

The White Stork Census in Greece, 2004/05

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Zusammenfassung

In Griechenland wurden 2004 insgesamt 2.157 Paare (HPa) des Weißstorks erfasst. Die durchschnittliche Siedlungsdichte betrug 9,61 Paare/100 km² bezogen auf die landwirtschaftliche Nutzfläche. 1.946 Paare hatten Bruterfolg (HPm) und 211 Paare waren erfolglos (HPo). Die Gesamtzahl der ausfliegenden Jungvögel (JZG) betrug 5.827. Damit betrug der Gesamtbruterfolg (JZa) 2,7 Junge/Paar und der Teilbruterfolg bezogen auf die erfolgreichen Paare (JZm) 2,99 Junge/Paar. Die meisten Brutpaare (77%) wurden im Norden Griechenlands, in den Regionen Makedonien und Thrakien, registriert. Die meisten Nester wurden von den Weißstörchen auf Strommasten gebaut: 60% brüteten auf Strommasten mit Nisthilfen und 21% bauten ihr Nest ohne Nisthilfe auf Strommasten. 14% der Storchennester befanden sich auf Kirchen und nur 3% der Paare nisteten in Bäumen. Der Stromtod und der fehlende Schutz in ihren Brutgebieten und Nahrungshabitaten sind die hauptsächlichen Gefährdungsursachen für die Art in Griechenland.

Summary

2,157 pairs (HPa) of White Storks were recorded breeding in Greece in 2004. The mean breeding density was 9.61 pairs/100 km² of agricultural land. There were 1,946 successful (HPm) and 211 unsuccessful pairs (HPo). The total number of fledged young (JZG) was 5,827. Productivity (mean number of fledglings per pair, JZa) was 2.70 and mean fledged brood size (JZm) was 2.99. Most (77%) breeding pairs were recorded in Northern Greece, in the regions of Macedonia and Thrace. Most nests (81%) were built on electricity poles: 60% of breeding pairs nested on poles equipped with an artificial nest platform and 21% built their own nests on poles. 14% of storks built nests on churches, and only 3% of the pairs nested in trees. Electrocutation and lack of protection in their breeding areas and feeding grounds are the main threats for the species in Greece.

Introduction

The White Stork *Ciconia ciconia* is widespread and locally common in Greece. It was present in most of the mainland and on some islands until the early decades of the 20th century. Nowadays

its presence is limited to Central and Northern Greece and a very few islands (HANDRINOS & AKRIOTIS 1997). Most White Stork studies in Greece have been carried out in the northern regions of the country and population data at a national level are insufficient. Estimates since the late 1950s show a rapid decline of the breeding population from c. 9,000 breeding pairs (bp) in 1958 down to 2,500 in the late 1960s, and c. 1,500 bp in the mid 1980s (HANDRINOS & AKRIOTIS 1997). According to BirdLife International estimates, the population has been stable at c. 2,000-2,500 bp since the early 1990s (TUCKER & HEATH 1994; BIRDLIFE INTERNATIONAL 2004).

Study area and methods

Greece lies at the southernmost part of the Balkan Peninsula. It is a mountainous country with an average altitude of 500 m and with 2 main mountain ranges, the Pindos Mt that separates Western Greece from the rest of the mainland and the Rodopi Mt in NE. Greece (HANDRINOS & AKRIOTIS 1997). Plains and watersheds are situated in the lowlands between the mountains, where most human settlements are concentrated.

The 1st White Stork Census in Greece was organised by the Hellenic Bird Ringing Centre (HBRC) in collaboration with the Hellenic Ornithological Society (HOS/BirdLife-Greece), within the framework of the 6th International White Stork Census. The census was carried out in the summers of 2004 and 2005, by volunteers under the supervision of one national coordinator, and a number of local coordinators.

Data collected includes information about the species' distribution (locations of occupied and unoccupied nests), population size (breeding pairs), and breeding success (number of nests with and without fledglings). Data were grouped according to the administrative division of the country in prefectures (called 'nomoi' in Greek) and in geographical regions (called 'diamerismata') as presented by HANDRINOS & AKRIOTIS p.29 (1997). The species data were imported into a GIS using ArcGIS9 and the Greek Grid (EGSA87) reference system to construct maps showing distribution, population density and breeding success. Data on elevation and NATURA 2000 sites were provided by HOS and agricultural data come from the National Statistical Service of Greece (NSSG, 2000).



