

# Monitoring of hydrological, hydraulic and morphological characteristics of the Danube and inventory of biodiversity components of the Croatian-Serbian common section of the Danube

Inventory of biodiversity components

preliminary results







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# 2. BIODIVERSITY INVENTORY and 3. ESTABLISHMENT OF GIS



#### 2. BIODIVERSITY INVENTORY

- 2.1 Fish fauna inventory
- 2.2 Habitat inventory
- 2.3 Bird fauna inventory
- 2.4 River benthos type inventory

# 3. ESTABLISHMENT OF A GEOINFORMATION SYSTEM (GIS)

### 2.1 Fish fauna inventory



- The electrofishing portion of the field work was conducted between July and August 2023.
- ▶ 17 critical sections of the river from Batina to Ilok
- Depending on the length of each critical section, one to four transects of 500 m were sampled
- During fish sampling, the following data were collected on all 43 transects:
  - date, critical section name, site name, transect name, transect coordinates,
  - habitat characteristics: Type of bank and stream bottom, aquatic and riparian vegetation, depth, flow velocity,
  - pressures, threats and habitat conservation
  - Catch data: Croatian name of species, scientific name of species, number of individuals, age structure, abundance of each species in the sample, age classes.

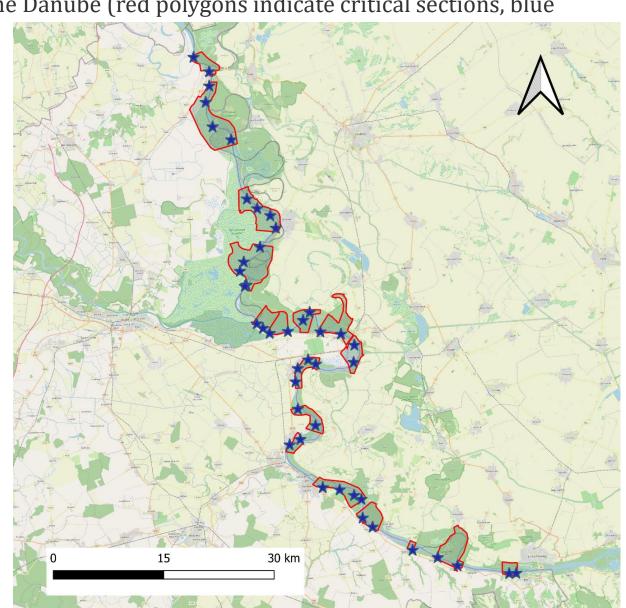
#### Fish sampling locations



Fish sampling locations on the Danube (red polygons indicate critical sections, blue

stars indicate transects):

- 1. Batina
- 2. Siga
- 3. Apatin
- 4. Židovski rukavac
- 5. Ušće Drave
- 6. Aljmaš
- 7. Staklar
- 8. Erdut
- 9. Bogojevo
- 10. Dalj
- 11. Borovo I
- 12. Borovo II
- 13. Vukovar
- 14. Sotin
- 15. Opatovac
- 16. Mohovo
- 17. Ilok



#### Preliminary results (1)



- The electrofishing method was used to sample 25 fish species with more than 4,500 specimens during the day.
- Among all the species, the most numerous were bleak (*Alburnus alburnus*), asp (*Aspius aspius*) and common carp (*Cyprinus carpio*).
- of the Natura 2000 target species, asp (*Aspius aspius*), european bitterling (*Rhodeus amarus*), and cactus roach (*Rutilus virgo*) were sampled.











# **Preliminary results (2)**



- Among the fish sampled, 7 species were invasive monkey goby (*Neogobius fluviatilis*), round goby (*Neogobius melanostomus*), bighead goby (*Ponticola kessleri*), prussian carp (*Carassius gibelio*), pumpkinseed (*Lepomis gibbosus*), silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*)
- Physical and chemical parameters were also measured: water temperature ranged from 26-28°C, the pH value ranged between 7.5 and 8, the oxygen level between 90% and 100%, while the water depth in the middle of the stream transect varied between 3 and 12 m. The shores are earthy with rip-rap present, mostly overgrown with trees and grass, while the bed is a mixture of sand and silt with slow to moderate water flow.





