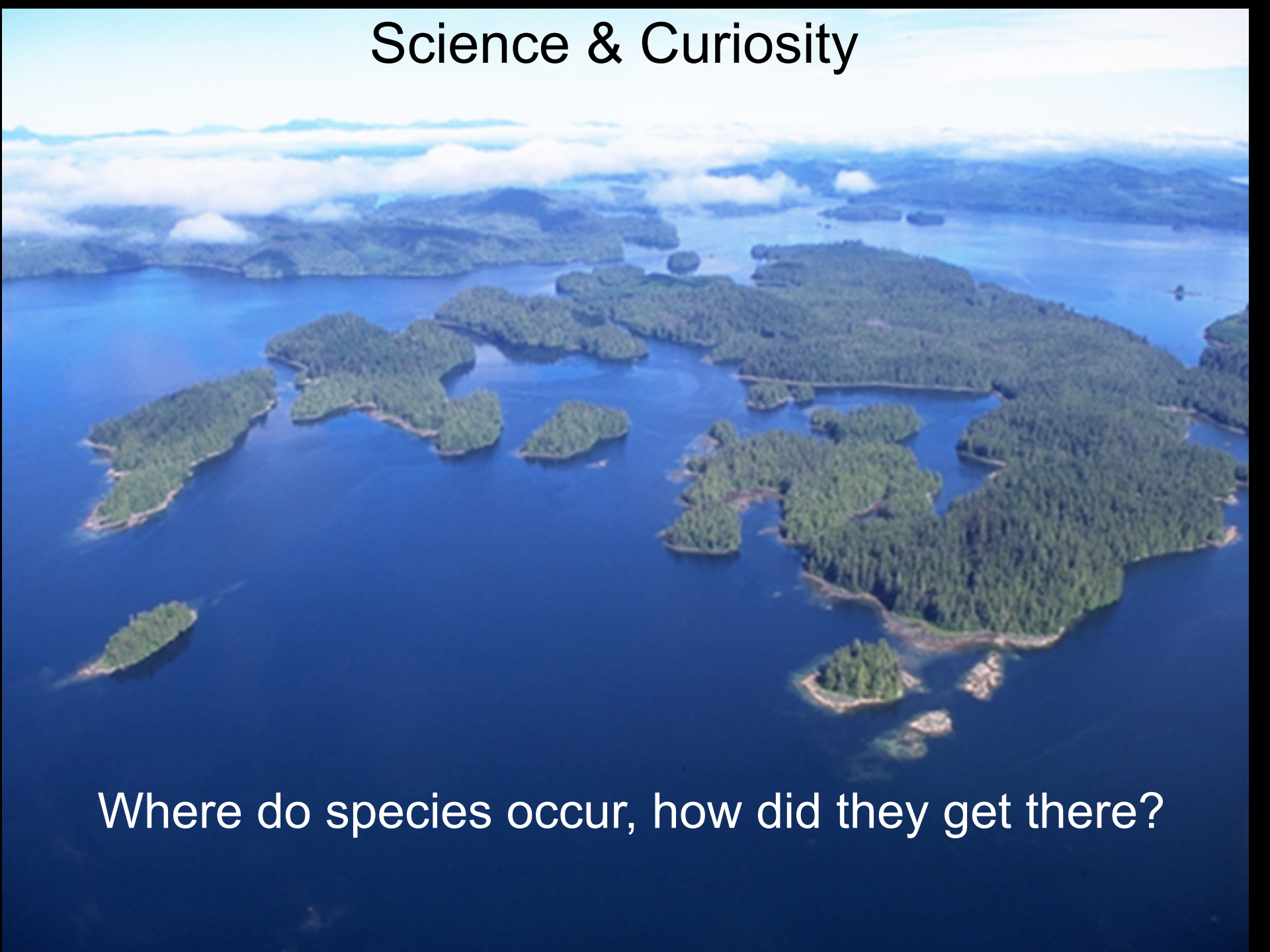


# Science & Curiosity



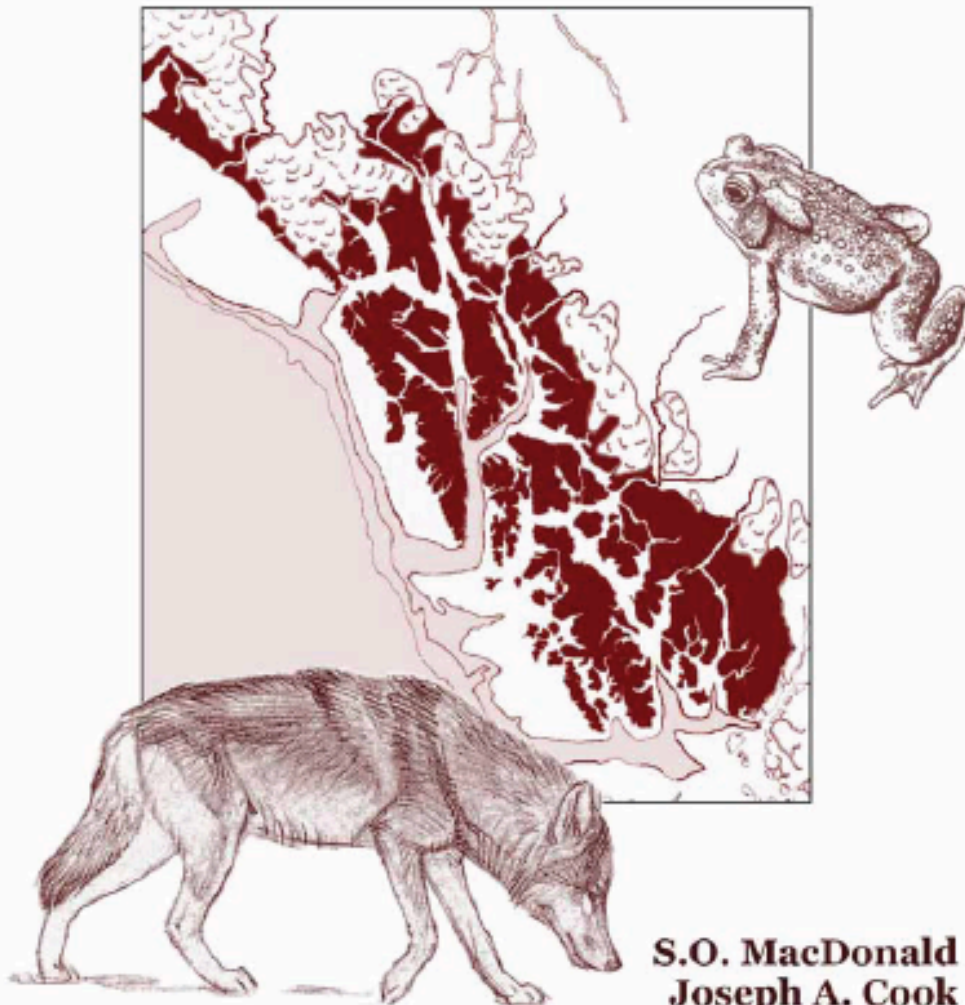
Where do species occur, how did they get there?

# How Do We Study Mammal Occurrence\* Information?

- Use Existing Information:
  - Published Work and Reports

\*Occurrence = range or distribution

# Mammals and Amphibians of Southeast Alaska



**S.O. MacDonald**  
**Joseph A. Cook**

**Special Publication Number 8 — Museum of Southwestern Biology**

# How Do We Study Mammal Occurrence Information?

- Existing:
  - Published Work and Reports
  - Explore On-line Museum Data\*

\* our detective work



# Arctos

## Multi-Institution, Multi-Collection Museum Database

[Search](#)[Portals](#)[My Stuff](#)[About/Help](#)

Access to 1,791,776 records

[Search](#)[Clear Form](#)[Use Last Values](#)See results as: Type: Require Tissues? 

### Identifiers

[Customize](#) [Show More Options](#)

Collection:

Catalog Number:

### Identification and Taxonomy

[Show More Options](#)

Identification

Include previous IDs?

