Hellenic Agricultural Organisation "DEMETER"
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The diet of the wintering Lesser White-fronted Goose (*Anser erythropus* L., 1758) in two wetlands in Greece

Final Report

Action A5 of the project: LIFE10NAT/GR/000638 "Safeguarding the Lesser White – fronted goose fennoscandian population in key wintering and staging sites within the European flyway"

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The present report includes the research results regarding the diet of the Lesser White-fronted Geese during the 2012-2013 and 2013-2014 wintering periods at Kerkini Lake and Evros Delta, Greece. The research was implemented in the framework of Action A5: "Diet analysis of the Lesser White-fronted Geese in selected sites for the identification of habitat requirements", in the framework of the LIFE project «Safeguarding the Lesser White-fronted Goose Fennoscandian population in key wintering and staging sites within the European flyway» (LIFE10 NAT/GR/000638).

Photo on the cover: *Echinochloa crus-galii*: one of heavily grazed by the Lesser White-fronted Geese plants at Kerkini Lake. Ilias Karmiris.

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CONTENTS

Abstract

Knowledge of diet selection and the relationships among herbivores is an integral component of the understanding of herbivores' ecology and management. The aim of this study was to investigate for first time the diet selection of the Lesser White-fronted Goose (*Anser erythropus* hereafter LWfG) in its wintering habitats in Greece, the Kerkini Lake and the Evros Delta, as well as to report preliminary results about the investigation of potential interactions between LWfG and co-existing livestock. For these purposes, the relative use of habitats by the herbivores, the availability of forage and the composition of diets were estimated using visual observations and the faeces-count method, the relative cover of plant species and the microhistological analysis of faeces respectively.

The feeding habitat of LWfG in Kerkini Lake was exclusively the marshy grassland following the water line (less than 5 cm deep) to 300 – 400 m away from the shore, while the main feeding habitat of buffaloes was the non-marshy habitat more than 400 m away from the shore. Consequently, a clearly differentiation of the main feeding habitat of LWfG in relation with that of water buffaloes (*Bubalis bubalis* – hereafter buffalo) was observed during the wintering periods 2012-2013 and 2013-2014. In the Evros Delta, cattle did not graze at all during the period that LWfG used this area for wintering. The departure time of LWfG from the Kerkini Lake (about the middle of December in both wintering periods) coincided with the great reduction of the total plant cover in their feeding habitat. The most preferred plant species for the LWfG in Kerkini Lake were *Echinochloa crus-galli*, *Cyperus esculentus*, *Scirpus lacustris* and *Ranunculus sceleratus*. Grasses were also an important forage resource for buffaloes but they mainly fed on different grass species (e.g. *Cynodon dactylon*, *Poa trivialis* and others) in relation to the LWfG. Graminoids (i.e. grasses and grass-likes) also constituted a preferred forage resource for the LWfG in the Evros Delta.

The availability of food in Kerkini Lake seems to influence not only the diet composition and the general feeding behavior of the LWfG, but it may play a crucial role in the selection of habitats by LWfG and its movements. Concerning the selection of habitats, LWfG could be considered specialist, as this species uses specified natural habitats, i.e. mainly marshy areas around lakes as well as salt marshes and coastal meadows. However, as concerns the selection of food, based on these results and previous studies, it seems that the LWfG consumes biomass produced by a

variety of plant species in both wintering and breeding habitats. All the birds comprising the flock of the LWfG (about 50-60 individuals) consumed the same forage resources on the same feeding ground, i.e. they exhibited similar feeding behavior. Based on these preliminary results, it seems that competition for food or habitat resources between LWfG and livestock is absent or at least very weak, clearly because these herbivores feed on different plant species growing at different habitats (Kerkini Lake) or at different time (Evros Delta).

The further and in depth investigation on the influences of the food availability on the feeding behavior and the movement pattern within and between habitats of LWfG during the next years. The marshy habitat is of prime importance for LWfG conservation, should be protected and the flooded period should not coincide with the period that birds spend in the Kerkini Lake. At that time, the several plant species occurring in the marshy habitat should have been grown quite enough in order to provide food to the LWfG. In consequence, sprouting of these plants should occur at least 1.5 months prior the arrival of the LWfG in the Kerkini Lake, i.e. not later that the end of August. This is usually happening in this area and should be followed in a strictly manner. On the other side, the closeness of the dam gates should be done after the departure of the birds from this area, usually at the end of the winter (late December – early January but it may be delayed until late January – early February) and not earlier. In the Evros Delta, the cattle grazing in this area should be stopped no later that the end of November in order to avoid the depletion of the food resources for LWfG. Under this aspect, cattle should not graze in this area throughout the whole period that LWfG winters in this habitat.

Introduction

The Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) is a vulnerable species according to IUCN criteria and, critically endangered according to the Red Data Book of the threatened animals of Greece (Legakis and Maragou 2009). Its world population size is estimated at 28,000 – 33,000 individuals (Jones et al. 2008). The Fennoscandian population however, is on the verge of extinction. It is estimated that about 60-80 individuals comprise the total population in the Nordic countries (Fox et al. 2010). The known breeding areas of the Fennoscandian population are located in northernmost Norway, and they usually winter in eastcentral Europe and the Balkans (see e.g. Jones et al. 2008). The main wintering areas in Greece are the Kerkini Lake and the Evros Delta (Lorentsen et al. 1998, Kazantzidis & Naziridis 1999, Vangeluwe 2004). There is some knowledge about the diet composition of the LWfG in northern Europe, mainly during spring, summer and autumn (Aarvak et al. 1996, Niemelä & Markkola 1997, Markkola et al. 2003). Grasses were the most important food category for the LWfG, whereas consumption of dicotyledons was at a relatively low level. However, there is a lack of knowledge on LWfG's diet composition and selection in the Balkans during winter. Grasses were also the main food resource for LWfG based on the analysis of 9 droppings collected in the 'Paloukia' area (Evros Delta) during the wintering period of 2005-06 (Karmiris et al. 2009). Except this note on the wintering diet of LWfG, there is not a single report on this topic in the Mediterranean region. It is well documented that food plays a major role for bird species in order to withstand the harsh weather conditions during winter and also to be prepared for the trip back to their breeding areas (Owen & Black 1990). Thus, it is of vital importance to broaden the scientific knowledge about the diet composition and selection of the LWfG in Greek wetlands where the species spent the whole wintering period, especially for conservational purposes.

Food competition among herbivores is possible only if there is overlap both on the feeding habitats and the compositions of their diets (de Boer and Prins 1990, Krebs 1999). In a specific habitat, the intensity of the potential competitive interactions among herbivores greatly depends on the magnitude of their diet overlap (Jenkins and Wright 1988, Thill and Martin 1989). However, competitive interactions could be emerged only in case of food limitation (Newton 1998). High diet overlap does not always mean that the different animal species use the common resource compete each other (Connell 1983, Schoener 1983, Ego et al. 2003); therefore, special

attention should be given at the interpretation of the results. For example, when the available food is plenty, then there is no competition among herbivores even if there is total overlap of their diets (de Boer and Prins 1990). On the other hand, if the available food is limited even a low degree of diet overlap could result in the emergence of competitive interactions among herbivores (Colwell and Futuyuma 1971, Rosenweig 1981).

Resource partitioning is considered to facilitate coexistence of sympatric herbivores and thus it plays a major role in community structure in nature (Walter 1991). According to the concept of hierarchical foraging, herbivores select their food on several scales, from landscape down to individual bite level (Bailey et al. 1996). Partitioning may occur for habitats, forage species, plant parts, season and time of using the shared resource or a combination of them (Jenkins and Wright 1988). In such cases, interacting species may have been subjected to mutual ecological and evolutionary divergence in response to interspecific competition. Thus, interspecific competition is considered as a selective force capable of shaping distribution and abundance in animal communities, leading to specialization of feeding processes (Gordon and Illius 1989), i.e. it promotes resource partitioning.

This pioneer study directly addresses the crucial issue of the diet selection of LWfG in its wintering habitats in northern Greece, as well as to report preliminary results about the investigation of potential interactions between LWfG and co-existing livestock. More specifically, the aim of this study was to investigate the diet selection of LWfG wintering in the Kerkini Lake and the Evros Delta during the wintering periods 2011-2012, 2012-2013 and 2013-2014, using the method of microhistological analysis of droppings. However, the natural meadows surrounding the Kerkini Lake, except the LWfG, are also used by water buffaloes (*Bubalis bubalis*, hereafter buffaloes) a very economically important activity for the local society. Consequently, the interactions that may emerge between LWfG and buffaloes may play an important role in the management planning of that system. That's why we decide to evaluate the use of habitats by LWfG and buffaloes too, in order to verify the possibility of negative competitive interactions for feeding habitat between these herbivores. Additionally, at the Evros Delta, apart from the LWFG and the other geese (mostly Greater White-fronted Geese), there are also cattle that exploit the same rangeland. The null hypothesis tested in this study, that there is no significant selection on the available forage by the LWfG in the Kerkini Lake should be false

at least for some forage items. In addition, the hypothesis that there are no significant differences in the relative use of available habitats by the LWfG and buffaloes should also be false since herbivores usually use differentially the available habitats according to their needs for food and protection from predators, humans, weather conditions, etc. Diet composition and selection of LWfG, as well as the magnitude of habitat overlap between LWfG and buffaloes (Kerkini Lake) or cattle (Evros Delta) will likely contribute to a better understanding of their forage needs and the potential interactions among them, as well as may help to predict their impact on forage categories and their role in ecosystem processes. Indubitably, such knowledge is valuable in drawing up guidelines for rational livestock management and wildlife conservation in the wetlands of northern Greece.

Study areas

Kerkini Lake

The study area is a reservoir created in 1932, mainly for irrigation purposes after the construction of a dam along the Strymon River circa 10 kilometres southwards of the border with Bulgaria (Map 1). In 1982, a higher dam and dykes all along the eastern lake coast were constructed. Kerkini Lake is included in the list of the prtotected wetlands under Ramsar convention as a wetland of international importance for waterbirds, in NATURA 2000 network and is a Special Protection Area (SPA).

Map 1. Kerkini Lake

The study area is defined as the grassland area at the northern (from Mandraki eastwards) and eastern parts of the Kerkini Lake. In this area, two major habitats can be discriminated – the marshy (no more than 300 – 400 m away from the shoreline) and the non-marshy habitat (more than 400 m away from the shoreline). Due to the lake's operation as an irrigation reservoir, its water level fluctuates by 5m and its surface usually decreases from 75km^2 to 50km^2 yearly (higher values in May – June and lower ones in August - September). As a consequence, the marshy habitat area (Appendix – Photographic documentation, Figure 1) is gradually decreasing during the period that the LWfG spends in Kerkini Lake each year (usually from October to December – January). This is depending mainly on the amount of precipitation during this period and its yearly fluctuations that are controlled by the pertinent authorities. This marshy freshwater habitat is dominated by plant species capable to grow in these conditions, such as *Echinochloa crus-galli*, *Paspalum paspalodes*, *Ranunculus* spp., species of the *Cyperaceae* family, etc.

The rest of the study area constitutes the non-marshy grassland dominated mainly by *Paspalum paspaloides*, *Cynodon dactylon* and *Xanthium strumarium* (Appendix – Photographic documentation, Figure 2). This is the main area where the activities of buffalo farming take place (i.e. livestock sheds, presence of humans and shepherded dogs, supplementary feeding points, etc.). It is estimated that nowadays, there are about 3,000 free grazing buffaloes on the wet meadows around the lake.

Evros Delta

Since 1986, Evros Delta has been protected under the Ramsar convention as a wetland of international importance (Ministry of Environment 1986); it is a part of the Natura 2000 network and it is also a Special Protection Area. Several human activities, such as hunting, agriculture, livestock farming, fishing and recreation, are carried out in this wetland. Over the last 60 years, various draining projects were instigated, whose primary objective was to increase the amount of arable land, such as the alignment of the lower route of the Evros River (Angelidis and Athanasiadis 1995). As a result, a decrease in the fresh water level horizon and the concomitant increase of soil salinity was observed which eventually favoured the halophytes over grass-forb communities which are usually more sensitive to salinity. Nowadays, the vegetation communities are both variable and patchy due to the shifting properties of the environmental conditions, namely, the presence or absence of water, its quality, depth, levels of salinity, etc. Arable land and farming occurs in the northern part of the wetland in the vicinity of the core protection area. The most important crops are cereals (mainly wheat), followed by sugar beet, corn, cotton, etc.

The LWfG arrived in Evros Delta at the middle to late December during the wintering periods 2012-2013 and 2013-2014 (www.piskulka.net). That means the LWfG uses this habitat about 2-2.5 months in a yearly basis since this species usually winters in this area until late February – early March. The main habitat of LWfG in Evros Delta is the 'Ktima Dimitriadis' area, i.e. the area where our research was mostly taken place (Map 2, Appendix – Photographic documentation, Figure 3). It is a typical Mediterranean halophytic grassland dominated by halophytes (*Salicornia* spp., *Limonium* spp., *Halimione portulacoides*, *Halocnenum strobilaceum*, *Salsola* spp.,), grasses (*Cynodon dactylon*, *Puccinelia festuciformis*, *Elymus* spp., *Poa* spp., *Lolium perenne*, *Agropyron* spp.), grass-likes (*Carex* spp.), legumes (*Trifolium* spp.,

Medicago spp.) and other forbs (*Taraxacum officinale*, *Plantago* spp., *Potentilla* spp., *Artemisia campestris*). Cattle usually graze freely in this area (in 2013 about 130 individuals) for 9 months yearly from March to November (Platis et al. 2013).

Map 2. Evros Delta

Materials and Methods

Habitat use

The relative use of the two available habitats in Kerkini Lake by the LWfG was based on visually observations of the flock of the LWfG during the 2 last wintering periods. The birds were monitored by us (once or twice every week) and the other colleagues in Kerkini Lake (about 3-4 days weekly) throughout the period that LWfG spent in this area, i.e. from early October to middle December in both wintering periods.

