

Biodiversity coverage of Austrian National Parks

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To inform about the biodiversity coverage of the Austrian National Parks, data on species occurrence have been compiled and aggregated. Data were collated, assigned to commonly accepted taxonomic or typological concepts and matched with current national checklists. Similarly, national park coverage of habitat types listed in the Annex I of the EU Habitats Directive has been assessed. Total coverage of all national parks combined ranged from 69 % for vascular plants (excluding apomictic taxa, aliens and extinct species) to 94 % for breeding birds. About 80 % of Austrian habitat types listed in the Annex I of the European Union Habitats Directive are represented within the boundaries of the Austrian national parks. With a coverage of 68 % of Austrian breeding birds, Neusiedler See – Seewinkel National Park is a hotspot of bird diversity, whereas 74 % of the Austrian fish fauna use the Donau-Auen National Park in one or another way. By contrast, the alpine national parks Gesäuse, Kalkalpen and Hohe Tauern are hotspots for Austrian endemic and subendemic species. Vascular plant species richness is higher in those alpine national parks and they protect more than twice the number of Austrian Annex I habitat types compared to the eastern national parks. National Park Thayatal shows an intermediate position between alpine and Pannonian national parks regarding species composition and an extraordinarily high species richness compared to its small area. The high overall coverage of species and habitats of Austrian national parks within a comparatively small area of 3 % of the Austrian territory is the result of complementarity between Pannonian lowland national parks that protect species of open wetland, dry grassland, salt pans and floodplains on the one hand and alpine national parks harboring species of woodland and mountain habitats on the other hand. Despite this high coverage, many species of conservation importance live beyond national park borders, particularly in the southern Alps and in the western Austrian states Vorarlberg and Tyrol. In summary, the current analyses highlight the role of the national parks in Austrian biodiversity conservation; national parks are cornerstones of a comprehensive biodiversity conservation system in Austria.

ZULKA K.P., GILLI C., PATERNOSTER D., BANKO G., SCHRATT-EHRENDORFER L. & NIKLFELD H., 2022: Biodiversitätsabdeckung österreichischer Nationalparks.

Um einen Überblick zu gewinnen, welchen Anteil der österreichischen Biodiversität die sechs Nationalparks abdecken, wurden Artnachweise gesammelt, organisiert und mit nationalen Checklisten abgeglichen. In gleicher Weise wurde die Abdeckung der Lebensraumtypen, die im Anhang I der Flora-Fauna-Habitat-Richtlinie aufgelistet sind, ermittelt. Die Abdeckung reicht von 69 % für die Gefäßpflanzen (außer Apomikten, gebietsfremde und ausgestorbene Arten) bis zu 94 % bei den Brutvögeln. Etwa 80 % der Anhang-I-Lebensraumtypen der Flora-Fauna-Habitat-Richtlinie sind in den Nationalparks repräsentiert. Mit 68 % Faunenabdeckung ist der Nationalpark Neusiedler See – Seewinkel ein Hotspot der Vogel-Artenvielfalt. Im Nationalpark Donau-Auen wurden 74 % der österreichischen Fischarten nachgewiesen. Im Gegensatz dazu sind die alpinen Nationalparks Gesäuse, Kalkalpen und Hohe Tauern Hotspots der in Österreich endemischen und subendemischen Arten; die Gefäßpflanzenvielfalt ist in diesen alpinen Nationalparks höher und sie beherbergen fast die doppelte Anzahl von Anhang-I-Lebensraumtypen verglichen mit den östlichen drei Tieflands-Nationalparks. Der Nationalpark Thayatal steht von seiner Artenzusammensetzung her zwischen den östlichen und den alpinen Nationalparks und zeigt im Verhältnis zu seiner geringen Ausdehnung einen sehr hohen Artenreichtum.

Die hohe Biodiversitäts-Abdeckung der österreichischen Nationalparks auf weniger als 3 % der Landesfläche wird als Folge der Komplementarität zwischen ihnen interpretiert: Die östlichen Tieflands-Nationalparks beherbergen Offenland-, Trockenrasen-, Feuchtgebiets-, Salzstandorts- und Flussauen-Arten; die alpinen Nationalparks ergänzen dieses Set mit Wald- und Gebirgsarten. Trotz der hohen Abdeckung leben

zahlreiche naturschutzrelevante Arten außerhalb der Nationalparks, insbesondere in den Südalpen und in den westlichen Bundesländern Vorarlberg und Tirol. Insgesamt unterstreicht die vorliegende Studie die Rolle der Nationalparks im österreichischen Naturschutz; Nationalparks sind Kernbestandteile eines umfassenden Biodiversitätsschutzsystems in Österreich.

Keywords: National parks, biodiversity coverage, checklist, gap analysis, systematic conservation planning.

Introduction

Biodiversity is in global decline (IPBES 2019). The current biodiversity crisis has been compared to the six geological mass extinctions in global history (BARNOSKY et al. 2011). Dramatic reductions in insect numbers illustrate a rapid deterioration of biodiversity also in Central Europe (HALLMANN et al. 2017, SEIBOLD et al. 2019). Apparently, large population declines are no longer restricted to sensitive demanding Red-Listed specialized species, but are beginning to affect a large set of common species as well.

National parks are a major conservation tool to counteract biodiversity declines. Between 1981 and today, six Austrian National parks have been established. The national parks Hohe Tauern, Neusiedler See – Seewinkel, Donau-Auen, Kalkalpen, Thayatal and Gesäuse have been positioned into landscape of extraordinary beauty and high ecological significance, encompassing, among others, the highest mountain in Austria, the westernmost alkaline salt pan area in Eurasia and the most important large-scale European floodplain corridor of the Danube River. On the other hand, all six national parks combined cover only 2,8 % of the Austrian total land area, with the National Park Hohe Tauern alone comprising 2,1 %. The smallest park, Thayatal National Park, measures only 13 km².

The species-area relationship, the frequently observed pattern of increasing species numbers with increasing area, albeit at a declining increase rate, has been called one of the few universal laws in ecology (SCHOENER 1976). Following this theory, the very limited area of Austrian national parks might be indicative of a poor coverage of Austria's biodiversity. On the other hand, Austria's national parks are situated in unique landscapes with rare habitat types, such as salt pans, wetlands, floodplains or high mountain environments. These habitat types harbor highly specialized species, which complement the pool of common species present in any national park. Judged from this perspective, a coverage far beyond the constraints imposed by the limited area could be possible.

Since their inception, the Austrian national parks have made substantial efforts to compile inventories of their biodiversity assets. In this way, a very large data body has been accumulated (e. g. MARINGER 2018). To date, these data have been collected individually and stored separately; no over-arching analyses across all national parks have ever been attempted. Hence, the exact amount of biodiversity covered by the Austrian national parks individually and collectively was not known.

In a project commissioned by National Parks Austria, Umweltbundesamt – Environment Agency Austria and Department of Botany and Biodiversity Research at the University of Vienna joined forces to assemble individual national park checklists of vascular plants, vertebrates, endemic/subendemic species and Habitats Directive Annex I habitat types and compared them to Austrian checklists developed and maintained at their institutions. The project was designed to provide a comprehensive overview of the biodiversity assets pro-

tected in Austrian national parks. Data on vertebrates and vascular plants have been compiled for decades; consequently, it is likely that the regional species pools of the national parks have been sufficiently and exhaustively documented. For the habitat types in Annex I of the habitat directive, a national documentation scheme has been operating at Umweltbundesamt – Environment Agency Austria for years. For endemic species, the comprehensive compilation in RABITSCH & ESSL (2009) provided a national reference for an overarching comparison of the endemic/subendemic species in the national parks. A detailed account of the project results and data has been compiled in Zulka et al. (2021); here, we summarize the most important results and provide some additional cross-taxon analyses.

Clearly, the main focus of the project was the biodiversity within the boundaries of the national parks. However, the analyses shed also light on the gaps of the current national park system and identify species that are threatened but not covered by any national park area. Thus, the results may also inform about a potential future development of the Austrian protected area network.

Material and Methods

Coverage for vertebrate and vascular plant species

Species lists for the national parks were generated from the national park species inventory databases and/or were submitted as pre-compiled lists to Umweltbundesamt – Environment Agency Austria and to the Department of Botany and Biodiversity Research, University of Vienna.

The Austrian national checklist of mammals was based on SPITZENBERGER (2005) and SPITZENBERGER (2002). The list was complemented with *Myotis alcathoe* VON HELVERSEN & HELLER 2001 (Alcathoe bat, newly recorded for Austria in SPITZENBERGER et al. 2008), *Myotis dasycneme* BOIE, 1825 (pond bat; first Austrian record in REITER et al. 2010), *Tadarida teniotis* RAFINESQUE, 1814 (European free-tailed bat; reported for Austria in DOBNER 2010). *Mus musculus* and *Mus domesticus* are now treated as subspecies (justification in SILVER 1995, see also MUSSER et al. 2016), whereas the separation of *Arvicola scherman* from *Arvicola amphibius* (= *Arvicola terrestris* in SPITZENBERGER 2002, 2005) seems to be increasingly appreciated. From this national checklist of 104 species, non-native alien species were excluded, which led to a reference set of 94 Austrian mammal species for the calculation of national park coverage proportions.

For the national reference of Austrian breeding birds, we used DVORAK et al. (2017). Taxon concepts and species names were aligned with RANNER (2017) and HBW & BIRDLIFE International (2019). Species no longer breeding in Austria (category RE in DVORAK et al. 2017; 16 species) were excluded for the calculation of coverage proportions, except for the Bearded Vulture *Gypaetus barbatus*, which has been reintroduced in the Alps (FREMUTH et al. 2008).

The reptile and amphibian checklists are based on GOLLMANN (2007) and CABELA et al. (2001); nomenclature of the reptiles has been updated according to UETZ et al. (2019), nomenclature of amphibians follows AMPHIBIAWEB (2020). *Lissotriton helveticus*, the Palmate Newt, was added to the Amphibia checklist, since this species had been confirmed as an Austrian species in 2008 (GRABHER & NIEDERER 2011). Records of *Triturus cristatus* from the national park Thayatal database were reassigned to *Triturus carnifex* (MILEK,

pers. comm.; GOLLMANN, pers. comm.; following the analyses in LAGLER [2015]), records from Donau-Auen National Park were reassigned to *Triturus dobrogicus* (C. BAUMGARTNER, in litt.).