Match Type

### Locality

[Show More Options](#)

Any Geographic Element:

[Select on Google Map](#)

### Date/Collector

[Show More Options](#)

Help

### Biological Individual

[Show More Options](#)

Part Name:

Define Add = for exact match

### Usage

[Show More Options](#)

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  - Explore Other Data (GenBank)

# How Do We Study Mammal Occurrence Information

- Existing:
  - Published Work and Reports
  - Explore On-line Museum Data
  - Explore Other Data (GenBank)
- New:
  - Do Fieldwork and Collect New Data



# Field Expeditions



**Where does information  
come from?**

**Museum Specimens**





# How Do We Study Mammal Occurrence Information

- Existing:
  - Published Work and Reports
  - Explore On-line Museum Data
  - Explore Other Data (GenBank)
- New:
  - Do Fieldwork and Collect New Data

But also explore other fields (Botany, Ornithology, Geology, Archaeology)

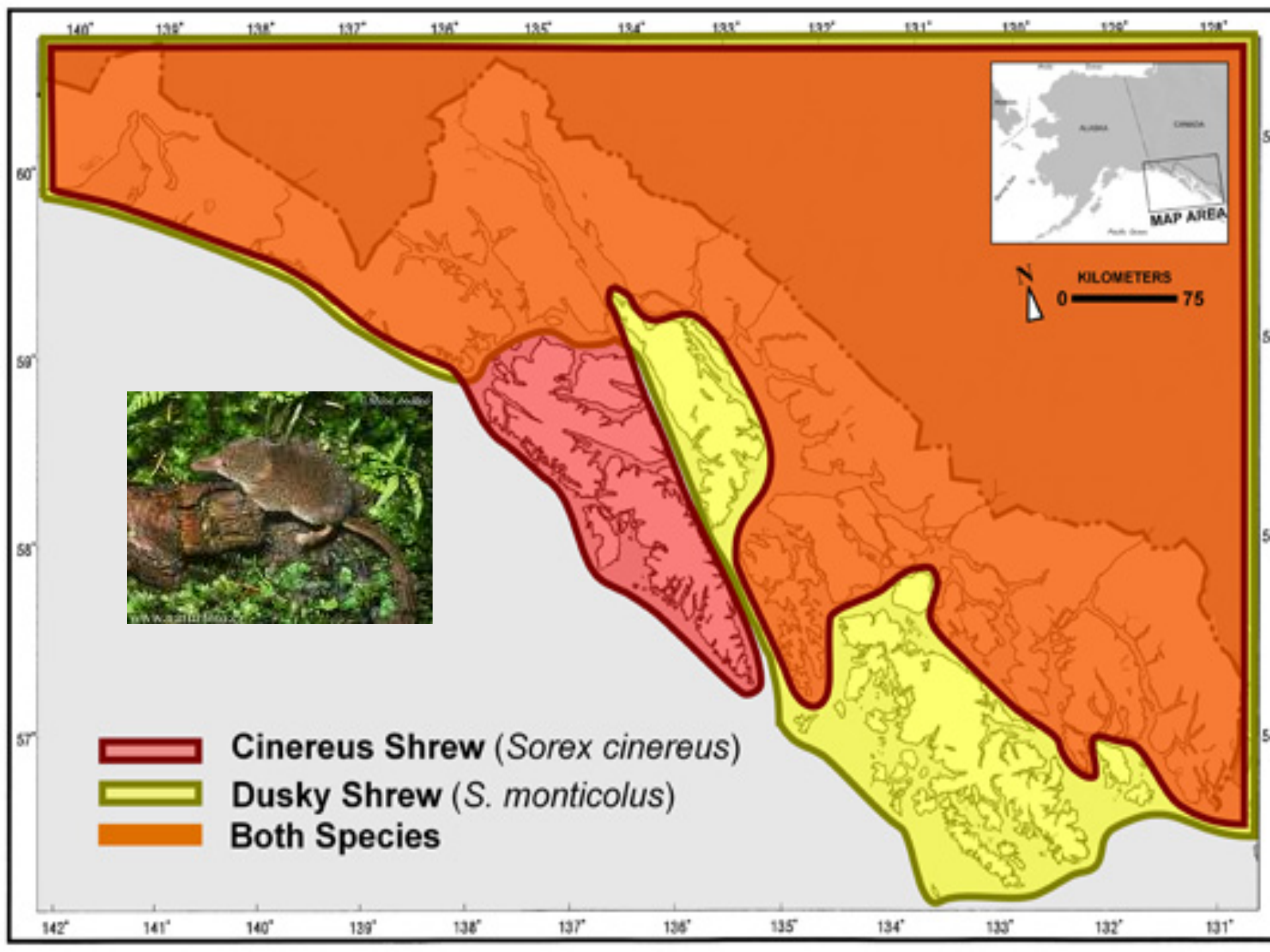
# Why Southeast Alaska?

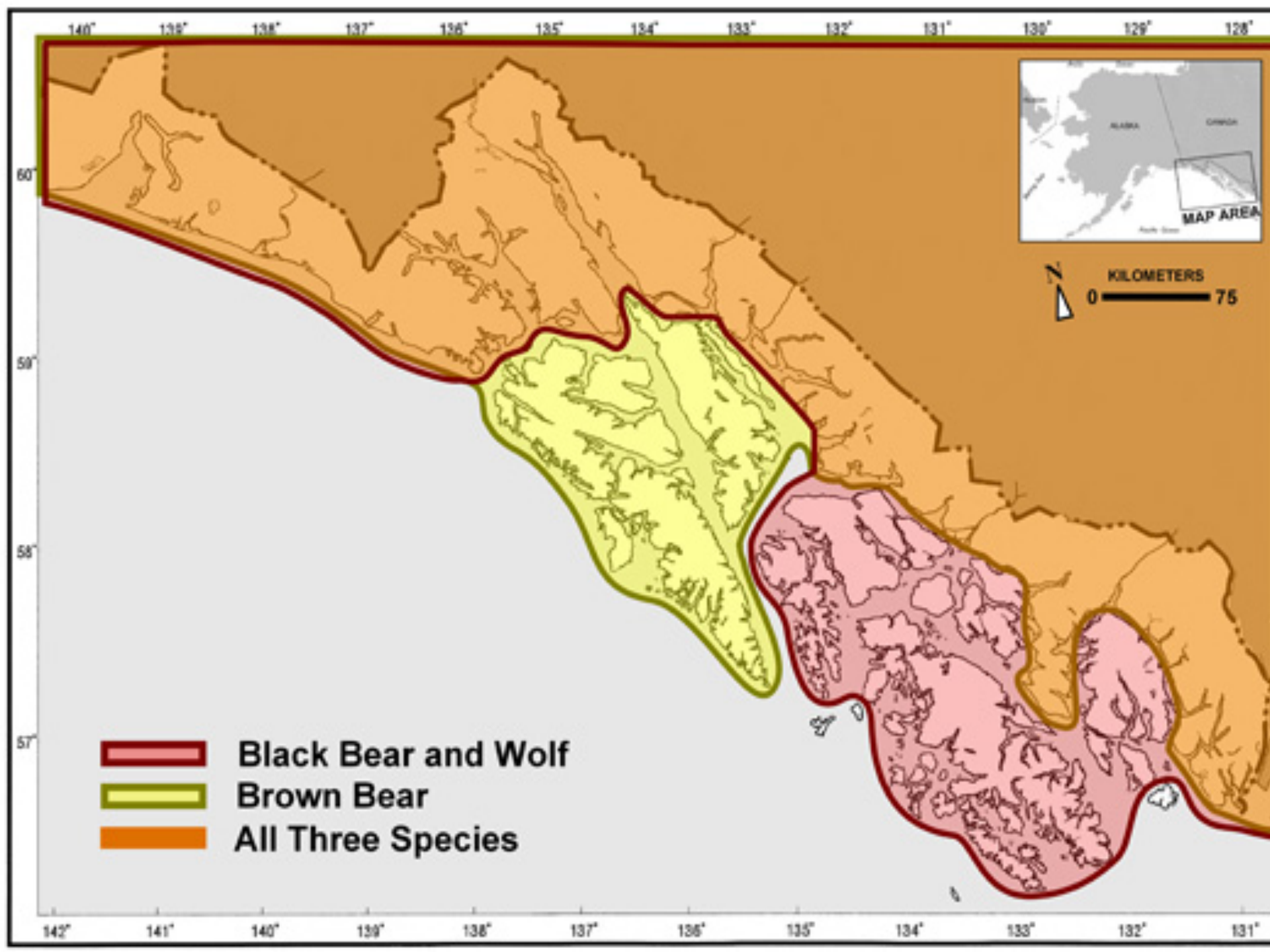
- Globally Important Coastal Rainforest
- Island Archipelago
  - Ecological Concepts
  - Evolutionary Concepts

