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## New Data Regarding the Spatial Distribution of White-Tailed Eagle (Aves: *Haliaeetus Albicilla*) and their Breeding Ecology between 2009 and 2018 within the Danube Delta Biosphere Reserve and its Surroundings (Romania)

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**ABSTRACT:** In this work we present some of the data about the nesting ecology of the White-tailed Eagle (*Haliaeetus albicilla*) collected during 2009-2018 in the Danube Delta Biosphere Reserve and its surroundings. A total of 144 different nests (occupied, unoccupied and destroyed) were recorded in this period. We also recorded 7 breeding pairs (territories) whose nests could not be identified.

The preferred tree species for nesting were *Salix alba* with 63% of all identified nests, 17% were in *Populus alba*, *Populus x canadensis hibrid* 15%, 3% in *Alnus glutinosa*, 1% in *Tilia tomentosa* and 1% in *Quercus robur*. The nests were located in the tallest trees available on the site and were placed at heights between 5 and 24 meters. 67% of these were above 13 m of the ground, while 33 % below. The *White-tailed Eagle* nest site selection may be a response both to tree availability in the foraging habitat as well as food supply.

**Keywords:** White-tailed Eagle, nest, *Haliaeetus albicilla*, D.D.B.R.

## INTRODUCTION

The Danube Delta Biosphere Reserve (D.D.B.R.), due to its geographic location and to the temperate continental climate with Pontic influences in the coastal area, hosts a remarkable diversity of flora and fauna. At the same time, the D.D.B.R. is traversed by an important bird migration route. One of Romania's most impressive diurnal birds of prey in this area, is the White-tailed Eagle - WtE - (*Haliaeetus albicilla* Linnaeus 1758). This diurnal raptor is the largest sedentary bird nesting in Romania. At the European level, the WtE was a very common species at the beginning of the 20<sup>th</sup> century (Cramp and Simmons, 1980; Dombrowski, 1912; Linția, 1954). Anthropogenic factors in effect during the period 1950-1960 led to the rapid decrease of the size of the WtE population in Romania, but also in many other European countries. The main causes that led to the decline of the species were: pesticides, poaching and habitat destruction (Bijleveld, 1974; Bodea *et al.*, 1957; Cătuneanu, 1973; Dragomir and Kiss, 1972; Klemm, 1973; Linția, 1954; Pușcariu, 1968; Radu, 1973; Rosetti-Bălănescu, 1957; Tălpeanu, 1967; Steinbacher, 1977). The decline of the WtE population in Romania continued until the early 1990s (Dragomir and Almășan, 1973; Grimett and Jones, 1989; Kiss, 1982; 1985; Klemm, 1973; Marinov, 1990; Marinov and Kiss, 1991; Munteanu, 2005; Stănescu *et al.*, 1985).

In 1990, when the Danube Delta Biosphere Reserve was established (\*\*\*\*, 1993), the WtE population started to recover. At the same time, it has been proven that the existence of an ecological surveillance structure can provide reliable information, in particular on nesting, but also on wintering or transit effectiveness. In the period 1990-2000, the number of reproductive WtE was estimated to be between 10-20 pairs (Burfield and Bommel, 2004; Ciochia, 1992; 2001; Daróczy and Zeitz, 2001; Gâstescu and Stiucă, 2006; Hagemeijer and Blair, 1997; Munteanu, 1998; 2002; 2009). With the prohibition of these factors, the population of this species is increasing. The size of the global population of *H. albicilla* is estimated at about 12,100-24,500 nesting pairs, of which 18,000-24,600 adult birds are found on our continent, representing 50-74% of the world's population (\*\*\*\* 2016). The largest WtE populations are located in Norway, Russia, Poland, Germany, Sweden, Finland and Greenland (Hagemeijer and Blair, 1997; \*\*\*\*, 2004).

