Parasite Sharing in Marine and Terrestrial Mammals

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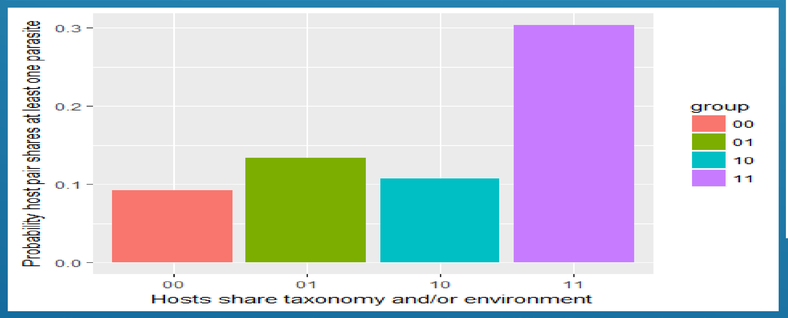
Introduction

Patterns in sharing of parasites among host species and groups of species areof general interest to understanding the ecology of multi-host parasites. We consider three primary mechanisms that lead to the sharing of parasites:common ancestry, ecological acquisition, and host shift. Relatively little is known about parasite sharing among marine mammals.

Methods

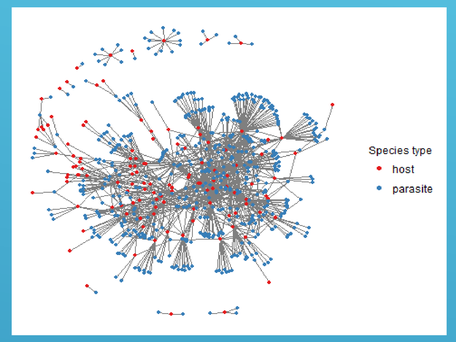
A literature review was performed to identify records of host-parasite associations among marine mammals. All recorded associations were compiled into a database, which was then appended to data from the Global Mammal Parasites Database (GMPD), and a life cycle database for parasitic acanthocephalans, cestodes, and nematodes. The combined data were then subsetted to contain records for species found in either marine or terrestrial environments, respectively. To assess hostpermissivity (propensity to be infected by multiple species) and parasite generalism (propensity to infect multiple species), an adjacency matrix was constructed so that margin sums quantified permissivity and generalism, respectively. To determine if parasite sharing depends more on habitat or taxonomy of the hosts, host pairs sharing at least one parasite were given binary scores reflecting if they shared environment and/or taxonomy. Logistic regression was then performed to assess statistical significance. To determine whether parasites that infect both environments are drawn disproportionately from one or more taxonomic groups, a contingency table was constructed with categories of (1) does/does not infect host of both environments and (2) parasite taxonomic group and analyzed using Fisher's exact test.

Is parasite sharing greater when hosts are grouped by taxonomy (cetacean/ungulate or carnivore) or habitat (marine vs terrestrial)?



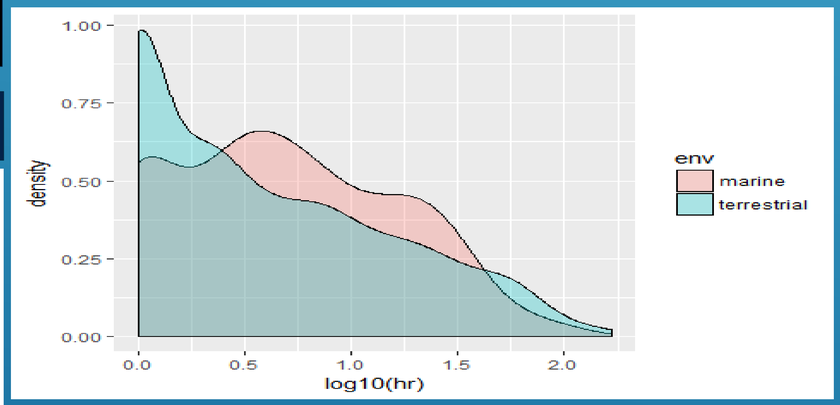
'00' represents host pairs that share neither taxonomy or environment. '01' signifies host pairs that only share environment, similarly '10' for host pairs that share only taxonomy. Lastly '11' signifies host pairs that share both taxonomy and environment.

Is parasite generalism greater in marine environments or terrestrial environments?



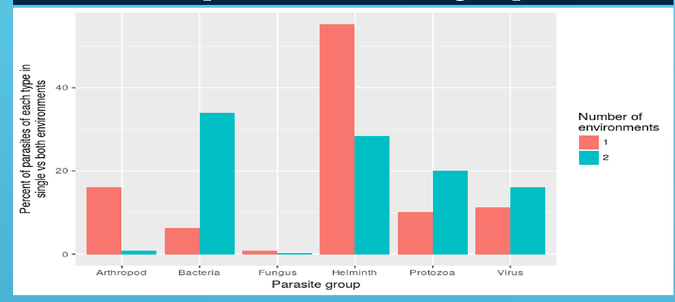
This network displays known associations between mammal host and parasite species in marine environments. The repeating fan motif captures the common trend of permissive hosts and specialist parasites.

This network represents known associations between mammal hosts and parasite species in terrestrial environments. In general, parasites appear to be more generalist in the marine environment



The graph above compares the host richness of parasites of marine and terrestrial hosts, showing that terrestrial parasites tend to exhibit intermediate generalism, whereas the marine parasites are frequently specialist (low host richness), with a few parasites exhibiting extreme generalism, but relatively few exhibiting intermediate generalism.

Are parasites that infect hosts of both environments drawn disproportionately from some parasite taxonomic groups?



Parasites infecting mammals of both marine and terrestrial environments are disproportionately drawn from the microparasite groups (bacteria, viruses, protozoa) Helminths species are more commonly found in a single environment, and arthropods infecting hosts in both environments are very rare.

Conclusion

This study showed that parasite sharing occurs frequently in both marine and terrestrial mammals. Based on environment, terrestrial mammals have a higher host richness and parasite richness. The host richness distribution of terrestrial parasites tends to be concentrated at intermediate levels, whereas marine typically exhibit either low host richness. Further, there are both significantly more host species infected in the terrestrial environment than in the marine, and more parasites species per host in a terrestrial environment than in the marine environment. The probability of parasite sharing is greater when the two host species are relatively closely related and share the same environment, but, when this is not the case, parasite sharing is greater when the hosts occur the same environment, rather than share taxonomic status. Logistic regression showed that both taxonomy and habitat are significant predictors of parasite sharing. Fisher's Exact Test ($p=0.0005$) showed that there are significant differences among parasite taxonomic groups with respect to occurrence in both vs. a single environment.

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