

Reintroduction of Bonelli's eagle in Sardinia

Action D.1
Post release monitoring





LIFE PROJECT “AQUILA a-LIFE” (LIFE16 NAT/ES/000235)

BONELLI’S EAGLE (*Aquila fasciata* Vieillot, 1822) HACKING SITE SELECTION

Azione D1: Post release monitoring

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SUMMARY

1.	POST RELEASE MONITORING AND SURVIVAL OF RELEASED ANIMALS	4
2.	MOVEMENT AND DISPERSION	5
3.	SIGNIFICANT DISPERSION AREAS.....	9
4.	CONCLUSION AND FUTURE PERSPECTIVE	10

1. POST RELEASE MONITORING AND SURVIVAL OF RELEASED ANIMALS

By the end of 2018, all the animals, except A05, are alive.

In November, at approximately 5 months of age, A05 died in the area where it dispersed and probably settled (Rio Palmas, approximately 190 km away from the release site). The cause of death was an encephalitis caused by West Nile virus. Necropsy was carried out by the Istituto Zooprofilattico of Cagliari, the public institution tasked with official diagnosis of animal disease according to Italian legislation. It was found death in a creek, in the vicinity of a dead Grey heron (negative for west Nile): most likely, the ongoing encephalitis didn't allow the bird to hunt properly, move and feed, although digested meat was found in its gut.

On 12/9 A04-Tepilora was re-captured in Muravera (approximately 130 km away from the release site) after very limited movements shown in the previous days. It was hosted at the recovery center of Monastir where it received first aid and, after two days, it was transferred to the hacking cage in Tepilora Regional Park, where she stayed for another 12 days before being released in nature, on September 27th. Upon capture, it seemed to be malnourished, but quickly and fully recovered within few days.

Name	PVC Ring	Origin	Sex	Birth date	Arrival	Release from the nest	Release in nature	Date of death
Abbaluchente	A01	LPO	F	4-5-18	29-6-18	17-7-18	20-8-18	
Helmar	A02	LPO	M	5-5-18	29-6-18	17-7-18	20-8-18	
Posada	A03	LPO	F	7-5-18	29-6-18	17-7-18	20-8-18	
Tepilora ⁱ	A04	LPO	F	9-5-18	29-6-18	17-7-18	20-8-18	
Nurasè	A05	GREFA	F	29-5-18	24-7-18	02-8-18	20-8-18	7-11-18
Saccaia	A06	Andalucia	F	10-4-17	15-12-18	-	21-12-18	

ⁱ Recaptured on 12/9, second release on 27/9

Tab. 1 List of the Bonelli's eagles hacked in 2018, in Tepilora Regional Park as the first selected release site for the project. PVC rings are yellow with black inscriptions. Eagles were also fitted with metal rings and GPS-tags (data omitted).

2. MOVEMENT AND DISPERSION

To check for any settlement up to 31 December, net squared displacement (NSD – net squared Euclidean distance between the release site and all subsequent locations) was used, to highlight movement *i)* within approx. one month after the release (30 September) and *ii)* up to 31 December. NSD highlights quite clearly the movement away from the release site as well as any settlement at a certain distance from the release site.

The eagles left the hacking site within 7-19 days; almost all animals, except A06-Saccaia, explored the whole island, showing directional dispersion towards south-west Sardinia (Sulcis), and preference for wetlands and lakes.

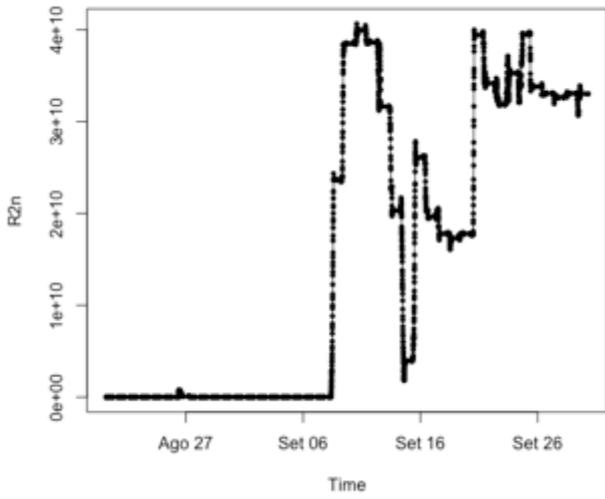
A01 and A03 remained longer around the release site (Fig. 1): A01 left on 8 September after short movements around the release site, A03 made some “out-in” movements around the hacking site, leaving definitively on 16 September. It was at the hacking site when A04 was back in the cage, showing an aggressive and territorial behavior against the eagle in the cage.

