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Trophically Transmitted Parasites as Wetland Assessors

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Trophically Transmitted Parasites as Wetland Assessors
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OVERVIEW

We assessed the use of larval trematode communities in California horn snails (*Cerithidea californica*) as bioindicators of the surrounding free-living community abundance and diversity. We hypothesized that trematode communities reflect the ecological richness and trophic structure of local free-living communities. Specifically, since birds are the sources of trematode stages that infect snails, we predicted that sites with greater bird abundance will have a greater abundance of trematodes in snails. Also, since different bird species harbor different trematode communities in their intestines, we predicted that sites that used by more species of birds will have more species of trematodes in snails. We tested these predictions by assessing bird communities (using time-lapse videography) and trematode communities in snail populations at several sites in Carpinteria Salt Marsh. We found positive correlations between bird abundance and trematode abundance and between bird species richness and trematode species richness in snails.

SUMMARY/ACOMPLISHMENTS

We hypothesize that the communities of trematode flatworm parasites in wetland snails can serve as good bioindicators of the ecological richness and trophic structure of surrounding fish, benthic, and bird communities. This is because trematodes have complex life cycles and sequentially rely upon several types of host. They are also dependent on predator-prey interactions because they are trophically transmitted to their final hosts. Since birds are the sources of trematode stages that infect snails, trematode communities in snails should directly reflect bird communities. The purpose of this project was to test the hypotheses that greater bird abundance should result in greater trematode parasite abundance, and that greater bird species richness should result in greater trematode species richness in snails.

Bird communities are extremely difficult to accurately assess using normal survey techniques, since birds move around so much in space and time. We therefore proposed an observational study using time-lapse videography to sample bird communities at

multiple wetland sites. We also proposed to implement a field manipulation of bird abundance, using motion-detecting bird repellents.

At each of the sites where we measured the bird community, we also measured the abundance and species richness of trematode parasites in the snail (*Cerithidea californica*) population. More than 18 species of trematodes use this snail species as their 1st intermediate host. The trematodes asexually produce swimming stages that leave the snails and infect various types of 2nd intermediate hosts (e.g., fishes, crabs, polychaetes) depending on the trematode species. The trematodes infect their final host birds, when the birds prey upon infected 2nd intermediate hosts. We collected 100 snails from each site and dissected them in the laboratory to determine abundance (number of infections/host) and species richness of the parasite community. We controlled for snail age (since older snails are more prone to be infected) within each habitat type by sampling the most common and available snail size-class for each habitat type: 20-25mm snails for channels and 25-30mm snails for pans.

As proposed, we were able to use camouflaged video cameras in the field to assess bird abundance and species richness at several wetland sites. We found that bird abundance was positively correlated with the abundance trematode parasites in snail populations at these sites (Fig. 1). We interpret this to mean that as more birds use a site, more trematode stages infectious to snails are deposited at that site. Then, more trematodes successfully infect snails at such sites, resulting in greater levels of parasite abundance. We also found positive correlations between bird species richness and trematode species richness in snail populations across sites (Fig. 2). We interpret this as meaning that different bird species harbor different adult trematode communities, and as more species of birds use a site, more species of trematodes successfully infect snails at those sites.

We originally planned on doing the work at both Carpinteria Salt Marsh UC Nature Reserve and Mugu Lagoon Naval Air Base. Due to tightened security following "9/11", we were unable to conduct our research at Mugu. We therefore decided to expand our research at Carpinteria by sampling in two different types of wetland habitat: channel sites in 2001-2002 and pan sites in 2003. Hence, we were able to show that the positive correlations we found between bird abundance/richness and trematode abundance/richness are of a more general nature, and not restricted to one habitat type.

We acquired and ran motion-detecting bird repellents at four sites throughout one year. The repellents did not experimentally decrease the abundance of parasites in snails (one site experienced a greater drop than any of the controls). We feel that such an experiment may work, but we must manipulate bird abundances more efficiently.

Two different work study undergraduate students were employed to assist with the project.

Our findings have been presented at eight professional meetings (Appendix 1). Also, we have submitted two manuscripts for peer-reviewed publication (Appendix 1).

