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Meta-analysis of 20 years of anisakid prevalence studies suggests no change in anisakid burden in the prey species of endangered marine mammals.

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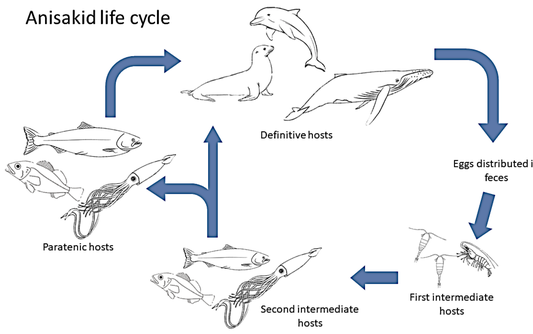
Background

- Marine mammals are subject to infection from *Anisakidae*, a family of parasitic nematodes referred to as anisakids, via trophic transmission.
- Anisakids thought to be increasing in fish, which act as intermediate hosts (Fiorenza et al. *in prep*).
- We sought to investigate whether this trend holds true for the prey species of endangered marine mammals around the world.

Anisakid life cycle

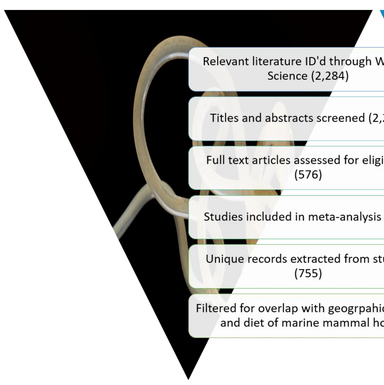


Objectives

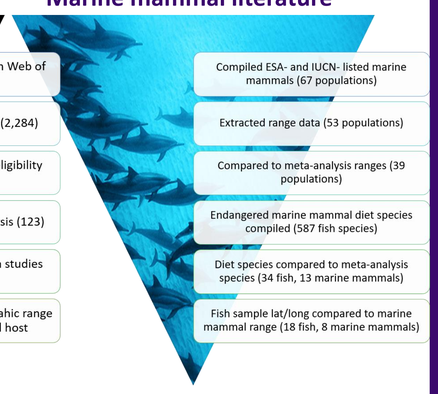
1. Determine if there has been a change in anisakid prevalence in key prey species of endangered marine mammals
2. Determine if there has been a change in anisakid risk to specific marine mammal species

Methods

Anisakid literature



Marine mammal literature



- We used all the resulting data to run our full model to on change in risk (Model 1)
- Data were then filtered to remove any marine mammals with less than 10 samples or less than 5 years of data.
- This resulted in 4 definitive hosts, Guadalupe fur seals, fin whales, sei whales, and ringed seals.
- We used these four species in our model testing change in risk to specific marine mammal species (Model 2)

Model 1

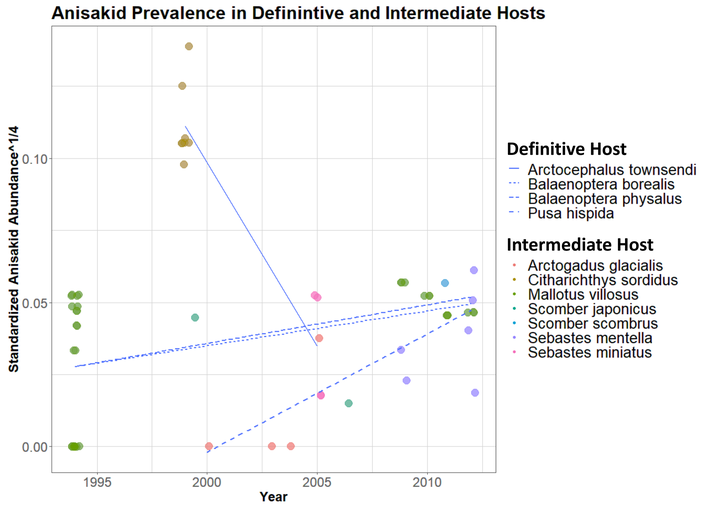
Anisakid Abundance$^{1/4}$ ~ Intermediate host length + Year + Parasite spp + Intermediate Host/Portion of Body + FAO region + Method of counting + Paper ID

Model 2

*Anisakid Abundance$^{1/4}$ ~ Intermediate host length + Definitive Host spp*Year + Parasite spp + Intermediate Host/Portion of Body + FAO region + Method of counting + Paper ID/Sample ID*

