Biotelemetry Data for Golden Eagles (*Aquila chrysaetos*) Captured in Coastal Southern California, November 2014–February 2016
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By Jeff A. Tracey, Melanie C. Madden, Jeremy B. Sebes, Peter H. Bloom, Todd E. Katzner, and Robert N. Fisher

Prepared for San Diego Association of Governments (SANDAG), California Department of Fish and Wildlife, Bureau of Land Management, and U.S. Fish and Wildlife Service

Data Series 994

U.S. Department of the Interior
U.S. Geological Survey
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Conversion Factors

International System of Units to Inch/Pound

<table>
<thead>
<tr>
<th>Multiply</th>
<th>By</th>
<th>To obtain</th>
</tr>
</thead>
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<tr>
<td>kilometer (km)</td>
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<td>mile (mi)</td>
</tr>
<tr>
<td>millimeter (mm)</td>
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</tr>
<tr>
<td>meter per second (m/s)</td>
<td>3.281</td>
<td>foot per second (f/s)</td>
</tr>
</tbody>
</table>

By Jeff A. Tracey1, Melanie C. Madden1, Jeremy B. Sebes1, Peter H. Bloom2, Todd E. Katzner1, and Robert N. Fisher1

Abstract

The status of golden eagles (Aquila chrysaetos) in coastal southern California is unclear. To address this knowledge gap, the U.S. Geological Survey (USGS) in collaboration with local, State, and other Federal agencies began a multi-year survey and tracking program of golden eagles to address questions regarding habitat use, movement behavior, nest occupancy, genetic population structure, and human impacts on eagles. Golden eagle trapping and tracking efforts began in October 2014 and continued until early March 2015. During the first trapping season that focused on San Diego County, we captured 13 golden eagles (8 females and 5 males). During the second trapping season that began in November 2015, we focused on trapping sites in San Diego, Orange, and western Riverside Counties. By February 23, 2016, we captured an additional 14 golden eagles (7 females and 7 males). In this report, biotelemetry data were collected between November 22, 2014, and February 23, 2016. The location data for eagles ranged as far north as San Luis Obispo, California, and as far south as La Paz, Baja California, Mexico.

Introduction

Growing uncertainty about the status of golden eagles (Aquila chrysaetos) in southern California has highlighted the need for ecological information that will allow local managers to evaluate and mitigate the effects of human activities on this species (Scott, 1985; Harlow and Bloom, 1989). Populations of golden eagles in California are typically comprised of resident or migratory breeders, resident or migratory non-breeders (for example, adult floaters or subadults), and seasonal itinerants. A better understanding of the current distribution, status, foraging requirements, and population characteristics of golden eagles can help to manage golden eagle habitat and threats/stressors to each nesting territory in coastal southern California. The U.S. Geological Survey (USGS) in collaboration with U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Wildlife (CDFW), and the San Diego Management and Monitoring Program (SDMMP) began a multi-year survey and tracking program of golden eagles to address questions regarding habitat use, movement behavior, nest occupancy, genetic population structure, and human impacts on eagles. This report presents biotelemetry data associated with the capture of 26 golden eagles from November 22, 2014 through February 23, 2016.

Methods

Biotelemetry

Since October 2014, we have been trapping eagles at targeted sites across San Diego County, California. We began the second season of eagle trapping in November 2015, and included trapping sites in San Diego, Orange, and western Riverside Counties.

Once captured, each eagle was given an eagle ID for this study, a USGS Bird Banding Laboratory leg band (if it did not already have one), and a GPS transmitter that sends data over the mobile phone network (a GPS-GSM transmitter; Dunstan, 1972; Kenward, 1985; Lanzone and others, 2012). The eagle ID consists of a four-letter code for the species, a two-letter code for the county of capture, and an “F” or “M” followed by a numeral (with up to two leading zeros) to indicate the sex and capture order of the individual. For example, the first female eagle captured in San Diego County was given an eagle ID of GOEA-SD-F001. We use the county code OC for Orange County and RV for Riverside County.
Standard morphological measurements and samples were taken from each captured eagle. Measurements included (1) weight, (2) wingspan, (3) hallux and culmen, and (4) characteristics of the primary and secondary flight feathers. Samples included (1) blood samples for genetic and lead testing, (2) swabs of the eyes, mouth and cloaca for chlamydia testing by University of California, Davis, and (3) 2–4 feathers for lead, stable isotope, and genetic testing. For the health of the eagle, rapid processing and release took precedence over collecting measurements and samples. Thus, in some cases we did not collect weight measurements or take blood samples for field lead testing in favor of properly attaching the GPS-GSM unit and releasing the eagle in a timely manner. When time permitted, eagles were tested in the field for lead toxicity using a LeadCare® II testing unit. If lead testing results were greater than 60 µL/dL, we planned to deliver the eagle to Scott Weldy DVM (Orange County Bird of Prey Center, Serrano Animal & Bird Hospital) for therapy. All samples were collected under Dr. Peter Bloom’s scientific collecting permit (Bloom Biological, Inc.) and delivered to the appropriate parties (University of California, Davis Wildlife Health Center, Todd Katzner of USGS, and Andrew DeWoody of Purdue University; each of whom is permitted to receive samples). No samples were retained in California by USGS. Sex was determined based on body size, weight, and measurements of the hallux and culmen and will be confirmed genetically. Age was estimated based on molt patterns (Bloom and Clark, 2001).