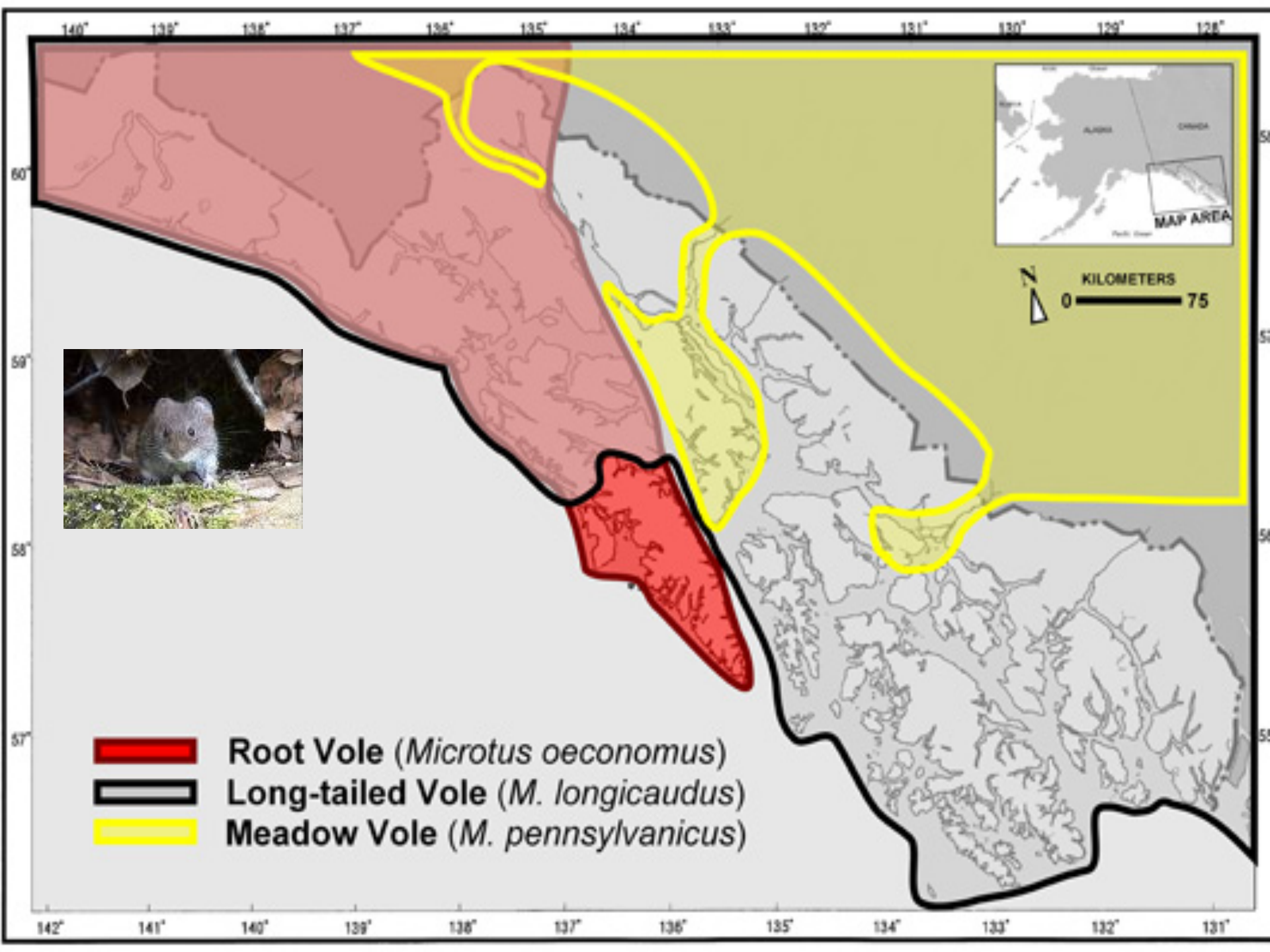
# Islands

## Ecological Concepts

- Each island is simplified subset-
  - Fewer species, easier to study









# Islands

## Ecological Concepts

- Each island is simplified subset-
  - easier to study

BUT with numerous islands--- overall complexity increases

# Islands

## Ecological Concepts II

- Small islands have fewer organisms
- Large islands more like the mainland
- Islands near mainland (source) have more species than far islands
  - so Distance and Size should be important

Can we test these ideas on our islands in Southeast Alaska?



# Arctos

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[Search](#)[Portals](#)[My Stuff](#)[About/Help](#)

Access to 1,791,776 records

[Search](#)[Clear Form](#)[Use Last Values](#)See results as: Type: Require Tissues? 

### Identifiers

[Customize](#) [Show More Options](#)

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[Show More Options](#)

Identification

Include previous IDs?

Match Type

### Locality

[Show More Options](#)

Any Geographic Element:

[Select on Google Map](#)

### Date/Collector

[Show More Options](#)

Help

### Biological Individual

[Show More Options](#)

Part Name:

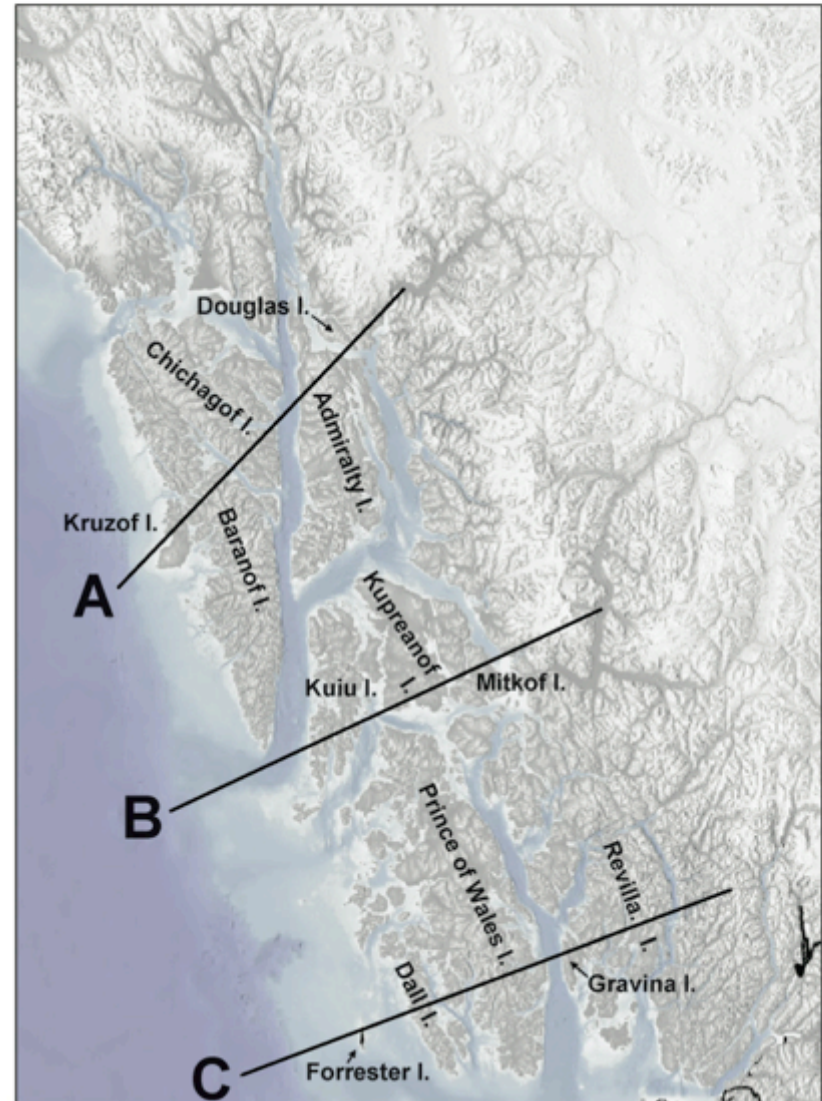
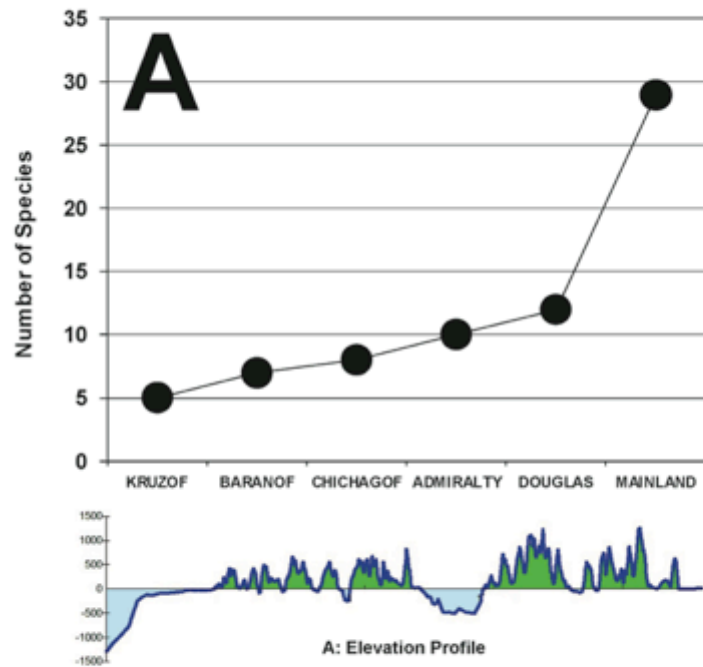
Define Add = for exact match

### Usage

[Show More Options](#)

