Update on Research on Golden Eagles

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Braham et al. 2015. Home in the Heat: Dramatic Seasonal Variation in Home Range of Desert Golden Eagles Informs Management for Renewable Energy Development.
Biological Conservation 186: 225–232.

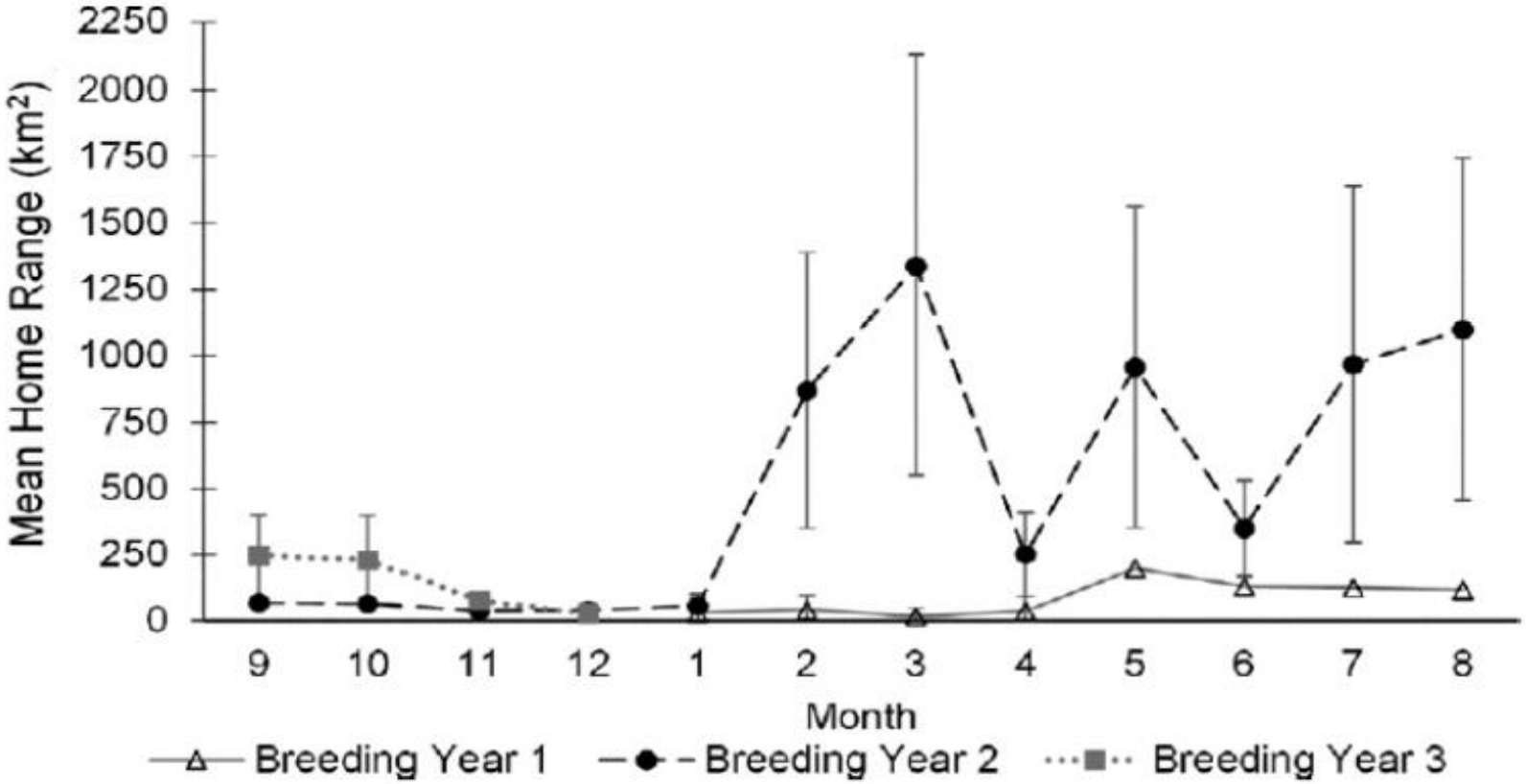
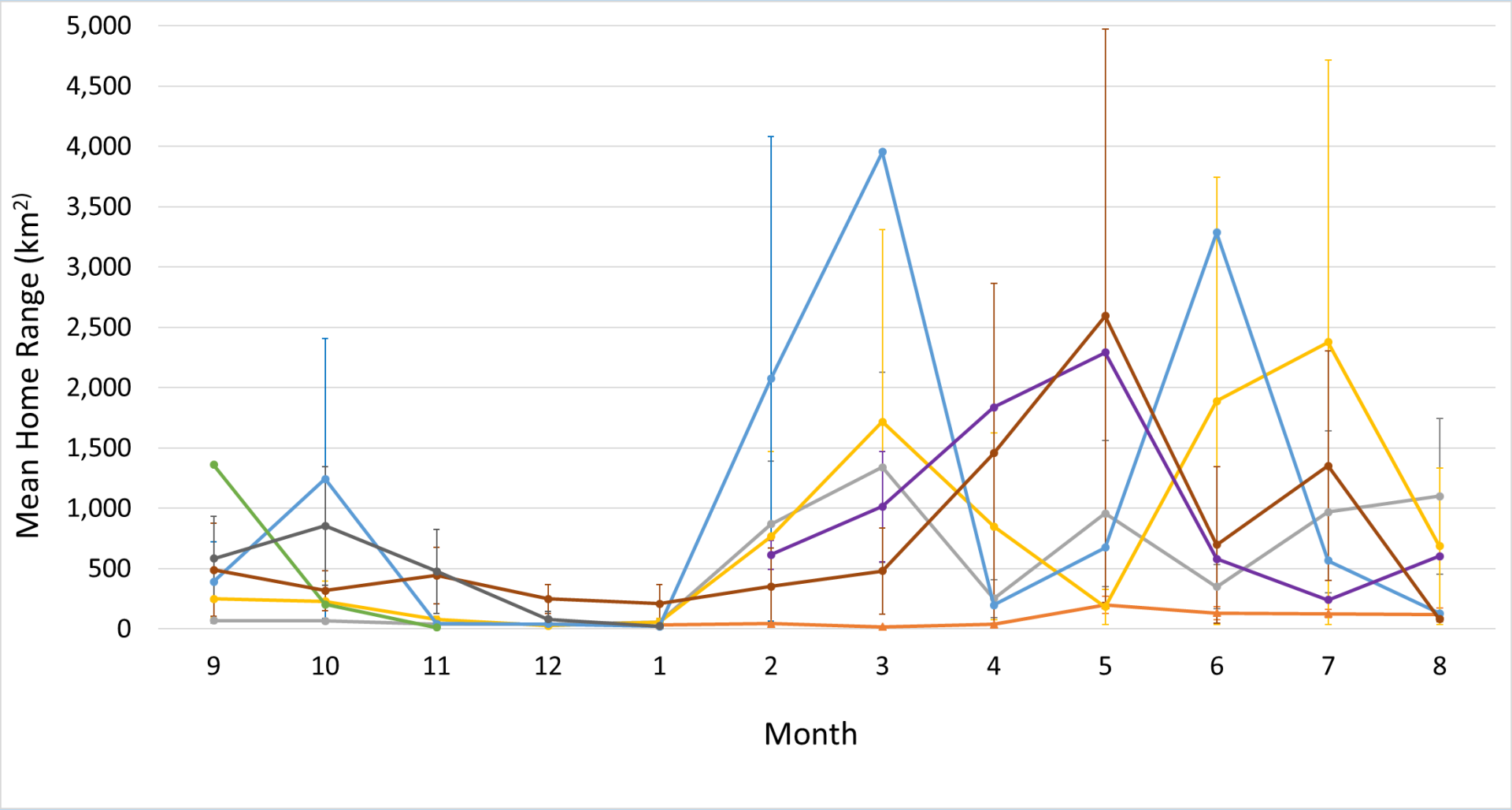
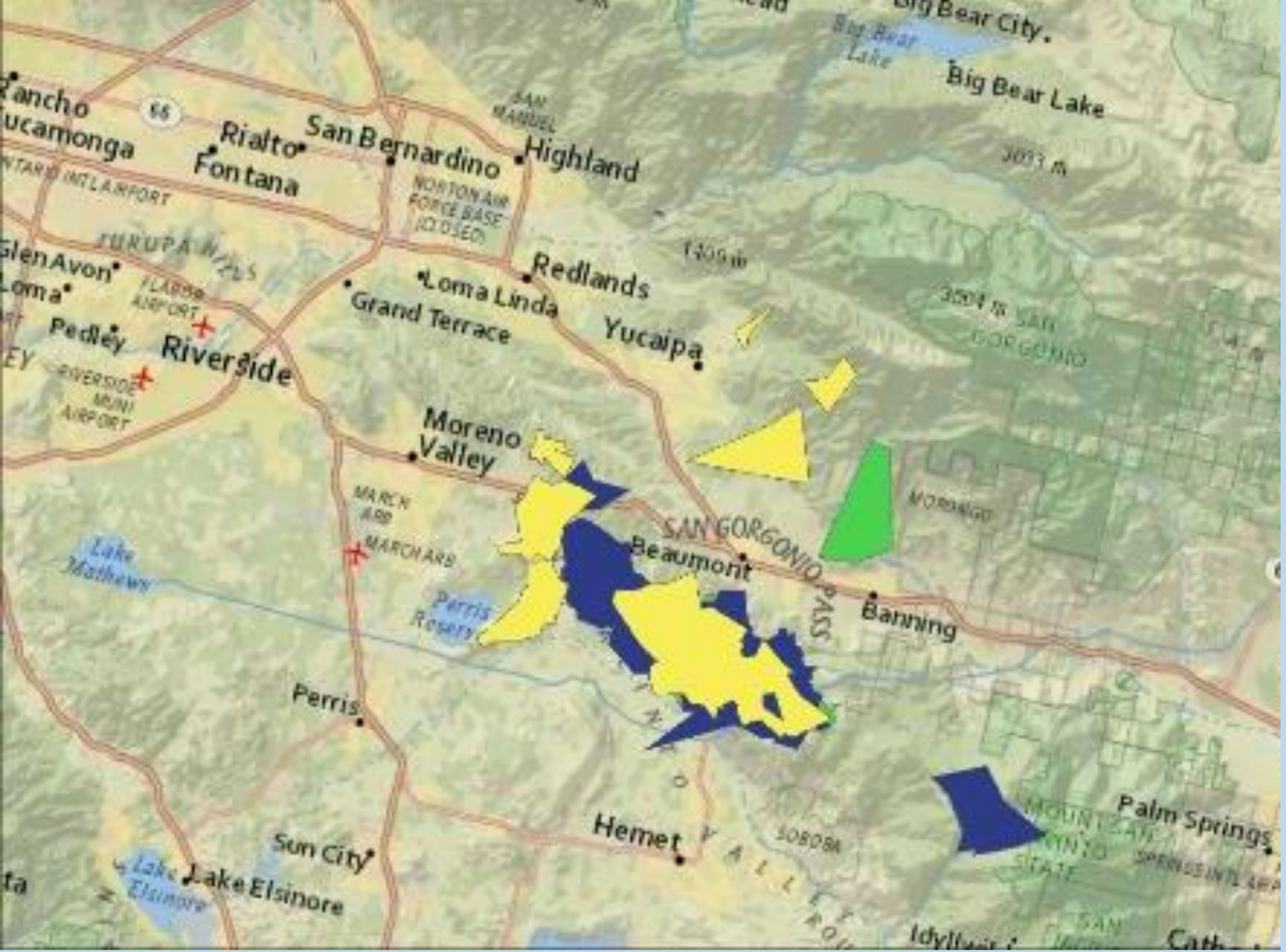
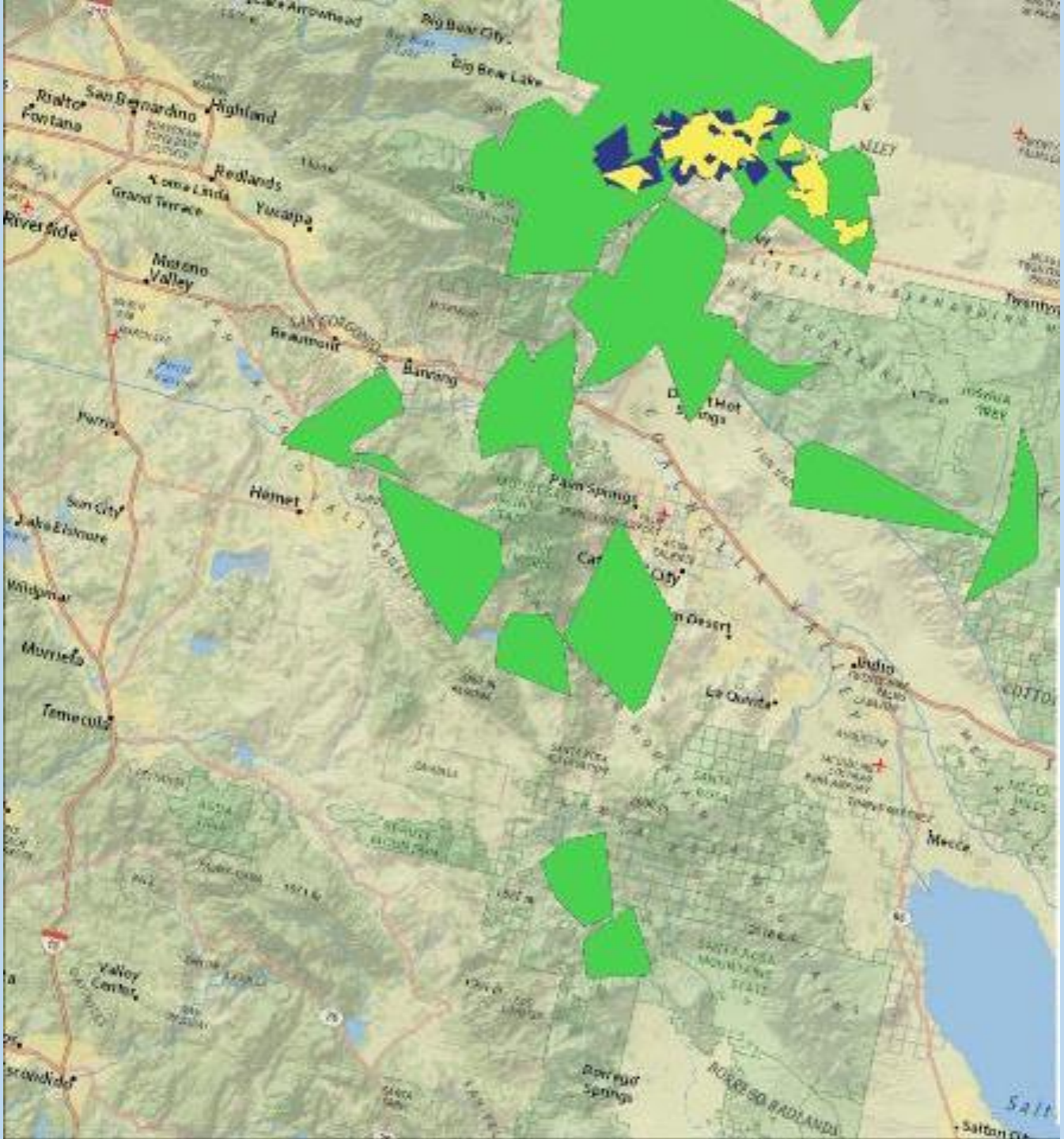


