

**Alaska Department of Fish and Game
Wildlife Restoration Grant**

Grant Number: W-33 **Segment Number:** 12
Project Number: 18.74
Project Title: Wildlife Health and Disease Surveillance in Alaska
Project Duration: July 1, 2013 – June 30, 2014
Report Due Date: September 1, 2014

Partner:

PRINCIPAL INVESTIGATOR: Kimberlee Beckmen

COOPERATORS: US Department of Agriculture/APHIS, Alaska Department of Environmental Conservation.

WORK LOCATION: Alaska, Statewide

I. PROGRESS ON PROJECT OBJECTIVES DURING LAST SEGMENT

OBJECTIVE: Document, evaluate, and monitor the incidence of diseases in free-ranging wildlife as well as the potential impacts of disease on wildlife populations in Alaska. Ensure animal welfare considerations in the capture and handling of wildlife by the Division for research or management purposes.

II. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD

JOB/ACTIVITY 1: Maintain the Chronic Wasting Disease Surveillance Program.

- Performed necropsies and collected appropriate tissues on target animals (cervids having signs consistent with CWD, are found dead unexplained, scientific collections or hit by vehicle).
- Samples for CWD testing were collected from 7 moose during FY14; these samples have not yet been tested. Tissues collected during FY13 from 85 cervids (69 moose and 16 caribou) were submitted to Colorado Veterinary Diagnostic Laboratory. All results were negative for CWD.

Federal funds were used to pay for salaries, supplies and services on this task.

JOB/ACTIVITY 2: Maintain the blood, serum and tissue banks (archives).

- Accessioned ~3200 blood / serum / swab samples from ~300 individuals, including brown bear, wood bison, caribou (representing 7 herds), moose, and muskox.
- Accessioned frozen and/or fixed tissues for 239 new pathology cases (see details under Job 3).
- Nearly 300 samples were accessed from the archived samples and distributed to research collaborators, DWC and non-DWC investigators as well as graduate students to fulfill requests for tissue, blood, serum or carcasses. Research colleagues and investigators from the following institutions were represented: University of Alaska Fairbanks (UAF) Museum of the North, Department of Veterinary Medicine, Colorado State University, University of Calgary, Norwegian School of Veterinary Science, Haartman Institute- Finland, US National Parasite Collections and Animal Research Laboratories/USDA, Princeton University, -University of New Mexico Museum of Southwestern Biology, US Fish and Wildlife Service, National Marine Fisheries, National Veterinary Services Laboratory, University of Pittsburg, University of Tennessee.

Federal funds were used to pay for salaries, supplies and services on this task.

JOB/ACTIVITY 3: Conduct disease and parasite surveillance and monitor changes in disease patterns.

- **Passive pathogen surveillance:** Conducted post-mortem examinations on 281 accessions of tissues, parasites, or whole carcasses presented by the public, as well as incidental takes such as road-kill, capture mortalities of other investigators, and animals found dead.
 - Mammalian Cases: 239 total (81 hoofstock, 144 terrestrial carnivores/furbearers, 6 marine mammals, 8 rodents/lagomorphs, 15 bats).
 - Other Cases: 11 birds and 31 ectoparasite only cases.
 - Gross observations and morphometric (on carcasses) data recorded, diagnoses assigned when possible, and samples for ancillary diagnostic testing or research requests were collected. Whenever feasible, parasite identification and definitive diagnoses will be pursued through histopathology (n = 86 cases).
 - Monitored and recorded numerous public and department personnel reports regarding disease and parasites in wildlife. Callers, email correspondence as well as drop-ins occur throughout the year but questions are particularly heavy during the first months of the hunting season and during the calving periods.

