

## Actual Numbers and Effects of Recreational Disturbance on the Distribution and Behaviour of Greylag Geese (*Anser Anser*) in the "Neusiedler See – Seewinkel" Nationalpark Area

Wolfgang Steiner<sup>1</sup>, Rosemarie Parz-Gollner<sup>2</sup>

<sup>1,2</sup> Institute for Wildlife Biology and Game Management  
University of Agricultural Sciences, 1190 Vienna, Austria  
Email: [wolfgang\\_steiner@chello.at](mailto:wolfgang_steiner@chello.at)

**Abstract:** The Neusiedler See – Seewinkel National Park area is confronted with a remarkable increase in tourism and recreational activities during the last years. The „Koppel“ area, situated on the eastern shore of the lake, is one of the most important breeding sites for Greylag Geese. Behaviour and distribution of the geese on the breeding site as well as touristic activities on the adjacent road leading along the „Koppel“ were examined to investigate relations and interactions between the Greylag Goose population and tourism. Taking into account the excellent weather and breeding conditions in the year 2000 the results of the survey indicate a stable or even rising Greylag population, increasing numbers of visitors and high disturbance frequencies in the vicinity of the study area. The number of disturbances on the adjacent road seems to affect the suitability of the site in general, leading to a specific temporal and spatial distribution of the birds, whereas different disturbance qualities result in changes of the birds behaviour.

### INTRODUCTION

According to the World Conservation Congress in Montreal in 1996 protected marine and terrestrial habitats with high biodiversity value are becoming popular tourism destinations throughout the world. Tourism is expected to double in the next twenty years and a growing share of that travel will affect national parks, protected areas and other nature conservation refuges. Many studies reveal that in the absence of appropriate policies and management plans, tourism to natural areas can be a handicap for nature conservation. Planning and supervision of tourism in areas with high ecological value is an important tool to avoid conversion to other forms of land use. Tourism represents a chance but yet a challenge for the national park management to raise the peoples interest for nature and to gain additional money for the targets of nature conservation.

The Neusiedler See – Seewinkel national park area supports a number of nationally and internationally important waterfowl species. The park is a border crossing nature reserve being situated partly on Austrian and on Hungarian territory. Being part of regional, national and international efforts for wildlife conservation, the Neusiedler See – Seewinkel national park plays a major role in promoting species preservation as well as habitat restoration. Due to overall increasing numbers of tourists in the recent time the aims of wildlife preservation in this area may interfere with the development of recreational opportunities. The geographic area under investigation, the region Neusiedler See – Seewinkel (Fig. 1), covers about

760 km<sup>2</sup> and is part of the peripheral region of the Western Hungarian Plain.

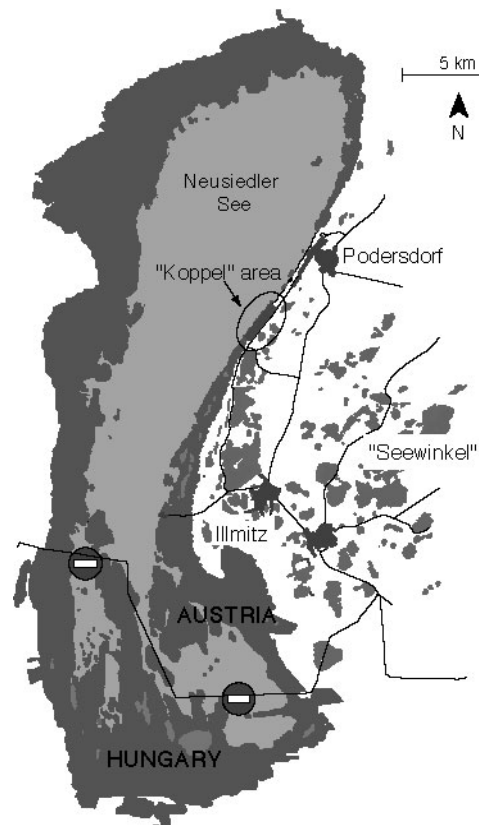


Figure 1.: Study area: Region Neusiedler See – Seewinkel and „Koppel“ area.

