



Final river birds breeding report for Croatia

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IMPRESSUM

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SUMMARY

During the 30.06.2021 bird monitoring on the Mura river was carried in the area of TBR MDD between Dekanovec (HR) (49 rkm) and Legrad (Mouth Mura in Drava, 0 rkm). A total of 107 data were collected on the occurrence of the following target bird species: *Accipiter gentilis*, *Accipiter nisus*, *Actitis hypoleucos*, *Alcedo atthis*, *Anas platyrhynchos*, *Ardea alba*, *Ardea cinerea*, *Buteo buteo*, *Charadrius dubius*, *Cygnus olor*, *Delichon urbica*, *Dryocopus martius*, *Haliaeetus albicilla*, *Merops apiaster*, *Microcarbo pygmaeus*, *Phalacrocorax carbo*, *Riparia riparia* and *Tringa glareola*. Threats to nesting birds on the Mura during 2021 relate to a fairly long period of high water and the channeling of the river with stone revetments.

During the 12.06.2022 bird monitoring on the Mura river was carried in the area of TBR MDD between Dekanovec (HR) (49 rkm) and Legrad (Mouth Mura in Drava, 0 rkm). A total of 78 data were collected on the occurrence of the following target bird species: *Actitis hypoleucos*, *Alcedo atthis*, *Anas platyrhynchos*, *Ardea cinerea*, *Buteo buteo*, *Charadrius dubius*, *Cygnus olor*, *Delichon urbica*, *Dryocopus martius*, *Falco tinnunculus*, *Haliaeetus albicilla*, *Merops apiaster*, *Phalacrocorax carbo*, *Riparia riparia*, *Sterna albifrons* and *Tringa glareola*. Threats to nesting birds on the Mura during 2021 and 2022 related to a fairly long period of high water and channeling of the river with stone revetments.

In the period between 08.06.-03.07.2021 bird monitoring on the Drava river was carried in the area of TBR MDD between Lovrečan (HR) (320 rkm) and Aljmaš (the confluence of the Drava and the Danube, 0 rkm). A total of 330 data was collected on the occurrence of the following target bird species: *Accipiter nisus*, *Actitis hypoleucos*, *Alcedo atthis*, *Anas platyrhynchos*, *Ardea alba*, *Ardea cinerea*, *Buteo buteo*, *Charadrius dubius*, *Ciconia nigra*, *Cygnus olor*, *Delichon urbica*, *Dryocopus martius*, *Egretta garzetta*, *Haliaeetus albicilla*, *Larus michahellis*, *Larus ridibundus*, *Mergus merganser*, *Merops apiaster*, *Microcarbo pygmaeus*, *Milvus migrans*, *Nycticorax nycticorax*, *Pernis apivorus*, *Phalacrocorax carbo*, *Riparia riparia*, *Sterna albifrons*, *Sterna hirundo*, *Tringa glareola* and *Vanelusvanelus*. Threats to nesting birds on the Drava river in 2021 related to a fairly long period of high water, channeling of the river with revetments and other river management constructions, and sediment excavation.

In the period 30.05.-19.06.2022 bird monitoring on the Drava river was carried in the area between Lovrečan (HR) (320 rkm) and Aljmaš (the confluence of the Drava and the Danube, 0 rkm). A total of 384 data were collected on the occurrence of the following target bird species: *Accipiter gentilis*, *Actitis hypoleucos*, *Alcedo atthis*, *Anas platyrhynchos*, *Ardea alba*, *Ardea cinerea*, *Ardea purpurea*, *Buteo buteo*, *Charadrius dubius*, *Ciconia ciconia*, *Ciconia nigra*, *Circus aeruginosus*, *Cygnus oloruginosus*, *Delichon urbica*, *Egretta garzetta*, *Haliaeetus albicilla*, *Mergus merganser*, *Merops apiaster*, *Nycticorax nycticorax*, *Phalacrocorax carbo*, *Riparia riparia*, *Sterna albifrons*, *Sterna hirundo* and *Tringa glareola*. Threats to nesting birds on the Drava in 2022 relate to channeling of the river with revetments and other river management constructions.

In the period 14.06.-15.06.2021 in the area of TBR MDD on the Danube river between Batina (HR) (1425 rkm) and Ilok (1299 rkm) bird monitoring was carried out. A total of 162 data were collected on the occurrence of the following target bird species: *Alcedo atthis*, *Anas platyrhynchos*, *Ardea cinerea*, *Buteo buteo*, *Chlidonias hybridus*, *Ciconia ciconia*, *Ciconia nigra*, *Cygnus olor*, *Egretta garzetta*, *Falco tinnunculus*, *Haliaeetus albicilla*, *Larus michahellis*, *Larus ridibundus*, *Merops apiaster*, *Milvus migrans*, *Nycticorax nycticorax*, *Phalacrocorax carbo*, *Riparia riparia* and *Tringa glareola*. Threats to nesting

birds on the Danube during 2021 related to a fairly long period of high water, channeling of the river by revetments and other river management constructions, and disturbance.

In the period 04.06.-05.06.2022 in the area of TBR MDD on the Danube river between Batina (HR) (1425 rkm) and Ilok (1299 rkm) bird monitoring was carried out. A total of 183 data were collected on the occurrence of the following target bird species: *Alcedo atthis*, *Anas platyrhynchos*, *Anser anser*, *Ardea alba*, *Ardea cinerea*, *Ardeola ralloides*, *Buteo buteo*, *Charadrius dubius*, *Chlidonias hybridus*, *Ciconia ciconia*, *Ciconia nigra*, *Cygnus olor*, *Egretta garzetta*, *Falco tinnunculus*, *Haliaeetus albicilla*, *Himantopus himantopus*, *Larus michahellis*, *Larus ridibundus*, *Mergus merganser*, *Merops apiaster*, *Milvus migrans*, *Nycticorax nycticorax*, *Parus major*, *Phalacrocorax carbo*, *Platalea leucorodia*, *Riparia riparia* and *Sterna hirundo*. Threats to birds nesting on the Danube in 2022 relate to the canalization of the river by embankments and other river management constructions and disturbance.

METHODOLOGY AND FIELD INVENTORIES

Drava

The monitoring of target bird species was carried out on the Drava River during the nesting season (May-July). It covered the area of the Drava River from Lovrečan to Aljmaš i.e. sections 320 - 0 rkm. The surveyed area can be divided into two basic types: the old courses of the Drava River around the hydroelectric reservoir and the Drava River downstream of the hydroelectric power plants. The total investigated part of the Drava River around the Reservoirs is 31 km. These parts of the Drava old courses have a low water flow for the most part of the year (biological minimum), while during the high water the flow can be many times higher, which results in significant movement of sediment and erosion of the bottom and banks. The consequences of high waters are the creation and maintenance of high-value river habitats such as steep banks and gravel banks, which are abundant in this section of the Drava. The upstream part of the Drava is located in the section from Lovrečan to the Otok Virje, i.e. from 320-314 rkm (Fig. 1 and Fig. 2). The second part is located on the section between the village of Svibovec Podravski and the city of Varaždin, i.e. from 300-289 rkm (Fig. 2). Monitoring of the parts of this segment of the Drava was performed from land, due to the water steps that are dangerous to cross with a boat, and are not plotted on the map. The third part is located on the section between the settlements of Veliki Bukovec and Donja Dubrava, i.e. from 256-242 rkm (Fig.3).

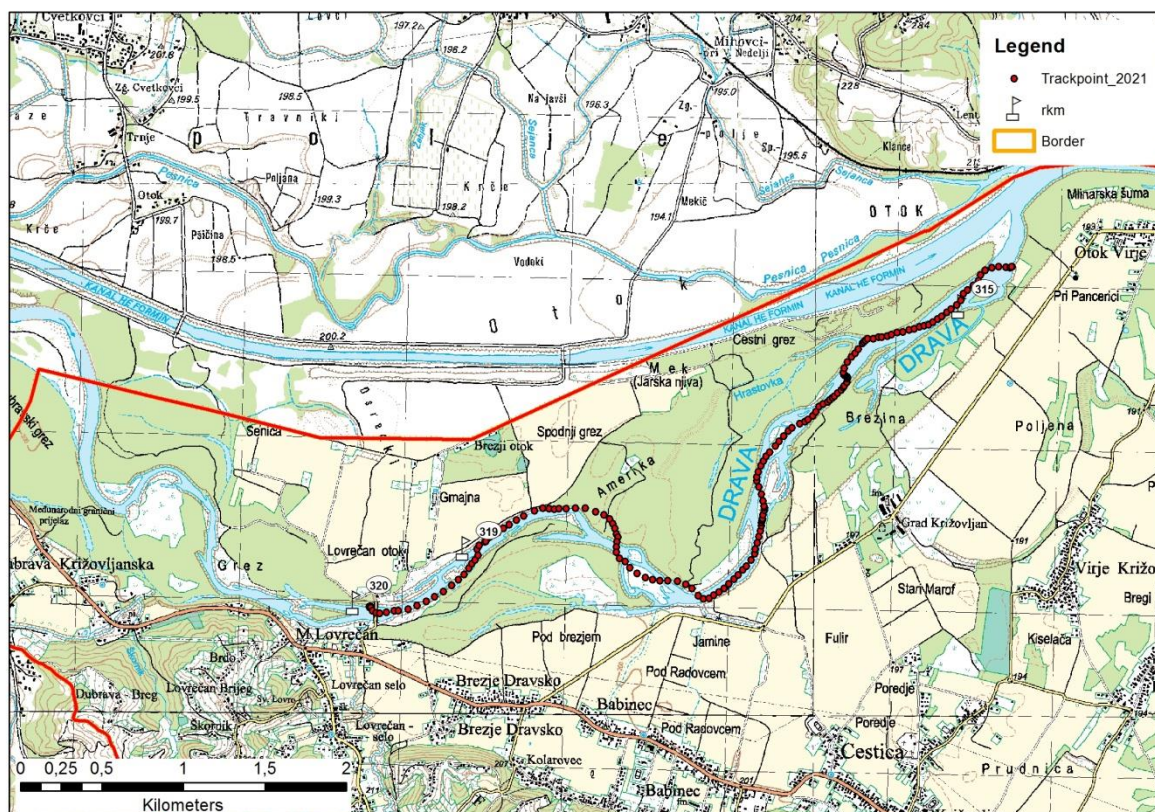


Fig. 1.

Monitored length of the Drava River from Lovrečan to the Otok Virje, 320-314 rkm

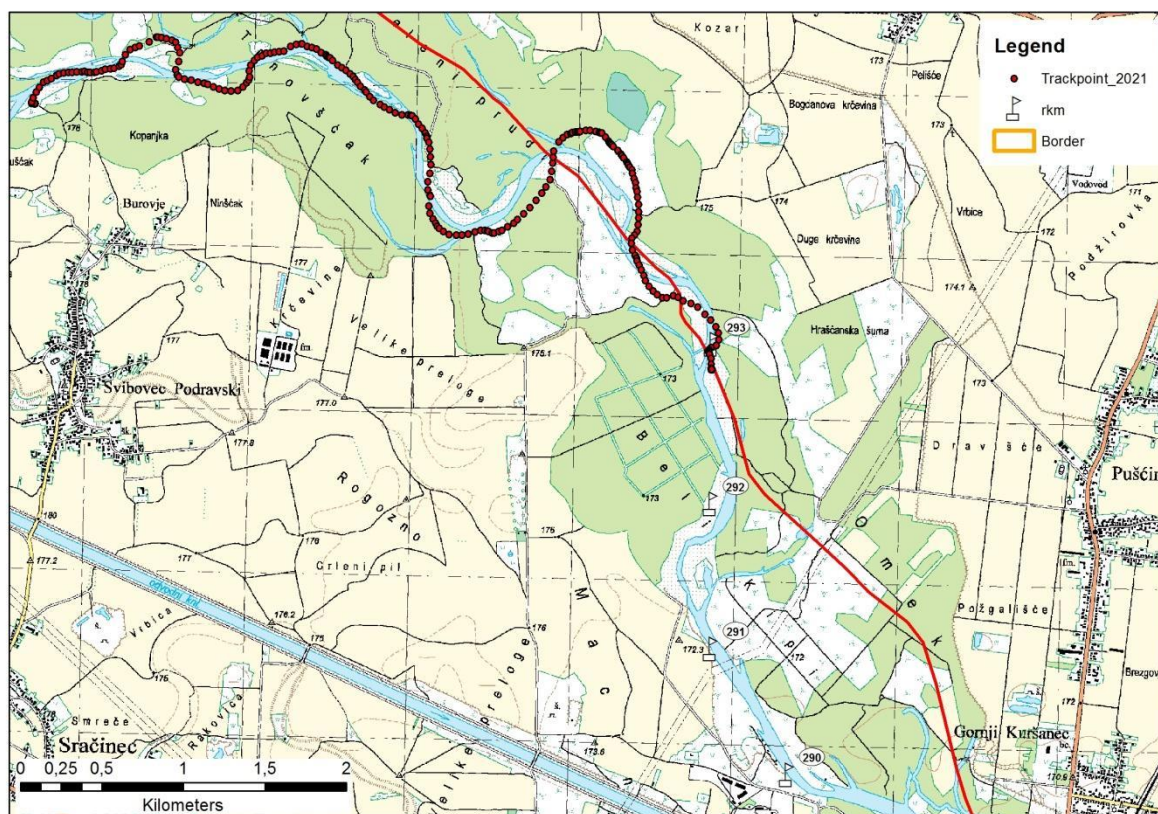


Fig. 2.

Monitored length of the Drava River from Svibovec Podravski to Varaždin, 300-289 rkm

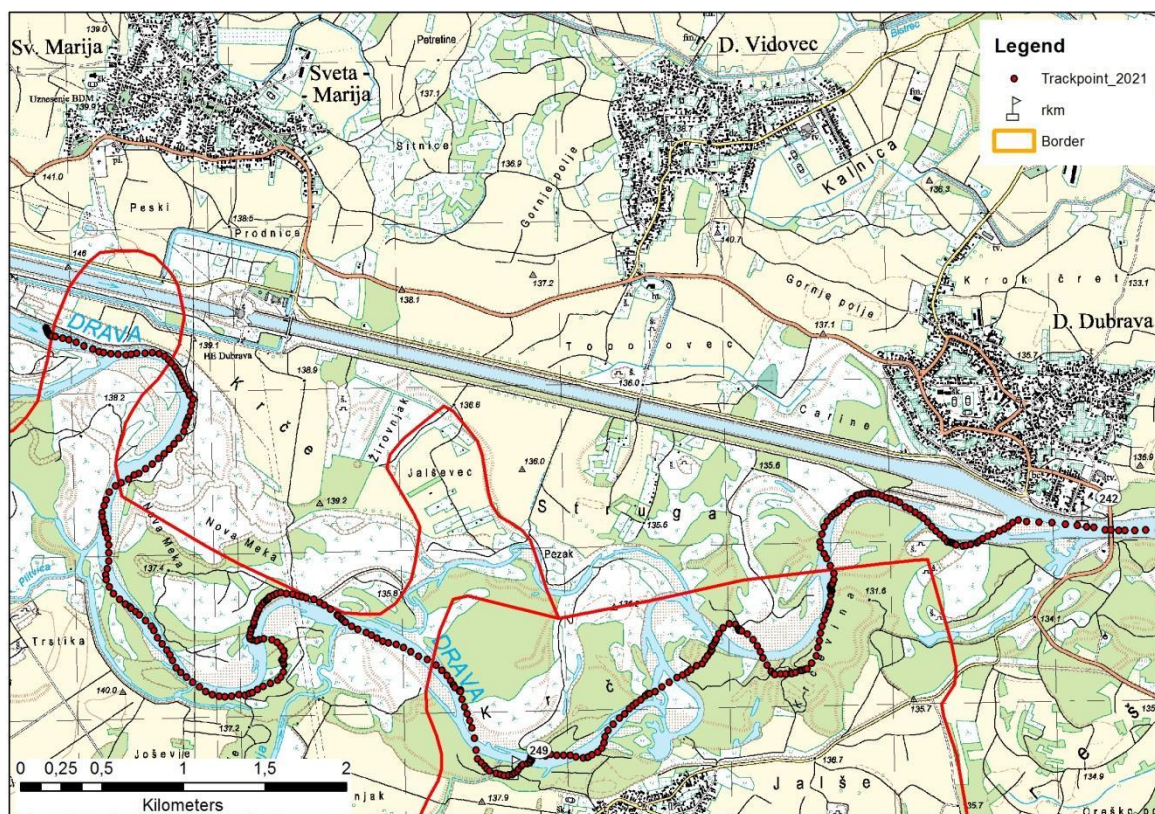


Fig.3.

