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FIRST SUCCESSFUL BREEDING OF REINTRODUCED OSPREYS *PANDION HALIAETUS* IN MAINLAND SPAIN

PRIMERA REPRODUCCIÓN CON ÉXITO DE ÁGUILAS PESCADORAS *PANDION HALIAETUS* REINTRODUCIDAS EN ESPAÑA CONTINENTAL

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SUMMARY.—In 2003 a reintroduction program of osprey started in the region of Andalusia, SW Spain, in order to recover the former breeding population in mainland Spain and to improve the situation of the species in the Mediterranean basin. From 2003 to 2009, 129 young ospreys were released by means of hacking. In 2009, the first breeding pair reared successfully three chicks in the Odiel Marshes for the first time in mainland Spain since 1981, when the species became extinct. The first breeding pair constitutes a significant indicator for the evaluation of the project and the beginning of a future population.

RESUMEN.—En 2003 se puso en marcha un programa de reintroducción del águila pescadora en la región de Andalucía, SO de España, con el fin de recuperar la población reproductora de España continental y mejorar la situación de la especie en el Mediterráneo. Entre 2003 y 2009 se soltaron 129 juveniles mediante crianza campestre. En 2009, la primera pareja reproductora crió con éxito tres pollos en las marismas del Odiel, siendo ésta la primera vez en España continental desde su extinción en 1981. Esta pareja reproductora constituye un importante indicador para la evaluación del proyecto y el inicio de una futura población.

The osprey *Pandion haliaetus* is a cosmopolitan bird of prey distributed over all the continents except the Antarctica (Poole, 1989). Although osprey populations are large and show stabilised or increasing trends in central and northern Europe, the situation is clearly unfavourable in the Mediterranean basin, with few, small and isolated popula-

tions (Saurola, 1997; Thibault *et al.*, 2001). The species was extirpated from mainland Spain after 1981, when the last pair bred in the province of Alicante (Uríos *et al.*, 1991), after a continuous decline since the 1960s. At present, there are only two small breeding populations in Spain, each consisting of 15 pairs, in the Balearic Islands and the Canary

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TABLE 1

Total number of released ospreys distributed by year, sex and reintroduction area. Return rate is provided for the birds released each year within the next seasons until 2009 in the reintroduction areas, including juveniles with resident behaviour. Years 2008 and 2009 were excluded since ospreys return when two years old.

[Número total de águilas pescadoras liberadas distribuidas por año, sexo y zona de liberación. Se proporciona la tasa de retorno de las aves liberadas cada año durante las siguientes temporadas hasta 2009 en las zonas de reintroducción, incluyendo los juveniles con comportamiento residente. Los años 2008 y 2009 fueron excluidos puesto que las pescadoras retornan en su segundo año de edad.]

Year [Año]	Barbate			Odiel			Total			Return rate (%) [Tasa de retorno]
	Males [Machos]	Females [Hembras]	M+F [M+H]	Males [Machos]	Females [Hembras]	M+F [M+H]	Males [Machos]	Females [Hembras]	M+F [M+H]	
2003	1	3	4	0	0	0	1	3	4	0.0
2004	10	3	13	6	1	7	16	4	20	0.0
2005	3	9	12	3	5	8	6	14	20	20.0
2006	7	4	11	4	6	10	11	10	21	14.3
2007	4	6	10	5	6	11	9	12	21	9.5
2008	6	4	10	6	2	8	12	6	18	-
2009 ^a	-	-	13	-	-	12	-	-	25	-
Total			73			56			129	10.5 ^b

^a Sex determination not available for birds in 2009 [Determinación de sexo no disponible en las aves de 2009.]

^b Total return rate of the birds released from 2003 to 2007 (N = 86) [Tasa de retorno total de las aves liberadas entre 2003 y 2007 (N = 86).]

Islands, and a single pair in Chafarinas Islands (Triay and Siverio, 2008). In spite of the important role of the Iberian Peninsula being as a passage area for migratory ospreys with apparently suitable breeding conditions (Casado and Ferrer, 2005), the species has been unable to recolonise the region owing to its philopatric behaviour. Therefore, in 2003 a reintroduction program of the osprey in the region of Andalusia, southern Spain, was begun with the main objectives of recovering the former breeding population of mainland Spain and encouraging the connexion of the small and isolated populations of the Mediterranean basin.

Between 2003 and 2009, 129 young ospreys have been released by means of hacking techniques in two different locations: the Barbate reservoir in the province of Cádiz and the Odiel coastal marshes in the province of Huelva (table 1).

