
Region I
Wolf Research in Southeast AK
Board of Game Meeting
Ketchikan, AK
January 20, 2023
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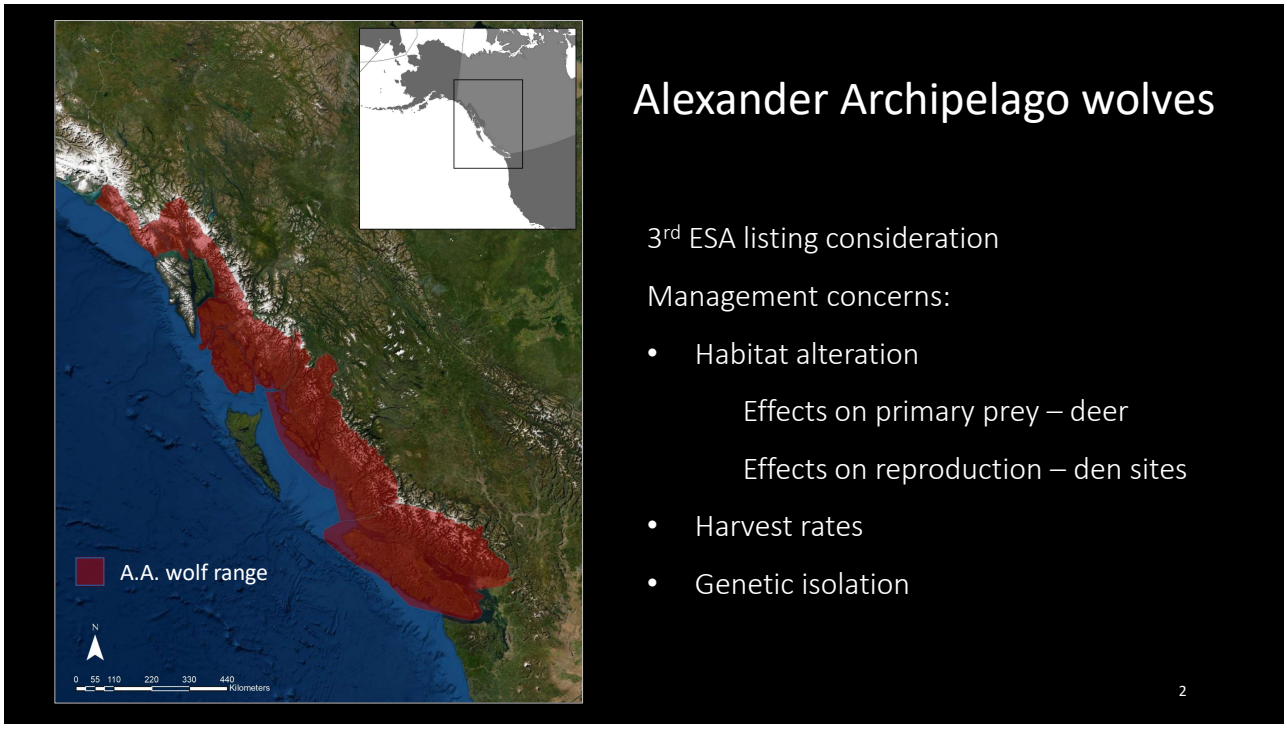
A.A. wolf range
N
0 55 110 220 330 440
Kilometers
Alexander Archipelago wolves
3rd ESA listing consideration
Management concerns:
• Habitat alteration
Effects on primary prey – deer
Effects on reproduction – den sites
• Harvest rates
• Genetic isolation
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## Information Needed for Management

- Habitat selection
- Denning ecology
- Geographic variation in diets
- Predation patterns and foraging ecology
- Genetic structure
- Inbreeding

Photo: B. Dihle

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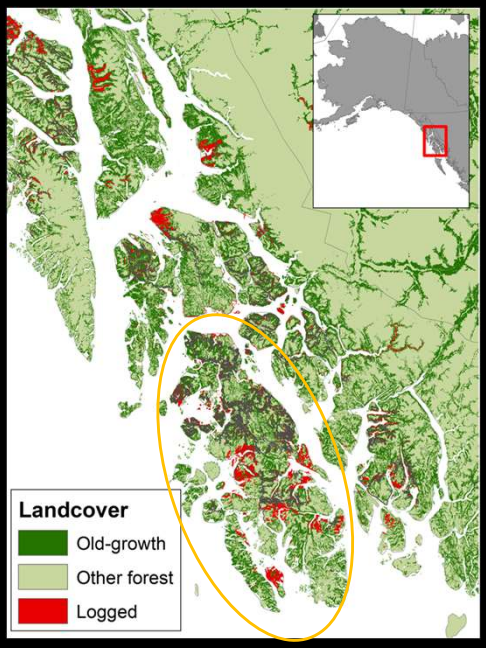


