Alaska Department of Fish and Game
State Wildlife Grant
ANNUAL INTERIM PERFORMANCE REPORT

Grant Number: T-1 **Segment Number:** 6
Project Number: 9
Project Title: Distribution and phylogeography of collared pika and Alaska marmot in Alaska
Project Duration: July 1, 2004 – June 30, 2007
Report Period: July 1, 2004 – June 30, 2005
Report Due Date: September 30, 2005

Objectives (*as submitted in grant project statement*):

1. Conduct aerial and ground surveys over the course of 3 summers to determine the distributional limits of collared pika and Alaskan marmot in Alaska.
2. Collect voucher specimens from all localities where one or both species are detected (to be deposited and curated at the University of Alaska Museum's (UAM) Mammals Division and Alaska Frozen Tissue Collection).
3. Obtain information from natural history museums on the elevation and collecting localities for specimens of both species to supplement information available from UAM specimens and surveys.
4. Perform standard morphometric analyses of all available specimens to test for sexual and/or geographic morphological variation.
5. Generate and analyze DNA sequence data to determine phylogeographic patterns in both species.

Summary of Accomplishments *(Describe accomplishments related to the work that was proposed to be done during this same period in the Project Description and work schedule****):***

The following accomplishment is related to Objective 1:

1. A survey for marmots and pikas was conducted in the following area:
    a) In late August 2004, the PI (Olson) conducted aerial surveys of Wolverine and Sawtooth Mts., NNW of Fairbanks and just south of the Yukon River. No small mammal inventories have ever been conducted in this area, but suitable habitat exists for both marmots and pikas.

The following accomplishments are related to Objective 2 :

2. Specimens were collected from the following areas:
    a) Jonathan Fiely collected 2 pikas near Healy in June 2005.
    b) Jonathan Fiely, Aren Gunderson and Link Olson collected 3 marmots from Slope Mountain, northern Brooks Range, in June 2005.

<u>The following accomplishment is related to Objectives 2, 3, 4, and 5 and was funded in part by this project):</u>

3. Hayley Lanier visited and studied the collections at the Natural History Museum at the University of Kansas. She gathered morphological data and obtained material from specimens of both pikas and marmots for DNA analysis in Fairbanks.

<u>The following accomplishment is related to Objectives 4 and 5:</u>

4. Two graduate students associated with this project entered the graduate program at UAF in Fall 2004. Aren Gunderson is studying the distribution and phylogeography of the Alaskan marmot for his master's thesis. Hayley Lanier is engaged in similar research on the collared pika for her Ph.D. dissertation. Both began working in Olson's molecular lab in January 2005 and have already sequenced DNA from several specimens archived at UAM. They have also begun to examine the specimens housed at UAM in preparation for performing morphometric analyses.

Significant Deviations *(if any, and explain the reasons for these):*

1. We had planned for funds to be available for the entirety of Summer 2004's field season. However, funds were not transferred to UAF until August 2004.   Thus surveys for marmots and pikas early in the 2004 field season were conducted in the following areas using other funds:
    a) CoPI Brandy Jacobsen surveyed ridges near Roche Mountonee Creek in the northern Brooks Range in June 2004 for marmots and pikas. No marmots or pika were observed.

    b) Brandy Jacobsen gathered information about marmots near Wiseman in June 2004. Future trips are planned for this area to further survey and collect specimens.

    c) Slope Mountain, northern Brooks Range, was surveyed by curatorial assistant, Jonathan Fiely, in June 2004. Marmots were observed, but not collected.

    d) The Elliot highway up through mile 90 was surveyed by the CoPI (Jacobsen) in July 2004 for marmots and pikas, none were observed.

Actual Costs during this Report Period *(personnel plus all operating expense totals)*:

Federal (from ADF&G):	Partner (nonfederal share):
$9,888.15	$3,296.05

Project Leader *(or Report Contact Person)*:   Link Olson

Additional Information: *(Not required. Add any additional detail, if desired, related to the progress of the project)*:

1. Additional surveys for marmots and pikas were conducted by two undergraduate research assistants in alpine habitat in the vicinity of Goodnews Bay in July 2004. Although this area was not on our original list of areas to be surveyed, UAM was contracted by BLM to

conduct a small mammal inventory in the area. No sign of marmots or pikas was detected.

2. Graduate student, Hayley Lanier was awarded an EPSCoR fellowship which will pay tuition and stipend support for AY2006. This will significantly defray costs of the project, and allow for additional field work, specimen collection and analysis.
3. Hayley Lanier presented preliminary results at a seminar at UAF during the academic year and subsequently at the annual meeting of the American Society of Mammalogists held in Springfield, Missouri (oral presentation, "Are North American pikas monophyletic?" H. Lanier and L. Olson.
4. Dr. David Hik, from the University of Alberta, was invited to give a seminar to the Institute of Arctic Biology at UAF in May 2005. Dr. Hik is well known for his research on population dynamics and foraging ecology of collared pikas and hoary marmots among other species.

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Project Duration: July 1, 2004 – June 30, 2007
Report Period: July 1, 2005 – June 30, 2006
Report Due Date: September 30, 2006
Partner: University of Alaska Fairbanks

Objectives:

1. Conduct aerial and ground surveys over the course of 3 summers to determine the distributional limits of collared pika and Alaskan marmot in Alaska.
2. Collect voucher specimens from all localities where one or both species are detected (to be deposited and curated at the University of Alaska Museum's (UAM) Mammals Division and Alaska Frozen Tissue Collection).
3. Obtain information from natural history museums on the elevation and collecting localities for specimens of both species to supplement information available from UAM specimens and surveys.
4. Perform standard morphometric analyses of all available specimens to test for sexual and/or geographic morphological variation.
5. Generate and analyze DNA sequence data to determine phylogeographic patterns in both species.

Summary of Accomplishments:

The following accomplishment is related to Objectives 1 and 2:

1. Surveys for marmots and pikas were conducted in the following areas:
    a) Several alpine areas in the Nulato Hills northeast of Unalakleet were surveyed by helicopter and on foot. No marmots or pikas were seen or heard. Participants included PI Olson, CoPI Jacobsen, UAF graduate students Aren Gunderson and Hayley Lanier, and UAF undergraduate Jonathan Fiely. *No marmot or pika specimens collected.*

    b) Gunderson surveyed additional sites in the vicinity of Slope Mountain. *One Alaska marmot specimen collected.*

    c) Several alpine sites on the Kenai Peninsula were surveyed by Lanier, postdoc Marcelo Weksler, and undergraduates Jonathan Fiely and Kyndall Hildebrandt in July and August 2005 in conjunction with a separate ADFG-funded field project. Hoary marmots were collected from the end of Palmer Creek Rd., near Hope. Suitable habitat near Kenai Lake was also surveyed and marmots were observed but not collected. Alpine habitat near Twin Lakes on the Kenai was surveyed in June 2006, and hoary marmots were collected. While suitable pika habitat (some talus, although most areas were marginal at best) was observed in all areas, no pikas or pika sign were documented from the Peninsula. *Four hoary marmot specimens were collected; no pikas were collected.*

d) In early June 2006, Gunderson, Lanier and Hildebrandt hiked in to the Elephant Mtns. and Wolverine Mtn. to assess the presence of marmots and pikas in the area. Two hoary marmots were collected, but pikas and sign thereof were absent from this seemingly ideal habitat. *Two hoary marmot specimens were collected; this represents a range extension for this species.*

e) In July 2005, Lanier traveled to Kluane, Canada, to learn pika-specific field demographic techniques with the students of Dr. David Hik, from the University of Alberta. She learned techniques for roughly assessing and identifying pika population sizes, grazing pressures, and latrine sites. Arrangements were made for some specimens to be deposited at UAM, and pika genetic samples were shared.

f) Lanier, Gunderson, Fiely, and Hildebrandt surveyed and sampled pikas from the Pinnell Mt. Trail in the White Mtns. These specimens represent some of most Northern records from the University of Alaska Museum.

g) Lanier and Hildebrandt surveyed known populations in the Talkeetna Mtns. during March 2006 looking for signs of winter activity, but no pikas were seen or heard.

<u>The following accomplishment is related to Objectives 3, 4, and 5 and was funded in part by this project):</u>

2. Olson visited the mammal collection at the University of California, Berkeley's Museum of Vertebrate Zoology in April to measure the holotype of *M. broweri*. He determined that both Lanier and Gunderson will need to visit the MVZ in order to measure the remaining marmot and pika specimens and sample them for DNA. (Olson's travel and lodging were paid for by U.C. Berkeley.)

   In March Olson visited the mammal collection at the United States National Museum of Natural History (Smithsonian) to record data on marmot and pika specimens. It was determined that Lanier will need to visit this collection to measure specimens and sample them for DNA. (Olson's travel was paid for by the National Science Foundation.)

   In late 2005 it was learned that Dr. Robert Rausch's sizeable personal collection of Alaskan mammal specimens was deposited at the Museum of Southwestern Biology (U. New Mexico). This important collection includes several specimens of marmots and pikas, and permission has already been granted to visit MSB in 2006 or early 2007 to measure and sample specimens.

   In April Olson and Fiely visited the mammal collection at the Field Museum of Natural History in Chicago, where Fiely photographed pika specimens for Lanier's dissertation research. No subsequent trips to the Field Museum will be necessary. (Olson and Fiely's travel was paid for by UAF.)

Lanier and Gunderson have created relational databases for managing and retrieving morphological, molecular, and museum specimen data. In addition to providing standardized image references for each measurement taken, this database (created in FileMaker Pro 8) will be used to capture measurements directly from the digital calipers ensuring ease and standardization of measurement work.

Gunderson successfully extracted, amplified, and sequenced DNA from individual marmot specimens collected in the Ray Mts. and the Kokrine Hills. Both of these specimens were enigmatic in that they were collected well outside of the known ranges of the hoary marmot and the Alaska marmot. Neither was associated with fresh tissues, but Gunderson employed techniques used in ancient DNA analysis to positively identify both specimens as *Marmota broweri*. This confirms the presence of Alaska marmots outside of the Brooks Range and represents a significant southern range extension for the species. When considered in contrast to the Elephant Mtn. documentation of hoary marmots, this supports the hypothesis that the Yukon river divides the two marmot species.

<u>The following accomplishment is related to Objectives 4 and 5:</u>

4. The two graduate students supported by this grant, M.S. student Aren Gunderson and Ph.D. student Hayley Lanier, have extracted and sequenced DNA from all frozen tissues at UAM for both marmots and pikas (respectively) for several different phylogeographic markers. The preliminary results from these data are being used to guide sampling efforts in the field (in terms of localities and numbers of individuals sampled). While the preliminary results are somewhat biased by the opportunistic nature of the samples represented, they indicate that there may be more gene flow occurring within collared pikas than previously expected.

   In addition to frozen tissues from the UAM collection, Lanier and Gunderson have begun work on the extraction of ancient and 'antique' DNA from museum specimens. The optimization of these techniques is under way, but the initial successes are promising and may allow for temporal as well as geographic analyses to be conducted. These techniques are also being optimized with the intention of being utilized as part of minimally destructive sampling efforts during upcoming visits to other museums.

Significant Deviations *(if any, and explain the reasons for these):*

None.

Actual Costs during this Report Period *(personnel plus all operating expense totals)*:
(Reported costs included ADF&G indirect calculated at 13.5%)

Federal (from ADF&G):	Partner (nonfederal share):
$43,603	$14,534

Project Leader *(or Report Contact Person)*: Link Olson

Additional Information:

1. Gunderson and Lanier both presented results from their research at the annual meeting of the American Society of Mammalogists held in Amherst, Massachusetts in June 2006. (oral presentations, “The distribution and genetic variation of Alaska’s endemic marmot,

Marmota broweri" A. Gunderson and L. Olson; "Pikas, peaks, and post-Pleistocene patterns: Phylogeography of an Alaska alpine lagomorph, *Ochotona collaris*", H. Lanier and L. Olson).

2. Lanier presented her pika research twice: once at the EPSCoR retreat and once at the Evo-WIBO meetings in Fort Townsend, Washington. At the EPSCoR retreat in Fairbanks, she gave a 15 minute oral presentation of preliminary phylogeographic results for an audience of professors and graduate students from UAF and UAA. At the Evo-WIBO conference she presented a poster, 'Behavioral and morphological evolution of pikas: Are North American pikas monophyletic?', and interacted with evolutionary biologists from Washington, Idaho, British Colombia, and Oregon [plus Alaska and California].

3. The field schedule for year 3 of this project is well under way. All sites identified in the original proposal (and several others) will be surveyed by the completion of the project, although a two-month extension may be requested for summer 2007. In summer 2006 the following sites have been or will be surveyed: Kenai Peninsula (additional sites from those listed above), the Denali and Richardson Highways, the Tok Cutoff, Kluane National Park (Canada), the Kilbuck Mts. south of Aniak, the mountains around Nome, two sites in the Arctic National Wildlife Refuge, one or more sites in the Ray Mts., and Lake Clark National Park and Preserve.

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Grant Number: T-1 **Segment Number:** 6

Project Number: 9

Project Title: Distribution and phylogeography of collared pika and Alaska marmot in Alaska

Project Duration: July 1, 2004 – May 1, 2008

Report Period: July 1, 2006 – June 30, 2007

Report Due Date: September 30, 2007

Partner: University of Alaska Fairbanks

Project Objectives

1. Conduct aerial and ground surveys over the course of 3 summers to determine the distributional limits of collared pika and Alaskan marmot in Alaska.
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5. Generate and analyze DNA sequence data to determine phylogeographic patterns in both species.

Summary of Accomplishments

Objective 1 and 2: The following sites were surveyed for pikas and/or marmots over the period covered by this report:

Lake Peters, Arctic National Wildlife Refuge (July 06). Two marmots and several small mammal specimens were collected. No evidence of pikas was found. *Participants: B. Jabosen, A. Ferry, P. Jacobsen, A. Ferry, M. Weksler.*

White Pass (Haines & Skagway), re-survey (July 06). Although no pikas were observed in this historic collecting locality near Skagway, scat was collected for DNA analysis. Marmots were not targeted on this trip. *Participants: H. Lanier.*

Kenai Peninsula (July 06). In conjunction with Thomas McDonough, ADFG-Homer, and as part of a separate ADFG-funded project, small mammal inventories were conducted at various localities on the Kenai Peninsula. No pikas or evidence thereof were observed, but four marmots were collected from three localities. *Participants: J. Fiely, K. Hildebrandt, M. Weksler, H. Lanier, L. Olson.*

Kongakut River, **Arctic National Wildlife Refuge** (August 06). During a 10-day expedition float trip to survey for marmots just east of the easternmost record, no marmots (or pikas) were observed. Twenty-nine arctic ground squirrels and one singing vole were collected. *Participants: L. Olson, A. Gunderson, K. Hildebrandt, J. Fiely.*

Denali Highway (August 06). Two separate trips to alpine areas along the Denali Highway resulted in the collection of one marmot and five pikas. *Participants: H. Lanier, L. Olson.*

Kluane National Park & Reserve (August 06). H. Lanier attended David Hik's (U. Alberta) 'pika camp' with members of his lab to learn pika trapping and survey techniques.