Monitored length of the Drava River from Veliki Bukovec to Donja Dubrava, 256-242 rkm

The Drava downstream of the hydroelectric power plants, i.e. from 242-0 rkm, partly passes through the border zone between Hungary and Croatia, and partly lies entirely on Croatian territory. The part of the Drava River from Donja Dubrava to the mouth of the Mura in the Drava 242-236 rkm is on Croatian territory, and from 236-229 rkm it crosses or forms the border with Hungary. From 229 to 199 rkm, the Drava is again completely on Croatian territory, and from 199-70 rkm it crosses or forms the border between Croatia and Hungary. From 70-0 rkm, the Drava is entirely on Croatian territory (Fig. 4).

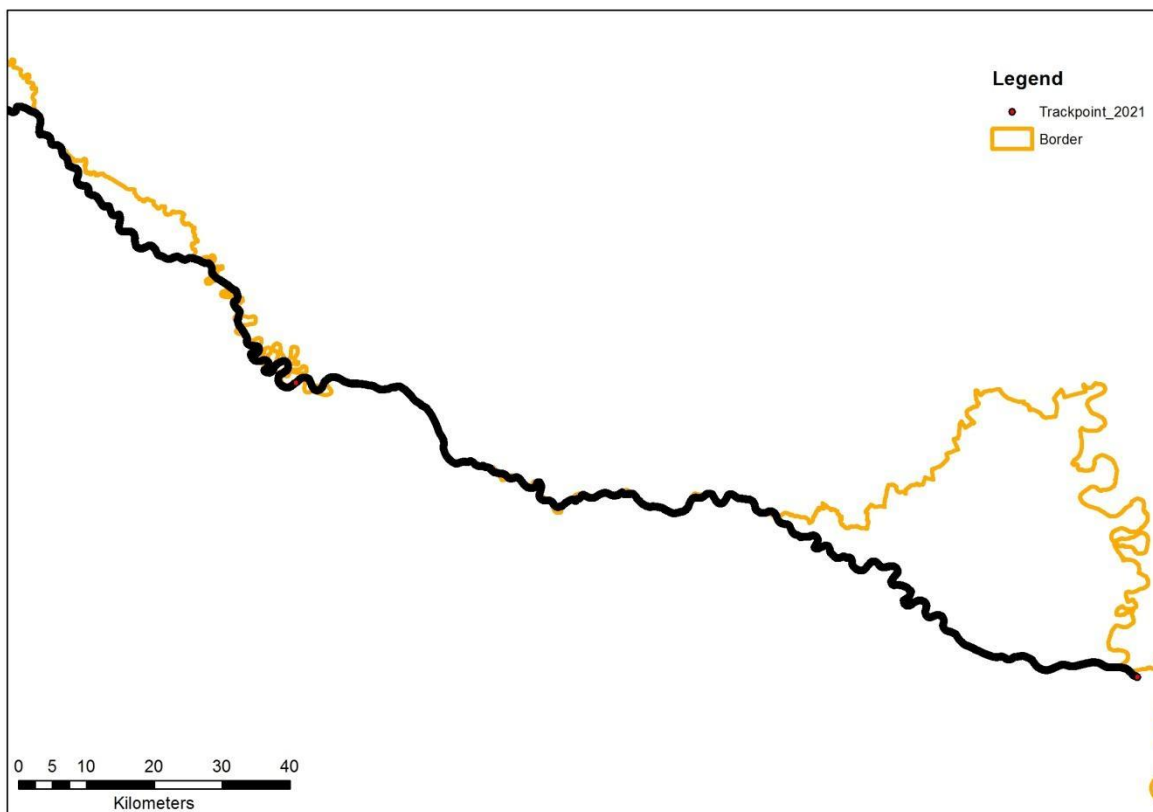


Fig. 4.

Monitored length of the Drava River from Donja Dubrava to Aljmaš, 242-0 rkm

Work method

During the implementation of monitoring, work was as much as possible, performed in the accordance with ToR. Due to the extremely long high water level periods of all three rivers during 2021, bird monitoring started a little later than planned. Although the water level of the Drava River was high, monitoring from its 161 rkm to 0 rkm was started on 08.06.2021. On this part of the Drava River, as well as on the entire part of the Danube through Croatia, birds that nest on river bars are very rare or no longer exist, and it was considered that despite the high waters, the results will not be significantly worse than in years with normal water levels. On the 17.06.2021, bird monitoring was carried out at the Šoderica gravel pit near Botovo (Fig. 5) as part of bird monitoring on the Drava River. During the 2022, the water level of the Drava was lower than usual, and monitoring started earlier than usual. Schedule of bird monitoring on the Drava River and Šoderica gravel pit is shown in Table 1.

Table 1. Schedule of bird monitoring on the Drava River and Šoderica gravel pit

Date of visit	rkm
08.06.2021	161-96
09.06.2021	96-39
11.06.2021	39-0
01.07.2021	256-201
02.07.2021	201-161
03.07.2021	320-314 and 300-389
17.06.2021	Šoderica
30.05.2022	161-124
31.05.2022	124-39
01.06.2022	39-0
11.06.2022	256-183
16.06.2022	183-161
19.06.2022	320-314 and 300-389
12.06.2022	Šoderica

During bird monitoring, a Nikon 810D camera with a 24-70 lens and a Nikon 810D camera with a 200-500 lens, additionally equipped with a GPS device, were used. GPS device Garmin e-trex 30x was used to record points (colonies, nests, etc.). The points were recorded as close as possible to the find or in a vertical line from the device to the find (shore, bank, etc.). The observation was made during daytime visibility from the boat, adhering to the principle of not disturbing the birds. At Šoderica and part of the old Drava near Varaždin, observation was made from land.



Fig. 5.

Šoderica gravel pit monitoring locations, Botovo, 2021

_____ Island with a colony of Common Tern and a Common Gull

_____ Colonies of Sand Martins

_____ Colony of Bee-eaters

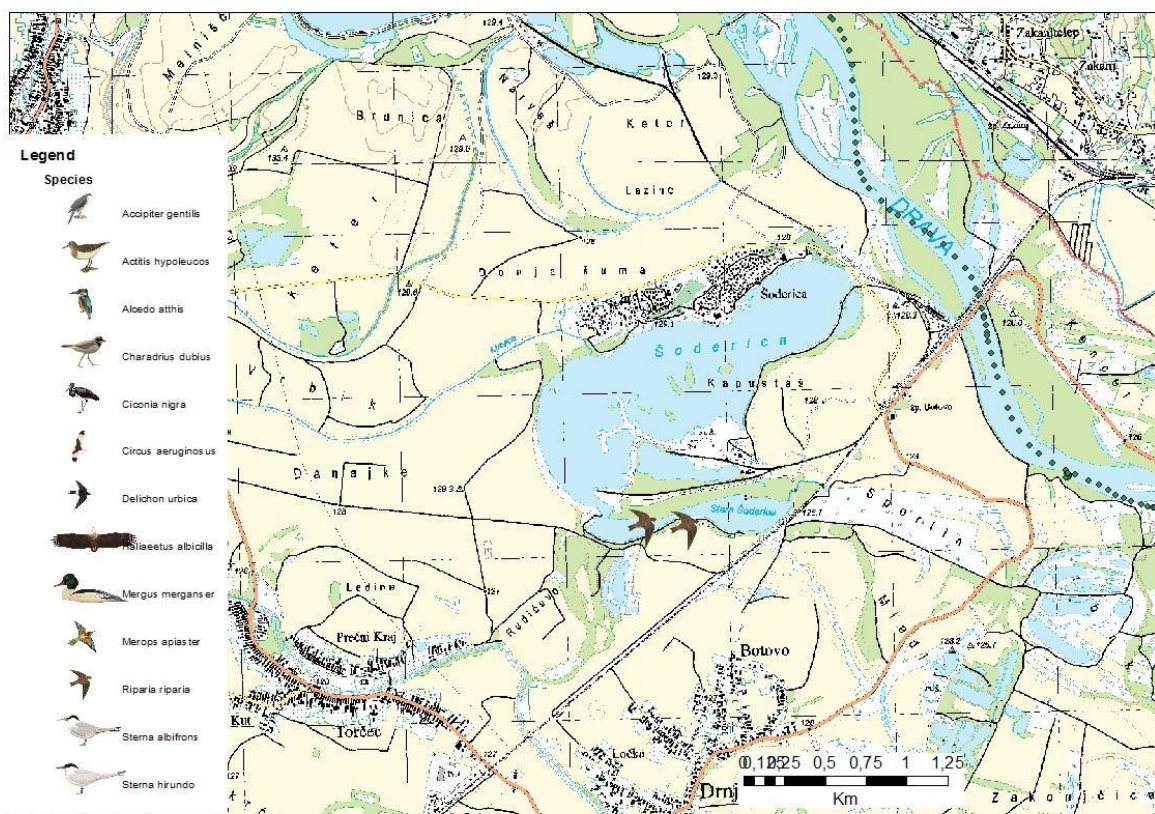


Fig.6.

Šoderica gravel pit monitoring locations, Botovo, 2022

Danube

During the nesting season (June) in 2021 and 2022, monitoring of target bird species was carried out on the Danube River. The covered area of the Danube River extends from Batina to Ilok, i.e. sections 1425 - 1299 rkm. The total length of the surveyed course is 126 rkm. In this section, the Danube is an international waterway and its bed has been significantly altered to facilitate navigation. The Danube passes through the border zone between Serbia and Croatia, and mostly its right bank and river bars were surveyed. The surveyed part of the flow is shown in Fig. 7, and the time necessary is shown in table 2.

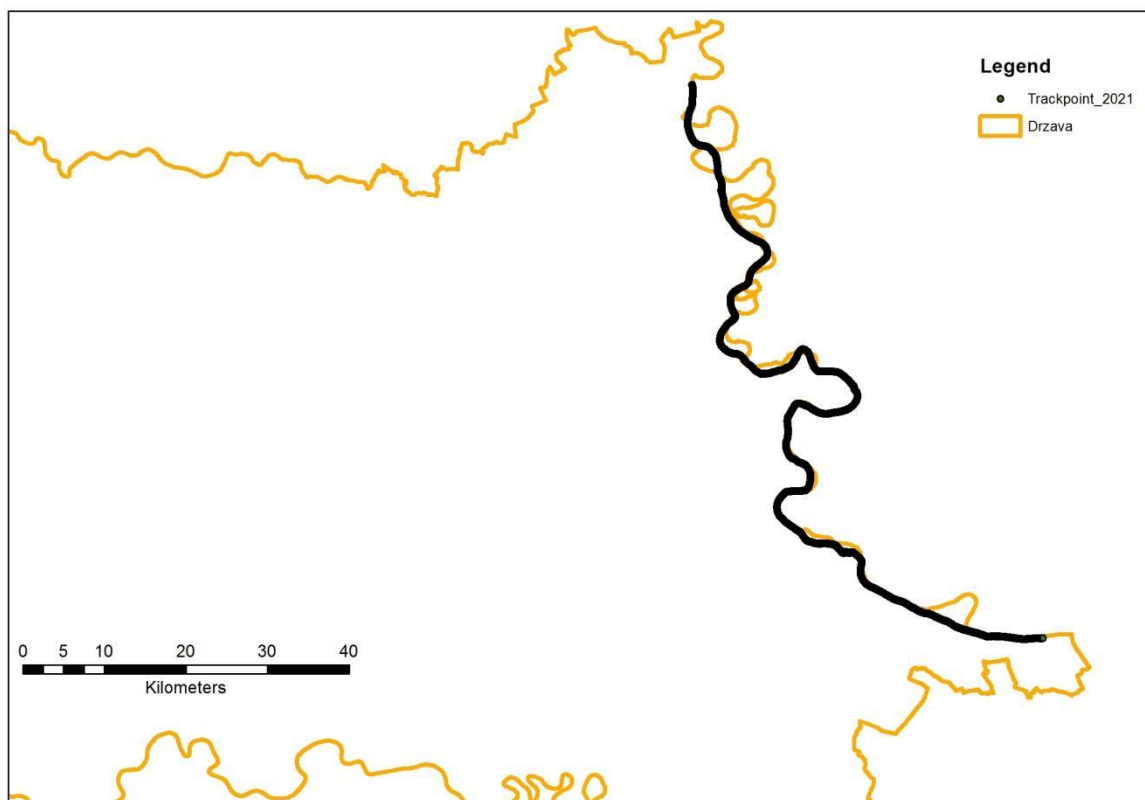


Fig.7.

Monitored length of the Danube River from Batina to Ilok, 1425-1299 rkm

Table 2. Schedule of bird monitoring on the Danube River

Date of visit	rkm
14.06.2021	1425-1353
15.06.2021	1353-1299
04.06.2022	1425-1331
05.06.2022	1331-1299

During bird monitoring, a Nikon 810D camera with a 24-70 lens and a Nikon 810D camera with a 200-500 lens, additionally equipped with a GPS device, were used. GPS device Garmin e-trex 30x was used to record points (colonies, nests, etc.). The points were recorded as close as possible to the find or in a vertical line from the device to the find (shore, bank, etc.). The observation was made during daytime visibility from the boat, adhering to the principle of not disturbing the birds.

Mura

During the nesting season (June), monitoring of target bird species was carried out on the Mura River. The covered area of the Mura River is from Dekanovec to Legrad, i.e. sections 49 - 0 rkm. The total length of the surveyed stream is 49 rkm. On this part the Mura passes through the border zone between Hungary

and Croatia, and on both banks and river bars were surveyed. The surveyed part of the flow is shown in Fig. 8, and the visit time in table 3.

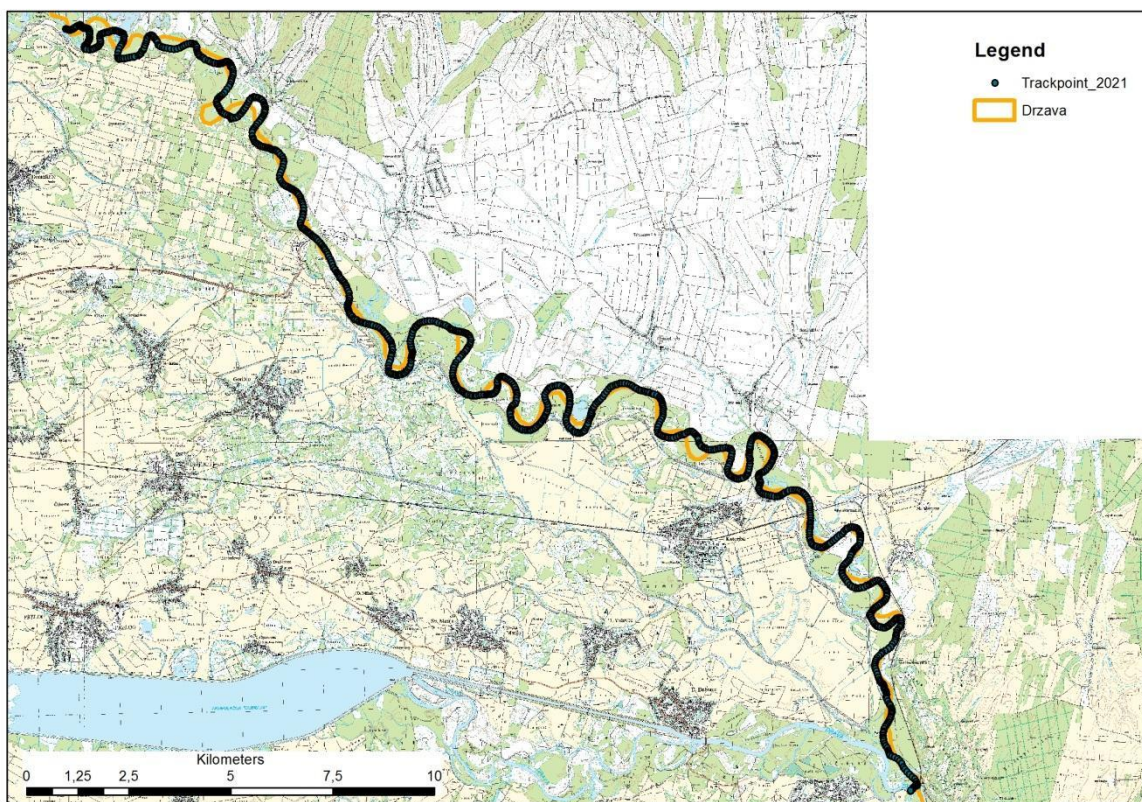


Fig.8.

