

Increase of white stork *Ciconia ciconia* population attracted by artificial nesting platforms in Calabria, Italy

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SUMMARY

Between 2002 and 2012, the return of breeding pairs of white storks to Calabria, Italy, was encouraged through the installation of 46 artificial circular wooden platforms, of which 35 were supported on masts, nine on utility poles, and two on iron poles. The first platform nest was built in 2007, when there were just three breeding pairs of white storks at the site. By 2012, eleven nests were on artificial platforms, and the total white stork population at these sites had risen to 12 pairs. Between 2007 and 2012, 103 juveniles fledged from 30 nests located on platforms. More young fledged from nests on artificial platforms (4.0 ± 1.0 per nest), than from nests located elsewhere (3.4 ± 0.9 per nest). These results show that artificial platforms installed in suitable areas can be an effective in helping to increase breeding populations of white storks.

BACKGROUND

The white stork *Ciconia ciconia* is a polytypic species with a European, Mediterranean, and Central Asia distribution (Brichetti & Gariboldi 1997). The species is classified as SPEC 2 (BirdLife International 2004), with major declines in Europe in 1970-1990, followed by a significant recovery in 1990-2000 (BirdLife International 2004). It is listed in Annex I of the EU Birds Directive (Directive 79/409/EEC) and is considered at Lower Risk of extinction in Italy (Peronace *et al.* 2012).

White storks were historically present in Italy, and spontaneously re-colonized the country in the late 1950s (Tallone *et al.* 1993). Most of the Italian population consists of trans-Saharan migrants, but an increasing number of birds remain in Italy in winter (Brichetti & Fracasso 2003). The Italian population constituted 103 pairs in 2002 (Gustin & Tallone 2005).

In the late 1990s, the species colonized southern Italy – especially Sicily – with a population that in 2012 exceeded 90 breeding pairs (Gustin unpub.). In Calabria, the species bred for the first time in 1992 (Capalbo 1993) but only bred sporadically (2-3 times) thereafter. However, colonization increased from the early 2000s, with three breeding pairs in 2005 (Santopaolo *et al.* 2006).

The availability of suitable nest sites is likely to limit the breeding population of white storks in some areas. Where this is the case, providing artificial nest platforms has the potential to attract breeding pairs, but the species is considered extremely vulnerable to electrocution risk (BirdLife International 2008). Nesting sites of the white stork on low and medium-voltage utility poles are a common problem throughout Europe (Fiedler & Wissner 1980). This situation, which not only endangers the species but also causes economic damage, can be prevented by installing artificial platforms on the utility poles above the power lines (Goriup & Schulz 1991). Various models and materials for such platforms are used in different European countries, with metal being used more often than wood. The choice is usually dependent upon availability of materials (Muznic & Cvitan 2001).

LIPU (Italian League for the Protection of Birds) has been monitoring the white stork in Calabria since 2003 and has shown that the most important action to facilitate the establishment of a breeding population has been the installation of artificial platforms (Miraglia *et al.* 2003; Santopaolo *et al.* 2006).

ACTION

Artificial platforms were installed in five study areas: Crati valley, Sibari plain, Neto valley, Cirò marina and Esaro valley (Table 1).

Table 1. Habitat type in five study areas.

Area	Habitat type
Crati valley (Cs)	Floodplain, mosaic of cropland – vegetables, seed crops, olive groves, poplar groves and peach and citrus orchards - fallow land, small Virgilian oak <i>Quercus virgiliana</i> woodlots, and riparian vegetation (<i>Alnus glutinosa</i> , <i>Populus</i> spp., <i>Salix</i> spp.).
Sibari plain (Cs)	Largest plain in Calabria; about 700 hectares of citrus and olive groves and rice fields.
Neto valley (Kr)	Arid areas on clay soils, where seed crops prevail over olive groves and vineyards. The area is mostly flat, with small hills and promontories and annual crops.
Cirò Marina (Kr)	Extensive plains with a mosaic of vineyards and fallow land.
Esaro valley (Cs)	A western extension of the Sibari plain, has a highly varied landscape; the ridges drop steeply and give way to a wide ring of hills overlooking the Esaro floodplain.

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Table 2. Platforms installed and used by white storks every year from 2007 to 2012

	2007	2008	2009	2010	2011	2012	
Crati valley (Cs)	7	8	10	10	11	15	Platform installed
	0	0	1	1	1	4	Platform used
Sibari plain (Cs)	9	14	15	20	25	25	Platform installed
	1	1	4	4	6	7	Platform used
Neto valley (Kr)	2	2	2	2	3	3	Platform installed
	0	0	0	0	0	0	Platform used
Cirò Marina (Kr)	0	0	0	2	2	2	Platform installed
	0	0	0	0	0	0	Platform used
Esaro valley (Cs)	0	0	0	0	0	1	Platform installed
	0	0	0	0	0	0	Platform used

Between 2007 and 2012 46 artificial circular wooden platforms were installed in the study areas, of which 35 were placed on masts (height $19.8 \text{ m} \pm 2.4 \text{ SD}$), nine on utility poles (height $13.4 \text{ m} \pm 1.5 \text{ SD}$), and two on specially-installed iron poles (12.0 m). Fifteen were located in the Crati valley (of which four were used by white stork), 25 in the Sibari plain (of which seven were used by white storks), three in the Neto valley (not used by white storks), two in Cirò Marina (not used by white storks), and one in the Esaro valley (not used by white storks; Table 2). The artificial platforms were constructed from the circular base flanges of discarded wooden electric cable spools of four different diameters: 100 cm, 120 cm, 125 cm and 135 cm. Wooden beams between 25 cm and 35 cm in length were secured on the external circumference of each flange. Table 2 shows the numbers of platforms present at each site every year.