Each captured eagle was fitted with a Cellular Tracking Technologies (CTTTM) CTTTM-1070a GPS-GSM telemetry unit (Dunstan, 1972; Kenward, 1985; Lanzone and others, 2012). The units were attached to the eagles using 11 mm natural tubular Teflon™ tape fed through the attachment holes on the GSP-GSM unit and around the wings to form a “backpack.” The Teflon™ ribbon is non-abrasive and the standard method for attaching telemetry units to eagles. If the eagle had other markings or telemetry devices, other than a USGS Bird Banding Laboratory (BBL) leg band, we were directed by the BBL to remove them.

**Data Filtering**

Once data were downloaded from CTT™ servers, the data were formatted (for example, formatting dates and converting text strings with latitude and longitude data into numerical values) and merged with data from prior downloads when needed. We applied two filters to the records to eliminate potentially erroneous locations prior to merging the new data with prior data.

To pass the first filter, six conditions had to be satisfied:
1. Location had to be at least 2D,
2. Horizontal dilution of precision (HDOP) had to be less than or equal to 5,
3. Vertical dilution of precision (VDOP), if available, had to be less than or equal to 5,
4. Longitudes values had to be available and be on the interval [−180, 180] degrees,
5. Latitude values had to be available and be on the interval [−90, 90] degrees, and
6. Fixes had to be at least 25 seconds apart (based on discussion with engineers at CTT™).

The second filter depends on distance metrics. To pass the second filter, two conditions had to be satisfied:
1. Location had to be within UTM zones 10, 11, or 12, and
2. Rate of displacement had to be realistic (≤ 89.4 m/s horizontal or ≤ 20.0 m/s vertical).

**Biotelemetry Data for Captured Golden Eagles**

As of February 23, 2016, we captured 27 golden eagles at 16 trapping locations (table 1, fig. 1). Currently, we have 15 eagles with active transmitters, 5 eagles with transmitters of unknown status, 3 eagles with inactive transmitters, and 4 eagles known to have died. An active transmitter is one from which we have received a download within the past 10 days. A transmitter with unknown status is one from which we have received data 11 to 60 days ago, an inactive transmitter is one from which we have not received a download in more than 60 days, and a mortality indicates that we have recovered the eagle’s remains. Location data for 26 of the 27 captured golden eagles with transmitters are shown in figures 2–27. The transmitter attached to golden eagle GOEA-OC-F012 malfunctioned and no data were received. Thus, there is not a location map for this golden eagle.

A view of the location data over the entire extent of the area used by the golden eagles is shown in figure 28. Note that a lack of eagle data for a particular area does not necessarily imply that it is not used by eagles we are not tracking.
Table 1. Summary of golden eagles captured in southern California, November 2014–February 2016.

[Sex: F, female; M, male. Age: HY, hatch year; TY, third year; FY, fourth year; AFY, after fourth year; AFFY, after fifth year]

<table>
<thead>
<tr>
<th>EagleID</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Age</th>
<th>Status</th>
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<tr>
<td>GOEA-SD-F001</td>
<td>11-22-14</td>
<td>Boulder Oaks</td>
<td>F</td>
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<td>GOEA-SD-F002</td>
<td>11-28-14</td>
<td>Cedar Canyon</td>
<td>F</td>
<td>AFY</td>
<td>Active</td>
</tr>
<tr>
<td>GOEA-SD-F003</td>
<td>12-05-14</td>
<td>Cedar Canyon</td>
<td>F</td>
<td>AFY</td>
<td>Mortality</td>
</tr>
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<td>GOEA-SD-F004</td>
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</tr>
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<td>Santa Ysabel</td>
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<td>Long Potrero</td>
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<td>GOEA-OC-F014</td>
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<td>GOEA-RV-M008</td>
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<tr>
<td>GOEA-OC-M012</td>
<td>12-27-15</td>
<td>Brush Canyon</td>
<td>M</td>
<td>FY</td>
<td>Active</td>
</tr>
</tbody>
</table>