Fig. 1. Mean monthly home range size (95% aLoCoH (adaptive local convex hull), $n = 8$ eagles and 117 eagle months) of golden eagles in the Mojave Desert of southern California, 2012–2013. Breeding years start in month 9 (September) and continue through month 8 (August).



- Mean monthly home ranges for Mojave Desert Golden Eagles
- 8 years


Big Bear City
Big Bear Lake
Big Bear Lake
Rancho Cucamonga
Rialto
Fontana
San Bernardino
Highland
Redlands
Loma Linda
Grand Terrace
Yucaipa
Glen Avon
Pedley
Riverside
Moreno Valley
Beaumont
Banning
SAN GORGONIO PASS
Perris
Hemet
Sun City
Lake Elsinore
Palm Springs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Sun City
Lake Elsinore
Wildomar
Murrieta
Temecula
Palm Springs
La Quinta
Indio
Mecca
Valley Center
Borrego Springs

Poessel, et al. 2016. Age- and Season-Specific Variation in Local and Long-Distance Movement Behavior of Golden Eagles.
European Journal of Wildlife Research 62(4): 377–393.

Photo: Mike Lanzone

Capture and Telemetry

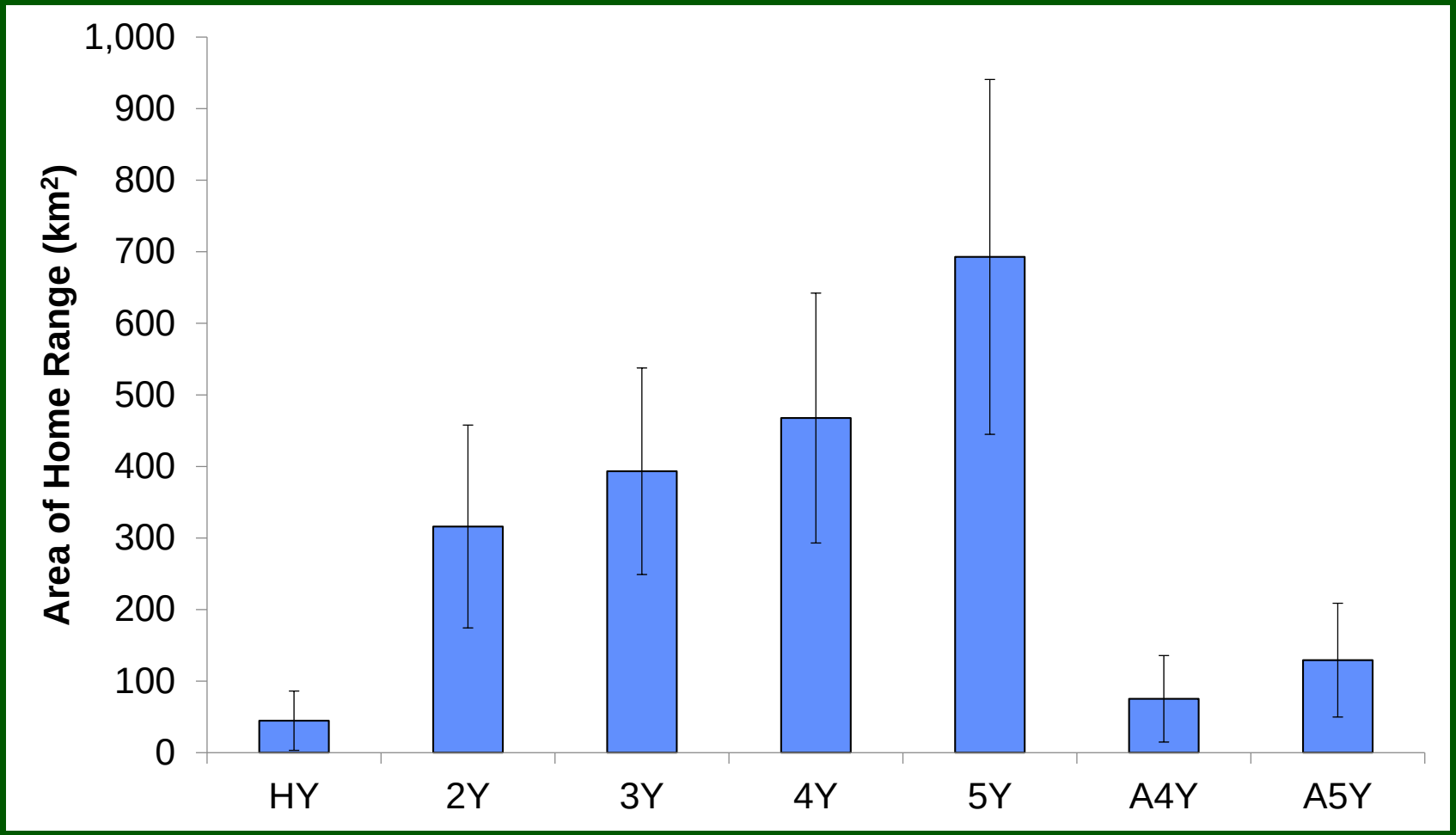
- 25 eagles (12 F, 13 M; 12 pre-adults, 13 adults)
- GPS-GSM telemetry units

