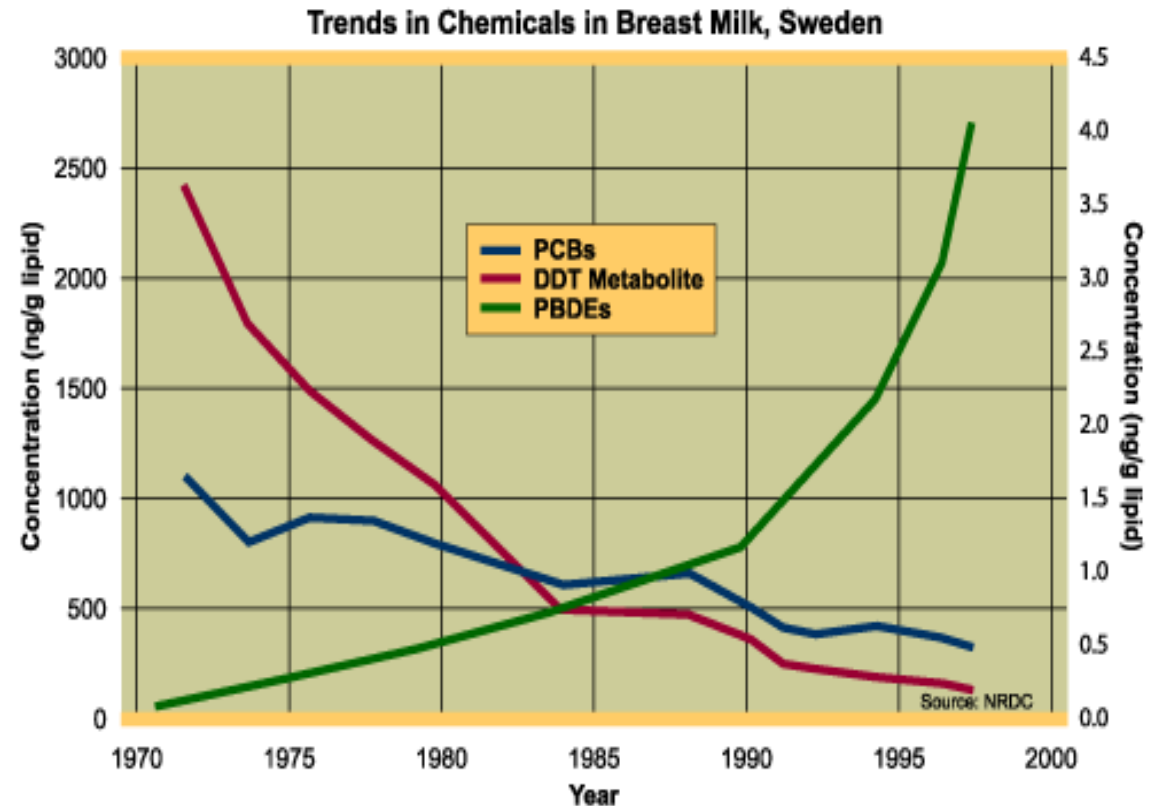
Baltic grey seals (1965-1985):

- Uterine occlusions and bone deformities were common.
- 53% of females had some degree of cancer related lesions.
- These lesions were linked to polychlorinated biphenyls (PCBs).
- A decrease in reproductive success was directly correlated with an increase in PCBs.



Why Should We Care About Toxic Baltic Gray Seals?

In **HUMANS**- Higher consumption of fatty fish in the Baltic correlated to statistically lower immuno-competence.



What Health Risks Affect Gray Seals Here?



NW-Atlantic Pinniped Health Risk Factors

Northwest Atlantic Seal Research Consortium
Pinniped Health Working Group

April 1 | 2016

Collaborators

Chair: Anna Bass, University of New England

Co-Chair: Andrea Bogomolni, Woods Hole Oceanographic Institution

Katie Pugliares, New England Aquarium

Kathy Zagzebski, National Marine Life Center

Kristina Cammen, University of Maine

Jon Runstadler, Massachusetts Institute of Technology

Wendy Puryear, Massachusetts Institute of Technology

Mendy Garron, NOAA Greater Atlantic Regional Fisheries Office

<http://nasrc.whoie.edu>

Identified Broad Category Risk Factors and Mitigation Efforts:

