ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

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, 2014 – June 30, 2015

Report Due Date: September 1, 2015

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 23 wild cervids (21 moose, 1 caribou) during FY15 and 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 359 blood / serum samples from 188 caribou, 158 wood bison and 13 moose.
- Accessioned 55 nasal swabs from 11 species.
- Accessioned frozen and/or fixed tissues for 239 new pathology cases
- More than 300 samples were 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; Museum of the North, Department of Veterinary Medicine, Institute of Arctic Biology Wildlife Toxicology Lab as well as Colorado State University, University of Calgary,-Norwegian School of Veterinary Science, US National Parasite Collections and Animal Research Laboratories/USDA, US Fish and Wildlife Service, National Marine Fisheries, University of Oregon Museum, Wildlife Conservation Society, Cornell University.

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 239 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.
    - 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.
    - 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, animal found dead and capture mortalities, especially caribou, moose, and mountain goats.

- **Serosurveillance:** Submitted nearly 300 serum samples for serologic tests including 239 for *Brucella;* test results from 326 animals were entered into the DWC Serology Database. When feasible, test results were reported back to the biologist who requested them.

- **Respiratory Pathogen Screen:** Submitted 55 swabs for bacterial and viral PCR of respiratory pathogens from 11 species. *Mycoplasma* surveillance was expanded after M. bovis was found in wood bison. Subsequently an apparently moose specific Mycoplasma very similar but distinct from *M. ovipneumoniae* as well as a unique Adenovirus were detected on diagnostic testing of deceased orphan moose. Screening in free-ranging moose and caribou failed to detect the Adenovirus outside of the captive facility. *Mycoplasma spp*. were detected in other species (free-ranging moose and zoo animals) but not caribou. Serosurveillance was reduced compared to previous years to only select cases such as animals that were to be translocated, moved or ongoing disease projects.

- **Muskox Health Assessment**: Continued collaboration with University of Calgary colleagues including contributing to a project proposal (subsequently funded) to determine the epizootiology and emergence of the agent involved in mass mortality events in Canada and detected in Alaska (*Erysipelothrix*).

- **Canine Distemper viruses in Alaskan Canids:** Collaborated with the Wildlife Conservation Society, Cornell University and USGS to conduct surveillance for morbilliviruses in brainstem samples that had been collected and tested for rabies by DWC WHDS. Over 300 samples were shipped and tested at Cornell to enhance the availability of canine distemper virus sequences from wildlife in Arctic regions.

- **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. Results presented at meetings, three manuscripts drafted, 1 submitted. An MPH/DVM student from Colorado State University completed analyses of archived caribou and walrus serum, compared methods, presented results and finished her Master's thesis. She conducted CARD tests and ELISA on caribou and walrus. She continued the work conduction PCR and histopathology on testicles from 98 reindeer culled on Nunivak Island. Routine surveillance for *Brucella* in live captured wildlife (239 samples) were submitted and tested by the Department of Environmental Conservation or submitted to diagnostic laboratories.

- **Parapoxvirus:** Dr. Morten Tryland, of the Section of Arctic Veterinary Medicine of the Norwegian School of Veterinary Science in Tromsø, Norway completed parapoxvirus isolation, identification and phylogeny from caribou, muskox, Dall's sheep and mountain goat. A manuscript draft is in preparation.

- **Zoonotic fecal parasites of ungulates**: We continue to monitor for pathogenic strains of *Cryptospordium* and *Giardia*. Twenty-two fecal samples were tested for

Cryptospordium 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 Direct Rapid Immunoassay Test (DRIT) we tested 207 samples of mammalian brain tissue for rabies. The majority were fox, followed by wolf, black bear and bats, 3 coyotes and one each brown bear, snowshoe hare, wolverine, caribou, river otter, lynx, beaver and Sitka blacktailed deer. Positive and indeterminate samples were sent to the CDC in Atlanta for confirmation. The Section of Epidemiology and Office of the State Veterinarian were apprised of results. Some of the supplies and staff salary was funded through RSA's with USDA funds.

- ***Trichinella*:** USDA collaborators continue analysis of masseter muscle and tongue samples collected at necropsy or during predator control operations for Trichinella prevalence and determining genotypes.

- **Moose Genetics:** Blood and tissue samples from 106 moose were subsampled from the archive for a study on the genetic diversity of moose "South-Central Moose Population Genetics Assessment". The project seeks to examine whether moose south of the Alaska Range show genetic differentiation across the game management units in the Mat-Su and upper Copper River and Nelchina river. Patterns of genetic differentiation will be used to infer which regions are demographically connected or isolated. Finally, we are examining whether major geographic features (i.e., Knik arm, the Alaska Range) form barriers to moose dispersal. Results will be used to help evaluate efficacy of trend count areas and understand disease transmission potential within and between regions.