The estimation of the relative use of marshy and non-marshy areas in Kerkini Lake by the buffaloes during the 2 last wintering periods was based on the faeces-count method (Litvaitis et al. 1996). More specifically, 10 squared plots (20 x 20 m) were established in each habitat and the number of faeces deposited in these plots every 15 days was recorded from middle October to middle December in each wintering period. Faeces were counted and subsequently removed from each plot. Faeces-count data were subjected to analysis of variance (ANOVA). Habitats (2 levels), wintering periods (2 levels) and sampling dates (5 levels) were fixed factors. Levene's test was performed prior the analysis in order to check the homogeneity of variances. Differences were considered significant at $P \leq 0.05$.

Food availability

Kerkini Lake

During the 2 last wintering periods (2012-2013 and 2013-2014), the feeding habitat of LWfG was the marshy habitat from the site 'Paratiritirio' and southernwards to the site 'Aggelochori' (Map 1). For that reason, the estimation of vegetation characteristics was based on data collected only in this area, i.e. the feeding area of LWfG. For that purpose, 9 field-surveys – 100 plots (0.5 x 0.5 m) per survey – were conducted to estimate plant cover and composition per species, at the same time with dropping collection (Cook and Stubbendieck 1986). These surveys were conducted from the early October to the middle of December during the 2 last wintering periods, in order to cover the whole period that LWfG was staying in the Kerkini Lake. In addition, 2 more field surveys were also conducted, the first in the middle of December 2013 and the second one in the middle of Juanuary 2014, i.e. the time that the flock of LWfG left the area. The

availability of the major forage categories for all herbivores was based on the relative cover of vegetation in the study area (Appendix – Photographic documentation, Figure 4). It is estimated by excluding mosses, bare soil and plant species which their biomass is not used as a food for LWfG at all, such as *Xanthium strumarium*, *Cirsium* sp., *Euphorbia villosa*, *Bidens tripartita*, *Conyza* sp. and others (Markkola et al. 2003).

In the non-marshy habitat, the main feeding place of buffaloes, the relative vegetation parameters were estimated once per month (October – January) in each wintering period, using the same methodology as in the marshy habitat.

Evros Delta

The estimation of the availability of the major forage categories in the 'Ktima Dimitriadis' area was also based on the relative cover of vegetation. Vegetation cover was assessed in 100 plots (0.5 x 0.5 m) per survey, randomly dispersed throughout the study area (Cook & Stubbendieck 1986). Data were collected in six vegetation surveys from December to February during the 2012-2013 and 2013-2014 wintering periods, i.e. the time that LWfG wintered at the Evros Delta during the last two years (www.piskulka.net). The availability of each major forage category was estimated by excluding litter, bare soil and water proportions. Woody vegetation was also excluded, since this forage category was a negligible component in both the plant community and the herbivores' diet (Markkola et al. 2003). On the other hand, newly sprouted plant matter underneath dead standing plant biomass was considered as available food for LWfG.

Diet composition

Microhistological analysis of droppings

Microhistological analysis of droppings is potentially the most frequently used method worldwide to estimate the diet composition of wild and tame herbivores (Paola et al. 2005). It is based on the comparison of the particles of epidermal tissue of forage found in faeces of herbivores with the epidermal tissue of parts of identified plant species which are available to herbivores (Holechek and Gross 1982). Every dropping was collected and preserved in a plastic bag separately (Appendix – Photographic documentation, Figure 5).

This method includes the following three steps (Litvaitis et al. 1996):

Step 1: Preparation of reference slides

The most common plant species presented in the marshy habitat in the Kerkini Lake and in the Evros Delta (about 60 species in each area) were collected in plastic bags and pots. Special attention was taken to collect several plant parts (stems, flowers, fruits, etc.) when these were available. Then, microscopic slides containing the epidermal tissue of the several plant parts were prepared for comparative purposes. The morphology of the epidermal tissue of the *Echinochloa crus-galli,* which constituted the bulk of the diet composition of LWfG in Kerkini Lake is presented in the Appendix – Photographic documentation, Figure 6. The epidermal cells with characteristically tooth-like margins are easily identified and the morphology of the stomata is typical among grass species.

Step 2: Collection of droppings

Fresh droppings from LWfG were collected in the field in Kerkini Lake during the 2012-2013 and 2013-2014 wintering periods and in Evros Delta during 2011-2012, 2012-2013 and 2013-2014 wintering periods from (Table 1). We watched the flock carefully with a telescope without causing disturbance, we located the exact feeding place of the birds and then we went *in situ* and collected only the fresh droppings we found. During the wintering period 2012-2013 in Kerkini Lake, we managed to collect 119 droppings. Another 190 droppings were also collected during the wintering period 2013-2014. In a few cases, a pile of several droppings was found in the field (Appendix – Photographic documentation, Figure 7). In these cases, only one dropping was analyzed to estimate the diet composition. The way that dropping collection and analysis were conducted allows us to suppose that each dropping in each survey – not between surveys – is probably origin from a different bird. For that purpose, only 12 among the 27 droppings collected in the middle of October 2012 were analyzed because the 20 of them were in piles. In addition, 43 and 48 randomly selected among the 82 and 57 droppings collected on the 10th of November 2012 and on the 11th of November 2013 respectively have been analyzed to estimate the diet composition of the LWfG because about 50 - 55 birds comprised the flock at that time. In total, during the first wintering period in Kerkini Lake, 119 droppings of LWfG were collected, all in the marshy habitat, which corresponds in 65 samples. The next wintering period, 190 droppings were collected in the same habitat which corresponds to 181 samples.

Table 1. Collection dates, number of droppings collected and analyzed microscopically to estimate the diet composition of LWfG in the Kerkini Lake and the Evros Delta.

Kerkini Lake			Evros Delta		
Collection date	**Droppings collected (n)**	**Droppings used in analysis (n)**	**Collection date**	**Droppings collected (n)**	**Droppings used in analysis (n)**
15/10/2012	27	12[a]	06/03/2012	19	19
31/10/2012	10	10	23/02/2013	38	38
10/11/2012	82	43[b]	20/12/2013	25	25
09/10/2013	32	32			
23/10/2013	36	36			
01/11/2013	17	17			
11/11/2013	57	48 [b]			
22/11/2013	26	26			
06/12/2013	22	22			
TOTAL	309	246		82	82

[a] only 1 dropping from each pile was analyzed.
[b] these droppings were randomly selected as there were about 50 birds.

However, in Evros Delta collecting LWfG's droppings is much more difficult and doubtful, mainly because of the habit of LWfG flock to graze in mix with flocks of other geese (mainly *Anser albifrons*). In such cases, discrimination of LWfG droppings from the droppings of other geese is highly ambiguous and probably would produce bias to our results. Nevertheless, despite this difficulty we managed to collect 19 droppings during the wintering period of 2011-2012, 38 ones in 2012-2013 and another 25 droppings in 2013-14 (Table 1). All these droppings were collected when the flock of LWfG was not in mix with other geese species.

Step 3: Preparation of microscope slides of droppings

The droppings were ovendried at 60 ^{o}C for 48 hours, grounded and mixed thoroughly to ensure particle uniformity. Microscope slides of faeces were then prepared and analyzed. Preparation of five slides is usually quite enough per sample. Twenty systematic fields per slide were examined for particle frequency. A field was considered to be the area delineated by a microscope using 100X magnification. Diet estimation was based on the frequency addition procedure, i.e. dividing

the frequency of each category by the total number of frequencies for all categories (Holechek and Gross 1982). Only particles containing epidermal tissue were considered. Each plant species identified in the herbivores' faeces was assigned to one of the following forage classes:

Kerkini Lake: (1) grasses, (2) grass-likes (species of the *Cyperaceae* and *Juncaceae* families), (3) aquatic species, (4) other forbs.

Evros Delta: (1) graminoids (grasses and grass-likes), (2) halophytes, (3) legumes, (4) other forbs.

Analysis of gizzards

We collected 15 gizzards of the Greater White-fronted Goose (*Anser albifrons* – hereafter GWfG) that had been harvested by hunters during January and February 2014. Another one gizzard was collected in January 2014 belonging to an individual found dead in the 'Ktima Dimitriadis' area. The gizzards were then deep frozen, as soon as possible, at -18^{o} C. Samples were collected in the morning and in the afternoon, thus the food samples should be representative of what birds consumed both on their feeding grounds and on day-roosts (Guillemain and Fritz 2002). Food items found in gizzards were dried to a constant mass at 65 ^{o}C for 48 hours and weighed (± 0.001g). Diet composition was evaluated using the percentage of occurrence (F) and the aggregated percent dry weight methods (DW) (Swanson et al. 1974). Empty digestive tracts or those which contained either fewer than 5 food items or less than 0.05 g of food were excluded from subsequent analysis (Woodin and Swanson 1989, Petrie and Rogers 1996). In total, 13 gizzards were analyzed.

Diet selection

Selection indices ($\hat{w}_i$) for each one of the forage categories in both study areas, as well as for every plant species identified in the herbivores' faeces (except the traces, i.e. percentages of diet composition equal of above 1%) in Kerkini Lake, were calculated as: $\widehat{w}_i = \frac{o_i}{p_i}$

where o_i is the proportion of used resource units and p_i is the proportion of available resource units. The standardized selection index B_i (Krebs 1999) was also calculated according the formula:

$$Bi = \frac{\hat{w}_i}{\sum_{i=1}^{n} \hat{w}_i}$$

where, B_i is the standardized selection index for species i, and $\hat{w}_i$ is the selection index for species i. Standardized selection indices for all forage resources add up to 1 and in essence give the probability of selection of forage resource i in case of equal availability of all resource categories.

We tested the null hypothesis of no selection using the G-test (Krebs 1999):

$$\chi^2 = 2\sum_{i=1}^{n}\left[u_i \ln\left(\frac{u_i}{Up_i}\right) + m_i \ln\left(\frac{m_i}{m_i + u_i \frac{M}{U+M}}\right)\right]$$

where χ^2 is the Chi-squared value with (n – 1) degrees of freedom, u_i is the number of observations using resource i, m_i is the number of observations of available resource i, U is the total number of observations of use (i.e. $\sum u_i$), M is the total number of observations of availability (i.e. $\sum m_i$) and n is the number of resource categories.

Standard errors of selection indices were calculated using the formula:

$$s_{\bar{w}i} = \sqrt{\frac{(1-o_i)}{Uo_i} + \frac{(1-p_i)}{p_i M}}$$

where $s_{\bar{w}i}$ is the standard error for a selection index and the other terms as defined above. 95% confidence intervals (CI) for selection indices were calculated using the Bonferroni correction as:

$\hat{w}_i \pm z_{0.0125} s_{\bar{w}i}$ for the 4 forage categories in Kerkini Lake and Evros Delta, and

$\hat{w}_i \pm z_{0.03125}\, s_{\bar{w}i}$ for the 16 plant species which identified in the LWfG's faeces and their correspondent percentage in the diet composition was equal or above 1%.

Confidence intervals of selection indices not containing the value 1 indicate significant selection. If a confidence interval contains the value 1 then the selection index does not differ from that value for a=0.05, i.e. there is no selection for or against the forage category. Indices of selection were then estimated based on the analogy between diet estimation and the availability of food for the LWfG. Values of indices above and below 1 indicate significant selection for or against a plant species respectively (Krebs 1999).

Results

Patterns of habitat use

Kerkini Lake

The feeding habitat of LWfG in Kerkini Lake was exclusively the marshy grassland following the water line (less than 5 cm deep) to 300 – 400 m away from the shore, at the sites of 'Aggelochori' and 'Paratiritirio'. This habitat is dominated by aquatic and wet tolerant plant species such as *Echinochloa crus-galli*, *Paspalum paspalodes*, *Limosella aquatica*, *Polygonum persicaria*, etc.

The relative use of the non-marshy area by buffaloes was significantly higher than in the marshy one (F = 2500.287, d.f.: 1, $P < 0.001$). There were no significant differences in the mean number of buffaloes' faeces either between wintering periods (F = 0.010, d.f.: 1, P = 0.921) or sampling dates (F = 0.577, d.f.: 4, P = 0.680). Buffaloes mainly grazed in the non-marshy grassland area (n = 10.65 faeces / plot / 15 days) which was more than 400m away from the lake's shoreline. On the contrary, the average use of the marshy grassland area (the feeding place of LWfG) by buffaloes was very limited (n = 0.63 faeces / plot / 15 days).

These results confirm that there is a clearly differentiation of the main feeding habitat of LWfG in relation with that of buffaloes, during the wintering periods 2012-2013 and 2013-2014. Under this perspective, there was a distinct partitioning of feeding habitats for LWfG and buffaloes in Kerkini Lake.

Evros Delta

In the Evros Delta, cattle were not grazed in the study area from October 2012 to March 2013 and from late November 2013 until April 2014 (they were kept indoors and fed supplements provided by the farmers). Hence, these herbivores (LWfG and cattle) were not grazing in common at all during the 2 last wintering periods. Consequently, in this case, the targeted harbivores (LWfG and cattle) use the same habitat but in different times of the year.

Vegetation parameters

Kerkini Lake

Total vegetation cover (excluding mosses) in the marshy habitat was about 60% (Table 2). Grasses was the most available forage category for LWfG (47.0%) and total monocotyledons constituted more than the half of the total available food resource. The rest was comprised almost equally by aquatic species (18.0%) and other forbs (24.4%). Waterweed species such as *Polygonum persicaria*, *Limosella aquatica*, as well as species thriving in damp, wet soils, such as *Echinochloa crus-galli*, *Paspalum paspalodes*, *Gnaphalium uliginosum*, *Amaranthus blitus*, *Cyperus michelianus* were the most available for LWfG (see Appendix: Tables A1 – A11).

Table 2. Vegetation cover, composition and forage availability of major plant categories in the marshy habitat in Kerkini Lake from October to middle December 2012 and 2013. Data are based on 900 plots (0.5 x 0.5 m) in 9 different dates.

