

Data to Design: Identifying Important Bird
Areas and Seabird Connectivity in the
Alaskan Arctic
Melanie Smith, Audubon Alaska



image: Milo Burcham

Overview

- Process from data to designing Important Bird Areas (IBAs)
- Three main analyses for seabird data
- Challenges related to connectivity

Data to Design

Data Gathering

Identify available data
Acquire and organize

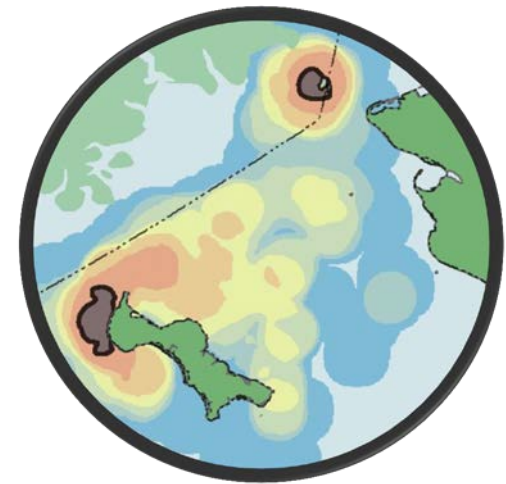


Data Synthesis

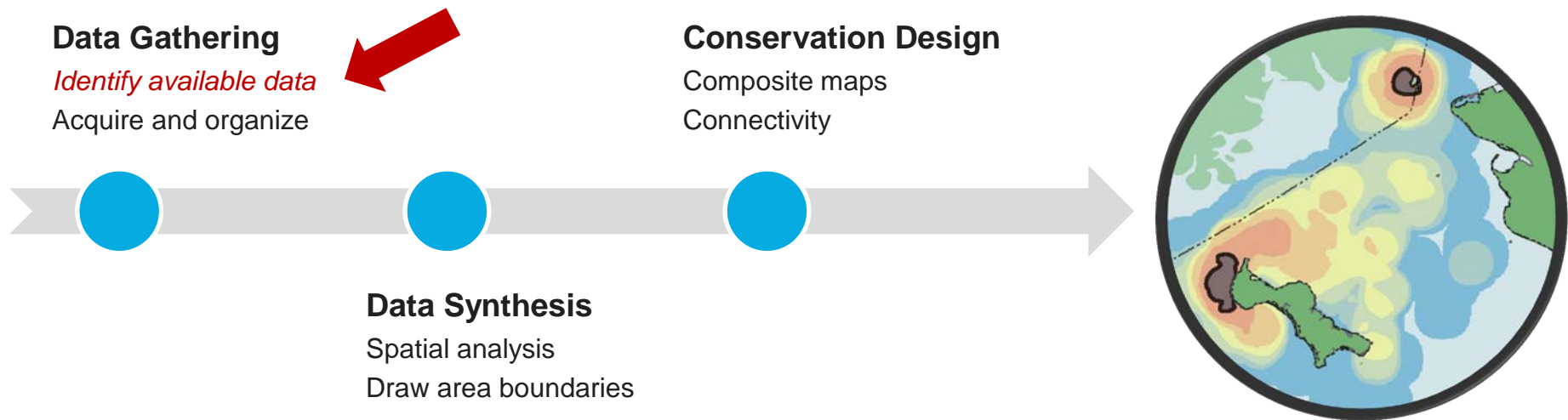
Spatial analysis
Draw area boundaries

Conservation Design

Composite maps
Connectivity



Data to Design



Identify Available Data



Colony

- Census count

Survey Transects

- Ship-based
- Aerial

Telemetry

- PTT
- GPS
- Geolocator

Expert

- Ecological, local, traditional knowledge

Genetic

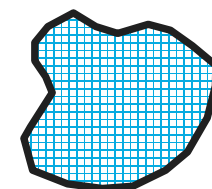
- Genetic markers
- Isotopes

Connecting the Annual Cycle

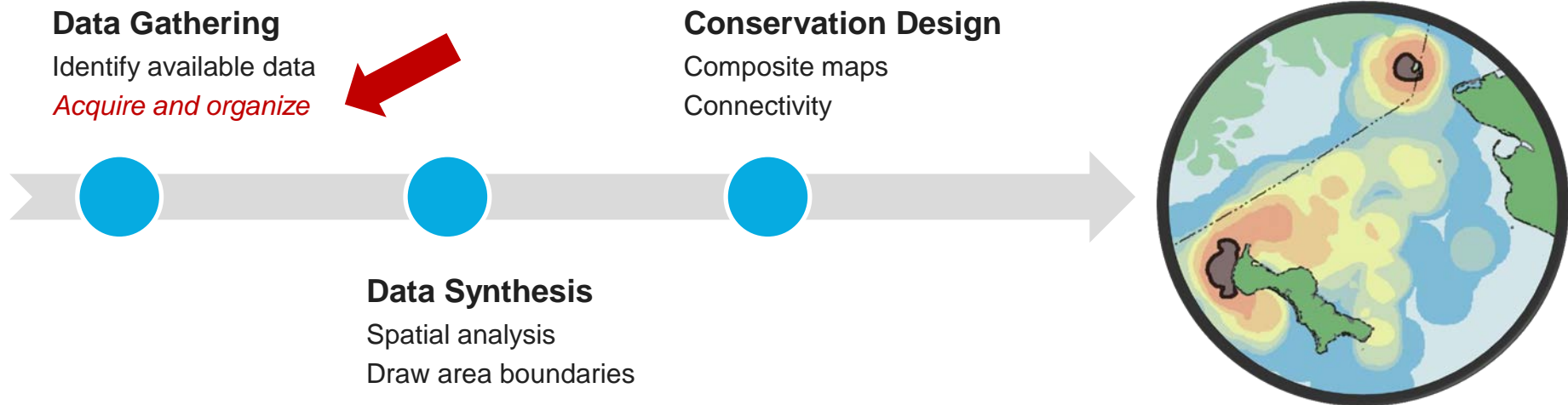
	Colony	Survey	Tracking
Breeding	x	x	x
Foraging	x	x	x
Staging		x	x
Molting		x	x
Wintering		x	x

Important Bird Areas =

- 1% or more of global or biogeographic population OR
- Congregation of species of special concern



Data to Design



Acquire and Organize



Survey Transect



Telemetry



Colony



Name	Type
Bathymetric	File Geodatabase Feature Dataset
Beluga_Whale	File Geodatabase Feature Dataset
Birds	File Geodatabase Feature Dataset
Bowhead_Whale	File Geodatabase Feature Dataset
Ecosystem_Analysis	File Geodatabase Feature Dataset
Energy	File Geodatabase Feature Dataset
Gray_Whale	File Geodatabase Feature Dataset
Marine_Mammals	File Geodatabase Feature Dataset
Polar_Bear	File Geodatabase Feature Dataset
Ringed_Seal	File Geodatabase Feature Dataset
Spotted_Seal	File Geodatabase Feature Dataset
Walrus	File Geodatabase Feature Dataset
benthic_biomass_g_m2	File Geodatabase Raster Dataset
Birds_Int_Glob_Sig_Prop	File Geodatabase Raster Dataset
IBCAO_GEBCO_blendedDEM	File Geodatabase Raster Dataset
IBCAO_GEBCO_hlsd	File Geodatabase Raster Dataset
IBCAO_v3	File Geodatabase Raster Dataset
pct_days_ice_Annual_Average_2008_2012	File Geodatabase Raster Dataset
pct_days_ice_Apr_June_2008_2012	File Geodatabase Raster Dataset
pct_days_ice_Jan_Mar_2008_2012	File Geodatabase Raster Dataset
pct_days_ice_July_Sept_2008_2012	File Geodatabase Raster Dataset
pct_days_ice_Oct_Dec_2008_2012	File Geodatabase Raster Dataset
PolarBear_autumn_mean_scaled	File Geodatabase Raster Dataset
PolarBear_spring_mean_scaled	File Geodatabase Raster Dataset
PolarBear_summer_mean_scaled	File Geodatabase Raster Dataset
PolarBear_winter_mean_scaled	File Geodatabase Raster Dataset
Primary_Productivity_mg_m3	File Geodatabase Raster Dataset

