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Waterbirds wintering at the Prespa lakes as revealed by simultaneous counts in the three adjoining littoral states

Презимување на водните птици на двете Преспански езера според резултатите од истовремени пребројувања во трите крајбрежни држави

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Lakes Prespa and Lesser Prespa are shared by Albania, Macedonia and Greece. Although situated at high altitudes they host notable numbers of wintering waterbirds. This paper presents results from simultaneous counts of wintering waterbirds in 2010-2012 carried out by researchers from the three adjoining littoral countries. The results are compared with those of almost simultaneous counts made in 1997-2000 as well as with older data in order to give the first complete account of the wintering birds at the Prespa lakes. Thirty bird species occurred regularly and another nine were observed irregularly. The six most numerous species were Common Coot *Fulica atra,* Great Crested Grebe *Podiceps cristatus,* Tufted Duck *Aythya fuligula,* Common Pochard *Aythya ferina,* Black-necked Grebe *Podiceps nigricollis* and Black-headed Gull *Larus ridibundus.* The first three made up over 80% of all wintering birds. The average number of wintering waterbirds for the period 2010-2012 was 39,089, 16% less than the average number of the previous period (1997-2000) which was 46,993 birds.

Total numbers of wintering birds present at the lakes in 2010-2012 ranged from 36,260 to 45,412, and were dominated by Common Coot, which comprised 61.5 % of all birds, compared to 53% in 1997-2000. Overall numbers of coots remained stable at around 24,500 individuals. Great Crested Grebe, the second most common species, showed a decline of ca 32% and a partial shift in distribution from Greece to Macedonia and the overall numbers of Black-necked Grebe, Tufted Duck and Common Pochard decreased compared to the earlier period. The mean number of wintering waterbirds at the two Prespa lakes by far exceeds the Ramsar criterion (20,000 individuals) and thus the lakes qualify as a wetland of international importance.

***Key words**: Prespa, wintering, waterbirds, waterfowl, IWC, Common Coot.*

Големото и Малото Преспанско Езеро се поделени помеѓу Албанија, Македонија и Грција. И покрај тоа што се наоѓаат на голема надморска височина, за презимување се посетувани од значителен број на водни птици. Овој труд ги прикажува резултатите од истовремените пребројувања на зимувачките водни птици во периодот 2010-2012 година, изведени од истражувачи од трите соседни крајбрежни држави. Резултатите се споредени со оние од скоро истовремените цензуси спроведени во периодот 1997-2000 година, како и со постари податоци, со цел да се даде прв целосен преглед на зимувачките водни птиици на Преспанските езера. Редовно беа регистрирани 30 видови птици, а уште девет беа нередовно набљудувани. Шесте најбројни видови беа: лиската *Fulica atra,* Цуцулестиот нуркач *Podiceps cristatus,* Цуцулестата патка *Aythya fuligula,* Црвеноглавиот кожувар *Aythya ferina,* Црновратиот нуркач *Podiceps nigricollis* и езерскиот галеб *Larus ridibundus.* Првите три видови сочинуваа преку 80% од вкупниот број на зимувачки птици. Просечниот број на зимувачки водни птици за периодот 2010-2012 година беше 39089 единки, 16% помалку од просечниот број за претходниот период (1997-2000) кој изнесуваше 46993 единки.
Вкупниот број на зимувачки водни птици присутни на Езерата од 2010 до 20120 се движеше од 36260 до 45412 единки, меѓу кои доминираше лиската со 61.5 % од сите единки, споредено со 53% во периодот 1997-2000. Вкупниот број на лиски е останат стабилен на околу 24500 единки. Цуцулестиот нуркач, вториот по бројност вид, покажа пад од околу 32% и делумна промена во распространувањето од Грција во Македонија, а вкупната бројност на црновратиот нуркач, цуцулестата патка и црвеноглавиот кожувар е намалена во однос на претходниот период. Вкупниот број на зимувачките водни птици многу го надминува Рамзарскиот праг од 20000 единки, и затоа езерата се квалификуваат како водни живеалишта од меѓународно значење.