A04, A05 and A02 left the site around 27 August, the first two moving straight towards south, the male moving more slowly and stopping frequently. Upon the second release, on 28/9/2018, A04-Tepilora moved straight back to Muravera, the site where she had been recovered, and flew also upon the Recovery Centre of Monastir (45 km apart), the place where it had received first aid upon its recovery.

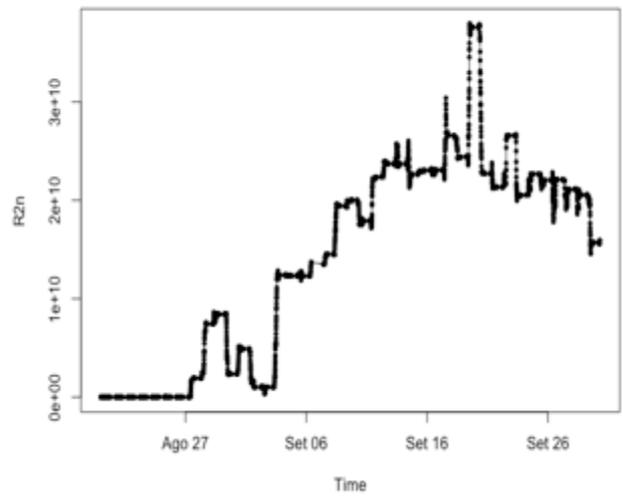
All animals visited at least one of the small islands surrounding mainland Sardinia, like Tavolara (A03), S. Antioco (A01, A04, A05), S. Pietro (A04, A05). Even if A03 visited La Maddalena Archipelago, which is the closest site to Corsica, it didn't leave Sardinia.

Within all eagles (Fig. 2), only A05-Nurasè seemed to be settled, making only short, infrequent excursions, around the area of Rio Palmas (Sulcis Iglesiente, southern Sardinia). The river is surrounded by set-aside agricultural fields and wetlands, with a highly diverse and locally abundant preys. Due to very limited movements of the eagle in the area, several surveys have been made to locate it and check its conditions: it has been observed several times, in very good conditions and with full crop.

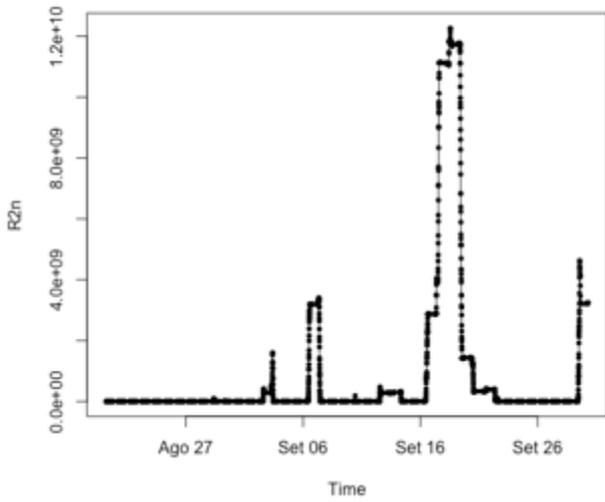
A04-Tepilora as well appears to have settled at a distance of less than 10 km from Nurase's range. However, by the end of December, all eagles showed a strong spatial instability; all of them, except the male, moved again to the north, where some of them visited new areas. The male A05 moved towards the south east and then back in central Sardinia.