Data to Design

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Conservation Design

Composite maps
Connectivity

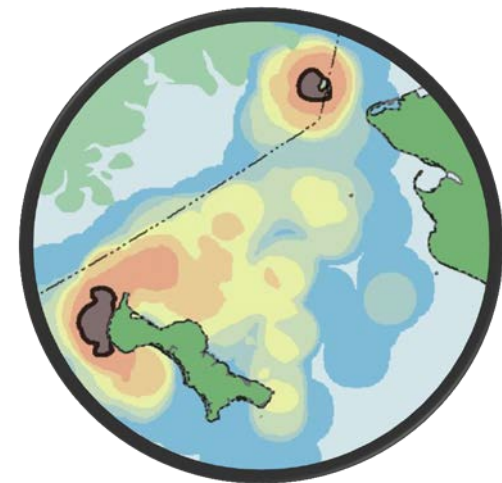
Data Synthesis

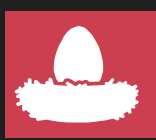
Spatial analysis

Draw area boundaries

Analytical approaches

- Foraging radius
- Survey data
- Tracking data

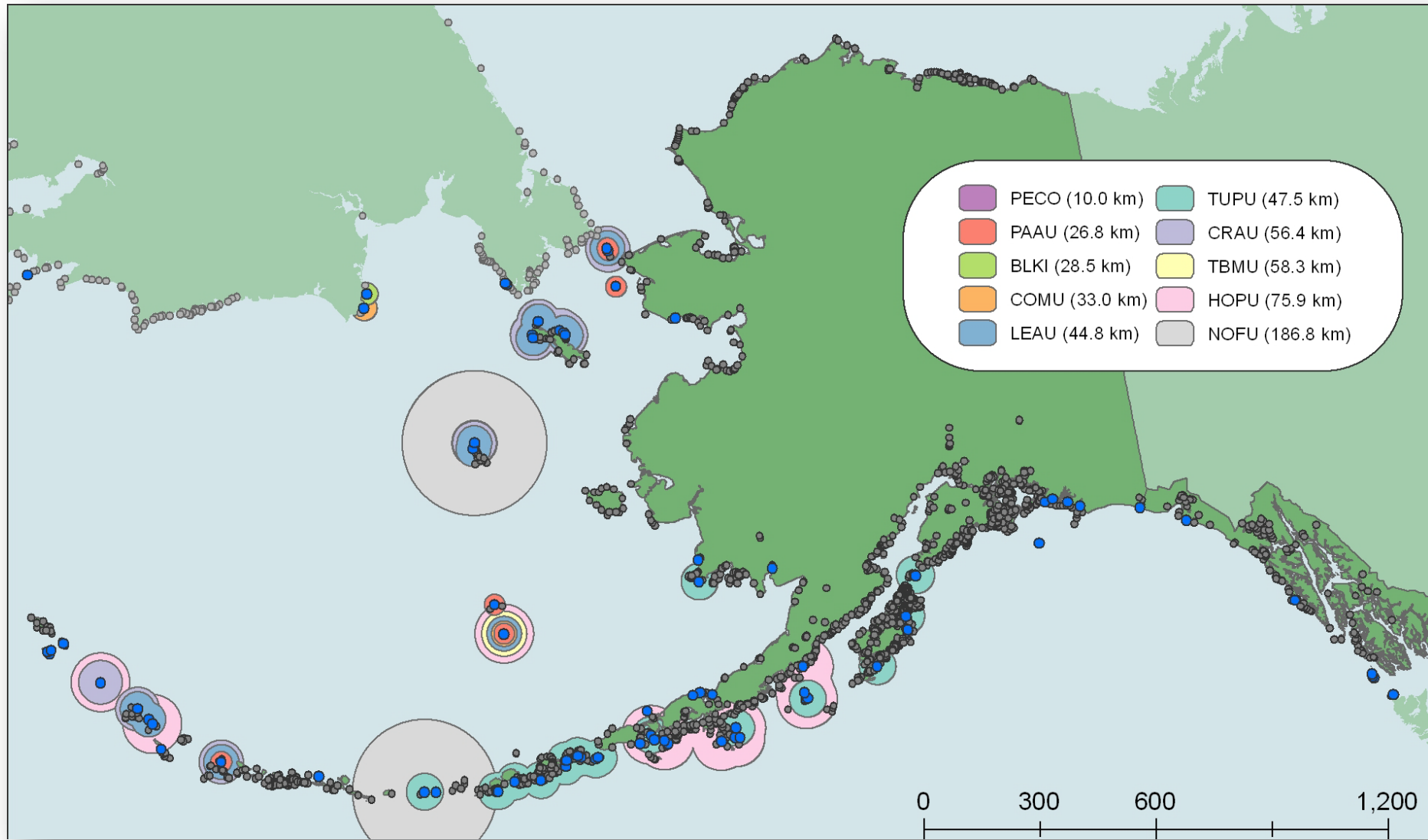




Common Name	Country	Site Name	Observed Foraging Distance	Avg. Average	Avg. Maximum	Max. Maximum
.....
.....
Thick-Billed Murre	Iceland	Latrabjarg	max 168km		168	168
Thick-Billed Murre	Greenland	Hakluyt Island	max 50km, avg 20-25km	22.5	50	50
Thick-Billed Murre	Greenland	Hakluyt Island	within 50km		50	50
Thick-Billed Murre	Norway	Western Spitsbergen	approx 85km	85		
Thick-Billed Murre			30-50km, max 100km	40	100	100
Thick-Billed Murre	US	Alaska	8-104km	56	104	104
Thick-Billed Murre	US	Pribilof Islands, Alaska	up to 110km		110	110
Thick-Billed Murre	Canada	Prince Leopold Island	avg 80km, max 150-175km	80	162.5	175
Thick-Billed Murre	Canada	Coats Island	c100km	100		
Thick-Billed Murre	Atlantic		normal 2-25km, max 75km	13.5	75	75
.....
.....

Foraging Radius Approach

Soanes et al. 2016, *Biological Conservation*



COLONY FORAGING DISTANCE BUFFERS

The average foraging radius for all seabird species listed in the BLI database

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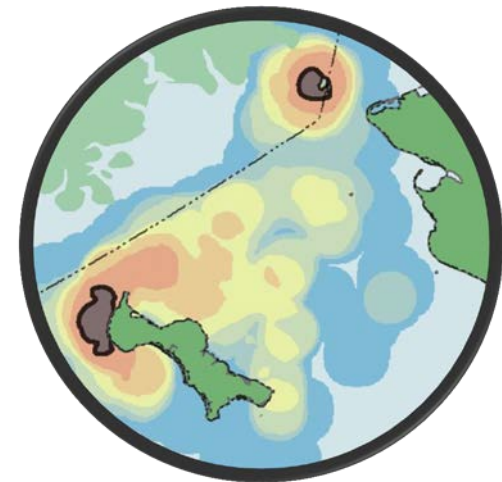
Data Synthesis

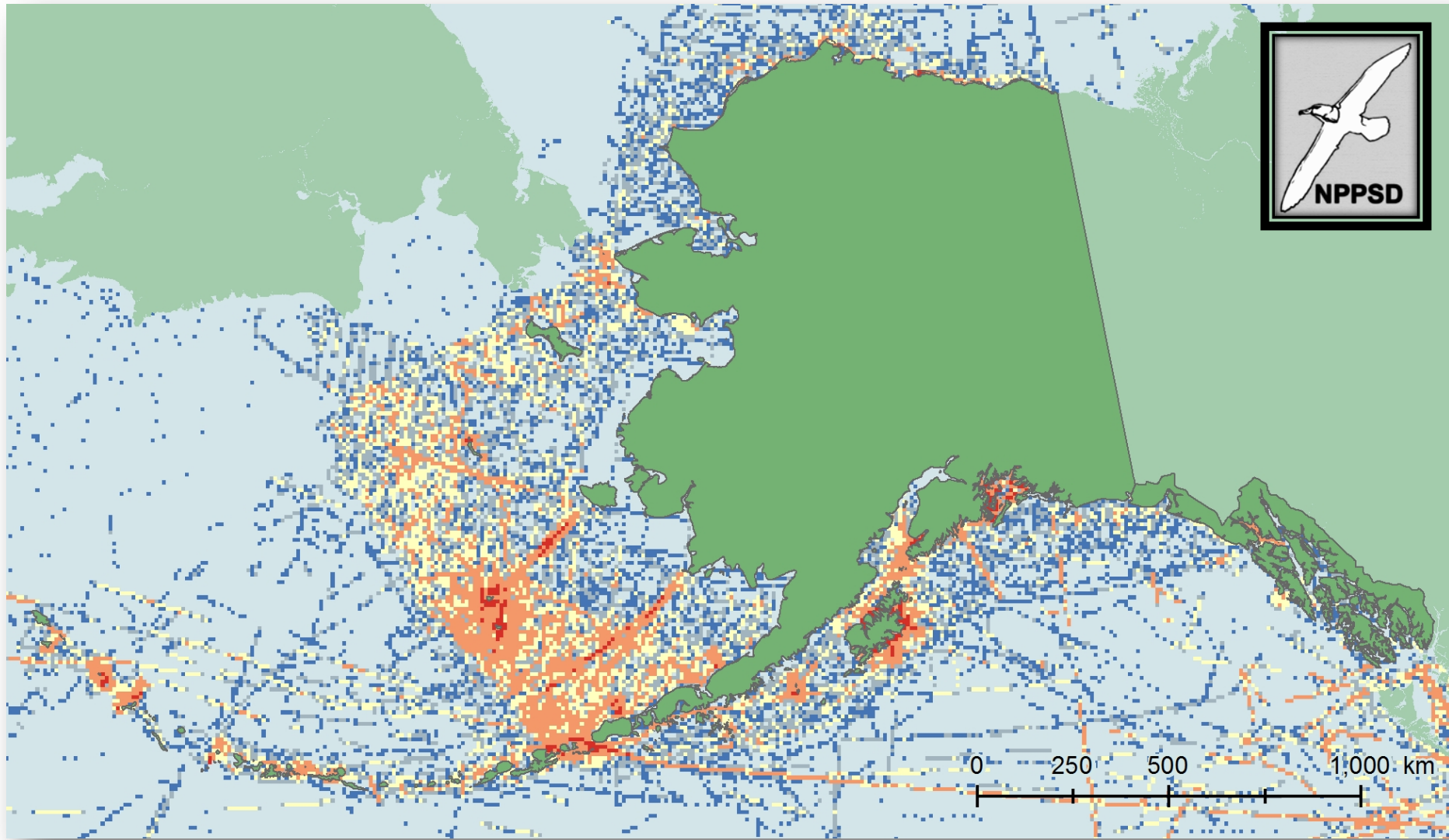
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Draw area boundaries

Analytical approaches

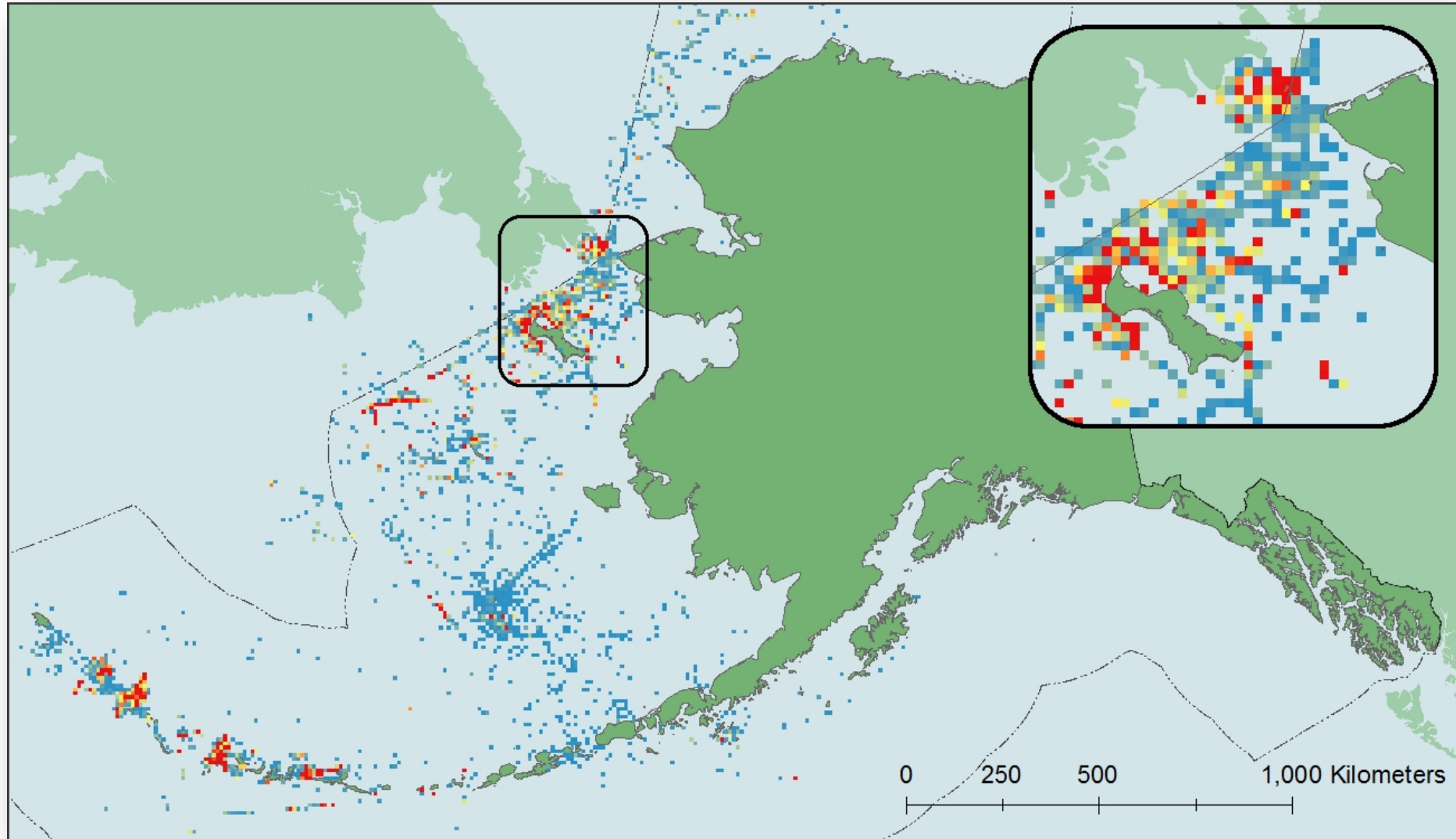
- Foraging radius
- **Survey data**
- Tracking data





