Volume 10, Issue 4

TWS WILDLIFE DISEASES WORKING GROUP

Winter 2016

The Vector

The Newsletter of The Wildlife Society Wildlife Diseases Working Group

Special points of interest:

- **WDWG Review of One Health Symposium**
- **Workshop Proposals**

The Vector Timeline

Spring (Vol. 11, Iss. 1)	Summer (Vol. 11, Iss. 2)
Submissions Due 17-Mar-17	Submissions Due 16-Jun-17
Publication Date 31-Mar-17	Publication Date 30-Jun-17

The editors of The Vector welcome your contributions. If you wish to submit an article, but suspect you will not quite make the deadline, please contact Samuel M. Goldstein.

Inside this issue:

Your membership in the WDWG can only be obtained by joining and renewing your annual TWS Membership each year. At the time that you join simply indicate that you want to be a member of this working group on the TWS application. Membership dues are $5.

With your membership you will receive our quarterly newsletter to keep up-to-date with our group business and the most current disease issues. Your membership also provides an opportunity to work closely with other wildlife disease professionals.

From the Chair:

It was wonderful seeing so many of you at the annual conference of The Wildlife Society in Raleigh. Professional society meetings are such a great way to reinvigorate our work, networks of colleagues, and our outlook on professional life in general. The annual Wildlife Diseases Working Group meeting and our sponsored symposium were well attended. If you weren't able to attend, no worries, just read on in *The Vector* to learn more about the highlights! Another big thanks to Kezia Manlove, Alan Franklin, and Rich Chipman for organizing the symposium on *Big Science & Wildlife Diseases: Applying One Health Approaches in the Real World*. It was a great session and fun to see one of the presentations highlighted in the December 2016 Wildlifer. Sponsoring workshops and symposia are an excellent way to share ideas and knowledge, and raise awareness of the working group. And while we just wrapped up the 2016 conference, it's already time for planning for the 2017 conference to be held in Albuquerque. If you have ideas and would like to request the Wildlife Diseases Working Group's support for your workshop, symposium, or panel discussion, please submit your proposal to Julie Blanchong (julieb@iastate.edu) by February 20th. Winter can be a busy capture and disease outbreak season, but hopefully you can take some time to prepare for September's conference. And of course, don't miss out enjoying the beauty of the season. All the best in 2017.

Current Research in Wildlife Disease

Pepin, K.M., S.L. Kay, B.D. Golas, S.S. Shriner, A.T. Gilbert, R.S. Miller, A.L. Graham, S. Riley, P.C. Cross, M.D. Samuel, M.B. Hooten, J.A. Hoeting, J.O. Lloyd-Smith, C.T. Webb, and M.G. Buhnerkempe. 2017. INFERRING INFECTION HAZARD IN WILDLIFE POPULATIONS BY LINKING DATA ACROSS INDIVIDUAL AND POPULATION SCALES. Ecology Letters. doi: 10.1111/ele.12732. Our ability to infer unobservable disease-dynamic processes such as force of infection (infection hazard for susceptible hosts) has transformed our understanding of disease transmission mechanisms and capacity to predict disease dynamics. Conventional methods for inferring FOI estimate a time-averaged value and are based on population-level processes. Because many pathogens exhibit epidemic cycling and FOI is the result of processes acting across the scales of individuals and populations, a flexible framework that extends to epidemic dynamics and links within-host processes to FOI is needed. Specifically, within-host antibody kinetics in wildlife hosts can be short-lived and produce patterns that are repeatable across individuals, suggesting individual-level antibody concentrations could be used to infer time since infection and hence FOI. Using simulations and case studies (influenza A in lesser snow geese and *Yersinia pestis* in coyotes), we argue that with careful experimental and surveillance design, the population-level FOI signal can be recovered from individual-level antibody kinetics, despite substantial individual-level variation. In addition to improving inference, the cross-scale quantitative antibody approach we describe can reveal insights into drivers of individual-based variation in disease response, and the role of poorly understood processes such as secondary infections, in population-level dynamics of disease.

