REINTRODUCTION OF THE OSPREY

(*Pandion haliaetus*)

IN PORTUGAL

Annual Report 2012

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SPONSOR

EDP - Energias de Portugal, S.A.

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The Osprey Reintroduction Project enjoyed of the partnership and support of the following entities:

Finnish Museum of Natural History

Finnish Osprey Foundation

Swedish Museum of Natural History

Swedish Society for Nature Conservation

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SAIP - Sociedade Alentejana de Investimentos e Participações, SGPS, SA.

ICNB – Instituto da Conservação da Natureza e da Biodiversidade

EDIA - Empresa de Desenvolvimento e Infra-estruturas do Alqueva, S.A.

TAP – Transportes Aéreos Portugueses

Hospital Veterinário da Universidade de Évora

RIAS – Centro de Recuperação e Investigação de Animais Selvagens

Oceanário de Lisboa

Município de Reguengos de Monsaraz

Sparos, Lda.

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Summary

The Osprey (*Pandion haliaetus*) reintroduction project started in 2011 in the Alqueva dam. The aim is establishing a founder population, which ultimately may help out the re-colonization of the maritime coast, the species historical breeding range in Portugal, where it went extinct as a breeder at the turn of the present century.

As in 2011, 11 nestlings, 5 from Sweden and 6 from Finland, were translocated in 2012 to the hacking tower at the shore of the Alqueva dam, within the Roncão estate belonging to the SAIP Company, where they completed growth. As fledglings they were released c.28 days later, after being equipped with VHF radiotags.

After release, the fledglings stayed c.27 days around the release area, with increasingly longer movements until final dispersal and the onset of migration.

The birds were primarily fed on exotic fish species from the very dam: 81 kg of fish was supplied to the juveniles while in the tower (mainly Barb *Barbus* spp., Goldfish *Carassius auratus* and Pike-perch *Sander lucioperca*), and 117 kg of the same species after release.

As negative incidents we had (details in the clinical report and its annexes, not translated):

a) While in the hacking facilities, one bird suffered a leg fracture with subsequent clinical complications and eventually died a few hours before surgical intervention. The necropsy unveiled a secondary osteodystrophy.

b) After release, another bird showed incapacity of upward flight from the ground and a wing with an abnormal posture for it was put back in the pen. At a second try to release it, the bird showed the same upward flight inability hitting the ground with impact, and the same anomalous wing posture. It was again recovered and transferred to a rehabilitation centre where it eventually died. The necropsy indicated an extensive internal bleeding as the cause of death. The bleeding was caused by a dislocated coracoid piercing the lung.

c) A third bird was predated after release by an undetermined predator, possibly an eagle-owl (*Bubo bubo*).

No other relevant incidents occurred with the birds caged or after their release.

1. Introduction

The project aims at the reintroduction of the Osprey (*Pandion haliaetus*) to Portugal as a breeder. It is an initiative of CIBIO (Research Centre in Biodiversity and Genetic Resources) with the funding of EDP Energias de Portugal, and the institutional collaboration of ICNF (Institute of Nature Conservation and Forests). Ultimately, the project seeks the re-establishment of an osprey population in its historical range along the Portuguese coastline, from where it disappeared as a breeder at the beginning of the 21st century. The project integrates the international efforts for the recovery of the Osprey in the Mediterranean region, where its populations are presently small and endangered.

The project is intended to have a stepwise development, of which the present initial phase aims at founding a viable breeding population in the Alqueva dam, an area with favourable ecological conditions. With that purpose, during the next 5 years, 10-12 nestlings will be translocated annually from Sweden and Finland for hacking facilities at the Alqueva dam, near Monte do Roncanito within Roncão estate. The project strictly follows the national, international and donating countries' pertinent legislation.

The project was set on in 2011 and the present report briefly describes its development during 2012 the second year of translocation, adaptation and release of osprey juveniles in the Alqueva dam.

2. Preparatory tasks

In the 2011 report, the preparatory procedures are described in detail namely how the initial release area was selected, as well as what methods were followed and the infrastructures

used. Hence, in the present report we only refer to relevant technical aspects namely the changes introduced.

2.1 Supply of nestlings

Translocation agreements

The general agreements established in 2011 with the authorities of the donor countries were maintained in 2012. These pertain to the annual provision of 5-10 nestlings until 2015 in the case of Finland, and up to 10 nestlings per year until 2013 in the case of Sweden. In 2012, the number of nestlings translocated was 6 from Finland and 5 from Sweden. In the latter country, unfavourable weather conditions during the breeding season impaired productivity and didn't allow providing a higher number of birds.

First project evaluation meeting

An evaluation meeting of the project first year was held in the Esporão estate in Reguengos de Monsaraz attended by the members of the consulting board (Pertti Saurola, Peter Lindberg, Roy Dennis and Eva Casado) and representatives of the project partners and collaborators.

The meeting included the presentation, evaluation and discussion of the procedures and results of the first year of the project (2011) as well as the evaluation of the project facilities in Monte do Roncanito and of the release area in the Alqueva dam. The majority of the technical changes suggested in the meeting were introduced in the project as follows.

2.2. Infrastructures

Hacking tower

As recommended by Roy Dennis, plywood panels were fixed to the side walls of the pens in order to prevent visual contact between the birds of the different compartments in a way to stimulate in the birds their identification to a particular brood as occurring in Nature. Therefore, four clusters are created instead of a single one made up of all birds, easing up

the establishment of stable hierarchies thus reducing interaction and relationship stress among the birds of different pens (Fig. 1).

Wooden steps were put beside the edge of the nest platforms to make easier for the nestlings to get access to them and back to the pen floor, particularly during their first days in the tower when their movement capability is limited (Fig. 1).

Roy Dennis mentioned the possibility of lining the nest with dry aquatic plants and mosses, to what Pertti Saurola added the idea of using lichens as well. Accordingly and resorting to the local vegetation, we used as lining material leaves and stems of Reedmace (*Typha latifolia*) and Whorled water milfoil (*Myriophyllum verticillatum*) (Fig.1).

Figure 1 – Hacking tower nest platforms lined with Reedmace and Whorled water milfoil (1); wooden steps by the edge of the nest platforms (2); plywood side panels insulating the pens (3) - photo Marco Mirinha.

