REINTRODUCTION OF THE OSPREY

(*Pandion haliaetus*)

IN PORTUGAL

Annual Report 2014

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INDEX

SUMMARY

In continuation of the Osprey (*Pandion haliaetus*) reintroduction in Portugal, which began in 2011 in the Alqueva reservoir and aims at establishing a founder breeding population in the area, 11 nestlings were translocated in 2014, 5 from Sweden and 6 from Finland. These young finished their development in the hacking tower at the shore of the Alqueva reservoir, within the Roncão estate, which belongs to the Casa de Bragança Foundation. Ten fledglings were released 20 – 22 days later, after being equipped with radiotags. The remaining juvenile was released only 50 days after arrival because of need to recover from skeletal lesions. After release, the birds remained in general around the area from 31 to 52 days until dispersal/migration. However, as in previous years, two fledglings dispersed prematurely, just 4 days after release. The birds were primarily fed with fishes caught in the reservoir, having been provisioned with c. 52 kg of fish during their stay in the tower and c. 165 kg after they were released. As a relevant clinical event, there was the fracture of the wishbone in one individual (P86) that was detected at Lisbon airport upon arrival. Later, a second fracture of the right ulna and a malformation of the right humerus head were observed in the same bird. At first the bird was maintained in the tower and then in a flight pen at the RIAS rehabilitation centre until recovery. After its final release and though seeming reasonably recovered and well reintegrated among the other birds, it suffered a lethal accident.

INTRODUCTION

The Osprey Reintroduction Project aims at the reestablishment of the species as breeder in the wild in Portugal. It was an initiative of CIBIO – Research Centre in Biodiversity and Genetic Resources with the financial support of EDP Energias de Portugal and the institutional collaboration of the Casa de Bragança Foundation, which owns the estate where the project facilities are located, and of EDIA (company that manages the reservoir) and ICNF (Nature Conservation and Forests Institute).

The ultimate goal of the project is contributing to the reestablishment of a breeding Osprey population in its historical range along the Portuguese coast, from where it disappeared as a breeder at the beginning of the present century. The project is part of the international efforts to recover the osprey across the Mediterranean region, where its populations are currently small and endangered.

The project is to be developed stepwise, and the goal of the present stage is the establishment of a viable founding breeding nucleus in an area of suitable ecological conditions – the Alqueva reservoir. For that, 10-12 young per year are translocated from Finland and Sweden to a hacking tower located in the Monte do Roncanito, Roncão estate, at the Alqueva reservoir. The project is implemented in the strict agreement with the pertinent national, international, and donor countries' legislations.

The present report summarises the development of the project in 2014, the fourth and second-to-last year of translocation, adaptation and release of osprey young in the Alqueva reservoir, including the adjustments and improvements introduced.

TRANSLOCATION AGREEMENTS

Provision of nestlings

In 2014, the agreement established in 2011 with the Finnish environmental authorities concerning the yearly provision of 5 to 10 young/year until 2015 was maintained. As for Sweden, as the agreement held since 2011 expired in 2013, an application was done for the agreement renewal up to the end of the project in 2015. This was accepted by the Swedish environmental authorities. Therefore, 6 nestlings from Finland and 5 from Sweden were transferred to Portugal in 2014.

INFRASTRUCTURES

Hacking tower

Ramps were attached to the inner edge of the nest supporting wooden frames (**Fig. 1**) in order to eliminate the risk of the birds introducing the hind limbs between the frame and the nest material, a potential cause of serious injury to leg tendons as observed in two previous cases.

Photo Jorge Safara

Figure 1. The arrow indicates the ramps placed inside the nest base frame to prevent tendon injuries.

Nests inside the pens were built with branches of broom (*Retama sphaerocarpa*), and this year lined only with moss and some terrestrial lichen. We abandoned the use of reedmace (*Typha* sp.) because in 2013 we realised that birds legs could get entangled in the leaves fibres during their first days in the tower, possibly leading to injuries. We confirmed that moss is the best option for nest lining in the tower (even better than lichens) as it makes the movement of the birds easier on the nest and also because it keeps in good conditions till the opening of the pens (**Fig. 2**).

Photo Luís Palma

Figure 2. Nest lining with mosses and lichens on top of broom bed.

In 2013, we realised that placing food directly on the nests eased up consumption by the birds as it avoids them being forced to come down from the nest to feed, as they are reluctant to do that. This way, the amount of unconsumed food on the cage bottom is reduced, thus lessening considerably the need of cleaning. However, the method used in 2013 needed the insertion of the "spoon" (see 2012 Annual Report, p. 19) through the holes on the rear panels to deliver the food on the nest, which implied a noticeable reaction and disturbance of the birds.

Therefore, to avoid this disturbance in 2014, we changed the way of inserting food. We adapted a sleeve with a flexible base to the inside of the feeding holes with the necessary length to deliver the food directly onto the nest. This way the birds could only see the extremity of the "spoon" as its slides all the way within the sleeve (**Fig. 3**).

Photo Jorge Safara

Figure 3. Feeding sleeve for unobtrusive food delivery directly on the nest.

This adaptation decreased the reaction of the birds to food delivery, even more that when food was thrown in through the original short PVC tubes used in 2011 and 2012. The shortcoming is that food remains infiltrate through the moss layer leading to putrefied leftovers impossible to remove while the birds are still in the cages. This problem will be corrected in 2015 (see *Project improvements*, p. 34).

Video monitoring (CCTV)

We maintained the monitoring of the bird behaviour by colour and infra-red CCTV cameras inside the cages that can be viewed at the field base, as well as by direct viewing through the on-way mirrors of the tower back walls.

Floating fish cage

In 2014, the daily provision of fresh fish to the young was obtained by fishing in the reservoir. The floating cage was used as a reserve stock of live fish, used only when daily fishing yielded insufficient quantities.

Feeders and Artificial Perches

The feeders remained unchanged. Like in 2013, fish was placed only in the three feeders closer to the hacking tower, the only ones used by the birds. To replace the artificial perches attached to the dead holm oaks logged in 2013 (see 2013 Annual Report), 24 new perches were newly set up along the shore, but this time fixed to live oaks.

Artificial nest platforms

Three new nest platforms were installed in islands in the three areas in the vicinity of the hacking area more often used by visiting ospreys. The old platforms were replenished with more plant material (**Fig. 4**).

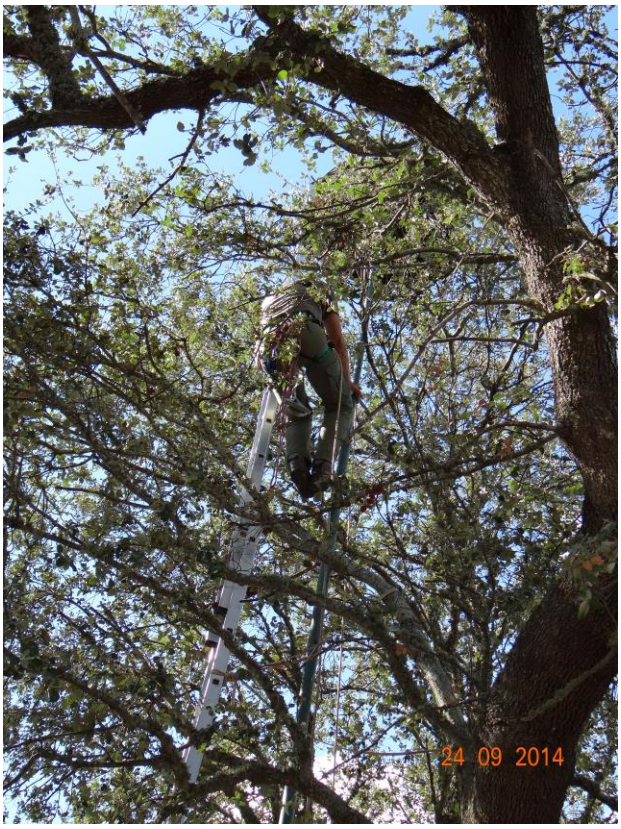

Figure 4. The project technician João Ferreira climbing up an artificial nest platform to refurbish its contents.

