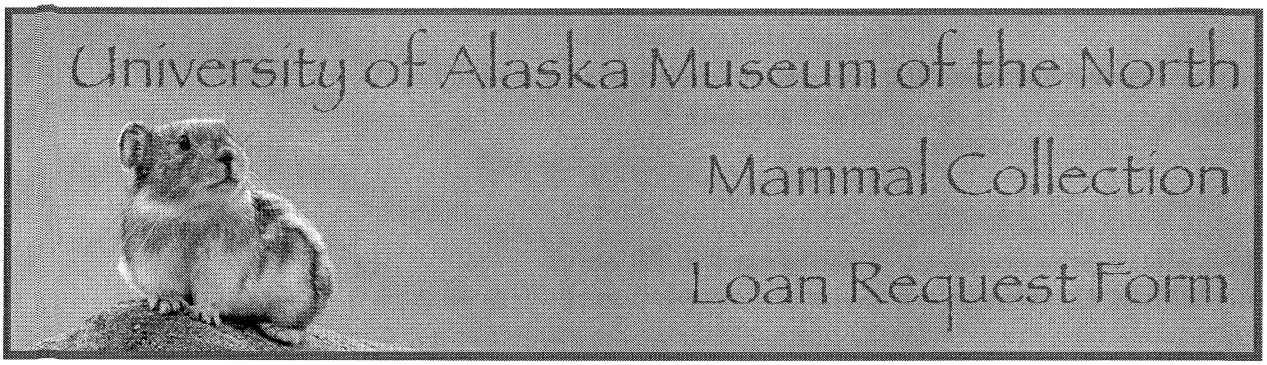


Please read and follow these instructions carefully.

- *Fill out every applicable field (fields will automatically expand as necessary).*
- *Sign and email the completed form to the Curator (Link Olson, link.olson@alaska.edu) and Collection Manager (Aren Gunderson, amgunderson@alaska.edu). If you are requesting frozen tissues, also copy the Genomic Resources Collection Manager Kyndall Hildebrandt (kbhildebrandt@alaska.edu)*
- *Review the conditions that apply to granted requests on our web page and be aware that compliance with these conditions will be considered when evaluating future requests from you, your advisor, or your lab PI.*

Date of request:2014-11-04

Your name: Jennifer Burns, Sean Brennan, Thure Cerling and Diego Fernandez

E-mail address:jmburns@uaa.alaska.edu, srbrennan@alaska.edu, diego.fernandez@utah.edu, thure.cerling@utah.edu

Your current position (e.g., graduate student, faculty researcher, etc.):
Jennifer Burns: Professor, Biological Sciences, UAA

Sean Brennan: Postdoc, University of Washington

Thure Cerling: Professor, Geology and Geophysics, U of UT

Diego Fernandez: Professor, Geology and Geophysics, U of UT

Advisor's name (if student or postdoc):

Institution (where research will be conducted): University of Utah. U of UT has the necessary laboratory and instruments needed to conduct these isotopic analyses; they do not exist in Alaska.

Street address (where loan will be sent):

Samples can be sent to:
Diego Fernandez
Geology & Geophysics
Frederick Albert Sutton Building
115 S 1460 East, Room 383

Salt Lake City, Ut 84112

Please note on the waybill under shipper/account reference that the package is for "Geology & Geophysics - Strontium"

Shipping is paid by the recipient. We ship via Fed-Ex only:
Please list Fed-Ex account number to be charged here:1119 6040 2

If other shipping arrangements are needed please enter details here:

Phone number (required for deliveries):(801) 587-9366

For destructive/consumptive requests (e.g., frozen tissues, samples for stable isotope analysis), please provide the name of the Principal Investigator whose lab will be used (if different from advisor): Deigo Fernandez and Thure Cerling

Project title (to be made publicly available on UAM's collection database):
Determining habitat use of Illiamna Lake harbor seals using strontium and oxygen isotopes of teeth

Brief summary of the proposed research. This should address the following:

1. **Objectives of the project**
2. **Complementarity of proposed research to previous or ongoing studies**
3. **Data to be obtained and methods of analysis**
4. **Feasibility and time frame**
5. **Qualifications of the investigator(s) to conduct the research**

A key question surrounding the conservation status of the harbor seals that are found within Iliamna Lake is whether the seals within the lake are a distinct population segment that is separate from the nearby, larger, Bristol Bay population. At issue is whether individual seals within the lake are born there, and reside there for their lifetime, or if individuals move between the lake and Bristol Bay via the Kvichak River.