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 available 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 390 blood, serum, liver, muscle, and/or kidney samples including those from Dall's sheep, moose, muskox, mountain goat, wood bison, and caribou for trace element screening, conducted at the Wyoming State Veterinary Laboratory.

Federal funds were used to pay for salaries, 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.

- Progress report generated for Federal Aid.

- 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 regional meetings.

- Co-authored manuscripts were drafted, prepared for submission or submitted for review *(accepted and published listed in V. Publications section*).

Submitted for review:

Title: THIAFENTANIL/AZAPERONE/XYLAZINE (TAX) AND CARFENTANIL/XYLAZINE (CX) IMMOBILIZATIONS OF FREE-RANGING CARIBOU (*RANGIFER TARANDUS GRANTI*) IN ALASKA

Authors: Marianne Lian[1, 2,3], Kimberlee B. Beckmen[2], Torsten W. Bentzen[2], Dominic J. Demma[3] and Jon M. Arnemo[1]

[1]Department of Forestry and Wildlife Management, Faculty of Applied Ecology and Agricultural Sciences, Hedmark University College, Campus Evenstad, NO-2480 Elverum, Norway

[2]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, AK, 99701, USA, [3]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1800 Glenn Highway, Suite 2, Palmer, AK, 99645, USA

[3]Corresponding author (email: mariannelian@gmail.com)

Abstract: Carfentanil/xylazine (CX) has been the primary drug combination used for immobilizing free-ranging ungulates in Alaska since 1986. We investigated the efficacy of a potential new drug of choice, thiafentanil (Investigational New Animal Drug A-3080). In order to determine efficacious doses for helicopter darting to immobilize free-ranging caribou calves (*Rangifer tarandus granti)* for radio-collaring, initial dosing trials were conducted on captive adult caribou which 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 three respiratory arrests and one mortality. The protocol was revised to thiafentanil/azaperone/xylazine (TAX), with good results. The induction time was not significantly different between the two combinations. However, the recovery time was significantly shorter for the TAX group than the CX group. A physiological evaluation was performed on 12 animals immobilized on CX and 15 animals on TAX. Arterial blood was collected after induction and again after 10 minutes of intranasal oxygen supplementation (1 L/min). Both groups had significant increases in PaO_2 after oxygen treatment. There was a concurrent significant increase in $PaCO_2$ in both groups. Rectal temperature increased significantly in both groups during the downtime, which is consistent with other studies of potent opioids in ungulates. Based on our results, we found TAX to be a potential alternative for the current CX protocol for immobilizing free-ranging caribou calves via helicopter darting.

Journal of Wildlife Diseases

Title: ANTI-*BRUCELLA* ANTIBODIES IN MOOSE, MUSKOXEN AND PLAINS BISON IN ALASKA

Authors: Ingebjørg Helena Nymo [1,3], Kimberlee Beckmen (kimberlee.beckmen@alaska.gov) [2], Jacques Godfroid (jacques.godfroid@uit.no) [1]
[1] UiT – The Arctic University of Norway, Research group for Arctic Infection Biology, Postboks 6050 Langnes, N-9010 Tromsø, Norway.
[2] Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701-1551, USA.

The presence of anti-*Brucella* antibodies (abs) in moose (*Alces alces gigas*), muskoxen (*Ovibos moschatus*) and plains bison (*Bison bison bison*) from various Game Management Units (GMUs) in Alaska, USA sampled between 1982 and 2010 was evaluated with an indirect enzyme-linked immunosorbent assay (ELISA) and the Rose Bengal Test (RBT). A portion of the sera had previously been tested with the standard plate test (SPT), the buffered *Brucella* antigen card test (BBA), and the CARD test. No seropositive plains bison were identified. Anti-*Brucella* abs were detected in moose (iELISA: n = 4/87, RBT: n = 4/87, SPT: n = 4/5, BBA: n = 4/4) from GMU 23 captured in 1992, 1993 and 1995; from muskoxen (iELISA: n = 4/52, RBT: n = 4/52, CARD: n = 4/35) from GMU 26A and 26B captured in 2004, 2006 and 2007. A negative effect of the infection on the health of individuals of these species is probable. The presence of seropositive animals from 1992 to 2007 suggests presence of brucellae over time. The seropositive animals were all found in northern Alaska, the part of Alaska with a historically higher prevalence of *Brucella*-positive caribou, and a spill over of *Brucella suis* biovar 4 from caribou may have taken place. *Brucella suis* biovar 4 cause human brucellosis and transmission from consumption of moose and muskoxen is possible.
Journal of Wildlife Diseases