- Anthropogenic Impacts
- Animal Disease
- Environmental and Ecological Changes

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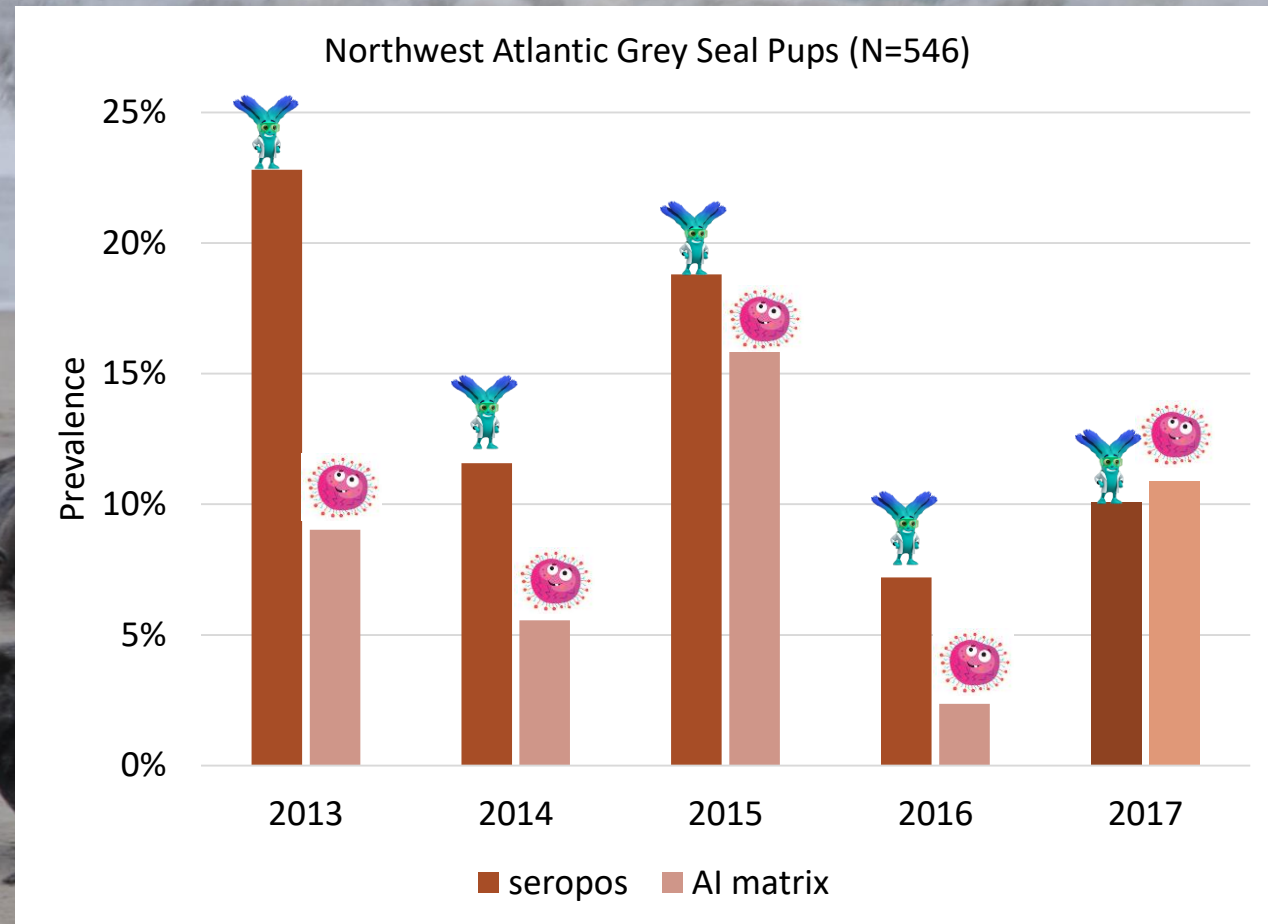




You want to
swab me
where?

Influenza A Virus (IAV)

Viral Prevalence 9.7%;
seroprevalance 14.1%



- no *apparent* illness or behavioral impact
- Antibodies recognize a breadth of subtypes

W. Puryear (*Unpublished data*)

Phocine Distemper Virus (PDV)



- Does Not Affect Humans.
- PDV is Similar to Canine Distemper Virus.
- Mortality of over half the population of harbor seals in Europe in 1988 and in 2002 (20,000+ seals).
- In 2006 PDV killed hundreds of seals, mostly harbor seals, in the New England.
- Unlike the European Virus, the virus was found to cause clinical disease in gray seals in the US.
- Current population has low protection/antibodies to PDV in stranded, wild adult and pups.

Alopecia



Cause: Unknown

Observed in 7.1% of gray seals examined in Massachusetts ($n = 2,134$) from 2004 – 2013

Observations were primarily reported in live seals, suggesting the syndrome is not associated with any condition which leads to imminent mortality.