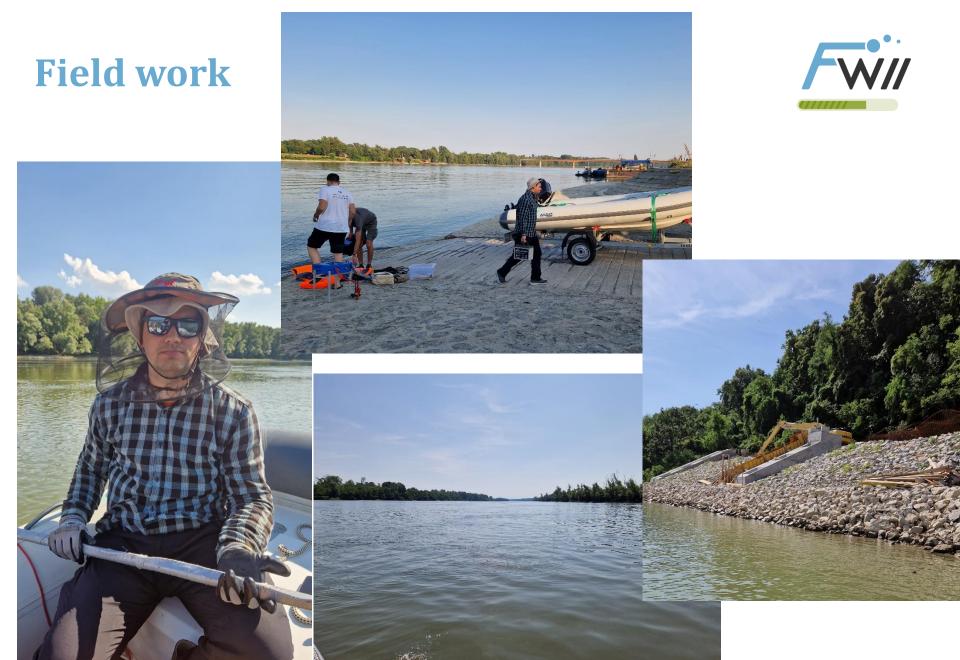


























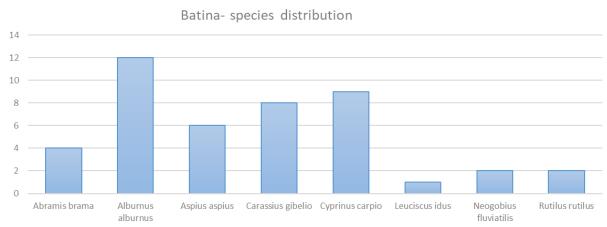
# Fish sampling locations - Batina



Only asp was recorded on this critical section from Natura 2000 target species

Scientific name	Croatian name	English name	Number
Abramis brama	deverika	Freshwater bream	4
Alburnus alburnus	uklija	Bleak	12
Aspius aspius	bolen	Asp	6
Carassius gibelio	babuška	Prussian carp	8
Cyprinus carpio	šaran	Common carp	9
Leuciscus idus	jez	Orfe	1
Neogobius fluviatilis	riječni glavočić	Monkey goby	2
Rutilus rutilus	bodorka	Roach	2





### Fish sampling locations - Siga



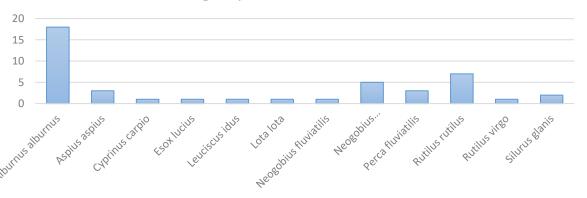
With present bayou there were greater species number

Pike was very low in abudance, it was speculated because of lack of aquatic plants

Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	18
Aspius aspius	bolen	Asp	3
Cyprinus carpio	šaran	Common carp	1
Esox lucius	štuka	Pike	1
Leuciscus idus	jez	Orfe	1
Lota lota	manjić	Thin-tailed burbot	1
Neogobius fluviatilis	riječni glavočić	Monkey goby	1
Neogobius melanostomus	glavočić okrugljak	Round goby	5
Perca fluviatilis	grgeč	River perch	3
Rutilus rutilus	bodorka	Roach	7
Rutilus virgo	plotica	Cactus roach	1
Silurus glanis	som	Wels catfish	2



Siga- species distribution



### Fish sampling locations - Apatin

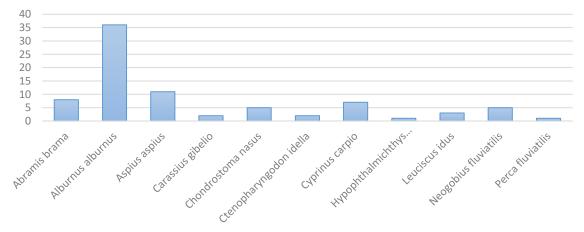


On this critical section a few silver carps were seen but only one was caught and measured