Thus, our findings have partially filled one of the gaps in our knowledge regarding how trematode community structure in snails reflects the rest of the wetland community. Our findings suggest that trematode communities in snails can be used to assess the abundance and species richness of free-living communities in coastal wetlands.

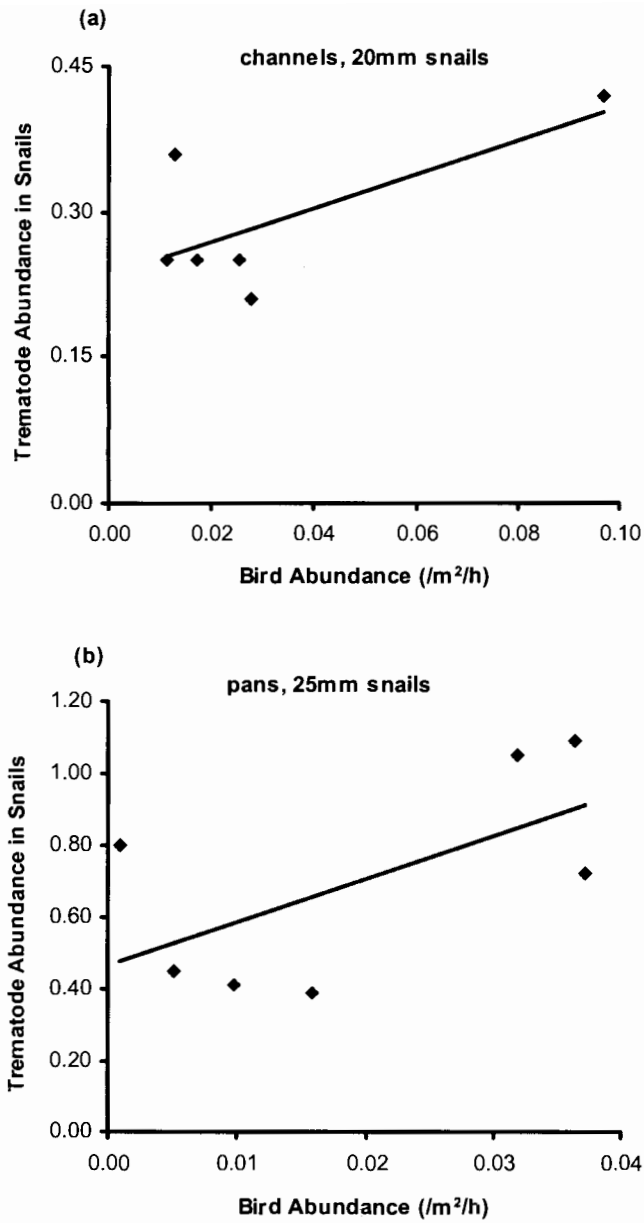


Figure 1 Positive correlations between trematode abundance (the number of individual infections per snail) in snail populations and bird abundance across sites in (a) channels, with 20-25mm snails and (b) pans, with 25-30mm snails (respectively, $R = .69$ and $R = .62$; combined $P = .038$).

