SOCIETY FOR THE PROTECTION OF PRESPA

Three years (2016-2018) of Southeastern European Pelican Census

SYNTHESIS AND EVALUATION REPORT

December 2019

Contents

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HELLENIC ORNITHOLOGICAL SOCIETY

Abstract

The aim of this census was to estimate the number of all individuals (overall population size) of both species of pelican, the DP and the GWP, being present in SE Europe during the breeding season and get a reliable quantitative snapshot of the geographical distribution of pelicans in spring, in areas outside the breeding colonies. Additionally, by assessing the numbers of immatures and of breeding pairs we could estimate the non-breeding proportion of the population, a very important variable, particularly for long-lived species such as pelicans. The census was conducted in single-afternoon surveys in early May in eight countries -Albania, Bulgaria, Greece, North Macedonia, Montenegro, Romania, Ukraine and Turkey- from 2016 to 2018. All individuals present in each wetland were counted and, when possible, aged.

100 wetlands were surveyed in 2016, 116 in 2017 and 143 in 2018. The increase in surveyed wetlands was not correlated to an increase in the overall number of DPs (6265 in 2016, 5617 in 2017 and 5814 in 2018) in the three years of the census. DPs were more widespread, occupying 63-67% of the sites, whereas although GWPs were more numerous they were concentrated in 40-48% of the wetlands surveyed. Both species together were present in 30-34% of the sites. The number of non-breeders was estimated only for 2016 and it was 813-859 individuals, i.e. 13-13.7% of the population. For the other two years the available range of estimates of breeding pairs were just above and below the calculation threshold, so they were not used at all. In contrast, for the western (Adriatic-Ionian) DP meta-population which accounted for 13-16% of the total number of individuals recorded, we estimated 259-324 non-breeders, i.e. an average 32.7% of the total. The interannual variation of 7.2-10.3% in the numbers of DPs should not be attributed only to actual fluctuation but might partly be an artefact of census constraints. The accuracy of the overall census was compromised by a variety of factors such as incomplete coverage of wetlands or not inclusion of all pelican wetlands due to logistical limitations, as well as identification and ageing restrictions. 94-98% of all DPs counted were concentrated in ten areas. Three areas were identified that hosted presumably only non-breeding individuals (2-6% of the total): a. all the wetlands along the River Olt in Romania; b. all the continental wetlands of Bulgaria and the wetlands in NE Greece east of Kerkini and c. Lake Marmara and Demirkopru Dam Lake in Turkey.

There were enormous interannual discrepancies in the numbers of counted GWPs (from 23000 in 2016 to 37300 in 2017). Despite some limitations of the used method this rather indicates that numbers varied hugely indeed for reasons not yet well understood. However, 73-90% of the GWP were concentrated at the nesting wetlands. All census dates before the 15th May are considered as not very appropriate for the census of GWP.

We recommend that in the future the duration of the census extends to one whole day and the census for GWP should be suspended. The census budget should be increased by 60% to cover aptly the expenses and allow for better coverage of all crucial wetlands. The same wetlands should be covered each year. Census of breeding pairs should follow to the maximum possible extent standardised methods.

Introduction and aim of research

The Balkan countries, Turkey and Ukraine (referred to hereafter as SE Europe) is home to about 30-40% of the world population of the Dalmatian pelican (DP) (Catsadorakis & Portolou 2018). This region hosts about 18-22 breeding colonies of the species distributed in 6-7 countries. DP is a short–distance migrant in SE Europe overwintering on the average within a radius of 1000km away from their breeding grounds, with most important wintering sites situated in Greece and Turkey. In the same area, the great white pelican (GWP) is a summer visitor breeding mainly in two -and up to four- sites and is a long-distance migrant overwintering in Africa, possibly in southern Sudan (Crivelli et al. 1991, Izhaki et al. 2002).

From the results of ringing studies in SE Europe there is adequate evidence that Dalmatian pelicans in Europe: 1) form almost distinct meta-populations (A.J. Crivelli, pers. comm., Saveljic & Rubinic 2009, Catsadorakis 2016), 2) their home ranges within and outside the breeding season are huge, extending to dozens of wetlands lying even in neighbouring countries (Georgopoulou et al. in prep.), and 3) there is a year-round movement of individuals between different sites (A.J. Crivelli , unpubl. ringing data, Efrat et al. 2018). Thus, in order to have a reliable picture of the status of their populations and their life history traits, simultaneous population censuses are needed to tackle the fact that pelicans can move very frequently even within the same day in distances over 200 km and in fact there is ample evidence they are doing so very frequently (Pyrovetsi 1989, Hatzilacou 1996, Efrat et al. 2018).

The Society for the Protection of Prespa (SPP) took the initiative to organize a simultaneous pelican census across SE Europe for 3 successive years, namely 2016-2018. The aim of this census was to estimate the number of all individuals (overall population size) of both species, the DP and the GWP, being present in this region during the breeding season and get a reliable quantitative snapshot of the geographical distribution of pelicans in SE Europe in spring in areas outside the breeding colonies. Additionally, by assessing the numbers of immatures and the number of breeding pairs we should have been able to estimate the non-breeding proportion of the population, a very important variable, particularly for long-lived species such as pelicans. In addition, we suspect that during the last decades both the DP and the GWP may be limited by the unavailability of proper nesting sites and the number of non-breeders would help us better understand this aspect. This information is so far unavailable and is expected to contribute to improved management decisions for pelican populations and their habitats.

Methods

The census was conducted in eight countries -Albania, Bulgaria, Greece, North Macedonia, Montenegro, Romania, Ukraine and Turkey- in collaboration with management authorities of protected areas, public institutions and environmental NGOs. Ukraine joined the census from the 2nd year and on. Turkey's participation was limited only at western wetlands, in particular wetlands westwards from 30° E, but this does not create a problem, as more easterly colonies likely belong to other group of meta-populations. Colleagues from North Macedonia contributed by helping to pull off transboundary pelican counts at Great Prespa Lake which is shared between Albania, North Macedonia and Greece.