Thompson Pass (August 06, June 07). Three pikas were collected enroute to Valdez during two field trips. Many marmots were seen, but none was collected. *Participants: H. Lanier, M. Weksler, S. Moore, K. Hildebrandt.*

Galbraith Lake (August 06). Three marmots and one arctic ground squirrel were collected. *Participants: A. Gunderson, J. Robichaud ("Marmothon 2006" leader).*

Rainbow Ridge, Richardson Highway (August 06). Three pikas were collected. *Participants: L. Olson, H. Lanier.*

Kokrines Hills (June 07). The area around Horner Hot Springs in the Kokrines Hills was surveyed for marmots. This is a known locality where a single marmot specimen was collected two decades ago. No marmots or sign thereof was observed. *Participants: A. Gunderson, C. Barger.*

Objective 3: During the period covered in this report, the following museums were visited by participants working on this project.

U.S. National Museum (Smithsonian), Washington, D.C. (March 2006). 12 marmot specimens were examined by L. Olson.

Museum of Vertebrate Zoology, University of California, Berkely (April 2006). Four marmots plus ca. 20 pikas were examined by L. Olson.

University of Kansas Natural History Museum, Lawrence (Jan. 2007). 12 pika specimens were examined and samples from 6 marmots were obtained by H. Lanier.

U.S. National Museum (Smithsonian), Washington, D.C. (February-March 2007): ca. 150 pika specimens were examined by H. Lanier.

Canadian Museum of Nature, Ottowa. (February-March 2007). ca. 130 pika specimens were examined by H. Lanier.

Museum of Southwestern Biology, University of New Mexico, Albuquerque (June 2007). 30 pikas and 36 marmots were examined by L. Olson and H. Lanier.

All of these museums have made samples available for the genetic component of this study. To date, data from over 500 pikas and 100 marmots, representing all known museum specimens of both species, have been collected. H. Lanier and A. Gunderson are in the process of revising the distribution maps for these two species.

Objective 4: Ongoing (see #3). Preliminary results suggest pikas have become significantly smaller over the past half decade. Unfortunately, the overwhelming majority of Alaska marmot specimens in museum collections are subadults and therefore not amenable to standard morphometric analyses.

Objective 5: Ongoing. For marmots, all fresh tissue samples available have been sequenced for the mitochondrial cytochrome-*b* gene. A subset of these have also been sequenced for partial mitochondrial 12S rRNA gene (to confirm the identify of two historic specimens). Degraded DNA from historic specimens is currently being amplified and sequenced. In general, there is very little genetic variation across the range of *Marmota broweri*. For pikas, all available fresh tissues have been extracted and most have been sequenced for cytochrome-*b* and the more rapidly evolving d-loop region of the mitochondrial genome. To date, analyses suggest very low levels of phylogeographic structure compared to those observed in the American pika (the only other species of pika in North America).

Significant Deviations: none

Project Leader*:* Link Olson

Additional Information:

Abstract from an oral presentation delivered at the 2007 joint meeting of the Alaska Chapter of The Wildlife Society and the 12th Northern Furbearer Conference in Juneau, AK. Research presented was a result of this grant.

PIKAS, PEAKS, AND POSTGLACIAL COLONIZATION: PHYLOGEOGRAPHY OF AN ALPINE LAGOMORPH, *OCHOTONA COLLARIS*

Hayley C. Lanier[1, 2] and Link E. Olson[1]
[1]University of Alaska Museum, 907 Yukon Drive, Fairbanks, AK 99775
[2]Department of Biology and Wildlife, University of Alaska Fairbanks, 211 Irving I, Fairbanks, AK 99775

North American pikas are generally restricted to alpine talus and are considered to be poor dispersers, making them susceptible to population isolation and vicariant events driven by climatic changes. Their evident restriction to ‘sky islands’ would lead one to suspect a high degree of phylogeographic structuring. In the American pika, *Ochotona princeps*, significant population differentiation is evident. The collared pika, *O. collaris*, found at higher altitudes in Alaska and northwestern Canada, has a much more recent history of radiation and colonization because much of it’s current range was covered with Pleistocene glaciers. It is therefore expected to be less phylogeographically structured than its sister species, *O. princeps*, but more structured than other vagile or generalist arctic mammals. We use mtDNA sequences to analyze phylogeographic patterns within *O. collaris*, looking for evidence of refugia, range expansion, and population isolation. While *O. collaris* does show a strong signal of post-glacial range expansion, montane-driven population structuring is less evident than anticipated. We discuss several reasons for this unexpected pattern.

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PROJECT TITLE: Distribution and phylogeography of collared pika and Alaska marmot in Alaska

PARTNER: University of Alaska Fairbanks

PRINCIPAL INVESTIGATORS: Link Olson

PROJECT DURATION: July 1, 2004 – May 1, 2008

REPORT PERIOD: July 1, 2007 – May 1, 2008

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

The collared pika (*Ochotona collaris* Nelson, 1893), Alaska's only species of pika, and the Alaska marmot (*Marmota broweri* Hall and Gilmore, 1934), which is endemic to Alaska, inhabit boulder fields, rock slides, talus slopes, and similar rocky habitat in different parts of the state. Since their original descriptions, relatively few studies have focused on either species. As a result, their distributional limits (both geographic and elevational) in Alaska were unclear. For example, extralimital reports of both species well outside their known range date back nearly 30 years, yet none of these had been surveyed in the field or documented with museum specimens. In the case of the Alaska marmot, whether or not it occured sympatrically (and possibly hybridizes) with hoary marmot (*M. caligata*) was unknown; their distributions were depicted erroneously in multiple recent publications (e.g., The Smithsonian book of North American Mammals, The Mammals of North America).

Both *M. broweri* and *O. collaris* are presumably restricted to higher elevations yet no study has attempted to confirm this in the field or through the compilation of existing literature accounts and museum specimen information. If intervening low-elevation habitats serve as barriers to dispersal (as they do in closely related pikas and marmots in the Great Basin) this reliance on "sky island" habitats has important implications for gene flow and the response to climate change. Pikas, for example, are known to be extremely philopatric and dispersal limited. Only 25% of offspring attempt dispersal in a given year, and inhospitable habitat obstacles as small as 300 meters can act as effective barriers to dispersal. American pikas (*O. princeps,* closest living relative of *O. collaris*) and yellow-bellied marmots (*M. flaviventris*) restricted to sky islands in the Great Basin were predicted by McDonald and Brown (1992) to go extinct over 80% and 36% of their current range, respectively, after an average global temperature increase of only 3º C. A recent survey of *O. princeps* in the Great Basin revealed that over 25% of historic populations have already gone extinct over the course of the past century alone (Beever et al., 2003). Populations of *O. princeps* in the Lower 48 exhibit strikingly low levels of genetic variability (Hafner and Sullivan, 1995), with local populations subject to accelerated morphological differentiation.

Whether or not isolated populations of *O. collaris* in Alaska have undergone genetic differentiation is unknown, but Baker (1951) noted morphological differences between Alaskan specimens and those from neighboring Canada (this has yet to be rigorously tested). Due to their association with discontinuously distributed talus habitat, their presumed vulnerability to warmer temperatures, and limited dispersal abilities, both *O. collaris* and *M. broweri* may act as early sentinels of changes in other montane species. However, baseline data on their current distributions and evolutionary differentiation (both morphological and genetic) are lacking. Because both species are diurnal, audiovisually conspicuous, easily approached, and have either similar or identical habitat requirements, both could be surveyed simultaneously.

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

There are no other studies in progress focused on addressing the problems discussed above. There are no prior studies focused on Alaska marmots specifically. Since the original description in 1934, all mentions of Alaska marmots in the literature have come in the context of the taxonomy of *Marmota broweri* and/or the biogeography and phylogenetics of the genus *Marmota*.

Currently, the lab of David Hik, at the University of Alberta Edmonton, is engaged in studying collared pika population dynamics and ecology at a long-term study site near Kluane Lake, Canada (in the Ruby Range). Their research into collared pika parturition, patch occupancy, grazing dynamics, and localized population dynamics has been instrumental in the development of our survey and monitoring techniques.

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

OBJECTIVE 1: Conduct aerial and ground surveys over the course of three summers to determine the distributional limits of collared pika and Alaskan marmot in Alaska.

Aerial and ground surveys were conducted for pikas and marmots to investigate those regions for which accounts of pikas are known and other areas constituting purported range margins. Field surveys were conducted during the summer months of 2005 – 2007. Survey areas were chosen based on their proximity to known Alaska marmot populations or reported observations of marmots outside the established range of this species and in areas known to support Alaska marmots but from which no fresh tissue material was available for genetic research. Aerial surveys were determined to be insufficient for the detection of marmots or pikas, therefore all field surveys were conducted on the ground and in one case with helicopter support for locating and accessing sites.

Areas surveyed for Alaska marmots are the following: alpine areas accessible on foot from the Dalton Highway (Slope Mountain, Jade Mountain, Imnavait Mountain, Galbraith area, near Toolik Field Station, Beaver Slide, Finger Mountain), the Nulato

Hills, Elephant Mountain, Kigluaik Mountains, Lake Peters, Kongukut River drainage, Kokrines Hills, Little Squaw Lake, Mulik Hills, Utukok River, Tupikchak Mountain, Kukpowruk River, and the Ray Mountains. Alaska marmots (*Marmota broweri*) were observed at the following survey areas: Slope Mountain, Galbraith area, near Toolik Field Station, Lake Peters, Little Squaw Lake, Utukok River, Tupikchak Mountain, Kukpowruk River, and the Ray Mountains. Hoary marmots (*M. caligata*) were found at Elephant Mountain, extending their known Alaskan range northward and within 45 miles of the closest population of Alaska marmots (across the Yukon River in the Ray Mts). This is significant in that parapatry of these two species had not been confirmed previously.

Areas of Alaska surveyed for collared pikas include the following: Wrangell-St. Elias National Park (areas accessible by foot from Kennicott), alpine areas near Cordova, Thompson Pass, the Pineal Trail in the White Mountains, Elephant Mountain, the Denali Highway, Lake Clark National Park (Twin Lakes), Lake Kenibuna, Rainbow Ridge, the Chugach Mountains near Anchorage, Mt. Healy, White Pass, and multiple localities on the Kenai Peninsula. On a survey of White Pass, north of Skagway (a historically occupied site; 2 pika specimens were collected there in the mid-90s), we were unable to find extant populations, however we found evidence of previous occupation (pika haypiles and latrine sites). The southeastern species boundary, an area of interest, was investigated through ground surveys on the Kenai for eight weeks over 2004 and 2005, and aerial surveys via helicopter of the Chugach Mountains (2007) on either side of the isthmus near Whittier. Pikas are known from near Girdwood Mine, but none of the appropriate habitat closer to Whittier or on the Kenai harbored populations or any signs of previous populations. This may be the result of the deep winter snows those areas have, or might be a historical anomaly.

OBJECTIVE 2: Collect voucher specimens from all localities where one or both species are detected (to be deposited and curated at the University of Alaska Museum's (UAM) Mammals Collection and Alaska Frozen Tissue Archive).

Where marmots were observed, a limited number of specimens were collected using firearms. Voucher specimens consisted of skin, skeleton, tissues, parasites (when available), standardized measurements, and precise locality information. We were unable to collect any of the Alaska marmots observed at the Utukok River site – a single marmot specimen was collected at that location in 1984. All voucher specimens were deposited at the University of Alaska Museum. In total, 26 Alaska marmot specimens and seven hoary marmot specimens were collected (five hoary marmots were collect during pika surveys). Hoary marmot specimens are being used in a new study on the distribution, taxonomy, and phylogeography of that species. Voucher specimens have been collected wherever possible from localities where pikas have been observed. Observations of pikas, or their vocalizations, haypiles, feces, or grazing lines, were used to verify presence of pikas. Most collecting was conducted via shotgun (12ga. with 7 ½ or 9 shot), which minimized the damage to the specimen while maximizing the efficiency of collection and flexibility of use. Some collecting was accomplished with a 20ga. shotgun, small-caliber rifle (.22), high-powered BB gun, or museum special snap traps. Pikas specimens included skulls and skeletons, study skins, standardized measurements and locality information, tissue samples for molecular analyses, endo- and ectoparasites (where available), and embryos. In total 85 collared pika voucher specimens have been collected.

OBJECTIVE 3: Obtain information from natural history museums on the elevation and collecting localities for specimens of both species to supplement information available from UAM specimens and surveys.

Prior to conducting any fieldwork, a database of all *Marmota broweri* museum voucher specimens was created, and their associated data, archived in museums worldwide (86 specimens existed prior to 2005; a complete list of all *M. broweri* specimens is included in the attached material). The geographic data from these specimens verified the presence of Alaska marmots at 15 localities across the Brooks Range. Two specimens of uncertain identity indicated the presence of marmots, either *M. broweri* or *M. caligata*, in the Kokrines Hills (skin and skull from 1983) and Ray Mountains (cranium only from 1979). Currently there are no cranial characters that can reliably identify marmot specimens to species. Therefore, we determined the species identity of these specimens by sequencing DNA from a portion of the mitochondrial cytochrome-*b* gene and comparing those sequences to DNA sequences we derived from *M. broweri* and *M. caligata* specimens. Both specimens were positively identified as *M. broweri*. These specimens represent the first confirmed records of Alaska marmots outside of the Brooks Range - a range extension of 250 miles southward. Subsequent field surveys in 2007 confirmed the presence of Alaska marmots in the Ray Mountains. No marmots were found at the Kokrines Hills locality, suggesting they were extirpated from that area sometime between 1983, when the specimen was collected, and 2006, when we surveyed the area. However, marmot populations are notoriously fluid and it's possible that extirpation is highly localized. Additional ground surveys in the Kokrines Hills will be necessary to confirm their presence or absence therein.

All major North American museum mammal collections have been queried as to their collared pika holdings (n_{tot} = 519). A georeferenced database of all the known collared pika specimens and localities in museum collections was created. The collections with the major holdings of collared pikas were visited, the Smithsonian (n =131), Canadian Museum of Nature (n = 127), Museum of Southwestern Biology (n = 30), University of Kansas Natural History Museum (n = 18). Specimen tags & collectors notes were examined to determine accurate locality information, cranial and postcranial characteristics were measured (Objective 4), and samples were taken for genetic analysis. A combined analysis of location information from all known museum specimens of collared pikas indicates that they have been found at elevations ranging from 2200-6500 ft. (median = 4000 ft., avg. = 4200 ft.).

OBJECTIVE 4: Perform standard morphometric analyses of all available specimens to test for sexual and/or geographic morphological variation.

Unfortunately, the overwhelming majority of Alaska marmot specimens in museum collections are subadults and therefore not amenable to standard morphometric analyses. The skulls and skins from specimens collected during recent fieldwork have not yet been completely processed, therefore, are not yet available for morphological analyses.

The morphometric analysis of collared pika specimens has involved an investigation of geographic variation, morphological change over time, and phenotypic divergence between disparate populations. For pikas, we have employed a series of approximately 25 craniodental measurements and 30 postcranial measurements to characterize the variability in this species. Although the collared pika has long been considered to be monotypic, morphometric studies comparing a limited number of *O. collaris* to its sister species (the American pika, *O. princeps*) indicate a comparable, and hitherto uncharacterized, amount of morphological variation. Specimens from the 2007 fieldwork have yet to be incorporated into morphometric datasets, although some preliminary analyses have been conducted on museum specimens. Preliminary analyses indicate that there are no significant morphometric differences between Canadian and Alaskan collared pikas (*contra* Baker 1951). There appear to be some slight size differences between male and female pikas in terms of cranial length.