- November 2012 – May 2015

- 20 Residents, 5 “Dispersers”

USGS

Home Range by Age Class



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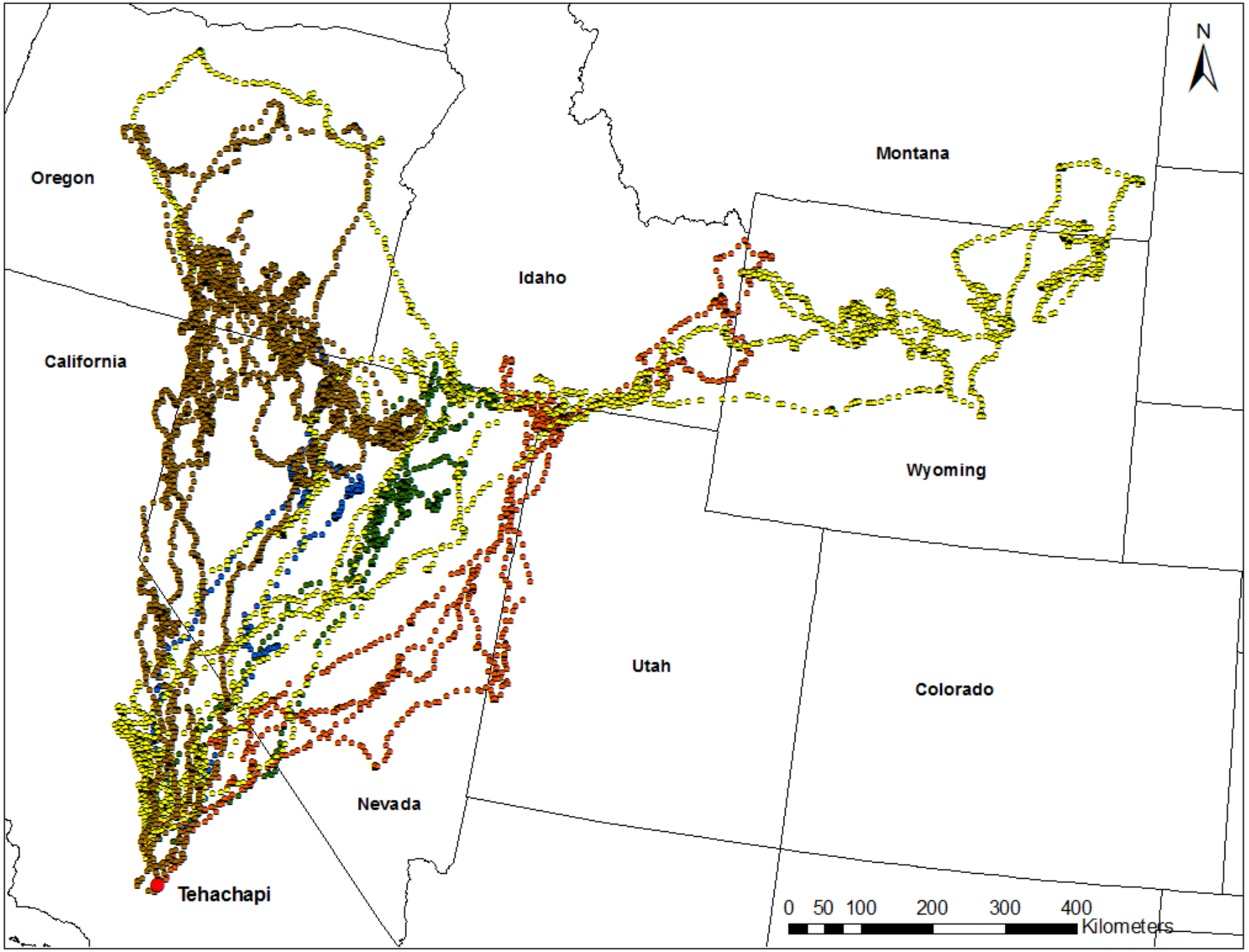
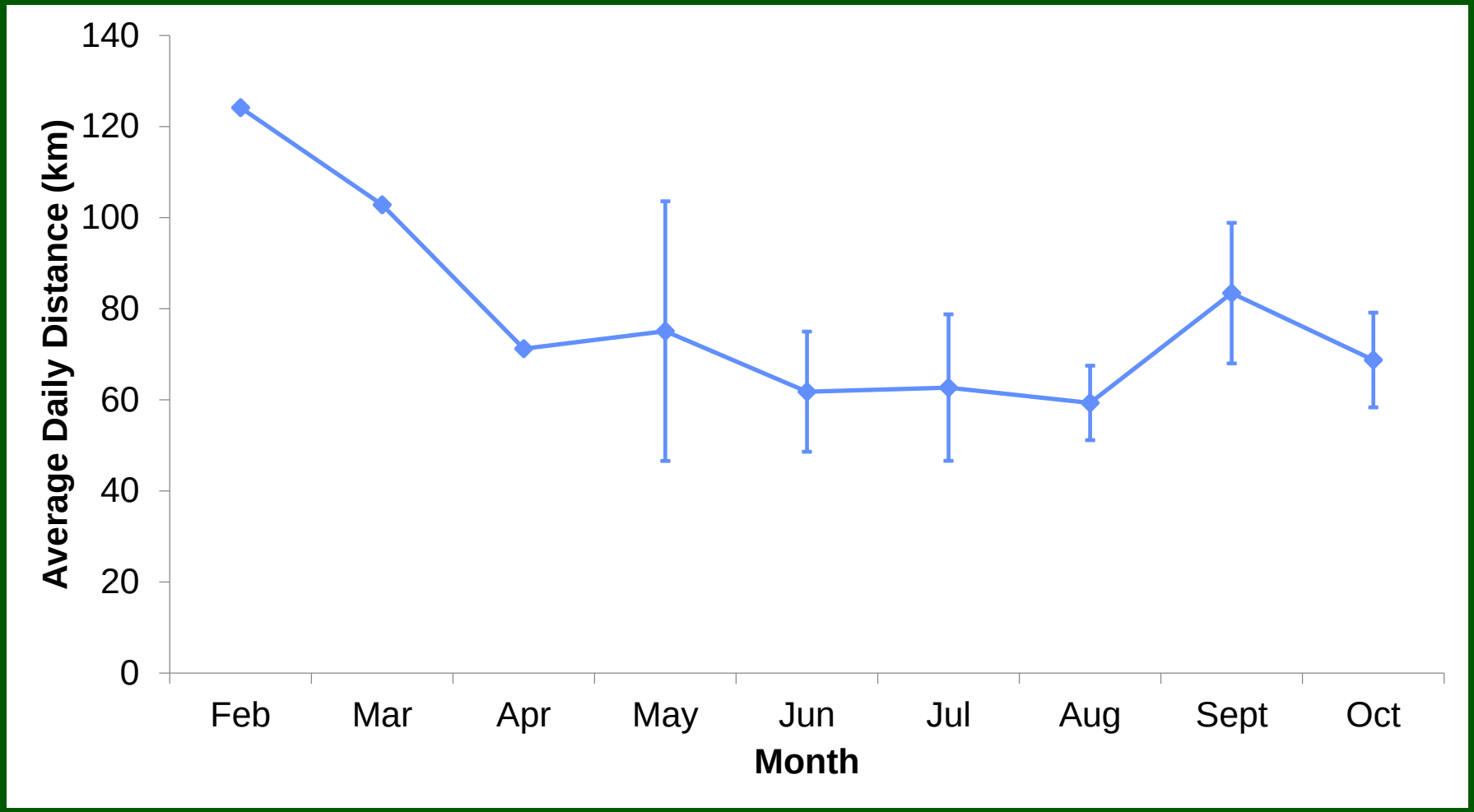