***Клучни зборови**: Преспа, презимување, водни птици, пловни птици, меѓународен зимски цензус, лиска.*

Introduction

The lakes Prespa and Lesser Prespa form one functional wetland, are shared by three countries, Albania, Macedonia* and Greece, and are over 300 km^2 in area (Hollis and Stevenson 1997; Matzinger et al. 2006). With an average altitude of ca 850 m a.s.l. they are situated at a higher altitude than any of the large Balkan lakes. They are surrounded by high mountains, and winter conditions are much harder than in coastal Mediterranean wetlands, which shelter thousands of waterbirds during winter. Despite this, every winter the Prespa lakes host substantial numbers of waterbirds (Bino and Jorgo 1997; Catsadorakis 1997; Micevski and Schneider-Jacoby 1997; Fremuth et al. 2000).

The International Waterbird Census (IWC) is a counting scheme aimed at monitoring waterbird numbers on a global level, and has been organised since 1967 by Wetlands International (formerly IWRB). Further aims of the IWC are to disclose trends in waterbird numbers and distribution and ultimately to provide information necessary for the conservation and management of waterbird populations. In Europe the IWC takes place once every mid-January.

Since 1987, the IWC has been carried out annually in the Greek part of Prespa (Society for the Protection of Prespa, unpublished data), while in Macedonia counts are available for 1987–1990, 1997–2002, 2004–2006 and 2009–2011 (Velevski et al. 2010) and in Albania for 1996-2002 and 2010-2012 (Bino and Jorgo 1997; Spase Shumka in litt.). However, these counts were made within the national borders of each country. As there is no simultaneous information from other parts of the lake system the data are of limited value. In 1997-2000, there was a simultaneous count in Albania and Macedonia (Fremuth et al. 2000), while a count in Greece was done either simultaneously (1997, 2000), or, two days (1999) or two weeks (1998) earlier. The establishment of the Trans-Boundary Monitoring Plan in 2009 (Perennou et al. 2009), following an initiative of the Society for the Protection of Prespa, led to fully synchronous counts between the three adjoining states for three consecutive years (2010-2012). Thus, for the first time we obtained a complete and unbiased picture of the birds overwintering at the lakes. In this paper we present the results of these counts and compare them with the results of the nearly simultaneous counts in 1997-2000 (Fremuth et al. 2000).

Study area

In the past, lakes Prespa and Lesser Prespa (Fig. 1) formed one contiguous water body, but in the Pleistocene they became separated by an alluvial strip of land. Their joint drainage basin is 2519.1 km^2. Lake Lesser Prespa is mesotrophic to eutrophic, ca 47.4 km^2 in area with a mean depth of 4.1 m and

* Authors refered to as FYR of Macedonia; modified by the Editorial Board.