Video monitoring

Birds' behaviour within the pens was monitored by colour and infra-red closed-circuit television (CCTV) and by direct observation through one-way mirrors on the tower back wall.

Floating fish cage

The permanent supply of fresh fish for feeding the ospreys kept being secured by keeping live fish in a floating cage. Goldfish (*Carassius auratus*), Carp (*Cyprinus carpio*) and Barb (*Barbus* spp.) from the dam were regularly delivered to the birds.

We firmly re-attached the protective canvas of the floating cage floor and placed a vertical PVC tube to allow delivering the food at the level of the cage floor and thus lessening its waste into the water (Fig. 2).

Figure 2 – Floating fish cage with feeding tube (1) – photo Luís Palma.

Feeders

There were no technical changes in the feeders, the same used in 2011 (Fig. 3).

Figure 3 – Fledglings eating together on a feeder, photo taken by camera trap.

Artificial perches

We increased the number of artificial perches with 16 new ones placed in the vicinity of the release area to make the landing and roosting easier to the young ospreys, in particular during the first days after release.

Artificial nest platforms

Pertti Saurola, Peter Lindberg, Roy Dennis and Eva Casado recommended smaller nest platforms, making them lighter and easier to set up. In 2012, 4 new nest platforms were put in place, 1 from the 2011 set and 3 new of shorter diameter (90cm), lighter and equipped with a lateral perch for the males (Fig. 4).

Figure 4 – Setting up an artificial nest platform – photo Andreia Dias.

The nests were filled with Broom (*Retama sphaerocarpa*) branches and lined with Reedmace (*Thypha latifolia*) (Fig. 5).

Figure 5 – Artificial nest filled with Broom material and lined with Reedmace – photo Andreia Dias.

Like the two nests already set up in 2011, the four 2012 nests were put in place in islets around the release area, following a pre-selection carried out in 2011 (Fig. 6).

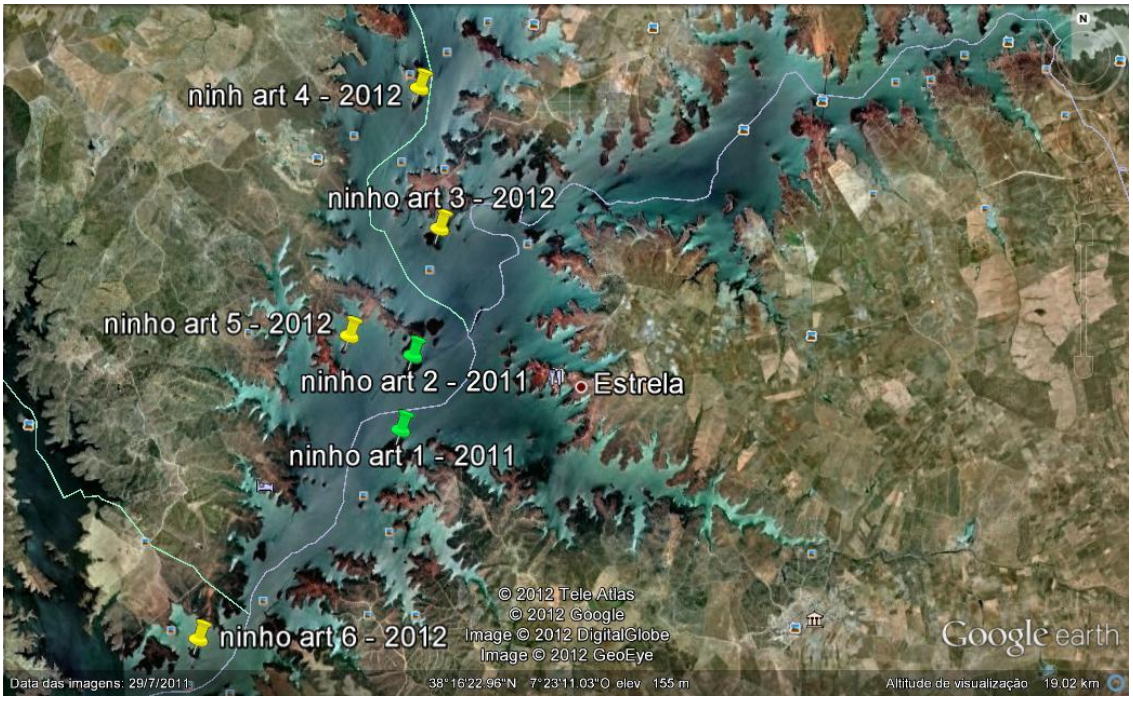

Figure 6 – Distribution of artificial nest poles in the islets of the Alqueva dam. In green, nests placed in 2011, and in yellow nests placed in 2012.

Field base

We installed a security alarm system in the project field base, improvements were added to the electric supply and the water supply pipe was buried for its protection.

3. Reintroduction

In this chapter we describe the methods used in the translocation of the osprey nestlings from the donor countries to Portugal, as well as during their residence in the hacking tower and period of dependence until dispersal. For a more detailed description read the 2011 Annual Report, Chapter 4.

3.1. Nestling collecting and transportation

Collecting

Both in Finland and Sweden, the nests from which the nestlings were to be taken were previously selected by or under the supervision of Pertti Saurola and Björn Helander, respectively. From broods with more than 2 nestlings, birds looking in good condition were chosen to guarantee a higher probability of survival. In Finland, 5 nestlings aged c. 5.5 weeks and 1 aged c. 6 weeks were collected (Fig. 7), and in Sweden 2 nestlings aged c. 6.5 weeks, 2 aged 4.5 and one 3.5. In all cases, age was estimated according to feather development (Fig. 8).

Figure 7 - Pertti Saurola climbing an osprey nest tree in Finland for collecting nestlings – photo Andreia Dias.

Figure 8 – Nestlings kept in an animal rescue centre in Sweden after being collected from the nests and prior to translocation to Portugal – photo João Ferreira.

After collecting, a solution of Vitamin A and Selenium was injected in the nestlings to reduce the chances of the deleterious effects of manipulation (capture myopathy). They were kept and fed in animal rescue centres until transportation to Portugal in plastic travel boxes.

All birds were ringed with official metallic rings of the donor countries on the left leg and with green PVC colour rings with white inscriptions on the right leg. The codes are the letter "P" (for Portugal) aligned horizontally followed by 2 vertical digits (Fig. 9), three times around, manufactured by Risto Juvaste (http://www.juvaste.fi).

