Alaska Department of Fish and Game
Division of Wildlife Conservation
2007

Wildlife Health and Disease Surveillance in Alaska

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Research Annual Performance Report
16 May 2003 – 30 June 2007
Federal Aid in Wildlife Restoration
Grants W-33-1 through W-33-4
Project 18.73

This is a progress report on continuing research. Information may be refined at a later date.

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FEDERAL AID
FINAL RESEARCH PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
Juneau, AK 99802-5526

PROJECT TITLE: Wildlife Health and Disease Surveillance in Alaska

PRINCIPAL INVESTIGATOR: Kimberlee Beckmen

COOPERATORS: US Department of Agriculture, Alaska Department of Environmental Conservation, University of Alaska Fairbanks, National Marine Fisheries, National Marine Mammal Laboratory, Alaska Department of Health and Human Services, U.S. Fish and Wildlife Service, The North Slope Borough, University of Connecticut and the University of Illinois

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR.: Initiated under W-33-1, W-33-2, W-33-3, completed under W-33-4

PROJECT NUMBER:18.73

WORK LOCATION: Alaska, Statewide

STATE: Alaska

PERIOD:16 May 2003 - 30 June 2007

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

The American public demand is high for wildlife populations which are healthy, abundant and available for both consumptive and non-consumptive uses. Alaskans have become increasingly concerned about the health of wildlife and how diseases and parasites not only adversely effect wildlife but how diseases and parasites in the animals they come in contact with can affect them. Not only is the concern about the fitness of wild foods for human consumption but also how the wildlife diseases can be indicators of pollution or degradation of ecosystems on which we depend. Recently, the threat of animal transmitted diseases such as West Nile Virus and highly pathogenic avian influenza have further heightened public and scientific interest (Guphill *et al.* 2003). Disease and parasites are not static in wildlife populations and must be continually studied, surveyed, and monitored to understand trends, recognize outbreaks, assess impacts on populations, and minimize impacts on wildlife, livestock and people (Spalding and Forrester 1993).

The Animal Welfare Policy of the DWC stipulates that all research and management uses of live mammals and birds will have oversight by the Division's Animal Care and Use Committee and attending/staff veterinarian. Additionally, the DWC Drug Policy as well as State and Federal regulations necessitate the oversight of the attending/staff veterinarian in all aspects of veterinary care and administration of immobilizing drugs to wildlife in the course of Division research and management activities.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Diseases and parasites in wildlife are becoming increasing understood as important mitigating factors in free-ranging wildlife populations (Daszak *et al*. 2000; Nettles 1992). Although some level of parasite infestation may be 'normal', it is now recognized that diseases and parasites are having significant impacts on the health of wild populations including population growth rates (Lyles and Dobson 1993). In more and more cases, the introduction of disease has expatriated population and even driven species extinct (Daszak *et al.* 2000).

Theoretical studies suggest that infectious diseases including parasites regulate host abundance by exerting density-dependent effects on reproduction or survival (Anderson 1979). A few studies of terrestrial wildlife have shown that interactions between disease and factors such as host nutrition, behavior, genetics and climate can influence life history parameters and population dynamics (reviewed in Hudson *et al*. 2002). Such investigations depend upon concurrent monitoring of both infectious disease and host population dynamics.

The most dramatic, visible effect of disease on wildlife populations is the increase in mortality during an epizootic. For example, canine distemper dramatically reduced black-footed ferret (*Mustela nigripes*) populations in Wyoming, bringing them to extinction in the wild (Thorne and Williams 1988). The impacts of the waves of epizootics of West Nile Virus (WNV) on North American bird populations are likely to be significant to the population dynamics of some species. It is noteworthy that the recognition of WNV as the cause of an epidemic of encephalitis among humans was subsequent to the detection of WNV as the agent causing widespread deaths of American crows by veterinary pathologists.

Movement of a pathogen-infected host into a previously unexposed (naïve) host population can result in severe epizootics of disease and can contribute to the competitive success of the invading host (Daszak *et al*. 2001). Movements of wildlife prompted by environmental changes, such global warming, can lead to movement of pathogens into susceptible host populations. For example, the 1988 PDV epidemic in the North Sea harbor seal population is believed to have been triggered by the southward movement of harp seals from the Barents and Greenland Seas, carrying the virus from where it was endemic into areas with a naïve population (Heide-Jorgensen *et al*. 1992). A dramatic reduction in the fish stocks in the Barents Sea in 1987 probably caused the harp seals to forage further south in search of prey. The common lungworm of Arctic seals, *Otostrongylus circumlitus*, has only recently been reported in the increasing northern elephant seal (*Mirounga angustirostris*) population in California, where it kills the host before reproducing (Gulland *et al*. 1997). This is probably a new host-parasite association, judging by the high pathogenicity and lack of transmission of the parasite before death of the host. It may be the result of expansion of the elephant seal population leading to increased range overlap with Arctic phocids.

Several parasites previously demonstrated to cause severe morbidity and mortality to moose or caribou have the potential to be readily translocated to Alaska. For example,

white-tailed deer were recently detected near Dawson City Yukon and if infected and moving into Alaska, that could introduce the parasite, *Paralephostrongylus tenius* with potentially devastating consequences to moose and caribou populations (Lankester & Samuel 1997). Likewise, moose winter tick, *Demacentor albipictus* has been demonstrated to be able to complete its life cycle in the environmental conditions of Alaska (Zarnke et al. 1990). All that is needed is a single tick infected cow, elk, or bison to be imported from Canada or the Lower 48.