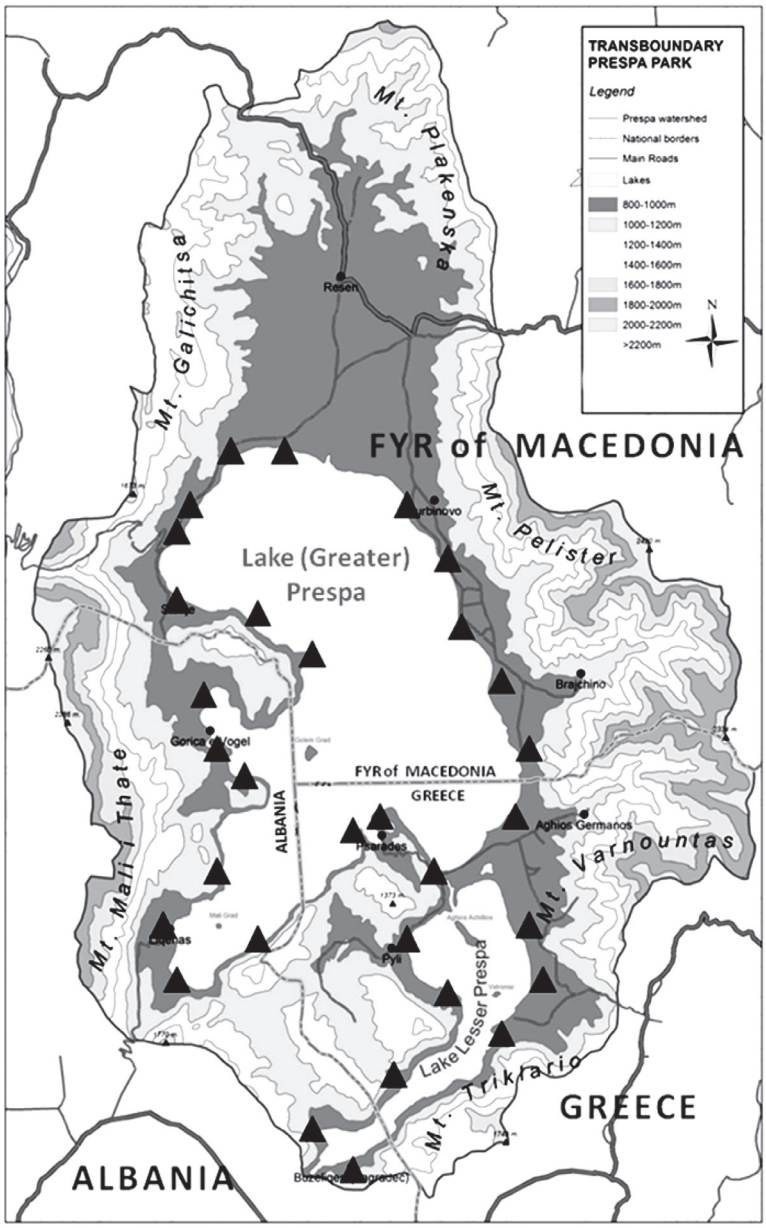

Fig. 1. Geomorphology map of the lakes Prespa and Lesser Prespa which, together with their catchment basin, have been declared a Transboundary Prespa Park. Triangles denote vantage points used for the ground counts of wintering waterbirds.

a maximum depth of 8.4 m. Its largest part is situated in Greece, while a small part in the south belongs to Albania. Due to its small size and shallow waters Lesser Prespa freezes easily, especially the Albanian part. Lake Prespa is mesotrophic, varying between 245 and 270 km^2 in area depending on water level, and has a maximum depth of 55 m and a mean depth of 14-18 m (Hollis and Stevenson 1997). It is shared between Albania, Macedonia and Greece.

Although discrete, the two lakes, Prespa and Lesser Prespa, should be considered as a functional unit since they are connected hydrologically (water from the latter flows to the former through an artificial sluice and natural seepage), fish move from Lesser Prespa to Prespa, and waterbirds use both lakes interchangeably for nesting and/or feeding. The Greek part of Lesser Prespa is of global and European importance as a breeding site for rare waterbirds such as Dalmatian Pelican *Pelecanus crispus*, Great White Pelican *Pelecanus onocrotalus*, Pygmy Cormorant *Phalacrocorax pygmeus*, Glossy Ibis *Plegadis falcinellus* and several species of heron. Four national parks are wholly or partly situated within the catchment area of the two lakes (Prespa in Greece and Albania, Galicica and Pelister in Macedonia). Both the Lake Prespa in Macedonia and Albania and the Lake Lesser Prespa in Greece are wetlands of international importance under the Ramsar Convention. The Greek part of the catch-

ment also contains two SCI (Sites of Community Interest) and SPA (Special Protection Areas) areas in accordance with European Union legislation and more specifically the EE Habitat Directive 92/43 and the 2009/147/EC Wild Bird Directive, respectively. More information on these two lakes is found in Crivelli & Catsadorakis (1997), Gjiknuri et al. (1997), Grupche & Kungulovski (2000) and Velevski et al. (2010).

Tab. 1. Numbers of individuals of each species counted in the Prespa lakes during the synchronised counts in the years 1997-2000 and 2010-2012. Trends are shown only for species with more than 10 inds on average; +++ : increasing, --- : decreasing, STA: stable, ?: uncertain, NA: non-applicable. The 1% thresholds based on the estimated size of biogeographical populations and the pertinent flyway trends (Wetlands International 2013) are also shown.