# East-West Transects from Mainland to Outer Islands

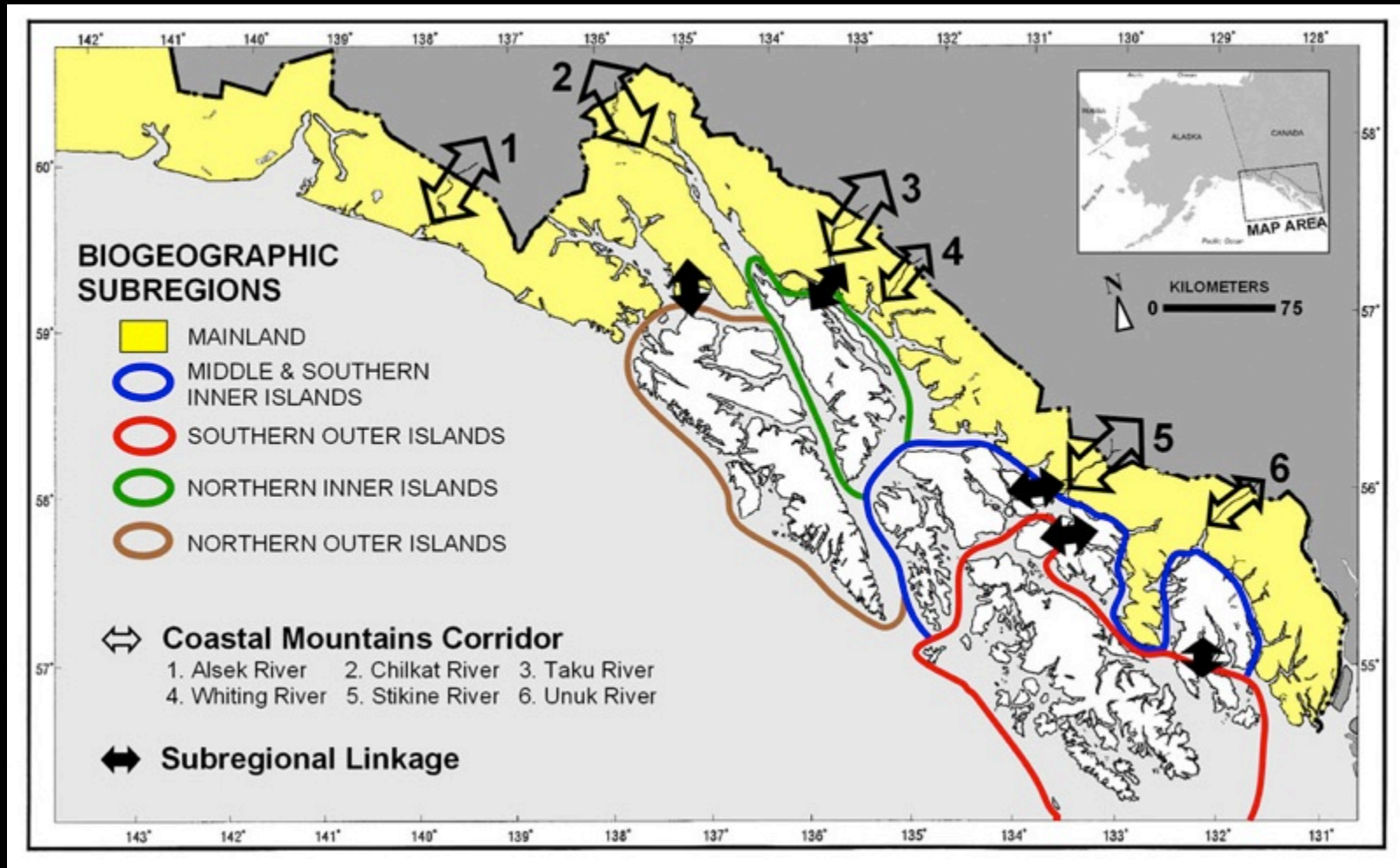
Number of Species Declines Away from Mainland Source



# **Mammals are not evenly distributed across the Alexander Archipelago**

- Do large islands, close to the mainland, have more species than small islands distant from the mainland?
- Science and Management needs to understand:
  - Variation from Island to Island
  - Connectivity Among Islands

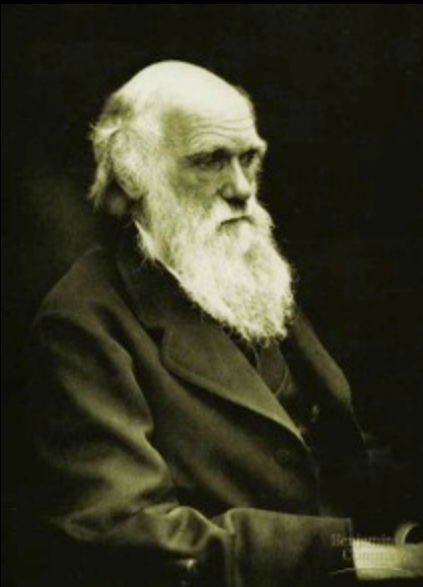
- Some islands share similar species.  
Linkages (connectivity) between these islands should be evaluated.





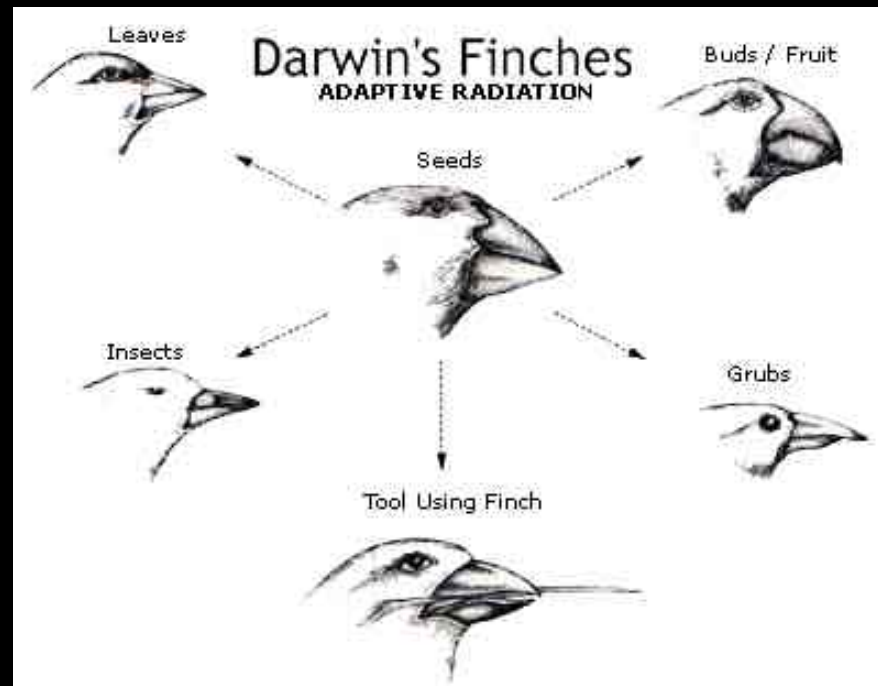
# Islands are Important to Biology

- Island Archipelago
  - Ecological Concepts
  - Evolutionary Concepts



**Island archipelagos are important models for understanding evolution.**

- **Divergence due to isolation leads to island endemics**



**An endemic is a distinctive organism with a restricted range such as an island.**

# Islands and Evolution

- Islands have distinctive organisms, because isolation over time leads to divergence.
  - Survey across island mammals for unique signatures or clues of isolation
- Time & Isolation important to document
- Research and Information Needs
  - How connected are island populations

Over what time scale has  
diversification occurred on the  
Alexander Archipelago?