Chronic Wasting Disease (CWD) is a transmittable disease that is not caused by an infectious organism. Sitka black tailed-deer are a type of mule deer and thus will likely is susceptible to the disease (Williams *et al.* 2002). There is an undetermined degree of risk that this disease could be, or may already have been, introduced into captive or free-ranging cervids in Alaska (Williams and Miller 2003). A high degree of vigilance, through the testing of dead animals, will be required to ensure early detection and prevent the spread of this deadly disease with free-ranging cervids in Alaska.

Alaskans are dependent on the presence of healthy wildlife populations managed for sustained yield for both subsistence and recreational needs. Understanding and monitoring diseases and parasites is a tool necessary to sustaining healthy wildlife populations. This includes not only infectious agents but also diseases caused by genetic, toxic, nutritional or other mechanisms. This information is especially critical when considering the manipulations of populations including translocations or re-introductions (Griffith *et al.* 1993). The maintenance of an adequate historic, baseline archive of tissue and serum is crucial to the success of future population genetics studies and disease diagnosis in the face of a new disease outbreak (Worley 1993). This project will continue to provide information that wildlife veterinarians and managers can use to critically understand the incidence and distribution of diseases and parasites in wildlife in Alaska (Biek *et al*. 2002; Burek *et al*. 2001; Chomel *et al*. 1995; Danner *et al*. 1998; O'Hara *et al*. 1998; Sheffield and Zarnke 1997; Zarnke *et al*. 1995; Zarnke *et al*. 2001; Zarnke *et al*. 2002; Zarnke *et al*. 1997c; Zarnke *et al*. 1997a; Zarnke *et al*. 1997b; Zarnke *et al*. 1999; Zarnke *et al*. 2000).

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: 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.

JOB/ACTIVITY 1: Implement Chronic Wasting Disease Surveillance Program.

In 2003, I formed and led the Alaska Chronic Wasting Disease (CWD) Task Force and developed the Alaska CWD Surveillance Plan. On behalf of the DWC, I drafted the Alaska CWD Surveillance in Free-Ranging Cervids Work plan each year and successfully obtained funding from the USDA to implement the work plan and surveillance activities. Along with pathology colleagues, I gave training on necropsy technique and CWD sample collection in Juneau, Anchorage, Soldotna and Fairbanks. I supervised technicians and a biologist to collect samples for testing from

hunter-harvested Sitka black-tailed deer and elk as well as from 'target' cervids which are found dead or have clinical signs compatible with CWD. We developed PSAs, brochures, posters, a website at **http://www.wc.adfg.state.ak.us/index.cfm?adfg=disease.cwd** and gave informational presentations to the public about the surveillance program and encouraged public and hunter participation. I drafted a policy for dealing with escaped privately-owned cervids which was adopted by the DWC.

To date in the CWD surveillance program, we've tested tissues from 1,680 Sitka Black-tailed deer, 61 elk, 39 caribou and 91 moose. All have been negative for CWD by the gold standard test, immunohistochemistry of the obex, retropharyngeal lymph node and tonsil. We have reached sufficient sample numbers of Sitka black-tailed deer on the island of Kodiak to be 99% confident that the population is CWD-free during this period.

Federal funds were used to pay salaries while working on this task.

JOB/ACTIVITY 2: Coordinate West Nile Virus surveillance of wild birds in Alaska.

In 2003, I began my tenure as the DWC member of the Alaska West Nile Virus (WNV) Surveillance Partners. Along with the Department of Health and Social Services Division of Epidemiology, I drafted and implemented a WNV surveillance program for Alaska and I coordinated the collection of dead wild birds (mainly corvids and raptors were targeted), submission of samples for testing at the Alaska State Virology Laboratory and created a summary report of the wild bird samples submitted for testing. Along with DHSS, we presented public service announcements, information pamphlets, brochures, a website at http://www.wc.adfg.state.ak.us/index.cfm?adfg=disease.wnv, and an email address about the program and to address public concerns or question. In 2004, the first year of implementation and testing for the program, 14 birds were tested and all were negative. In 2005, 36 birds were tested (all negative) and in 2006, 34 were tested (all negative). No testing was conducted in 2007 because the ASVL discontinued testing.

Federal funds were used to pay salaries while working on this task.

JOB/ACTIVITY 3: Maintain serum and tissue banks.

Blood and/or serum were accessioned into the archive from over 3,000 mammals and birds that are captured by ADFG personnel. Blood, serum or tissues as suitable were also collected at necropsy on specimens presented for postmortem examination. Samples were accessed to outside investigators and graduate students, including the University of Alaska Fairbanks Museum, who are working on collaborative projects with ADFG. Three publications resulted [Appendices 1, 2, and Happ et al 2007]. A computerized database was created so records and test results of archived samples can be easily queried electronically. An inventory of the serum and blood stored in the ultra-cold freezers was completed and samples from over 25,000 individual animals were recorded. Their locations in the freezer archive were entered to allow rapid location of samples. One ultra cold freezer broke down twice and was un-repairable so was replaced; samples were redistributed before thawing occurred.

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

JOB/ACTIVITY 4: Conduct disease and parasite surveillance.