The census was implemented on a simultaneous, single-afternoon survey on an agreed date in early May. The selection of the date was a compromise between optimal dates for the two species, the breeding periods of which only slightly overlap –the short-distance migrant DP starting in late January-early February or even earlier in some wetlands, while the long-distance migrant GWP starting in April and going until mid-May. For counting GWPs, a later date would be preferred, as in early May migration has not been completed for a considerable portion of the population and some GWPs are still dispersed at wetlands located along the flyway. Especially for Romania it is known that during the beginning of May there is still a considerable influx of non-breeding individuals that have not completed their migration (S. Bugariu, pers. comm., Crivelli et al. 1991). On the other hand, a later date would be problematic for counting DPs, as young of the year have already grown big, posing some risk for confusion between young and immature individuals, especially when they are located at long distances from observers or when observers are less experienced. As the DP was the main focus of this census, the compromise was made in favor of it, yet trying not to affect significantly GWP numbers.

All individuals present in each wetland were counted, distinguishing between adult and immature birds, when possible, and excluding the young of the year. Counts were performed mainly from vantage points, already used by the International Waterbird Census programme (IWC). Boats were also used in order to survey the more distant parts of large wetlands and even a light aircraft had to be employed for the survey of the Danube Delta colonies, which lie within vast inaccessible reedbeds.

The SPP covered a significant part of transportation costs for volunteers in all countries; however additional funds were required in some countries.

Participant organizations

A large number of volunteers, staff of National Parks and other protected areas, other public institutions and environmental organizations embarked on this ambitious venture (Table 1). A short overview of participant organizations is given in the following paragraph, while a full list of participant bodies can be found in Annex I and a complete list of all participants in Annex II.

In Albania and Montenegro, Noé Conservation led the census with the participation of 3 environmental NGOs -Protection and Preservation of Natural Environment in Albania (PPNEA), Albanian Ornithological Society (AOS) and Center for Protection and Research of Birds of Montenegro (CZIP/BirdLife partner) - as well as 4 public institutions, namely the Natural History Museum of Montenegro, and 3 Management Bodies of National Parks. In

Bulgaria, 2 environmental NGOs were involved: the Bulgarian Society for the Protection of Birds (BSPB/BirdLife partner) and the Le Balkan-Bulgaria Foundation, as well as 2 public institutions. In Greece, the census was conducted in collaboration with the Hellenic Ornithological Society (BirdLife partner) and its volunteers, yet the Management Bodies of 12 National Parks had a decisive role as they covered most of the country's important wetlands, some having under their jurisdiction more than 1 wetland (max. number was 7) and others having to cover very extensive or difficult to monitor wetlands. The Macedonian Ecological Society from North Macedonia covered its part of the transboundary Great Prespa Lake. In Romania, the census was led by the Romanian Ornithological Society (SOR-BirdLife partner) with the participation of Danube Delta Biosphere Reserve Administration. In Turkey, Ass. Prof. Ortaç Onmuş (Ege University, Izmir, Turkey) led the census in 2016, while in 2017 and 2018 the census was conducted by Doğa Derneği (BirdLife partner). In Ukraine, the Ukrainian Society for the Protection of Birds (USPB/Birdlife partner) together with the Management Bodies of 3 protected areas covered Ukrainian wetlands.

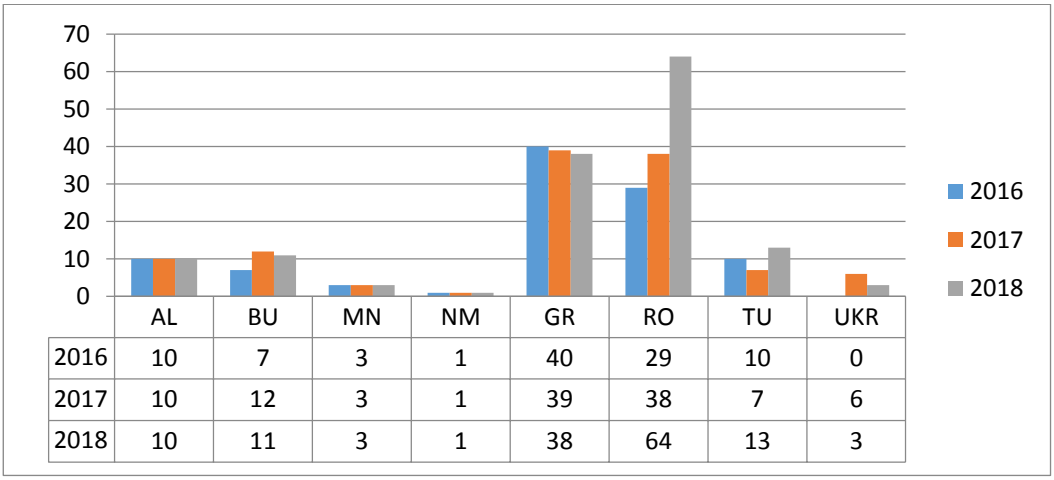
Table 1. Number of participants/observers in the SE European census per country and year.

	No. of participants		
Country/Year	**2016**	**2017**	**2018**
Albania	29	20	28
Bulgaria	6	26	16
Montenegro	21	9	6
North Macedonia	1	2	4
Greece	59	63	52
Romania	18	14	16
Turkey	4	13	6
Ukraine	N/A	10	5
TOTAL	**138**	**157**	**133**

Results

Occupancy, distribution and population size

The census was conducted simultaneously in all countries on the afternoons of May 7, 2016, May 6, 2017 and May 12, 2018. In exceptional cases two subsequent days were used, due to limited human resource availability. In such cases, the census was usually conducted in the afternoon of the first day followed by the morning of the second day in order to avoid as much as possible double-counting due to pelican movements between wetlands.



	AL	BU	MN	NM	GR	RO	TU	UKR
2016	10	7	3	1	40	29	10	0
2017	10	12	3	1	39	38	7	6
2018	10	11	3	1	38	64	13	3

Figure 1. Number of surveyed sites per country and year.

