ENDANGERED NATURAL VALUES OF THE UPPER PART OF THE DRAVA RIVER BASIN IN CROATIA

Croatian Laws and International regulations define the responsibilities of flora and fauna protection in the upper part of the Drava river basin in Croatia

Due to the pressure humans impose on natural habitats generally, but in particular their disregard of the law, violation of regulations of the Republic of Croatia and international regulations in force in Croatia, **the distribution of most species of the upper part of the Drava basin in Croatia is rapidly being reduced**. Many of these species (at least 50 species) on the Drava river between the Ormoz reservoir and Donja Dubrava are facing near-extinction if the activities and works that are destroying their natural habitats and all natural elements of the Drava ecosystem (the 'Stara Drava' or 'Old Drava'), preserved in the natural state after the construction of three Croatian hydroelectric power plants, are not immediately stopped and future works banned.

The Croatian Constitution and the following laws and regulations bind the Republic of Croatia to preserve and protect the natural heritage of the river Drava, especially the endangered and rare species and their habitats.
Nature Protection Law (Official Gazette N. N. no. 30/94, 72/94), **Environment Protection Law** (N. N. no. 82/94), **Forestry Law** (N. N. no. 52/90, 9/91, 61/91, 76/93), **The Strategy and Action Plan for the Protection of Biological and Landscape Diversity of Croatia** (N. N. no. 81/99), **Environment Impact Assessment Regulations** (N. N. no. 59/00), and **Decisions and Regulations for the protection of particular plants and animal species in the Republic of Croatia** (N. N. no. 28/66, 45/67, 10/70, 15/70, 42/72, 23/77, 12/78, 43/78, 52/79, 30/80, 53/81, 22/82, 31/95, 43/95, 47/95, 76/98, 80/99).

The obligation to protect and preserve the endangered natural heritage of Drava is also stipulated in the following international conventions that are in force in the Republic of Croatia whereby the State has taken full responsibility for their implementation (precondition for entering the EU).
The Biological Diversity Convention (Rio de Janeiro, 1992, N. N. International contracts no. 1/6/96), **The Convention on the Protection of European Wild Species and Natural Habitats** (Bern, 1979, N. N. International Contracts no. 6/00, 11/00 and **The Convention Co-operation on the Protection and Sustainable Use of the River Danube** (Sophia, 1994 N. N. International Contracts no. 2/96).

The endangered species of the upper Drava are registered in the Red Lists and Books of Croatia, in the IUCN's Red List of globally endangered species (IUCN, 2000), included among the endangered species in the European Union Directives (Council Directive 79/409EEC of 2 April 1979 on conservation of wild birds, Council Directive 92/43EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) and listed in The Emerald Network documents – a network of Areas of Special Conservation Interest for Europe, T-PVS (2001)51.
Endangered habitats

1. The main course of the river

Many water plants live in the shallow parts of reservoirs, of the Drava riverbed and derivation channels, in Drava side branches and swamps created by the changes in the river's course. Among others the following species are represented here: Lemna trisulca, L. minor, Spirodela polyrrhiza, Ceratophyllum demersum, Potamogeton nodosus, Nuphar luteum, Sparganium emersum, Elodea canadensis, Hydrocharis morsus-ranae, Utricularia vulgaris, Nymphoides peltata and others.
On the sections of the so-called Old Drava, river crabs (Astacus astacus) can still be found. About 40 fish species inhabit the Drava. They are mainly from the carp family (Cyprinidae). The hydroelectric power plants have changed the living conditions in the Drava river and thus the structure of the river's ichtiofauna. The construction of the hydroelectric power plants has disabled their migrations and communication among the same species populations along the river. In case of the construction of the planned 'water-steps' on the Old Drava its course will be divided into a number of slow "free-flowing lakes" causing the disappearance of life conditions for the endangered species like Hucho hucho, Zingel zingel, Z. streber, Cobitis taenia and others.

2. Hyporeic (interstitial waters under the riverbed) and phreatic (alluvial interstitial waters)

Inhabited by special and insufficiently explored fauna (e.g. Proasellus slavus, Microcharon acherontis, Niphargus aberans, N. longgidactylus and others). These habitats and species are exposed to pollution filtered through the alluvial terrain, such as nutrients and pesticides from cultivated soil, substances from waste disposal, contaminated surface waters, spills caused by pollution incidents.