Results

The success of the census was primarily due to the participation of a large number of volunteers: 136 people took part in the census, which covered approximately 98% of White Stork breeding locations in 2004. A small number of places that were not surveyed in 2004 were visited in 2005. The census results are presented in Table 1.

Population size

A total of 1,712 areas, including towns, villages and other locations were surveyed during the census: 1,348 of these held nests occupied by white storks.

The number of occupied nests was 2,284. This includes breeding pairs and single birds occupying a nest. The total number of breeding pairs (HPa) was 2,157 of which 1,946 were successful (HPm) (Tab. 1).

Distribution

White Storks were recorded in 29 prefectures (*nomoi*) in 6 geographical regions (Tab. 1). Storks were present in Central and Northern Greece, in some regions of Western Greece and on one island (Lesvos) (Fig. 1).

Most nests were found in the lowlands of the country (see Fig. 1). The mean altitude of nest sites was 192 m a.s.l. Nest locations were recorded at altitudes between 0 m (in several regions) up to 907 m in the village of Platy in the prefecture of Florina, NW. Greece. Mean altitude of nest sites was more than 400 m in 4 prefectures, while most of the regions with White Storks had an altitude of 200 m or below, as shown in Figure 1. When the regions of higher altitudes were excluded from elevation data, mean altitude of nest sites was reduced to 109 m.

The prefectures with the highest mean altitudes for White Stork nests were Kastoria, Florina, and Grevena in NW. Macedonia (see Fig. 2). Attiki in S. Greece has only one nest located in a region at an altitude of 395m.

Breeding density

The density of breeding pairs per 100 km² of agricultural land is presented in Table 1 (column 12) and Figure 3. Population density (StD) ranges between 0.28 pairs/100 km² in Attiki, which held only a single pair, up to 25.46 pairs/100 km² in Xanthi in NE. Greece, where 102 nests occupy a relatively small area. The average breeding density for the whole country was 9.61 pairs/100 km².

As shown in Figure 3 & 4, most White Storks in Greece are found in the north of the country. The prefectures with the highest breeding numbers were Evros and Serres in NE Greece, with 311 and 333 nests respectively (see Tab. 1). Population numbers and density were also very high in the central regions of N. Greece, while W. and C. Greece had very low densities (see Fig. 3 & 4).

The village with most white stork nests was Kerkini in Serres with 31 breeding pairs. Other villages with high number of nests were Kleidi in Imathia with 30 pairs, Eginio in Pieria with 28 pairs, Ferres in Evros with 26 pairs and Vafiochori in Kilikis with 25 pairs.

Breeding success

The total number of fledglings (JZG) in 2004/5 was 5,827 (see Tab. 1), ranging from 1 to 6 fledged chicks per successful nest. The commonest fledged brood size was 3 (41% of nests), as shown in Figure 5 and the second most frequent was 4. Only 5 nests held 6 chicks (that is why this category is presented as 0% in Figure 5). There were 211 unsuccessful nests (HPo), which corresponded to 9.8% of the total number of breeding pairs.

Productivity (mean number of fledglings per breeding pair (JZa), was 2.7 and mean fledged brood size (mean number of chicks fledged per successful nest (JZm), was 2.99 (Tab. 1). Mean fledged brood size for each prefecture is presented in Figure 6. The regions with the largest fledged broods were Fthiotida in C. Greece, Kozani in NW. Greece, Arta, Thesprotia in W. Greece and Kavala in NE. Greece (see also Table 1).

Nest locations

Most nests (81%) were built on electricity poles, as shown in Figure 7: 60% of the breeding pairs nested on poles with an artificial nest platform and 21% built the nest themselves on the poles. The second most frequent type of nesting location was church roofs (14%). Only 3% of the pairs nested in trees. Other locations of nests included tall buildings such as chimneys, towers and a variety of artificial objects.

Discussion

Population status

The results of the census showed that the population of White Storks in Greece lies within the estimates presented by BirdLife International (1994 & 2004). According to a previous national census in the early 1990s based on questionnaires, breeding numbers were 2,387 pairs in 1993 (TSACHALIDIS & PAPAGEORGIOU 1996). However, comparisons with the present census cannot be made, because different methods were used for data collection. Other studies on the Greek population of White Storks are rather fragmentary. National censuses were carried out in 1974 and 1975, also based on questionnaires, and giving population estimates of 1,325 and 3,014 individuals respectively (KANELLIS 1976). The difference between the years was because of the small number of participants in 1974. A census in N. Greece in 1968 showed that the breeding population in the area of W. Macedonia was 169 pairs (HECKENROTH 1969). Finally, a survey in N. Greece (including N. Thessaly) in 1986 showed that the breeding population in that area was 754 pairs (HÖLZINGER & KÜNKELE 1986).