N
Oregon
Montana
Idaho
California
Wyoming
Utah
Colorado
Nevada
Tehachapi
0 50 100 200 300 400
Kilometers

Daily Distances



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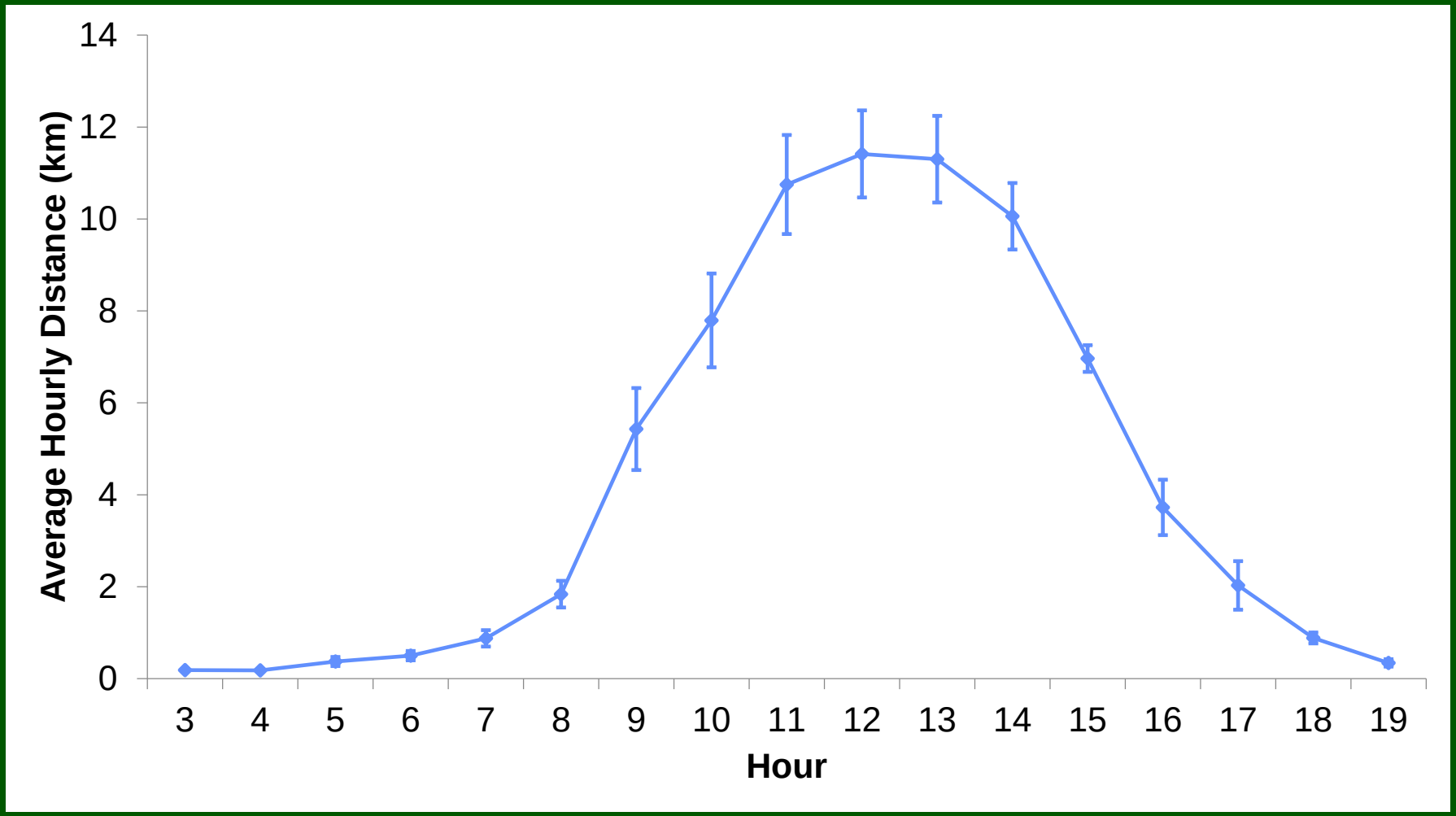
Hourly Distances



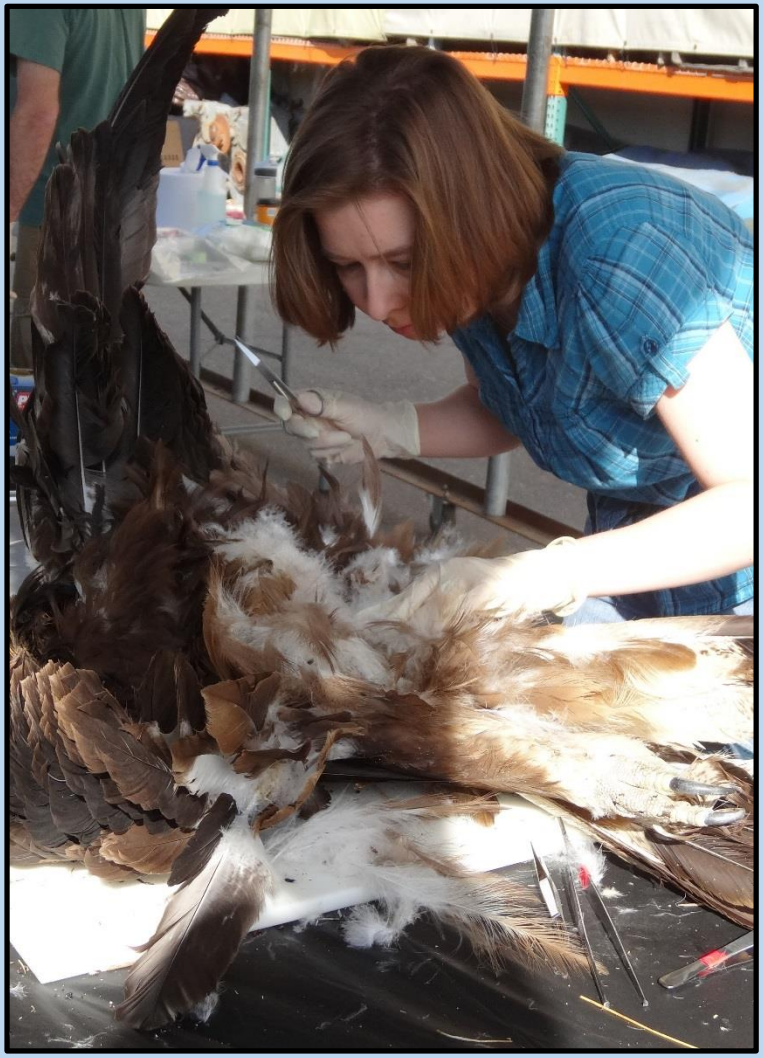
USGS

Conclusions

- Two distinct movement types exhibited by the golden eagles we studied
- Implications for population connectivity and gene flow