3. River banks, sand banks, islands, side branches, dead branches and swamps

These are the habitats of numerous species that require specific living conditions and cannot be adapted to habitats with different characteristics, or to a wider range of ecological factors (so-called "stenovalence species"). The dynamics of the river course constantly changes the physical arrangement and appearance of most of these habitats and enables their permanent presence as inseparable elements of the river ecosystem. Their presence is therefore a significant indicator of the ecological state of the Drava ecosystem.

3.1. **Steep eroding banks** from earth substrate with a portion of sand – are key factors for the nesting of sand-martins (Riparia riparia) and kingfishers (Alcedo atthis).

3.2. **Sloping earthen banks covered with trees and thick vegetation** – are key factors for otters (Lutra lutra) and beavers (Castro fiber) for making their shelter lairs and raising their young.

3.3. River branches, dead branches, swamps and shallow waters with slow flowing or stagnant water

The communities of Myriophyllo-Nupharetum - Myriophyllum verticillatum and Nuphar lutea, Ranunculus circinatus, Ceratophyllum demersum, Potamogeton nodosus, P. natans and other, Trapa natans, Nymphaea alba and others.

Communities of Lemno-Spirodeletum, Lemnetum minoris with species of Lemna trisulca, L. minor, Lemna gibba, Spirodela polyrrhiza, Wolffia arrhiza and others.

The community of Scirpo-Phragmitetum – Phragmites australis, Scirpus lacustris, Typha latifolia, T. angustifolia, and also Iris pseudacorus, Equisetum fluviatile, Alisma plantago-aquatica, Oenanthe acquatica, Butomus umbellatus and other.

The community of reeds and cattails (Phragmiti – Typhetm minimae) – between the reservoirs of HEP Varaždin and HEP Čakovec and downstream from the reservoir of HEP Dubrava a few smaller communities, the only ones in Croatia, have been recorded. Typhetum minimae is facing extinction both on the Drava and in Croatia. If the remaining habitats on the Drava are to be destroyed this will mean its extinction in Croatia.

Reeds are the nesting places of Botaurus stellaris, some types of Acreocephalus arundinaceus, A. schoenobaenus, A. scirpaceus. These are also nesting places of herons, Ardea pupurea, Egretta alba, Ixobrychus minutus and Podiceps cristatus, P. ruficollis, Fulica atra and others.

River branches and stagnant water habitats are rich in various fauna, among which a number of endangered and protected species are present. This is the home of endangered amphibians and reptiles, such as the swamp frog, Rana arvalis, turtle Emys orbicularis, and snake Natrix tessellata.

Particular dead branches on this part of the Drava, together with the dead branches of the Mura, are the only recorded habitats of Umbera krameri in Croatia. Misgurnus fossilis is also an endangered species from this habitat.

3.4. **Gravel bars and islands –** an identifiable feature of the low winding course of the Drava. The gravel-bar banks are covered with Nasturtium officinale, Polygonum hydropiper, Lythrum salicaria and others. On bars that haven't been inundated for some time Myricaria germanica has developed within the association of Salicetum purpureae, and together with willows forms the pioneer association Salici-Myricarietum. Calamagrostis epigeios also grows here. Sterna albifrons nests in unapproachable gravel bars and islands. These bars, when partly covered with primary vegetation, are the nesting places for Charadrias dubius and Actitis hypoleucos. The construction of the existing hydroelectric power plants and reservoirs have caused the drowning of some very significant parts of the range of species and communities associated with gravel bars. Every further loss of gravel bars and islands is a step towards the extinction of Myricaria germanica and Sterna albifrons on the Drava and thus in Croatia.

4. Isthmus (higher parts of terrain) on sandy substrate

An association of willows Salicetum eleagno – daphnoidis) is formed on higher grounds. Once, Hippophae rhamnoides densely covered the floodplains of the upper part of the Drava in Croatia but today it is facing extinction. On the natural section of

the river between the reservoirs of HEP Varaždin and HEP Čakovec a smaller population is recorded on Slovenian territory, while on the Croatian part, including the parts belonging to the Međimurska County, this species has not been recorded in the past few decades. This section of the Drava is the only habitat of Hippophae rhamnoides in Croatia.