A mosaic of agricultural land, vineyards, pastures with grazing management and shallow, mostly alkaline ponds with abundant rushes and salt marshes characterizes the landscape.

The size and the geographical position of the lake and the climate offer special conditions for watersport and other outside recreational activities. The close proximity to major cities like Vienna, Sopron and Bratislava as well as an excellent road network provide a sizeable catchment area. The lake's extent is 36 km in length and 7 – 15 km in width. It is the largest European pannonic steppe lake representing the western border of the Hungarian Plain. The national border between Austria and Hungary cuts through the southern part of the lake. Regardless of today's existing political borders the region constitutes an ecological entity and an interdependent habitat for the related fauna and flora.

About forty little inland ponds are forming the „Seewinkel“ (Fig. 1), offering a great variety of different habitats for various species of the pannonic flora and fauna.

The national park Neusiedler See – Seewinkel was established in 1994 with an area of approximately 8.000 hectare on Austrian and almost 7.000 hectare on Hungarian territory (1 hectare = 100m x 100m). The Austrian part of the national park consists of several spatial connected and unconnected subareas, which have been implemented into the existing cultural landscape. Following the IUCN guidelines these areas are designated for different objectives of management and nature protection. A growing and improved network of roads for common traffic, farm workers and tourists (including biking routes) was established during the past years with various impacts on adjacent habitats of wildlife species.

The whole national park area represents a worldwide known bird sanctuary of international importance for migrating, wintering and breeding waterbird species. Greylags are endemic breeding birds and use different locations as breeding and resting sites in numerous amounts. The Central European Greylag Goose population belongs almost completely to the subspecies *Anser anser rubirostris* (Madsen et al., 1999). The main breeding and rearing areas are situated in the Hungarian Plain and the Northern Viennese Basin. In Austria the distribution of breeding Greylags is concentrated in the reed-belt of the Neusiedler See as well as among many inland ponds in the central part of the Seewinkel.

The road leading along the eastern shore of the lake connecting the villages Podersdorf and Illmitz was originally built for agricultural purposes. But the increase in tourism and outdoor recreational activities also result in rising numbers of seasonal visitors and therefore users of the road network in the national park area. Roads are representing guidelines in the landscape, concentrating and canalizing high numbers of potential disturbance

factors which may affect adversely the adjacent wildlife refuges.

The study area, the „Koppel“ (= paddock; ref. Fig. 2), is the most important breeding site of Greylags on the Austrian side of the nature reserve and is harbouring a variety of other waterbird species too (i.e. herons, ducks, waders). The site covers about 27 hectare and is a narrow strip of land laying between the road under investigation and the lake itself. The distribution and the structure of the vegetation on the „Koppel“ is strongly influenced and modified by grazing horses. Short vegetation seems to suit the needs of Greylags as a good breeding habitat. It is well known that the quality and the quantity of an area's resources including the density and growth of vegetation have an important influence on habitat selection (Bauernfeind, 1979).

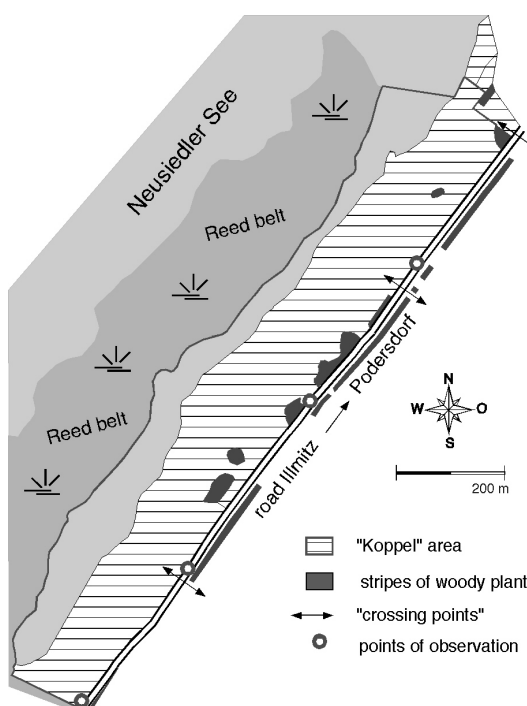


Figure 2.: „Koppel“ area with points of observation and „crossing points“ (for details see text).