USGS

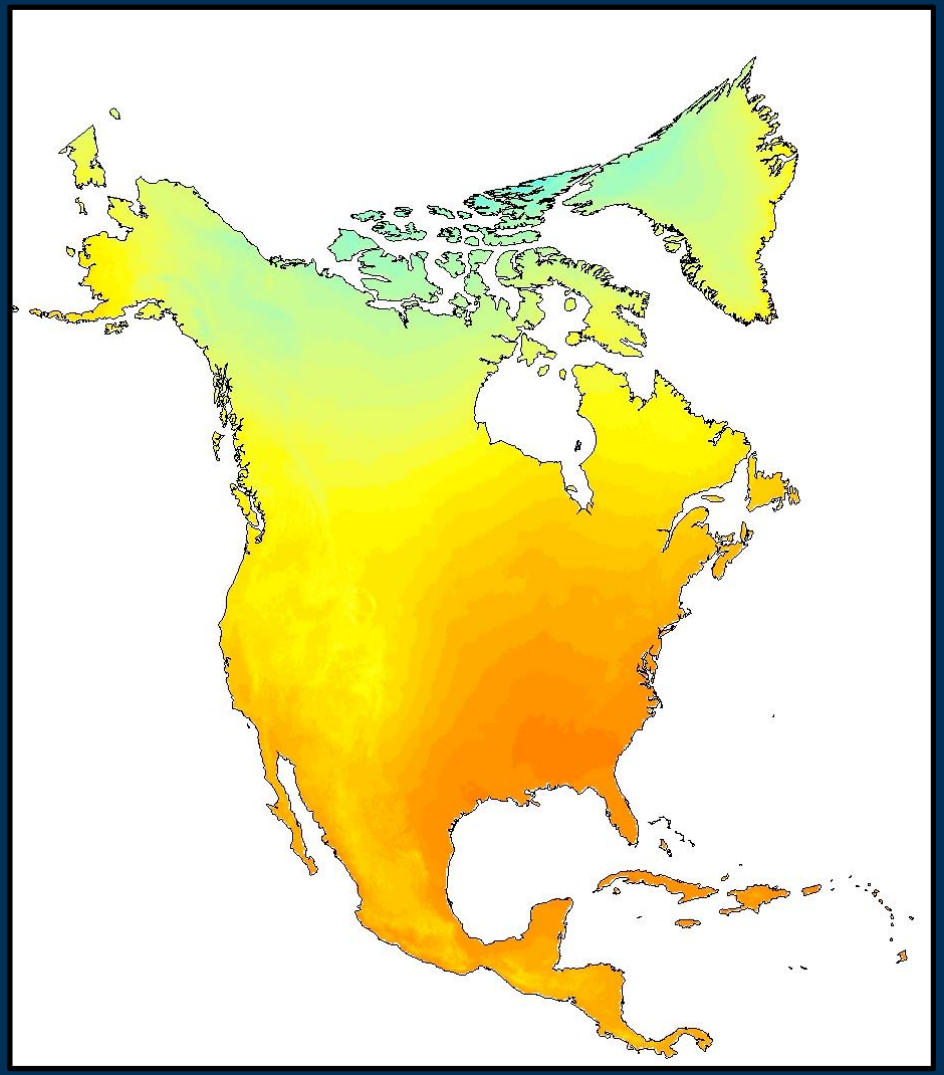
Katzner et al. 2017. Golden Eagle Fatalities and the Continental-Scale Consequences of Local Wind-Energy Generation: Continental Effects of Wind-Energy Production. **Conservation Biology 31(2): 406–415.**



Research Question

- What is the origin of eagles killed at Altamont?
- What does that mean for eagle demography?