Figure 9 – Juhani Koivu and Harri Koskinen from Finland placing the green PVC colour rings that identify the birds of the Portuguese reintroduction project – photo Andreia Dias.

Transportation

The osprey nestlings were transported by direct flights from Helsinki and Stockholm. The time schedule was organized in a way that the nestlings could arrive at Lisbon's airport at the end of the day, in order to avoid the summer daytime high temperatures.

Figure 10 – Transport boxes with the nestlings being prepared for flying to Portugal, under the supervision of Björn Helander – photo João Ferreira.

Upon arrival, the nestlings were submitted to clinical inspection by the project veterinarians (Pedro Melo e Margarida Melo) at the airport cargo customs (Posto de Inspecção Fronteiriço

de Carga, PIF) for evaluation of their general health condition. Samples of blood and faeces were collected for further laboratorial analysis (Fig. 11). Blood samples were also used for sexing the nestlings at the CIBIO's Molecular Testing Centre (CTM).

All birds were in good health condition and were rehydrated and fed with 4-5 small 8-10g fishes each (Sprat, *Sprattus sprattus*, Clupeidae) offered by the Lisbon Oceanarium.

Although with no signs of infirmity, the youngest nestling received from Sweden (P14) bared a fungal plaque in the mouth, which was removed and analysed. The laboratorial analysis showed that the causal agents were two non-pathological filamentous fungi (*Geotrichum* sp. and *Penicillium* sp.).

Figure 11 - Nestlings being clinically examined and sampled by the project veterinarians Margarida Melo and Pedro Melo, at the Lisbon's airport cargo customs facilities – photo Andreia Dias.

The nestlings were then carried by car to the hacking tower in Roncão (Alqueva dam). Car travel to the hacking place was done at night, when the young are quieter and temperatures lower. All steps were accompanied by a project technician.

Table 1 – Young ospreys translocated to Portugal (origin, ring numbers, sex, collecting and arrival dates, and radiotag frequency). (* – died).

Rings				Dates		
PVC	**Metallic**	**Sex**	**Origin**	**Collecting**	**Arrival**	**VHF**
P09	92A05795	♀	Sweden	08-07-2012	10-07-2011	151.011
P10	92A05781	♀	Sweden	08-07-2012	10-07-2011	151.032
P12	92A05787	♂	Sweden	08-07-2012	10-07-2011	151.290
P13	92A05792	♀	Sweden	08-07-2012	10-07-2011	*
P14	92A05790	♀	Sweden	08-07-2012	10-07-2011	*
P17	M61584	♂	Finland	11-07-2012	14-07-2012	*
P18	M61569	♂	Finland	11-07-2012	14-07-2012	151.071
P20	M61557	♂	Finland	11-07-2012	14-07-2012	151.092
P21	M61567	♂	Finland	11-07-2012	14-07-2012	151.134
P22	M61532	♂	Finland	11-07-2012	14-07-2012	151.153
P23	M61520	♂	Finland	11-07-2012	14-07-2012	151.173

3.2. Pre-release phase

This is the phase during which the juveniles are kept within the hacking tower. They were distributed by the 4 pens following their arrival date and plumage development (i.e. joining together birds of closer age).

The first birds to arrive, from Sweden, were placed in the pen 2 (P12, P13 and P14, the younger); and pen 3 (P09 and P10, the older); subsequently, the birds from Finland were placed in pen 1 (P17, P18 e P23) and pen 4 (P20, P21 e P22).

Table 2 – Approximate age of the osprey nestlings at the date of arrival in the hacking tower. (* – died)

PVC	Pen	No. birds/pen	Approx. age at arrival (in weeks)	Release date	No. days caged
P09	3	2	6,5	06-08-2012	28
P10	3	2	6,5	06-08-2012	28
P12	2	3	4,5	*	*
P13	2	3	4,5	16-08-2012	38
P14	2	3	3,5	*	*
P17	1	3	5	*	*
P18	1	3	5	06-08-2012	24
P20	4	3	5	06-08-2012	24
P21	4	3	6	06-08-2012	24
P22	4	3	5	06-08-2012	24
P23	1	3	5	06-08-2012	24

After being put in the tower (between 00:00 and 01:00) the birds remained quiet and lying down. All ate for the first time only on their second day in the tower. During the first meals small conflicts occurred until hierarchies were established. In general, we recorded normal behaviour patterns, which were mostly peaceful, and only occasionally were conflicts seen in defence of food or the keeping of hierarchies.

We followed he development of motion skills and coordination such as food prehension with feet and beak. Gradually, the birds began to stand up often instead of solely on their tarsus as before. Plumage and musculature developed until they began flapping around in the enclosure. At that time we considered them ready for release. However, we recorded abnormal behaviours in P14, to be described ahead.

The birds were handled the least possible. Therefore, weight was only occasionally recorded, e.g. when birds were ringed or tagged, or when examined by the veterinarian (table 3).

Table 3 – Nestling weights recorded when collected, clinically examined, and ringed and tagged

	Weight (g)					
Osprey No.	**At collecting**	**Veterinarian exam**	**Ringing and tagging**	**Veterinarian exam**	**Radiotag Checking**	**Veterinarian exam**
		25 July	**01 Aug**	**12 Aug**	**14 Aug**	**22 Aug**
P09	1675	1600	1525			
P10	1660	1660	1680			
P12	1305	1650	1480		1450	1300
P13	1335	1505	1400		1500	
P14	1115	1450	1500	1100		
P17	1330	1380	1350			
P18	1302	1250	1200			
P20	1227	1380	1290			
P21	1180	1610	1310			
P22	1267	1370	1410			
P23	1359	1390	1300			

We recorded persistent weight loss only in P12 e P14, birds that showed clinical abnormalities (details in the annexed clinical report, not translated). All other birds presented the usual weight variation in reaction to the initial adaptation to the hacking tower and later to the approaching date of release.

Feeding

In the hacking tower, fish was provided three times a day (~8:00, 12:00-13:00, and 19:00-20:00) in small pieces of c.1.5 cm, without scales and central spine (but with the spines embedded in the flesh). By this way it was always available to the birds. Food was previously weighed in order to take record of the quantity delivered and rough consumption rate.