- **Active pathogen surveillance:** As requested by biologists, there was a continuing investigation into the causes of neonate/fetal mortalities, especially the Teshekpuk (n=3) and Mulchatna (n=2) caribou herds, moose (n=10), and muskox (n=2).
- **Serosurveillance:** Submitted nearly 400 serum samples for ~ 650 serologic tests; all test results are eventually entered into the DWC Serology Database. When feasible, test results were reported back to the biologist who requested them.
- **Respiratory Pathogen Screen:** Submitted 37 swabs for bacterial and viral PCR of respiratory pathogens from moose (n=27), plains bison (n=23), and wood bison (n=8). *Mycoplasma* surveillance in moose and bison was initiated after the discovery of *Mycoplasma spp* in a wood bison and moose.
- **Muskox Health Assessment:** Participated in conference call with University of Calgary colleagues including a new PhD student about the new developments in Erysipelothrix diagnoses and die-off of muskox in Canada and Alaska.
- **Caribou Herd Health Assessments:** Collaborated with a Alaska Veterinary Pathology Services on continuing to develop objective health scores for caribou herd health assessments.
- **Rangiferine Brucellosis:** Continued a collaborative research project on *Brucella* with colleagues in the Arctic Section of the Norwegian School of Veterinary Science in Tromsø, Norway utilizing a multi-species indirect ELISA. Many of the ~1400 serum samples have been analyzed and preliminary data results received. Results presented at meetings. An MPH/DVM student from Colorado State University spent 2 months in residence setting up the pan-*Brucella* ELISA in a lab on the UAF campus. She conducted CARD tests and ELISA on caribou and walrus. She also examined and tested testicles from 98 reindeer culled on Nunivak Island.
- **Parapoxvirus:** Dr. Morten Tryland, of the Section of Arctic Veterinary Medicine of the Norwegian School of Veterinary Science in Tromsø, Norway conducted parapoxvirus isolation and identification from caribou, muskox, Dall's sheep and mountain goat. He extracted DNA of parapox from tissues of suspected cases of contagious ecthyma in the species listed above. These included the first documented cases of parapox in caribou and a Sitka blacktailed deer in Alaska. It also confirmed some very subtle chronic ulcers and minute intradigital proliferative lesions as parapox. These DNA has been sequenced in Norway and phylogeny will be compared with other sequences in Genbank in hopes of identify the origin and probably spread of parapox among Alaskan ungulates.
- **Zoonotic fecal parasites of ungulates:** We continue to monitor for pathogenic strains of *Cryptosporidium* and *Giardia*. a large sampling of available moose and a lesser number of caribou feces were tested for *Cryptosporidium* and *Giardia* and the isolates sequenced Colorado State University in order to assess the prevalence and potential risk factors with this zoonotic parasite.

- **Enhanced Rabies Surveillance:** Using the DRIT method of rabies testing, we tested 414 samples of mammalian brain tissue. Nearly 200 of these were trapped foxes or wolves, screened to determine rabies prevalence in a ‘random’ sample. Federal funds were used to pay for salaries, supplies, travel and services on this task.

JOB/ACTIVITY 4: Monitor levels of environment contaminants in species of concern.

- Analyzed 29 new tissue samples from caribou, Dall’s sheep, mountain goat, moose, and muskox for heavy metals.

JOB/ACTIVITY 5: Assess the nutritional trace mineral status of Dall’s sheep, moose, muskox, mountain goat, and caribou.

- Submitted ~ 500 blood, serum, liver, muscle, and/or kidney samples including those from Dall’s sheep (n = 1), moose (n = 333), muskox (n = 6), mountain goat (n = 1), wood bison (n=94), and caribou (n = 78) for trace element screening, conducted at the Wyoming State Veterinary Laboratory.
- Approximately 2400 results generated from trace mineral analyses during and prior to FY14 were entered into the DWC Clinical Pathology database. DWC collaborator Kalin Seaton is working on data analysis of the moose samples.
- Compiled all available trace minerals results from Dall’s sheep to examine relationship with risk of capture-related mortality as part of a Masters of Conservation Medicine thesis project of a Tufts University student.

Federal funds were used to pay for salaries, travel, supplies and services on this task.

