



The impact of satellite tags - towards best practice

Daniel Hegglin, José Tavares & Louis Phipps

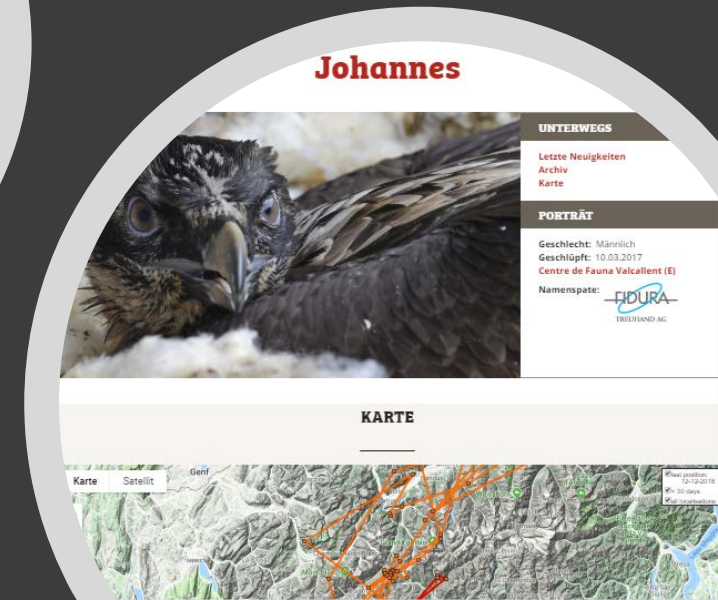
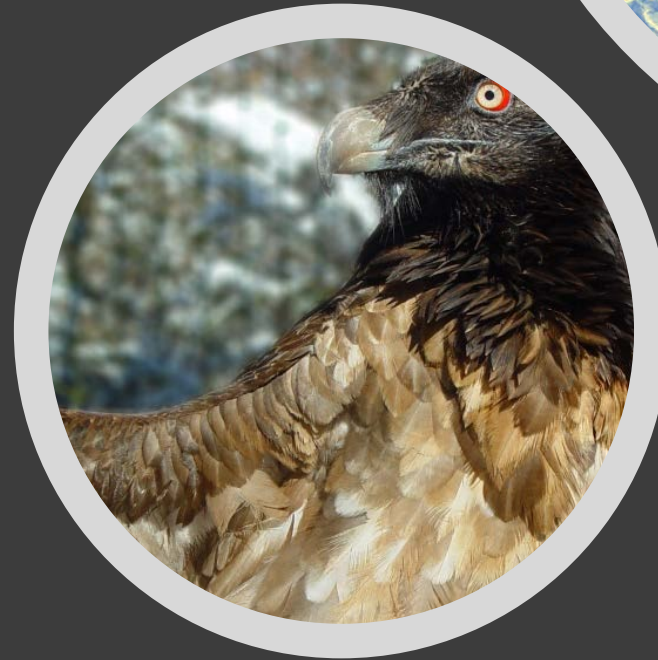
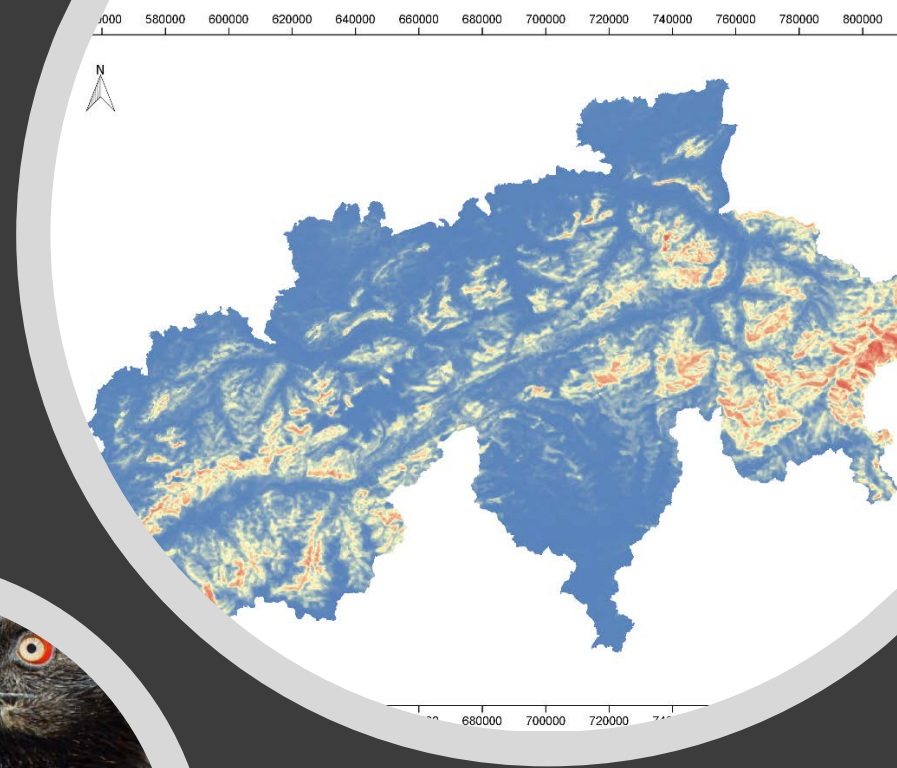


Content

- Pros & cons of satellite tagging
- A global survey: preliminary results
- Experiences from the Alpine bearded vulture reintroduction project

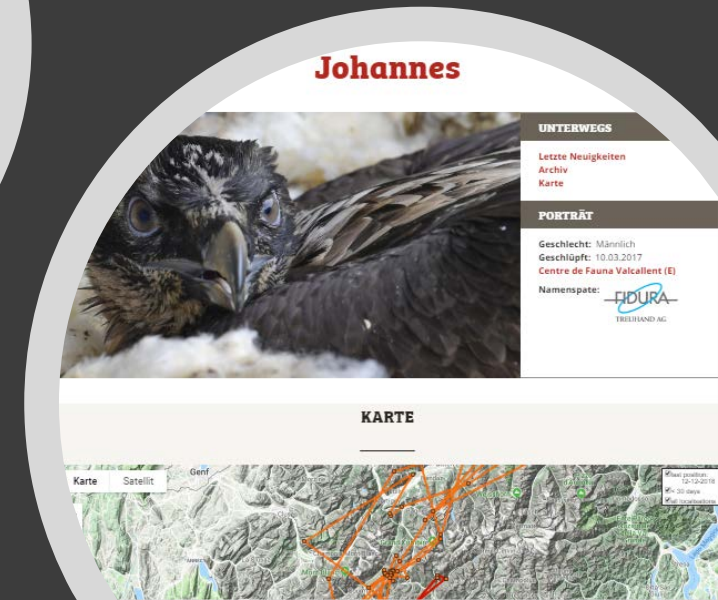
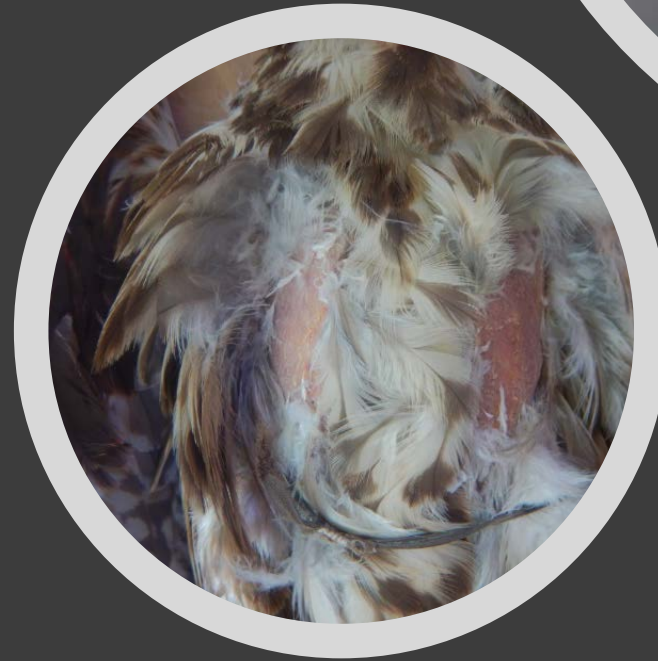
Some pros ...

- Understandig the species ..
 - Migration routes
 - Habitat requirements
 - ...
- Understanding the threats
 - Detection of mortality (e.g. lead, windfarms, etc.)
 - Identification of risk zones
 - ..
- Direct protection
 - Recovery of birds / incease survival
 - ...
- Promotion of the species
 - Attractive information for the public
 - ...



Some cons ...

- Damage to the birds
- Misuse of data
- Negative reputation for conservation projects
- ...



Increasing use: high relevance of best practice!

s. Alarcon & Lambertucci 2018

Alarcón and Lambertucci *Movement Ecology* (2018) 6:13
<https://doi.org/10.1186/s40462-018-0133-5>

Movement Ecology

REVIEW

Open Access

A three-decade review of telemetry studies on vultures and condors



Pablo A. E. Alarcón^{1,2*} and Sergio A. Lambertucci¹

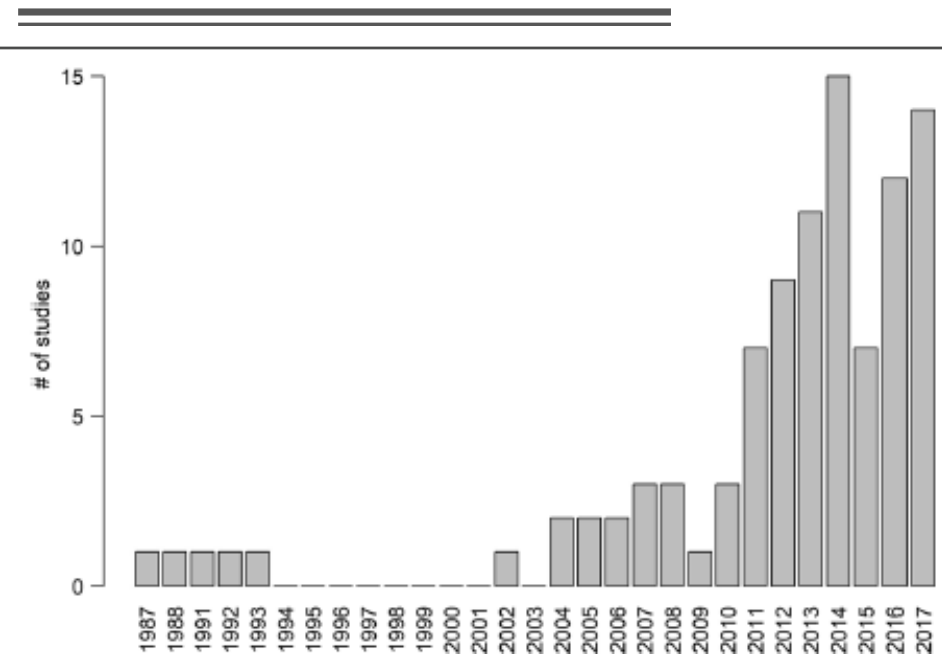


Fig. 2 Yearly number of telemetry studies on vultures and condors published between 1987 and 2017

A global survey of tracking raptors and vultures and the negative effects of different methods

Louis Phipps



Intention of the survey

- Collection of basic information:
 - Attachment methods used
 - Detection/mitigation of negative effects and failures
 - Perceptions of importance of reporting negative effects
- Not intended to be a rigorous scientific survey



Online survey via Google forms



Raptor / vulture tracking survey

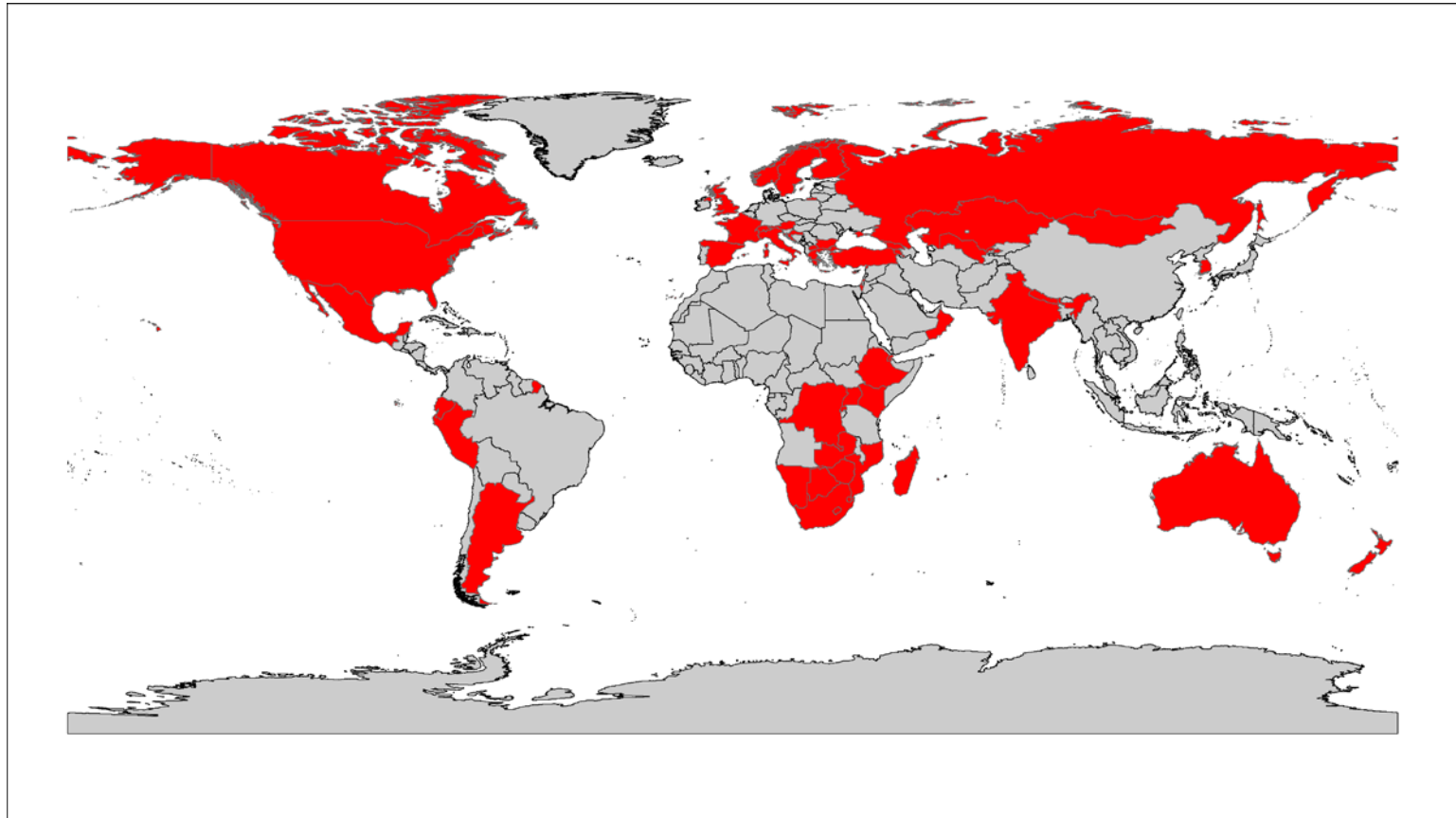
Thank you for participating in this survey. Completing your responses should only take 5-10 minutes once the relevant information is collated from your records.