## Wolf Habitat Selection

Concerns focused on Prince of Wales Island

Logging → declines in deer habitat quality

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## Forest succession post-logging

| 0-25 years | 25-120 years | Old-growth |
|---|---|---|
|  |  |  |
| Open canopy<br>Forage availability high | Closed canopy<br>Forage availability low | Closed canopy<br>Forage availability medium-high |
| 10 deer/km$^2$ | 7 deer/km$^2$ | 12 deer/km$^2$ |

*Brinkman et al., 2011*



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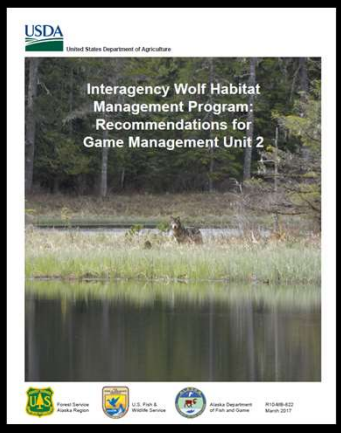
## Wolf Habitat Selection




Management recommendations:

- Close roads
- Thinning treatments for young-growth
- Buffers around den sites

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## Wolf Habitat Selection

- Avoided old clearcuts (>30 years)
- Selected young clearcuts (<30 years)
- Avoided thinned forest
- Avoided roads during summer
- Selected roads during winter
- Selected salmon habitat in the fall

Roffler, G. H. et al. 2018. Resource selection by coastal wolves reveals the seasonal importance of seral forest and suitable prey habitat. For. Ecol. Manage. 409: 190–201.

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Photo: B. Dihle

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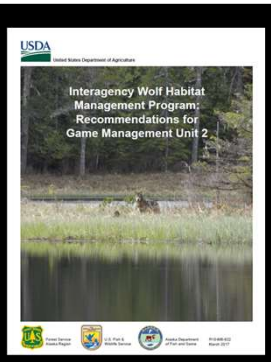


## Denning Ecology

Management recommendations:

- 1,200 ft (366 m) forested buffer
- Buffers required on all active and inactive dens

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## Denning Ecology

Roffler, G. H., & Gregovich, D. P. 2018. Wolf space use during denning season on Prince of Wales Island, Alaska. Wildlife Biology, 2018. wlb.00468

- Den occupancy May 2nd – July 1st
- Core area smaller for breeding wolves vs. non-breeding wolves
- Minimum den buffer distance 734 m (2,408 ft)
- Half of occupied dens were from previously used sites

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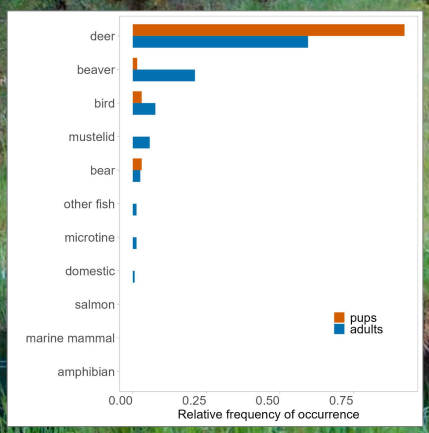
# Denning Ecology




Roffler, G.H., et al. in press. Variation in adult and pup wolf diets at natal den sites is influenced by forest composition and configuration. Ecology and Evolution.

- Wolf pups ate more deer than adults
- Only 4 prey species detected in pups' diets
- Litter sizes highest in packs that ate the most deer
- Deer more vulnerable to predation in clearcuts and fragmented habitat

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Photo: B. Dihle

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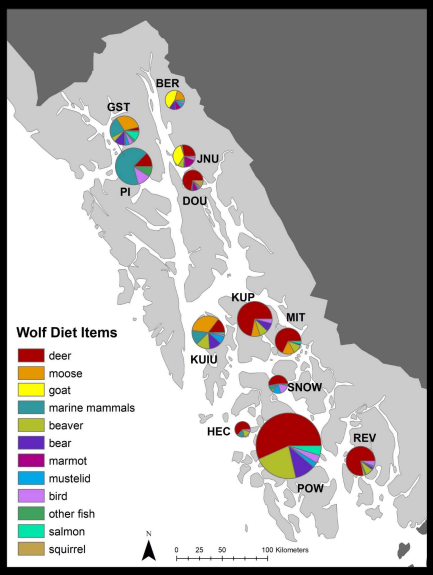


# Geographic Variation in Wolf Diets

- 55 diet items
- Wolf diet composition varied by study site
- Ungulates contributed most, but wide variation
- Beaver, black bears, and marine mammals important alternate prey

Roffler, G.H., et al. 2021. Regional metabarcoding of fecal DNA shows that dietary diversification in wolves substitutes for ungulates in an island archipelago. Ecosphere. 12:e03297.