Photo Luís Palma

With the installation of these new platforms, the total number of nest platforms erected in islands across the reservoir grew up to 9 (**Fig. 5**).

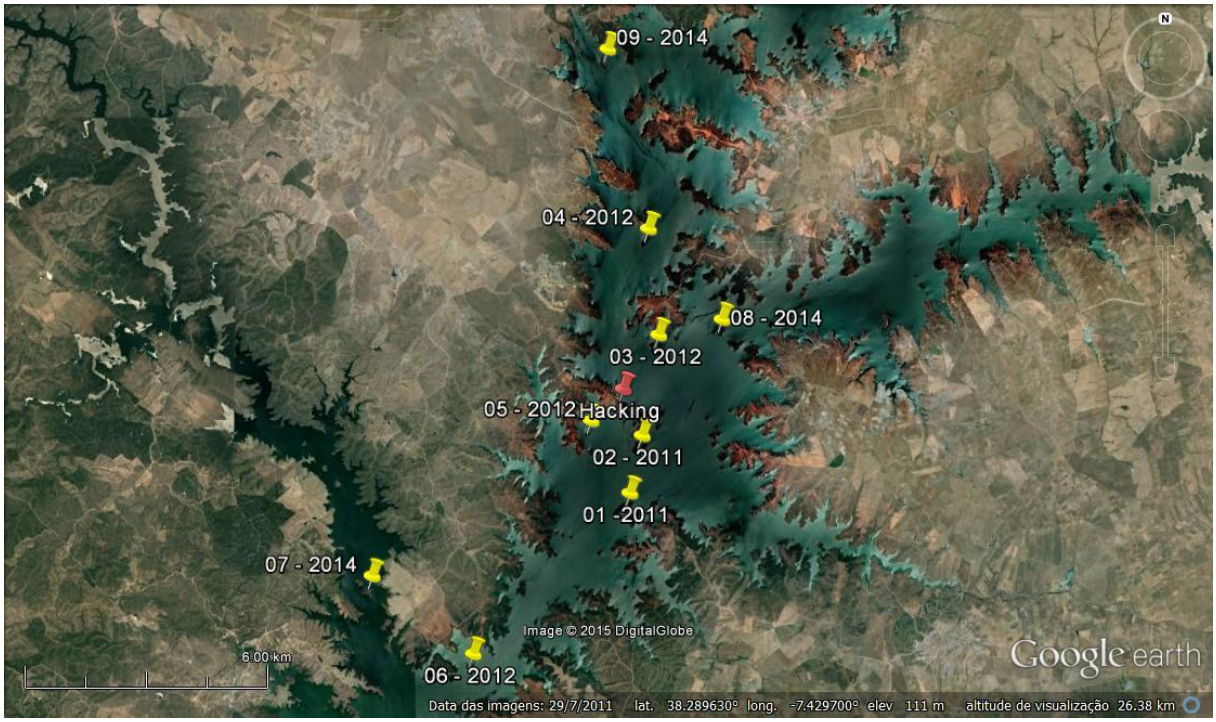

Figure 5. Distribution of the nest platforms installed in 2011 (2), 2012 (4) and 2104 (3), and location of the hacking site.

REINTRODUCTION

Nestling collecting and veterinary certification

In 2014, the nestling collecting, maintenance, ringing and transportation procedures in the countries of origin remained unchanged. As in 2013, the veterinary certification followed the requirements of the Directorate General of Food and Veterinary (DGAV). Thus, in both countries the veterinary authorities issued certificates on the occurrence of infectious pathologies. Moreover, the birds were checked prior to boarding by veterinary officers who issued the respective health certificates, declaring that the birds didn't show clinical signs of infectious disease.

Transportation and clinical examination of the nestlings

As in previous years, the juveniles were flown by direct flights from Helsinki and Stockholm to Lisbon, where they arrived at the end of the day and later taken by car during the night to the hacking site. This way, the high summer temperatures were avoided. Five juveniles from

Sweden and 6 from Finland were translocated, corresponding to 7 males and 4 females (**Table 1**).

Table 1 – Nestlings translocated to Portugal: country of origin, arrival dates, ring and colour ring numbers (*replacement of colour rings, see p. 19), and gender.

Origin	Arrival date	Ring	Colour ring	Sex
Sweden	15/07	92A05839	P62	M
		92A05833	P63 > P57*	F
		92A05832	P64	M
		92A05775	P65 > P67*	M
		92A05779	P66	M
Finland	16/07	M67224	P82	M
		M67249	P84	F
		M67206	P85	M
		M67257	P86	F
		M67258	P87	F
		M67234	P88	M

As usual, upon arrival at Lisbon airport, the juveniles were clinically examined by the project veterinarian at the airport cargo custom inspection facilities (PIF – Posto de Inspecção Fronteiriço de Carga). Blood and feces samples were collected for pathogen screening. Blood samples were also sent to the the CTM/CIBIO lab for molecular sexing.

Likewise previous years, all birds were rehydrated and fed with 4 to 5 fishes of 8-10g each ("sprats", *Sprattus sprattus*, Clupeidae) supplied by the Lisbon Oceanarium. Only one bird did not arrive in perfect clinical conditions (P86) as it had a fracture of the wishbone, probably occurred 1-2 weeks ago and already in healing process. The fracture was later confirmed by X-Ray.

Distribution of the juveniles by the hacking tower compartments

As in the previous years, the nestlings were divided by the 4 hacking compartments, as far as possible according with their size and age inferred by the degree of plumage development. The animals with apparent close age or size were kept together (**Table 2**). In the cage # 4 we

placed P86 and P87, both of the same brood. P86 was the individual with the injured wishbone.

By avoiding the interaction of P86 with strange individuals, we expected to induce less reactivity and mobility, a fact that we eventually confirmed. We remind that there is no visual contact between the birds of different pens due to the plywood panels placed in between.

Table 2 – Distribution of the nestlings by the hacking tower compartments in 2014: cage number, colour ring number, gender and weight at the origin.

Cage	PVC	Sex	Weight
1	P57	F	1860
1	P67	M	1320
1	P84	F	1700
2	P62	M	1420
2	P64	M	1380
2	P66	M	1400
3	P82	M	1470
3	P85	M	1360
3	P88	M	1460
4	P86	F	1540
4	P87	F	1300

Bird weight monitoring

The birds were manipulated the least possible. Thus, their weight was manually recorded only at the countries of origin before boarding and during the second clinical examination made few days before release. In 2014 there was no automatic weighing on the perch-scale because the camera trap was stolen shortly before releasing the birds and it was inviable to replace it within useful time. **Table 3** shows weights just after collecting and at the time of the pre-release clinical examination, and the trend between both weights.

Table 3 – Nestling weight trends between the dates of collecting and pre-release clinical assessment (31/07). (*) Weight when transferred to RIAS for rehabilitation (20/08).

Bird	Sex	Collecting date	Original weight (g)	Weight on 31/07 (g)	Trend (%)
P57	F	13/07	1860	1530	-17,74
P62	M	13/07	1420	1290	-9,15
P64	M	13/07	1380	1290	-2,17
P66	M	13/07	1400	1290	-7,85
P67	M	13/07	1320	1200	-9,09
P82	M	15/07	1470	1220	-17,01
P84	F	15/07	1700	1590	-6,47
P85	M	15/07	1360	1200	-11,76
P86	F	15/07	1540	1500 (1485*)	-2,60
P87	F	15/07	1300	1620	24,62
P88	M	15/07	1460	1330	-8.90

Diet supplied to the juveniles

As in previous years, the birds were fed almost entirely on fish caught in the reservoir close to the project facilities. Occasionally, we provided fish bought in supermarket.

