Danube Dragon Action Plan

Action Plan for the Danube Crested Newt

(*Triturus dobrogicus*)

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Front cover picture: Female and male Danube crested newt (Hohenau, Austria, picture by Hartmut Nüsken)

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Table of contents

1. Context of the Action Plan

The Danube crested newt (*Triturus dobrogicus*) is an iconic European amphibian species due to its large size and distincive distribution in the floodplains of the Danube, Tisza, Mura, Drava and Sava rivers on the Pannonian and Dobrogean plains, ranging from the Vienna basin and Zakarpattia lowlands to the Black Sea as well as occurring in the Dnipro valley in Ukraine.

The Danube crested newt is listed on the Annex II of the EU Habitats Directive. Although the latest IUCN Red List Assessment of the amphibians of Europe and the European Union listed this species as Least Concern, this categorisation was largely due to the wide distribution of this species and the lack of quantitative data. There is indeed strong evidence that its populations are decreasing and its habitats are deteriorating quickly across various parts of its range. For example, biogeographical assessments of the conservation status of species and habitats under Article 17 of the Habitats Directive (https://nature-art17.eionet.europa.eu) indicate an unfavourable status in the majority of EU countries and an unknown status in the rest. Due to its distribution in floodplains that underwent significant restructuring prior to the initial assessments, it is also likely that the species was historically much more widespread. There is therefore an urgent need for quantitative assessments of its current status, its decline across its range, the drivers of population losses as well as to implement conservation actions to reverse negative trends and achieve a favourable status across the different parts of its range.

The Central European Initiative (CEI) is a regional intergovernmental forum that was established in 1989. It gathers 17 member states in Central, Eastern and South-Eastern Europe united by a central mission: working towards European integration and sustainable development through regional cooperation (www.cei.int). CEI supported the establishment of the DANUBEPARKS Newt Conservation Partnership. It was initiated by Kopački rit Nature Park, Croatia, and DANUBEPARKS to protect the Danube crested newt and to restore and preserve its terrestrial and water habitats (Marušić 2023). DANUBEPARKS is a network of Protected Areas from nine Danube countries working together to ensure the integrity of the river ecosystems (Danubeparks 2019; www.danubeparks.org). Establsihed in 2007, DANUBEPARKS now includes 20 protected areas, most of which within the distribution range of the Danube crested newt.

Societas Europaea Herpetologica (SEH) is a non-profit scientific society created in 1979 to support research and conservation in herpetology, with a focus on European amphibians and reptiles (www.seh-herpetology.org).

DANUBEPARKS has commissioned SEH to draw up an action plan for the Danube crested newt in order to assess the extent of the problems faced by this species across its distribution range and to make appropriate recommendations for its conservation (Danubeparks 2024). This is particularly needed as the only available action plan was written for the group of crested newt species as a whole (Edgar & Bird 2006), which gives less specific information on the Danube crested newt. Knowledge of the Danube crested newts has increased over the last two decades but the number of research programs and conservation projects remains lower than the number of those on the great crested newt (*Triturus cristatus*). This action plan should therefore be seen as a first step, aiming to provide both an overview of the current knowledge and threats on this species along with recommendations for future works and conservation measures.

The preparation of this action plan started during a dedicated meeting hosted by J. Vörös and B. Halpern at the HUN-REN Balaton Limnological Research Institute (Tihany, Hungary, 16–18 October 2024; Fig. 1).

Fig. 1. Participants of the action plan meeting in the HUN-REN Balaton Limnological Research Institute (Tihany, Hungary, 16–18 October 2024).

2. Background

2.1. Systematics

The crested newt species complex is distributed widely across most of Europe, except Ireland, the Iberian Peninsula and southwest France. Seven species are currently recognized in the *Triturus cristatus* complex (Wielstra *et al*. 2014):

- Danube crested newt *Triturus dobrogicus* – floodplains of the Danube, Tisza, Drava, Mura and Sava rivers on the Pannonian and Dobrogean plains, from the Vienna basin and Zakarpattia lowlands to the Black Sea. The distribution is narrowed or interrupted at the Iron Gate where the Danube runs close to the southern Carpathians. It also has an isolated population in the Dnipro Delta (Ukraine) on the northern coast of the Black Sea (see 2.2. and Fig. 2 for more details).
- Great crested newt *Triturus cristatus* – northern and central Europe, eastwards to the Urals.
- Italian crested newt *Triturus carnifex* – Italy, southern central Europe and the north-western Balkan peninsula.
- Macedonian crested newt *Triturus macedonicus* – Western Balkan peninsula
- Balkan crested newt *Triturus ivanbureschi* – Southeastern Balkan peninsula plus small enclave in Central Serbia and part of western Türkiye.
- Anatolian crested newt *Triturus anatolicus* – Asiatic Türkiye.
- Southern crested newt *Triturus karelinii* – Crimea, Caucasus mountain range, North-easternmost Türkiye and northern Iran.

The Danube crested newt - *Triturus dobrogicus* (Kiritzescu, 1903)

Originally described as *Triton cristatus* var*. dobrogicus* Kiritzescu, 1903. Type locality restricted (Mertens & Müller 1928) – "lakes in the environs of Sulina", Danube Delta, Romania. Until 1993, it was considered as a subspecies of *T. cristatus* (Arntzen *et al*. 1997). Based on the comparative analysis of specific and subspecific genomic characters, as well as on the results of cytogenetic studies on interspecific and interracial hybrids, Bucci-Innocenti *et al*. (1983) elevated it to full species status. Further taxonomic changes are detailed in Frost (2025).

Although a subspecific differentiation was proposed by Boulenger (*Triturus dobrogicus macrosoma* (Boulenger,