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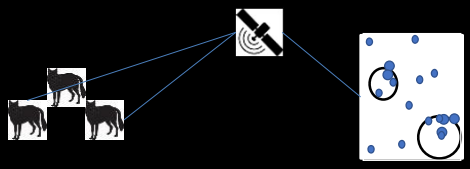
## Seasonal Predation Patterns of Wolves

- Direct estimates of predation rates
- GPS collar locations every 30 minutes
- Estimation periods: Late summer, and late winter



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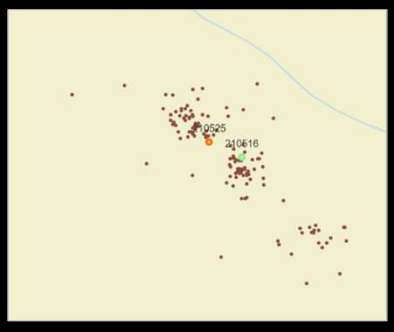
## Seasonal Predation Patterns of Wolves




Photos: S. Neilson

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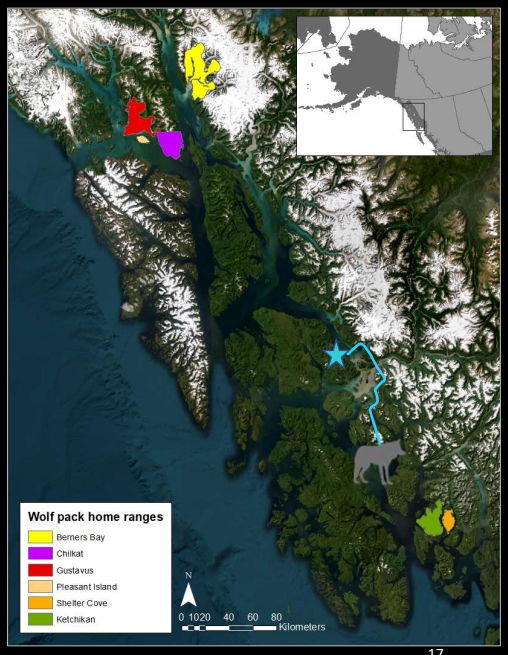
# Seasonal Predation Patterns of Wolves

2018 – 2022

- 20 wolves instrumented
- 7 wolf packs, 4 study areas
- Average home range size = 384 km$^2$

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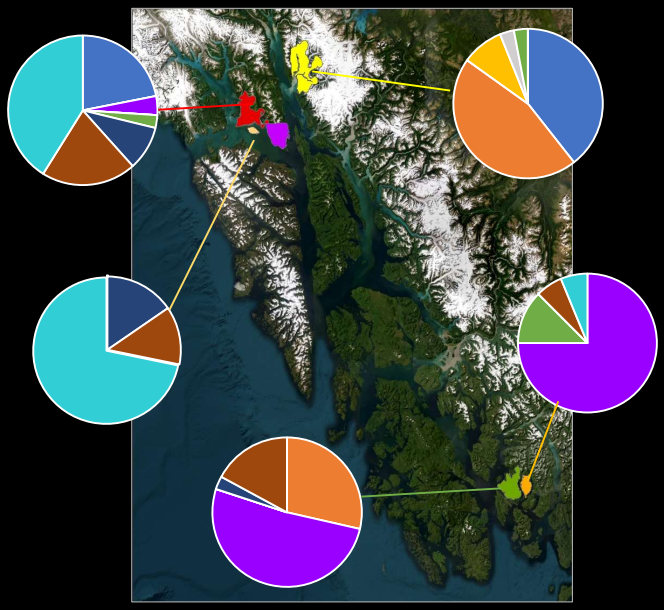
# Seasonal Predation Patterns of Wolves



