PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
ANNUAL PROJECT REPORT

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TITLE: Wildlife Health Activities

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TITLE: Diagnostic Approaches for Identifying Mange in Pennsylvania Black Bears

PERIOD COVERED: 1 July 2014 to 30 June 2015

WORK LOCATION(S): Statewide but focused in the counties with high incidence of mange

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ABSTRACT Mange refers to a group of parasitic diseases of the skin in wild and domestic mammals caused by multiple species of mites. In black bears, mange has been reportedly associated with infection with *Demodex ursus*, *Ursicoptes americanus*, and *Sarcoptes scabeii*. All 3 of these have been identified in Pennsylvania; however, the relative prevalence of these mites in bears with and without gross evidence of disease is poorly understood. Mange in free-ranging black bears is generally a sporadic problem involving individuals or low numbers of bears. In Pennsylvania, however, mange in bears began occurring more regularly beginning in the early 1990s, and has subsequently become a significant source of morbidity and mortality in parts of the Northcentral, Southwest, and Southcentral regions. The number of black bears with clinical signs of mange appears to be increasing in Pennsylvania, both in frequency and locations of reports. It still remains unknown whether this apparent increase in disease reflects an expanding bear population, change in disease frequency, or both. Currently, detection of mange in bears relies on syndromic surveillance, in which infection is identified by grossly visible lesions in the skin. Previous attempts to utilize more sensitive surveillance approaches, focused on the detection of mite infection or host antibody response, have been hindered by a lack of validated diagnostic assays and a poor understanding of the disease syndrome. To address these gaps, we developed a pilot diagnostic protocol for bears with severe mange and distributed sampling packets to select Wildlife Conservation Officers in the Northcentral, Southcentral, and Southwest regions that have historically had a high incidence of mange. Samples will be evaluated to determine the tissue type and corresponding diagnostic test best suited for a population-scale surveillance program of mange in black bears. To date, samples have been collected from 58 black bears with severe mange. Samples were processed and temporarily stored at the Animal Diagnostic Laboratory until they were delivered to the Southeastern Cooperative Wildlife Disease Study for laboratory analysis.

OBJECTIVES

1. To determine the type of sample and method of preservation best suited for a population-scale surveillance program of mange in Pennsylvania black bears.

2. To characterize the species of mites infecting Pennsylvania black bears, both genetically and morphologically.

3. To compare the performance of different diagnostic approaches for detecting mite infections of varying severity.

4. To determine if other causes of skin disease that appear grossly similar to mange occur in Pennsylvania black bears, for which additional research may be required.

METHODS

During 2014, a pilot diagnostic protocol was developed and sampling packets were distributed to select Wildlife Conservation Officers (WCOs) in the Northcentral and Southwest regions that have historically had a high incidence of mange in black bears. This protocol was developed to evaluate a variety of sample types, sample preservation methods, and diagnostic tests available for identifying mite infections in severe cases of mange (Table 1). In order to address the 4 objectives listed above, the following samples were collected from bears that were euthanized due to severe mange as per Standard Operating Procedure 40.11 1) blood for serum antibody detection; 2) skin scrapes for cytologic examination; 3) skin samples for histopathologic examination; 4) skin samples for polymerase chain reaction (PCR) testing; 5) a hole punch skin sample from the ear for PCR testing, and 6) feces for PCR testing. Routine data was also collected on each bear sampled as well as information on the anatomic distribution of grossly apparent skin disease. All samples were stored at 4° C and delivered to the wildlife veterinarian or bear biologist within 24 hours. Once processed, serum and feces were stored at -80° C and samples in alcohol or formalin were stored at room temperature. Serologic testing, histopathologic and cytologic examinations, and PCR testing was conducted at the Southeastern Cooperative Wildlife Disease Study (SCWDS).

RESULTS

To date diagnostic samples have been collected from 58 Pennsylvania black bears with severe mange. When possible, all samples listed in Table 1 were collected from each bear; however, in some cases either the sample was not present (i.e. feces) or a prolonged post-mortem interval precluded collection (i.e. blood). Samples have been submitted to SCWDS for laboratory analysis and results are pending.

Based on the initial year of sampling, the ear punch was determined to not be a useful sample, both due to the difficulty in collection as well as the observation that the ear was one of the last parts of the body affected by mange. Based on these results, collection of the ear punch was discontinued. Starting in 2015, in addition to the Northcentral and Southwest regions, sampling packets were also distributed to select WCOs in the Southcentral Region with historically high prevalence of mange.

Extramural funding to support this research was applied for and received from the National Center for Veterinary Parasitology. An article that summarizes the known epidemiology and ecology of Mange in Pennsylvania Black Bears was published in the Newsletter of the International Association for Bear Research and Management (refer to LITERATURE CITED section). An oral presentation on the preliminary results of this research was given by a SCWDS collaborator at the Annual Meeting of the Southern Society of Parasitologists.

RECOMMENDATIONS

1. In order to genetically characterize the causative mite(s) of mange in Pennsylvania black bears, additional mange samples will be collected from 1) black bears in surrounding states, and 2) canids (coyote and red fox) in Pennsylvania.

2. Once a sensitive diagnostic approach or approaches are identified and validated, an active surveillance program should be developed to determine the relative prevalence of mite infection in Pennsylvania black bears without gross evidence of mange from throughout the state. Comparing distribution of causative mite infection vs. overt disease will address a simple question of whether the spatial patterns of mange in Pennsylvania are reflective of the mite distribution or additional risk factors associated with the development of clinical disease (i.e. genetics, immunity, co-infections, etc.).

3. If warranted, explore potential risk factors that could account for any regional differences in disease.

LITERATURE CITED

Peltier, S. K., J. D. Brown, M. Yabsley, and M. Ternent. 2015. Understanding the ecology and epidemiology of mange in Pennsylvania black bears. Newsletter of the International Association for Bear Research and Management. Spring:36-37.

Table 1. Matrix of sample types, preservation methods, and diagnostic tests being explored in a pilot study of mange infection in Pennsylvania black bears.

Sample Type	Collection Method	Sample Preservation	Diagnostic Test
Blood	Venipuncture	Refrigerate and centrifuge within 24 hrs Serum frozen at -80° C	Serum antibody detection to measure prior exposure to mite(s)
	Collected from body cavity to simulate bears examined at check stations	Refrigerate and centrifuge within 24 hrs Serum frozen at -80° C	Serum antibody detection to measure prior exposure to mite(s)
Skin	Epidermis/dermis scraping	70% isopropyl alcohol	Cytologic examination to identify mites based on morphology
	Full-transect sample	10% neutral buffered formalin	Histopathologic examination to characterize skin disease
	Full-transect sample	70% isopropyl alcohol	PCR (polymerase chain reaction) testing to identify mites molecularly
	Hole punch from ear to simulate ear-tagging of live bears	70% isopropyl alcohol	PCR testing to identify mites molecularly
Fresh feces	Collected from rectum of bear or inside trap	Frozen at -80° C	Cytologic examination to identify mites based on morphology
	Collected from rectum of bear or inside trap	Frozen at -80° C	PCR testing to identify mites molecularly