Lavelle, M.J., S.L. Kay, K.M. Pepin, D.A. Grear, H. Campa III, and K.C. VerCauteren. 2016. EVALUATING WILDLIFE-CATTLE CONTACT RATES TO IMPROVE THE UNDERSTANDING OF DYNAMICS OF BOVINE TUBERCULOSIS TRANSMISSION IN MICHIGAN, USA. Preventive Veterinary Medicine 135:28-36. doi: 10.1016/j.prevetmed.2016.10.009. Direct and indirect contacts among individuals drive transmission of infectious disease. When multiple interacting species are susceptible to the same pathogen, risk assessment must include all potential host species. Bovine tuberculosis (bTB) is an example of

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Student Paper:

It Takes Guts: Examining Disease Risk and Coinfection Using Hunter Harvested Deer

by J. Trevor Vannatta

Articles are in-progress reports by students & young professionals. If you wish to cite this information, please contact the author directly for a personal communication or formal citation.

Hidden within layers of flesh and organs, parasites inhabit an often unseen and mysterious host ecosystem. Within a host, multiple parasite species must find and exploit a unique niche. This creates complex interactions among numerous parasites within a host. Partly due to the difficulties of observing these within-host parasite communities, we often approach disease research from a single-host, single-parasite perspective. For complex life cycle parasites, we encounter the additional complexity of how various hosts interact across landscapes and with the landscape itself.

Studying host-parasite interactions across landscapes often requires killing the host to collect samples, sampling a wide area, long hours in the field, and cutting through administrative red tape. So, if we want to study disease on a large scale using species of management interest, how do we proceed?

One potential solution to this problem is collecting data from hunter- or trapper-harvested animals. This allows us to: 1) collect data without harvesting animals exclusively for research, 2) sample a large area, 3) 'employ' a large number of people without depleting research funding, and 4) avoid some hurdles associated with studying vertebrate taxa. In other words, hunters and trappers can be a great source of study material and a disease ecologist's best friend. We used this approach to observe coinfection and landscape patterns of disease in a suburban white-tailed deer population in Duluth, Minnesota.

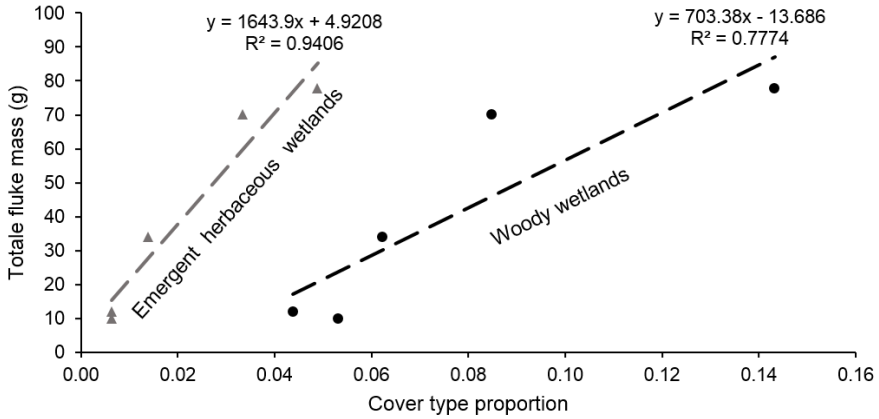
A giant liver fluke (~65 mm in length). (Photo: J. Trevor Vannatta)

The resurgence of white-tailed deer across North America and their often high abundances in suburban landscapes have led many cities to institute citywide deer hunts. These hunts are thought to curb disease outbreaks, such as Lyme disease, and can help limit traffic accidents, overbrowsing, and other wildlife conflicts. In the city of Duluth, there is a particularly robust white-tailed deer population from which > 400 deer are harvested annually.

Piggy backing on the hunts success, we requested that hunters collect deer livers and record which Deer Hunting Area (DHA) that deer was harvested from. We were most interested in livers because a trematode parasite, called the giant liver fluke (GLF; *Fascioloides magna*), is found within deer livers. GLF has been the focus of debate in Minnesota in recent years because of the damage it can cause in moose. Moose populations have declined by more than 50% since 2006 in northeastern Minnesota due to a combination of factors, including diseases and parasites. As we began processing deer livers, we also found a cestode parasite, called the thin-necked bladderworm (*Taenia hydatigena*). Although bladderworm rarely impacts the host's health, we noticed that GLF and bladderworm often occurred together within deer livers and began documenting their co-occurrence.

Our goal was to use the highly variable landscapes found among DHAs and analyze which habitats were correlated with infection. Using the National Land Cover Dataset, we found that increasing proportions of emergent herbaceous wetland and woody wetland were correlated with adult fluke biomass within DHAs (see figure on left).