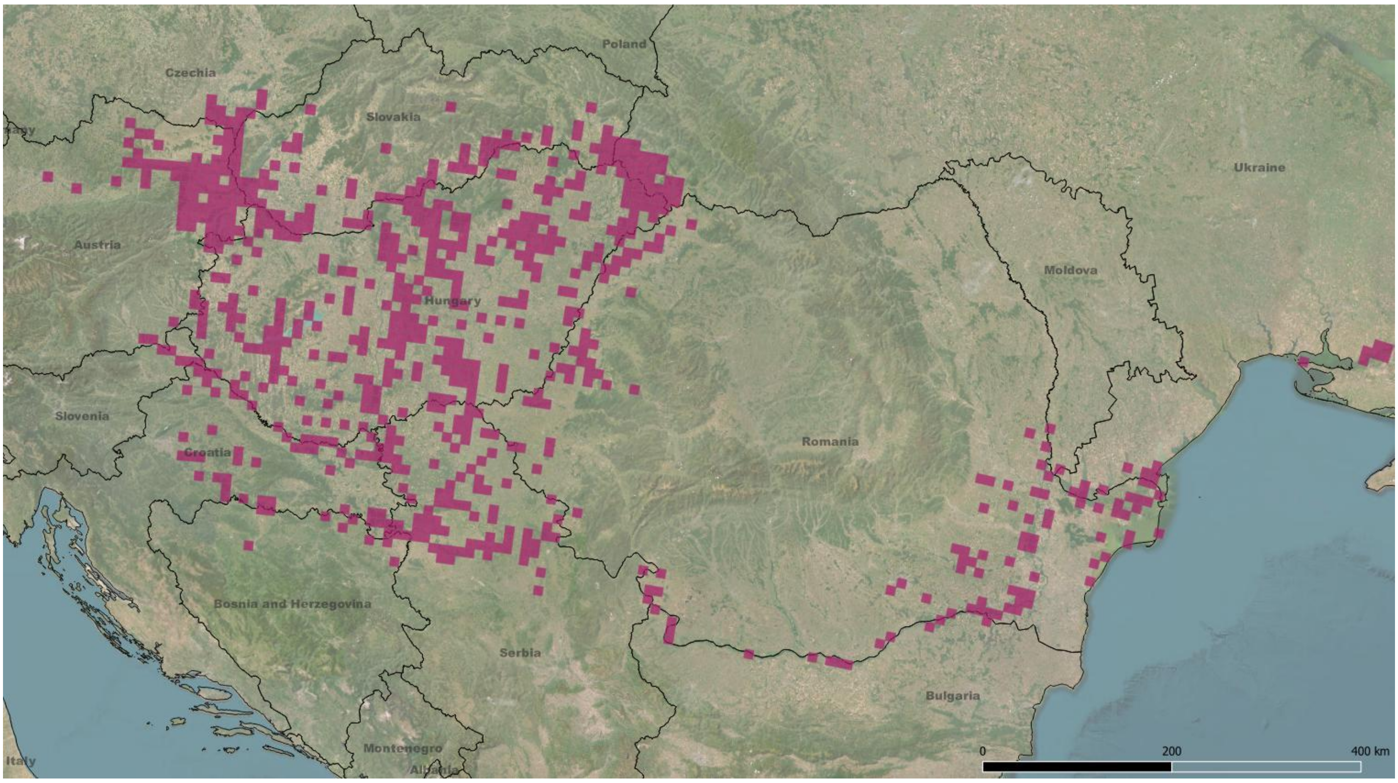

Fig. 2. Preliminary overview of the distribution of the Danube crested newt at a grid cell resolution of 10 km (EEA) from open sources and some national data bases. Beside showing the general distribution range, the map aims at illustrating the disparity in the datasets, which are indicative of true and false absences given the disparity of survey intensities across countries and data received, highlighting needs in monitoring, data validation and data centralization. Due to resolution issues for some UTM-based data, small approximations in projections in EAA grid cells are not to be excluded. Moreover, the presence of hybrid zones needs to be delineated to take apart the different crested newt species and their hybrids. Completing a more comprehensive distribution map with recent, verified data is therefore a priority for the conservation of the Danube crested newt. Background: ESRI Satellite.

1908) (the type locality is unknown – presumed to be near Vienna, Austria)), based on accumulated data from multiple molecular marker systems, including large scale nuclear DNA data, Wielstra and colleagues (2016) recommended that the Danube crested newt is treated as monotypic.

Vernacular names: Panonski krestasti vodenjak (Bosnian), Дунавски гребенест тритон (Bulgarian), Veliki dunavski vodenjak (Croatian), Čolek Dunajský (Czech), Donaukamsalamander (Dutch), Danube crested newt (English), Triton crêté du Danube (French), Donaukammmolch (German), Dunai tarajosgőte (Hungarian), Triton dobrogean (Romanian), Подунавски велики мрмољак (Serbian), Panonski pupek (Slovenian), Mlok Podunajský (Slovak), Тритон дунайський (Ukrainian).

Along the edge of its distribution the Danube crested newt hybridizes with parapatric crested newt species and forms transition zones:

- with *T. cristatus*: northeast Austria (Lagler 2015), southeastern Czechia (Mačát *et al*. 2019), southern Slovakia (Mikuliček *et al*. 2004), western Ukraine (Morozov-Leonov 2003), northeast Hungary (Vörös *et al*. 2016), Romania (Arntzen 2001; Cogălniceanu *et al*. 2013; Wielstra *et al*. 2015), Serbia (Wielstra *et al*. 2017), western Bulgaria (Wielstra *et al*. 2015).
- with *T. macedonicus*: Bosnia and Herzegovina, Serbia (Wallis & Arntzen 1989, Wielstra *et al*. 2017).
- with *T. carnifex*: eastern Austria (Wallis & Arntzen 1989; Czurda 2022), southeastern Czechia (Mačát *et al*. 2019), western Hungary (Gubányi *et al*. 2010), eastern Slovenia (Stanković & Delić 2012; Rašl 2017).
- with *T. ivanbureschi*: central Serbia (Vučić *et al*. 2020) and northern Bulgaria (Wielstra *et al*. 2017).

Fig. 3. Examples of floodplains and wetlands in the distribution range of the Danube crested newt, with ponds often at proximity of the main rivers and their tributaries. Top left: Morava - Danube, Slovakia, 2024 and Top right: Tisza, Ukraine, 2025 (photos by M. Denoël); Bottom left: Külső Lake close to Lake Balaton, Hungary, 2005 (photo by J. Vörös); Bottom right: Grindul Lupilor, Danube Delta, 2020 (photo by D. Cogălniceanu). See Fig. 6 for examples of ponds used by the Danube crested newt.

2.2. Distribution

The Danube crested newt is a lowland species which is found in three allopatric areas of distribution from central to eastern Europe: the Pannonian basin, Lower Danube and Danube Delta, and Dnipro Delta (Fig. 2 and 3).

The Danube crested newt is naturally present in twelve European countries:

Austria. It is present in the Pannonian lowlands at the north-east of the country with most occurrence points along the Danube river. It is present along the border of Czech Republic and Slovakia (rivers Thaya and Morava) and in the region Neusiedler See-Seewinkel close to the Hungarian border (Cabela *et al*. 2001).

Bosnia and Herzegovina. It is very localized in the north-eastern part of the country (Lelo 2010).

Bulgaria. It follows only the Danube River in several disconnected areas along the Romanian border from the border of Serbia to the Black Sea (Naumov & Biserkov 2013).

Croatia. It is located in Sava, Drava and Danube basins, from central to the eastern side of the country (Jelić et al. 2015).

Czech Republic. It is only located in the south-eastern part of the country, along the border with Slovakia and Austria (Mikuliček *et al*. 2012; Mikuliček *et al*. 2004).

Hungary. It is widely distributed over the country, i.e. not only along the Danube basin, with records from throughout the lowlands such as in Tisza and Zagyva valleys (Herpterkep, Hungarian database, accessed 17.10.2024; Vörös *et al*. 2016; Fig. 3).

Moldova. It is present in the south-western part of the country along the Prut River in connection with the Danube river populations, but with a geographical gap towards the Transcarpathian populations (Litvinchuk 2005; Jalba 2007).

Romania. It is present along the Hungarian border, in the Danube delta (Fig. 3) and along the Lower Prut river. There are also disconnected populations along the Danube River along the Bulgarian border in the south of the country and further isolates in the southwest of the country at the Serbian border (Cogălniceanu *et al*. 2013).

Serbia. It is widely present in the Pannonian and partly Peripannonian areas as well as in a small area in the north-eastern part of Serbia at the Romanian border (Vučić *et al*. 2020).

Slovakia. It is present in the west of the country, particularly along the Danube but also along other rivers (Fig. 3). It is also present in the east of the country close to Ukraine (Kautman & Zavadil 2001), and in the south along the Hungarian border (Mikuliček *et al*. 2012).

Slovenia. It is restricted to the eastern part of the country, occurring in the Mura River Valley (Rašl 2017; Stanković & Delić 2012). The Danube crested newt is more frequently recorded along the left bank of the Mura River and downstream towards its confluence with the borders of Croatia and Hungary.