Monitored length of the Mura River from Domašinec to Legrad, 49-0 rkm

Table 3. Schedule of bird monitoring on the Mura River

Date of visit	rkm
30.06.2021	49-0
12.06.2022	49-0

During bird monitoring, a Nikon 810D camera with a 24-70 lens and a Nikon 810D camera with a 200-500 lens, additionally equipped with a GPS device, were used. GPS device Garmin e-trex 30x was used to record points (colonies, nests, etc.). The points were recorded as close as possible to the find or in a vertical line from the device to the find (shore, bank, etc.). The observation was made during daytime visibility from the boat, adhering to the principle of not disturbing the birds.

Results of the work

The results of the work are presented in an Excel table as separate sheet for each river. A cartographic representation of the entire area was created and connected by ESRI tools to Excel tables. The original GPS files are also attached. In addition to the above, photos taken in the field for all three rivers and Šoderica are attached.

RESULTS AND EXPERT OPINION ON NESTING SUCCESS

Results of nesting success on the Drava

Sand Martin

On the river Drava during the nesting season of 2021 in the section 320 rkm - 0 rkm, 32 colonies of Sand Martins with a total of 7979 pairs were recorded. In 2022, the same number of colonies was recorded on the same section, but only 4591 pairs of Sand Martins.

On the old part of the Drava river from Lovrečan to Otok Virje, a colony of Sand Martins near Dravsko Brezje on the left bank was recorded in 2022, and it had 70 pairs.

On the old part of the course of the Drava River around HPP Varaždin, from Svibovec Podravski to Varaždin, two colonies of Sand Martins were recorded, which had 110 and 50 pairs. The colonies were located on the left bank, south of the settlement of Trnovec, and in 2022, one colony with 150 pairs was recorded in the same location. In this part of the Drava, it is the only suitable habitat for a colony of Sand Martins.

On the old part of the Drava River around HPP Dubrava, one colony of Sand Martins with 5 pairs was recorded. The colony was located north of the Mali Bukovec settlement on the left bank of the old course of the Drava River. The colony is located in a place where the material is not suitable for Sand Martins and the nesting success is questionable.

The number of recorded Sand Martin colonies in the old courses of the Drava around the reservoirs in 2021 was 3, in which a total of 171 pairs of Sand Martins nested, and in 2022, 225 pairs of Sand Martins nested in the 3 recorded colonies.

Given that this part of the Drava is dominated by coarser sediment (mainly gravel and sand), there are few steep banks suitable for nesting of Sand Martins. In 2022, all remaining suitable nesting places for Sand Martins were inhabited, and considering the long period of high water, we believe that 171 pairs is quite a good number considering all the circumstances. During 2022, 225 pairs of Sand Martins nested in the same area in three colonies, this increase in the number of nesting pairs was probably caused by a more favorable water level in 2022, as well as erosions caused by high waters in 2021.

In the part of the Drava downstream from the hydroelectric power plants (242-0 rkm), 29 colonies were recorded in 2021 in which 7808 pairs of Sand Martins nested, and in 2022, 4366 pairs of Sand Martins nested in the 29 recorded colonies. Considering the long period of high water and the constant channeling of the river, we consider 7979 pairs of Sand Martins to be extremely good, i.e. the year 2021 is the third most numerous since 2005. Since 2021, more Sand Martins nested only in 2005 and 2007.

Just as on the old Drava streams, as well as on the entire part of the Drava downstream from the power plant, all suitable nesting sites were inhabited. Table 4 shows the number of nesting pairs per colony on the entire surveyed course of the Drava River.

Table 4. Number of nesting pairs per colony on the entire surveyed course of the Drava River

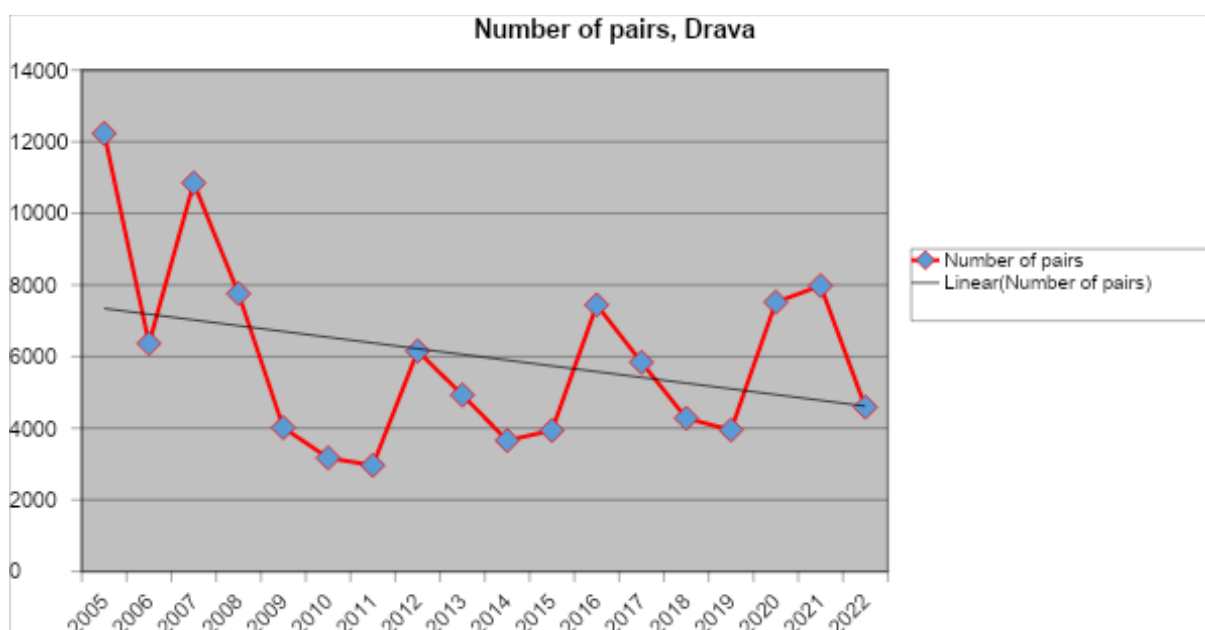
Location rkm	Pairs 2021	Pairs 2022
320-314		70
300-289	110	150
300-289	50	
256-242	11	5
242-236	120	25
242-236	500	500
236-230	450	100
236-230		150
226-220	400	25
226-220	19	40
226-220		40
220-210	250	300
220-210	11	50
220-210	9	
220-210	5	
210-201	8	50
190-183	600	250
190-183	400	25
190-183	35	40
190-183	250	200
183-180	25	40
180-170	40	250
180-170	700	100
180-170	300	250
180-170	500	1000
180-170	350	120
180-170	59	50
180-170		9
180-170		40
150-140	35	20
110-104	22	
96-90	200	2
96-90		35
96-90		55
96-90		150
65-60	40	
65-60	30	
65-60	700	
65-60	1500	
50-39		450
39-30	250	

In table 5 and Graph 1 and 2 show the number of Sand Martins on the Drava and the trend line from 2005 to 2022.

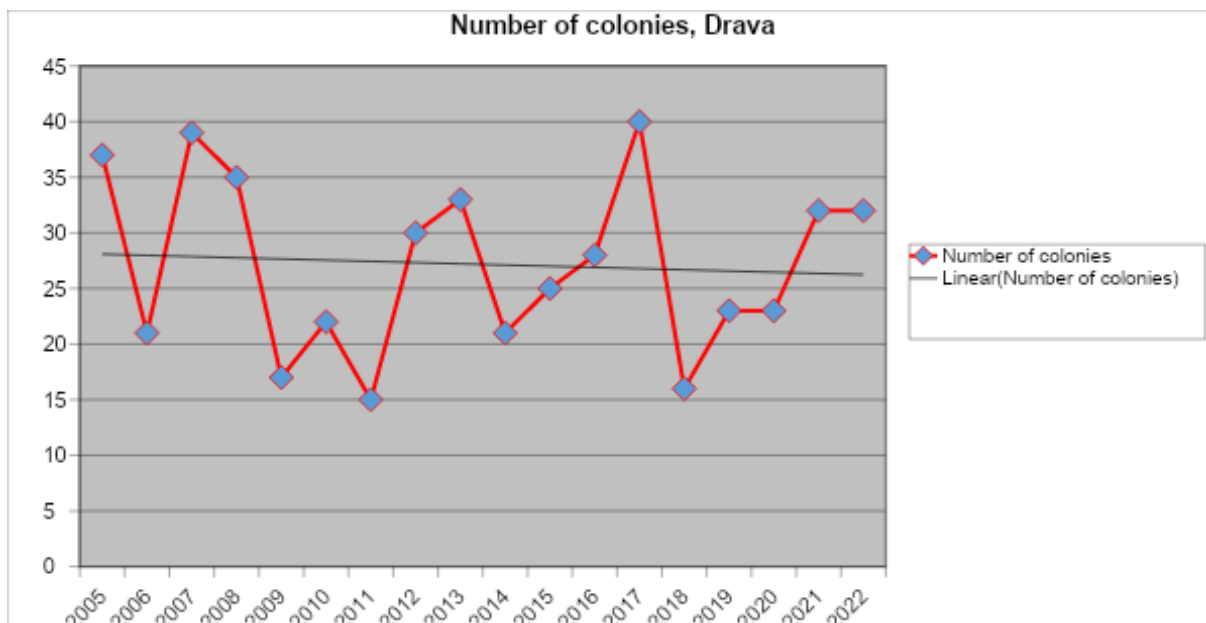
Table 5. Number of Sand Martins on the Drava River from 2005 to 2022

Year	Number of pairs	Number of colonies	Number of pairs HE	Number of colonies HE	Number of pairs	Number of colonies
	Drava	Drava	Old Drava	Old Drava	Drava total	Drava total
2005	12232	37			12232	37
2006	6367	21			6367	21
2007	10848	39			10848	39
2008	7760	35			7760	35
2009	4016	17			4016	17
2010	3172	22			3172	22
2011	2964	15			2964	15
2012	6116	29	40	1	6156	30
2013	4618	31	310	2	4928	33
2014	3336	18	321	3	3657	21
2015	3777	22	162	3	3939	25
2016	7171	24	273	4	7444	28
2017	5626	36	215	4	5841	40
2018	4093	13	185	3	4278	16
2019	3633	21	315	2	3948	23
2020	7406	21	113	2	7519	23
2021	7808	29	171	3	7979	32
2022	4366	29	225	3	4591	32

Graph 1. Number of pairs of Sand Martin on Drava River from 2005 to 2022, trend



Graph 2. Number of Sand Martin colonies on Drava River from 2005 to 2022, trend



Kingfisher

On the Drava River during nesting season 2021 on section 320 rkm – 0 rkm, a total of 81 pairs of Kingfishers were recorded, and in the 2022 season, 101 pairs.

In 2021, three pairs were recorded on the old part of the Drava between Svibovec Podravski and Varaždin, and 9 pairs on the old part of the Drava downstream from the HPP Dubrava reservoir. The other 69 pairs of Kingfishers were recorded on the Drava downstream from Donja Dubrava.

In 2022, three pairs were recorded on the old part of the Drava between Lovrečan and Otok Virje, 8 pairs on the old part of the Drava between Svibovec Podravski and Varaždin, and 12 pairs on the old part of the Drava downstream from the HPP Dubrava reservoir. The other 78 pairs of Kingfishers were recorded on the Drava downstream from Donja Dubrava. The number of pairs on individual sections of the Drava is shown in Table 6.

Table 6. Number of pairs of Kingfisher on individual sections of the Drava River

Location rkm	Pairs 2021	Pairs 2022
320-314		3
300-289	3	8
256-242	9	12
242-236	2	3
236-230	3	1
230-226	2	3
226 -220	5	6
220-210	4	1
210-201	2	3
201-190	3	2
190-183	3	3
183-180	2	3

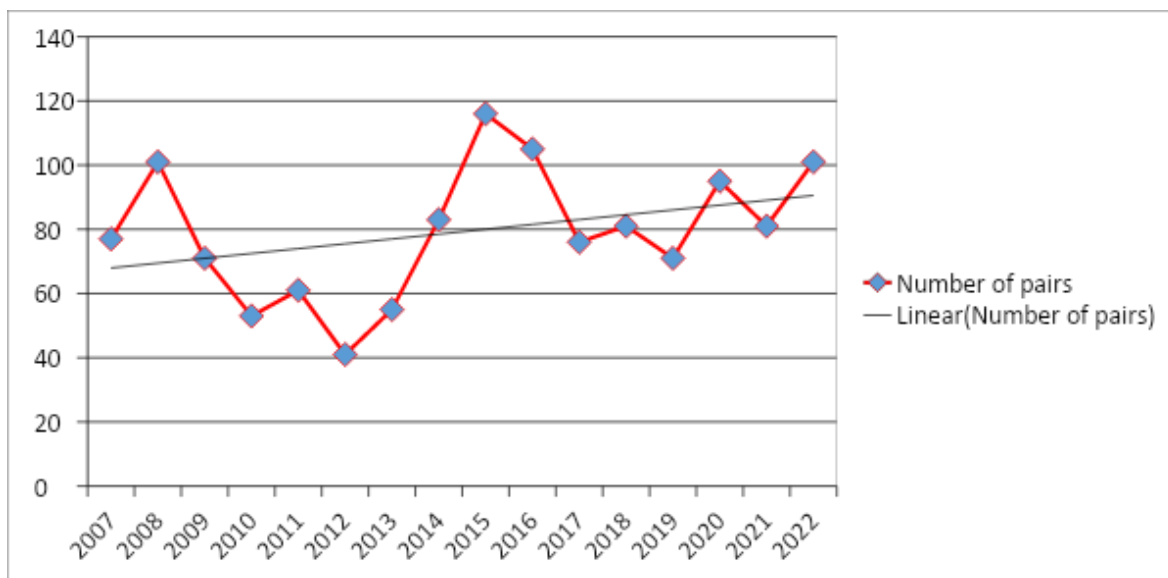
Location rkm	Pairs 2021	Pairs 2022
180-170	9	9
170-161	2	2
150-140	1	1
130-124	1	1
124 -120	1	1
120-110	2	2
110-100	2	1
100-90	2	4
90-80	2	4
80-70		2
70-65	1	4
65-60	6	4
60-50	3	2
50-39	2	3
39- 30	2	5
30-20	1	3
20-10	2	1
10-0	4	4

Table 7 and Graph 3 show the number of Kingfishers on the Drava and the trend line from 2007 to 2022.

Table 7. Number of pairs of Kingfisher on the Drava River from 2007 to 2022

Year	Number of Pairs
2007	77
2008	101
2009	71
2010	53
2011	61
2012	41
2013	55
2014	83
2015	116
2016	105
2017	76
2018	81
2019	71
2020	95
2021	81
2022	101

Graph 3. Number of pairs of Kingfisher on the Drava River from 2007 to 2022, trend



During 2021, throughout the surveyed part of Drava all suitable places for nesting were inhabited. Kingfishers have often been recorded nesting on the edges of colonies of Bee-eaters and Sand Martins. Given the long period of high water and available nesting sites, the number of pairs that nested during the 2021 nesting season is quite large. A larger number of pairs was recorded in the nesting season, and the reason for this is probably the lower water level, which resulted in a larger number of suitable places for nesting. In previous research, only in two years (2015 and 2016) was a higher number of nesting Kingfishers recorded and the same number of pairs was recorded in 2008.

Bee-eater

During the nesting season of 2021 on the Drava River section 320 rkm - 0 rkm, 22 colonies of Bee-eaters with a total of 309 pairs were recorded, and in 2022, 141 pairs of Bee-eaters nested in 12 colonies.

