USGS
science for a changing world

Assigning birds to regions in the Bering Sea using stable isotopes of feathers

Steffen Oppel and Abby Powell

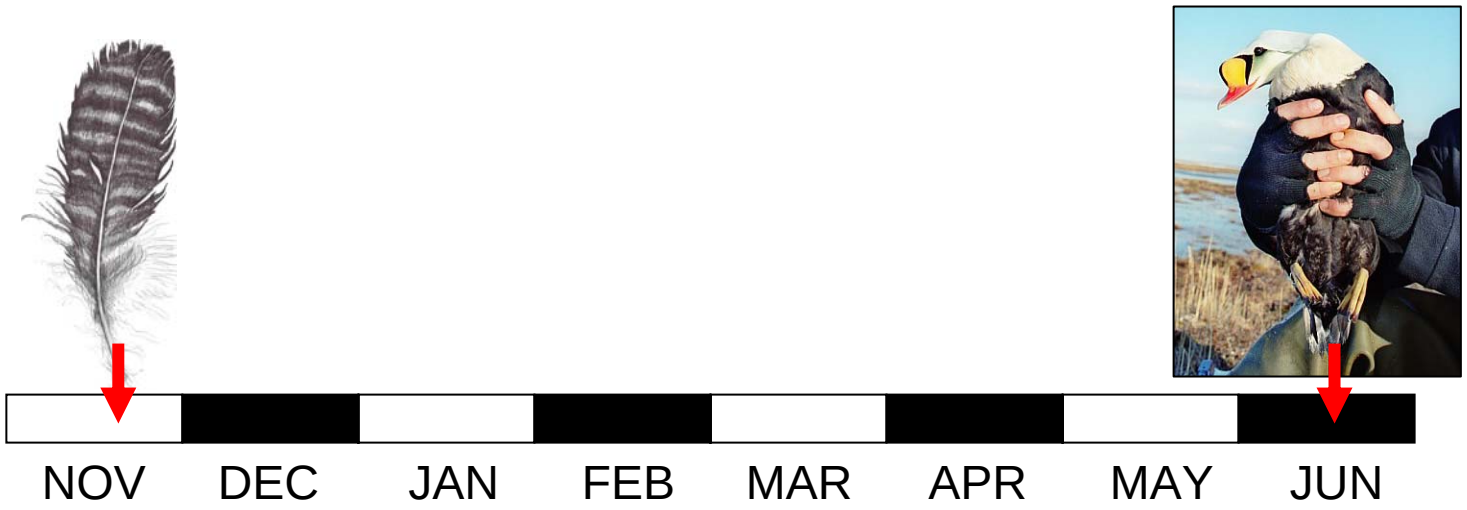
University of Alaska Fairbanks

Background

- Seabirds spend >10 months per year at sea
- distribution at sea often poorly known
- capture is easy on breeding grounds

Stable Isotope Ratios ($^{13}C/^{12}C$, $^{15}N/^{14}N$)

- reflects bird diet during feather synthesis
- isotope ratio does not change in feather



requires geographic variation

Question

Do feather ^{13}C and ^{15}N isotope ratios differ among regions in the Bering Sea?

King Eider wintering regions

Russia

Chukotka

Alaska

Kamchatka

Bering Sea

0 500 1,000 1,500 Kilometers

Methods: model building

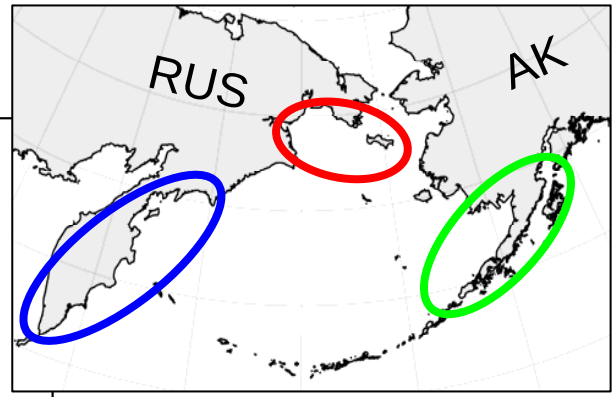
- in 2005 and 2006 collected one head feather from 25 King Eiders
- analyzed $\delta^{13}C$ and $\delta^{15}N$ of head feathers
- equipped ducks with satellite transmitter
- discriminant function analysis to classify feathers