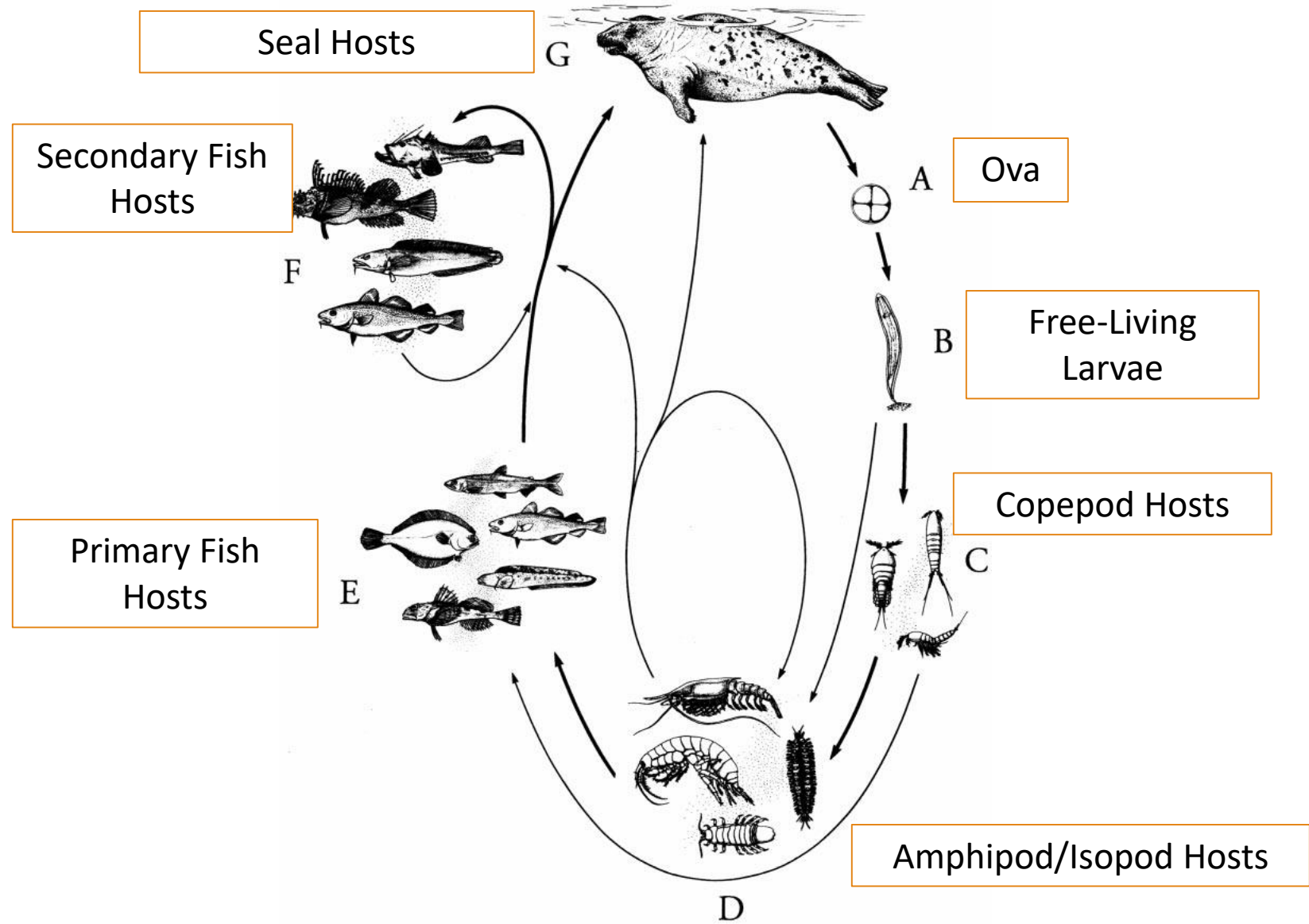
Cases: Majority from Nantucket, MA and southeastern Cape Cod.

The prevalence of alopecia in gray seals also appears to be increasing over time, suggesting a change or disruption within their environment.

Codworm



Pseudoterranova spp.



Codworm



Pseudoterranova spp.

Does Seal Distribution Influence Codworm Distribution?

Regression analyses indicates there is NO RELATIONSHIP between the two in the Gulf of Maine.

HOWEVER, based solely on cod stock, there is a relationship, but this is most likely based on many other factors that need further investigation:

- Location and movement of stocks
- Bottom water temperature
- Water current patterns/transport
- Other hosts (planktonic and fish)