In 2021, one colony in which 14 pairs of Bee-eaters nested was recorded on the old course of the Drava River near HPP Dubrava. The largest colony of Bee-eaters was located at 188 rkm, on the left bank, in the territory of Hungary. All colonies were located between 252 and 86 rkm. Almost all suitable nesting sites were inhabited. Given the long period of high water and available nesting sites, the number of pairs that nested during the 2021 nesting season was relatively large. In 2022, a significant decrease in the number of colonies and nesting pairs of Bee-eaters on the Drava was recorded. Table 8 shows the distribution of colonies and pairs by individual sections of the Drava during 2021 and 2022.

Table 8. Distribution of Bee-eater colonies and pairs by individual sections of the Drava during 2021 and 2022

Location rkm	2021	Colony 2021	Pairs 2022	Colony 2022
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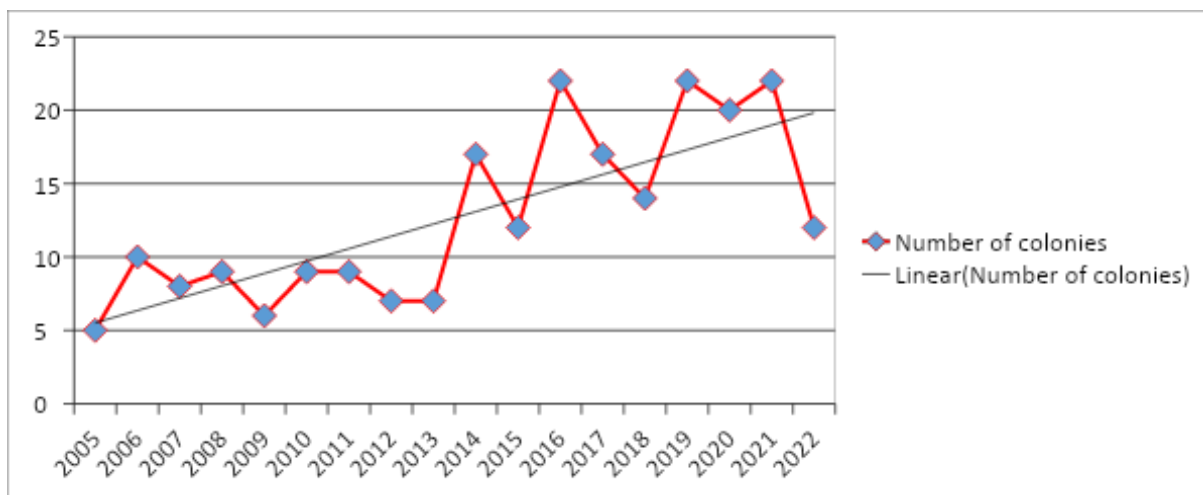
256-242	14	1	3	1
236-230	6	1	4	1
226-220	28	4	18	1
220-210	45	1	30	2
190-183	85	2	19	2
130-140	3	2	2	1
100-96	6	1	2	1
96-90	48	3	35	1
90-80	74	7	28	2

Table 9 and Graphs 4 and 5 show the number of Bee-eaters on the Drava and the trend line from 2005 to 2022.

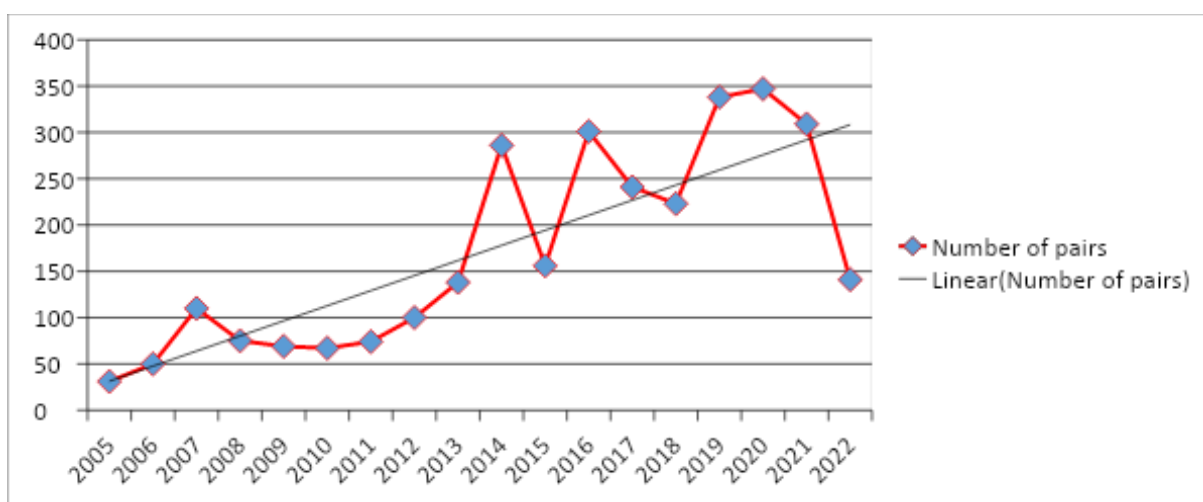
Table 9. Number of pairs of Bee-eater on the Drava River from 2005 to 2022

Year	Number of Pair	Number of Colonies
2005	31	5
2006	50	10
2007	110	8
2008	75	9
2009	69	6
2010	67	9
2011	74	9
2012	100	7
2013	138	7
2014	286	17
2015	156	12
2016	301	22
2017	241	17
2018	223	14
2019	338	22
2020	347	20
2021	309	22
2022	141	12

Graph 4. Number of colonies of Bee-eater on the Drava River from 2005 to 2022, trend



Graph 5. Number of pairs of Bee-eater on the Drava River from 2005 to 2022, trend



Little Ringed Plover

On the Drava River during the nesting season of 2021 in the section 320 rkm - 0 rkm, 21 pairs of Little Ringed Plover were recorded, and in 2022, 41 pairs.

On the old course of the Drava river from Lovrečan to the Otok Virje (320-314 rkm), not a single individual of the Little Ringed Plover was recorded. On the old course of the Drava from Svibovec Podravski to Varaždin (300-289 rkm), only one pair was recorded nesting on the coastal sandbank in 2021, or respectively 2 pairs in 2022. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), 7 pairs were recorded in 2021, and in 2022, 10 pairs were recorded on the same section. In 2021, 13 pairs nested downstream from the power plant, and in 2022, 27 pairs nested in the same area. The lowest recorded nesting pair was at the 186th rkm in 2021, and in 2022 at the 50th rkm. Most of the suitable places for nesting were submerged in the nesting season of 2021, and in 2022 due to the lower water level, the situation was much more favorable for this species, which resulted in a larger number of nesting pairs. Given the long period of high water and available nesting sites, the number of pairs that nested during the 2021 nesting season is as expected. The positions for individual pairs are shown in table 10.

Table 10. Distribution of Little Ringed Plover pairs by individual sections of the Drava during 2021 and 2022

Location rkm	Pairs 2021	Note 2021	Pairs 2022	Note 2022
300-289	1	Gravel bar, right side	1	Gravel bar, right side
300-289			1	Gravel bar, right side
256-242	1	Gravel bar, left side	1	Gravel bar, right side
256-242	1	Gravel bar, left side	2	Gravel bar, left side
256-242	1	Gravel bar, right side	1	Gravel bar, right side
256-242	1	Gravel bar, left side	3	Gravel bar, right side
256-242	2	Gravel bar, left side	2	Gravel bar, left side
256-242	1	Gravel bar, left side	1	Island
230-226	1	Island	1	Island
230-226	1	Island		
220-210	1	Island	1	Island
210-201	1	Island	1	Island
210-201	1	Island	4	Island
210-201	1	Island		
201-190	3	Island	2	Island
201-190	1	Island		
190-183	1	Island	1	Island
190-183	1	Island	3	Island
190-183	1	Island	2	Gravel bar, left side
190-183			1	Gravel bar, right side
183-180			2	Island
180-170			1	Gravel bar, left side
170-161			3	Island
170-161			4	Island
50-39			1	Island

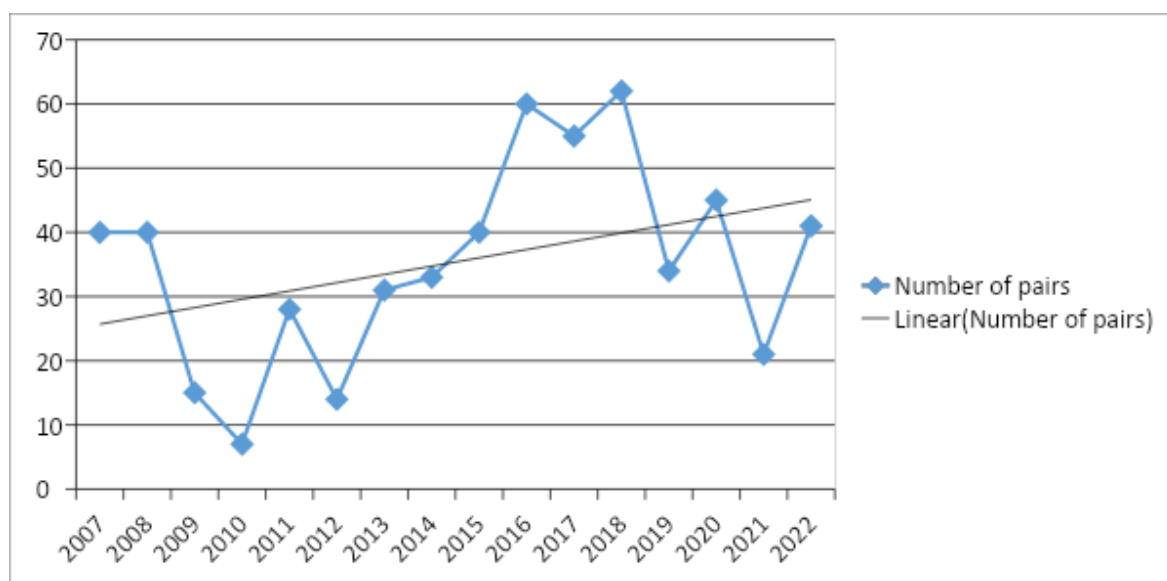
In Table 11 and Graph 6 the abundance of Little Ringed Plover on the Drava and the trend line from 2007 to 2022 is shown.

Table 11. Number of pairs of Little Ringed Plover on the Drava River from 2007 to 2022

Year	Number of Pairs
2007	40
2008	40
2009	15
2010	7
2011	28
2012	14
2013	31

2014	33
2015	40
2016	60
2017	55
2018	62
2019	34
2020	45
2021	21
2022	41

Graph 6. Number of pairs of Little Ringed Plover on the Drava River from 2007 to 2022, trend



Common Sandpiper

During nesting season 2021 on the Drava River section 320 rkm - 0 rkm, a total of 8 pairs and 5 non-nesting individuals of the Common Sandpiper were recorded, and during the nesting season of 2022, 10 pairs and two non-nesting individuals were recorded on the same section.

On the old course of the Drava River from Lovrečan to the Otok Virje (320-314 rkm), in 2021 one pair and one non-nesting individual of the Common Sandpiper was recorded. On the old course of the Drava from Svibovec Podravski to Varaždin (300-289 rkm), only one pair was recorded nesting on the coastal sandbank. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), two pairs were recorded nesting on the coastal banks. Only 4 nesting pairs and 4 non-nesting individuals were recorded downstream from the power plant. The lowest recorded nesting pair was located on the 187th rkm. Downstream from the 187th rkm, only one non-nesting individual of the Common Sandpiper was recorded. As with Little Ringed Plover, most of the suitable nesting sites were submerged during the nesting season of this species, and it is not known whether the Common Sandpipers nested later or nested elsewhere. Despite a long period of high water and available nesting sites, the number of pairs that nested during the 2021 nesting season is below expectations. The positions are shown in table 12. During the nesting season of 2022 on the old course of the Drava River from Lovrečan to the Otok Virje (320-314

rkm), 5 pairs of terns were recorded in 2022. On the old course of the Drava from Svibovec Podravski to Varaždin (300-289 rkm), 2 pairs were recorded nesting on the coastal banks. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), one pair was recorded nesting on the coastal sandbar. Downstream from the power plant, only 2 nesting pairs and two non-nesting individuals were recorded.

The positions for individual pairs are shown in table 12.

Table 12. Distribution of Common Sandpiper pairs by individual sections of the Drava during 2021 and 2022

Location rkm	Exam. 2021	Pairs 2021	Notes 2021	Exam. 2022	Pairs 2022	Notes 2022
320-313		1	Island		1	Gravel bar, left side
320-313	1				1	Gravel bar, right side
320-313					1	Gravel bar, right side
320-313					1	Gravel bar, left side
320-313					1	Island
300-289		1	Gravel bar, left side		1	Gravel bar, right side
300-289					1	Gravel bar, left side
256-242		1	Gravel bar, right side		1	Gravel bar, right side
256-242		1	Gravel bar, right side			
242-236		1	Gravel bar, right side	1		
230-226		1	Island	1		
226-220	1				1	Island
201-190		1	Island			
201-190	2					
190-183		1	Gravel bar, right side		1	Island
170-161	1					

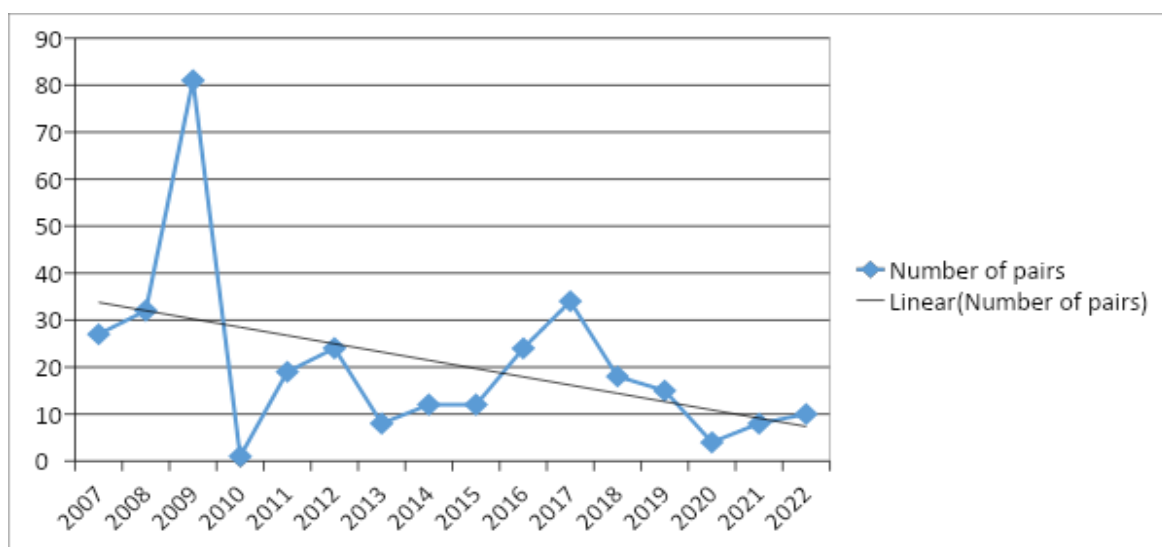
Table 13 and Graph 7 show the number Common Sandpiper on the Drava and the trend line from 2007 to 2022.

Table 13. Number of pairs of Common Sandpiper on the Drava River from 2007 to 2022

Year	Number of Pairs
2007	27
2008	32
2009	81
2010	1
2011	19
2012	24
2013	8
2014	12
2015	12
2016	24

Year	Number of Pairs
2017	34
2018	18
2019	15
2019	15
2021	8
2022	10

Graph 7. Number of pairs of Common Sandpiper on the Drava River from 2007 to 2022, trend



Little Tern

During nesting season 2021 on the Drava River section 320 rkm - 0 rkm, not a single nesting pair of Little Tern was recorded.

On the old course of the river Drava from Lovrečan to the Otok Virje (320-314 rkm), not a single individual of the little tern was recorded. On the old course of the Drava from Svibovec Podravski to Varaždin (300-289 rkm), also not a single individual of the Little Tern was recorded. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), two individuals of the Little Tern were recorded, which did not show any nesting ground related behavior. On the Drava downstream from the power plant, only two more individuals of Little Tern were recorded on the section between 190-183. rkm. These individuals did not show nesting ground behavior either. Due to the long period of high water, all the gravel islands were submerged, and there were no suitable nesting sites during the nesting season of the Little Tern. It is not known whether the Little Tern attempted to nest later, but this result was expected. For the Little Tern, it is not unusual for the nesting to fail in the unfavorable years.