The starting point for the compilation of the Austrian fish reference was the Austrian Red List (WOLFRAM & MIKSCHI 2007). The split of *Eudontomyzon mariae*, *Salmo trutta*, *Gobio albipinnatus*, *Rutilus pigus*, already discussed in WOLFRAM & MIKSCHI (2007), has been performed in the meantime (FROESE & PAULY 2020). “*Barbus* sp.” (*petenyi* group) in WOLFRAM & MIKSCHI (2007) is associated with *Barbus carpathicus*, as delineated in FROESE & PAULY (2020). “*Cobitis* sp.” in WOLFRAM & MIKSCHI (2007) probably refers to *Cobitis elongatoides* and *Cobitis taenia*. The species “Kröpfung” of Attersee in WOLFRAM & MIKSCHI (2007) corresponds to the taxon concept of *Coregonus austriacus* VOGT, 1909 in KOTTELAT & FREYHOF (2007). All of these taxonomic interpretations are preliminary. The checklist has been complemented with *Romanogobius skywalkeri* FRIEDRICH, WIESNER, ZANGL, DAILL, FREYHOF & KOBLMÜLLER, 2018, a newly described species (FRIEDRICH et al. 2018; WOLFRAM, pers.comm.). Depending on the number of alien species included, the full Austrian fish checklist comprises around 100 species. For the coverage calculations, we excluded introduced species and extinct species (species in Red List categories RE and EX in WOLFRAM & MIKSCHI 2007 and *Salmo schiefermuelleri*), which led to a reference set of 70 Austrian native fish species.

A recently published checklist of Austrian vascular plants (GILLI et al. 2019) provided the reference set for the calculation of the vascular plant biodiversity coverage. Plant distribution data came from the Austrian flora mapping project (NIKLFELD, SCHRATT-EHRENDORFER et al., unpublished) and from several private and institutional sources. Records prior to 1950 were excluded. All data records were thoroughly checked for plausibility and taxonomic viability. From the remaining data, vascular plant species checklists for all national parks were generated and coverage proportions were calculated. For the analyses, only native and archaeophytic plant species were considered. Extinct species were excluded from the coverage proportion calculations, as were subspecies and varieties. Secondary occurrences of native species with ephemeral populations in national parks were not considered for the six national park checklists; apomictic taxa with a large number of poorly known species (*Alchemilla*, *Hieracium*, *Ranunculus auricomus* agg., *Rubus* Sect. *Rubus*, *Taraxacum*) were treated as aggregates. With a few exceptions, taxon concepts and nomenclature followed FISCHER et al. (2008).

Coverage of Austrian habitat types

Several Austrian habitat classifications systems were considered for the assessment of habitat diversity. Owing to the comprehensive national coverage of the distribution data, we used the system of Annex I of the EU Habitats Directive (COUNCIL OF THE EUROPEAN UNION 2013). This system comprises habitat types of European importance, however, not all habitat types occurring in Austrian national parks are listed.

For all of the six national parks, a list of Annex I habitat types was compiled. The selection was based on a database maintained and managed in Umweltbundesamt – Environment Agency Austria on behalf of the Austrian provinces containing the Habitats Directive Annex species and habitat records (Umweltbundesamt – Environment Agency Austria 2020). As a spatial reference, we used the 3' × 5' grid (grid cell size 5.55 × 6.25 km) which is also used for the Austrian flora mapping project. We restricted our analysis to data recorded

between 2013 and 2018; this restriction has led to omission of some habitat types that are present in the national parks but were not recorded in that period.

Faunal and floral similarity

Using the vertebrate and plant presence data, we calculated a hierarchical cluster analysis (LEGENDRE & LEGENDRE 1998). As a proximity measure, we calculated Jaccard's coefficient of community (LEGENDRE & LEGENDRE 1998, p. 256), which is computed as $J = a/(a+b+c)$ with a being the number of species present in both national parks A and B, b the number of species present only in national park A and c the number of species present only in national park B.

This similarity matrix was then subjected to hierarchical cluster analysis using the UPGMA algorithm (unweighted arithmetic average clustering, LEGENDRE & LEGENDRE 1998 p. 319; corresponding to "between-groups linkage" in SPSS terminology). The multivariate analyses were performed with SPSS Windows 10.0 (IBM INC.).

Uniqueness

If five national parks already existed in Austria and a sixth national park would be added, how would that change the national park coverage of all parks combined? In other words, how unique are Austria's national parks within the set of six national parks? To answer these questions, we calculated the number of species restricted to one of the six national parks within the national park network. These species would be added to the national park species richness set if the national park were included into the set of national parks.

Species coverage of threatened vertebrates

About one third of the Austrian vertebrates is listed in one of the Red List Categories CR (Critically Endangered), EN (Endangered) or VU (Vulnerable) (SPITZENBERGER 2005, GOLLMANN 2007, WOLFRAM & MIKSCHI 2007, DVORAK et al. 2017). In addition to the coverage calculations for all species, we computed the proportions only for these threatened vertebrates in the six national parks.

Coverage of endemic and subendemic species

Endemic species are species with a small range restricted to a particular region; Austrian endemic species are species of which all global populations are restricted to Austria, Austrian subendemic species are those with at least 75% of their populations in Austria, as defined in RABITSCH & ESSL (2009). Endemic species are of primary concern in biodiversity conservation, since (1) their extinction risk is frequently elevated owing to the small range and small total abundance, (2) responsibility for their global survival rests with the region of their occurrence.

Data for the present analyses are primarily from this atlas of Austrian endemic and subendemic species (RABITSCH & ESSL 2009). Species distribution map grid cells (3' x 5') covering a national park were compared with all grid cells of the species in Austria. This allows not only a compilation of national park endemics/subendemics checklists, but also allows for an assessment of the concentration of the species in particular regions.

Atlas data were modified and updated in three ways: (1) Owing to the coarseness of the grid cells, endemic species may be assigned to a national park that, in reality, live outside

of its borders: If the species is listed for a national park grid cell, but is known to live in habitat types only occurring outside of the national park, it was excluded from the national park checklist. (2) If a species has lost its status as an Austrian endemic or subendemic species owing to new records beyond the known range, it was deleted from the respective national park checklist. However, no such validation could be done for all species in the database of the Austrian endemism atlas (RABITSCH & ESSL 2009). The overall Austrian reference number may therefore be too high. Therefore, no coverage proportions were calculated for endemic and subendemic species. (3) Within the national parks, several programmes have been performed to uncover new and to better document already known endemic species, in particular in Gesäuse National Park and in Kalkalpen National Park. Endemic species newly discovered since the publication by RABITSCH & ESSL (2009) were added to the national park checklists.

The national concentration of an endemic or subendemic species was calculated as the proportion of national park grid cells divided by the number of occupied grid cells in Austria. For endemics, the resulting figure was multiplied by 100 for endemic and by 75 for subendemic species. The result can be interpreted as an approximative measure of the proportion of the world population of a species living in a particular Austrian national park.

Then, the resulting species-specific concentration measure numbers were summed up across all species occurring in a national park to obtain a comprehensive measure for the park.

Results

Species coverage for vertebrates, vascular plants and Habitats Directive Annex I habitats

A high percentage of Austria's biodiversity is located and protected in the Austrian national parks (Fig. 1). Almost 90 % of the native Austrian vertebrate fauna is occurring in at least one of the Austrian national parks. Among single national parks, species coverage ranges from 30 % (Kalkalpen) to 60 % (Neusiedler See – Seewinkel). For plant species, numbers are around 30 % in the eastern lowland national parks and around 35 % in the alpine national parks, yet the overall coverage of all parks combined is about 70 % of the Austrian native flora (Fig. 1). The coverage of habitat types of the Annex I of The European Union Habitats Directive is almost twice as high in the alpine national parks compared to the eastern Austrian national parks. More than 80 % of the Austrian Annex I habitat types are located in one or more national parks.

Coverage among vertebrate groups

Between 79 % (reptiles) and 94 % (breeding birds) of the Austrian native vertebrate species (excluding alien species and extinct species, Tab. 1) are occurring in Austrian national parks. The coverage is comparatively homogeneous for mammals among the six national parks, but uneven for birds, amphibians and fishes. Almost 70 % of the Austrian bird species breed in Neusiedler See – Seewinkel National Park, and almost 75 % of Austria's native fish fauna has been recorded in Donau-Auen National Park. These two national parks are also biodiversity hotspots for reptiles and amphibians. Table 2 provides a comprehensive checklist of Austrian vertebrates and their occurrences in Austrian national parks.

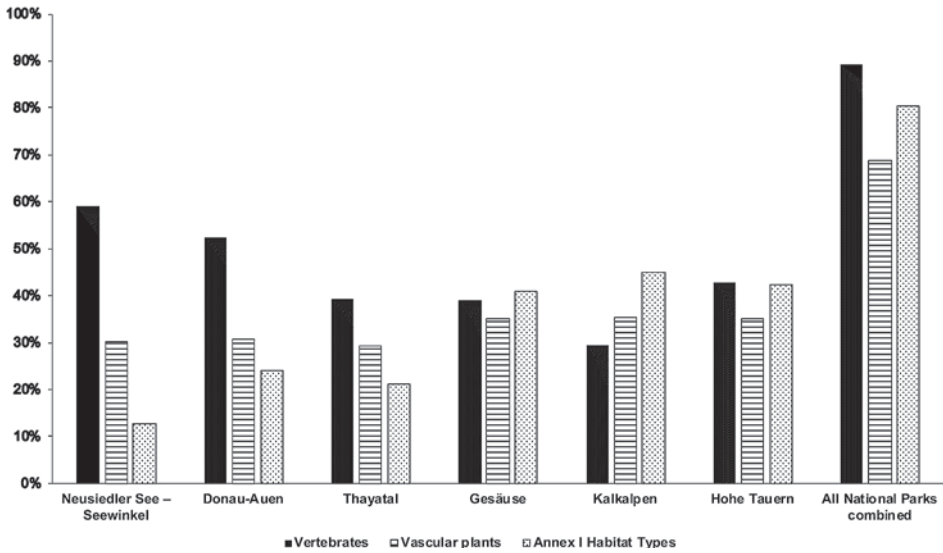


Fig. 1: Representation of Austrian native vertebrate species, native vascular plant species and Habitats Directive Annex I habitat types in Austrian national parks. – Abb. 1: Abdeckung der österreichischen einheimischen Wirbeltier- und Gefäßpflanzenarten sowie der Lebensraumtypen des Anhangs 1 der Fauna-Flora-Habitat-Richtlinie.

Tab. 1: Representation of native vertebrate species in Austrian national parks. – Tab. 1: Abdeckung der einheimischen Wirbeltierarten in den österreichischen Nationalparks.

	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern	All National Parks combined	Austria total
Species numbers of native vertebrate species								
Mammals (Mammalia)	56	38	55	51	45	55	82	94
Breeding Birds (Aves)	146	105	81	82	60	110	202	215
Reptiles (Reptiila)	9	8	7	7	7	5	11	14
Amphibians (Amphibia)	12	14	11	7	7	4	18	21
Fishes (Pisces)	22	52	9	15	3	3	57	70
Proportion of native vertebrate species								
Mammals (Mammalia)	60%	40%	59%	54%	48%	59%	87%	
Breeding Birds (Aves)	68%	49%	38%	38%	28%	51%	94%	
Reptiles (Reptiila)	64%	57%	50%	50%	50%	36%	79%	
Amphibians (Amphibia)	57%	67%	52%	33%	33%	19%	86%	
Fishes (Pisces)	31%	74%	13%	21%	4%	4%	81%	

Similarity of vertebrate fauna and vascular plant flora among the national parks

Cluster analysis showed two distinct clusters, one with alpine national parks, one with Pannonian national parks. Thayatal National Park had an intermediate position, it was attached to the alpine national park cluster for vertebrates and to the Pannonian national park cluster for vascular plants (Fig. 2). Gesäuse National Park and Kalkalpen National Park showed a high degree of similarity. Vertebrates of Hohe Tauern National Park were also closely attached within this cluster, whereas vascular plants showed a lower degree of similarity. National Parks Neusiedler See – Seewinkel and Donau-Auen are more mutually distinct than the alpine national parks with respect to vertebrates, less so with regard to vascular plants (Fig. 2).