According to Roy Dennis recommendation, fish was provided in small slices throughout the whole period in the hacking tower until release, thus their size not increasing as the birds grew up as we did in 2011. Still, this was complemented with half or whole fish carcasses beyond the second week.

Since their arrival the nestlings were already feeding on their own. However, the three younger (P12, P13 and P14) showed some difficulty in getting to the food. For these, fish slices were placed directly on the pen nest with the help of an improvised spoon, until we could see some progress in their motion skills (Fig. 12). Later, we switched to fish carcasses filled up with slices that we named "sandwiches" (Fig. 13).

Figure 12 – Use of a "spoon" to deliver the fish slices directly onto the nest – photo João Ferreira.

Figure 13 – Goldfish carcass filled up with small fish pieces directly delivered onto the nest – photos Andreia Dias and João Ferreira.

As Roy Dennis also recommended, we performed adult female calls recorded at the nest each time 10 minutes before the meals, in an attempt to stimulate a higher ingestion rate (Fig. 14).

Figure 14 – Broadcasting adult female calls (1) during meals to stimulate food intake – photo João Ferreira.

Food not consumed was regularly removed from the boxes before the next meal to avoid salmonellosis outbreaks (Ferrer *et al*., 2003). We always tried to avoid visual contact of the birds with the staff.

277 kg of fish were caught from the dam throughout the whole hacking period – 11 July to 12 September – of which 81 kg were supplied to the birds while still in the tower.

We identified, measured and weighed all fishes caught in order to record the species and sizes of the fish available in the dam (Table 4).

Table 4 – Species and biometry (length and weight) of fishes caught in the Alqueva dam during the hacking period.

Species	Illustration	Biometry	Mean	SD	Max	Min	N
Barb *Barbus* spp.		lenght (cm)	46	3,7	59,0	39,4	74
		weight (g)	1068	338,0	2609,0	597,0	
Goldfish *Carassius auratus*		lenght (cm	36	2,2	40,9	27,6	42
		weight (g)	773	132,9	1049,0	336,0	
Pike-perch *Sander lucioperca*		lenght (cm	42	12,8	56,0	17,5	24
		weight (g)	740	464,8	1465,0	39,0	
Carp *Cyprinus carpio*		lenght (cm	49	5,9	59,0	40,0	13
		weight (g)	1463	577,5	2457,0	133,0	
Catfish *Ameiurus melas*		lenght (cm	28	-	-	-	1
		weight (g)	290	-	-	-	

The quantities of fish provided in the 3 daily meals distributed as follows (Fig. 15) (carcass weight was not considered, only sliced fish).

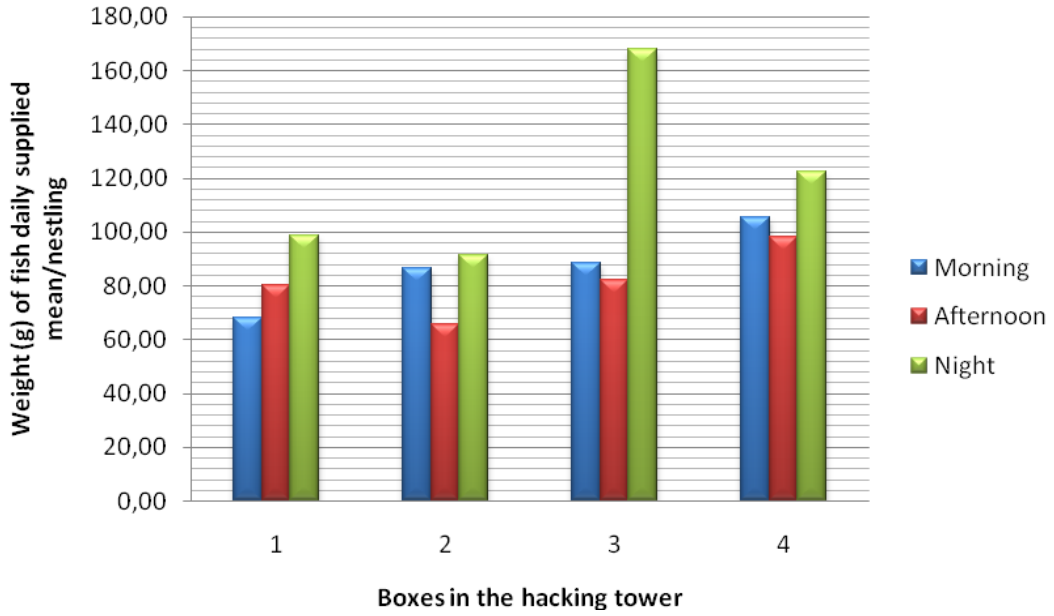

Figure 15 – Weight (g) of fish daily supplied to the nestlings in the hacking tower at the three meals. Boxes 1, 2 and 4 accommodated 3 birds and box 3, 2 birds.

Despite the pen number 3 was the only one to host 2 ospreys (all the remaining contained 3 birds) this was the compartment where a larger quantity of fish was provided. These birds (P09 and P10) were the eldest in the group having arrived at 6.5 weeks old and taking more food than the others. Besides being older, both were females and the biggest and more robust ospreys recorded in the project up to the moment.

Food quantities provided were always adjusted to actual consumption. The drop in consumption in the afternoon meal compared to the other two was not so marked in 2012 as it was in 2011. Also in contrast to what occurred in 2011, some birds even preferred this meal to the early morning meal. We provided a higher quantity of fish at night as we wanted food to be fully available at day break. This was based on the fact that all the food provided at night was usually consumed in early morning.

While in the hacking tower, the ospreys were fed with the following fish species, all obtained in the dam: barb (*Barbus* spp.), goldfish (*Carassius auratus*), pike-perch *(Sander lucioperca*), carp (*Cyprinus carpio*), catfish (*Ameiurus melas*, 1 individual only). Supermarket mackerel

(*Trachurus* sp.) was delivered to all birds only on two occasions and to P12 on two additional meals. We also supplied to this bird two meals of supermarket sardine (*Sardina pilchardus*). Figure 16 shows the relative contribution of the different fish species to the diet provided.