1The transmitter attached to golden eagle GOEA-OC-F012 malfunctioned and no data were received. Thus, there is not a location map for this eagle.
Figure 1. Golden eagle trapping locations, southern California.
Figure 2. Location data for eagle GOEA-SD-F001 captured at Boulder Oaks, San Diego County, California, November 22, 2014.
Figure 3. Location data for eagle GOEA-SD-F002 captured at Cedar Canyon, San Diego County, California, November 28, 2014.
Figure 4. Location data for eagle GOEA-SD-F003 captured at Cedar Canyon, San Diego County, California, December 5, 2014.
Figure 5. Location data for eagle GOEA-SD-F004 captured at Marron Valley, San Diego County, California, December 27, 2014.
Figure 6. Location data for eagle GOEA-SD-F005 captured at O’Neal Canyon, San Diego, California, January 3, 2015.
Map image is the intellectual property of Esri and is used herein under license.
Copyright © 2014 Esri and its licensors. All rights reserved.
Projection: Web Mercator Auxiliary Sphere, Datum is World Geodetic System of 1984,
UTM grid, zone 11

Figure 7. Location data for eagle GOEA-SD-F006 captured at Santa Ysabel, San Diego County, California, February 2, 2015.
Figure 8. Location data for eagle GOEA-SD-F007 captured at Long Potrero, San Diego County, California, February 23, 2015.
Figure 9. Location data for eagle GOEA-SD-F008 captured at Pamo Valley, San Diego County, California, March 14, 2015.
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Figure 28. Location data for all eagles since time of capture, southern California.
Acknowledgments

We thank the USGS field biologists who have made this project possible, including Jordyn Mulder, Monique Wong, James Molden, Michelle Curtis, Devin Adsit-Morris, Karen Aerni, Nicole Deatherage, Robert Krijgsman, and Cary Cochran. We thank Susan Phillips, Sue Jones, and Keith Miles of USGS for their managerial support. We also thank Bloom Biological Inc. biologists Michael Kuehn, Marcus England, Karly Moore, and Jackie Catino and Wendy Humphrey of Bloom Biological Inc. for administrative support. John Martin, Jeff Wells, Joe Papp, Sharon Coe, Kris Preston, Barbara Kus, Suellen Lynn volunteered to assist in eagle trapping. Members of the numerous agencies provided support, including the California Department of Fish and Wildlife (Karen Miner, Tracie Nelson, Jason Price, Carie Battistone, and Rich Burg); the U.S. Fish and Wildlife Service (Susan Wynn, Mary Beth Woulfe, Tom Dietsch, Jill Terp, John Martin, Randy Nagel, Joel Pagel, and Karen Goebel); the Bureau of Land Management (Amy Fesnock, Joyce Schlachter, and Carrie Simmons), the U.S. Forest Service (Jeff Wells), the County of San Diego (Jennifer Price), the City of San Diego (Nicole McGinnis, Tim Nguyen), SANDAG/SDMMP (Keith Greer, Paul Fromer, Ron Rempel, Yvonne Moore, Kris Preston, and the EMP Working Group), the Irvine Ranch Conservancy (David Raetz, Sherry Fuller, and Jutta Burger), Orange County Parks (John Gump and Sean Bengtson), California State Parks (Ken Kietzer and Michael Puzzo), Pala Band of Mission Indians, Corte Madera Ranch, Jerry Crowe FBI Regional Tactical Training Center (El Toro), Santa Margarita Ecological Reserve, Back Country Land Trust, Santa Rosa Plateau Ecological Reserve (Carole Bell), Gonzalo De León (Centro de Investigaciones Biológicas del Noroeste, S. C.), and Amber Craig (Border Patrol). We thank Winston Vickers (University of California, Davis) and Jeff Lincer (Researchers Implementing Conservation Action) for their support. We thank Andrew McGann at Cellular Tracking Technologies for technical support. Finally, Frank Konyn, Robert Van Ommering, Brad Scott, and Steve Stiles provided assistance in acquiring bait.

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