During the nesting season of 2022 on the section 320 rkm - 0 rkm, one nesting pair of Little Tern was recorded on the 187th rkm on a gravel island. In several other locations, individual birds were observed, but without nesting ground behavior. The positions for individual individuals are shown in Table 14.

Table 14. Distribution of Little Tern individuals and pairs by individual sections of the Drava during 2021 and 2022

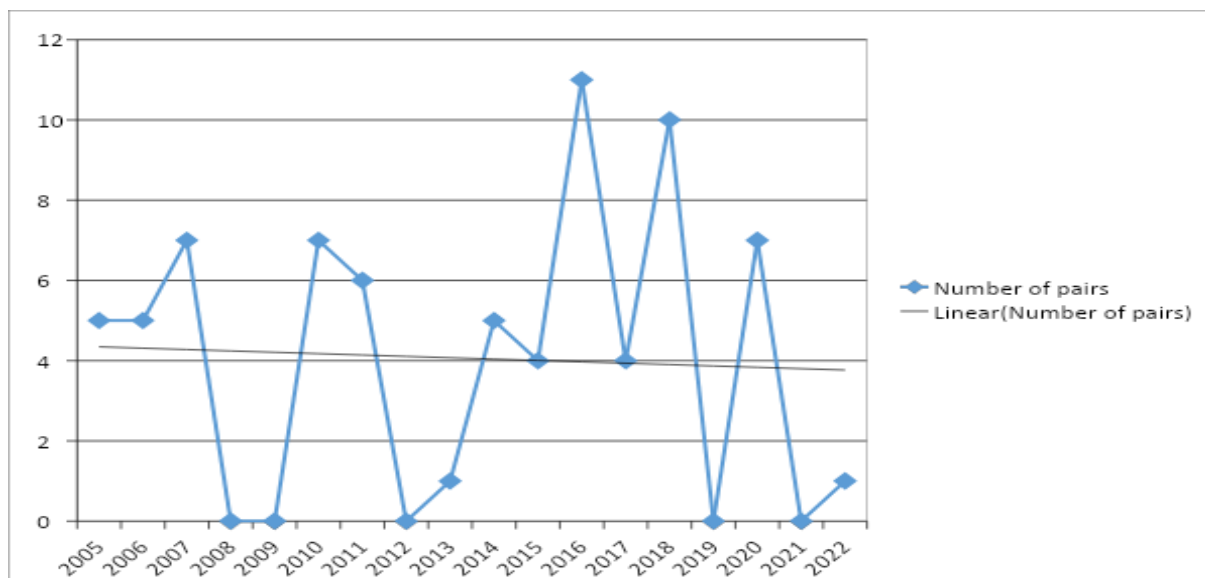
Location rkm	Examples 2021	Pairs 2022
256-242	2	
190-183	1	1
190-183	1	

Table 15 and Graphs 8 and 9 show the number of Little Terns on the Drava and the trend line since 2007 until 2022.

Table 15. Number of pairs and colonies of Little Tern on the Drava River from 2005 to 2022

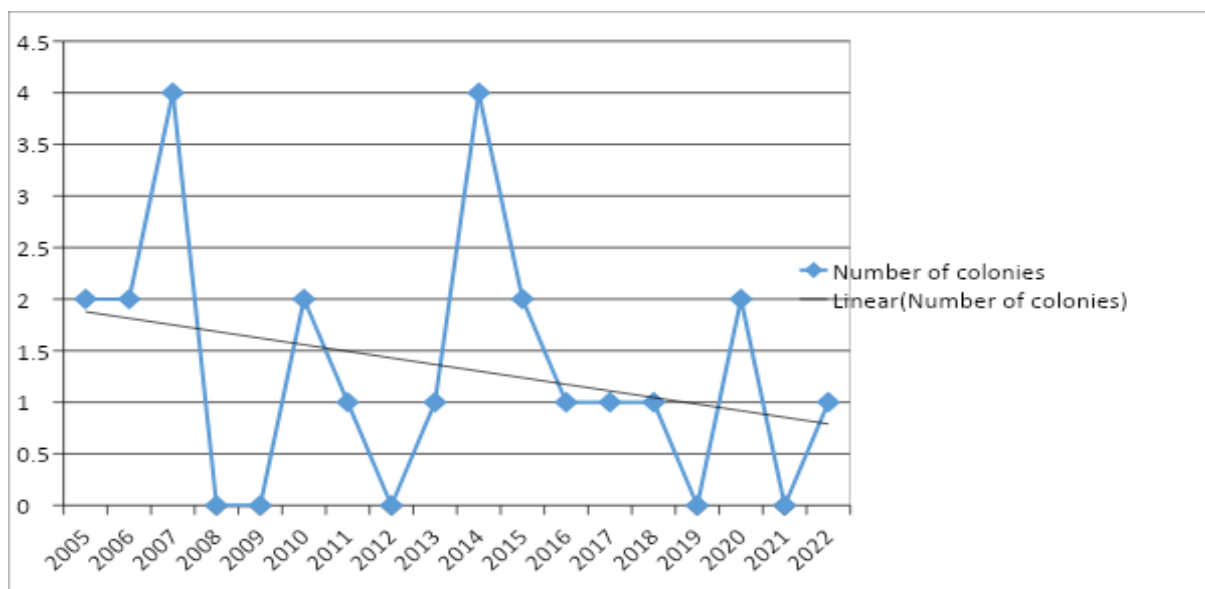
Year	Number of pairs	Number of colonies
2005	5	2
2006	5	2
2007	7	4
2008	0	0
2009	0	0
2010	7	2
2011	6	1
2012	0	0
2013	1	1
2014	5	4
2015	4	2
2016	11	1
2017	4	1
2018	10	1
2019	0	0
2020	7	2
2021	0	0
2022	1	1

Graph 8. Number of pairs of Little Tern on the Drava River from 2005 to 2022, trend



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Graph 9. Number of colonies of Little Tern on the Drava River from 2005 to 2022, trend



Common Tern

On the Drava River, during the nesting season of 2021 in the section 320 rkm - 0 rkm, not a single nesting pair of Common Tern was recorded.

On the old course of the river Drava from Lovrečan to the Otok Virje (320-314 rkm), 13 individuals of the Common Tern were recorded. All individuals were feeding and there is a possibility that they nest somewhere nearby (the Ormož reservoir). On the old course of the Drava from Svibovec Podravski to Varaždin (300-289 rkm), not a single individual of the Common Tern was recorded. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), only one individual of the Common Tern was recorded, which did not show any nesting grounds behavior. On the Drava downstream from

the last power plant, 23 individuals of Common Tern were recorded in the section between 242-104 rkm and these individuals did not show nesting ground behavior. It is not known whether the Common Tern tried to nest later, but this result is expected. It is not unusual for the Common Tern to miss nesting in unfavorable years. Right next to the Drava on Lake Šoderica, 40 nesting pairs of Common Tern terns were recorded, and it is very likely that this is the Drava population.

During the nesting season of 2022, on the section 320 rkm - 0 rkm, two colonies Common Terns were recorded in which a total of 8 pairs nested. There were 5 pairs nesting in the colony at the 205 rkm, and 3 pairs of Common Tern in the colony at the 187 rkm.

The positions for individual individuals and pairs are shown in table 16.

Table 16. Distribution of Common Tern individuals and pairs by individual sections of the Drava during 2021 and 2022

Location rkm	Examples 2021	Pairs 2022
320-314	13	
256-242	1	
242-236	1	
236-230	1	
230-226	2	
230-226	1	
226-220	3	
220-210	6	
220-210	1	
210-201	3	5
210-201	2	
210-201	2	
190-183		3
110-104	1	

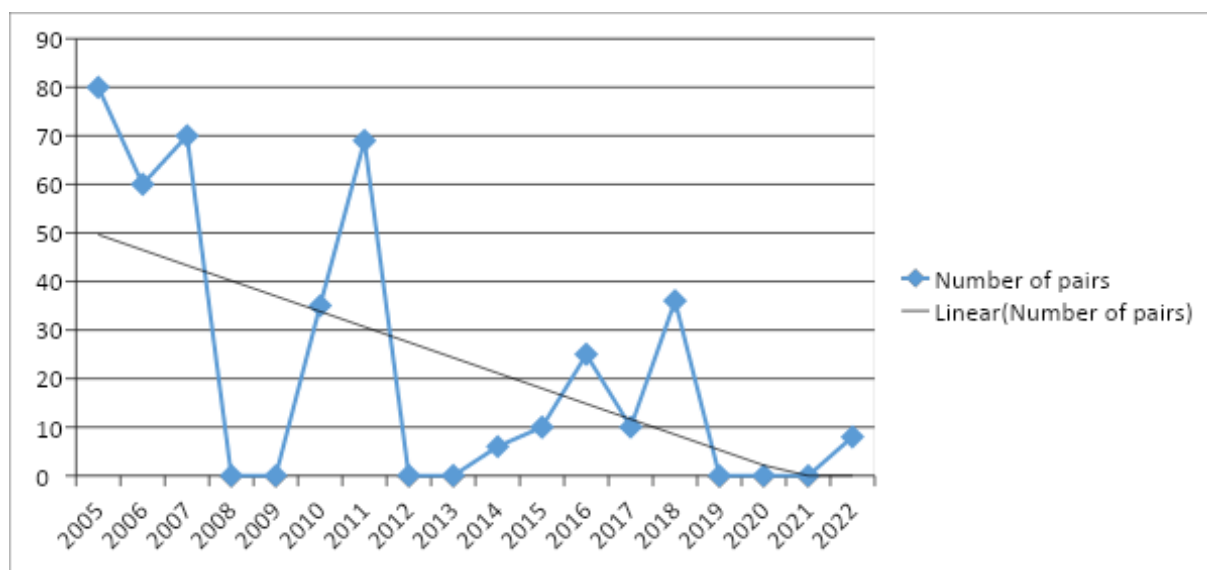
Table 17 and Graphs 10 and 11 show the number of Common Tern on the Drava and the trend line from 2005 to 2022.

Table 17. Number of pairs and colonies of Common Tern on the Drava River from 2005 to 2022

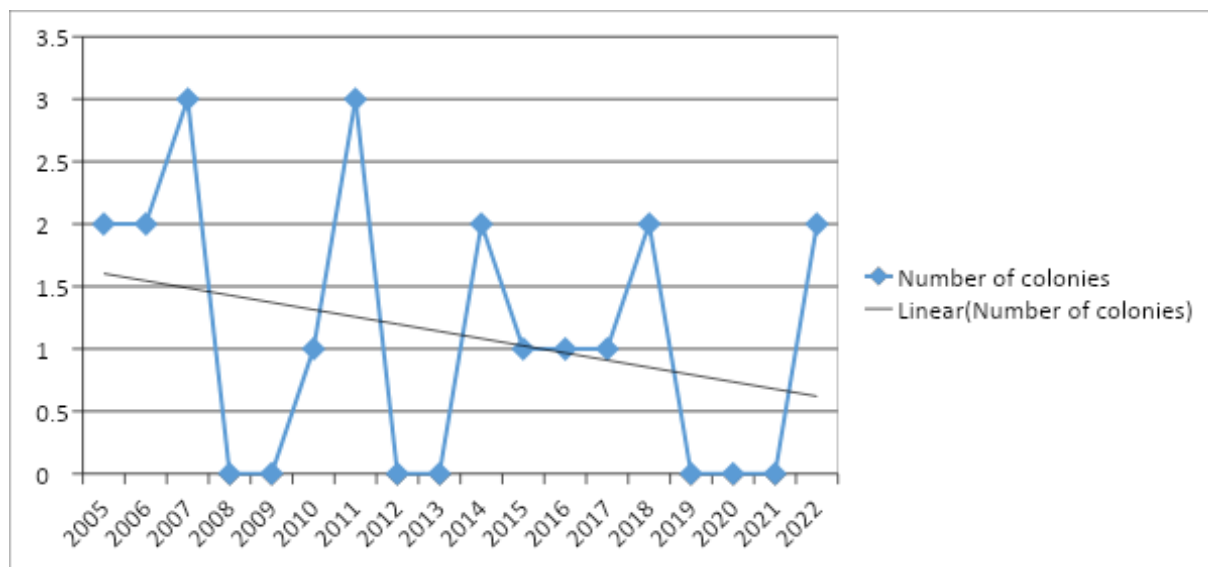
Year	Number of pairs	Number of colonies
2005	80	2
2006	60	2
2007	70	3
2008	0	0
2009	0	0
2010	35	1
2011	69	3
2012	0	0
2013	0	0
2014	6	2
2015	10	1

Year	Number of pairs	Number of colonies
2016	15	2
2012	10	17
2016	18	2
2019	0	0
2020	0	0
2021	0	0
2022	8	2

Graph 10. Number of pairs of Little Tern on the Drava River from 2005 to 2022, trend



Graph 11. Number of colonies of Common Tern on the Drava River from 2005 to 2022, trend



Black Stork

On the river Drava during the nesting season of 2021 in the section 320 rkm - 0 rkm, 9 individuals of Black Stork were recorded, probably 7 pairs. This year is relatively favorable for this species because due to the high waters that are gradually receding, the Black Stork can easily find food. On the old course of the river Drava from Lovrečan to the Otok Virje (320-314 rkm), one Black Stork was recorded. On the old course of the Drava from Svibovec Podravski to Varaždin (300-289 rkm) not a single Black Stork was recorded. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), three Black Storks were recorded at one location while feeding. Downstream from the last power plant, 5 Black Storks were recorded in four locations in the section of the Drava from Donja Dubrava to Ferdinandovac (242-183 rkm). The most downstream recorded individual was at 187 rkm. Downstream from the 187 rkm, not a single Black Stork was recorded.

During the nesting season of 2022, on the section 320 rkm - 0 rkm, 8 Black Storks were recorded, and probably 7 pairs. On the old courses of the river Drava from Lovrečan to the Otok Virje (320-314 rkm) and from Svibovec Podravski to Varaždin (300-289 rkm), not a single Black Stork was recorded. On the old course of the Drava from Veliki Bukovec to Donja Dubrava (256-242 rkm), four Black Storks were recorded feeding. Downstream from the power plant, 4 more Black Storks were recorded in 3 locations. The furthest recorded individual was located at 53 rkm. Downstream from the 53rd rkm, not a single Black Stork was recorded. Their number is probably much higher, but they feed on coastal waters and puddles. This number of Black Storks is common for the Drava River. The positions for individual individuals are shown in table 18.

Table 18. Distribution of Black Stork individuals by individual sections of the Drava during 2021 and 2022

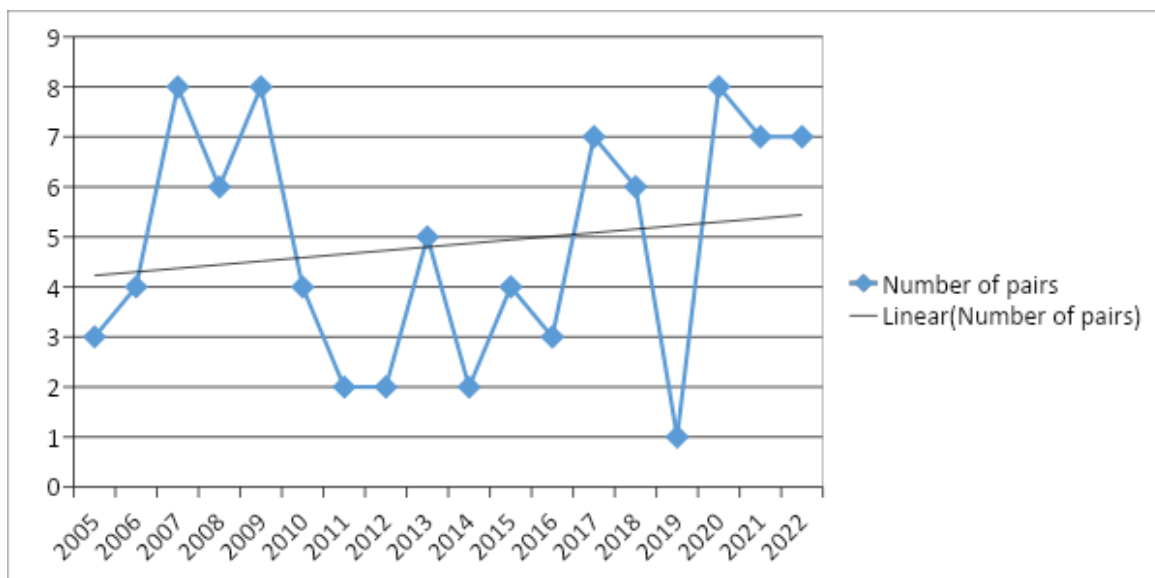
Location rkm	Examples 2021	Examples 2022
320-313	1	
256-242	3	4
242-236	2	
236-230	1	
220-210	1	
190-183	1	
140-130		1
70-60		1
60-50		2

Table 19 and Graph 12 show the abundance of Black Storks on the Drava and the trend line from 2005 to 2022.