Survey still active:
www.goo.gl/muuVC8

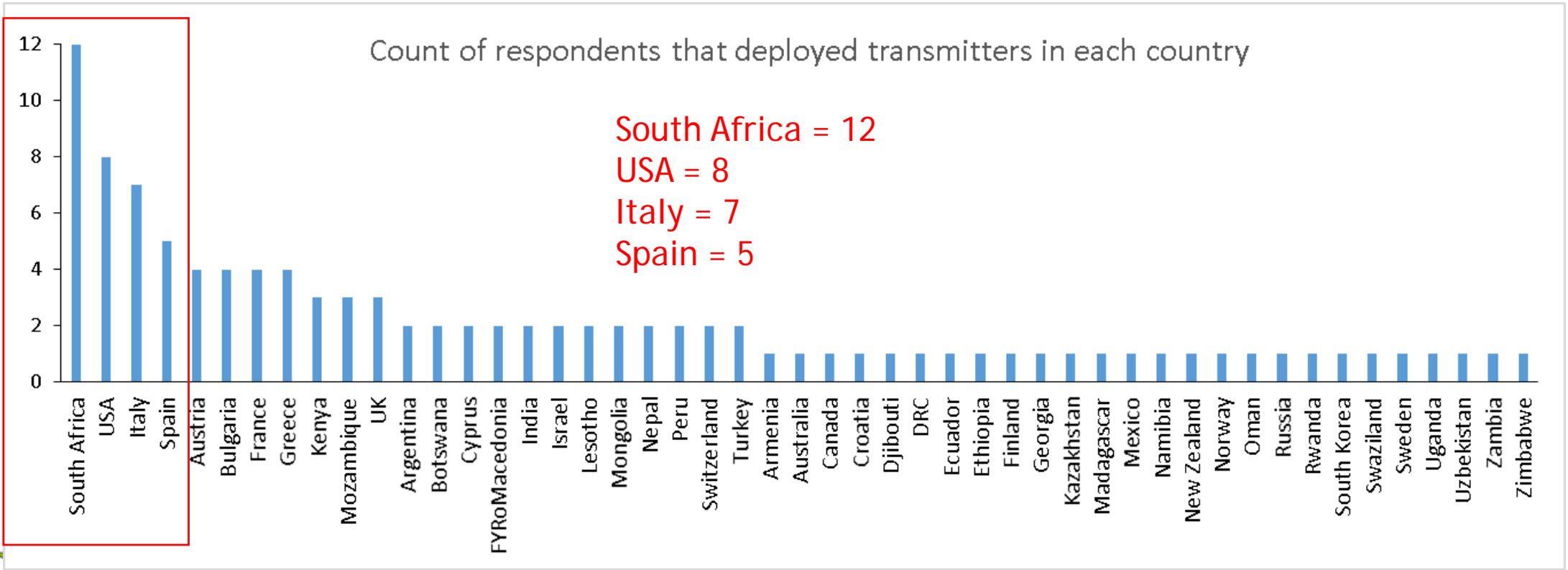
Respondent details

- 51/53 respondents deployed transmitters
- Transmitters deployed in 49 different countries
- Mean \pm SD countries per person = 2.20 \pm 1.17 ; max. = 7



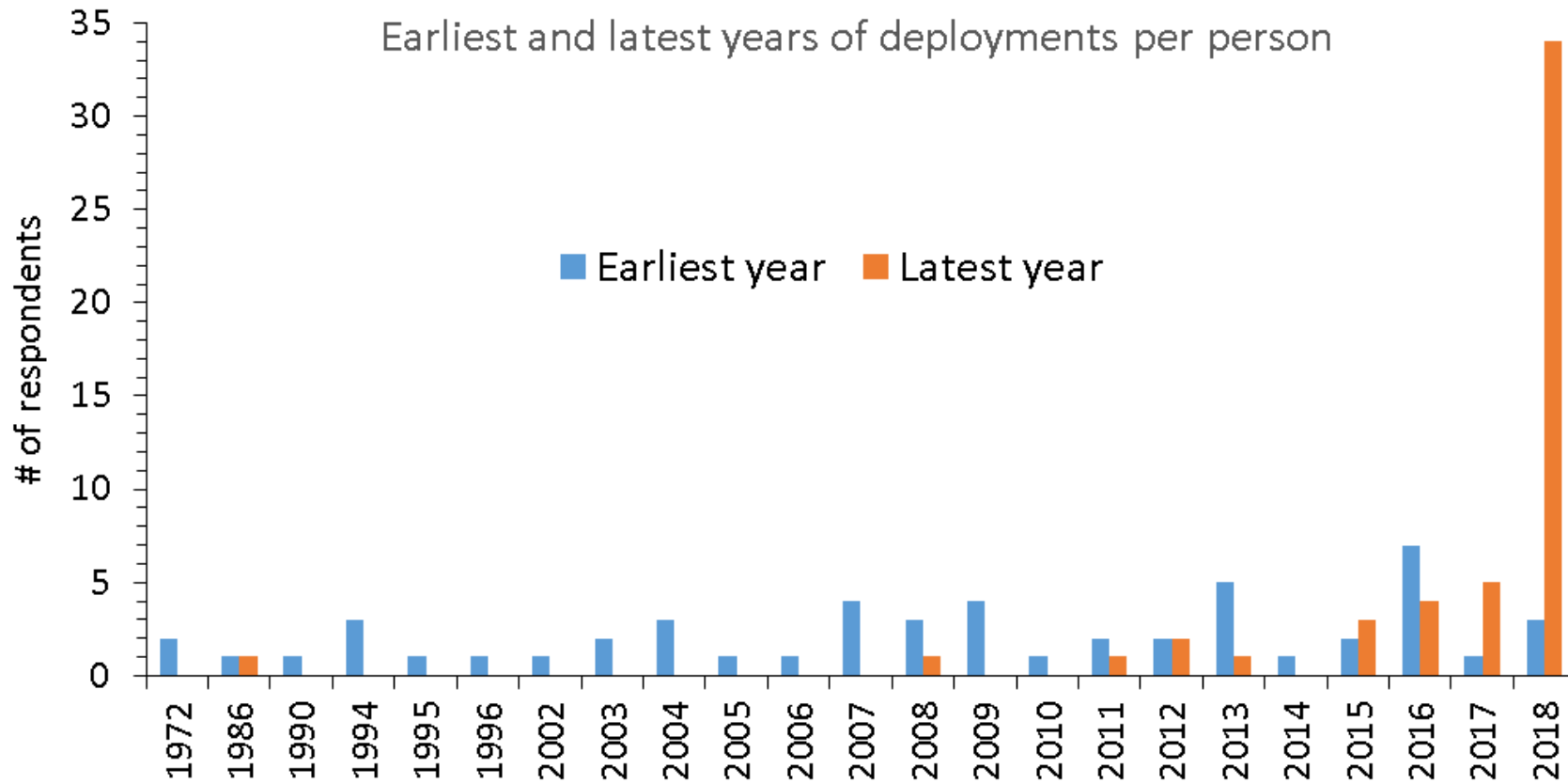
Respondent details

- 51/53 respondents deployed transmitters
- Transmitters deployed in 49 different countries



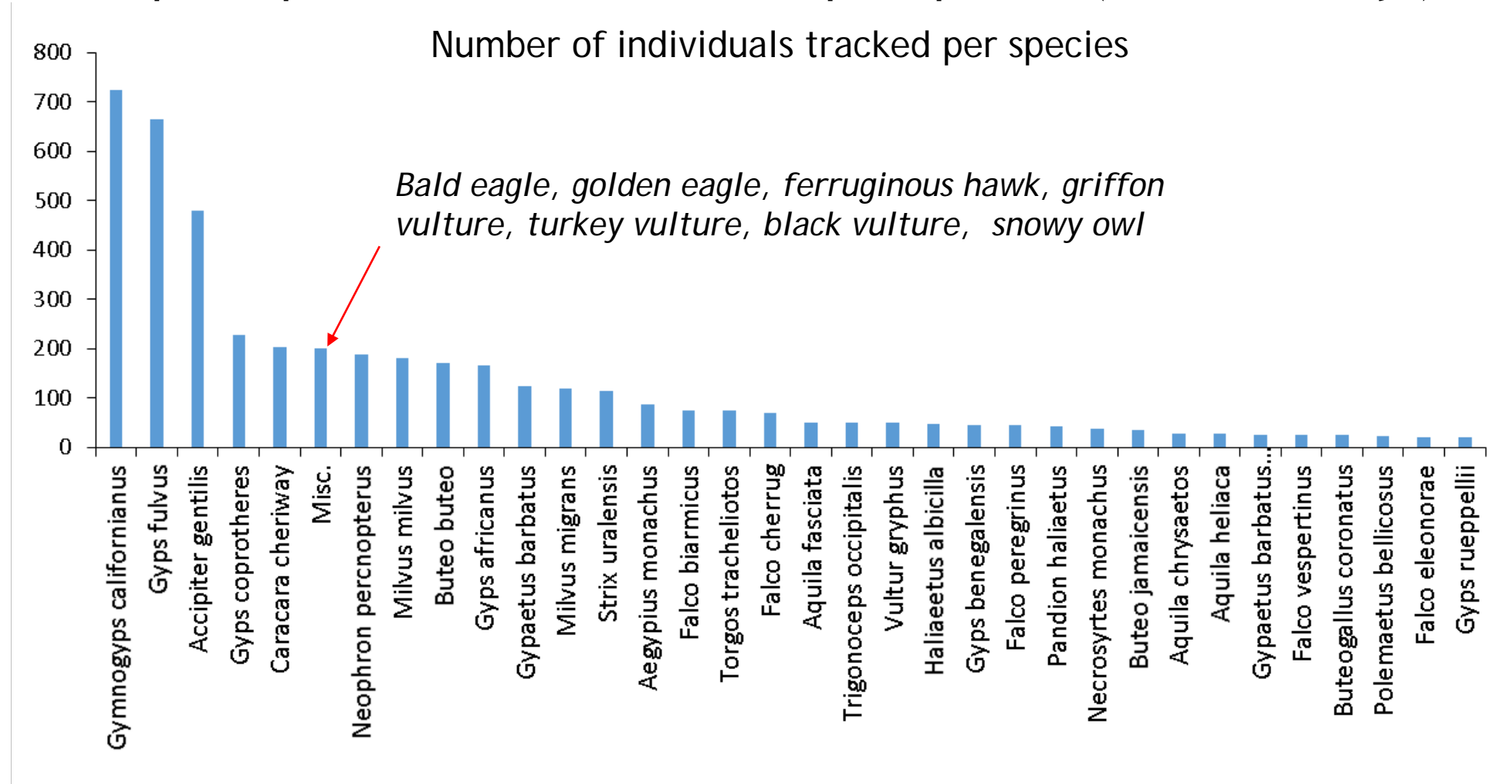
Results: SECTION 2: Respondent details

- 51/53 respondents deployed transmitters
- Transmitters deployed in 49 different countries
- 34/53 respondents deployed transmitters in 2018



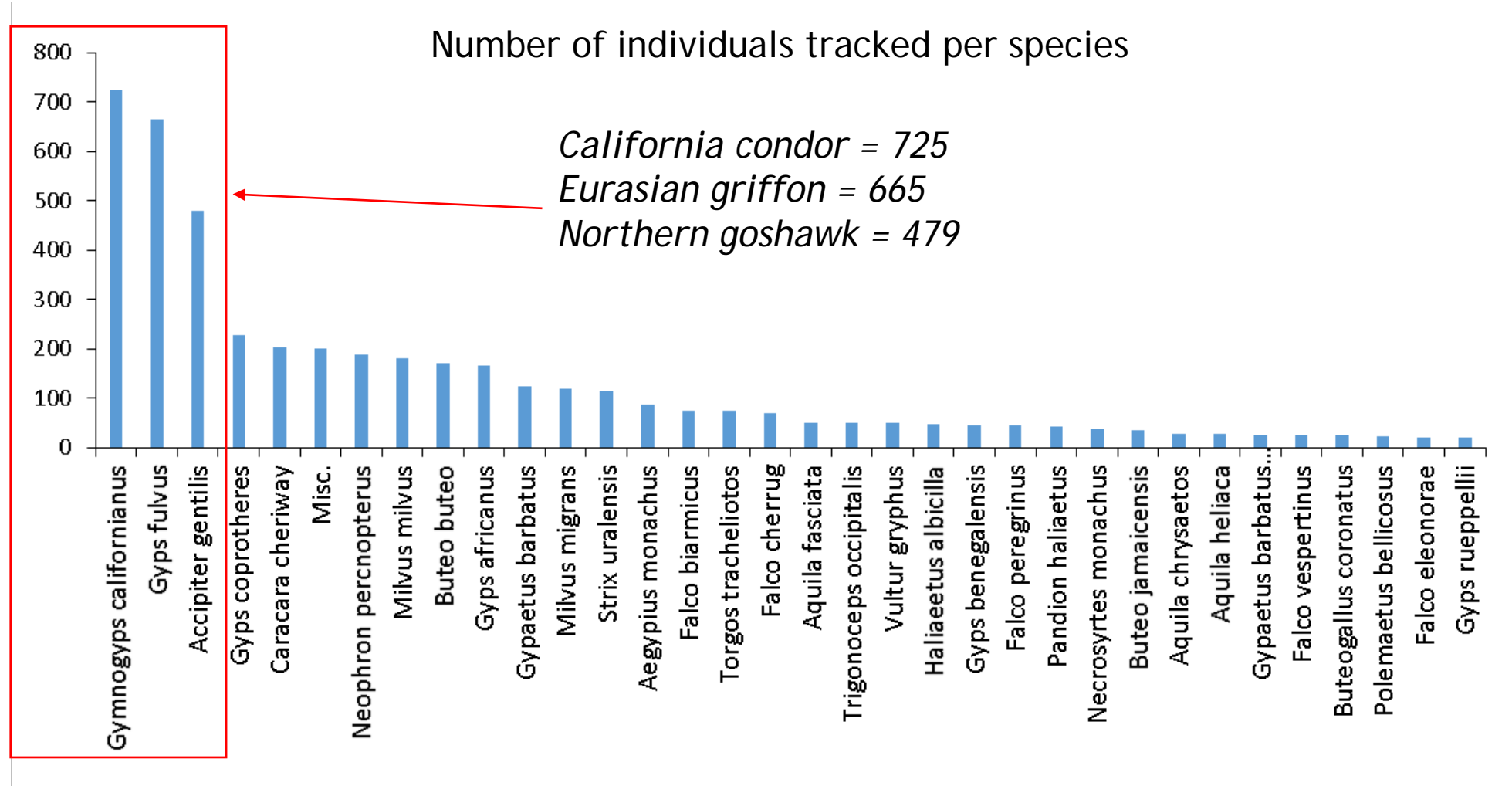
Tracker deployments

- 4,687 individuals from 71 species
- Top 34 species with ≥ 20 tracked per species (in this survey!)