Plant categories	Cover (%)	Synthesis (%)	Availability (%)
Grasses	22.9	39.5	47.0
Grass-likes	5.3	8.9	10.6
Aquatic	11.1	19.0	18.0
Other forbs	19.1	32.6	24.4
Mosses	20.1	–	–
Soil	21.6	–	–
TOTAL	100.0	100.0	100.0

The data presented in Figures 1 and 2 are of particular interest. More specifically, plant cover of the major plant categories (grasses, grass-likes, aquatic species and other forbs) are more or less stable during October and November but it is (the plant cover) greatly reduced during December (Figure 1). Practically, in January, plant cover is almost eliminated (see also Appendix – Table A2). The same trend is also observed for the 4 most highly selected plant species by LWfG (Figure 2). Practically, their plant cover was eliminated in the end of December. It is noteworthy, that the departure time of LWfG from the Kerkini Lake (about the middle of December) coincides with the great reduction of the total plant cover in their feeding habitat. That may explain, at least in part, the LWfG's moving behavior, i.e. to make the decision to leave this area.

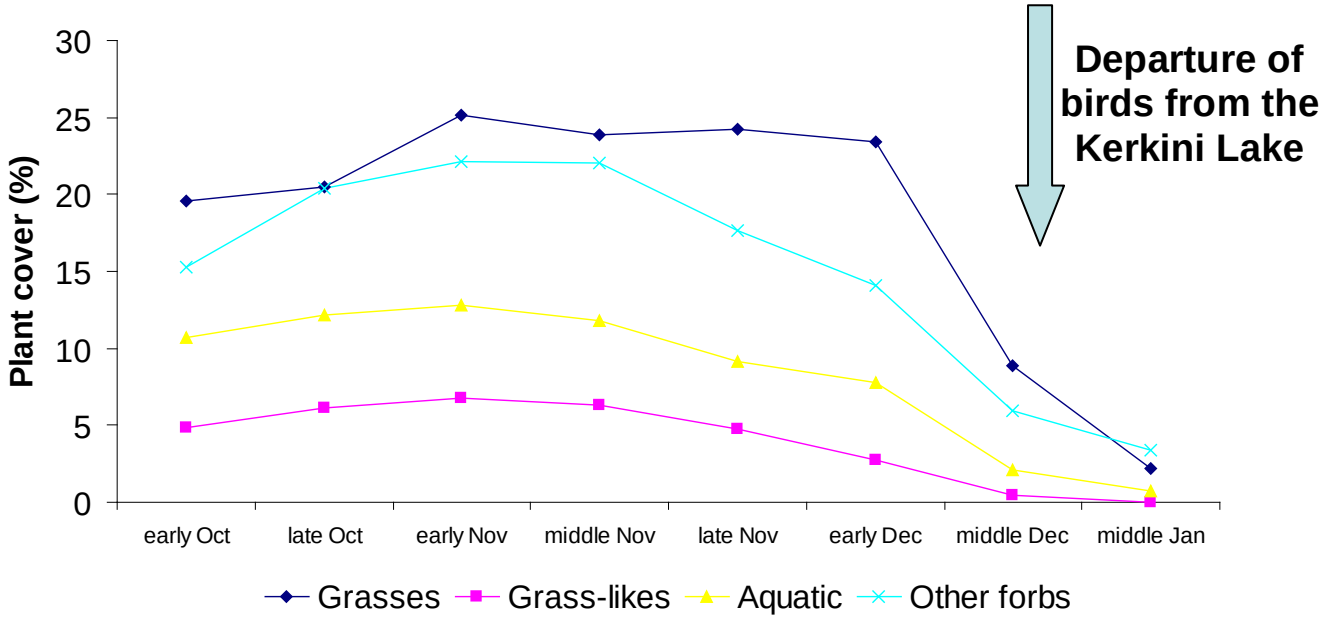

Figure 1. Temporal change of cover (%) of major plant categories in the marshy habitat in Kerkini Lake from early October 2013 to the middle of January 2014. Data are based on 8 field surveys.

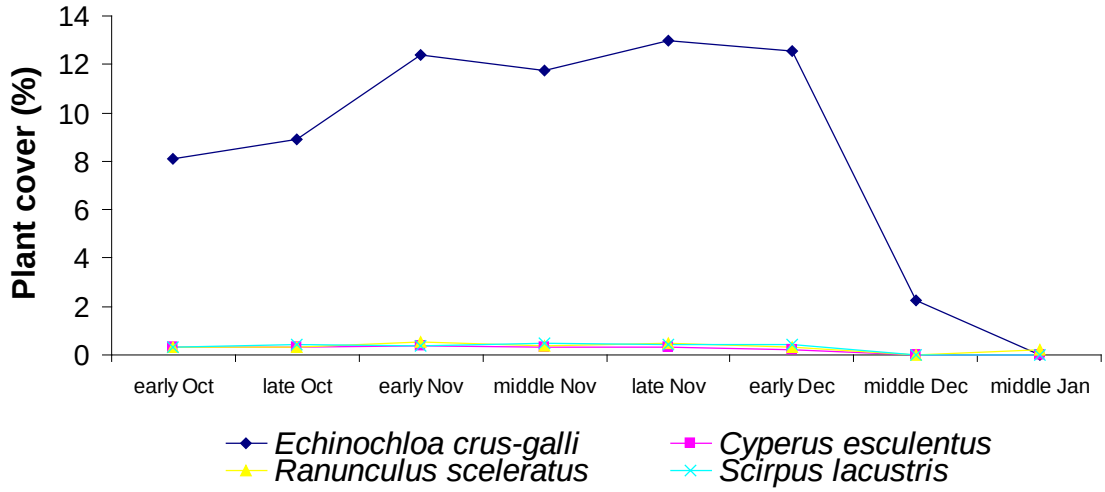

Figure 2. Temporal change of cover (%) of the 4 most highly selective plant species by LWfG in Kerkini Lake during the wintering period 2013-2014. Data are based on 8 field surveys.

Paspalum paspalodes was the dominant species in vegetation composition in the non-marshy habitat, as it comprised almost the half of the total vegetation composition. *Cynodon dactylon*, *Poa trivialis* and *Xanthium strumarium* comprised about a quarter of the total vegetation composition in this habitat (10%, 9% and 5% respectively). Other forbs comprised another quarter of the total vegetation composition. Aquatic species were absent in the non-marshy habitat.

Evros Delta

Halophyte biomass was the most available forage resource for LWfG during the wintering months, as it comprised more than 3/5 of the total available resources in the 'Ktima Dimitriadis' area (Table 3). Graminoids (grasses and grass-likes) constituted the 15.9% of the total availability of forage, whereas the availability of the categories 'other forbs' and 'legumes' was almost 12% and 10% respectively. Dry matter and soil constituted about the 2/5 of the total vegetation cover.

Table 3. Vegetation cover, composition and forage availability of major plant categories in the marshy habitat in Evros Delta from December to February during the wintering periods 2012-2013 and 2013-2014. Data are based on 600 plots (0.5 x 0.5 m) in 6 different dates.

Vegetation categories	**Cover (%)**	**Synthesis (%)**	**Availability (%)**
Graminoids	9.0	15.6	15.9
Halophytes	35.8	61.9	62.9
Legumes	5.3	9.2	9.3
Other forbs	6.8	11.7	11.9
Woody species	0.9	1.6	–
Dry matter	30.8	–	–
Soil	11.3	–	–
TOTAL	100.0	100.0	100.0

Diet estimation

Kerkini Lake – LWfG

At least 32 plant species have been recognized and quantified in the droppings of LWfG during the 2012-2013 and 2013-2014 wintering periods in Kerkini Lake (Table 4). Species as the *Echinochloa crus-galli*, *Paspalum paspalodes*, *Cyperus* spp., *Scirpus lacustris*, *Limosella aquatica* and *Ranunculus sceleratus* constituted important food resources for the LWfG in all the 9 different sampling dates (see Appendix: Tables B1 – B9). These species grow up mainly in the marshy habitat, but some of them may also participate in the vegetation composition of the terrestrial habitat, such as the *Paspalum paspalodes*.

Table 4. Diet composition (% dry weight) of the Lesser White-fronted Goose based on 246 droppings in Kerkini Lake during the wintering periods 2012-2013 and 2013-2014.

Plant species	**Dry Weight (%) (n=246)**
Grasses	
Agrostis stolonifera	*
Crypsis aculeata	1.2
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	47.4
Paspalum paspalodes	8.5
Total grasses	58.0
Grass-likes	
Cyperus esculentus	2.9
Cyperus fuscus	2.2
Cyperus longus	*
Cyperus michelianus	1.4
Juncus bufonius	*
Juncus capitatus	*
Scirpus lacustris	3.5
Total grass-likes	12.0
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.4
Polygonum persicaria	*
Ranunculus repens	2.0
Ranunculus sceleratus	3.3

Table 4 : cont.

Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	10.2
Other forbs	
Amaranthus lividus	1.7
Atriplex hastata	*
Cardamine pratensis	1.2
Filaginella uliginosa	*
Lindernia dubia	1.9
Myosoton aquaticum	*
Portulaca oleracea	1.8
Rumex palustris	1.4
Taraxacum palustre	*
Veronica beccabunga	1.5
Veronica catenata	*
Total other forbs	11.8
Unidentified	8.0
Total	100.0

***** less than 1%.

The same trend of the diet composition of LWfG was observed during 2012-2013 and 2013-2014 (see Appendix: Tables B10 – B11), as it was expected since the LWfG used the same habitat (the marshy habitat near the shoreline) in both wintering periods. The main food of LWfG was grasses (especially *Echnochloa crus-galli*) and grass-likes (mainly species of the *Cyperaceae* family). About the 2/3 of the LWfG total diet constituted by these two categories of plant species. Aquatic species and other forbs were also found in the droppings of the LWfG but to a lesser extent (about the 1/4 of the total diet).

Frequency of occurrence of each plant species in the droppings of the LWfG was especially high (90 – 100%) for the 12 species with the highest participation in its diet composition in Kerkini Lake during the study (more than 80% of its total diet). These species include *Echnochloa crus-galli*, *Paspalum paspalodes*, *Cyperus esculentus*, *Cyperus fuscus*, *Scirpus lacustris*, *Limosella aquatica*, *Ranunculus repens*, *Ranunculus sceleratus*, *Amaranthus lividus*, *Lindernia dubia*, *Portulaca oleracea*, *Veronica beccabunga*. These high percentages of frequency of occurrence resulted to a limited variation of the diet composition amond LWfG droppings.

In the Table 5 the most favourable foods of the LWfG in the Kerkini Lake during the 2 wintering periods are presented. *Echinochloa crus-galli*, *Cyperus esculentus*, *Scirpus lacustris* and *Ranunculus sceleratus* were the most highly selective species by LWfG. This trend was also found in both wintering periods. All these four species are capable of growing in wet soils and their biomass is used as food repeatedly in different days by the LWfG. As a consequence, their above ground biomass has been gradually reduced as time passed.

Table 5. The most highly selective plant species by Lesser White-fronted Goose in Kerkini Lake during the 2012-2013 and 2013-2014 wintering periods.

Plant species	2012-13		2013-14		Total (2 wintering periods)	
	$\hat{w}_i$[a] **(95% CI)**	B_i[b]	$\hat{w}_i$ **(95% CI)**	B_i	$\hat{w}_i$ **(95% CI)**	B_i
Echinochloa crus-galli	2.257 (1.701-2.813)	0.062	2.212 (1.676-2.747)	0.064	2.229 (1.686-2.771)	0.064
Cyperus esculentus	5.021 (1.218-8.823)	0.137	5.033 (1.343-8.723)	0.147	5.035 (1.307-8.764)	0.145
Scirpus lacustris	4.718 (1.435-8.000)	0.129	4.374 (1.191-7.557)	0.127	4.487 (1.269-7.704)	0.129
Ranunculus sceleratus	5.308 (1.782-8.834)	0.145	4.402 (1.110-7.693)	0.128	4.678 (1.311-8.045)	0.135

[a] all values of the selection index $\hat{w}_i$ above the value 1 indicate preferential selection.
[b] all values of the selection index B_i above the critical value 0.062 indicate preferential selection.

Grasses (mainly *Echinochloa crus-galli* and *Paspalum paspalodes*) were the only forage category which was significantly selected by the LWfG both in each one of the two previous wintering periods and in total (Table 6). On the contrary, other forbs (e.g. *Lindernia dubia*, *Portulaca oleracea*, *Amaranthus lividus* and others) were marginally avoided by the LWfG during the first wintering period and in total but not during the second wintering period as upper limit of the respective selection index slightly exceeds the value 1.

Table 6. Selection indices ($\hat{w}_i \pm$ 95% confidence intervals) and standardized selection indices (B_i) of major forage categories for Lesser White-fronted Goose in Kerkini Lake during the 2012-2013 and 2013-2014 wintering periods.

Forage category	2012-13		2013-14		Total (2 wintering periods)	
	$\hat{w}_i$[a] **(95% CI)**	B_i[b]	$\hat{w}_i$ **(95% CI)**	B_i	$\hat{w}_i$ **(95% CI)**	B_i
Grasses	1.369 (1.091-1.647)	0.358	1.317 (1.056-1.578)	0.357	1.335 (1.068-1.602)	0.357
Grass-likes	1.307 (0.559-2.055)	0.341	1.215 (0.492-1.938)	0.329	1.245 (0.512-1.979)	0.333
Aquatic species	0.663 (0.134-1.192)	0.173	0.609 (0.059-1.159)	0.165	0.628 (0.082-1.174)	0.168
Other forbs	0.489 (0.059-0.919)	0.128	0.547 (0.087-1.006)	0.148	0.526 (0.074-0.979)	0.141

[a] confidence intervals of the selection indexes $\hat{w}_i$ above or below the value 1 indicate significant selection for or against the forage category respectively.

[b] all values of the selection index B_i above the critical value 0.250 indicate preferential selection.

