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Conservation problems in the Neusiedler See–Seewinkel National Park, Austria: an arachnological perspective

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Summary

The Seewinkel area between Neusiedler See and the Hungarian border is characterized by numerous saline alkaline pans that are situated within a patchwork of mown and extensively grazed meadows. However, degradation of salt pans as well as cessation of cattle grazing has led to substantial loss of these unique habitats. With the establishment of the National Park Neusiedler See–Seewinkel in 1994, conservation research to support improvements necessary to counteract habitat loss became a priority. For this purpose, we used spiders as an indicator group, owing to their species richness and the variety of their habitat requirements. Our approaches can be classified into different levels of complexity: (1) species inventory, (2) species assemblage structure, (3) habitat preferences. We have recorded species of taxonomic or zoogeographical interest (e.g. *Zelotes mundus* (Kulczyński), *Pardosa maisa* Hippa & Mannila, *Sitticus inexpectus* Logunov & Kronestedt), and raised the number of species recorded for the region to 213. Comparison of two grassland spider assemblages, one grazed, one ungrazed, with a set of 207 central European grassland assemblages revealed a remote position for the Seewinkel fauna. Habitat selection analysis along environmental gradients is exemplified by *P. maisa*. Future studies should address, in particular, the problems of spatial and temporal dynamics.

Introduction

The plain east of the Neusiedler See, the "Seewinkel" (Fig. 1), is one of the most important biodiversity hot-spot regions in Austria. A number of factors contribute to its richness: (1) The area is situated geographically within the Hungarian plain, i.e. open towards the east but isolated from the west by several mountain ridges. Thus, many organisms with a Central Asian or ancient Mediterranean distribution reach their western limit in eastern Austria (Mazek-Fialla, 1936). (2) Climatically, the region is characterized by high summer temperatures, high radiation values, high wind velocities, and occasional semi-arid conditions during summer. This permits the existence of many xero-thermophilic Mediterranean species. (3) Geological (a salty soil horizon), climatic (see above) and geomorphological (a plain with internal drainage) conditions have led to soda accumulation in the soil and to the existence of salt pans (large, shallow, often ephemeral, alkaline waters). The Seewinkel is the largest inland salt region in Austria, one of the most important in Europe, and the westernmost soda salt pan region in Eurasia (Löffler, 1982). (4) Land use formerly dominated by extensive cattle grazing led to an open mosaic of dry grassland, semiterrestrial swampland and salt marshes of high attractiveness for many organisms, notably breeding birds (Kohler *et al*., 1994). These four components together permit the coexistence of ecologically specialized forms alongside the ubiquitous Central European species on a small scale.

However, within the past 150 years, habitat loss and habitat devaluation has proceeded at an accelerating pace. The number of salt pans has decreased from 139, covering an area of 3615 ha in 1850, to 79 (1360 ha) in 1957, and to 63 (805 ha) in 1986 (Kohler *et al*., 1994). Today, about 40 salt pans are left, but typical conditions (vegetation zonation, salt content, hydrology) prevail in fewer than 20 of these (Milasowszky

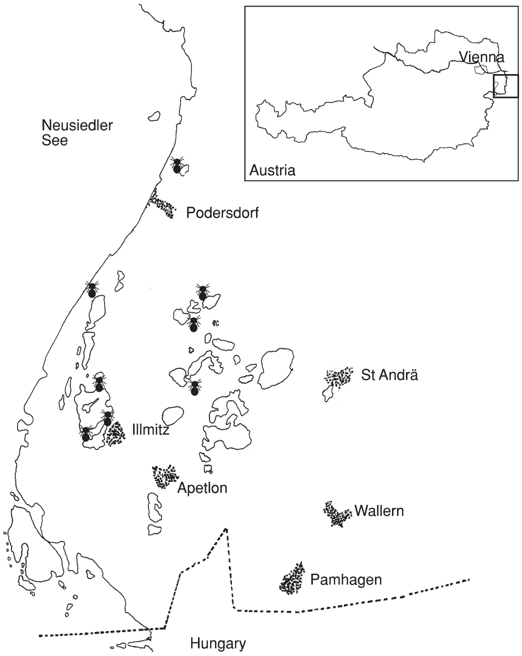

Fig. 1: Map of the Seewinkel region, Eastern Austria, comprising the salt pan area. Spider symbols indicate sites where *Lycosa singoriensis* occurs.

& Zulka, 1994). Similarly, the area of extensively used pastures decreased from 3800 ha in 1855/58 to 815 ha, while reed areas increased from 1009 ha to 3016 ha, fragmenting once continuous open grassland.

These tendencies have their common cause in the change from extensive land use to industrial agriculture and viniculture in the region, accompanied by irrigation, lowering of the ground water table (Krachler, 1993), drainage of salt pans, soil amelioration (Ghobadian, 1966), high fertilizer and pesticide application, habitat eutrophication, cessation of grazing, and spread of reed vegetation (Löffler, 1982). Extrapolating these trends and considering "eradication thresholds" (Nee, 1994), a complete loss of many typical halophilic organisms can be predicted for the near future in the region.