Revised and submitted shortly after FY15:

Title: Organochlorine contaminant concentrations in multiple tissues of live Steller sea lions (*Eumetopias jubatus*) in Alaska

Authors: Kimberlee B. Beckmen[1*], Mandy J. Keogh[1], Kathleen A. Burek-Huntington [2], Gina M. Ylitalo[3], Brian S. Fadely[4] and Kenneth W. Pitcher[5]
[1]Division of Wildlife Conservation, Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701[2]Alaska Veterinary Pathology Services, 23834 The Clearing Drive, Eagle River AK 99577[3]Environmental Conservation Division, Northwest Fisheries Science Center, National Marine Fisheries Service, 2725 Montlake Blvd. East, Seattle, WA 98112
[4]National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, WA 98115
[5]Division of Wildlife Conservation, Alaska Department of Fish and Game, 525 West 67th Avenue, Anchorage, AK 99518

Abstract: We examined the relationships of organochlorine (OC) contaminants between multiple tissues of young, live captured Steller sea lions (*Eumetopias jubatus*). Blubber

(N=48), blood (N=13), feces (N=34), and milk (N=21) were collected from free-ranging Steller sea lions in Alaska over 6 years (1998-2003) to assess exposure of selected OC contaminants (e.g., dioxin-like PCBs, DDTs). Both between and within each matrix there was considerable individual variation. In spite of the individual variation, similar patterns were observed across the matrices for most of the selected PCB congeners. In all four matrices, the major PCB congeners were -101, -118, -138, and -153. The most prominent congener, both as a weight (ng/g l.w.) and as a percentage of summed PCBs (ΣPCB) was PCB-153. Comparisons between paired matrices showed that ΣDDT in blubber samples were related to concentrations in blood, feces, and milk. Whereas ΣPCB in blubber was related to concentrations in paired milk and fecal samples, this relationship was extremely weak in feces (r^2=0.143). These findings indicate that alternative tissues may be obtained less-invasively and used as indicators of relative contaminant exposure in lieu of surgical blubber biopsy. In particular, milk samples were related to paired blubber samples for ΣDDT, ΣPCB, and summed PCB toxic equivalents (ΣPCB TEQ) highlighting the potential utility of orogastric collected milk samples eliminating the need to handle adult female SSL. Feces may be used as a population-level screen or monitoring tool of relative OC exposure without handling of animals for sample collection, but should be used with caution as samples are not attributable to individuals. Science of the Total Environment

Co-authored papers and posters presented at meetings:

The Wildlife Society Alaska Chapter Annual Meeting, Juneau AK, April 13-17, 2015
Oral Presentation Title: Alaska's Wildlife Health and Disease Surveillance Program
Presenter/Author: Kimberlee B. Beckmen
The Alaska Department of Fish and Game's Wildlife Health and Disease Surveillance Program has evolved over 40+ years into a comprehensive and collaborative effort to fulfill the wildlife conservation mission of the Division of Wildlife Conservation. Despite limitations such as minimal staff, lack of in state diagnostic facilities, reduced funding and expansive geographic area, significant advances within the framework of a One Health concept continue. Collaborations with a network of international researchers and diagnosticians are critical especially for pathogen discovery. The public, not just hunters/trappers, as well as biologists/technicians do much of the actual 'work' of obtaining samples or carcasses for both active and passive disease surveillance. Surveillance for new pathogen introductions such as from domestic animals, as well as changes in disease exposure, prevalence, and population health assessments are ongoing. The program efforts focus on zoonotic diseases/parasites, pathogens that have the potential to significantly impact the health or reproduction of important game, keystone or threatened species/populations, emerging pathogens expected to be introduced and spread with globalization and climate change. Recent work includes discovery of new parasites and pathogens of moose, muskox, wood bison, caribou and Steller sea lions; Development of in house diagnostic capabilities for rabies and brucellosis; the detection of multiple introductions and establishment of several dog tick species that are potential vectors of deadly diseases; successful field treatment to eradicate dog lice on Interior wolf packs; health assessments of Steller sea lions, muskox and caribou; development of improved anesthetic protocols for sea lions, caribou, moose, muskox and wolves.