Kerkini Lake – Buffaloes

The main dietary components of buffaloes in Kerkini Lake (Table 7) were grasses (mainly *Cynodon dactylon* and *Poa trivialis*). *Paspalum paspalodes*, despites its dominance in this wetland, participates in the diet composition of buffaloes with relatively low percentage (7.3%). Supplements (mainly corn) were also a substantial component of the wintering diet of buffaloes (more than a quarter of its total diet composition). On the contrary, legumes and other forbs were consumed by buffaloes in small percentages (less than 2%).

Table 7. Diet composition of the buffaloes in Kerkini Lake from October 2012 to January 2013. Data are based on 5 sampling dates.

Plant species	**Dry weight (%)**
Grasses	
Agrostis stolonifera	*
Cynodon dactylon	24.8
Chrysopogon gryllus	*
Dactylis glomerata	1.0
Echinochloa grus-galii	1.3
Paspalum paspalodes	7.1
Poa trivialis	17.4
Total grasses	52.6
Grass-likes	
Carex sp.	*
Cyperus michelianus	*
Cyperaceae	1.3
Total grass-likes	2.9
Legumes	
Trifolium sp.	*
Total legumes	*
Other forbs	
Amaranthus lividus	1.7
Conyza canadensis	1.6
Cruciferae	*
Cichorium intybus	*
Filaginella uliginosa	*
Geranium sp.	*
Plantago sp.	1.2
Portulaca oleracea	*
Salix spp.	*
Xanthium strumarium	1.1
Total other forbs	9.3
Supplements	26.1
Unidentified	8.4
Total	100.0

***** less than 1%.

Evros Delta - LWfG

During the second half of the wintering period (i.e. January and February), LWfG were in Evros Delta, in a totally different habitat in relation to Kerkini Lake, which is dominated by halophytic vegetation and generally by species capable to grow in soils with high salinity levels. As a result, the diet composition of LWfG in Evros Delta was totally different in relation to that in Kerkini Lake (Table 8). The diet of the LWFG at the Evros Delta was much less divers including at least 18 plant species. The main food of LWfG was grasses (mainly *Poa* sp., *Bromus hordeaceus* and *Avena barbata*) as they constituted about 1/3 of the total diet). Grasses and grass-likes (*Carex* spp.) constituted almost the half of the total diet composition. It is noteworthy that consumption of halophytes (*Halimione portulacoides* and *Salicornia europaea*) is relatively high (about 20% of the total diet), despite the fact that halophytes typically contain lower metabolisable energy than traditional forages and the energy content of most of them is not adequate for liveweight maintenance (Norman et al. 2013). Legumes (species of the genus *Trifolium* and *Medicago*) and other forbs (mainly *Spergularia media*) were consumed by the LWfG in smaller percentages, however these forage categories constituted together about the 26% of the total diet (Table 8).

Table 8. Diet composition of the Lesser White fronted Goose based on 82 droppings in Evros Delta from the wintering periods of 2011-2012, 2012-2013 and 2013-2014.

Plant species	2011-12 n=19	2012-13 n=38	2013-14 n=25	TOTAL n=82
	Dry weight (%)			
Grasses				
Avena barbata	6.5	6.4	6.4	6.4
Bromus hordeaceus	7.3	7.9	8.0	7.8
Hordeum spp.	3.5	4.5	4.3	4.2
Lolium spp.	4.8	3.5	3.3	3.7
Poa sp.	9.1	10.2	7.2	9.0
Puccinellia festuciformis	4.7	3.2	3.1	3.5
Total grasses	35.8	35.7	32.4	34.7
Grass-likes				
Carex spp.	13.6	11.4	10.7	11.7
Total grass-likes	13.6	11.4	10.7	11.7
Halophytes				
Halimione portulacoides	13.0	14.4	12.8	13.6
Salicornia europaea	5.7	6.6	6.5	6.4
Total halophytes	18.7	21.0	19.3	20.0
Legumes				

Table 8 : cont

Medicago arabica	3.4	3.0	3.5	3.3
Trifolium repens	2.8	3.1	3.5	3.1
Trifolium campestre	3.5	3.0	3.5	3.3
Table 8 continue				
Trifolium sp.	3.5	3.4	3.5	3.5
Total legumes	13.3	12.6	13.9	13.2
Other forbs				
Atriplex hastata	1.3	1.4	1.5	1.4
Capsella bursa-pastoris	3.2	3.3	2.5	3.0
Plantago lanceolata	1.4	2.0	4.6	2.6
Spergularia media	4.0	4.2	5.7	4.6
Taraxacum officinalis	1.2	2.0	1.6	1.7
Total other forbs	11.0	13.0	15.9	13.4
Unidentified	7.6	6.4	7.8	7.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

Graminoids was preferentially selected by the LWfG, as the respective 95% confidence intervals of the selection index $\hat{w}_i$ was clearly above the value 1 (Table 9). The selection index of this forage category was also significant higher than the indexes of all the others available forage categories. On the other hand halophytes are considered as non-preferred forage category, as they consumed less than expected according to availability.

Table 9. Selection indices ($\hat{w}_i$ ± 95% confidence intervals) and standardized selection indices (B_i) of major forage categories for Lesser White-fronted Goose in Evros Delta. Data are based on 82 droppings and 600 plots (0.5 x 0.5 m) in 6 vegetation surveys during the 2011-2012, 2012-2013 and 2013-2014 wintering periods.

Forage category	$\hat{w}_i$	B_i
Graminoids	3.166 (2.589-3.742)	0.506
Halophytes	0.331 (0.127-0.534)	0.053
Legumes	1.523 (0.739-2.308)	0.243
Other forbs	1.240 (0.556-1.924)	0.198

[a] confidence intervals of the selection indexes $\hat{w}_i$ above or below the value 1 indicate significant selection for or against the forage category respectively.

[b] all values of the selection index B_i above the critical value 0.250 indicate preferential selection.

Evros Delta – GWfG

Halophytes (32.4%), grasses (26.5%) and crops (mainly wheat, 23.0%) constituted the most important food resources for GWfG (Table 10). Among wild plant species, the halophyte *Halimione portulacoides* had the highest percentage of dry weight (14.0%), followed by grass-like species (*Carex* spp., 7.8%) and the *Salicornia europaea* (7.6%). Forbs were a minor portion of the total dry weight (4.6%).

Table 10. Dry weight (%) and frequency of occurrence of plant species found in 13 gizzards of Greater White-fronted Goose collected in the Evros Delta during January and February 2014.

Plant species	Dry weight (%)	Frequency of occurence
Grasses		
Bromus hordeaceus	6.2	38.5
Puccinellia festuciformis	4.6	30.8
Other grasses	15.8	53.8
Total grasses	26.5	76.9
Graminoids		
Carex spp.	7.8	30.8
Scirpus maritimus	*	7.7
Total graminoids	8.3	38.5
Halophytes		
Arthrocnemum fruticosum	6.0	30.8
Halimione portulacoides	14.0	38.5
Salicornia europaea	7.6	23.1
Salsola sp.	*	7.7
Other halophytes	4.4	23.1
Total halophytes	32.4	69.2
Forbs		
Trifolium repens	*	7.7
Plantago lanceolata	1.1	7.7
Other forbs	2.9	15.4
Total forbs	4.6	23.1
Crops	23.0	46.2
Unidentified	5.7	30.8
Total	100.0	

***** less than 1%.

Discussion – Conclusions

A clearly differentiation of the main feeding habitat of LWfG (marshy wetland) in relation with that of buffaloes (non marshy wetland) was observed in the Kerkini Lake during the 2 last wintering periods (2012-2013 and 2013-2014). Under this perspective, there was a distinct partitioning of feeding habitats for LWfG and buffaloes in Kerkini Lake. Consequently, competition for habitat between these species is considered negligible confirming the mainstay of ecological theory about the occupation of unique feeding niches by coexisting herbivores (Chesson 2000, Behmer and Joern 2008). Furthermore, the time-partitioning of habitat which was observed between LWfG and cattle in the Evros Delta contributes to the minimization of direct competition between these herbivores. However, it does not ensure that cattle grazing in this habitat during the time that LWfG does not use this area (i.e. usually from March-April to November-December) has not any kind of effects (positive and negative ones) on the vegetation and generally on the habitat and subsequently on the LWfG. It is well documented that livestock grazing in spring and summer may influence in a positive way the population of wild herbivores by improving and increasing the forage quality and availability in other critical times of the year, e.g. winter (Gordon 1988, Rhodes and Sharrow 1990, Loft et al. 1991, Clark et al. 2000). In such cases, the management key is to provide adequate food and cover for the wild herbivores during the critical times.

The LWfG consumed mainly grasses in both wintering areas in Greece; however, different plant species constitutes its diet composition in Kerkini Lake and Evros Delta, highlighting its flexibility in feeding behavior. The availability of food in Kerkini Lake seems to influence not only the diet composition and the general feeding behavior of the LWfG, but it may play a crucial role in the selection of habitats by LWfG and its movements. Departure of birds from Kerkini Lake to the Evros Delta was happened on the 15th and the 21st of December 2012 and 2013 respectively (www.piskulka.net), i.e. about 1-2 weeks before the minimization of food availability in Kerkini Lake. If this is the key, then the availability of food is potentially a valuable 'tool' for the conservation of this bird species and its wintering habitats in Greece. Similar results have also been presented recently about the eastern Asiatic population of LWfG in China where food constraints seem to regulate its movements and the selection of its feeding habitats (Wang et al. 2013). Concerning the selection of habitats, LWfG could be considered

specialist, as this species uses specified natural habitats, i.e. mainly marshy areas around lakes as well as salt marshes and coastal meadows. However, as concerns the selection of food, based on these results and previous studies (Markkola et al. 2003, Karmiris et al. 2009), it seems that LWfG consumes biomass produced by a variety of plant species in both wintering and breeding habitats. The use of the marshy habitat as the primary feeding place for the LWfG has been observed not only during the 2 last wintering periods but also for many years prior this study with a few exceptions (they have been observed to feed on the non-marshy habitat and in cereal crops outside of the protected area of the Kerkini Lake National Park). In the case that the LWfG change this behavior in the future, i.e. to feed in other habitats outside the marshy habitat, the finally proposed conservational strategy would be quite different.

The high percentages (90-100%) of frequency of occurrence of the 12 most highly consumed plant species by the LWfG in Kerkini Lake. These high percentages of frequency of occurrence resulted to a limited variation of the diet composition amond LWfG droppings. This is an indication that all the birds comprising the flock of the LWfG (about 50-60 individuals) consumed the same forage resources on the same feeding ground, i.e. they exhibited similar feeding behavior. Except the ecological implications, this finding also contributes in feeding research as the required sample size for estimating the diet composition of LWfG is greatly reduced. Based on the results of this study, in both wintering areas of the LWfG in Greece, it is estimated that about 20-25 droppings per field survey are an adequate sample size to estimate the diet composition of LWfG. About three to four field surveys should be conducted during the period that the birds wintering in an area (in Greece it is usually about 2-2.5 months both in Kerkini Lake and in Evros Delta). In years that the birds spend more time in a specific wintering area, then extra sampling effort should take place in this area (about 1 field survey every 20 days).

As in the case of LWfG, buffaloes consumed mainly grasses in Kerkini Lake. Their primary food was *Cynodon dactylon, Paspalum paspalodes* and supplements provided by the farmers. Secondarily, they consumed a great variety of other species growing in the non marshy area, even species which theoretically are usually considered as pests and highly unpalatable such as *Conyza canadensis* and *Xanthium strumarium*. According to the optimal foraging theory, animals are less selective in times of food scarcity (Stephens et al. 1986). This is usually observed in cases of

overgrazing as it is happening in the non-marshy habitat of the Kerkini Lake where forage production in the non-marshy area is not enough to sustain the total buffalo population which, nowadays, it is estimated around the 3.000 individuals. Inevitably, there is a need to provide supplements by the farmers in relatively huge amounts. In such cases, the availability of preferred plant species for herbivores is reduced, forcing them to consume higher quantities of plant species that are less or even not at all preferable (Bailey et al. 1996). In conclusion, the diet similarity between buffalo and LWfG is too low, which means that the possibility to emerge competitive relationships for food between these herbivores is highly minimized. In our case, competition for food or habitat resources between LWfG and livestock is absent or at least very weak, clearly because these herbivores feed on different plant species growing at different habitats (Kerkini Lake) or at different time (Evros Delta).

Management implications – Future research

The LWfG wintering in Greece fed mainly on what was available in its feeding habitats (Kerkini Lake and Evros Delta). Availability of food therefore, seems to play a very important role concerning the selection of foods and habitats by the LWfG in both wintering areas in Greece. Apparently, the future conservation actions of the wet grasslands in Kerkini Lake (marshes and not) should primarily focused on the grassland improvement with preferred local plant species (mainly grasses) capable to grow in such environments which are expected to increase the availability of forage for herbivores. Under this aspect, seeding cereals (e.g. durum wheat) in specific sites in the marshy habitat before the arrival of the LWfG (i.e. late September – early October) is a promishing management practice which may increase the availability of food during December and January (i.e. the time that the cover of natural vegetation is too low). With this research approach, it is expected an important benefit for the LWfG because both the availability of forage is expected to increase and its movements to other areas outside the protected area of the Kerkini Lake National Park are also expected to be further minimized. The ultimate result will be the conservation of the European population of LWfG, as well as the increase and the improvement of the livestock production. Consequently, it is expected that such approach will strengthen the stability of the ecosystem through the increase of grazing capacity (livestock) and generally of carrying capacity (wild and tame herbivores) of the ecosystem to support a higher number of herbivores for a greater time period per year, while the need to provide supplements will be reduced. For that purpose, the participation and the cooperation of scientists, the local authorities, the farmers and generally the local community is required for the benefit of the wildlife, the humankind and especially the well-being of the future generations. As a consequence, the further and in depth investigation on the influences of the food availability on the feeding behavior and the movement pattern within and between habitats of LWfG during the next years. This knowledge is required to assist in prioritizing multiple management actions for the conservation of the European LWfG population and its habitats along with the development of livestock farming in a sustainable way.