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 were examined. Accessions exceeded 750 specimens. Gross diagnoses were assigned when possible and parasite identification or histopathological diagnoses were pursued on unusual cases or those with lesions of concern. Among the significant or interesting findings were: three parasites of moose not previously documented in Alaska were detected, the first case of avian tuberculosis in a free-ranging bird in Alaska was diagnosed, two outbreaks of tularemia (a reportable disease) detected, parasitic diseases and mineral deficiencies contributing to death were found in Dall's sheep and moose, and several malignant cancers in moose were described [Appendix 10, abstracts 13, 22]. Most significantly, an extension of the range of the biting dog louse on wolves was detected north of the Alaska range in 2004. This finding lead to the development of a more sensitive detection technique, expanded surveillance efforts and a new treatment/management experiment to mitigate lice infection on wolves. We also identified disease and parasite issues of concern in the population decline of the western stock of Steller sea lions and conducted further research into hookworm disease [Appendix 10, abstracts 7,8, 9, 10, 11, 14, 15, 16, 23, 26, 27]

Additionally, several die-offs were investigated including moose in GMU's 20D, 20A [Appendix 10, abstracts 13, 22] and Teshepuk caribou herd. A die-off of redpolls in the Fairbanks area was investigated and diagnosed as *E. albertii*, a bacterial pathogen that can cause fatal infections in infants but has never been detected in wildlife before and a publication is draft [Appendix 10, abstract 12]. A rabies epizootic in red and arctic foxes on the north and west coasts was investigated the winter of 2006-7. Carnivores that bit a pet, person or displayed signs suggestive of rabies that was presented for post-mortem examination was submitted for rabies testing at the Alaska State Virology Laboratory. Collaborations with UAF faculty to further define rabies and morbillivirus outbreaks in foxes were engaged.

The possible role of disease in the decline in bison was investigated though a large serosurvey in 2004. Fecal samples from moose, caribou and bison were submitted for Johne's disease surveillance from 2003 to 2006. Serosurveillance for a number of potentially significant pathogens to wildlife were conducted on archived and incoming sera. An expansion of the distribution of *Brucella, Neospora, Toxoplasma* and bovine respiratory complex viruses were detected [Appendix 10, abstract 17].

A health assessment and calf mortality study of the North Alaska Caribou herd was conducted which detected severe parasite effects and potentially important disease and nutritional problems [Appendix 10, abstract 17]. A preliminary report is attached [Appendix 3]. These are being further investigated was well as a parasite treatment trial conducted. A herd health assessment for the Mulchatna herd was initiated. A review of muskox serology and pathology was undertaken to develop a investigation plan for the recent population decline [Appendix 4]. Routine surveillance as well as submission to research projects on avian influenza was instituted for all suitable avian carcasses. I participated on the Alaska Avian Influenza Information and

Communication Committee and the Interagency Committee that developed the An Early Detection System for Highly Pathogenic H5N1 Avian Influenza in Wild Migratory Birds U.S. Interagency Strategic Plan. I developed our DWC avian mortality and morbidity investigation plan [Appendix 5].

Three training workshops were held (in Juneau, Fairbanks and Anchorage) to train more than 30 wildlife biologists and technicians on necropsy technique and proper tissue sample collection/preservation. Dr. Beckmen attended a 1-day workshop on recognition and diagnosis of foreign animal diseases and was designated the State Wildlife Liaison by the USDA.

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

JOB/ACTIVITY 5: Monitor levels of contaminants in species of concern.

Hair for mercury and other heavy metal determination were collected from bears, wolves, coyotes, Steller sea lions, marten, lynx, moose, and caribou. Fat biopsies were collected via biopsy from black bears, grizzly bears and Steller sea lions for organochlorine analysis. Hair, blood, liver, kidney and bone were collected for trace minerals and metals analysis on Dall's sheep, moose, muskoxen and caribou. Wolf kidneys were collected per an outside institution request for organochlorine contaminants. Fresh and frozen caribou blood samples were submitted to the University of Illinois for cholinesterase determination to establish normal baselines for the future diagnosis of organophosphate toxicity.

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

JOB/ACTIVITY 6: Review literature, preparing reports and manuscripts, and travel.
Progress reports were generated for Federal Aid and CWD Surveillance program [Appendices 5-8] as well as periodic reports on disease surveillance activities. Six manuscripts were published are listed in section VII and attached as cited. Two manuscripts were submitted that have not yet been accepted:

Wobeser, G., T. Bollinger, A. Neimanis, and K.B. Beckmen. Dermoid Cysts in Caribou. Journal of Wildlife Diseases.

ABSTRACT*:* Subcutaneous dermoid cysts were identified in eight wild caribou (*Rangifer tarandus*) from northern Canada and one wild caribou from Alaska. The dermoid cysts from Canadian caribou were found among 557 diagnostic specimens that had been detected by hunters and submitted by resource officers and biologists between 1 January 1966 and 15 May 2007. All of the cysts were located in the cervical region and five of nine were found in the throat area. Dermoid cysts were not diagnosed in any of 1108 white-tailed deer (*Odocoileus virginianus*), 293 mule deer (*Odocoileus hemionus*), 174 elk (*Cervus elaphus*) or 529 moose (*Alces alces*) examined during the same period at the Canadian laboratory.

Beckmen, K.B., K.W. Pitcher, K.A. Burek, and G.M. Ylitalo. Organochlorine contaminant concentrations in scats collected from Steller sea lion (*Eumetopias jubatus*) rookeries. Marine Pollution Bulletin. Organochlorine contaminant

concentrations in scats collected from Steller sea lion (*Eumetopias jubatus*) rookeries. Marine Pollution Bulletin.