Poster Title: Current Research on *Trichinella* Prevalence and Genotypes among Alaskan Carnivores

Kimberlee B. Beckmen[1*], Detiger Dunams-Morel[2], Dolores Hill[2] and Benjamin M. Rosenthal[2]

[1]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, AK, 99701, USA; [2]Animal Parasitic Diseases Laboratory, Agricultural Research Service, United States Department of Agriculture, Beltsville, MD, 20705, USA

Abstract: Trichinellosis is a zoonotic parasitic disease acquired by consuming raw or improperly cooked meat containing encysted muscle larvae nematodes in the genus *Trichinella. T. nativa* infects Alaskan wild carnivores. Seventeen cases from nine human outbreaks were reported in Alaska from 2005-2014. Outbreaks typically occur in non-resident hunters consuming undercooked bear meat, but an outbreak among 29 native subsistence consumers of a walrus was documented in 1975. Here, we examined 126 carcasses sampled during necropsy or predator control actions in 2012-2014 from arctic fox (N=61), black and brown bears (27 and 17, respectively), wolves (15), 3 lynx, 1 coyote and 1 wolverine to determine the prevalence of *Trichinella* and genotypes. Masseter muscle (n=118) and tongue (n=11) samples were digested in pepsin-HCl and larvae were collected by sedimentation. Prevalence rates were ~31% for North Slope arctic fox, 47% in brown bears (GMU19A, 26B, 20C, 13E), 40% in wolves. Four to 493 larvae were recovered, the most numerous occurring in individual arctic fox, brown bear and wolves. Larval numbers did not increase with age. Most infections in brown bears and wolves were attributed to the T6 genotype, and others to *T. nativa*. T6 was recovered from the wolverine. No infection was detected in black bears, lynx or coyote, even those sympatric with infected brown bears and wolves. Freeze-resistant *Trichinella* occupy a wide geographic and host range, and consumers of undercooked game encounter significant risk for infection, not just at the higher latitudes but also in southcentral Alaska.

Poster Title: Improving body condition and resolution of anemia in wood bison (*Bison bison athabascae*) calves

Authors**:** Vanessa Santana, Kimberlee B. Beckmen, MS, DVM, PhD, Tom Seaton

Abstract: The Alaska Department of Fish & Game maintained an increasing herd of wood bison *(Bison bison athabascae*) captive for 4 years longer than the anticipated 2 year quarantine prior to reintroduction. Calves and yearlings in poor body condition underwent a treatment to improve health. Twenty-five young bison were blood sampled prior to (January 2014) and after treatment (March 2014). The treatment included injections of ivermectin (parasiticide), oxytetracycline (antibiotic), selenium, vitamins B1, B12 and E. A copper bolus was also administered. A complete blood count and serum chemistry including blood urea nitrogen, creatinine, calcium, total protein, albumin, globulin, glucose, phosphorus, total bilirubin and cholesterol was conducted at University of Alaska Fairbanks Animal Resources Center. Selected trace minerals concentrations (copper and iron) and thiamine were detected in serum and selenium in whole blood at Wyoming State Veterinary Diagnostic Laboratory. Prior to treatment, red blood cell indices indicated a mild anemia (low mean red blood cell volume, hematocrit, mean corpuscular hemoglobin) as compared to the normal ranges of plains bison. After treatment there was a trend in the red blood cell indices indicating a resolution of the

anemia and significant increase in mean platelet volume. Prior to treatment the mean selenium ($\bar{x}$ = 0.122 ppm) was at the lower limits of the normal range for cattle. After treatment there were significant increases in blood selenium, serum iron and copper. Most importantly, mean body condition scores increased by 4% indicating a positive response to the treatment regime. Individuals continued to improve over 12 months.