The Barbate reservoir is a 2,540 ha artificial lake used for agricultural irrigation, protected as part of a Natural Park and surrounded by Mediterranean forests and grasslands. The Odiel marshland is a tidal estuary at the mouth of the rivers Odiel and Tinto with more than 7,000 ha, which are legally protected (Ramsar Wetland, E.U. Site of Community Importance and Natural Reserve) and have a considerable ornithological diversity. Both areas are relevant for wintering ospreys in the Iberian Peninsula, especially the Odiel marshland with 20 - 30 individuals every winter (fig. 1). All the hacked birds were wild-hatched chicks of the Palearctic subspecies (ssp. *haliaetus*) translocated from Finland (14.7 %), Germany (65.1 %) and Scotland (20.2 %) when 3.5 - 6 weeks old and kept in the hacking facilities for an average of 30 days until release.

The final goal of any reintroduction program is to re-establish a self sustaining population in the planned area (Griffiths *et al.*, 1989; Seddon, 1999). However, for a long-lived species with retarded maturity and low fecundity, it is usually a long-term process. Thus, before that objective may be accom-

plished, several previous stages must be used as reliable success indicators for the programme evaluation. In this sense, the return of released individuals to the hacking localities from the wintering grounds constitutes one of the first indicators that confirm juvenile survival and the capacity to settle in the area and perform subsequent breeding attempts. Between 2007 and 2009, at least 14 ospreys have been recorded in the reintroduction areas, including eight returned individuals and six non-migratory young that had stayed in the hacking localities. Juvenile ospreys spend two years in their wintering grounds before migrating back to the breeding areas (Poole 1989), hence the cumulative return rate calculated for ospreys released between 2003 and 2007 was 10.5 %, slightly lower than the 13.9 % estimated by Martell *et al.* (2002) after 16 years translocating young ospreys in Minnesota. However, the return rate was not homogeneously distributed among years, ranging between seasons with no returned birds in subsequent years (i. e. 2004) and others with a return rate of 15 - 20 % (table 1).

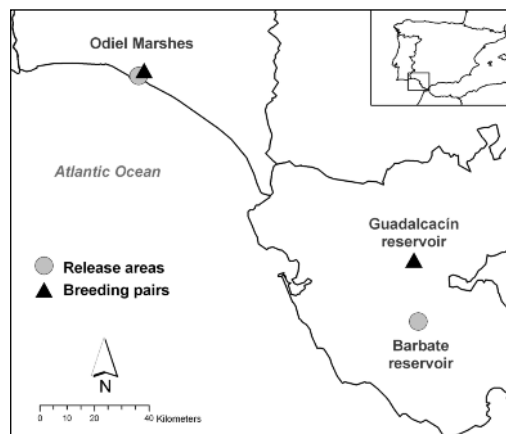


FIG. 1.—Geographical location of reintroduction areas and breeding pairs in Andalusia (SW Spain). [Localización geográfica de las áreas de reintroducción y de las parejas reproductoras en Andalucía.]

Some of the most relevant milestones for a reintroduction program are the settlement of the first territorial pair and the first breeding success, which mean the starting point for a new viable population. Since the beginning of the reintroduction program an increasing territorial activity of non-reintroduced ospreys was recorded, this probably related to a conspecific attraction by the presence of released ospreys. In 2005, after two years releasing young ospreys, the first breeding attempt by non-reintroduced ospreys was detected in the Guadalcaçín reservoir, 30 km from the nearest reintroduction area in the province of Cádiz. They laid one egg but it did not hatch after more than 60 days of incubation. In order to encourage successful breeding behaviour by the pair and its site fidelity, two osprey chicks were translocated from Germany to be fostered by the pair before the breeding attempt was abandoned. The chicks were immediately accepted and reared properly until they started migration (for more details see Muriel *et al.*, 2006). In 2006 the osprey pair made a second breeding attempt, but the same problem recurred again during the incubation so the fostering process was carried out once more with the same successful result. After that breeding season the female disappeared and did not return in subsequent years, only the male stayed in the area.

In April 2008 two returned ospreys, a male from Germany released in Odiel Marshes and a female from Scotland released in the Barbate reservoir, both released in 2005, occupied an artificial platform installed on an out of service power pole only 800 m away from the hacking facilities in the Odiel Marshes. The birds displayed courtship behaviour and copulation attempts, but no laying took place. This is not rare in three year old breeders in their first breeding attempt, and thus with no previous experience (Poole, 1989). Nonetheless, they stayed in the area until migration in mid August.

