One Health, Marine Mammal Health and Climate Change

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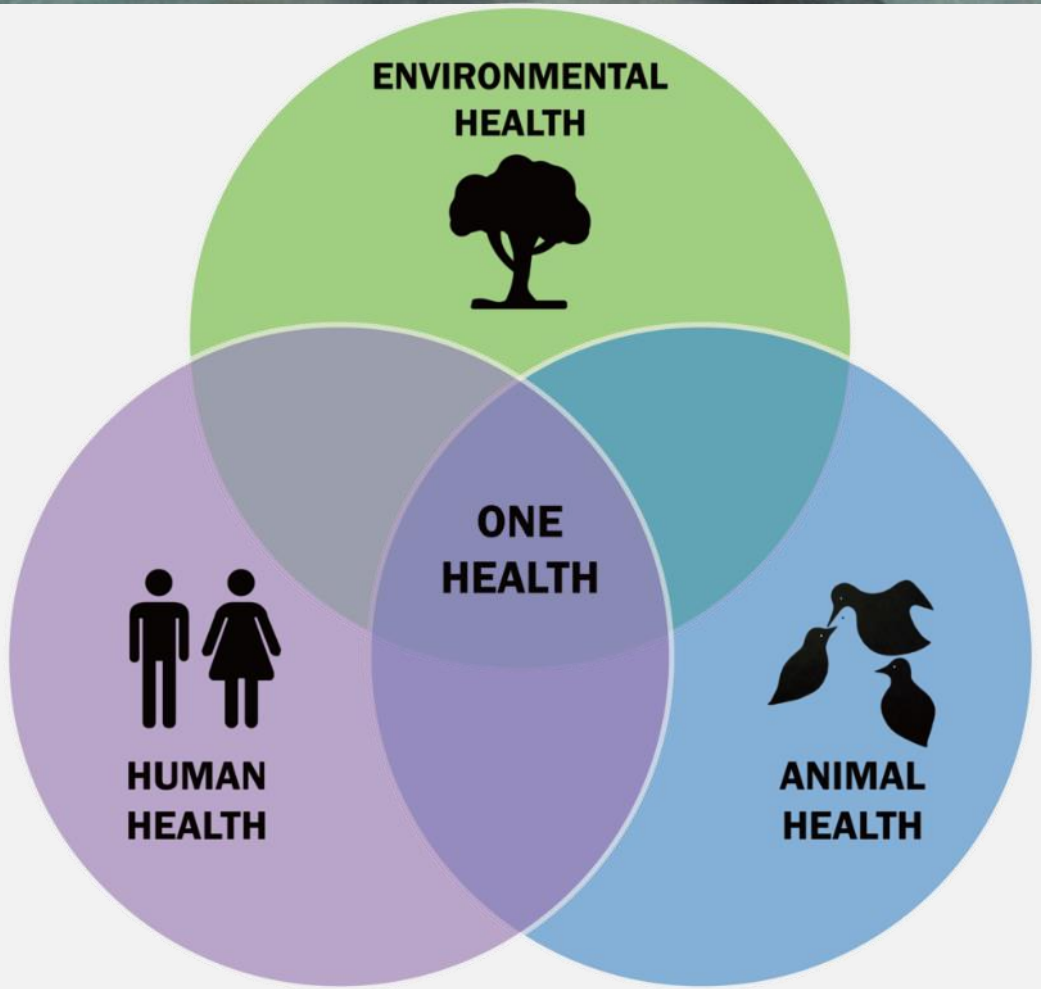