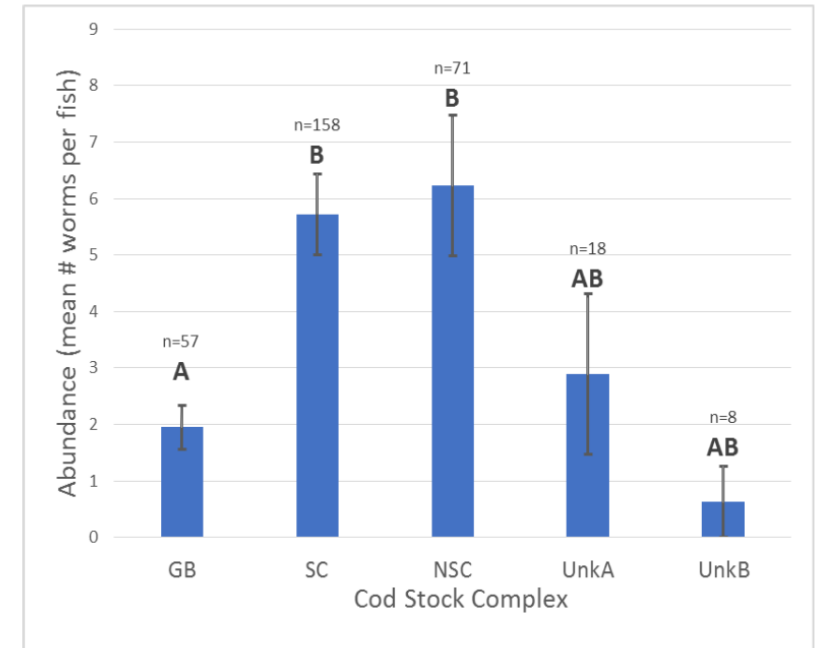


Figure 2.8. Codworm Abundance across Cod Stock Complexes. Abundance of codworm (*Pseudoterranova*) in samples of Atlantic cod (*Gadus morhua*) collected from the different Atlantic cod stock complexes in the Gulf of Maine. Error bars represent standard errors, letters on top of bars represent significant differences, and n represents sample size.

Are Seals Polluting Our Water?