- 1,000 clusters investigated
- 172 kill sites
- 120 scavenging sites

Moose
Mountain goat
Deer
Sea otter
Beaver
Porcupine
Bear
Bird
Salmon

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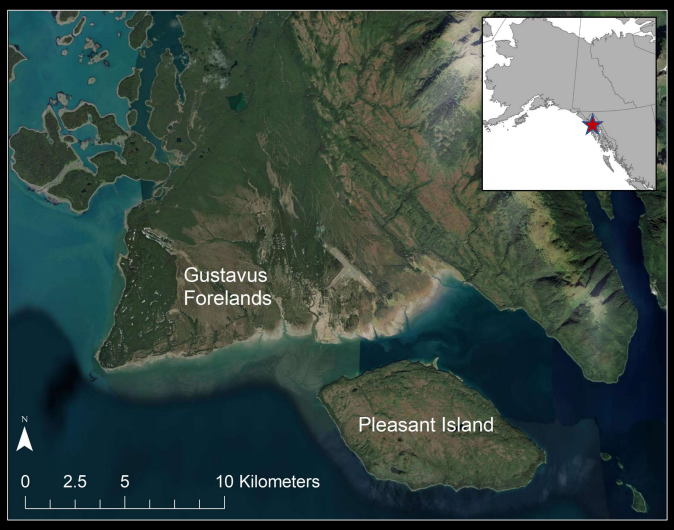
# Seasonal Predation Patterns of Wolves




- 2013 wolves colonized Pleasant Island
- 50 km$^2$ island with 120–200 deer
- Gustavus – mainland system
- 3.9 moose/km$^2$

Roffler, G.H., et al. In press. Recovery of a marine keystone predator transforms terrestrial predator-prey dynamics. PNAS.

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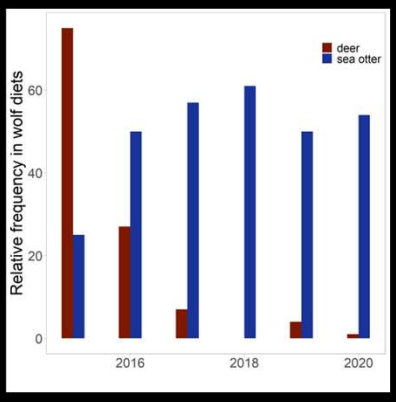
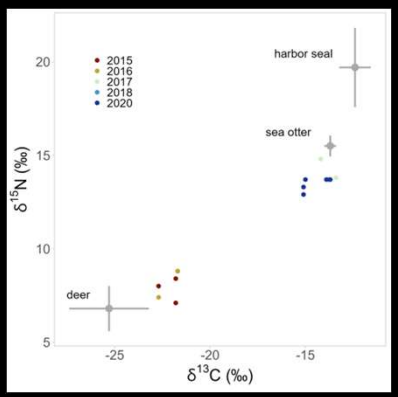
# Dietary shifts – Pleasant Island




Fecal metabarcoding




Stable isotope ratios

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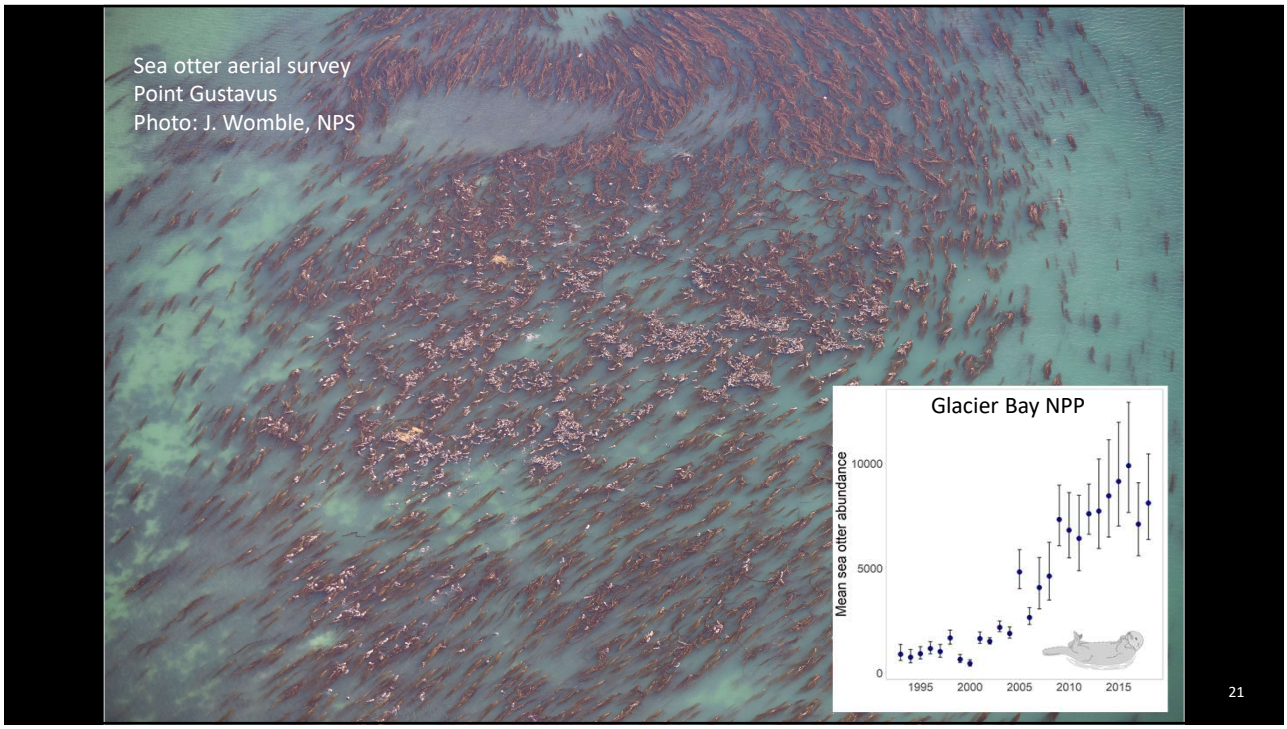
Sea otter aerial survey
Point Gustavus
Photo: J. Womble, NPS
Glacier Bay NPP
Mean sea otter abundance
10000
5000
0
1995
2000
2005
2010
2015
21