In 2009, they were recorded again in the same eyrie in the Odiel Marshes on 20 March. They showed a clear preference for the same platform, but it was being used by non-breeding white storks *Ciconia ciconia*. Since the osprey pair was observed in the area, the reintroduction program team tried to keep the storks away from the platform, until the osprey pair occupied it definitively one week later. The white stork population has increased greatly in Spain in the last 20 years, exceeding 30,000 breeding pairs at the present (Molina and Del Moral, 2005). Hence, the competition with white storks for nesting platforms could pose an important problem for the osprey in the future as they show similar nest-site selection, especially in marshlands where the availability of suitable nesting sites is lower.

The osprey pair showed typical pre-laying behaviour: carrying material to the nest, nest defence against white storks, fish offerings from the male to the female and frequently copulations. Finally, they laid eggs and started incubation on 3 April. After 38 days of incubation, close to the mean documented incubation period for the species (Green, 1976; Poole, 1989; Thibault *et al.*, 2001), on 11 May the first egg hatched and fifteen days later three chicks were confirmed in the nest. The area was monitored to ensure the adequate parental behaviour, the normal development of the nestlings and to avoid possible human disturbances. Before fledging, the chicks were measured, weighed, ringed and blood samples were collected for sex determination. All the three nestlings were males with an average weight of $1,593.3 \pm 11.6$ g (mean age: 44 ± 1 d). In early July the juveniles fledged at a mean age of 54.7 ± 2.89 d. During the post-fledging period they improved their flight skills and fishing attempts, interacting occasionally with released young ospreys. Although both parents, but mainly the male, provided fish, on several occasions the fledglings visited the nearby artificial feeders installed to supply fish for the released ospreys. On the other hand,

the reintroduced fledglings were not observed in the vicinity of the nest or begging to the adults for food, though the adults were tolerant of the presence of the released fledglings, even to share perches in the surroundings. In mid-August the three juveniles left the area and started their migration, 34.3 ± 3.2 days after fledging. Post-fledging length, as well as fledging age, was within the normal range recorded for the species in Europe (Stitson, 1977; Bustamante, 1995). Contrary to the usual migration timing (Poole, 1989), the male left the area on the same day as the juveniles, whereas the female stayed at least two more days in the breeding area.

The non-reintroduced osprey pair in 2005 and 2006 showed a resident behaviour, probably because it was breeding in its wintering range. Nonetheless, the resident conduct has been described as the typical pattern in Mediterranean populations (Triay, 2002; Thibault *et al.*, 1995) due to the mild winter conditions and fish availability (Poole, 1989). On the other hand, the reintroduced breeders from Odiel Marshes left the area after the breeding season and probably started migration. This could be related to innate migration patterns, though some translocated ospreys showed also resident behaviour after postfledging period, performing only short local movements in the reintroduction area during the winter.

Also in 2009, another successful breeding attempt was recorded in the Guadalcaén reservoir by non-reintroduced ospreys. Probably the same male* as in 2005 - 2006 and a new female laid eggs on 6 April, four days later than the pair in Odiel Marshes. Two chicks, a male and a female, hatched after 38 days of incubation and were reared normally by their parents.

Therefore, the natural breeding of translocated ospreys in Odiel Marshes constitutes the first successful breeding of reintroduced ospreys and the first free-living ospreys hat-

ched in mainland Spain for 28 years and 6 years after first releases. It represents also the achievement of an important success indicator for the reintroduction program together with the recruitment of non-released individuals to the new breeding population.

The osprey has become a clear example of a flag species in the framework of active management for population recovery since it has been involved in up to 25 release projects in 11 states of U.S.A. and also in England and Italy (Dennis and Dixon 2001; Martell *et al.*, 2002; Sforzi *et al.*, 2007). In those projects with breeding pairs settled, the first successful breeding attempt was usually recorded around 5 years after reintroduction starting, due to the delayed maturity and relatively high juvenile mortality of the species. For instance, in the Twin Cities project (Minnesota, U.S.A.; 143 birds released between 1984 and 1995) the first breeding success took place after 4 years (Martell *et al.*, 2002), in the Pocono project (Pennsylvania, U.S.A.; 111 birds released from 1980 to 1986) after 6 years (Rymon, 1989) and at Rutland Water (England; 64 birds from 1996 to 2001) after 5 years (Dennis and Dixon, 2001). Thus, the 6 year-period recorded in the Andalusian project is congruent with the results observed for other osprey reintroduction programs.

Nevertheless, we can not still consider the programme as definitively successful until there is a long-term sustainable population. Consequently, we suggest that releases should continue at least until attaining a natural reproduction which matches the average number of released birds per year (18.4 ± 6.7 ind) prior to achieve the final objective.

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