The aim of the study was to investigate the impact of recreational disturbances on Greylags and their habitats in the national park Neusiedler See – Seewinkel. It is obvious that human induced disturbances can release changes in behaviour as well as in the spatial and temporal distribution of migrating, wintering and breeding waterbirds (Eichelmann, 1993; Madsen, 1985, 1995). Different species react in varying ways and have differing sensitivities towards disturbances depending on time, habitat and physiological constitution (Gold et al., 1993). Geese and especially Greylags are well known for their adaptability and learning ability (Kühl, 1979, Lorenz, 1979). In areas like the „Koppel“ effects of habituation can even be stronger because the geese are familiar with the location and show a strong site fidelity. So if human disturbances result in a negative impact on geese in

such areas, an even higher effect on other more sensitive bird species using the same or adjacent habitats can be assumed.

## METHODS

The results of the study are based on field observations using binoculars (7x50) and a dictaphone for data recording. Field work was carried out between March to September 2000.

Climatic conditions (temperature, wind, rainfall), during the year 2000 were recorded using a weather station situated at the Biological Station in Illmitz. Information and data about the development of overnight lodgings and tourism were made available by the tourism information bureau of the village of Illmitz.

Number and type of touristic activities were recorded along the road touching the „Koppel“ area. During days of observation counts were taken every 15 minutes. The following types of disturbances were distinguished: cyclists, cars, pedestrians, tractors, agricultural machinery, motorcycles, carriages, riders and dogs. Additionally movements on the lake (i.e. boats, surfers etc.) were observed.

Altogether 82 surveys were made to assess the spatial and temporal distribution of Greylag Geese on the „Koppel“ area. Between 6 o' clock a.m. and 7 o' clock p.m. the positions of Greylag breeding pairs and non-breeders on the „Koppel“ area were registered. For a better orientation and to define the position of the Greylag individuals on the site, characteristic landmarks and a 10 x 10 meter grid were used to provide distribution maps.

The behaviour of Greylag flocks on the „Koppel“ area was also monitored. Four observation points were chosen and scans to take records of the activity pattern of all Greylag Geese visible were made every 15 minutes (Altmann, 1974). The following activities were distinguished: lying, sleeping (head on the back or under wings), grazing, alertness, aggressive behaviour, running, flight (flying), flight (running) and comfort behaviour (e.g. preening). Activities that did not fit into the above-mentioned scheme were classified as „normal behaviour“ (e.g. standing, inactivity).

## RESULTS AND DISCUSSION

Due to the seasonal varying water level of the lake the mosaic of terrestrial habitats on the „Koppel“ is frequently changing. In general these facts are influencing and modifying the length of stay of the geese as well as the spatial distribution and the usage of the site.

### *Climate*

Many of already published data proof the impact of climatic conditions on wildlife species in various ways (Frenzel & Schneider 1987, Gerdes 1994, Parz-Gollner 1991, Parz-Gollner & Farago 2000,).

In the year 2000 the first goslings on the „Koppel“ were noticed on 31. March. Taking into account 28 days of incubation, breeding must have started around 3<sup>rd</sup> of March in this year. A comparison with already published data (Bauernfeind 1979) indicates a good correlation between temperature and the start of the breeding period in the Seewinkel area. Low temperatures in February and March seems to delay the start of incubation by one or two weeks.

### *Greylag Goose population size*

To estimate the size of the total Greylag population in the central part of the Seewinkel, 14 breeding and rearing localities have been controlled on 23 days during spring time. Breeding pairs and their goslings, as well as non-breeders were counted driving along on specific routes by car. A sum of 300 breeding pairs was recorded. This count does not include the birds on the western shore of the lake and comprises only a rough estimate of the population in the southern part of the lake. This zone is almost completely covered with a dense reed-belt and represents the core area of the park with the highest degree of protection. Additional observations in well-known grazing areas resulted in an estimated number of 700 – 800 non-breeding Greylags.