From 15/07 to 18/09, 435 fishes were caught corresponding to a total of c. 323 kg (not including 3 fishes of unrecorded weight due to the scale being temporarily out of order). Whenever possible, fishes captured were identified to species level, and measured and weighed (**Table 4**).

Barbs (*Luciobarbus* spp.) were represented by 3 species (*L. steindachneri*, *L. microcephalus* e *L. comizo*) (**Fig. 6** and **7**, p. 15). Yet, due to the difficulty in the definite identification of species in local conditions and considering the potential existence of hybrids, barbs were recorded only at genus level. Nevertheless, we can state that L. *steindachneri* was the species more frequently caught, followed by L. *microcephalus*, while L. *comizo* was more rarely present. In an attempt to identify barbs to species level, between 27/08 and 18/09 (N = 12, 22.6% of barbs caught) we recorded the following proportions: *L. steindachneri* – 8 (67%); *L. microcephalus* – 3 (25%); *L. comizo* – 1 (8%).

Table 4. Number, lenght (average, minimum, maximum), individual weights (average, minimum, maximum), and total weight of individuals of each fish species caught in the reservoir.

Species	**N**	**Lenght (cm)** average [min – max]	**Weight (g)** average [min – max]	**Total weight (kg)**
Goldfish *Carassius auratus*	181	32.4 [25.5 – 56.9]	632.4 [277 – 2000]	114.46
Pikeperch *Sander lucioperca*	81	43.3 [26.5 – 61.4]	636.9 [131 – 1743]	50.31
Barb *Luciobarbus* spp.	53	49.1 [38.3 – 60.3]	1297.6 [595 – 2882]	68.77
Carp *Cyprinus carpio*	49	45.9 [35.1 – 67.1]	1332.2 [548 – 3842]	65.28
Allis shad *Alosa alosa*	31	34.7 [8.5 – 55.8]	437.5 [258 – 1601]	13.56
Largemouth bass *Micropterus salmoides*	24	26.6 [14 – 38.8]	310.8 [34 – 947]	7.15
Pumpkinseed *Lepomis gibbosus*	7	13.2 [11.9 – 16.5]	51.6 [35 – 104]	0.36
American catfish *Ameiurus melas*	5	22.,8 [21.4 – 26.4]	160.8 [112 -252]	0.80

Because *L. comizo* looks scarce in the area, two large-sized individuals (58.7cm/2100g; 57.9cm/2168g) identified as of this species were temporarily kept in the floating cage in order they could be later let free in case they survived. The first was removed few days later and delivered to the birds as it seemed not going to survive, whereas the other (**Fig. 7**) was released.

In the case of goldfishes, despite its wide morphological and chromatic variability, we decided to consider only *Carassius auratus* as the species present in the dam.

Photo Luís Palma

Figure 6. The two types of barb most often caught in the reservoir, identified as *Luciobarbus steindachneri* (above) and *L. microcephalus* (below).

Photo Luís Palma

Figure 7. Large-sized barb (57.9cm/2168g) identified as *Luciobarbus comizo* and later released.

The specimens of the genus *Alosa* were identified in CIBIO as being of a landlocked population of Allis shad (*Alosa alosa*), one of the only three presently known in Portugal (Paulo Alexandrino, pers. comm.). Allis shad is an anadromous species whose natural life cycle implies migration between the sea and rivers to reproduce, but this migration is blocked by the construction of dams. The majority of the specimens were photographed (**Fig. 8**) and a sample of muscle was sent to genetic analysis for the current research at CIBIO.

Photo Luís Palma

Figure 8. Two of the *Alosa alosa* specimens caught in 2014 from which samples were taken for the ongoing research on the species.

Feeding in the hacking tower

During this period the birds were fed as a rule twice a day (usually during the periods 07:30-09:00 and 18:00-19:00). Occasionally, when consumption was above the usual in certain pens as told from the lack of food remains, an extra in-between meal was provided.

As in the years before, beyond the 9th day of the birds stay in the tower the size of the slices was gradually incremented. Fish heads and tails also started to be added in order to

stimulate talon seizing of food and its visual recognition after release when food is placed in large portions on the feeders.

Photo Luís Palma

Figure 9. Preparation of osprey food by the volunteers Sara Oliveira (left) and Carolina Paz, under the supervision of the project technician Jorge Safara.

Prior to release, 52 kg of fish were given to the birds. In compartments # 1, 2 and 3 (3 young each) we delivered 314.3g/meal/pen in average, i.e. 105g/bird/meal or 210g/bird/day. In compartment # 4 (2 young, including the handicapped one) we supplied 264g/meal in average, i.e. 132g/bird/meal or 264g/bird/day. In relation to the average quantity provided per bird per day in 2013 (309g), in 2014 72g less were supplied. However, taken that there was less visually perceptible leftovers, it seems likely that the actual consumption was equivalent. As in 2013, we provided fish livers for a higher input of Vitamin D.

Food provision procedures were the same as in 2013, i.e. we used the improvised “spoon” to deliver the food directly onto the nest but with the difference that it was inserted through

the extended tube ("sleeve"), which replaced the original short one. The effect was the same but without disturbing the birds. As by this way there were less unconsumed remains inside the pens, in 2014 the cleaning of the false floor was seldom done. This year, the female calls were not broadcasted at meal time as there was no evidence that it stimulated consume rates.

During the hacking period (57 meals provided) the birds were fed almost exclusively with reservoir fishes of the following species, by order of decreasing frequency (in % of the number of meals in which they were present): pikeperch (52.6), goldfish (45.6), carp (43.8), barb (40.3), pumpkinseed (5.3), catfish (1.7) and bleak *Alburnus alburnus* (1.7). Thus, meal composition was relatively balanced among the 4 main species (or group of species in the case of barbs). In 3 meals (5.3%) we supplied supermarket marine fish – jack mackerel (*Trachurus* sp.). In each meal 1 to 3 species were present, rarely 4 and sporadically 5.

In the last days within the cages (with the exception of P86) and aiming at a gradual familiarisation to the post-release food delivery scheme, the morning meal started to be placed on the feeders during the night before (10:00-02:00) thus being available at dawn. On those days the afternoon meal was brought forward to the 14:00-17:30 period.

Pre-release clinical assessment and deploying of radiotags

In 2014, in order to minimize bird manipulation and stress induction, clinical examination prior to release was done in the same night as radiotag deployment. After being put individually in transport boxes, each juvenile was processed within the house, first submitted to clinical assessment and sample collecting and then equipped with a radiotag. The colour rings P63 and P65 were originally misplaced, so they were replaced by new ones during the handling of those birds.

Photo Luís Palma

Figure 10. Pre-release radiotag deployment by Víctor Matarranz with the help of Andreia Dias.

The birds were equipped with backpack VHF radiotags (Biotrack TW-3 10-28, with 15.5-16g, activity sensor and 3.5 months lifespan). The tags were previously tested and all manufacturer indications were followed. The radiotags were placed on by Víctor García Matarranz, specialized technician of the Spanish Ministry of the Environment, five days before the birds were released (**Fig. 10**; cf. radiofrequencies used in **Table 5**, p. 20). In order to secure the tags on the bird's back, they were glued to specifically prepared small boards.

Release and first flights

As in years before, when we judged the birds were ready for release as told by the complete flight feathers development and behaviour, e.g. frequent sustained wing exercise, persistently looking towards the outside, unease and frequent interaction with the cage net showing willingness to get out, we decided opening the pens.

The day before release, the front panels were slightly opened to allow a smoother and less disturbing definite opening in the next morning. The cages were opened at 5.30 a.m., 1h 10' before sunrise. Project technicians followed at the distance the birds leaving the pens and their first flights.