SPECIES	1997	1998	1999	2000	2010	2011	2012	Trend	Flyway Trend	1% Threshold
Anas acuta	0	12	0	0	5	5	9	?		7,500
Anas clypeata	5	0	0	0	362	114	187	+++	+++	4,500
Anas crecca	2520	1385	310	0	603	204	101	---	+++	10,200
Anas penelope	138	97	463	12	13	9	60	---	STA	3,000
Anas platyrhynchos	1377	2922	1145	331	1345	203	400	---	---	20,000
Anas strepera	5	0	2	0	9	11	35	?		1,100
Anser anser	19	14	108	0	0	202	20	+++	unknown	850
Anser albifrons	0	0	0	0	6	0	0	?		2,000
Anser sp.	0	0	0	0	140	0	0	NA		
Ardea cinerea	2	9	8	6	30	17	20	+++	+++	2,200
Aythya ferina	2351	2810	2828	1445	1039	311	1501	---	---	8,000
Aythya fuligula	3430	4106	3816	1472	1569	2314	3733	---	+++	6,000
Aythya nyroca	0	0	0	1	0	25	0	?		500
Aythya sp.	0	0	0	0	0	50	0	NA		-
Botaurus stellaris	0	0	0	0	2	0	0	?		1000
Bucephala clangula	36	84	102	70	36	49	21	---	STA	600
Cygnus olor	0	3	4	0	26	22	4	+++	+++	450
Egretta alba	3	13	15	8	68	77	30	+++	+++	460
Egretta garzetta	0	0	0	0	0	0	2	?		560
Fulica atra	17001	27467	32072	23484	20876	21992	28842	STA	+++	25,000
Gavia arctica	24	0	0	0	2	0	0	?		-
Larus michahellis	63	111	230	90	166	216	334	+++	+++	7,000
Larus ridibundus	2284	670	1008	459	527	578	883	STA	STA	11,800
Larus canus	2	0	0	0	0	0	0	?		16,400
Larus sp.	0	0	0	0	11	0	0	NA		
Mergellus albellus	3	0	0	2	51	48	26	+++	STA	350
Mergus merganser	30	12	15	20	54	27	20	+++	unknown	1
Netta rufina	13	19	9	0	87	11	0	+++	unknown	290
Pelecanus crispus	3	8	36	1	7	25	25	+++	+++	65
Pelecanus onocrotalus	0	0	0	0	9	0	0	?		-
Phalacrocorax carbo	517	298	146	158	1027	375	401	+++	+++	4,000
Phalacrocorax pygmaeus	526	560	1098	1049	1112	415	749	STA	STA	290
Podiceps auritus	6	12	1	0	0	0	0	?		-
Podiceps cristatus	5623	8436	9464	7776	3575	6498	5918	---	---	7,100
Podiceps nigricollis	3037	1108	1983	1431	1062	1003	607	---	---	2,100
Tachybaptus ruficollis	908	918	749	892	186	114	837	---	+++	3,900
Tadorna tadorna	0	1	0	0	3	0	0	?		1,200
Unidentified ducks	55	2000	0	600	2251	683	646	NA		
TOTAL	**39981**	**53075**	**55612**	**39307**	**36259**	**35598**	**45411**			
Number of species	26	24	23	19	29	26	25			

Materials and methods

The International Waterbird Census (IWC) is a site-based counting scheme for monitoring waterbird numbers, and has been organised since 1967 by Wetlands International, formerly the International Waterfowl and Wetlands Research Bureau (IWRB). The census method followed the procedure established for the IWC by Wetlands International (Delany 2005). All birds present on the surface and the shores of the lakes were counted from the ground with the aid of binoculars and telescopes from fixed vantage points covering practically the entire lake. The same vantage points were used consistently during all years (Fremuth et al. 2000; Fig. 1). The lakes were divided into non-overlapping areas visible from the chosen vantage points and without any part of the lake obscured from view. Counts were made by scanning flocks of waterbirds (which usually comprise several species) with a telescope or with binoculars as appropriate, and counting each species one-by-one, or in "blocks" for larger numbers (Delany 2005).

Counting was done by three different groups of counters (one in each country) always led by an experienced ornithologist. Counting was done during the second or third weekend of January each year. Counting started at the same time each day and the groups followed the same itinerary until the whole lake area had been covered (Fremuth et al. 2000). In this way double-counting was practically completely avoided. Only species from the families Gaviidae, Podicipedidae, Phalacrocoracidae, Pelecanidae, Ardeidae, Anseridae, Anatidae, Laridae and the Common Coot *Fulica atra* (Rallidae) are treated in this paper. We used 2-tailed Mann-Whitney U-tests to compare the mean values of the two count periods (1997-2000 and 2010-2012) with the significance level at 5%.

Results

The total number of bird species recorded in 1997-2000 was 30, as opposed to 32 in 2010-2012 (Table 1). In both periods together, 34 species were recorded while three more were only identified to genus. Out of these, 22 were observed every year in the first period and 24 in the second period.