The various breeding locations in the national park differ in quality and size. Most of the localities hold an average of 20 breeding pairs, proving the „Koppel“ site to be an extraordinary breeding place where a maximum of 60 families could be observed.

A detailed survey regarding the structure of the Greylag population was concentrated on the „Koppel“ site. Table 1 shows the total number of Greylag families observed and the number of goslings per pair. Families with four goslings represent the most common family size.

Pair + goslings	N	%
P + 1	174	6,85
P + 2	651	25,6
P + 3	610	23,99
P + 4	672	26,44
P + 5	318	12,51
P + 6	113	4,45
P + 10	4	0,16
	<b>2.542</b>	<b>100</b>

Tab. 1: Family size with different numbers of goslings per pair on the „Koppel“ area.

From March to May an average of 3,6 goslings per pair was counted. In June, two months after the appearance of the first goslings, the mean number dropped to 2,65 goslings per pair. According to literature, this result indicates a low gosling mortality rate of only 25% among the breeding population on the „Koppel“ site (Litzbarski, 1982).

It has to be pointed out, that the warm temperatures and few rain during spring caused

ideal breeding and rearing conditions in the year 2000. Considering these facts results indicate a positive trend of the Greylag population at the „Koppel“ at least in the year 2000.

Assessing 300 breeding pairs counted with an average of 3,6 goslings per pair the breeding population is reaching a total sum of 1.680 family members. Adding the number of non-breeders the actual overall population size of Greylags Geese in the area surveyed can be estimated as approximately 2.400 individuals at the time of fledging.

The breeding success and the start of incubation mainly is dominated and influenced by climatic conditions and food availability. To assess the impact of tourism and recreational activities on the spatial and temporal distribution as well as on the behaviour of Greylags during their breeding time on the „Koppel“, visitor counts were made and data about touristic activities were collected.

## TOURISM

Tourism plays an important role and is of high economical value for the residents in the Neusiedler See – Seewinkel area. The administration of the national park therefore has to realize two partly contradictory management goals. According to the IUCN criteria for national parks (IUCN/WCPA & WCM, 1994) the management on one hand should provide a refuge for spiritual, scientific, educational and recreational opportunities. On the other hand the adherence to stringent regulation of nature protection is obligatory.

An adequate visitor management in national parks needs to get sufficient information about the demographic data of the public. A well informed administration is able to react to visitor streams and trends in time and therefore is able to enhance the recreation value of an area within the scope of the nature protection regulations. The analysis of the touristic data results in four main conclusions:

1. The number of overnight stays is showing a clear rising tendency in the Neusiedler See – Seewinkel area.
2. Visitors prefer higher standards in accommodation but also a trend to more independence (e.g. apartments for families with children) can be noticed.
3. The number of visitors from Germany, the most numerous visitor group in former times, is constantly decreasing during the last 20 years. In return for this evaluation, more Austrian tourists spent their holidays in the Seewinkel lately.
4. An essential part of tourism, the one-day trips, has been neglected for a long time. Because of its spontaneity and mobility, this type of tourism is especially difficult to calculate.

The positive touristic trends may interfere with the aims of wildlife preservation. High numbers of visitors should not only result in an uncontrolled

extension of infrastructure. The national park administration has to develop solutions to enable a temporal and spatial organized visitor management - at least in highly sensitive areas of the national park.

### *Human induced disturbance factors*

83 % of potential disturbances observed on the „Koppel“ road were represented by cyclists, the share of cars is 8 %, the share of pedestrians is 6 %, tractors, motorcycles and other disturbance factors amount to 1 % each. The goose population on the „Koppel“ is almost permanently confronted with high human induced activities along the „Koppel“ road during daytime. In the morning hours and about noon peak numbers of more than 3 disturbances per minute and in the afternoon still about 2,5 disturbances per minute have been recorded. The maximum value was registered on 10.6.2000 around 10 a.m., when more than 10 people per minute were driving or walking along the road.