With the exception of P86 and P87, all birds were let free on the 5th August, 20-21 days after their arrival on the 15th or 16th July (**Table 5**). P87 was released only two days later because the fact it stayed with P86 (injured bird with reduced mobility) induced a decrease of activity (lack of stimulation?) and consequently less wing exercising. Hence, we expected that the sight of other birds flying outside would bring the necessary stimulation for exercising flight, what we did confirm.

In the days before the opening of the cages we placed food also on the feeders closer to the tower in order the birds could recognise them as feeding sites. After release day, food was delivered twice a day on the feeders: during the afternoon (in general from 15:00 to 17:00, sporadically at 17:30 and 18:30), and after sunset (21:00 – 01:00). Placing of the food during the night allows it to be available still in good condition at early morning (6:00 – 9:00).

Table 5. Fledgling release schedule in 2014 and radiotag fequencies.

Cage	Colour ring	Sex	Release date	No. days in tower	Tag frequency
1	P57	F	05/08	21	151,073
1	P67	M	05/08	21	151,183
1	P84	F	05/08	20	151,304
2	P62	M	05/08	21	151,283
2	P64	M	05/08	21	151,093
2	P66	M	05/08	21	151,203
3	P82	M	05/08	20	151,111
3	P85	M	05/08	20	151,132
3	P88	M	05/08	20	151,322
4	P86	F	---	---	151,052
4	P87	F	07/08	22	151,223

Radiotracking

Radiotelemetry fixes were registered several times during the day, and systematically at feeding periods in the early morning and late afternoon. As in previous years, local conditions did not allow triangulations for it is impossible to move quickly between land and water. Therefore, only determination of the presence/absence of individuals and roughly their distance from the hacking area (by the signal intensity), and their activity status is possible. Activity can be judged by the signal pulse: slow pulse means a resting upright posture and allows confirming the bird is alive, while a fast pulse means movement. A slow/fast pulse indicates an alternately upright and non-upright posture indicating feeding activity or unstable perching above or on the ground, hence also indicative of a live bird. Conversely, if the pulse remains persistently fast for an extended period it may indicate accident or mortality. We afforded a special attention to such situations, sometimes tracking the bird until visual detection as it happened with P86 after its final release next to recovery (see ***Clinically relevant cases***, p. 23). These data were systematically recorded.

Control of predation

In 2014, no measure of fox predation control was implemented whatsoever, as we considered the methods previously tested as not effective to get foxes away from hazardous areas. However, no case of predation occurred in the present year. Several foxes were regularly sighted patrolling the area of the feeders including during the day, so foxes remain a potential hazard.

Veterinary monitoring (veterinary annexes only in Portuguese version of the report)

Veterinary follow-up was regularly afforded to all translocated juveniles, including the pre-release *in situ* clinical assessment including new blood and fecal samples collecting for blood parameters analysis and pathogen screening. The 2011 collaboration agreement for clinical emergencies with the Évora University Veterinary Hospital remained active as well as the collaboration with the RIAS wildlife rehabilitation centre in Olhão for the needs of accommodation and protracted treatment.

Analytical results were negative for Avian Influenza (AI) H5 and H7, Newcastle Disease (ND) and other pathogenic agents in blood and fecal samples, either in those collected in the airport or the pre-release ones done 15 two weeks later. As previously, AI and ND analysis were done at the INIAV (National Agrarian and Veterinarian Research Institute) whereas biochemical and parasitological (coprological and hematological) analyses were made at the University of Évora.

Considering the cases of secondary osteodistrophy observed in two individuals in 2012, which suggested a possible calcium-phosporus imbalance, as well as the subsequent detection of an anomalous rise in P values in 2013 (between the first and the second determinations of Ca, P and Parathormone) recalling a possible anomaly in Ca and P metabolism, we ordered the same set of analyses as in 2013 plus the determination of Vitamin D3 (cholecalciferol). All these analyses were performed by the DNAtech Lda. Company (www.dnatech.pt).

Table 6. Biochemical and endocrinous parameters in blood samples of translocated ospreys (Pthi = parathormone; Vit D3 = vitamin D3). (* Reference intervals). Values in red see text p.23.

	Biochemistry				**Endocrinology**			
	Calcium (6,5-13,0) *		**Phosphorus (2,0 -10,0) ***		**Pthi (5,0 - 15,0) ***		**VitD3 (7,2 - 380,0) ***	
Date	*16-17/07*	*31/07*	*16-17/07*	*31/07*	*16-17/07*	*31/07*	*16-17/07*	*31/07*
P57	10,37	9,17	7,3	4	7,4	9,2	49,5	50,3
P62	9,66	10,19	6,2	5,3	9,4	9,8	30,8	32,2
P64	9,34	9,22	7	5,1	8,6	8,8	27,5	26,2
P66	9,71	8,97	6,7	4,2	8,9	9,3	38,3	40,1
P67	9,94	9,54	6,2	4,5	7,6	7,9	25,3	30,1
P82	9,81	9,47	5,9	3,9	10,5	9,3	52	54,3
P84	9,54	9,53	7,3	5,3	9,7	10,3	53	56,3
P85	9,69	9,39	6,2	4,7	8,7	8,2	67,3	62,4
P86	9,21	10,74	5,8	4,3	28,3	28	69,3	70,9
P87	8,34	9,75	5,9	6	11,3	10,4	44	39,4
P88	9,43	9,29	6,6	5,5	9,2	9,7	37,5	36,8

In opposition to what occurred in 2013, the 2014 values of parameters analysed remained within the reference intervals (**Table 6**) both in the first and in the second determinations. Therefore, the abnormal rise in 2013 P values remained unexplained.

In P 86 the level of parathormone (Pthi) was higher than in the other individuals as expected denoting Ca metabolisation due to the ongoing healing process of the fractures (in red on **Table 6**). Curiously, the VitD3 values of the Swedish male nestlings (in red on **Table 6**) were generally lower than in the Finnish birds suggesting they received less sunlight, possibly related to bad weather conditions during the breeding season (B. Helander, pers. comm.).

Relevant clinical cases

In 2014 we had only one clinical case concerning P86, a Finnish bird arrived with a 1-2 weeks old fracture in the right branch of the wishbone, confirmed on the following day by X-rays at the Évora Veterinary Hospital (HVE). We tried to immobilise the wings with a wrap around bandage in the hacking tower, although unsuccessfully. The bird was kept in captivity 11 days longer than its sister with whom it shared the compartment and 13 more days than the other birds. During this stay it was administered every night with 2 drops of the anti-inflamatory Metacam.

A first release attempt was made on 18/08 without success. The bird couldn't take off the ground so it was put back in the cage and a new clinical assessment and X-ray was done the following day in the HVE (**Fig. 11**). Whereas this showed the wishbone fracture had completely healed, it showed an improper calcification of the right humerus head. The juvenile was sent to RIAS where it was kept in a flight pen for 15 days until it showed enough flight skills for a second release attempt. The X-rays done at RIAS on the day of admittance reaffirmed the previous results at the HVE but a new already consolidated fracture could be seen on the right ulna (**Fig. 12**).

Photo Luís Palma

Figure 11. P86 being submitted to anesthesia for radiography at the Évora Veterinary Hospital.