5. Forests

The natural sections of the upper Drava in Croatia (the so-called "Old Drava" is today flanked by a wide continuous zone of forest. These forests mainly consist of phreatophite species of trees that satisfy their water demands mainly from ground waters and occasionally from flood-waters. The most widespread native species are willows (Salix alba, S. purpurea, S. fragilis, S. caprea, S. cinerea and other, white poplar (Populus alba), black poplar (P. negra), common oak (Quercus robur), black alder (Alnus glutinosa), white alder (A. incana), field elm (Ulmus carpinifolia), U. laevis and other. These species together with the attendant formation of shrubs and herbaceous plants form forest associations of white and black poplar with dewberry (Salici – Populetum nigrae – rubetosum caesii), the association of white willow and black poplar with narrow leaf sedge (Carici brizoides – Alnetum glutinosae), the association of black and white alder (Alnetum glutinosae – incanae), the association of hornbeam and common oak (Carpino beluti – Quercutum roboris). Euro-American poplar (Populus x euroamericana) is the main non-native species that has been planted. Due to the mostly preserved natural vegetation covering, these forests still have an outstanding diversity of fauna.

Endangered species

Plant species

RL (Red List) – species from the red list of endangered species in Croatia (author: Toni Nikolić), and respectively, the future Red Book of endangered species of Croatia: EX – extinct species, CR – critically endangered species, EN – endangered species, VU – vulnerable species.

Lemna giba – RL (EN)
Wolffia arrhiza (RL (VU)
Typha minima RL (CR)
Myricaria germanica RL(CR)
Hippophae rhamnoides RL (EN)
Marsilea quadriofolia RL (EN)

Animal species

NPL (Nature Protection Law) – species protected by the Nature Protection Law
IUCN – species that is listed on the red list of globally endangered species (2000 IUCN Red List of threatened species). In brackets: EX (extinct) – species which have died out, CR (critical) – critically threatened species, EN (endangered) – endangered species, VU (vulnerable) - vulnerable species, LR (low risk) – endangered species of low risk from total extinction.

BC (Bern Convention) – species for which all the signatory countries of the Bern Convention on the protection of European wild species and natural habitats are obliged to provide strict protection in natural habitats.

DH – species listed on the EU Directive on the conservation of natural habitats and of wild fauna and flora – 92/43/EEC) for which all the EU countries need to provide protected areas.

DH! – species on the list of EU Directive on the habitats and species that in the countries of EU are the most strictly protected.

DB – species on the list of EU Directive on the conservation of wild birds – 79/409/EEC for which all the EU countries should ensure survival and breeding within their distribution range by suitable protective measures.

EN – species on the list of the Emerald Network/2001 for which it is necessary to undertake certain measures to protect their habitats.

Invertebrates

Astacus astacus	NPL
Hirudo medicinalis	NPL
Aeschna viridis	BC, DH!
Cerambyx cerdo	BC
Lucanus cervus	DH, EN

Fish

Hucho hucho	IUCN (EN), DH, EN
Zingel zingel	IUCN (VU), DH!, EN
Zingel streber	IUCN (VU), DH, EN
Gymnocephalus schraetzer	IUCN (VU), DH, EN
Cobitis taenia	DH, EN
Umbra krameri	NPL, IUCN (VU), BC
Misgurnus fossilis	IUCN (LR), DH, EN

Amphibians

Triturus vulgaris	NPL
Bombina bombina	NPL, IUCN (LR), BC, DH!, EN
Bufo bufo	NPL
B. viridis	NPL. BC, DH!
Rana arvalis	NPL, BC, DH!
Rana dalmatina	NPL, BC, DH!
Hyla arborea	NPL, BC, IUCN(LR), DH!

Reptiles

Emys orbicularis	NPL, IUCN(LR), BC, DH!, EN
Natrix natrix	NPL
N. tessellata	NPL, DH!
Anguis fragilis	NPL
Coronella austriaca	NPL, DH!
Elaphe longissima	NPL, BC, DH!
Lacerta viridis	ZZP, BC, DH!