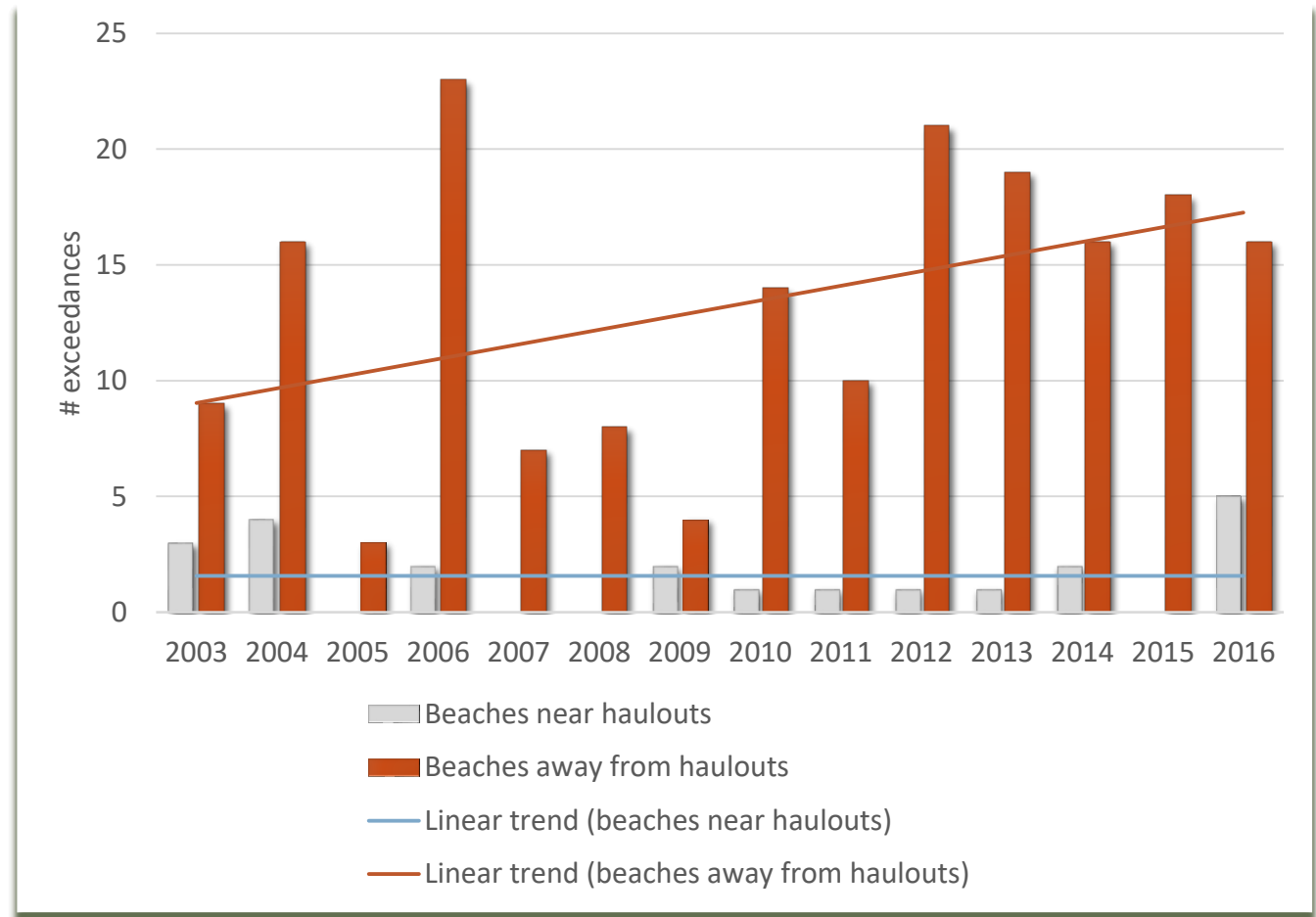
Water Quality

Data derived from MA Department of Public Health (MDPH)

Beaches near seals = any beaches within a 5 mile radius of known seal haul-out sites on Cape Cod

http://ma.healthinspections.us/public_21/maps.cf?map=Cape%20Cod

No. Beaches NEAR seal haul outs have FEWER exceedances



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Needed: Better Tools to Track Bacterial Source

Current Methods used for beach water quality assessment DO NOT identify source of bacteria.

Media reports blaming seals for beach closures during the summer of 2017 in ARE NOT correct.

SOLUTION:

- Source Tracking Methodologies DO EXIST
- Current Collaboration with the EPA to assess the use of Phylochip



PhyloChip: DNA Microarray for Rapid Profiling of Microbial Populations



Can Humans Get Sick From Gray Seals?

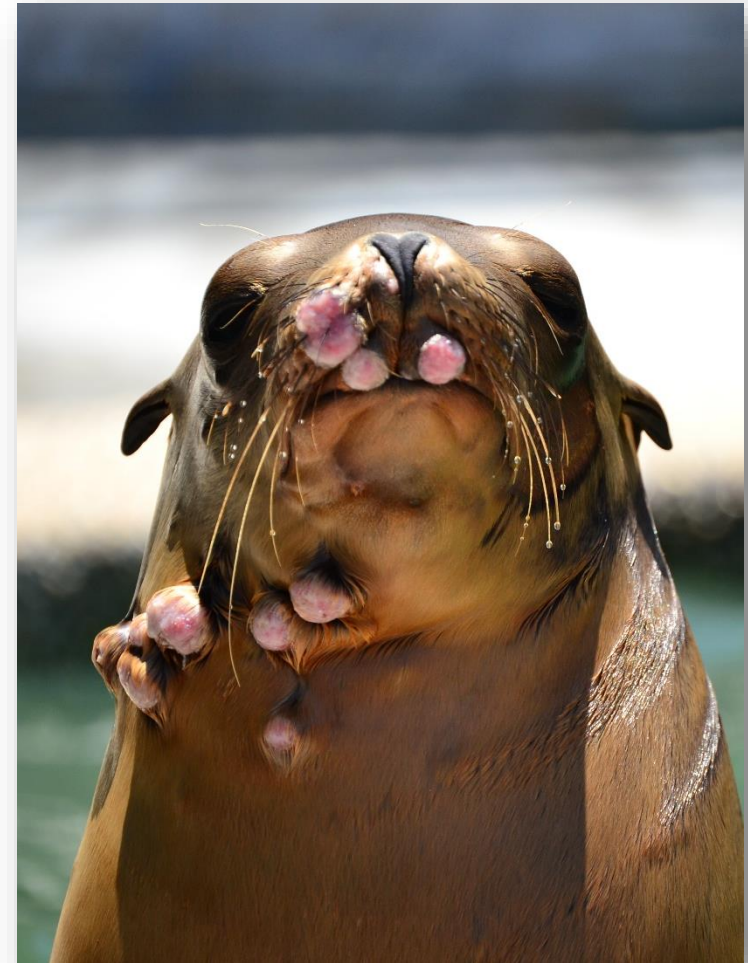
Possible, but it is very unlikely.



**ASSESSMENT OF THE RISK OF ZONOTIC DISEASE TRANSMISSION
TO MARINE MAMMAL WORKERS AND THE PUBLIC:
SURVEY OF OCCUPATIONAL RISKS**



Final Report
Research Agreement Number K005486-01



<http://marinemammalcare.org/blog/>

HEALTH AND SAFETY BROCHURE



Photo by Jonna Mazet

Safety measures to prevent injury and infections:

Obtain the recommended training, and follow all of your institution's safety procedures for safe animal handling



Wear gloves and other protective gear when handling animals and specimens



Avoid contact with animals if you are ill



Use additional safety equipment when risks of acquiring an infection are high



Use necropsy, husbandry and laboratory procedures that minimize the risk of cuts and injuries



Consult your physician before working with marine mammals if you are pregnant or have other health concerns



Wash hands thoroughly after animal and specimen contact

Knowledge and careful work practices are your best defense!