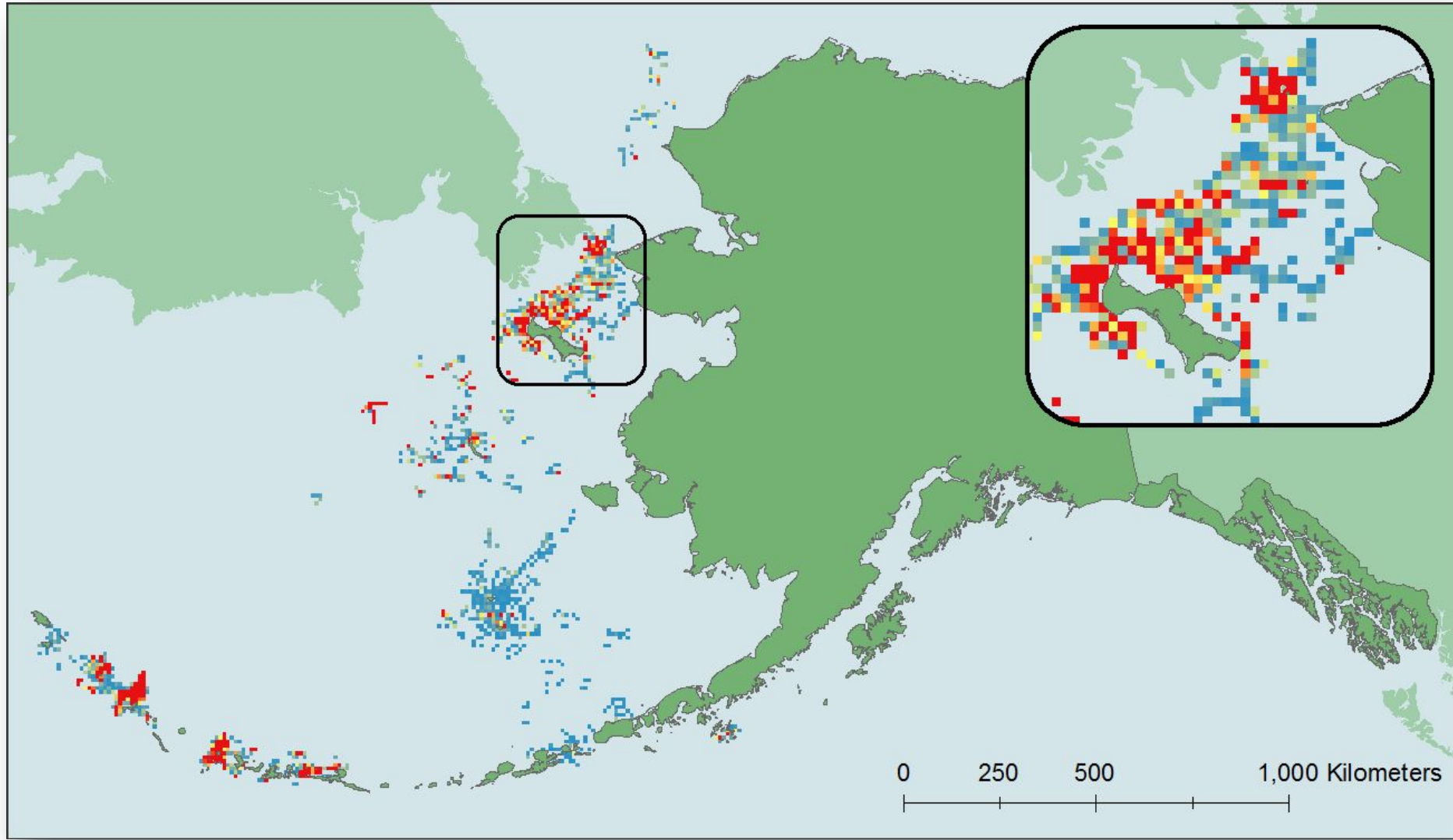
Survey Data Approach

Smith et al. 2014, *Biological Conservation*

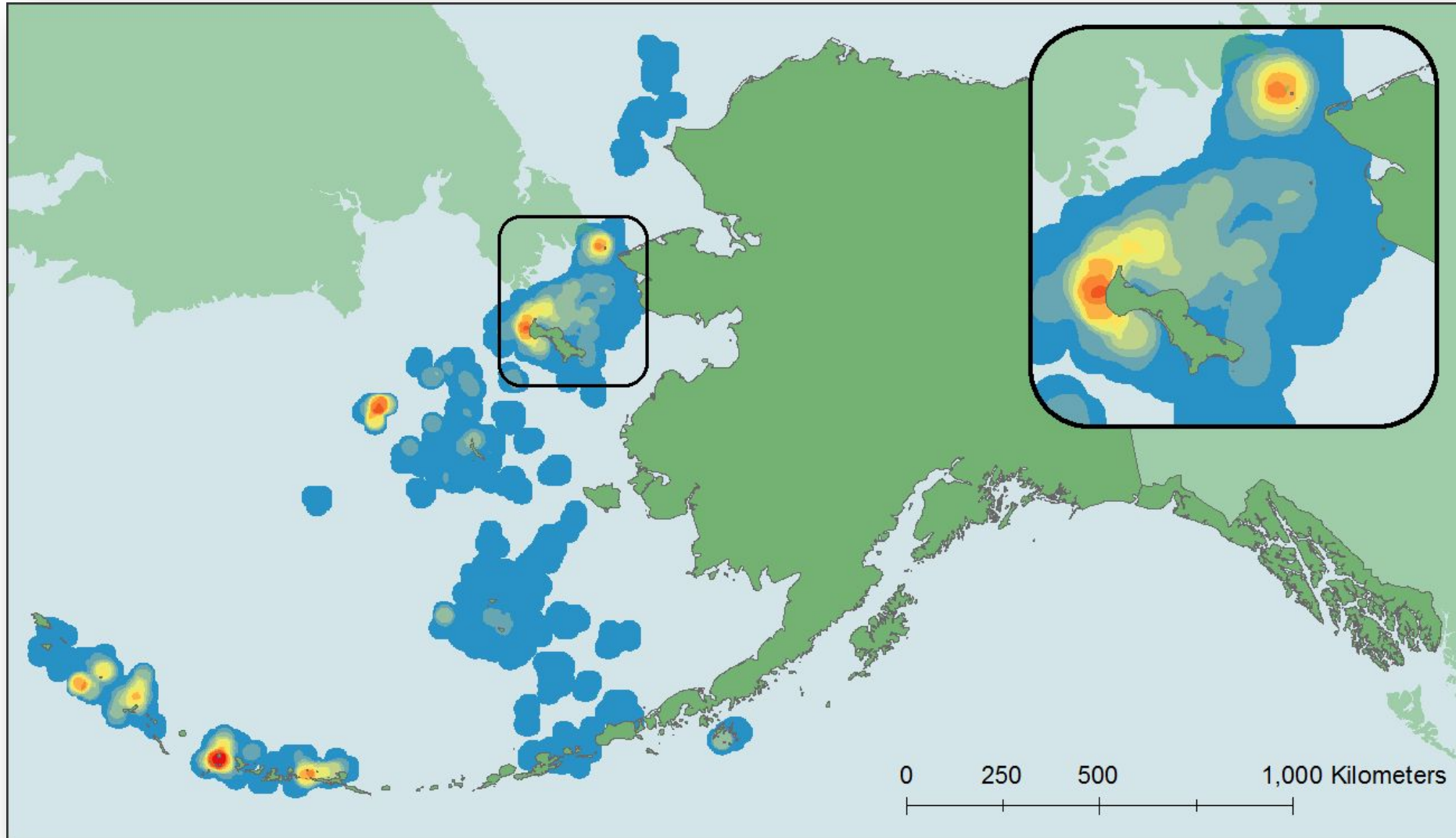


PRESENCE

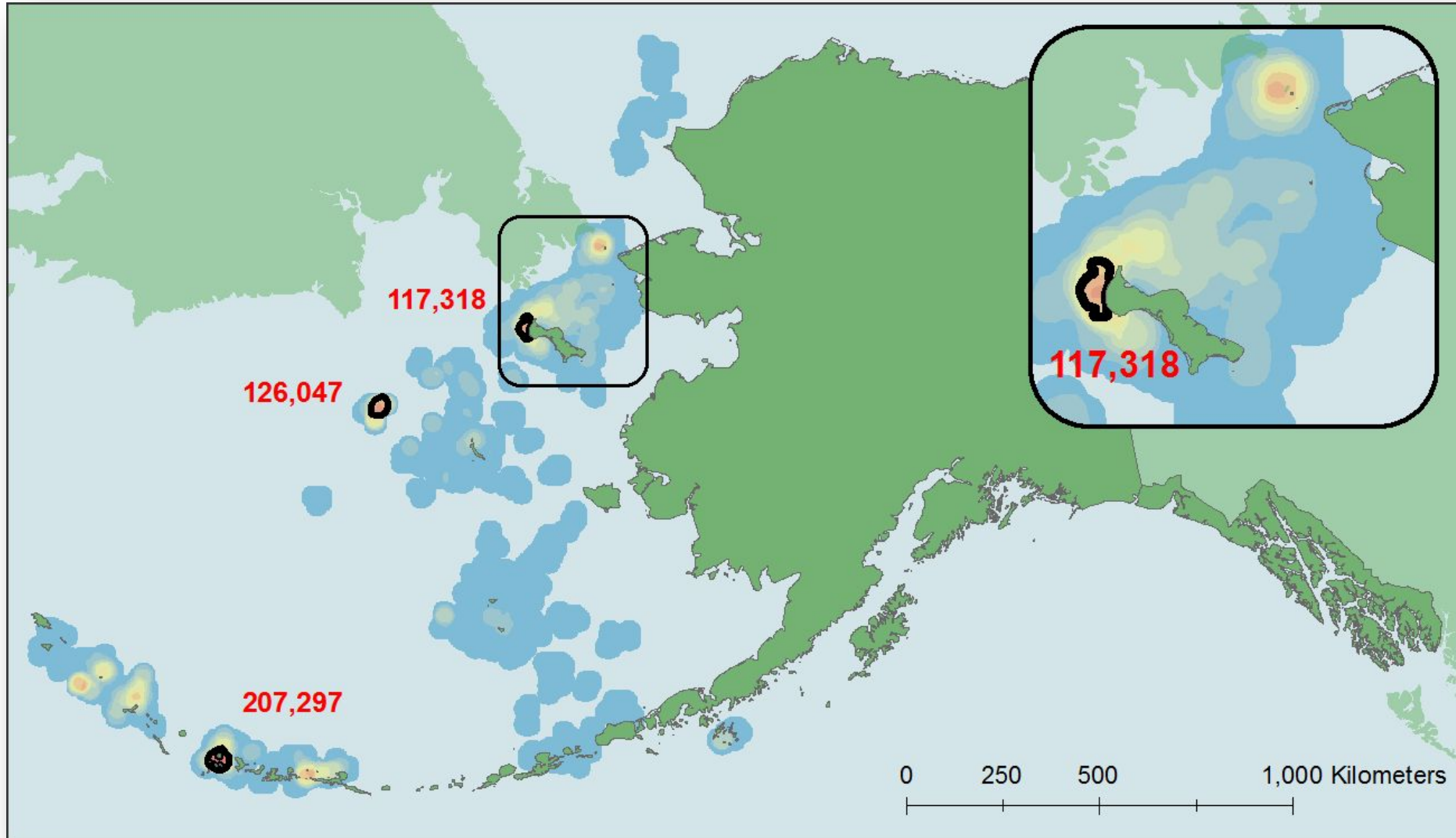
The distribution of Crested Auklet data



PERSISTENT, ADJACENT
Data that will be used for hotspot analysis of Crested Auklets



ANALYZE LOCAL ABUNDANCE
Results of the hotspot analysis for Crested Auklet