The coverage of wetlands increased significantly from one year to another: from 100 wetlands in 2016 to 116 in 2017 and 143 in 2018, and this expansion is mainly due to Romania (Fig.1). Occurrence distribution maps of surveyed wetlands per year can be found in the following pages (Fig. 2 for DP and Fig. 3 for GWP). According to the partners responsible for organizing the census in each country, the coverage of wetlands can be considered satisfactory. However, Turkey and especially Ukraine were under-represented in the census because several important wetlands were not covered, and thus pelican numbers present in those countries were under-estimated (Fig. 1). Both these countries are large and have a high number of wetlands, and thus a better coverage would require a larger number of volunteers and a higher budget.

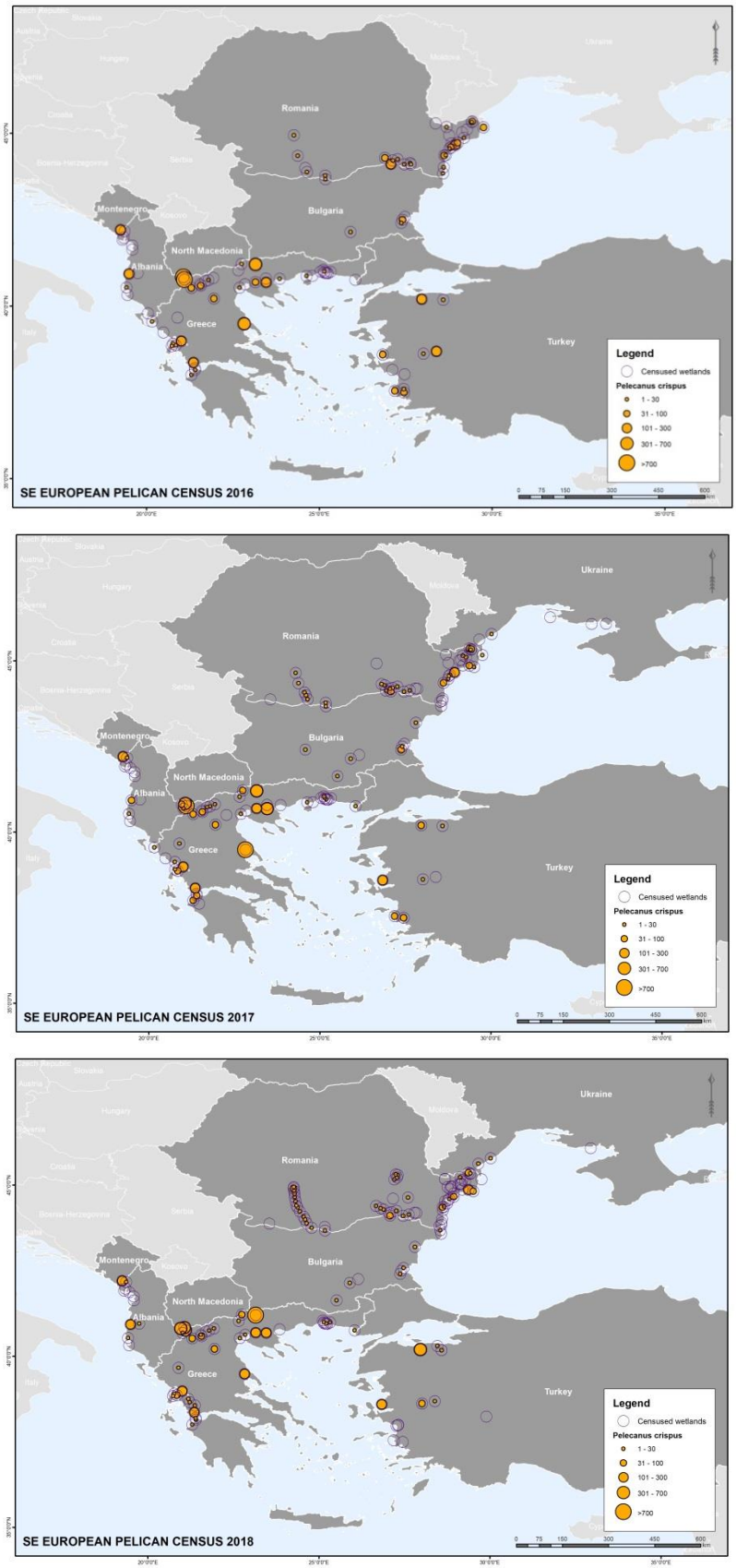
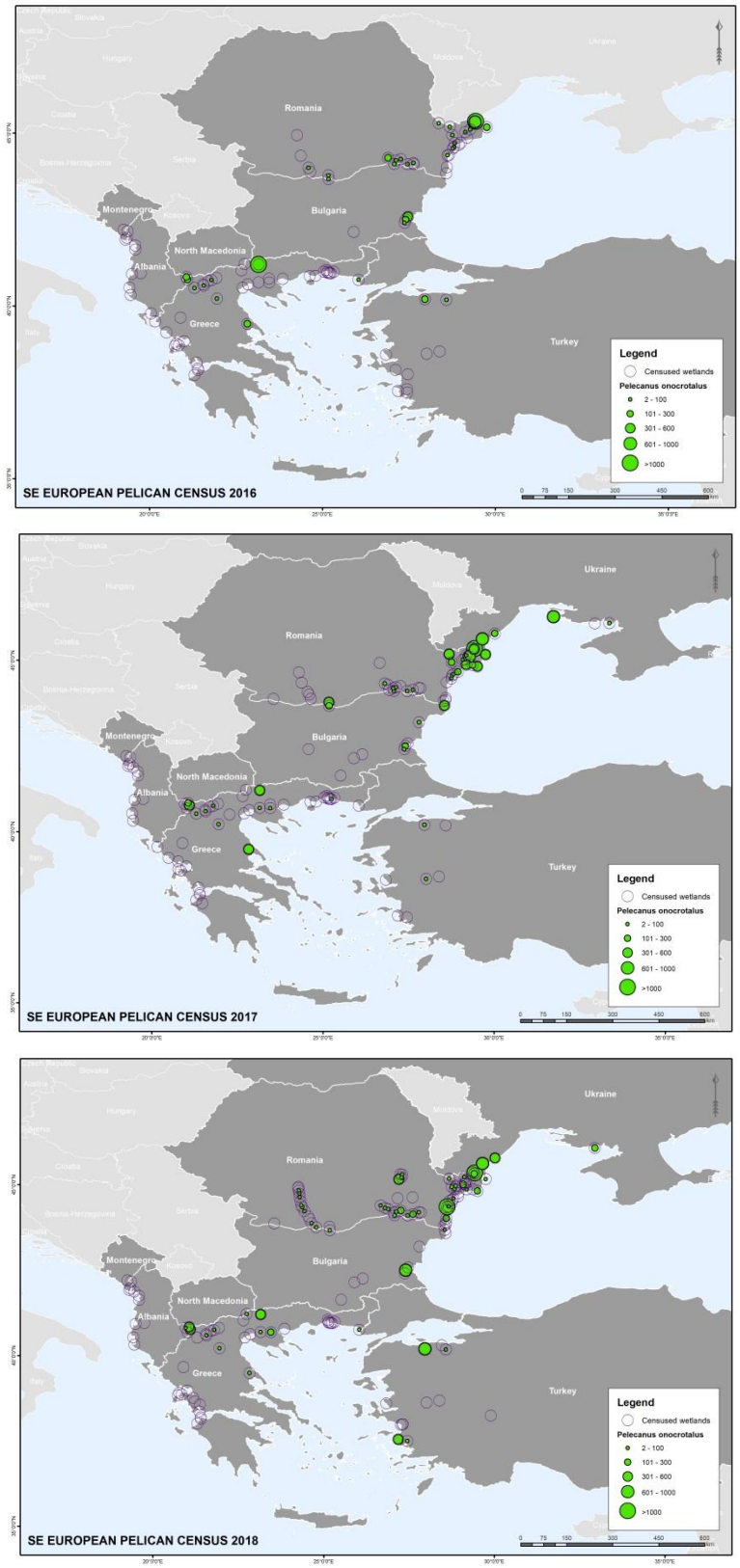