## MATERIAL AND METHODS

The monitoring of WtE nests within the D.D.B.R. and its surroundings took place between 2009-2018, intensifying with 2015. Identification of the WtE nests was carried out in two stages: the first was carried out during the winter period (December - March), when trees are without leaves and the nests are visible and can be observed even from a few kilometres, and the second stage took place during the spring-summer period (April-June), to investigate nesting of the WtE. Among the methods used to identify the WtE nests, the method of transects and fixed point (Bibby *et al.*, 2000) was used, in the following areas: Parcheş, Somova, Nufăru, Victoria, Băltanii de Sus, Enisala, Mândra forest (Agighiol) and Murighiol-Dunavăț. The method for nest searching within the D.D.B.R. was particularly complex. Searching for nests involved navigating the territory by boat on the D.D.B.R.'s canals and lakes. Thus, on a lake or on a backwater, the trees around the lake were scanned using binoculars. When an adult bird was seen on a tree, the observer headed in the bird's direction by boat and started looking for the nest in a 300-meter radius. Usually, the adult bird (generally the male) is standing guard near the nest. This method has produced good results and in this way a significant number of WtE nests were found.

A large part of the nests were located with the help of the ornithologists and the field workers of the Danube Delta National Institute for Research and Development (D.D.N.I.R.D.) and others were reported by the inspectors and the ecological agents (rangers) of the Danube Delta Biosphere Reserve Administration (D.D.B.R.A.) and the environmental commissioners within the Danube Delta Biosphere Reserve Commissariat, but also with the help of the forestry technicians and foresters who are assigned to the territory of Tulcea County. At the same time, fishermen and locals from the study area were also involved. All of the nests were checked by the author.

Vehicles were used for terrestrial routes and boats with engines ranging from 6 to 20 HP were used for aquatic routes. The identification of birds from a distance was done using optical instruments (binoculars and photo camera).

The GPS (Global Positioning System) was used in order to locate as accurately as possible the WtE nests. These points were taken at the tree, or where this wasn't possible, near it, followed by coordinates' correction using QGIS.

## RESULTS AND DISCUSSION

Investigations on the distribution of WtE pairs and nests within the D.D.B.R. and its surroundings were carried out during 2009-2018. Part of the results up to 2017 was presented in a previous paper (Alexe *et al.*, 2018). The aim of the following study is to add new information collected in 2018 regarding the trend of the WtE population and complete the database that can be used to elaborate management measures for this and other sympatric species.

The recent distribution of the WtE nests and pairs in Northern Dobruja is limited particularly to the D.D.B.R., with some local presence in the wooded massifs at the limits of the D.D.B.R. At present, the only areas on the continental side with WtE nests that are known since 2008 and are still used are in the Babadag-Enisala and Mândra (Agighiol) forests. At the same time, these areas are also known as roosting places for the non-nesting population, or for individuals that are migrating in southern Europe or remain within the D.D.B.R. during the cold period. The studies conducted during 10 years of investigation of WtE nests and pairs in the D.D.B.R. and its surroundings attest the existence of 144 occupied, unoccupied and destroyed nests (Table 1, Figure 1). Figure 2 shows the situation of the WtE nests within the D.D.B.R. and its surroundings since 2018.

The studies related to WtE within the D.D.B.R. and its surroundings during the last few years appear in subchapters in doctoral dissertations, some of them being published (Dorosencu, 2011; Pocora and Ion, 2005; 2006; Pocora, 2007; Pocora and Pocora, 2008; Stanciu, 2017), but a more comprehensive situation regarding current nesting on the territory of the D.D.B.R. of this bird of prey can be found in more recent works (Kiss *et al.*, 2013; 2014; Sándor *et al.*, 2015). During a study between 2009-2017, there were localized 74 nests within the D.D.B.R. and its surroundings, out of which 61 nests proved the success of breeding, with a total of 193 chicks. Thus the average successful brood in all the years of research was calculated at 1.2 chicks/nest. The issue of nesting success will be debated in another article (Alexe *et al.*, 2018a).