OBJECTIVE 5: Generate and analyze DNA sequence data to determine phylogeographic patterns in both species.

Six fresh tissue samples were available from Alaska marmot museum specimens collected prior to 2005 (four at UAM, two at USNM). Of the 26 specimens we collected, one consisted of a dentary only (from the Kukpowruk River where we collected another specimen with fresh tissue). The specimen collected from Toolik Field Station was obtained after all other lab work had been completed. These two specimens were excluded from our genetic sample, leaving 30 specimens with available fresh tissue for DNA extraction. An additional 27 “degraded” tissue samples were obtained from museum collections (USNM, MVZ, KU, MSB, and UAM), including the type specimen, as skin subsamples taken from dried study skins or residual tissue left on skeletal material ("crusties"). Of the 27 degraded tissue sample extractions, four were unsuccessful or failed to amplify during PCR, leaving a total sample size of 53 individuals representing 18 localities. The entire length (1140 bp) of the mitochondrial cytochrome-*b* gene was amplified through PCR and sequenced using standard protocols. We analyzed the DNA sequence data set using standard phylogenetic and phylogeographic methods to produce a phylogenetic tree and statistical support for phylogeographic inferences.

In general, there is very little genetic variation across the range of *Marmota broweri*. The results of our analyses indicate that *Marmota broweri* populations from central Alaska (Ray Mountains and Kokrines Hills) and from the central and eastern Brook Range (Lake Peters, Arctic Village, Chandler Lake, Slope Mountain) have higher levels of genetic diversity than populations found in the western Brooks Range (Tupichak Mountain, Point Lay, Cape Lisburne). This suggests that Alaska marmots have persisted longer in central Alaska and in the eastern and central Brooks Range than in the western Brooks Range. Both the Kokrines Hills and the Ray Mountains sites were in the ice-free refugium, Beringia, during the glacial cycles of the Pleistocene Epoch and would have been available to Alaska marmots (perhaps portions of the eastern Brooks Range were as well). As the glaciers retreated, exposing more suitable habitat, marmots would have colonized the Brooks Range from the south (Ray Mountains) and east. A similar pattern of recent expansion into the Brooks Range has been observed in arctic ground squirrels.

Phylogeographic analyses for collared pikas have been conducted using the mitochondrial genes cytochrome-*b* and the Control Region (a more rapidly evolving mitochondrial marker). Final analyses will be conducted once samples from summer 2008 are incorporated into the matrix, but preliminary analyses indicate that pikas have undergone a recent, rapid range expansion from a source population that may have been located in the interior of the state (an area now inhospitable to pikas). This scenario is similar to one that has been suggested for Arctic ground squirrels (*Spermophilus parryii*).

IV. MANAGEMENT IMPLICATIONS

Alaska marmots are patchily distributed across the Brooks Range, from Cape Lisburne in the west to Lake Peters in the east, and in the Ray Mountains of interior Alaska. While we did not find marmots in the Kokrines Hills, where they were previously known to occur, they may still inhabit the area further north and west of our survey location. They likely occur east of Lake Peters, perhaps into the Yukon Territory, but we were unable to find them within the Kongakut River drainage and literature accounts of Alaska marmots in neighboring Yukon Territory in Canada could not be confirmed with museum specimens. We did not find marmots in the Kigluaik Mountains. However, other alpine regions of the Seward Peninsula may support *Marmota broweri*. Further field surveys are necessary to establish the eastern distributional limits of *M. broweri*, to confirm its occurrence in the Kokrines Hills, and an effort should be made to survey alpine areas of the Seward Peninsula.

From July 29 through August 15, 1952, Bee and Hall (1956) surveyed the Lake Peters area for marmots. They reported observing marmots in eleven locations surrounding the lake and that “the marmot was common and lived in loose communities.” During a ten-day survey effort in July 2006, we searched the area from Whistler Creek to the peak of Mt. Chamberlin and observed four marmots at just two locations. These marmots occurred within the elevation range reported by Bee and Hall, though they were not common and no community structure was apparent at either of the two locations. Fifty-four years after Bee and Hall’s original survey, Alaska marmots appear to have declined in both distribution and abundance in the Lake Peters area.

With our discovery of hoary marmots inhabiting Elephant Mountain, directly south of the Ray Mountains and across the Yukon River, the southern limit of the Alaska marmot’s distribution apparently occurs in the Kokrines Hills and Ray Mountains. The ecological similarity of the two species makes it unlikely that they will be found in sympatry. It appears that the Yukon River forms the current boundary between the parapatric distributions of *Marmota broweri* and *M. caligata* in Alaska.

In terms of range margins, collared pika populations are not on the Kenai Peninsula and don’t appear to be much closer to the peninsula than Girdwood Mine. None of the early biological surveys (conducted by USGS and the US National Museum) mention rock rabbits, pikas, coneys, or mouse hares on the Peninsula, and several even note their absence. Pikas are found north of there, in the Chigmit Mountains and Lake Clark National Park, they extend up through the Alaska Range, and get up into the White Mountains and the northern Yukon Territory. The eastern range margins are still unclear, but extend into the Northwest Territories. Localities at White Pass, in Alaska, and near Bennett, in British Columbia, are some of the furthest south known for collared pikas, leaving an 800 km gap between their southernmost locality and the northernmost populations of American pikas. The western range margins, into the Kuskokwim Mountains and south of the Chigmit Mountains along the Alaska Peninsula, should be surveyed for pika populations. The suggested morphometric differentiation between pika populations in Canada and Alaska has been unsubstantiated by modern morphologic techniques. Unlike many other montane species, collared pikas don't show a deep history of separation between populations in different mountain ranges. While this might be interpreted to indicate high levels of dispersal over large distances, given their biology it is probably a signal of a relatively recent range expansion into their current distribution. We are currently further investigating these questions using voucher specimens resulting from this ADF&G-funded project, endoparasites from pikas, and additional molecular markers to understand the historical demography and biogeography of the pikas in this part of Beringia.

Collared pikas are found in naturally fragmented talus, a habitat choice that strongly influences their survival and reproduction strategies. A limited number of individual territories can be supported by any given patch of talus, and occupancy of these territories varies from year to year. High-quality territories seem to be frequently occupied, whereas lower-quality territories become occupied when populations are robust. Landscapes where they are found tend to have several, semi-isolated patches of talus, where any given patch may undergo a local extirpation. Evidence of past occupation of talus by pikas can be provided by old, inactive haypiles and old latrine sites. Collared pika populations, much like those of their southern congener (the American pika, *O. princeps*) can be considered to exhibit metapopulation characteristics (including localized extinction- recolonization dynamics) that need to be accounted for during management and status surveys. Some areas that were surveyed for this project, including White Pass, had previously supported populations of collared pikas but individuals were no longer present. Without a thorough survey of all surrounding talus patches on local mountains and in ravines, pikas cannot be said to have gone extinct in the area. Long-term monitoring at several sites may be necessary to determine population trends with respect to recent and ongoing climate change.

Both marmots and pikas are restricted to boulder fields or talus slopes within alpine tundra habitats. As climate change progresses, and shrub- and tree-lines shift northward and upslope, marmot and pika populations will become increasingly fragmented and isolated. Our research suggests the possible extirpation of Alaska marmots from one locality in the Kokrines Hills, pikas from White Pass, and a decrease in abundance of Alaska marmots surrounding Lake Peters. While a pattern of localized extirpation and recolonization is a natural part of marmot and pika population dynamics, shrinking habitats due to climate change will likely make extirpation more likely and recolonization more difficult for these species. Alaska marmots are particularly vulnerable to climate change effects – with no option of shifting their distribution northward, *Marmota broweri* can only move upslope in the Brooks Range and isolated mountains to the south (but north of the Yukon River). If hoary marmots shift their distribution northward, they will come into contact with, and potentially compete with, Alaska marmots in the Ray Mountains. This region of close proximity of marmot species should be surveyed more thoroughly and at regular intervals.

Knowledge of where a species naturally occurs is essential to understanding that species' ecology, evolution, and historical biogeography. Museum voucher specimens establish species distributions and provide a historical baseline for evaluating change in distributions over time. As specimens represent populations, the value of large series of specimens increases through time, particularly as the habitat quality of many localities is degraded. Baseline data are critical to the interpretation of ecological and environmental impacts. Without the preservation of specimens, field surveys such as this would have extremely limited value. This is particularly true of Alaska marmots, which are difficult to distinguish from hoary marmots in the field. Funding used for biodiversity assessments is most efficiently spent if agencies recognize the critical need for vouchers and provide support in both field and museum budgets for their preservation and maintenance.

V. SUMMARY OF WORK COMPLETED ON JOBS FOR LAST SEGMENT PERIOD ONLY (July 1, 2007 – May 1, 2008)

JOB/ACTIVITY 1: Conduct aerial and ground surveys over the course of 3 summers to determine the distributional limits of collared pika and Alaskan marmot in Alaska.

The following sites were surveyed for pikas and/or marmots over the period of July 1, 2007 – May 1, 2008:

Finger Mountain (Aug 2007). No evidence of any marmot activity was found.
Participants: A. Gunderson.

Ray Mountains (Sep 2007). Six Alaska marmots and five arctic ground squirrels were collected.
Participants: A. Gunderson, I. Herriott.

Thompson Pass, Cordova, and Wrangell-St. Elias (July 2007). Two collared pika specimens were collected. No pikas were collected at Wrangell-St. Elias, although several individuals were observed, due to inclement weather and terrain difficulties.
Participants: H. Lanier, K. Hildebrandt, S. Moore, and M. Weksler.

Denali Highway (Mile 33 & Paxson Mountain) (July 2007). Twenty-six collared pikas were collected along the Denali Highway.
Participants: H. Lanier, S. Moore, E. Miller, and S. Trefry

Chugach Mountains (July 2007): Nineteen collared pika specimens were collected from five localities in the Chugach Mountains north of Whittier. Three additional sites were surveyed on either side of the isthmus, and no pikas were found.
Participants: H. Lanier, I. Herriott

Twin Lakes, Lake Clark National Park (August 2007). Five collared pika specimens were collected, along with a series of other small mammals.
Participants: H. Lanier, L. Olson, N. Woodman, and E. Sargis

Lake Kenibuna (August 2007). Fifteen collared pikas were collected from the SE shore.
Participants: H. Lanier, L. Olson, N. Woodman, and E. Sargis

JOB/ACTIVITY 2: Collect voucher specimens from all localities where one or both species are detected (to be deposited and curated at the University of Alaska Museum's (UAM) Mammals Division and Alaska Frozen Tissue Collection).

See #1.

JOB/ACTIVITY 3: Obtain information from natural history museums on the elevation and collecting localities for specimens of both species to supplement information available from UAM specimens and surveys.

Already completed; see above.

JOB/ACTIVITY 4: Perform standard morphometric analyses of all available specimens to test for sexual and/or geographic morphological variation.

Not conducted during this time period but currently in progress.

JOB/ACTIVITY 5: Generate and analyze DNA sequence data to determine phylogeographic patterns in both species.

Degraded DNA from historic Alaska marmot specimens was extracted, amplified, and sequenced for the mitochondrial cytochrome-*b* gene. The *Marmota broweri* data set was analyzed using standard phyolgenetic and phylogeographic methods. The results and conclusions (discussed above) were presented by Aren Gunderson for his M. S. degree thesis defense in November 2007 and two manuscripts are currently being prepared for publication (to be submitted before September 2008).

Generation and analysis of DNA sequence data for collared pikas continued during this time period. Datasets will be complete and analyzed at the end of this field season. A manuscript based upon the results of these analyses to date has been submitted to *Molecular Phylogenetics and Evolution*.

VI. PUBLICATIONS

Lanier, H.C. and L.E. Olson. (submitted to Molecular Phylogenetics and Evolution) Inferring divergence times within pikas (genus *Ochotona*) using mtDNA and relaxed molecular dating techniques.

Although several studies have recently addressed phylogenetic relationships within Asian pikas (*Ochotona* spp.), the North American species have been relatively neglected and their monophyly unquestioned or assumed. Given the high degree of intraspecific diversity in pelage and call structure, the recent identification of previously unrecognized species of pika in Asia, and the increasing evidence for multiple trans-Beringian dispersals in several small mammal species, the monophyly of North American pikas has been called into question. In addition, previous studies have applied an externally calibrated rate to examine the timing of diversification within the genus. This method has been increasingly shown to return results that, at the very least, are overly narrow in their confidence intervals, and at the worst can be entirely spurious. For this study we combined GenBank sequences from the mitochondrial genes cyt *b* and ND4 with newly generated sequence data from *O. hyperborea* and *O. collaris* to investigate the origin of the North American lineages and the timing of phylogenetic diversification within the genus *Ochotona*. Specifically we address three goals: (1) summarize and reanalyze the molecular evidence for relationships within the genus using statistically supported models of evolution; (2) add additional sequences from *O. collaris* and *O.*

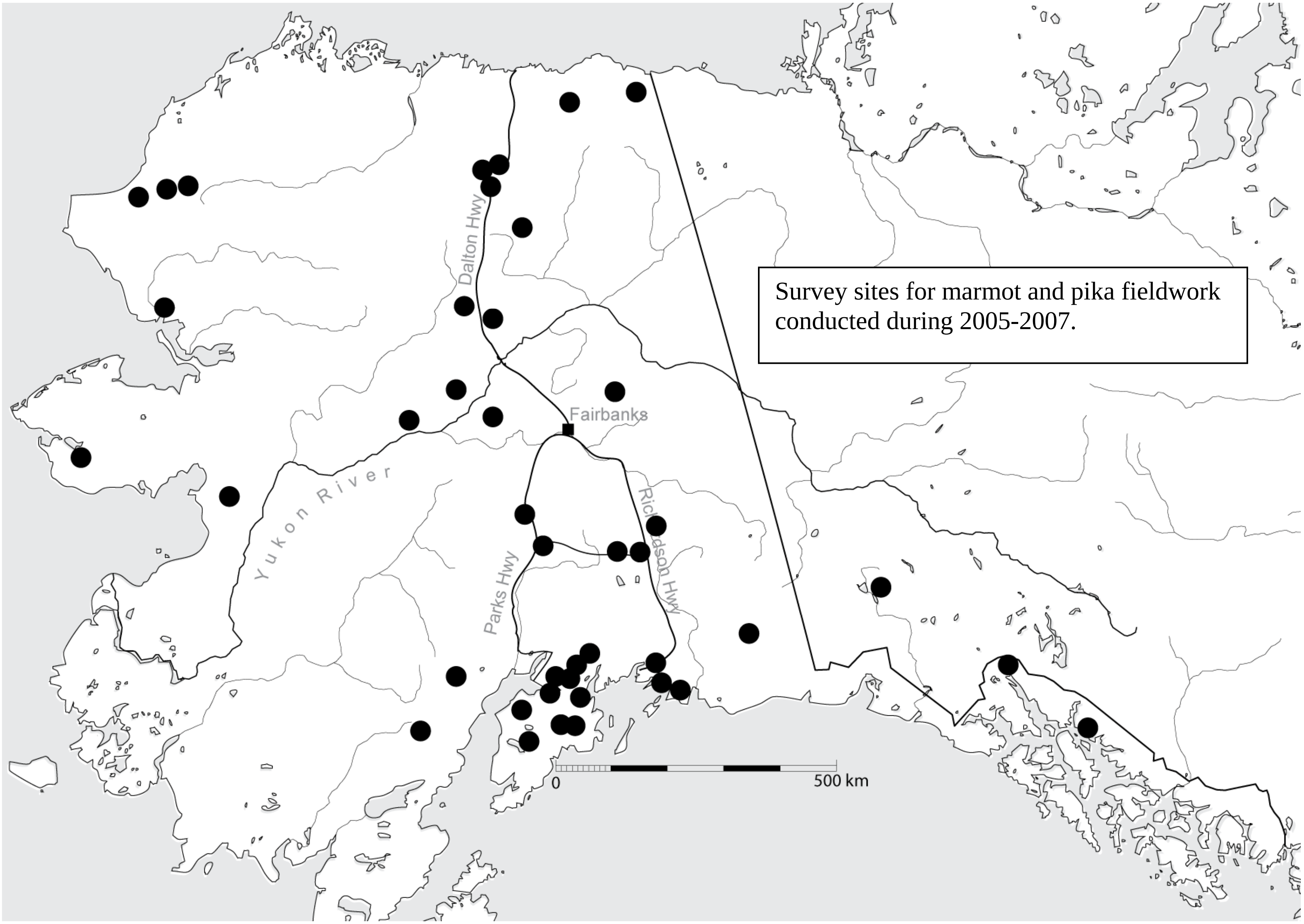
hyperborea to rigorously test the monophyly of North American pikas; and (3),examine the timing of the diversification within the genus using relaxed molecular clock techniques. We found no evidence of multiple trans-Beringian dispersals into North America, thereby supporting the traditional hypothesis of a single invasion of North America. We also provide evidence that the major splits within the genus occurred in the Miocene, and the Nearctic pikas diverged sometime before the Pleistocene.