Figure 2a-2c. Dalmatian pelican presence in SE European wetlands during the spring census 2a: 2016, 2b: 2017 and 2c: 2018.



Figures 3a-3c. Great white pelican presence in SE European wetlands during the spring census 3a: 2016, 3b: 2017 and 3c: 2018.

The total number of DPs varied by 7.2-10.3% between the three years of the census, (Table 2), with highest numbers recorded in 2016 and no apparent trend. It is noted here that Doğa Derneği (Turkish BirdLife partner, responsible for organizing the 2017 and 2018 census in Turkey) specified that wetland coverage in 2017 was insufficient, and moreover an important DP colony, Lake Manyas was not adequately covered, and thus total DP numbers have been affected correspondingly that year. The increase of census wetlands was accompanied by an increase in the number of DPs only in Romania, both in 2017 and 2018 (Table 2), but not in the overall numbers counted. The vast majority of DPs was recorded all years in Greece, where the species' largest colonies are located (Table 2).

The total number of GWPs varied significantly between the three years (Table 2). The large increase (63%) in 2017 is due to the very high numbers counted that year on the GWP colony, in the Danube Delta, Romania (Table 2). A smaller part of the increase between the first year and the other two years can be attributed to the participation of Ukraine in 2017 and 2018 (Table 2). The vast majority of GWPs were recorded in Romania, the country hosting the largest GWP colony in the region.

Table 2. Results per country and in total of the 3-year SE European pelican census.

Country	Dalmatian pelican			Great white pelican		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**
Albania	307	193	469	7	0	75
Bulgaria	277	216	142	839	1038	1017
Greece	3743	3858	3342	1959	1650	1596
Montenegro	146	241	190	0	0	0
North Macedonia[1]	663	187	339	20	15	38
Romania	534	563	657	19993	32494	21752
Turkey	595	329[2]	668	126	21	1055
Ukraine	N/A	30	7	N/A	2116	1403
TOTAL	**6265**	**5617**	**5814**	**22944**	**37334**	**26936**

[1] Only the part of Great Prespa Lake belonging to the country, no other wetlands included.

[2] Lake Manyas, an important DP colony, inadequately covered

More wetlands with pelican presence were recorded each year (Table 3), mainly due to the fact that a larger number of wetlands were included in 2017 and 2018 censuses, principally in Romania. Overall, the percentage of wetlands with pelican presence was rather steady throughout the 3 years of the census: pelicans (either species) were recorded in 76-77% of the wetlands surveyed. DPs were more widespread occupying 63-67% of the sites, whereas although GWPs were more numerous, they were concentrated in 40-48% of the wetlands surveyed. Presence of both species was recorded in 30-34% of the sites (Table 3).

Table 3. Pelican presence in surveyed sites (Tno.: Total number of surveyed sites, Pno.: Number of sites with either species present, DPno.: Number of sites with DP presence, GWPno.: Number of sites with GWP presence, DP+GWPno.: Number of sites with both species present).

Country/Year/ No. of sites with pelican presence	2016					2017					2018				
	Tno.	Pno.	DP no.	GWP no.	DP+GWP no.	Tno.	Pno.	DP no.	GWP no.	DP+GWP no.	Tno.	Pno.	DP no.	GWP no.	DP+GWP no.
Albania	10	4	4	1	1	10	5	5	0	0	10	6	6	1	1
Bulgaria	7	7	6	5	4	12	10	9	6	5	11	9	8	6	5
Greece	40	26	23	11	9	39	30	29	11	10	38	32	32	12	12
Montenegro	3	1	1	0	0	3	1	1	0	0	3	1	1	0	0
North Macedonia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Romania	29	29	23	21	15	38	31	26	22	16	64	48	33	40	25
Turkey	10	8	8	3	3	7	6	6	2	2	13	10	7	6	3
Ukraine	N/A	N/A	N/A	N/A	N/A	6	4	1	4	1	3	3	2	3	2
TOTAL	**100**	**76 (76%)**	**66 (66%)**	**42 (42%)**	**33 (33%)**	**116**	**88 (76%)**	**78 (67%)**	**46 (40%)**	**35 (30%)**	**143**	**110 (77%)**	**90 (63%)**	**69 (48%)**	**49 (34%)**

Nesting colonies and other wetlands

The bulk of DPs and GWPs were recorded in the wetlands where breeding colonies are located (Fig. 4), with 75-81% and 73-90% of the DPS and GWPs respectively, being recorded at sites hosting colonies. A larger number of GWPs was being recorded year after year at no -nesting wetlands, a fact most likely attributable to presence of late migrants in no-nesting wetlands and also with the more extensive coverage of no-nesting wetlands in Romania in 2017 and 2018.