28,000 years ago

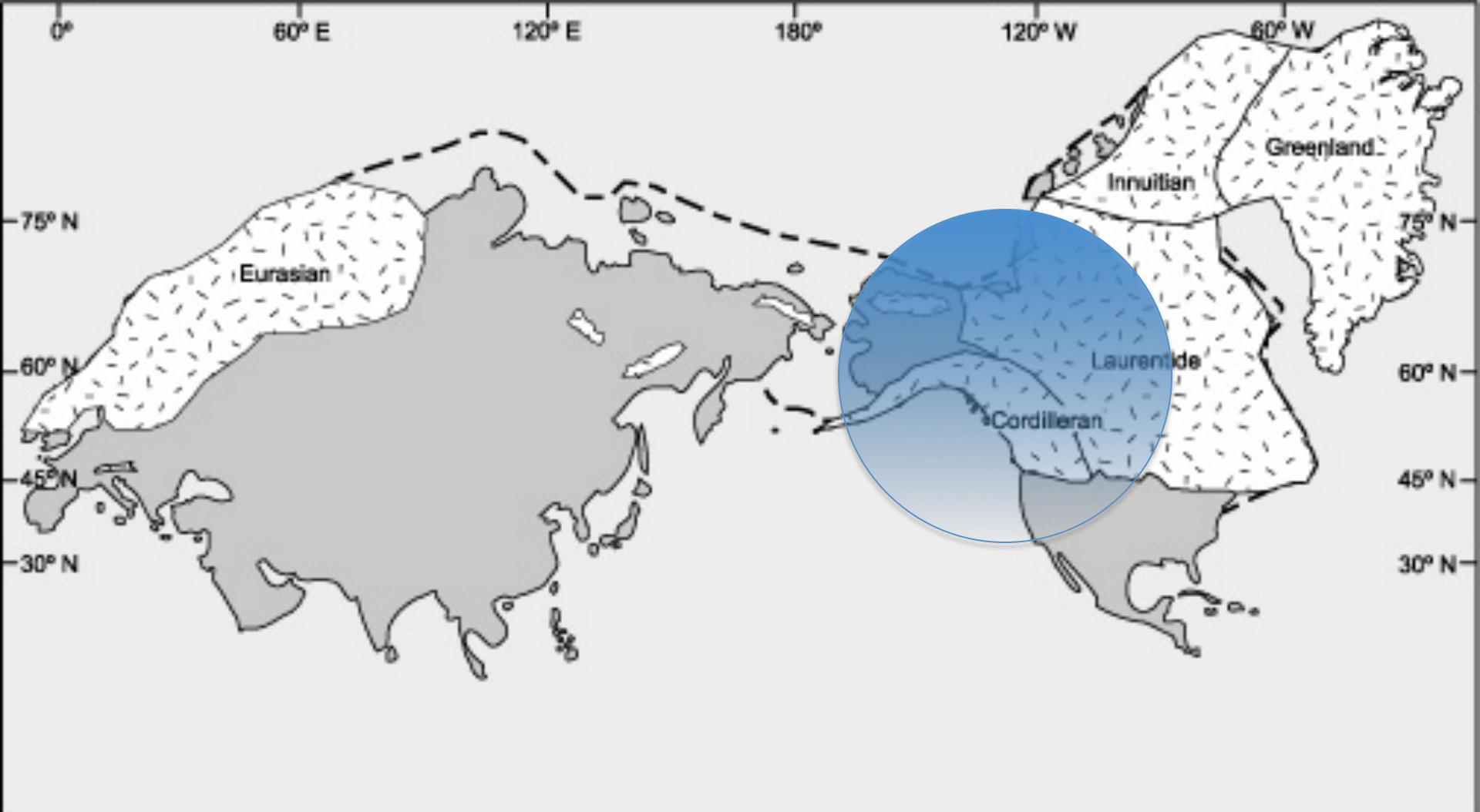


Extent of Last Full Glacial Advances  
in Northern Hemisphere

# Environments and Species Distributions are Changing







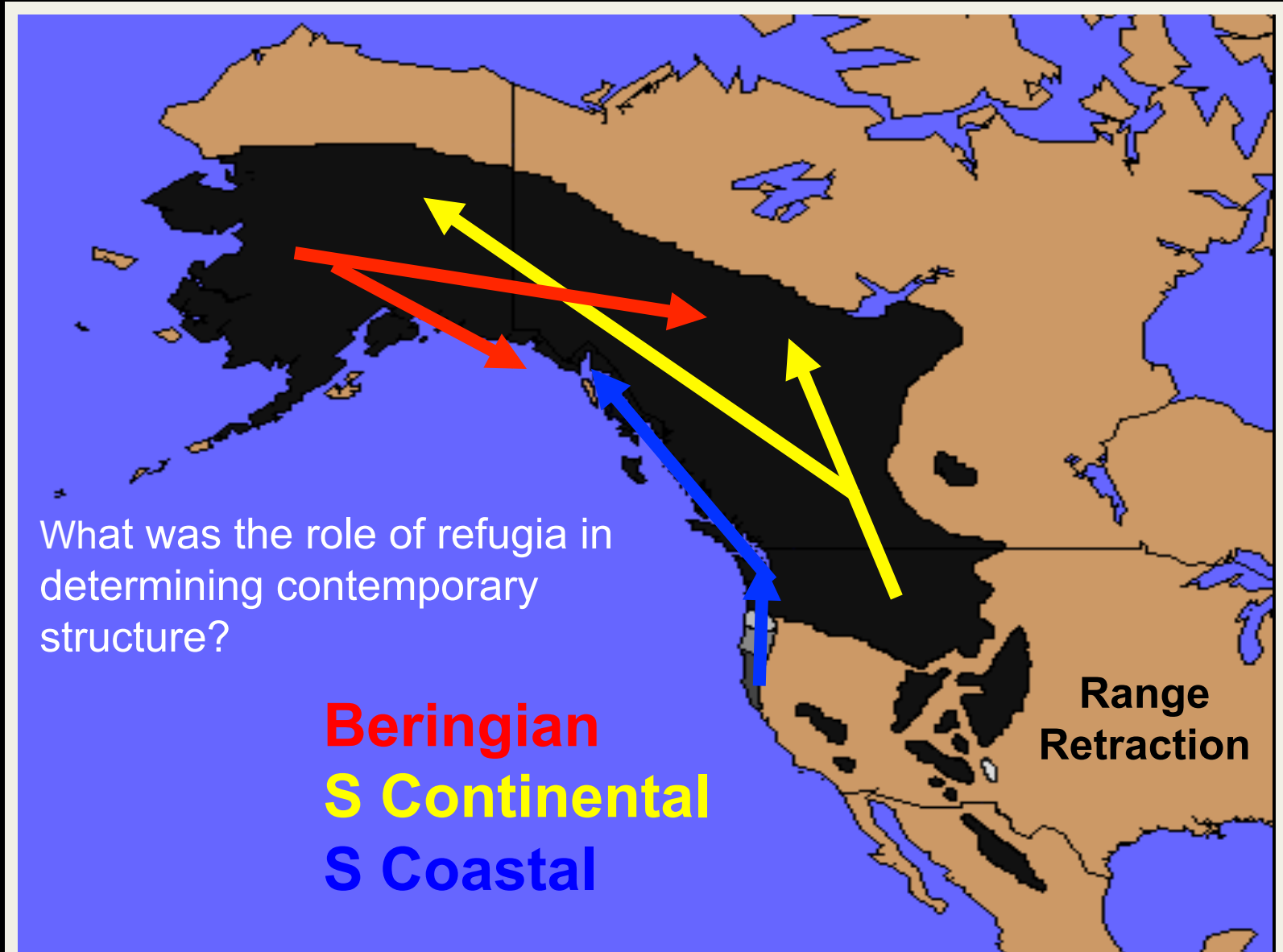
## Focus on Impact of Glacial Advances on Mammals-

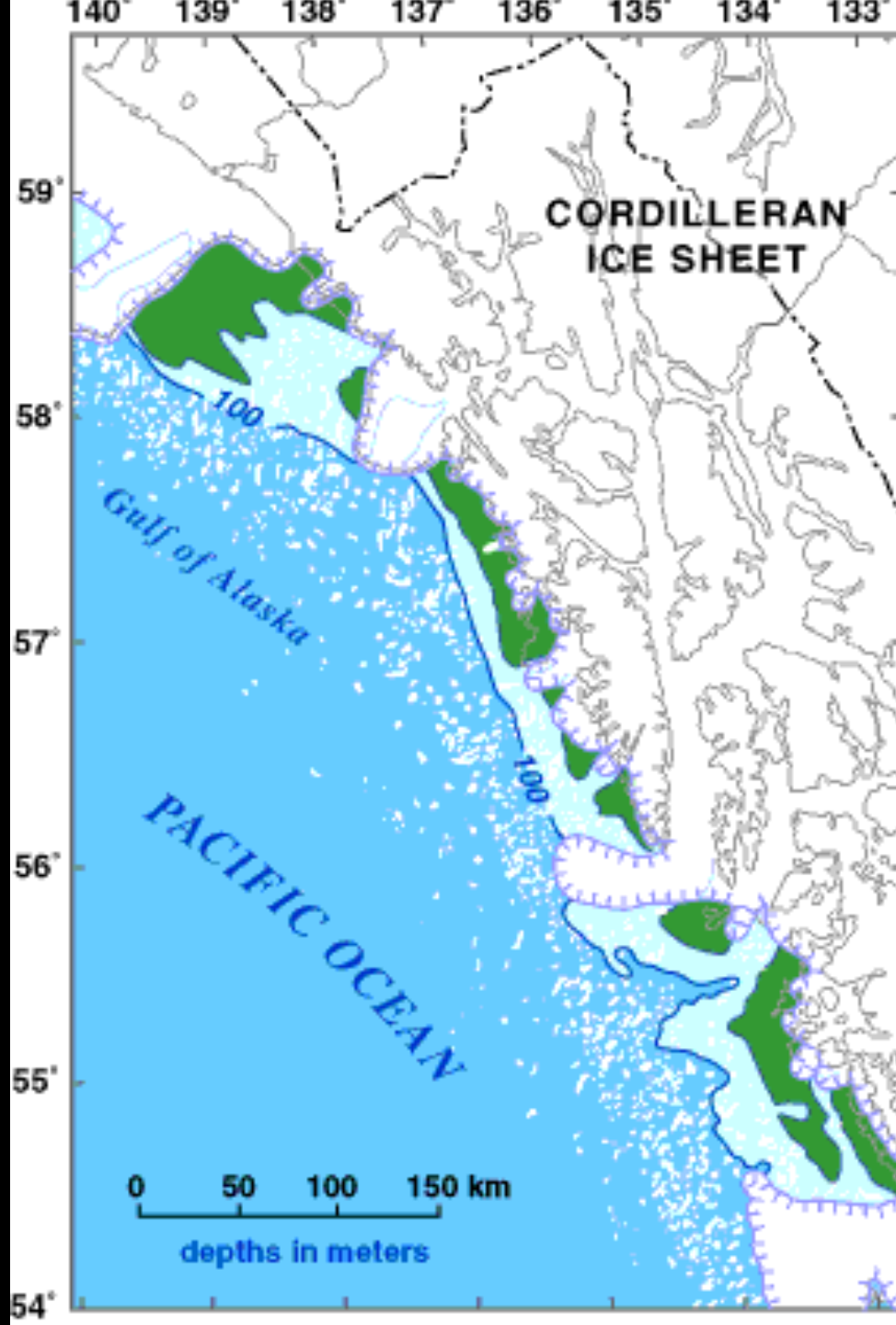
Glaciated regions should reflect colonization processes

# Biotic refugia as sources for colonization of Southeast Alaska.

- Origin or source can be explored through DNA signatures

# Glacial Refugia, Mountains and Possible Post-glacial Colonization Routes





Hypothesized extent of Cordilleran Ice Sheet at 15,000 ybp (Carrara et al. 2003, 2007). Outer shelf refugia may have persisted during full glacial advances.