Annual Conference of the Wildlife Disease Association, New Mexico, July 28-Aug 1, 2014
Oral Presentation Title: EVALUATION OF STRESS IN CARIBOU *(RANGIFER TARANDUS GRANTI)* ATTRIBUTED TO DIFFERENT CAPTURE METHODS
Authors: Marianne Lian[1,2] and Kimberlee Beckmen[2].
[1]Department of Forestry and Wildlife Management, Faculty of Applied Ecology and Agricultural Sciences, Hedmark University College, Campus Evenstad, NO-2480 Elverum, Norway, [2]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, AK, 99701, USA
Abstract: Caribou *(Rangifer tarandus granti)* are routinely live-captured in Alaska for research and management. Capture methods varies from chemical immobilization with a dart gun from helicopter, net-gunning from helicopter or hand-capture from boats during a river crossing. We evaluated the effect of different capture methods on selected blood constituents known to be influenced by stress. Venous samples were collected from the jugular or cephalic vein, from caribou captured with net-gun (NG, N =28), hand-captured (HC, N = 20) or darted from a helicopter with carfentanil/xylazine (CX, N = 54), medetomidine/ketamine (MK, N = 9) or thiafentanil/azaperone/xylazine (TAX, N = 8). To quantify stress, blood constituents used included lactate and creatine kinase (CK). Use of a hand-held lactate monitor was validated for field use in caribou with a significant correlation to laboratory serum lactate (P<0.05). Lactate was increased in all groups, and significantly increased (P = 0.001) in both NG and HC, compared to chemical immobilization via helicopter darting. Mean±SD (range) for lactate was 4.9±2.7 (1.0 - 13.0) for CX, 4.8±2.0 (2.4 - 7.4) for MK, 4.3±1.1 (2.8 - 6.0) for TAX, all measured in field, and 21.7±5.6 (12.4 - 31.2) for NG and 18.4±7.6 (6.6 - 42.8) for HC both measured in lab. We found a significant correlation (P<0.05) between increased lactate values and chase time. CK was increased in all groups, with a trend of highest increase in the hand-captured group. However, this was not proven statistically (P = 0.063). Physically restrained caribou had lactate levels four times higher than chemically immobilized caribou. This indicates that physical restraint causes more distress for caribou than helicopter darting and thereby may present a higher risk for capture myopathy. Further, our findings show that longer chase times increases lactate, and we recommend that concentrated pursuit of individual caribou be kept <2 minutes.

Poster Title: EVALUATION OF THIAFENTANIL DOSING IN MIXTURES FOR CHEMICAL CAPTURE OF FREE-RANGING CARIBOU (*RANGIFER TARANDUS GRANTI*)
Authors: Marianne Lian[1,2], Torsten W. Bentzen[2], Dominic J. Demma and Kimberlee B. Beckmen

[1]Department of Forestry and Wildlife Management, Faculty of Applied Ecology and Agricultural Sciences, Hedmark University College, Campus Evenstad, NO-2480 Elverum, Norway
[2]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, AK, 99701, USA
[3]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1800 Glenn Highway, Suite 2, Palmer, AK, 99645, USA
Abstract: 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 revised to thiafentanil (5 mg), azaperone (25 mg) and xylazine (20 mg) (TAX), with good results. The mean ± 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 O_2 supplement (1 L/min). Both groups had a significant ($P < 0.001$) increase in PaO_2 after oxygen treatment. However, only the CX group had a significant ($P = 0.019$) increase in $PaCO_2$, suggesting better ventilation in the TAX group. Based on our current results, we found that TAX proved to be a safe and efficient drug protocol for free-ranging caribou calves. Additional trials using CX, TAX and TX during April 2014 are expected to further refine the most efficacious protocol.

Poster Title: SPATIO-TEMPORAL TRENDS IN PREVALENCE OF ANTI-*BRUCELLA* ANTIBODIES IN BARREN-GROUND CARIBOU (*RANGIFER TARANDUS GRANTI*) IN ALASKA – AN EXAMPLE OF ENZOOTIC EQUILIBRIUM

Authors: Kimberlee Beckmen[1], Ingebjørg H. Nymo[2,5], Jim Dau[3], Rolf Rødven[4,5], Jacques Godfroid[1,5,6]
[1] Alaska Department of Fish and Game, Fairbanks, Alaska.
[2] University of Tromsø - The Arctic University of Norway, Department of Arctic and Marine Biology, Research group for Arctic Infection Biology, Tromsø, Norway.
[3]Alaska Department of Fish and Game, Kotzebue, Alaska.
[4] Bioforsk - Norwegian Institute of Agricultural and Environmental Research, Tromsø, Norway.
[5] Member of the Fram Centre - High North Research Centre for Climate and the Environment, Tromsø, Norway.
Abstract: Alaska has approximately 750000 barren-ground caribou (*Rangifer tarandus granti*) in 32 herds. Semi-domesticated reindeer (*Rangifer tarandus tarandus*) were introduced in 1891. Free-ranging descendants of these once numbered over 20000, but 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., causes 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. Of importance, *B. suis* biovar 4 poses a zoonotic risk.

We analyzed the spatial-temporal trends in *Brucella* seroprevalence from 11 caribou herds between 1975 and 2010. The overall pattern over time was a low seroprevalence (average 1.2 %). The Western Arctic Herd (WAH), however, had a decline from 23 to 3 % in seroprevalence in the investigated period (logistic regression estimate of slope, 95 % CI = [-0.09, -0.04]). In the WAH, seropositives were found only among individuals above 23 months. Analysis of a sub-sample of individuals tested by several different serological tests showed good coherence between the tests.