However, neither bladderworm infection nor rates of coinfection with GLF and bladderworm were correlated with the various habitat types. The lack of correlations between coinfection and habitat types was surprising since GLF and bladderworm coinfection occurred more often than would be expected by chance alone:



Correlation between proportions of woody wetlands (circles; p = 0.048) and emergent herbaceous wetlands (triangles; p = 0.006) against total adult fluke biomass.

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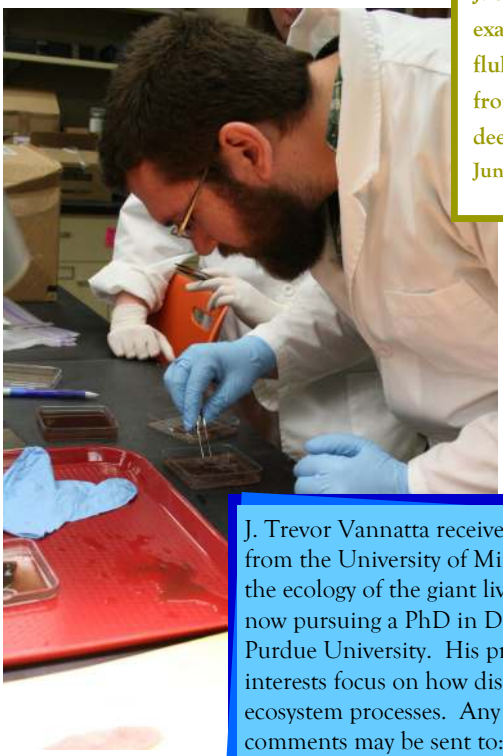
Fisher's P < 0.001	GLF (+)	GLF (-)
Bladderworms (+)	17	6
Bladderworms (-)	35	67

To understand the relationships between infections and the landscape, we must consider the life cycles of the two parasites. GLF has a complex life cycle in which parasite eggs are released in feces which hatch and infect an aquatic snail. The parasite then leaves the snail and encysts on a plant where it is eaten by a deer host. This life cycle couples infection risk to aquatic environments, like emergent herbaceous wetlands and woody wetlands, which contain both snails and palatable aquatic plants. In contrast, the bladderworm life cycle is completed when deer ingest bladderworm eggs while foraging near canid scat, and that deer is later consumed by a canid. This life cycle is not coupled to any particular habitat type and both hosts are highly mobile, thus explaining a lack of correlation between bladderworm infection and any habitat type.

But what about coinfections? If the two infections are associated, why would they not share a common spatial metric? Although infection status was correlated, the intensity of infections were not. This leads to three primary possibilities for explaining coinfections. Either 1) Individual deer have behaviors which determine exposure to these parasites, 2) individual deer may be immunologically more prone or resistant to infections, or 3) once one parasite establishes, it weakens the host's immune response allowing the other parasite to take hold.

More work is needed to tease apart these three competing explanations. Coupling GPS collar deployments with continued deer harvests and genetic analyses of hosts and parasites could give us a better understanding of the complex mechanisms at play in this system. Until then, the ecosystem hidden within a deer's liver will remain a mystery.

We would like to acknowledge The University of Minnesota – Duluth, Natural Resources Research Institute, The Environmental and Natural Resources Trust Fund, The Clean Water, Land, and Legacy Amendment, and Minnesota Zoo for financial support. The presentation of this work was also facilitated by an *Alces* Newcomer's travel award. We are also indebted to Brian Borkholder, the Duluth city bowhunters, and the Arrowhead Bowhunters' Alliance for providing deer livers for this study.



J. Trevor Vannatta examining liver flukes removed from a white-tailed deer's liver. (Photo: June Breneman)

J. Trevor Vannatta received his Master's from the University of Minnesota studying the ecology of the giant liver fluke and is now pursuing a PhD in Disease Ecology at Purdue University. His primary research interests focus on how diseases impact ecosystem processes. Any questions or comments may be sent to: jvannat@purdue.edu

Current Research in Wildlife Disease

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a disease that can be transmitted among several wildlife species and to cattle, although the potential role of several wildlife species in spill back to cattle remains unclear. To better understand the complex network of contacts and factors driving disease trans-mission, we fitted proximity logger collars to beef and dairy cattle (n=37), white-tailed deer (*Odocoileus virginianus*; n=29), raccoon (*Procyon lotor* n=53), and Virginia opossum (*Didelphis virginiana*; n=79) for 16 months in Michigan's Lower Peninsula, USA. We determined inter-and intra-species direct and indirect contact rates. Data on indirect contact was calculated when collared animals visited stationary proximity loggers placed at cattle feed and water resources. Most contact between wildlife species and cattle was indirect, with the highest contact rates occurring between raccoons and cattle during summer and fall. Nearly all visits (>99%) to cattle feed and water sources were by cattle, whereas visitation to stored cattle feed was dominated by deer and raccoon (46% and 38%, respectively). Our results suggest that indirect contact resulting from wildlife species visiting cattle-related resources could pose a risk of disease transmission to cattle and deserves continued attention with active mitigation.