JOB/ACTIVITY 6: Review literature; prepare annual progress reports, a final report, and manuscripts for publication in refereed literature.

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- Quarterly reports of rabies surveillance testing prepared for the Office of the State Veterinarian (DEC) and Section of Epidemiology (HSS).
- Presented an oral summary report of research projects and disease surveillance at the Regional staff meetings.
- Co-authored manuscripts were drafted, prepared for submission or submitted for review (*accepted and published listed in V. Publications section*).

Submitted for review: Metagenomic survey for viruses in Western Arctic Caribou, Alaska, through iterative assembly of taxonomic units Anita C. Schürch, Debby

Schipper, Maarten A. Bijl, Jim Dau, Kimberlee B. Beckmen, Claudia M.E. Schapendonk, V. Stalin Raj, Albert D. M. E. Osterhaus¹, Bart L. Haagmans, Morten Tryland and Saskia L. Smits. (accepted PLOS ONE 7/20/2014).

Submitted for review: RESTRICTED EVALUATION OF *TRICHODECTES CANIS* (PHTHIRAPTERA: TRICHODECTIDAE) DETECTION METHODS IN ALASKA GRAY WOLVES. Theresa M. Woldstad, Kimberly N. Dullen, Kris J. Hundertmark, and Kimberlee B. Beckmen. International Journal for Parasitology: Parasites and Wildlife (Open Access accepted August 11, 2014).

Submitted for review: Prevalence and Spatio-Temporal Variation of an Alopecia Syndrome in Polar Bears of the Southern Beaufort Sea. Todd Atwood, Elizabeth Peacock, Kathy Burek-Huntington, Valerie Shearn-Bochsler, Barbara Bodenstein, Kimberlee Beckmen, and George Durner. Journal of Wildlife Diseases. (Acceptable with revision Feb 15, 2014).

- **Co-authored papers and posters presented at meetings:**

Oral presentations by Kimberlee Beckmen at the 62nd Annual Conference of the Wildlife Disease Association, Knoxville TN, July 2013. ENHANCED RABIES SURVEILLANCE IN ALASKAN WILDLIFE: DETECTION OF NEW HOST RANGE AND RISKS TO TRAPPERS

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Historically, rabies surveillance in Alaska were limited a public health laboratory evaluation of brain from suspect animals by direct fluorescent antibody (dFA) test typically following exposure to a human or pet. In 2006, the Centers for Disease Control and Prevention (CDC) validated the direct rapid immunohistochemistry test (dRIT) using brain tissue unsuitable for standard techniques. This rapid test doesn't require fluorescent microscopy or opening the skull to retrieve appropriate samples. Beginning in 2011 wildlife agency staff, certified by CDC, utilized dRIT on neurologic tissues of free-ranging wildlife obtained as trapper/hunter-killed, found dead, killed in vehicular collisions, culled for management or euthanized. The enhanced surveillance effort evaluated ~1100 specimens representing 18 species. All dRIT positive and 10% of negative tests were verified by CDC. We identified rabies positive cases in 2.9% of red foxes (n=467) and 4.0% of arctic foxes (n=100) tested with a prevalence of 1.8% among 403 trapper-killed foxes. Additionally, in 2012 we documented the first case of rabies in a wolverine in North America (1 of 42 tested). High specificity and sensitivity was obtained using dRIT on foxes however false positive results were increased in some species (e.g. bats when sampled by needle aspiration). Enhanced surveillance identified the significant risk of rabies transmission to trappers within the fox rabies enzootic region and detected presence in a wolverine (also a trapper target). Continuing to utilize the dRIT for rabies surveillance will enhance our ability to rapidly detect rabies outbreaks and changes in species or geographic distribution.