21


Wolf predation of sea otters
Photo: B. Dihle
Photo: B. Dihle
Photo: S. Neilson
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## Wolf predation of sea otters

- Pleasant Island kill sites
- 30-day sessions, n = 3
- 26 wolf-killed sea otters
- 11 sea otters scavenged





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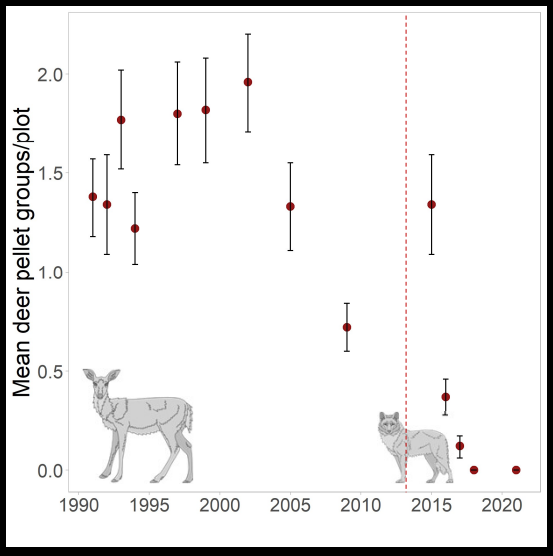
## Deer abundance – Pleasant Island

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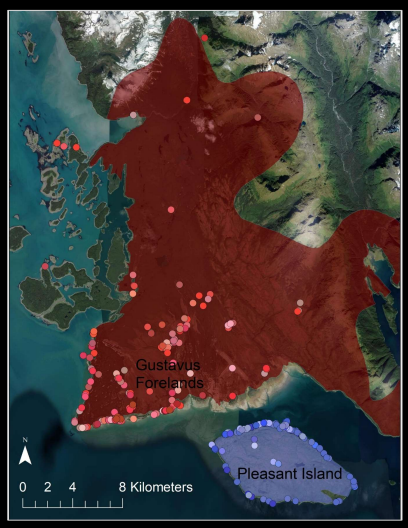
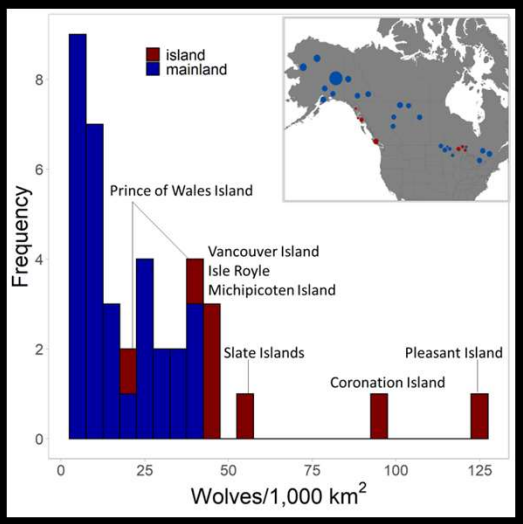
# Wolf distribution and densities