ABSTRACT: Adult female Steller sea lion (*Eumetopias jubatus*) scats (feces) were collected from 20 rookeries over 4 years (1998-2001) to determine the levels of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in the northern portion of the thriving eastern stock in Southeast Alaska/British Columbia (SE/BC) as compared to the depleted western stock in Gulf of Alaska (GOA) and eastern Aleutian Islands (EAI). Concentrations of OCs in scats were used as a semi-quantitative indicator of recent exposure reflecting excretion of PCBs congeners in addition to recent dietary intake. The rank order of mean OC concentrations in scats was EAI > SE/BC > GOA. These data suggest that exposure to the OCs is elevated in portions of the range of the declining western stock of Steller sea lions. These findings also show that scat can be used a non-invasive indicator of contaminant exposure.

One publication has been accepted:

Kutz, S.J., I. Asmundsson, E.P. Hoberg, G.D. Appleyard, E.J. Jenkins, K. Beckmen, M.. Branigan, L. Butler, N. B. Chilton, D. Cooley, B. Elkin, F. Huby-Chilton, D. Johnson, A. Kuchboev, J. Nagy, M. Oakley, R. Popko, A. Scheer, M. Simard, A. Veitch. In Press. Serendipitous discovery of a novel protostrongylid (Nematoda: Metastrongyloidea) in caribou (*Rangifer tarandus*), muskoxen (*Ovibos moschatus*) and moose (*Alces americanus)* from high latitudes of North America based on DNA sequence comparisons. Canadian Journal of Zoology.

ABSTRACT: Many protostrongylid nematode species produce dorsal spined larvae (DSL) that are shed in feces of wild ungulates. Definitive identification of DSL is rarely possible through comparative morphology and often, fecal samples are the only feasible means to assess the distribution of these nematode parasites in wildlife. In the present study, molecular techniques were employed to differentiate among protostrongylid species using DNA from individual larvae obtained in geographically extensive surveys. Partial sequences from the second internal transcribed spacer region (ITS-2) of the nuclear ribosomal DNA were used to differentiate DSL recovered from feces of caribou (*Rangifer tarandus tarandus, R. t. caribou, R. t. grantii* (Linnaeus, 1758)), muskoxen (*Ovibos moschatus moschatus* and *O. m. wardi* (Zimmerman, 1780)), and moose (*Alces americanus gigas)* in the North American Arctic and Subarctic. A previously uncharacterized and genetically distinct species was recognized based on the ITS-2 sequences of 37 DSL from 19 ungulate hosts across a range extending from Alaska to Labrador and 1 third stage larva from a slug (*Deroceras laeve*) collected in the Mackenzie Mountains, Northwest Territories. Sequence similarity among individuals of this putative species was 91-100%. For many individual DSL, paralogues of ITS-2 were detected. The ITS-2 sequences from this putative species were 72-77% similar to those of *Varestrongylus alpenae*, 58-61% similar to those of elaphostrongylines (*Elaphostrongylus* spp. and *Parelaphostrongylus* spp.), and 51-60% similar to those of other protostrongylids known in North American and some Eurasian ungulates. The sequence results indicate a discrete lineage of a currently undescribed protostrongylid, infecting

muskoxen, caribou and moose across northern North America. Sympatric infections with *P. andersoni* were demonstrated in two caribou herds.

Two additional manuscripts have been drafted and are in review with the co-authors agencies prior to submission to journals:

Beckmen, K.B., K.A. Burek, K.W. Pitcher, G.M. Ylitalo, and B.S. Fadely. Organochlorine contaminant concentrations in multiple tissue matrices of live Steller sea lions (*Eumetopias jubatus*) in Alaska. Organochlorine contaminant concentrations in multiple tissue matrices of live Steller sea lions (*Eumetopias jubatus*) in Alaska.

ABSTRACT: Blood, blubber, milk, and feces were collected from 53 free-ranging and 3 captive Steller sea lions (*Eumetopias jubatus*) in Alaska over 6 years (1998-2003) to assess exposure of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in these animals. The relationships of various OC contaminants in multiple matrices from individuals were examined to determine the appropriate matrix for exposure monitoring in live animals and to minimize invasive sampling techniques. Concentrations of certain OC contaminants in blubber, milk and blood were highly correlated within individuals; however fecal concentrations were only correlated with those measured in blood. These findings indicate that a whole blood sample may be the best alternative as a less-invasive indicator of relative contaminant exposure in lieu of surgical blubber biopsy. Feces may be used a non-invasive monitoring tool of relative OC exposure without direct handling of animals for sample collection.

Beckmen, K.B., K.A. Burek, K. W. Pitcher, G. M. Ylitalo, and B.S. Fadely. Organochlorine contaminant concentrations in blubber of free-ranging Steller sea lion (*Eumetopias jubatus*) pups and juveniles in Alaska.

ABSTRACT: Blubber samples were collected by surgical biopsy and necropsy from 145 free-ranging pup and juvenile Steller sea lions (*Eumetopias jubatus*) in Alaska over 6 years (1998 - 2004) to assess exposure of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in the stable eastern stock in Southeast Alaska (SE) as compared to the depleted western stock in Gulf of Alaska (GOA) and eastern Aleutian Islands (EAI). Results of a rapid OC screening were used to assess exposure of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in dependent pups through subadults in consideration of developmental age. Transplacental transfer of OCs was extremely low. Concentrations of OCs peaked in pups sampled between 2 weeks and 1.5 months of age and declined by midway through the suckling period and then increased again through the first year of the dependent period and though the presumed weaning period. Pesticides and brominated di-benzo furans were determined by GC/MS in 25 and 15 animals respectively, including 4 that were sampled at 5 month intervals. These data suggest that exposure to the OCs is at a level of concern especially in young pups in portions of the range of the endangered western stock of Steller sea lions.