VALIDATE IBAs

Adequate abundance, repeated high use, multi-year persistence

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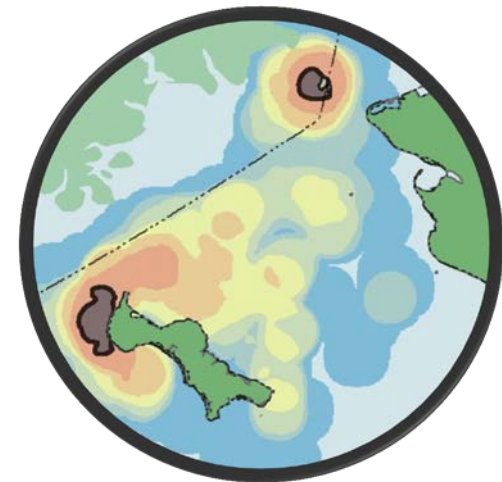
Data Synthesis

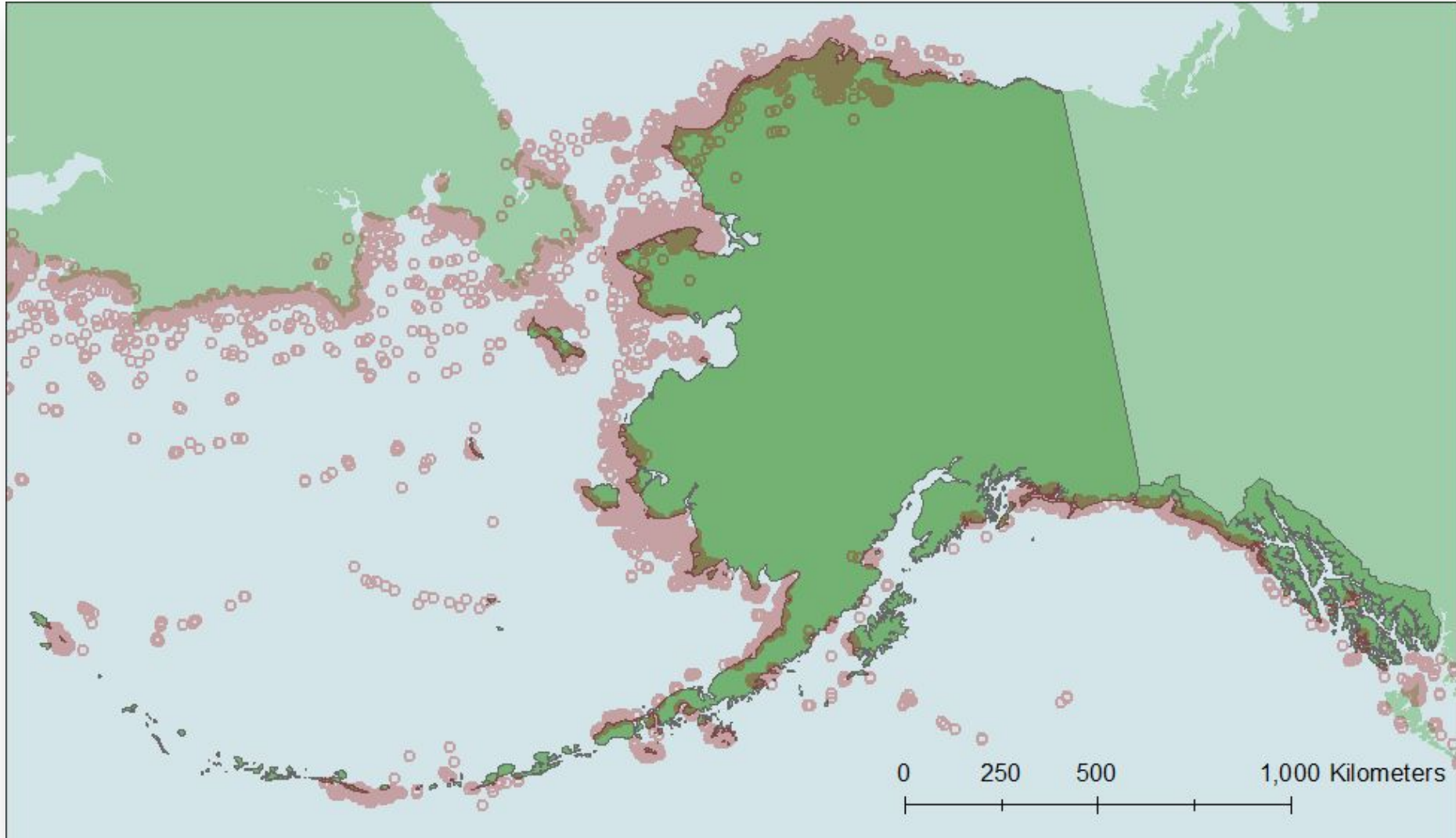
Spatial analysis

Draw area boundaries

Analytical approaches

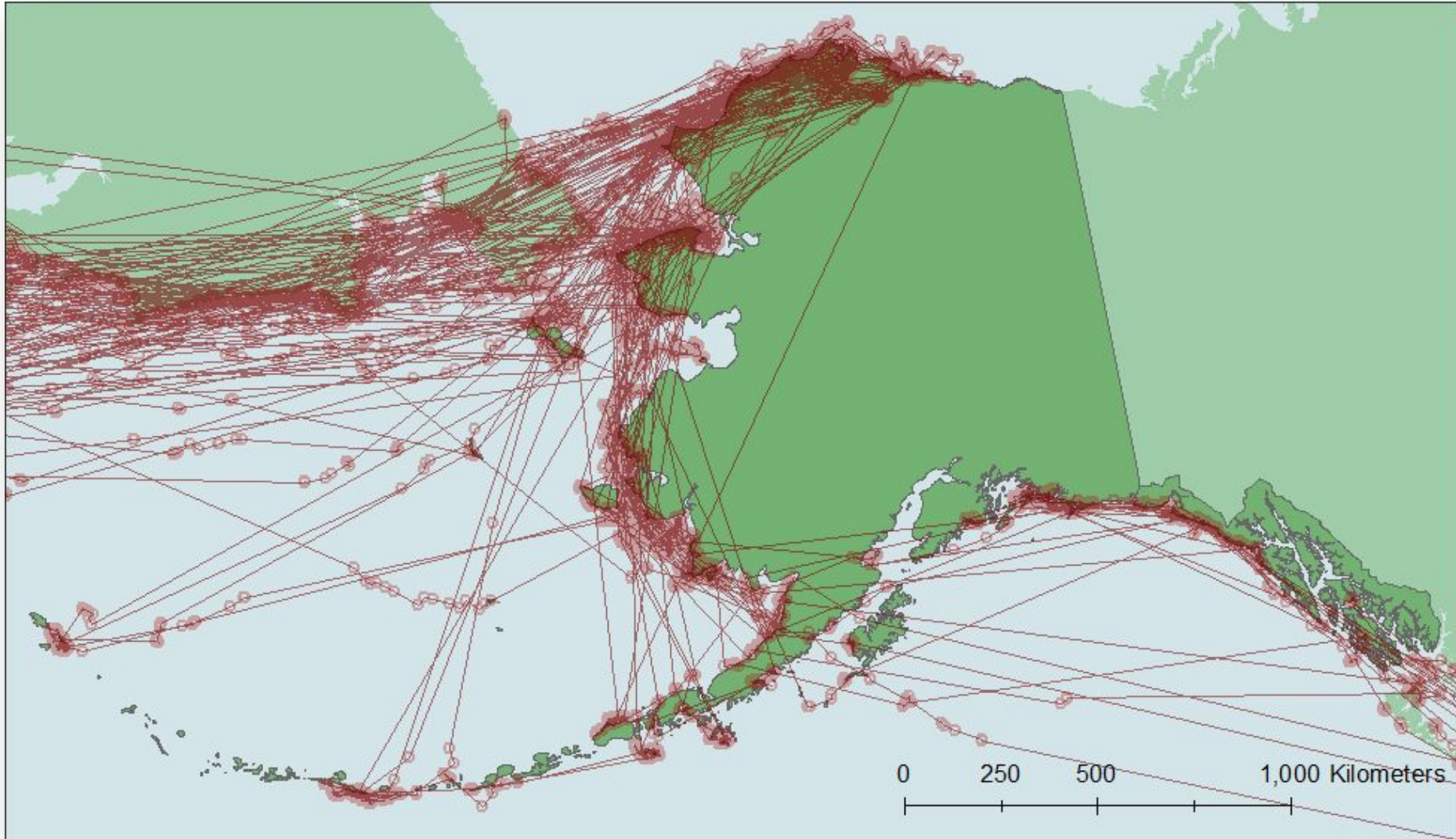
- Foraging radius
- Survey data
- **Tracking data**