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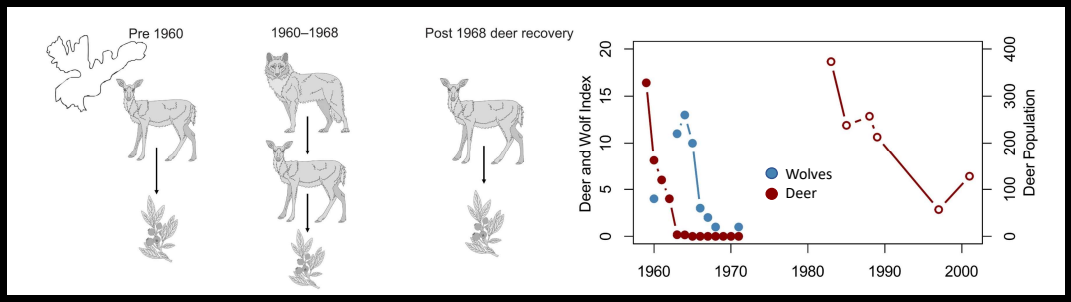
## Coronation Island




## Pleasant Island

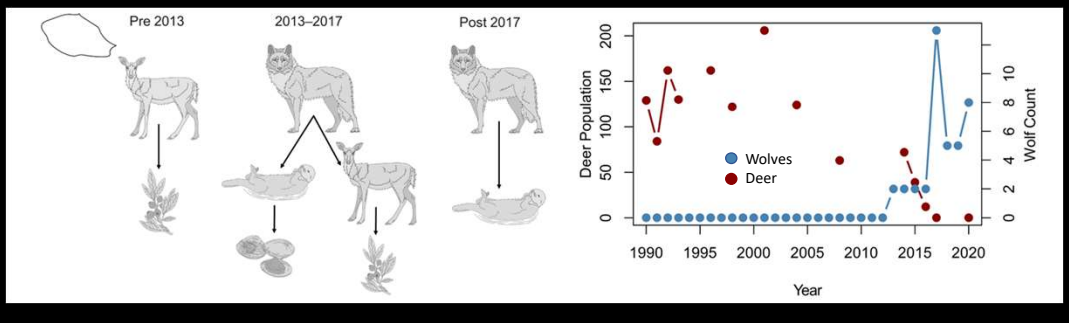



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Photo: B. Dihle

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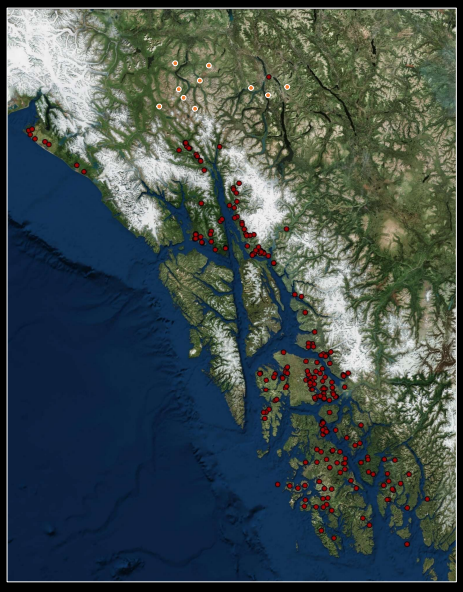

## Genetic Structure

- Identify isolated populations and areas of connectivity
- Define population boundaries
- Identify recent immigrants = gene flow
- ~600 samples
- ~37,000 SNPs

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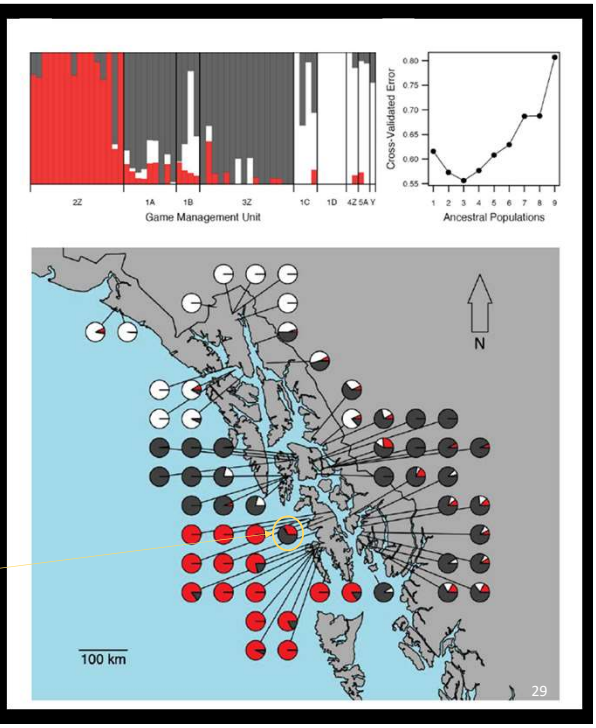
## Genetic Structure

- 3 populations
- GMU2 distinct cluster
- Some evidence of admixture

Wolf 201501

Zarn, K. et al. Genomic analysis of inbreeding in Alexander Archipelago wolves (*Canis lupus ligoni*). In review. Evolutionary Applications.