Table 19. Number of pairs of Black Stork on the Drava River from 2005 to 2022

Year	Number of pairs
2005	3
2006	4
2007	8
2008	6
2009	8
2010	4
2011	2
2012	2
2013	5
2014	2
2015	4
2016	3
2017	7
2018	6
2019	1
2020	8
2021	7
2022	2

Graph 12. Number of pairs of Black Stork on the Drava River from 2005 to 2022, trend



White-tailed Eagle

On the Drava River during bird monitoring in 2021 in the section 320 rkm - 0 rkm, 32 individuals and one safe pair of White-tailed Eagle were recorded, it is very likely that they correspond to 24 the White-tailed Eagle territories in the researched area. On the old courses of the Drava from 320 rkm - 314 rkm and 300 rkm - 289 rkm not a single individual was recorded. On the old part of the Drava from 256rkm - 242 rkm one sure pair and one adult individual were recorded. Given the good knowledge of this terrain, we can claim with great certainty that these are two pairs of birds. Downstream from the power plant, there are at least 22 territories of White-tailed Eagle (probably about 30), which are more or less populated depending on the preservation of the river and the coast.

During bird monitoring in 2022, 32 individuals were recorded, probably 25 pairs of White-tailed Eagles. The actual number nesting in the researched area is certainly somewhat higher, and according to current research, the probable number of nesting pairs in the area of the Drava River is 30-35 pairs. The time when the monitoring was carried out is not representative for this species, so we believe that the obtained results are more than good. The ideal time for monitoring White-tailed Eagle is January and February when these birds are most active, and the surrounding forests have no leaves and are much easier to spot. According to research carried out so far, the number of White-tailed Eagle on the Drava is increasing slightly, and the reason for this is probably reduced poaching. The positions for individual individuals are shown in table 20.

Table 20. Distribution of White-tailed Eagle individuals and pairs by individual sections of the Drava during 2021 and 2022

Location rkm	Examples 2021	Pairs 2021	Examples 2022	Pairs 2022
256-242		1	1	

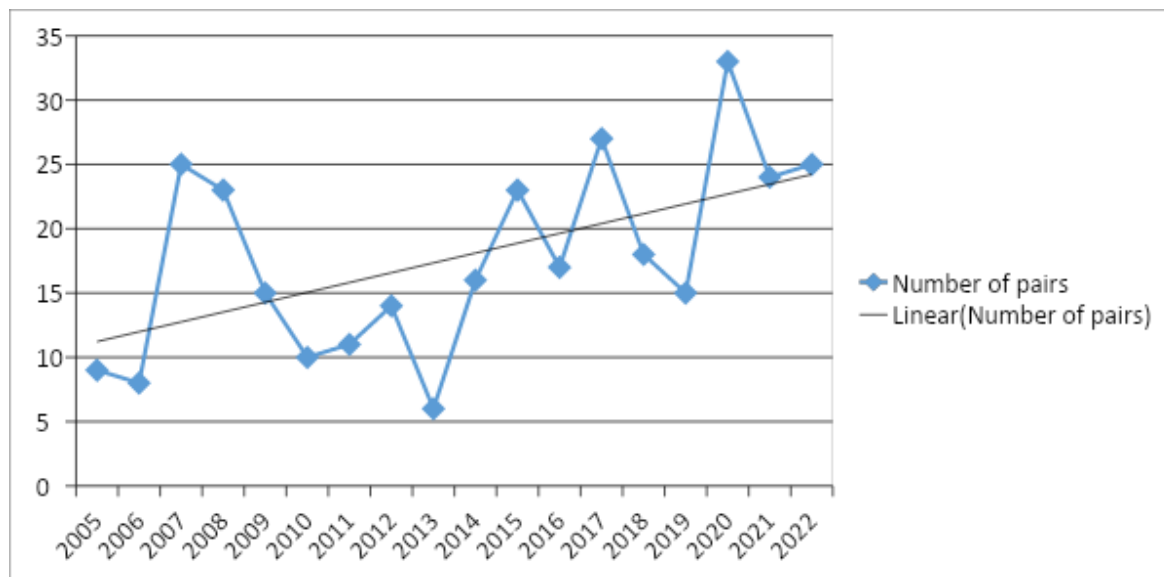
Location rkm	Examples 2021	Pairs 2021	Examples 2022	Pairs 2022
256-242	1		1	
242-236	1		2	
242-236			1	
230-220			1	
230-220			1	
220-210	1		1	
220-210	2			
190-183	2			
190-183	2			
183-180			2	
180-170	2		2	
170-161	1		1	
161-150	1		1	
150-140			1	
150-140			1	
140-130			1	
140-130			1	
140-130			1	
130-124			1	
120-110	2			
100-90			1	
100-90			1	
90-80	1		1	
80-70	1		1	
80-70	1		2	
80-70	1			
80-70	2			
80-70	2			
65-60	1		1	
50-39	1		2	
50-39	2			
39-30	1			
30-20	1			
20-10	1		1	
10-0	2		2	

Table 21 and Graph 13 show the number of White-tailed Eagles on the Drava and the trend line from 2005 to 2022.

Table 21. Number of pairs of White-tailed Eagle on the Drava River from 2005 to 2022

Year	Number of pairs
2005	9
2006	8
2007	25
2008	23
2009	15
2010	10
2011	11
2012	14
2013	6
2014	16
2015	23
2016	17
2017	27
2018	18
2019	15
2020	33
2021	24
2022	25

Graph 13. Number of pairs of White-tailed Eagle on the Drava River from 2005 to 2022, trend



Goosander

Goosander was recorded only on the old part of the course of the river Drava from Svibovec Podravski to Varaždin (300-289 rkm). It was recorded for the first time on the Drava in 2017 and since then it has been regularly nesting in more or less the same location (≈ 295 rkm). During the field survey in 2021, only three young individuals were recorded, it is very likely that a certain number of birds were nearby on the waters

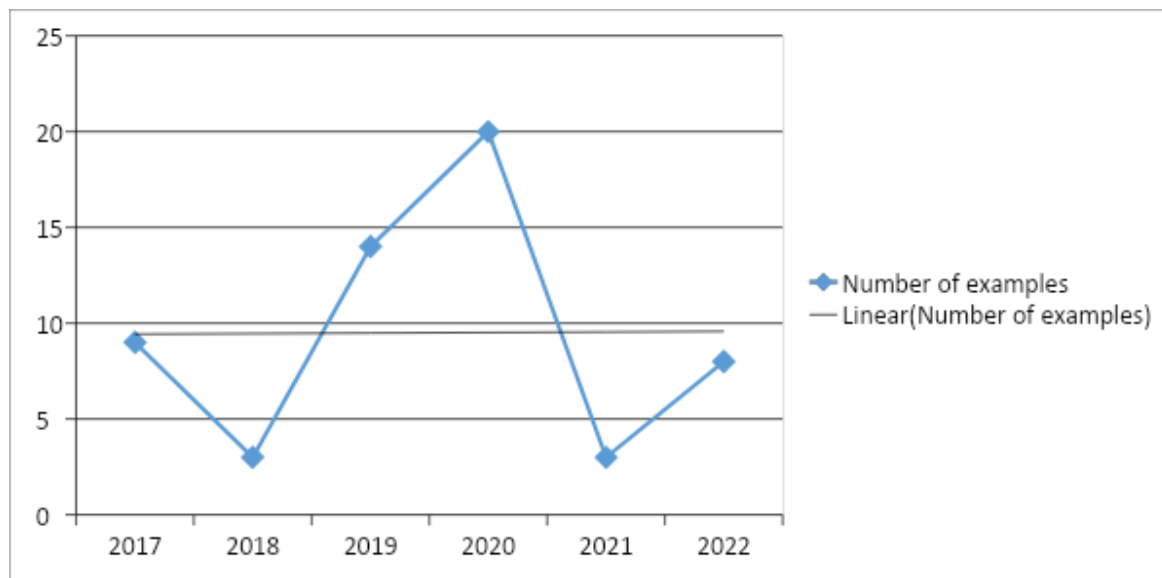
remaining after high waters or in the old branches. In 2022, 8 individuals of the Goosander were recorded, of which one was an adult and 7 were young. The sighting of young sub-adults is proof of the successful nesting of the Goosander in this area.

Table 22 and Graph 14 show the number of Goosander on the Drava from 2017 to 2022.

Table 22. Number of individuals of Goosander on the Drava River from 2017 to 2022

Year	Number of examples
2017	9
2018	3
2019	14
2020	20
2021	3
2022	8

Graph 14. Number of individuals of Goosander on the Drava River from 2017 to 2022, trend



Other species

All other recorded species are shown in the main table. For very rare species that are territorial, exact coordinates were taken, and for species that are only feeding or resting, a rough locality was taken, shown as a segment of the river in rkm.

Results of nesting success on Šoderica

Sand Martin

On Lake Šoderica during the nesting season of 2021, 4 colonies of Sand Martin with a total of 2270 pairs were recorded. So far, according to the data available to us, this is the largest concentration of Sand Martins on stagnant waters in Croatia. These colonies are very close to each other and could be seen as a single colony. During the nesting season of 2022, 525 pairs of Sand Martins nested in two colonies at the same location. This number is much more appropriate for this type of habitat, but even though only a quarter of Sand Martins nested compared to last year, this is still an important nesting site for Sand Martins in Croatia. A threat to these colonies is the digging of gravel near the colony during nesting, because the colony may collapse and a large number of birds may be lost. Excavation of gravel should be adapted to the position of the colony and the time of nesting. The number of nesting pairs at this location is higher than expected and is very significant for the Croatian population of these birds, and it needs to be monitored with extreme attention.

Bee-eater

On Lake Šoderica during the nesting season of 2021, one colony of Bee-eaters was recorded in which 4 pairs were nesting. The colony was located in excavated tailings (soil) next to the access road. This colony was created on an artificial feature and its number of pairs does not represent a significant share of the Croatian population of Bee-eaters, but it contributes to the biological diversity of this area. In 2022, Bee-eaters were not recorded nesting.

Common Tern

On Lake Šoderica during the nesting season of 2021, one colony of Common Terns was recorded. The colony is located on an islet, in the southern part of Šoderica. 70 nesting pairs of Common Terns were recorded in the colony. It is interesting that this is the number of pairs that nested on the Drava River in good years. On this island, the birds are not exposed to water oscillations like on the Drava, and it represents a safe place for them to raise their young. A possible threat to the loss of this habitat is the overgrowth of vegetation, and as a protective measure the island should be cleaned, primarily of woody plants. This area represents a significant potential for the continental population of terns and should be monitored and the necessary measures taken to protect this species. In 2022, the Common Tern was not recorded at nesting.

Mew Gul

On the same islet where Common Terns nest, 4 adult Mew Gul were also recorded in 2021. It is probably two pairs nesting on the island. As with the Common tern, all rules and measures also apply to the Mew Gul. In 2022, no Mew Gul were recorded at nesting.

Results of nesting success on the Danube

Sand Martin

On the Danube river during the 2021 nesting season in the section 1425 rkm - 1299 rkm, 9 colonies of Sand Martins with a total of 598 pairs were recorded, in 2022 there were 770 pairs in 5 colonies.

On the part of the Danube between Batina and Aljmaš, not a single colony of Sand Martin was recorded. The first three colonies could be characterized as one since they are located in the right branch of the Danube near the settlement of Novi Erdut at 1365 rkm. These colonies are also the most significant colonies on the Danube in 2021. Downstream from Dalj at 1352 rkm, there are two smaller colonies that are the remnants of the once much larger colony of Sand Martin. The next colony is located at 1347 rkm and it is also just a remnant of a once very large colony. At 1327 rkm, in the old branch near Vučedol, there are two more colonies of Sand Martins with a total of 80 pairs. The last colony was recorded at 1311 rkm, in the area of Šarengradska ada, and it had only 13 pairs of Sand Martins. The number of pairs that nested in the 2021 season was expected, because there were few suitable places for nesting, and some of them were submerged due to prolonged high waters. In 2022 the first colony was located at 1371 rkm, on the left bank (island), on the territory of Serbia, and had about 100 pairs of Sand Martins. The second colony was located in the old branch, on the right bank, at 1364 rkm, near Novi Erdut, and had 170 pairs of Sand Martins. The third colony was located at 1348 rkm, on the right bank, near the Savulja area, and had 400 pairs of Sand Martins. The fourth colony of Sand Martins was located at 1327 rkm, in the old branch near Vučedol, on the right bank, and had 80 pairs. The fifth, last colony of Sand Martins was located at 1313 rkm, on the left bank of the Danube, on Šarengradska ada, and had 20 pairs of Sand Martins.

Table 23 shows the number of nesting pairs per colony on the entire surveyed course of the Danube River in 2021 and 2022.

Table 23. Distribution of Sand Martin pairs by individual sections of the Danube River during 2021 and 2022

Location rkm	Pair 2021	Pairs 2022
1380-1370		100
1370-1360	35	170
1370-1360	100	
1370-1360	280	
1353-1350	10	
1353-1350	30	
1350-1340	50	400
1330-1320	40	80
1330-1320	40	
1320-1310	13	20

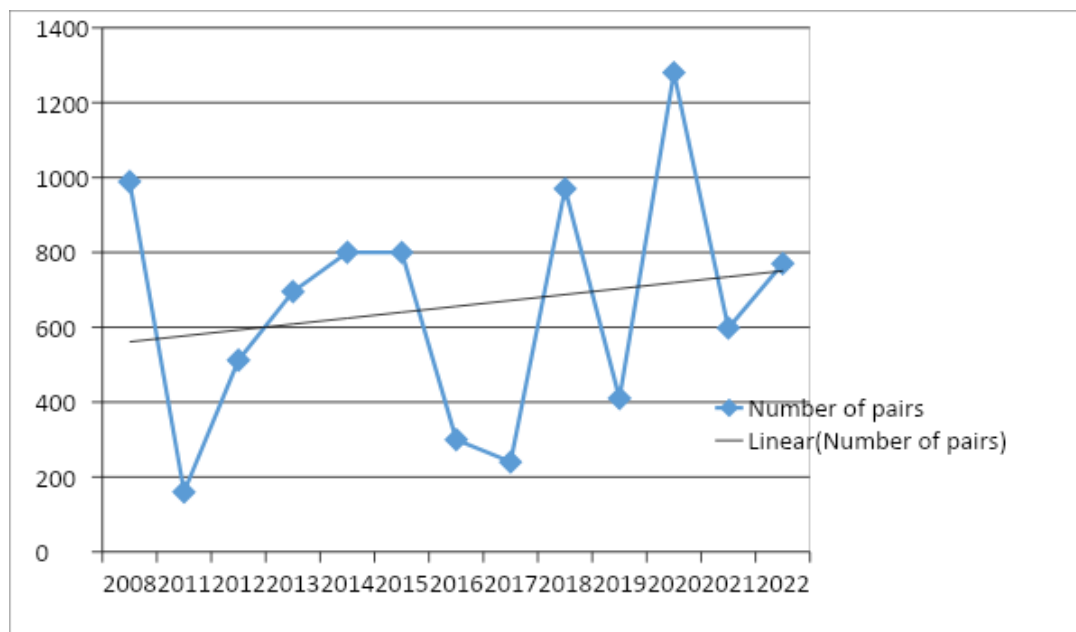
Table 24 and Graphs 15 and 16 show the number of Sand Martins on the Danube River from 2011 to 2022.