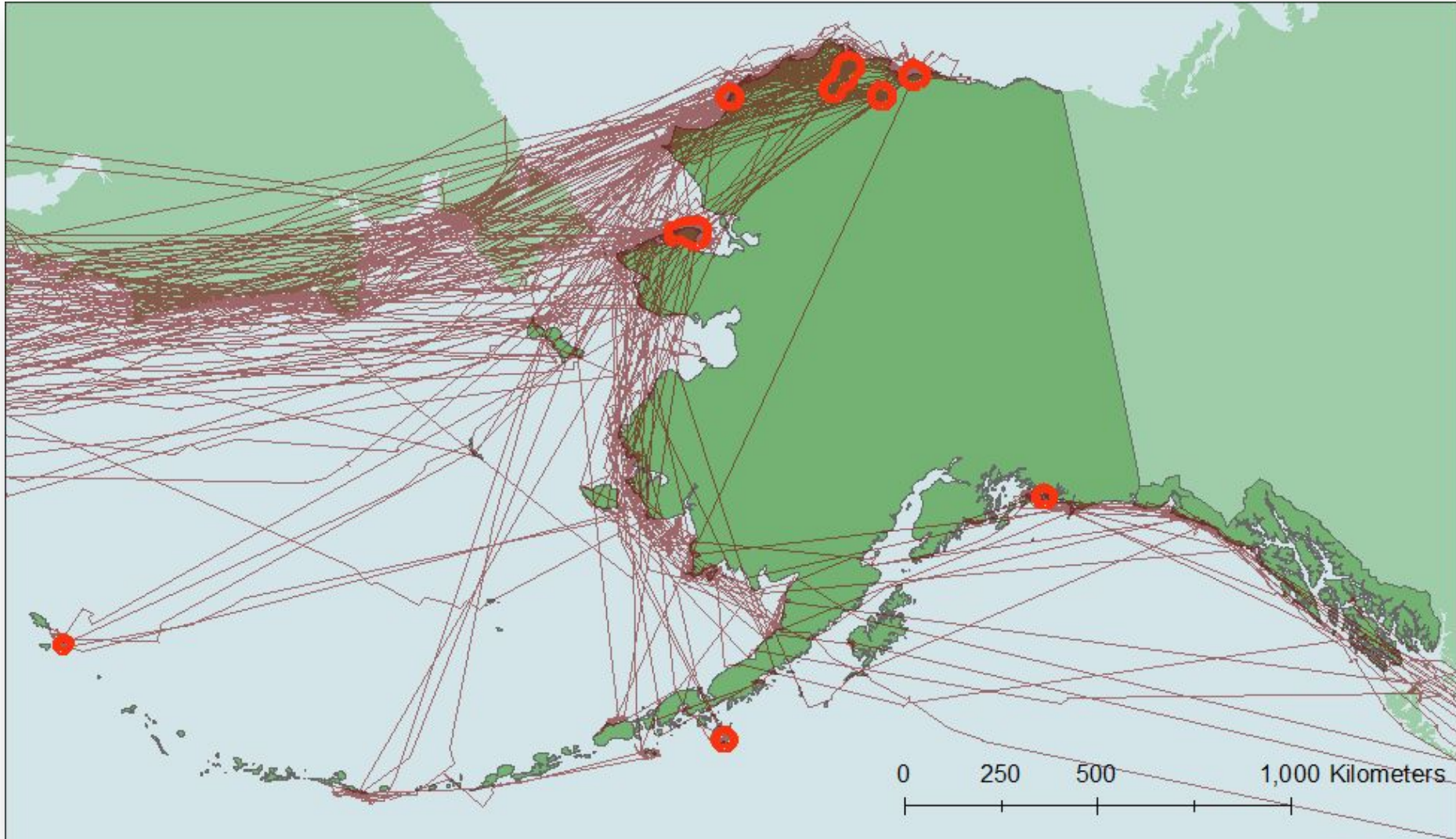
Tracking Data Approach

Lascelles et al. 2016, *Diversity and Distributions*



CONNECT TRIPS

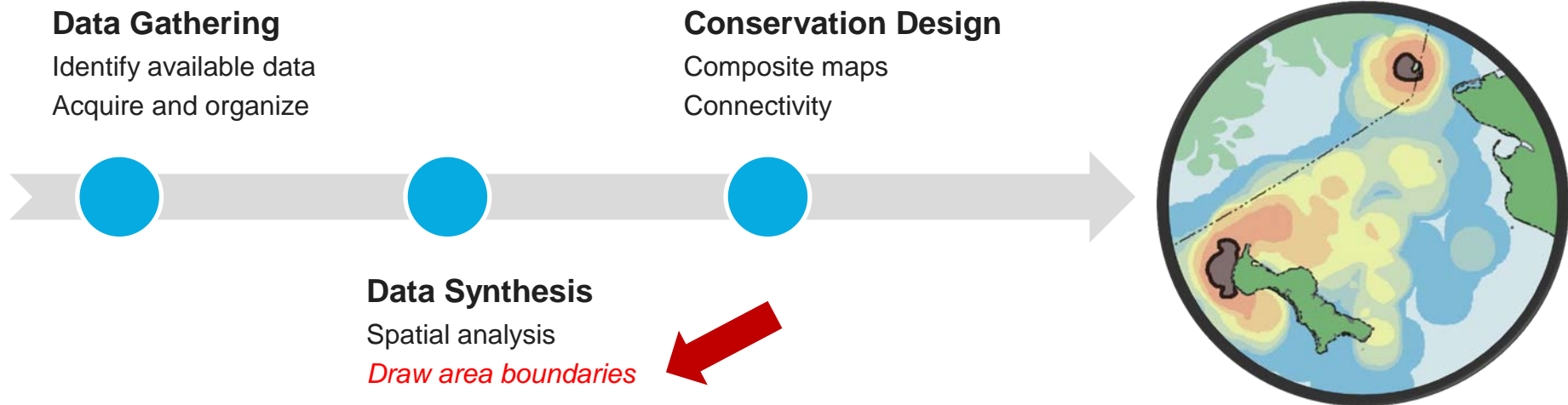
Map trips by individual, combine for population-level overview



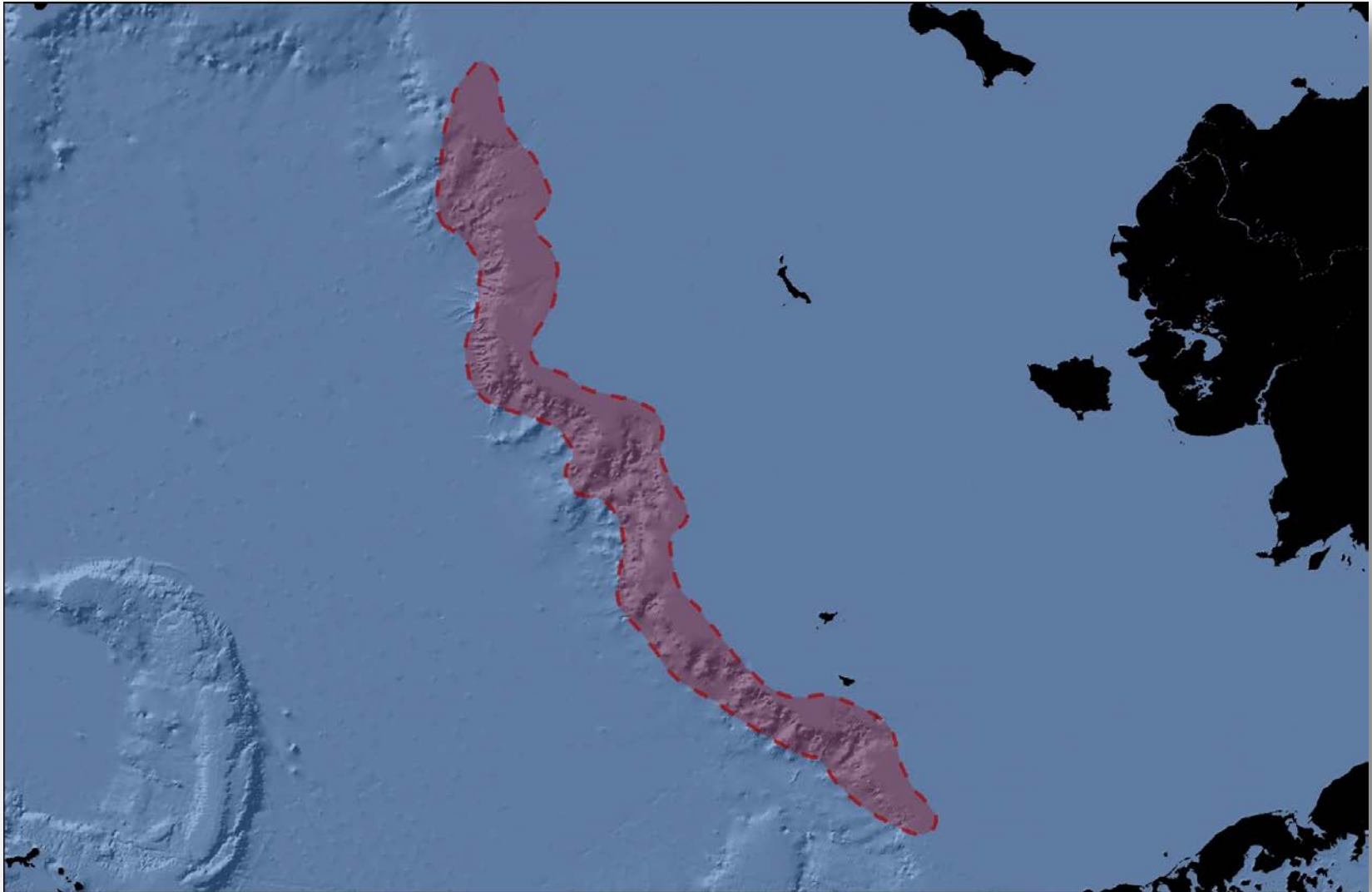
IDENTIFY IBAs

Validation steps to ensure representation of population patterns

Data to Design



Drawing Area Boundaries :)