# Testing the Impact of Isolation Along the Northwest Pacific Coast

- LGM Isolation by Cordilleran Ice
- Now Isolated by Coast Mtn Range
- More Recently Fragmented into Islands



# Connectivity among islands has shifted dramatically in last 10,000 years.



8,000 years ago

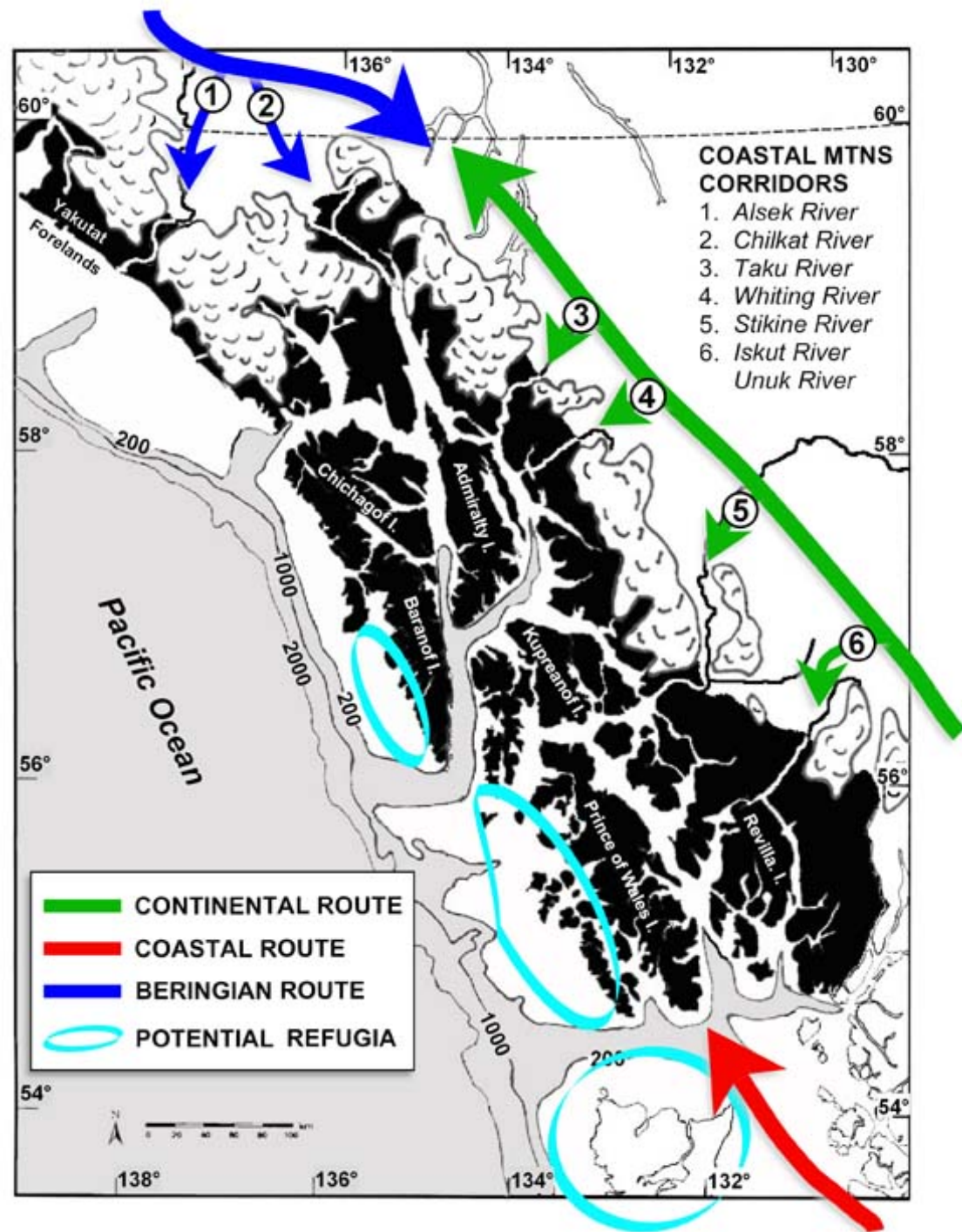


Today



Glaciers receded, ocean levels rose and islands rebounded. Provided new territory for species to colonize.





Nucleotide

Nucleotide [Limits](#) [Advanced](#)

**i** The information on this web site remains accessible; but, due to the lapse in government funding, the information may not be up to date to inquiries until appropriations are enacted. For updates regarding government operating status see [USA.gov](https://www.usa.gov).

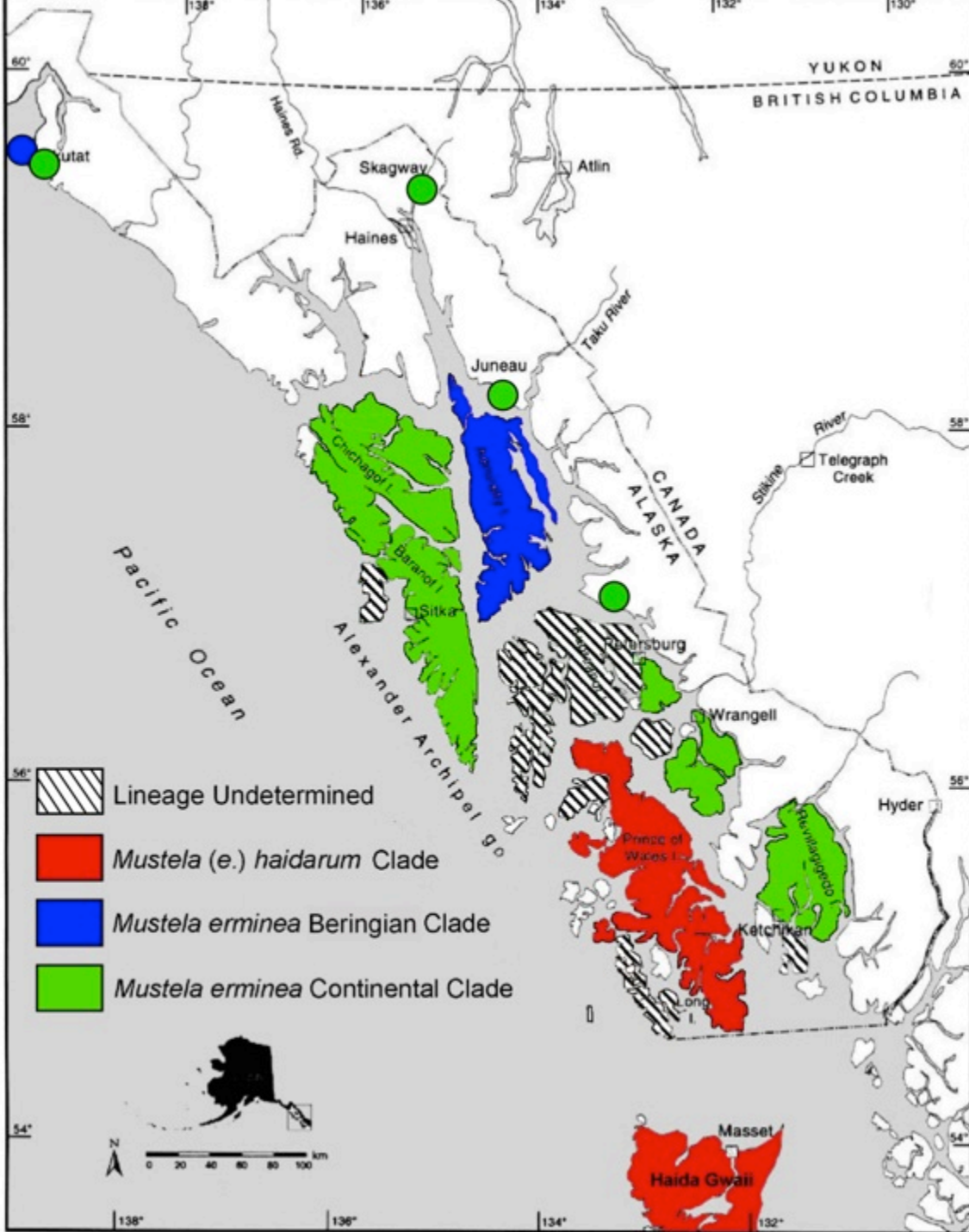
[Display Settings:](#)  GenBank[Send:](#) 

## Canis lupus voucher UAM:Mamm 63147 cytochrome b (CYTB) gene, partial cds; tRNA-Thr and tRNA-Pro genes, complete sequence; and control region, partial sequence; mitochondrial

GenBank: JF311434.1

[FASTA](#) [Graphics](#) [PopSet](#)[Go to:](#) 

LOCUS JF311434 611 bp DNA linear MAM 13-MAY-2012  
DEFINITION Canis lupus voucher UAM:Mamm 63147 cytochrome b (CYTB) gene,  
partial cds; tRNA-Thr and tRNA-Pro genes, complete sequence; and  
control region, partial sequence; mitochondrial.  
ACCESSION JF311434  
VERSION JF311434.1 GI:386776327  
KEYWORDS .  
SOURCE mitochondrion Canis lupus (gray wolf)  
ORGANISM [Canis lupus](#)