Methods - Stable Isotopes



Light water: $^{1}H^{1}HO$

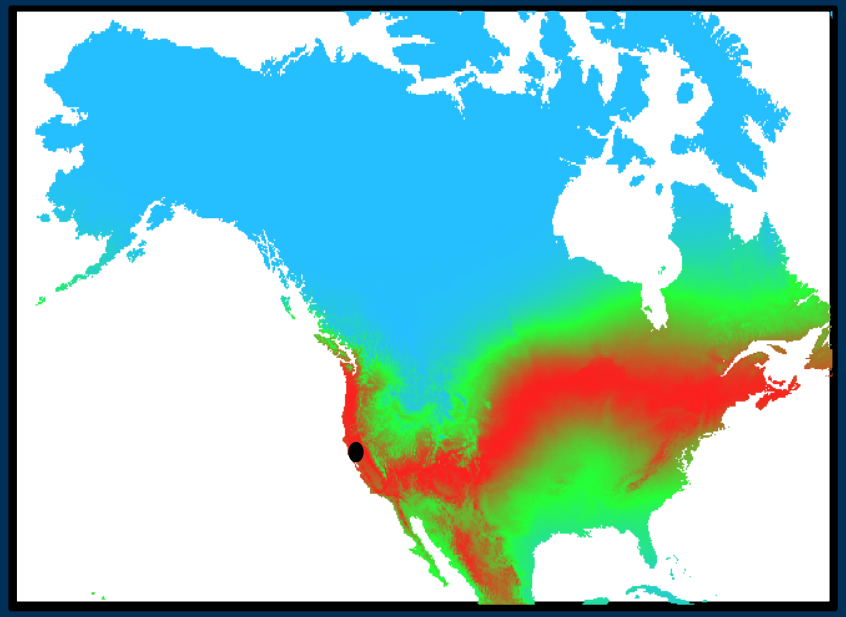
$\delta^{2}H$: more negative

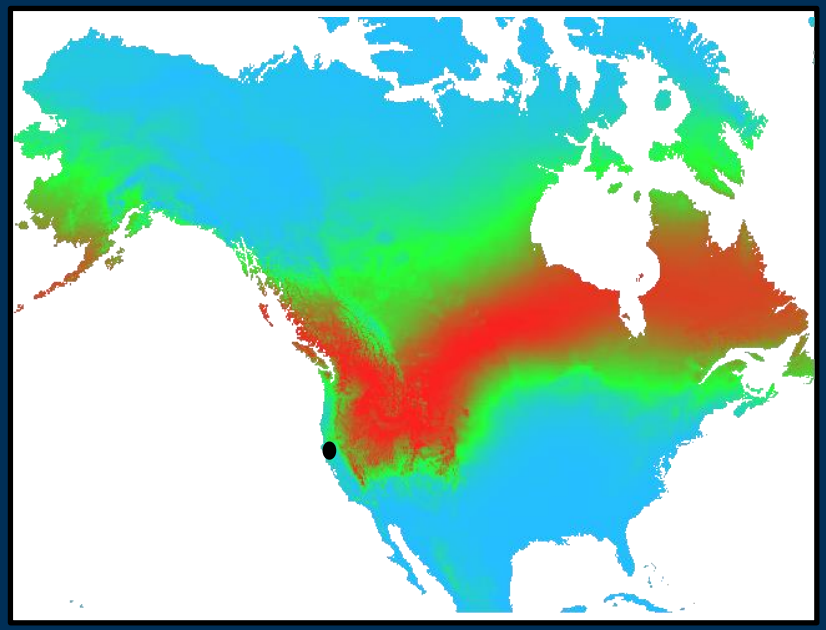
Heavy water: $^{1}H^{2}HO$

$\delta^{2}H$: more positive

Results – stable isotopes

- some birds clearly grew feathers locally
- others clearly grew feathers non-locally





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Origins of birds at APWRA

- Eagles at APWRA are one genetic population
- ~25% of the birds killed at APWRA are “non-local”
- Population sustained by immigration of 2Y-4Y birds

USGS

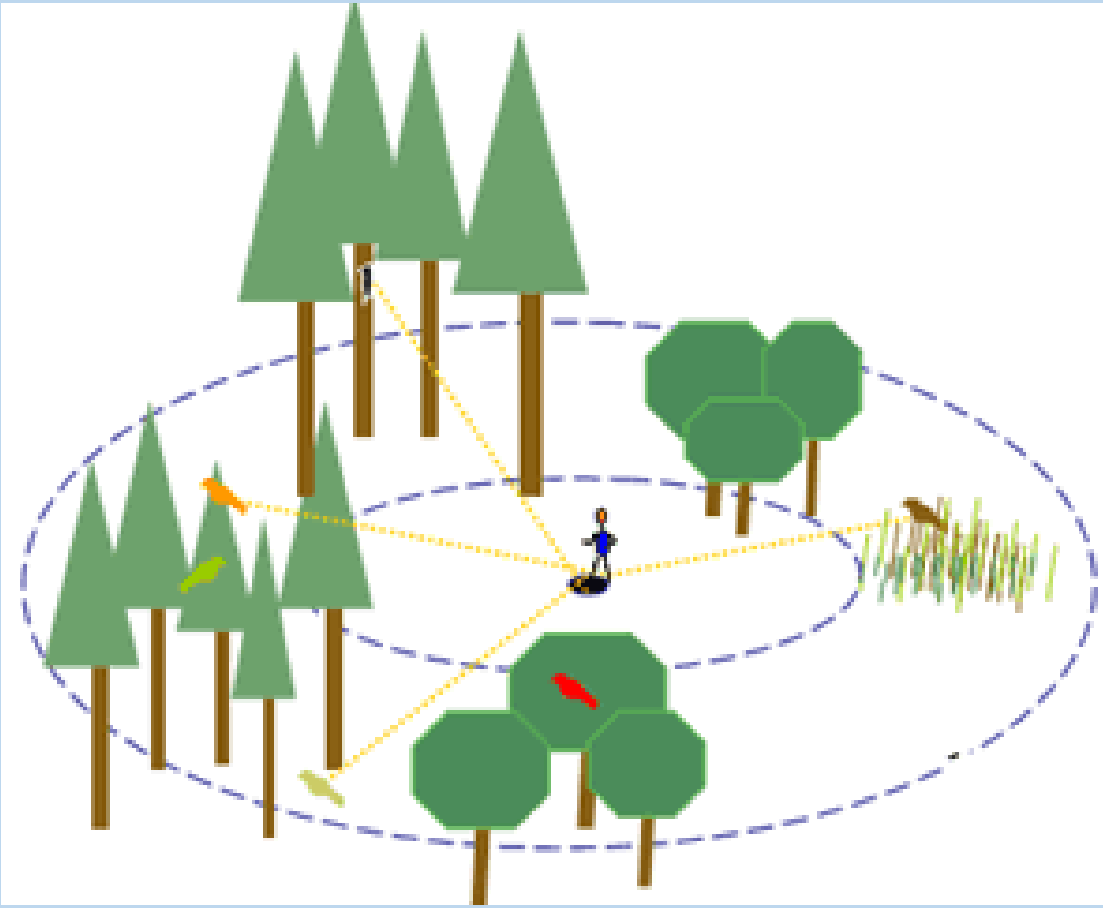
Origins of birds at APWRA

- APWRA influences continental-scale demographic processes

- Illustrates important considerations for wildlife managers & EIAs

USGS

Sur et al. 2018. The utility of point count surveys to predict wildlife interactions with wind energy facilities: An example focused on golden eagles. **Ecological Indicators 88 (2018) 126–133.**



What degree do point counts relate to actual use of a project footprint by eagles