I attended several major international meetings, conferences, or symposia to present research findings and received continuing education credits required to retain veterinary licensure in Alaska. In chronological order these meetings included:

- 52nd Annual Wildlife Disease Association Conference, Presenter and continuing education recipient, Aug 11-14, 2003, Saskatoon, SK Canada
- International Workshop on Chronic Wasting Disease, Aug 15, 2003, Western College of Veterinary Medicine, Canadian Cooperative Wildlife Health Centre, Saskatoon, SK
- XV Biennial Conference of Marine Mammals, presenter, Dec 14-19 2003, Greensboro, NC
- Steller Sealion Epidemiology Workshop, Presenter and Participant, Jan 2004, Seward AK.
- American Association of Zoo Veterinarians/American Association of Wildlife Veterinarians/Wildlife Disease Association Joint Conference, Presenter and Continuing Education recipient, Aug 28-Sept 3, 2004, San Diego CA
- Sealions of the World, 22nd Wakefield Symposium, presenter, Sept 30-Oct 3 2004, Anchorage AK
- West Coast Marine Mammal Health and Disease Workshop, participant, Northwest Fisheries Science Center, Nov 8-9, Seattle WA
- 16th Biennial Conference of Marine Mammals, Presenter and Continuing Education recipient Dec 12-16 2005, San Diego CA
- Alaska Stranding Network Meeting, Feb 1-4 2006, Participant, Anchorage, AK
- American Association of Zoo Veterinarians/American Association of Wildlife Veterinarians/Nutrition Advisory Group Joint Conference, Presenter and Continuing Education recipient, Oct 16-21 2005, Omaha NE
- 55th Annual Meeting of the Wildlife Disease Association, Presenter and Continuing Education recipient, Aug 6-10 2006, Storrs CN
- The Wildlife Society 13th Annual Conference, Symposium chair and Presenter, Aug 24-26 2006, Anchorage AK
- Alaska Rabies Summit. Attendee. December 11, Anchorage AK.

Abstracts for presentations/posters and co-authored presentations/posters are attached [Appendix 10]. I kept abreast of current research in wildlife disease through the literature.

- Training and teaching that was attended or presented are listed below in chronological order:
- Chronic Wasting Disease Surveillance Training, Attendee, Sept 25-30, 2003. Kodiak AK.
- Necropsy, Diagnostic & CWD Sampling Workshop for Wildlife Biologists, Instructor, April 28-29, 2004. Anchorage AK.
- IACUC 101 Workshop, Presenter/Moderator, May 13, 2004. Fairbanks AK

- Research with Free-Ranging Wildlife Workshop, Presenter and participant, May 14, 2004. Fairbanks AK
- Foreign Animal and Emerging Disease Recognition and Response Plan Training. Participant and Continuing Education recipient, June 19, 2004. Fairbanks AK.
- Necropsy, Diagnostic & CWD Sampling Workshop for Wildlife Biologists, Instructor, July 15-16, 2004. Juneau AK
- Necropsy, Diagnostic & CWD Sampling Workshop for Wildlife Biologists, Instructor, October 25-26, 2004. Soldotna AK
- Necropsy, Diagnostic & CWD Sampling Workshop for Wildlife Biologists, Instructor, Jan 12-14, 2005. Fairbanks AK
- Wildlife Disease Seminar, Participant and Continuing Education recipient, May 17-19, 2005. Georgia Center for Continuing Education, Athens GA
- Wildlife Immobilization Workshop, Instructor, March 14-15, 2006. Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks AK
- Advanced Immobilization Field Techniques Laboratory, Instructor, March 1, 2007. Anchorage AK
- Diagnostic Pathology of the disease of Aerial, Terrestrial and Aquatic Wildlife, Attendee Continuing Education recipient, April 4-6, 2007. Davis Foundation, Madison WI.

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

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

I trained, assisted and conducted wildlife capture operations. I purchased, prescribed and dispensed animal capture drugs to DWC personal. I gave advice and information to the public and DWC employees related to wildlife health and zoonotic diseases via personal contact in the office, on the phone and through the media. I installed a new DWC Animal Care and Use Committee (ACUC) and served as chair as well as the attending veterinarian for the committee to assure Division compliance with the Animal Welfare Act. I conducted a veterinary review of all (98) Assurances of Animal Care Protocols submitted to the DWC ACUC prior to committee review. I've developed or co-developed numerous handouts and information documents on wildlife health and zoonotic disease issues. I have developed a strong relationship as a liaison between ADF&G and the Department of Health and Human Services/Division of Epidemiology and the Division of Environmental Conservation/Office of the State Veterinarian.

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

IV. MANAGEMENT IMPLICATIONS

Detection of the introduction of new diseases or parasites, expansion of geographic or host range, and the presence of zoonotic diseases all can have management implications. Continued intense surveillance for introduction of Chronic Wasting Disease, Moose Winter Tick, Johnes Disease, West Nile Virus, Mycoplasma pneumonia of sheep, brain worm, highly pathologic avian influenza are most critical. The routine examination of found dead wildlife and identification of parasites are crucial to these efforts. Since the

institution of our CWD surveillance program, we can be highly confident at this time that we do not have CWD present in Sitka black-tailed deer in the Kodiak Archipelago. However, continued surveillance must be maintained because of the threat of captive elk on Kodiak that are recently imported and of unknown status. Other populations of wild cervids have not reached sampling levels sufficient to have confidence in our negative results. If CWD were to be detected, it would necessitate immediate, wide scale management actions by the department and plans for these scenarios must be planned for. Likewise, the detection of any of the other diseases mentioned above would likely necessitate quick and decisive management actions by the department.