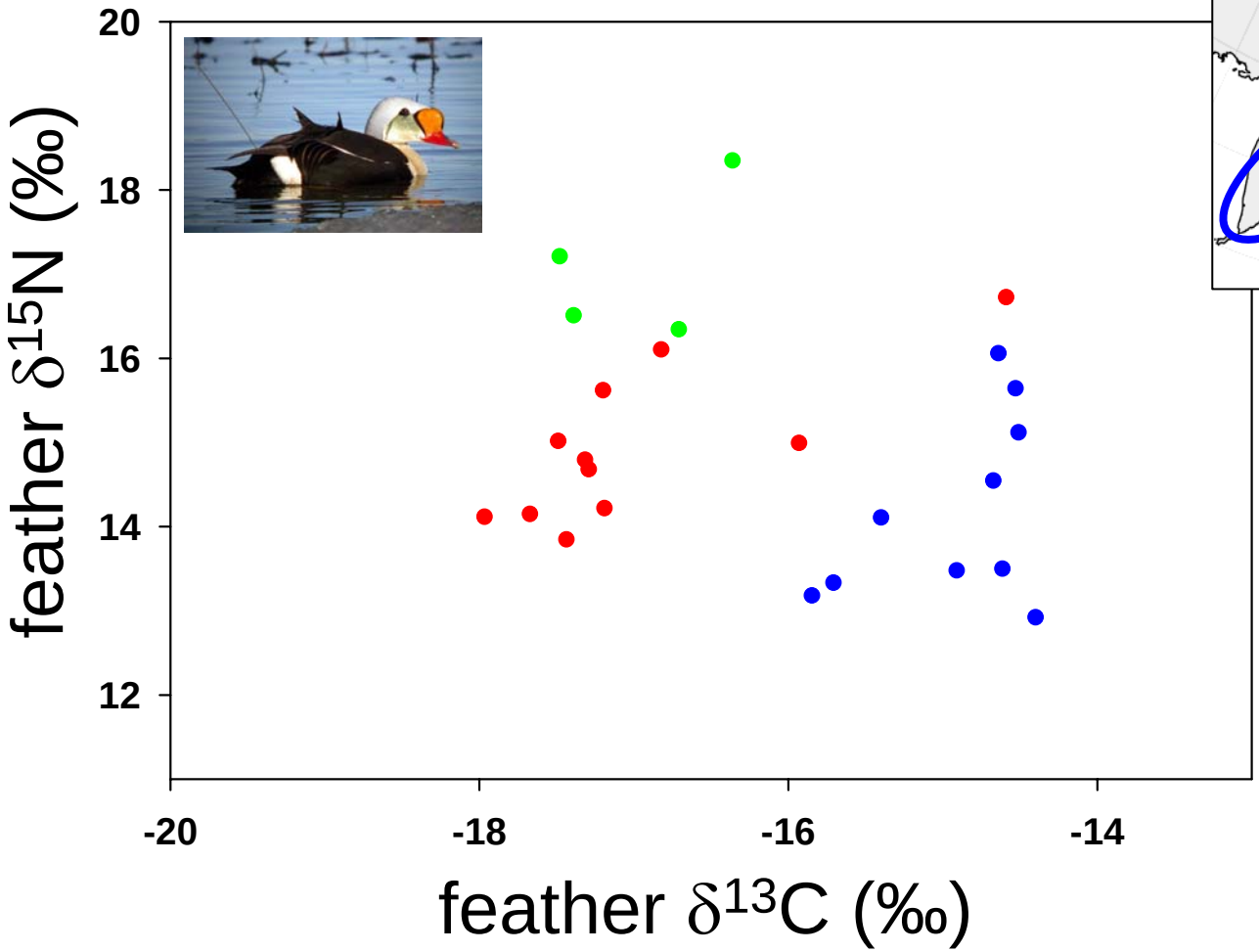
Methods: application of model

- captured 108 King Eiders in 2006 and 2007
- analyzed $\delta^{13}C$ and $\delta^{15}N$ of head feathers
- assigned birds to a region using model
- excluded feathers with <80% probability