The population of White Storks in Greece has declined by roughly 75% since the late 1950s, falling from 9,190 pairs in 1958 (KANELLIS 1976) to 2,157 pairs in 2005 (present study). Local studies support this trend, revealing dramatic population changes. A study in the region of Nestos Delta in NE. Greece by JERENTRUP (1989) showed a decline of 40-50% between 1970 and 1985, while TSAHALIDIS & PAPAGEORGIOU (1996) reported a decline of 45% in the population in the prefecture of Serres. Lack of long-term population monitoring studies makes it difficult to determine where the species is more vulnerable to extinction. However, the islands appear to have suffered major losses. White

Storks used to breed on the islands of Evvoia, Lesvos, Limnos and Kos in the Aegean Sea (HANDRINOS & AKRIORIS 1997). The results of the present census showed that they breed only on the island of Lesvos, while its distribution on the mainland remains rather stable.

Northern Greece remains the stronghold of the population, with 77% of the breeding pairs recorded in the regions of Macedonia and Thrace. The prefectures of NE Greece, in particular, have very high breeding densities. This might be explained at least in part by the occurrence there of extensive plains with traditional farmlands and wetlands, at low altitude, since such habitats are considered as the optimum foraging grounds for white storks. Breeding performance is higher in W and C Greece (except the prefecture of Voiotia) than in N Greece, although breeding densities are lower. A further assessment of habitat usage and habitat suitability is needed to uncover the reasons for this.

Differences in the timing of breeding, especially between W and N Greece, may have affected the recorded number of fledglings. In some cases, observers could not estimate the number of chicks in the nest, while on other occasions the pairs were still incubating at the time of the survey, so these areas had to be revisited. GOUTNER & TSAHALIDIS (1995) also noted asynchrony in breeding amongst various regions, based on their personal observations and past evidence.

Conservation issues

The natural habitats of White Storks, such as lowland grasslands with freshwater elements nearby and wetlands, have been dramatically reduced over the last century in Greece (LEGAKIS 1998), and consequently the species depends largely on agricultural lands to feed. Data on Important Bird Areas (IBAs) in Greece (HEATH & EVANS 2000) illustrate that intensification of farming threatens half of all IBAs and is a high impact threat in 27%. The absence of the species from islands and its former southern range in the mainland, such as the Peloponnese, and the small populations in C and W Greece is related to the loss of wetlands and grasslands and the intensification of agriculture in these areas.

Low population density could be a problem for the continuity of White Stork distribution, especially in S and C Greece. In the region of Thessaly, for example, although White Storks are widespread, they occur at very low densities, with few breeding pairs in each village or town (Fig. 4). The disappearance of a small number of pairs could lead to fragmentation of the population in that region. Therefore, any overall changes in the population of the White Stork in Greece are primarily related to the species' abundance rather than its distribution.

Another region of Greece with a very low breeding density is Etoloakarnania in W Greece, despite the presence of several wetlands, including the Messolongi Lagoon and lakes. The western population might be more vulnerable to extinction, because it is separated from the main population by extensive mountain ranges (Fig. 1) and, therefore, should be a priority for the species' conservation in Greece. Part of this population follows a different migratory route, not via the Bosphorus but over the Greek Peninsula and the Mediterranean Sea, as shown by observations of White Storks migrating over the island of Kythera and the Antikythera

Bird Observatory (KOMINOS 1995 and pers. obs.). KANELIS (1976) mentioned that small numbers of White Storks migrate via the southern Peloponnese and Crete towards Africa. The significance of migratory routes for population change in the White Stork in Europe was illustrated by BAIRLEIN (1991). Young birds may be particularly vulnerable during their first migration, as they have to cover a long distance over the sea and many of them do not survive. This assumption is supported by the number of birds found drowned along the coast of Kythera (Kominos, pers. obs.). However, long-term studies are needed before drawing any conclusions.

An important conservation issue for the White Stork in Greece is the lack of protection for agricultural areas. As shown in Figure 8, most of the lowland cultivated plains are not covered by the NATURA 2000 site network (DAFIS *et al.* 1997) and, consequently only a small proportion of the species' breeding season habitat, such as areas adjacent to large wetlands, is protected. Lack of protection is also relevant to the destruction of natural nesting sites, especially the cutting of old trees. A very recent example comes from northern Greece, where an old oak tree with 15 white stork nests was cut in 2005 (HOS, pers.com.). Conservation measures for the species should include the preservation of old trees both in built-up areas and in the countryside, since most of the trees have disappeared, in particular from fields, due to the mechanization of farming practices in recent decades.