Ukraine. It is present in Transcarpathian lowlands (Fig. 3), from the eastern Hungarian and southeastern Slovakian border to the foothills of the Carpathians (Smirnov 2011). Some populations are known from the Danube delta and isolates were confirmed in the Dnipro delta (Pysanets 2012; Suriadna & Mykytynets 2018). Some records were documented between these two regions, but need confirmation (GBIF Data, accessed October 2024).

2.3. Description

2.3.1. Morphology

The Danube crested newt is a slender-bodied species, with a small head, short legs and narrow tail base (Fig. 4 and 5). The skin is coarse in texture. As with other European newts, it shows a strong sexual dimorphism, especially during the breeding period. Breeding males have a jagged crest on the body, which reaches right to the front of the head. It is deeply indented at the tail base and is distinctly separate from the relatively smoother-edged tail crest. They also exhibit an enlarged cloaca (Fig. 4). The cloaca of females also develops at maturity but is smaller and more elongated than that of males and presents typical groves. Although this species can exceptionally reach up to 175 mm in total length (Ghuerghel & Iftime 2009), sizes of 130 – 145 mm are more frequent. Snout-vent length is on average 67 mm in males and 69 mm in females in a subset of populations (Colleoni *et al*. 2014) but there is a need of a broader analysis across the distribution range. The Wolterstoff index (WI) is a metric that was proposed to help distinguish crested newt species. In the Danube crested newt, this index for males is usually less than 0.54, and for females under 0.46. This species possesses 16 to 18 rib-bearing vertebrae (for methodology see Arntzen & Wallis 1994 and references therein; see also Crnobrnja-Isailović *et al*. 1997 and Fahrbach & Gerlach 2018). In areas where the ranges of the Danube crested newt and other *Triturus* species come into contact, WI results can directly contradict identification confirmed by other, more reliable means, such as genetic analysis. Therefore, this metric needs to be used with caution in these areas. Similarly, size patterns are often population specific.

Fig. 4. Danube crested newt during the breeding season: male in lateral and ventral view (Hohenau, Austria; photos by H. Nüsken). Note the conspicuous secondary sexual traits (cloaca, crest, tail coloration).

2.3.2. Colouration

The Danube crested newt has a dark brown body and white stippling on the flanks (Fig. 4 and 5). Males have a conspicuous whitish stripe on their tail. The light vertebral line is common in females and juveniles. It may be brown or yellow in juveniles and orange, brown or reddish in adult females. The underside is deep orange with sharp roundish black spots – these may fuse to form two longitudinal bands. The gular colouration is clearly delimited, usually black with white spot in males; smaller in females (Fahrbach & Gerlach, 2018). There are marked differences among populations and, in the areas of contact with other *Triturus* species, these characters are often difficult to use. The belly and throat patterns differ among individuals and can be used for individual identification.

Fig. 5. Danube crested newt female (Hohenau, Austria; photo by H. Nüsken).

2.4. Habitat

The Danube crested newt is a mostly aquatic species. It inhabits lowland habitats and is mostly restricted to floodplains and wetlands often associated with smaller tributaries of the Danube and other rivers (Fahrbach & Gerlach 2018; Fig. 3 and 6). Due to its peculiar distribution, its habitat also differs from other newt species.

Fig. 6. Habitats of the Danube crested newt. Top: pond in Hohenau, Austria; 2025; Middle: flooded pond in Obrež, Serbia, 2013; Bottom: channel in Kőrös-Maros National Park, Hungary, 2004 (photos by T. Zuna-Kratky, J. Crnobrnja-Isailović, J. Vörös, respectively from top to bottom).

The primary habitat mainly encompasses oxbow ponds and floodplain wetlands or various natural depressions in a setting of natural hydrology. The secondary breeding sites are all kinds of manmade ponds, or many modified natural ponds (irrigation canals, drainage ditches and cattle ponds, etc) on floodplains, fields, pastures, forest and villages. The breeding sites with successful breeding are mostly characterized by natural water, not too eutrophic with a rich invertebrate diversity the larvae and adults can prey on. Breeding sites are typically shared by other amphibian species, such as *Bombina bombina*, *Bufo bufo, Bufotes viridis, Hyla* sp*., Lissotriton vulgaris, Pelobates* sp., *Pelophylax* sp., *Rana arvalis* and *Rana dalmatina*.

The terrestrial habitats are composed of various deciduous wet and dry forests in close connection with the breeding site. Old logs and tree stumps as well as mammal burrows are often used as shelter (Fig. 7). Newts in their terrestrial phase have a rougher skin (Fig. 8). Hedges, stone fences, and gardens are also valuable secondary habitats. The original and current vegetation structure of the terrestrial habitats can be a key feature to sustain newts during their terrestrial life.

Fig. 7. Terrestrial micro-habitat of the Danube crested newt (Danube Delta, Romania). Old logs and tree stumps are often used by newts as a shelter (Photo by J. Vörös). It is not uncommon to find several individuals sheltering together.

Fig. 8. Female Danube crested newt in terrestrial phase, Peceneaga, Lower Danube Floodplain, Romania (Photo by D. Cogălniceanu).

Crested newt species overwinter both in water and on land, but they are mainly biphasic. Higher and not flooded grounds with structures where the Danube crested newt can hide in frost free areas such as deadwood must be protected from artificial flooding and logging.

2.5. Life history and behaviour

The Danube crested newt has a relatively short life span, estimated at 5–6 years, with sexual maturity being achieved at an age of 2 years, based on skeletochronology in the lower Danube Floodplain (Cogălniceanu & Miaud 2002). In other parts of the range, longevity can be higher as adults of 9 years were found in Vienna as part of a capture-mark-recapture study (Jehle *et al*. 1995). The Danube crested newt can have the longest aquatic phase among crested newts, of up to six months (Ivanović *et al*. 2012). Mating takes place in early spring, with the spermatophore being transmitted after a complex courtship display. Females can pick up multiple spermatophores with their cloaca. Oviposition can last 23 days on average, with females producing 306 eggs on average (range 160–489) (Cogălniceanu *et al*. 2013) but this is expected to vary with local conditions such as temperature. Females provide protection for the eggs by individually wrapping them in vegetation. Variation of egg laying in space and time limits the environmental and predatory risks for the spawn, while egg wrapping behaviour increases the survival of individual eggs in newts (Miaud 1994). Only about 50% of eggs develop successfully, due to a genetic defect known as a balanced lethal system (Horner & MacGregor 1985; Meilink *et al*. 2025). The Danube crested newt appears to be the outlier species among closely related crested newt species and show (1) the smallest egg size, (2) the smallest larval size at hatching and (3) the longest larval period, resulting in the largest metamorphosed juveniles (Furtula *et al*. 2009).

It has been suggested that when the Danube crested newt colonized the floodplains along the present-day Danube river and its tributaries, covered with extensive swamps and marshes, this facilitated the species' acquisition of phenotypic innovations (Cvijanović *et al*. 2009).

A single case of paedomorphosis was reported in a soda pan on the Danube-Tisza rivers interfluve (Mester *et al*. 2013). Like all caudates, the Danube crested newt has impressive regeneration capabilities and can regrow lost toes, limbs, parts of the tail, jaws, and even eyes (Kumar & Simon 2015). The skin toxins secreted may limit (but do not prevent) predation in the Danube crested newt which, when threatened, can show defensive behaviours, a usually immobile posture and the Unken reflex (Fig. 9) (Telea *et al*. 2021).