What you can do:

Care must be taken to **avoid all possible routes of exposure to marine mammal infections**. Although bites and contact with existing wounds are the most common routes, infections can occur through your mouth, eyes, respiratory system and skin.

Report any animal bite, scratch, or other significant exposure to marine animal blood, saliva, or other excretions to the appropriate supervisor.

If you develop an illness or other condition that could be caused by exposure, be sure to **tell your physician that you work with marine mammals**.

Resources for more information:

1. Full report available from the UC Davis Wildlife Health Center at www.wildlifehealthcenter.org
2. "Public Health" by Cowan et al. in L.A. Dierauf and F.M.D. Gulland, *CRC Handbook of marine mammal medicine 2nd ed.* 2001, Boca Raton, FL: CRC Press
3. The Centers for Disease Control and Prevention www.cdc.gov
4. National Institute of Environmental Health Science: Biological Safety <http://www.niehs.nih.gov/odhsb/home.htm>

Working with Marine Mammals and Your Health



Photo by Deborah Gabris

A guide for marine mammal workers and rehabilitation volunteers

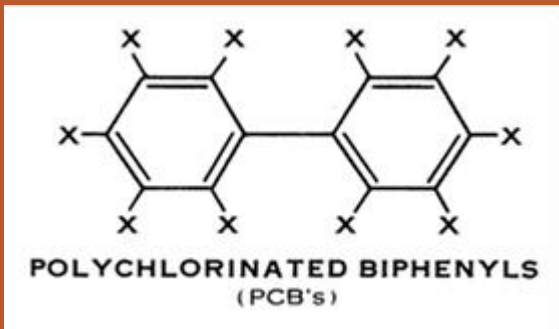
Important information to keep you aware, safe, and healthy

Provided by:

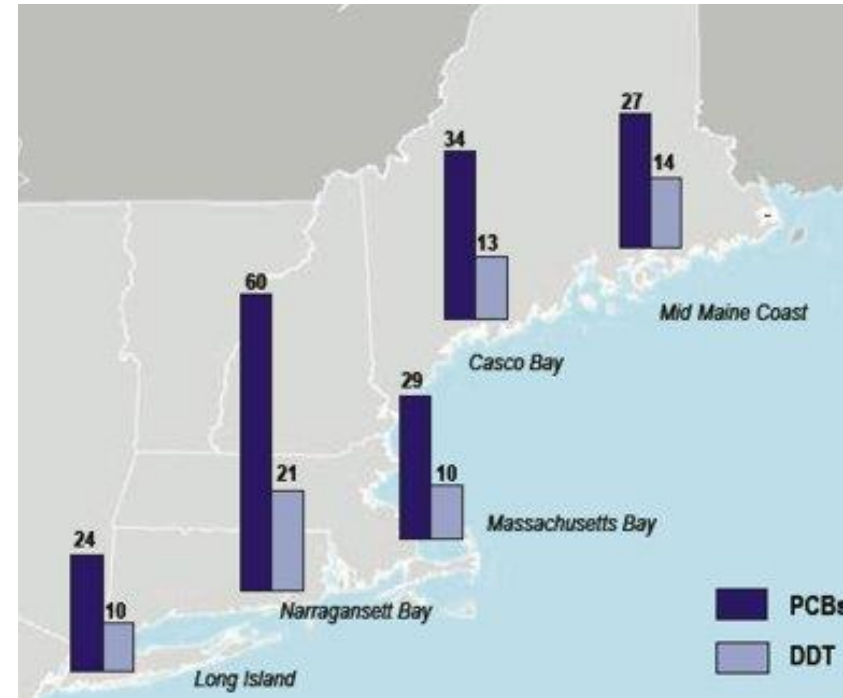
U.S. Marine Mammal Commission
National Marine Fisheries Service
Wildlife Health Center, UC Davis

Are Gray Seals Exposed To and Affected by Toxins?