Lack of suitable natural nest sites forces the birds to build their nests on man-made structures, such as electricity transmission poles. Collision with and electrocution by power lines is considered a great threat to White Storks in Greece, given that 81% of Greek nests are located on electricity poles. The number of deaths by electrocution was very high in the years between 1996 and 2003, as illustrated by the Hellenic Rehabilitation Centre of Wild Animals (HRCWA) (HRCWA, unpublished data). Their records showed that c.15 storks were sent to the Centre for treatment every year. However, based on evidence from volunteers and field observers in Central Greece, it is estimated that only 1% of the animals that collide with power lines actually survive and are sent to the Centre. HRCWA argues that about 1,000-1,500 White Storks die every year due to electrocution. Most of these are young birds that die in their first flights around the nest. This evidence is very important for the conservation of the species in Greece, and it is also supported by information gathered during the census, which showed that deaths by electrocution were very common throughout the country. Recent contacts made by HOS with the Public Power Corporation S.A. (Δ.Ε.Η.) to develop conservation measures were unsuccessful, as the company rejected proposals that would have increased protection for the species.

Other activities associated with the census

Activities associated with the census included: 1) advertising in the press (newspapers, radio and TV stations); 2) collaboration with HOS and information of its members and researches for the census - contacts were also developed with 17 other bodies including WWF-Dadia, environmental departments of universities (Thrace, Ioannina and Aegean), local services such as the Forest Service and Conservation Bodies; 3) designing of a website hosted by HOS; 4) designing of a poster sent to all participants who distributed it throughout the county; 5) presentation of prelimi-

nary results at a Greek Zoological Society conference on Lesbos, in December 2004; and 6) discussions with the administration of Δ.E.H. for the protection of the species.

Acknowledgements

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Tab. 1. Results of the 2004/05 White Stork census in Greece.

Ergebnisse des 6. Internationalen Weißstorchszensus 2004/05 in Griechenland.

PERIFEREIA (geographical region)	NOMOS (prefecture)	Occupied nests	empty nests	HE	HPa	HPm	HPo	JZG	JZa	JZm	StD
THRACE	Evros	312	35	1	311	273	38	659	2.58	2.94	20.68
	Rodopi	101	28	5	96	85	11	230	2.43	2.74	12.8
	Xanthi	102	45	7	95	94	1	249	2.79	2.82	25.46
MACEDONIA	Kavala	68	31	5	63	58	5	167	3.3	3.59	14.02
	Drama	73	23	5	68	67	1	169	2.78	2.82	14.39
	Serres	359	55	26	333	320	13	773	2.82	2.93	22.95
	Kilkis	103	23	6	97	88	9	229	2.46	2.72	9.15
	Thessaloniki	195	51	5	190	173	17	441	2.64	2.9	14.66
	Halkidiki	3	2	0	3	2	1	8	2	3	0.39
	Imathia	89	54	7	82	71	11	232	2.27	2.62	15.27
	Pieria	45	12	1	44	35	9	102	2.5	3.14	9.65
	Pella	100	55	9	91	84	7	255	2.55	2.76	11.75
	Kozani	10	9	0	10	8	2	29	2.9	3.63	1.13
	Grevena	3	0	0	3	1	2	6	0.67	2	0.72
	Florina	72	18	7	65	62	3	162	2.6	2.73	12.27
	Kastoria	19	10	0	19	18	1	48	3	3.17	7.62
IPEIROS	Ioannina	38	44	5	33	32	1	120	3.3	3.41	7.64
	Thesprotia	41	19	1	40	35	5	101	3.15	3.6	14.17
	Preveza	41	15	2	39	38	1	97	3.26	3.34	14.8
	Arta	40	19	0	40	38	2	99	3.45	3.63	15.09
STEREA HELLAS	Etoloakarnania	19	2	3	16	13	3	40	2.88	3.54	1.26
	Fthiotida	74	50	7	67	57	10	198	3.22	3.79	5.13
	Voiotia	7	2	0	7	7	0	16	1.86	1.86	0.72
	Attiki	1	0	0	1	1	0	2	4	4	0.28
THESSALIA	Larisa	134	28	6	128	114	14	296	2.8	3.15	6.76
	Magnisia	40	3	1	39	31	8	83	2.26	2.84	5.38
	Trikala	88	10	12	76	57	19	186	2.37	3.16	12.66
	Karditsa	102	31	6	96	83	13	235	2.6	3.01	10.76
AEGEAN ISLANDS	Lesvos	5	0	0	5	1	4	10	0.8	4	0.42
TOTALS		2,284	674	127	2,157	1,946	211	5,242	2.70	2.99	9.61

HPa: numbers of pairs occupying a nest, HPo: number of unsuccessful pairs, HPm: number of successful pairs, JZG: total number of fledged young, JZa: productivity (mean number of young fledged per pair - JZG/HPa), JZm: mean fledged brood size (JZG/HPm) and StD: number of pairs (HPa) per 100 km² (of agricultural land).