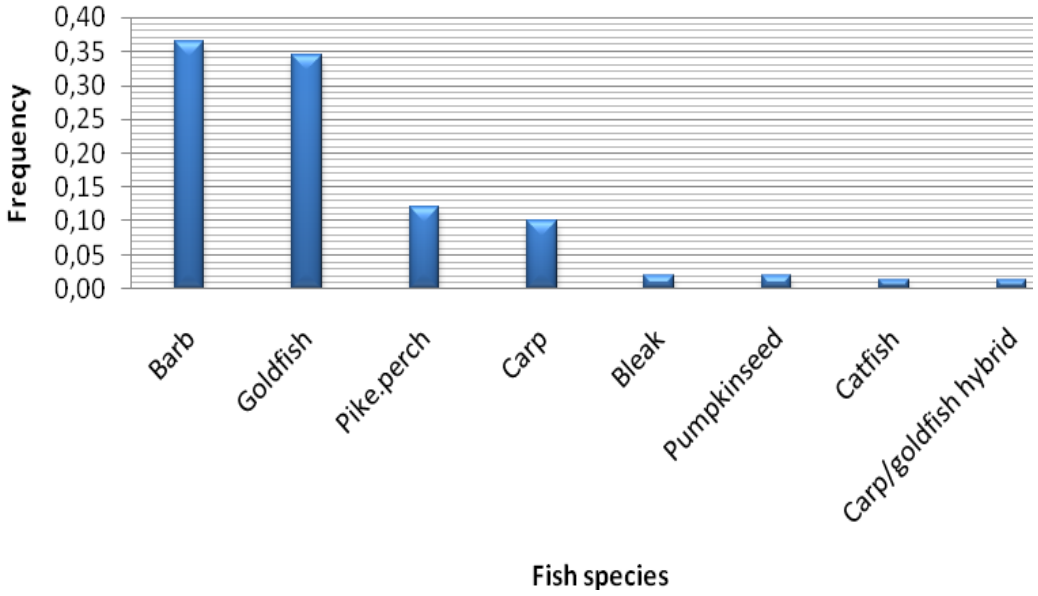

Figure 16 – Relative frequencies of fish species supplied to the osprey nestlings in the hacking tower.

Feeding behaviour of the juveniles within the tower was watched through the one-way mirrors and CCTV. We paid special attention to the food quantities ingested. The sequence by which the young of similar age from the same compartment used to feed themselves depended on their relative hunger, therefore the one eating first was the one that ate less or nothing at all in the previous meal. In case of marked age difference, the one to eat first was in general the larger of all. As far as possible, we tried to provide fish carcasses along with the fish portions to allow birds to later recognise the shape of the prey.

3.3. Release and first flights

At the age of c.9 weeks ospreys are fully feathered and ready for flying. As suggested by Roy Dennis during the project evaluation meeting we slightly opened the tower front panels in the night before release for an easier and less disturbing full opening at dawn. The project technicians discreetly followed at the distance the birds leaving pens and the first flights.

In the days preceding the opening of the panel we supplied a larger quantity of fish on the feeders closer to the tower allowing the ospreys to visually recognise them as feeding sites. After the release day, food was provided twice a day (early afternoon and after sunset) to always assure food in good condition (Muriel et al.).

Owing to the age span among birds they were released in different days (cf. Table 2, page 16). Finnish birds were let free together with the two Swedish older ones and 10 days later we released ospreys P12 and P13. P14 died two days before release date. As when P12 couldn't fly up after leaving the pen we had to enclose it back (see "Summary of individual history and relevant events", page 26). Due to age differences, we had birds inside and outside the hacking tower for a period of 10 days.

Perch-scale and camera trap

As Pertti Saurola recommended, in view of the possible effect of local high temperatures lessening food intake below the rate needed for perfect fitness for migration, we tried to check fledglings' weight after release with a perch-scale. Therefore we built, mounted and tested a perch-scale prototype inspired on Poole (1982). However, firmware problems precluded the record of the actual bird weights and the wind caused thousands of meaningless weightings. Thus, the balance was sent back for technical assessment and correction of malfunctioning.

Figure 17 – Osprey fledgling on the perch-scale – camera trap photo.

To allow identification of the ospreys weighed by the perch-scale we installed a camera trap (ScoutGuard SG570-6M) to take synchronized photos of the birds.

Radiotracking

We couldn't deploy PTTs or other long-range telemetry devices for financial reasons. Nevertheless, foreseeing the possibility of using GPS/GSM devices in the future we tested a test unit from "Cellular Tracking Technologies, LCC" in Guinea-Bissau, one of the potential migration destination countries of the reintroduced ospreys. We confirmed though that this country was not covered by roaming agreements with the local GSM operators. However, fixes were recorded and could be read after the unit returned to Portugal.

All birds were equipped with backpack VHF radiotags (Biotrack Pip Ag357 weighing 6-7 g, with activity sensor and 3.5 months lifespan). The birds were tagged during the night by Víctor García Matarranz, a specialist from the Spanish Ministry of the Environment, four days before being released and at the age of c.10.5 weeks for the two older Swedish ospreys, at

c.9.5 weeks for the younger ones, and c.9 weeks for all Finnish birds but one which was tagged at c.10 weeks (Table 5).

The tags were previously tested and we followed all procedures recommended by the manufacturer. In order to assure the tag remaining in position on the back of the birds, they were previously mounted on a small platform made on purpose (Fig. 18 A and B).

Table 5 – Approximate ages of the ospreys at tagging dates (* died before).

PVC	Tagging age (weeks)
P09	10,5
P10	10,5
P12	9,5
P13	9,5
P14	*
P17	9
P18	9
P20	9
P21	10
P22	9
P23	9

Figure 18 – (A) Biotrack Pip Ag 357 radiotags mounted on platforms – photo João Ferreira; (B) Tagging an osprey – photo Andreia Dias.

The signal of P18, P20 and P21 tags stopped being detected 5 days after release. We slowly investigated the whole shore of the dam by boat and all its surroundings by car, looking for

radio signal. The surroundings of the release area were searched on foot and the medium voltage powerlines in the vicinity of the dam were also surveyed.

Nonetheless, 8 days after we lost the signal of the three ospreys we saw one of them (P20) eating on one of the feeders though the tag was not working. The same may have occurred with the other two ospreys without notice. But as these two birds showed dominance behaviour inside the pen it seems also possible that they started dispersive movements earlier than the others. Furthermore, in contrast with 2011, the water of the dam remained fully clear throughout the whole summer, which may have eased fishing thus inducing a premature dispersal.