	Scientific name	Croatian name	English name	Number
	Abramis brama	deverika	Freshwater bream	8
	Alburnus alburnus	uklija	Bleak	36
y	Aspius aspius	bolen	Asp	11
	Carassius gibelio	babuška	Prussian carp	2
•	Chondrostoma nasus	podust	Undermouth	5
	Ctenopharyngodon idella	amur	Grass carp	2
	Cyprinus carpio	šaran	Common carp	7
	Hypophthalmichthys molitrix	bijeli glavaš	Silver carp	1
	Leuciscus idus	jez	Orfe	3
	Neogobius fluviatilis	riječni glavočić	Monkey goby	5
	Perca fluviatilis	grgeč	River perch	1



#### Apatin-species distribution



# Fish sampling locations - Židovski rukavac FW//

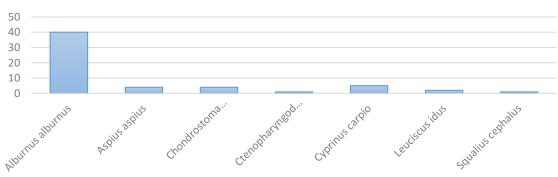


This was the first critical section where common chub was caught



Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	40
Aspius aspius	bolen	Asp	4
Chondrostoma nasus	podust	Undermouth	4
Ctenopharyngodon idella	amur	Grass carp	1
Cyprinus carpio	šaran	Common carp	5
Leuciscus idus	jez	Orfe	2
Squalius cephalus	obični klen	Common chub	1

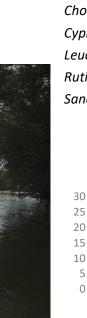
#### Židovski rukavac- species distribution



# Fish sampling locations - Ušće Drave

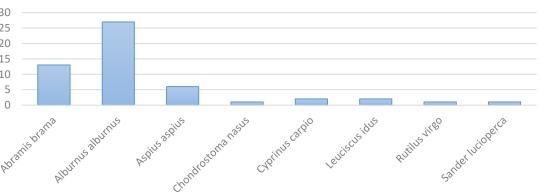


First zander was caught on this critical section



Scie	entific name	Croatian name	English name	Number
Abramis bra	ma	deverika	Freshwater bream	13
Alburnus alb	urnus	uklija	Bleak	27
Aspius aspiu	S	bolen	Asp	6
Chondroston	na nasus	podust	Undermouth	1
Cyprinus car	oio	šaran	Common carp	2
Leuciscus idu	ıs	jez	Orfe	2
Rutilus virgo		plotica	Cactus roach	1
Sander lucio	oerca	smuđ	Zander	1

#### Ušće Drave- species distribution



# Fish sampling locations - Aljmaš

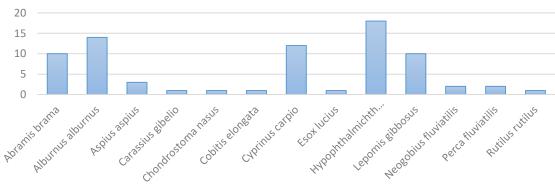


First sighting of invasive pumkinseed was recorded on this critical section



Scientific name	Croatian name	English name	Number
Abramis brama	deverika	Freshwater bream	10
Alburnus alburnus	uklija	Bleak	14
Aspius aspius	bolen	Asp	3
Carassius gibelio	babuška	Prussian carp	1
Chondrostoma nasus	podust	Undermouth	1
Cobitis elongata	vijun	Balkan loach	1
Cyprinus carpio	šaran	Common carp	12
Esox lucius	štuka	Pike	1
Hypophthalmichthys molitrix	bijeli glavaš	Silver carp	18
Lepomis gibbosus	sunčanica	Pumpkinseed	10
Neogobius fluviatilis	riječni glavočić	Monkey goby	2
Perca fluviatilis	grgeč	River perch	2
Rutilus rutilus	bodorka	Roach	1

#### Alimaš- species distribution



### Fish sampling locations - Staklar



Only three species were recorded on this critical section with bleak beeing most abudant

Scientific name	Croatian name	English name	Number
Scientific flame	Croatian name	Liigiisii ilailic	Number
Abramis brama	deverika	Freshwater bream	1
Alburnus alburnus	uklija	Bleak	118
Aspius aspius	bolen	Asp	4