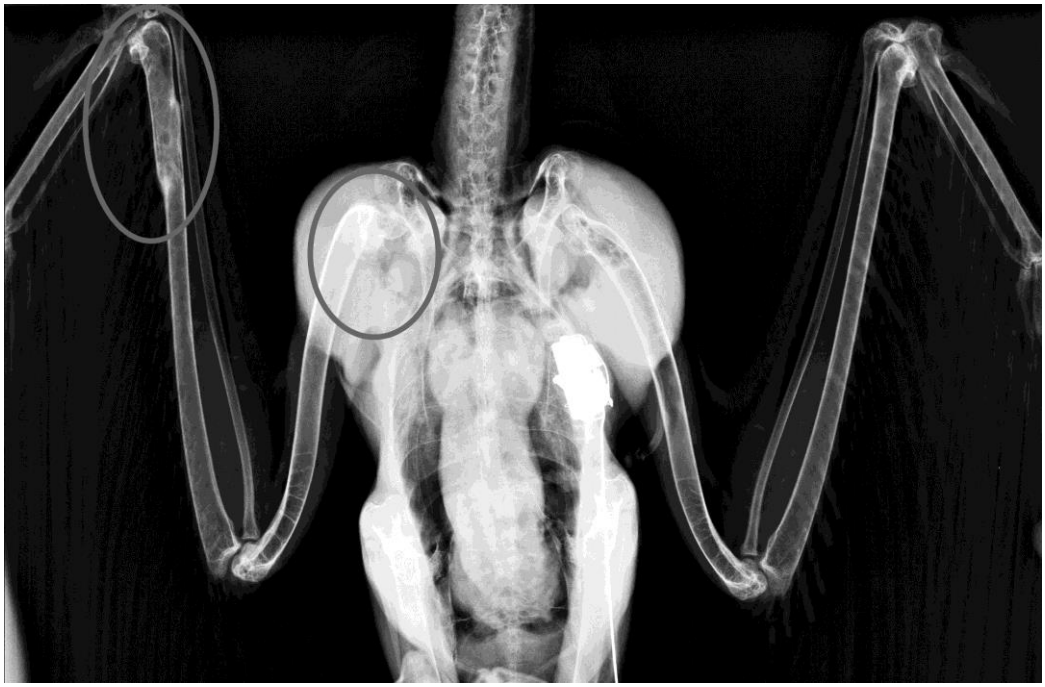

Figura 12. X-ray on 20/09 showing complete reduction of wishbone and ulna fractures (left) and a malformation of the right humerus head (centre).

P86 was was taken back to the hacking tower on the night of the 3rd September and was finally released the dawn of the same day. The evolution of feeding and social behaviour, and flight capability was thoroughly followed. The situation seemed clearly improving when the bird was found recently dead by collision with a cattle fence on the 10th September, one week after being released.

Biochemical composition of fish species used as osprey food

Due to the anomalous phosphorus (P) levels recorded in the second sampling of 2013, we checked whether the anomaly could be originated in an excess of P in the flesh of fishes of the Alqueva reservoir. With that objective 3-4 specimens of each of the following species were collected at the usual fishing location: carp, largemouth bass, pikeperch, barb (undetermined species) and goldfish (small and large), which were kept frozen until analysed at SPAROS, Lda.

The samples were analysed for their proximal composition (dry matter, ashes, protein, lipids and energy), and aminoacids and minerals (P, Ca, Zn and Fe). The results seemed normal according with literature on biochemistry and stoichiometry of freshwater fishes (e.g. Sterner & George 2000, Hendrixson et al. 2007, Stanek et al. 2013) including phosphorus. Thus, the study showed that diet is not the plausible cause for the abnormal values of P recorded in 2013. **Table 7** shows the values (average + SD) of the minerals analysed.

Table 7. Values of phosphorus (P), calcium (Ca), zinc (Zn) and iron (Fe) of the fish samples analysed. DM = dry matter

Species	P (% DM)	Ca (µg/g DM)	Zn (µg/g DM)	Fe (µg/g DM)
Carp	1,81 ± 0,22	123 ± 5	55 ± 1	90 ± 6
Largemouth bass	2,21 ± 0,17	128 ± 5	39 ± 4	94 ± 2
Pikeperch	2,78 ± 0,06	105 ± 3	33 ± 3	95 ± 3
Barb	1,93 ± 0,00	164 ± 8	50 ± 3	93 ± 3
Goldfish (large)	1,50 ± 0,07	138 ± 4	46 ± 2	91 ± 3
Goldfish (small)	2,33 ± 0,07	167 ± 6	60 ± 4	88 ± 2

Food delivery after release

In 2014, we followed the same food delivery schedule as in previous years, i.e. after sunset (21:00-23:30) and in the middle afternoon (15:00-17:00). Fish was supplied in large portions (151±42 g) in order each bird could take possession of one portion, hence avoiding competition over whole fishes. Each meal was made of 16±3.9 portions, equivalent to ≥2 portions per bird with 8 birds present and ≥ 2.6 portions with 6 birds present, presumably high enough quantity.

In total, 165.6 kg of fish were supplied from release to final dispersal, equivalent to 89 meals in 44 days (05/08 – 22/09). Considering the 33 days when there were at least 6 juveniles present (10/08 – 11/09: 8 birds until 04/09 and 6 between 05 and 11/09) 2310g/meal (= 4620/day) were provided. Each individual had at its disposal 331g/meal and 662g/day in average.

During the emancipation period, the birds were fed on the following species, by decreasing frequency (in No. meals in which they are present): goldfish (57.3%), barb (34.8%), carp (33.7%), pikeperch (17.9%), mackerel (15.7%), shad (5.6%), bass (4.5%), pumpkinseed (3.4%), catfish (2.2%), and sardine (1.1%). Mackerels, sardines and one meal of barb were bought in the supermarket in circumstances of shortage of reservoir fish. Namely, we witnessed a sharp decrease in the availability of pikeperch from the period before release to the post-release as its frequency in diet dropped from 52.6 to 17.9% (**Fig. 13**). After the 18th September the diet of the last bird still around (P82) until its dispersal was made of thawed goldfish, barb and carp earlier caught in the dam.

Feeding patterns observed did not difer from the ones seen in the preceding years in which feeding activity was concentrated in the first two hours after dawn and the two last before dusk.

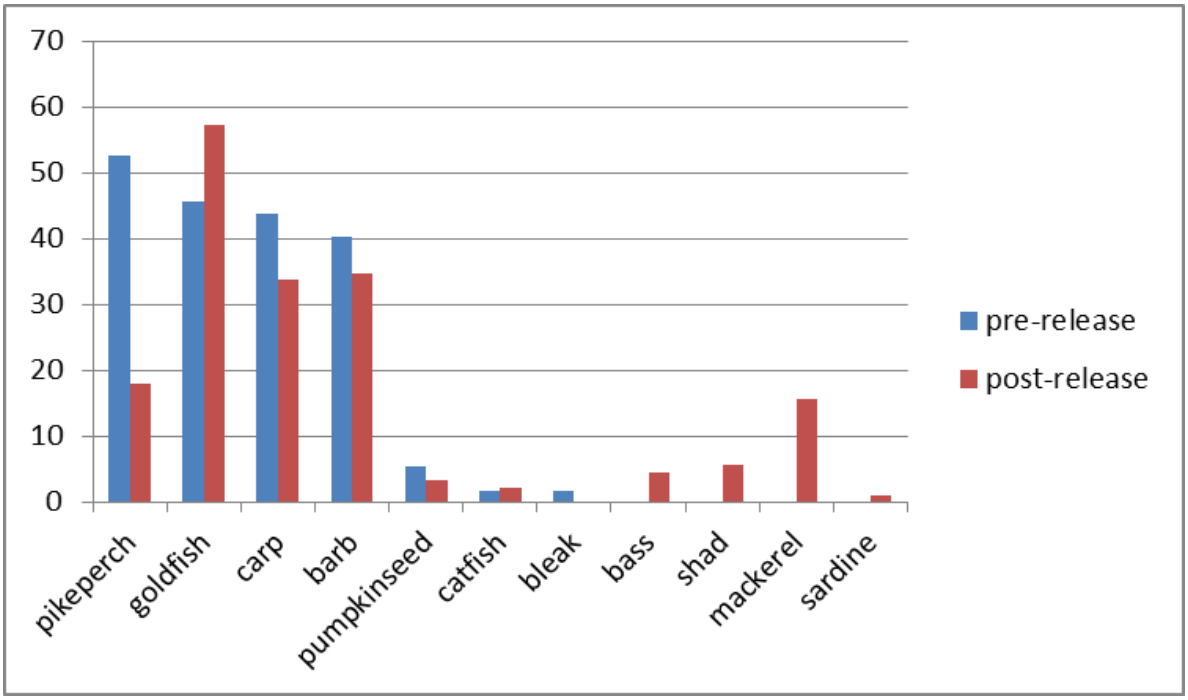

Figure 13. Composition of juveniles diet (% of No. meals in which each species or group of species [barbs] was supplied) before and after release.