Table 24. Number of pairs of Sand Martin on the Danube River from 2008 to 2022

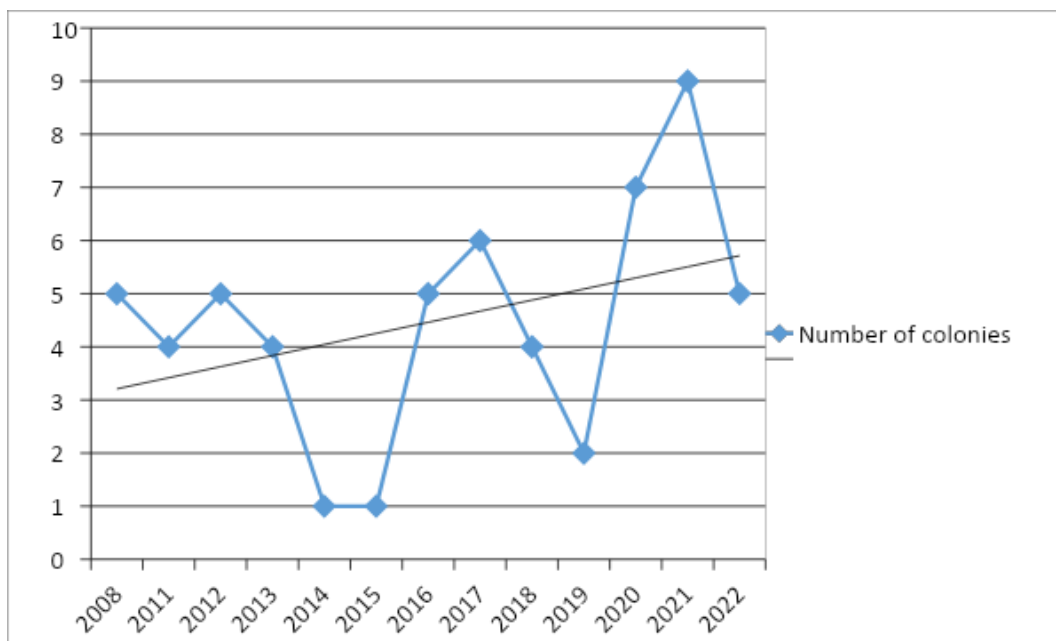
Year	Number of Pairs	Number of Colonies
2008	989	5
2011	160	4
2012	512	5
2013	695	4
2014	800	1
2015	800	1
2016	300	5
2017	240	6
2018	970	4
2019	410	2
2020	1280	7
2021	598	9
2022	770	5

Data for 2008, 1425-1380 rkm apply only to the part of the Danube River from Batina to Aljmaš.

Graph 15. Number of pairs of Sand Martin on the Danube River from 2008 to 2022, trend



Graph 16. Number of colonies of Sand Martin on the Danube River from 2008 to 2022, trend



Kingfisher

On the Danube River during the nesting season of 2021 in the section 1425 rkm - 1299 rkm, 34 pairs of Kingfishers were recorded. The largest concentration of Kingfishers is in the area of Porić (1378-1375 rkm), where 7 pairs of Kingfishers were recorded nesting.

During the nesting season of 2022, 45 pairs of Kingfishers were recorded on the section 1425 rkm - 1299 rkm. Kingfishers were recorded only on the right bank of the Danube. The actual number of Kingfishers can be up to 50% higher because not all river branches are controlled, and Kingfisher nests are often much hidden, so they are easy to overlook. Considering the long period of high water, the number of Kingfisher pairs is higher than expected. The main threat to the kingfisher are numerous coastal revetments that are built in places where the river erodes the banks. Table 25 shows the distribution of individual pairs per section of the river.

Table 25. Distribution of Kingfisher pairs by individual sections of the Danube River during 2021 and 2022

Location rkm	Pairs 2021	Pairs 2022
1420-1410	3	4
1410-1400	4	10
1400-1390	4	4
1390-1380	1	4
1380-1370	7	7
1370-1360	2	1
1360-1353	2	2
1353-1350	2	5
1350-1340	3	3
1340-1330	1	
1330-1320	5	4
1320-1310		1

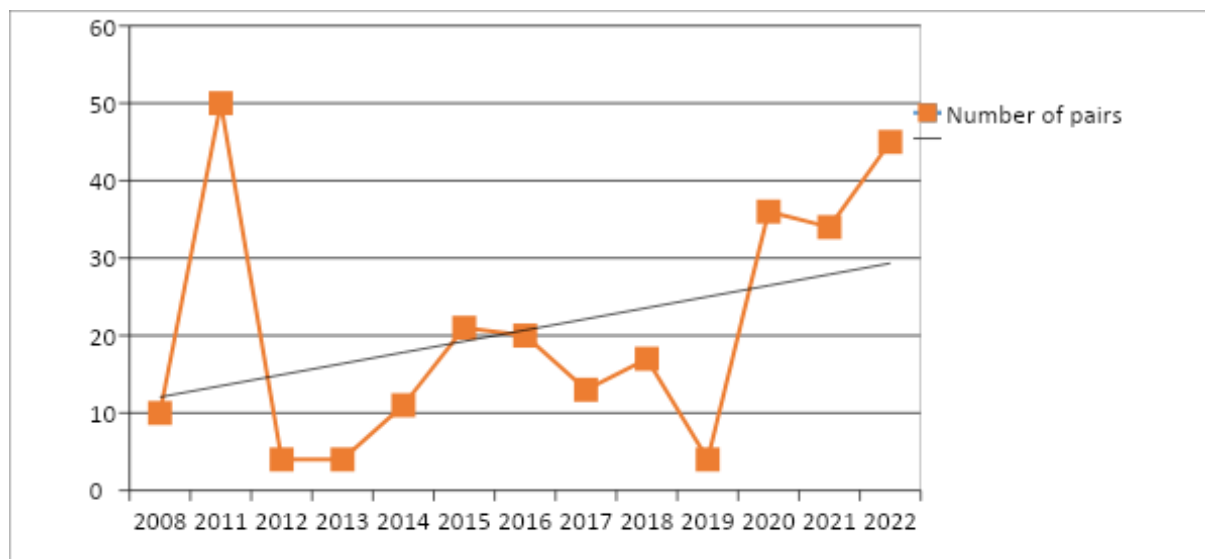
Table 26 and graph 17 show the number of Kingfishers on the Danube from 2011 to 2022.

Table 26. Number of pairs of Kingfisher on the Danube River from 2008 to 2022

Year	Number of pairs
2008	10
2011	50
2012	4
2013	4
2014	11
2015	21
2016	20
2017	13
2018	17
2019	4
2020	36
2021	34
2022	45

The data for 2008 refer only to the part of the Danube from Batina to Aljmaš 130-138 rkm.

Graph 17. Number of pairs of Kingfisher on the Danube River from 2008 to 2022, trend



Bee-eater

On the Danube River during the nesting season of 2021 in the section 1425 rkm - 1299 rkm, 14 colonies of Bee-eaters with a total of 130 pairs were recorded, in 2022 only 35 pairs in 3 colonies.

In 2021, not a single colony of Bee-eaters was recorded on the part of the Danube between Batina and Dalj (1425 rkm -1353 rkm). The first 5 colonies are located on a steep marl coast downstream from Dalj, which is becoming more and more overgrown with vegetation, and the survival of Bee-eaters and Sand Martins in this area is questionable if new erosions do not occur. The next two colonies are located on 1347 rkm on a steep coast that was eroding until a few years ago. In these colonies, there was a decrease in the number of Bee-eaters and Sand Martins after the construction of the revetment. The next five colonies of Bee-eaters are located in the eastern part of Vukovar (1332 rkm -1330 rkm). Colonies are located on marl cliffs. Inside the first colony of Bee-eaters, two nesting Common Kestrels were recorded in extended holes. The last two colonies of Bee-eaters were recorded upstream from Šarengrad (1309 rkm -1307 rkm) and these two colonies are located on marl cliffs. Although the water level of the Danube was high, the number of pairs of Bee-eaters was lower than expected. The probable reason for this is the overgrowth of high banks and cliffs along the Danube. The first two colonies are located on a steep marl coast downstream from Dalj, which is becoming more and more overgrown with vegetation, and the survival of Bee-eaters and Sand Martins in this area is increasingly questionable, if new erosions do not occur. The third colony is located at 1347 rkm on a steep coast that was eroding until a few years ago. In this colony the number of Bee-eaters decreased and Sand Martins disappeared, after the construction of the revetment, as we predicted. The main threat to Bee-eaters is represented by numerous revetments that are built in places where the river erodes the coast and the overgrowth of steep cliffs. Table 27 shows the number of nesting pairs per colony on the entire surveyed course of the Danube River.

Table 27. Distribution of Bee-eater pairs by individual sections of the Danube River during 2021 and 2022

Location rkm	Pair 2021	Pairs 2022
1353-1350	5	15
1353-1350	5	15
1353-1350	3	
1353-1350	2	
1353-1350	5	
1350-1340	10	5
1350-1340	35	
1340-1330	35	
1340-1330	5	
1340-1330	3	
1340-1330	5	
1340-1330	4	
1310-1299	10	
1310-1299	3	

Table 28 and Graphs 18 and 19 show the number of Bee-eaters on the Danube from 2011 to 2022.

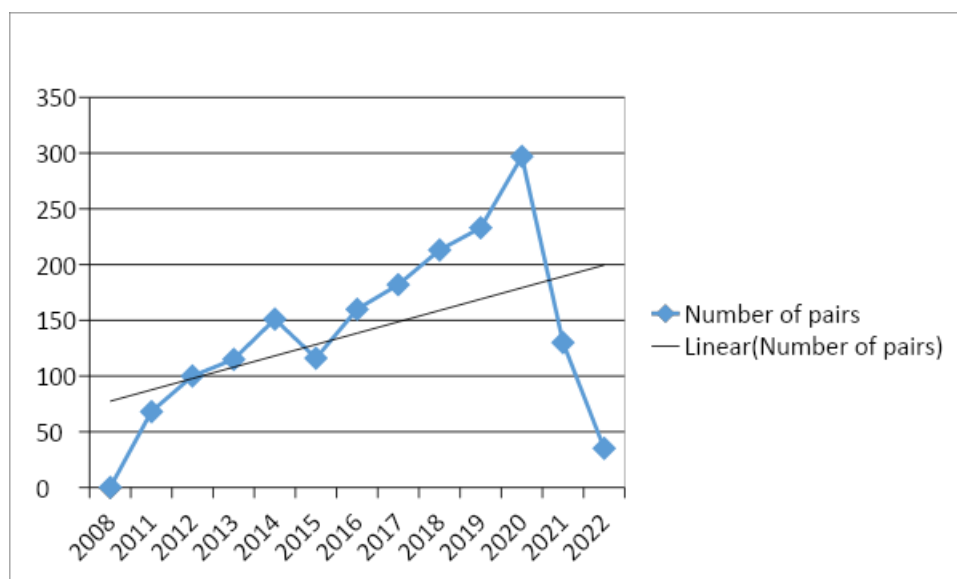
Table 28. Number of pairs of Bee-eater on the Danube River from 2008 to 2022

Year	Number of Pairs	Number of Colonies
2008	0	0
2011	68	6
2012	100	6
2013	115	11

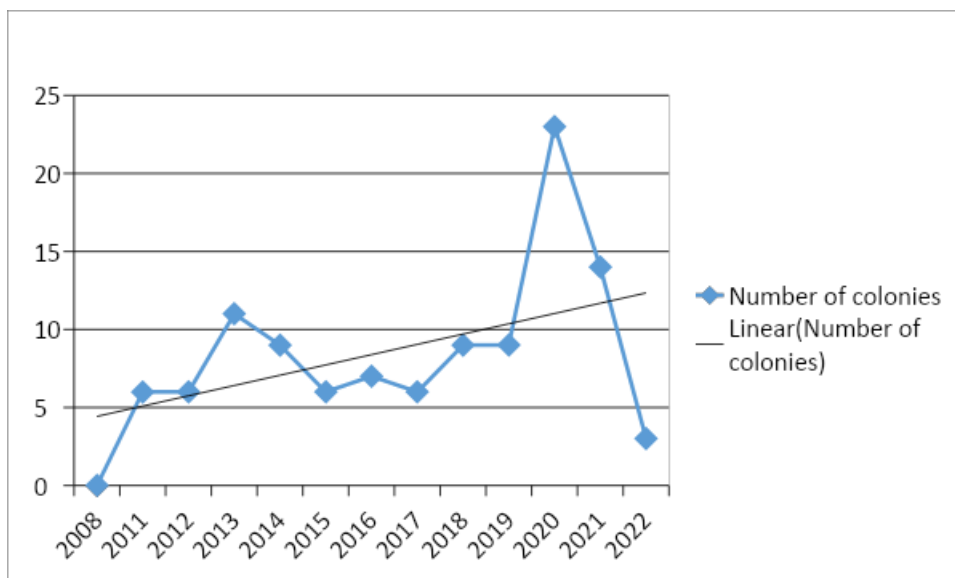
Year	Number of Pairs	Number of Colonies
2014	151	9
2015	116	6
2016	160	7
2017	182	6
2018	213	9
2019	233	9
2020	297	23
2021	130	14
2022	35	3

Data for 2008, 1425 rkm -1380 rkm apply only to the part of the Danube from Batina to Aljmaš.

Graph 18. Number of pairs of Bee-eater on the Danube River from 2005 to 2022, trend



Graph 19. Number of colonies of Bee-eater on the Danube River from 2005 to 2022, trend



River bar birds

During the tour of the Danube in 2021, not a single bird which nests on river bars was recorded, nor nesting nor individually. This includes Little Ringed Plover, Common Sandpiper, Common Tern and Little Tern. The reason for the disappearance of these species is probably a long period of high water, which resulted in the submergence of the few already remaining bars. As a rule, the remaining bars that appear at lower water levels are occupied by fishermen, bathers and picnickers. Many years of systematic disturbance of these birds resulted in the disappearance of these species from that area. During a tour of the Danube in 2022, two pairs of Little Ringed Plover were recorded on the bank of the island near Vučedol, at 1328 rkm. The only species that we find in similar habitats, of which only two individuals were recorded feeding near Vukovar, was the Wood Sandpiper (*Tringa glareola*) in 2021 and one Common Tern, downstream from Batina, in 2022.

White-tailed Eagle

On the Danube River during bird monitoring in 2021 in the section 1425 rkm - 1299 rkm, 28 individuals and two confirmed pairs of White-tailed Eagle were recorded, it is very likely that these are 25 White-tailed Eagle territories in the researched area. During the monitoring of birds in 2022 in the section 1425 rkm - 1299 rkm, 18 individuals and two confirmed pairs of White-tailed Eagle were recorded, it is very likely that these are the 13 territories of White-tailed Eagles in the researched area. The actual number nesting in the researched area is certainly higher and according to the current research, the probable number of pairs nesting in the researched area of the Danube is 30-35 pairs. The time when the monitoring was carried out is not representative for this species, so we believe that the obtained results are more than good. The ideal time for monitoring White-tailed Eagle is January and February when these birds are most active, and the surrounding forests have no leaves and are much easier to spot. According to the research carried out so far, the number of White-tailed Eagles on the Danube is increasing slightly, as well as on the Drava River. The positions for individual individuals are shown in table 29, where it is evident that the White-tailed Eagle is distributed over the entire investigated part of the Danube.

Table 29. Distribution of White-tailed Eagle individuals and pairs by individual sections of the Danube River during 2021 and 2022

Location rkm	Examples 2021	Pairs 2021	Examples 2022	Pairs 2022
1420-1410	1		2	
1420-1410	1		1	
1420-1410	1		1	
1410-1400	1			
1410-1400	1			
1410-1400	2			
1400-1390	1		2	
1400-1390	1		1	
1400-1390				2
1390-1380	1		1	
1380-1370	1		1	
1380-1370	1			
1370-1360	1		1	
1360-1353	2			
1360-1353	1			
1360-1353	1			
1350-1340	1			
1350-1340	3			
1340-1330	1			
1330-1320	2		1	
1330-1320		2		
1330-1320	1			
1320-1310	1		3	
1310-1299	1		1	
1310-1299	1		1	
1310-1299			1	
1310-1299			1	

Table 30 and graph 20 show the number of territories occupied by White-tailed Eagle on the Danube from 2008 to 2022.