# Staklar- species distribution 120 100 80 60 40 20 Abramis brama Alburnus alburnus Aspius aspius

# Fish sampling locations - Erdut

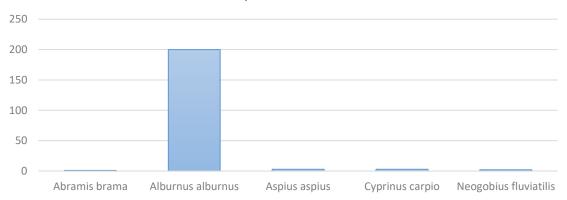


# Most of the fish were caught around rock walls



Scientific name	Croatian name	English name	Number
Abramis brama	deverika	Freshwater bream	1
Alburnus alburnus	uklija	Bleak	200
Aspius aspius	bolen	Asp	3
Cyprinus carpio	šaran	Common carp	3
Neogobius fluviatilis	riječni glavičić	Monkey goby	2

#### Erdut- species distribution



### Fish sampling locations - Bogojevo



Similar to Staklar critical section Bogojevo was poor in abudance of fish species with

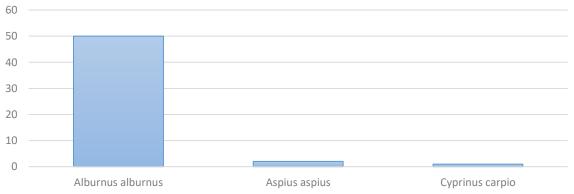
bleak again beeing most

abudant



Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	50
Aspius aspius	bolen	Asp	2
Cyprinus carpio	šaran	Common carp	1

#### Bogojevo-species distribution



#### Fish sampling locations - Dalj

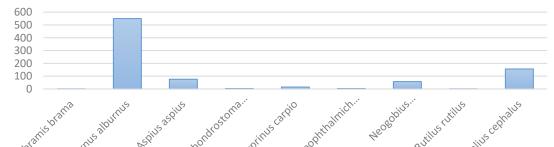


First critical section where chub abudance was recorded above 100 individuals

It is concerning fact that 58 of monkey goby's were caught

Scientific name	Croatian name	English name	Number
Abramis brama	deverika	Freshwater bream	1
Alburnus alburnus	uklija	Bleak	550
Aspius aspius	bolen	Asp	77
Chondrostoma nasus	podust	Undermouth	4
Cyprinus carpio	šaran	Common carp	15
Hypophthalmichthys molitrix	bijeli glavaš	Silver carp	4
Neogobius fluviatilis	riječni glavočić	Monkey goby	58
Rutilus rutilus	bodorka	Roach	1
Squalius cephalus	obični klen	Common chub	157





Dalj- species distribution

### Fish sampling locations - Borovo I



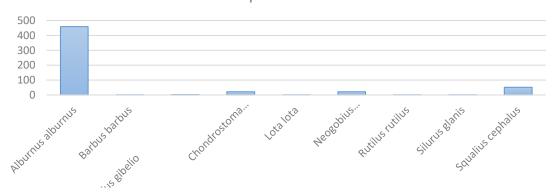
#### First barbel was recorded on

this critical section



Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	460
Barbus barbus	mrena	Barbel	1
Carassius gibelio	babuška	Prussian carp	2
Chondrostoma nasus	podust	Undermouth	22
Lota lota	manjić	Thin-tailed burbot	1
Neogobius fluviatilis	riječni glavočić	Monkey goby	21
Rutilus rutilus	bodorka	Roach	1
Silurus glanis	som	Wels catfish	1
Squalius cephalus	obični klen	Common chub	52

#### Borovo I- species distribution



#### Fish sampling locations - Borovo II

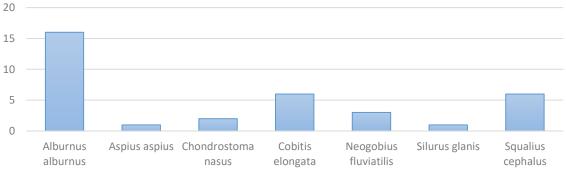


In comparison with previous section where bleak was far superior in sampled species, on this section bleak was not so abudant in the sample.



Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	16
Aspius aspius	bolen	Asp	1
Chondrostoma nasus	podust	Undermouth	2
Cobitis elongata	vijun	Balkan loach	6
Neogobius fluviatilis	riječni glavočić	Monkey goby	3
Silurus glanis	som	Wels catfish	1
Squalius cephalus	obični klen	Common chub	6

#### Borovo II- species distribution



#### Fish sampling locations - Vukovar



Bleak being most abudant in this critical section, with first zanthe caught in bayou

European bitterling was caught only on this section.

Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	207
Aspius aspius	bolen	Asp	2
Cobitis elongata	vijun	Balkan loach	4
Cyprinus carpio	šaran	Common carp	3
Ponticola kessleri	keslerov glavočić	Bighead goby	2
Rhodeus amarus	gavčica	European bitterling	2
Squalius cephalus	obični klen	Common chub	1
Vimba vimba	nosara	Zanthe	1



#### Vukovar- species distribution



#### Fish sampling locations - Sotin

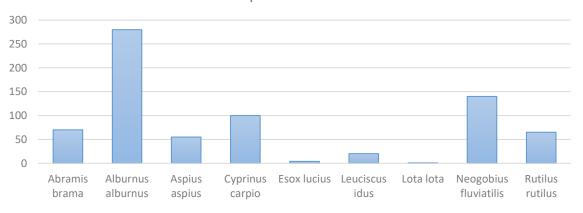


In comparison with other section's it seems that pike was likely to be found downstream



Scientific name	Croatian name	English name	Number
Abramis brama	deverika	Freshwater bream	70
Alburnus alburnus	uklija	Bleak	280
Aspius aspius	bolen	Asp	55
Cyprinus carpio	šaran	Common carp	100
Esox lucius	štuka	Pike	4
Leuciscus idus	jez	Orfe	20
Lota lota	manjić	Thin-tailed burbot	1
Neogobius fluviatilis	riječni glavočić	Monkey goby	140
Rutilus rutilus	bodorka	Roach	65

#### Sotin-species distribution



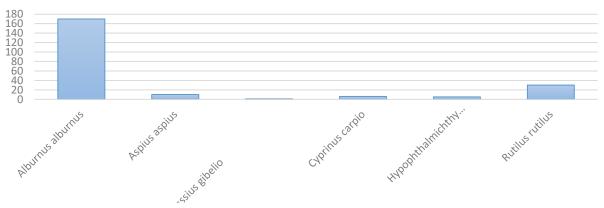
# Fish sampling locations - Opatovac



	Scientific name	Croatian name	English name	Number
,	Alburnus alburnus	uklija	Bleak	170
,	Aspius aspius	bolen	Asp	10
(	Carassius gibelio	babuška	Prussian carp	1
(	Cyprinus carpio	šaran	Common carp	6
,	Hypophthalmichthys molitrix	bijeli glavaš	Silver carp	5
	Rutilus rutilus	bodorka	Roach	30



#### Opatovac- species distribution



## Fish sampling locations - Mohovo

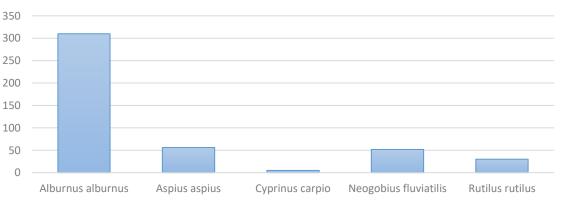


Bleak was most abudant fish species on this section, with asp and monkey goby as wall

Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	310
Aspius aspius	bolen	Asp	56
Cyprinus carpio	šaran	Common carp	5
Neogobius fluviatilis	riječni glavočić	Monkey goby	52
Rutilus rutilus	bodorka	Roach	30



#### Mohovo-species distribution



### Fish sampling locations - Ilok

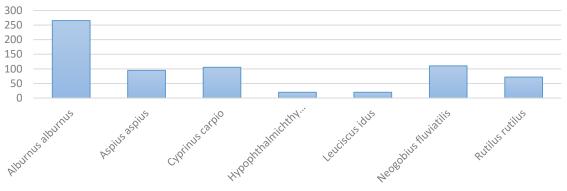


Silver carp was most abudant on this section

Scientific name	Croatian name	English name	Number
Alburnus alburnus	uklija	Bleak	265
Aspius aspius	bolen	Asp	95
Cyprinus carpio	šaran	Common carp	105
Hypophthalmichthys molitrix	bijeli glavaš	Silver carp	20
Leuciscus idus	jez	Orfe	20
Neogobius fluviatilis	riječni glavočić	Monkey goby	110
Rutilus rutilus	bodorka	Roach	72