Unconsumed fish was removed during night food provision. Besides the food was weighed before delivered, we recorded the number of portions placed on the feeders as well as the unconsumed ones removed in order to roughly estimate consume rates.

We saw that, in the month spreading from 13/08 (after adaptation to food being delivered outside) to 12/09 (when only one bird remained in the area), only in 8 (13%) out of the 62 meals supplied there was unconsumed fish left. In 6 of these meals, the number of unconsumed portions was only 15.6% of those supplied. On the two other days exceptional situations occurred: on the 4th September, disturbance by a cattle herd that invaded the hacking area (resulting in 8 out 21 pieces not being consumed = 38%); and on the 12th September, the simultaneous dispersal of 5 out of the 6 young still present (almost all of the fish portions left unconsumed).

We can state though that the rule was for the food placed on the feeders being almost totally consumed by the ospreys, except for the little quantities consumed by white storks (*Ciconia ciconia*) and gulls (*Larus ridibundus*) during the day, and by a genet (*Genetta genetta*) by night. Besides, as most of the fish was carried to the perches and consumed there, some unquantifiable waste is presumable.

Intra- and interspecific interactions

As usual, intraspecific agonistic interactions were rare, besides the constant vocalising when individuals come close to each other during meals. Only once there was food defense aggressive attitude observed by P86 (after its post-recovery release) towards its sister P87 at a feeder. This occurrence contrasted with the usual relationship between the two, either inside or outside the tower, generally much more intimate than with the other individuals. Inside the tower we verified a permanent physical closeness between the sisters, especially on resting periods. Apparently, the relative immobility of P86 due to its physical impairment induced less flight exercising in P87. Based on this assumption, P87 was only released 2 days after other ospreys in the expectation that the sight of the other birds flying outside would stimulate its activity inside the pen. In fact we saw immediately a notable increase in wing exercise and nervousness. P86 remained in rehabilitation.

A curious behaviour was the frequent interaction of P87 with several objects such as herbs, cables, tubes, cow dung, etc. that can be describe as play, simulating prey capture activity. Playing with objects is described as occurring in birds, especially juveniles, and including raptors (e.g. Negro et al. 1996; Kitowski 2005, Sazima 2006). Despite the playful beak grabbing of objects, especially thread, has already been observed in other translocated juveniles in previous years, this was the first time we saw the throwing of objects to be "captured" with talons as if they were live prey.

In 2014, there were interspecific interactions with white storks (*Ciconia ciconia*), grey herons (*Ardea cinerea*), gulls (*Larus fuscus e L. ridibundus*), black kites (*Milvus migrans*), buzzards (*Buteo buteo*), booted eagles (*Hieraaetus pennatus*), and ducks (*Anas strepera*?). Of the 57

interactions recorded, nearly 70% were with white storks and grey herons in even proportions. In the beginning, storks while trying to eat on or near the feeders caused a strong inhibition in ospreys over access to food. However, gradually they started to react aggressively, sometimes several birds in sequence, and succeeding in driving the storks away. Interaction with grey herons was comparable but less intense and more frequently with ospreys dominating in confrontations. As fish portions were large sized, herons couldn't ingest them and generally they waited for pieces to fall while ospreys were feeding, not without harassing them. As opposite to previous years *Larus ridibundus* were also frequent users of the feeders, yet much better tolerated by the fledglings although occasionally chased away.

Interactions with other species were sporadic and basically consisted in young ospreys chasing them away, yet reciprocal in the case of *Larus fuscus*. Foxes wandering around feeders were generally ignored besides vocalizations and some feeding inhibition observed at the beginning. Although detected only to the end of the hacking period, a genet (*Genetta genetta*) also raided fish from the feeders at night. For this reason though there was no interaction of the genet with the birds. As referred before, the sudden advent of a cattle herd in the area of feeders and perches (due to an unexpected crossing of the fences) completely hindered feeding during the whole day. Cattle were in general kept out of the hacking area for the rest of the period.

Human disturbance

Although in 2014 there were a higher number of boats and fishermen in the vicinity of the hacking area, the associated disturbance remained slight as the birds did not react much to the approaching of people from the water. Also this year the area was not accessible to unauthorised people by land as the estate remained locked. The uncommon human disturbance incidents were associated with cattle management and easily solved with the cooperation of the cattle manager and the herdsmen. Therefore, the human disturbance factors during the periods of pre-release and emancipation remained negligible.

Dispersal and migration

The definite dispersal date and likely onset of migration of each individual was considered as the one after which there were no more records of its presence in the vicinity, either by sighting or radiotracking. In 2014, the juveniles dispersed 37.4 ± 6.1 (30-51) days after release, not taking into account P64 and P67, the two that left prematurely (**Table 8**). Like in 2013, dispersal occurred after a last contact at the morning monitoring, the absence of the birds being noticed at the visual and radio monitoring of late afternoon.

Table 8. Osprey first flight and dispersal dates in 2014. (*) died

Osprey	Sex	1st flight	Dispersal	No. days elapsed
P64	M	05/08	09/08	4
P67	M	05/08	09/08	4
P57	F	05/08	04/09	30
P85	M	05/08	04/09	30
P87	F	07/08	12/09	36
P62	M	05/08	12/09	38
P66	M	05/08	12/09	38
P84	F	05/08	12/09	38
P88	M	05/08	12/09	38
P82	M	05/08	25/09	51
P86	F	03/09	------*	------

As in similar former cases, there was the premature dispersal of two males (P64 and P67). Both birds were present in the release area in the morning of the 8th August (3rd day after being freed) but the respective signals were inaudible at 17:30 and then very faint at 17:49 and 18:40, indicating departure downstream to SW and WSW. Yet, at 20:22 P64 signal was again perceptible in the release area whereas not the one of P67, indicating it stayed overnight at a distance. Both juveniles were eared again the next day at 06:34 (4th day after release) though far away and again to the SW and SWS. Still, P64 was sighted close to the tower at 08:55 with a full crop though P67 stayed undetectable. None of the birds was again noticed, either by sight or radiotracking. The reservoir was repeatedly surveyed in search of the missing young, and the powerlines in the direction of their disappearence were checked.

We also surveyed the Pedrógão reservoir, downstream from the Alqueva dam as well as the Guadiana River valley in several locations down to its mouth and the Ria Formosa wetlands in the Algarve southern coast with neither visual nor radio contact. Therefore, as there was no clue suggesting mortality we assumed as the most plausible explaination that the birds dispersed/migrated. The premature dispersal pattern was likewise previous years with a tendency to move away since the first days and a final dispersal between the 4th and 5th day after release.

The male P82 was the last to disperse on the 25th September, 51 days after being released. The day before it was watched several times trying to fish, and though it showed to be dexterous no success was seen. Also again this year we observed a tendency for several birds to disperse simultaneously.

Project improvements

Several improvements were implemented in the project, as anticipated in the 2013 report, namely: adding ramps to the inside edge of the nests wooden frames inside the tower in order to prevent leg injuries in the birds; easing up access to food by adapting an extension to the feeding tube in order that food could be placed directly on the nest without disturbing the nestlings; adding the determination of Vitamin D3 level to the calcium-phosphorus (Ca/P) balance and parathormone (Pthi) assessment.