Gunderson, A.G., and L.E. Olson. Revised distribution of the Alaska marmot, *Marmota broweri*: new specimen records and mitochondrial DNA confirmation of close parapatry with hoary marmots (*M. caligata*) in Alaska (to be submitted to Journal of Mammalogy, July 2008).

The distribution and taxonomic status of the Alaska marmot (*Marmota broweri*) have been the subject of much debate and confusion since the taxon was first described as a subspecies of the hoary marmot (*M. caligata*). As a result of its early association with *M. caligata* and a lack of focused effort to determine its range, our current understanding of the distribution of *M. broweri* is vague at best and completely erroneous at worst. Through a review of all museum specimens and published accounts of this species, field surveys, and the identification of previously unidentified marmot specimens we have determined that the current distribution of the Alaska marmot includes not only the Brooks Range, but also the Ray Mountains and Kokrines Hills of northern interior Alaska. We report the first records of this species outside of the Brooks Range and a commensurate range extension of 250 miles southward. The Yukon River appears to form the current boundary between the perapatric distributions of *M. broweri* and *M. caligata* in Alaska, but additional field work will be necessary to confirm that the two species are not allopatric.

Peterson, M. 2007. Collared pika---Arctic canary? BT Journal, 121:4-16.

A .pdf of this article has been e-mailed separately.


Survey sites for marmot and pika fieldwork conducted during 2005-2007.
Dalton Hwy
Fairbanks
Yukon River
Parks Hwy
Richardson Hwy
0
500 km

Alaska Department of Fish and Game
State Wildlife Grant
ANNUAL INTERIM PERFORMANCE REPORT

Grant Number: T-1 **Segment Number:** 6
Project Number: 10
Project Title: Acoustic monitoring of Southeast Alaska bats
Project Duration: July 1, 2004 – June 30, 2007
Report Period: July 1, 2004 – June 30, 2005
Report Due Date: September 30, 2005

Objectives (*as submitted in grant project statement*):

1. Develop a new type of sensor system specifically designed for long-term acoustic monitoring of bats.
2. Deploy and test the sensor in locations for monitoring bat activity over an entire season in a manner enabling initial data collection regarding bat management in Southeast Alaska.
3. Determine the optimal deployment solution for these new sensor systems for characterizing the ecology of bat populations in Southeast Alaska.

Summary of Accomplishments *(Describe accomplishments related to the work that was proposed to be done during this same period in the Project Description and work schedule)***:**

The following accomplishments relate to Objective 1:

1. Dr. Heavner has developed the hardware required for long-term acoustic bat monitoring. Currently three different computer systems are being evaluated during the 2005 summer season. Tradeoffs between processing power, power consumption, ease of use, and price are the primary factors being considered for the three systems being evaluated.
2. The software to control the computer, record and log bat signals, and automatically identify and eliminate background noise has been developed. The software is being tested to identify any necessary improvements.
3. Dr. Heavner has coordinated the development of the sensor with bat acoustics experts such as Chris Corben (who developed the Anabat detector commonly used in acoustic field work) as well as bat field research experts. Dr. Heavner's discussions with these experts have vastly improved the development of the new acoustic bat sensors.

The following accomplishment relates to Objectives 2 and 3:

4. Field deployment of the sensors in the Juneau area has been successful. Two different prototype systems have been temporarily deployed in four different locations around Juneau. Deployments at a larger number of sites are planned for July 2005. Liz Mallott, a UAS funded student, will finish her project in August 2005 and will include in her final report a summary of suggested deployment strategies.

Significant Deviations *(if any, and explain the reasons for these):*

1. The FY2005 personnel budget was under-spent. The student support that was contributed was critical for the project, but due to a heavy class load less time was

available for the project and not all the budgeted first year student support was spent. The lack of student assistance did delay the spring sensor development work, primarily impacting the testing of the long-term power system. The power system is currently under development.

Actual Costs during this Report Period *(personnel plus all operating expense totals)*:

Federal (from ADF&G):	Partner (nonfederal share):
$26,065.96	$8,688.65

Project Leader *(or Report Contact Person)*: Matt Heavner

Additional Information: *(Not required. Add any additional detail, if desired, related to the progress of the project)*: None

Alaska Department of Fish and Game
State Wildlife Grant
ANNUAL INTERIM PERFORMANCE REPORT

Grant Number: **T-1** **Segment Number:** **6**
Project Number: **10**
Project Title: Acoustic monitoring of Southeast Alaska bats
Project Duration: July 1, 2004 – June 30, 2007
Report Period: July 1, 2005 – June 30, 2006
Report Due Date: September 30, 2006
Partner: University of Alaska Southeast

Objectives:

1. Develop a new type of sensor system specifically designed for long-term acoustic monitoring of bats.
2. Deploy and test the sensor in locations for monitoring bat activity over an entire season in a manner enabling initial data collection regarding bat management in Southeast Alaska.
3. Determine the optimal deployment solution for these new sensor systems for characterizing the ecology of bat populations in Southeast Alaska.

Summary of Accomplishments:

The following accomplishment relates primarily to Objective 1:

1. Dr. Heavner has identified all components of the new sensor system and has integrated them together. The software to control the hardware and analyze the recorded signal to discriminate between bats and rain has been developed. The software is currently being tested against all acoustic recordings made to date for verification and improvements. Dr. Heavner's work was reported on and received with interest at the 2005 North American Symposium on Bat Research.

The following accomplishment relates primarily to Objective 2:

2. Five UAS undergraduate students contributed to the project during the time period. Two students worked on intense undergraduate summer research projects and other students worked on collecting bibliographic background information, mapping out site locations for class projects, deploying sensors around the Juneau area, collecting public reports of bats, and other general project support tasks. One undergraduate project completed in August 2005 was the documentation of unexpected foraging patterns through multiple nights on Prince of Wales. The 2005 work was presented and discussed at the 2005 North American Symposium on Bat Research. The 2006 data gathered will be analyzed to see if the preliminary finding is supported.

The following accomplishments relate to Objective 2 and 3:

3. In October 2005, acoustic technician Carolyn Talus began supporting the project through significant analysis of acoustic data, leading to improved software. The analysis has identified improvements in the deployment of the sensors.

4. Bat recordings have been collected in multiple locations in the Juneau area and on Prince of Wales Island. This provides an excellent set of over 35 hours of acoustic data from multiple habitat types for software testing and analysis. The experience gained has contributed to development of the protocol to fulfill objective three.

Significant Deviations:
No significant deviation.

Actual Costs during this Report Period *(personnel plus all operating expense totals)*:
(Reported costs included ADF&G indirect calculated at 13.5%)

Federal (from ADF&G):	Partner (nonfederal share):
$43,949	$14,650

Project Leader *(or Report Contact Person)*: Matt Heavner

Additional Information:
1. Do you anticipate having any unspent funds at the end of the project? _No____

FEDERAL AID
FINAL PERFORMANCE REPORT

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-1 **Segment Number:** 6

Project Number: 10

Project Title: Acoustic monitoring of Southeast Alaska bats

Project Duration: July 1, 2004 – June 30, 2007

Report Period: July 1, 2006 – June 30, 2007

Report Due Date: September 30, 2007

Partner: University of Alaska Southeast

Project Objectives

1. Develop a new type of sensor system specifically designed for long-term acoustic monitoring of bats.
2. Deploy and test the sensor in locations for monitoring bat activity over an entire season in a manner enabling initial data collection regarding bat management in Southeast Alaska.
3. Determine the optimal deployment solution for these new sensor systems for characterizing the ecology of bat populations in Southeast Alaska.

Summary of Project Accomplishments for entire project

1. A new acoustic system for long-term monitoring of bats in Southeast Alaska was developed under this project. Different hardware solutions were tested and reliability, cost, and capabilities were compared and discussed in the final detailed report. Discussions with the bat research community regarding this technological development informed the design and provided feedback to the community via conference presentations at the North American Symposium of Bat Research, the Western Bat Working Group, and the Acoustic Society of America. This specifically relates to Objective 1.

2. Multiple sensor systems were deployed during the summers of 2005 and 2006 to test baseline bat acoustic data. Results include new insight into activity patterns through the night that differ from that reported in the literature to date. This specifically relates to Objective 2.

3. The project has developed recommendations for best deployment strategies of the sensors to characterize the ecology of bat populations in Southeast Alaska. These strategies are outlines in the final detailed report provided to the Alaska Dept. of Fish and Game. This specifically relates to Objective 3.

Project Accomplishments during last segment period only (July 1, 2006 – June 30, 2007)

1. Some final refinements of the hardware and software components of the acoustic system were made and tested during fall 2007. This specifically relates to Objective 1.

2. Final sensor system designs were tested in the field July-Sept 2006. Some suggestions for future improvements and deployments of the acoustic sensor system are included in the final report to Alaska Dept. of Fish and Game. This specifically relates to Objective 2.

3. Various sensor system deployment strategies were tested in the Prince of Wales area in many different habitat types. Optimal deployment strategies were developed from this experience and are included in the final report to Alaska Dept. of Fish and Game. This specifically relates to Objective 3.

4. The final project report for Alaska Dept of Fish and Game for this project was the major effort during January through June 30, 2007.

Significant Deviations*:* **None**

Project Leader: Matt Heavner

Additional Information: None.

Alaska Department of Fish and Game
State Wildlife Grant
ANNUAL INTERIM PERFORMANCE REPORT

Grant Number: T-1 **Segment Number:** 6
Project Number: 12
Project Title: Distribution and habitat ecology of bats in Southeast Alaska with emphasis on Keen's long-eared myotis
Project Duration: July 1, 2004 – June 30, 2007
Report Period: July 1, 2004 – June 30, 2005
Report Due Date: September 30, 2005

Objectives (*as submitted in grant project statement*):

1. To determine the distribution of bats in Southeast Alaska.
2. To determine the influences of forest management practices, and habitat characteristics on distribution and activity levels of bats in Southeast Alaska.
3. To develop a framework for future monitoring efforts for bats in Southeast Alaska.

Summary of Accomplishments *(Describe accomplishments related to the work that was proposed to be done during this same period in the Project Description and work schedule)***:**
The following accomplishments are related to Objective 1.

1. As of June 30, 2005 we surveyed three areas in Southeast Alaska: Yakutat, Juneau, and Hoonah.
2. We used various capture techniques including mistnets, harptraps, and stacked mistnets.
3. We conducted captures and echolocation monitoring in a variety of habitat types including muskeg, old-growth dominant, second-growth dominant, and clearcut.
4. We conducted captures over various water sources including ponds, creeks, and rivers. We also captured bats from roosts in buildings.
5. In Yakutat and Hoonah we caught exclusively little-brown myotis (*Myotis lucifugus*). In Juneau we caught little-brown bats, Keen's myotis (*M. keenii*) and California myotis (*M. californicus*). We caught 151 bats total and had no mortalities. Details of captures follows:

SUMMARY OF BAT CAPTURES 12 MAY 2005- 30 JUNE 2005

DATE	AREA	SITE TYPE	NUMBER	SPECIES	# OF NETS	COMMENTS	MORTALITIES
12-May	YAKUTAT	RIVER	0	0	8		0
13-May	YAKUTAT	HOME	5	MYLU	HARP	RAIN	0
14-May	YAKUTAT	CREEK	0	0	8	RAIN	0
15-May	YAKUTAT	RIVER	3	MYLU	8		0
16-May	YAKUTAT	BUSINESS	6	MYLU	HARP		0
17-May	YAKUTAT	CREEK	4	MYLU	4		0
17-May	YAKUTAT	CREEK	2	MYLU	4		0
18-May	YAKUTAT	RIVER	31	MYLU	8		0
19-May	YAKUTAT	RIVER	0	0	8	RAIN	0
20-May	YAKUTAT	FOREST	1	MYLU	STACKNET	RAIN	0
21-May	YAKUTAT	HOME	5	MYLU	HARP	RAIN	0
22-May	YAKUTAT	RIVER	2	MYLU	8		0

23-May	YAKUTAT	RIVER	0	0	8		0
31-May	JUNEAU	CREEK	0	0	4		0
31-May	JUNEAU	POND	0	0	4		0
1-Jun	JUNEAU	CREEK	0	0	8		0
2-Jun	JUNEAU	CREEK	1	MYLU	8		0
3-Jun	JUNEAU	RIVER	0	0	8		0
4-Jun	JUNEAU	APARTMENT BLDG	40	MYLU	HARP		0
5-Jun	JUNEAU	POND	0	0	4	RAIN	0
5-Jun	JUNEAU	POND	2	MYLU	4	RAIN	0
6-Jun	JUNEAU	POND	1	MYCA	8		0
8-Jun	JUNEAU	POND	0	0	8		0
9-Jun	JUNEAU	CREEK	0	0	4		0
9-Jun	JUNEAU	CREEK	0	0	4		0
11-Jun	JUNEAU	POND	10	MYLU	8	RAIN	0
13-Jun	JUNEAU	POND	7	MYCA(3),MYLU(2), MYKE(2)	4		0
13-Jun	JUNEAU	POND	2	MYLU	4		0
16-Jun	JUNEAU	CREEK	1	MYLU	4		0
16-Jun	JUNEAU	CREEK	0	0	4	CLOSED NETS 0100	0
18-Jun	HOONAH	CREEK	2	MYLU	8		0
19-Jun	HOONAH	RIVER	4	MYLU	8		0
20-Jun	HOONAH	CREEK	1	MYLU	8		0
21-Jun	HOONAH	CREEK	0		4		0
21-Jun	HOONAH	POND	0		4		0
23-Jun	HOONAH	POND	1	MYLU	8		0
24-Jun	HOONAH	CREEK	6	MYLU	4		0
24-Jun	HOONAH	CREEK	4	MYLU	4		0
25-Jun	HOONAH	CREEK	0	0	8		0
26-Jun	HOONAH	CREEK	7	MYLU	8		0
27-Jun	HOONAH	RIVER	2	MYLU	8	RAIN	0
29-Jun	HOONAH	ROAD	1	MYLU	STACKNET		0
29-Jun	HOONAH	POND	0	0	4		0

6. In addition to bats listed above, we recorded echolocation calls from what we believe to be silver-haired bats (*Lasionycteris noctivagans*) in Juneau and Hoonah.