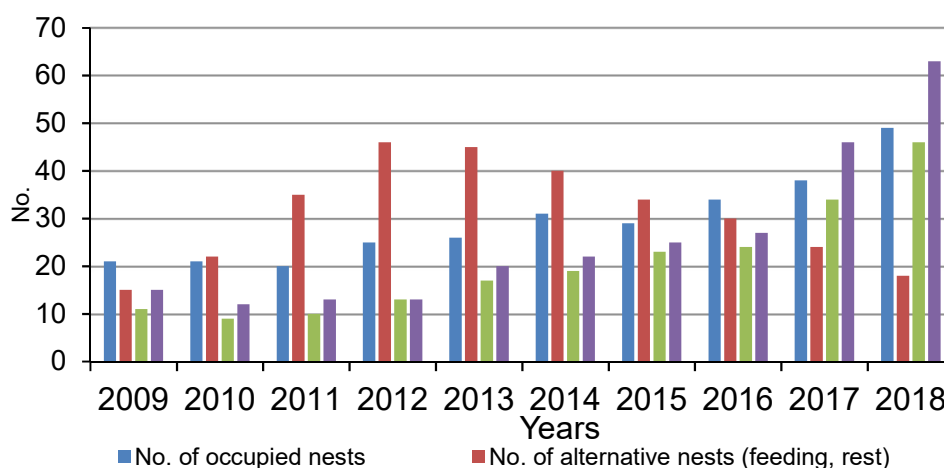
The data regarding WtE breeding evolution in the study period are presented in table 1.

**Table 1.** The evolution of White-tailed Eagle (*Haliaeetus albicilla*) nesting success between 2009 and 2018 within the D.D.B.R. and its surroundings (Romania)

Year	No. of nests visited (total)	No. of occupied nests	Occupancy percent	No. of alternative nests (feeding, rest, etc.)	No. of nests destroyed	No. of successfully completed nestings
2009	36	21	58.34 %	15	7	11
2010	43	21	48.89 %	22	6	9
2011	55	20	36.36 %	35	2	10
2012	71	25	35.21 %	46	8	13
2013	71	26	36.62 %	45	0	17
2014	71	31	43.66 %	40	5	19
2015	63	29	46.03 %	34	3	23
2016	64	34	53.02 %	30	13	24
2017	62	38	61.29 %	24	16	34
2018	67	49	73.13 %	18	12	46

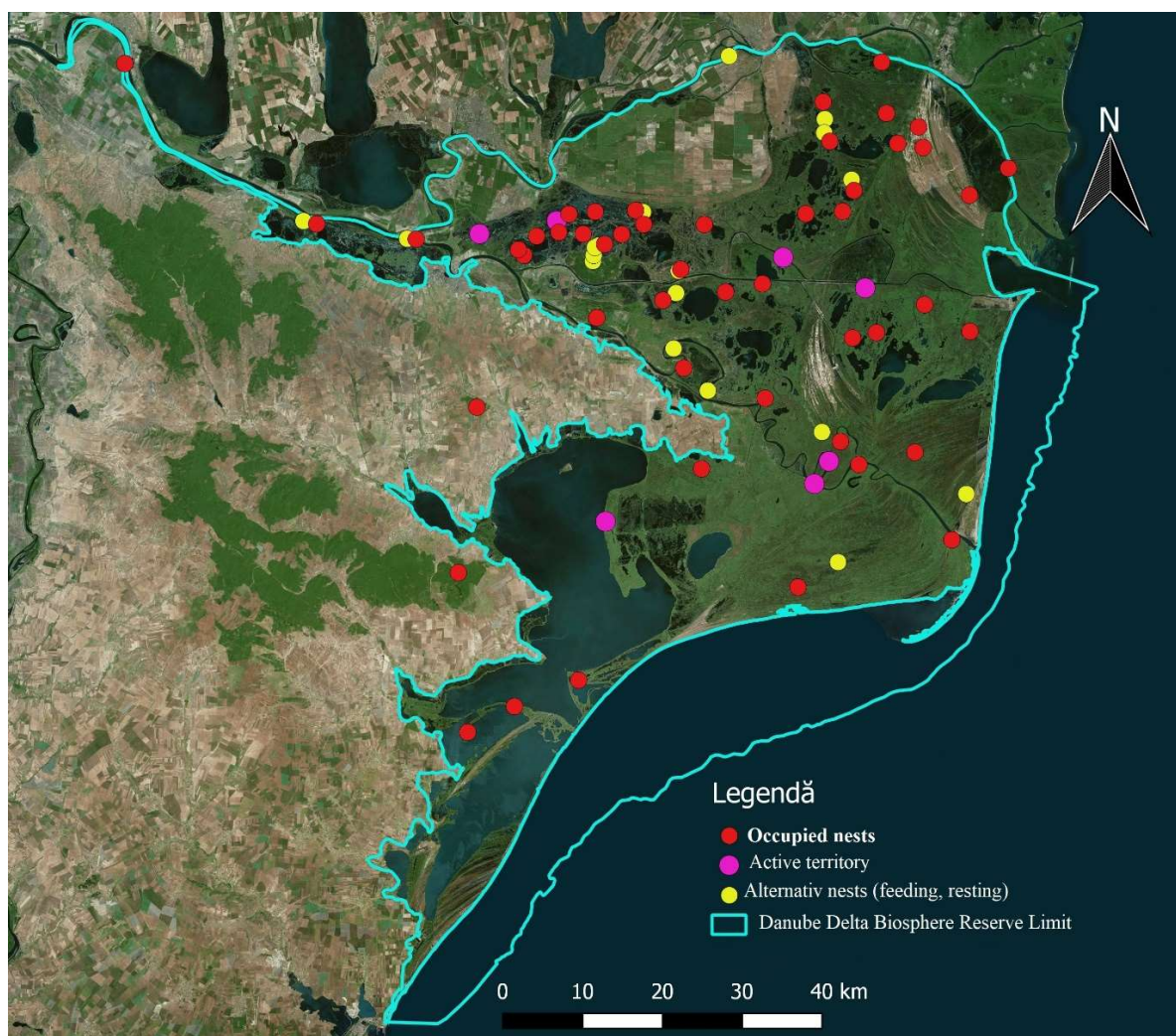
**Figure 1.** represents the WtE breeding trend in the study period.