Fig. 9. Unken reflex in the Danube crested newt, Peceneaga, Lower Danube floodplain, Romania (Photo by D. Cogălniceanu).

2.6. Threats

The main identified threats for the Danube crested newt are habitat loss, degradation and fragmentation, introduced fish and crayfish, pathogens, pollution, and climate change. The detailed understanding of the detrimental effects of anthropogenic pressures often comes from more in-depth studies done on related taxa, such as in other newt or crested newt species. There is enough confidence to consider that most of the threats have a detrimental effect on all species. However, the specificities of the Danube crested newt as a species typical of flood plains involve specific threats (see hereunder) and a need for specific research on this species to better understand the most important drivers of change.

The loss of habitats of this species in general is related to changes in land use. As the Danube crested newt is mainly a lowland species, large floodplains along the Danube river and its tributaries have been recognized as its primary habitat. For example, along the Sava river tributary there are eight focal riparian habitat types for the conservation of biodiversity of this watercourse (Crnobrnja-Isailović *et al*. 2014). Most of these habitats have been destroyed due to anthropogenic change of river dynamics and/or terrestrial habitat alteration. Changes in river dynamics include regulation by cutting the connection with the oxbows, construction of dykes, draining of associated wetlands, construction of dams for hydropower development and water flow regulation. These changes have led to aquatic habitat disconnection and isolation of local populations of the Danube crested newt. In addition to these aspects, there are various other causes of habitat loss, as evidenced by other newt species. This includes voluntary destruction of habitat caused by urbanisation, extensive agriculture, development of quarries (particularly the large ones), and road construction.

The drainage of the landscape caused rapid anthropogenic destruction of Danube crested newt primary terrestrial habitats. It has been occurring for the purpose of conversion to arable land in the Pannonian and Wallachian plains (Constantinescu *et al*. 2015), but also for the purpose of spreading urban areas. Abstraction of surface and ground water through drainage and through the reduction of river dynamics could lead to a decrease in the level of underground water. This could be detrimental to the Danube crested newt aquatic habitats. For example, a decrease in the underground water level occurred in the south of Romania due to the collapse of the former widespread irrigation system.

Furthermore, habitat alteration related to an increase in intensive agriculture, industrial and urban areas also caused disconnectivity of the Danube crested newt primary terrestrial habitats such as riparian forests, as well as secondary ones, such as ponds in gravel pits. Terrestrial habitat alteration includes the change of land use, not only by converting natural habitats of the Danube crested newt to agricultural, industrial and/or commercial land, but also by developing infrastructure such as roads. Intensification of motorways increased habitat fragmentation but can also directly cause mortalities due to roadkill.

Pollution has been impacting the Danube crested newt (Oaie *et al*. 2015). Given its distribution along the Danube floodplain, local pollution events can have detrimental effects over long distances. A variety of pollutants, including domestic and urban wastewater, industrial, agricultural and forestry effluents, could pose issues to populations as has been observed in many other amphibian species. As the Danube crested newt often inhabits agricultural areas of floodplains, many of its breeding sites and surrounding terrestrial habitats are likely to be affected by various pesticides. As is often the case with pond-breeding amphibians, there is a lack of available data. In addition, many ponds and their surrounding areas are filled with waste (Fig. 10), which may ultimately lead to a lack of local interest in these valuable habitats and their subsequent destruction.

Climate change has a negative influence by shifting and increasing drought periods throughout the species distribution area, as was documented, for example, in the southern part of the Danube crested newt range, where loss of breeding habitats has been shown in recent years due to increased aridification (Ionita *et al*. 2016). Lower precipitation and higher temperatures increase the risk of drying of breeding localities (Fig. 11). In addition, mild winters have also been highlighted as a threat, as shown for the great crested newt (Griffiths et al. 2010). A study on the predicted range shifts caused by climate changes in Romania showed a severe decline in the Danube crested newt range by 2050 (Popescu *et al*. 2013).

Fig. 10. A channel passing by the suburb of Belgrade, Serbia, 2018, situated on the left side of the once wetland area along the Danube river. This was the one of the local breeding sites for the Danube crested newt but is also recognized as the local deposition spot for all kinds of domestic waste (Photo by J. Crnobrnja-Isailović).

Russia's war against Ukraine also affected Danube crested newts as exemplified by the high mortalities reported in the Dnipro delta in Ukraine (with newts flushed into the Black Sea) caused by the destruction of the Kakhovka dam by the Russian army (Marushchak *et al*. 2024; Vasyliuk *et al*. 2024). This destruction led to a major alteration and pollution of the Dnipro valley, constituting an ecocide (Tsymbalyuk 2025).

Alien fish are one of the main threats to amphibian populations in Europe and can particularly pose a major problem to newt conservation, including the Danube crested newt through multiple effects, particularly predation but also competition as shown in other newt species (Denoël & Ficetola 2025). In addition, some native fish are often introduced in habitats such as ponds and lakes that were naturally devoid of fish. The introductions result in a large number of introduced species, sometimes in the same waterbodies (Denoël *et al*. 2009). Although the effects are species- and life stage specific, any introduction can have detrimental effects on crested newts, particularly in closed ponds (Denoël *et al.* 2009; Hartel *et al.* 2010; Tiberti 2018). Introduced fish species are a major threat to the Danube crested newt because they can feed on eggs, larvae and sometimes adults. Herbivorous species of fish are also detrimental as they graze on vegetation which is used as shelter by amphibians and their prey as well as a place to lay eggs (Lejeune *et al*. 2024). They can therefore destabilize the whole aquatic habitat and its food web. Specific studies are typically lacking for the Danube crested newt, but the threat posed by fish is nonetheless considered likely to be high.

Similarly, several crayfish species pose a threat as they spread easily along the Danube and their ability to colonize water bodies overland (Parvulescu *et al*. 2009,

Fig. 11. Pond drying can affect the Danube crested newt, as here in Rabensburg, Austria, 2025 (photo by U. Nüsken). Although drying can be helpful in preventing alien fish persistence, this can be harmful when it occurs frequently before the completion of metamorphosis of larval newts.

2017; Puky 2009, 2014; Lipták & Vitázková 2014; Todorov *et al*. 2020; Zorić *et al*. 2020).

Alien species, such as teleosts, can invade the habitat of the Danube crested newt through voluntary introductions or flooding events. Some exotic amphibian species, for example in the pet trade, are documented as carriers of lethal pathogens such as fungus *Batrachochytrium salamandrivorans* (Nguyen *et al*. 2017) and may therefore pose an additional risk to the Danube crested newt as shown in a sister species (Fernández Meléndez *et al*. 2025). At the time of writing, Bsal has not been found in the distribution range of the Danube crested newt. A documented pathogen for the Danube crested newt are the viruses in the genus *Ranavirus*, detected in Hungary (Vörös *et al*. 2020).

Aquaculture can therefore pose a threat to Danube crested newts by converting naturally fish free amphibian ponds to commercial fish ponds and this particularly impacts the Danube crested newt as it can be found in large ponds. More generally, allochthonous aquatic and terrestrial plant species could reduce habitat quality, making it potentially unsuitable for the Danube crested newt (Fig. 12).

Finally, illegal collecting may be a local threat particularly in remote populations. The Danube crested newt is indeed a frequently owned amphibian among pet keepers (Fahrbach & Gerlach 2018).