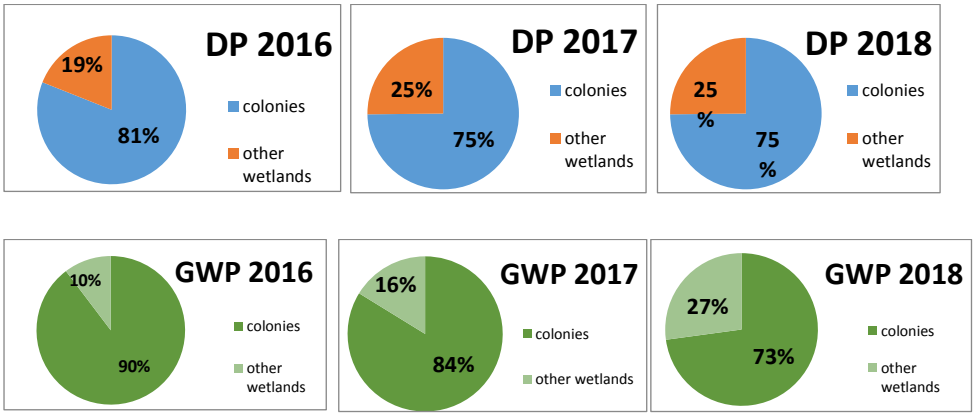


Figure 4. Percentages of DPs and GWPs recorded at sites with breeding colonies and at other no-nesting wetlands.

Estimation of non-breeders

Dalmatian pelican breeding data (number of breeding pairs) derived through other targeted counts at all DP colonies in SE Europe (except for a small DP colony in Ukraine)

were kindly provided by the partners[1]. The total number of DP breeding pairs was used to assess the number of immature and adult non-breeders present during the breeding period in this region. The number of non-breeders was calculated after subtracting the number of breeding individuals from the number of DPs recorded in the census. The number of non-breeders was estimated only for 2016 and it was 813-859 individuals (Table 4). For the other two years the available range of estimates of breeding pairs was just above and below the calculation threshold, so they were not used at all (Table 4). This had been a striking piece of evidence that a substantial number of individuals was not recorded in the spring censuses, at least for 2017 and 2018 or that our calculations of the number of breeding individuals were erroneous. This last may sound strange but it is not. Replacement nests may increase artificially the numbers of estimated breeding pairs if the census methods used are not capable to estimate the re-nesting pairs and the final estimation of breeding pairs includes double counts. At least in Prespa there are strong indications, but not evidence, that a very large proportion of the overall breeding attempts estimated come from re-placement nests, which in fact means lower actual numbers of breeders than those used in our calculations to estimate the non-breeder proportions.

Table 4. Estimation of DP non-breeders present during the breeding period in SE Europe based on breeding data derived from other focused surveys and data from the spring censuses.

SE Europe data/year	2016	2017	2018
Total no. br. pairs (other targeted counts)	2703 -2726	2792 - 2921	2896 - 3032
Total no. br. inds. (no. br. pairs X 2)	5406 - 5452	5584 - 5842	5792 - 6064
Total no. inds recorded (spring census)	6265	5617	5814
Non-breeders	**813 – 859**	**-105 – 33**	**-114 – 22**

Results for GWP non-breeders are not presented, as full GWP breeding data were not available at the time of writing of this report. Additionally, GWP non-breeders' estimation is even more challenging than for DP, since, as mentioned before, the timing of the census coincides with late "waves" of the species' migration.

Non-breeders in the western DP sub-population

The western (Adriatic-Ionian) DP populations form a more or less distinct meta-population (A. Crivelli pers. comm., Catsadorakis 2016) and accounted for 13-16% of the total number of individuals recorded in the spring censuses 2016-2018 (Table 5). Based on breeding data from the 4 western colonies (2 in Greece, 1 in Albania and 1 in Montenegro) we estimated 259-324 non-breeders in the western sub-population (Table 5). This means

[1] Breeding data were kindly provided by: Noé Conservation for Albanian and Montenegrin colonies, BSPB for Bulgarian colonies, SOR for Romanian colonies and Dr. Ortaç Onmuş for Turkish colonies. For Greek colonies breeding data were provided by: SPP, Management Body of Kerkini National Park, Management Body of Amvrakikos Wetlands and Management Body of Messolonghi Lagoon.

that in this specific group of populations the percentage of non-breeding individuals varies from 27.6% (2017) up to 38.8% (2016).

Table 5. Estimation of DP non-breeders present during the breeding period in western wetlands based on breeding data derived from other focused surveys and data from the spring censuses.

Western subpopulation data/year	**2016**	**2017**	**2018**
Total no. br. pairs (other targeted counts)	255	339	300
Total no. br. inds. (no. br. pairs X 2)	510	678	600
Total no. inds recorded (spring census)	834	937	885
% of total SE Europe inds. recorded (spring census)	13%	16%	15%
No. of western wetlands (spring census)	22	22	22
No. of western wetlands with DP presence (spring census)	11	13	16
Non-breeders	324	259	285
Proportion of non-breeders (%)	**38.8**	**27.6**	**32.2**

Discussion and conclusions

Dalmatian pelican

Very few times has it been attempted to count the absolute numbers of two bird species in one day over such a large area. This of course was facilitated by the large size and conspicuous presence of pelicans and their colonies in relatively restricted areas in their wetland habitats. The endeavour offered some unique and useful results and its initial goal was achieved to a large degree.