As we can see, the number of nesting pairs has a slightly increasing trend, as opposed to alternative nests.



**Figure 1.** The evolution of White-tailed Eagle (*Haliaeetus albicilla*) nesting success between 2009 and 2018, within the D.D.B.R. and its surroundings (Romania), in numbers and presented graphically

The figure 2 represents the spatial distribution of WtE nests in 2018.



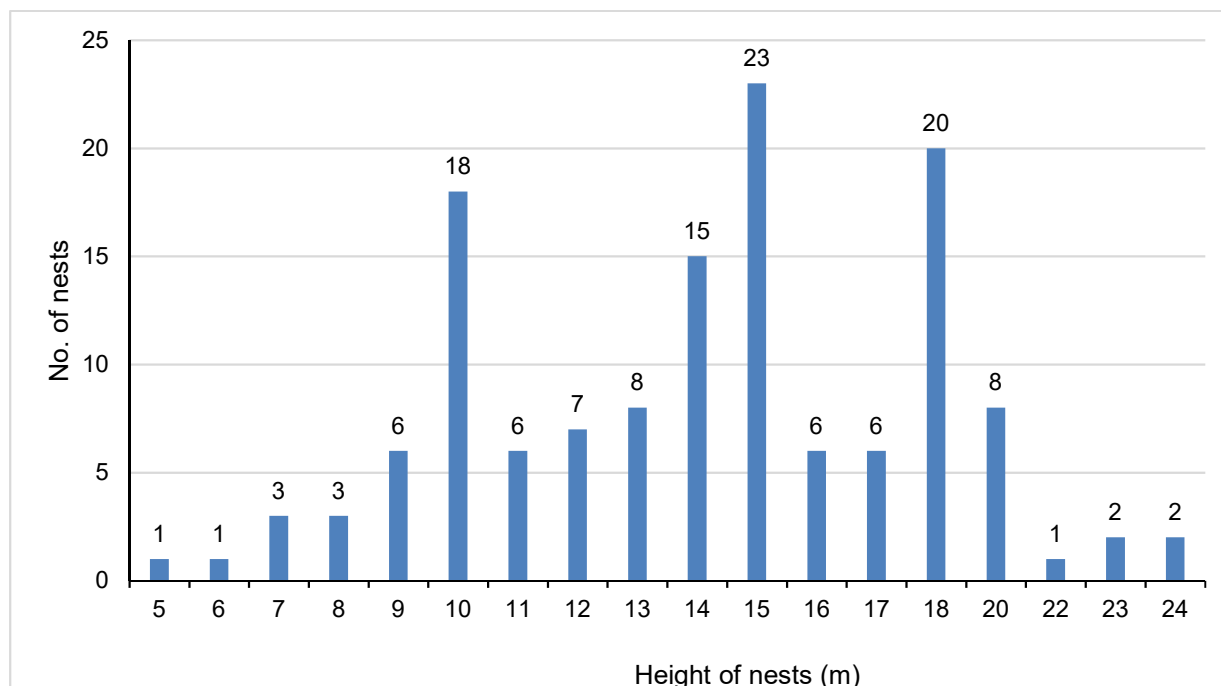
**Figure 2.** Distribution of White-tailed Eagle nests (*Haliaeetus albicilla*) in 2018 from the D.D.B.R. and its surroundings-Romania

The nests in Figure 2 have been marked with different colours, depending on the information regarding their usage. In 7 cases we marked the position of some nesting pairs in which we were unable to locate the nests, but the adult birds were seen during the breeding period, exhibiting territorial behavior.