The average total number of birds present at both lakes in 1997-2000 was 46,993±7,436 (SD, n=4) *vs* 39,089±4,478 (n=3) in 2010-2012, a non-significant difference (Mann-Whitney U test, P=0.229) of 16% (Fig. 2).

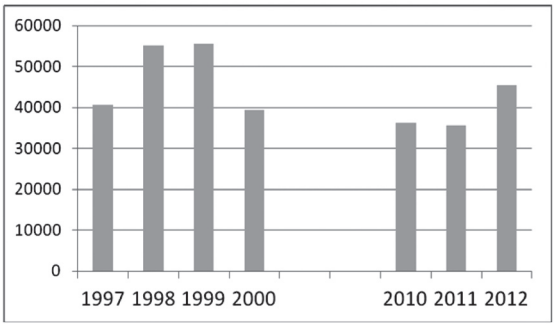

Fig. 2. Total yearly number of waterbirds counted during the IWC in two periods of simultaneous counts at the two Prespa lakes.

The two most numerous species in all years and periods were Common Coot *Fulica atra* and Great Crested Grebe *Podiceps cristatus*. Together they comprised 70% of the total number in the first period and 75% in the second period (Fig. 3).

Six species dominated in the first period comprising on average 88.8 % of total numbers (listed from more to less numerous): Common Coot, Great Crested Grebe, Tufted Duck *Aythya fuligula,* Common Pochard *Aythya ferina,* Black-necked Grebe *Podiceps nigricollis* and Mallard *Anas platyrhynchos*.

The following six species comprised on average 87.9% of the numbers counted in the second period: Common Coot, Great Crested Grebe, Tufted Duck, Common Pochard, Black-necked Grebe and Pygmy Cormorant *Phalacrocorax pygmeus* (Fig.3).

The diving ducks *Aythya* spp. comprised 11.8%

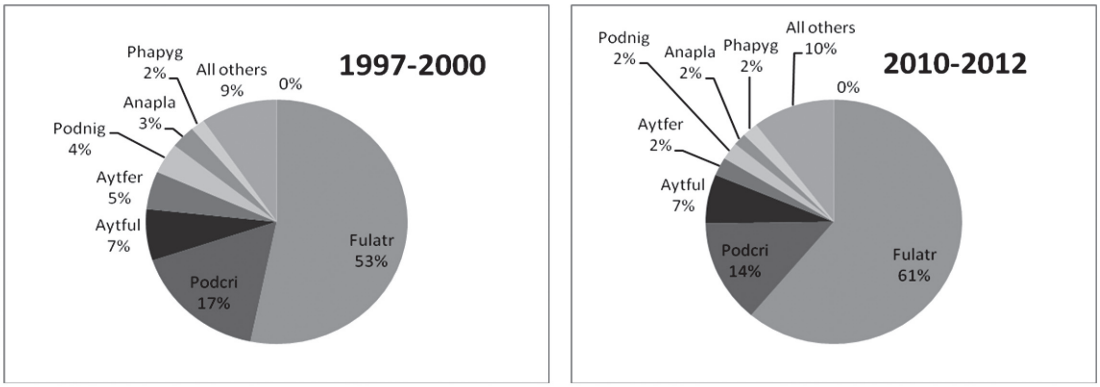

Fig. 3. Average contribution of each species to the overall winter counts at the Prespa lakes in the two periods

of the total in the first period and 8.9% in the second, while the dabbling ducks *Anas* spp. accounted for 5.7% of the total number of waterbirds in the first period and 3.1% in the second (Fig. 3).

Among the 23 species that appeared regularly in the counts (≥4 out of the 7 years) with on average more than 10 individuals in each period, eleven showed an increase, nine showed a decrease and three remained stable. Among the most numerous species only Common Coot, Pygmy Cormorant and Black-headed Gull *Larus ridibundus* showed stable average numbers between the two periods, while all the others showed a clear decrease. All species that increased are species present in low numbers (Table 1).

The average count for Lesser Prespa in the first period (Table 2) was 1,583 ±1,448, while for the latter period it was 2,209±330 (Mann-Whitney U test, P=0.400). The much higher variability in the first pe-riod apparently reflects the large variation in the harshness of winter conditions compared to almost equally mild winters in the second.