#### Ilok- species distribution



# **Summary Results**



Latin name	Species name	1.Batin	2.Siga	3.Apatin	4.Židovski rukavac	5.Aljmaš	6.Ušće Drave	7.Staklar	8.Erdut	9.Bogojevo	10.Dalj	11.Borov o I	12.Borov o II	13.Vukova	14.Sotin	15.Opato vac	16.Moho vo	17.llok
Abramis brama	Freshwater bream	х		х	· unusus	х	х	x	x		х		<u> </u>		х			
Alburnus alburnus	Bleak	x	x	x	x	x	x	х	x	x	x	x	x	x	x	х	x	х
Aspius aspius	Asp	x	x	х	x	x	х	х	x	×	x		x	x	x	х	x	х
Barbus barbus	Barbel											х						
Carassius gibelio	Prussian carp	x		х		x						х				х		
Chondrostoma nasus	Undermouth			х	x	x	x				x	х	х					
Cobitis elongata	Balkan loach					x							х	x				
Ctenopharyngodon idella	Grass carp			x	x													
Cyprinus carpio	Common carp	x	x	x	x	x	x		x	х	x			x	x	x	x	x
Esox lucius	Pike		х			x									x			
Hypophthalmichthys molitrix	Silver carp			x		x					x					х		x
Lepomis gibbosus	Pumpkinseed					x												
Leuciscus idus	Orfe	х	x	х	x		х								x			х
Lota lota	Thin-tailed burbot		х									х			х			
Neogobius fluviatilis	Monkey goby	x	х	х		x			x		x	х	х		х		х	х
Neogobius melanostomus	Round goby		х															
Perca fluviatilis	River perch		х	х		x												
Ponticola kessleri	Bighead goby													x				
Rhodeus amarus	European bitterling													x				
Rutilus rutilus	Roach	x	х			x					x				x	x	x	х
Rutilus virgo	Cactus roach		х				х											
Sander lucioperca	Zander						x											
Silurus glanis	Wels catfish		х									х	х					
Squalius cephalus	Common chub				x						x	x	х	x				
Vimba vimba	Zanthe													x				

#### **Future actions?**



- ▶ Nighttime electrofishing (September October 2023.)
- ► Electrified dredge (September October 2023.)
- Monitoring of winter habitats with sonar (December 2023. February 2024.)

### **Progress on Serbian side of Danube**

- All permits are gathered
- Monitoring of fish (electrofishing): September October 2023

# 2.2 Habitat inventory



#### Objectives

- Mapping of target habitat types of the critical sections in the Danube floodplain
- Final habitat map integrated into GIS database, scale
   1:5.000
- Data on target habitat distribution incorporated and presented as part of the Biodiversity Catalogue









- focusing on mapping of 5 target habitat types
  - 1. One forest habitat type riparian forests periodically inundated by the annual rise of the river 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)



Target habitat type 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)



- focusing on mapping of 5 target habitat types
  - 2. Two habitats occuring on standing water bodies
    - Amphibious short annual vegetation, pioneer of land interface zones of standing water bodies with nutrient poor soils, or which grows during periodic drying of these standing waters 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or Isoeto-Nanojuncetea
    - Lakes and ponds with free-floating surface communities or, in deep, open waters, with large pondweeds – 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition



Example of small pond in the floodplain with free-floating surface communities of the Hydrocharition



- focusing on mapping of 5 target habitat types
  - **3. One habitat type occurring along the shallow muddy banks of the Danube**, with annual pioneer nitrophilous vegetation 3270 Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation
  - 4. One habitat belonging to alluvial type of meadows with natural flooding regime
     6440 Alluvial meadows of river valleys of the Cnidion dubii

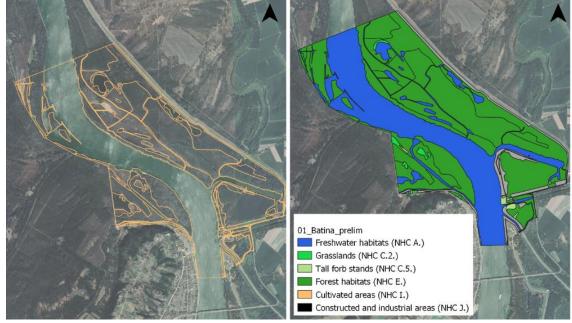


Example of muddy natural river bank where vegetation starts to develop – photo taken at the end of July

#### **Status**



- Existing data gathered (habitat maps, available data on other habitat and vegetation surveys conducted in the Danube floodplain
- Preliminary map is (the basis for field survey) is prepared
- Field survey started late in the vegetation season, after awaiting the period of low water levels stabilization
- Necessary permits are gathered on both sides of the Danube
- Field works are now in progress and will be finished during autumn 2023

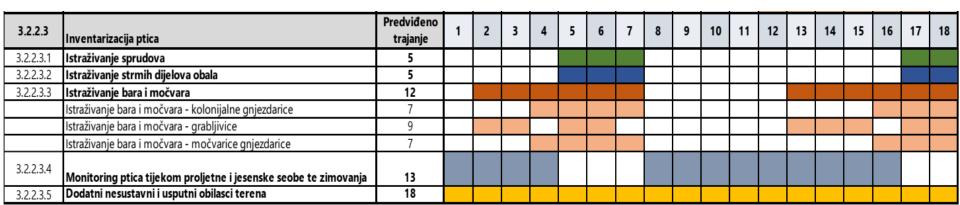


Example of a preliminary map for the critical location of Batina left – polygon delineation right polygon interpretation according to basic habitat classes