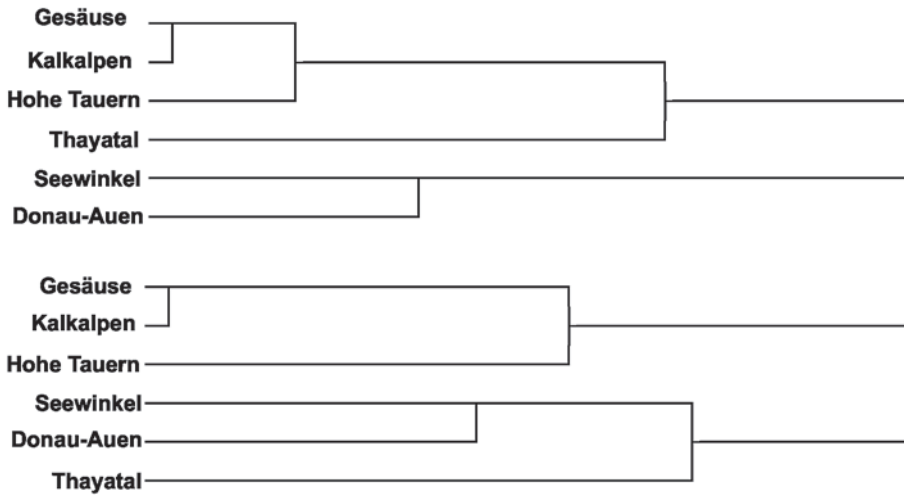


Fig. 2: Similarity of vertebrate faunas (above) and vascular plant floras (below) between the six Austrian national parks, measured by Jaccard's community coefficient. Hierarchical clustering, UPGMA method. – Abb. 2: Ähnlichkeit der Wirbeltierfauna (oben) und der Gefäßpflanzenflora (unten) zwischen den sechs österreichischen Nationalparks, gemessen mit dem Jaccard-Index. Hierarchische Clusteranalyse mit der UPGMA-Methode.

Uniqueness

The highest species increase of a single national park to the species coverage of the remaining parks comes from Neusiedler See – Seewinkel National Park with 58 additional species (Fig. 3); corresponding to 23 % of the vertebrate national park fauna, 15 % of the vertebrate fauna of all national parks and 13 % of the Austrian current native vertebrate fauna. For vascular plants, the highest coverage boost is obtained when including Hohe Tauern National Park into the set of Austrian National Parks with 230 additional species (21 % of the vascular plant flora of the park, corresponding to 12 % of the national park set richness and 8 % of the Austrian native vascular plant flora richness, Fig. 3). Uniqueness is high for Donau-Auen National Park with regard to vertebrates and vascular plants; it is lowest for Gesäuse National Park and Kalkalpen National Park (Fig. 3).

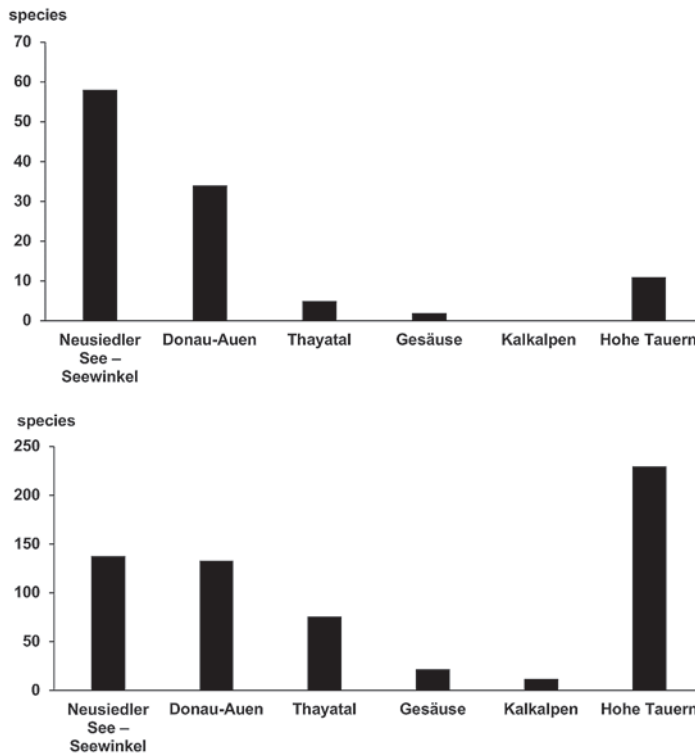


Fig. 3: Coverage improvement when adding one national park to the set of the other five national parks for vertebrates (above) and plants (below). – Abb. 3: Abdeckungsverbesserung beim Hinzufügen des jeweiligen Nationalparks zum Set der anderen Nationalparks für Wirbeltiere (oben) und der Gefäßpflanzenflora (unten).

Vertebrate species not covered in Austrian national parks

In Table 2, all Austrian vertebrate species are listed along with their occurrence in Austrian national parks. For species without any occurrence in any of the national parks, reasons for their absence are given. Most frequently, species are not covered within the national park set because of geographical constraints (Fig. 4). Several of these uncovered species have a western European range; overlap with Austria's national area is limited and confined to the western state Vorarlberg (e. g. *Crocidura russula*, *Sorex coronatus*, *Lissotriton helveticus*). Two reptiles (*Iberolacerta horvathi*, *Vipera ammodytes*) overlap into Austrian territory at their northern range border and occupy here a small and shrinking (*V. ammodytes*) range area.

Several species, some of them Red-Listed as Endangered or Critically Endangered (Tab. 2), occupy a range so small that it is not covered by any national park (e. g. Bavarian Vole *Microtus bavaricus*, *Coregonus* spp. restricted to individual prealpine lakes).

A substantial number of species has not been recorded because of taxonomical issues (e. g. species has been redelineated) or because they have been only recently discovered on Austrian territory (e. g. *Apodemus agrarius*, *Taderida teniotis*) or are currently being re-established in Austria (*Strix uralensis*). With expanding ranges and better knowledge of these species, they might end up on national park checklists in the future (Fig. 4).

Tab. 2: Occurrence of vertebrates in Austrian national parks, along with their Red List threat category (SPITZENBERGER 2005, DVORAK et al. 2017, GOLLMANN 2007, WOLFRAM & MIKSCHI 2007). For species not occurring in any one of the six national parks, a potential reason is given². – Tab. 2. Vorkommen von Wirbeltieren in den österreichischen Nationalparks; mit der Rote-Liste-Gefährdungskategorie (SPITZENBERGER 2005, DVORAK et al. 2017, GOLLMANN 2007, WOLFRAM & MIKSCHI 2007). Wenn Arten in keinem der sechs Nationalparks vorkommen, wird ein möglicher Grund angegeben².

Species	National Park								All National Parks combined	Red List Category ¹	Reason for non-coverage ²	Notes
	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Alces alces</i> , Elk			●						●	NE		
<i>Apodemus agrarius</i> , Striped Field Mouse									●	NE	New	3
<i>Apodemus alpicola</i> , Alpine Mouse									●	NT	Tax	
<i>Apodemus flavicollis</i> , Yellow-necked Mouse	●		●	●	●	●	●	●	●	LC		
<i>Apodemus sylvaticus</i> , Wood Mouse	●		●	●	●	●	●	●	●	LC		
<i>Apodemus uralensis</i> , Pygmy Field Mouse	●								●	DD		
<i>Arvicola amphibius</i> , European Water Vole	●						●		●	LC		4
<i>Arvicola scherman</i> , Montane Water Vole									●	NA	Tax	4
<i>Barbastella barbastellus</i> , Barbastelle		●	●	●	●	●	●	●	●	VU		
<i>Canis aureus</i> , Golden Jackal	●								●	NE		
<i>Canis lupus</i> , Grey Wolf							●		●	RE		
<i>Capra ibex</i> , Alpine Ibex				●	●	●	●	●	●	LC		
<i>Capreolus capreolus</i> , Roe Deer	●	●	●	●	●	●	●	●	●	LC		
<i>Castor canadensis</i> , American Beaver									●	NE	Ali	5
<i>Castor fiber</i> , European Beaver	●	●	●	●					●	LC		
<i>Cervus elaphus</i> , Red Deer	●	●	●	●	●	●		●	●	LC		
<i>Cervus nippon</i> , Sika Deer									●	NE	Ali	5
<i>Chionomys nivalis</i> , Snow Vole				●	●	●	●	●	●	LC		
<i>Cricetus cricetus</i> , Common Hamster	●								●	VU		
<i>Crocidura leucodon</i> , Bi-coloured White-toothed Shrew	●	●							●	LC		
<i>Crocidura russula</i> , Greater White-toothed Shrew									●	VU	Geo	
<i>Crocidura suaveolens</i> , Lesser White-toothed Shrew	●	●	●						●	LC		
<i>Dama dama</i> , Fallow Deer			●						●	NE		5
<i>Dryomys nitedula</i> , Forest Dormouse							●	●	●	LC		

Species	National Park								All National Parks combined	Red List Category ¹	Reason for non-coverage ²	Notes
	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Eliomys quercinus</i> , Garden Dormouse							●	●	●	NT		
<i>Eptesicus nilsonii</i> , Northern Bat	●	●	●	●	●	●	●	●	●	LC		
<i>Eptesicus serotinus</i> , Serotine	●	●	●		●	●		●	●	VU		
<i>Erinaceus europaeus</i> , Western Hedgehog			●						●	NT		
<i>Erinaceus roumanicus</i> , Northern White-breasted Hedgehog	●		●						●	LC		
<i>Felis silvestris</i> , Wildcat			●						●	RE	6	
<i>Glis glis</i> , Fat Dormouse			●	●			●		●	LC	7	
<i>Hypsugo savii</i> , Savi's Pipistrelle	●	●	●						●	EN		
<i>Lepus europaeus</i> , Brown Hare	●	●	●	●	●	●	●	●	●	NT		
<i>Lepus timidus</i> , Mountain Hare				●	●	●	●	●	●	LC		
<i>Lutra lutra</i> , European Otter	●	●	●	●	●	●		●	●	NT		
<i>Lynx lynx</i> , Eurasian Lynx				●	●		●	●	●	EN		
<i>Marmota marmota</i> , Alpine Marmot				●		●	●	●	●	NT		
<i>Martes foina</i> , Beech marten	●		●	●	●	●	●	●	●	LC		
<i>Martes martes</i> , Pine marten	●		●	●	●	●	●	●	●	LC		
<i>Meles meles</i> , Badger	●		●	●	●	●	●	●	●	LC		
<i>Micromys minutus</i> , Harvest Mouse	●	●	●						●	NT		
<i>Microtus agrestis</i> , Field Vole			●	●		●	●	●	●	LC		
<i>Microtus arvalis</i> , Common Vole	●	●	●		●	●	●	●	●	LC		
<i>Microtus bavaricus</i> , Bavarian Vole										CR	Geo	
<i>Microtus liechtensteini</i> , Illyrian Vole										EN	Geo	
<i>Microtus oeconomus</i> , Root Vole	●								●	VU		
<i>Microtus subterraneus</i> , Common Pine Vole	●	●	●	●	●	●	●	●	●	LC		
<i>Miniopterus schreibersii</i> , Schreiber's Bat										RE	Ext	
<i>Mus musculus</i> , House Mouse	●	●	●				●	●	●	LC		8
<i>Mus spicilegus</i> , Steppe Mouse	●								●	EN		
<i>Muscardinus avellanarius</i> , Common Dormouse			●	●	●	●	●	●	●	LC		
<i>Mustela erminea</i> , Stoat	●		●	●	●	●	●	●	●	LC		
<i>Mustela eversmanii</i> , Steppe Polecat	●		●						●	EN		
<i>Mustela nivalis</i> , Weasel	●		●		●	●	●	●	●	LC		