With the help of the receiver we found the remains and the radiotag of P17 after being preyed upon by an unidentified predator, possibly an eagle owl, shortly after one month of being released.

Veterinarian monitoring

Regular veterinarian monitoring was awarded to all translocated ospreys. We maintained the collaboration agreement with the Veterinarian Hospital of Évora University established in 2011 for emergency procedures impossible to perform in the field and hospital admission if needed. Two ospreys (P12 and P14) were also assisted at the RIAS Rehabilitation Centre.

Summary of Individual history and relevant events

P09 – First osprey to leave the tower after the opening of the panels, with no incidents until dispersal.

P10 – Last osprey to leave the tower when released and the last one to begin dispersal, with no incidents until it left the area.

P12 – One of the younger birds from Sweden, this osprey was let free for the first time with one of its pen mates (P13) at the dawn of the 16th August (2nd release event) but it landed on

the ground with a bending wing and not able to take off. Therefore it was put back in the tower. In the next day it was observed by the project veterinarians at the Évora Veterinarian Hospital. Breast muscles were looking poorly developed and the bird weighed 1450g. X-ray was taken but the clinical screening did not indicate bone fracture despite a lesion on the right coracoid was suspected.

After being taken back to the hacking tower, Metacam and Duphaphral Multi® were administered. On the 22th August the osprey was released for the second time (weighing 1300g) but it landed again hitting the ground with the chest with impact and was put back in the pen again. On the 27th it was re-examined by the veterinarians in Évora Hospital, with new X-rays and endoscopy. Blood was collected for biochemical and haematological analysis, which revealed signs of infection and some hypoproteinaemia. On the same day the bird was translocated to the RIAS rehabilitation centre where it was weighed (1100g) and energetic supplement and antibiotics were supplied for some days.

On the 4th September, P12 was transferred from the accommodation room to a large flight enclosure and resumed eating regularly. On the 10th September though, some blood was observed on the beak and mouth, which was attributed to possible impact against the enclosure mesh but thought negligible. Eventually, on the 13th afternoon the bird was found dying with a blood clot within the pharynx despite having shown a normal behaviour in the morning.

The necropsy unveiled an internal bleeding as likely cause of death from lung piercing probably by the disrupted coracoid. This coracoid luxation could have been due to a poor musculoskeletal development in association with bone tissue fragility from vitamin D and/or calcium deficiency or a calcium phosphorus imbalance in diet causing a secondary osteodistrophy (annexed clinical reports, not translated).

P13 – Released with P12, 10 days after the release of the first group of fledglings, with no incidents until dispersal.

P14 – As mentioned before, a non-pathogenic diphtheric lesion was removed from the bird's mouth after arrival at the airport. Notwithstanding being the youngest among the nestlings from Sweden, this birds always fed by itself without the need of forceps or dummy. However, the stage of locomotion on the tarsus was longer than usual and even after walking upright it was often observed lying down, what motivated a clinical examination that revealed a fracture of the proximal end of the tibiotarsus and fibula. The bird showed poor general condition, abnormal light weight and massive ectoparasite infestation.

The injured leg was restrained and selenium and vitamin E (Selbion®) administered subcutaneously as well as Duphafral multi® and Metacam® provided, and the bird was transferred to the RIAS rehabilitation centre. When arrived it was weighing 1146g and through palpation the keel presented a sinuous and somewhat flexible consistency. The bird stayed hospitalized and was initially forced fed with hydrated fish although it resumed feeding by itself the next day (weight 1120g). Surgery was schedule for the following day but the bird died during the night. The necropsy revealed that health deterioration was gradual and linked to the fracture, and showed signs of secondary osteodistrophy (annexed clinical reports, not translated).

P17 – Osprey from the first group released, predated in the vicinity of the hacking tower 32 days later. We found the feathers and the radiotag close to an eagle-owl pellet and otter faeces. The contents of the otter faeces were analysed but no osprey feathers were found in them. Last November eagle-owl calls were heard in a nearby islet, suggesting that the owl could indeed have been the responsible predator.

P18 – Released within the first group with its pen mates soon exhibited dominance as was also usual within the tower. It went undetectable 5 days after release, possibly due to an impaired tag or a premature dispersal.

P20 – Released within the first group, the tag became inaudible 5 days later. Yet, the bird was observed feeding together with other ospreys 11 days after the tag breakdown. It remained around the release area until the 1st September with no further instances.

P21 – This was the only osprey that occasionally exhibited signs of stress while caged, pecking at the frontal panel mesh and fluttering about when feeling people's presence. It was released with the pen mates the 6th August but as occurred with P18 it became undetectable 5 days later, possibly due to tag impairment or premature dispersal.

P22 – Released within the first group, remained in the area with no incidents until dispersal.

P23 – Released within the first group, remained in the area with no incidents until dispersal.

3.4. Dependence phase

This was the period from release up to dispersal/migration. The behaviour and movements of the juveniles were followed by sight and radiotracking and we recorded data on flight and feeding behaviours, use of the area, and intraspecific and interspecific interactions.

Food delivery after release

Taking in account that during the first 10 days after release there were birds inside and outsider the tower we delivered food on the feeders only in two periods in order to reduce disturbance: 1) after sunset to make the technicians less visible by the birds and lessen their responsiveness, at the same time assuring that food would be available at dawn; 2) at mid-afternoon during the hottest part of the day when the birds outside were resting and the caged birds less reactive, therefore having food available at the end of the day when birds resume activity. Unconsumed fish remains were also removed at this time.

Such as when all birds were still inside the tower, the fish species supplied on the feeders came from the dam (Table 6). Whereas captured by techniques directed to them, these species probably mirror the food resources available in the dam.

Table 6 – Species and sizes of fishes captured in the Alqueva dam and supplied to the birds after release.