Fig. 12. Indigo bush *Amorpha fruticosa*, an invasive plant from North America which threatens natural Danube crested newt habitats, Lower Danube Floodplain, Romania, 2022 (Photo by D. Memedemin).

2.7. Current protection and status

2.7.1. European level

The Danube crested newt is classed in Annex II of the Convention on the Conservation of European Wildlife and Natural Habitats (1979). Similarly, in the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora OJ L 206, 22.7.1992), the Danube crested newt is included in Annex II, as a species of community interest whose conservation requires the designation of special areas of conservation. This directive applies to eight out of the 12 countries where the species is found. The species assessment for the Danube crested newt under article 17 (period 2013-2018) highlighted a detrimental status in five out of these eight countries (see 2.7.2. for details).

In the latest IUCN Red List Assessment of the amphibians of Europe and the European Union, the species was considered as Least Concern (Crnobrnja-Isailović *et al*. 2025), i.e. downgraded from its previous status of "Near Threatened", even close to "Vulnerable" (Edgar & Bird, 2006). This status is largely due to the wide distribution of this species, its abundance in some parts of its distribution, and the lack of data on population dynamics. Therefore, a quantitative assessment of its global decline is needed.

2.7.2. Country level

The Danube crested newt is protected throughout its distribution range by nation-based protective legislation. Its habitat is also protected within the Natura 2000 framework for the involved countries. According to the Article 17 web tool on biogeographical assessments of conservation status of species and habitats under Article 17 of the Habitats Directive, two countries reported an unknown status and six an unfavorable overall conservation status (Table 1).

Table 1. Assessment of conservation status of the Danube crested newt under Article 17 of the Habitats Directive (period 2013-2018: https://nature-art17.eionet.europa.eu). The status was identical between the different bioregions mentioned for the relevant countries (i.e. in Romania and Slovakia).

Country	Overall conservation status
Austria	Unfavourable – Bad (U2)
Bulgaria	Unfavourable – Inadequate (U1)
Croatia	Unknown (XX)
Czech Republic	Unfavourable – Bad (U2)
Hungary	Unfavourable – Inadequate (U1)
Romania	Unknown (XX)
Austria	Unfavourable – Bad (U2)
Slovakia	Unfavourable – Bad (U2)
Slovenia	Unfavourable – Bad (U2)

Red list status was evaluated in the different countries of its distribution range (Table 2), often based on IUCN criteria, but not yet in Slovenia and Moldova given the lack of data since its discovery (Ion *et al*. 2004; Stanković *et al*. 2015). Status assessments have therefore much improved since 2006, when this species was listed as "Data Deficient" in almost all countries (Edgar & Bird 2006). From the last national reports, it is concluded that the Danube crested newt is considered a Critically Endangered species in the Czech Republic (Jeřábková *et al.* 2017) and an Endangered species in Austria (Gollmann 2007) and Romania (Iftime 2005; Cogălniceanu & Rozylowicz 2015). Whereas it is proposed to receive the same status in Bosnia and Herzegovina, at the level of both entities: Federation of Bosnia and Herzegovina and the Republic of Srpska, it is not yet formally added to the red list (Zimić 2016; A. Zimić & E. Šunje, personal communication). It is considered Vulnerable in Bulgaria (Beschkov 2015), Slovakia (Kautman *et al*., 2001), Ukraine (Pysanets 2012) and Serbia (Kalezić *et al.* 2015) whereas it is evaluated as a Near Threatened status in Hungary (Vörös *et al.* 2019)

Table 2. Red list status of the Danube crested newt at a national level. See text for references.

Country	Status
Austria	Endangered (EN)
Bosnia - Herzegovina	Not assessed*
Bulgaria	Vulnerable (VU)
Croatia	Near Threatened (NT)
Czech Republic	Critically Endangered (CR)
Hungary	Near Threatened (NT)
Moldova	Data Deficient (DD)*
Romania	Endangered (EN)
Serbia	Vulnerable (VU)
Slovakia	Vulnerable (VU)
Slovenia	Not assessed*
Ukraine	Vulnerable (VU)

* In Bosnia and Herzegovina, Moldova and Slovenia, the Danube crested newt is very rare and therefore would likely be listed in threatened category when assessed.

and Croatia (Jelić *et al*. 2012). Therefore, in all countries, its status is in a more threatened category than in the global red list (Crnobrnja-Isailovic *et al*. 2025), calling therefore for a re-assessment and following more closely the Edgar & Bird (2006) considerations. Some national assessments are also quite old, calling also for a re-evaluation. In addition, within each country some isolated populations can be particularly threatened, and therefore require special attention.

3. Recommendations

3.1. Habitat restoration

A substantial part of the Danube crested newt range is part of the European Union. In the EU on 18 August 2024 the Nature Restoration Regulation (EU 2024/1991) came into force, which obliges member states to restore at least 20 % of the EU's land and sea by 2030, including 25.000 km of free flowing rivers. The Regulation requires each member state to submit a draft National Restoration Plan (NRP) to the European Commission by 1 September 2026 and to identify the restoration measures necessary to meet the restoration targets and fulfil the obligations. The need for the conservation of the Danube crested newt has been outlined in several countries such as Romania, Hungary, Slovakia, Bulgaria, Croatia, Czech Republic, Slovenia and Austria. For instance in Bulgaria, by 2050 all habitats that require management should be restored. The restoration targets following ecological approaches for habitats and focusing on restoring the ecosystem functions at the landscape-scale go hand in hand with the "favourable conservation status" logic set out in Habitats Directive. Measures to restore the floodplain dynamics must thus ensure that the species' habitat requirements are not neglected. For example, removing barriers from rivers without restoring retention capacity of the floodplain landscapes leads to further habitat loss of amphibians, when dynamic floodplains are not simultaneously restored. Introductions of invasive fish, plants, crayfish and other invasive species that threaten breeding success must be stopped and invasive populations must be removed whenever feasible.

3.1.1. Pond creation and restoration

Habitat management and creation are in many cases sufficient to restore and make populations grow to a viable and favourable conservation status (Briggs & Rannap 2006; Moor *et al.* 2022). These are two key actions for the preservation of the Danube crested newt and they are typically associated as new ponds are often built close to old ponds needing management (Fig. 13 and 14). Several actions are done by DANUBEPARKS in this perspective, including purchase of lands to guarantee the conservation future of the ponds. It is also done as part of the LIFE AMPHICON for the Italian crested newt (*T. carnifex*), through maintaining breeding sites and creation of a network of breeding sites. Crested newts are highly favoured when ponds are close to each other (preferably less than 100m) as they can visit several ponds during and between breeding seasons. In addition, connectivity between waterbodies should be maintained in the landscape to maintain dispersal and long-term survival of populations (Griffiths & Williams, 2000; Denoël *et al.* 2013, 2018; Tiberti 2018).

Favourable habitat conditions require a dominance of submerged macrophyte vegetation, as also shown in the great crested newt (Hartel *et al.* 2010). If the trophic state of the pond is affected by an excess of

Fig. 13. Conservation management for the Danube crested newt, involving land purchase, pond creation and habitat restoration (Marcelová, Slovakia, photos by Tomáš Kušík)

Fig. 14. Pond construction for the Danube crested newt: (top) Bernhardsthal, Austria (photo by U. Nütske) and (bottom) Štrbac, Serbia (photo by R. Šakić Peurača).

eutrophication, it shifts to a phytoplankton dominance that creates increased sedimentation and an unfavourable light regime for macrophytes, diminishing the habitat quality for the Danube crested newt. The ponds must be kept in a relatively equilibrium state, avoiding an overload of nutrient imports and other pollutants. In case of deteriorated habitats, for example affected by eutrophication or overgrowing, a site-specific restoration plan (also incorporating other threatened species) must be composed and implemented (Tetelea 2017).