Persistent Organic Pollutants



Levels of PCBs in Harbor Seals*

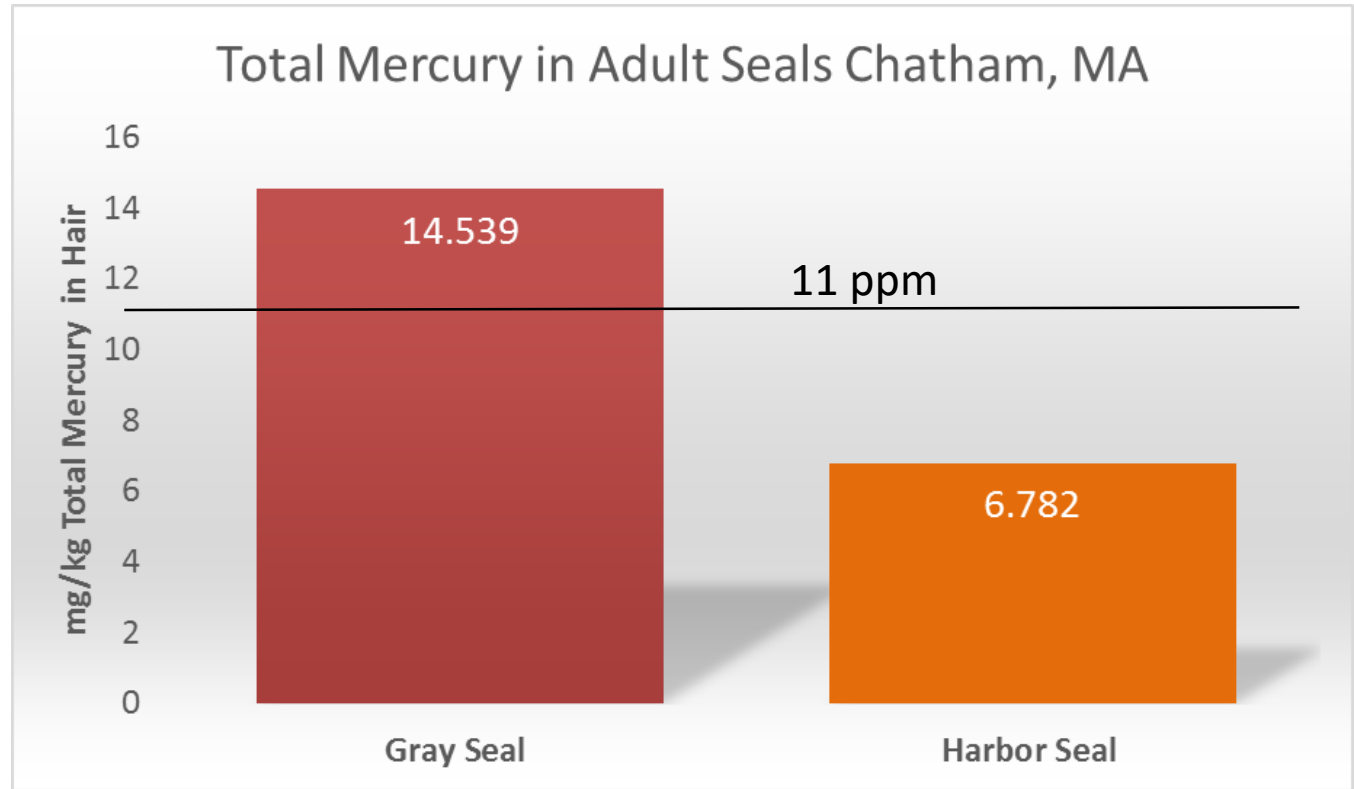


MERI: PCB and DDT concentrations (micrograms per gram lipid weight ppm) in blubber of Northwest Atlantic harbor seals (data 2005). <http://www.meriresearch.org/focus/marine-wildlife-exposure>

*Immunotoxic effects are known to occur at 17 ppm in harbor seals.

Mercury

Analysis Courtesy of the Biodiversity Research Institute, unpublished data.



11 mg/kg (ppm) in human maternal hair is associated with clinically discernible, adverse neurodevelopmental effects in children following in utero exposure MeHg (EPA).

Chatham Gray Seal Hair from 2013 measured up to **22 mg/kg**

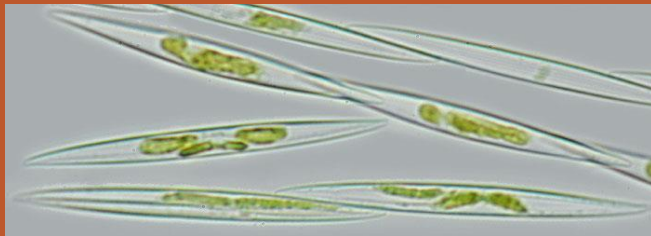
Likely that there are effects associated with these levels.

Algal Toxins

“Red Tides”