The exclusively use of the marshy habitat of Kerkini Lake by the LWfG during the wintering periods 2012-2013 and 2013-2014 indicated that these are the most important feeding habitats of the species in this wetland. However, there are older records when LWfG have been observed to

make daily movements to the non-marshy habitat surrounding the lake, as well as to feeding areas away from the lake. Such changes in habitat use, obviously, will result in changes in diet composition and selection. Under this perspective, the unusual and maybe peculiar behavior of LWfG to visit other feeding areas and nearby farm crops in mixed flocks with other species of *Anseriformes* at the very end days before the departure to Evros Delta may be justified by the unavailability of their food. If this happens, then future research activities should include the exact location and the description of these new feeding areas, the creation of reference slides and the collection of additionally number of droppings from these areas. That's why, further monitoring of LWfG feeding habitat and of possible changes in the bird's feeding and moving behavior should follow in the future in order to verify what the rules are and what the exceptions.

The periodic flood of the marshy and the terrestrial grasslands surrounding the northern and eastern part of the Kerkini Lake make them available for wild and domestic herbivores only for about five months yearly (from July-August to January-February). The marshy habitat is of prime importance for LWfG conservation, should be protected and the flooded period should not coincide with the period that birds spend in the Kerkini Lake. When the marshy habitat is totally or partially not available due to inundation (i.e. about 7 months yearly), the Kerkini Lake is no more a hospitable place for LWfG and other geese species (Greylag *Anser anser* and GWfG) as well. LWfG usually arrives at Kerkini Lake in early October. At that time, the several plant species occurring in the marshy habitat should have been grown quite enough in order to provide food to the LWfG. In consequence, sprouting of these plants should occur at least 1.5 months prior the arrival of the LWfG in the Kerkini Lake, i.e. not later that the end of August. This is usually happening in this area and should be followed in a strictly manner. On the other side, the closeness of the dam gates should be done after the departure of the birds from this area, usually at the end of the winter (late December – early January but it may be delayed until late January – early February) and not earlier. This is more or less followed for other management purposes (irrigation), it is definitely vital for the LWfG and should be followed in the future years in a flexible way, i.e. the closeness of the dam gates should be regulated based on the departure date of the LWfG which it may fluctuate from year to year.

In the Evros Delta, the LWfG feeds mainly on C3 grasses (cool season grasses) and generally on species sprouting in late autumn and winter. That means, when the birds arrive at this area

(usually late December – early January) the vegetation height (except halophytes) was in a relatively low level (usually less than 5 cm). On the other hand, cattle were usually removed out of the study area at the end of November. At that time, the vegetation height of the species which constitute available food for the LWfG is even lower (about 2-3 cm). The cattle, however, are not capable to consume such low height biomass due to the morphology of their mouth (Illius and Gordon 1992). That means, the cattle grazing in this area should be stopped no later that the end of November in order to avoid the depletion of the food resources for LWfG. Under this aspect, cattle should not graze in this area throughout the whole period that LWfG winters in this habitat.

The results of the analysis of GWfG gizzards are based on data from 13 samples collected mainly in January and secondarily in February 2014, thus we should be very careful in their interpretation. For example, the remarkably high percentage of crops (almost a quarter of the total dry weight) is attributed mainly to the inclusion of two gizzards collected in the 9th of January and they were totally filled (100%) with crop biomass (wheat). Increasing sample size is expected to lower this high percentage of dry weight of crops. Quite high was also the percentage of halophytes (almost the 1/3 of the total dry weight) which indicates a special importance of halophytic vegetation for the wintering GWfG in the Evros Delta. However, as in the case of crops, increasing sample size (i.e. the number of gizzards) is expected to alter the final percentages of the forage resources of GWfG in this area.

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APPENDIX

Table A1. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 15th of October 2012. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.4	0.8	0.9
Crypsis aculeata	1.3	2.3	2.7
Crypsis alopecuroides	0.3	0.6	0.7
Cynodon dactylon	1.1	2.0	2.3
Digitaria sanguinalis	0.5	0.9	1.1
Echinochloa crus-galli	9.5	17.3	20.1
Paspalum paspalodes	8.3	15.0	17.4
Total grasses	**21.4**	**23.2**	**45.1**
Grass-likes			
Cyperus esculentus	0.3	0.5	0.6
Cyperus fuscus	1.9	3.4	3.9
Cyperus longus	0.5	0.8	0.9
Cyperus michelianus	1.1	1.9	2.2
Juncus bufonius	0.5	0.9	1.0
Juncus capitatus	0.2	0.3	0.4
Scirpus lacustris	0.4	0.8	0.9
Total grass-likes	**4.7**	**5.1**	**10.0**
Aquatic			
Alisma plantago-aquatica	0.1	0.2	0.3
Ceratophyllum demersum	0.3	0.5	–
Limosella aquatica	1.8	3.3	3.8
Nymphoides peltata	0.4	0.7	–
Oenanthe aquatica	0.1	0.2	–
Polygonum amphibium	0.1	0.1	–
Polygonum persicaria	5.4	9.7	11.3
Ranunculus repens	0.4	0.7	0.8
Ranunculus sceleratus	0.3	0.6	0.7
Ranunculus trichophyllus	0.5	0.8	0.9
Rorippa amphibia	0.5	0.9	1.0
Trapa natans	1.2	2.1	–
Total aquatic	**10.9**	**11.8**	**18.8**
Other forbs			
Amaranthus lividus	2.0	3.7	4.3
Artemisia sp.	0.3	0.5	–
Atriplex hastata	0.6	1.1	1.2
Bidens tripartita	0.7	1.3	–
Capsella bursa-pastoris	0.2	0.4	–
Cardamine pratensis	0.7	1.3	1.6
Cirsium arvense	0.4	0.7	–
Conyza canadensis	1.5	2.7	–

Table A1 continue

Erigeron sp.	0.2	0.3	–
Euphorbia villosa	0.3	0.6	–
Filaginella uliginosa	2.6	4.8	5.6
Heliotropium europaeum	0.3	0.6	–
Lindernia dubia	1.2	2.1	2.5
Lycopus europaeus	0.2	0.4	–
Medicago arabica	0.1	0.2	–
Mentha aquatica	0.1	0.2	–
Myosoton aquaticum	0.3	0.5	0.6
Plantago sp.	0.1	0.2	–
Portulaca oleracea	1.4	2.5	2.9
Rumex palustris	1.8	3.2	3.7
Solanum nigrum	0.1	0.1	–
Sonchus oleraceus	0.1	0.2	–
Taraxacum palustre	1.1	1.9	2.3
Urtica dioica	0.1	0.3	–
Veronica beccabunga	0.7	1.3	1.5
Veronica catenata	0.1	0.1	0.1
Xanthium strumarium	0.9	1.6	–
Total other forbs	**18.0**	**19.6**	**26.1**
Mosses	17.5	–	–
Soil	27.4	–	–
Total	**100.0**	**100.0**	**100.0**

Table A2. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 31th of October 2012. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.2	0.2	0.5
Crypsis aculeata	1.4	1.4	2.7
Crypsis alopecuroides	0.1	0.1	0.2
Cynodon dactylon	0.5	0.5	1.0
Digitaria sanguinalis	0.4	0.4	0.8
Echinochloa crus-galli	12.5	12.2	23.8
Paspalum paspalodes	8.5	8.3	16.2
Total grasses	**23.7**	**23.2**	**45.2**
Grass-likes			
Cyperus esculentus	0.3	0.3	0.6
Cyperus fuscus	2.1	2.0	3.9
Cyperus longus	1.2	1.1	2.2
Cyperus michelianus	0.8	0.7	1.5
Juncus bufonius	0.5	0.5	0.9
Juncus capitatus	0.1	0.1	0.1
Scirpus lacustris	0.4	0.4	0.7
Total grass-likes	**5.2**	**5.1**	**9.9**
Aquatic			
Alisma plantago-aquatica	0.4	0.4	0.7
Ceratophyllum demersum	0.1	0.1	–
Limosella aquatica	2.0	1.9	3.8
Nymphoides peltata	0.3	0.3	–
Oenanthe aquatica	0.3	0.2	–
Polygonum amphibium	0.2	0.2	–
Polygonum persicaria	6.0	5.9	11.5
Ranunculus repens	0.6	0.6	1.1
Ranunculus sceleratus	0.3	0.3	0.6
Ranunculus trichophyllus	0.2	0.2	0.4
Rorippa amphibia	0.3	0.3	0.6
Trapa natans	1.4	1.3	–
Total aquatic	**12.1**	**11.8**	**18.7**
Other forbs			
Amaranthus lividus	2.5	2.4	4.8
Artemisia sp.	0.2	0.2	–
Atriplex hastata	0.3	0.3	0.5
Bidens tripartita	0.9	0.9	–
Capsella bursa-pastoris	0.1	0.1	–
Cardamine pratensis	0.9	0.9	1.8
Cirsium arvense	0.5	0.5	–
Conyza canadensis	2.5	2.4	–

Table A2 continue

Erigeron sp.	0.3	0.3	−
Euphorbia villosa	0.1	0.1	−
Filaginella uliginosa	2.9	2.9	5.6
Heliotropium europaeum	0.2	0.2	–
Lindernia dubia	1.4	1.3	2.6
Lycopus europaeus	0.1	0.1	−
Medicago arabica	0.1	0.1	−
Mentha aquatica	0.1	0.1	−
Myosoton aquaticum	0.5	0.5	1.0
Plantago sp.	0.1	0.1	–
Portulaca oleracea	1.3	1.3	2.5
Rumex palustris	1.9	1.9	3.7
Solanum nigrum	0.2	0.2	−
Sonchus oleraceus	0.2	0.2	−
Taraxacum palustre	0.9	0.9	1.8
Urtica dioica	0.2	0.2	–
Veronica beccabunga	0.9	0.9	1.7
Veronica catenata	0.1	0.1	0.2
Xanthium strumarium	1.0	0.9	–
Total other forbs	**18.0**	**20.0**	**26.1**
Mosses	18.3	−	−
Soil	20.4	−	−
Total	**100.0**	**100.0**	**100.0**

Table A3. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 10th of November 2012. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.2	0.2	0.4
Crypsis aculeata	1.5	1.4	2.8
Crypsis alopecuroides	0.2	0.2	0.3
Cynodon dactylon	0.6	0.5	1.0
Digitaria sanguinalis	0.4	0.4	0.7
Echinochloa crus-galli	12.3	11.4	22.5
Paspalum paspalodes	9.0	8.4	16.6
Total grasses	**24.1**	**22.5**	**44.4**
Grass-likes			
Cyperus esculentus	0.3	0.3	0.6
Cyperus fuscus	2.3	2.1	4.2
Cyperus longus	1.1	1.0	2.0
Cyperus michelianus	0.9	0.8	1.6
Juncus bufonius	0.7	0.7	1.3
Juncus capitatus	0.1	0.1	0.2
Scirpus lacustris	0.4	0.4	0.8
Total grass-likes	**5.8**	**5.4**	**10.6**
Aquatic			
Alisma plantago-aquatica	0.3	0.2	0.5
Ceratophyllum demersum	0.1	0.1	–
Limosella aquatica	2.2	2.0	4.0
Nymphoides peltata	0.3	0.3	–
Oenanthe aquatica	0.4	0.3	–
Polygonum amphibium	0.1	0.1	–
Polygonum persicaria	6.2	5.8	11.4
Ranunculus repens	0.7	0.7	1.3
Ranunculus sceleratus	0.4	0.4	0.8
Ranunculus trichophyllus	0.1	0.1	0.2
Rorippa amphibia	0.4	0.3	0.6
Trapa natans	1.6	1.5	–
Total aquatic	**12.7**	**11.9**	**18.7**
Other forbs			
Amaranthus lividus	2.5	2.3	4.6
Artemisia sp.	0.3	0.3	–
Atriplex hastata	0.2	0.2	0.4
Bidens tripartita	1.2	1.1	–
Capsella bursa-pastoris	0.2	0.1	–
Cardamine pratensis	1.0	0.9	1.8
Cirsium arvense	0.5	0.5	–
Conyza canadensis	2.6	2.5	–

Table A3 continue

Erigeron sp.	0.2	0.2	−
Euphorbia villosa	0.1	0.1	−
Filaginella uliginosa	2.9	2.7	5.4
Heliotropium europaeum	0.2	0.2	–
Lindernia dubia	1.5	1.4	2.7
Lycopus europaeus	0.2	0.2	−
Medicago arabica	0.1	0.1	−
Mentha aquatica	0.3	0.2	−
Myosoton aquaticum	0.4	0.4	0.8
Plantago sp.	0.1	0.1	–
Portulaca oleracea	1.2	1.1	2.2
Rumex palustris	1.9	1.8	3.5
Solanum nigrum	0.2	0.2	−
Sonchus oleraceus	0.3	0.3	−
Taraxacum palustre	1.1	1.1	2.1
Urtica dioica	0.1	0.1	–
Veronica beccabunga	1.2	1.1	2.2
Veronica catenata	0.3	0.3	0.6
Xanthium strumarium	1.2	1.1	–
Total other forbs	**21.9**	**20.5**	**26.3**
Mosses	16.2	−	−
Soil	19.3	−	−
Total	**100.0**	**100.0**	**100.0**