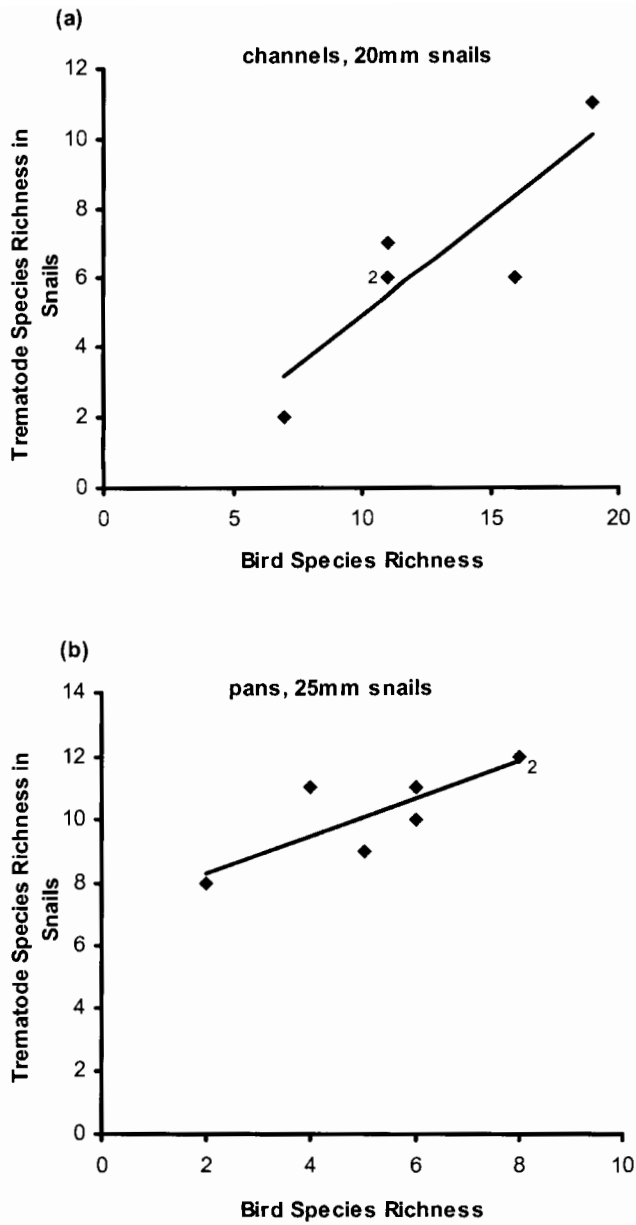


Figure 2 Positive correlations between trematode species richness in snail populations and bird species richness across sites in (a) channels, with 20-25mm snails, and (b) pans, with 25-30mm snails (respectively, $R = .86$ and $R = .84$; combined $P = .0019$).

Appendix Presentations and publications.

Hechinger, R.F. and K. D. Lafferty. 2002. Birds as determinants of parasite community structure. Presented Talk. International Congress of Parasitology, Vancouver, British Columbia.

Hechinger, R.F., T.C. Huspeni, and K.D. Lafferty. 2003. What can snail parasites tell us about wetland biocomplexity? Presented Poster. UC Toxics meeting, Oakland, CA.

Hechinger, R.F., T.C. Huspeni, and K.D. Lafferty. 2003. Larval trematode infections in snails in relation to the distribution and abundance of food sources for final host birds. Presented Talk. American Society of Parasitologists, Halifax, Nova Scotia, Canada.

Lafferty, K.D. and R.F. Hechinger. 2003. Parasites of snails as indicators of estuarine bird communities. Presented Talk. Natural Areas Conference, Madison, WI.

Kuris, AM and KD Lafferty. 2003. The role of parasites in salt-marsh ecosystems. Presented poster. NIH-NSF Ecology of Infectious Diseases annual meeting, Washington, D.C.

Huspeni, T.C., R.F. Hechinger, and KD Lafferty. 2003. Trematode parasites as estuarine indicators: Opportunities and applications. Presented talk. Estuarine Indicators Conference, Sanibel, FL

Hechinger, R.F., T.C. Huspeni, and K.D. Lafferty. 2003. What can snail parasites tell us about wetland biocomplexity? Presented Poster. All-PEEIR (Pacific Estuarine Ecosystem Indicator Research Consortium) meeting, Bolinas, CA

T.C. Huspeni, Hechinger, R.F., and K.D. Lafferty. 2003. What can snail parasites tell us about wetland communities? Presented Poster. Presented Poster. EPA EaGle meeting, Bolinas, CA

Hechinger, R.F. and K.D. Lafferty. Submitted manuscript. Direct positive links between bird communities and parasite communities in snails. *Ecology Letters*.

Huspeni, T.C., R.F. Hechinger, and K.D. Lafferty. Submitted manuscript. Trematode parasites as estuarine indicators: Opportunities, applications, and comparisons with conventional community approaches. *In* Estuarine Indicators (S.Bartone, ed.). CRC Press, Boca Raton, Fl.