Species	National Park								All National Parks combined	Red List Category ¹	Reason for non-coverage ²	Notes
	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Mustela putorius</i> , Western Polecat	●			●	●	●		●	●	NT		
<i>Myocastor coypus</i> , Coypu	●								●	NE		5
<i>Myodes glareolus</i> , Bank Vole	●	●	●	●	●	●	●	●	●	LC		9
<i>Myotis alcaethoe</i> , Alcaethoe Bat		●	●						●	NA		10
<i>Myotis bechsteinii</i> , Bechstein's Bat		●	●	●	●				●	VU		
<i>Myotis blythii</i> , Lesser Mouse-Eared Bat	●	●							●	CR		
<i>Myotis brandtii</i> , Brandt's Bat			●	●	●	●		●	●	VU		
<i>Myotis capaccinii</i> , Long-fingered Bat										NE	Gue	11
<i>Myotis dasycneme</i> , Pond bat		●	●						●	NA		10
<i>Myotis daubentonii</i> , Daubenton's Bat	●	●	●	●	●	●		●	●	LC		
<i>Myotis emarginatus</i> , Geoffroy's Bat		●	●	●	●				●	VU		
<i>Myotis myotis</i> , Greater Mouse-eared Bat	●	●	●	●	●	●		●	●	LC		
<i>Myotis mystacinus</i> , Whiskered Bat	●	●	●	●	●		●	●	●	NT		
<i>Myotis nattereri</i> , Natterer's Bat		●	●	●	●				●	VU		
<i>Neomys anomalus</i> , Miller's Water Shrew	●			●			●	●	●	LC		
<i>Neomys fodiens</i> , Water Shrew	●	●		●	●	●	●	●	●	NT		
<i>Neogale vison</i> , American Mink		●							●	NE		5, 12
<i>Nyctalus leisleri</i> , Leisler's Bat	●	●	●						●	VU		
<i>Nyctalus noctula</i> , Noctule	●	●	●	●	●		●	●	●	NE		
<i>Nyctereutes procyonoides</i> , Raccoon Dog	●		●		●				●	NE		5
<i>Ondatra zibethicus</i> , Muskrat	●	●							●	NE		5
<i>Oryctolagus cuniculus</i> , Rabbit	●								●	VU		
<i>Ovis orientalis</i> , Red Sheep			●	●			●	●	●	NE		5
<i>Pipistrellus kuhlii</i> , Kuhl's Pipistrelle	●					●		●	●	VU		
<i>Pipistrellus nathusii</i> , Nathusius pipistrelle	●	●	●	●	●				●	NE		
<i>Pipistrellus pipistrellus</i> , Common Pipistrelle	●	●	●	●	●	●	●	●	●	NT		
<i>Pipistrellus pygmaeus</i> , Soprano Pipistrelle	●	●	●	●	●		●	●	●	DD		
<i>Plecotus auritus</i> , Brown Long-Eared Bat	●	●	●	●	●		●	●	●	LC		
<i>Plecotus austriacus</i> , Grey Long-eared Bat	●	●	●						●	VU		
<i>Plecotus macrobullaris</i> , Grey Long-eared Bat										DD	Tax	