The numbers of DP during the breeding season ranged from 5617 to 6265. This variation should not be attributed only to actual fluctuation but might partly be an artefact of logistical constraints that did not allow the full exploitation of the census' advantages.

The accuracy of the overall census was partially compromised by a variety of factors:

a. Wetlands with pelicans are too many to be covered and so some minor ones apparently remained unsurveyed but may have hosted some or more individuals which stayed unrecorded. This might have been aggravated by the fact that the resources available for the census were limited to allow full coverage: the available window of some hours in one afternoon may not suffice, especially in combination with lack of sufficient personnel, funds or means (vehicles, boats, etc.). Additionally, absolute synchronization of all teams was not achieved due to lack of adequate human resources, e.g. the same team or individual had to cover more than one site.

b. There are inaccessible, or difficult to-access-parts particularly in large and complex wetlands and some pelicans may have remained unrecorded there. For various logistical reasons, coverage of some wetlands was partial or problematic. Limited budget in combination with limited human resources and/or other constraints did not allow full

coverage especially in some countries (e.g. Turkey and Ukraine), but this was not possible to anticipate.

c. All year round many pelicans commute from one wetland to the other (Efrat et al. 2018) and it is possible that some of them may have been still on the move and not yet having reached their destination to get recorded during the short time of the census.

d. Despite the fact that the dates chosen in all three years were very similar, weather conditions may vary substantially from one year to the next, thus affecting counts significantly.

In early May, a period of peak food demand during chick rearing, pelicans disperse to a large number of wetlands to forage. Most of these wetlands are included in the spring censuses, yet there are strong indications (including data from tagged DPs) that an unknown number of smaller wetlands, such as fishponds or small reservoirs are sporadically used during this period. These smaller wetlands are not necessarily included in the spring census' counts and thus an unknown number of pelicans were not recorded. An interesting remark is that DPs in Romania were widespread in an equal number of wetlands to Greece although in much lower numbers. This signifies the importance of this huge wetland complex -the Danube Delta and lower Danube- and further indicates that the value of each wetland for pelicans is amplified by its proximity to other wetlands.

For a specific, discrete part of the census area, namely the area including the group of four nesting colonies of the DP along the Dalmatian and the Ionian coast line (Skadar-ME, Karavasta-AL, Amvrakikos-GR, Messolonghi-GR) referred to as the Western meta-population (Catsadorakis 2016), we were able to estimate the proportion of non-breeders. Specifically, it appeared that ca 32.7% of all pelicans counted were non breeding individuals, i.e. on the average one out of three individuals do not breed every year, or from another aspect, each adult individual in this population will breed on the average two out of three years and even less than that because a proportion of all pelicans counted have been 2nd year birds which are yet immature for breeding. This information is a very important one for the life history traits of the species, especially given that there are already many indications that pelicans are limited by availability of proper nesting islands at all of these sites. We presume that until some other more accurate estimation of the number of non-breeders is achieved in the future, this ration is the best approximation of non-breeding individuals proportions for all the other DP nesting populations in SE Europe.

Overall, the number of pelicans counted each year was not correlated with the number of wetlands surveyed which differed from one year to the next.

There were also limitations in ageing of individuals. Distinguishing immatures (especially 2nd calendar year birds) may be very challenging because around early May many adult DPs have started moulting particularly their back coverts and acquire a plumage very much resembling those of the immatures. Very few people are capable of consistently distinguishing these age classes, something which is made more difficult under poor visibility conditions. Therefore, counts of immature birds are considered unreliable. This is the reason that these counts of immature birds were not presented in this report. Furthermore, in large wetlands many birds may stay very far away from the observers and although they may be counted they cannot be approached enough to determine their age.

The main concept behind the calculation of the proportion of non-breeders in the populations was that we count and age all individuals and at the same time we count all breeding pairs in each one of the colonies (all colonies are considered known). The numbers of breeding pairs is multiplied by two and this number is subtracted from the overall

counted individuals. What remains is, theoretically, the number of non-breeders. There are of course some underlying assumptions in this: a. all individuals in the populations are accurately counted and b. the estimated or counted number of nesting pairs is also counted accurately. These assumptions hold only partially true. The limitations of complete counting were described above. Counting accurately the number of nesting pairs is also challenging. There are multiple limitations both in regards to carrying out the count itself as well to its accuracy. For example, a non-exhaustive list of limiting factors is the following: a. inaccessibility of some sites; b. lack of resources for doing the necessary number of visits to the colonies; c. limitations in the number of visits due to disturbance; d. rolling and overlapping abandonments and initiations of nests within a colony; e. difficulty in estimating percentage of replacements of lost nests, f. poor visual accessibility of some sites, g. lack of competent and experienced personnel, etc. For all these reasons, reliability and accuracy of estimations of nesting pairs may vary significantly among sites and between years, leading both to under-estimations and over-estimations. These limitations may compromise our ability to estimate accurately the number of breeding individuals and consequently the number of non-breeders.

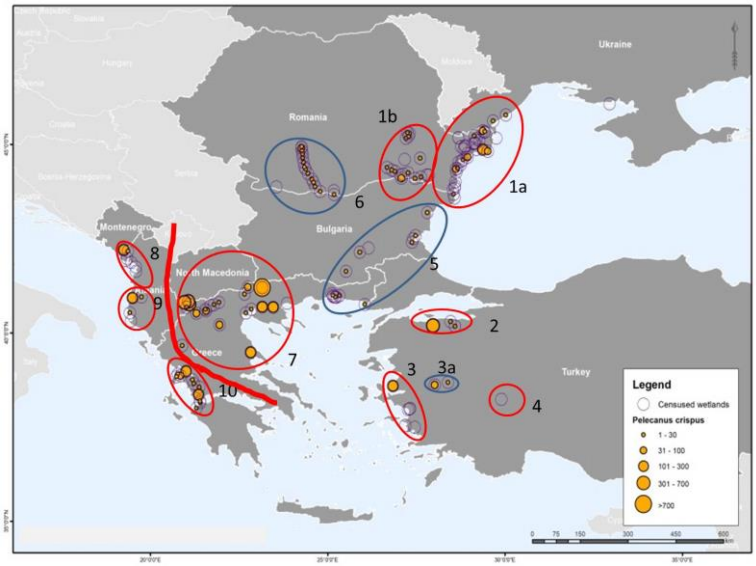


Figure 5. In red, groups of wetlands that are "closely connected" with one or more breeding sites. Blue lines delineate groups of wetlands that contain no regular breeding sites and are quite far away from the closest breeding sites.