Recently, we started to investigate the utility of using isotopic tracers naturally occurring in the lake and river environments, to discern the relative habitat use of seals from Iliamna Lake. The freshwater region of Iliamna Lake and the surrounding watersheds (e.g., the Nushagak River) differ in the strontium (87Sr/86Sr) and oxygen (δ 18O) isotope ratios as compared to the marine environment (>> 2SD analytical uncertainty). These isotopic tracers are incorporated into animal tissues, such as teeth, from the environment via dietary and water sources. In the case of 87Sr/86Sr ratios, 87Sr/86Sr ratios of teeth directly reflect those of water and dietary sources due to the fact that this ratio is not modified during physical or physiological processes. δ 18O values of teeth are a function of an animal's body water δ 18O value (derived from dietary and water sources) and offset by a well-defined temperature fractionation for homeothermic animals. In seals, tooth enamel and dentine are deposited incrementally, and record isotopic signals derived from the environments experienced over the life of an individual, allowing a longer picture of the diet and habitat use than is possible to obtain through the analysis of any soft tissue.

Thus, we hypothesized that any migration between the marine and freshwater environments undertaken by the seals during their lives would be easily detectable in the isotopic signals from across the width of the tooth. To test this hypothesis we undertook two sets of preliminary measurements. First, we measured the δ 18O isotopic values in three enamel samples per tooth that

represent the seal's early life (apex), middle life (midpoint) and late life (enamel-dentine interface). We then compared values to those in the marine and freshwater environments (Figure 1). There was no indication of marine influence from any individual or along the general time axis for any of the 4 individual seals we analyzed (ranging in age from 4-15).

Second, we measured the 87Sr/86Sr ratio along the entire width of the dentine in the tooth recovered from a single, 5 year-old, seal using a micro-drilling technique that provides multiple values per annuli (at 100um intervals, approximately 2 samples / year) within the tooth, and thus the resolution to address both within and among year difference. The isotope ratios in this seal showed no intra-annual signal, and values were only slightly elevated above those in freshwater in the oldest dentine (Figure 2). While values gradually increased toward the pulp cavity (more recently deposited), they never reached those of seawater, suggesting that – at no time in its life – did the seal reside in the marine habitat. The increase could reflect a greater reliance on marine derived prey once the seal was large enough to capture salmon returning from Bristol Bay to the lake to spawn.

We are currently seeking funds to complete the life-long 87Sr/86Sr profiles for the remaining 3 seals for which we have canine teeth samples. By completing these analyses we will be able to determine 1) if δ18O isotopic values assayed at a coarse temporal resolution are reflective of the finer scale data on habitat use provided by the micro-drilling techniques, and 2) if all four Lake Illiamna seals spent their entire lives in Lake Iliamna, as is suggested by δ 18O values. If so, this will provide an important insight into this population's ecology and their effective conservation.

The UAM seal teeth samples requested herein will compliment our ongoing sample set and analyses by substantially increasing the number of individuals incorporated into this study. It will also allow us to compare observed isotope patterns recorded in teeth of current and past harbor seal populations.

All PIs of this project are qualified to conduct this research. Dr Jennifer Burns is an expert in marine mammal biology and ecology, including seals. Sean Brennan recently (June 2014) successfully defended is dissertation on using 87Sr/86Sr to track migrations of animals, specifcally Pacific salmon. Dr. Thure Cerling is an expert in using materials, such as teeth, to track movement patterns of a diverse array of animals, cincluding mammals. Cerling has 30+ years of experience working with museum collections within the context of stable isotope ecology. Dr. Diego Fernandez is an expert analytical chemist and is the director of the University of Utah, ICPMS laboratory we will use to conduct analyses.

Briefly explain your efforts to obtain material from other sources and why the requested UAM specimens are necessary for this project:

Jennifer Burns has been studying the current Illimana Lake harbor seals for the past four years, which is where we obtained our existing sample set. By using museum samples we are increasing our current sample set and provided an opportunity to compare past and current population behavior. Additionally, by using museum samples we can minimize our impact on currently living populations.