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Procyon lotor</i> , Raccoon					●		●	●	●	NE		5
<i>Rattus norvegicus</i> , Brown Rat	●		●	●			●	●	●	LC		
<i>Rattus rattus</i> , Black Rat	●								●	CR		
<i>Rhinolophus ferrumequinum</i> , Greater Horseshoe Bat										CR	Rec	
<i>Rhinolophus hipposideros</i> , Lesser Horseshoe Bat			●	●	●		●	●	●	VU		
<i>Rupicapra rupicapra</i> , Alpine Chamois				●	●	●	●	●	●	LC		
<i>Sciurus vulgaris</i> , Red Squirrel	●		●	●	●	●	●	●	●	LC		
<i>Sicista betulina</i> , Northern Birch Mouse				●		●	●	●	●	VU		
<i>Sicista subtilis</i> , Southern Birch Mouse										RE	Ext	
<i>Sorex alpinus</i> , Alpine Shrew				●	●	●	●	●	●	NT		
<i>Sorex araneus</i> , Common Shrew	●	●	●	●	●	●	●	●	●	LC		
<i>Sorex coronatus</i> , Miller's Shrew										VU	Geo	
<i>Sorex minutus</i> , Pygmy Shrew	●	●	●	●	●	●	●	●	●	LC		
<i>Spermophilus citellus</i> , European Ground Squirrel	●								●	EN		
<i>Sus scrofa</i> , Wild Boar	●	●	●	●	●	●	●	●	●	LC		
<i>Tadarida teniotis</i> , European Free-tailed Bat										NA	New	10
<i>Talpa europaea</i> , Common Mole	●		●	●	●	●	●	●	●	NT		
<i>Ursus arctos</i> , Brown Bear				●			●	●	●	VU		
<i>Vespertilio murinus</i> , Parti-coloured Bat	●	●	●	●	●	●	●	●	●	NE		
<i>Vulpes vulpes</i> , Red Fox	●	●	●	●	●	●	●	●	●	LC		
Birds												
<i>Acanthis flammea</i> , Common Redpoll				●		●	●	●	●	LC		
<i>Accipiter gentilis</i> , Goshawk		●	●	●	●	●	●	●	●	NT		
<i>Accipiter nisus</i> , Sparrow Hawk	●	●	●	●	●	●	●	●	●	LC		
<i>Acrocephalus arundinaceus</i> , Great Reed Warbler	●	●							●	LC		
<i>Acrocephalus melanopogon</i> , Moustached Warbler	●								●	VU		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Acrocephalus paludicola</i> , Aquatic Warbler										RE	Ext	
<i>Acrocephalus palustris</i> , Marsh Warbler	●	●	●						●	LC		
<i>Acrocephalus schoenobaenus</i> , Sedge Warbler	●	●							●	LC		
<i>Acrocephalus scirpaceus</i> , Reed Warbler	●	●							●	LC		
<i>Actitis hypoleucos</i> , Common Sandpiper		●		●		●	●	●	●	EN		
<i>Aegithalos caudatus</i> , Long-tailed Tit	●	●	●	●	●	●	●	●	●	LC		
<i>Aegolius funereus</i> , Tengmalm's Owl				●	●	●	●	●	●	LC		
<i>Alauda arvensis</i> , Sky Lark	●	●				●	●	●	●	NT		
<i>Alcedo atthis</i> , Kingfisher		●		●					●	NT		
<i>Alectoris graeca</i> , Rock Partridge						●	●	●	●	LC		
<i>Anas acuta</i> , Pintail	●								●	CR		
<i>Anas crecca</i> , Teal		●							●	EN		
<i>Anas platyrhynchos</i> , Mallard	●	●	●	●	●	●	●	●	●	LC		
<i>Anser anser</i> , Grey-lag Goose	●								●	LC		
<i>Anthus campestris</i> , Tawny Pipit										CR	Eco	
<i>Anthus pratensis</i> , Meadow Pipit							●	●	●	VU		
<i>Anthus spinoletta</i> , Water Pipit				●		●	●	●	●	LC		
<i>Anthus trivialis</i> , Tree Pipit	●	●	●	●	●	●	●	●	●	NT		
<i>Apus apus</i> , Swift	●	●				●	●	●	●	LC		
<i>Aquila chrysaetos</i> , Golden Eagle				●	●	●	●	●	●	LC		
<i>Aquila heliaca</i> , Imperial Eagle	●								●	EN		
<i>Ardea alba</i> , Great White Egret	●								●	LC		
<i>Ardea cinerea</i> , Grey Heron	●	●				●	●	●	●	NT		
<i>Ardea purpurea</i> , Purple Heron	●								●	VU		
<i>Asio flammeus</i> , Short-eared Owl	●								●	EN		
<i>Asio otus</i> , Long-eared Owl	●	●			●	●		●	●	LC		
<i>Athene noctua</i> , Little owl	●								●	EN		
<i>Aythya ferina</i> , Pochard	●								●	EN		
<i>Aythya fuligula</i> , Tufted Duck				●		●		●	●	LC		
<i>Aythya nyroca</i> , Ferruginous Duck	●								●	VU		
<i>Bonasa bonasia</i> , Hazel Grouse				●	●	●	●	●	●	NT		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Botaurus stellaris</i> , Bittern	●								●	VU		
<i>Bubo bubo</i> , Eagle Owl	●			●		●	●	●	●	LC		
<i>Bucephala clangula</i> , Goldeneye										VU	Geo	
<i>Burbinus oedicnemus</i> , Eurasian Stone-curlew										CR	Eco	
<i>Buteo buteo</i> , Buzzard	●	●	●	●	●	●	●	●	●	LC		
<i>Calidris pugnax</i> , Ruff										RE	Ext	
<i>Caprimulgus europaeus</i> , Nightjar		●								VU		
<i>Carduelis carduelis</i> , Goldfinch	●	●	●			●	●	●	●	LC		
<i>Carduelis citrinella</i> , Citril Finch							●	●	●	NT		
<i>Carpodacus erythrinus</i> , Scarlet Rosefinch							●		●	EN		
<i>Certhia brachydactyla</i> , Short-toed Tree Creeper	●	●	●							LC		
<i>Certhia familiaris</i> , Tree Creeper		●	●	●	●	●	●	●	●	LC		
<i>Charadrius alexandrinus</i> , Kentish Plover	●									EN		
<i>Charadrius dubius</i> , Little Ringed Plover	●	●								VU		
<i>Chlidonias niger</i> , Black Tern										RE	Ext	
<i>Chloris chloris</i> , European Greenfinch	●			●	●	●	●	●	●	LC		
<i>Ciconia ciconia</i> , White Stork	●	●								LC		
<i>Ciconia nigra</i> , Black Stork	●	●								NT		
<i>Cinclus cinclus</i> , Dipper				●	●	●	●	●	●	LC		
<i>Circus aeruginosus</i> , Marsh Harrier	●	●								NT		
<i>Circus cyaneus</i> , Hen Harrier										CR	Geo	
<i>Circus pygargus</i> , Montagu's Harrier	●									EN		
<i>Clanga pomarina</i> , Lesser Spotted Eagle										RE	Ext	
<i>Coccothraustes coccothraustes</i> , Hawfinch	●	●	●				●	●	●	LC		
<i>Columba oenas</i> , Stock Dove	●	●	●							LC		
<i>Columba palumbus</i> , Wood Pigeon, Ring Dove	●	●	●	●		●	●	●	●	LC		
<i>Coracias garrulus</i> , European Roller										CR	Geo	
<i>Corvus corax</i> , Raven	●		●	●	●	●	●	●	●	LC		
<i>Corvus corone</i> , Carrion Crow	●	●	●	●		●	●	●	●	LC		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Corvus frugilegus</i> , Rook	●								●	LC		
<i>Corvus monedula</i> , Jackdaw	●	●					●	●	●	LC		
<i>Coturnix coturnix</i> , Quail	●								●	LC		
<i>Crex crex</i> , Corncrake	●								●	VU		
<i>Cuculus canorus</i> , Cuckoo	●	●	●	●		●	●	●	●	LC		
<i>Cyanecula svecica svecica</i> , Red-spotted Bluethroat						●	●	●	●	CR		
<i>Cyanecula svecica cyanecula</i> , White-Spotted Bluethroat	●								●	EN		
<i>Cyanistes caeruleus</i> , Eurasian Blue Tit	●	●		●	●		●	●	●	LC		
<i>Delichon urbicum</i> , Common House Martin	●	●				●	●	●	●	NT		
<i>Dendrocopos leucotos</i> , White-backed Woodpecker				●	●		●		●	LC		
<i>Dendrocopos major</i> , Great Spotted Woodpecker	●	●		●	●	●	●	●	●	LC		
<i>Dendrocopos syriacus</i> , Syrian Woodpecker	●	●							●	NT		
<i>Dryobates minor</i> , Lesser Spotted Woodpecker	●	●							●	LC		
<i>Dryocopus martius</i> , Black Woodpecker	●	●	●	●	●	●	●	●	●	LC		
<i>Egretta garzetta</i> , Little Egret	●								●	EN		
<i>Emberiza calandra</i> , Corn Bunting	●	●							●	EN		
<i>Emberiza cia</i> , Rock Bunting										NT	Eco	
<i>Emberiza citrinella</i> , Yellowhammer	●	●	●			●	●	●	●	LC		
<i>Emberiza hortulana</i> , Ortolan Bunting										CR	Geo	
<i>Emberiza schoeniclus</i> , Reed Bunting	●	●							●	LC		
<i>Erithacus rubecula</i> , Robin	●	●	●	●	●	●	●	●	●	LC		
<i>Eudromias morinellus</i> , Eurasian Dotterel										CR	Geo	
<i>Falco cherrug</i> , Saker Falcon	●	●							●	EN		
<i>Falco naumanni</i> , Lesser Kestrel										RE	Ext	
<i>Falco peregrinus</i> , Peregrine Falcon				●	●				●	NT		
<i>Falco subbuteo</i> , Hobby	●	●				●		●	●	LC		
<i>Falco tinnunculus</i> , Kestrel	●	●		●	●	●	●	●	●	LC		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Falco vespertinus</i> , Red-footed Falcon	●								●	CR		
<i>Ficedula albicollis</i> , Collared Flycatcher	●	●	●	●	●				●	LC		
<i>Ficedula hypoleuca</i> , Pied Flycatcher			●	●	●				●	LC		
<i>Ficedula parva</i> , Red-breasted Flycatcher			●	●	●				●	NT		
<i>Fringilla coelebs</i> , Chaffinch	●	●		●	●	●	●	●	●	LC		
<i>Fulica atra</i> , Coot	●	●				●		●	●	LC		
<i>Galerida cristata</i> , Crested Lark	●								●	NT		
<i>Gallinago gallinago</i> , Snipe	●								●	CR		
<i>Gallinula chloropus</i> , Moorhen	●	●							●	LC		
<i>Garrulus glandarius</i> , Jay		●	●	●	●	●	●	●	●	LC		
<i>Gelochelidon nilotica</i> , Common Gull-billed Tern										RE	Ext	
<i>Glaucidium passerinum</i> , Pygmy Owl				●	●	●	●	●	●	LC		
<i>Grus grus</i> , Crane										RE	Ext	
<i>Gypaetus barbatus</i> , Bearded Vulture						●	●	●	●	RE		
<i>Haliaeetus albicilla</i> , White-tailed Eagle	●								●	EN		
<i>Hieraaetus pennatus</i> , Booted Eagle										RE	Ext	
<i>Himantopus himantopus</i> , Black-winged Stilt	●								●	NT		
<i>Hippolais icterina</i> , Icterine Warbler	●	●							●	LC		
<i>Hirundo rustica</i> , Swallow	●	●			●	●	●	●	●	LC		
<i>Ixobrychus minutus</i> , Little Bittern	●	●							●	VU		
<i>Jynx torquilla</i> , Wryneck	●	●	●			●	●	●	●	VU		
<i>Lagopus muta</i> , Ptarmigan				●		●	●	●	●	LC		
<i>Lanius collurio</i> , Red-backed Shrike	●	●	●		●	●	●	●	●	LC		
<i>Lanius excubitor</i> , Great Grey Shrike										CR	Geo	
<i>Lanius senator</i> , Woodchat Shrike										RE	Ext	
<i>Larus canus</i> , Common Gull										EN	Geo	
<i>Larus melanocephalus</i> , Mediterranean Gull	●								●	VU		
<i>Larus michahellis</i> , Yellow-legged Gull	●								●	VU		
<i>Larus ridibundus</i> , Black-headed Gull	●								●	LC		
<i>Leiopicus medius</i> , Middle Spotted Woodpecker	●	●							●	LC		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Limosa limosa</i> , Black-tailed Godwit	●								●	EN		
<i>Linaria cannabina</i> , Common Linnet	●	●				●	●	●	●	NT		
<i>Locustella fluviatilis</i> , River Warbler	●	●	●						●	NT		
<i>Locustella luscinioides</i> , Savi's Warbler	●	●							●	LC		
<i>Locustella naevia</i> , Grasshopper Warbler	●	●	●						●	NT		
<i>Lophophanes cristatus</i> , Crested Tit				●	●	●	●	●	●	LC		
<i>Loxia curvirostra</i> , Crossbill			●	●		●	●	●	●	LC		
<i>Lullula arborea</i> , Wood Lark	●								●	NT		
<i>Luscinia luscinia</i> , Thrush Nightingale										RE	Ext	
<i>Luscinia megarhynchos</i> , Nightingale	●	●							●	LC		
<i>Lyrurus tetrix</i> , Black Grouse				●	●	●	●	●	●	NT		
<i>Mareca strepera</i> , Gadwall	●								●	NT		
<i>Mergus merganser</i> , Goosander										VU	Geo	
<i>Merops apiaster</i> , Bee-eater	●	●							●	NT		
<i>Microcarbo pygmaeus</i> , Pygmy Cormorant	●								●	VU		
<i>Milvus migrans</i> , Black Kite		●							●	EN		
<i>Milvus milvus</i> , Red Kite, Kite	●	●					●	●	●	VU		
<i>Monticola saxatilis</i> , Rock Thrush						●	●	●	●	VU		
<i>Montifringilla nivalis</i> , Snowfinch				●		●	●	●	●	LC		
<i>Motacilla alba</i> , White Wagtail	●	●		●	●	●	●	●	●	LC		
<i>Motacilla cinerea</i> , Grey Wagtail				●	●	●	●	●	●	LC		
<i>Motacilla flava</i> , Blue-headed Wagtail	●					●	●		●	LC		
<i>Muscicapa striata</i> , Spotted Flycatcher	●	●	●	●		●	●	●	●	LC		
<i>Netta rufina</i> , Red-crested Pochard	●								●	NT		
<i>Nucifraga caryocatactes</i> , Nutcracker				●	●	●	●	●	●	LC		
<i>Numenius arquata</i> , Curlew	●								●	EN		
<i>Nycticorax nycticorax</i> , Night Heron	●								●	EN		
<i>Oenanthe oenanthe</i> , Northern Wheatear	●			●	●	●	●	●	●	LC		
<i>Oriolus oriolus</i> , Golden Oriole	●	●	●						●	LC		
<i>Otis tarda</i> , Great Bustard	●								●	VU		
<i>Otus scops</i> , Scops Owl	●								●	EN		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Pandion haliaetus</i> , Osprey										RE	Ext	
<i>Panurus biarmicus</i> , Beardet Tit	●								●	NT		
<i>Parus major</i> , Great Tit	●	●	●	●	●	●	●	●	●	LC		
<i>Passer domesticus</i> , House Sparrow	●	●		●		●	●	●	●	LC		
<i>Passer italiae</i> , Italian Sparrow										EN	Geo	
<i>Passer montanus</i> , Tree Sparrow	●		●	●				●	●	LC		
<i>Perdix perdix</i> , Partridge	●	●							●	VU		
<i>Periparus ater</i> , Coal Tit				●		●	●	●	●	LC		
<i>Pernis apivorus</i> , Honey Buzzard	●	●	●		●	●	●	●	●	LC		
<i>Phalacrocorax carbo</i> , Great Cormorant	●								●	EN		
<i>Phoenicurus ochruros</i> , Black Redstart	●	●		●	●	●	●	●	●	LC		
<i>Phoenicurus phoenicurus</i> , Redstart		●	●		●	●	●	●	●	LC		
<i>Phylloscopus bonelli</i> , Bonelli's Warbler				●	●	●	●	●	●	LC		
<i>Phylloscopus collybita</i> , Chiffchaff	●	●	●	●		●	●	●	●	LC		
<i>Phylloscopus sibilatrix</i> , Wood Warbler	●	●	●	●		●	●	●	●	LC		
<i>Phylloscopus trochilus</i> , Willow Warbler	●	●	●	●		●	●	●	●	NT		
<i>Pica pica</i> , Magpie	●	●						●	●	LC		
<i>Picoides tridactylus</i> , Three-toed Woodpecker				●	●	●	●	●	●	LC		
<i>Picus canus</i> , Grey-headed Woodpecker		●	●	●	●	●	●	●	●	NT		
<i>Picus viridis</i> , Green Woodpecker	●	●	●	●		●	●	●	●	LC		
<i>Platalea leucorodia</i> , Spoonbill	●								●	VU		
<i>Plegadis falcinellus</i> , Glossy Ibis										RE	Ext	
<i>Podiceps cristatus</i> , Great Crested Grebe	●	●							●	LC		
<i>Podiceps nigricollis</i> , Black-necked grebe	●								●	CR		
<i>Poecile montanus</i> , Willow Tit		●		●	●	●	●	●	●	LC		
<i>Poecile palustris</i> , Marsh Tit	●	●		●	●	●	●		●	LC		
<i>Porzana porzana</i> , Spotted Crane	●								●	CR		
<i>Prunella collaris</i> , Alpine Accentor				●	●	●	●	●	●	LC		
<i>Prunella modularis</i> , Dunnock, Hedge Sparrow		●	●	●	●	●	●	●	●	LC		
<i>Ptyonoprogne rupestris</i> , Crag Martin				●	●	●	●	●	●	LC		