TASER ELECTRONIC CONTROL DEVICE USE FOR WILDLIFE MANAGEMENT
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In some situations, the use of standard techniques to restrain wildlife (e.g. chemical immobilization) or modify their behavior (e.g. hazing with beanbag or rubber projectile, or noisemaker rounds fired from 12GA shotgun), may not be practicable or desirable. Wildlife managers need additional, safe methods provide short term (<1 minute) restraint of animals to allow manipulation (e.g. release from entanglements) as well as more effective hazing. We evaluated the impact and risk of capture myopathy with ECD application on moose compared with a 3 cc Cap-chur explosive dart delivery of chemical capture agents. Body temperature, salivary cortisol, as well as selected blood parameters were used as potential predictors of indicators of trauma, organ damage, or increased risk of capture myopathy. Behavioral responses to ECD and the associated painful stimulus included an immediate flight response after application and a prolonged aversion to human presence. Mean cortisol and lactate concentrations were 3 to 5 times higher with ECD compared to darting but there was no significant difference in body temperature and other parameters. Although we could detect a brief, elevated stress responses greater than with darted, we concluded that a short (<1 minute) application ECD was not more likely to induce capture myopathy than darting. While both darting and ECD are painful (the later only during application), the escape/flight behavior and prolonged aversion to human presence to ECD indicates the potential use of this technique as an alternative to destruction of animals that have become food conditioned and/or dangerous to the public.

Oral Presentation by Kimberlee Beckmen at the Alaska TWS Meeting, March 31- April 3, 2014, Anchorage, AK. Evaluation of thiafentanil dosing in mixtures for chemical capture of free-ranging caribou (*Rangifer tarandus granti*)

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For many years, carfentanil/xylazine (CX) has been the drug combination used for immobilizing free-ranging ungulates in Alaska. However, carfentanil is extremely hazardous for humans. The new drug of choice is expected to be thiafentanil (A-3080), which has a higher safety index. This motivated a drug trial to determine efficacious doses for free-ranging caribou calves (*Rangifer tarandus granti*). Data collected in April 2010, on free-ranging calves darted with thiafentanil/azaperone, suggested the addition of

a sedative for muscle relaxation. Subsequent trials on captive adult caribou indicated thiafentanil/azaperone/medetomidine provided good levels of immobilization. However, field trials conducted in October 2013 on free-ranging caribou calves, found the combination too potent, causing respiratory arrest and one mortality. The protocol was changed to thiafentanil (5 mg), azaperone (25 mg) and xylazine (20 mg) (TAX), with good results. The mean \pm SD (range) induction time for TAX was 3.3 ± 1.6 (2.0 - 7.0) minutes vs 2.8 ± 1.5 (1.5-5.2) for CX. To further compare TAX with the previous CX protocol, a physiological evaluation was performed on 5 animals immobilized on CX and 8 animals on TAX. Arterial blood was collected after induction, and again after 10 minutes of nasal O₂ supplement (1 L/min). Both groups had a significant ($P < 0.001$) increase in PaO₂ after oxygen treatment. However, only the CX group had a significant ($P = 0.019$) increase in PaCO₂, suggesting better ventilation in the TAX group. Based on our results, we found that TAX proved to be a safe and efficient drug protocol for free-ranging caribou calves.

Poster presentation by Hilary Schwafel at the Alaska TWS Meeting, March 31- April 3, 2014, Anchorage, AK. Assessment of Selenium Status and Susceptibility to Capture Mortality in Five Populations of Dall's Sheep. Hilary Schwafel and Kimberlee Beckmen. Abstract: Dall's sheep (*Ovis dalli dalli*) inhabit areas in Alaska with low nutrient availability and may be susceptible to trace mineral imbalances negatively impacting their health. Adequate selenium and antioxidant activity may play a role in preventing capture myopathy and reducing subsequent mortality. Blood samples were collected from five populations Dall's sheep over seven years. Mortality within 30 days of capture was compared to blood selenium concentration in ewes. The White Mountains population experienced a higher rate of mortality associated with capture compared to other populations. Modeling analysis via QAICc suggested that lower blood selenium concentration was associated with a higher risk of capture mortality in White Mountain ewes ($R^2 = 0.30$, $p = 0.055$). A sharply increased risk of capture mortality was associated with a blood selenium concentration at or below 0.2 ppm, suggesting that this may be the adequacy threshold in White Mountain ewes. This blood selenium concentration falls within the range considered adequate for domestic sheep. There was also significant difference in blood selenium concentration between herds ($p < 0.0001$, $R^2 = 0.53$, $AICc = -73.35$), but blood selenium concentration did not predict capture mortality across all herds ($p = 0.11$, $R^2 = 0.09$). This suggests that some populations of Dall's sheep may be at greater risk than others of capture mortality influenced by low blood selenium. Sheep supplemented at capture with vitamin E and selenium are probably less likely to suffer from capture myopathy and mortality.

