THE GLOBAL MAMMAL PARASITE DATABASE: AN ONLINE RESOURCE FOR SCIENTISTS AND THE PUBLIC

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Abstract

Parasites constitute a major portion of the Earth's biodiversity. Knowledge of human pathogens is relatively well advanced, but comprehensive data on infectious diseases from wildlife are needed. Because of their close relationships to humans and domesticated animals, wild mammals have been well studied for parasites and infectious diseases. The Global Mammal Parasite Database (GMPD) is a collection of over 19,000 records from published sources that report information on host-parasite associations from wild mammal populations. The database covers ungulates, carnivores and primates and all major groups of parasites. Starting in 2006, my contribution involved standardizing different sources of data into a unified format on a public database server. I created webpages that serve the database on the GMPD website so that the information is freely available and searches can be performed based on host, parasite, and location. I also add new layers of data, including host threat status and biomes of locations. I assisted in assembling data for several papers that used the databases to investigate questions related to parasite biodiversity, mammalian extinction risk, and host-sharing among parasite species. In the future I will present my own research regarding patterns of parasite diversity and transmission in different biomes.

About the Database

The Global Mammal Parasite Database contains information on all major parasite types (virus, bacteria, fungi, protozoa, helminths and arthropods) from wild populations of primates, carnivores and ungulates. Each record refers to a journal article or other published reference and contains information regarding the host and parasite species, the location of the study, the type of sampling and prevalence data. The main data table on host-parasite records can be joined to other tables containing information on host and parasite phylogeny, host species traits (such as IUCN threat status) and parasite species traits (such as host specificity and transmission modes).

Data are available for over 119 primate species, 153 carnivore species and 103 ungulate species, representing approximately half of all species in these groups. Across mammal species, helminths are the most commonly reported parasite type, followed by viruses, with other groups varying according to host taxonomic orders (Figure 1).

Figure 1: The Taxonomic Distribution of Parasites Reported from Each Host Group
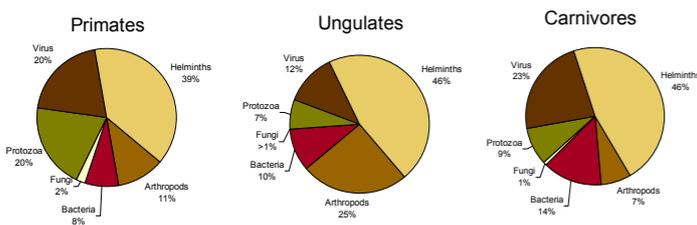
Sampling Effort in Wild Mammals

Analysis of the database has shown that parasite species richness is directly correlated with sampling effort, such that host species that are better studied tend to have more parasites species reported from them. Two measures of sampling effort commonly used are the total number of host individuals summed across all studies recorded in the database, and citation indices obtained by searching for Latin names of each host species on bibliographic databases. This pattern indicates that most host species have not been well studied for parasites and that many more host-parasite combinations (and indeed, parasite species) remain to be discovered (Figure 2).
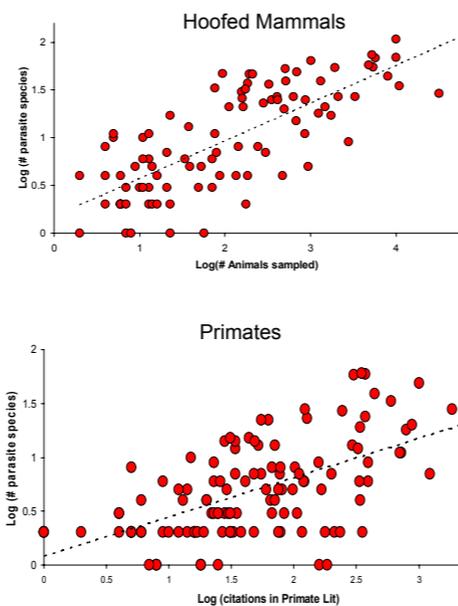

Figure 2: Parasite species richness (log transformed) in relation to host sampling effort for hoofed mammals and primates. Sampling effort was calculated as the sum of the number of animals sampled across all studies (hoofed mammals) or based on citation counts in the *PrimateLit* database. Each point represents a single host species. Reproduced from: Altizer, S. and Pedersen, A. B. 2007 Host-pathogen evolution, biodiversity, and disease risk for natural populations. In: Carroll, S. and Fox, C. *Conservation Biology: Evolution in Action* (in press)