We did not build a new compartment to the hacking tower because we did not judge it fully necessary. As referred before, the perch-scale remained inoperational because the associated camera trap used to read the colour rings of the birds during weighing was stolen. Likewise, we didn't give the birds Ca and VitD3 supplements for their values in blood remained normal in 2014.

Future improvements

In 2015, a new shading panel like the one placed in 2013 in the opposite end of the tower will be installed on the East facing wall (cage 1) to reduce direct sunlight incidence in the morning and decrease temperature inside the pen. Small platforms will be attached to the fore edges of the nests where food can be dropped instead of onto the nest itself. Thus we expect to avoid food infiltration through the moss lining and the unremovable roten left-overs. We will also evaluate the suggestion of the Consultive Board to build two new artificial nests in the area of Juromenha, an apparently favourable area of the reservoir farther upstream of the hacking location. Also, cattle fences near the hacking area will be signalled with colour ribbons to reduce collision risk.

Resolution of former project constraints

The constraints reported in 2013 did not repeat or were resolved. Although the water level was high at the beginning of the working period, it did not reach 2013 levels so it was possible to drive by car to the tower and observation point. The artificial perches destroyed and removed in 2013 due to the logging of the supporting dead holm oaks, were replaced and attached to live holm oaks, the closest to the shore as possible.

The indefined situation concerning the contuinity of the project in the present location was solved, and we now have the agreement of the estate owner, the Casa de Bragança Foundation, to stay in place until the project completion in 2015.

Monitoring of return of translocated ospreys

We carried out two long range surveys of the Alqueva reservoir to check the possible return of the first ospreys. Thus, on the 7th April the whole reservoir downstream from Monsaraz was thoroughly searched by boat by two project technicians. And the Juromenha area further upstream, considered one of the most favourable areas for ospreys, was checked from the shore. On the 14th and 15th May the whole reservoir from Juromenha up to the dam wall was surveyed in detail by boat by three technicians in a linear distance of over 110 km.

The 2nd July, an apparently subadult osprey with a green colour ring on its right leg, probably one of the formerly release birds, was seen catching a catfish in front of the project facilities. The bird was photographed (**Fig. 14**) but the inscription is not readable. The green colour was confirmed by wavelenght analysis on Adobe Photoshop.

Photo Jorge Safara

Figure 14. Osprey with green coulour ring on the right leg, presumably one of the project translocated birds.

The main water body was repeatedly checked in July and August to try sighting and photographing the bird in better conditions but without success. However, both in these surveys and those carried out in April and May we observed and photographed several other ospreys, always in adult or subadult plumage. In several cases, the observation showed that they were not transient birds; instead, they were stationary in some particular areas of the reservoir for more or less lengthy periods. In half of the occasions the birds were seen eating (**Table 9**).

Table 9. Ospreys observed in the Alqueva reservoir (April – Setember 2014).

(*) Probably released by the project.

	Date	N	Observers	Location	Colour ring	Notes
1	07/04	1	J. Safara, M. Mirinha	Estrela	No	
2	07/04	1	J. Safara, M. Mirinha	Foz do Degebe	No	
3	14/05	2	J. Ferreira, J. Safara, L. Palma	Juromenha	No	Eating
4	15/05	1	J. Safara, L. Palma	Foz do Degebe	No	
5	14/06	1	J. Safara	Ponte de Mourão	Blue?	Fishing
6	02/07	1	J. Safara	Zona de *hacking*	Green*	
7	16/07	1	J. Safara, L. Palma	Foz do Alcarrache	No	Eating
8	16/07	1	J. Safara, L. Palma	Campinho	No	Eating
9	20/07	1	J. Safara, L. Palma, M. Pereira	Campinho	No	
10	03/08	1	J. Safara	Campinho	No	
11	05/08	1	J. Ferreira	Zona de *hacking*	?	With a fish
12	13/08	1	J. Ferreira, J. Safara, M. Santos	Campinho	No	Eating
13	20/08	1	J. Ferreira	Ponte de Mourão	?	Fishing
14	19/09	2	J. Ferreira	F. do Degebe (prox.)	No	Interacting

The natural occurrence of ospreys in Alqueva, especially the fact they are adults and subadults, partially stationary, and frequently seen feeding, supports the assumption that the area offers suitable conditions for the establishment of a breeding population.

Visit of the Consulting Board

On 11-13 September, the project was visited by members of the Consultive Board (CB): Pertti Saurola from Finland, Björn Helander of Sweden and Roy Dennis from Scotland. Eva Casado from Spain could not attend the meeting. As Björn Helander recently retired, and will be replaced by Peter Hellström as the focal project support in Sweden, he was also present.

Days 11 and the morning of 12 were spent in the hacking area and facilities where the CB members could witness routine activities and watch the behaviour of the six ospreys still present, 5 of which departed on the afternoon of the second day. This period was also used to discuss and make the project's state of play. The CB members were unanimously positive about the project course and quality.

Several issues were discussed such as premature dispersal and the use of GPS/GSM trasmitters to try clarifying its causes, as well as to allow identifying the areas in Portugal used by the dispersing translocated ospreys. The deployment of GPS/GSM transmitters remained a controversial issue. Yet, the CB delegated on the project coordination the final decision on the subject.

Also approached were the project improvements for 2015. Roy Dennis recommended studying the possible installation of two new nest platforms in the Juromenha area, an area apparently with very suitable conditions for ospreys. Also recommended was the fostering of translocated juveniles in possible future cases of nests with addled eggs. Roy Dennis offered to provide those nestlings if needed.