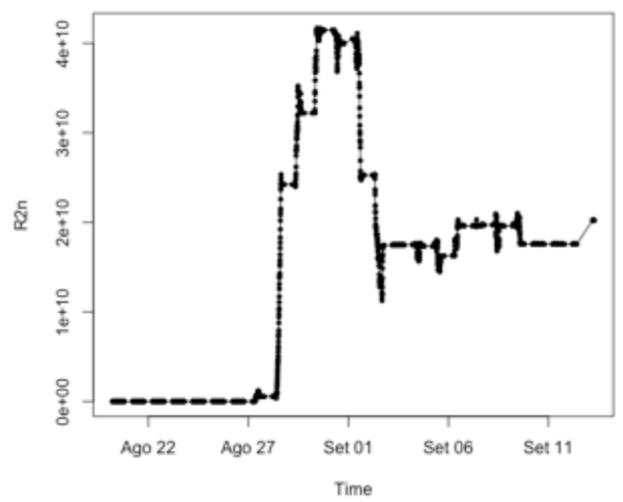
A01-Abbaluchente



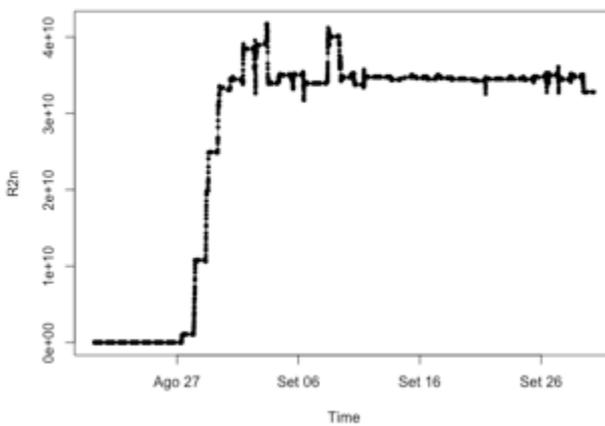
A02-Helmar



A03-Posada



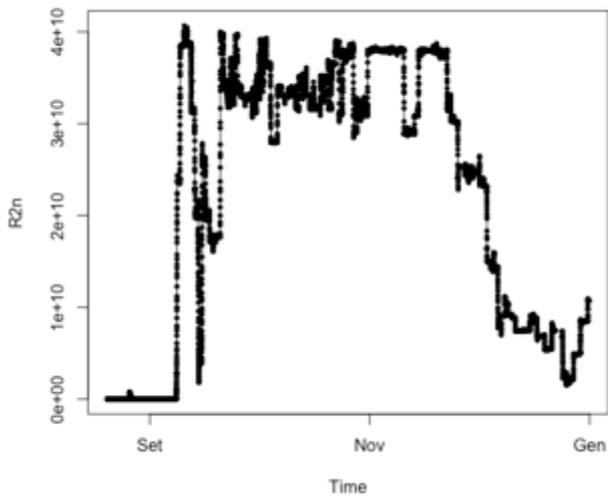
A04-Tepilora



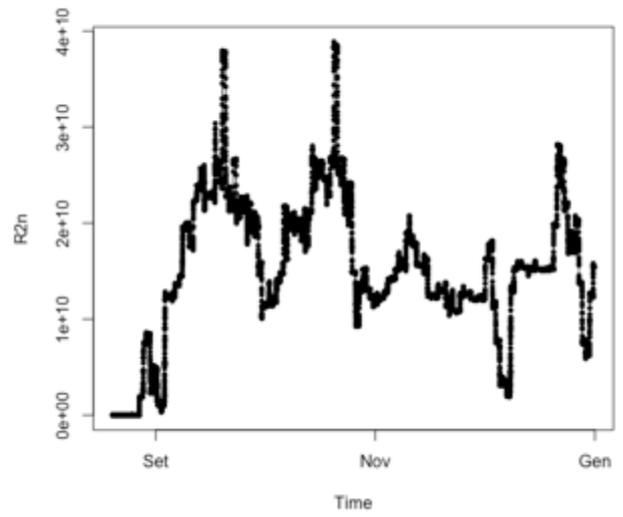
A05-Nurasè

Fig. 1. NSD of the released eagles between the day of release and the end of September. Irregular trajectories, i.e. variable time lag between locations.