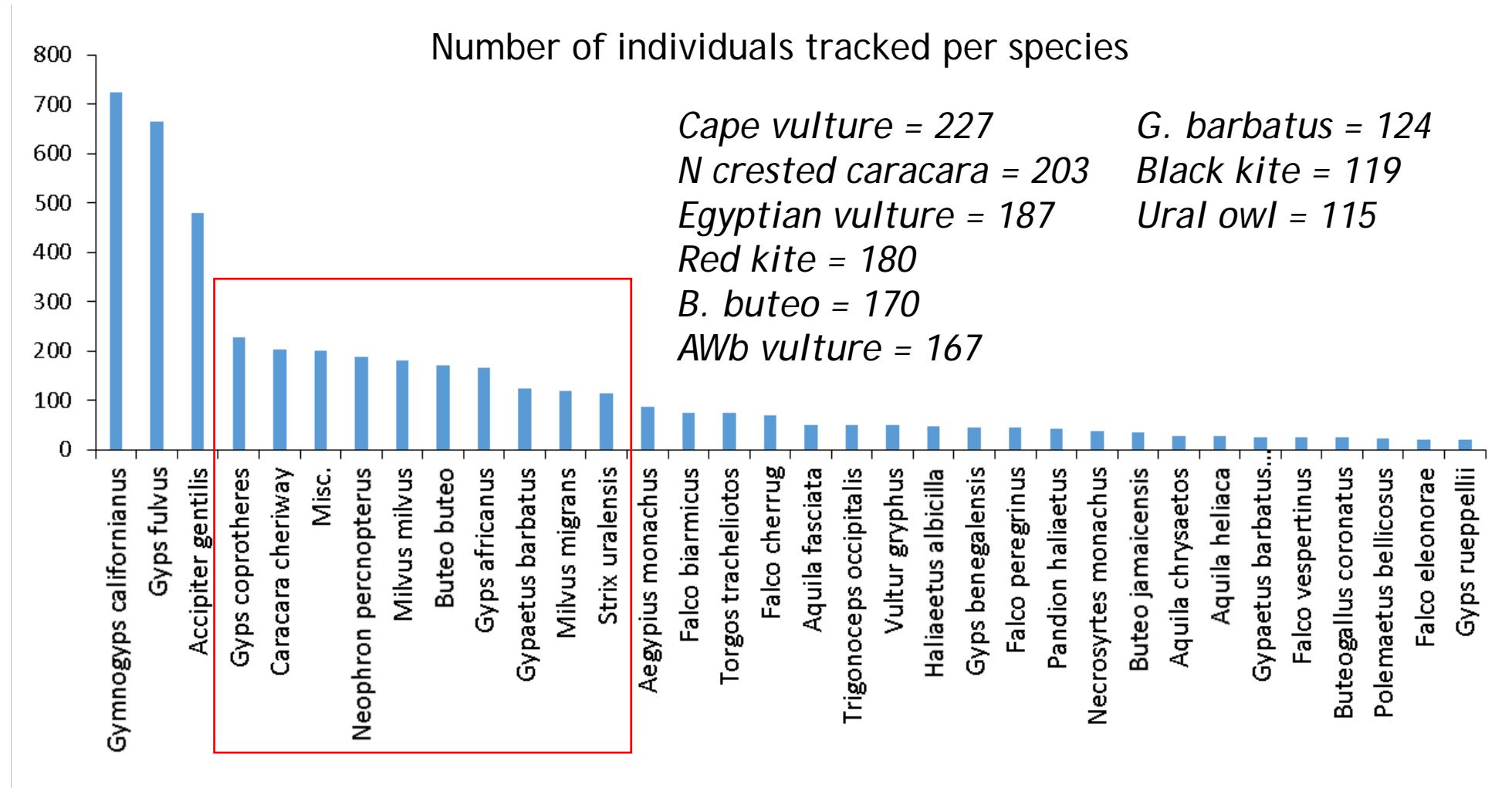
Tracker deployments

- Top 3 species tracked (in this survey!)



Tracker deployments

- 9 species with >100 tracked



Results: SECTION 3: Tracker deployment methods

- Attachment methods surveyed:

- Backpack
- Leg-loop
- Patagial
- Tail-mount
- Leg-mount
- Other (e.g. implant)



Photo by Mike Wallace/San Diego Zoo

A GPS patagial (wing) transmitter on the wing of a juvenile condor.

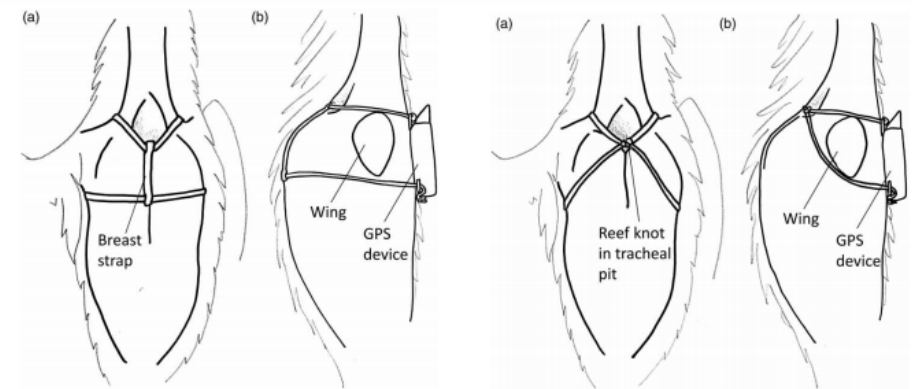
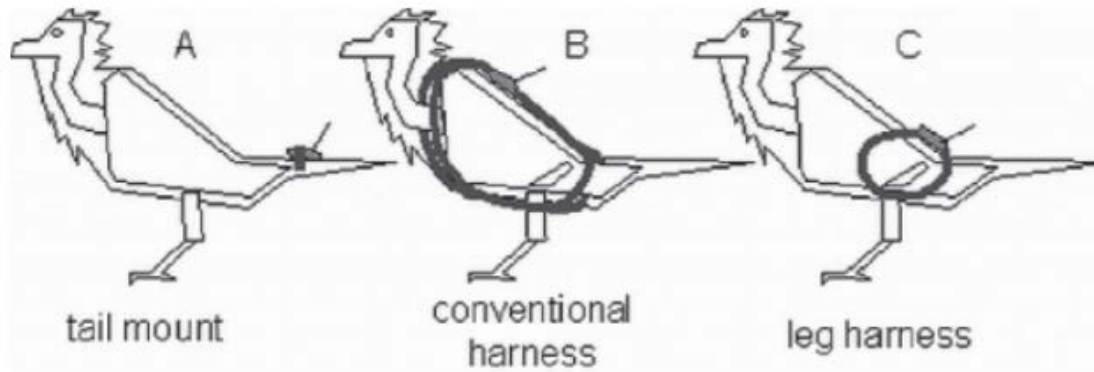


Marshall telemetry



APPENDIX FIGURE 8. Example of a solar-powered GPS-GSM transmitter (Microwave Telemetry, Columbia, Maryland, USA) attached to a Turkey Vulture.

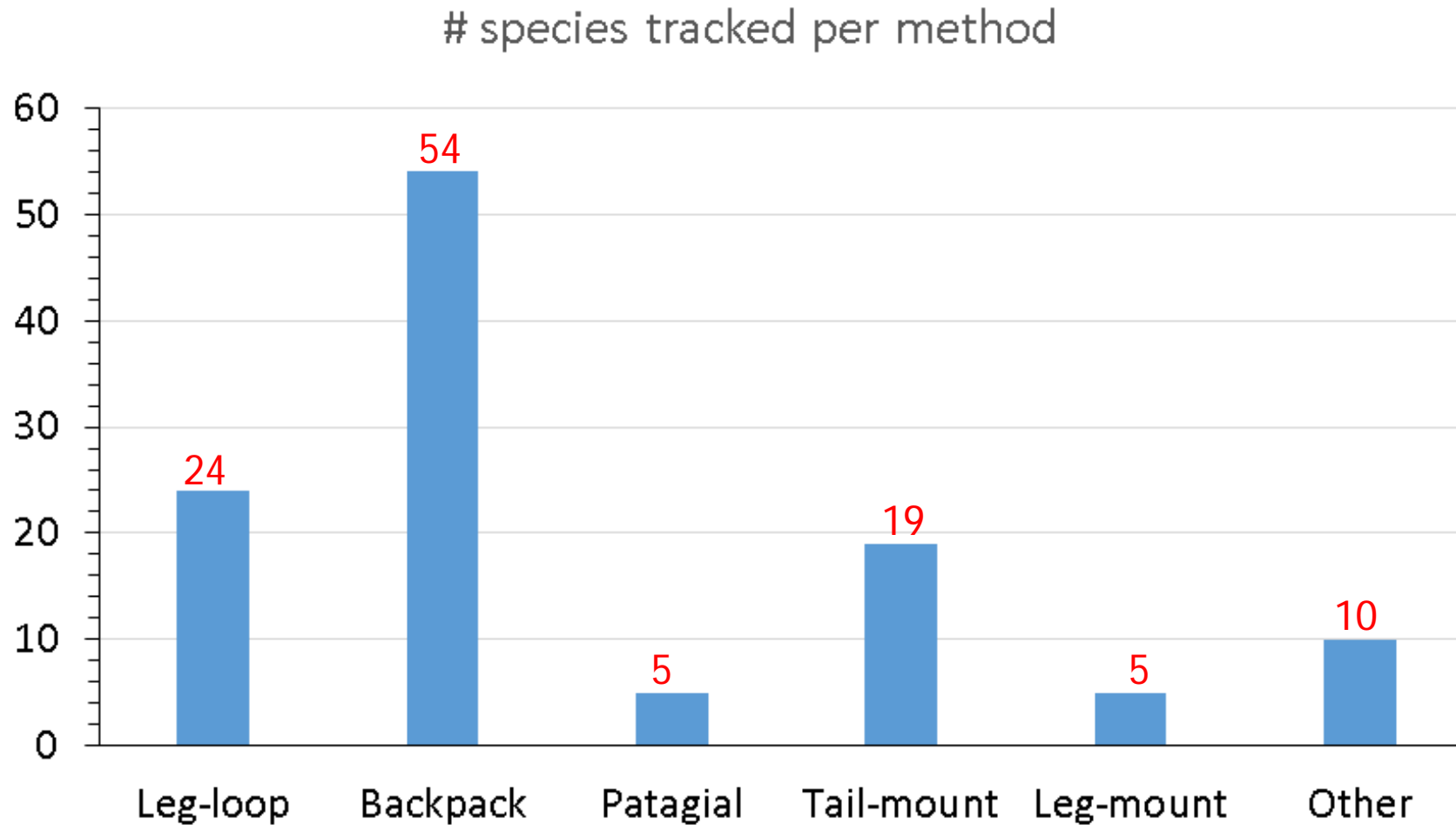
The Condor: Ornithological Applications 119:389–404, © 2017 American Ornithological Society