3.1.2. Invasive species removal

The main breeding site must be without invasive fish species. The same applies to invasive species of crayfish, but this is often more difficult to manage. Removal of alien species and prevention of new introductions are essential, particularly for the preservation of newt populations. Previous removal management has given good results in newts (Denoël & Winandy, 2015), including in crested newts (Mori *et al*, 2017) but remains to be applied to the Danube crested newt. Such alien species can pose a serious threat to the survival of Danube crested newt populations. Although it remains logistically "easy" to empty small water bodies (e.g. by water pumping when waters are at their lowest level, Denoël & Winandy 2015), it is much harder for large waterbodies (Schabetsberger *et al*. 2023). If there is no direct connection to fish habitats such as rivers, repeated removals using fyke nets, possibly combined with electrofishing could help eradicate the introduced fish as shown in other freshwater environments (Tiberti *et al.*, 2021). This can require long efforts to make sure no fish remain and success may vary with the involved fish species. In any operation, the risk from "natural" reintroduction via flooding from nearby fish inhabited water bodies need to be taken into consideration. This is particularly important for the Danube crested newt which lives in floodplains. To prevent future re-introductions, maintaining a network of habitats without fish and crayfish at the landscape scale is essential for amphibian conservation (Manenti *et al.*, 2019). For the Danube crested newts, this refers mainly to ponds as oxbows and nearby rivers are typically stocked with both native and alien fish species. Native fish species are also problematic in isolated ponds where their presence is typically caused by human mediated introductions. In addition, invasive plant management can also be needed as invasive plants can also significantly modify the aquatic and terrestrial habitat and decrease its suitability (Fig. 12).

3.1.3. Preserving the natural hydrological regime in the landscape

It is important to avoid and limit the initiation of development plans that can alter the natural hydrological flow of the site such as hydropower dams, urbanisation, flood protection involving levees and embankments, intensification of agriculture including drainage and agrochemicals. The negative influence of draining must be mitigated. Preserving primary habitat involves maintaining oxbow ponds and floodplain wetlands and various natural depressions in a setting of natural hydrology, which is particularly needed for the Danube crested newt.

3.1.4. Preserving terrestrial habitats

As an amphibiontic species, i.e. requiring both a favourable aquatic and terrestrial habitat to sustain its life cycle, it is essential to preserve its both habitats. The experts must therefore evaluate the potential feeding and overwintering sites that can be used by the Danube crested newt, typically in the few hundreds meters from the breeding ponds (see e.g. Schabetsberger *et al.* 2004 for another crested newt species). Various deciduous wet and dry forests must be improved to a more natural state with an increased number of shelters such as dead wood. This will provide adequate feeding areas and overwintering sites. Such places should not suffer from flooding risk – although this is not always possible. Particular attention should be paid to urban development and agriculture intensification, which often disregards terrestrial habitats. A plan for restoring and creating adequate terrestrial habitat must be drawn up. In this perspective, land purchase and creation of reserves, not only for ponds, but also their surrounding terrestrial habitats is an asset for newt conservation (Schabetsberger *et al.* 2004) (Fig. 13).

3.2. Avoiding road mortalities and lack of aquatic - terrestrial connectivity

Roadkill mitigation measures include the implementation of alternative road routes that have lower or no impacts on newts as well as the installation of amphibian tunnels and permanent fences that prevent newts from accessing the road and effectively direct them toward their breeding ponds and back to the terrestrial habitats (Fig. 15). Such measures have been carried out at multiple Natura 2000 sites designated for *Triturus* species, for example in Slovenia under the LIFE AMPHICON (Poboljšaj *et al*. 2025) and in Germany, in Niedersachsen kreis Ulzen Oetzendorf. The amphibian migration route in the Natura 2000 area in Hohenau, Austria, is also protected by a 1.8 km long amphibian protection system, established partly due to the presence of the Danube crested newt (Schedl 2008).

3.3. Monitoring and species management

3.3.1. Maintaining viable population sizes

A key aspect for conservation is ensuring sufficiently large local populations and high survival rates (Karlson *et al.* 2007; Griffiths *et al.* 2010). Breeding sites must therefore be assessed by monitoring. It is important to evaluate not only the population size of adults but also reproduction success — that is, to identify where larvae occur — since some water bodies may function as reproductive traps (see e.g. Lejeune *et al.* 2023 for another newt species). If the experts determine that the number of populations or successful breeding sites is too low, a landscape-scale plan for creating additional ponds should be developed to support a viable and favourable conservation status of the local or meta population (Briggs & Rannap 2006). There are currently no such values for the ideal population size of Danube crested newts. However, research on crested newts suggests that this value depends on the possible colonization by neighbouring dispersal individuals (Griffiths & Williams, 2000). Some conservation projects recommend a population size over 1000 individuals for an isolated population or group of subpopulations of great crested newts. However, in many cases, populations are much smaller (e.g. in Belgium: Denoël et al., 2018), indicating the frequent need to improve conditions in order to sustain population viability.

Fig. 15. A Danube crested newt using an amphibian tunnel between its terrestrial habitat and its breeding pond (Hohenau, Austria, 2016; photos by U. Nüsken).

3.3.2. Ex-situ conservation, reintroduction and translocation

As a last resort, reintroductions and translocations have become a widely used conservation practice. Translocations should follow best practices, as outlined in the IUCN general guidelines (IUCN/SSC 2013) as well as those specific for amphibians (Linhoff *et al.* 2021). A well-structured translocation plan, outlining all essential steps, is crucial before being carried out. Fundamentally, releasing large numbers of individuals is critical, as this is often cited as the main factor influencing the success of a translocation (Germano & Bishop 2009). Although avoiding consanguinity is important in translocation procedures, it is also essential to prevent introductions of Danube crested newts from distant areas and possibly different lineages that would not have met naturally. Individuals should therefore come from targeted pond or the same area. Genomic studies can therefore be needed before taking action. The distinction between the possible types of translocations is essential (i.e., population reinforcement, reintroduction, assisted recolonization, and genetic rescue). These approaches can involve direct translocation or *ex-situ* breeding, preferentially close to the origin / released site to avoid risk (e.g. disease transmission). as introducing pathogens can lead to catastrophic consequences. Ex-situ programs can take place in dedicated structures or possibly in local zoos but only if all biosafety procedures are properly handled and organisms previously tested for high-risk pathogens. Species from different countries / areas should not be kept in the same structure and local (e.g. on site) ex-situ programs should always be preferred (see also 3.4). Regulation associated with Bsal such as in the EU also clearly limits transfer of individuals, particularly between countries. Besides these aspects, Such ex-situ programs proved to be successful in crested newts from various countries such as Slovenia with the LIFE AMPHICON (Bolčina *et al*. 2025), Denmark and Belgium. By increasing the survival of progeny during *ex-*

Fig. 16. Using gloves for newt manipulation: Juvenile Danube crested newt (Tihany, Hungary, 2024; photo by M. Denoël).

situ breeding programs, the releases gave viable populations, now expanding. In some situations, newts can be directly rescued such as in Ukraine to save the Danube crested newts that were flushed on the Odesa beaches following the destruction of a major dam by the Russian army in Ukraine (Vasilyuk *et al.*, 2024).