Saxitoxin

Domoic Acid



State: Shellfish closure expands to Cape and Islands

Tuesday

Posted at 5:13 PM

Updated at 5:56 PM

By Doug Fraser

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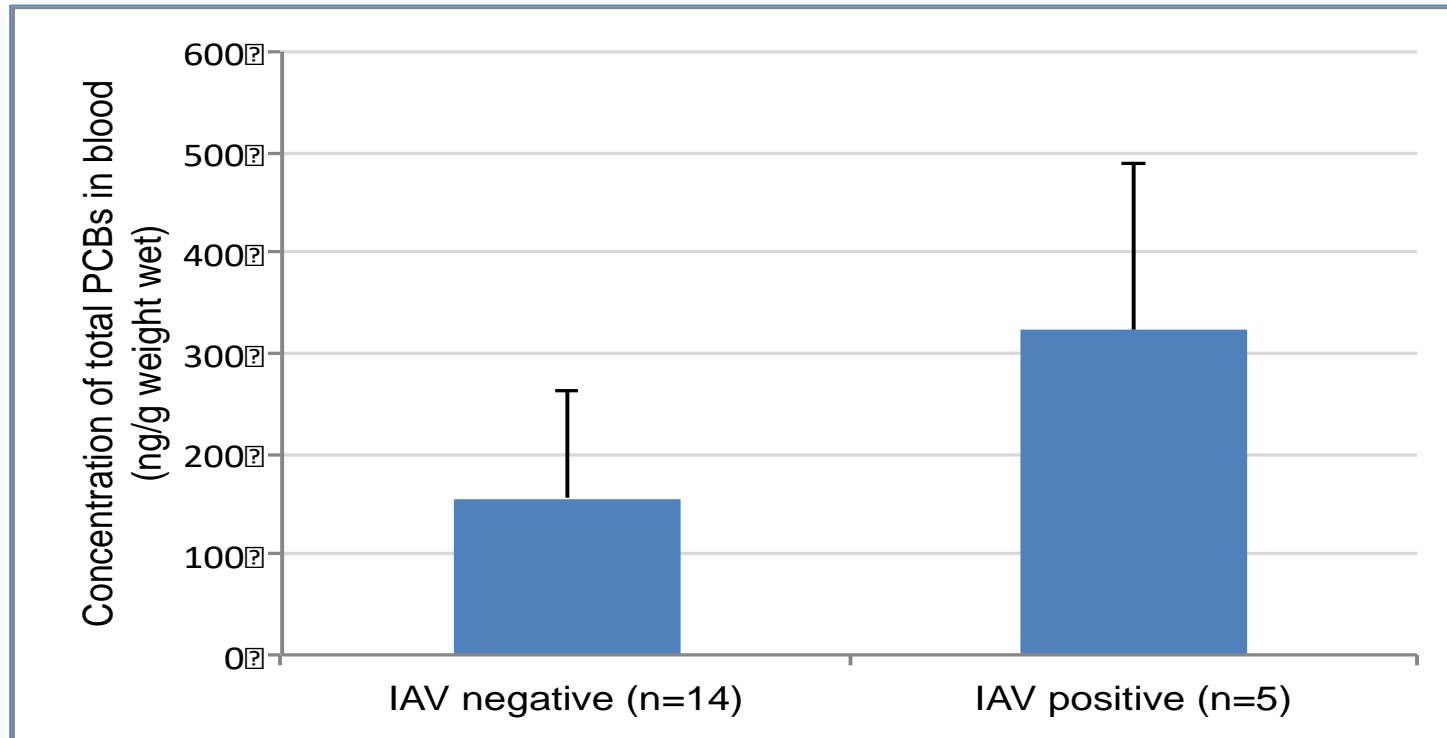
Because of a toxic algal bloom, the state Division of Marine Fisheries has just expanded its shellfish closure from Buzzards Bay to include all areas in the southern portion of Cape Cod, Martha's Vineyard and Nantucket.

Towns with closures include Falmouth, Mashpee, Barnstable, Yarmouth, Dennis, Harwich, Chatham, Aquinnah, Chilmark, West Tisbury, Tisbury, Oak Bluffs, Edgartown and Nantucket.



S. Fire unpublished data, A. Bogomolni et al. 2015

What Do These Contaminants Mean for Gray Seals?



Concentrations of blood PCBs in gray seal pup measured from dried blood spot cards. Influenza (IAV) positive grey seals had significantly higher concentrations of total PCBs compared to seals that were IAV negative (t-test; $p < 0.05$).

Pinnipeds are Ecosystem Sentinels

Between 2013-2015, THOUSANDS of sea lion pups stranded along the Southern California Coast

“All the animals that are coming ashore are showing the same symptoms and that is that they're emaciated, they're dehydrated and they just are apparently having difficulty finding food.”



So What Does This Mean For Us?

We need to monitor our sentinels.

We need to understand the host, their environment and what affects them.



Threats to Marine Mammals are Ultimately Threats to Us.

We need to determine the best ways to assess their health.....

.....rather than be unprepared and unaware when the boomerang comes back to us.

Future Directions

- Work collaboratively to answer questions pertaining to seal, ocean and human health.
- Long Term Baseline Data including clinical baselines and pathogen exposure.
- Effects of anthropogenic impacts on health including pollutants, contaminants, coastal /offshore development.
- Climate change and shifting food resources.
- Effects of natural algal bloom (HAB) toxins on health.
- “Track” the health of seals through temporal and spatial scales.
- Understand health as a complex system.