#### 2.3 Bird fauna inventory



- All planned activities carried out
- ▶ Breeding birds of Danube islands and sand bars (May-July)
- ▶ Breeding birds of Danube steep banks (May-July)
- ▶ Wetlands birds in Danube floodplain (17 sub-sites)
  - colonial waterbirds (April-July)
  - marshland breeding birds (April-July)
  - raptors (February-July)
- ► Migratory birds along the Danube (March-May; September-November in progress)
- Wintering birds along the Danube December-February 2022/2023

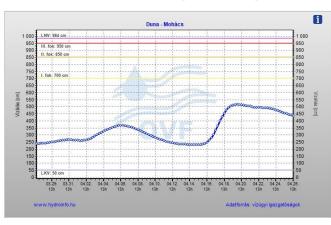


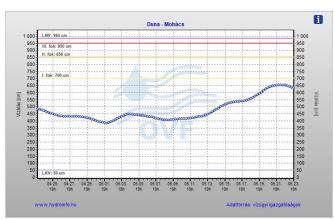


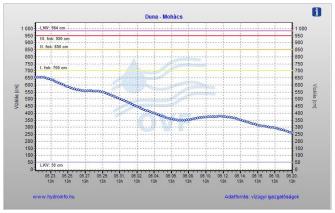
# Bird fauna inventory

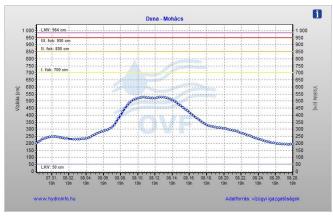


- ▶ Breeding season characterised with high water levels
  - Mid-April to early June
  - Mid-August (9-17.08)
  - Beginning of September (01-08.09)















#### **Bird fauna inventory**



- Flooding of sandbars prevented ground nesting bird (Little-ringed plover, terns)
- Flooding of lower steep banks prevented breeding of Sand Martins and most likely affected breeding success of Kingfishers



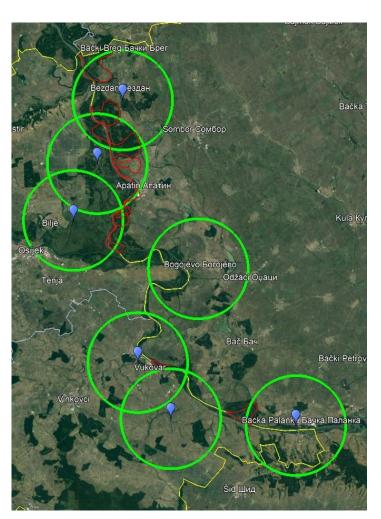


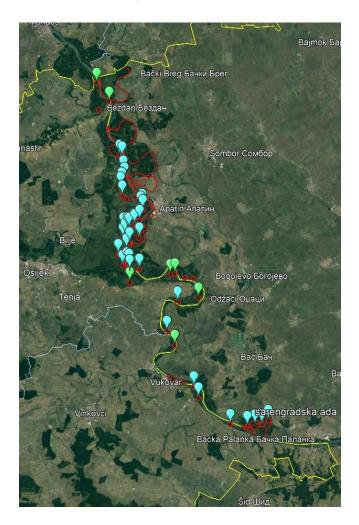


# Bird fauna inventory



- Heron and cormorant colonies were mapped and explored
- Raptor territories established (White-tailed eagle)





# 2.4 River benthos type inventory





#### Objectives

- 1. Survey river macroinvertebrate community structure in the critical sections of Danube river
- 2. Integration of data into GIS database and presentation of macrozoobenthic communities within the Biodiversity Catalogue



- Sampling methodology is following the national Methodology of sampling, laboratory analyzes and determining the ecological quality ratio for biological quality elements
  - sampling between May to October



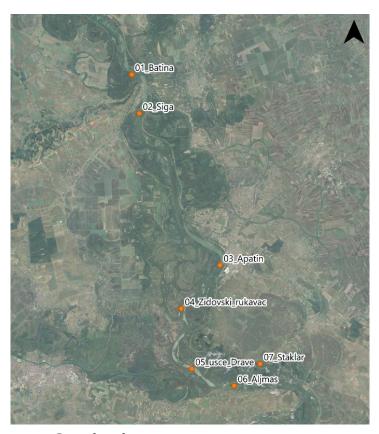


Danube

#### **Status**



# **Field survey has been completed** between June and July on 17 critical sections





Sampling locations

Left – locations sampled during June 2023 Right downstream locations sampled at the end of July 2023