3.4. Prevention of emerging diseases

Given the risk of pathogen transmission (e.g. chytrids), much care is needed for all manipulation of newts and works in their habitat. Using gloves is recommended for work involving the manipulation of newts (Fig. 16). The manipulations should be as short as possible while keeping the gloves wet. In addition, all equipment (e.g. boots, traps and nets) in contact with soil and/or water must be adequately cleaned before going to new geographical areas. Disinfecting equipment (e.g. using ethanol or bleach, two accessible products) is highly recommended between distant sites but needs to be washed afterwards far from waterbodies (Schmidt *et al.* 2009). Sun drying and high temperatures help to disinfect material once cleaned of all mud. Regular sampling and testing for chytrid funguses (mainly Bsal) and Ranaviruses are recommended. In the case of Bsal detection at one site, strict biosecurity procedures are needed. As captive breeding can be the source of unwanted pathogens, a great deal of consideration is required before any operations are undertaken (see also 3.3.2). Tests are particularly necessary if operations are not carried out on a local scale.

3.5. Public awareness

Conservation starts with awareness. From awareness grows appreciation — and from appreciation, action. Environmental education is therefore a critical component of biodiversity conservation, promoting ecological literacy, pro-environmental behaviour, and long-term stewardship. Amphibians, particularly urodeles such as the Danube crested newt, serve as effective flagship species due to their sensitivity to habitat degradation and reliance on both aquatic and terrestrial ecosystems.

Fig. 17. Didactical material for the conservation of the Danube crested newt (Verein AURING, Austria).

Fig. 18. Folder for the conservation of the Danube crested newt (Donau-Auen National Park, Austria).

Educational initiatives utilizing species such as newts — framed as "little water dragons" — can effectively communicate the ecological significance of freshwater habitats and the anthropogenic threats they face. Integrating direct nature experiences with interdisciplinary approaches (e.g., cultural media, outdoor learning) strengthens cognitive, affective, and behavioural domains of environmental awareness, especially in younger audiences. For instance, showing the newt with a striking appearance, displaying impressive mating behaviour can improve communication (Fig. 17). More globally, by linking local species and habitats to broader sustainability goals, such programs cultivate emotional engagement and foster a multiplier effect, wherein participants become informal advocates for conservation within their communities. Therefore, the Danube crested newt is an ideal flagship species for amphibian conservation, also for promoting the importance of water resource management on a landscape level, also for Natura 2000 network.

Multiple tools can be used to promote the Danube crested newt and its conservation, such as mobile exhibition, environmental education program, including interactive games, competitions (drawing contest, artistic events), promotional gifts, information sources (leaflet, brochure, website) (Fig. 17). Information flyers were already produced by Nationalpark Donau-Auen (Fig. 18) and Nature Park Kopački rit, DANUBEPARKS.

Functioning both as an animal-assisted therapy dog and a trained detection canine for the the Danube crested newt, a dog can play a significant role in herpetological environmental education. As a living ambassador for amphibian conservation, the dog actively supports environmental outreach programs and facilitates citizen science involvement, thereby enhancing public engagement and awareness across diverse age groups.

3.6. Improving knowledge

3.6.1. Short and long-term research

In contrast to other crested newt species, the current knowledge of the Danube crested newt remains rudimentary. In order to apply conservation management efficiently and at the right places, it is important to improve our knowledge on this species, its requirements and threats at both local and global scales. New research projects on this species should be launched over most axes associated with its diversity, ecology, ethology and conservation. Genetic assessments throughout the distribution range are needed to determine adequately the limits of the range, considering the hybridization with its sister crested newt species and to highlight the species diversity. Beyond and in line with inventories and monitoring, analyses of field-based survey data at both the pond and landscape scale will help to understand habitat use, distribution, threats and decline of the species (see e.g. Denoël *et al.* 2013 for the great crested newt). This is particularly awaited as the biology of the Danube crested newt differs from the biology of the other crested newt species (Edgar & Bird 2006; Fahrbach & Gerlach 2018). For instance, more work is needed to understand the effect of the diversity of fish introductions on this species as well as on the level of contamination to its habitats. Research in trophic ecology is also particularly needed to determine the position of the Danube crested newt in its food web and how it can be affected by various anthropogenic factors such as fish introductions. Ultimately, new assessments are required to possibly revise its regional and global status, combining knowledge in the twelve countries of presence of the species. In this perspective comparisons of past versus recent data and the use of occupancy modelling can highlight declines (Denoël 2002; Maletzky *et al.* 2007, Falaschi *et al*. 2022).

3.6.2. Distribution surveys

There are still many gaps in the knowledge of the distribution, particularly obvious along the Danube between Serbia and Romania and between the Danube and Dnipro deltas (Fig. 2). Starting targeted campaigns in these regions is essential while centralizing distribution data across countries could help to avoid gaps and to have a global and detailed figure of the distribution (see e.g. Denoël *et al*. 2023 for an example in another newt species). Indeed, not all data are currently openly available at a high resolution whereas they are stored privately in local databases. New surveys are currently hampered in a key part of the distribution in Ukraine due to the war situation. More generally, future global mapping will benefit from a broadening of collaborations across the whole range of the Danube crested newt.

The use of (mobile) applications for citizen science is a key to gathering large amounts of distribution data over wide geographic areas (e.g. Trichkova *et al*. 2021). Interoperability between applications in the different countries would be an asset to reach the aim of data exchange. A validation step of such data is necessary, including using pictures when available, as several crested newt species could be misidentified or locations wrongly assessed. Such validation process should be carried out in the original databases so it can be further merged for compilations (Sillero *et al.* 2018). This may explain the presence of outliers in varied databases such as GBIF. Improving the knowledge on the hybrid zones will also be helpful to adequately draw the limits of the distribution range of the different taxa and their hybrids but would necessarily require genetic barcoding.

Fig. 19. Environmental DNA (eDNA) sampling in Hungary. The technique can inform on the occurrence of the Danube crested newt (Photo by B. Preiszner).

In recent years, environmental DNA (eDNA) has become available as a tool for detection of amphibians, including newts (Takahashi *et al*. 2023). It allows large-scale, cost-efficient, and detailed assessments of species distribution and is an important tool to complement direct methodologies such as traps or visual surveys (Buxton *et al*. 2022) and can be used to verify potential locations. Even though the method is only reliably applied to assess the presence-absence of species, eDNA concentration may reflect relative abundance in different ponds, although environmental factors can affect the concentrations observed (Buxton *et al.* 2017). Therefore, this will not replace monitoring using traditional methods such as trapping which can measure abundance (see 3.5.3). In England, eDNA is successfully used for surveying the great crested newt (*Triturus cristatus*) (Buxton *et al.* 2017, 2021, 2022) which may serve as a model for surveying Danube crested newt.

Specially trained wildlife detection dogs are an effective tool for locating cryptic or nocturnal species that are difficult to detect using conventional survey methods. Due to their highly sensitive olfactory system, detection dogs are capable of identifying specific scent cues even at extremely low concentrations. This method is increasingly being integrated into amphibian monitoring protocols, particularly for the detection of newts, which

Fig. 20. Using trained dogs to find the Danube crested newt (Austria, photo by H. Nüsken). This approach helps finding newts on land, where the presence of the newt is less assessed than in water.

often inhabit concealed or inaccessible environments (Grimm-Seyfarth *et al*. 2024, Glover *et al.* 2023).