Species	National Park								All National Parks combined	Red List Category ¹	Reason for non-coverage ²	Notes
	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Pyrrhonorax graculus</i> , Alpine Chough				●	●	●	●	●	●	LC		
<i>Pyrrhonorax pyrrhonorax</i> , Chough										RE	Ext	
<i>Pyrrhula pyrrhula</i> , Bullfinch				●	●	●	●	●	●	LC		
<i>Rallus aquaticus</i> , Water Rail	●	●								●	LC	
<i>Recurvirostra avosetta</i> , Avocet	●									●	VU	
<i>Regulus ignicapilla</i> , Firecrest			●	●						●	LC	
<i>Regulus regulus</i> , Goldcrest			●	●	●	●	●	●	●	●	LC	
<i>Remiz pendulinus</i> , Penduline Tit	●	●								●	VU	
<i>Riparia riparia</i> , Sand Martin	●	●								●	NT	
<i>Saxicola rubetra</i> , Whinchat	●					●	●	●	●	●	EN	
<i>Saxicola torquatus</i> , Stonechat	●	●								●	NT	
<i>Scolopax rusticola</i> , Woodcock			●	●	●	●	●	●	●	●	NT	
<i>Serinus serinus</i> , Serin	●	●				●	●	●	●	●	VU	
<i>Sitta europaea</i> , Nuthatch	●	●	●	●	●	●	●	●	●	●	LC	
<i>Spatula clypeata</i> , Shoveler	●									●	EN	
<i>Spatula querquedula</i> , Garganey	●									●	VU	
<i>Spinus spinus</i> , Eurasian Siskin			●	●		●	●	●	●	●	LC	
<i>Sterna hirundo</i> , Common Tern	●									●	NT	
<i>Sternula albifrons</i> , Little Tern											RE	Ext
<i>Streptopelia decaocto</i> , Collared Dove, Collared Turtle Dove	●	●						●	●	●	LC	
<i>Streptopelia turtur</i> , Turtle Dove	●	●	●							●	NT	
<i>Strix aluco</i> , Tawny Owl	●	●	●	●	●	●	●		●	●	LC	
<i>Strix uralensis</i> , Ural Owl											CR	New
<i>Sturnus vulgaris</i> , Starling	●	●	●			●		●	●	●	LC	
<i>Sylvia atricapilla</i> , Blackcap	●	●	●	●	●	●	●	●	●	●	LC	
<i>Sylvia borin</i> , Garden Warbler	●	●	●	●		●	●	●	●	●	LC	
<i>Sylvia communis</i> , Whitethroat	●	●	●	●			●		●	●	LC	
<i>Sylvia curruca</i> , Lesser Whitethroat	●	●	●	●		●	●	●	●	●	LC	
<i>Sylvia nisoria</i> , Barred Warbler	●	●								●	LC	
<i>Tachybaptus ruficollis</i> , Little Grebe	●	●				●			●	●	NT	

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Tachymarptis melba</i> , Alpine Swift						●	●	●	●	●	VU	
<i>Tadorna tadorna</i> , Shelduck	●									●	VU	
<i>Tetrao urogallus</i> , Capercaillie				●	●	●	●	●	●	●	NT	
<i>Tetrax tetrax</i> , Little Bustard											RE	Ext
<i>Tichodroma muraria</i> , Wall Creeper				●	●	●	●	●	●	●	LC	
<i>Tringa totanus</i> , Redshank	●									●	VU	
<i>Troglodytes troglodytes</i> , Wren	●	●	●	●	●	●	●	●	●	●	LC	
<i>Turdus merula</i> , Blackbird	●	●	●	●	●	●	●	●	●	●	LC	
<i>Turdus philomelos</i> , Song Thrush	●	●	●	●	●	●	●	●	●	●	LC	
<i>Turdus pilaris</i> , Fieldfare			●	●		●	●	●	●	●	NT	
<i>Turdus torquatus</i> , Ring Ouzel				●	●	●	●	●	●	●	LC	
<i>Turdus viscivorus</i> , Mistle Thrush		●	●	●	●	●	●	●	●	●	LC	
<i>Tyto alba</i> , Barn Owl	●									●	CR	
<i>Upupa epops</i> , Hoopoe	●	●	●				●	●	●	●	LC	
<i>Vanellus vanellus</i> , Lapwing	●	●								●	NT	
<i>Zapornia parva</i> , Little Crake	●	●								●	VU	
Reptiles												
<i>Anguis fragilis</i> , Slow Worm	●	●	●	●	●	●	●		●	●	NT	
<i>Coronella austriaca</i> , Smooth Snake	●	●	●	●	●					●	VU	
<i>Emys orbicularis</i> , European Pond Terrapin	●	●								●	CR	
<i>Iberolacerta horvathi</i> , Horvath's Rock Lizard											VU	Geo
<i>Lacerta agilis</i> , Sand Lizard	●	●	●	●	●	●	●		●	●	NT	
<i>Lacerta viridis</i> , Green Lizard		●	●							●	EN	
<i>Natrix natrix</i> , Grass Snake	●	●	●	●	●	●	●		●	●	NT	
<i>Natrix tessellata</i> , Dice Snake	●	●	●							●	EN	
<i>Podarcis muralis</i> , Common Wall Lizard											EN	Eco
<i>Vipera ammodytes</i> , Nose-horned viper											CR	Geo
<i>Vipera berus</i> , Adder; Common viper				●	●	●	●	●	●	●	VU	
<i>Vipera ursinii</i> , Meadow viper	●									●	CR	

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Zamenis longissimus</i> , Aesculapian Snake	●	●	●	●	●				●	NT		
<i>Zootoca vivipara</i> , Viviparous Lizard	●			●	●	●	●	●	●	NT		
Amphibians												
<i>Bombina bombina</i> , Fire-bellied Toad	●	●	●						●	VU		
<i>Bombina variegata</i> , Yellow-bellied Toad				●	●				●	VU		
<i>Bufo bufo</i> , Common Toad	●	●	●	●	●	●	●	●	●	NT		
<i>Bufo viridis</i> , European Green Toad	●	●	●						●	VU		
<i>Epidalea calamita</i> , Natterjack Toad										CR	Geo	
<i>Hyla arborea</i> , European Tree Frog	●	●	●						●	VU		
<i>Ichthyosaura alpestris</i> , Alpine Newt				●	●	●	●	●	●	NT		
<i>Lissotriton helveticus</i> , Palmate Newt										NA	Geo	13
<i>Lissotriton vulgaris</i> , Smooth Newt	●	●	●	●	●				●	NT		
<i>Pelobates fuscus</i> , Common Spadefoot	●	●							●	EN		
<i>Pelophylax esculentus</i> , Green Frog	●	●	●						●	NT		
<i>Pelophylax lessonae</i> , Pool Frog	●	●	●						●	VU		
<i>Pelophylax ridibundus</i> , Marsh Frog	●	●							●	VU		
<i>Rana arvalis</i> , Moorfrog	●	●							●	VU		
<i>Rana dalmatina</i> , Leap Frog	●	●	●						●	NT		
<i>Rana temporaria</i> , Grass Frog		●	●	●	●	●	●	●	●	NT		
<i>Salamandra atra</i> , Alpine Salamander				●	●	●	●	●	●	NT		
<i>Salamandra salamandra</i> , Fire Salamander			●	●	●				●	NT		
<i>Triturus carnifex</i> , Alpine Crested Newt			●						●	VU		14
<i>Triturus cristatus</i> , Great Crested Newt										EN	Geo	
<i>Triturus dobrogicus</i> , Danube Crested Newt	●	●							●	EN		
Fishes												
<i>Abramis brama</i> , Common Bream		●							●	LC		
<i>Acipenser gueldenstaedtii</i> , Russian Sturgeon										RE	Ext	
<i>Acipenser nudiiventris</i> , Barbel Sturgeon										RE	Ext	

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Acipenser ruthenus</i> , Sterlet Sturgeon		●							●	CR		
<i>Acipenser stellatus</i> , Starred Stellate Sturgeon										RE	Ext	
<i>Alburnoides bipunctatus</i> , Riffle Minnow		●							●	LC		
<i>Alburnus alburnus</i> , Bleak	●	●							●	LC		
<i>Alburnus mento</i>										LC	Geo	15
<i>Ameiurus melas</i> , Black Bullhead										NA	Ali	
<i>Ameiurus nebulosus</i> , Brown Bullhead	●								●	NA		
<i>Anguilla anguilla</i> , European Common Eel	●	●		●					●	RE		
<i>Babka gymnotrachelus</i> , Racer Goby		●							●	NE		
<i>Ballerus ballerus</i> , Blue Bream		●							●	EN		
<i>Ballerus sapa</i> , White-eye Bream		●							●	EN		
<i>Barbatula barbatula</i> , Stone Loach		●	●						●	LC		
<i>Barbus barbus</i> , Barbel		●	●						●	NT		
<i>Barbus carpathicus</i> , Carpathian Brabel		●							●	CR		
<i>Blicca bjoerkna</i> , White Bream	●	●							●	LC		
<i>Carassius auratus</i> , Goldfish		●							●	NA		
<i>Carassius carassius</i> , Crucian Carp	●	●							●	EN		
<i>Carassius gibelio</i> , Prussian Carp	●	●		●					●	LC		
<i>Chondrostoma nasus</i> , Sneeep		●		●					●	NT		
<i>Cobitis elongatoides</i> , Danubian Spined Loach		●							●	NA		16
<i>Cobitis taenia</i> , Spined Loach		●							●	NA		16
<i>Coregonus arenicolus</i>										VU	Geo	
<i>Coregonus atterensis</i>										VU	Geo	
<i>Coregonus austriacus</i>										CR	Geo	
<i>Coregonus danneri</i>										VU	Geo	
<i>Coregonus gutturosus</i> , Lake Constance Whitefish										EX	Geo	
<i>Coregonus macrophthalmus</i> , European Whitefish										LC	Geo	
<i>Coregonus renke</i>										VU	Geo	