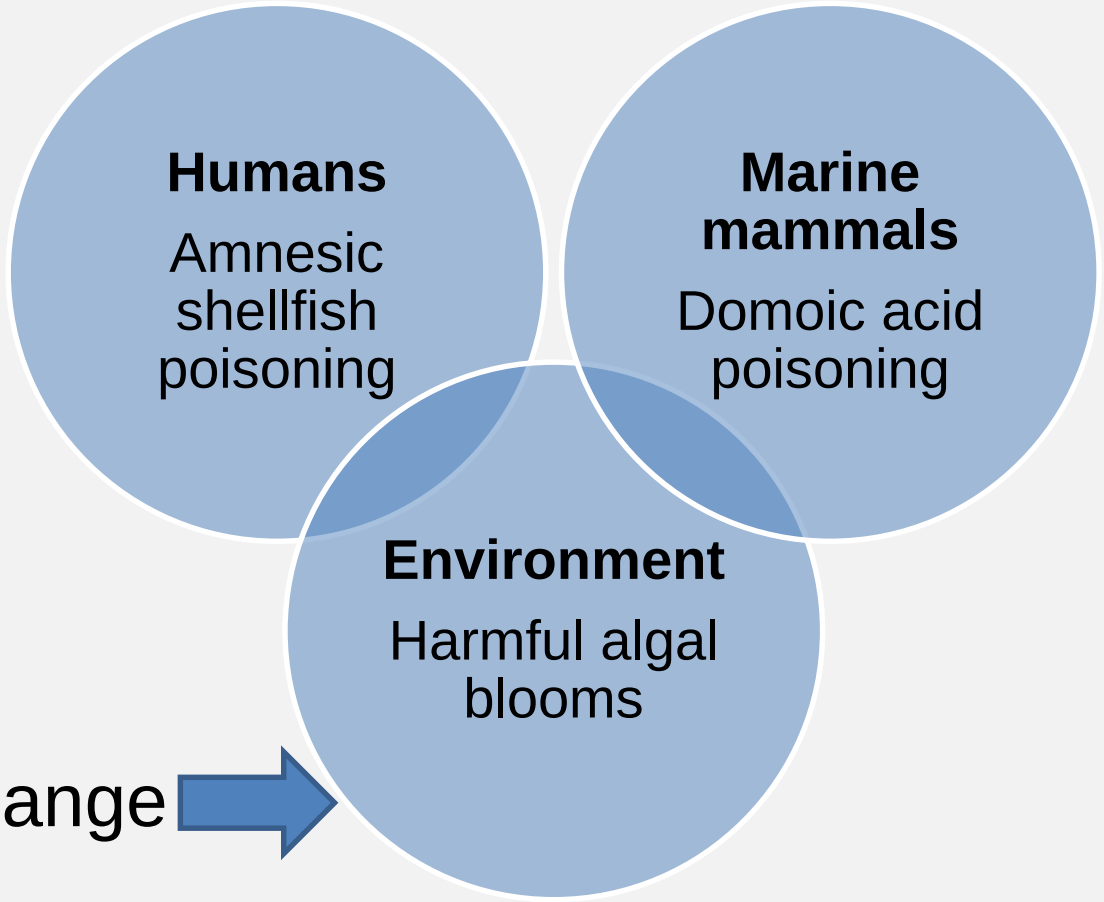
With input from Jason Baker, Peter Thomas, Sue Moore, Lauri Leach, Erin LaBrecque, Lori Schwacke