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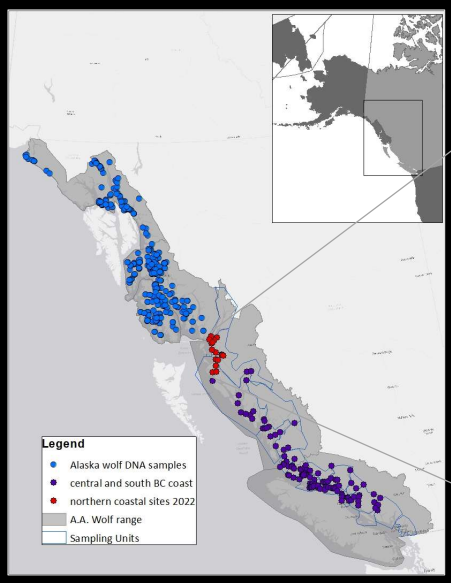
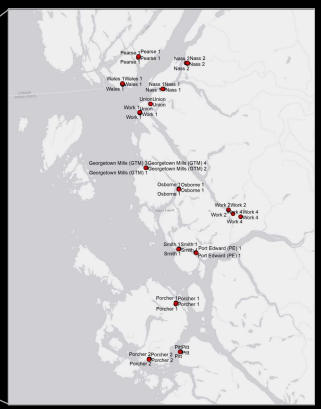
## Genetic Structure – Range-wide A.A. Wolves



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## Information Needed for Management

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Photo: B. Dihle

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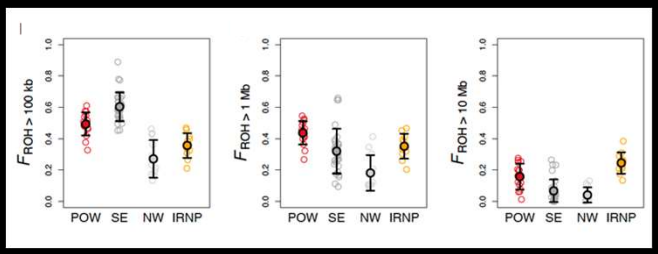
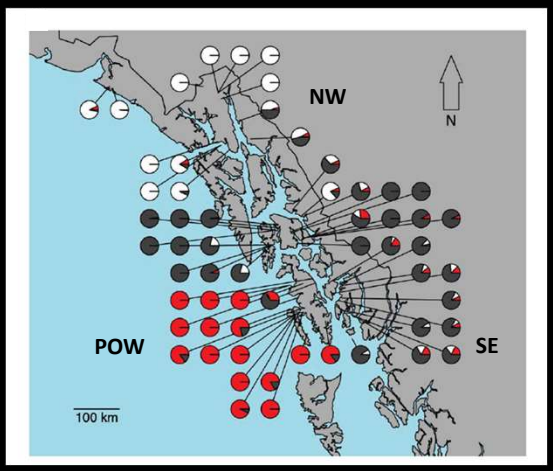
## Inbreeding

- Recent inbreeding in POW population
- More historically distant inbreeding in SE population

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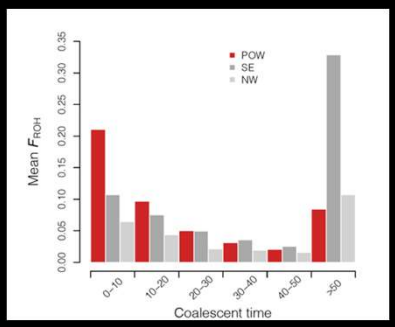
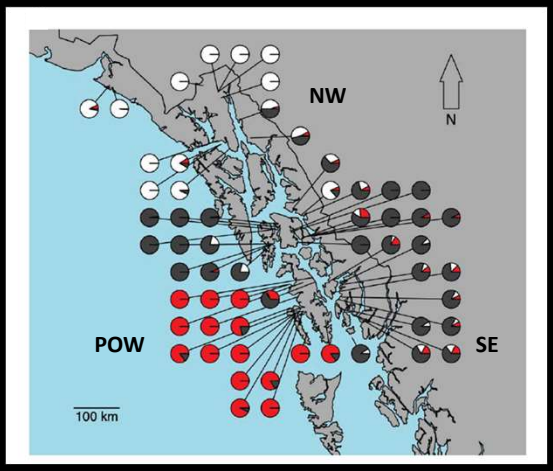
# Inbreeding