Table A4. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 9th of October 2013. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.5	0.9	1.1
Crypsis aculeata	1.3	2.5	2.9
Crypsis alopecuroides	0.4	0.8	0.9
Cynodon dactylon	1.1	2.2	2.6
Digitaria sanguinalis	0.3	0.6	0.7
Echinochloa crus-galli	8.1	16.1	18.7
Paspalum paspalodes	7.9	15.7	18.3
Total grasses	**19.6**	**38.9**	**45.3**
Grass-likes			
Cyperus esculentus	0.3	0.6	0.7
Cyperus fuscus	1.6	3.2	3.7
Cyperus longus	0.9	1.8	2.1
Cyperus michelianus	1.0	2.0	2.3
Juncus bufonius	0.4	0.9	1.0
Juncus capitatus	0.3	0.5	0.6
Scirpus lacustris	0.3	0.6	0.7
Total grass-likes	**4.9**	**9.6**	**11.2**
Aquatic			
Alisma plantago-aquatica	0.2	0.4	0.4
Ceratophyllum demersum	0.1	0.2	–
Limosella aquatica	1.7	3.3	3.9
Nymphoides peltata	0.5	1.1	–
Oenanthe aquatica	0.2	0.4	–
Polygonum amphibium	0.4	0.7	–
Polygonum persicaria	4.6	9.1	10.6
Ranunculus repens	0.8	1.6	1.8
Ranunculus sceleratus	0.3	0.6	0.7
Ranunculus trichophyllus	0.5	1.0	1.1
Rorippa amphibia	0.5	1.0	1.1
Trapa natans	1.0	1.9	–
Total aquatic	**10.7**	**15.9**	**19.7**
Other forbs			
Amaranthus lividus	1.9	3.8	4.4
Artemisia sp.	0.2	0.3	–
Atriplex hastata	0.3	0.7	0.8
Bidens tripartita	0.6	1.1	–
Capsella bursa-pastoris	0.1	0.2	–
Cardamine pratensis	0.4	0.9	1.0
Cirsium arvense	0.4	0.7	–
Conyza canadensis	1.0	1.9	–

Table A4 continue

Erigeron sp.	0.2	0.4	−
Euphorbia villosa	0.1	0.2	−
Filaginella uliginosa	2.5	4.9	5.7
Heliotropium europaeum	0.2	0.4	–
Lindernia dubia	0.7	1.3	1.5
Lycopus europaeus	0.2	0.5	−
Medicago arabica	0.2	0.3	−
Mentha aquatica	0.3	0.7	−
Myosoton aquaticum	0.4	0.8	0.9
Plantago sp.	0.1	0.2	–
Portulaca oleracea	1.1	2.2	2.6
Rumex palustris	1.1	2.1	2.4
Solanum nigrum	0.3	0.5	−
Sonchus oleraceus	0.1	0.2	−
Taraxacum palustre	1.3	2.5	2.9
Urtica dioica	0.3	0.6	–
Veronica beccabunga	0.5	1.0	1.1
Veronica catenata	0.2	0.5	0.6
Xanthium strumarium	0.8	1.5	–
Total other forbs	**15.3**	**6.8**	**23.9**
Mosses	16.3	−	−
Soil	33.3	−	−
Total	**100.0**	**100.0**	**100.0**

Table A5. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 23th of October 2013. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.4	0.7	0.9
Crypsis aculeata	1.7	2.8	3.4
Crypsis alopecuroides	0.2	0.4	0.5
Cynodon dactylon	0.9	1.5	1.7
Digitaria sanguinalis	0.2	0.4	0.4
Echinochloa crus-galli	8.9	15.0	18.1
Paspalum paspalodes	8.2	13.9	16.7
Total grasses	**20.5**	**34.6**	**41.6**
Grass-likes			
Cyperus esculentus	0.3	0.6	0.7
Cyperus fuscus	2.3	3.8	4.6
Cyperus longus	1.3	2.1	2.6
Cyperus michelianus	1.1	1.8	2.2
Juncus bufonius	0.5	0.8	1.0
Juncus capitatus	0.3	0.4	0.5
Scirpus lacustris	0.4	0.7	0.9
Total grass-likes	**6.1**	**10.3**	**12.4**
Aquatic			
Alisma plantago-aquatica	0.3	0.5	0.5
Ceratophyllum demersum	0.1	0.1	–
Limosella aquatica	1.6	2.6	3.2
Nymphoides peltata	0.5	0.9	–
Oenanthe aquatica	0.2	0.3	–
Polygonum amphibium	0.2	0.3	–
Polygonum persicaria	6.0	10.1	12.1
Ranunculus repens	1.1	1.9	2.3
Ranunculus sceleratus	0.3	0.5	0.6
Ranunculus trichophyllus	0.3	0.6	0.7
Rorippa amphibia	0.4	0.6	0.7
Trapa natans	1.3	2.1	–
Total aquatic	**12.2**	**16.1**	**20.1**
Other forbs			
Amaranthus lividus	2.6	4.4	5.3
Artemisia sp.	0.2	0.3	–
Atriplex hastata	0.3	0.4	0.5
Bidens tripartita	1.5	2.5	–
Capsella bursa-pastoris	0.2	0.3	–
Cardamine pratensis	0.6	1.0	1.2
Cirsium arvense	0.6	0.9	–
Conyza canadensis	1.9	3.1	–

Table A5 continue

Erigeron sp.	0.2	0.3	−
Euphorbia villosa	0.1	0.2	−
Filaginella uliginosa	2.7	4.5	5.4
Heliotropium europaeum	0.3	0.5	–
Lindernia dubia	0.9	1.5	1.7
Lycopus europaeus	0.1	0.2	−
Medicago arabica	0.1	0.2	−
Mentha aquatica	0.2	0.4	−
Myosoton aquaticum	0.6	1.0	1.3
Plantago sp.	0.1	0.2	–
Portulaca oleracea	0.9	1.5	1.8
Rumex palustris	1.4	2.3	2.8
Solanum nigrum	0.5	0.9	−
Sonchus oleraceus	0.3	0.5	−
Taraxacum palustre	1.8	3.0	3.6
Urtica dioica	0.2	0.4	–
Veronica beccabunga	0.8	1.3	1.6
Veronica catenata	0.3	0.6	0.7
Xanthium strumarium	1.3	2.1	–
Total other forbs	**20.4**	**8.8**	**25.9**
Mosses	16.5	−	−
Soil	24.3	−	−
Total	**100.0**	**100.0**	**100.0**

Table A6. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 1th of November 2013. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.3	0.5	0.6
Crypsis aculeata	1.9	2.9	3.5
Crypsis alopecuroides	0.4	0.7	0.8
Cynodon dactylon	0.9	1.3	1.5
Digitaria sanguinalis	0.3	0.5	0.6
Echinochloa crus-galli	12.4	18.5	22.2
Paspalum paspalodes	8.9	13.3	15.9
Total grasses	**25.1**	**37.6**	**45.1**
Grass-likes			
Cyperus esculentus	0.4	0.5	0.6
Cyperus fuscus	2.8	4.2	5.1
Cyperus longus	1.6	2.4	2.9
Cyperus michelianus	0.9	1.3	1.5
Juncus bufonius	0.6	0.9	1.0
Juncus capitatus	0.2	0.4	0.4
Scirpus lacustris	0.4	0.5	0.6
Total grass-likes	**6.8**	**10.2**	**12.2**
Aquatic			
Alisma plantago-aquatica	0.2	0.3	0.3
Ceratophyllum demersum	0.1	0.1	–
Limosella aquatica	1.8	2.7	3.2
Nymphoides peltata	0.4	0.6	–
Oenanthe aquatica	0.1	0.2	–
Polygonum amphibium	0.3	0.4	–
Polygonum persicaria	5.9	8.8	10.5
Ranunculus repens	1.3	2.0	2.4
Ranunculus sceleratus	0.5	0.8	1.0
Ranunculus trichophyllus	0.3	0.4	0.5
Rorippa amphibia	0.4	0.5	0.6
Trapa natans	1.6	2.3	–
Total aquatic	**12.8**	**15.2**	**18.6**
Other forbs			
Amaranthus lividus	3.1	4.7	5.6
Artemisia sp.	0.1	0.1	–
Atriplex hastata	0.3	0.5	0.6
Bidens tripartita	1.8	2.6	–
Capsella bursa-pastoris	0.1	0.1	–
Cardamine pratensis	0.9	1.4	1.6
Cirsium arvense	0.7	1.0	–
Conyza canadensis	0.2	3.8	–

Table A6 continue

Erigeron sp.	0.2	0.2	–
Euphorbia villosa	0.2	0.3	–
Filaginella uliginosa	2.4	3.5	4.3
Heliotropium europaeum	0.1	0.2	–
Lindernia dubia	1.2	1.9	2.2
Lycopus europaeus	0.1	0.1	–
Medicago arabica	0.1	0.2	–
Mentha aquatica	0.2	0.3	–
Myosoton aquaticum	0.3	0.4	0.5
Plantago sp.	0.2	0.2	–
Portulaca oleracea	0.8	1.1	1.3
Rumex palustris	1.6	2.5	2.9
Solanum nigrum	0.4	0.6	–
Sonchus oleraceus	0.2	0.3	–
Taraxacum palustre	1.8	2.7	3.2
Urtica dioica	0.4	0.6	–
Veronica beccabunga	0.9	1.4	1.7
Veronica catenata	0.1	0.2	0.2
Xanthium strumarium	1.5	2.3	–
Total other forbs	**22.1**	**8.0**	**24.1**
Mosses	17.0	–	–
Soil	16.2	–	–
Total	**100.0**	**100.0**	**100.0**

Table A7. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 11th of November 2013. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.3	0.4	0.5
Crypsis aculeata	2.2	3.5	4.2
Crypsis alopecuroides	0.5	0.8	1.0
Cynodon dactylon	0.5	0.8	0.9
Digitaria sanguinalis	0.2	0.3	0.3
Echinochloa crus-galli	11.8	18.4	22.2
Paspalum paspalodes	8.4	13.2	15.9
Total grasses	**23.9**	**37.3**	**45.1**
Grass-likes			
Cyperus esculentus	0.3	0.5	0.6
Cyperus fuscus	2.3	3.6	4.3
Cyperus longus	1.7	2.6	3.1
Cyperus michelianus	1.1	1.7	2.1
Juncus bufonius	0.4	0.5	0.7
Juncus capitatus	0.1	0.1	0.2
Scirpus lacustris	0.5	0.8	0.9
Total grass-likes	**6.3**	**9.8**	**11.8**
Aquatic			
Alisma plantago-aquatica	0.3	0.5	0.6
Ceratophyllum demersum	0.0	0.0	–
Limosella aquatica	1.9	3.0	3.6
Nymphoides peltata	0.2	0.3	–
Oenanthe aquatica	0.3	0.4	–
Polygonum amphibium	0.2	0.3	–
Polygonum persicaria	5.5	8.6	10.4
Ranunculus repens	0.9	1.5	1.8
Ranunculus sceleratus	0.4	0.6	0.7
Ranunculus trichophyllus	0.2	0.3	0.3
Rorippa amphibia	0.3	0.5	0.6
Trapa natans	1.6	2.5	–
Total aquatic	**11.8**	**14.3**	**18.0**
Other forbs			
Amaranthus lividus	3.2	5.0	6.1
Artemisia sp.	0.2	0.3	–
Atriplex hastata	0.3	0.5	0.6
Bidens tripartita	1.4	2.2	–
Capsella bursa-pastoris	0.2	0.3	–
Cardamine pratensis	0.6	1.0	1.2
Cirsium arvense	0.5	0.8	–
Conyza canadensis	2.8	4.4	–

Table A7 continue

Erigeron sp.	0.3	0.4	–
Euphorbia villosa	0.1	0.2	–
Filaginella uliginosa	2.0	3.1	3.8
Heliotropium europaeum	0.1	0.2	–
Lindernia dubia	1.3	2.1	2.5
Lycopus europaeus	0.2	0.3	–
Medicago arabica	0.1	0.2	–
Mentha aquatica	0.1	0.2	–
Myosoton aquaticum	0.4	0.6	0.7
Plantago sp.	0.1	0.2	–
Portulaca oleracea	0.5	0.7	0.9
Rumex palustris	1.8	2.8	3.4
Solanum nigrum	0.4	0.7	–
Sonchus oleraceus	0.2	0.2	–
Taraxacum palustre	1.8	2.9	3.5
Urtica dioica	0.5	0.7	–
Veronica beccabunga	1.1	1.7	2.0
Veronica catenata	0.2	0.4	0.5
Xanthium strumarium	1.5	2.4	–
Total other forbs	**22.0**	**8.9**	**25.1**
Mosses	22.3	–	–
Soil	13.7	–	–
Total	**100.0**	**100.0**	**100.0**

Table A8. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 22th of November 2013. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.2	0.3	0.3
Crypsis aculeata	1.6	2.8	3.4
Crypsis alopecuroides	0.1	0.2	0.2
Cynodon dactylon	0.1	0.1	0.2
Digitaria sanguinalis	0.2	0.3	0.4
Echinochloa crus-galli	13.0	23.2	28.1
Paspalum paspalodes	9.2	16.4	19.9
Total grasses	**24.3**	**43.5**	**52.6**
Grass-likes			
Cyperus esculentus	0.3	0.5	0.7
Cyperus fuscus	1.7	3.0	3.6
Cyperus longus	1.5	2.7	3.3
Cyperus michelianus	0.5	0.9	1.1
Juncus bufonius	0.3	0.5	0.6
Juncus capitatus	0.1	0.1	0.1
Scirpus lacustris	0.4	0.8	1.0
Total grass-likes	**4.8**	**8.6**	**10.4**
Aquatic			
Alisma plantago-aquatica	0.4	0.7	0.8
Ceratophyllum demersum	0.0	0.0	–
Limosella aquatica	1.6	2.8	3.4
Nymphoides peltata	0.0	0.0	–
Oenanthe aquatica	0.2	0.4	–
Polygonum amphibium	0.3	0.4	–
Polygonum persicaria	3.3	5.8	7.0
Ranunculus repens	0.8	1.5	1.8
Ranunculus sceleratus	0.5	0.8	1.0
Ranunculus trichophyllus	0.0	0.0	0.0
Rorippa amphibia	0.2	0.4	0.5
Trapa natans	2.0	3.6	–
Total aquatic	**9.1**	**12.5**	**14.5**
Other forbs			
Amaranthus lividus	2.4	4.3	5.2
Artemisia sp.	0.1	0.2	–
Atriplex hastata	0.2	0.4	0.5
Bidens tripartita	1.5	2.6	–
Capsella bursa-pastoris	0.3	0.5	–
Cardamine pratensis	0.4	0.6	0.8
Cirsium arvense	0.4	0.7	–
Conyza canadensis	2.9	5.1	–