In Figure 5 all groups of wetlands that are closely connected with one or more breeding sites are indicated. "Closely connected" or affiliated, means that there is already some kind of evidence or strong indication that every single pelican present in each one of these wetlands may well be an individual breeding or trying to breed in a nearby wetland, which may have travelled to a neighbouring wetland to feed. We have identified nine or ten such wetland groups. The distances between the two most distant sites within this group vary from 67 km to 200 km. Six out of the ten groups include up to ten sites while four groups include from 10 up to 30 sites. The latter are: the Messolonghi - Amvrakikos area and the Prespa - Kerkini - Karla area in Greece, the Danube Delta - Black Sea coast area in Romania, and an area around the Srebarna colony in Bulgaria (Figure 5). The 94-98% of all pelicans

counted in the breeding season as present in SE Europe was concentrated in these ten areas. On the other hand, 75-81% of all the DP and 73-90% of all the GWP were concentrated at the wetlands where nesting takes place for either species. The average percentage for GWP is higher because in 2018 many GWP had not yet completed their migration on the date of census. Crivelli et al. (1991) and Izhaki et al. (2002) have shown that high numbers of GWP "roam" around the wetlands of SE Europe during late spring and summer. Our data indicated that at least in early spring all these GWPs first visit the nesting sites, prospect the situation there and if they do not breed then start roaming around.

We have also identified two large areas-groups of closely lying wetlands which are far away from any breeding site (or contain one irregular breeding site), for which groups we can make the legitimate assumption that all pelicans met there in May are non-breeders (Figure 5). The first of these two areas is the one containing all the wetlands along the River Olt (a tributary to Danube) in Romania. The second group includes all the continental wetlands of Bulgaria and all the wetlands in NE Greece east of Kerkini. There is also a possible small such area in Turkey which includes Marmara Lake and Demirkopru Dam Lake. All pelicans recorded in these three areas in the three years of census represented 5.7% (2016), 2.0% (2017) and 1.8% (2018) of all individuals counted. Taking into consideration the previously described drawbacks of the method, we can legitimately conclude that something around 2-6 % of all recorded pelicans are non-breeding individuals met at least in these three areas.

Great White Pelican

There has been enormous inter-annual variation in the numbers of counted GWPs in the census years. This might be an indication that our basic approach and working hypotheses do not apply for this species, but it is not the only scenario. While inter-annual differences for the DP numbers ranged in 3.5 - 10.3 %, the same differences for the GWP ranged in 37 - 61.4 %, i.e. more than 6-10 times higher. The ecology and behaviour of this species in SE Europe has been described to be extremely different from this of its congener (Crivelli et al. 1991, Izhaki et al. 2002). To the uncertainties caused by the behaviour of the species it must be added the stunning difference in the estimation of breeding pairs in 2016 raising the total breeding pairs estimation from 4100-4500 to over 17000 pairs! (Marinov et al. 2017). It is not known to what extent this impressive increase is owed to the different census methods used (photos from drones instead of aerial census) or to real changes incurred to the habitats of the Danube delta, which allowed the establishment of over 13000 more pairs which were possibly present (?) there but could not nest in the previous years (?). In 2016 the census resulted to a total of 22944 individuals in all countries, while, for the same year, only in the Danube Delta the data provided by Marinov et al. (2017) estimated the breeding individuals of GWP as 30000-34000.

Furthermore, we did a compromise on the selection of the date for the census in order to accommodate both species within the same one-afternoon census. It was clearly shown from our results that GWPs have not always completed their migration to SE Europe from Africa within the first 10 days of May. Especially in 2018 it was clear that quite an important proportion of birds with destination SE Europe were recorded in Turkey while still on their northwards migration. It is suspected that quite a few other birds were registered while on their way to their final breeding destination sites in Greece and Romania.

Conclusions

The census produced some unique and useful results but there have been also some difficulties. The numbers of DP during the breeding season ranged from 5617 to 6265. This variation should not be attributed only to actual changes but should be treated as an artefact of census constraints. The numbers and proportions of either immatures or non–breeders for SE Europe as a whole were not estimated adequately. The effectiveness and accuracy of the census was compromised by a variety of factors.

For the western metapopulation the results showed that on average 32.7% of all DPs counted were non breeding individuals, i.e. on the average one out of three individuals does not breed every year. There were also substantial limitations in ageing of individuals but this only partly impacted the results.

The estimation of numbers of non-breeders depends on an accurate count of all individuals and accurate estimation of breeding individuals. This latter cannot always be achieved without a very substantial investment in effort and resources in each colony, something which falls outside the domain of the present census.

Through the census we discovered that a proportion of 94-98% of all DPs counted in the breeding season as present in SE Europe is concentrated in nine areas. On the other hand, 75-81% of the DP gathered at the wetlands where nesting takes place for the species.

We also discovered that there are two large and -possibly- one small area that during the breeding season host only non-breeding individuals. These are: a. all the wetlands along the River Olt (a tributary to Danube) in Romania; b. all the continental wetlands of Bulgaria and all the wetlands in NE Greece east of Kerkini and c. Lake Marmara and Demirkopru Dam Lake in Turkey. These three areas concentrate 2-6 % of all counted pelicans.

There had been enormous discrepancies in the numbers of counted GWPs between the years of census. So far, the causes behind this impressive inter-annual are not well understood. However, through the census we learned that 73-90% of the GWP will likely be concentrated at the nesting wetlands. All census dates before the 15th May are considered as not very appropriate for the census of GWP.