### *Reaction of the geese*

#### Spatial and temporal distribution

In the morning hours some of the families with goslings were leaving the site by walking south and eastwards to neighbouring feeding grounds. This displacement of a varying number of families was taking place by using specific „crossing points“ leading over the by humans frequently used road (ref. Fig. 2).

The crossing of the „Koppel“ road by Greylag families was documented for the first time during this study in detail. This behaviour may be a result of possible increased intraspecific competition for food resources among the breeding pairs. Another reason for the regular displacement observed might be the avoidance of human induced disturbances taking place along the „Koppel“ road, while the geese preferred to graze in more quiet areas with more or better food quality. Morning hours were preferred to cross the road to visit the adjacent grassland areas, where the geese spent time for grazing. The same distinct „crossing points“ were also used by geese to return to the „Koppel“, where the families stayed overnight.

In general, the geese kept a distance of approximately 60 m to the road in response to human induced high disturbance frequencies. The distribution of geese on the „Koppel“ site however was not constant and depended also on the actual habitat quality and water level. In particular, the poorly structured dry grass area in the northern part and center of the „Koppel“ site was normally avoided by geese families. Places behind stripes of woody plants featured the highest densities of Greylag breeding pairs. These wood-lots offered effective covering and also enabled the geese to graze in closer distance to the road than on the rest of the open „Koppel“ area.

The distribution of various flocks of non – breeding Greylags on the „Koppel“ indicates a quite different usage of the site by these groups of birds. Non – breeders mainly used this location for assembling or as a roosting place during daytime. Only a few amount of the non-breeding birds used the „Koppel“ as a feeding ground.

Activity pattern

A remarkable detail in the dataset was the small amount of alertness (9,8%) and aggressive behaviour (0,1%) among the group of breeding birds observed. The low level of aggression in the Greylag population seems to be a result of the local displacement to adjacent localities. Competition for resources and space is the most common reason for intraspecific aggression.

Breeding pairs in close proximity to the road tend to show alertness behaviour more often or even continuously. These birds seem to achieve a „guard function“ for the benefit of the other family groups. Furthermore the knowledge of the „trained“ borderline formed by a fence, which very rarely is overstepped by visitors, as well as the possibility to retreat in the close reed-belt in case of danger, seem to be effective strategies by Greylags to ensure an adequate use of the Koppel site as a breeding area, - despite to the outstanding numbers of tourists observed. For further discussion normal behaviour, comfort behaviour, lying and sleeping are combined to the term „resting behaviour“.

The results of the „behavioural scans“ confirm again the different utilisation of the „Koppel“ by Greylag breeding pairs and non-breeders. Figure 3 and 4 show the activity patterns between April and August. The non-breeders (Fig. 3) are resting most of the time on the „Koppel“ site whereas the breeding pairs (Fig. 4) spend most of the time grazing. The highest amount of alertness was registered in June and July, being the months with the maximum disturbance frequencies.

The most distinctive factor that emphasizes the special position of the „Koppel“ in comparison to all other breeding sites investigated, is the vast number of potential disturbances. No other area in the Neusiedler See – Seewinkel national park faces such high numbers of tourists in such short periods of time and on such a spatial restricted location. The fence which is separating the „Koppel“ site from the road forms a natural borderline. The crossing of this borderline by humans causes the families with goslings to react with a panic flight into the reed-belt and the non-breeders to leave the „Koppel“ by flying away. Despite to the Greylags distinct adaptability and well known learning behaviour some conclusions can be drawn. Assuming that the percentage of geese showing alertness is an adequate tool or indicator to describe the impacts of disturbances, the following „classification“ can be made:

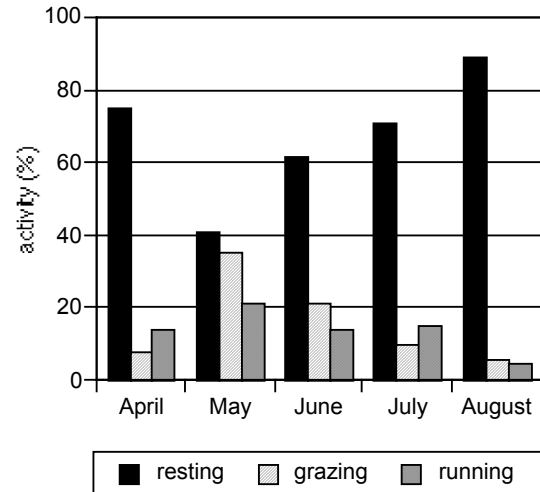


Figure 3.: Activity pattern (%) of non-breeders per month; observation period: April – August 2000.