To acknowledge the biodiversity importance of the region and to obtain a more effective conservation instrument, the Neusiedler See–Seewinkel National Park was established in 1994. Since the peripheral parts and buffer zones are mainly cultivated countryside, and many of the typical habitat types are the result of moderate human impact (Herzig, 1991), a consensus exists that appropriate management measures are of utmost importance to reverse detrimental trends. A grazing programme (Rauer & Kohler, 1990), however, revealed that much basic information for a successful implementation is still lacking, and that more accompanying monitoring programmes are urgently needed.

Owing to their species richness and ecological specificity, spiders are appropriate indicators of habitat quality. We feel that data are necessary from four levels of complexity: (1) occurrence and distribution of species in the region; (2) assemblages of the major vegetation types; (3) habitat requirements of single species, in particular with regard to vegetation height. In this paper, we give an overview on efforts regarding these points. A fourth level, addressing the effects of spatio-temporal variation, disturbance frequency, patch dynamics, and habitat fragmentation, is largely a programme for the future.

Species inventory

The Seewinkel has been attracting zoologists for a long time (Löffler, 1982, and references therein). However, the first comprehensive spider inventory of the region was provided only in the fifties (Nemenz, 1958). A species accumulation curve (Gaston, 1996) can be used to assess the degree of completeness achieved by the studies performed in the region since then (cf. Thaler, 1980). With increasing sampling effort, the growth of the cumulative species number should be expected to dwindle, though a strict asymptotic behaviour cannot be expected, owing to the turnover in the species pool by immigration and extinction. The curve displayed in Figure 2 looks rather like the lower branch of a sigmoidal function than like an asymptote, and, compared to other Central European species inventories (e.g. Platen *et al.,* 1995), the total of 213 species reached so far seems much too low for a nearly complete list. Thus, even basic faunistic information is inadequate in the region. The spider fauna of many Seewinkel regions (e.g. Hanság, Seedamm) is still completely unexplored.

Even for spider species which are traditionally recognized as highly typical elements of the region, the state of knowledge is often unsatisfactory. *Lycosa singoriensis* (Laxmann) is the largest Central European spider. Distributed across the Eurasian steppe belt, it reaches its westernmost outpost in Eastern Austria (Kratochvíl, 1932). Although it has been mentioned in many entomological publications on the region (e.g. Machura, 1935; Mazek-Fialla, 1936; see also references in Milasowszky & Zulka, 1996), its local distribution and habitat requirements have never been assessed in detail. When mapping its local occurrence (Milasowszky & Zulka, 1996), we found 8 sites housing 14 colonies that can be grouped into 3 isolated areas (Fig. 1). While prospects for the colonies around Illmitz seem to be good, colonies on the eastern salt pans are small, isolated and doomed to extinction.

	Numbers caught	
	U	**G**
Dominant species (>100 individuals)		
Pardosa agrestis (Westring)	4	1482
Ozyptila simplex (O. P.-Cambridge)	134	561
Pardosa prativaga (L. Koch)	587	71
Silometopus reussi (Thorell)		259
Zelotes mundus (Kulczyński)		170
Pirata latitans (Blackwall)	152	
Pocadicnemis juncea Locket & Millidge	129	3
Trochosa ruricola (de Geer)	74	54
Syedra apetlonensis Wunderlich	105	4
Species of conservation interest		
Crustulina sticta (O. P.-Cambridge)	1	1
Enoplognatha mordax (Thorell)	1	
Silometopus bonessi Casemir	2	1
Tallusia vindobonensis (Kulczyński)	4	
Trichopterna thorelli (Westring)	39	
Arctosa figurata (Simon)		1
Lycosa singoriensis (Laxmann)		1
Pardosa cribrata Simon		52
Pardosa maisa Hippa & Mannila	26	
Argenna patula (Simon)	1	13
Clubiona subtilis L. Koch	24	9
Haplodrassus minor (O. P.-Cambridge)	12	28
Micaria romana L. Koch		8
Zora armillata Simon	13	
Thanatus arenarius Thorell	1	8
Thanatus striatus C. L. Koch	2	9
Sitticus inexpectus Logunov & Kronestedt		6

Table 1: Dominant and rare species in ungrazed (U) and grazed (G) meadows in the Seewinkel. A complete list is given in Zulka *et al*. (1997).

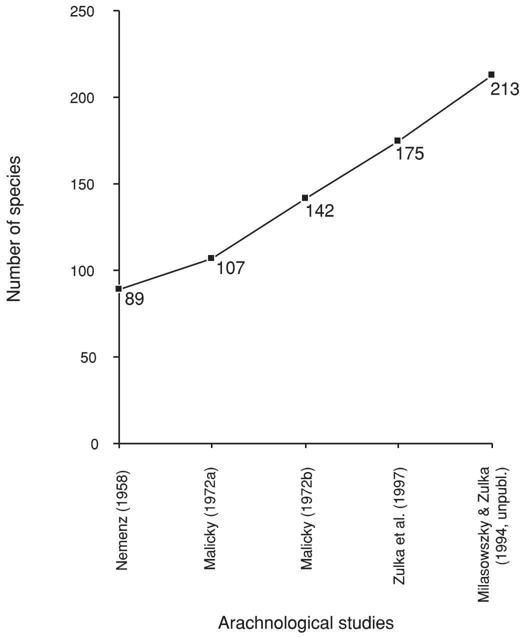

Fig. 2: Species accumulation curve. Development of the spider species inventory in the Seewinkel region, plotted as cumulative number of recorded species against successive studies.