- Inbreeding in POW 1970 - present
- Inbreeding in SE population ~ 1790

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# Inbreeding

- Inbreeding depression = reduced fitness of individuals with related parents
- No evidence for reduction in fitness on POW
- Inbreeding depression very difficult to measure in natural populations
- Whole genome sequencing to measure accumulation of deleterious genetic variants
- Simulations – measure effects of migration on increasing genetic diversity

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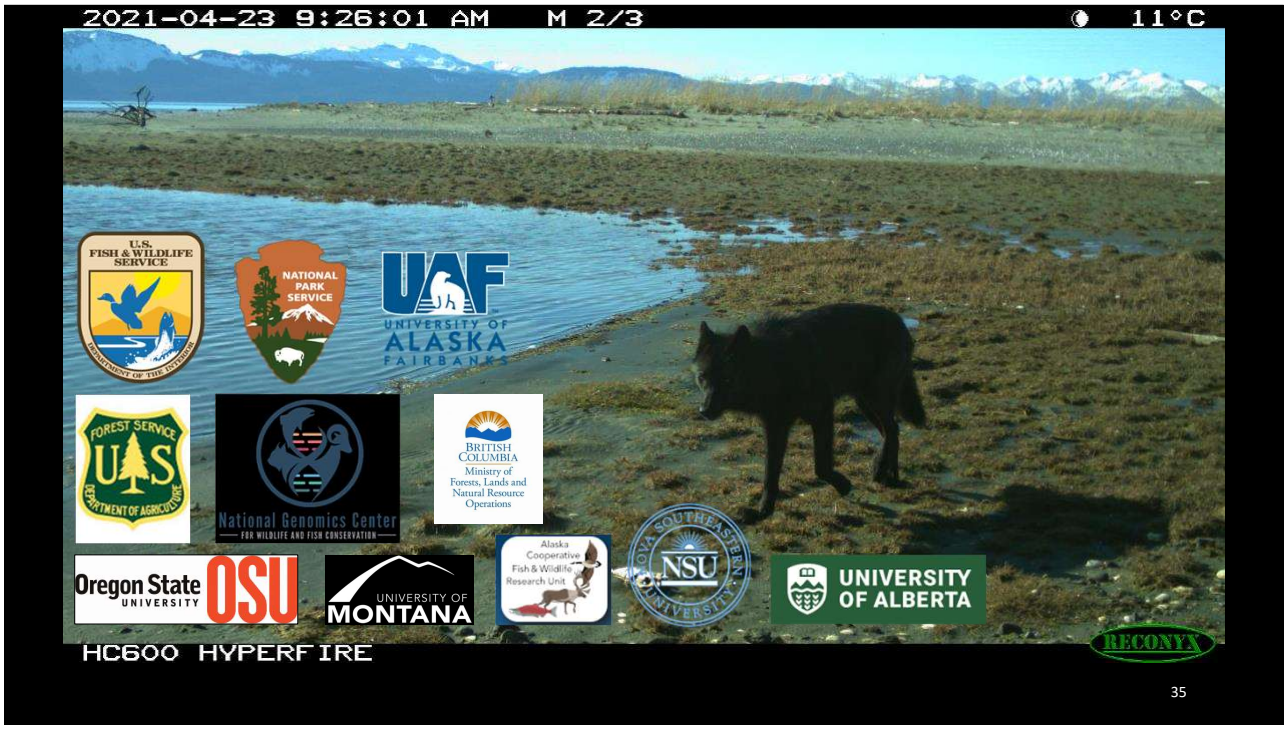
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11°C
U.S. FISH & WILDLIFE SERVICE
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UNIVERSITY OF ALASKA FAIRBANKS
FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE
National Genomics Center
FOR WILDLIFE AND FISH CONSERVATION
BRITISH COLUMBIA
Ministry of Forests, Lands and Natural Resource Operations
Oregon State UNIVERSITY OSU
UNIVERSITY OF MONTANA
Alaska Cooperative Fish & Wildlife Research Unit
NSU
NOVA SOUTHEASTERN UNIVERSITY
UNIVERSITY OF ALBERTA
RECONYX
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