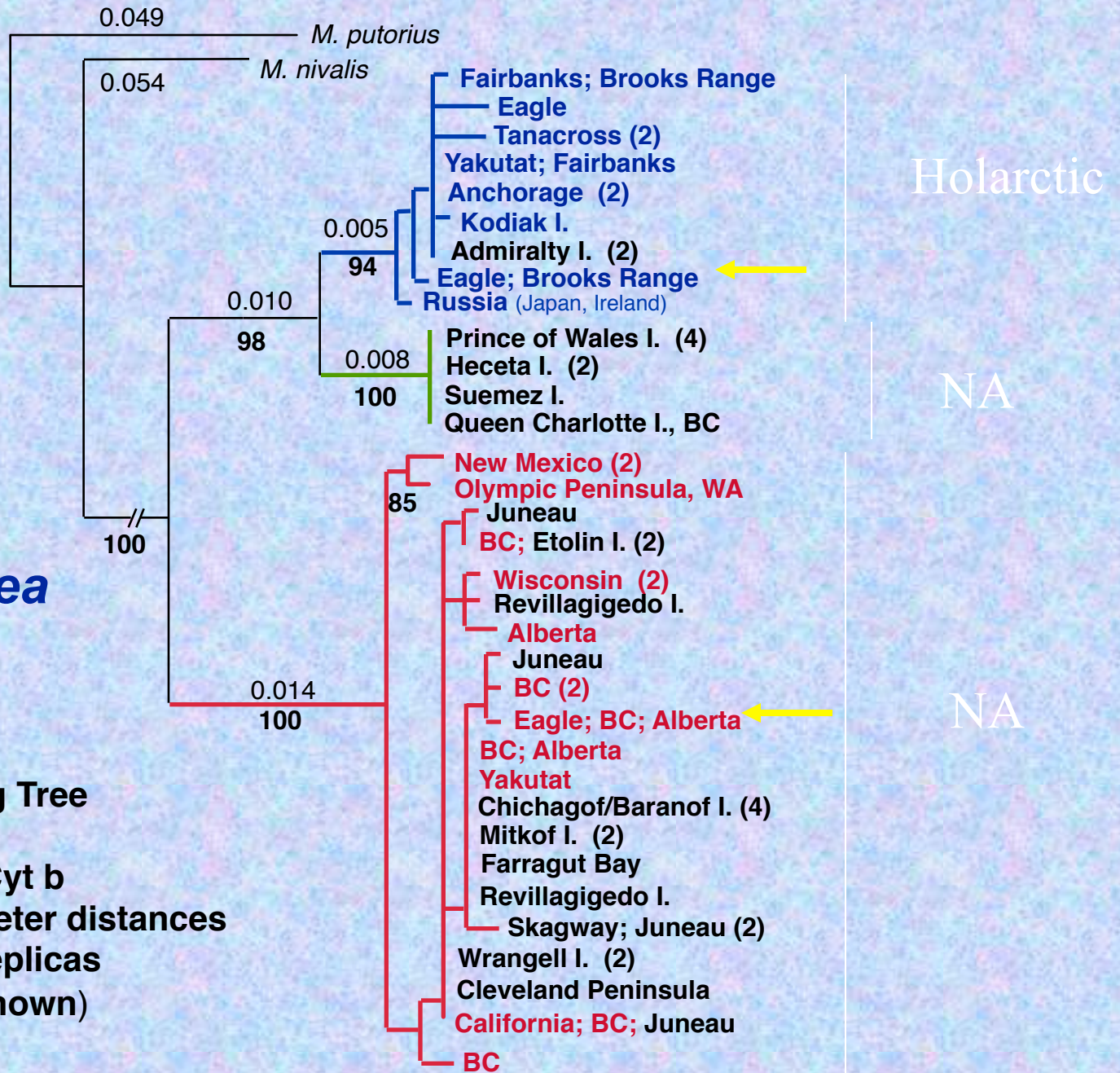






# *Mustela erminea* Ermine

Neighbor-joining Tree  
68 Ermine  
1140 or 790 bp Cyt b  
Kimura 2-parameter distances  
500 Bootstrap replicas  
(values > 70% shown)