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

Poster Title: EVALUATION OF STRESS IN CARIBOU *(RANGIFER TARANDUS GRANTI)* ATTRIBUTED TO DIFFERENT CAPTURE METHODS

Authors: Kimberlee Beckmen[1] and Marianne Lian[1,2].
[1]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, AK, 99701, USA
[2]Department of Forestry and Wildlife Management, Faculty of Applied Ecology and Agricultural Sciences, Hedmark University College, Campus Evenstad, NO-2480 Elverum, Norway

Caribou *(Rangifer tarandus granti)* are routinely live-captured in Alaska for research and management. Capture methods varies from chemical immobilization with a dart gun from helicopter, net-gunning from helicopter or hand-capture from boats during a river crossing. We evaluated the effect of different capture methods on selected blood constituents known to be influenced by stress. Venous samples were collected from the jugular or cephalic vein, from caribou captured with net-gun (NG, N =28), hand-captured (HC, N = 20) or darted from a helicopter with carfentanil/xylazine (CX, N = 54), medetomidine/ketamine (MK, N = 9) or thiafentanil/azaperone/xylazine (TAX, N = 8). To quantify stress, blood constituents used included lactate and creatine kinase (CK). Use of a hand-held lactate monitor was validated for field use in caribou with a significant correlation to laboratory serum lactate ($P<0.05$). Lactate was increased in all groups, and significantly increased ($P = 0.001$) in both NG and HC, compared to chemical immobilization via helicopter darting. Mean±SD (range) for lactate was 4.9±2.7 (1.0 -

13.0) for CX, 4.8±2.0 (2.4 - 7.4) for MK, 4.3±1.1 (2.8 - 6.0) for TAX, all measured in field, and 21.7±5.6 (12.4 - 31.2) for NG and 18.4±7.6 (6.6 - 42.8) for HC both measured in lab. We found a significant correlation ($P<0.05$) between increased lactate values and chase time. CK was increased in all groups, with a trend of highest increase in the hand-captured group. However, this was not proven statistically ($P = 0.063$). Physically restrained caribou had lactate levels four times higher than chemically immobilized caribou. This indicates that physical restraint causes more distress for caribou than helicopter darting and thereby may present a higher risk for capture myopathy. Further, our findings show that longer chase times increases lactate, and we recommend that concentrated pursuit of individual caribou be kept <2 minutes.

Poster Title: *PASTEURELLA MULTOCIDA* CAUSES MARINE BIRD MORTALITY IN THE BERING STRAIGHT REGION OF ALASKA

Authors: Barbara Bodenstein[1], Kimberlee Beckmen[2], Gay Sheffield[3], Kathy Kuletz[4], Caroline Van Hemert[5], Valerie Shearn-Bochsler[1], David Blehert[1]

[1] U.S. Geological Survey, National Wildlife Health Center, 6006 Schroeder Rd., Madison, Wisconsin, USA

[2] Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, Alaska, USA

[3] University of Alaska Fairbanks, Marine Advisory Program, Pouch 400, Nome, Alaska, USA

[4] U.S. Fish and Wildlife Service, Migratory Bird Management, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska, USA

[5] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska, USA

Abstract: Avian cholera has long been documented as one of the most significant infectious diseases of wild birds throughout the lower 48 United States and Canada , causing large scale mortality in waterfowl and other water birds. The disease is caused by the highly contagious bacterium *Pasteurella multocida*. Here we describe an unusual mortality event in marine birds along the northern coast of Saint Lawrence Island, Alaska, caused by infection with *Pasteurella multocida.* The event occurred in late November 2013 and involved Crested Auklet (*Aethia cristatella*), Thick-billed Murre (*Uria lomvia*), Northern Fulmar (*Fulmarus glacialis*) and Common Eider (*Somateria mollissima*). This mortality event was the first confirmed report of avian cholera in Alaska involving these species. Other species may have been involved but evidence (carcasses) could not be obtained. The closest geographical avian cholera outbreak was reported on Banks Island, Northwest Territories, Canada, and involved Lesser Snow Geese (*Chen caerulescens*) (1995-1996). Other outbreaks have been reported in Common Eiders (*Somateria mollissima*) on East Bay Island, Nunavut, Canada, (2005) and in the Baltic Sea (1998). The disease was also reported in Common Murre (*Uria aalge*) in the Baltic Sea (1998). Many marine birds, including the world population of threatened Spectacled Eiders (*Somateria fischeri*) overwinter around Saint Lawrence Island. Native Alaskans from the remote communities of Savoonga and Gambell who rely almost exclusively on marine wildlife, including seabirds, for food were the first to report and respond to this event. They collected specimens for diagnostic evaluation and documented the size and scope of the mortality event. They surveyed a total of 21 km of

shoreline and recorded 912 bird carcasses. By extrapolation to the immediate area, a conservative estimate of 7, 000 birds died, but mortality may have been considerably higher than this given weather and shoreline conditions during the survey.