UAM is the only holder of samples from Iliamna Lake Harbor seals

Have you (or your current advisor/Lab PI) previously borrowed or used material from UAM's Mammal Collection? Yes☒ No☐

If you answered "yes":

Have all resulting publications, GenBank accession numbers, or other products been communicated to UAM? **Yes☐ No☐**

Were all UAM specimens included in any published study individually identified by UAM

catalog number? **Yes☐ No☐ No resulting publications☒**

Please indicate how data you will obtain from UAM specimens will be made available to the scientific community (e.g., publications, GenBank accessions, MorphoBank submissions):

These data will be published in peer-reviewed journals.

If this is a request for destructive sampling (e.g., hair, bone, skin, or other material to be permanently removed from a specimen; does not apply to consumptive requests for frozen tissues), please describe the type and amount of material you are requesting and your experience and expertise in obtaining similar data from similar specimens or samples:

To conduct said analyses we will need to section and microdrill teeth. The powder obtained from microdrilling will be completely consumed during analyses. However, we only need one canine tooth per individual. The Cerling-Fernandez isotope labs are world leaders in these types of analyses on teeth, incl. both from museum and modern specimens. The Cerling-Fernandez lab has successfully executed similar analyses on ancient and modern teeth of many mammals, including hominids, horses, rabbits, goats, elephants, etc … Many of these samples were obtained from museum collections, as such the Cerling-Fernandez lab has a lot of experience with, appreciates, and is sensitive to the nature of museum collections.

Source of funding for the proposed research (if applicable):

Funding to complete research is pending via Alaska Sea Grant

If NSF funds are being used for the proposed research, please provide:

***NSF project title:**

***NSF Award Number:**

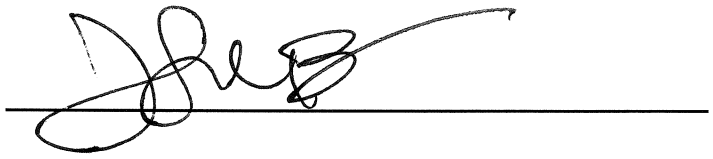
***NSF abstract URL:**

**Because we rely on funding from the National Science Foundation to support our collections, we ask that you provide this information to further demonstrate and document NSF's support of collection development* and *use. Knowledge of other sources of funding for collections-based research is also helpful in our efforts to continue obtaining funds for supporting the collection and making specimens freely available to the scientific community.*

Material requested. For each specimen requested, please provide the UAM *catalog* number (do not use any other number), scientific name, and specimen part (e.g., frozen tissue sample; skin; skull; etc.). Tabular data downloaded from Arctos and edited in Excel or any word processor can be pasted directly into the field below. If you are not requesting a specific specimen (e.g., if you only need a tissue sample from a single representative of a particular taxon), please provide as much information on what you are requesting as possible.

We are requesting one canine tooth from each of the 14 specimens listed below. We initially contacted UAM about this request in May 2014, and were told that all skulls currently contained both canines (although two were still being processed).

GUID	SCIENTIFIC_NAME	CATALOGNUMBERS	PARTS
UAM:Mamm:52183	Phoca vitulina	AF=13961; GenBank=AF522755	1 Canine tooth
UAM:Mamm:42152	Phoca vitulina	AF=13940; GenBank=AF522657	1 Canine tooth
UAM:Mamm:99605	Phoca vitulina	AF=68526	1 Canine tooth
UAM:Mamm:52184	Phoca vitulina	AF=13962; GenBank=AF522819	1 Canine tooth
UAM:Mamm:42151	Phoca vitulina	AF=13939; GenBank=AF522648	1 Canine tooth
UAM:Mamm:3716	Phoca vitulina	richardsi	1 Canine tooth
UAM:Mamm:42149	Phoca vitulina	AF=13937; GenBank=AF522649; original identifier=96-HS-ILI-001	1 Canine tooth
UAM:Mamm:3409	Phoca vitulina	richardsi	1 Canine tooth
UAM:Mamm:110328	Phoca vitulina	AF=70846	1 Canine tooth
UAM:Mamm:111951	Phoca vitulina	original identifier=70846	1 Canine tooth
UAM:Mamm:42150	Phoca vitulina	AF=13938	1 Canine tooth
UAM:Mamm:28987	Phoca vitulina	AF=1428; orig id=LCI-23-78	1 Canine tooth
UAM:Mamm:28989	Phoca vitulina	original identifier=LCI-31-78	1 Canine tooth
UAM:Mamm:28988	Phoca vitulina	AF=5932; orig.ID=LCI-30-78	1 Canine tooth

Jennifer M. Burns, 11/5/14 

Signature

Advisor's signature

(for graduate students or postdocs, your advisor or major professor must cosign)