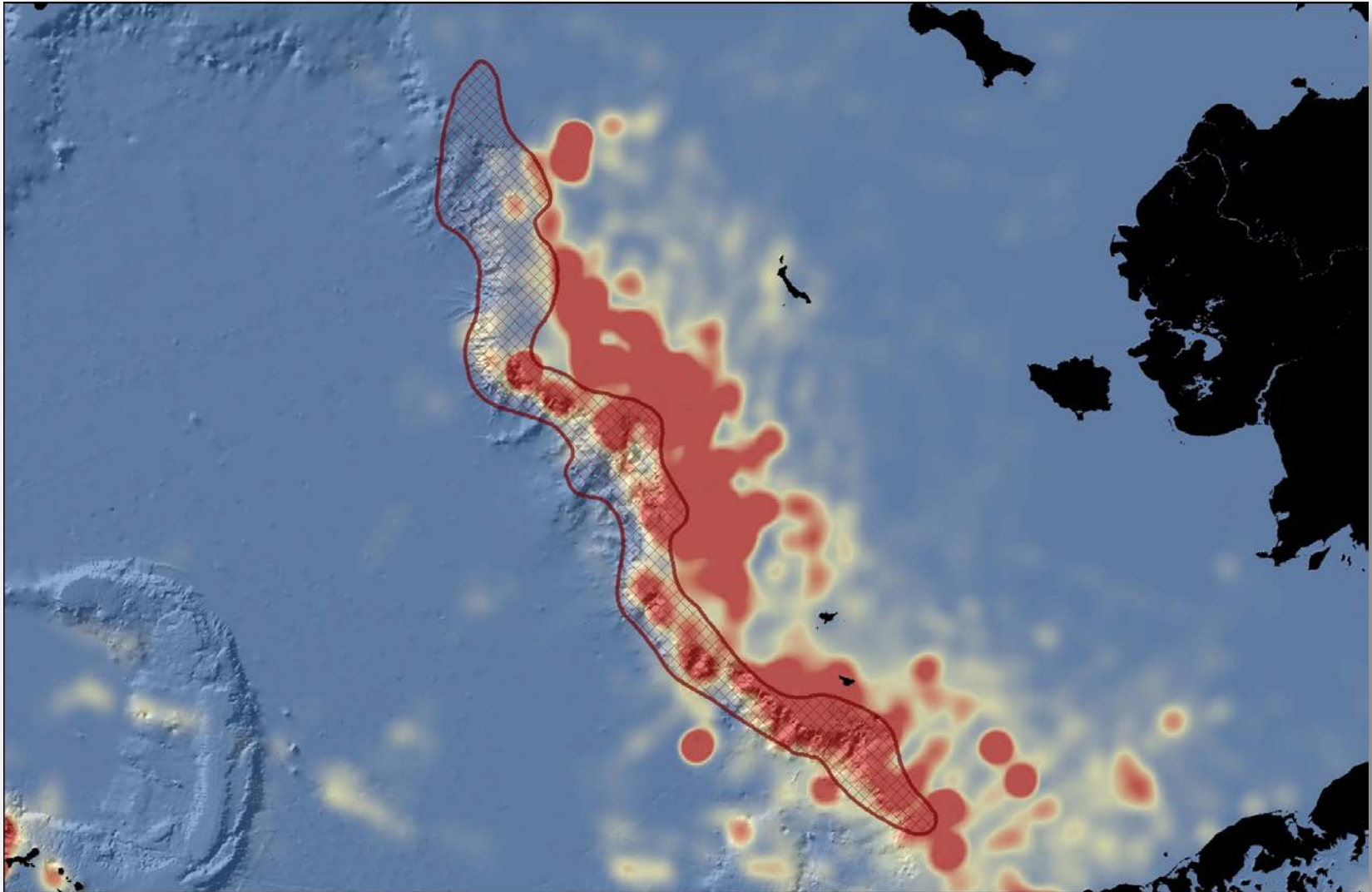


Bering Sea Shelf Break
Expert Drawn

Drawing Area Boundaries



Audubon

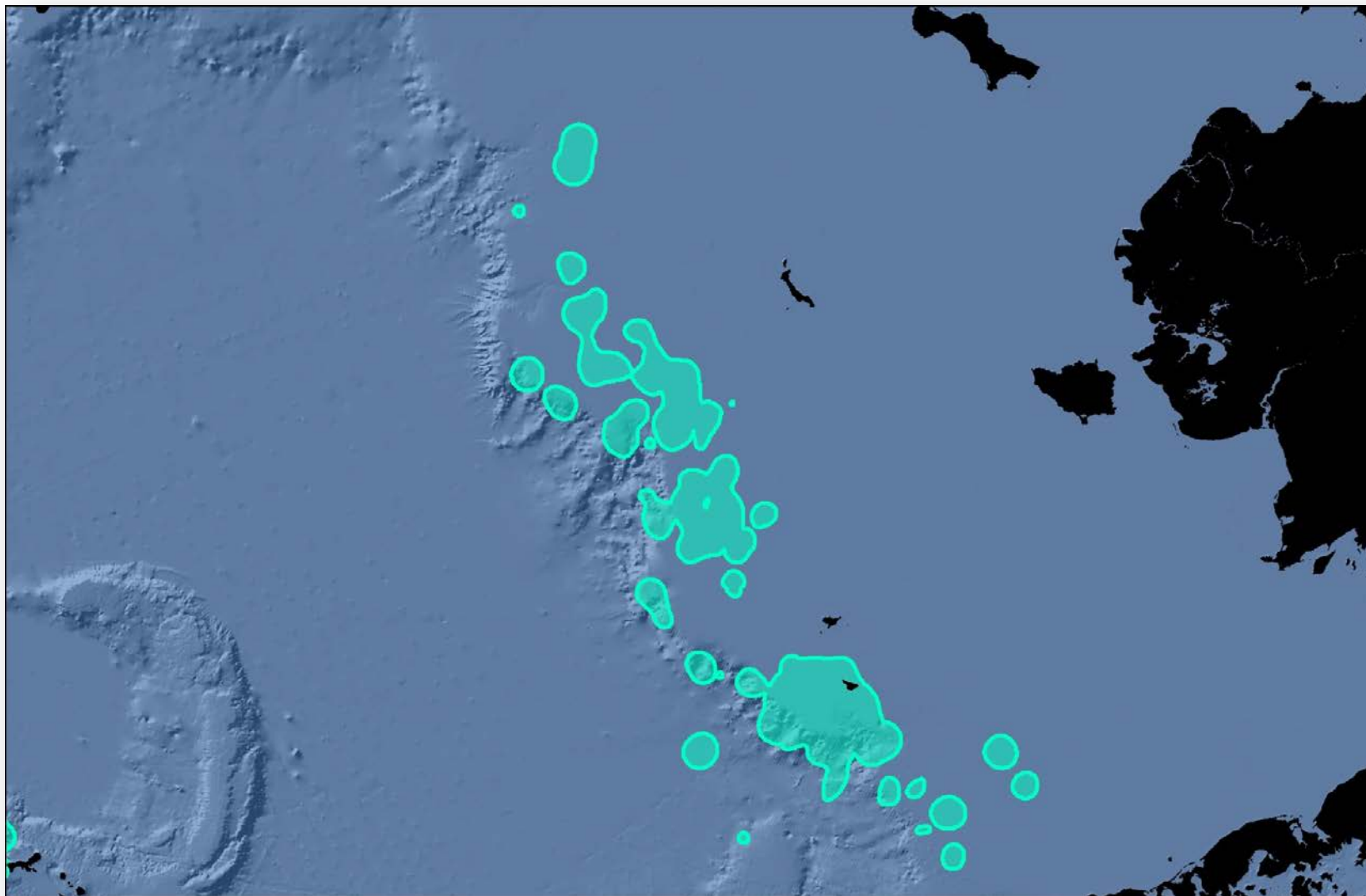


Bering Sea Shelf Break
Expert Drawn (survey data comparison)