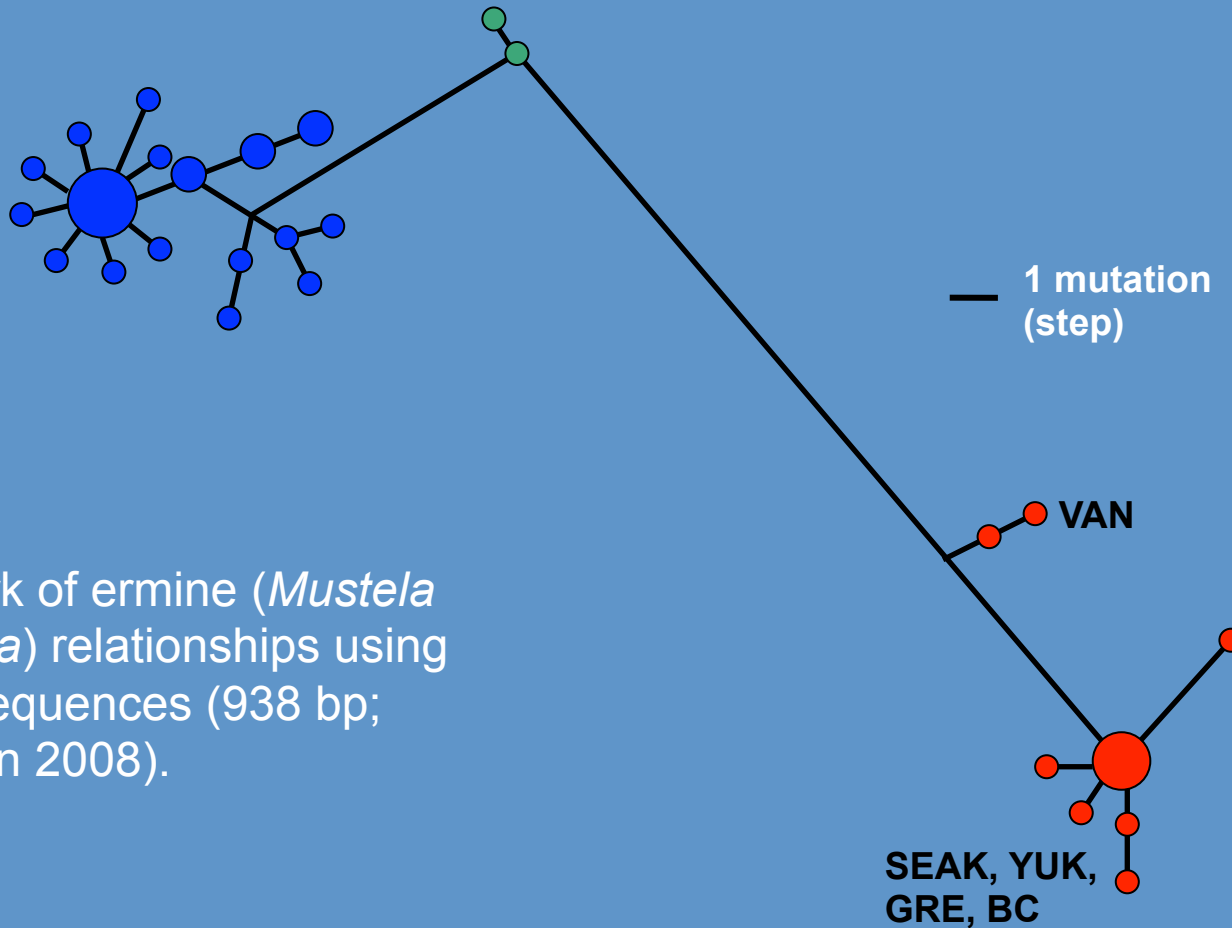


**Contact Eastern Beringia**

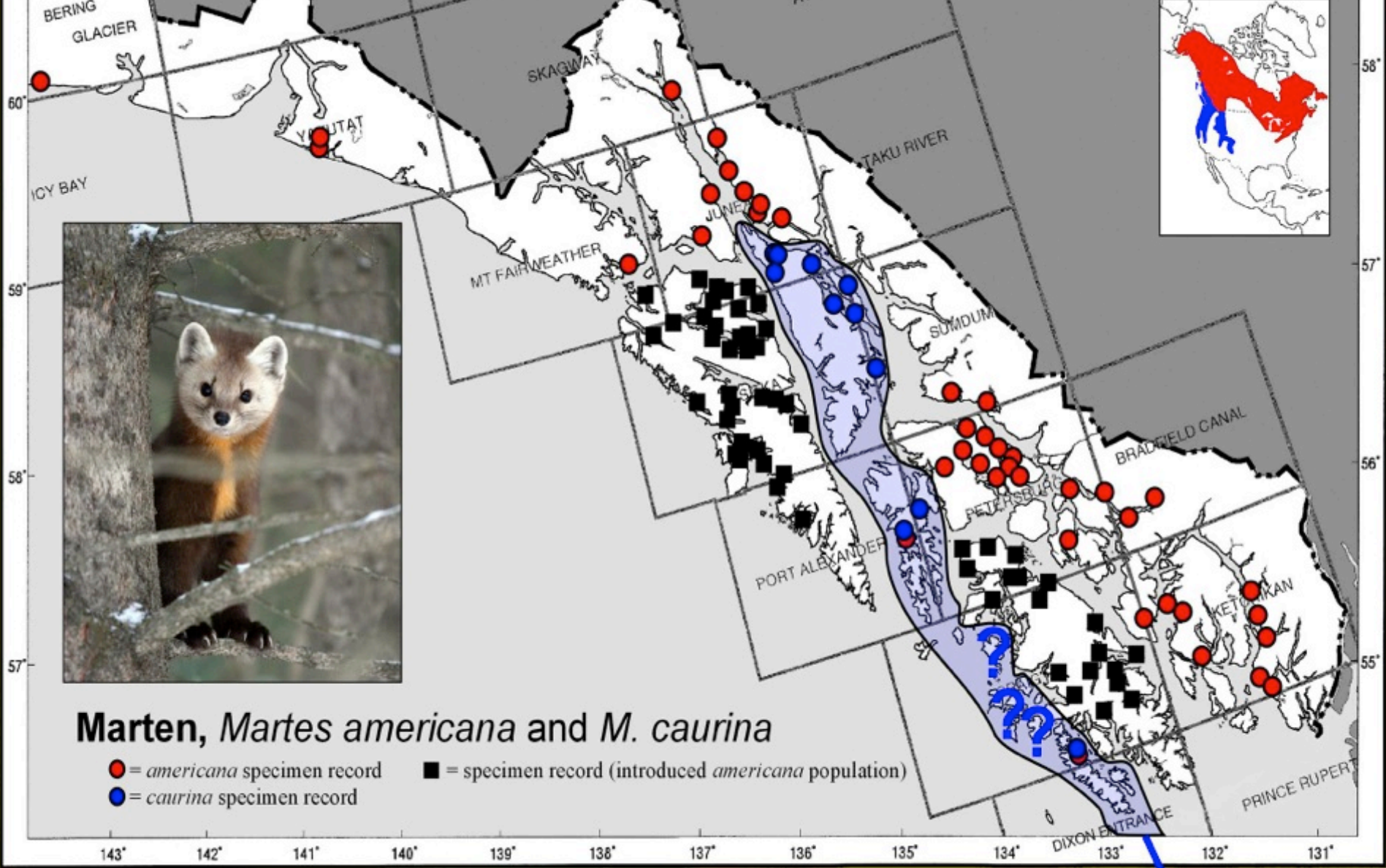
# Ermine

IRE, SWZ, NET,  
FIN, GBR, RUS,  
AK (Admiralty I)

POW, QCI



Network of ermine (*Mustela erminea*) relationships using DNA sequences (938 bp; Dawson 2008).



Haida Gwaii



# Origins (Refugia) of NW Coastal Mammals

## Beringian Origin (7):

moose (*Alces alces*)

wolverine (*Gulo gulo*)

northern red-backed vole (*Myodes rutilus*)

root vole (*Microtus oeconomus*)

arctic ground squirrel (*Spermophilus parryii*)

collared pika (*Ochotona collaris*)

brown lemming (*Lemmus trimucronatus*)

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## Continental (Eastern and Southern) Refugia (4)

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southern red-backed vole (*Myodes gapperi*)

meadow vole (*Microtus pennsylvanicus*)

American marten (*Martes americana*)

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American marten *Martes americana*

## Multiple Lineages (likely multiple refugial origins)

dusky shrew (*Sorex monticolus*)

long-tailed vole (*Microtus longicaudus*)

black bear (*Ursus americanus*)

ermine (*Mustela erminea*)

## Potential Support for Coastal Refugium:

northwestern deermouse (*Peromyscus keeni*)

wolf (*Canis lupus ligoni*)

Sitka black-tailed deer (*Odocoileus hemionus sitkensis*)

mountain goat (*Oreamnos americanus*)

Pacific marten (*Martes caurina*)

ermine (*Mustela erminea haidarum*)

Further tests of these preliminary hypotheses needed

# Threats to Endemics on Island Systems

- Pathogens
- Introduction of Exotics
- Over exploitation
- Environmental change
  - Habitat conversion
  - Climate



• **Speciation -island endemics due to isolation.**

• **Extinction-**

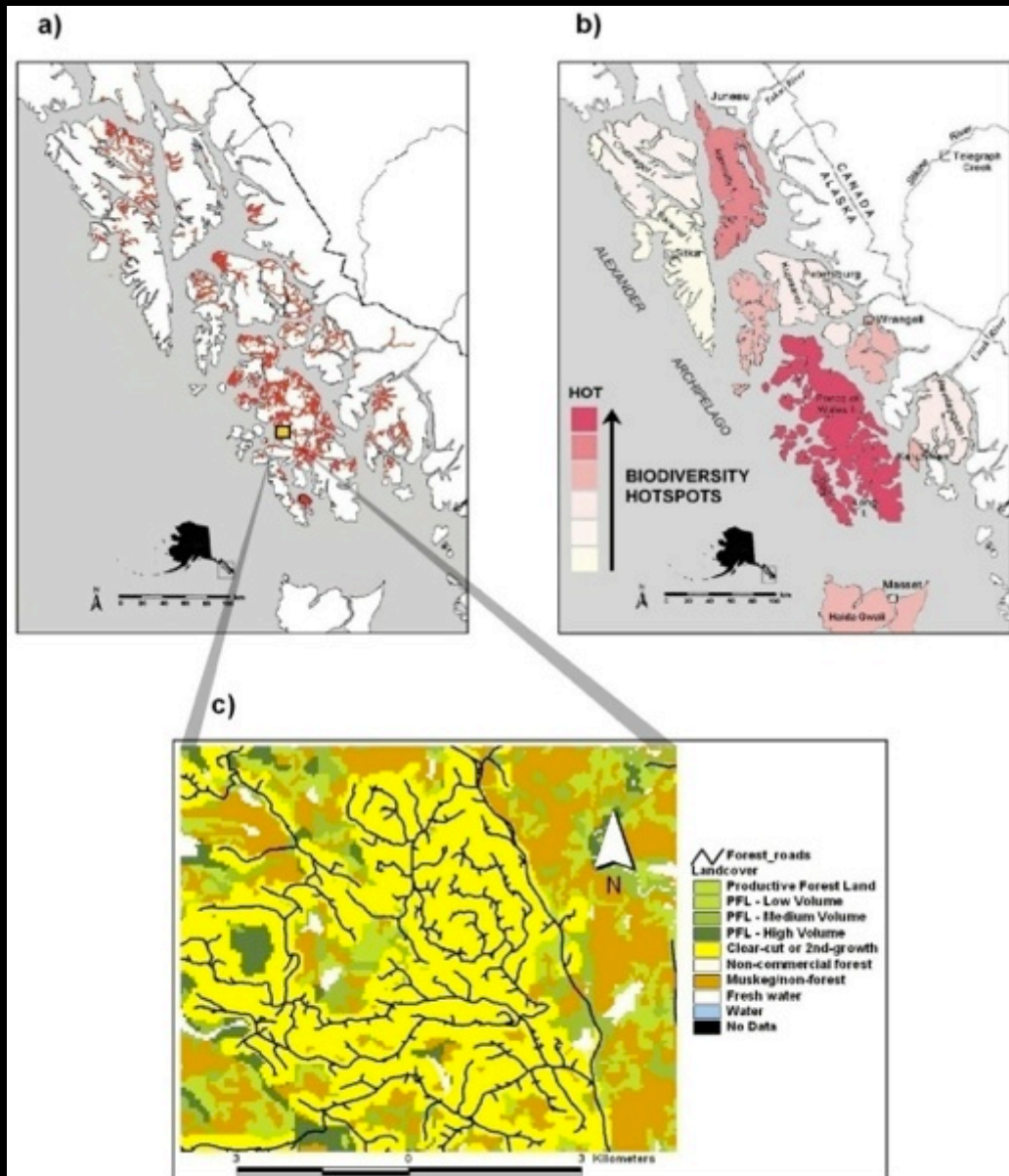
**More than 65% of all documented vertebrate extinctions in the last 400 years are island endemics due too habitat destruction, overhunting, pathogens or introduced exotics.**



Dawson's caribou—Haida Gwaii



# Deforestation and Endemism



# **Endemism in Southeast Alaska**

**An endemic is a distinctive organism with a restricted range such as an island.**

**Some were restricted to one island (Suemez Island ermine)**

**About 24 of 107 mammals (species or subspecies) recognized as endemic,  
But < 28 islands were visited (out of 1000+ named islands).**

**Molecular genetics to reassess endemics, uncover hidden diversity,  
and provide new insight.**

**Similar study needed for many insects, plants, fungi and other organisms.**

# A Bit More About Museum Specimen Archives

- Why, What, and How?
  - Temporally Deep and Geographically Broad
  - Geo-referenced (GIS applications)
  - Multiple Datasets tied to central specimen
- **Searchable Databases**
- **Web-based Interfaces**

Why? Significant questions are centered on our ability to assess change.

- Climate change
- Habitat conversion
- Pollutants
- Emerging pathogens & diseases
- Introduction of exotics
- Loss of biotic diversity

U Alaska Museum  
Walrus and Bud Fay

Baseline or historic information is crucial to documenting changing environments

# Museum Specimens - Historic Conditions

- **Parasite and disease screening**
  - Emergent infectious diseases
  - Historical/baseline infection rates
  - Identifying new hosts or pathogens
- **Stable-isotope ratios and ecology**
  - predator/prey
  - seasonal diet shifts
  - primary productivity
- **Toxins**
  - mercury, POPS
- **Analyses of genetic relationships**
  - among individuals, populations, species