Table A8 continue

Erigeron sp.	0.2	0.3	–
Euphorbia villosa	0.1	0.2	–
Filaginella uliginosa	1.5	2.7	3.3
Heliotropium europaeum	0.0	0.0	–
Lindernia dubia	1.2	2.1	2.5
Lycopus europaeus	0.0	0.0	–
Medicago arabica	0.0	0.0	–
Mentha aquatica	0.2	0.3	–
Myosoton aquaticum	0.1	0.2	0.3
Plantago sp.	0.0	0.0	–
Portulaca oleracea	0.3	0.6	0.7
Rumex palustris	1.7	3.0	3.6
Solanum nigrum	0.1	0.2	–
Sonchus oleraceus	0.1	0.2	–
Taraxacum palustre	1.7	3.1	3.7
Urtica dioica	0.2	0.4	–
Veronica beccabunga	0.8	1.4	1.6
Veronica catenata	0.1	0.1	0.2
Xanthium strumarium	1.2	2.2	–
Total other forbs	**17.6**	**7.5**	**22.5**
Mosses	26.4	–	–
Soil	17.8	–	–
Total	**100.0**	**100.0**	**100.0**

Table A9. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini on the 6th of December 2013. Data are based on 100 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.1	0.2	0.2
Crypsis aculeata	1.4	3.0	3.6
Crypsis alopecuroides	0.1	0.3	0.3
Cynodon dactylon	0.0	0.0	0.0
Digitaria sanguinalis	0.1	0.2	0.3
Echinochloa crus-galli	12.5	26.1	31.4
Paspalum paspalodes	9.1	19.0	22.9
Total grasses	**23.4**	**48.7**	**58.6**
Grass-likes			
Cyperus esculentus	0.2	0.5	0.6
Cyperus fuscus	0.5	1.1	1.3
Cyperus longus	1.1	2.3	2.8
Cyperus michelianus	0.3	0.6	0.7
Juncus bufonius	0.2	0.3	0.4
Juncus capitatus	0.1	0.1	0.2
Scirpus lacustris	0.4	0.9	1.1
Total grass-likes	**2.8**	**5.7**	**6.9**
Aquatic			
Alisma plantago-aquatica	0.3	0.7	0.8
Ceratophyllum demersum	0.0	0.0	
Limosella aquatica	1.8	3.7	4.4
Nymphoides peltata	0.0	0.0	
Oenanthe aquatica	0.3	0.5	
Polygonum amphibium	0.1	0.3	
Polygonum persicaria	2.8	5.8	6.9
Ranunculus repens	0.6	1.2	1.4
Ranunculus sceleratus	0.3	0.7	0.8
Ranunculus trichophyllus	0.0	0.0	0.0
Rorippa amphibia	0.1	0.2	0.2
Trapa natans	1.6	3.3	
Total aquatic	**7.8**	**11.4**	**14.6**
Other forbs			
Amaranthus lividus	1.4	3.0	3.6
Artemisia sp.	0.2	0.5	
Atriplex hastata	0.2	0.4	0.5
Bidens tripartita	0.9	1.9	
Capsella bursa-pastoris	0.1	0.2	
Cardamine pratensis	0.4	0.8	1.0
Cirsium arvense	0.5	1.0	
Conyza canadensis	2.7	5.7	

Table A9 continue

Erigeron sp.	0.2	0.4	
Euphorbia villosa	0.0	0.0	
Filaginella uliginosa	0.5	1.0	1.2
Heliotropium europaeum	0.0	0.0	
Lindernia dubia	1.1	2.3	2.8
Lycopus europaeus	0.0	0.0	
Medicago arabica	0.0	0.0	
Mentha aquatica	0.1	0.2	
Myosoton aquaticum	0.1	0.2	0.3
Plantago sp.	0.0	0.0	
Portulaca oleracea	0.2	0.4	0.5
Rumex palustris	1.9	3.9	4.7
Solanum nigrum	0.0	0.0	
Sonchus oleraceus	0.2	0.4	
Taraxacum palustre	1.4	2.9	3.5
Urtica dioica	0.1	0.3	
Veronica beccabunga	0.7	1.4	1.7
Veronica catenata	0.1	0.2	0.2
Xanthium strumarium	1.0	2.1	
Total other forbs	**14.1**	**7.3**	**19.9**
Mosses	30.2	–	–
Soil	21.7	–	–
Total	**100.0**	**100.0**	**100.0**

Table A10. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini during the wintering period 2012-13. Data are based on 300 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.3	0.5	0.6
Crypsis aculeata	1.4	2.3	2.7
Crypsis alopecuroides	0.2	0.4	0.4
Cynodon dactylon	0.7	1.2	1.4
Digitaria sanguinalis	0.4	0.7	0.8
Echinochloa crus-galli	11.4	18.9	22.1
Paspalum paspalodes	8.6	14.3	16.7
Total grasses	**23.1**	**38.3**	**44.9**
Grass-likes			
Cyperus esculentus	0.3	0.5	0.6
Cyperus fuscus	2.1	3.4	4.0
Cyperus longus	0.9	1.5	1.7
Cyperus michelianus	0.9	1.5	1.8
Juncus bufonius	0.6	0.9	1.1
Juncus capitatus	0.1	0.2	0.2
Scirpus lacustris	0.4	0.7	0.8
Total grass-likes	**5.2**	**8.7**	**10.2**
Aquatic			
Alisma plantago-aquatica	0.3	0.4	0.5
Ceratophyllum demersum	0.2	0.3	–
Limosella aquatica	2.0	3.3	3.8
Nymphoides peltata	0.3	0.6	–
Oenanthe aquatica	0.2	0.4	–
Polygonum amphibium	0.1	0.2	–
Polygonum persicaria	5.9	9.7	11.4
Ranunculus repens	0.5	0.9	1.0
Ranunculus sceleratus	0.4	0.6	0.7
Ranunculus trichophyllus	0.3	0.4	0.5
Rorippa amphibia	0.4	0.6	0.7
Trapa natans	1.4	2.3	–
Total aquatic	**11.9**	**19.7**	**18.7**
Other forbs			
Amaranthus lividus	2.3	3.9	4.6
Artemisia sp.	0.3	0.4	–
Atriplex hastata	0.4	0.6	0.7
Bidens tripartita	0.9	1.5	–
Capsella bursa-pastoris	0.2	0.3	–
Cardamine pratensis	0.9	1.5	1.7
Cirsium arvense	0.5	0.8	–
Conyza canadensis	2.2	3.6	–

Table A10 continue

Erigeron sp.	0.2	0.4	–
Euphorbia villosa	0.2	0.3	–
Filaginella uliginosa	2.8	4.7	5.5
Heliotropium europaeum	0.3	0.4	–
Lindernia dubia	1.3	2.2	2.6
Lycopus europaeus	0.2	0.3	–
Medicago arabica	0.1	0.2	–
Mentha aquatica	0.2	0.3	–
Myosoton aquaticum	0.4	0.7	0.8
Plantago sp.	0.1	0.2	–
Portulaca oleracea	1.3	2.2	2.5
Rumex palustris	1.9	3.1	3.6
Solanum nigrum	0.1	0.2	–
Sonchus oleraceus	0.2	0.4	–
Taraxacum palustre	1.0	1.7	2.0
Urtica dioica	0.1	0.2	–
Veronica beccabunga	0.9	1.5	1.8
Veronica catenata	0.2	0.2	0.3
Xanthium strumarium	1.0	1.6	–
Total other forbs	**20.1**	**33.3**	**26.2**
Mosses	17.3	–	–
Soil	22.3	–	–
Total	**100.0**	**100.0**	**100.0**

Table A11. Vegetation cover and composition and forage availability in the marshy habitat in Lake Kerkini during the wintering period 2013-14. Data are based on 600 plots (0.5 x 0.5 m).

Plant species	Cover (%)	Composition (%)	Availability (%)
Grasses			
Agrostis stolonifera	0.3	0.5	0.6
Crypsis aculeata	1.7	2.9	3.5
Crypsis alopecuroides	0.3	0.5	0.6
Cynodon dactylon	0.6	1.0	1.2
Digitaria sanguinalis	0.2	0.4	0.5
Echinochloa crus-galli	11.1	19.6	23.4
Paspalum paspalodes	8.6	15.3	18.3
Total grasses	**22.8**	**40.1**	**48.1**
Grass-likes			
Cyperus esculentus	0.3	0.5	0.6
Cyperus fuscus	1.9	3.1	3.8
Cyperus longus	1.3	2.3	2.8
Cyperus michelianus	0.8	1.4	1.7
Juncus bufonius	0.4	0.6	0.8
Juncus capitatus	0.2	0.3	0.3
Scirpus lacustris	0.4	0.7	0.9
Total grass-likes	**5.3**	**9.0**	**10.8**
Aquatic			
Alisma plantago-aquatica	0.3	0.5	0.6
Ceratophyllum demersum	0.0	0.1	–
Limosella aquatica	1.7	3.0	3.6
Nymphoides peltata	0.3	0.5	–
Oenanthe aquatica	0.2	0.4	–
Polygonum amphibium	0.2	0.4	–
Polygonum persicaria	4.7	8.0	9.6
Ranunculus repens	0.9	1.6	1.9
Ranunculus sceleratus	0.4	0.7	0.8
Ranunculus trichophyllus	0.2	0.4	0.4
Rorippa amphibia	0.3	0.5	0.6
Trapa natans	1.5	2.6	
Total aquatic	**10.7**	**18.7**	**17.6**
Other forbs			
Amaranthus lividus	2.4	4.2	5.0
Artemisia sp.	0.2	0.3	–
Atriplex hastata	0.3	0.5	0.6
Bidens tripartita	1.3	2.2	–
Capsella bursa-pastoris	0.2	0.3	–
Cardamine pratensis	0.5	0.9	1.1
Cirsium arvense	0.5	0.9	–
Conyza canadensis	2.3	4.0	–

Table A11 continue

Erigeron sp.	0.2	0.3	−
Euphorbia villosa	0.1	0.2	−
Filaginella uliginosa	1.9	3.3	3.9
Heliotropium europaeum	0.1	0.2	–
Lindernia dubia	1.1	1.8	2.2
Lycopus europaeus	0.1	0.2	−
Medicago arabica	0.1	0.1	−
Mentha aquatica	0.2	0.3	−
Myosoton aquaticum	0.3	0.5	0.7
Plantago sp.	0.1	0.1	–
Portulaca oleracea	0.6	1.1	1.3
Rumex palustris	1.6	2.8	3.3
Solanum nigrum	0.3	0.5	−
Sonchus oleraceus	0.2	0.3	−
Taraxacum palustre	1.6	2.8	3.4
Urtica dioica	0.3	0.5	–
Veronica beccabunga	0.8	1.4	1.6
Veronica catenata	0.2	0.3	0.4
Xanthium strumarium	1.2	2.1	–
Total other forbs	**18.6**	**32.2**	**23.6**
Mosses	21.4	−	−
Soil	21.2	−	−
Total	**100.0**	**100.0**	**100.0**

Table B1. Diet composition of the Lesser White fronted Goose based on 12 droppings in Lake Kerkini on the 15th of October 2012.

Plant species	**Dry Weight**
Grasses	**(n=12)**
Agrostis stolonifera	*
Crypsis aculeata	1.0
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	48.5
Paspalum paspalodes	6.7
Total grasses	**57.7**
Grass-likes	
Cyperus esculentus	2.7
Cyperus fuscus	1.8
Cyperus longus	*
Cyperus michelianus	1.6
Juncus bufonius	1.0
Juncus capitatus	*
Scirpus lacustris	3.2
Total grass-likes	**11.1**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	2.9
Polygonum persicaria	*
Ranunculus repens	1.9
Ranunculus sceleratus	3.9
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**10.6**
Other forbs	
Amaranthus lividus	1.8
Atriplex hastata	*
Cardamine pratensis	1.0
Filaginella uliginosa	1.2
Lindernia dubia	1.5
Myosoton aquaticum	*
Portulaca oleracea	2.1
Rumex palustris	1.1
Taraxacum palustre	1.0
Veronica beccabunga	1.3
Veronica catenata	*
Total other forbs	**12.7**
Unidentified	7.8
Total	100.0

***** less than 1%.

Table B2. Diet composition of the Lesser White fronted Goose based on 10 droppings in Lake Kerkini on the 31th of October 2012.

Plant species	**Dry Weight**
Grasses	**(n=10)**
Agrostis stolonifera	*
Crypsis aculeata	1.1
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	47.0
Paspalum paspalodes	8.4
Total grasses	**58.0**
Grass-likes	
Cyperus esculentus	3.2
Cyperus fuscus	2.1
Cyperus longus	*
Cyperus michelianus	2.0
Juncus bufonius	1.0
Juncus capitatus	*
Scirpus lacustris	3.2
Total grass-likes	**12.6**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.5
Polygonum persicaria	*
Ranunculus repens	2.1
Ranunculus sceleratus	3.3
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**10.6**
Other forbs	
Amaranthus lividus	1.7
Atriplex hastata	*
Cardamine pratensis	*
Filaginella uliginosa	*
Lindernia dubia	1.5
Myosoton aquaticum	*
Portulaca oleracea	2.1
Rumex palustris	*
Taraxacum palustre	*
Veronica beccabunga	1.5
Veronica catenata	*
Total other forbs	**11.1**
Unidentified	7.6
Total	100.0

***** less than 1%.

Table B3. Diet composition of the Lesser White fronted Goose based on 43 droppings in Lake Kerkini on the 10th of November 2012.

Plant species	**Dry Weight**
Grasses	**(n=43)**
Agrostis stolonifera	*
Crypsis aculeata	1.2
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	44.5
Paspalum paspalodes	8.6
Total grasses	**55.4**
Grass-likes	
Cyperus esculentus	2.8
Cyperus fuscus	2.2
Cyperus longus	*
Cyperus michelianus	2.2
Juncus bufonius	1.1
Juncus capitatus	*
Scirpus lacustris	3.7
Total grass-likes	**12.7**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	4.3
Polygonum persicaria	*
Ranunculus repens	2.5
Ranunculus sceleratus	3.2
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**11.5**
Other forbs	
Amaranthus lividus	1.9
Atriplex hastata	*
Cardamine pratensis	*
Filaginella uliginosa	*
Lindernia dubia	1.8
Myosoton aquaticum	*
Portulaca oleracea	2.1
Rumex palustris	1.5
Taraxacum palustre	*
Veronica beccabunga	1.7
Veronica catenata	*
Total other forbs	**11.9**
Unidentified	8.4
Total	100.0

***** less than 1%.

Table B4. Diet composition of the Lesser White fronted Goose based on 32 droppings in Lake Kerkini on the 9th of October 2013.