“One Health”


ENVIRONMENTAL HEALTH
ONE HEALTH
HUMAN HEALTH
ANIMAL HEALTH

Domoic Acid Toxicosis: an example of One Health



Complexity of Interactions

Understanding whale entanglements off the U.S. west coast

Changes in ocean conditions

- Persistent marine heat wave
- Massive bloom of toxic algae

Changes in whales' prey

- Lower krill abundance off shelf break
- Switch to low abundance anchovies nearshore
- Humpback whales seek other prey further north

KRILL

ANCHOVIES

Changes in whale presence & abundance

- Recovering whale populations
- Humpback whales switched prey, found closer to shore

Continental shelf

Changes in dungeness crab fishery

- Harmful algal bloom delayed opening of fishery in 2016
- More crab shing gear when whale concentrations were high

400%

increase of confirmed whale entanglements

Record increases in whale entanglements in recent years. confirmed whale entanglements on the WA, OR, CA coast increased 400% to a historic high of 50 in 2015, from an average of 10 per year pre-2014.

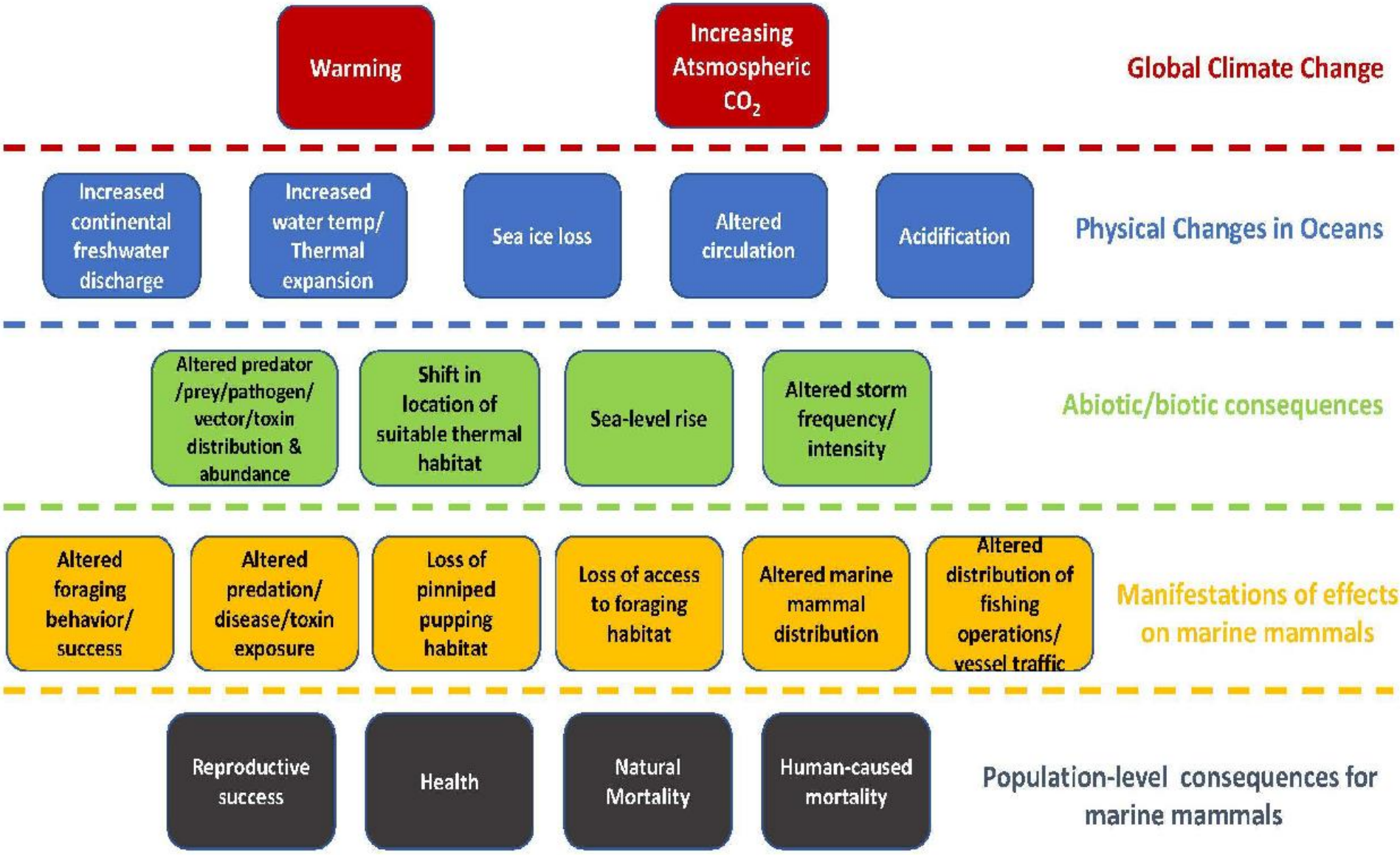
While many entanglements in recent years have been reported in central CA, we know at least some of these entanglements occurred elsewhere along the west coast.

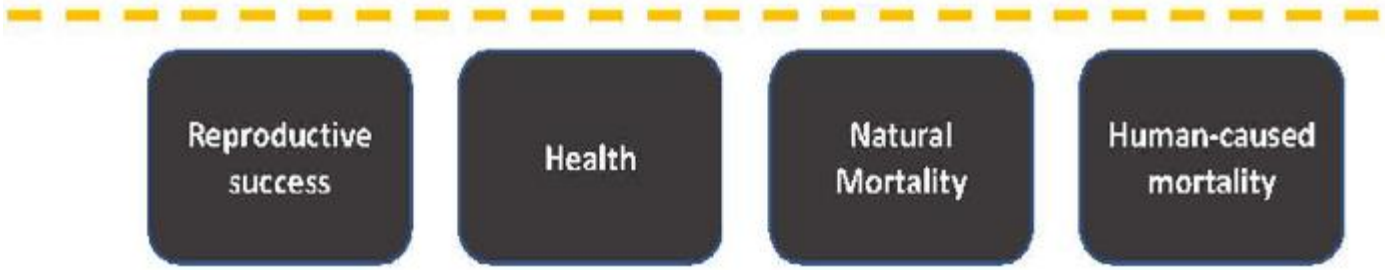
Fishing gear

Most of the whale entanglements are due to unknown types of fishing gear; of the fishing gear that we can identify, trap/pot fisheries are the primary source.