The spatial layout of the nests within the D.D.B.R. shows two areas of concentration, which account for more than half of the identified nests between 2009 and 2018. Both are located on the north side of the Delta with a total of 79 nests, most of them located between the Chilia and Sulina branches. The first important area is located in the fluvial Delta Sontea-Furtuna complex, with a total of 55 nests (occupied, unoccupied, destroyed), marking the most important part of the D.D.B.R. for the studied species. The second area is located in the maritime delta, especially on the territory of Letea, the Matita-Merhei Complex and the Ceamurlia Fishery, with a total of 24 nests.

We mention that some of the monitored nests are over 10 years old. From our own data, collected from the field, we can note that in the case of some pairs of WtE, if the nest was destroyed by natural causes, that pair built another nest near the fallen one, either 10-20 meters away or not more than 100-200 meters away, depending on the old trees availability within that habitat. But if the nest was destroyed due to the human factors, that pair would not build another nest near the fallen one.

Out of the total of 144 WtE nests (occupied, unoccupied, destroyed) reviewed within the D.D.B.R. and its surroundings during 2009-2018, the height of 136 nests could be estimated. It should be noted that during the study no nests were found at the ground level, all of them being placed on trees at different heights. The figure below shows this trend (Figure 3).



**Figure 3.** Selection of trees for White-tailed Eagle (*Haliaeetus albicilla*) nest site depending on height, from the D.D.B.R. and its surroundings (Romania) during 2009 - 2018 – n = 136

As can be seen from Figure 3, the nests were located at heights of 5 to 24 m from soil or water, with more than half, 91 nests (67%) being found at heights greater than 13 m, and 45 nests (33%) at heights under this size. We mention that the trees within the study area are on average lower than in other geographical areas of the country.

There are few old data from Romania regarding the heights or tree species in which WtE nests. According to literature, the nests were built in strong trees (white or black poplar, willows) and also on trees with heights of 3 – 4 m. Dombrowski (1912) also mentioned nests build upon cliffs in Razim – Sinoe area.

In Romanian literature the data regarding the heights of the nests is scarce: 10 – 80 feet (3.3 – 26.6 m in Jourdain *et al.*, 1925), 2 – 3 m (Rosetti-Bălănescu, 1975) or in general in short trees (Almási, 1898). Jourdain (*et al.*, 1925) mentions the presence of a nest on the ground level, on an island in one lagoon (unspecified location, by context probably in Sinoe Lagoon). We consider that this unusual nest is mentioned also by Linția (1954) in his work. A newly built nest on the ground was found in 2010 in the area of the St. George arm by the ranger Acsentiev Nicu (personal communication) from the Danube Delta Integrated Commissariat of Control of the D.D.B.R.A.