Plant species	**Dry Weight**
Grasses	**(n=32)**
Agrostis stolonifera	*
Crypsis aculeata	1.1
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	46.9
Paspalum paspalodes	7.7
Total grasses	**56.9**
Grass-likes	
Cyperus esculentus	2.7
Cyperus fuscus	2.0
Cyperus longus	*
Cyperus michelianus	1.6
Juncus bufonius	1.2
Juncus capitatus	*
Scirpus lacustris	3.9
Total grass-likes	**12.1**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.4
Polygonum persicaria	*
Ranunculus repens	2.2
Ranunculus sceleratus	4.2
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**11.9**
Other forbs	
Amaranthus lividus	1.8
Atriplex hastata	*
Cardamine pratensis	*
Filaginella uliginosa	1.0
Lindernia dubia	1.8
Myosoton aquaticum	*
Portulaca oleracea	1.7
Rumex palustris	*
Taraxacum palustre	*
Veronica beccabunga	1.1
Veronica catenata	*
Total other forbs	**11.1**
Unidentified	7.9
Total	100.0

***** less than 1%.

Table B5. Diet composition of the Lesser White fronted Goose based on 36 droppings in Lake Kerkini on the 23th of October 2013.

Plant species	**Dry Weight**
Grasses	**(n=36)**
Agrostis stolonifera	*
Crypsis aculeata	1.3
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	45.6
Paspalum paspalodes	7.9
Total grasses	**55.8**
Grass-likes	
Cyperus esculentus	3.6
Cyperus fuscus	2.3
Cyperus longus	1.2
Cyperus michelianus	2.0
Juncus bufonius	1.1
Juncus capitatus	*
Scirpus lacustris	4.0
Total grass-likes	**14.5**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.1
Polygonum persicaria	*
Ranunculus repens	2.3
Ranunculus sceleratus	3.3
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**11.0**
Other forbs	
Amaranthus lividus	1.6
Atriplex hastata	*
Cardamine pratensis	*
Filaginella uliginosa	*
Lindernia dubia	1.9
Myosoton aquaticum	*
Portulaca oleracea	1.7
Rumex palustris	*
Taraxacum palustre	*
Veronica beccabunga	1.8
Veronica catenata	*
Total other forbs	**11.6**
Unidentified	7.0
Total	100.0

***** less than 1%.

Table B6. Diet composition of the Lesser White fronted Goose based on 17 droppings in Lake Kerkini on the 1th of November 2013.

Plant species	**Dry Weight**
Grasses	**(n=17)**
Agrostis stolonifera	*
Crypsis aculeata	1.0
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	45.3
Paspalum paspalodes	7.6
Total grasses	**55.1**
Grass-likes	
Cyperus esculentus	3.2
Cyperus fuscus	2.3
Cyperus longus	1.0
Cyperus michelianus	2.0
Juncus bufonius	1.1
Juncus capitatus	*
Scirpus lacustris	3.8
Total grass-likes	**13.6**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.0
Polygonum persicaria	*
Ranunculus repens	1.9
Ranunculus sceleratus	3.5
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**9.9**
Other forbs	
Amaranthus lividus	1.7
Atriplex hastata	*
Cardamine pratensis	2.0
Filaginella uliginosa	*
Lindernia dubia	2.0
Myosoton aquaticum	*
Portulaca oleracea	2.1
Rumex palustris	1.3
Taraxacum palustre	*
Veronica beccabunga	1.7
Veronica catenata	*
Total other forbs	**13.6**
Unidentified	7.9
Total	100.0

***** less than 1%.

Table B7. Diet composition of the Lesser White fronted Goose based on 48 droppings in Lake Kerkini on the 11th of November 2013.

Plant species	**Dry Weight**
Grasses	**(n=48)**
Agrostis stolonifera	*
Crypsis aculeata	1.0
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	48.9
Paspalum paspalodes	8.2
Total grasses	**58.9**
Grass-likes	
Cyperus esculentus	2.6
Cyperus fuscus	2.4
Cyperus longus	1.1
Cyperus michelianus	1.2
Juncus bufonius	1.0
Juncus capitatus	*
Scirpus lacustris	3.3
Total grass-likes	**11.8**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	2.8
Polygonum persicaria	*
Ranunculus repens	1.7
Ranunculus sceleratus	3.1
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**8.6**
Other forbs	
Amaranthus lividus	1.8
Atriplex hastata	*
Cardamine pratensis	1.6
Filaginella uliginosa	*
Lindernia dubia	1.6
Myosoton aquaticum	*
Portulaca oleracea	2.1
Rumex palustris	1.3
Taraxacum palustre	*
Veronica beccabunga	1.7
Veronica catenata	*
Total other forbs	**12.4**
Unidentified	8.3
Total	100.0

***** less than 1%.

Table B8. Diet composition of the Lesser White fronted Goose based on 26 droppings in Lake Kerkini on the 22th of November 2013.

Plant species	**Dry Weight**
Grasses	**(n=26)**
Agrostis stolonifera	–
Crypsis aculeata	1.6
Crypsis alopecuroides	–
Cynodon dactylon	–
Digitaria sanguinalis	–
Echinochloa crus-galli	50.2
Paspalum paspalodes	10.2
Total grasses	**62.1**
Grass-likes	
Cyperus esculentus	2.8
Cyperus fuscus	2.2
Cyperus longus	1.2
Cyperus michelianus	–
Juncus bufonius	*
Juncus capitatus	–
Scirpus lacustris	2.8
Total grass-likes	**9.6**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.4
Polygonum persicaria	*
Ranunculus repens	1.8
Ranunculus sceleratus	2.8
Ranunculus trichophyllus	–
Rorripa amphibia	–
Total aquatic	**8.5**
Other forbs	
Amaranthus lividus	1.5
Atriplex hastata	*
Cardamine pratensis	1.5
Filaginella uliginosa	*
Lindernia dubia	2.2
Myosoton aquaticum	*
Portulaca oleracea	1.6
Rumex palustris	2.1
Taraxacum palustre	*
Veronica beccabunga	2.1
Veronica catenata	*
Total other forbs	**12.2**
Unidentified	7.7
Total	100.0

***** less than 1%.

Table B9. Diet composition of the Lesser White fronted Goose based on 26 droppings in Lake Kerkini on the 22th of November 2013.

Plant species	**Dry Weight**
Grasses	**(n=26)**
Agrostis stolonifera	–
Crypsis aculeata	1.9
Crypsis alopecuroides	–
Cynodon dactylon	–
Digitaria sanguinalis	–
Echinochloa crus-galli	51.6
Paspalum paspalodes	10.4
Total grasses	**63.9**
Grass-likes	
Cyperus esculentus	2.8
Cyperus fuscus	2.4
Cyperus longus	1.3
Cyperus michelianus	–
Juncus bufonius	–
Juncus capitatus	–
Scirpus lacustris	2.6
Total grass-likes	**9.2**
Aquatic	
Alisma plantago-aquatica	–
Limosella aquatica	4.1
Polygonum persicaria	*
Ranunculus repens	1.8
Ranunculus sceleratus	2.5
Ranunculus trichophyllus	–
Rorripa amphibia	–
Total aquatic	**9.2**
Other forbs	
Amaranthus lividus	1.8
Atriplex hastata	–
Cardamine pratensis	2.0
Filaginella uliginosa	–
Lindernia dubia	2.4
Myosoton aquaticum	–
Portulaca oleracea	–
Rumex palustris	2.2
Taraxacum palustre	–
Veronica beccabunga	*
Veronica catenata	*
Total other forbs	**9.2**
Unidentified	8.4
Total	100.0

***** less than 1%.

Table B10. Diet composition of the Lesser White fronted Goose based on 65 droppings in Lake Kerkini during the wintering period 2012-13.

Plant species	**Dry Weight**
Grasses	**(n=65)**
Agrostis stolonifera	*
Crypsis aculeata	1.2
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	45.6
Paspalum paspalodes	8.2
Total grasses	**56.3**
Grass-likes	
Cyperus esculentus	2.8
Cyperus fuscus	2.1
Cyperus longus	*
Cyperus michelianus	2.1
Juncus bufonius	1.1
Juncus capitatus	*
Scirpus lacustris	3.5
Total grass-likes	**12.4**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.9
Polygonum persicaria	*
Ranunculus repens	2.3
Ranunculus sceleratus	3.3
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**11.2**
Other forbs	
Amaranthus lividus	1.8
Atriplex hastata	*
Cardamine pratensis	*
Filaginella uliginosa	*
Lindernia dubia	1.7
Myosoton aquaticum	*
Portulaca oleracea	2.1
Rumex palustris	1.3
Taraxacum palustre	*
Veronica beccabunga	1.6
Veronica catenata	*
Total other forbs	**11.9**
Unidentified	8.2
Total	100.0

***** less than 1%.

Table B11. Diet composition of the Lesser White fronted Goose based on 181 droppings in Lake Kerkini during the wintering period 2013-14.

Plant species	**Dry Weight (n=181)**
Grasses	
Agrostis stolonifera	*
Crypsis aculeata	1.3
Crypsis alopecuroides	*
Cynodon dactylon	*
Digitaria sanguinalis	*
Echinochloa crus-galli	48.1
Paspalum paspalodes	8.6
Total grasses	**58.6**
Grass-likes	
Cyperus esculentus	2.9
Cyperus fuscus	2.3
Cyperus longus	1.1
Cyperus michelianus	1.2
Juncus bufonius	*
Juncus capitatus	*
Scirpus lacustris	3.4
Total grass-likes	**11.9**
Aquatic	
Alisma plantago-aquatica	*
Limosella aquatica	3.2
Polygonum persicaria	*
Ranunculus repens	1.9
Ranunculus sceleratus	3.3
Ranunculus trichophyllus	*
Rorripa amphibia	*
Total aquatic	**9.9**
Other forbs	
Amaranthus lividus	1.7
Atriplex hastata	*
Cardamine pratensis	1.4
Filaginella uliginosa	*
Lindernia dubia	1.9
Myosoton aquaticum	*
Portulaca oleracea	1.6
Rumex palustris	1.4
Taraxacum palustre	*
Veronica beccabunga	1.5
Veronica catenata	*
Total other forbs	**11.7**
Unidentified	7.9
Total	100.0

***** less than 1%.

Photographic documentation

Fig.1. Marshy habitat in Paratiritirio area, Kerkini Lake.

Fig. 2. Terrestrial grassland in Mandraki area, Kerkini Lake.

Fig. 3. The 'Ktima Dimitriadis' area, Evros Delta.

Fig. 4. Experimental plot for estimating vegetation parameters.

Fig. 5. Collecting droppings in the field

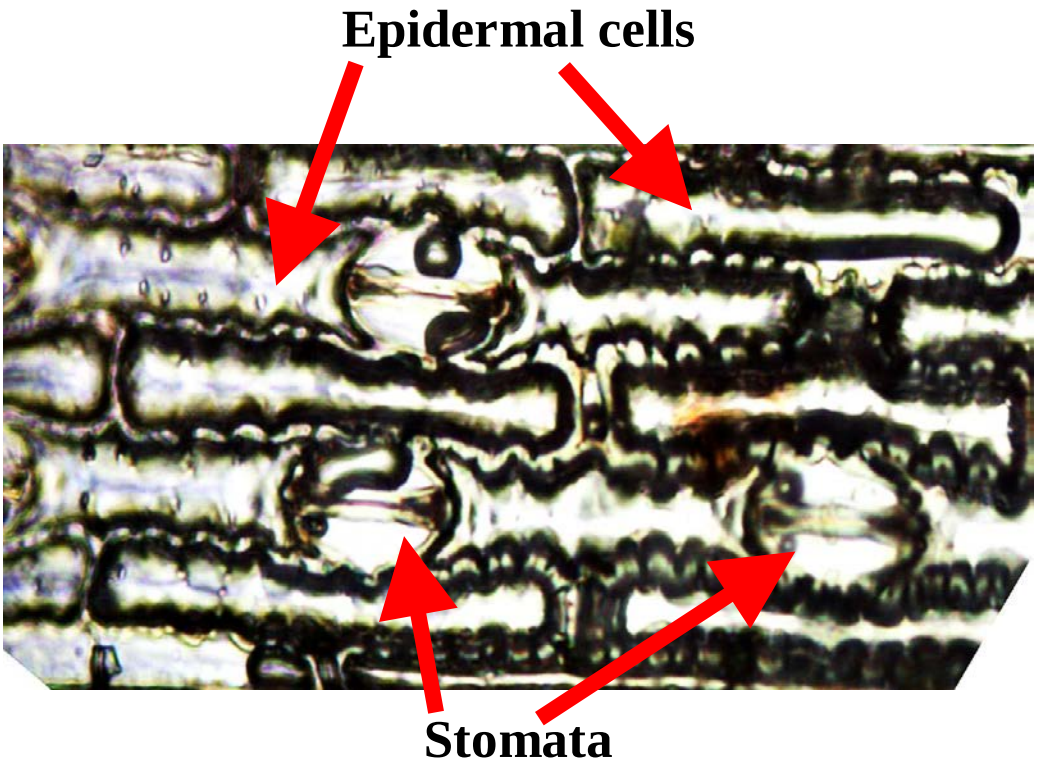

Fig. 6. Epidermal tissue of the stem of *Echinochloa crus-galli*.

Fig. 7. A pile of LWfG droppings in Paratiritirio site, Kerkini Lake.

Fig.8. *Echinochloa crus-galii* (left) and *Cyperus esculentus* (right). Both plants have been heavily grazed by LWfG.