#### **Status**





Laboratory analyses of samples have started (isolation of animals from all samples) which will be followed by determination of taxons





- Activities within the scope of the project:
  - Set-up and configuring of a server



• Implementation of a WebGIS system (user requirement analysis, application development and implementation)



Collection of monitoring data, systematization and GIS database establishment



#### Set-up and configuring of a server

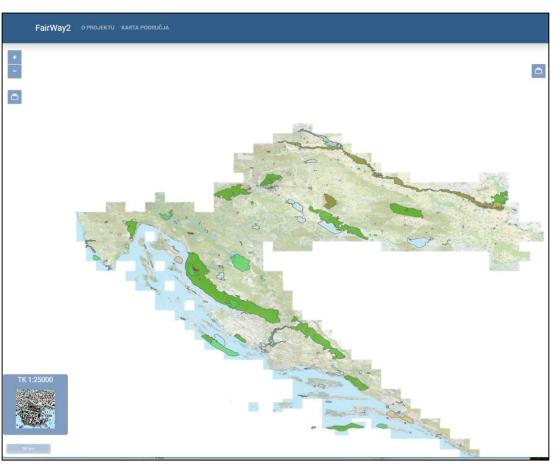


- Technical characteristics defined
  - local server at least 5 TB of disk space (upgradable)
  - interface requirements at least 128 GB of RAM
  - min 2xIntel Xeon processors
- The procurement of local server components -> in progress

# Implementation of a WebGIS system (user requirement analysis,



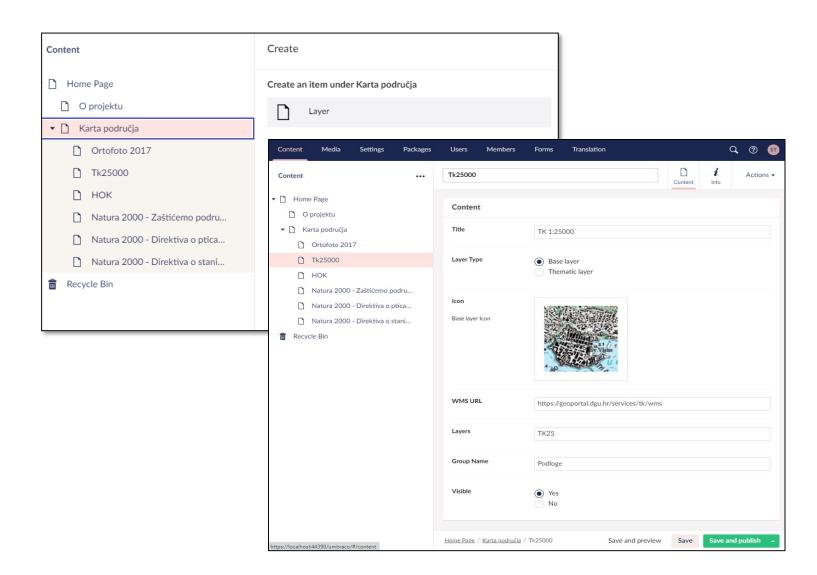
application development and implementation)





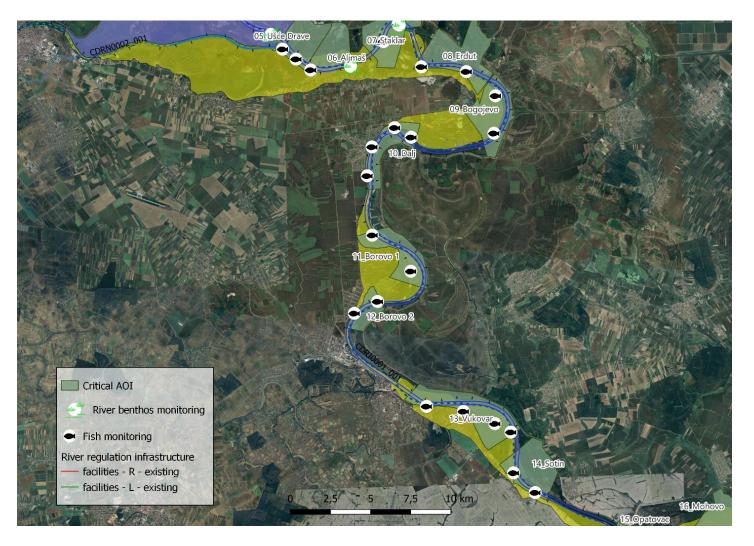
# Implementation of a WebGIS system (user requirement analysis, application development and implementation)





# Collection of monitoring data, systematization and GIS database establishment







# Thank you for your attention



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