- Response variable
- Fixed effects
- Random effects

Results



- Model 1 suggests no significant trends over time in marine mammals globally over time
- Model 2 suggests no significant trends in any host species over time
- Future steps:
  - Verify the ranges of marine mammal species through species-specific experts
  - Verify the diets of marine mammals
  - Assess risk by determining the percentage of each species that the diet makes up

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Preliminary results suggest **no change** in parasitic nematode **anisakid risk** to endangered marine mammals **over past 20 years.**

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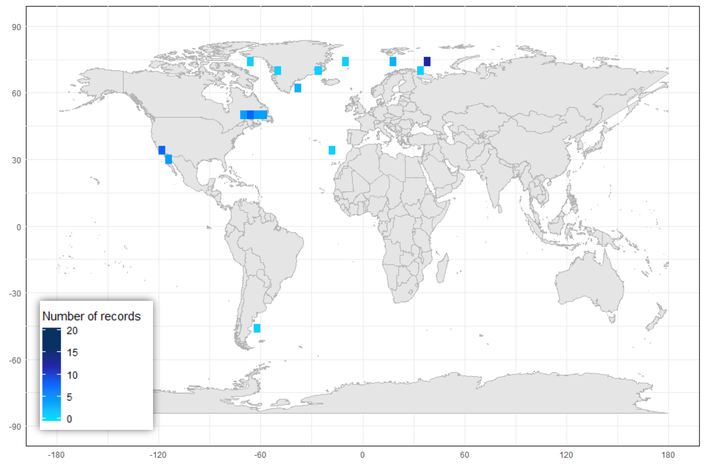
Additional Information

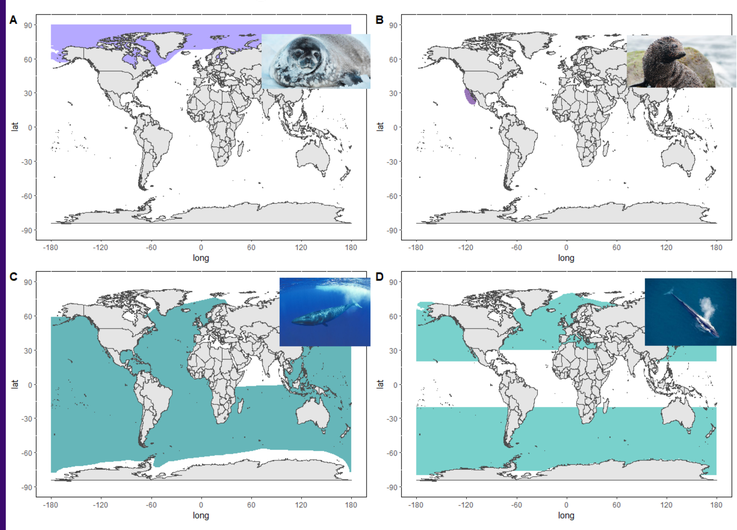
Species/Population	Location/Season	Diet species	Citation
Arctocephalus townsendi	Guadalupe island	*Scomber japonicus*	Gallo-Reynoso 1994
Arctocephalus townsendi	Summer diet	*Sebastes miniatus*	Pablo-Rodriguez 2009
Arctocephalus townsendi	Farallon Island	*Citharichthys sordidus*	Hanni et al. 1997
Pusa hispida		*Boreogadus saida, Arctogadus glacialis, Sebastes mentella, Mallotus villosus, Oncorhynchus nerka*	Lowry et al. 1980, Holst et al. 2001, Labansen et al. 2007, Sipilä and Hyvärinen 1998, Agafonova et al. 2007
Balaenoptera borealis	Western N Pacific, Japan	*Scomber australasicus, Scomber japonicus, Scomber scombrus, Mallotus villosus*	Shuntov and Ivanov 2015, Watanabe et al. 2012
Balaenoptera physalus	Newfoundland	*Mallotus villosus*	Mitchell 1972

Diet species and references of endangered marine mammals.

Global anisakid records



Marine mammal ranges



Range maps of A) Ringed seal (*Pusa hispida*), B) Guadalupe fur seal (*Arctocephalus townsendi*), C) Sei whale (*Balaenoptera borealis*), and D) Fin whale (*Balaenoptera physalus*), from IUCN Red list database and ESA database.

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