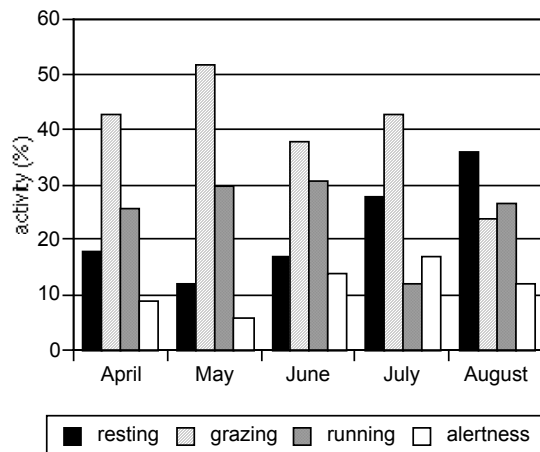


Figure 4.: Activity pattern (%) of breeding pairs per month; observation period: April – August 2000.

1. Boat traffic, water sport activities: The assumption that human activities on the lake entail stronger reactions by the geese than disturbance factors taking place on the land side, can neither be certified nor rejected. The fact is, that the man high reed-belt and the sloping area form a secure barrier where the geese can hide effectively.
2. Cyclists, cars, pedestrians: These three types of impacts constitute 97 % of overall recorded disturbances on the „Koppel“ road. In general the reaction of geese to very high numbers of tourists on the road resulted in the avoidance of the „crossing points“ and the geese stayed in a greater security distance to the road (spatial zonation). The decisive factor for Greylag families to walk over the street seems to be the period of time needed for crossing the road safely. A constant flow of tourist on the road inhibits the displacement behaviour observed. An exception to the habituation (adaptive behaviour) is the limiting value of 100 or more cyclists per 15 minutes. This high disturbance frequency triggers the geese to show alertness more often. In the past years such high numbers of visitors were an exception, but with

seasonal rising numbers of tourists this stress-situation for the geese will increase.

3. Tractors and motorcycles: These two categories cover only 2 % of all disturbance factors but caused the second largest change in the activity pattern. It can be assumed that the increased alertness of the geese is a reaction to the loud noise of motor engines and the rareness of this type of influence.
4. Carriages, riders and dogs: Only 1 % in each case of overall noted disturbances are covered by these categories. Animals like dogs and riding horses caused the most intense flight reaction by geese. In some way the reaction to horses is surprising because the area is frequently used as a paddock.

### CONCLUSIONS

Human induced disturbance can cause birds to abandon a breeding, grazing or resting area. If an area of high ecological value is avoided because of „disturbance“, these human caused impacts are equal to habitat loss. The „Koppel“ area represents on one hand an optimal breeding and rearing area for Greylag Geese. On the other hand the area is strongly influenced by touristic activities on a road leading along the site.

Results of data analysis give evidence that the number of disturbances on the „Koppel“ road seem to affect the temporal and spatial distribution of the birds and the general usage of the site, whereas specific disturbance types induce behavioral changes.

Compared to existing literature data the surveyed tourism frequencies with an average of three human induced disturbances per minute are high.

Greylags prefer the type of habitat as actually can be found on the „Koppel“. Stripes of woody plants and reed are important habitat structures. The combination of low temperatures and severe wind conditions forces the geese to feed in these wind-sheltered zones which are also used as a shelter against human induced disturbances. Open areas where no habitat structures or vegetation can be found are in general avoided by geese.

