

Satellite tracking of juvenile dispersal in Golden and Bonelli's eagles in Spain.

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In 2002, Terra Natura Biological Station (University of Alicante, Spain) started a research project on the natal dispersal of the Golden eagle *Aquila chrysaetos* and the Bonelli's eagle *Hieraaetus fasciatus* using Argos satellite telemetry technology.

Between 2002 and 2004 a total of 16 Bonelli's eagles and 13 Golden eagles were tagged with PTT in eastern Spain during the breeding season. The nests selected covered a range of latitudes (37° 36' 26'' N - 41° 18' 05'' N).

Six different models of transmitters were used, all manufactured by Microwave Telemetry, Inc.:

1. Argos PTT-100 battery powered 30g (n=6 Bonelli's eagles).
2. Argos PTT-100 battery powered 45g (n=4 Golden eagles).
3. Argos PTT-100 solar powered 35g (n=8 Bonelli's eagles).
4. Argos PTT-100 solar powered 50g (n=6 Golden eagles).

All set on an 8h on / 120h off schedule.

5. GPS/Argos PTT solar powered 45g (n=2 Bonelli's eagles).
6. GPS/Argos PTT solar powered 70g (n=3 Golden eagles).

These new GPS transmitters were only used in 2004. This is the first time this type of PTTs was used to track raptors in Spain. They were set on a 16h on / 3 days off schedule.

Age at tagging was approximately 50 days, when body growth is nearly completed but early fledging is still unlikely. Each nestling was measured, weighed, and fitted with two types of rings (metallic from the Spanish government and PVC to field identification). Transmitters were fixed to the birds' back by a Teflon harness. The four Teflon ribbons were sewn together using silk thread under the animal's breast bone.

This thread will tear after an expected time of three or four years, setting the animal free of the PTT.

A blood sample was taken and used to sex the birds by molecular techniques, resulting in 11 females and 5 males Bonelli's eagles and 7 females and 6 males Golden eagles. These samples were also set aside to be used in population genetics surveys.

Concerning dispersal movements, nearly all the birds left their natal area and settled in temporary settlements after exhibiting a wandering behaviour of variable length. Bonelli's eagles leave the birth area in August, as an average, at a mean age of 142 ± 23 days, earlier than Golden eagles, which do it in September-October as an average, at a mean age of 132 ± 28 days. A tendency of females to leave the nest area before males was observed in Bonelli's eagles, though it was not statistically significant. In contrast, between-gender differences were found when comparing the distances covered by juveniles, with females reaching the furthest locations. The extent of the juveniles' movements either during their wandering period or their settling phase was different between both species. The most distant places reached by Golden eagles were located around 100 km far away from their nests, whereas it was nearly 700 km in Bonelli's eagles.

In Bonelli's eagle a "*the first goes further*" pattern was found, that is, birds leaving the nest area earlier were found in more distant places than those which stayed in the birth area for longer. Several factors could be conditioning this pattern, like food availability or genetic features, though further research is needed in order to entirely understand it. Such a pattern was not observed in Golden eagles.

Most of the juveniles settled in delimited areas, probably with abundance of prey and absence of adult territories. The present work demonstrates that, unlike adults, young Bonelli's and Golden eagles are not territorial, since the temporary settlements they use are overlapped. Furthermore, some of these areas are shared between both species, basically those placed in SE Spain.

Transmitters ceasing was recorded in both species. A total of 9 PTT in Bonelli's and 6 PTT in Golden eagles have stopped working hitherto. Some of them corresponded to assured mortality cases, basically due to accidents with power lines (collision and electrocution). Other mortality causes, like poisoning, were also recorded. In the

remainder of the cases it was not possible to elucidate the cause of the PTT transmitting stop.

The information here presented will be key to take on the most appropriate conservation measures for these species, which must take into consideration the different behaviour and ranging behaviour of juveniles and adults of Bonelli's and Golden eagles in Spain.