Poster Presentation by Ingebjørg H. Nymo at the 66th Brucellosis Research Conference and Conference of Research Workers in Animal Diseases, Decemeber 2014, Chicago IL Spatio-temporal trends in prevalence of anti-*Brucella* antibodies in barren-ground caribou (*Rangifer tarandus granti*) in Alaska – an example of enzootic equilibrium

Kimberlee Beckmen¹, Ingebjørg H. Nymo^{2,4,5}, Morten Tryland^{2,4}, Kjetil Åsbakk^{2,4}, Anett K. Larsen^{2,4}, Jacques Godfroid^{2,4}, Jim Dau¹, Rolf Rødven^{3,4}

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Alaska has approximately 750 000 barren-ground caribou (*Rangifer tarandus granti*) distributed in 32 herds. Semi-domesticated reindeer (*Rangifer tarandus tarandus*) were first introduced to North America from Siberia in 1891. Though free-ranging descendants of these once numbered over 20 000, only remnant managed herds of less than 8000 remain on the Seward Peninsula and fewer than 3000 are unmanaged on remote islands. *Brucella suis* biovar 4, the causative agent of brucellosis in *Rangifer tarandus* spp., may cause bursitis, orchitis, epididymitis, retained placenta, metritis, abortions, and abscesses. Vaccination of semi-domesticated reindeer on the Seward Peninsula against brucellosis started in the mid-1980's reducing the disease prevalence among some herds. Brucellosis in *Rangifer tarandus* sp. may pose a zoonotic risk.

In this study we analysed the spatio-temporal trends in *Brucella* seroprevalence from 11 different caribou herds in a long-term record (1975-2010). Blood samples were collected in serum separator evacuated tubes from the jugular or cephalic vein of caribou during live capture/release activities. Serum was stored frozen (-50 to -80 °C).

The overall pattern in all herds but one was a low seroprevalence (average 1.2 %). The Western Arctic Herd was unique because of a marked decline from 23 to 3 % in seroprevalence in the investigated period (logistic regression estimate of slope, 95 % CI = [-0.09, -0.04]). In the Western Arctic Herd, seropositives were found only among individuals older than 23 months of age. Analysis of a sub-sample of individuals being tested by several tests showed good coherence between the various tests. Likewise, the results from an indirect ELISA recently validated as a sensitive and specific method for the detection of anti-*Brucella* antibodies in reindeer and caribou were in coherence with former testing (Cohen's Kappa = 0.66, 95% CI = [0.49, 0.81]).

The Western Arctic Herd home range overlaps with semi-domesticated reindeer on the Seward Peninsula. While the semi-domesticated reindeer could have been a source of introduction of *B. suis* biovar 4 into the Western Arctic Herd earlier, efficient treatment of the semi-domesticated reindeer may have reduced the caribou exposure rate. Stochastic severe declines in caribou herd populations leading to reduced animals densities and thus less exposure on the calving grounds possibly reduced transmission between caribou. Alternative reasons for the declining seroprevalence in the Western Arctic Herd may exist, and warrants further investigation. The severe decline in *Brucella* seroprevalence in the Western Arctic Herd, however, may indicate a herd reaching an enzootic equilibrium in brucellosis prevalence, to the same level as the other arctic caribou herds.