The disease surveillance program has lead to the detection of the expansion of the range of the biting dog louse on wolves north of the Alaska Range. This has lead to a preliminary and on-going study of a new method for remote delivery of oral treatment to mitigate the effects on wolves. This method appears to be more effective and much less expensive to administer than previous attempts at lice eradication. If this study proves the method to be efficacious, it may be considered as a management tool to increase pelt quality of wolves in lice infected packs and thus maintain or enhance trapping effort in these areas.

The health assessment of Northern Peninsula Caribou Herd revealed severe parasite and nutritional problems as well as overwhelming neonatal calf mortality due to predation. A field study to examine the effect of treatment of parasite burden with ivermectin (removing the small stomach worm, *Ostertagia*) may provide information on the efficacy of treatment to boost calf production, survival and herd health. The decline in this population is so severe; all hunting including subsistence was halted. Without drastic measures, it appears this population may decline to unrecoverable levels. Understanding the role that this parasite plays in the health and survival of caribou may be key to mitigating the decline in conjunction with management of predation.

The studies of trace mineral status and disease/parasites of Dall's sheep and muskoxen are in preliminary stages. However, these studies will be important to determine if nutritional, infectious diseases or parasites are contributors to population declines or reproductive suppression. Depending on the responsible factors, management actions to supplement, treat or prevent spread of disease may be viable management tools for these populations. First and foremost, the significance of the effects of these factors on population health must be investigated.

V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY

JOB/ACTIVITY 1: Implement Chronic Wasting Disease Surveillance Program.

Obtained funding to conduct CWD surveillance during the period by submission of a new work plan to USDA for Federal FY06 and establishment of a cooperative agreement and transfer of funds for the Federal FY06. Continued a cooperative agreement with the Department of Environmental Conservation to establish hunter-harvest surveillance on deer and elk in southeast Alaska. I supervised the biologist in charge of hunter-harvest surveillance activities. Brain and tissue samples were collected from 519 cervids killed by hunters and submitted for testing during the period. Besides hunter-harvest surveillance 27 detailed necropsies and testing were conducted on target animals (found dead with signs

compatible with CWD). The new CWD work plan for Federal FY07 was developed, submitted and accepted by USDA.

Federal funds were used to pay salaries while working on this task.

JOB/ACTIVITY 2: Coordinate West Nile Virus surveillance of wild birds in Alaska.

During this period, carcasses from 19 corvids and raptors were collected, necropsied and sampled for West Nile Virus testing at the ASVL. All PCR tests for WNV were negative. I worked with the DHSS Division of Epidemiology to compile and annual report of 2006 WNV surveillance activities.

Federal funds were used to pay salaries while working on this task.

JOB/ACTIVITY 3: Maintain serum and tissue banks.

During the period, over 500 samples were accessioned and processed for archiving. Serum from collaborating organizations including the USFWS, National Park Service Yukon Dept of the Environment, Togiak, Kodiak, Alaska Peninsula/Becharof National Wildlife refuges (NWRs) and the North Slope Borough were accepted for archiving and disease surveillance. More than 20 requests for blood, serum or tissue requests were filled for researchers within ADFG or at other institutions including UAF Wildlife Toxicology, UAF Institute of Arctic Biology, University of Tennessee and University of Connecticut. Fifty moose serum samples sent out for pregnancy tests at the request of biologist.

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

JOB/ACTIVITY 4: Conduct disease and parasite surveillance.

Two hundred and fifty carcasses or tissue specimens were submitted for examination and diagnosis. Thirty shipments of serum and tissues for diagnostic purposes were submitted. Twenty three carcasses of red and arctic foxes were necropsied and tested for rabies and an epizootic of rabies and morbillivirus (distemper) was detected. I completed serum and tissue collections on two projects on caribou herd health and disease assessments. Routine surveillance as well as submission to research projects on avian influenza was instituted for all suitable avian carcasses. I developed an avian mortality and morbidity investigation plan for the Division [Appendix 5]. Federal funds were used to pay salaries, supplies and services on this task.

JOB/ACTIVITY 5: Monitor levels of contaminants in species of concern.

Tissues of caribou, moose, Dall sheep and muskox were examined for trace minerals and heavy metals. No heavy metal (mercury, cadmium, zinc, and iron) levels of concern were detected however, trace element deficiencies (copper and selenium) were. Preliminary results and interpretations were reported [Appendix 11]. Federal funds were used to pay salaries, supplies and service on this task.

JOB/ACTIVITY 6: Review literature, preparing reports and manuscripts, and travel.

Progress reports were generated for CWD Surveillance program [Appendix 9] as well as periodic reports on disease surveillance activities [Appendices 4, 11]. Six manuscripts were

published are listed in section VII and attached as cited. Two manuscripts were written, revised and submitted that have not yet been accepted:

Wobeser, G., T. Bollinger, A. Neimanis, K.B. Beckmen. Dermoid Cysts in Caribou. Journal of Wildlife Diseases.

ABSTRACT*:* Subcutaneous dermoid cysts were identified in eight wild caribou (*Rangifer tarandus*) from northern Canada and one wild caribou from Alaska. The dermoid cysts from Canadian caribou were found among 557 diagnostic specimens that had been detected by hunters and submitted by resource officers and biologists between 1 January 1966 and 15 May 2007. All of the cysts were located in the cervical region and five of nine were found in the throat area. Dermoid cysts were not diagnosed in any of 1108 white-tailed deer (*Odocoileus virginianus*), 293 mule deer (*Odocoileus hemionus*), 174 elk (*Cervus elaphus*) or 529 moose (*Alces alces*) examined during the same period at the Canadian laboratory.