This is further supported by a geographical gap analysis of primate distributions, showing areas for which parasite data is proportionally less represented. Specifically, some geographic areas are poorly sampled for parasites relative to the number of primate species with overlapping ranges, especially in East Asia, Southeast Asia and the Amazon (Figure 3). Gap analyses such as these can point to areas for future field studies of primate diseases.
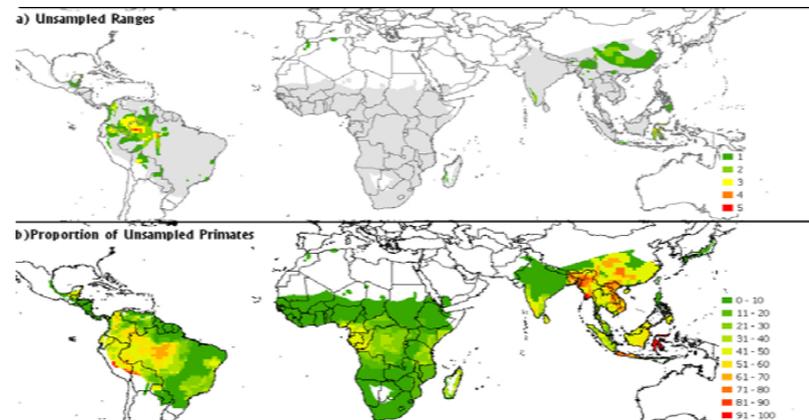

Figure 3: Regions where primates are poorly sampled for parasites. A) Areas where primates have never been sampled within their geographic range. B) Proportion of unsampled primate species within each one degree squared cell. Reproduced from Hopkins, M. E., and Nunn, C. L. 2007 A Global Gap Analysis of Infectious Agents in Wild Primates, *Diversity and Distribution* (in review)

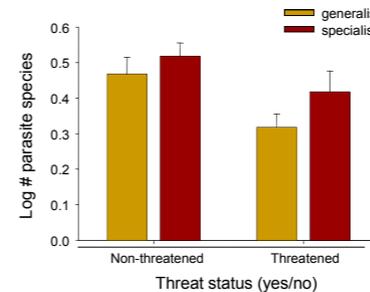## Insights for Conservation and Public Health

Figure 4. Parasite diversity in non-threatened and threatened primates. Researchers examined parasite species richness in threatened versus nonthreatened primate species (based on IUCN Red List data). Results showed threatened taxa have fewer generalist and specialist parasites than nonthreatened taxa. This could be because threatened species have smaller population sizes and narrower geographic ranges. Reproduced from Altizer, S., Nunn, C. and Lindenfors, P. 2007 Do threatened hosts have fewer parasites? A comparative study in primates. Journal of Animal Ecology (in press)
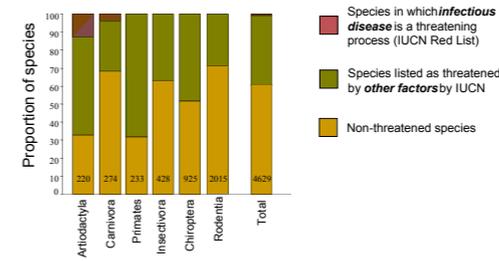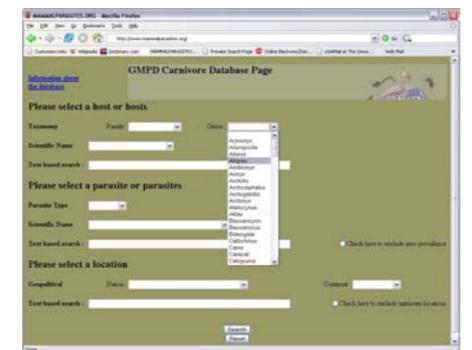

Figure 5. Threat Due to Disease in IUCN Red List. Mammals threatened due to infectious diseases are concentrated in artiodactyls (even-toed ungulates) and carnivores, reflecting cases of spillover from domesticated species. Proportions are relative to total number of species in each mammalian order. Reproduced from Pedersen, A., Jones, K., Nunn, C., and Altizer, S. 2007 Infectious diseases and extinction risks in wild mammals. Conservation Biology (in review)

Figure 6: Localized Risk of Emerging Zoonotic Diseases from Nonhuman Primates to Humans. Colors show areas of high geographic overlap of primate species that are closely related to humans, and hence more likely to transfer infectious disease into human populations. Reproduced from Davies, J. and Pedersen, A. 2007 Predicting infectious disease in primates and emergence in humans (in review)
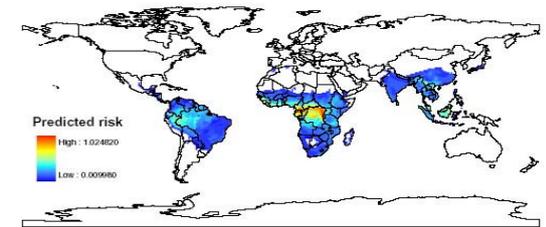
Public Access on the WWW

The Database can be accessed via the Web (www.mammalparasites.org) which allows for searches based on host phylogeny, parasite type and location. These data are intended to serve scientists, students, veterinary and wildlife field workers and other interested members of the public. Data on primates have been available since 2004; we recently uploaded carnivore and ungulate data in Fall 2006. Other taxa are scheduled to come online in the future.

Acknowledgements