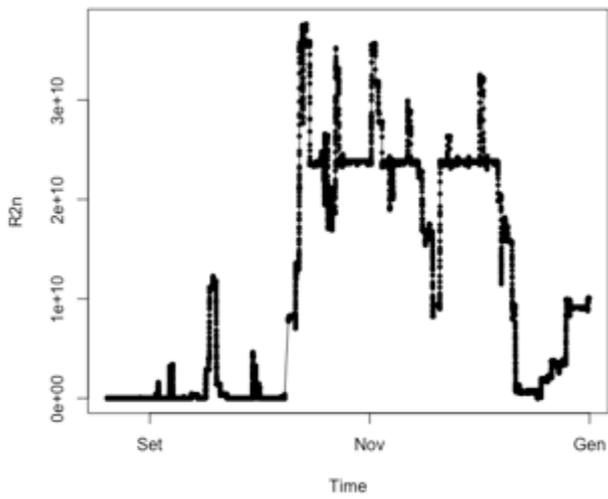
Fig. 2. (next page) NSD of the released eagles between the day of release and 31 December



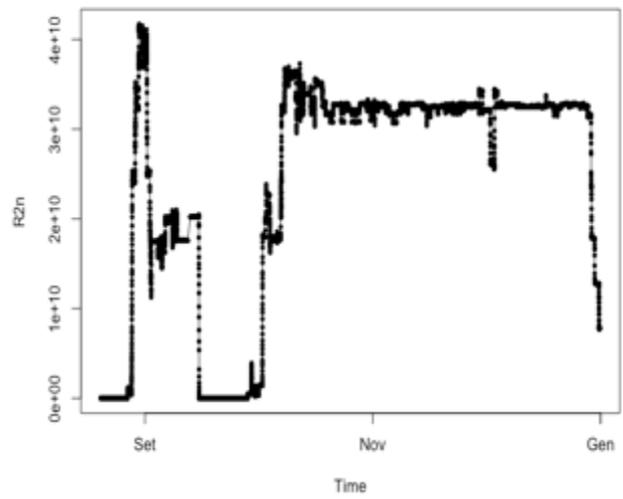
A01-Abbaluchente



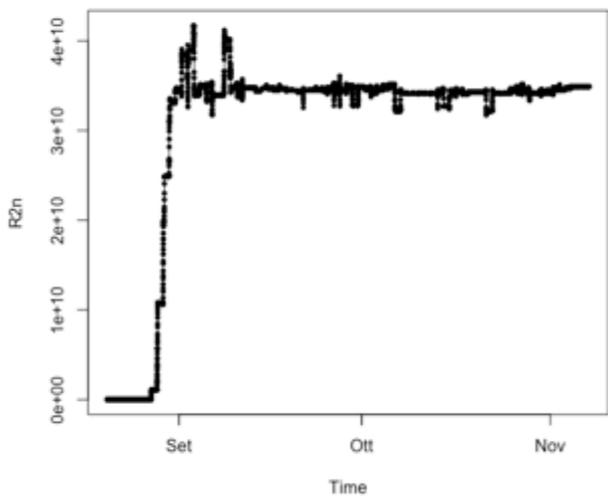
A02-Helmar



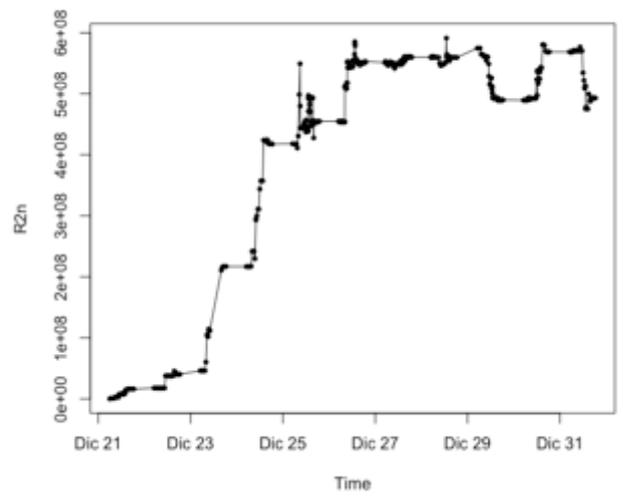
A03-Posada



A04-Tepilora



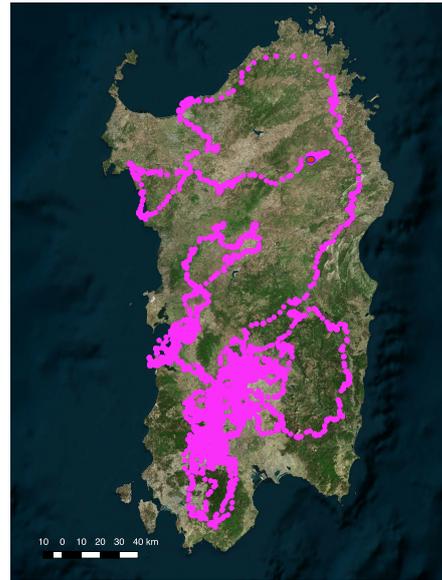
A05-Nurasè



A06-Saccaia



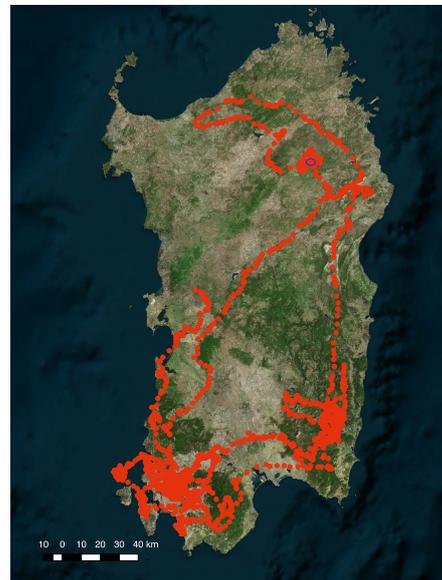
A01



A02



A03



A04



A05



A06

Fig. 3 Movement of the released eagles from 20 august to 31 December 2018

3. SIGNIFICANT DISPERSION AREAS

Based upon Bonelli's eagles movements up to 31 December, several highly frequented areas can be identified (Fig. 4). Although the eagles roamed across almost all the island, these areas have been visited repeatedly by different animals and/or have been frequented for periods of time. The area of Sulcis (south Sardinia) has been visited by all the released eagles, except A06 Saccaia, which however has been released in December and therefore didn't have yet enough time to explore the region; two of them – Tepilora and Nurasè – probably settled there.



Fig. 4 Areas highly frequented by the 6 released eagles, from 20 August to 31 December 2018. Green: Sulcis; orange: Campidano-Marmilla; grey: Oristanese.

The area is characterized by plains and hills, but Monte Arcosu and Monte Linas (in the south and west respectively) might offer suitable nesting sites in the future.

The Campidano-Marmilla area is basically a cultivated plain connecting Cagliari to Oristano, characterized by scattered hills and surrounded by Monte Arcosu and Monte Linas (SW), by the isolated Monte Arci to the north and the south-western slopes of Gennargentu Massif. The male A02-Helmar stayed longer in this area, which was crossed by the other eagles too.

The Oristanese is located along the western coast and it's rich of wetlands and cultivated plains. Monte Arci and the northern slope of Monte Linas represent the only mountains present in the area; however, there's high availability of cliffs along the coast. This area is particularly attractive for the eagles because of the presence of wetlands and rice fields, which offer a high variety/availability of prey species.

4. CONCLUSION AND FUTURE PERSPECTIVE

The first period of monitoring up to 31 December only provides a partial view of spatial use and movements during dispersion and before settlement. The post-release phase is however critical; the analysis of behavior and movements soon after release helped to identify any risk for their survival within the release site as well as all the improvements needed both in the nest/cage and outside, stated that hacking will be carried out again within Tepilora Regional Park, in 2019.

As for the first aspect, e-distribuzione managed to retrofit part of a power line within 5 km from the hacking cage, located in an area frequented by the eagles in the days immediately following release.

As for the second point, we identified the most used platforms and feeding points outside the cage, so that the surroundings will be re-arranged accordingly, in order to facilitate prey detection and consumption. The cage will be also improved to facilitate animal monitoring, both while in the nest and in cage, and to set up the surveillance system.