The „Koppel“ site seems to be a perfect breeding and rearing area for Greylag Geese. Despite to the high number of human induced disturbances the geese are able to compensate these impacts in various ways. Effects like habituation, changes in activity pattern, learning behaviour and adaptations in spatial and temporal distribution on the site have been observed.

Ways to define the numbers and expectations of „one-day visitors“ must be found. As a solution random sample interviews of people in the national park area should be taken. Visitors who stay over night or longer, visitors on a one day trip and the

local people visiting the national park area can be counted and interviewed. People involved will be informed and can improve their knowledge about the park and wildlife protection.

The overall breeding conditions for Greylag Geese in the Neusiedler See – Seewinkel national park suggests a positive trend of the breeding population. It can be expected that especially during the rearing time the geese will continue to expand the habitat use in adjacent feeding areas. Breeding and feeding grounds are often divided by roads with high traffic frequencies. Mechanisms have to be found so that breeding pairs and goslings are able to cross streets safely and without disturbances. At least in ecological highly sensitive areas a temporal and spatial organized visitor management has to be implemented.

### REFERENCES

- Altmann, J. (1974): Observational study of behaviour Sampling methods. *Behaviour* 49: 227-267.
- Bauernfeind, E. (1979): Nahrungsökologie und Bestand der Graugans (*Anser a. rubirostris*) im öster-reichischen Neusiedlersee Gebiet. Diss. Univ. Wien.
- Eichelmann, U. (1993): Fluchtdistanzen und Bestand von Stockente und Graureiher im Bereich des geplanten Nationalparks Donau-Auen. i.A. des Nationalpark-Inst. Donau-Auen und des WWF Österreich.
- Frenzel, P. & Schneider, M. (1987): Ökologische Untersuchungen an überwinternden Wasservögeln im Ermatinger Becken: Die Auswirkungen von Jagd, Schifffahrt und Freizeitaktivitäten. *Ornith. Jh. Bad.-Württ.* 3: 53-79.
- Gerdes, K. (1994): Lang- und kurzfristige Bestandsänderungen der Gänse (*Anser fabalis*, *A. albifrons*, *A. anser* und *Branta leucopsis*) am Dollart und ihre ökologischen Wechselbeziehungen. *Die Vogelwarte* 37: 157-178.
- Gold, R., Knebel, W. & Putzer, D. (1993): Mauerplätze für bedrohte Wasservogelarten. Planungskonflikte und Erfahrungen mit Freizeitnutzern im Rheinland. *Natursh. & Landschaftsplan.* 25 (4): 140-145.
- IUCN/WCPA & WCM (1994): Guidelines for Protected Area Management Categories. Gland (Switzerland).
- Kühl, J. (1979): Zum Flucht und Anpassungsverhalten der Graugänse (*Anser anser*) nach Untersuchungen an schleswig-holsteinischen Gewässern. *Die Vogelwelt* Heft 6, 217-225.
- Litzbarski, H. (1982): Populationsstruktur und Zugverhalten der Graugans (*Anser anser*) in der DDR. *Beitr. Vogelk.* 28: 107-128.
- Lorenz, K. (1979): Das Jahr der Graugans. R. Piper & Co., München & Zürich 199pp.
- Madsen, J. (1985): Impact of disturbance on Field Utilization of Pink-footed Geese in West Jutland, Denmark. *Biological Conservation* 33: 53-63. (1995): Impacts of disturbance on migratory waterfowl. *Ibis* 137 Suppl.1.
- Madsen, J. (1995): Impacts of disturbance on migratory waterfowl. *Ibis* 137/ Suppl. 1. 67-74.
- Madsen, J., Cracknell, G. & Fox, T. (Eds.) (1999): Goose Populations of the Western Palearctic. Wetlands International Publications No. 48.
- Parz-Gollner, R. (1991): Wildbiologische Untersuchungen und Jagd im Seewinkel. AGN – Forschungsprojekt BU 7, 3. Zwischenbericht Juli 1991.
- Parz-Gollner, R. & Farago, S. (2000): Phenology, distribution and protection of migrating geese in the national park area Lake Neusiedl/ Lake Fertő. *Hungarian Waterfowl Publ.* 6, 157-177.