<u>The following accomplishment is related to objective #2:</u>

7. We monitored bat activity in muskeg, clearcuts, structurally complex conifer stands, and structurally simple conifer stands in Yakutat, Juneau, and Hoonah. Time and weather permitting, we attempted to replicate each habitat 3-4 times for 3-4 nights per type in each area depending on availability of each habitat type.

<u>Accomplishments made in relation to objective #3:</u>

All data (including activity, timing of reproductive events, successful capture sites, weather variables during capture attemts, etc.) collected from captures and activity monitoring will contribute to knowledge required for establishing a framework for monitoring bats in Southeast Alaska.

Significant Deviations *(if any, and explain the reasons for these):*

None

Actual Costs during this Report Period *(personnel plus all operating expense totals)*:

Federal (from ADF&G):	Partner (nonfederal share):
$17,554.88	$5,851.63

Project Leader *(or Report Contact Person)*:   John Hayes

Additional Information: *(Not required. Add any additional detail, if desired, related to the progress of the project)*:   None

Alaska Department of Fish and Game
State Wildlife Grant
ANNUAL INTERIM PERFORMANCE REPORT

Grant Number: **T-1** **Segment Number:** **6**
Project Number: **12**
Project Title: <u>Distribution and habitat ecology of bats in Southeast Alaska with emphasis on Keen's long-eared myotis</u>
Project Duration: July 1, 2004 – June 30, 2007
Report Period: July 1, 2005 – June 30, 2006
Report Due Date: September 30, 2006
Partner: Oregon State University

Objectives:

1. To determine the distribution of bats in Southeast Alaska.
2. To determine the influences of forest management practices, and habitat characteristics on distribution and activity levels of bats in Southeast Alaska.
3. To develop a framework for future monitoring efforts for bats in Southeast Alaska.

Summary of Accomplishments:

<u>The following accomplishments are related to Objectives 1 and 2.</u>

1. From 1 July to 1 September 2005 we continued capture surveys of bats in the areas of Petersburg, Wrangell, and Prince of Wales Island. We used various capture techniques including mistnets, harptraps, hand nets, and stacked mistnets in a variety of habitat types including muskeg, old-growth dominant, second-growth dominant, and clearcut. We conducted captures over various water sources including ponds, creeks, and rivers as well as roads and trails. We also captured bats from roosts in buildings. A crew of four worked approximately 400 hours during 41 nights and we captured 73 bats of four species including *Myotis lucifugus*, *M. keenii*, *M. volans*, and *M. californicus*. We also spent approximately 400 hours passively monitoring bat activity and 150 hours measuring stem density in muskeg, clearcuts, old-growth dominant, and second-growth dominant conifer stands in all areas. Time and weather permitting, we attempted to replicate each habitat 3-4 times for 3-4 nights per type in each area depending on availability of each habitat type.

2. We returned to Prince of Wales Island 18 May 2006 with objectives of continuing capture surveys of bats on the island and radio-tracking Keen's myotis to day roosts. Between 18 May and 30 June 2006 we spent approximately 230 hours during 23 nights and captured 36 bats of the same four species listed above.

3. May-July 2006 we captured and radio-tagged 8 Keen's myotis on Prince of Wales Island and we tracked these bats to 40 roosts. We have measured and documented various characteristics of the areas surrounding the roosts as well as the roosts themselves in order to determine which habitat characteristics, if any, are selected for by the Keen's

myotis. Our team of four spent approximately 40 days and 360 hours tracking and measuring vegetation and terrain characteristics.

Accomplishments made in relation to objective #3:

All data (including activity, timing of reproductive events, successful capture sites, weather variables during capture attemts, etc.) collected from captures and activity monitoring will contribute to knowledge required for establishing a framework for monitoring bats in Southeast Alaska.

Significant Deviations
None

Actual Costs during this Report Period *(personnel plus all operating expense totals)*:
(Reported costs included ADF&G indirect calculated at 13.5%)

Federal (from ADF&G):	Partner (nonfederal share):
$132,057	$44,019

Project Leader *(or Report Contact Person)*: Julia Boland (Julia.boland@oregonstate.edu)
David Hibbs

Additional Information:
1. Do you anticipate having any unspent funds at the end of the project? No

FEDERAL AID
INTERIM PERFORMANCE REPORT

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-1 **Segment Number:** 6

Project Number: 12

Project Title: Distribution and habitat ecology of bats in Southeast Alaska with emphasis on Keen's long-eared myotis

Project Duration: July 1, 2004 – September 30, 2007

Report Period: July 1, 2006 – June 30, 2007

Report Due Date: September 30, 2007

Partner: Oregon State University

Project Objectives

1. To determine the distribution of bats in Southeast Alaska.
2. To determine the influences of forest management practices, and habitat characteristics on distribution and activity levels of bats in Southeast Alaska.
3. To develop a framework for future monitoring efforts for bats in Southeast Alaska.

Summary of Accomplishments

Objective 1: We returned to Prince of Wales Island 18 May 2006 to continue surveys of bats on the island and radio-track Keen's myotis to day roosts. From 18 May to 16 Aug 2006 we spent approximately 330 hours (700 man-hours) during 33 nights and captured 84 bats. We captured 19 *Myotis californicus* (13 female, 6 male), 34 *Myotis keenii* (28 female, 6 male), 23 *Myotis lucifugus* (17 female, 6 male), and 8 *Myotis volans* (2 female, 6 male).

Objective 2: We radio-tagged 19 Keen's myotis (13 female, 6 male) on Prince of Wales Island and we tracked these bats to 97 day roosts. We tracked 71 days (approx. 1400 man-hours) and located 86 roosts in live trees or snags, 1 in a house, 6 in stumps, 3 under loose rocks in a quarry, and 1 in a rock crevice. We are using vegetation and topography data collected in the field and from GIS maps of the island to examine selection of day-roosts by Keen's myotis at four spatial scales. Our team of four researchers spent approximately 27 days (560 man-hours) measuring vegetation and terrain characteristics.

Objective 3: We are compiling a full report of our findings as well as our successful and unsuccessful methods that will contribute to future monitoring efforts.

Significant Deviations: none

Project Leader: Julia Boland (Julia.boland@oregonstate.edu) and David Hibbs

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-1 **Segment Number:** 6

Project Number: 12

PROJECT TITLE: Distribution and habitat ecology of bats in Southeast Alaska with emphasis on Keen's long-eared myotis

PARTNER: Oregon State University

PRINCIPAL INVESTIGATORS: Julia Boland and David Hibbs

PROJECT DURATION: July 1, 2004 – September 30, 2007

REPORT PERIOD: July 1, 2007 – September 30, 2007

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Existing data are limited regarding the presence, distribution, and natural history of bats in Southeast Alaska (MacDonald and Cook 1996, Parker and Cook 1996, Parker et al. 1997). Bats comprise the second largest order of mammals after rodents, but the challenges associated with observing volant, nocturnal animals have contributed to the deficiency of information on their general biology and ecology worldwide. These general difficulties are compounded in the temperate rainforest of Southeast Alaska by the rugged terrain, wet climate, and low densities of bats. Due to the limited availability of data, it is not certain whether the apparent rarity of bats in Southeast Alaska is a result of the species occurring at their distributional limits, some other ecological factor, or an artifact of inadequate investigation.

Keen's myotis has the most limited distribution of any species of bat in North America (Nagorsen and Brigham 1993, Parker and Cook 1996, COSEWIC 2003). Prior to this study, rigorous examination of habitat associations of Keen's myotis had not been conducted and nothing was known of their habitat requirements in Southeast Alaska. The Keen's myotis appears to be rare throughout its range, but without appropriate knowledge regarding critical habitat requirements, effective conservation strategies cannot be developed. Suitable day-roost habitat is critical for populations of forest-dwelling bats (Kunz and Lumsden 2003) and dependence of bats on trees for day-roosting may make populations of forest-dwelling bats vulnerable to decline due to timber harvest (Hayes 2003, Hayes and Loeb 2007).

Limited information regarding distribution and habitat associations inhibits our ability to mitigate for potential negative impacts of forest management activities on bat populations (Christy and West 1993, Racey and Entwistle 2003) and lack of information on population status and trends hampers prioritization of mitigating efforts. The conservation status of bats in Alaska is unclear due to the lack of information pertaining to their population status and trends and region-specific ecology. The temperate rainforests of the Pacific Northwest comprise a unique biome in North America and caution should be taken when making extrapolations of ecology from other parts of a species' range. Many questions regarding ecological requirements of bats within this system need to be addressed.

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

Five species of bat have been documented in Southeast Alaska (little brown myotis, *Myotis lucifugus*; California myotis, *M. californicus*; long-legged myotis, *M. volans*; Keen's myotis, *M. keenii*, and the silver-haired bat, *Lasionycteris noctivagans*). Southeast Alaska is thought to be the northern distributional limit for all species of bat that occur there except the little brown myotis, which is found in the interior of Alaska (Parker et al. 1997). The California myotis has been documented in Alaska from 5 specimens found on and around Prince of Wales Island (ca. 54-56° N latitude) (Parker et al. 1997). Only two specimens of Keen's myotis exist from Southeast Alaska; one found on Wrangell Island in 1887 and one from northern Prince of Wales Island in 1993 (Parker et al. 1997). The little brown myotis is common throughout Canada, the United States, and Mexico, appears to be the most abundant species of bat in Alaska (Parker et al. 1997), and has been recorded as far north as Fort Yukon (Hall 1981) and Fairbanks (Fenton and Barclay 1980, Parker et al. 1997). Five specimens of long-legged myotis are recorded from locations in Southeast Alaska; the northernmost location being Admiralty Island (ca. 57.5° N latitude, Parker et al. 1996). Four specimens of silver-haired bats have been collected as far north as Juneau in Southeast Alaska (Parker et al. 1996).

The Keen's myotis was listed as a species of special concern in 1988 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), but has since been down-listed to 'data deficient' due to insufficient knowledge regarding population status, habitat ecology, and basic natural history (COSWIC 2003). The distribution of Keen's myotis is one of the smallest known for bats in North America. This species appears to be restricted to low elevation coastal coniferous forests of western Washington, southern British Columbia, and Southeast Alaska (Nagorsen and Brigham 1993, van Zyll de Jong and Nagorsen 1994). Keen's myotis are reported to roost in caves, rock crevices, and under boulders in British Columbia (Firman and Barclay 1993, Burles 2000), but knowledge of the structural characteristics of natural roosts or habitat surrounding roosts is minimal and nothing is known about the roost requirements of Keen's myotis in Southeast Alaska.

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

OBJECTIVE 1: To determine the distribution and relative abundance of bats in Southeast Alaska.

We captured bats and recorded their echolocation calls from 13 May to 31 August 2005 to assess their presence and distribution across a broad range of habitats in six areas along a latitudinal gradient in Southeast Alaska. We captured bats in Yakutat, Juneau, Chichagof Island, Mitkof Island, Wrangell Island, and Prince of Wales Island. We continued survey efforts with emphasis on Keen's myotis on Prince of Wales Island from 20 May to16 Aug 2006. We captured bats using mistnets (Kunz and Kurta 1988) and four-banked harp traps (G5 Bat Trap, Bat Conservation and Management, Inc., Carlisle, PA; Francis 1989) suspended outside roosts and over water and flyways. At selected locations, mistnets were also mounted on pulley systems from 20-30 ft stacked steel poles (Tom O'Shea and Dan Neubaum, personal communication). In 2006 we focused effort on capturing Keen's myotis and most capture attempts were made with mistnets placed over water or trails where entire corridors could be closed off. In an attempt to detect bats that were not captured, we also acoustically monitored bats using Anabat II detectors in the area where captures were conducted.

We caught 308 bats comprising four of the five species that were previously known to occur in the region (little brown myotis, California myotis, long-legged myotis, and Keen's myotis) and we sighted and acoustically detected the silver-haired bat. We captured 226 bats with mistnets during 118 nights and, in addition, 62 little brown myotis were captured from roosts in buildings, 1 little brown myotis was captured as it exited a Keen's myotis maternity roost in a tree, and 19 Keen's myotis were captured from the maternity roost in a tree.

The little brown myotis was the most frequently captured species (87% of mistnet captures in 2005; 34% of mistnet captures in 2006). Little brown myotis were present in each area sampled and were the only bats captured in Yakutat and on Chichagof Island. Fifty-five percent of little brown myotis captured in mistnets were captured over creeks and 29% were captured over rivers. The little brown myotis was the only species of bat captured from roosts in buildings or detected in urban environments. We found Keen's myotis in each area except Chichagof Island and Yakutat. Although we captured Keen's myotis throughout much of the region, captures were relatively rare in 2005 (*ca.* 6% of mistnet captures). Seventy-one percent of Keen's myotis captured in mistnets in 2005 and 2006 were captured over creeks. California myotis were found in Juneau and on Mitkof and Prince of Wales Islands. In 2005 only 6% of mistnet captures were of California myotis, but in 2006 California myotis comprised 30% of all captures on Prince of Wales Island. Sixty-two percent of captures of California myotis from 2005 and 2006 were on creeks. We captured 2 long-legged myotis in 2005 on Wrangell and Prince of Wales Islands, comprising only 1% of mistnet captures for that year. Eight individuals were captured on Prince of Wales Island in 2006 (13% of all 2006 captures). All but one long-legged myotis were netted over creeks. We recorded echolocation calls with frequencies and shape characteristic of silver-haired bats on 2 occasions in Juneau, 4 occasions on Prince of Wales Island, and 2 occasions on Wrangell Island, but visual confirmation of the bat was only achieved once on Prince of Wales Island. Given low rates of detection, all species appear to occur in low densities in Southeast Alaska.

OBJECTIVE 2: To determine the influence of tree and landscape characteristics on selection of day-roosts in trees by Keen's myotis on Prince of Wales Island.