Thaxter *et al.* 2015

Hegglin *et al.* 2004

Results: SECTION 3: Tracker deployments



Results: SECTION 4: Abrasion from harness

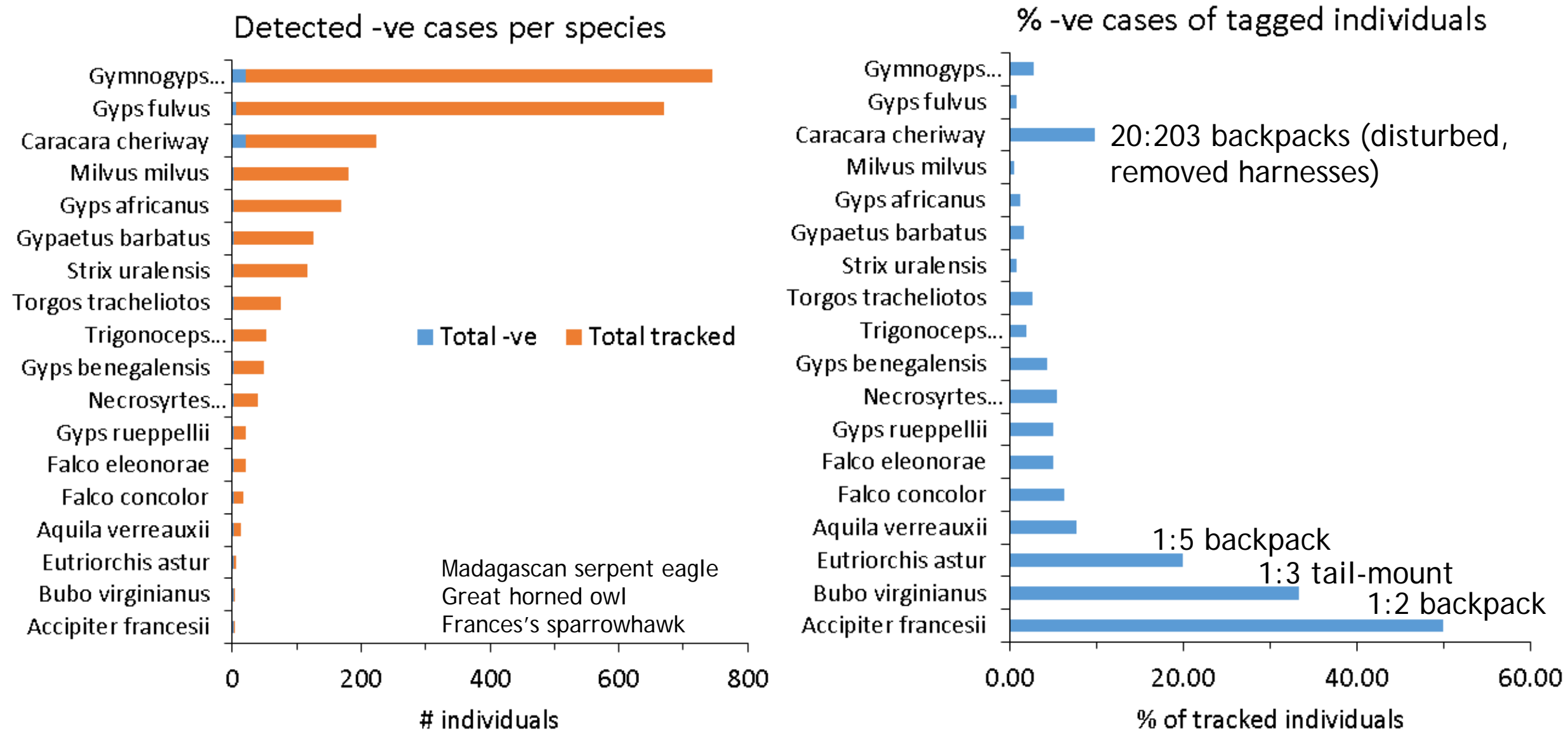


Results: SECTION 4: Attachment failures

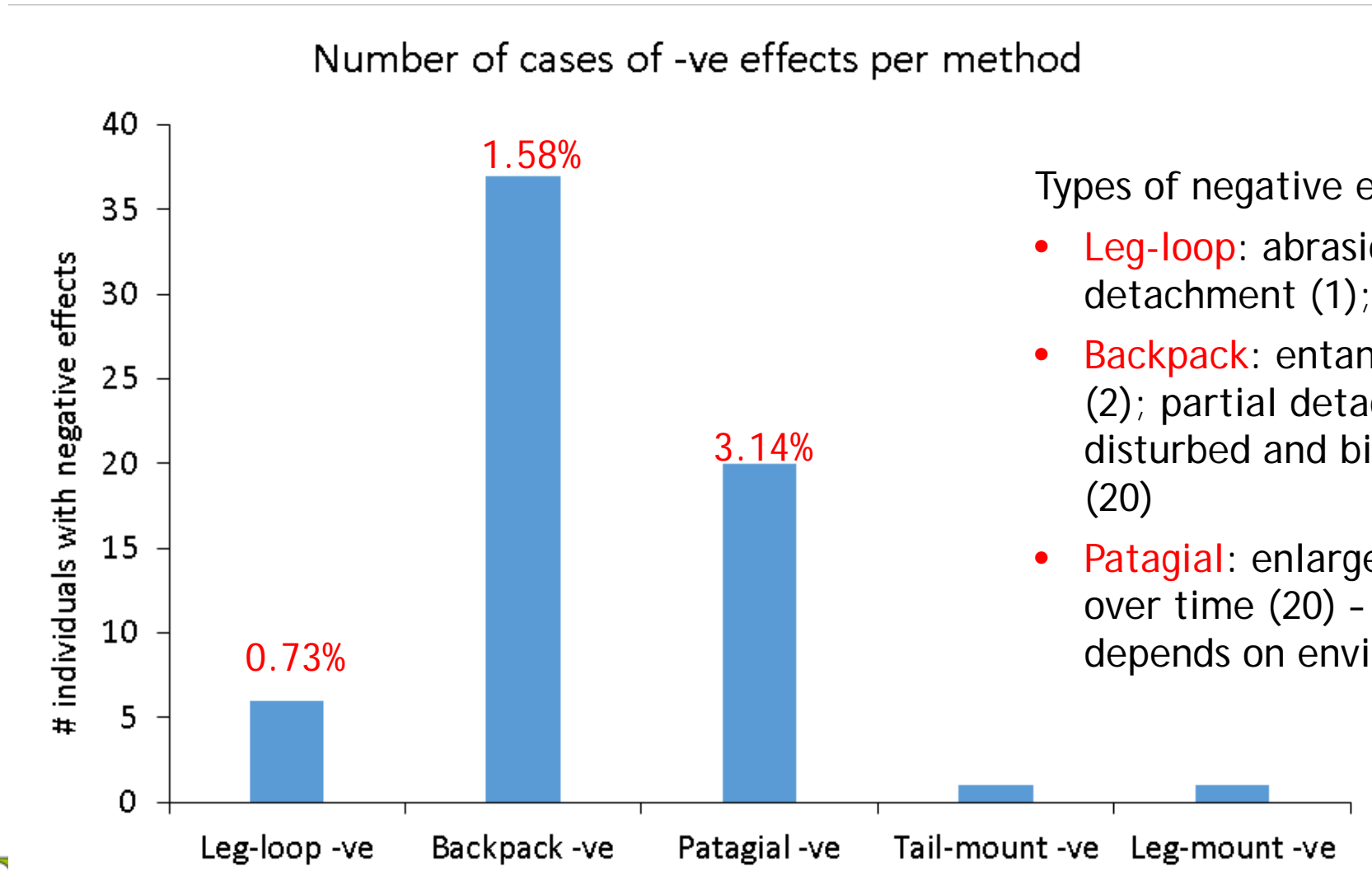




Results: SECTION 3: Negative effects: 65 cases (1.4%), 18 species



Results: SECTION 3: Negative effects: 65 cases, 18 species



Types of negative effects:

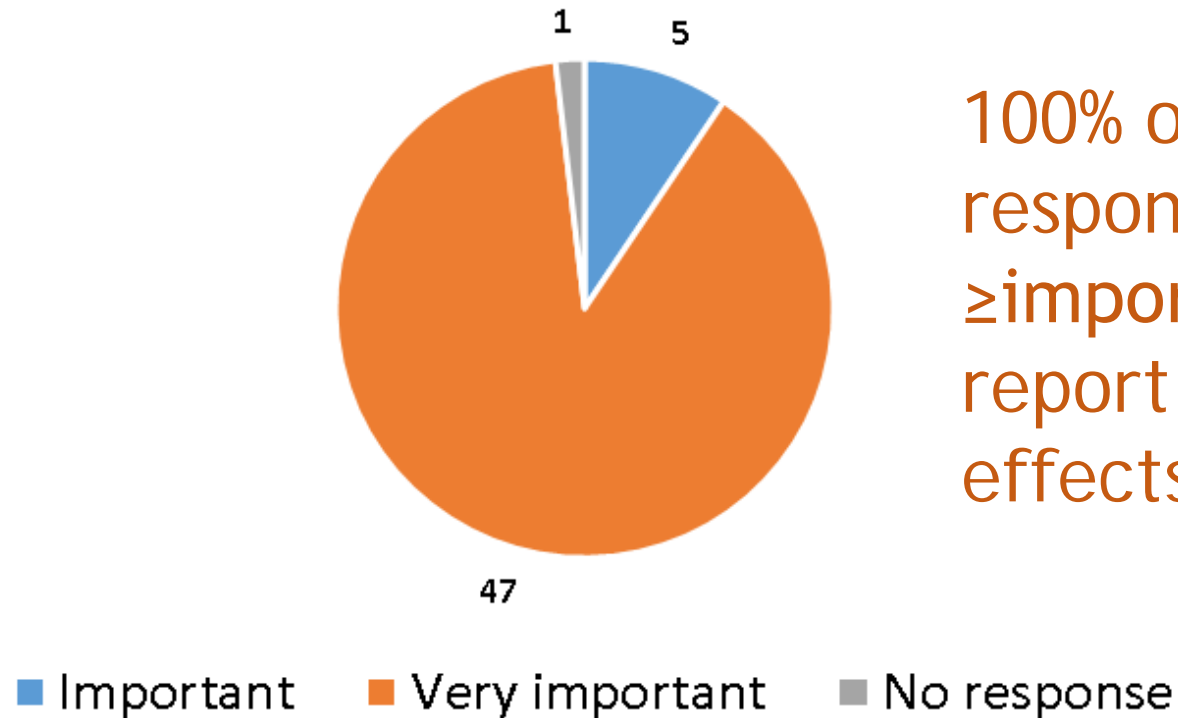
- **Leg-loop**: abrasion (3); partial detachment (1); entangled (2)
- **Backpack**: entangled (5); abrasion (2); partial detachment (5); disturbed and bird removed harness (20)
- **Patagial**: enlarged holes in patagia over time (20) - not consistent, depends on environment and flight

Results: SECTION 4: Transmitter and attachment failures

- Wide range of makes/models
- tag failure rate = $8.7\% \pm 18.5\%$ (n = 48 responses)
- attachment failure rate = $2.7\% \pm 6.6\%$ (n = 48)
- Total = 65 attachment failures from 12 respondents
 - 9/12 respondents stated that failures were backpack attachments
 - 2 tail-mounted and ~3 patagial tags

Results: SECTION 6: Perception of reporting importance

How important/unimportant do you believe it is to report negative effects of tracking studies?



100% of respondents:
≥important to
report negative
effects

Future work

- Not intended as a rigorous scientific study but to promote further discussion and develop future strategies
(-> Summary for IUCN vulture specialist group)
- Develop tagging / tracking / attachment / post-release monitoring protocols and standards?
- Promoting publications on assessing tag effects

Meta-analysis of transmitter effects on avian behaviour and ecology

Douglas G. Barron^{*†}, Jeffrey D. Brawn and Patrick J. Weatherhead

- Meta-analysis of 84 studies
- Found significant negative effect in 8/12 aspects
- Increased energy expenditure + reduce probability of breeding most substantial



No effect of satellite tagging on survival, recruitment, longevity, productivity and social dominance of a raptor, and the provisioning and condition of its offspring

Fabrizio Sergio^{1*}, Giacomo Tavecchia², Alessandro Tanferna¹, Lidia López Jiménez¹, Julio Blas¹, Renaud De Stephanis¹, Tracy A. Marchant³, Nishant Kumar^{4,5} and Fernando Hiraldo¹

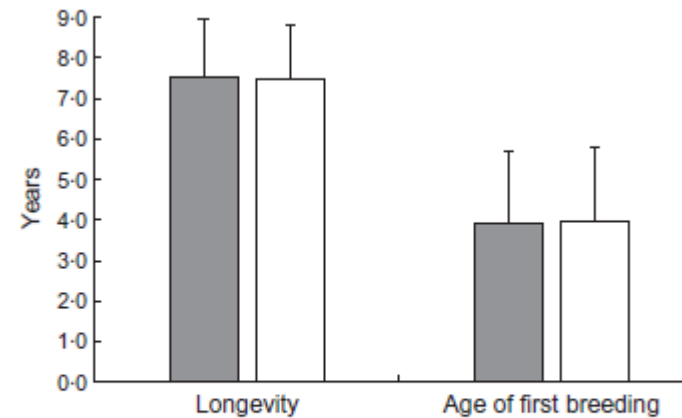


Fig. 3. Age of first breeding and longevity of satellite-tagged black kites (grey bars) and control individuals (white bars). Bars represent mean \pm 1 SE.

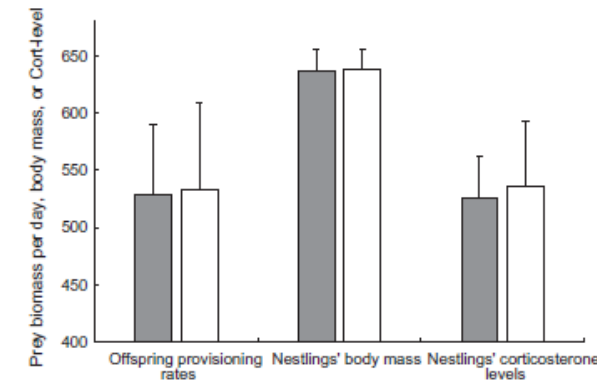


Fig. 6. Prey provisioning rates by adults to their nestlings (grams of prey delivered per day), and offspring body mass (in grams) and corticosterone (Cort) levels in feathers (pg mm⁻¹) for nests of satellite-tagged black kites (grey bars) and control individuals (white bars). Corticosterone levels were multiplied by 50 for clarity of presentation. Bars represent mean \pm 1 SE.

- 110 black kites, backpacks, closely monitored
- No detectable difference in vital rates or behaviour

Conclusions of the survey

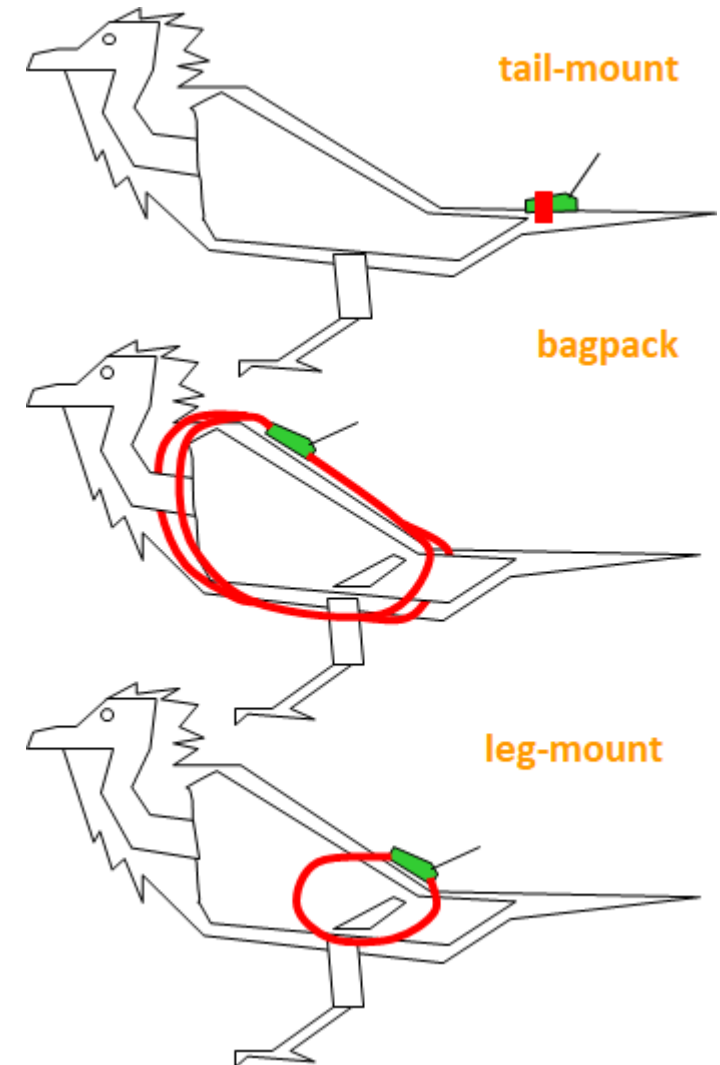
- A large number of individuals from many different species have been tracked, with numbers of publications increasing each year
- Effects of tracking are hard to measure and monitor
- Researchers consider it important to report negative effects
- Further research is required to develop “best practice” in trapping, attachment and monitoring
- Important to remember the ground-breaking contributions of tracking data to the conservation of threatened species

GPS tags in the Alpine reintroduction project

- Safety first!
 - Tests in captivity
- Instant data control
 - Data control tool
- Promote public awareness
 - Public maps