Species assemblages

As described, one of the major problems is the spread of reed vegetation, overgrowing salt pan shores and open grassland. Grazing management as a conservation tool (Rauer & Kohler, 1990) was accompanied by research on grazing effects. Among others, invertebrates of a grazed and an ungrazed meadow were recorded by pitfall trapping (performed from 9 April to 26 October 1990: Lethmayer, 1992). The ungrazed meadow contains a number of rare wetland species (Table 1, see also Zulka *et al.,* 1997), e.g. *Trichopterna thorelli* (Westring), *Clubiona subtilis* L. Koch and *Pardosa maisa* Hippa & Mannila (see below). *Syedra apetlonensis* Wunderlich, a species recently described from the Seewinkel pastures (Wunderlich, 1992) and named after a village in the salt pan region (Fig. 1), also occurs abundantly in this habitat.

In contrast, the grazed meadow can be regarded as a compound assemblage of disturbance tolerators (e.g. *Pardosa agrestis* (Westring)) and halophilic species (e.g.

Silometopus reussi (Thorell), *Pardosa cribrata* Simon). *Zelotes mundus* Kulczyński, almost forgotten but recently redescribed (Bauchhenss *et al.,* 1997), is one the dominant species of this assemblage (Table 1). The description of *Sitticus inexpectus* Logunov & Kronestedt is based in part on material from the Seewinkel region (Logunov & Kronestedt, 1997). While the spider occurred in the grazed meadow with only a few specimens, it is quite frequent in the salt pan littorals.

When compared to 207 grassland spider assemblages from Central Europe using Sørensen's index, the highest similarity was found between the two Seewinkel assemblages (Zulka *et al.,* 1997). Thus, from their faunal composition, they occupy a rather remote position. From a conservation point of view, both assemblages are of high value, yet for very different reasons. Consequently, grazing management should provide a patchwork of short-grassed and high-sward areas, which is usually realized by sufficiently low grazing rates.

Habitat analysis

A comparison between a few assemblages cannot usually provide information about the effect of a particular ecological factor, because of compounding factors. In order to try to disentangle ecological relationships between habitat conditions and the occurrence of species, we sampled 60 littoral sites during three 10-day periods (June, July and September) and 20 sites in April by pitfall trapping (3 glass jars each). We recorded 14 continuous and 5 categorical variables for each trapping period. Even for rare species like *Pardosa maisa*, information can be gained in this way. Lowest error probabilities were found for the association with the categorical variable "waterline" (Fisher's exact test, $P = 0.014$), and for the preference for short-grassed sites (U-test between variable values of occupied and unoccupied sites, $P = 0.064$; Milasowszky & Zulka, 1998). Significance levels were not Bonferroni-adjusted, and these habitat relationships remain to be confirmed by larger data sets and experiments, but the preference for sites with wet or flooded soil agrees with the habitat descriptions in the literature (e.g. Miller & Obrtel, 1975, sub *Pardosa* sp.; Kupryjanowicz, 1995).

Discussion and outlook

Even if the approaches used so far might have shed some arachnological light onto conservation problems of the region, one might argue that true conservation biology (cf. Simberloff, 1988) has not yet begun. According to the "intermediate disturbance hypothesis" (Huston, 1979), species diversity is a curvilinear function of disturbance frequency, with an optimum between very high disturbance and no disturbance at all. This concept seems to be very important for the problems of the region: extensive grazing is regarded as beneficial, but how much is extensive, in terms of visiting frequency of the herd, time spent in one site, number of animals/ha, pasture size and geometry? Salt pans drying out early in the year are as useless as ponds with stabilized water level, as neither habitat provides large nutrient-rich drying-out littorals. But what is the optimal flooding frequency?

Answering these questions requires a landscape ecology approach and the assessment of the spatio-temporal variability: hence, the observation of a large area over several years. But even recording of variables related to management, such as grazing intervals per site, may not be feasible given the present grazing practice. Although the funding situation has considerably improved with a consensus on the need for National Park management research (Herzig, 1991), such a programme very probably lies beyond any budget possibilities.

In these circumstances, "traditional" approaches regain importance in pinpointing those species which can be used as *pars pro toto*, or in New's (1995) terms as "umbrella" and "flagship" species. Monitoring such selected species will be cheaper, easier and more reliable, since methods can be used that are specifically designed for the organism under observation (Underwood, 1996). A carefully selected combination of species, typical for habitats of the region, of high conservation value, of different requirements and/or life-history strategies, may provide only a little less relevant information than the animal group as a whole. Efforts to measure environmental variables will be high nevertheless, but animal sampling and identification labour can be limited in this way.

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