Actual time on project footprint

Use high-resolution GPS-GSM telemetry data

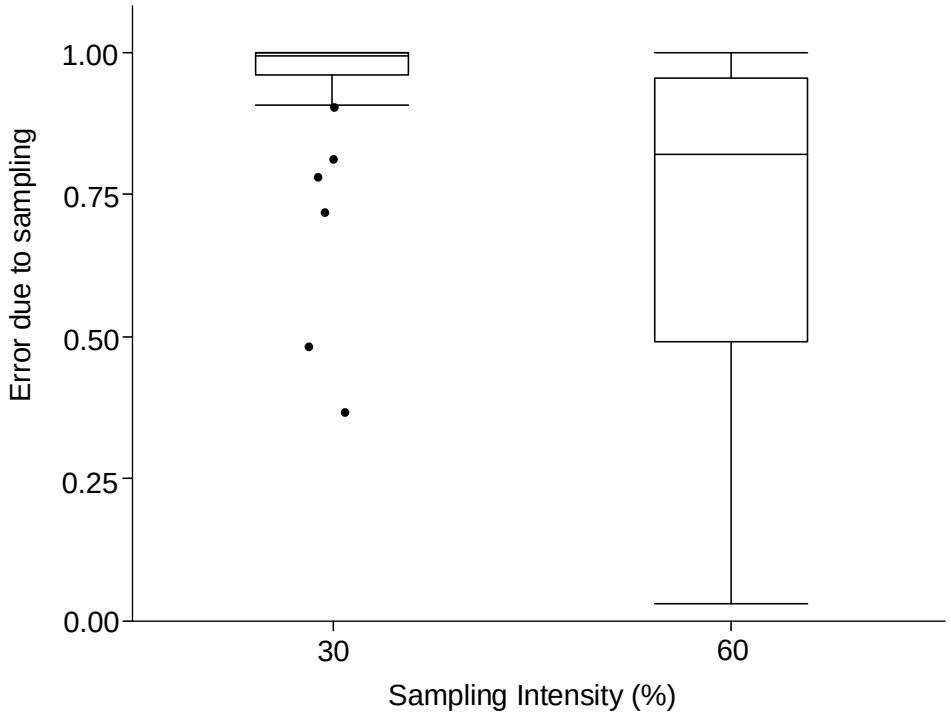
Predicted time

potentially observed in point count plot

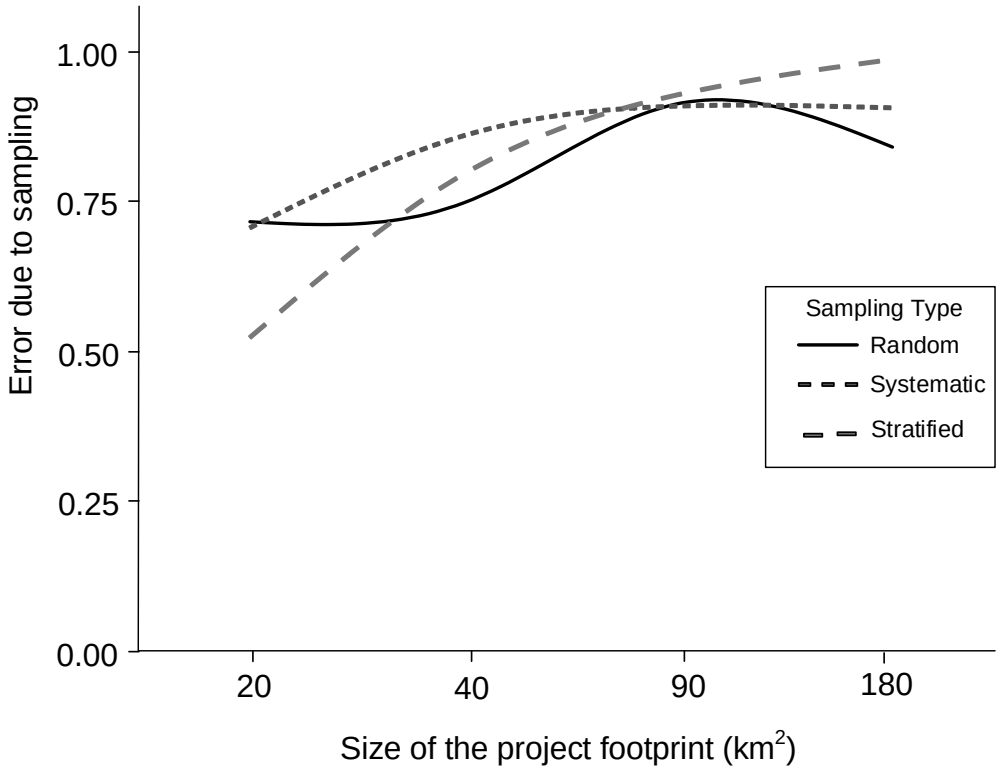
Error due to sampling =

(Actual time – predicted time) / Actual time

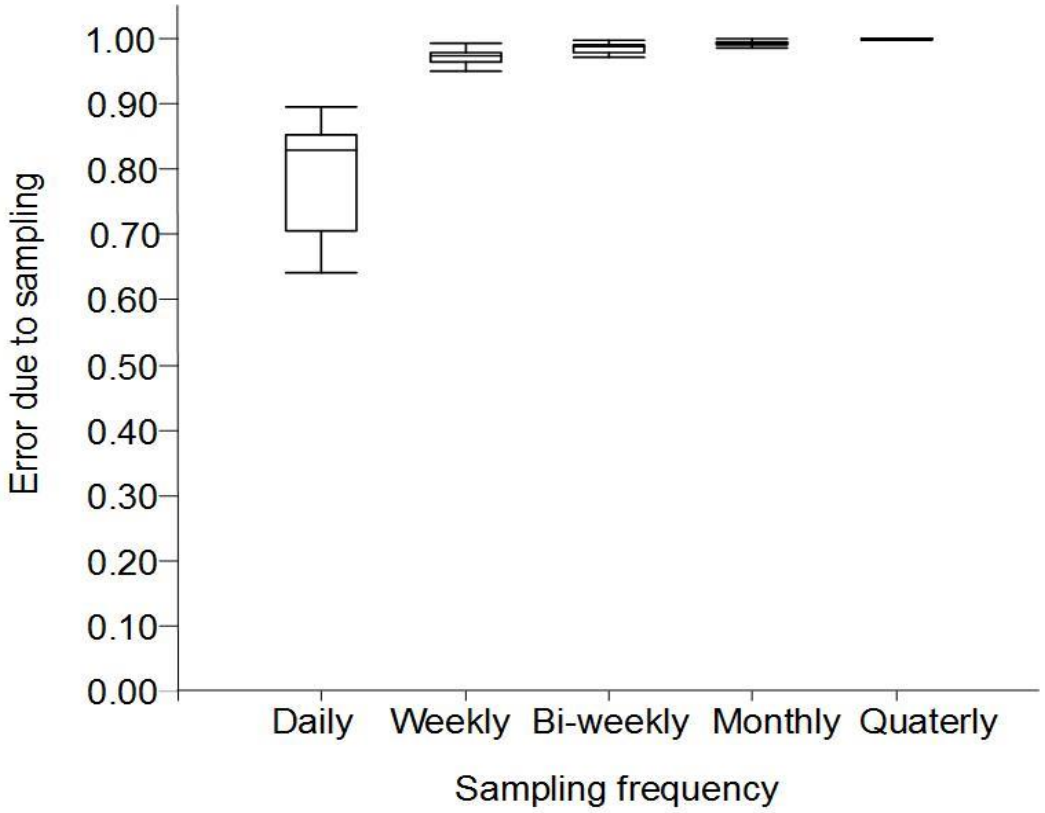
Main effect of sampling intensity



Interacting effect of size of project footprint and sampling type



Effect of sampling frequency
(reduce sampling frequency error increases)



Improving point count surveys

- Adaptive sampling designs improve precision & efficiency of surveys

- Design flexible monitoring protocol adapted to variations in eagle behavior
  - use resource selection functions (RSF) to stratify sampling by habitat type
  - account for annual variation in behavior

Duerr et al. 2019 (In Press). Topographic drivers of flight altitude over large spatial and temporal scales.
The Auk Ornithological Advances.

- Slope
- Aspect
  - Eastness
  - Northness
- Elevation
- Topographic roughness
- Topographic position
- BCR

(Some) Next Steps

- Individual and Environmental Drivers of Movement in a 3-Dimenstional Landscape – Sur et al. in review

- Risk to Golden Eagles from Wind Turbines Risk Model for Golden Eagles in California
  - Combined Likelihood of
  - Eagle at a certain spot in landscape
  - Eagle at a certain flight altitude at that spot
  - Type of behavior of the eagle at that spot and altitude