Upcoming Conferences

International Urban Wildlife Conference, San Diego, California, June 4-7, 2017

Wildlife Disease Association, San Cristobal de las Casas, Chiapas, Mexico, July 23-28, 2017

The Wildlife Society, Albuquerque, New Mexico, September 23-27, 2017

Symposium Review: Big Science and Wildlife Diseases: Applying One Health Approaches in the Real World

by Kezia Manlove

The Wildlife Disease Working Group organized and sponsored a symposium on "Big Data" and wildlife diseases at this year's annual TWS meeting in Raleigh, which also included a number of WDWG members as speakers. The symposium consisted of a mixture of talks, some delineating key aspects of cross-disciplinary collaboration in One Health, and others diving deep into key aspects of two different case-study systems: pneumonia in bighorn sheep, and white-nose syndrome in bats.

Kezia Manlove (Washington State University), Jonathan Sleeman (USGS National Wildlife Health Center), and Margaret Wild (National Park Service) provided framing talks that outlined the overarching drivers of wildlife disease, and demonstrated the key infrastructural and logistical challenges in wildlife disease management, and also pointed out the major threat that emerging pathogens pose for North American wildlife.

The two case-studies focused on different aspects – within-host processes, population-level processes, and management – of the focal systems, and emphasized how research on one scale can inform research and management on another. Speakers Emily Almberg (Montana Fish Wildlife and Parks) and Craig Willis (University of Winnipeg) showed how simulation studies in both systems provided insight into long-term dynamics and management. Frances Cassirer (Idaho Fish and Game) and Jeremy Coleman (US Fish and Wildlife Service) discussed management applications and team building at both local and continental scales, and made the salient point that often methods that are novel in one system have been well-developed in another.

On the in-host side, Tom Besser (Washington State University College of Veterinary Medicine) illustrated modern mechanisms to identify causal agents. Tina Chang (UC Santa Cruz) showed the key role that metabolics might play in protecting some bats from WNS. Both Besser and Chang tied their research to population-level processes, and spoke about how information in-host could alter expectations at the population scale (in the case of natural selection on body fat in WNS), but could also be informed by population-level observations (as has occurred through population-level observations of high prevalence of some agents, even in the absence of apparent disease in bighorn sheep pneumonia system).

The symposium was well-attended, with audience sizes exceeding 100 for several talks.

2017 TWS Conference: Submit Your Workshop Proposals

Proposals for Workshops and Symposia for the 2017 Wildlife Society Conference in Albuquerque from September 23-27 are due by March 10, 2017. If you are developing a proposal for a workshop or a symposium and you would like to request the Wildlife Diseases Working Group's support for your proposal, please submit your proposal to Julie Blanchong at julieb@iastate.edu by February 20, 2017.

The working group board will discuss your proposal and decide if its content is appropriate for working group support. Working group support comes primarily in the form of submission of a letter indicating our support to the conference organizers. Financial support from the working group will be considered under special circumstances. Please note that you are responsible for submitting your proposal for a workshop or symposium to the conference website.

Look for information on past workshops and symposia that the working group has supported, as well as examples of previously successful proposals on the Wildlife Diseases Working Group website (http://wildlife.org/wdwg/). Questions about developing or submitting proposals to the working group for support can be emailed to Julie Blanchong at julieb@iastate.edu.

Call for Written Contributions to The Vector

The Wildlife Diseases Working Group is just one of 27 working groups in TWS, but it has one of the largest memberships—close to 200!! You should be proud to be part of a group with such a dedicated group of researchers, biologists, managers, students, and others who have a commitment to furthering our mission. That being said, let's share our knowledge and passion with each other!

Each quarter, the WDWG distributes The Vector showcasing the wonderful work of our students, ongoing research, and current topics related to wildlife disease. We need your help!! With writings contributed from our large and diverse membership, we can supplement the content of The Vector and augment the number of informative articles disseminated through the newsletter. This is an opportunity for you to share information on a topic you find important and valuable to our members.