Drawing Area Boundaries

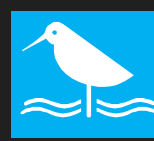


Audubon

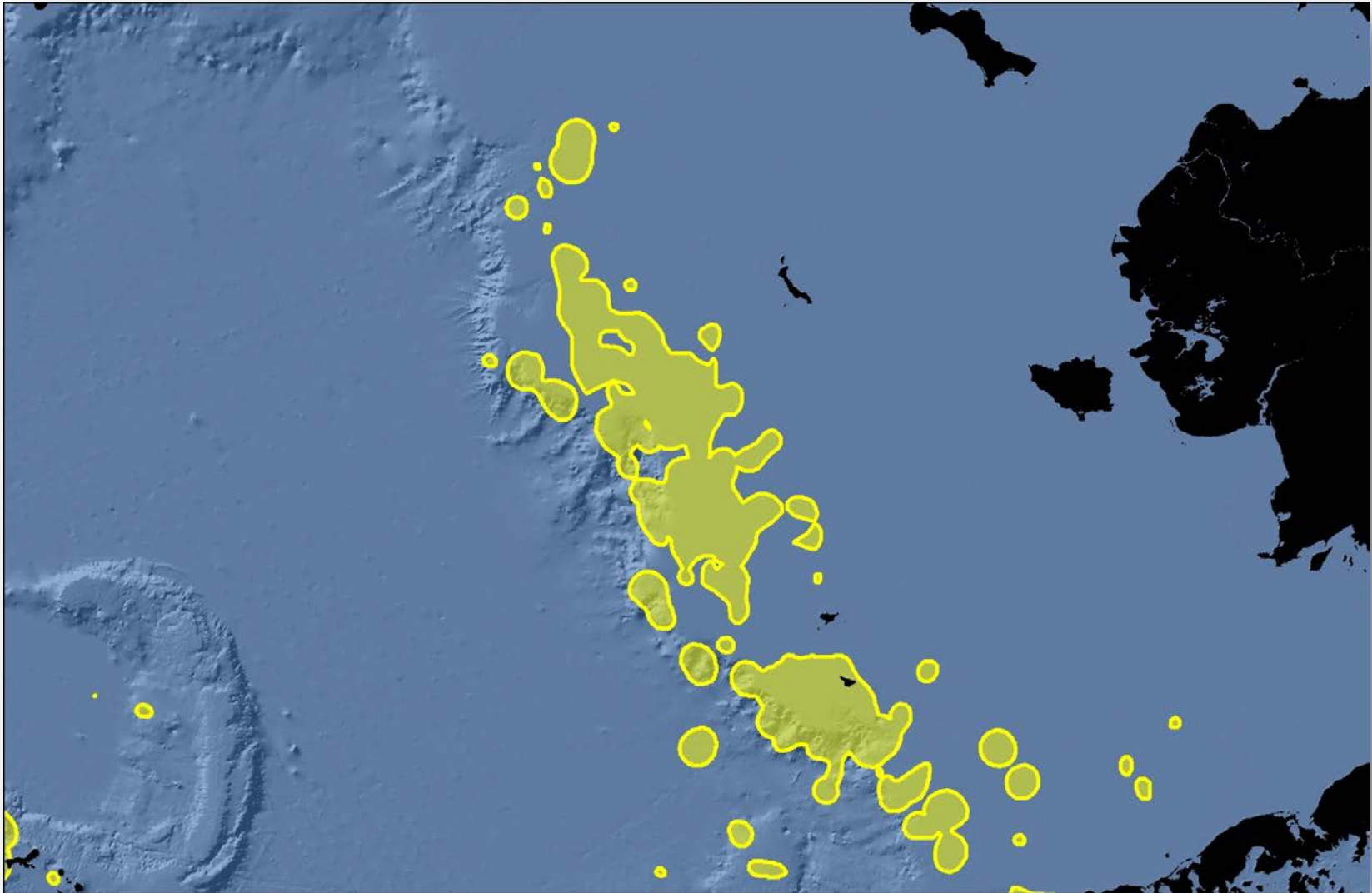


Bering Sea Shelf Break
Top Quantile

Drawing Area Boundaries



Audubon

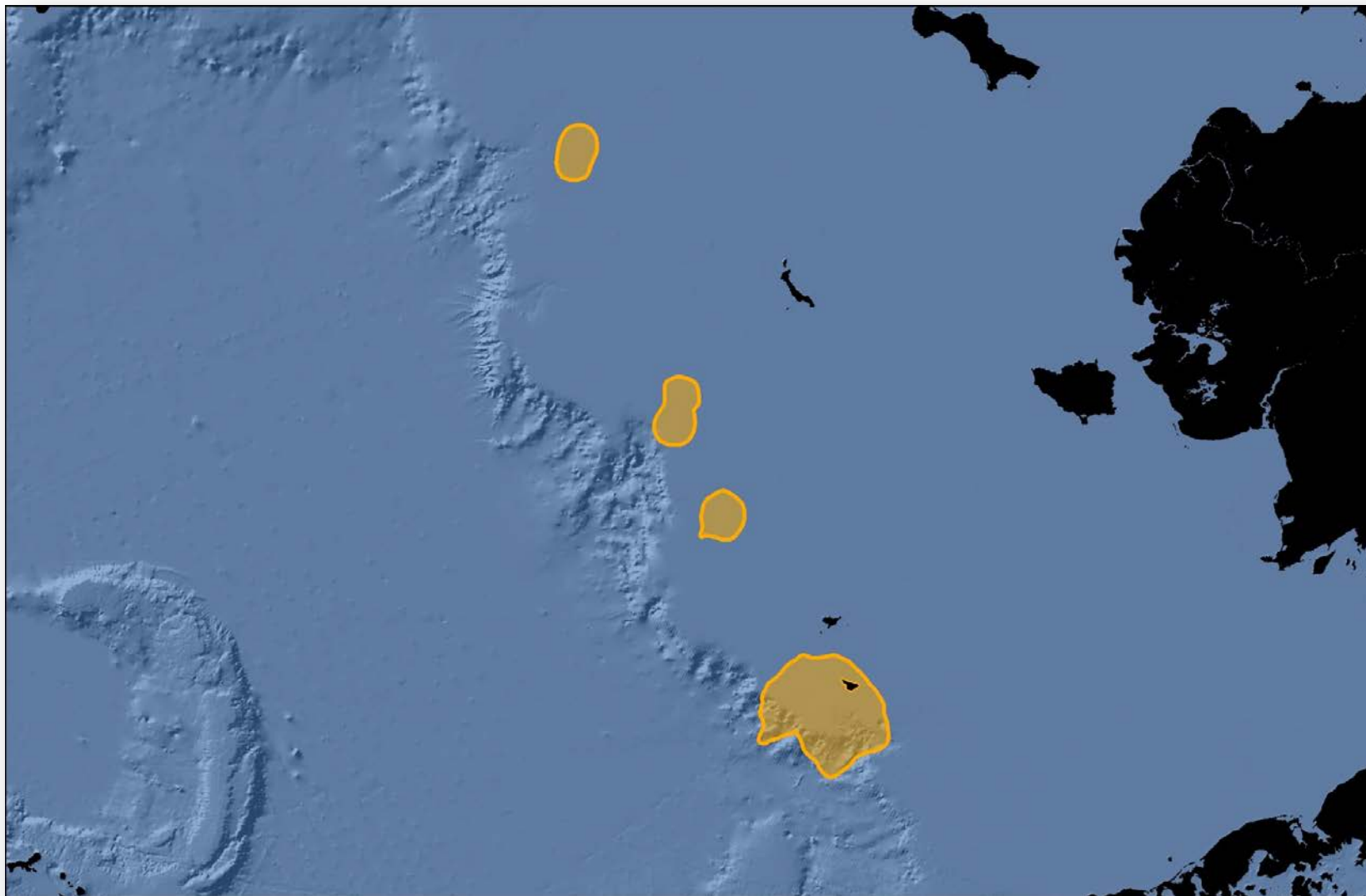


Bering Sea Shelf Break
4x Average Density

Drawing Area Boundaries

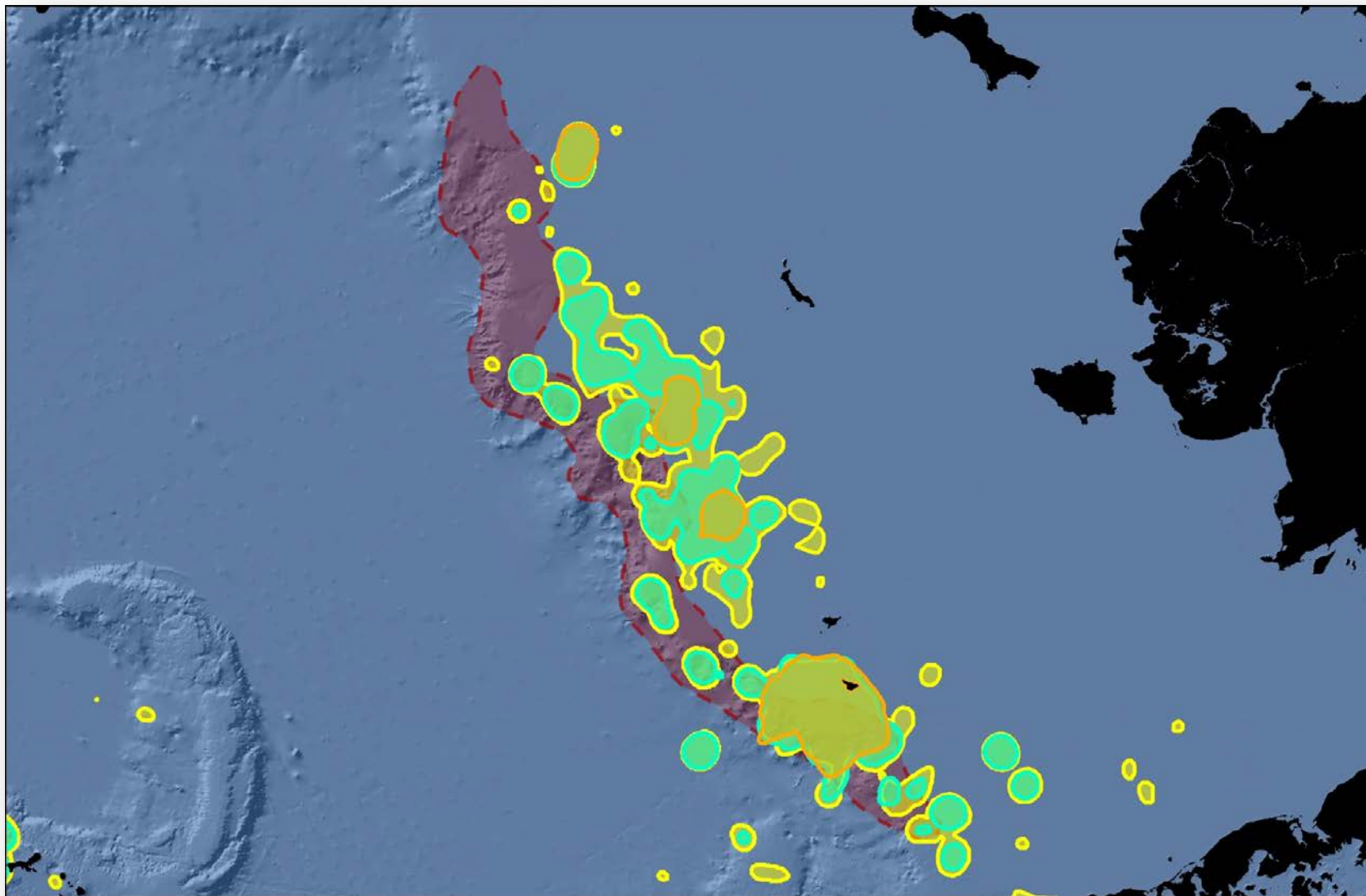


Audubon



Bering Sea Shelf Break
Moving Window

Drawing Area Boundaries



Bering Sea Shelf Break
Moving Window

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Acquire and organize

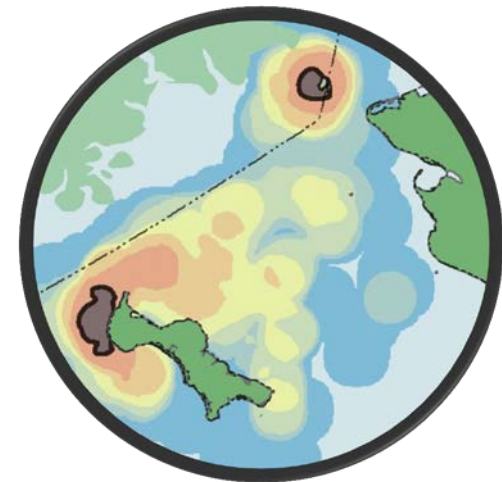


Data Synthesis

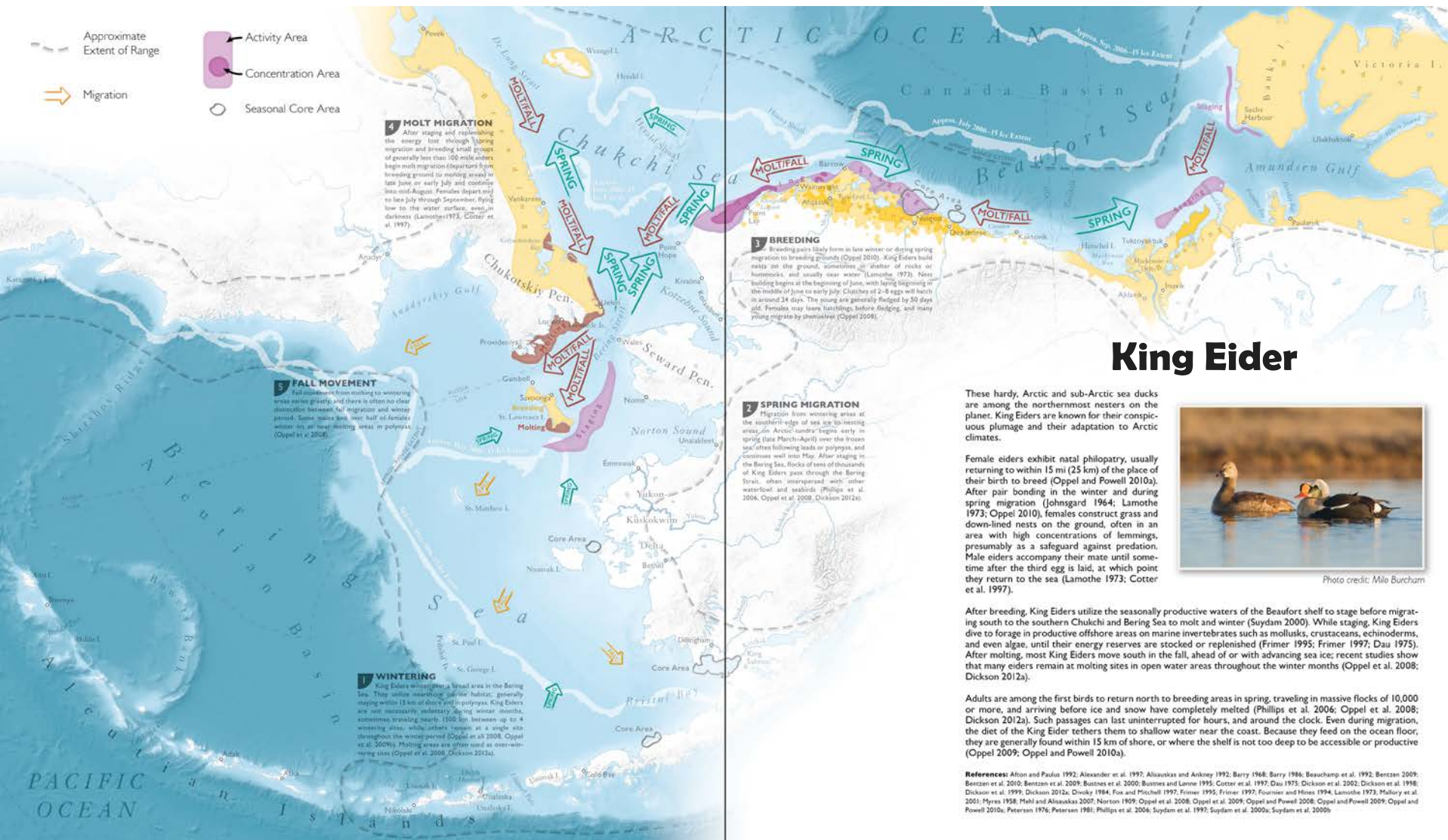
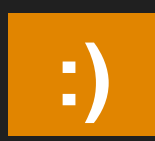
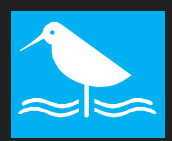
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Composite Maps



King Eider

These hardy, Arctic and sub-Arctic sea ducks are among the northernmost nesters on the planet. King Eiders are known for their conspicuous plumage and their adaptation to Arctic climates.



Photo credit: Milo Burcham et al. 1997.

Female eiders exhibit natal philopatry, usually returning to within 15 mi (25 km) of the place of their birth to breed (Oppel and Powell 2010a). After pair bonding in the winter and during spring migration (Johnsgard 1964; Lamotte 1973; Oppel 2010), females construct grass and down-lined nests on the ground, often in an area with high concentrations of lemmings, presumably as a safeguard against predation. Male eiders accompany their mate until sometime after the third egg is laid, at which point they return to the sea (Lamotte 1973; Cotter et al. 1997).

After breeding, King Eiders utilize the seasonally productive waters of the Beaufort shelf to stage before migrating south to the southern Chukchi and Bering Sea to molt and winter (Suydam 2000). While staging, King Eiders dive to forage in productive offshore areas on marine invertebrates such as mollusks, crustaceans, echinoderms, and even algae, until their energy reserves are stocked or replenished (Frimer 1995; Frimer 1997; Dau 1975). After molting, most King Eiders move south in the fall, ahead of or with advancing sea ice; recent studies show that many eiders remain at molting sites in open water areas throughout the winter months (Oppel et al. 2008; Dickson 2012a).