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Coregonus wartmanni</i>										LC	Geo	
<i>Cottus gobio</i> , River Bullhead		●	●	●	●					●	NT	
<i>Ctenopharyngodon idella</i> , Grass Carp	●	●								●	NA	17
<i>Cyprinus carpio</i> , Common Carp	●	●								●	EN	
<i>Esox lucius</i> , Northern Pike	●	●		●						●	NT	
<i>Eudontomyzon mariae</i> , Ukrainian Brook Lamprey	●			●						●	VU	
<i>Eudontomyzon vladykovi</i> , Danubian Brook Lamprey				●						●	NA	18
<i>Gasterosteus aculeatus</i> , Three-spined Stickleback		●								●	NE	
<i>Gobio gobio</i> , Gudgeon		●	●							●	NA	19
<i>Gobio obtusirostris</i>											NA	Tax 19
<i>Gymnocephalus baloni</i> , Danube Ruffe		●								●	VU	
<i>Gymnocephalus cernua</i> , Ruffe	●	●								●	LC	
<i>Gymnocephalus schraetser</i> , Schraetzer		●								●	VU	
<i>Hemichromis fasciatus</i> , Banded Jewelfish											NA	Ali 17
<i>Hemichromis guttatus</i> , Jewel Cichlid											NA	Ali 17
<i>Hucho hucho</i> , Danube Salmon		●		●						●	EN	
<i>Huso huso</i> , Great White Sturgeon											RE	Ext
<i>Hypophthalmichthys molitrix</i> , Silver Carp		●								●	NA	17
<i>Hypophthalmichthys nobilis</i> , Bighead Carp	●	●								●	NA	17
<i>Lampetra planeri</i> , Brook Lamprey											EN	Geo
<i>Lepomis gibbosus</i> , Pumpkinseed		●								●	NE	
<i>Leucaspis delineatus</i> , Belica	●	●								●	EN	
<i>Leuciscus aspilus</i> , Asp	●	●								●	EN	
<i>Leuciscus idus</i> , Golden Orfe		●								●	EN	
<i>Leuciscus leuciscus</i> , Common Dace										●	NT	
<i>Lota lota</i> , Burbot		●								●	VU	
<i>Micropterus salmoides</i> , Largemouth Bass											NA	Ali
<i>Misgurnus fossilis</i> , Weather Loach	●	●								●	CR	
<i>Mylopharyngodon piceus</i> , Black Amur											NA	Ali 17

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Neogobius melanostomus</i> , Caspian Round Goby		●							●	NE		
<i>Oncorhynchus mykiss</i> , Coast Rainbow Trout		●		●	●				●	NE		
<i>Pelecus cultratus</i> , Rasorfish	●	●							●	NT		
<i>Perca fluviatilis</i> , European Perch	●	●	●	●					●	LC		
<i>Phoxinus phoxinus</i> , Common Minnow			●	●		●		●	●	NT		
<i>Polyodon spatula</i> , Mississippi Paddlefish										NA	Ali	17
<i>Ponticola kessleri</i> , Bighead Goby		●							●	NE		
<i>Proterorhinus semilunaris</i> , Western Tubenose Goby	●	●							●	EN		
<i>Pseudorasbora parva</i> , Stone Moroko	●	●	●						●	NE		
<i>Pungitius pungitius</i> , Ninespine Stickleback										NA	Ali	17
<i>Rhodeus amarus</i> , European Bitterling	●	●							●	VU		
<i>Romanogobio kesslerii</i> , Kessler's Gudgeon		●							●	EN		
<i>Romanogobio skywalkerii</i> , Skywalker's Gudgeon										NA	Tax	20
<i>Romanogobio uranoscopus</i> , Danubian Longbarbel Gudgeon		●							●	CR		
<i>Romanogobio vladykovi</i> , White-finned Gudgeon		●							●	LC		21
<i>Rutilus meidingeri</i> , Black Sea Roach		●							●	EN		
<i>Rutilus rutilus</i> , European Roach	●	●		●					●	LC		
<i>Rutilus virgo</i> , Cactus Roach		●							●	EN		22
<i>Sabanejewia balcanica</i> , Balcan Spined Loach		●							●	EN		
<i>Salmo labrax</i> , Black Sea Salmon										NA	Tax	23
<i>Salmo schieffermuelleri</i>										NA	Ext	23
<i>Salmo trutta</i> , Brown Trout		●	●	●	●	●		●	●	NT		23
<i>Salvelinus fontinalis</i> , Brook Trout										NE	Ali	
<i>Salvelinus namaycush</i> , Lake Trout		●							●	NA		17
<i>Salvelinus profundus</i> , Deepwater Char										EX	Geo	24
<i>Salvelinus umbla</i> , Lake Char				●		●		●	●	LC		
<i>Sander lucioperca</i> , Pikeperch	●	●							●	NT		

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	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern (Carinthia)	Hohe Tauern (Salzburg)	Hohe Tauern (Tyrol)				
<i>Sander volgensis</i> , Volga Pikeperch	●	●							●	EN		
<i>Scardinius erythrophthalmus</i> , Redeye	●	●							●	LC		
<i>Silurus glanis</i> , European Catfish	●	●							●	VU		
<i>Squalius cephalus</i> , European Chub		●	●	●					●	LC		
<i>Telestes souffia</i> , Souffia				●					●	EN		25
<i>Thymallus thymallus</i> , Grayling		●	●	●	●				●	VU		
<i>Tinca tinca</i> , Tench	●	●							●	VU		
<i>Umbra krameri</i> , European Mudminnow	●	●							●	CR		
<i>Vimba vimba</i> , Baltic Vimba		●							●	VU		
<i>Vimba elongata</i>										EN	Geo	26
<i>Zingel streber</i> , Streber		●							●	EN		
<i>Zingel zingel</i> , Chop		●							●	VU		

1 Red List Categories (cf. IUCN 2001): CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD ...Data Deficient, NE..Not Evaluated (typically alien species). NA = not listed in SPITZENBERGER (2005), FRÜHAUF (2005), GOLLMANN (2007), WOLFRAM & MIKSCHI (2007)

2 New ...Newly recorded in Austria

Tax ...Taxonomical issues (species split or redelineation), taxon formerly not considered a separate entity in a national park

Ext ...Taxon extinct in Austria

Ali ...Alien species with recent introduction

Geo ...Geographical constraints, range of occurrence outside national parks

Gue ...Guest species with inconstant occurrence in Austria

Rec ...Occurrence possible, but no recordings to date

Eco ...Ecological constraints, habitat requirements not met within Austrian national parks

3 First Austrian record in 1996 (SPITZENBERGER 1997).

4 *Arvicola terrestris* in SPITZENBERGER (2005) has been split into *Arvicola amphibius* and *Arvicola scherman* (cf. PANTELEYEV 2001, CASSOLA 2016).

5 Introduced species

6 *Felis silvestris* has been repeatedly documented in Austria, yet reproduction and the establishment of a population remains to be confirmed.

7 Listed as *Myoxus glis* in one national park checklist

8 *Mus domesticus*, the Western House Mouse, is treated as a separate species in SPITZENBERGER (2005) and categorized as NT (Near Threatened). Currently, it is usually treated as a subspecies of *Mus musculus* sensu lato.

9 Syn. *Clethrionomys glareolus*

10 Newly recorded in Austria after SPITZENBERGER (2005)

11 Currently, no populations are present in Austria.

12 Syn. *Mustela vison*

13 Newly recorded in Austria in 2008 (GRABHER & NIEDERER 2011), not listed in GOLLMANN (2007).

- 14 Listed as *T. cristatus* in the national park checklist, but according to LAGLER (2015) more closely related to *T. carnifex* within the hybrid zone (MILEK pers.comm., GOLLMANN, pers. comm.).
- 15 Listed as *Chalcalburnus chalcoides* in WOLFRAM & MIKSCHI (2007) with subspecies *C. c. mento* occurring in Austria; currently considered a proper species with genus *Alburnus*.
- 16 Listed as *Cobitis* sp. in WOLFRAM & MIKSCHI (2007), categorized as VU (Vulnerable).
- 17 Alien species, not in WOLFRAM & MIKSCHI (2007)
- 18 Currently considered a proper species and not a subspecies of *Eudontomyzon mariae*. It is not entirely clear whether the Gesäuse National Park individuals refer to *E. mariae* or *E. vladkykovi*.
- 19 „*Gobio gobio*“ s. lat. in WOLFRAM & MIKSCHI (2007) includes the species *Gobio gobio* s. str. and *Gobio obtusirostris*.
- 20 New species (FRIEDRICH et al. 2018).
- 21 Listed in WOLFRAM & MIKSCHI (2007) as *Gobio albipinnatus*. The species has been split, the European populations belong to *Romanogobio vladkykovi*.
- 22 WOLFRAM & MIKSCHI (2007) list the Austrian populations as *Rutilus pigus*, in the meantime, the ssp. *virgo* has been elevated to species rank.
- 23 WOLFRAM & MIKSCHI (2007) reject the split and refer to the Austrian *Salmo* taxa as *Salmo trutta*. Populations from the Danube National Park probably belong to *Salmo labrax*, although all Austrian population have been impacted by stocking. *Salmo schiefermuelleri* is poorly documented and considered extinct.
- 24 The fish species was considered extinct, but has been rediscovered.
- 25 A reintroduction attempt into National Park Gesäuse failed. The species has not been recorded since then.
- 26 In the Austrian checklist (AHNELT 2008) not as a separate species; in WOLFRAM & MIKSCHI (2007) and FROESE & PAULY (2018) the split has been accepted.

Fig. 4: Reasons for vertebrate species not covered by Austrian national parks. – Abb. 4: Gründe für die Nichtabdeckung von Wirbeltieren in österreichischen Nationalparks. Abbreviations:

Ali...Alien species with ± recent introduction
 Eco...Ecological constraints, habitat requirements not met within Austrian national parks
 Ext...Taxon extinct in Austria
 Geo...Geographical constraints, range of occurrence outside national parks
 Gue...Guest species with inconsistent occurrence in Austria

New...Newly recorded in Austria

Rec...Occurrence possible, but no recordings to date

Tax...Taxonomical issues (species split or redelineation); taxon formerly not considered a separate entity in a national park

Abkürzungen:

Ali...Gebietsfremde Art mit ± rezenter Einschleppung

Eco...Ökologische Restriktion, Habitatansprüche von österreichischen Nationalparks nicht erfüllt

Ext...Taxon in Österreich ausgestorben

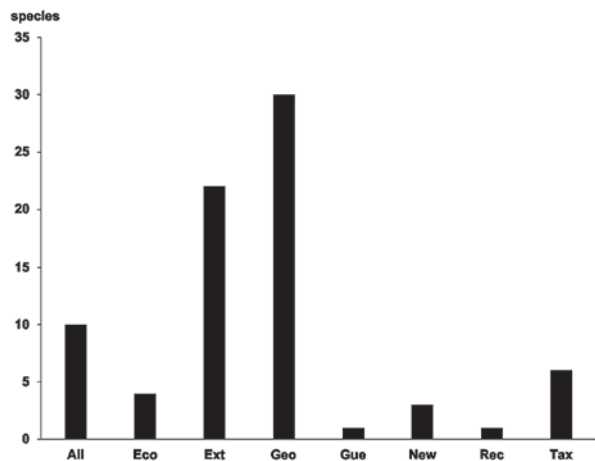
Geo...Geographische Restriktion, Areal der Art außerhalb der österreichischen Nationalparks

Gue...Gastart mit unregelmäßigem Vorkommen in Österreich.

New...Neu in Österreich

Rec... Vorkommen möglich, aber einstweilen nicht dokumentiert

Tax...Taxonomische Probleme (Aufspaltung oder Neuabgrenzung); Taxon wurde früher nicht als separate Art in den Nationalparks geführt.