Birds

Remiz pendulinis	NPL
Acrocephalus arundinaceus	NPL
A. schoenobaenus	NPL
A. scirpaceus	NPL
Parus palustris	NPL
Emberiza schoeniclus	NPL
Alcedo atthis	NPL, BC, DB, EN
Riparia riparia	NPL
Ciconia ciconia	NPL, BC, DB, EN
Ciconia nigra	NPL, BC, DB, EN
Ardea cinerea	NPL
Ardea purpurea	NPL, BC, NSAP, DB, EN
Egretta alba	NPL, DB, EN
Ixobrychus minutus	NPL, BC, EN
Egretta garzetta	NPL, BC, DB, EN
Nycticorax nycticorax	NPL, BC, DB, EN
Botaurus stellaris	NPL, BC, DB, EN
P. pygmaeus	NPL, IUCN (LR), EN
Charadrius dubius	NPL, BC
Actitis hypoleucos	NPL, BC
Tringa totanus	NPL, DB
T. ochropus	NPL, BC
T. nebularia	NPL, DB
Sterna hirundo	NPL, BC, DB, EN
S. albifrons	NPL, BC, DB, EN
Strix aluco	NPL
Asio otus	NPL
Dendrocopus major	NPL
D. minor	NPL
Picus viridis	NPL
Cuculus canorus	NPL
Oriolus oriolus	NPL, BC
Sitta europaea	NPL, BC
Troglodytes troglodytes	NPL, BC
Chloris chloris	NPL
Turdus viscivorus	NPL, DB
T. iliacus	NPL, DB
Upupa epops	NPL, BC

Mammals

Myotis daubentoni	NPL, BC
M. dasycneme	NPL, BC, DH, EN
Castor fiber	IUCN (LR) DH, EN
Lutra lutra	NPL, BC, IUCN (VU), EN
Erinaceus concolor	NPL
Sorex araneus	NPL
S. minutus	NPL
Nyctalus noctula	NPL
Plecotus auritus	NPL
Myotis myotis	NPL, EN

Sciurus vulgaris NPL

Every change of the river regime, hydro-morphologic and hydro-geologic characteristics of the river and the levels of surface and ground water have harmful impacts on all the stated habitats and attendant species. In recent decades a significant loss of the listed species has occurred within the Drava ecosystem. **The major changes of the original characteristics of the Drava ecosystem and the loss of natural habitat have been caused by the construction of HEP Varaždin, HEP Čakovec and HEP Dubrava. The river ecosystem had just begun to adapt to the changes caused by the construction and working regime of the hydroelectric plants, when the overall destruction of the remaining natural habitats began with the regulation of the Old Drava. Particular communities and species have been brought to the brink of survival. Typha minima and Hyppophae rhamnoides are facing extinction on the Croatian part of the Drava and therefore in Croatia. At least 50 species protected by the Bern Convention and Croatian laws will lose their habitats in the upper part of Drava in Croatia through the river regulation that started with the extraction of large amounts of gravel from the Drava for road-building purposes. Successive recovery will not be possible for most of the stated habitats and species. Neither will re-naturalisation procedures be able to bring back most of the lost habitats and species.**

The accuracy of this statement can be proved by examining the already-excavated section of the Old Drava, between the reservoirs of HE Cakovec and HE Dubrava where habitats have been destroyed, species have become extinct and a total disorder of the ecological balance in the wider region has occurred. The regime of surface waters and groundwater has been disturbed, causing the draining of smaller swamps, dead branches and side branches, the dying of forests in the floodplain, the draining of village wells and pumps, a significant increase in aridity of cultivated land and the need for its irrigation during dry periods, reduced ecosystem immunity to extreme meteorological conditions and to the pollution of water, soil and air.

What have we gained by this – justified as flood protection works - when the influence on the river ecosystem of this process is completely harmful? This negative assessment was established in the Environmental Impact Study of the proposed river-embankment for the flood protection of Varazdin – Svibovec. Only gravel, that is currently the resource most in demand, for sale to road-builders. However, gravel can be extracted in many other ways without such long-term disastrous consequences for one of the key footholds of biological diversity and endangered species in north-western Croatia and the wider region. It is particularly significant that international and Croatian regulations have been completely violated, which is certainly no recommendation for Croatia's entry into the EU.