Species	Illustration	Measurements	Mean	SD	Max	Min	N
Barb		length (cm)	46	3,9	59,0	35,3	127
Barbus spp.		weight (g)	1016	328,0	2609,0	110,0	
Goldfish		length (cm)	37	2,1	44,6	27,6	93
Carassius auratus		weight (g)	789	171,2	1275,0	79,4	
Pike-perch		length (cm)	47	39,0	283,0	17,5	42
Sander lucioperca		weight (g)	669	429,5	1465,0	39,0	
Carp		length (cm)	50	5,6	61,5	40,0	28
Cyprinus carpio		weight (g)	1506	574,7	3215,0	133,0	
Bleak		length (cm)	19	0,6	19,0	17,8	3
Alburnus alburnus		weight (g)	55	5,2	62,0	50,0	
Catfish		length (cm)	24	3,3	27,6	21,4	3
Ameiurus melas		weight (g)	180	95,6	290,0	123,0	
Blackbass *Micropterus salmonoides*		length (cm)	21	8,9	27,6	15,0	2
		weight (g)	186	187,4	318,0	53,0	
Carp/goldfish hybrid		length (cm)	40	9,2	46,6	33,6	2
		weight (g)	896	540,9	1278,0	513,0	

Food quantities supplied onto the feeders decreased after the ospreys' needs and according to how the area was being gradually abandoned. On average c.3 kg of fish was supplied per day. In total we estimate c.117 kg of fish provided at this stage.

The following figure shows the relative frequencies of each fish species supplied on feeders after release of the ospreys.

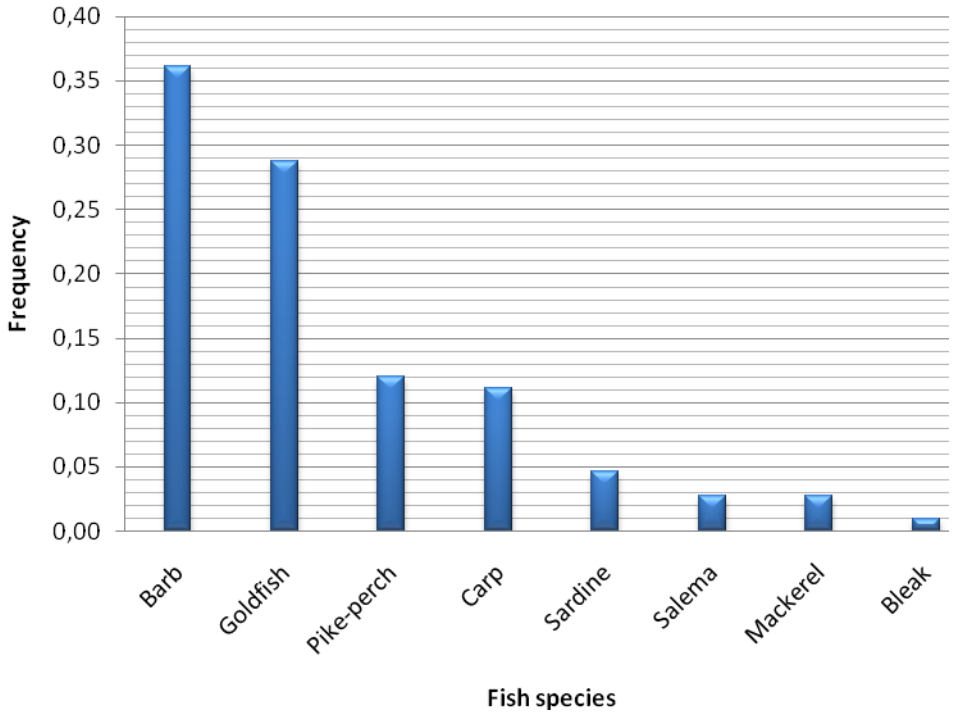

Figure 19 – Relative frequencies of fish species supplied on the feeders. Sardines, salema and mackerel were purchased in the supermarket.

Spatial use of the area

After release, the ospreys were followed by radiotracking and direct observation. The following figures illustrate the areas used by the birds before dispersal.

Figure 20 – Radiotracking locations of P09, P10, P17, P18, P20, P21, P22 and P23 on release day (06/08/2012 at 16:00).

Figure 21 – Radiotracking locations of P09, P10, P17, P18, P20, P21, P22 and P23, 4 days after release (10/08/2012 at 07:15).

Figure 22 – Radiotracking locations of P09, P10, P17, P22 and P23 on the day P12 and P13 were released (16/08/2012, 10 days after the first release, at 11:50). P18, P20 and P21 were not detected.

Figure 23 – Radiotracking locations of P09, P10, P13, P17, P22 and P23 on 27/08/2012 at 06:20, 21 days after the first release and 11 days after the release of P13.

Areas used as resting sites

Soon after release, the ospreys used as preferred perching places the areas "1" but gradually they started exploring areas farther away, moving to areas "2" (Fig. 24). Every day at the beginning and end of the day they visited the release area to feed but exploratory movements were increasingly distant.

Figure 24 – Areas often used as roosting sites

Analysing 171 observation records on the type of perches used (Fig. 25) we see that, except for the feeders used only to eat, the most often used were the artificial perches (60%) followed by the water at the shore edge (10%) and holm oaks (9%) (Fig. 26B). Perching on the hacking tower (Fig. 27A) and on the ground (Fig. 27B) occurred at a frequency of 7% each. The birds were observed on the tower while resting or eating and on the ground while eating pieces of fish fallen from the feeders. The ground was also used to approach the shore for drinking or bathing. They were observed sitting on the roof of the camp base house (Fig. 28A) and of the "fish cuisine" (Fig. 28B) at the day of the first group release.