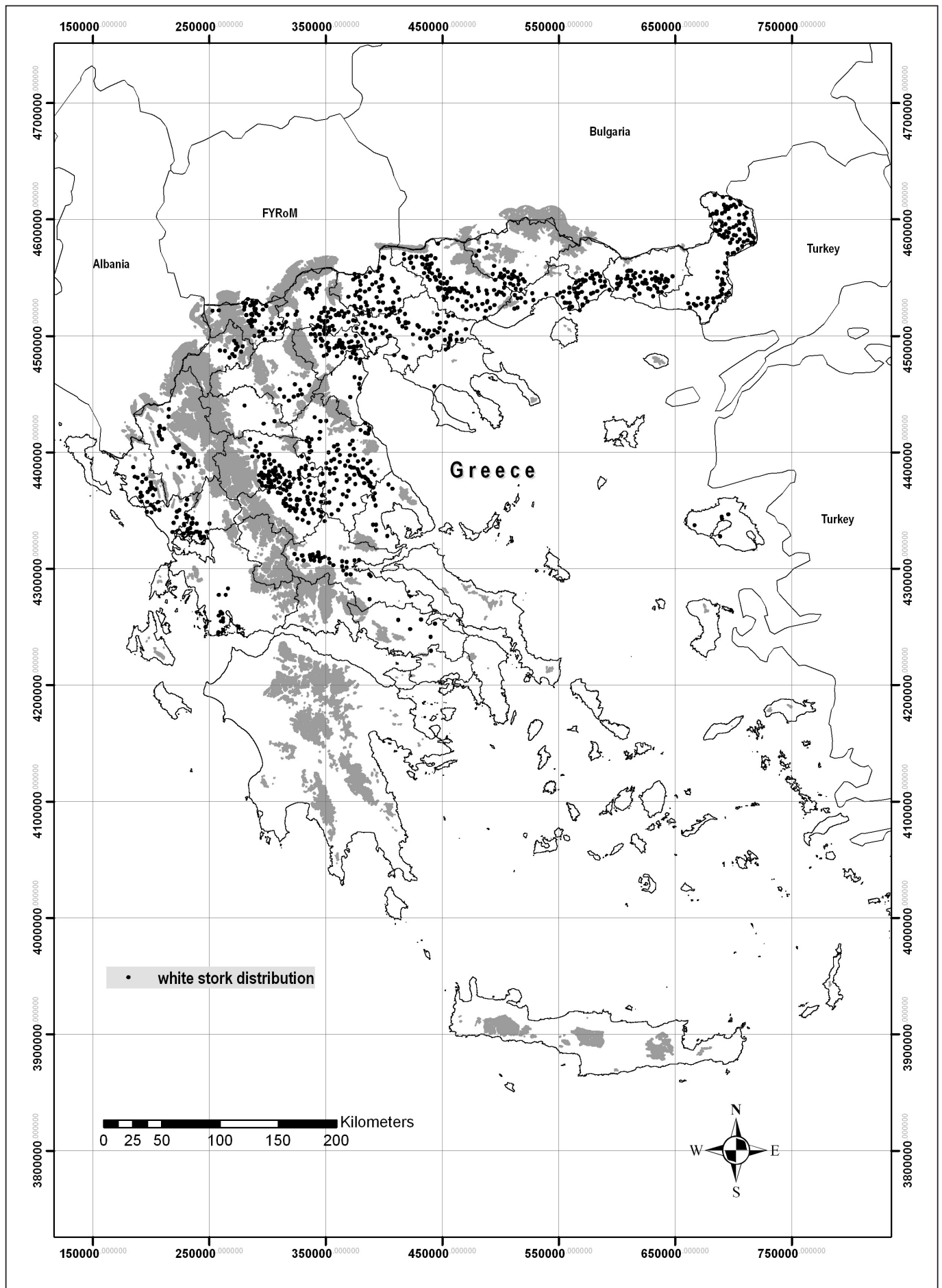


Fig. 1. Distribution of the White Storks in Greece in 2004/05. Grey areas show mountains and mountain ranges with an altitude of more than 1,000 m a.s.l.