Santora et al. 2020

Cascading Effects of Climate Change





Toxin exposure from HABs

Pathogen exposure – increased survival of viral vectors, T° sensitive bacteria, fungi

Increasing HABs

Increased mortality, reproductive failure, health effects

- 1998 Domoic acid toxicosis first diagnosed in California sealions

  -Since then increased sea lions cases, range of species impacted,

  -Northern & Guadalupe fur seals, sea otters, cetaceans

  (*Lefebvre et al 2010 Harmful Algae 9:374-383)*

- 1987 Saxitoxin first detected in humpback whales off Cape Cod, USA
  - 2015: 343 Sei whales died in southern Chile *(Haussermann et al 2017)*
  - 2022: 28 Southern right whales died at Península Valdés , Argentina *(Uhart et al 2023*)

Shift in Pathogen Exposure

Polar bears in western Hudson Bay exposed to terrestrial pathogens following ice loss , prevalence of antibodies to the parasites *Toxoplasma gondii* and *Trichinella* spp. increased from 1986-1989 to 2015-2017

Pilford et al *https://doi.org/10.1111/gcb.15537*

Vibrio parahaemolyticus (proliferates in water over 15°C)

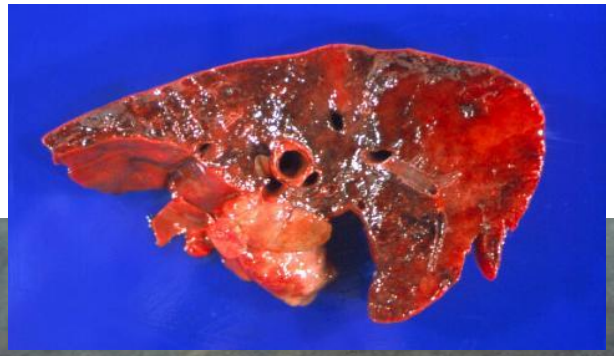
- 2004 first human cases of poisoning due to ingestion of *Vibrio*-contaminated oysters from Prince William Sound
- 2013 *Vibrio* reported in fecal samples from belugas, sea otters and a harbor porpoise, expanding the known distribution in Alaska to Seward, Cook Inlet, Kachemak Bay, Kodiak, and Dillingham

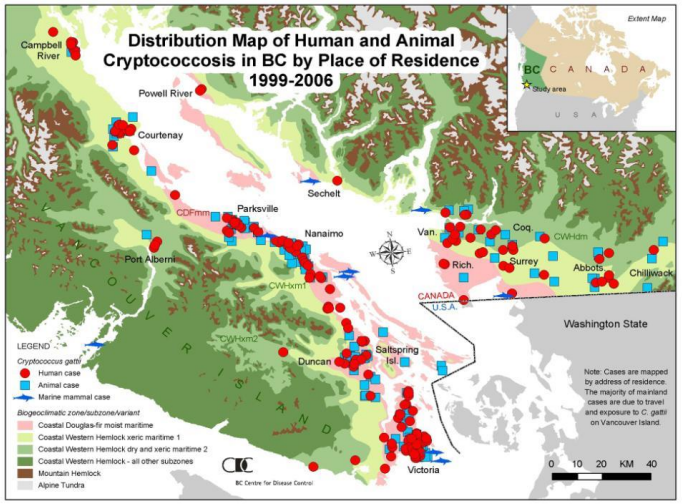
Novel Pathogens

***Cryptococcus gatti* type B**

- Temperature sensitive fungus in Pacific North West
- Respiratory disease, abortion
- Historically a sub-tropical disease, distribution follows eucalyptus trees
- Canada, USA first reports 1999,
  - > 300 human cases, 25/million annually in Vancouver Island, highest globally
  -> 300 animal cases, Dall's porpoise, harbor porpoise, PWS dolphin, harbor seals

Teman et al 2021





What We Don't Know

- Data associating health changes with environmental measurements are scant
- Large scale systematic sampling for specific pathogens over time and space is rare, so distribution of infectious pathogens in marine mammals are largely unknown,
  - makes prediction and response preparation for disease outbreaks difficult.

Future Directions

- Population-level health surveillance
  (beyond single case investigations)
- Targeted studies of climate sensitive pathogens
  - Spatial and temporally structured sampling designs
- Integration of environmental, animal distribution and health/cause of death data to track changes due to climate change

Path Toward Marine Mammals as Ecosystem Sentinels

OCEAN HEALTH ASSESSMENT

- linking to -

GOOS & NOAA One-Health goals