Alaska Marine Science Symposium, Anchorage, January 2015
Presentation Title: Live capture and disentanglement of Steller sea lions in Southeast Alaska
Authors: Lauri Jemison, Kate Savage, Justin Jenniges, Mike Rehberg, Marty Haulena, Kimberlee Beckmen, Kim Raum-Suryan, Greg Snedgen, Dennis McAllister, Neil Barten, Betsy Van Burgh, Chad Rice
Abstract: Entanglement in marine debris and ingestion of fishing gear contribute to Steller sea lion (SSL) injury and mortality. In Southeast Alaska, from 2000-2014 we photo-documented ~330 live SSLs that were entangled in marine debris, most with debris encircling and cutting into their necks. Entangling debris may cause respiratory distress, lacerations, and infection, with eventual death possible through strangulation, starvation, or drowning. Short of removing the material, there is little that can be done for animals with a durable neck entanglement. We additionally documented ~ 385 SSLs that had ingested fishing gear, including lures (e.g., flasher, spoon) hanging out of the animal's mouth, presumably with an ingested hook in esophagus or stomach. SSLs with these ingestions also face injury and possible death. Historically, getting close enough to remove these entanglements has not been possible. However, recent development of a drug combination that allows for sedation without respiratory compromise has enabled targeted captures of hauled out SSLs. In 2013-2014, Alaska Department of Fish and Game researchers and veterinarians from the National Marine Fisheries Service and Vancouver Aquarium chemically immobilized three entangled animals; entanglement/gear was removed from two and a satellite tag attached to one animal. We have been actively involved with educating the public about impacts of entangling debris on marine animals. The separate problem of SSL-fishery interactions in Southeast Alaska may be increasing, to the detriment of both SSLs and fishermen who lose gear, money, and time. Currently there are no legally approved, non-harmful methods of deterrence that we can suggest to fishermen, leaving them to suffer losses without compensation or even a clear means to reduce those interactions. We believe the survival of SSLs that ingest fishing gear may be increased by modifying gear, including creating a weak link between the hook and the lure. We hope to test this idea by removing lures/flashers from SSLs and attaching transmitters to track their survival. This may help in the short term by reducing SSL injury and some loss of gear (lures) for fishermen, but what is needed is a non-harmful deterrent that prevents SSLs from interacting with fishing gear.

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

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

Provided advice, consultation, and services to Division staff and the public related to wildlife capture, disease, mortality, euthanasia, and zoonotic disease risk/diagnosis.

- Conducted two 5-day courses in Chemical Immobilization of Wildlife for DWC staff (30 participants).

- Developed and updated drug dosing/capture protocols for ACUC Capture manual.

- Developed tooth removal protocols.

- Reviewed ACUC protocols for drug doses and veterinary procedures.

- Trained DWC staff in the handling of Controlled Substances in accordance with changes in DEA regulations. Updated/revised drug handling manual to comply with federal regulation changes.

- Addressed public concerns about wildlife disease, parasites, and lesions in game meat, zoonotic diseases, and animal welfare. Responded to walk-ins, phone calls, e-mails, and public information requests. Provided updates for the Alaska Dept of Fish and Game website on Wildlife Diseases and parasite

- Presented workshops for dog owners on protecting pets from wildlife disease risk and the recent tick invasion, removing pets from traps/snares, first aid and CPR on pets. Provided public outreach materials including FAQs on rabies, Tularemia, Q-fever and Avian Cholera.

- Continued to review staff training and supply preparations for responding to wildlife caused human morbidity and mortalities.

- Provided multiple training seminars in Animal Welfare Policy, Wildlife Diseases and Parasites, Drug Handling and Chemical Immobilization training via DWC Vimeo.

- Updated Drug/capture training and informational materials for the public on wildlife disease on the Sharepoint website.

- Prepared capture and sampling supplies for ~12 capture events (including moose and caribou) and supported 50 personnel days to assisting biologists with captures and/or sample collection. Of those 32 were for wood bison restoration.

- Wood Bison Reintroduction: provided veterinary advice and staff to perform disease testing, blood analysis, anesthesia assistance/monitoring. Compiled health and husbandry data for a final assessment of captive management.