Tab. 2. Total numbers of birds counted in the Greek and Albanian parts of the Lake Lesser Prespa in 1997-2000 and 2010-2012.

Year	Greece	Albania	Total
1997	838	809	1647
1998	1599	2148	3747
1999	574	0	574
2000	0	0	0
2010	2546	130	2676
2011	1855	101	1956
2012	1997	0	1997

Discussion

The papers which have been published so far reporting on the wintering waterbirds at Prespa, have referred to counts in one or two of the countries (Bino & Jorgo 1997; Catsadorakis 1997; Micevski & Schneider-Jacoby 1997; Fremuth et al. 2000; Koutseri et al. 2012). Although the two periods compared in the present paper are short (4 and 3 years), there are a few conclusions that can be drawn from the results.

The number of species registered in the two periods is quite similar, 30 and 32, respectively. More importantly, there are almost no real differences in the composition of the winter avifauna (Table 3). The regular presence of the Smew *Mergellus albellus* in recent years, compared to relatively low numbers of the species in the past is the most interesting one in this regard. Catsadorakis (1997) for Greece, Bino and Jorgo (1997) for Albania and Fremuth et al. (2000) for Macedonia give some information in their accounts of the spatial distribution of species, an issue we have not tried to include in this paper.

The Prespa lakes are situated at the southernmost edge of the West Balkans, a geographic subregion which includes Albania, Macedonia, Serbia, Bosnia and Herzegovina and Croatia. Birds wintering at Prespa arrive from the north and are thus highly dependent upon the weather conditions prevailing in the West Balkans. In 1951-2006 the West Balkans have experienced an increase in temperature of 0.005 to 0.025 °C per year as well as a decrease of precipitation of -0.1 to 0.5% per year (Zoï Environment Network 2012). Winters are becoming milder and this is also reflected in the number of years Lake Lesser Prespa has frozen: 7 out of 12 years in 1989-2000 in contrast to 2 out of 12 years in 2001-2012.

Tab. 3. Total numbers of waterbirds counted in the Greek, Macedonian and Albanian parts of the two lakes in 1997-2000 and 2010-2012, respectively.

Year	Greece	Macedonia	Albania
1997	11538	17741	11448
1998	13871	14828	26581
1999	13890	15160	26577
2000	10868	4857	23586
2010	6442	12282	17536
2011	8110	13975	13517
2012	8530	13835	23047

The decrease in the overall numbers of birds wintering at the lakes (by ca 16%) is not related to the numbers of its most numerous species: although Common Coot numbers comprise between 53% of all birds in the first period and 61% in the second, its absolute numbers remain practically unchanged between the two periods at ca 24,000-25,000 birds. Pygmy Cormorant numbers also remain stable. Thus the decrease is attributed to the other numerous bird species which show a clear decline over the 12 years: Common Pochard, Tufted Duck, Black-headed Gull, Great Crested Grebe and Black-necked Grebe. The cause of the decrease may be the milder winters which allow many birds to stay further north as has been shown many times (Ridgill & Fox 1990; Austin & Rehfisch 2005; Maclean et al. 2008). The decrease may also be related to the rapid eutrofication of both Prespa lakes (Matzinger et al. 2006; Patceva & Mitic 2010; Katsiapi et al. 2012; Krstić 2012) as has been shown for example for breeding waterbirds in Finland (Lehikoinen et al. 2013).

The contribution of the dabbling ducks to the total numbers remains very low (343 in 2000 up to 4416 in 1998) and in fact their numbers can be considered negligible in Prespa. There is a statistically non-significant difference between the two periods (2,681±1652 in the former and 1,225±792 in the latter) which can be attributed to the fact that due to milder winters these ducks do not move further south but stay in northerly areas as has been repeatedly shown elsewhere (Dalby et al. 2013). However, to predict effects of climate change on the winter distributions of dabbling ducks, studies need also to include non-climatic factors such as food abundance, availability and quality (Dalby et al. 2013).

The numbers of diving ducks have dropped from an average of 5,564 to ca. 3,488 individuals, a decline of almost 38% which may well be attributed also to milder winters. Weather conditions in winter affect directions of movements in Common Pochards (Gourlay-Larour et al. 2012) and it has been shown by Lehikoinen et al. (2013) that over the past three decades, the numbers of wintering Tufted Ducks increased at the northeastern edge of the flyway with a simultaneous decrease in the southwestern edge of its distribution as a response to changes in temperature. This might well also be true for the southeastern distribution edge such as the Prespa lakes.