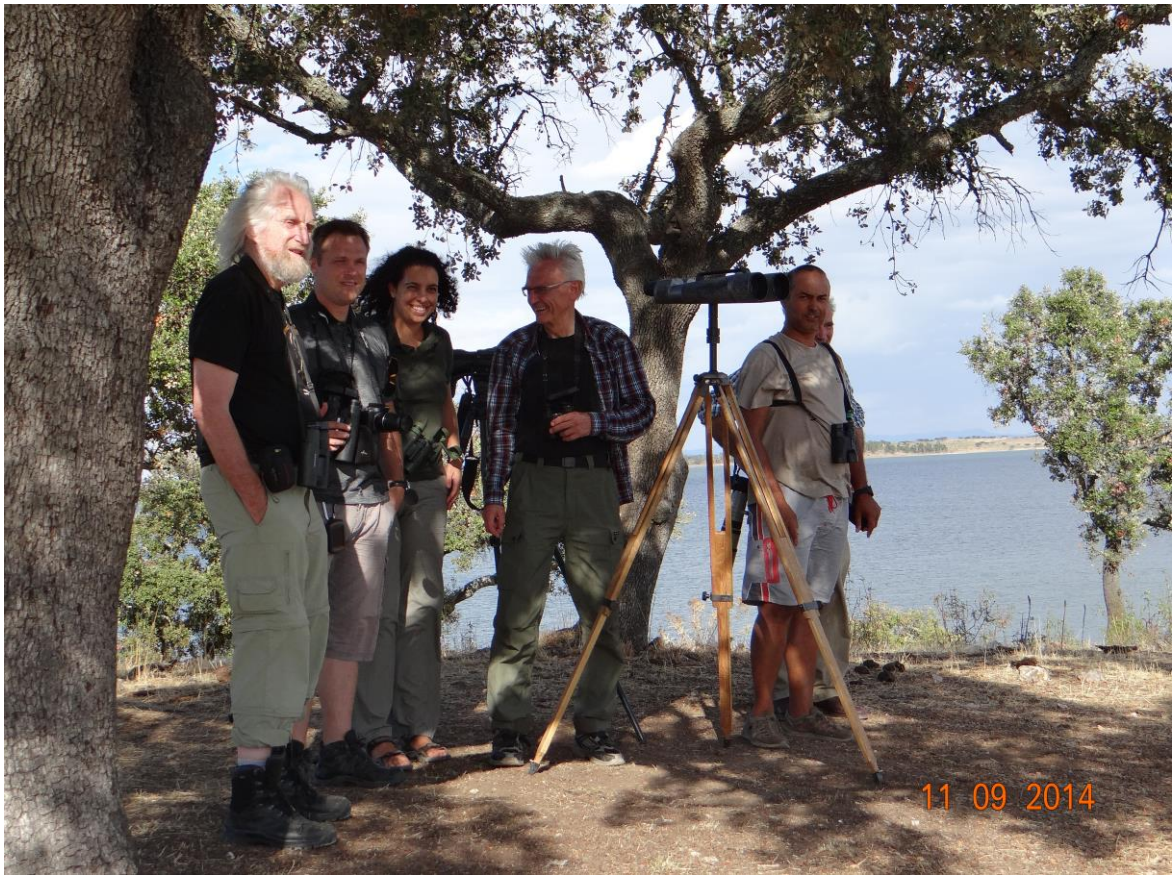

Photo Luís Palma

Figure 15. Members of the Consulting Board visiting the project in the company of members of the staff. From left to right Pertti Saurola, Peter Hellström, Andreia Dias, Björn Helander, Jorge Safara and Roy Dennis (hidden).

We discussed the possibility of the present donor countries continuing to support the project in the case it can go on beyond 2015. Pertti Saurola informally stated that Finnish authorities are positive regarding the continuity of the project. As for the Swedish authorities, Peter Hellström said they had to be consulted about that possibility although it is presumable they will agree. The members of the CB stated that it would be highly convenient for the project to be extended beyond 2015, as a guarantee of success. Ideally, the project should go on with the support of the Casa de Bragança Foundation about the use of the present location and facilities, which has been highly valuable at the present stage. Transferring the project somewhere else, besides the huge costs involved of doubtful resolution, the loss of a large part of the investment poured so far on the present facilities would be at stake.

Nevertheless, if the project cannot continue in the present location the CB agrees with the Esporão estate dam as an alternative. Despite its small size (c.120 ha) it lies only c.15.5 km from the present facilities, at 10 km of the nearest point of the main body of the Alqueva reservoir and only 2 km from its Degebe River arm. The Esporão estate administration was contacted in 2013 when the continuity of the project in the present location up to 2015 was in doubt and agreed with that possibility. Naturally, in case of need, the Esporão administration will have to be consulted again about this issue. If the project ongoing in Alqueva becomes impossible, a second alternative would be implementing it in the Southwest coast. For that new sponsors might have to be seeked.

On the 12th September afternoon and during the following day, the CB was taken on a visit to the Southwest coast to allow Swedish members to take acquaintance of the last occupied area within the historical breeding range of osprey in Portugal and discuss the possibility of a new stage of the project being implemented there.

After their visit to the project the members of the Consulting Board issued a collective project evalution statement (in Annex).

Foto João Ferreira

Figure 16. Consulting Board members on visit to the Southwest coast, in the company of Luís Palma (second to the left). From left to right: Björn Helander, Pertti Saurola, Peter Hellström, and Roy Dennis.

Project dissemination and public awareness

As project dissemination activities and public awareness the project brochure was widely distributed to people hiring recreational boats at the Alqueva dam with the collaboration of Amieira Marina Co. The brochure was also distributed to some hunters associations, a waterside tourism settlement (Herdade das Alcarias), and incidentally to fishermen throughout the reservoir.

In March we made a presentation of the project at the SPEA VIII Ornitological Congress, under the title [Decline, extinction and reintroduction of the osprey *Pandion* haliaetus as a breeding bird in Portugal] (in Portuguese). The project was also presented at the FAPAS Nature Conservation and Environmental Education meeting in May, and then in June at a meeting organised by EDIA on biological work carried out in Alqueva.

With the support of the Reguengos de Monsaraz Municipality we also participated with a public presentation of the project in the ExpoReg fair in August 2014 (**Fig. 17**).

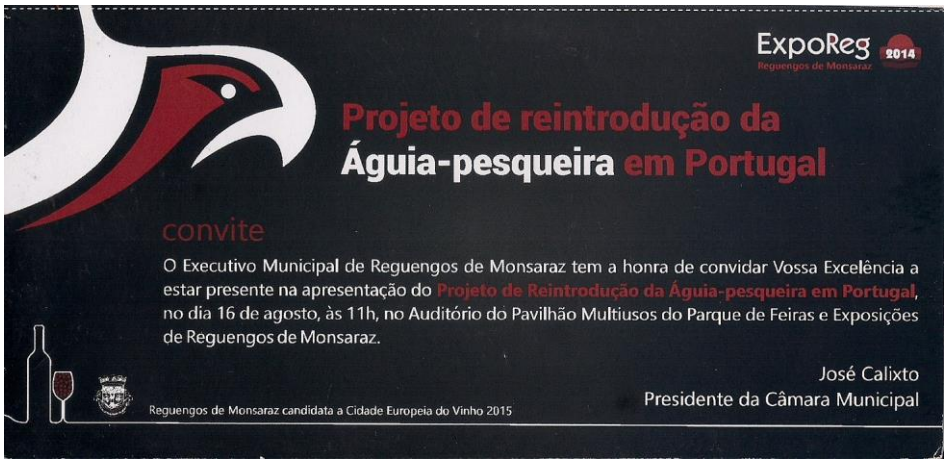

Figure 17. Flyer of the project public presentation at the 2014 ExpoReg fair in Reguengos de Monsaraz.

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We are also grateful to:

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Dr Andrea Ljung and Dr Elisabet Lindal (Swedish Board of Agriculture); Dr Henrik Ericsson (Länsstyrelsen Uppsala Län, County Administrative Board of Uppsala), Dr Camila Jüllig (Länsstyrelsen Stockholms län, County Administrative Board in Stockholm). Dr Ann Jaconelli

(Länsstyrelsen Södermanlands län, County Administrative Board in Södermanland), and Dr Tove Sällberg (District Veterinarian).

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ANNEX: CONSULTING BOARD EVALUATION STATEMENT

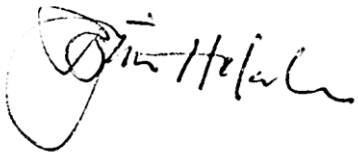
Reintroduction of the Osprey (*Pandion haliaetus*) in Portugal

Project Review Meeting September 2015

Our visit to the Osprey Project release area on 11th and 12th September proved very encouraging. On the first day we watched six remaining juveniles during the day and in the late afternoon saw all of them come to the feeding platforms for fish. All appeared to be in excellent condition and behaving as young ospreys should prior to migration. Perfect weather next day (12th September) resulted in five of the ospreys setting off on their first migration to Africa. The review team were again impressed by the dedication of the staff, the hacking set-up and support facilities. The techniques of rearing, feeding, releasing and post-fledging management have clearly been refined to a high standard. We commend the project team on an excellent project and recommend that the project is continued for several more years in order to achieve the goal of restoring breeding ospreys to Portugal, set out at the start of the project.

31st December 2014

The members of the project's Consulting Board:



Björn Helander, PhD, Senior scientist (retired 2013)

Leader, Project Sea Eagle/Sweden 1971-2014 (Swedish Society for Nature Conservation)

Head, national monitoring of white-tailed sea eagle population and reproduction, 1989-2013

(Swedish Museum of Natural History, for Swedish EPA)

Pertti Saurola, Prof., Emeritus researcher
Finnish Museum of Natural History
University of Helsinki

Peter Hellström, PhD

Leader, Project Sea Eagle/Sweden 2015- (Swedish Society for Nature Conservation)

Head, national monitoring of white-tailed sea eagle population and reproduction, 2014-

(Swedish Museum of Natural History, for Swedish EPA)

Roy Dennis, Director of Highland Foundation for Wildlife; expert on species recovery of birds and mammals, including reintroductions and translocations