Please consider providing a short article about your profession or path to becoming a wildlife disease expert, major projects, research findings, or a hot topic in the wildlife disease field. Senior-level professionals may feel free to share lessons learned in their career to benefit students and early career professionals. Please encourage your students or technicians to do the same. Articles are not only a great way to share your current work, but they can also open doors for future collaboration. Articles need not be long or formal, and will go through an editing process by the editors and/or Student Affairs Committee upon submission. We encourage you to submit a few photos to accompany your writing.

Please jump at this opportunity to get involved, give back to your profession, share a little bit about what you do, and help shape your working group for the future. Inquiries and articles can be submitted at any time to Sam Goldstein (Samuel.M.Goldstein@aphis.usda.gov) or Brianna Williams (williamsbriannam@gmail.com).

International Urban Wildlife Conference: Call for Abstracts

San Diego State University • San Diego, California

June 4-7, 2017

The Urban Wildlife Working Group of The Wildlife Society and San Diego State University are hosting the next International Urban Wildlife Conference in San Diego, California, June 4-7, 2017, the fourth such meeting since 2009 (Amherst, MA in 2009; Austin, TX in 2011; Chicago, IL in 2015).

The program committee is soliciting abstracts for oral presentations and posters to be submitted by **February 17, 2017**.

We are also accepting proposals for organized **symposia**. Half-day symposia will consist of 10 talks, so proposals should include as many as 10 committed speakers. Shorter symposia of 5 talks (1/2 session) may also be proposed. Anyone interested in organizing a symposium should also contact the program committee chair, Bob McCleery, at ramccleery@ufl.edu.

Information on how to submit abstracts and symposia proposals will be available on the conference website: **www/urban-wildlife.org**

Potential topic areas for presentations or symposia may include:

Ecology of wildlife in urban areas.

- Taxonomically oriented sessions, e.g., ungulates, carnivores, small mammals, songbirds, raptors, waterfowl, reptiles, amphibians, invertebrates, fish
- Conceptually oriented sessions, e.g., roads and urban wildlife, disease and urban wildlife, predator-prey interactions in urban wildlife, etc.

Improved conservation of and coexistence with urban wildlife through urban planning, landscape architecture, and wildlife-friendly development

- Planning for wildlife in urban areas
- Wildlife-friendly landscape architecture
- Wildlife-friendly urban development
  - Creation and management of open space in urban areas
  - Connectivity for wildlife in urban areas

Management of human-urban wildlife conflicts.

- Unique methods/approaches to conflicts
- Population control for urban wildlife
- Hazing/aversive conditioning of urban wildlife
  - Individual species of particular interest or concern, e.g., white-tailed deer, Canada geese, beavers, coyotes, raccoons, crows, gray squirrels, bats, etc.

  Symposia on particular species could include both ecology and management.

Humans and Urban Wildlife

- Educating the public about urban wildlife
- Attitudes towards wildlife in urban areas
- (Social?) Value of wildlife for people in urban areas

International urban wildlife ecology and management

- We hope to have extensive participation from our colleagues studying urban wildlife in other parts of the world as well. This could involve specific sessions about work being done in other countries, international presentations throughout the sessions of the conference, or both.

Wildlife Diseases
The Wildlife Society
Working Group

Mission Statement

The mission of the Wildlife Diseases Working Group is to promote better scientific understanding of the causes and consequences of disease in ecosystems and wildlife populations; to apply the principles of wildlife science, ecology, and epidemiology to the prevention and management of diseases in wildlife; to foster education and transfer of information on diseases to wildlife management professionals and the public; and to apply this knowledge to enhance the health and conservation of wildlife populations and their interactions with humans and domestic animals.

Have you worked on a wildlife disease research project?
Have you engaged in a wildlife-related veterinary externship?

We want to hear about it!

Here is a short list of all the things we like to publish right here in The Vector:

- Abstracts or summaries and URL for recently published articles
- Summaries of ongoing research or management projects
- Field observations and photos with captions
- Press releases of scientific articles
- Meetings and conferences
- Lessons learned from your project or career

We accept topics from all-comers: students, technicians, biologists, managers, researchers, etc.

For student and postdoctoral authors whose article gets published in The Vector, the WDWG is happy to **sponsor a 1-year membership to <u>both</u> TWS and WDWG!

Interested in learning more?
Contact the WDWG Student Affairs Committee Chair:
Brianna Williams: williamsbriannam@gmail.com

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