We focused our efforts on Keen's myotis given their apparent rarity and the lack of available information regarding their habitat associations. Our objectives were to 1) examine relationships between and determine relative importance of habitat characteristics on selection of day-roosts in trees at three spatial scales: the tree, tree plot, and landscape, and 2) determine if habitat associations for males and females differed at each scale. From May to September 2006 we examined selection of day-roosts by Keen's myotis using radio telemetry.

We attached transmitters to 13 adult female and 6 adult male Keen's myotis. We tracked females to 62 roosts in trees and 1 in a house and we tracked males to 24 trees (n=6 bats), 6 stumps (n=2 bats), the space under 3 loose rocks in a quarry (n=1 bat), and 1 rock crevice (n=1 bat). Characteristics measured at each spatial scale appear to influence selection of day-roosts by female Keen's myotis, but characteristics of trees were more influential than those measured at other scales. Cedars comprised 87% of roosts used by females. Females were never found roosting in a live tree without defects (cracks, cavities, or broken tops) although the vast majority of available trees (70%) were in this category. Fifty-six percent of trees used by females were live with defects, 37% were snags in early decay, and 6% were snags in intermediate decay. Mean diameter, height, and slope-height of trees used as roosts by female Keen's myotis were significantly greater and percent bark remaining on roost trees was significantly less than available trees. Trees surrounding roosts of female Keen's myotis had large mean diameters and there was a high abundance of roost-like trees in plots surrounding roosts. Roosts were generally located closer to riparian habitat and in landscapes with more old-growth.

Associations were evident for male Keen's myotis at the tree and plot scales, but characteristics at the landscape scale were most influential. Male Keen's myotis exhibited flexibility in the types of roosts they chose, but tree roosts were primarily cedar and hemlock snags in intermediate and late stages of decay with defects and sloughing bark. Roost trees for males were surrounded by a high relative abundance of roost-like trees, closer to roads, and further from riparian habitat than were randomly selected trees.

OBJECTIVE 3: To develop a framework for future monitoring efforts for bats in Southeast Alaska.
(In progress- to be submitted by 30 November 2007)
The monitoring protocol provides a standardized survey effort and sampling design to inventory the presence, relative abundance, and population trends of bat species throughout the Southeast region. The protocol also outlines techniques for collecting baseline data on morphology, timing of reproductive events, echolocation call characteristics, and genetics of each species of bat.

IV. MANAGEMENT IMPLICATIONS

OBJECTIVE 1: Distribution and relative abundance of bats throughout the region

The species of bat that inhabit Southeast Alaska are long-lived with naturally low reproductive rates (Fenton and Barclay 1980, Kunz 1982, Warner and Czaplewski 1984, Nagorsen and Brigham 1993, Simpson 1993). Although data are currently insufficient for conclusive determination of habitat associations for all species of bat in Southeast Alaska, many of the species are primarily associated with forested habitats in other parts of their range. Low densities in conjunction with life history traits and region-specific ecologies may make populations of forest-dwelling bats in Southeast Alaska vulnerable to decline due to loss of habitat. Forests in Southeast Alaska, especially on private land, are being rapidly clearcut (DeGange 1996, Iverson et al. 1996, US Forest Service 1996). To understand how the increasing rate of habitat loss and alteration affect population status and distribution of bats in Southeast Alaska, the current status and future trends of populations and habitat associations for each species across multiple spatial scales is required.

OBJECTIVE 2: Influence of tree and landscape characteristics on selection of day-roosts in trees by Keen's myotis on Prince of Wales Island.

A disproportionate amount of logging has occurred on Prince of Wales Island relative to the rest of Southeast Alaska. Forest management can affect the distribution and abundance of bats by altering the availability and quality of roost sites (Hayes 2003, Hayes and Loeb 2007) and removal of large trees from forest habitats during harvest has been associated with a decrease in abundance of bats (Lunney et al. 1985). However, mitigation may be possible with retention of roost-like trees (Campbell et al. 1996, Hayes and Loeb 2007).

The conservation status of Keen's myotis throughout its range is currently unclear. We have limited knowledge of its biology and habitat associations and no knowledge of population status or trends. Day roosts in trees are a critical resource for many forest-dwelling species of bat. Removal of large diameter trees during timber harvest can reduce the number of potential roosts available to bats and harvesting forests under short rotations can inhibit the development of suitable roosts over time (Hayes and Loeb 2007). Evidence from this study suggests that maintaining forests with high proportions of live or recently dead, large-diameter trees in close proximity to riparian habitats may provide critical roosting habitat for female Keen's myotis on Prince of Wales Island.

V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY *(*July 1, 2007 – September 30, 2007)

JOB/ACTIVITY 1A: Capture bats in a variety of Southeast Alaska locations.

Performed data analyses and prepared report of findings

JOB/ACTIVITY 1B: Identify species of captured bats through morphological characteristics, pelage, and DNA analysis of tissue biopsies.

Performed data analyses and prepared report of findings

JOB/ACTIVITY 2A: Radio-tag and track bats on Prince of Wales Island to determine roosting areas.

Performed data analyses and prepared report of findings

JOB/ACTIVITY 2B: Collect and describe habitat characteristics of roosting sites.
Performed data analyses and prepared report of findings

JOB/ACTIVITY 3: To develop a framework for future monitoring efforts for bats in Southeast Alaska.

Performed data analyses and prepared report of findings

VI. PUBLICATIONS

Publications are in progress of being submitted

FEDERAL AID
FINAL PERFORMANCE REPORT

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-1 **Segment Number:** 3

Project Number: 6.10

Project Title: Baseline survey of small mammal species and their distribution across the Kenai Peninsula

Project Duration: July 1, 2006 – June 30, 2007 *(This project is continued from the T-1-8 grant and began in state FY 2005.)*

Report Period: 1 July 2006 – 30 June 2007

Report Due Date: September 30, 2007

Partner: Alaska Department of Fish and Game

Project Objectives

OBJECTIVE 1: Inventory small mammal species on the Kenai Peninsula and determine their distribution across habitat types.

OBJECTIVE 2: Assemble the first comprehensive series of small mammal specimens from the Kenai Peninsula for the University of Alaska Museum (UAM).

OBJECTIVE 3: Archive a specimen voucher and frozen tissue database of this notably insular and rapidly developing peninsula for future research, including genetic investigations of species endemism, epidemiology and parasite studies, dietary analyses of isotopes, and contaminant comparisons.

Summary of Project Accomplishments for entire project

OBJECTIVES 1&2: This project successfully completed the first comprehensive series of Kenai Peninsula small mammals. Eight areas across the peninsula were surveyed and over 1,700 specimens from 10 different species were captured.

OBJECTIVE 3: Some of the over 1,700 specimens captured during the project are still being processed at the University of Alaska Museum. The entire collection from this project should be completely processed and archived by the end of December, 2007.

Project Accomplishments during last segment period only (July 1, 2006 – June 30, 2007)

OBJECTIVES 1&2: Steps toward completing a comprehensive series of Kenai Peninsula small mammals continued from July 2006 through June 2007. Three areas were sampled from July 2006 through June 2007. In each of these three areas, over 400 traps were set for five nights totaling over 6000 trap nights. Eight hundred and fifty-eight specimens were collected from 8 different small mammal species.

OBJECTIVE 3: Specimens collected from July 2006 through June 2007 are currently being process and archived at the University of Alaska Museum. The entire collection from this project should be completely processed and archived by the end of December, 2007.

Prepared By: Thomas McDonough

FEDERAL AID
INTERIM PERFORMANCE REPORT

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-1 **Segment Number:** 3

Project Number: 6.11

Project Title: Inventory of small mammals on Minto Flats State Game Refuge, Alaska

Project Duration: July 1, 2006 – June 30, 2009

Report Period: 1 July 2006 – 30 June 2007

Report Due Date: September 30, 2007

Partner: Alaska Department of Fish and Game

Project Objectives

OBJECTIVE 1: Document species of Arvicoline rodents, Cricetid rodents, and Soricid species that reside in the various habitats of the refuge.

JOB/ACTIVITY A: Establish standardized and semi-permanent traplines that are sampled each August/September during the period 2006-2009.

JOB/ACTIVITY B: Provide voucher specimens to the University of Alaska Museum for all small mammal species captured on the refuge.

JOB/ACTIVITY C: At each successful trap site, conduct 1-meter radius vegetation plot frame sampling to document habitat use by each species of small mammal captured on the refuge.

JOB/ACTIVITY D: Provide annual abundance index analyses on each species of small mammal captured on the refuge.

Summary of Project Accomplishments

OBJECTIVE 1:

JOB/ACTIVITY A: During both 2006 and 2007, sampling was conducted during 1-5 August. A total of 543 snaptrap and 130 pitfall trapnights were accumulated during 2006, while 593 snaptrap and 86 pitfall trapnights were completed during 2007. Snaptraps (museum specials) were deployed along +/- linear lines in all available habitats and baited with peanut butter. Pitfall traps were generally relegated to wetter habitats where soils were conducive to easy placement, and were also baited with peanut butter. All traps were checked at least three times daily, and all captured specimens were removed and individually bagged.

During 2006, 87 individuals of 6 small mammal species were captured in 673 trapnights. In 2007, 372 small mammals of 8 species were collected in 679 trapnights. Notable captures were a melanistic meadow vole (*Microtus* *pennsylvanicus*) in 2006, and an albino northern red-backed vole (*Myodes rutilus*) and a least weasel (*Mustela nivalis*) during 2007.

JOB/ACTIVITY B: All specimens were deposited at the University of Alaska Fairbanks Museum of the North.

JOB/ACTIVITY C: During 2007, a total of 183 trap sites were subjected to vegetation sampling. Almost 20,000 individual plants in 33 taxa were enumerated. Sufficient captures of 7 species of small mammals (*Sorex cinereus, Sorex hoyi, Myodes rutilus, Microtus pennsylvanicus, Microtus oeconomus, Synaptomys borealis*, and *Zapus hudsonius*) enabled habitat affinity calculations. With only a single capture, no habitat preference/avoidance calculations were possible for *Mustela nivalis*.

JOB/ACTIVITY D: Northern red-backed voles (*Myodes rutilus*) were the most commonly captured rodent during both years, while common shrews (*Sorex cinereus*) were the most common soricid. Snaptrap capture rates for *M. rutilus* varied greatly between years, with capture rates of 0.9% and 25.6% during 2006 and 2007, respectively (a phenomenal increase of 28x). *Sorex cinereus* captures in both trap types combined were 9.8% and 22.2% in 2006 and 2007, respectively, indicating an increase of 2.3x.

Prepared By: Jackson S. Whitman

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-3 **Segment Number:** 1

Project Number: 6.11

Project Title: Inventory of small mammals on Minto Flats State Game Refuge, Alaska

Project Duration: July 1, 2006 – June 30, 2009

Report Period: 1 July 2007 – 30 June 2008

Report Due Date: September 30, 2008

Principal Investigator: Jackson Whitman, Alaska Department of Fish and Game

Project Objectives

OBJECTIVE 1: Document species of Arvicoline rodents, Cricetid rodents, and Soricid species that reside in the various habitats of the refuge.

JOB/ACTIVITY 1A: Establish standardized and semi-permanent traplines that are sampled each August/September during the period 2006-2009.

JOB/ACTIVITY 1B: Provide voucher specimens to the University of Alaska Museum for all small mammal species captured on the refuge.

JOB/ACTIVITY 1C: At each successful trap site, conduct 1-meter radius vegetation plot frame sampling to document habitat use by each species of small mammal captured on the refuge.

JOB/ACTIVITY 1D: Provide annual abundance index analyses on each species of small mammal captured on the refuge.

Summary of Project Accomplishments

OBJECTIVE 1:

JOB/ACTIVITY 1A: Establish standardized and semi-permanent traplines that are sampled each August/September during the period 2006-2009.

Accomplishments: In August 2007, 372 small mammals of 8 species were collected in 679 trapnights (Table 1; 54.8% capture rate). Differential catch rates were evident between the two trap types. Snaptraps yielded a higher diversity of catches than pitfalls during both years, but a lower catch rate. During both years, least shrews (*Sorex hoyi*) were taken only in pitfall traps, while snaptraps were responsible for captures of all root voles (*Microtus oeconomus*).

Northern red-backed voles (*Myodes rutilus,* formerly known as *Clethrionomys rutilus*) were the most commonly captured rodent during both years, while common shrews (*Sorex cinereus*) were the most common soricid. Snaptrap capture rates for *M. rutilus* varied greatly between the years, with capture rates of 25.6% during 2007, respectively (a phenomenal increase of 28x). *Sorex cinereus* captures in both trap types combined were 22.2% in 2007, indicating an increase of 2.3x from 2006 to 2007.

During 2007, two catches were notable. An albino adult male northern red-backed vole (*Myodes rutilus*) was collected, as well as an adult male least weasel (*Mustela nivalis*). Incidental catches included 10 avians (see Table 1) of 4 species as well as 16 wood frogs (*Rana sylvatica*). All avians were captured in snaptraps and were collected as specimens. Wood frogs were generally captured in pitfall traps, thus were usually released unharmed.

JOB/ACTIVITY 1B: Provide voucher specimens to the University of Alaska Museum for all small mammal species captured on the refuge.

Accomplishments: Captured specimens were removed and individually bagged in whirl-paks. Specimens were curated at the University of Alaska Fairbanks Museum of the North.

JOB/ACTIVITY 1C: At each successful trap site, conduct 1-meter radius vegetation plot frame sampling to document habitat use by each species of small mammal captured on the refuge.

Accomplishments: All plant taxa that were at least 10cm high were counted or estimated within a 1-m radius of the center of the trap. Capture locations for each species were compared against all non-capture locations with means (for each plant taxa), standard deviations, and confidence limits calculated. A total of 183 trap sites were subjected to vegetation sampling in 2007. Almost 20,000 individual plants in 33 taxa were enumerated (Table 2). Sufficient captures of 7 species of small mammals enabled habitat affinity calculations (Table 3).

JOB/ACTIVITY 1D: Provide annual abundance index analyses on each species of small mammal captured on the refuge.

Accomplishments: See Table 1.

Table 1. Species captured during 2006 and 2007 on Minto Flats State Game Refuge, Alaska, by year and trap type.

SPECIES CAPTURED	2006 SNAP	2006 PITFALL	2007 SNAP	2007 PITFALL	TOTAL
Sorex cinereus	16	50	43	108	217
Sorex hoyi	0	10	0	7	17
Myodes rutilus	5	1	152	3	161
Microtus pennsylvanicus	2	0	29	1	32
Microtus oeconomus	0	0	5	0	5
Synaptomys borealis	1	0	15	5	21
Zapus hudsonius	1	1	3	0	5
Mustela nivalis	0	0	1	0	1
TOTAL MAMMALS	**25**	**62**	**248**	**124**	**459**
white-crowned sparrow	1	0	1	0	2
American tree sparrow	1	0	0	0	1
Lincoln’s sparrow	2	0	1	0	3
dark-eyed junco	1	0	2	0	3
TOTAL AVIANS	**5**	**0**	**4**	**0**	**9**
wood frog	**0**	**2**	**4**	**12**	**18**
TOTAL CAPTURES	**30**	**64**	**256**	**136**	**486**

Table 2. List of vegetative taxa enumerated on 183 1-m radius vegetation plots at small mammal trap sites on Minto Flats State Game Refuge, Alaska, during August 2006 and August 2007. Stems of all plants ≥ 10-cm tall were tallied.