Verbreitung des Weißstorks in Griechenland 2004/05. Die grau unterlegten Areale zeigen die Bergregionen mit einer Höhe von 1.000 m ü NN.

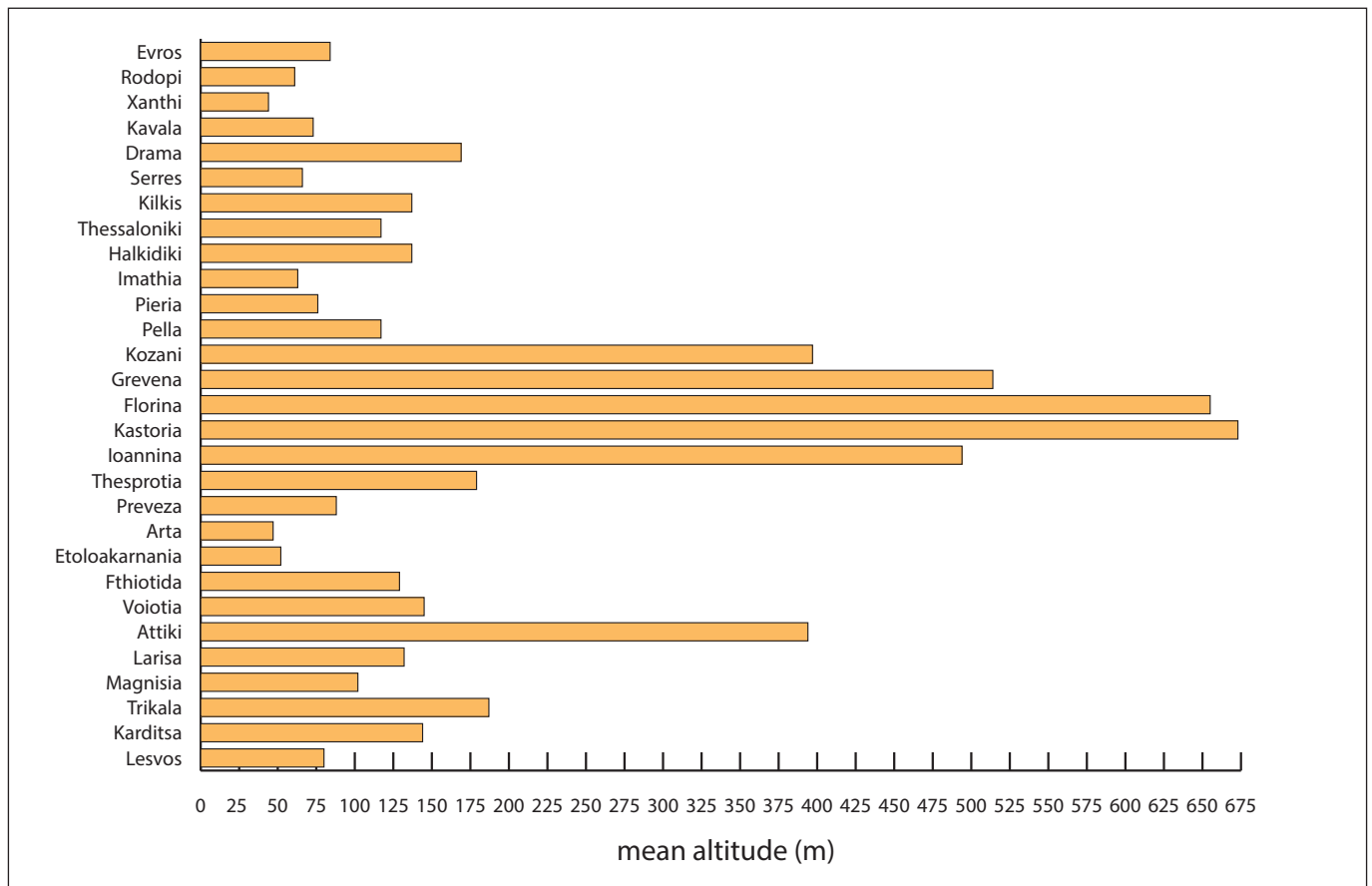


Fig. 2. Mean altitude (m) of White Stork nest sites in each prefecture in Greece in 2004/05.
Mittlere Höhe (m ü NN) der Weißstorchnester in den Präfekturen Griechenlands 2004/05).