Species coverage for threatened vertebrates

An analysis restricted only to the threatened vertebrates has shown similar patterns as the analyses for all vertebrate species given above. The hotspot character of Neusiedler See – Seewinkel National Park and Donau-Auen National Park is even more pronounced for threatened species, with 68 % of threatened bird species and 67 % of amphibian species around Neusiedler See and 75 % of threatened amphibians and 76 % of threatened fish species represented in Donau-Auen National Park (Tab. 3).

Tab. 3: Representation of threatened vertebrates (Red List categories CR, EN, VU) in Austrian National Parks. – Tab. 3: Abdeckung der gefährdeten einheimischen Wirbeltiere in den österreichischen Nationalparks.

Organism Group	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern	All National Parks combined	Austria
Species numbers								
Mammals (Mammalia)	13	9	11	9	8	8	22	27
Breeding Birds (Aves)	46	14	2	1	0	11	57	68
Reptiles (Reptilia)	4	4	3	2	2	1	6	9
Amphibians (Amphibia)	8	9	5	1	1	0	10	12
Fishes („Pisces“)	12	29	1	4	1	0	31	38
All vertebrates	83	65	22	17	12	20	126	154
Proportion of Austrian threatend species								
Mammals (Mammalia)	48%	33%	41%	33%	30%	30%	81%	
Breeding Birds (Aves)	68%	21%	3%	1%	0%	16%	84%	
Reptiles (Reptilia)	44%	44%	33%	22%	22%	11%	67%	
Amphibians (Amphibia)	67%	75%	42%	8%	8%	0%	83%	
Fishes („Pisces“)	32%	76%	3%	11%	3%	0%	82%	
All vertebrates	54%	42%	14%	11%	8%	13%	82%	

Endemic and subendemic species

In total, 188 endemic and subendemic animal species and 37 vascular plant species were found to be represented in the Austrian national parks, corresponding to at least one third of the Austrian animal endemic species biodiversity and one fourth of the vascular plant endemic species biodiversity. Within the national parks; occurrences of endemic and sub-endemic species are strongly biased towards the alpine national parks. However, Donau-Auen National Park also houses a substantial number of endemic animals in the ground-water.

Tab. 4: Species numbers and spatial concentration for Austrian endemics and subendemics in the six national parks. – Tab. 4: Artenzahlen und räumliche Konzentration in Österreich endemischer und subendemischer Arten in den sechs Nationalparks.

	Neusiedler See – Seewinkel	Donau-Auen	Thayatal	Gesäuse	Kalkalpen	Hohe Tauern	All National Parks combined
Species numbers							
Animal species							
Endemic taxa	0	11	0	37	21	33	84
Subendemic taxa	1	5	0	61	37	66	104
Total	1	16	0	98	58	99	188
Weighted by spatial concentration (see text)	63	780	0	1127	552	2937	5444
Vascular plants (endemic and subendemic)	1	0	2	19	16	17	37

Discussion

We found an overall species coverage of Austrian national parks of 89 % for vertebrates, of 69 % for vascular plants and of 80 % in Habitats Directive Annex I habitat types. These numbers are much higher than what could be expected given the small area of Austrian national parks. The difference in coverage between vertebrates and plants can be explained by a higher mobility of vertebrates, which leads to a larger range and higher probability of occurrence and detection in any region. Accordingly, coverage is much lower in endemic species, which are range-restricted by definition.

The main reason for the high species coverage appears to be complementarity. The idea of complementarity has been a main concept in Systematic Conservation Planning (SCOTT et al. 1993, MARGULES & PRESSEY 2000) and the associated reserve selection algorithms. In such selection procedures, a maximum coverage is reached by starting with the areas of highest species richness and adding successively those regions that increase the species richness by the highest amount.

The delineation and positioning of the Austrian national parks have not been the result of such formal procedures. Nevertheless, the current pattern appears to be remarkably effective in covering large parts of Austria's biodiversity. The important role of complementarity is evident from several analyses performed here. (1) The difference between the coverage of a single national park and the whole set of parks is substantial (Tab. 2). (2) Apart from the high similarity between the Gesäuse and Kalkalpen National Parks, which can be explained by their close geographical proximity, similar geology and almost identical altitudinal range, uniqueness among national parks is high (Fig. 3); all other national parks contribute a large number of unique species. For example, the higher altitudinal range and the higher geological diversity of Hohe Tauern might explain the large addition of vascu-

lar plant species to the species set of the national parks. Austrian national parks complement each other since (1) the main Austrian climatic regions (Alpine, Central European and Pannonia) are represented in the national park set and (2) both EU Habitat Directive biogeographical regions, the Alpine and the Continental region, are represented with three national parks each. The three alpine national parks cover all the main geological formations; with Central Alps (predominantly siliceous rocks and intermediate calcareous schists), Greywacke zone and Northern Limestone Alps being represented by Hohe Tauern, Gesäuse and Kalkalpen National Parks, respectively. (4) The eastern lowland national parks cover a range of habitat types from saline, dry and wet open grassland to floodplain forests. The alpine national parks cover the whole range of altitudinal gradient habitat types from valley woodland to high altitude woodland and grassland habitat types. Consequently, the combination of all six national parks leads to high habitat type coverage and, as a consequence, also to a high species coverage.

However, the coverage is not complete. Many vertebrates, some of them highly endangered, live outside the national park borders. With Hohe Tauern National Park being the westernmost outpost of the national park set, Western European species with a range beachhead in the Rhine delta are not covered. Karwendel is the home of the only endemic Austrian mammal, the Bavarian Pine Vole *Microtus bavaricus*, which is currently Red-Listed as Critically Endangered (SPITZENBERGER 2005). Summits at the eastern border of the Alps (Koralpe, Stubalpe, Gleinalpe) remained unglaciated during the ice ages and are therefore endemism hotspots (RABITSCH & ESSL 2009), but they are located far away from any national park area. The Southern Limestone Alps represent another conspicuous biodiversity coverage gap.

Limitations

The results presented here depend on species mapping, habitat surveillance and documentation work in the national parks, which in turn may depend on research priorities. This may have influenced the species coverage proportions of single parks, but is unlikely to have distorted the overall picture, in particular, if all national parks are considered simultaneously.

Recordings of species in the national parks require differentiated interpretations. Observations of large mammals can be frequent but are not necessarily indicative of a permanent population in the area, let alone a viable population. However, such data records show that these species do use the national parks in one way or another, e. g. as a migration corridor or as a foraging site. Caution is also required in the interpretation of fish species presences; as with mammals, listing on a national park's checklist does not guarantee a standing or thriving population in the park. Many vascular plant species listed in the park checklists occur in the periphery of the park areas with limited protection.

By contrast, for small mammals, reptiles, amphibians and most plant species, national park presences as documented and counted here indicate the presence of a population. Clearly, the long-term viability of these populations needs to be assessed and verified by repeated studies and continuous documentation.

Protection

Obviously, being covered by a national park does in no way guarantee long-term survival for any of the species listed and documented here. However, national park status is a significant hurdle to development projects and to generic pressures impinging on many species,

such as habitat loss and habitat fragmentation. Secondly, by IUCN definition, national parks are established to provide and maintain natural ecological processes which support ecosystems, habitats and species depending on the particular ecosystem conditions. This is evident in the Donau-Auen National Park with a landscape uniquely developed, maintained and geomorphologically shaped by recurring inundations.

However, national parks are embedded in landscapes influenced by many human-induced impacts. “No park is an island” (JANZEN 1983). In three Austrian national Parks, Thayatal, Donau-Auen and Neusiedler See – Seewinkel, hydrological processes outside the national park borders, which operate beyond any national park management influence, determine to a large extent the ecological conditions and, as a consequence, the well-being of species living within the national park borders. For example, ground water management and water abstraction policies not only within the national park, but also within the entire Seewinkel region, have a major influence on the saline habitats in and around the typical salt pans (KRACHLER et al. 2012). Upstream dams in the rivers Dyje and Danube affect the hydrological regime within the National Parks Thayatal and Donau-Auen. Permanent excessive nitrogen influx has been a threat for decades, impinging on all low nutrient habitat types within and beyond national park boundaries.

As an over-arching pressure on biodiversity, climate change similarly does not stop at national park gates and borders. It represents a significant threat for many of the high-altitude species living in the three alpine national parks Gesäuse, Kalkalpen and Hohe Tauern. Elevated temperatures may simply drive species in higher altitudes out of their original range. This is particularly worrying for endemic high-altitude species, for which the conservation responsibility lies entirely with Austria. Only a strict and decisive climate change mitigation programme seems to be able to rescue this significant part of Austria’s fauna and flora for future times and generations. But climate change will also affect lowland national parks with a changing hydrological regime, prolonged droughts and a transformation of habitats towards xerothermophilous assemblages. As a consequence of climate change, CIVANTOS et al. (2012) modelled a large-scale faunal exchange in central Europe, with Mediterranean species replacing central European species over time.

But even under such a scenario, national parks continue to play an important role as a biodiversity conservation safeguard. Providing and guaranteeing natural ecological processes will benefit all kinds of assemblages, even if some species may become replaced over time. As THOMAS & GILLINGHAM (2015) show, even if some species may have declined in some protected areas, they remain more abundant inside the areas compared to outside. The authors conclude that despite substantial environmental changes, networks of protected areas have been essential to safeguard biodiversity in the past and continue to play this role in the future.

Conclusions

Networks of protected areas are not the only tool in the conservationist’s toolbox, but they are an important component in any biodiversity conservation strategy. Despite being positioned by necessity and political considerations, Austria’s national park archipelago has shown to be remarkably effective in representing large parts of Austria’s biodiversity. Climate change and overall species declines do not bode well for biodiversity trends in the future, unless decisive action is taken. The Austrian national parks could be a starting

point and building block for an effective counter strategy to prevent extinctions and biodiversity losses.

Acknowledgments

We are very grateful to Kristina BAUCH, Florian JURGEIT, Katharina AICHHORN (Hohe Tauern National Park), Aaron GRIESBACHER, Karoline ZSAK, Christian BAUMGARTER, Teresa KNOLL (Donau-Auen National Park), Benjamin KNES, Harald GRABENHOFER (Neusiedler See – Seewinkel National Park), Alexander MARINGER (Gesäuse National Park), Christoph MILEK, Christian ÜBL (Thayatal National Park), Erich WEIGAND (Kalkalpen) and Haus der Natur (Robert LINDNER, Helmut WITTMANN) for data, input, discussion and criticism. Georg WOLFRAM gave advice in fish taxonomy and raised awareness for the recent description of *Romanogobius skywalkeri*. Stefan SCHINDLER read the manuscript and suggested improvements.

The project was commissioned and supported by National Parks Austria (scientific coordination by Christian ÜBL). A substantial part of the data on which the analyses were based were collected by enthusiastic citizen scientists. Without these contributions, evidence-based biodiversity conservation would not be possible.

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Received: 2021 10 22

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Jahr/Year: 2022

Band/Volume: [158](#)

Autor(en)/Author(s): Zülka Klaus-Peter, Gilli Christian, Paternoster David, Banko Gebhard, Schrott-Ehrendorfer Luise, Niklfeld Harald

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