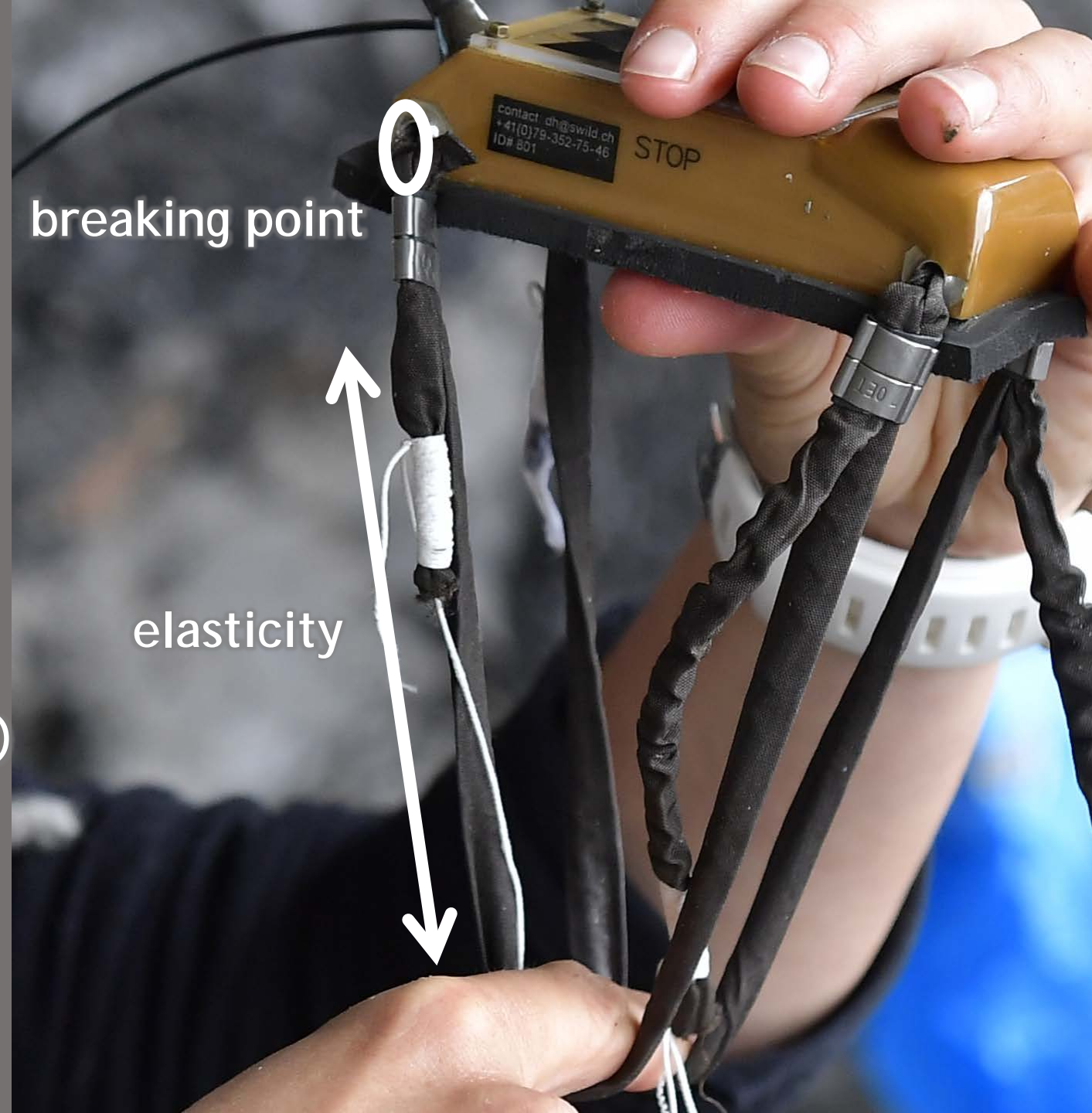
Methods of marking - evaluation in the captivity

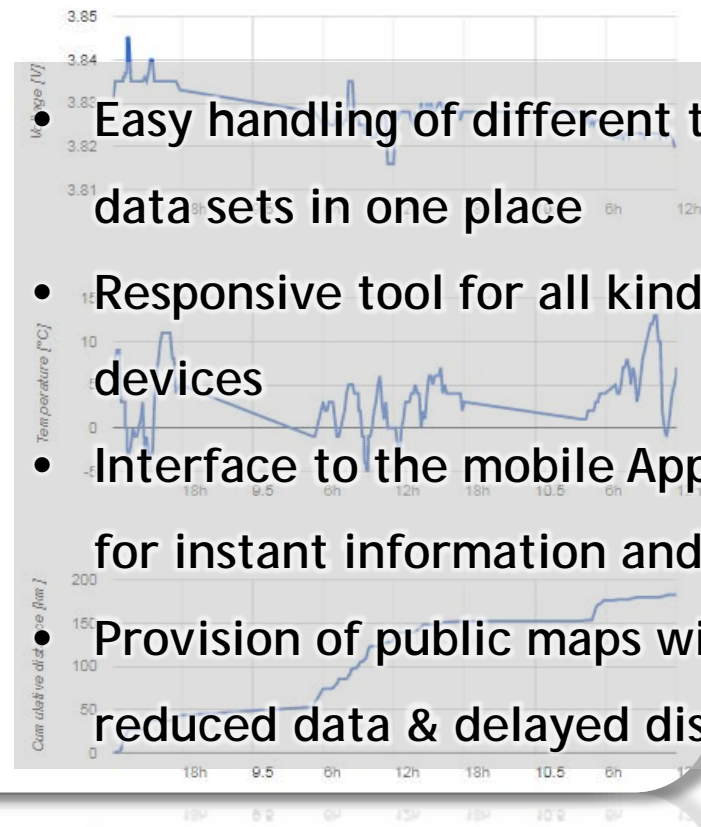
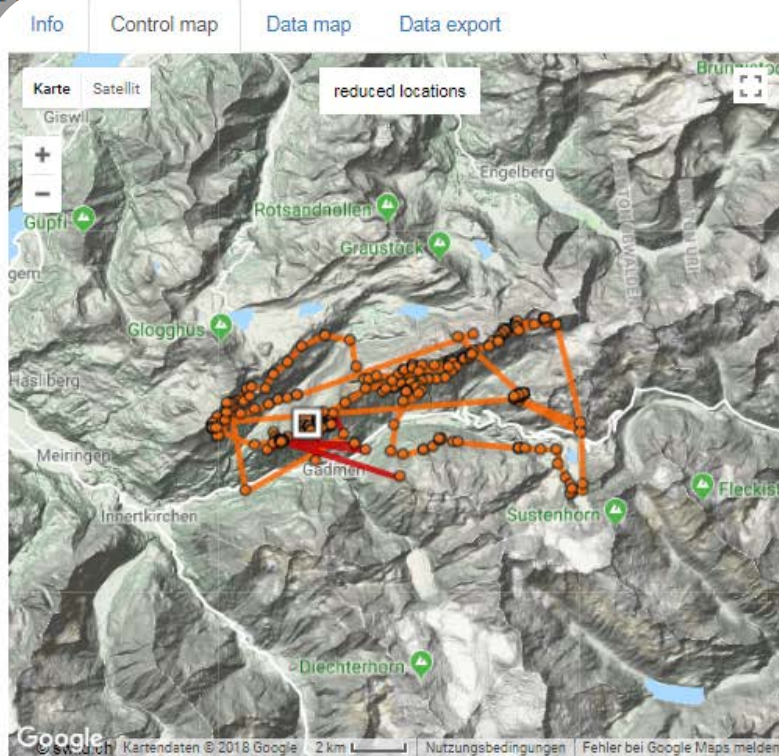
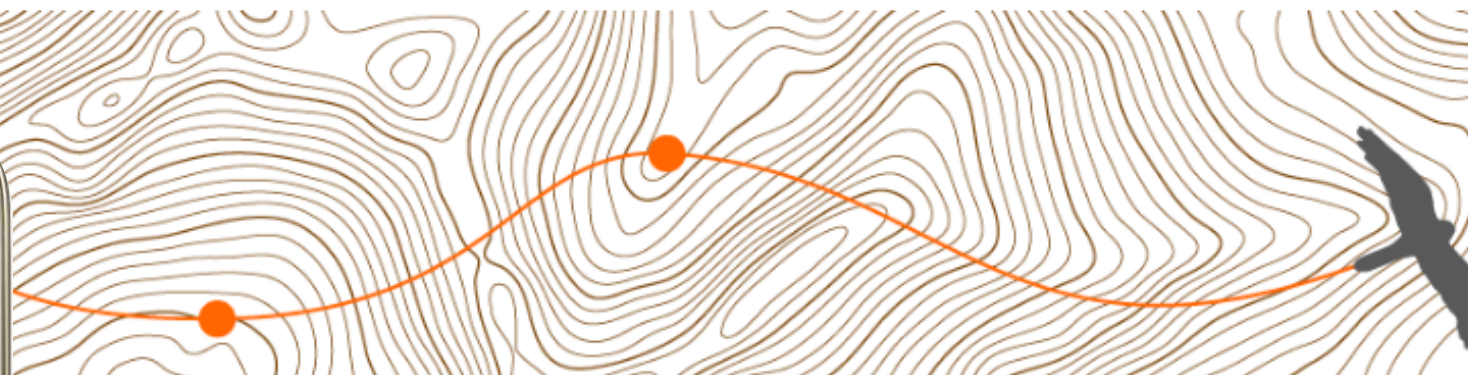
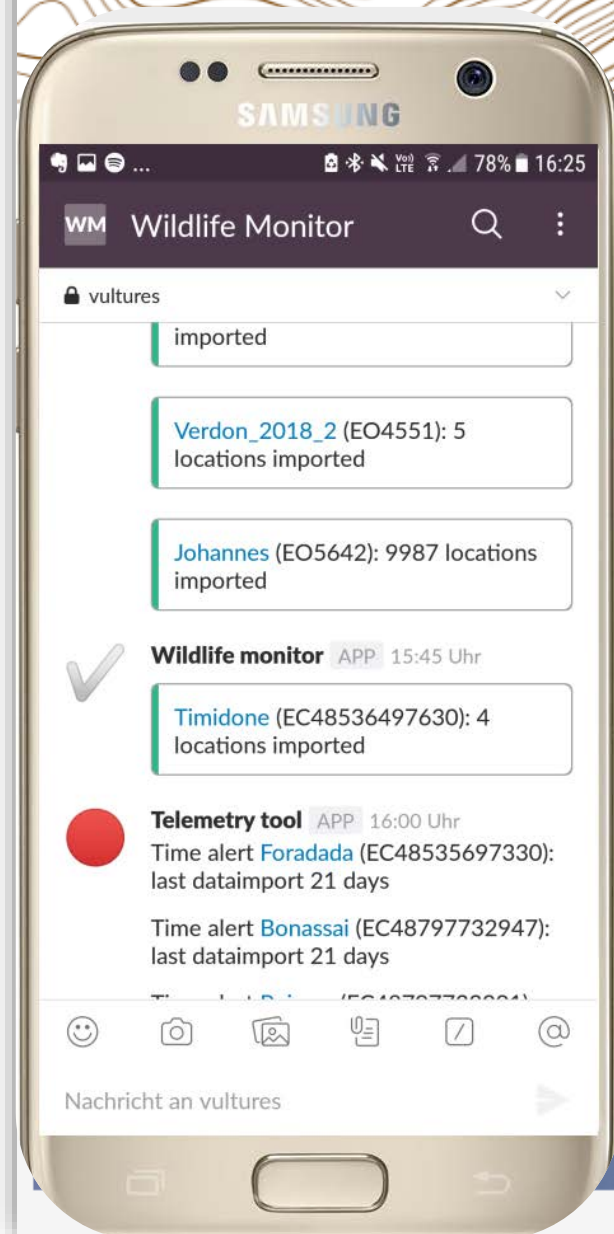


Leg harnesses

Revealed to be animal friendly

- secure drop-off
- free shoulder girdle
- no injuries or skin irritations
- normal behavior
- stable (teflon) and elastic (silicon)
- easy to mount





- Easy handling of different tags & big data sets in one place
- Responsive tool for all kind of mobile devices
- Interface to the mobile App "Slack" for instant information and alerts
- Provision of public maps with reduced data & delayed display

- GPS tagging: Important conservation tool
- Considerable risks (birds, results, reputation)
- Reporting & guidelines important
- Need for species specific marking methods
- Need for effective tools for data control (alerts, control on mobile devices, etc.)
- Make use of additional benefit for public awariness!





Many thanks for your attention

Thanks for contributing!



Published work - Peniche *et al.* 2011

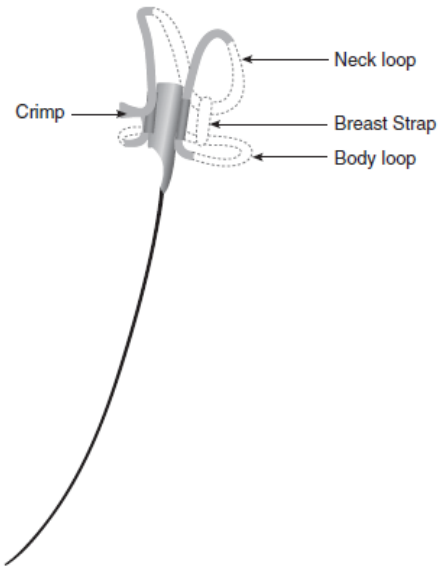


FIG 1: Harness-mounted radio transmitter used on red kites for radio tracking (illustration courtesy of Jeremy Sutherland, British Trust for Ornithology)

Long-term health effects of harness-mounted radio transmitters in red kites (*Milvus milvus*) in England

G. Peniche, R. Vaughan-Higgins, I. Carter, A. Pocknell, D. Simpson, A. Sainsbury



FIG 5: Adult male red kite 925/09. On the dorsal midline two raised lesions of inflamed granulation tissue were evident immediately caudal to the blue radio transmitter

- 4/18 (22%) showed evidence of lesions caused by harness
- Linked to duration of deployment >
- Undetected effects?
- These were early designs

Published work - Gregory *et al.* 2003

Ibis (2003), 145, 113–119

- Reduced reproductive success after trapping

Impact of nest-trapping and radio-tagging on breeding Golden Eagles *Aquila chrysaetos* in Argyll, Scotland

M. J. P. GREGORY,¹ A. G. GORDON² & R. MOSS^{3*}

¹10 Kilmory Road, Lochgilphead, Argyll, Scotland PA31 8SZ, UK

²Balmenach, Borrowfield, Cardross, Dunbartonshire, Scotland G82 5NL, UK

³Centre for Ecology and Hydrology, Hill of Brathens, Banchory, Aberdeenshire, Scotland AB31 4BW, UK

Golden Eagles *Aquila chrysaetos* in South Argyll, Scotland, have been monitored annually since 1964. Other workers trapped and radiotagged breeding adults there for a separate study during 1991–1996. Our analysis of our monitoring data shows that the trapping and tagging was followed by reduced reproductive success (proportion of territories producing young each year). Also, nest-sites where adults had been trapped were used less frequently after the trapping.

Published work - Marzluff *et al.* 1997

J. Raptor Res. 31 (3):223–227

© 1997 The Raptor Research Foundation, Inc.

- Reduced # nestlings in 1/3 years
- Small sample, limited period

PRODUCTIVITY OF GOLDEN EAGLES WEARING BACKPACK RADIOTRANSMITTERS

JOHN M. MARZLUFF¹ AND MARK S. VEKASY¹

Greenfalk Consultants, 8210 Gantz Avenue, Boise, ID 83709 U.S.A.