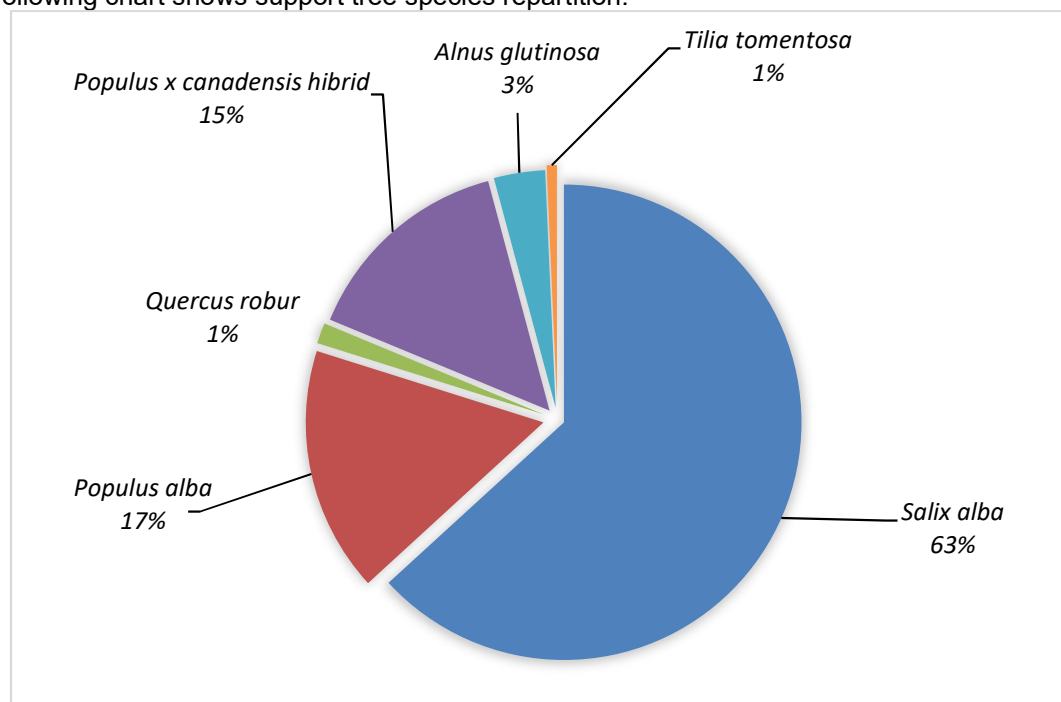
By the time the article was written, we succeed in diameter measuring 52 support trees of the 144 nests that were inventoried in the D.D.B.R. and its surroundings, so the average diameter was calculated at 2.82 m. Research in Croatia reveals a medium diameter of 1 m for nest support trees of WtE nests (Radović and Mikuska, 2009), while in Czech Republic and Germany they prefer 80 – 150 years old forests with nests placed at 18 – 25 m above ground level (Glutz Von Blotzheim, *et al.*, 1971; Rajchard *et al.*, 2010). Keeping of these kinds of forests in the two WtE concentration areas at the current state of preservation is one of the most important management measure for the WtE. Thus we suggest a close collaboration with D.D.B.R.A and forestry officials that manages these forests. Sparing only the nest support trees from cutting will not ensure the breeding success of WtE if the entire surrounding area is cut down, as we often saw in the field. The tolerance distance from the nests in the case of different forestry works are already known (Pongrácz and Horváth, 2010), but the buffer areas must be established in advance and mentioned in the exploitation documents of the forestry agents. D.D.B.R.A. must also keep in mind the location of main breeding sites of WtE and manage and control economical activities like fishing, hunting, tourism and hydrotechnical works in these areas. In D.D.B.R. this situation is rare.

During the '50s, the Danube Delta was wilder, less disturbed than today. Klemm (1973) finds 13 nests build in poplar, 10 of which were in trees of 20 m height. There are two cases mentioned in literature in which the WtE pair built two nests in the same poplar tree (Radu, 1979; Pocora, 2007).



According to our own investigations, it was found that out of the 144 nests located in the D.D.B.R. and its surroundings, 63% were located on willows, 17% on white poplars, 15% on hybrid poplars, 3% on alders, 1% on oaks and 1% on lindens (Figure 4). This shows that *H. albicilla* selects habitats with old willows for nest construction, an issue that was presented in previous papers (Kiss *et al.*, 2013; 2014; Sándor *et al.*, 2015).