Beckmen, K.B., K.W. Pitcher, K.A. Burek, and G.M. Ylitalo. Organochlorine contaminant concentrations in scats collected from Steller sea lion (*Eumetopias jubatus*) rookeries. Marine Pollution Bulletin. Organochlorine contaminant concentrations in scats collected from Steller sea lion (*Eumetopias jubatus*) rookeries. Marine Pollution Bulletin.

ABSTRACT: Adult female Steller sea lion (*Eumetopias jubatus*) scats (feces) were collected from 20 rookeries over 4 years (1998-2001) to determine the levels of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in the northern portion of the thriving eastern stock in Southeast Alaska/British Columbia (SE/BC) as compared to the depleted western stock in Gulf of Alaska (GOA) and eastern Aleutian Islands (EAI). Concentrations of OCs in scats were used as a semi-quantitative indicator of recent exposure reflecting excretion of PCBs congeners in addition to recent dietary intake. The rank order of mean OC concentrations in scats was EAI > SE/BC > GOA. These data suggest that exposure to the OCs is elevated in portions of the range of the declining western stock of Steller sea lions. These findings also show that scat can be used a non-invasive indicator of contaminant exposure.

One publication has been accepted:

Kutz, S.J., I. Asmundsson, E.P. Hoberg, G.D. Appleyard, E.J. Jenkins, K. Beckmen, M.. Branigan, L. Butler, N.B. Chilton, D. Cooley, B. Elkin, F. Huby-Chilton, D. Johnson, A. Kuchboev, J. Nagy, M. Oakley, R. Popko, A. Scheer, M. Simard, A. Veitch. In Press. Serendipitous discovery of a novel protostrongylid (Nematoda: Metastrongyloidea) in caribou (*Rangifer tarandus*), muskoxen (*Ovibos moschatus*) and moose (*Alces americanus)* from high latitudes of North America based on DNA sequence comparisons. Canadian Journal of Zoology.

ABSTRACT: Many protostrongylid nematode species produce dorsal spined larvae (DSL) that are shed in feces of wild ungulates. Definitive identification of DSL is rarely possible through comparative morphology and often, fecal samples are the only feasible means to assess the distribution of these nematode parasites in wildlife. In the present study, molecular techniques were employed to differentiate among protostrongylid species using DNA from individual larvae obtained in geographically

extensive surveys. Partial sequences from the second internal transcribed spacer region (ITS-2) of the nuclear ribosomal DNA were used to differentiate DSL recovered from feces of caribou (*Rangifer tarandus tarandus, R. t. caribou, R. t. grantii* (Linnaeus, 1758)), muskoxen (*Ovibos moschatus moschatus* and *O. m. wardi* (Zimmerman, 1780)), and moose (*Alces americanus gigas)* in the North American Arctic and Subarctic. A previously uncharacterized and genetically distinct species was recognized based on the ITS-2 sequences of 37 DSL from 19 ungulate hosts across a range extending from Alaska to Labrador and 1 third stage larva from a slug (*Deroceras laeve*) collected in the Mackenzie Mountains, Northwest Territories. Sequence similarity among individuals of this putative species was 91-100%. For many individual DSL, paralogues of ITS-2 were detected. The ITS-2 sequences from this putative species were 72-77% similar to those of *Varestrongylus alpenae*, 58-61% similar to those of elaphostrongylines (*Elaphostrongylus* spp. and *Parelaphostrongylus* spp.), and 51-60% similar to those of other protostrongylids known in North American and some Eurasian ungulates. The sequence results indicate a discrete lineage of a currently undescribed protostrongylid, infecting muskoxen, caribou and moose across northern North America. Sympatric infections with *P. andersoni* were demonstrated in two caribou herds.

Two additional manuscripts were revised and are in review with the co-authors agencies prior to submission to journals:

Beckmen, K.B., K.A. Burek, K. W. Pitcher, G. M. Ylitalo, and B.S. Fadely. Organochlorine contaminant concentrations in multiple tissue matrices of live Steller sea lions (*Eumetopias* jubatus) in Alaska. Organochlorine contaminant concentrations in multiple tissue matrices of live Steller sea lions (*Eumetopias jubatus*) in Alaska.

ABSTRACT: Blood, blubber, milk, and feces were collected from 53 free-ranging and 3 captive Steller sea lions (*Eumetopias jubatus*) in Alaska over 6 years (1998-2003) to assess exposure of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in these animals. The relationships of various OC contaminants in multiple matrices from individuals were examined to determine the appropriate matrix for exposure monitoring in live animals and to minimize invasive sampling techniques. Concentrations of certain OC contaminants in blubber, milk and blood were highly correlated within individuals; however fecal concentrations were only correlated with those measured in blood. These findings indicate that a whole blood sample may be the best alternative as a less-invasive indicator of relative contaminant exposure in lieu of surgical blubber biopsy. Feces may be used a non-invasive monitoring tool of relative OC exposure without direct handling of animals for sample collection.

Beckmen, K.B., K.A. Burek, K.W. Pitcher, G.M. Ylitalo, and B.S. Fadely. Organochlorine *contaminant* concentrations in blubber of free-ranging Steller sea lion (*Eumetopias jubatus*) pups and juveniles in Alaska.