MICHAEL N. KOCHERT AND KAREN STEENHOF

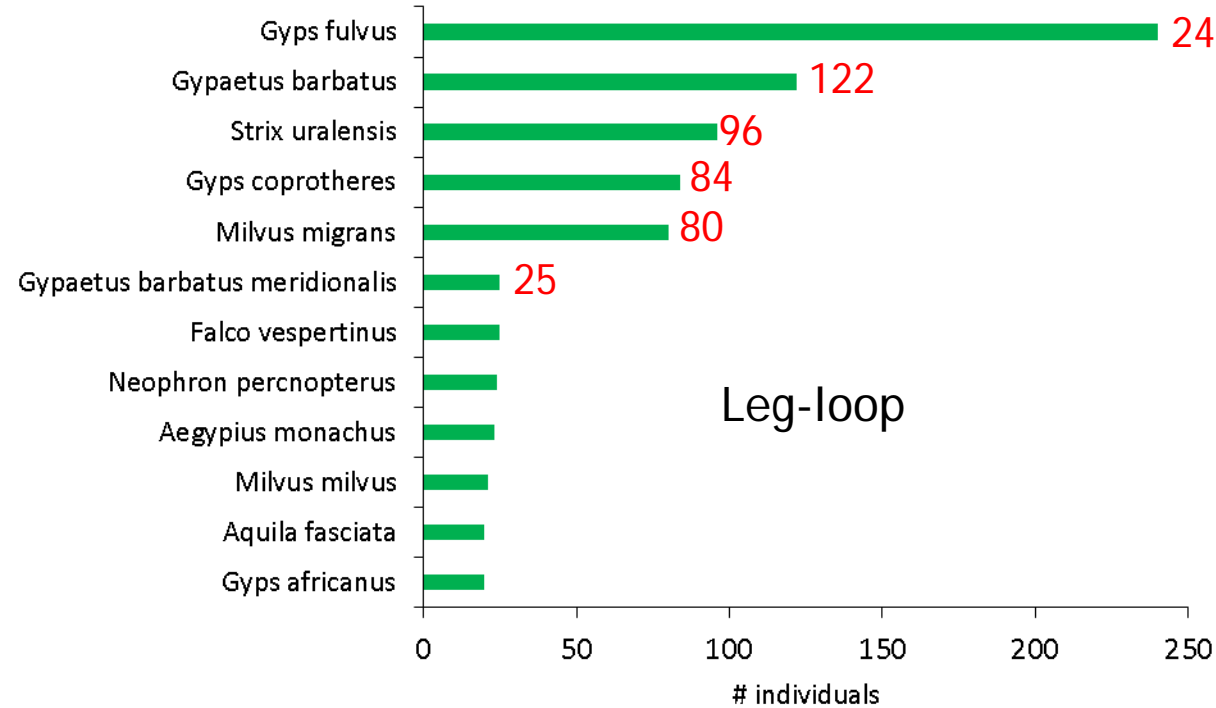
*U.S. Geological Service, Biological Resources Division, Forest and Rangeland Ecology Science Center,
Raptor Research Field Station, 970 Lusk Street, Boise, ID 83706 U.S.A.*

ABSTRACT.—We examined the association between the presence of backpack radiotransmitters and Golden Eagle (*Aquila chrysaetos*) reproduction (percentage of occupied territories producing young, and number of nestlings produced) over three years. The association between radio-tagging and nesting success and the number of nestlings produced varied significantly among years. A negative association with tagging was observed in one of three years, which coincided with low prey (jackrabbit) populations and a cold spring. However, small sample size and breeding by subadults may confound this result.

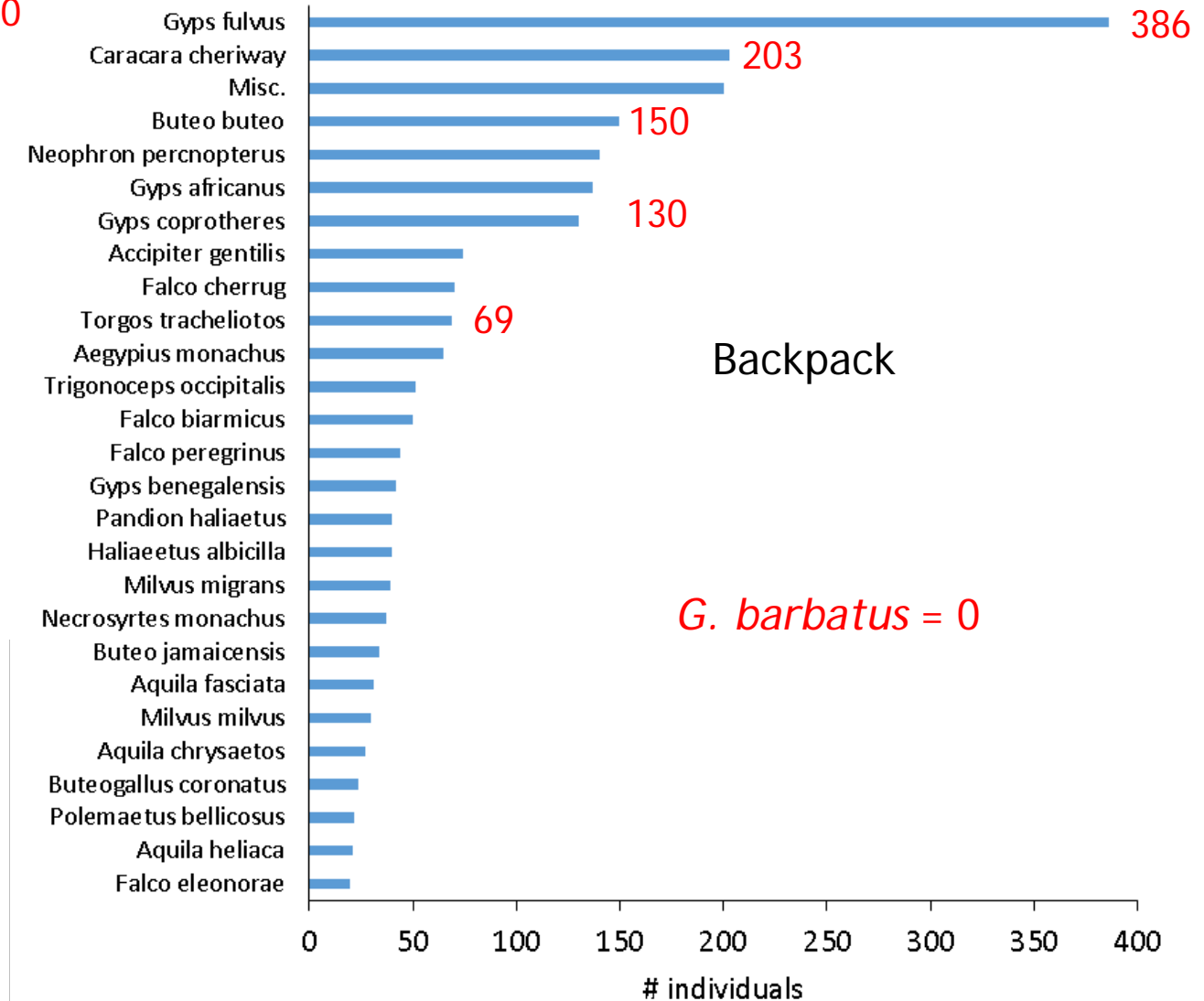
KEY WORDS: *Aquila chrysaetos; Golden Eagle; productivity; radio-tagging; weather.*

Results: SECTION 3: Tracker deployments

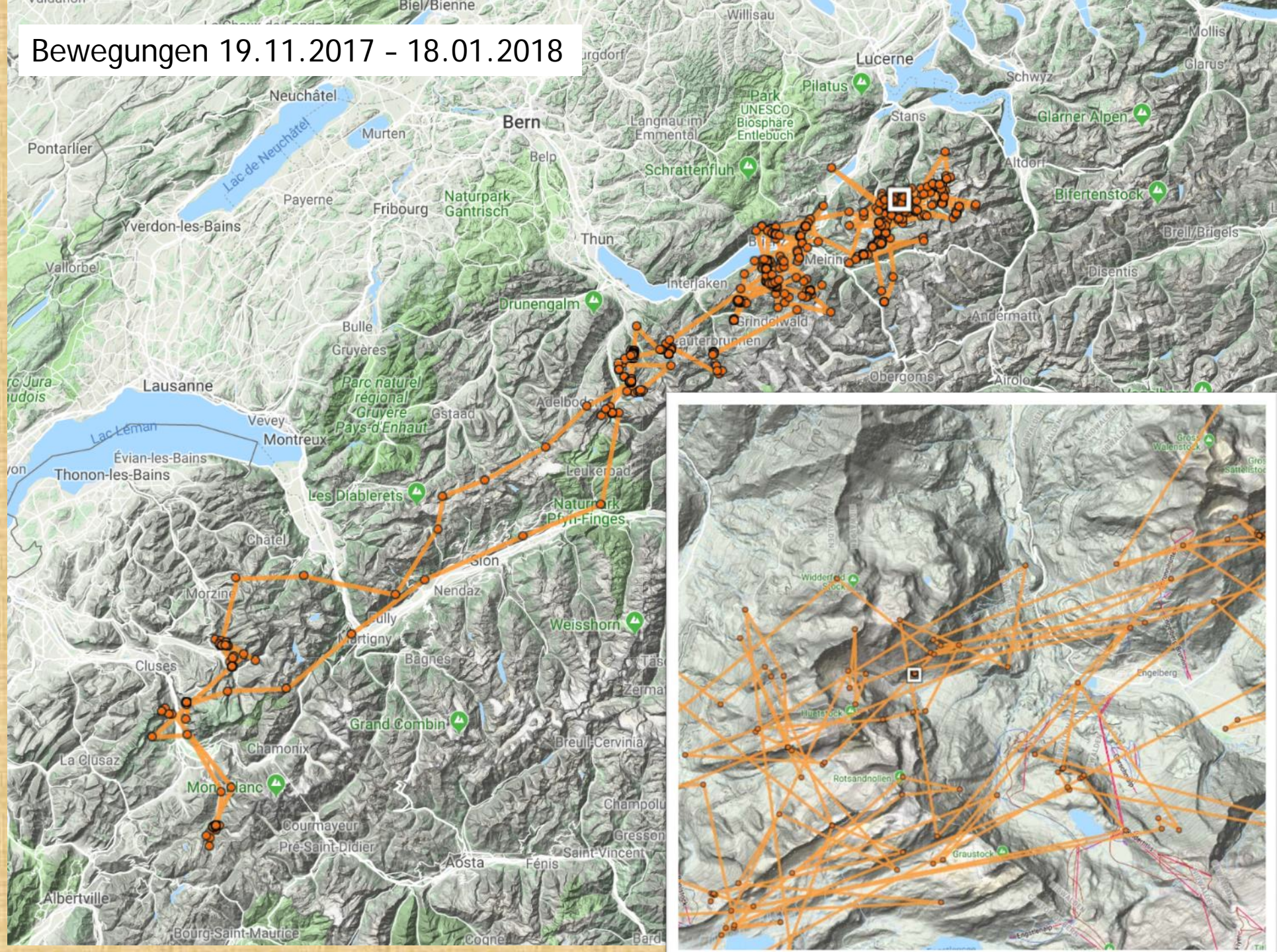
Leg-loop method: individuals per species



Backpack method: individuals per species



Bewegungen 19.11.2017 - 18.01.2018



Alois: 2018-01-17 14:28:43 [UTC] ✕
Lat: 46.8204, Long: 8.34741, Height: 0
Voltage: 3.79, Temp: 0.4
Speed: 0
Course: 0
HDOP: 1.5
VDOP: 4.6
Satellite count: 5
Activity count: 61

Alois: 2018-01-17 15:49:22 [UTC] ✕
Lat: 46.8199, Long: 8.34769, Height: 0
Voltage: 3.78, Temp: -0.3
Speed: 0
Course: 0
HDOP: 2.3
VDOP: 4.5
Satellite count: 5
Activity count: 71

Alois: 2018-01-17 13:12:23 [UTC] ✕
Lat: 46.82757, Long: 8.40031, Height: 0
Voltage: 3.76, Temp: 17.9
Speed: 22
Course: 255
HDOP: 1.5
VDOP: 2.3
Satellite count: 7
Activity count: 35

Alois: 2018-01-17 21:24:58 [UTC] ✕
Lat: 46.82035, Long: 8.34781, Height: 0
Voltage: 3.77, Temp: 5.1
Speed: 0
Course: 0
HDOP: 23.6
VDOP: 6.7
Satellite count: 4
Activity count: 77

Alois: 2018-01-18 08:50:46 [UTC] ✕
Lat: 46.81964, Long: 8.34754, Height: 0
Voltage: 3.75, Temp: 8.3
Speed: 0
Course: 0
HDOP: 2.8
VDOP: 4.6
Satellite count: 4
Activity count: 77

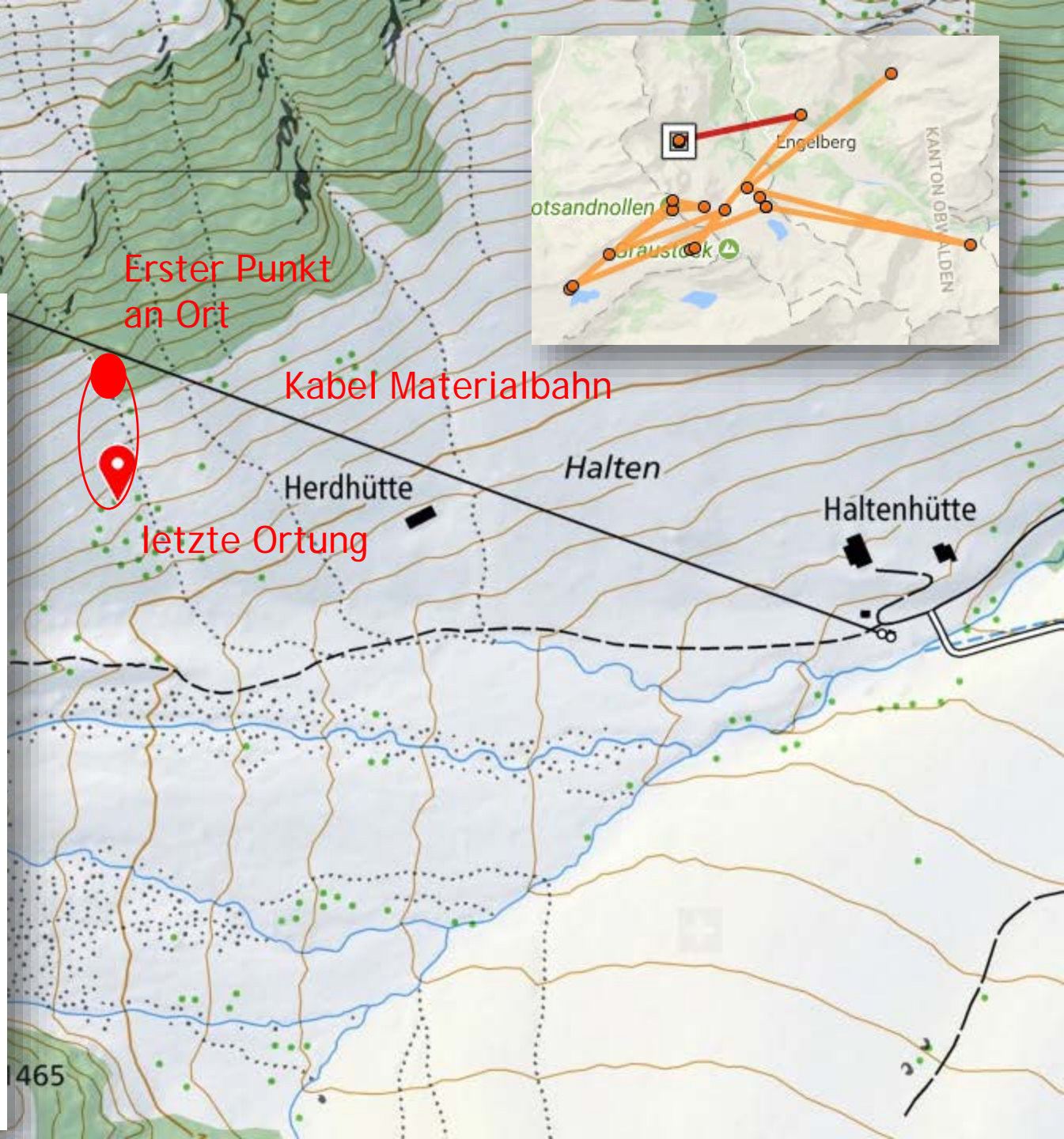
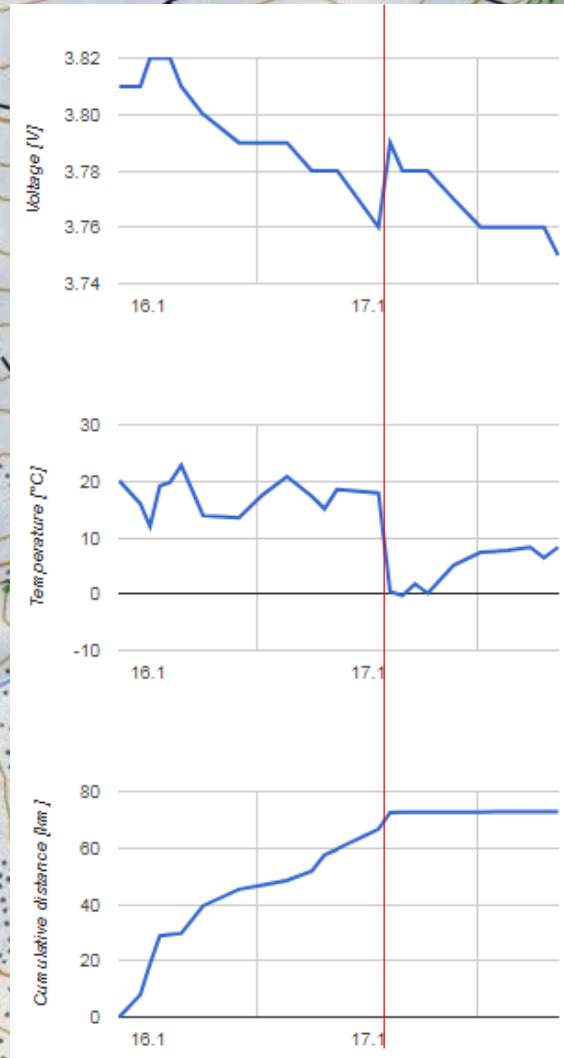