Poster presentation at the Invasive Species Conference, November 5-7, 2013, Fairbanks AK.

MASS MORTALITY EVENT OF MOOSE FROM CONSUMPTION OF TOXIC ORNAMENTALS

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ABSTRACT

From January 2 to Feb 7 2011, three moose calves were found dead in a residential neighborhood of Anchorage. Just prior to death, apparently healthy moose were observed browsing on ornamental shrubs, staggered away and fell over dead. A carcass that was necropsied within a few hours of death had an overpowering odor of bitter almond classically associated with cyanide. Toxicologic analysis of liver, muscle, rumen content and plants that had been browsed determined that all three calves had died from cyanide toxicosis from the consumption of *Prunus spp.* (European bird cherry, Mayday or chokecherry). In addition, the third calf had consumed an extremely toxic *Taxus sp.* (Yew) with fatal concentrations of taxine B in the rumen. These three plus an single case in 2006 in the same area are the only documented cases of cyanide toxicosis from chokecherry consumption in moose. The only other documented yew poisoning in moose is reported from Norway in 2008. Typically, freezing causes cyanogenic glycosides to accumulate in the buds of chokecherry trees. The toxin builds up immediately after a freeze, but then dissipates within days. When the buds are chewed and swallowed, they react with chemicals in the rumen to release cyanide gas which can kill in minutes. A midwinter poisoning at this latitude is extremely unexpected. Yew, an evergreen, are toxic year round do both ruminants and monogastrics. Urban sprawl, invasive *Prunus sp.*, climate change and increased awareness are expected to increase the number of cases detected.

Federal funds were used to support salary and expenses this task.

JOB/ACTIVITY 7: Perform duties of the attending veterinarian.

- Provided advice, consultation, and services to Division staff related to wildlife capture, disease, mortality, euthanasia, and zoonotic disease risk/diagnosis.
 - Conducted a 4-day course in Chemical Immobilization of Wildlife for DWC staff (27 participants) during February 2014.

- Provided multiple training seminars in Animal Welfare Policy, Wildlife Diseases and Parasite, Answering public and staff inquiries about wildlife disease and parasites, and Handling of Controlled Substances. Updated training and informational materials on the Sharepoint website.
 - Prepared capture and sampling supplies for ~12 capture events (including moose and caribou) and supported 42 personnel days to assisting biologists with captures and/or sample collection.
 - Provided veterinary care and advice for husbandry for the captive animals at the Moose Research Center, Palmer moose and caribou facility and the Alaska Wildlife Conservation Center.
- Provide veterinary capture drugs/supplies to Division staff.
 - Coordinated and completed 6 veterinary drug/supply orders for Divisional staff and dispensed drugs/supplies throughout year.
 - Conducted annual controlled substances inventory (~1100 individual vials of drugs) involving DWC staff that have been dispensed drugs (n = ~120 staff) throughout the state (n = 23 area offices).
 - Throughout the year, order and dispense drugs/supplies (> 2000 individual items), receive and process controlled substance use reports and individual capture records, and empty/partial vials for destruction.
 - All data related to controlled substance procurement, dispensing, and use are entered into a drug tracking database.
 - Address public concerns about wildlife disease, parasites, and lesions in game meat, zoonotic diseases, and animal welfare. Attended to on a case by case basis (walk-ins, phone calls, e-mails, and public information requests).
 - Continued to review staff training and supply preparations for responding to wildlife caused human morbidity and mortalities.
 - Performed the duties of the Attending Veterinarian for the DWC Animal Care and Use Committee. Provided training to new staff on the Animal Welfare Policy. Consulted on the development of new protocols, reviewed protocols submitted to the committee. Conducted research facility inspections. Responded to DWC personnel calls and reports of capture related morbidities and mortalities.

Federal funds were used to pay for salaries, supplies and services on this task.