ABSTRACT: Blubber samples were collected by surgical biopsy and necropsy from 145 free-ranging pup and juvenile Steller sea lions (*Eumetopias jubatus*) in Alaska over 6 years (1998 - 2004) to assess exposure of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in the stable eastern stock in Southeast

Alaska (SE) as compared to the depleted western stock in Gulf of Alaska (GOA) and eastern Aleutian Islands (EAI). Results of a rapid OC screening were used to assess exposure of selected organochlorine (OC) contaminants (e.g., dioxin-like PCBs, DDTs) in dependent pups through subadults in consideration of developmental age. Transplacental transfer of OCs was extremely low. Concentrations of OCs peaked in pups sampled between 2 weeks and 1.5 months of age and declined by midway through the suckling period and then increased again through the first year of the dependent period and though the presumed weaning period. Pesticides and brominated di-benzo furans were determined by GC/MS in 25 and 15 animals respectively, including 4 that were sampled at 5 month intervals. These data suggest that exposure to the OCs is at a level of concern especially in young pups in portions of the range of the endangered western stock of Steller sea lions.

One paper was published: Happ, G.M., H.J. Huson, K.B. Beckmen, L.J. Kennedy. 2007. Prion protein genes in caribou from Alaska. Journal of Wildlife Diseases 43(2): 224-228.

I attended 2 conferences during this period**:** The Wildlife Society 13th Annual Conference, Symposium chair and Presenter, Aug 24-26 2006, Anchorage AK and the Alaska Rabies Summit, December 11 2006, Anchorage AK.

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

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

I assisted and conducted wildlife capture operations. Along with SafeCapture International instructors, I gave training in anesthesia, capture and advanced field techniques (March 1, 2007, Anchorage AK). I purchased, prescribed and dispensed animal capture drugs to DWC personal. I gave advice and information to the public and DWC employees related to wildlife health and zoonotic diseases via personal contact in the office, on the phone and through the media. I continued to serve as the DWC Animal Care and Use Committee (ACUC) and the attending veterinarian for the committee to assure Division compliance with the Animal Welfare Act. I conducted a veterinary review of twenty-five Assurances of Animal Care Protocols submitted to the DWC ACUC prior to committee review. I continued to work as the liaison between ADF&G and the Department of Health and Human Services/Division of Epidemiology and the Division of Environmental Conservation/Office of the State Veterinarian on zoonotic and reportable disease issues. Federal funds were used to pay salaries, supplies and services while working on this task.**ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THE LAST SEGMENT PERIOD, IF NOT REPORTED PREVIOUSLY**

Not applicable.

VII. PUBLICATIONS

Happ, G.M., H.J. Huson, **K.B. Beckmen,** and L.J. Kennedy. 2007. Prion protein genes in caribou from Alaska. Journal of Wildlife Diseases. 43(2): 224-228.

Bracht, A.J., R.L. Brudek, R. Ewing, C.A. Manire, K.A. Burek, C. Rosa, **K.B. Beckmen,** J. E. Maruniak, and C.H. Romero. 2006. Genetic identification of novel poxviruses of cetaceans and pinnipeds. Archives of Virology 151:423-438.

Bowen, L.B., Aldridge, T. Gelatt, L. Rea, K. Burek, **K. Beckmen**, and J.L. Stott. 2006. Differential expression of immune response genes in Steller sea lions: A tool for timely identification of alterations in ecosystem health? Journal of Ecosystem Health 3(2):109-113.

Burek, Kathy, Francis Gulland, Gay Sheffield, **Kimberlee Beckmen**, Enid Keys, Terry Spraker, Alvin Smith, Douglas Skilling, James Evermann, Jeffery Stott, Jerry Saliki and Andrew Trites. 2005. Infectious disease and the decline of Steller sea lions (*Eumetopias jubatus*) in Alaska, USA: Insights from serological data. Journal of Wildlife Diseases 41(3): 512-524.

Kathy A. Burek, **Kimberlee Beckmen**, Tom Gelatt, Woody Fraser, Alexa J. Bracht, Kara A. Smolarek, and Carlos H. Romero. 2005. Poxvirus Infection of Steller Sea Lions (*Eumetopias Jubatus*) in Alaska. Journal of Wildlife Diseases. 41: 745-752

Beckmen, K.B., Blake, J.E., Ylitalo, G.M., Stott, J.L., and T. O'Hara. 2003. Organochlorine contaminant exposure and associations with hematological and humoral immune functional assays with dam age as a factor in free-ranging northern fur seal pups (*Callorhinus ursinus*). Marine Pollution Bulletin 46:594-606.

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

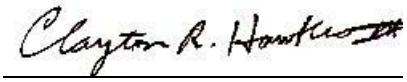
Disease surveillance and veterinary activities have steadily increased in scope and intensity over the course of this performance period. This is an important trend that should be continued. However, for this to occur, enhanced staffing levels and funding must coincide. Federal funding of CWD surveillance is decreasing and with in one or two years will no longer be sufficient to maintain adequate surveillance of free-ranging cervids in Alaska. Likewise, funding for West Nile Virus surveillance is no longer available for Alaska. These deficiencies will need to be mitigated by other funding sources including Federal Aid. Additional field and captive studies testing the effects of diseases and parasites on wildlife health are needed to understand the role of these factors on populations so they can be manipulated as needed for management purposes.

IX. APPENDIX See Attachments.

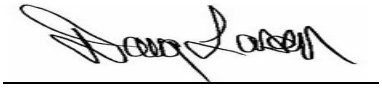
PREPARED/SUBMITTED BY:

Kimberlee Beckmen
Wildlife Veterinarian

APPROVED BY:



Clayton R. Hawkes
Federal Assistance Coordinator
Division of Wildlife Conservation



Douglas N. Larsen, Director
Division of Wildlife Conservation

APPROVAL DATE: 28 September 2007