VEGETATIVE TAXA	**SUM**	**MEAN**	**ST.DEV.**
Grass, unidentified	5003	27.34	35.93
Sedge, unidentified	5190	28.36	35.90
Equisetum spp.	841	4.60	7.40
Geocaulon lividum	260	1.42	3.64
Myrica gale	1475	8.06	9.21
Salix spp.	235	1.28	3.65
Cicuta mackenzieana	6	0.03	0.25
Picea glauca	24	0.13	0.50
Potentilla palustris	814	4.45	6.74
Vaccinium uliginosum	816	4.46	15.80
Vaccinium vitis-idaea	976	5.33	12.09
Alnus incana	111	0.61	1.82
Betula glandulosa	348	1.90	4.67
Betula papyrifera	49	0.27	0.89
Rosa acicularis	78	0.43	1.65
Epilobium angustifolium	11	0.06	0.43
Galium boreale	58	0.32	1.84
Ledum palustre	1518	8.30	23.98
Mertensia paniculata	1	0.01	0.07
Populus tremuloides	129	0.70	2.21
Menyanthes trifoliata	1316	7.19	13.23
Iris setosa	52	0.28	2.26
Cornus canadensis	13	0.07	0.53
Rubus arcticus	3	0.02	0.16
Shepherdia canadensis	119	0.65	3.04
Stachys palustris	8	0.04	0.59
Spiraea beauverdiana	25	0.14	0.99
Pedicularis parviflora	321	1.76	5.10
Unidentified Labiateae	26	0.14	0.95
Unidentified Leguminoseae	2	0.01	0.10
Arctostaphylos uva-ursi	27	0.15	1.10
Unidentified Compositeae	9	0.05	0.47
Chamaedaphne calyculata	128	0.70	3.63
TOTAL VEGETATION	**19992**	**109.25**	**38.90**
CWD - all	147	0.80	2.74

Table 3. Habitat affinities displayed by 7 species of small mammals during August 2007 on Minto Flats State Game Refuge, Alaska. Plus signs (+) denote preference and minus signs (-) denote avoidance, with 1 sign showing 80%, 3 signs is 90%, and 5 signs being preference or avoidance at 95% confidence limits.

Vegetative Taxa	SOCI[1]	SOHO	MYRU	MIPE	MIOE	SYBO	ZAHU
Grass, unidentified							-----
Sedge, unidentified			-	+++++		+++++	+++++
Equisetum spp.						-	-----
Cicuta mackenzieana			-	-	-		-
Potentilla palustris				+++	-----		-
Menyanthes trifoliata			-----	+++		+++++	+++++
Stachys palustris							
Geocaulon lividum			+	-----	-----	-----	-----
Epilobium angustifolium						---	---
Galium boreale	-----			-----	-----	-----	-----
Mertensia paniculata							
Iris setosa				---	---	---	---
Cornus canadensis				---		---	---
Rubus arcticus							
Spiraea beauverdiana				---	---	---	---
Pedicularis parviflora				+++		+++++	
Labiatae, unidentified			-----		---		
Leguminosae, unidentified							
Compositae, unidentified	+						
Myrica gale							
Salix spp.	+++++			-----			-----
Vaccinium uliginosum			+++++	-----		-----	-----
Vaccinium vitis-idaea		---	+++	-----	-----	-----	-----
Alnus incana		-				-----	-----
Betula glandulosa							-----
Rosa acicularis		-		-----		-----	-----
Ledum palustre		---	+++++	-----	-----	-----	-----
Shepherdia canadensis				-----	-----	-----	-----
Arctostaphylos uva-ursi	---			---	---	---	---
Chamaedaphne calyculata			+	-	-----	-----	-----
Picea glauca					-----	-----	-----
Betula papyrifera	---		+++	-----	-----	-----	-----
Populus tremuloides	-----			-----	-----	-----	-----
TOTAL VEGETATION			**+**	**+++**		**+**	
Coarse woody debris - all						-----	-----

[1]Four letter denotations across the top are small mammal species encountered on Minto Flats State Game Refuge. SOCI = *Sorex cinereus*, SOHO = *Sorex hoyi*, MYRU = *Myodes rutilus*, MIPE = *Microtus pennsylvanicus*, MIOE = *Microtus oeconomus*, SYBO = *Synaptomys borealis*, and ZAHU = *Zapus hudsonius*.

Prepared By: Jackson S. Whitman

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-3 **Segment No.** 1

Project Number: 6.11

Project Title: Inventory of small mammals on Minto Flats State Game Refuge, Alaska

Project Duration: July 1, 2006 – June 30, 2009

Report Period: July 1, 2008 – June 30, 2009

Report Due Date: September 30, 2009

Partner: Alaska Department of Fish and Game

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Minto Flats State Game Refuge encompasses about 500,000 acres (2,023 km^2) of unique riverine and lacustrine riparian habitats 35 miles (56 km) west of Fairbanks. Because of its proximity to Fairbanks and its world-class waterfowl productivity, it has been subjected to extensive research efforts by the University of Alaska-Fairbanks staff and students, the U.S. Fish and Wildlife Service, and the Alaska Department of Fish and Game Statewide Waterfowl Program. However, basic inventories of other nongame vertebrates have not been undertaken. Because of recent interest in extractable natural resources in and adjacent to the refuge (including natural gas exploration leasing, white spruce timber harvesting) and aerial military training (supersonic and low altitude), habitat alteration in this pristine area will occur. Baseline information on the extent of use by all nongame species would be beneficial in future planning and mitigation processes on the refuge.

Small mammal populations have not been adequately surveyed in interior Alaska. Arvicoline rodents, in particular, provide the food base for a plethora of predators, both avian and mammalian. Management of Minto Flats State Game Refuge (Minto) is a state responsibility, and recent interest in natural resource extraction has the potential to degrade existing habitat. Alaska State Statutes establishing the refuge and the refuge management plan mandate that the Department of Fish and Game manage the refuge to protect and enhance fish and wildlife habitat and conserve fish and wildlife populations and diversity. However, a paucity of information exists on the extent of use of the area by nongame species.

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

To our knowledge, no previous, formal, small mammal inventories have been conducted on Minto Flats. The Alaska Comprehensive Wildlife Conservation Strategy lists basic inventory of nongame species as a primary recommendation across the state and specifically states that the distribution of small mammals in Alaska remains unknown.

Hence, there has been little inventory work on small mammals in Alaska and none specifically on Minto Flats. Therefore, we found no formal prior research and we know of no studies in progress that inventory small mammals on Minto Flats other than the work described here.

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

OBJECTIVE 1: Document species of Arvicoline rodents, Cricetid rodents, and Soricid species that reside in the various habitats of the refuge.

During 2007, sampling was conducted during 1-5 August. A total of 593 snaptrap and 86 pitfall trapnights were completed during 2007. Snaptraps were deployed along linear lines in all available habitats and baited with peanut butter. Pitfall traps were generally relegated to wetter habitats where soils were conducive to easy placement, and were also baited with peanut butter. All traps were checked at least three times daily, and all captured specimens were removed and individually bagged. 372 small mammals of 8 species were collected in 679 trapnights. Notable captures were an albino northern red-backed vole (*Myodes rutilus*) and a least weasel (*Mustela nivalis*) during 2007. All specimens were deposited at the University of Alaska Fairbanks Museum of the North.

During 2007, a total of 183 trap sites were subjected to vegetation sampling. Almost 20,000 individual plants in 33 taxa were enumerated. Sufficient captures of 7 species of small mammals (*Sorex cinereus, Sorex hoyi, Myodes rutilus, Microtus pennsylvanicus, Microtus oeconomus*, *Synaptomys borealis*, and *Zapus hudsonius*) enabled habitat affinity calculations. With only a single capture, no habitat preference/avoidance calculations were possible for *Mustela nivalis*.

Northern red-backed voles (*Myodes rutilus*) were the most commonly captured rodent, while common shrews (*Sorex cinereus*) were the most common soricid. Snaptrap capture rates for *M. rutilus* varied greatly between years, with capture rates of 0.9% and 25.6% during 2006 and 2007, respectively (a phenomenal increase of 28x). *Sorex cinereus* captures in both trap types combined were 9.8% and 22.2% in 2006 and 2007, respectively, indicating an increase of 2.3x.

IV. MANAGEMENT IMPLICATIONS

This study provided the first baseline data on the occurrence, relative abundance, and habitat preferences of small mammals on the Minto Flats State Game Refuge. These data will have important management implications to the state of Alaska when evaluating future management decisions. They document the current status of small mammals on the Refuge for the first time and can be used to compare to future inventories to investigate changes in small mammal occurrence, relative abundance, and habitat preferences over time and potentially in relation to management or development decisions.

V. SUMMARY OF WORK COMPLETED ON JOBS <u>FOR LAST SEGMENT PERIOD ONLY</u> (July 1, 2008 – June 30, 2009)

JOB/ACTIVITY 1A: Establish standardized and semi-permanent traplines that are sampled each August/September during the period 2006-2009.

No field work was conducted during this period because the position was vacant. T. Booms reviewed previous reports and compiled information for this final report.

JOB/ACTIVITY 1B: Provide voucher specimens to the University of Alaska Museum for all small mammal species captured on the refuge.

No field work was conducted during this period because the position was vacant. T. Booms reviewed previous reports and compiled information for this final report.

JOB/ACTIVITY 1C: At each successful trap site, conduct 1-meter radius vegetation plot frame sampling to document habitat use by each species of small mammal captured on the refuge.

No field work was conducted during this period because the position was vacant. T. Booms reviewed previous reports and compiled information for this final report.

JOB/ACTIVITY 1D: Provide annual abundance index analyses on each species of small mammal captured on the refuge.

No field work was conducted during this period because the position was vacant. T. Booms reviewed previous reports and compiled information for this final report.

VI. PUBLICATIONS

None.

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
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Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: **T-3** **Segment Number: 1**
Project Number: **11.12**
Project Title: Population and habitat assessments for CWCS featured species in Southcentral Alaska
Project Duration: January 1, 2007 – June 30, 2009
Report Period: 1 January 2007 – 1 January 2008
Report Due Date: March 30, 2008
Partner: Alaska Department of Fish and Game

Project Objectives

OBJECTIVE 1: Identify and evaluate various survey and monitoring strategies for selected species in Southcentral Alaska and establish protocols.

JOB/ACTIVITY 1A: Review current scientific literature; consult with species experts, species working groups, and other partners; define specific survey and monitoring protocols.

JOB/ACTIVITY 1B: Design survey and monitoring techniques that provide both accuracy and precision for assessing population status and trends of various vertebrate species in Southcentral Alaska.

JOB/ACTIVITY 1C: As needed, design and implement research to determine most accurate, defensible and cost-effective survey and monitoring techniques.

OBJECTIVE 2: Conduct survey and/or monitoring of selected species in Southcentral Alaska to determine population status, abundance, and distribution of the species.

JOB/ACTIVITY 2A: Recruit, hire, and train a field crew as necessary to carry out fieldwork. Purchase equipment and arrange charters as necessary to support the fieldwork.

JOB/ACTIVITY 2B: Conduct surveys using identified techniques. Water-borne, aerial, and ground-based approaches may be employed, depending upon taxa studied. Amphibian work generally will follow USGS-ARMI (Amphibian Research and Monitoring Initiative) protocols when possible unless modified based on information from active Partner Project: T-1-6-18, Amphibian Monitoring in Southeast Alaska, Dr. Sanjay Pyare. Standard visual surveys, calling surveys, and pitfall trapping also may be utilized. Techniques for birds could include standard North American Breeding Bird Survey roadside counts, Alaska Landbird Monitoring System protocols, line transect surveys, point counts, calling surveys, and specialized techniques as needed to produce accurate and credible information on abundance and distribution. Mammal survey techniques include a variety of visual, aural, and sign (track, scat, hair) surveys with more specialized techniques as needed. Curate and archive 1,042 small mammal specimens collected during the 2006 field season on the Kenai Peninsula.

JOB/ACTIVITY 2C: Conduct genetic analysis where deemed appropriate to determine genetic relatedness and distinctiveness of island endemic species.

OBJECTIVE 3: Identify habitat types and needs associated with the selected species and identify existing or potential problems, needs, or concerns regarding habitats.

JOB/ACTIVITY 3A: Based on results of surveys, identify habitats that are important for population maintenance, especially for those species with indicated declines either on a national level or within the state.

JOB/ACTIVITY 3B: Where practical, provide land managers with recommendations on habitat maintenance, especially if those habitats are negatively impacted through anthropogenic causes.

OBJECTIVE 4: Examine population dynamics and identify factors limiting population growth or reproductive success, such as predators, habitat loss or degradation, and contaminants.

JOB/ACTIVITY 4A: Where possible, gather supplemental ecological data to accompany population parameters on Southcentral Alaskan vertebrates. These data may include demographic information, predation risks and factors, and habitat preference or avoidance parameters.

OBJECTIVE 5: Analyze, disseminate and share information and data with partners, cooperators, the scientific community, and the general public.

JOB/ACTIVITY 5A: Analyze data**,** prepare reports, maps, and associated publications and presentations.

JOB/ACTIVITY 5B: Attend conferences and workshops and/or write articles to present findings.

OBJECTIVE 6: Develop and implement a regional CWCS step-down strategy.

JOB/ACTIVITY 6A: Identify implementation partners.

JOB/ACTIVITY 6B: Identify implementation projects and activities.

JOB/ACTIVITY 6C: Implement projects and activities as part of objectives 1 – 5, or under a separate implementation grant.

Summary of Accomplishments

OBJECTIVE 1:

JOB/ACTIVITY 1A: Review current scientific literature; consult with species experts, species working groups, and other partners; define specific survey and monitoring protocols.

No progress.

JOB/ACTIVITY 1B: Design survey and monitoring techniques that provide both accuracy and precision for assessing population status and trends of various vertebrate species in Southcentral Alaska.

No progress.

JOB/ACTIVITY 1C: As needed, design and implement research to determine most accurate, defensible and cost-effective survey and monitoring techniques.

No progress.

OBJECTIVE 2:

JOB/ACTIVITY 2A: Recruit, hire, and train a field crew as necessary to carry out fieldwork. Purchase equipment and arrange charters as necessary to support the fieldwork.

No progress.

JOB/ACTIVITY 2B: Conduct surveys using identified techniques. Water-borne, aerial, and ground-based approaches may be employed, depending upon taxa studied. Amphibian work generally will follow USGS-ARMI (Amphibian Research and Monitoring Initiative) protocols when possible unless modified based on information from active Partner Project: T-1-6-18, Amphibian Monitoring in Southeast Alaska, Dr. Sanjay Pyare. Standard visual surveys, calling surveys, and pitfall trapping also may be utilized. Techniques for birds could include standard North American Breeding Bird Survey roadside counts, Alaska Landbird Monitoring System protocols, line transect surveys, point counts, calling surveys, and specialized techniques as needed to produce accurate and credible information on abundance and distribution. Mammal survey techniques include a variety of visual, aural, and sign (track, scat, hair) surveys with more specialized techniques as needed. Curate and archive 1,042 small mammal specimens collected during the 2006 field season on the Kenai Peninsula.