CONSEQUENCES

White storks nested on a platform for the first time in 2007, and in 2012 92% of nests were on platforms (Figure 1). Between 2007 and 2012 white storks used 26% of the platforms installed in the study areas in Calabria (Table 2). Figure 2 shows the numbers of juveniles flying in 2002-2012 from nests with and without platforms.

A total of 103 juveniles fledged from nests on platforms ($n = 30$ nests) and 79 juveniles fledged from nests not on platforms ($n = 25$ nests). The average number of juveniles fledged from non-platform nests was $3.4 \pm 0.9 \text{ SD}$, while the average number of juveniles fledged from platform nests was $4.0 \pm 1.0 \text{ SD}$.

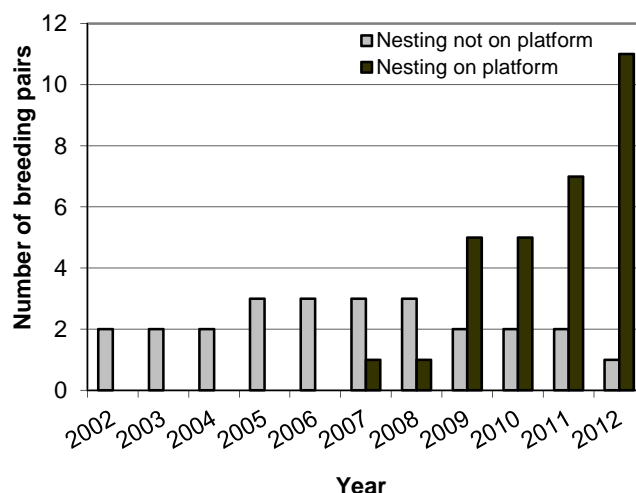


Figure 1. Numbers of pairs of white storks nesting on artificial nest platforms and at other sites in Calabria (southern Italy).

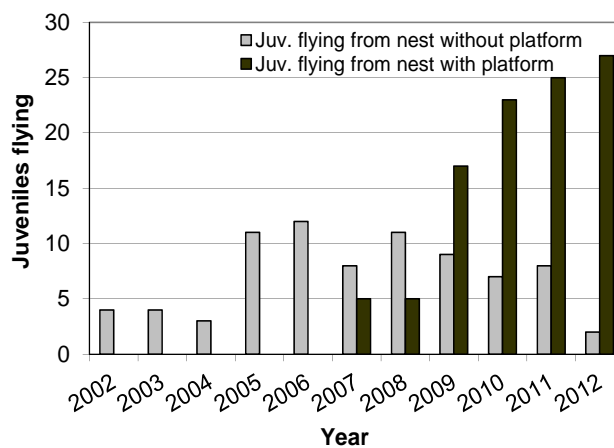


Figure 2. Juveniles flying from nests with and without platforms in study area.

DISCUSSION

Between 2007 and 2012 the number of breeding pairs of white storks in Calabria increased three-fold linked to the installation of 46 artificial platforms.

Although numerous flat-topped power masts are present in all areas where breeding took place, they were not used by the nesting pairs, which preferred masts with artificial platforms. In 2012, the species resumed breeding in the Tarsia plain (Crati valley, Cosenza province) and two pairs took up residence for the first time in the municipalities of Bisignano and Rende (Crati valley, Cosenza province), using artificial platforms in both cases and expanding the species' breeding range.

The presence of breeding platforms may serve to attract migrating individuals (Vaschetti *et al.* 1997). It is recommended that the ideal diameter of artificial platforms is 125 cm, based on a study in Croatia (Muznic and Cvitan 2001). Although not tested, we suggest that the beams should be 30-35 cm long in order better to hold the nesting material brought in by the breeding pair.

The two closest occupied platforms during the current study were 600 m apart, but interspecific competition behaviour was observed between two neighbouring pairs. In light of these observations, we feel that platforms installed in the vicinity of existing nest sites are unlikely to be occupied by new pairs. We therefore recommend that the minimum distance between two such platforms should be 800-900 m. Ideally, natural or artificial barriers should be present between nearby platforms so that they are not visible from each other.

In Spain, low predation rates and the lack of direct human disturbance may explain the absence of significant differences in reproductive success between platform and non-platform nests (Vergara and Aguirre 2006).

Unlike in other study areas (Omnus *et al.* 2012) the number of breeding pairs and fledglings increased throughout the study period, with a higher than average success (4.0 ± 1.0 per nest) than for other populations in the Mediterranean (Barbraud *et al.* 1999) and northern Italy (2.8 ± 0.9 (Tallone *et al.* 1993).

These results show that, as in Israel (Muznici & Cvitan 2001), artificial platforms, if installed in suitable areas, can be an effective in helping to expand the breeding range of white storks.

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