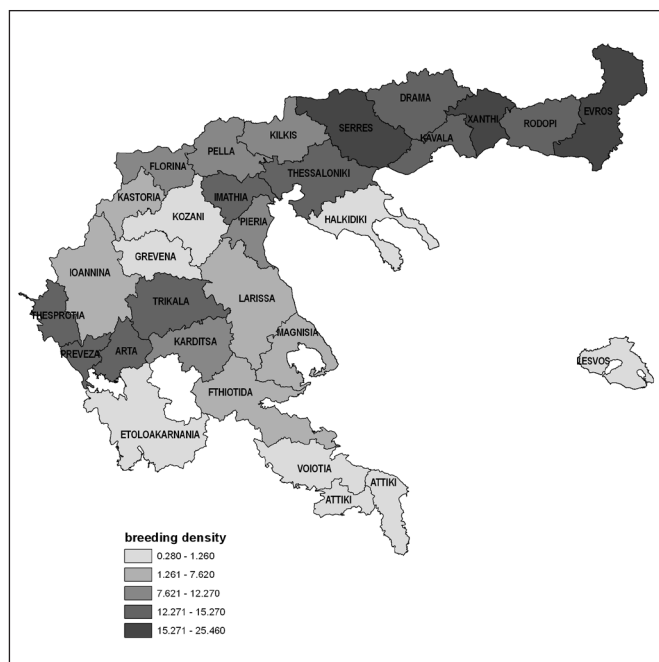


Fig. 3. Breeding density of White Storks per 100 km² of agricultural land in each prefecture in Greece in 2004/05.
Siedlungsdichte des Weißstorchs pro 100 km² landwirtschaftlicher Nutzfläche in den Präfekturen Griechenlands im Jahr 2004/05.

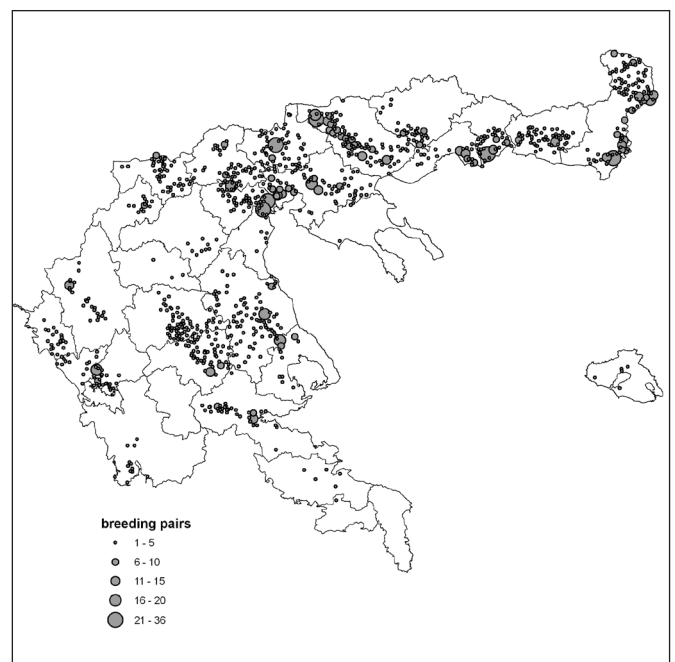


Fig. 4. Distribution of White Stork nests in each prefecture in Greece in 2004/05. Size of dots indicates the number of breeding pairs (HPa) in each village/town.
Verbreitung des Weißstorchs in den Präfekturen Griechenlands 2004/05. Die Größe der Punkte gibt die Anzahl der Brutpaare (HPa) in den Ortschaften wieder.

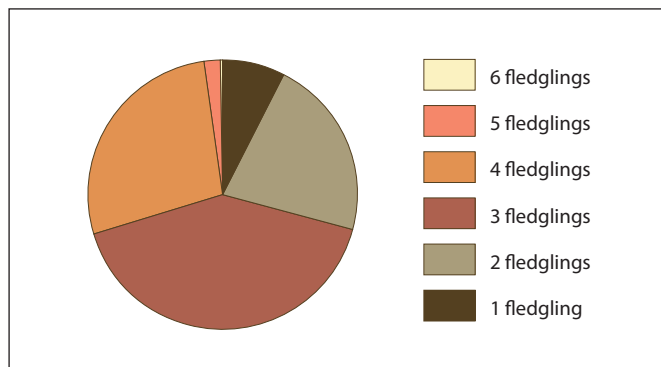


Fig. 5. Mean fledged brood size of White Storks in Greece in 2004/05.
Durchschnittliche Größe der Bruten des Weißstorchs in Griechenland 2004/05.