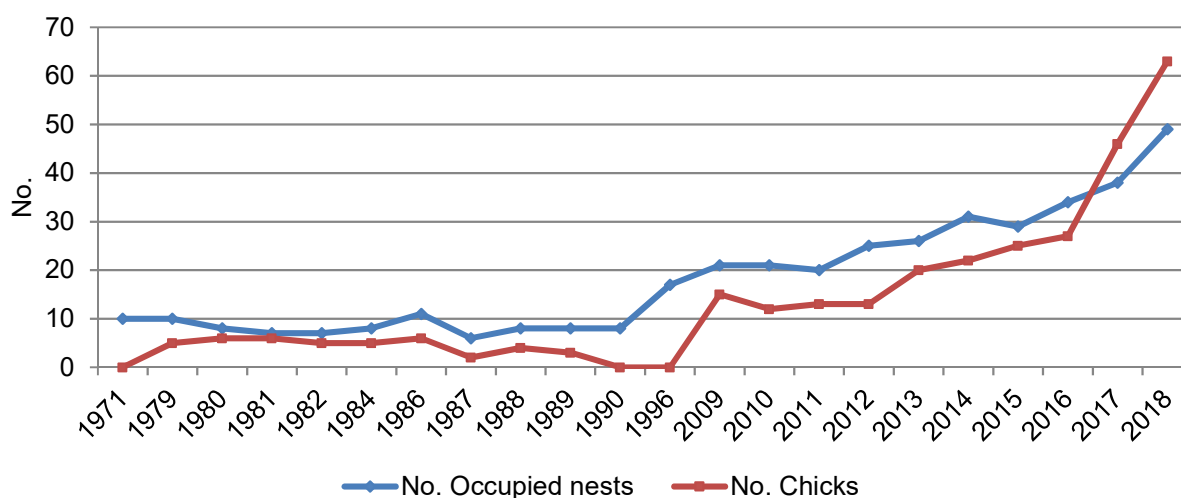
The following chart shows support tree species repartition.



**Figure 4.** Percentage distribution of tree species used to support nests White-tailed Eagle (*Haliaeetus albicilla*) in the D.D.B.R. and surroundings (Romania) during 2009-2018 (no.= 144 trees)

As can be observed, the species of nesting tree seems to be another important factor for the nest location. The support – tree species also translate into forest composition of the studied area, with willow being predominant species, followed by poplar. The least represented species of support – trees are also the rarest in Danube Delta: *Alnus* sp., *Quercus* sp., *Tilia* sp. Trees dimensions plays an important role in nest placement. Same is for the shape of the canopy, which differs from species to species.

In Figure 5 we present the current trend over time of WtE nesting and effective number of chicks in the D.D.B.R. and its surroundings, based on data published in specialized literature (1971-1990), unpublished data (1996) and own data (2009-2018).



**Figure 5.** The trend of White-tailed Eagle (*Haliaeetus albicilla*) nests and brood in the D.D.B.R. and its surroundings - Romania (according to data found in literature and own data)

As can be seen from the graph in Figure 5, over the years the WtE population has a slightly increasing trend, valid for the last quarter of a century. This is also the case of, other WtE populations (Horváth 2007, Horváth and Pintér 2005), where the medium brood is increasing along with the number of breeding pairs.

Based on our observations, the total number of nesting pairs in 2018 within the D.D.B.R. was estimated at about 57-67.

For a better management of this flag species, more data regarding population trend and nest placement is needed, thus our study will continue in the future.

Figure 6 represents a WtE female on the nest, followed by a male nearby.



**Figure 6.** White-tailed Eagle (*Haliaeetus albicilla*) female on the nest and nearby male in the Zmeica Lake area, 01.04.2017

## CONCLUSION

Between 2009 and 2018 in the D.D.B.R. and surrounding area there were 144 nests (occupied, unoccupied, destroyed) and another 7 adult pairs were noticed in 2018, but their nests were not found.

Out of a total of 136 nests located between 2009 and 2018, on the territory of D.D.B.R. and its surroundings, 91 nests (67%) being found at heights greater than 13 m, and 45 nests (33%) at heights under 13 m.

Out of the 144 nests found in the study area, only 4 are located outside the Danube Delta Biosphere Reserve, the rest being located in D.D.B.R., and most of these occupied nests are located between the Chilia and Sulina branches.

The total number of nesting pairs in 2018 within D.D.B.R. was estimated at about 57-67, noting that some nests from the inaccessible areas could not be controlled by the methods we dispose. Thus, we can mention that the WtE population within D.D.B.R. is increasing.

The factors that are damaging to the WtE nests within D.D.B.R. are those caused by humans (through fishermen's disturbance during the White-tailed Eagle's breeding period, construction of fishermen's huts near the nest, fires caused by locals, photography at nests during hatching, deforestation) or caused by natural factors (falling of trees or branches that support the nests, strong winds during the

year, liquid and solid precipitation). We consider that the keeping of forests in the WtE concentration areas and reduce the disturbance during the nesting period are some of the most important management measures to ensure a stable and even increased population of this species. We also suggest a close collaboration between D.D.B.R.A. and forestry agency for these measures to be well applied.

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