III. COSTS INCURRED DURING THIS SEGMENT

Not applicable

IV. SIGNIFICANT DEVIATIONS AND/OR ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

- Frequent monitoring of wildlife disease related reports via the internet and electronic newsletter as well as notifications of outbreaks were conducted. In addition, meetings (phone as well as in person) related to urgent zoonotic, human health or agricultural disease issues were attended.
 - Monitor Promed and Wildlife Health Alerts listservs for disease outbreaks and infectious disease discoveries pertinent to Alaskan wildlife and zoonotic disease risks or introductions of exotic (non-endemic) disease. Alert or report pertinent issues to DWC staff via an email list.
 - Participate as a member of the Wildlife Health Committee of AFWA, WAFWA, the Alaska One Health Group and other subcommittees related to wildlife health and zoonotic disease. Report pertinent issues to DWC staff.
- K. Beckmen attended the USDA Foreign Animal Disease Diagnostician training, Jan 27-Feb 2014, : Plum Island New York.
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Federal funds were used to pay for salaries, supplies, services, and some travel costs for this work.

V. PUBLICATIONS

1. *Published (Appendix 1):* McGrew, Ashley K., Lora R. Ballweber, Sara K. Moses, Craig A. Stricker, Kimberlee B. Beckmen, Mo D. Salman, and Todd M. O'Hara. 2004 **Mercury in gray wolves (*Canis lupus*) in Alaska: Increased exposure through consumption of marine prey.** *Science of the Total Environment* 468-469 (609-613).

Published (Appendix 2): Nadler, Steven A., Eugene T. Lyons, Christopher Pagan, Derek Hyman, Edwin E. Lewis, Kimberlee Beckmen, Cameron Bell, Aurelie Castinel, Robert L. DeLong, Padraig J. Duignan, Cher Farinpour, Kathey Burek Huntington, Thijs Kuiken, Diana Morgades, Soraya Naem, Richard Norman, Corwin Parker, Paul Ramos, Terry R. Spraker, and Bárbara Berón-Vera. 2013. **Molecular Systematics of Pinniped Hookworms: Species Delimitation, Host Associations, and Host-Induced Morphometric Variation.** *International Journal for Parasitology* 43:1119-1132.

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VI. RECOMMENDATIONS FOR THIS PROJECT

Disease surveillance and veterinary activities have continued to steadily increase in scope and intensity over the course of this performance period. To continue to provide wildlife veterinary services at the level currently expected by Alaskans (and demanded by DWC personnel), veterinary staffing levels and funding for wildlife disease surveillance must be increased as well as a decrease in some less critical tasks. The demands for serum and tissue samples from the DWC frozen archive has increased exponentially. The ability of maintain this archive in terms of accessioning, data entry, sample processing, freezer maintenance and record keeping for both incoming and outgoing samples has overwhelmed the WVS staff. Hiring a dedicated collections manager is the only way this valuable resource can continue to be utilized by the DWC staff as well as the myriad of research collaborators. Federal funding of CWD surveillance is no longer available, so we will no longer be able to maintain a significant level of CWD surveillance of free-ranging cervids in Alaska unless allocated additional funding and staff. The hiring of a WBI or II in support of wildlife disease monitoring and veterinary services in southcentral has not been approved but is necessary to carry on the current level of work with the loss of the CWD seasonal non-perm WBII position. These deficiencies in funding and staffing will need to be mitigated by other funding sources including Federal Aid. A cooperative agreement with USDA Wildlife Services or a contact with Alaska Veterinary Pathology Services may provide a temporary but immediate solution to this urgent need. The dedicated assistance of a biometrician or statistician is critical to analyze, appropriately interpret and report the comprehensive, complicated data generated through these surveillance programs. Consultations with colleagues with wildlife epidemiologic expertise are needed to advance the understanding of the role of these potential pathogens on Alaska's wildlife populations and determine if and when there is a need for intervention, mitigation or further study and monitoring for wildlife disease management purposes.

Prepared by: Kimberlee Beckmen, M.S., D.V.M., Ph.D.

Date: 8/25/2014

Attachments: Appendix1-2 : PDFs of publications