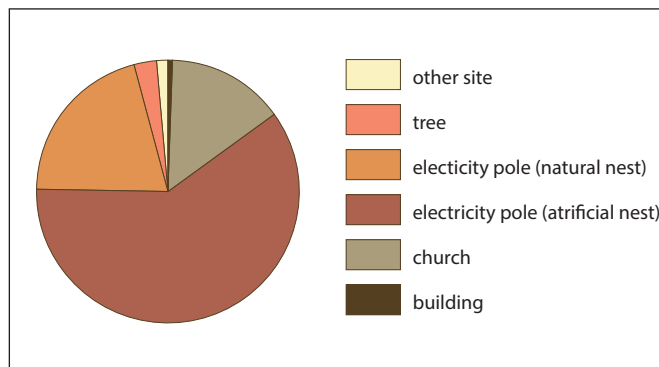


Fig. 7. Nesting locations of White Storks in Greece in 2004/05.
Nistplätze des Weißstorchs in Griechenland 2004/05.

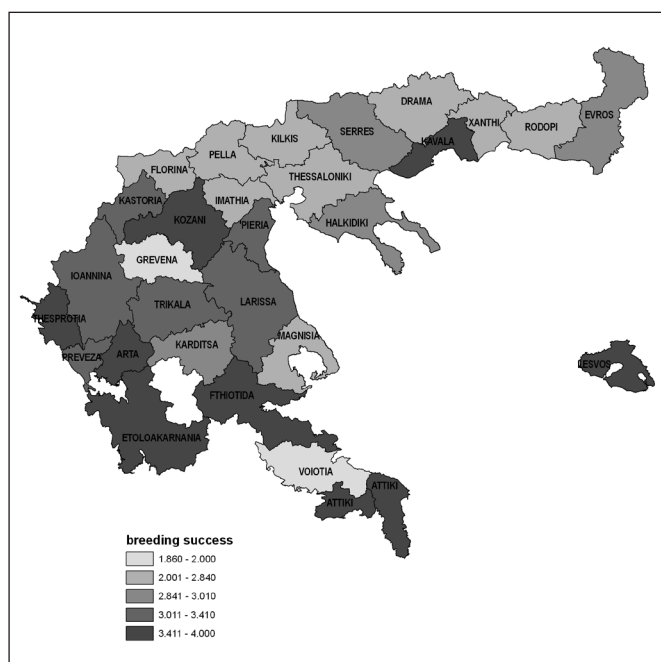


Fig. 6. Mean fledged brood size (JZm) of White Storks in each prefecture in Greece in 2004/05.
Durchschnittlicher Teilbruterfolg (JZm) des Weißstorchs in den Präfekturen Griechenlands 2004/05.

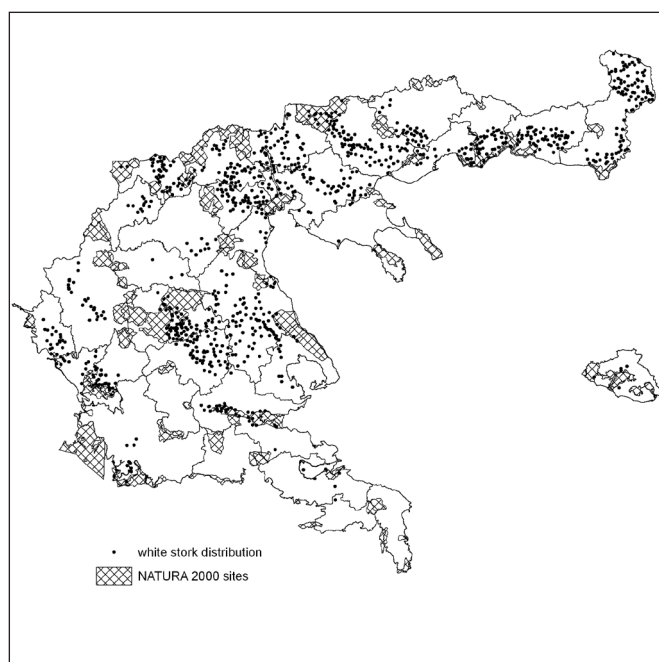


Fig. 8. Coverage of White Stork breeding areas by the NATURA 2000 network in Greece.
Überschneidung der Brutgebiete des Weißstorchs mit dem NATURA2000 Netzwerk in Griechenland.

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