Prior to 2007, University of Alaska Museum (UAM) mammals collection staff consulted with ADFG to develop survey and monitoring techniques and protocols for small mammals. UAM staff designed a standardized trapping protocol that was used during the initial survey and collection of small mammals and recording of data such as capture locality and habitat on the Kenai Peninsula during the summer of 2006.

During this reporting period (2007), UAM implemented curation of the 1,042 species that were collected. This work included verifying species identifications, cleaning skulls and skeletons, labeling specimens and preparing them for long-term archival storage. Proper curation of the specimens and their data is vital to determining species distribution and may be useful in determining population abundance.

JOB/ACTIVITY 2C: Conduct genetic analysis where deemed appropriate to determine genetic relatedness and distinctiveness of island endemic species.

No progress.

OBJECTIVE 3:

JOB/ACTIVITY 3A: Based on results of surveys, identify habitats that are important for population maintenance, especially for those species with indicated declines either on a national level or within the state.

No progress.

JOB/ACTIVITY 3B: Where practical, provide land managers with recommendations on habitat maintenance, especially if those habitats are negatively impacted through anthropogenic causes.

No Progress

OBJECTIVE 4:

JOB/ACTIVITY 4A: Where possible, gather supplemental ecological data to accompany population parameters on Southcentral Alaskan vertebrates. These data may include demographic information, predation risks and factors, and habitat preference or avoidance parameters.

No progress.

OBJECTIVE 5:

JOB/ACTIVITY 5A: Analyze data**,** prepare reports, maps, and associated publications and presentations.

In 2007, UAM verified mammal specimen data that were entered into the UAM database, Arctos, which are available to the public online. These data may be downloaded from the database. Specimen locations can be mapped using the database.

JOB/ACTIVITY 5B: Attend conferences and workshops and/or write articles to present findings.

No Progress.

OBJECTIVE 6:

JOB/ACTIVITY 6A: Identify implementation partners.

No Progress.

JOB/ACTIVITY 6B: Identify implementation projects and activities.

No Progress.

JOB/ACTIVITY 6C: Implement projects and activities as part of objectives 1 – 5, or under a separate implementation grant.

No Progress.

Significant Deviations: none.

Additional Information: none.

Prepared By: Brandy Jacobsen, Mammals Collection Manager (UAM small mammal component of project)

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: **T-3** **Segment Number: 1**
Project Number: **11.12**
Project Title: Population and habitat assessments for CWCS featured species in Southcentral Alaska
Project Duration: January 1, 2007 – June 30, 2009
Report Period: 1 January 2008 – 31 December 2008
Report Due Date: March 31, 2009
Partner: Alaska Department of Fish and Game, University of Alaska Museum

Project Objectives

OBJECTIVE 1: Identify and evaluate various survey and monitoring strategies for selected species in Southcentral Alaska and establish protocols.

JOB/ACTIVITY 1A: Review current scientific literature; consult with species experts, species working groups, and other partners; define specific survey and monitoring protocols.

JOB/ACTIVITY 1B: Design survey and monitoring techniques that provide both accuracy and precision for assessing population status and trends of various vertebrate species in Southcentral Alaska.

JOB/ACTIVITY 1C: As needed, design and implement research to determine most accurate, defensible and cost-effective survey and monitoring techniques.

OBJECTIVE 2: Conduct survey and/or monitoring of selected species in Southcentral Alaska to determine population status, abundance, and distribution of the species.

JOB/ACTIVITY 2A: Recruit, hire, and train a field crew as necessary to carry out fieldwork. Purchase equipment and arrange charters as necessary to support the fieldwork.

JOB/ACTIVITY 2B: Conduct surveys using identified techniques. Water-borne, aerial, and ground-based approaches may be employed, depending upon taxa studied. Amphibian work generally will follow USGS-ARMI (Amphibian Research and Monitoring Initiative) protocols when possible unless modified based on information from active Partner Project: T-1-6-18, Amphibian Monitoring in Southeast Alaska, Dr. Sanjay Pyare. Standard visual surveys, calling surveys, and pitfall trapping also may be utilized. Techniques for birds could include standard North American Breeding Bird Survey roadside counts, Alaska Landbird Monitoring System protocols, line transect surveys, point counts, calling surveys, and specialized techniques as needed to produce accurate and credible information on abundance and distribution. Mammal survey techniques include a variety of visual, aural, and sign (track, scat, hair) surveys with more specialized techniques as needed. Curate and archive 1,042 small mammal specimens collected during the 2006 field season on the Kenai Peninsula.

JOB/ACTIVITY 2C: Conduct genetic analysis where deemed appropriate to determine genetic relatedness and distinctiveness of island endemic species.

OBJECTIVE 3: Identify habitat types and needs associated with the selected species and identify existing or potential problems, needs, or concerns regarding habitats.

JOB/ACTIVITY 3A: Based on results of surveys, identify habitats that are important for population maintenance, especially for those species with indicated declines either on a national level or within the state.

JOB/ACTIVITY 3B: Where practical, provide land managers with recommendations on habitat maintenance, especially if those habitats are negatively impacted through anthropogenic causes.

OBJECTIVE 4: Examine population dynamics and identify factors limiting population growth or reproductive success, such as predators, habitat loss or degradation, and contaminants.

JOB/ACTIVITY 4A: Where possible, gather supplemental ecological data to accompany population parameters on Southcentral Alaskan vertebrates. These data may include demographic information, predation risks and factors, and habitat preference or avoidance parameters.

OBJECTIVE 5: Analyze, disseminate and share information and data with partners, cooperators, the scientific community, and the general public.

JOB/ACTIVITY 5A: Analyze data, prepare reports, maps, and associated publications and presentations.

JOB/ACTIVITY 5B: Attend conferences and workshops and/or write articles to present findings.

OBJECTIVE 6: Develop and implement a regional CWCS step-down strategy.

JOB/ACTIVITY 6A: Identify implementation partners.

JOB/ACTIVITY 6B: Identify implementation projects and activities.

JOB/ACTIVITY 6C: Implement projects and activities as part of objectives 1 – 5, or under a separate implementation grant.

Summary of Accomplishments

OBJECTIVE 1:

JOB/ACTIVITY 1A: Review current scientific literature; consult with species experts, species working groups, and other partners; define specific survey and monitoring protocols.

No progress.

JOB/ACTIVITY 1B: Design survey and monitoring techniques that provide both accuracy and precision for assessing population status and trends of various vertebrate species in Southcentral Alaska.

No progress.

JOB/ACTIVITY 1C: As needed, design and implement research to determine most accurate, defensible and cost-effective survey and monitoring techniques.

No progress.

OBJECTIVE 2:

JOB/ACTIVITY 2A: Recruit, hire, and train a field crew as necessary to carry out fieldwork. Purchase equipment and arrange charters as necessary to support the fieldwork.

No progress.

JOB/ACTIVITY 2B: Conduct surveys using identified techniques. Water-borne, aerial, and ground-based approaches may be employed, depending upon taxa studied. Amphibian work generally will follow USGS-ARMI (Amphibian Research and Monitoring Initiative) protocols when possible unless modified based on information from active Partner Project: T-1-6-18, Amphibian Monitoring in Southeast Alaska, Dr. Sanjay Pyare. Standard visual surveys, calling surveys, and pitfall trapping also may be utilized. Techniques for birds could include standard North American Breeding Bird Survey roadside counts, Alaska Landbird Monitoring System protocols, line transect surveys, point counts, calling surveys, and specialized techniques as needed to produce accurate and credible information on abundance and distribution. Mammal survey techniques include a variety of visual, aural, and sign (track, scat, hair) surveys with more specialized techniques as needed. Curate and archive 1,042 small mammal specimens collected during the 2006 field season on the Kenai Peninsula.

In FY2008, University of Alaska Museum collection staff processed mammal specimens, including verifying species identifications, cleaning skulls ad skeletons, verifying data in the database, labeling specimens and preparing them for long-term archival storage.

JOB/ACTIVITY 2C: Conduct genetic analysis where deemed appropriate to determine genetic relatedness and distinctiveness of island endemic species.

No progress.

OBJECTIVE 3:

JOB/ACTIVITY 3A: Based on results of surveys, identify habitats that are important for population maintenance, especially for those species with indicated declines either on a national level or within the state.

No progress.

JOB/ACTIVITY 3B: Where practical, provide land managers with recommendations on habitat maintenance, especially if those habitats are negatively impacted through anthropogenic causes.

No Progress

OBJECTIVE 4:

JOB/ACTIVITY 4A: Where possible, gather supplemental ecological data to accompany population parameters on Southcentral Alaskan vertebrates. These data may include demographic information, predation risks and factors, and habitat preference or avoidance parameters.

UAM recorded the habitats in which mammal species were collected during the 2006 field survey.

OBJECTIVE 5:

JOB/ACTIVITY 5A: Analyze data, prepare reports, maps, and associated publications and presentations.

In FY08, standard data for mammal specimens collected by UAM were entered into the UAM database, Arctos, and are available to the public online (http://arctos.database.museum/home.cfm). Specimen locations can be mapped using the database.

JOB/ACTIVITY 5B: Attend conferences and workshops and/or write articles to present findings.

No Progress

OBJECTIVE 6:

JOB/ACTIVITY 6A: Identify implementation partners.

No Progress

JOB/ACTIVITY 6B: Identify implementation projects and activities.

No Progress

JOB/ACTIVITY 6C: Implement projects and activities as part of objectives 1 – 5, or under a separate implementation grant.

No Progress

Significant Deviations: none.

Additional Information: none.

Prepared By: David Tessler, ADF&G

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

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: T-9 **Segment Number:** 1

Project Number: 1.0

Project Title: Phylogeography, taxonomy, and conservation genetics of Alaska's enigmatic hoary marmots

Project Duration: 1 July 2008 – 30 June 2012

Report Period: 1 July 2008 – 30 June 2009

Report Due Date: September 30, 2009

Partner: University of Alaska Museum

Project Objectives:

OBJECTIVE 1: Determine the number of species currently referred to *Marmota caligata*.

JOB/ACTIVITY 1A: Collect and prepare voucher specimens from localities where divergent haplotypes occur in sympatry or near-sympatry to obtain larger sample sizes of fresh tissue and to characterize pelage phenotypes.

JOB/ACTIVITY 1B: Use DNA sequence data from multiple unlinked loci to further test the results obtained from a subset of available material sequenced for mtDNA only, particularly with respect to the phylogenetic position of *M. vancouverensis*.

JOB/ACTIVITY 1C: Use mtDNA sequence data from museum specimens representing the entire range of *M. caligata* to see if phylogeography is concordant with recognized subspecies (and see below).

JOB/ACTIVITY 1D: Re-examine type material and a majority of available specimens of *M. caligata* to determine if original diagnostic morphological characters are constant within *M. caligata* and its constituent subspecies given a much larger available sample.

OBJECTIVE 2: Determine the persistence and taxonomic validity of the Montague Island marmot.

JOB/ACTIVITY 2A: Conduct limited aerial and extensive ground surveys on Montague Island to ascertain whether marmots have persisted.

JOB/ACTIVITY 2B: Live-trap marmots (if possible) and collect blood and ear biopsies prior to on-site release for archiving at the University of Alaska Museum and inclusion in the molecular studies above.

JOB/ACTIVITY 2C: Collect feces and any marmot remains found during ground surveys as voucher material and possible sources of DNA.

JOB/ACTIVITY 2D: Obtain skin or dried tissue samples from existing museum specimens of MI marmots for inclusion in the mtDNA study above.

OBJECTIVE 3: Determine the taxonomic validity of the Glacier Bay marmot.

JOB/ACTIVITY 3A: Re-visit the type locality and conduct limited collecting (3-5 individuals) to obtain material for multi-locus molecular study above and to characterize pelage phenotype.

JOB/ACTIVITY 3B: Collect additional specimens in other accessible areas around Glacier Bay in order to characterize phenotype and the degree of mtDNA haplotype sympatry as well as to study gene flow between GB marmots and adjacent populations.

JOB/ACTIVITY 3C: Obtain skin or dried tissue samples from existing museum specimens of GB marmots for inclusion in the mtDNA study above.

Summary of Project Accomplishments

JOB/ACTIVITY 1A: Collect and prepare voucher specimens from localities where divergent haplotypes occur in sympatry or near-sympatry to obtain larger sample sizes of fresh tissue and to characterize pelage phenotypes.

Accomplishments: 2 hoary marmots were collected from Castner Glacier Valley in the Alaska Range. 4 marmots were collected from Wrangell St. Elias National Park. All were prepared as voucher specimens.

JOB/ACTIVITY 1B, 1C: Use DNA sequence data from multiple unlinked loci to further test the results obtained from a subset of available material sequenced for mtDNA only, particularly with respect to the phylogenetic position of *M. vancouverensis*. Use mtDNA sequence data from museum specimens representing the entire range of *M. caligata* to see if phylogeography is concordant with recognized subspecies.

Accomplishments: 2 individuals were preliminarily sequenced two nuclear genes (PRKCI and THY) to determine variable regions.

JOB/ACTIVITY 1D: Re-examine type material and a majority of available specimens of *M. caligata* to determine if original diagnostic morphological characters are constant within *M. caligata* and its constituent subspecies given a much larger available sample.

Accomplishments: The Burke Museum of Natural History in Seattle was visited to examine hoary marmot specimens - 9 specimens were photographed and 13 samples were collected for genetic analysis. The Museum of Comparative Zoology, at Harvard was also visited to examine hoary marmot specimens – 24 specimens were photographed and 14 samples were taken for genetic analysis.

JOB/ACTIVITY 2A, 2B, 2C: Conduct limited aerial and extensive ground surveys on Montague Island to ascertain whether marmots have persisted. Live-trap marmots (if possible) and collect blood and ear biopsies prior to on-site release for archiving at the University of Alaska Museum and inclusion in the molecular studies above. Collect feces and any marmot remains found during ground surveys as voucher material and possible sources of DNA.

Accomplishments: Surveying and collecting marmots from Montague Is. has not been accomplished. Logistical access to the island has proved more difficult than anticipated, especially combined with the delayed arrival of the student working on the project. This work will be done during the next reporting period.

JOB/ACTIVITY 2D: Obtain skin or dried tissue samples from existing museum specimens of MI marmots for inclusion in the mtDNA study above.

Accomplishments: The two Musuems that were visited during this reporting period do not have any Montague Island marmot specimens.

JOB/ACTIVITY 3A, 3B: Re-visit the type locality and conduct limited collecting (3-5 individuals) to obtain material for multi-locus molecular study above and to characterize pelage phenotype. Collect additional specimens in other accessible areas around Glacier Bay in order to characterize phenotype and the degree of mtDNA haplotype sympatry as well as to study gene flow between GB marmots and adjacent populations.

Accomplishments: Travel to Glacier Bay and surrounding areas for additional collecting has not been accomplished. This will happen during the next reporting period with the new student working on this project.

JOB/ACTIVITY 3C: Obtain skin or dried tissue samples from existing museum specimens of GB marmots for inclusion in the mtDNA study above.

Accomplishments: The two Musuems that were visited during this reporting period do not have any Glacier Bay marmot specimens.

Significant Deviations: None.

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