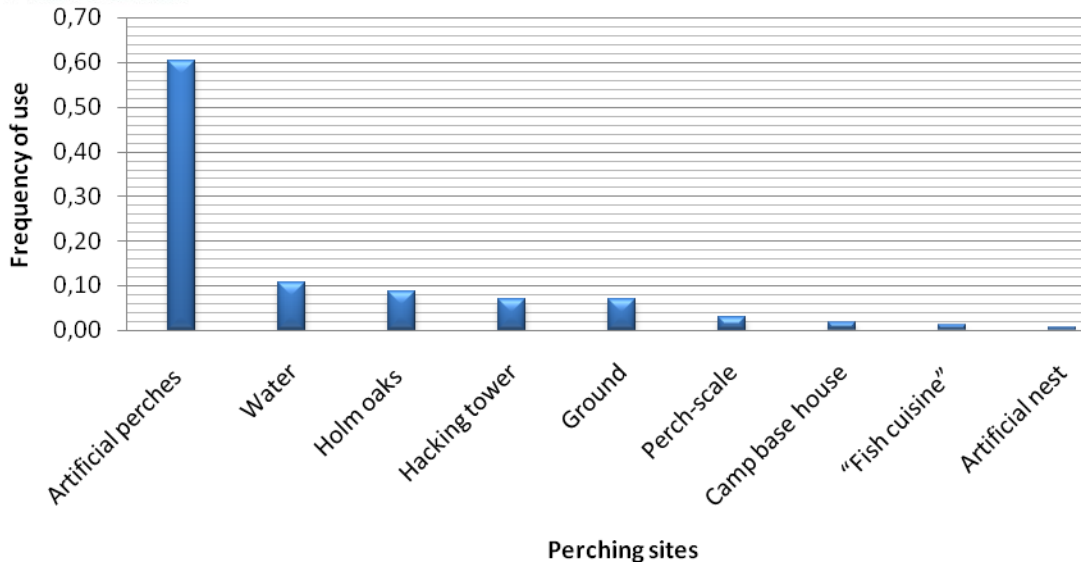

Figure 25 – Relative frequency of use of structures and places as perching sites.

Figure 26 – Osprey sitting on an artificial perch (A) and on a holm oak (B) – photos Andreia Dias.

Figure 27 – Osprey perching on the hacking tower (A) and on the ground (B) – photos Marco Mirinha.

Figure 28 – Osprey sitting on the roof of the house (A) and of the "fish cuisine" (B) – photos Marco Mirinha.

The birds were also five times observed perched on the perch-scale (Fig. 17) and once on one of the artificial nest platforms erected on an island in 2011.

Intraspecific interactions

During all the dependence period the juveniles showed a semi-gregarious behaviour with frequent visual and vocal contact, and often using the feeders and artificial perches together. We've seen up to four individuals on the same feeder (Fig. 30) and the same perch although also contending for food and chasing each other.

Figure 29 – Four ospreys eating together on a feeder – camera trap photo.

Interspecific interactions

Interspecific interactions were observed only on three occasions: once with a marsh harrier (*Circus aeruginosus*), once with a common buzzard (*Buteo buteo*) and once with black crows (*Corvus corone*). The harrier flew across the bay in front of the hacking tower in the day P12 was released causing persistent calling from the osprey. A flock of crows was seen chasing an osprey and an osprey chasing a common buzzard. No other species but the ospreys were seen eating on the feeders.

Disturbance

Besides the occasional interactions with other species, the only disturbance recorded was caused by a fire fighting aircraft filing up water fairly close to the release area, making the ospreys to fly off. We did not record disturbance from fishermen in the current year because the access to the property was restricted as the gate remained shut out of working hours and during weekends. The few fishermen we saw readily abandoned the area after being alerted by the project workers. We also did not register disturbances caused by boat traffic.

Flight behaviours

- As soon as released fledglings were watched in drinking events, touching the water surface in flight after meals and one of the birds deliberately falling into the water and floating with open wings.
- Two days after release, one osprey apparently tried fishing.
- Three days after release, the tags of P18 and P21 became hardly audible. Presumably, the birds were already engaging in distant flights.
- Five days after release, two birds were seen soaring high.
- Nine days after release, we watched several birds soaring to great heights.
- Twenty two after release, some ospreys started engaging in flights beyond the receiver's 10 km detection limit and returning to the feeding site less assiduously.

3.5. Dispersal and migration

We defined an approximate date for the onset of dispersal/migration from the lack of observation of the individuals and their absence at the feeders. However we could not precise their age at departure as we didn't know their exact birth date. Seemingly, dispersal took place about 26.5 ± 7.3 days after release. We did not consider the two ospreys with impaired transmitters (Table 8).

Table 8 – Ospreys' first flight and dispersal dates. *radio signal was lost beyond this date

Osprey	1st flight	Dispersal	No. days to dispersal
P09	06-08-2012	02-09-2012	27
P10	06-08-2012	11-09-2012	36
P13	16-08-2012	06-09-2012	22
P18	06-08-2012	11-08-2012	5*
P20	06-08-2012	21-08-2012	16
P21	06-08-2012	11-08-2012	5*
P22	06-08-2012	08-09-2012	33
P23	06-08-2012	31-08-2012	25

The 27th August was the last day with simultaneous records of all the radiotagged ospreys, 21 days after the date of first release and 11 days after the release of P13. Between the 27th August and the 11th September, the birds gradually began to leave the release area and all were absent on the 12th September, and no radiotag signal could be heard or any other kind of observation could be done thereafter. P10 was the last bird to leave the area on the 11th September, 36 days after the opening of the pen.

4. Project improvements

Mortality

The fencing of the area to prevent the access of the release area to foxes is currently under study.

A procedure aiming to tackle the calcium absorption deficit by the young in their first days in the tower was discussed in order to prevent skeletal abnormalities. Namely, fish livers will hereafter be delivered with the food as a natural provision of vitamin A.

Telemetry

New types of tags will be chosen to avoid the problems found with those used this year. We are also evaluating the possibility of deploying GPS/GSM transmitters in some of the birds.

Perch-scale

The mechanical working of the perch-scale will be improved to mitigate wind interference and other structural improvements to improve its performance will be tried as well. The balance will be previously tested with falconry birds before the arrival of the nestlings.

Fish cage

The bottom of the cage will be covered with a less flexible material and in a way to remain firmly attached to avoid fishes to get imprisoned between the cage mesh and the lining and thus get injured.

Hacking tower

The possibility of adding an extra box to the tower to allow more room to ease managing the osprey lodging will be again evaluated.

Veterinarian aspects

The clinical cases of P12 and P14 may be associated with weakness of bone tissue resulting from vitamin D and/or calcium deficiency or from calcium-phosphorus imbalance in diet and originating secondary osteodistrophy (SO). Therefore, we will take a prophylaxis approach from the analytical screening for SO early detection, the nutritional assessment of those elements in diet to the supply of a balanced diet to the artificial provisioning of elements in shortage in case of need (annexed clinical report, not translated)

5. Final considerations

On the course of the second reintroduction year we verified that the radiotags used did not work conveniently as expected. Three units stopped signalling and we realised that any slight obstruction from relief precluded signal detection. Already in the 2011 report we stated that radiotracking in itself was inadequate to track the birds across the dam area. Yet, the lack of funds and the fact that the unit tested in Guinea Bissau couldn't send data in real time, led us to use only conventional telemetry.

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