Project evaluation and recommendations

The census was done for three consecutive years and its goal was to estimate the total number of pelicans present in SE Europe during the breeding season for the two species, their geographical distribution as well as the number of non-breeders.

The project was meant to cover a very large number of scattered wetlands, it was successfully based upon a high number of volunteers and the budget available only marginally covered promptly all its expenses. The duration of the census was rather short to cover adequately all wetlands (if considered together with the availability of volunteers and means (vehicles, boats, etc.). The number of competent ornithologists and bird-watchers who were able to voluntarily participate simultaneously in the census was not adequate in some countries. The compromise in date selection in order to accommodate both species in one census effort seemed to have not favoured a fully satisfactory count of GWP.

The project produced a number of useful results, but some questions were not answered adequately. Our suggestion is thus to suspend it and in case it is judged useful to be replicated in the future its aims should be slightly modified to achieve higher efficiency.

FUTURE RECOMMENDATIONS
• The duration of the census time should be extended to at least one whole day. Discussions between partners and arrangements are needed beforehand to cope with the likelihood of double counts. • Until a reliable method is found to record GWP nesting pairs in the Danube delta, the census should not include GWP. • The census budget should be increased by 60% to cover adequately the expenses and allow for better coverage of wetlands. • It is of utmost importance to cover the same wetlands each year in each country. The list of wetlands to be covered in each country should be decided, agreed and standardised beforehand. • Census of breeding pairs should follow standard methods to the maximum possible extent and certainly the number of replacement nests should be excluded from the calculations.

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Annex I – Participant organizations per country

Albania

1. Prespa National Park Management Body
2. Divjaka-Karavasta National Park Management Body
3. National Agency for Protected Areas in Albania
4. Regional Agency for Protected Areas in Fier
5. Regional Agency for Protected Areas in Shkodra
6. Regional Agency for Protected Areas in Lezha
7. Regional Agency for Protected Areas in Vlora
8. Protection and Preservation of Natural Environment in Albania (PPNEA)
9. Albanian Ornithological Society (AOS)
10. Noé Conservation - Albania

Bulgaria

1. Institute of Biodiversity and Ecosystem Research-Bulgarian Academy of Sciences (IBER-BAS)
2. Regional Inspectorate of Environment and Waters (RIOSV-Ruse)
3. Bulgarian Society for the Protection of Birds (BSPB/Birdlife partner)
4. Le Balkan-Bulgaria Foundation

Greece

1. Management Body of Koronia - Volvi and Chalkidiki
2. Management Body of the protected areas of Thermaikos Gulf
3. Management Body of Evros Delta and Samothraki
4. Management Body of Kotychi - Strofilia and Kyparissia Bay
5. Management Body of Messolonghi Lagoons and Akarnanika Mountains
6. Management Body of Nestos Delta, Vistonida – Ismarida Lakes and Thasos
7. Management Body of Lake Kerkini
8. Management Body of Kalama - Acheron and Corfu
9. Management Body of Amvrakikos Gulf and Lefkada
10. Management Body of Pamvotis Lake
11. Management Body of Karla – Mavrovouni – Kefalovriso Velestino and Pinios Delta
12. Management Body of Prespa National Park
13. Society for the Protection of Prespa
14. Hellenic Ornithological Society/BirdLife partner

Montenegro

1. Skadar Lake National Park Management Body
2. Natural History Museum of Montenegro
3. Center for Protection and Research of Birds of Montenegro/Birdlife partner
4. Noé Conservation – Montenegro

North Macedonia

1. Macedonian Ecological Society/BirdLife partner

Romania

1. Danube Delta Biosphere Reserve Administration
2. Romanian Ornithological Society/BirdLife partner

Turkey

1. Ege University, Izmir
2. Doğa Derneği/BirdLife partner

Ukraine

1. Black Sea Biosphere Reserve Administration
2. National Nature Park “Dzharilgachsky”
3. National Nature Park "Tuzlovsky limani"
4. National Nature Park "Meotida"
5. Biosphere Reserve "Askania Nova"
6. Ukrainian Society for the Protection of Birds/BirdLife partner

Annex II – Full list of participants

Albania

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2. Taulant Bino
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8. Fatjon Prence
9. Festim Hoxha
10. Denik Ulqini
11. Agim Dardha
12. Toni Kreshnik
13. Pashk Noka
14. Tonin Ndreka
15. Gjergj Pjetri
16. Genci Kadilli
17. Eva Kocaj
18. Gjok Bici
19. Indrita Petritaj
20. Erald Xeka
21. Florian Rustemaj
22. Nexhip Hysolakoj
23. Armend Muzhai
24. Mirjan Topi
25. Roland Lleshi
26. Vasil Male
27. Olsi Duma
28. Astrit Kodra
29. Edi Lico
30. Agim Mullai
31. Festim Borja
32. Luan Halluni
33. Ramaj Kreshnik
34. Geg Paloka
35. Pjetri Ndoc
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38. Ervin Xhani
39. Toni Pjeter
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16. Stoyan Nikolov
17. Maria Krumova
18. Asen Ignatov
19. Atanas Delchev
20. Nevena Ivanova
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22. Ivaylo Dimtchev
23. Desislava Stefanova
24. Svilen Dimitrov
25. Zoya Kondova
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27. Elena Krastenekova
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15. Giannis Roussopoulos
16. Aris Christidis
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23. Nikos Noulas
24. Efterpi Patetsini
25. Thanasis Gouvras
26. Lila Karta
27. Athina Patsia
28. Vaso Kaliva
29. Fotini Tsavdaroglou
30. Ioanis Vardanis
31. Dimitris Kokinidis
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51. Irene Koutseri
52. Olga Alexandrou
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55. Giannis Gatas
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57. Lydia Alvanou
58. Stella Anagnostou
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63. Fotis Pergantis
64. Giannis Vergos
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69. Evi Sintichaki
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11. Lisavencu Dumitru
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14. Achimfiev Constantin
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18. Eugen Botezatu
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