The fish-eating birds, if considered as a discrete assemblage, do not show clear trends as Great Crested Grebe numbers have declined, while Dalmatian Pelican *Pelecanus crispus*, Great Cormorant *Phalacrocorax carbo* and Common Merganser *Mergus merganser* show increasing trends and the number of Pygmy Cormorants is stable. A few less numerous species that are considered to be either residents or locally dispersive in winter, show some increase. Amongst those are Greylag Goose *Anser anser,* Grey Heron *Ardea cinerea,* Mute Swan *Cygnus olor,* Great White Egret *Egretta alba,* Yellow-legged Gull *Larus michahellis*, Common Merganser, Dalmatian Pelican and Great Cormorant. It seems justified to attribute the increase in their numbers to the milder winter conditions during the last 15 years (Zoï Environment Network 2012) allowing more and more individuals of these species to spend the winter in the area. On the other hand, some of these species have shown a consistent increasing trend at their breeding grounds in Greece and in Macedonia (Society for the Protection of Prespa and Galicica National Park, unpublished data).

Populations of the following species exceed the 1% threshold of the biogeographical flyway population for all or some years and thus fulfil the pertinent Ramsar and IBA criterion: Common Merganser, Pygmy Cormorant (all years), Common Coot, Great Crested Grebe and Black-necked Grebe (some years).

Counts of overwintering avifauna have also been made at the adjacent Lake Ohrid (Fremuth et al. 2000). The average for the counts in 1997-2000 was 58,015 birds as compared to a mere 26,449 in the 2010-2012 period (Macedonian Ecological Society / MES and Protection and Preservation of Natural Environment in Albania / PPNEA, unpublished data). Thus, it is apparent that in contrast to Prespa, which has shown a non-significant decrease in waterbird numbers by 16%, numbers at Lake Ohrid show a statistically significant decrease of 54.4%. At present, there are no available environmental data with which this dramatic decrease might be correlated.

With respect to the overall trends of waterbird populations in Greece (Kazantzidis et al. 2012), there is one issue to be underlined. In the 19 larger Greek wetlands, as well as in Prespa, the Common Coot is the most numerous species, but in contrast to Prespa, in those wetlands the second and third most numerous species are two *Anas* ducks (Kazantzidis et al. 2012). Moreover, whereas the Common Coot is in decline in Greece, it is stable at Prespa and its flyway population trend is increasing (Table 1). This is another clear indication that milder winters may allow more birds to remain at higher latitudes in winter.

We should be cautious, however, when interpreting trends in overall numbers because two periods of four and three years, respectively, seriously limit our possibilities to draw reliable conclusions. For example, while the results of this paper show a clear decline in waterbird numbers at the two lakes, and more particularly in the Greek parts, the results of 25 years of uninterrupted counts at the Greek parts (Koutseri et al. 2012) show no significant trends!

In contrast, important differences in the spatial distribution of the waterbirds were found, which apparently reflect habitat differences between the parts belonging to the three states. The most obvious of these is that in the parts of Albania and Macedonia, the Common Coot was by far the most numerous species. This was not the case in the Greek part, where the most abundant species was the Great Crested Grebe. This distribution pattern is likely explained by the fact that the majority of Great Crested Grebes are observed at the deepest parts of lake Prespa, close to cape Roti (40º 50. 611´ N, 21º 0.686´ E) which lies in Greek waters. Nevertheless, in contrast to the first period when almost no Great Crested Grebes were observed in Macedonia, during the second period large numbers of these birds were observed there.

The Lakes Prespa by consistently hosting from 35,000 to more than 55,000 waterbirds every winter, by far exceed the pertinent criterion for sites of International Importance ("site known to hold on a regular basis 20,000 waterbirds..." Global IBA Criteria, BirdLife International). Thus, apart from all other criteria which the Prespa lakes fulfil as a wetland of international importance, they also do so based up-

on their wintering birds. Additionally, it should not go unnoticed that the Dalmatian Pelican, a globally threatened species listed as "Vulnerable" in the IUCN Red List, and the Ferruginous Duck, a "Near Threatened" species, both overwinter at the lakes albeit in small numbers.

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