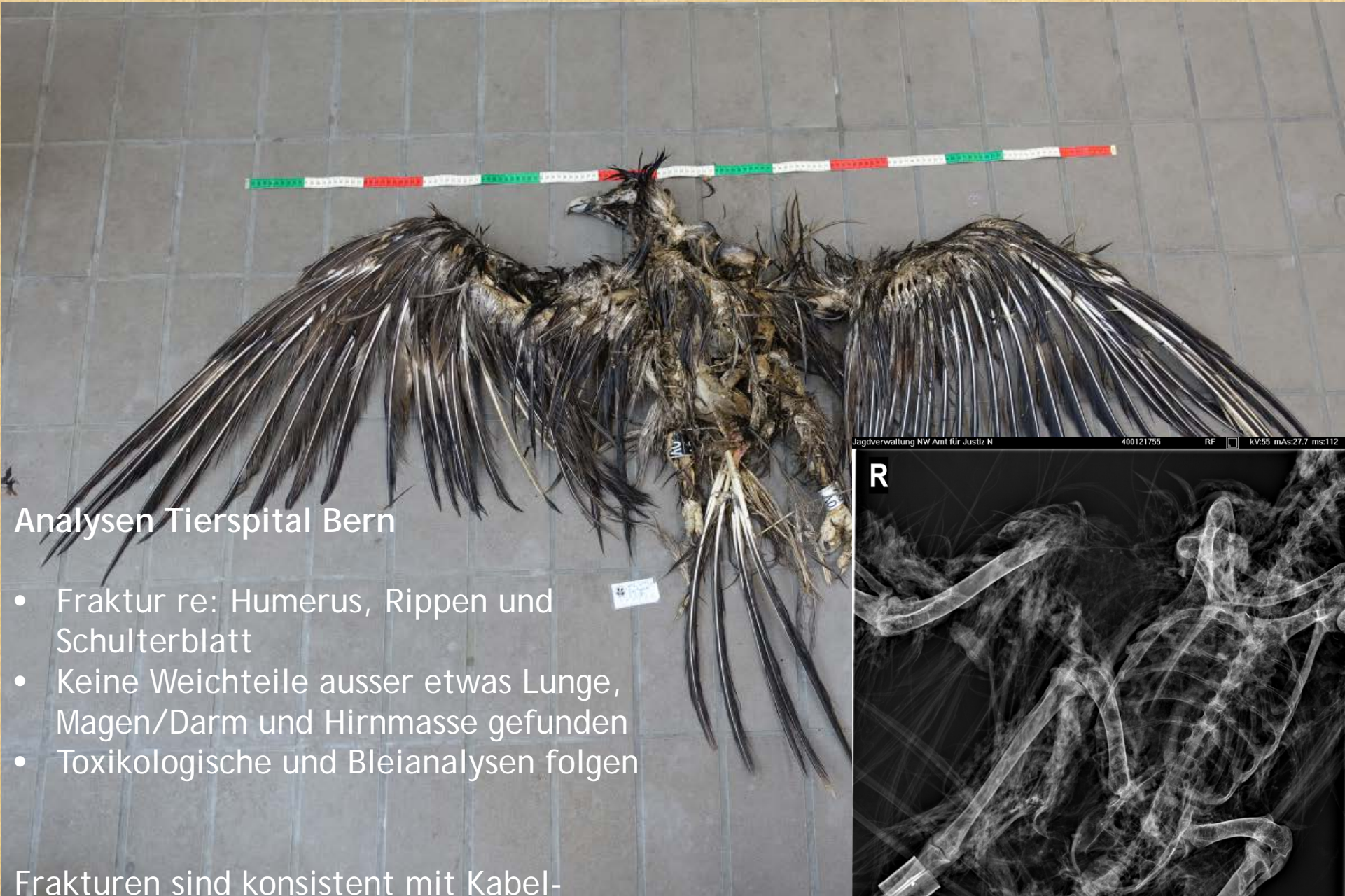
Bild von Wildhüter Werner Durrer



Bereich letzte Ortungen

Sicht von letzten Ortungen

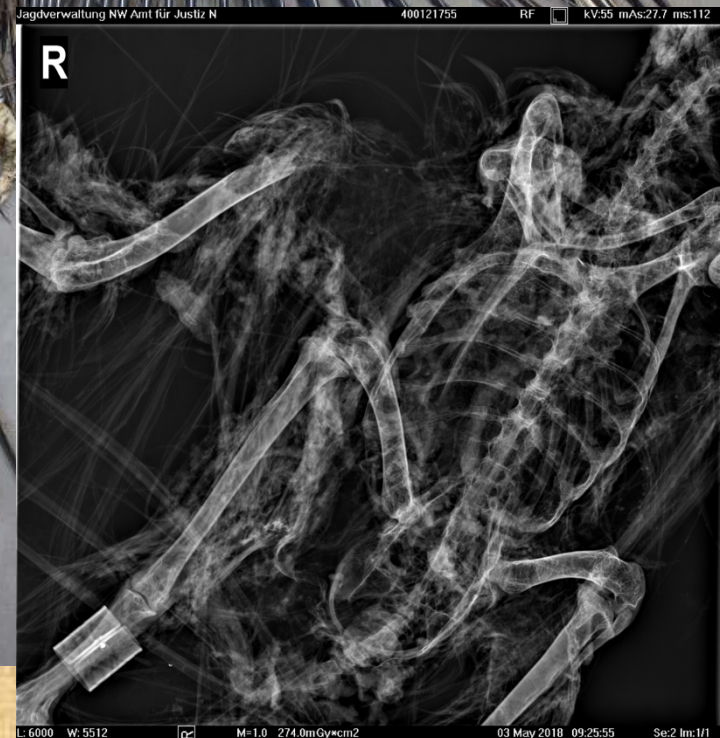




Analysen Tierspital Bern

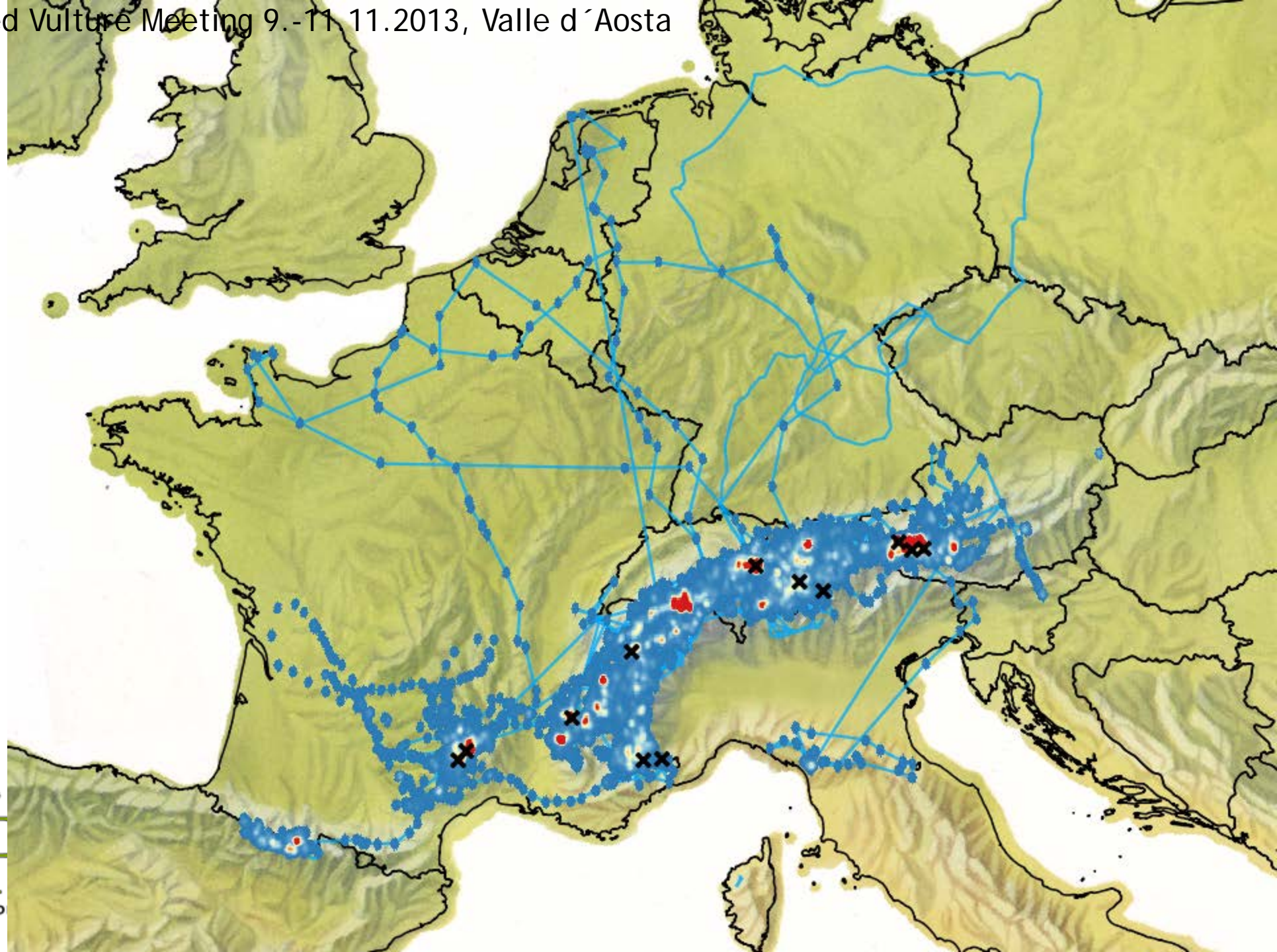
- Fraktur re: Humerus, Rippen und Schulterblatt
- Keine Weichteile ausser etwas Lunge, Magen/Darm und Hirnmasse gefunden
- Toxikologische und Bleianalysen folgen

Frakturen sind konsistent mit Kabel-Kollision





- Definitives Resultate Pathologie?
- Handlungsbedarf?