- Provided veterinary care and advice for husbandry for the captive animals at the Moose Research Center, Palmer moose and caribou facility, the Alaska Wildlife Conservation Center, and Moose Mamas.

- Orphan Moose: Collected samples for disease and health assessments, processed blood for clinical health parameters and trace mineral assays to be correlated with hand-rearing outcomes and survival. Drafted report.

- Advised the DWC Permit office on disease testing requirements for the import and holding of wildlife.

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.

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.
    - Attend remotely and presented at the Animal Determinants of Emerging Disease Seminar Series “Zoonoses” rounds.
    - Participate as a member of the Wildlife Health Committee of AFWA, WAFWA, the Alaska One Health Group, Marine Mammal Health MAP Data committee, and other subcommittees related to wildlife health and zoonotic disease. Report pertinent issues to DWC staff.

- Attended the Alaska Veterinary Medical Association meeting in Anchorage (Sept 2014) and Wildlife Disease Association Annual meeting (July 2014) to obtain continuing education credits required for maintenance of Alaska veterinary licensure.
- Co-authored the "Best Practices for Management and Use of Controlled Substances for Fish and Wildlife Management Agencies"
- Attended UAF Department of Veterinary Medicine staff meeting on the development of the curriculum for the new Vet Med program.
- Established relationships with the UAF DVM program pathologist and anatomist for the benefit of shared research, teaching and disease surveillance goals.

- Trained 3 college interns who are primarily involved with assisting in necropsy, processing blood/tissues samples, archiving/inventory/shipment of samples and preparing field supplies.

Federal funds were used to pay for salaries, supplies, services, and some travel costs for this work.

V. PUBLICATIONS

Published (attached as appendices by number):

1. Atwood, Todd; Elizabeth Peacock; Kathy Burek-Huntington; Valerie Shearn-Bochsler; Barbara Bodenstein, **Kimberlee Beckmen,** and George Durner. 2015. Prevalence and Spatio-Temporal Variation of an Alopecia Syndrome in Polar Bears of the Southern Beaufort Sea.*Journal ofWildlife Diseases* 51(1):48-59

2. Woldstad, Theresa M. Kimberly N. Dullen, Kris J. Hundertmark, and **Kimberlee B. Beckmen**. 2014. Restricted evaluation of *Trichodectes canis* (Phthiraptera: Trichodectidae) Detection Methods in Alaska gray wolves. International Journal for Parasitology: Parasites and Wildlife 3 (2014), pp. 239-241 DOI information: 10.1016/j.ijppaw.2014.08.002.

3. Schürch, Anita C; Debby Schipper; Maarten A Bijl; Jim Dau; **Kimberlee B Beckmen**; Claudia M.E. Schapendonk; V Stalin Raj; Albert D.M.E. Osterhaus; Bart L Haagmans; Morten Tryland; Saskia L Smits. 2014. Metagenomic survey for viruses in Western Arctic Caribou, Alaska, through iterative assembly of taxonomic units. PLOS ONE DOI: 10.1371/journal.pone.0105227.

Accepted:

Title: Avian Cholera Causes Marine Bird Mortality in the Bering Sea of Alaska

Authors: Barbara Bodenstein,[1,6] Kimberlee Beckmen,[2] Gay Sheffield,[3] Kathy Kuletz,[4] Caroline Van Hemert,[5] Brenda Berlowski,[1] and Valerie Shearn-Bochsler[1]
[1]US Geological Survey, National Wildlife Health Center, 6006 Schroeder Rd., Madison, Wisconsin 53711, USA; [2]Alaska Department of Fish and Game, Division of Wildlife Conservation, 1300 College Road, Fairbanks, Alaska 99701, USA; [3]University of Alaska Fairbanks, Marine Advisory Program, Pouch 400, Nome, Alaska 99762, USA; [4]US Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Rd., Anchorage, Alaska 99503, USA; [5] US Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, USA; [6]Corresponding Author (email: bbodenstein@usgs.gov)
ABSTRACT: The first known avian cholera outbreak among wild birds in Alaska occurred during November 2013. Liver, intestinal, and splenic necrosis consistent with avian cholera was noted and *Pasteurella multocida* serotype 1 was isolated from liver and lung or spleen in *Aethia cristatella*, *Uria lomvia*, *Somateria mollisama*, *Fulmarus glacialis, Larus glaucescens*. Journal of Wildlife Diseases

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. 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. A veterinary technician stationed in Anchorage or Palmer, and a Collections Manager in Fairbanks would allow the program to fulfill the demands for service. 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: 9/1/2015

Attachments: Appendix1-3 : PDFs of publications