Adults are among the first birds to return north to breeding areas in spring, traveling in massive flocks of 10,000 or more, and arriving before ice and snow have completely melted (Phillips et al. 2006; Oppel et al. 2008; Dickson 2012a). Such passages can last uninterrupted for hours, and around the clock. Even during migration, the diet of the King Eider tethers them to shallow water near the coast. Because they feed on the ocean floor, they are generally found within 15 km of shore, or where the shelf is not too deep to be accessible or productive (Oppel 2009; Oppel and Powell 2010a).

References: Alton and Paulus 1992; Alexander et al. 1997; Alisauskas and Ankeny 1992; Barry 1968; Barry 1986; Beauchamp et al. 1992; Berntzen 2009; Berntzen et al. 2010; Berntzen et al. 2009; Bustnes et al. 2000; Bustnes and Lønne 1995; Cotter et al. 1997; Dau 1975; Dickson et al. 2002; Dickson et al. 1998; Dickson et al. 1999; Dickson 2012a; Divoky 1984; Fox and Mitchell 1997; Frimer 1995; Frimer 1997; Frimmer 1997; Fourmeier and Hines 1994; Lamotte 1973; Mallory et al. 2001; Myers 1958; Mehl and Alisauskas 2007; Norton 1909; Oppel et al. 2008; Oppel et al. 2009; Oppel and Powell 2006; Oppel and Powell 2009; Oppel and Powell 2010a; Peterson 1976; Peterson 1981; Phillips et al. 2006; Suydam et al. 1997; Suydam et al. 2000a; Suydam et al. 2000b.

Composite Mapping Approach

Smith et al. 2017, *Ecological Atlas of the Bering, Chukchi, and Beaufort Seas*

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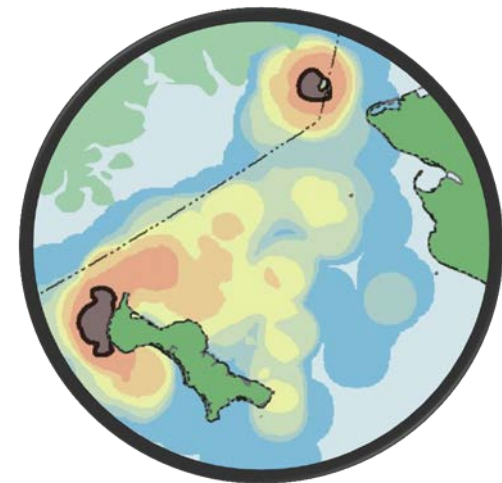


Data Synthesis

Spatial analysis
Draw area boundaries

Conservation Design

Composite maps
Connectivity





Connectivity is difficult to define

- Dynamic conditions
 - Daily to decadal variability
 - Shifting ice, productivity
- Focus on the most predictably occupied areas

CONNECTIVITY
CHALLENGES



Connectivity is difficult to define

- Drawing boundaries
 - Marine environment lacks clear boundaries
 - Methods produce different lines
- Experiment with methods and be aware of their implications for conservation area design

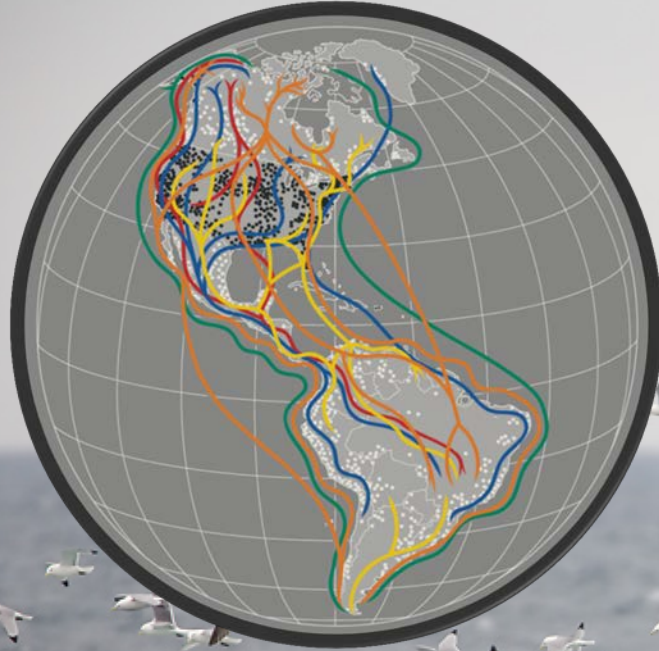
CONNECTIVITY
CHALLENGES



Connectivity is difficult to define

- Species behave differently
 - Colonial seabirds tied to breeding colonies
 - Destination-oriented migrants with predictable stopovers
 - Pelagic wanderers following food
- Blend multiple data types and methods
- Look at the annual cycle holistically to identify connections

CONNECTIVITY
CHALLENGES



???

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