e-obs

++ burst mode



Microwave

+ performance
- prize



Ecotone

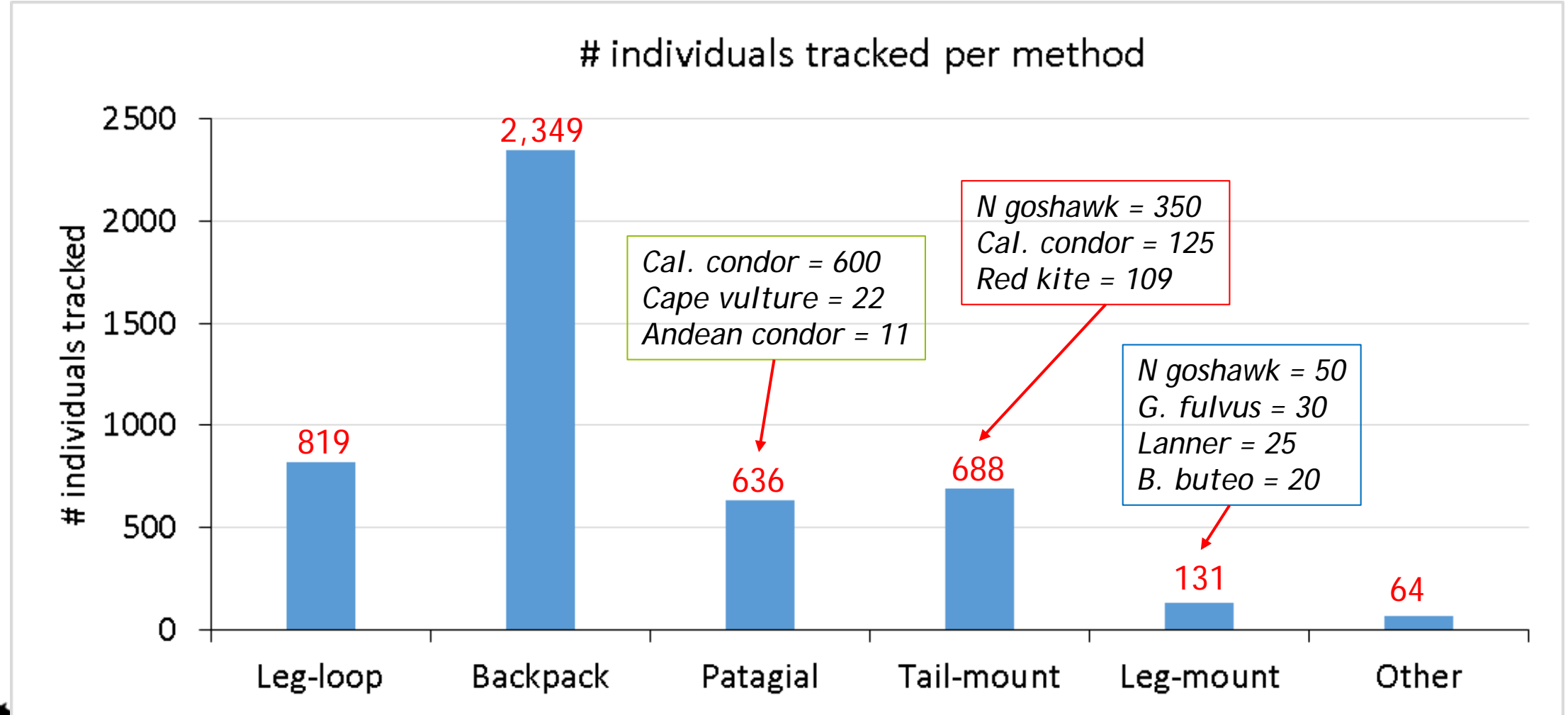
+ uhf / vhf
- - sensitive batteries

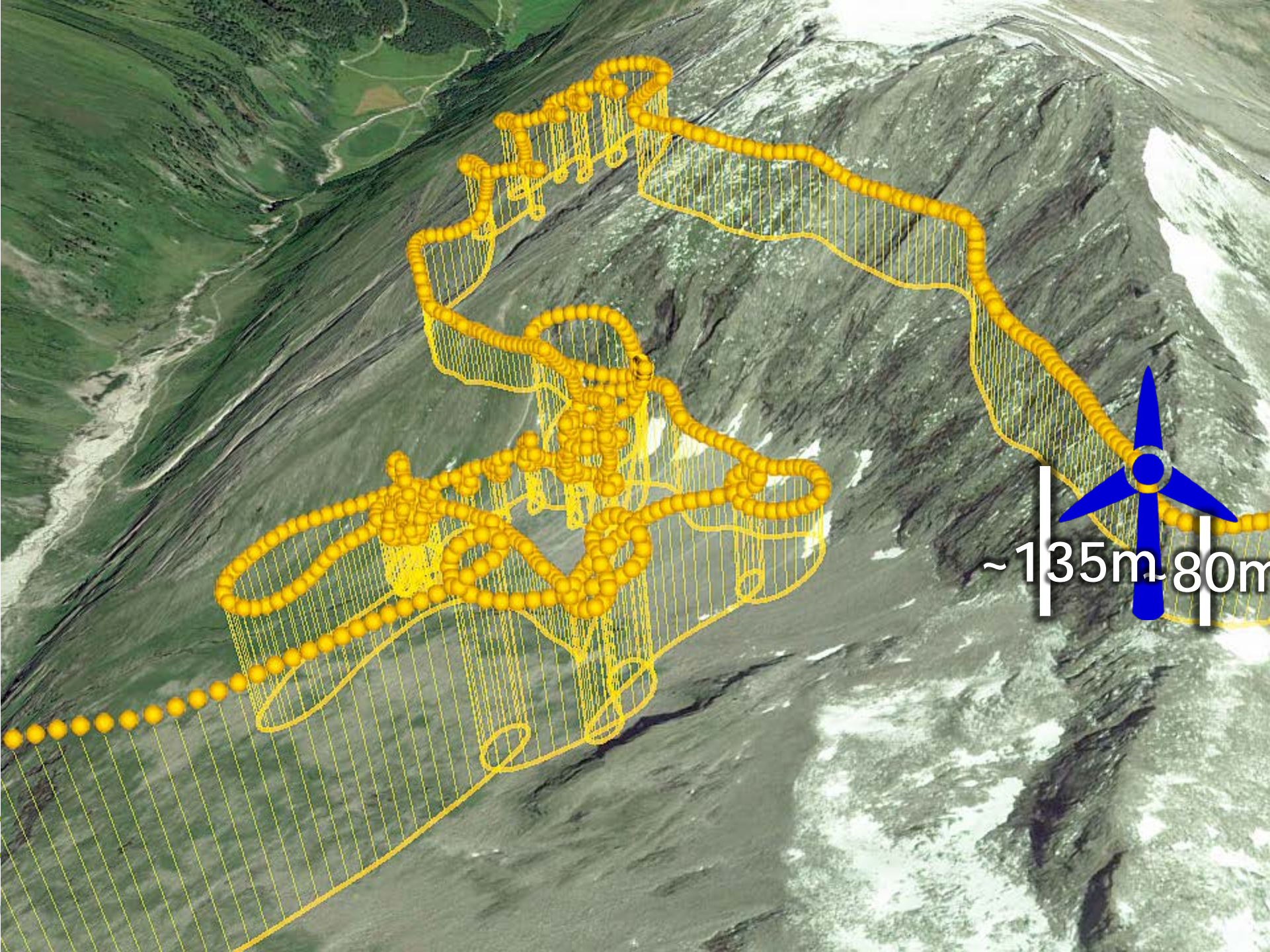


Ornitela

+ prize
+ easy control

Results: SECTION 3: Tracker deployments





No effect of satellite tagging on survival, recruitment, longevity, productivity and social dominance of a raptor, and the provisioning and condition of its offspring

Fabrizio Sergio^{1*}, Giacomo Tavecchia², Alessandro Tanferna¹, Lidia López Jiménez¹, Julio Blas¹, Renaud De Stephanis¹, Tracy A. Marchant³, Nishant Kumar^{4,5} and Fernando Hiraldo¹

- 110 black kites with backpacks, ~4% body mass
- Intensively monitored
- No detectable difference in vital rates or behaviour

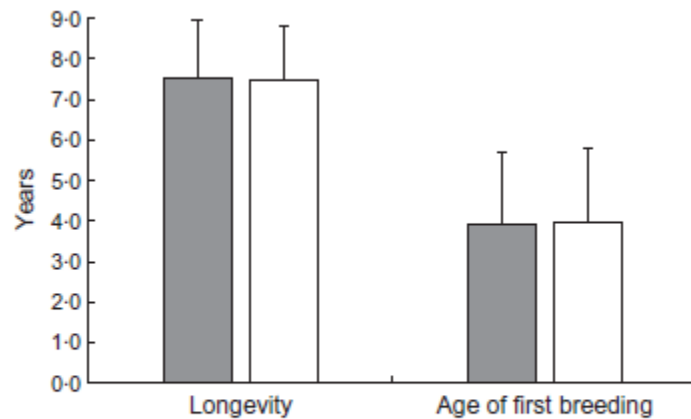


Fig. 3. Age of first breeding and longevity of satellite-tagged black kites (grey bars) and control individuals (white bars). Bars represent mean + 1 SE.

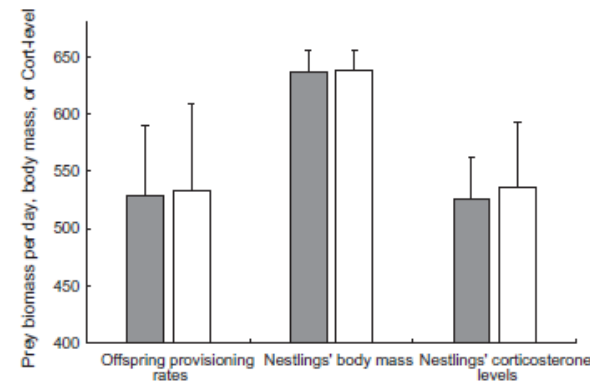


Fig. 6. Prey provisioning rates by adults to their nestlings (grams of prey delivered per day), and offspring body mass (in grams) and corticosterone (Cort) levels in feathers (pg mm^{-1}) for nests of satellite-tagged black kites (grey bars) and control individuals (white bars). Corticosterone levels were multiplied by 50 for clarity of presentation. Bars represent mean + 1 SE.

Using GPS data to detect mortality - Sergio *et al.* 2018

Reliable methods for identifying animal deaths in GPS- and satellite-tracking data:

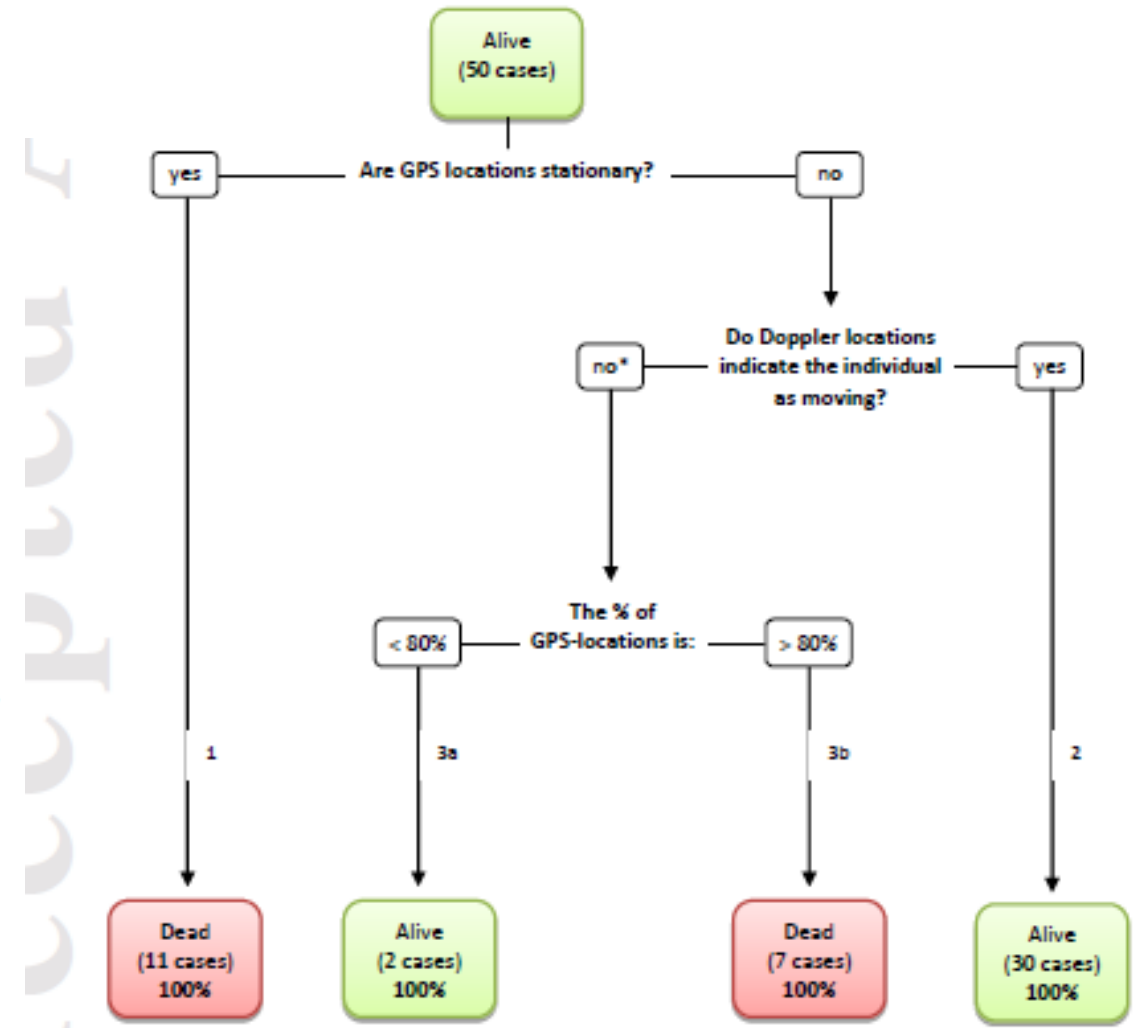
review, testing and calibration

Fabrizio Sergio ¹, Alessandro Tanferna ¹, Julio Blas ¹, Guillermo Blanco ², & Fernando

Hiraldo¹ *Journal of Applied Ecology*

- Useful protocol for detecting mortality and differentiating from tag failure
- Also see: Whitefield & Fielding (2017)

Whitfield, D.P. & Fielding, A.H. 2017. Analyses of the fates of satellite tracked golden eagles in Scotland. *Scottish Natural Heritage Commissioned Report No. 982*.



* Identifies cases in which Doppler locations were too few, too scattered, or of too low LC-quality to discriminate between a moving and non-moving individual.
Numbers (1, 2, 3a, 3b) along the vertical lines identify each branch in the main text.

Context

Tracking data have revealed amazing findings, that have been used very effectively for conservation:

- vast distance that vultures travel in Africa (and elsewhere) have only been revealed in last 5 years
- ability to identify key foraging and breeding locations
- identifying threats such as power lines, wind farms
- revealing migratory bottlenecks - e.g. Buechley's EV work
- monitoring reintroduced and rehabilitated birds
- use of feeding sites
- etc

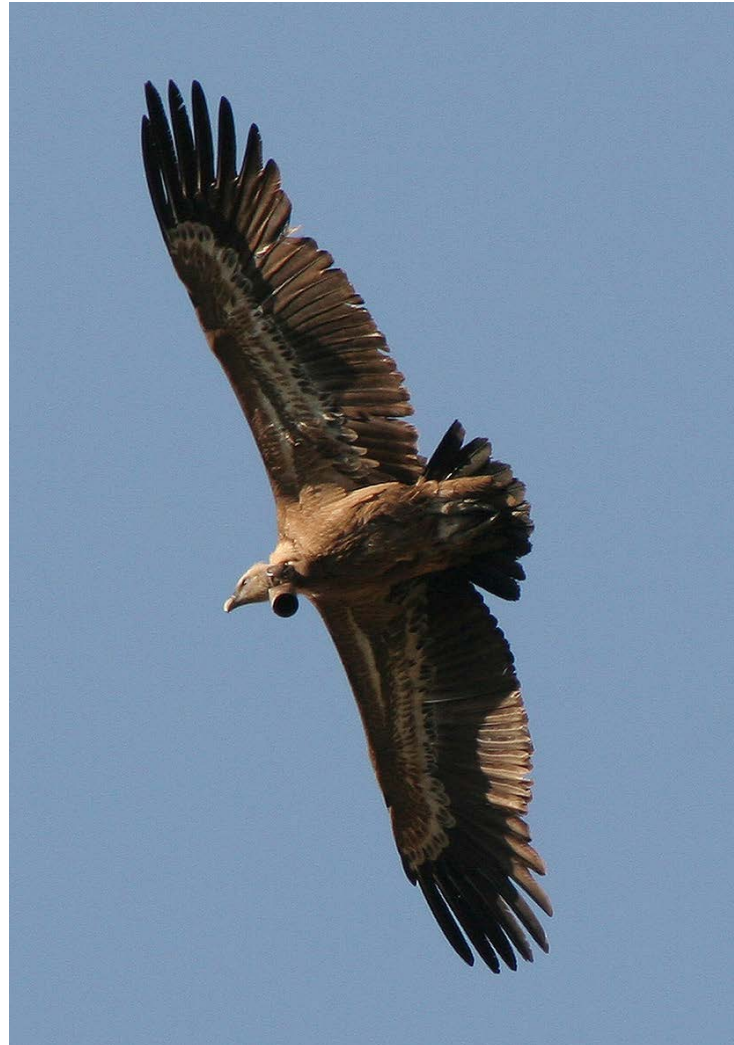




Workshop on tagging and marking of vultures and other raptors

José Tavares, Director, VCF

Munir Virani, Peregrine Fund



Objectives: To discuss the (positive & negative) impacts of different tagging methods, to promote standardized reporting of negative effects, contribute to the enhancement of protocols and guidelines - establish a framework for best practice - this has been addressed for some avian guilds but not yet fully for raptors