Results: feathers of satellite tracked birds

head feathers from 25 King Eiders

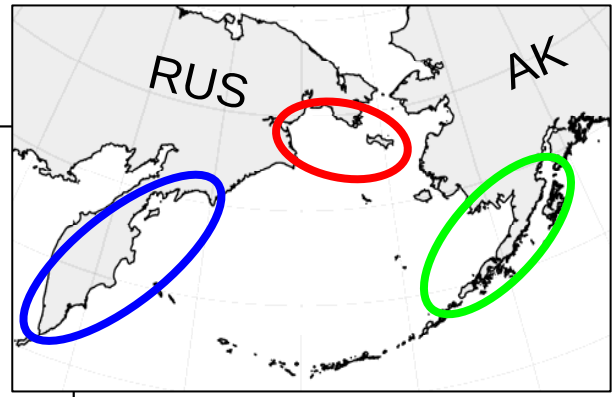


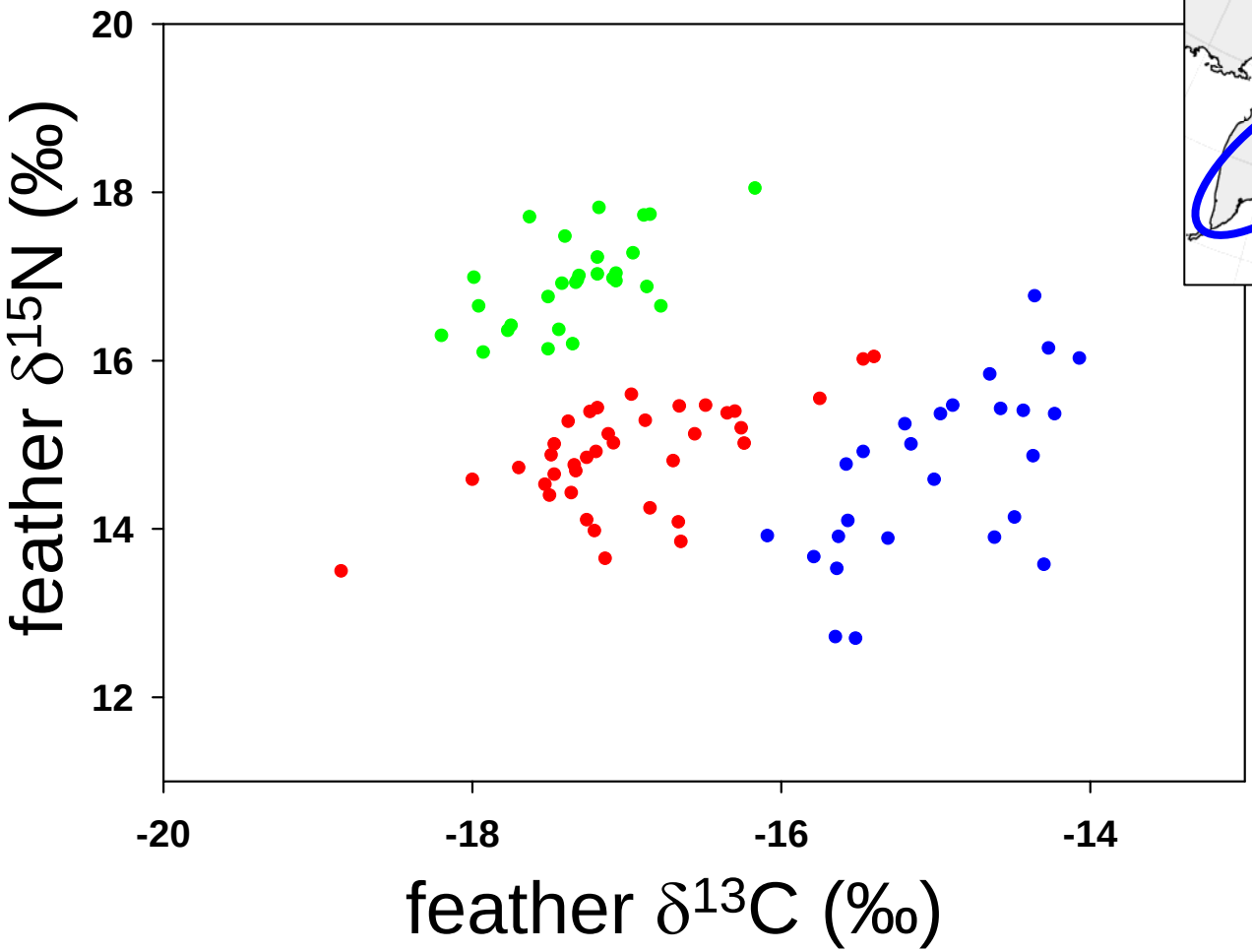


Classification accuracy = **88 %**

Results: feathers of unknown origin

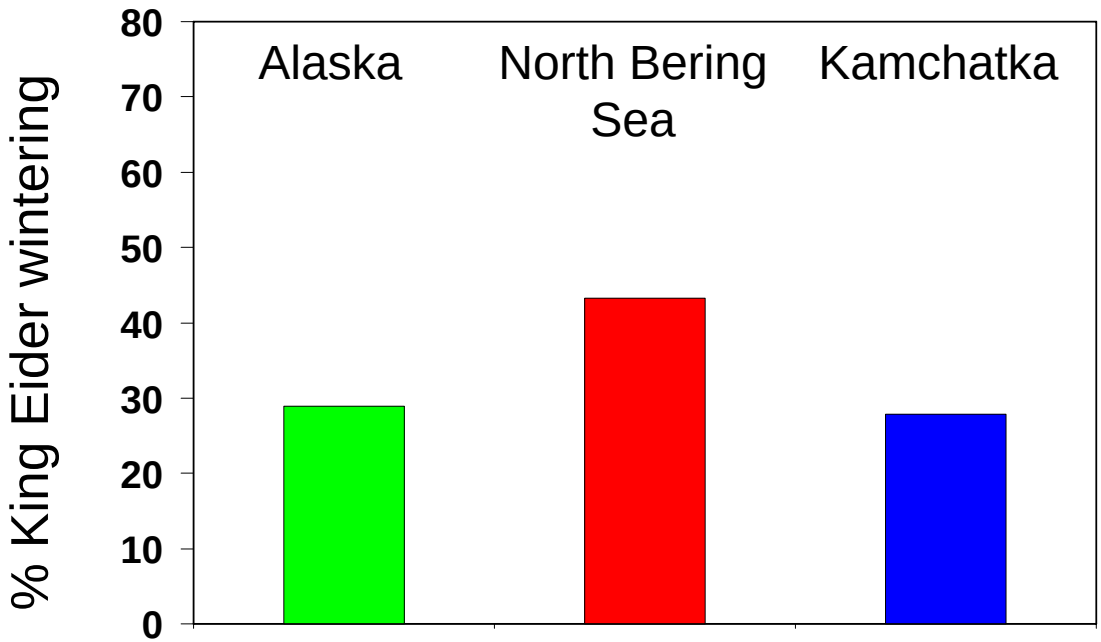
10% of feathers not reliably classified



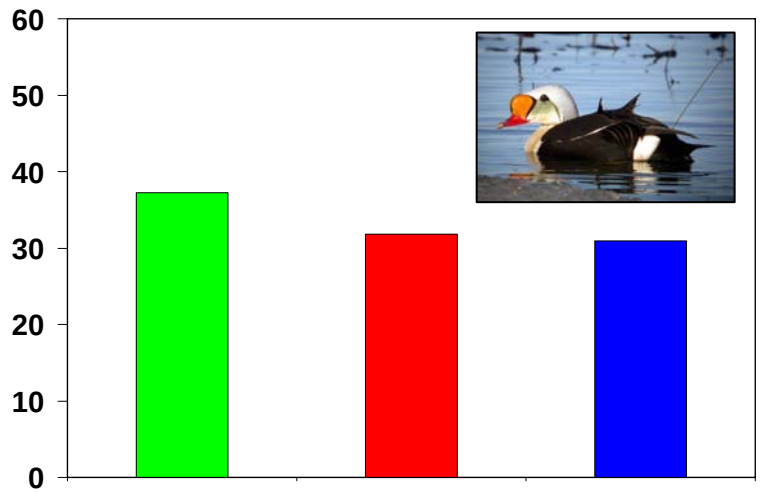


Results: feathers of unknown origin

winter distribution equal across regions



Satellite telemetry data 2002-2007
(*n* = 85 adult King Eiders):



Phillips et al. (2006)

Discussion

- regions in Bering Sea isotopically distinct
- reliable technique to identify spatial distribution
- agrees with estimates from satellite telemetry

Outlook and applications

- applicable to other benthivoric species (sea-ducks, gray whales, walrus…)
- great potential for population inference

Acknowledgements

Minerals Management Service

US Fish and Wildlife Service

Sea Duck Joint Venture

Coastal Marine Institute

North Slope Borough

Conoco Phillips, AK

US Geological Survey

ABR, Inc.

Alaska Stable Isotope Facility

Troy Ecological Research Associates, Inc.

Alaska Cooperative Fish and Wildlife Research Unit

Mike Knoche
Chris Latty
Rebecca Bentzen
Robert Suydam
Sumiyo Sekine
Micah Miller
Diane O'Brien

….and many field assistants

Questions?

pictures courtesy of Ray Fellner, Robert Suydam, and Keith Brady