3.6.3. Population and conservation status monitoring

In selective areas representative of the distribution of the Danube crested newt and in varied countries, population monitoring needs to be established with repeated surveys each year. The use of a standardised design across sites (e.g. similar traps and sampling time) is recommended for an efficient data analysis within and across populations (Fig. 21). Traps need to be placed in several waterbodies per site and checked regularly to prevent mortalities, which can be due to high densities, predators or air access. As the coloration pattern of the belly of the Danube crested newt can be used for individual identification, it can also be used to estimate population sizes (Gollmann 2016). PIT-tagging was also shown to be adequate in the study of the Danube crested newt (Jehle & Hodl 1998). It is essential to determine adulthood while it adds some interest to identify the sexes during sampling. It is important to identify the presence and abundance of larvae caught as these are measures of reproductive success. Indeed, in some habitats, newts can be present without reproductive success (Lejeune *et al*. 2023).

Fig. 21. Traps used for monitoring the Danube crested newt (Wiedem am See, Austria, 2019; photo by U. Nüsken). This technique can give occurrence and abundance data and be used to depict changes in population size across time.

4. Recommendations on priorities

Prioritizing conservation management depends on the scale of action, immediate to medium term threats, the status of populations, and funding possibilities (see Table 3 for a summary of priorities). From a geographical point of view, isolated populations (particularly in the Dnipro delta in Ukraine, but also along the Danube in Romania and Bulgaria) and those rare at the edge of their distribution in several of the involved countries are certainly good candidates for priority actions, yet without neglecting other areas that could be threatened in a longer term perspective. Taking benefits of protected habitats, such as in DANUBAPARKS or in Natura2000 sites will help the establishment of actions, some already undertaken (Danubeparks 2019) but a broader perspective is needed as they are not present in all the countries inhabited by the Danube crested newt. Particularly when basic data are lacking, inventories are needed whereas short and long-term monitoring is needed throughout all the distribution range. Among the threats, those at the pond scale can be the easiest to deal with, by restoring adequate aquatic conditions (e.g. a fishless state) and creating new fishless and connected ponds. At a broader scale, much effort should be done to prevent large-scale threats such as the global alteration of hydrological flow by dam construction and land reconversion. In the case of catastrophic events that can deeply affect populations and/or when there is an immediate risk to the viability of isolated populations, many actions may need a more immediate response (e.g. *ex-situ* breeding until other actions can take place). Besides management, improving knowledge is a high priority to understand the specific ecology and peculiarities of the Danube crested newt and therefore to adequately guide conservation measures and allow the link between local and global conservation actions. In this perspective, networking among newt experts and those within the twelve countries inhabited by the Danube crested newt is essential as a direct continuation of the present action plan. Accumulating these data will also help to quickly re-assess the global status of the Danube crested newt, and evaluate its current status where it has not been evaluated and where the previous assessments are outdated.

5. Conclusions

The Danube crested newt is an extraordinary newt species because of its distinctive distribution and habitat. Despite a very large distribution range and high abundance in some areas, its habitats have been threatened first by large modifications of the landscape and hydrography and more recently by a multitude of additional threats. It is also rare at many locations across its distribution with isolated populations at risk of extirpation. In comparison with other amphibian species included in the *Triturus* genus, it has so far received much less attention, both in terms of scientific knowledge and large conservation plans.

The main global threats include the destruction and alteration of its habitats at multiple scales, including by hydrological regulations and the introduction of invasive alien species, particularly teleost fish and crayfish. The European Union (EU) has an obligation to preserve and protect its biodiversity against threats, based on international agreements, including the United Nations Convention on Biological Diversity (CBD), the Bern Convention and the Habitats Directive. To avert further declines, it is necessary to have a clear and long-term commitment from the EU and its member states as well as from other countries inhabited by the Danube crested newt.

Table 3. Prioritising actions for the Danube crested newt, covering all the distribution range of the species. A higher geographical priority is given to countries with a smaller distribution range (see Figure 2) and/or an endangered Red List status (see Table 2) and in geographic isolates. Local conditions (e.g. immediate and or specific risk) may involve shift in the timing and priority of actions for all countries.

Actions	Priority	Schedule
Habitat preservation and restoration		
Creating new ponds	High	Immediate
Restoring pond physical characteristics (e.g. water depth)	Medium	Short term
Removing fish from core conservation sites	High	Immediate
Removing fish from peripheral sites	Medium	Short term
Removing alien plant species	Medium	Medium term
Preventing and removing major habitat disruptions (e.g. dams)	High	Short term
Preserving and restoring terrestrial habitat	High	Immediate
Preserving and restoring terrestrial – aquatic connectivity	High	Short term
Preserving and restoring aquatic connectivity (clusters of nearby ponds)	High	Immediate
Preserving and restoring aquatic connectivity (landscape scale)	High	Short term
Species management		
Implementing *ex-situ* conservation breeding programs	Medium	Medium term
Reinforcing populations	Medium	Medium term
Applying disease prevention measures (e.g. biosecurity)	High	Immediate
Conducting disease testing in wild populations	Medium	Medium term
Communication		
Raising public awareness	High	Immediate
Improving knowledge		
Compiling all existing quantitative data	High	Immediate
Conducting range-wide distribution surveys	High	Immediate
Implementing monitoring programs using traps and eDNA	High	Short term
Identifying and assessing threats	High	Immediate
Conducting targeted scientific research	High	Short term
Collaborative works		
Establishing an international board of experts	High	Short term
Linking research projects with conservation actions	High	Short term
Developing regional conservation projects	High	Immediate
Implementing transnational conservation projects	High	Short term

This first Danube crested newt Action Plan summarises the main aspects of the current state of knowledge and defines the conservation priorities. It aims to guide DANUBEPARKS and subsequently the European Commission, the EU member states and other countries in their response, as well as to promote initiatives at multiple levels to protect the Danube crested newt. The next step to be implemented is the preparation of targeted actions and the development of networks of experts and local researchers and stakeholders to promote research and conservation of the Danube crested newt. In this perspective, the DANUBEPARKS structure and network represent a key asset to promote the conservation of the Danube crested newt. In addition, involving experts from all the countries inhabited by the Danube crested newt is essential to extend monitoring and management actions to the entire range of the species and take into consideration the specificities of the local threats.

Summary

This first Action Plan for the Danube crested newt (*Triturus dobrogicus*) summarises the main lines of knowledge and defines conservation priorities for this distinctive amphibian species. The Danube crested newt is distributed across 12 European countries, in the lowlands of the Danube floodplains and Dnipro Delta. Its habitats have been under threat for a long time due to major alterations of the hydrographic landscape and, more recently, from a range of additional threats, including the introduction of alien species, climate change, and war. Despite national and international protection (e.g. listing in Annex II of the Habitats Directive), the species is declining throughout most of its range and is classified there from Vulnerable to Critically Endangered according to national IUCN Red List criteria. In comparison to other crested newt species, there is still an important lack of knowledge and a shortage of large-scale conservation actions. It is therefore urgent to recognize the Danube crested newt as a priority and flagship species, to fill gaps in our understanding of its biology and its responses to anthropogenic pressures, and to implement effective, targeted managements and other conservation measures a both local and international scales, including transnational projects. In this context, conservation networks such as Danubeparks represent a valuable platform for coordinated action.

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