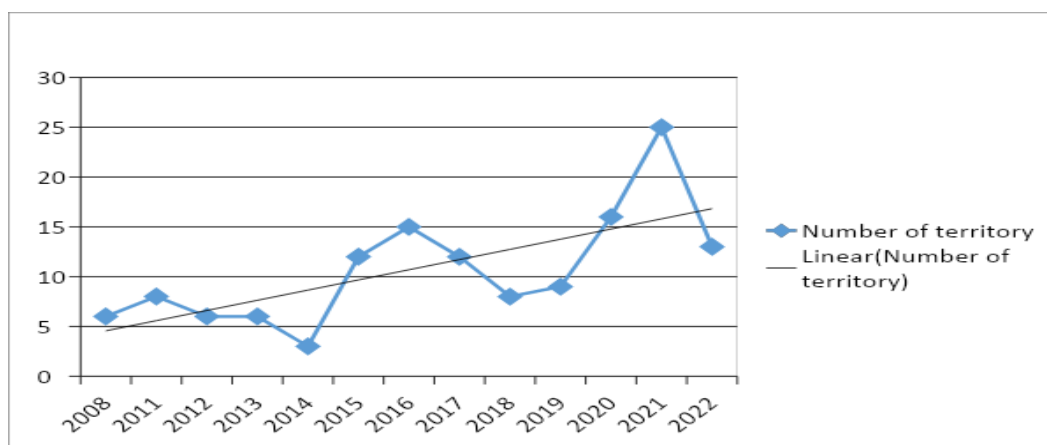
Table 30. Number of territories occupied by White-tailed Eagle on the Danube River from 2008 to 2022

Year	Number of territories
2008	6
2011	8
2012	6
2013	6
2014	3
2015	12
2016	15
2017	12

2018	8
2019	9
2020	16
2021	25
2022	13

Data for the year 2008 refer only to the part of the Danube from Batina 185-34 rkm.

Graph 20. Number of territories occupied by White-tailed Eagle on the Danube River from 2008 to 2022, trend



Black Stork

On the Danube River during bird monitoring in 2021 in the section 1425 rkm - 1299 rkm, only 2 individuals of Black Storks were recorded. They were recorded in the upper part of the Danube upstream from Kopački Rit. This number is significantly lower than expected. The reason for such a low number of recorded Black Storks on the river is probably the high water level of the Danube, which resulted in the submergence of the area between the river and the embankment, in which good conditions for feeding Black Storks and a larger number of species that feed in shallow waters were created. During bird monitoring in 2022 on the section 1425 rkm - 1299 rkm, 7 individuals of Black Storks were recorded. One individual of the Black Stork was recorded at 1425 rkm near Batina, at 1369 rkm near Erdut and 5 individuals at 1324 rkm near Sotin. We believe that reason for such a low number of sightings is actually just a better opportunity for bird feeding in the wider submerged area along the main river course so they were not observed on the river. The biggest threat to Black Storks is forest clearing and disturbance of birds during the nesting season, as well as the drying up of wetlands. Table 31 shows the sections of the river where Black Storks were recorded.

Table 31. Distribution of black Stork individuals by individual sections of the Danube River during 2021 and 2022

Location rkm	Examples 2021	Examples 2022
1425-1420		1
1410-1400	1	
1400-1390	1	

1370-1360		1
1330-1320		5

Other species

All other recorded species are shown in the main table. For very rare species that are territorial, exact coordinates were taken, and for species that are only feeding or resting, a rough locality was taken, shown as a segment of the river in rkm.

Results of nesting success on the Mura River

Sand Martin

During the nesting season of 2021 in the section 49 rkm - 0 rkm, 12 colonies of Sand Martins with a total of 681 pairs were recorded, and in 2022 518 pairs in 14 colonies.

In 2021, the first three colonies were recorded near Domašinec on the left bank, between 49-46 rkm. The first colony was located on Croatian territory, and the second and third on Hungarian territory. The fourth colony was located on the right bank on the very border of Croatia and Hungary at 43 rkm. The fifth colony is extremely small and had only 3 pairs of Sand Martin, and was located on the left bank in Croatian territory. The sixth colony was located on the right bank, between 31 and 30 rkm, on Croatian territory, and had 80 pairs of Sand Martins. The seventh colony of Sand Martins was located at 29 rkm, on the right bank at the very border of Croatia and Hungary, and had 40 pairs. Right next to it was the eighth colony on the left bank, at 29 rkm, on Hungarian territory, and it had 10 pairs. The ninth colony was located on the left bank, between 26 and 27 rkm, on Croatian territory, and had 100 pairs. The tenth colony was located on the left bank, between 12 and 13 rkm, on Croatian territory, and had 25 pairs. The eleventh colony was located on the right bank, at 5 rkm, on Croatian territory, and had 230 pairs. This colony is the largest colony of Sand Martins on the Mura in 2021. The twelfth colony was located on the right bank, between 3 and 4 rkm, on Croatian territory, and had only 3 pairs. This number of Sand Martin is higher than expected, and the reason for this is probably a slightly earlier drop in the waters of the Mura compared to the Drava. Although the number of suitable nesting sites was not large, most of them were inhabited. In 2022, the first colony was located on the left bank, at the 49th rkm, and had 5 pairs of Sand Martins. The second colony was located on the left bank, at the 47th rkm, and had 100 pairs of terns, both colonies were located on Hungarian territory. The next three colonies were located on the 33rd rkm, on the left bank, also on Hungarian territory, and had 6, 12 and 30 pairs of terns. The sixth colony of Sand Martins was located at the 31st rkm, on the right bank (Croatia), and had 20 pairs. The seventh and eighth colonies were located on the 29th rkm, and had 10 and 12 pairs (seventh Hungary, eighth Croatia). The ninth colony was located on the left bank, at the 27th rkm, and had 8 pairs (Croatia). The tenth colony was located on the 13th rkm, on the left bank, it had 120 pairs of Sand Martins, and it was located on the very border of Hungary and Croatia. The eleventh colony was located on the 5th rkm, on the left bank, it had 80 pairs of Sand Martins (Croatia), but unfortunately this colony is in danger of being destroyed by the construction of a revetment. The last three colonies are located on the 4th rkm, on the right bank (Croatia) and have 30, 25 and 50 pairs of Sand Martins. Table 32 shows the number of nesting pairs per colony on the entire surveyed course of the Mura River.

Table 32. Distribution of Sand Martin pairs by individual sections of the Mura River during 2021 and 2022

Location rkm	Pairs 2021	Pairs 2022
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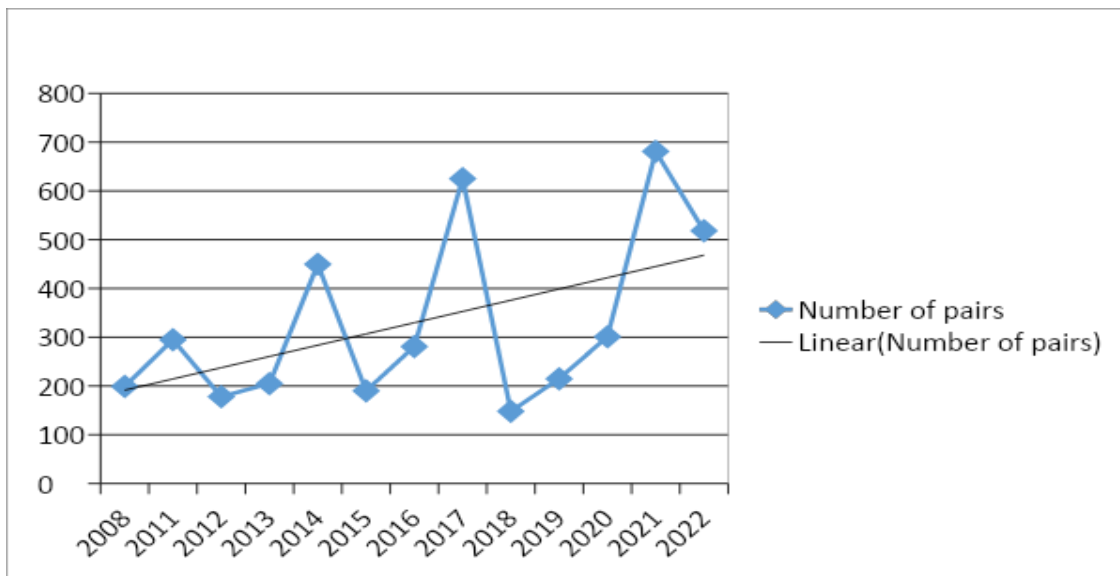
49-40	20	5
49-40	50	100
49-40	90	
49-40	30	
49-40	3	
40-30	80	6
40-30		12
40-30		30
40-30		20
30-20	40	10
30-20	10	12
30-20	100	8
20-10	25	130
10-0	230	80
10-0	3	30
10-0		25
10-0		50

Table 33 and graphs 21 and 22 show the number of Sand Martins and their trend on Mura River from 2008 to 2022.

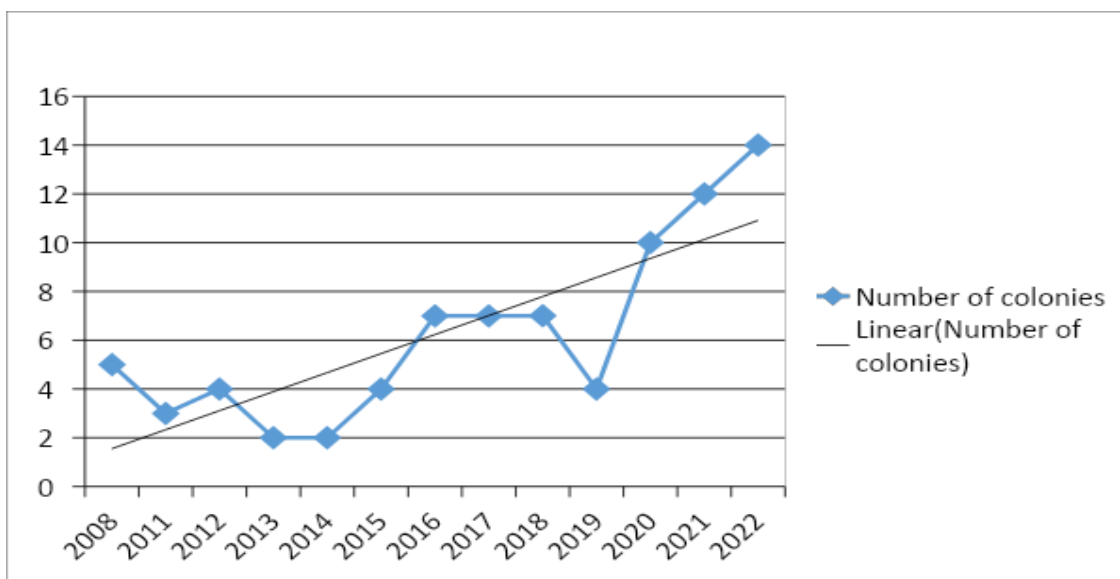
Table 33. Number of pairs and colonies of Sand Martin on the Mura River from 2008 to 2022

Year	Number of Pairs	Number of Colonies
2008	199	5
2011	295	3
2012	178	4
2013	205	2
2014	450	2
2015	190	4
2016	281	7
2017	625	7
2018	148	7
2019	215	4
2020	301	10
2021	681	12
2022	518	14

Graph 21. Number of pairs of Sand Martin on the Mura River from 2008 to 2022, trend



Graph 22. Number of colonies of Sand Martin on the Mura River from 2008 to 2022, trend



On the Mura River during the nesting season of 2021 on the section of 49 rkm - 0 rkm, 25 pairs of Kingfishers were recorded. The highest concentration of Kingfishers is in the area 49-39 rkm, where 9 pairs of Kingfishers were recorded as nesting. In the nesting season of 2022, 16 pairs of Kingfishers were recorded on the section of 49 rkm - 0 rkm. The actual number of Kingfishers can be up to 50% higher because the river branches are not controlled, as they are often impassable, and Kingfisher nests are often much hidden, so they are easy to overlook. Considering the long period of high water, the number of Kingfisher pairs is higher than expected in 2021, but lower than expected in 2022. The main threat to the Kingfisher are numerous coastal revetments that have paved most of the stream. Table 34 shows the distribution of individual pairs per section of the river.

Table 34. Distribution of pairs of Kingfisher by individual sections of the Mura River during 2021 and 2022

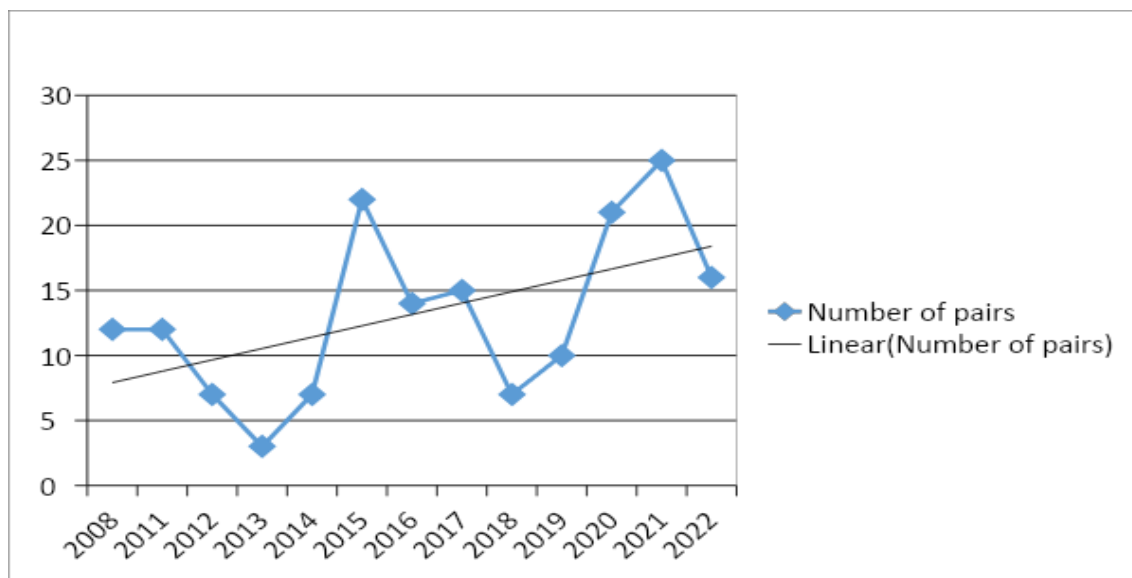
Location rkm	Pairs 2021	Pairs 2022
49-40	8	3
40-30	3	3
30-20	5	3
20-10	2	1
10-0	7	6

Table 35 and Graph 23 show the number of Kingfishers and their trend on the Mura since 2011 until 2022.

Table 35. Number of pairs of Kingfisher on the Mura River from 2008 to 2022

Year	Number of pairs
2008	12
2011	12
2012	7
2013	3
2014	7
2015	22
2016	14
2017	15
2018	7
2019	10
2020	21
2021	25
2022	16

Graph 23. Number of pairs of Kingfisher on the Mura River from 2008 to 2022, trend



Bee-eater

On the Mura River during the season of 2021 on the section of 49 rkm - 0 rkm, two colonies of Bee-eaters with a total of 14 pairs were recorded, and in 2022, one colony with 5 pairs was recorded on the same section.

In 2021, Bee-eaters were recorded only on the part of the Mura between 47 and 46 rkm, on the left bank, on Hungarian territory. Only two colonies were recorded and each had 7 pairs. No colonies were recorded in the rest of the Mura and this number is probably the real number of Bee-eaters nesting in this part of the Mura. In 2022, Bee-eaters were recorded only on the 4 rkm of the Mura, on the right bank, on Croatian territory. Only one colony was recorded, and it had 5 pairs. The main threat to Bee-eaters are numerous coastal revetments that have stabilized the banks, and the lack of high steep banks. Table 36 shows the number of nesting pairs per colony on the entire surveyed course of the Mura River.

Table 36. Distribution of pairs of Bee-eater by individual sections of the Mura River during 2021 and 2022

Location rkm	Pairs 2021	Pairs 2022
49-40	7	
49-40	7	
10-0		5

Little Ringed Plover

A total of 18 pairs of Little Ringed Plover were recorded on the Mura river during the 2021 nesting season in the section 49 - 0 rkm, and in the 2022 nesting season year on the section 49 - 0 rkm, a total of 10 pairs of Little Ringed Plover were recorded.

In 2021, out of a total of 18 pairs, 17 of them nested on the island bars, and only one pair on a river bar that had contact with the mainland. In 2022, all 10 pairs nested on the island bars. In 2021, the highest density of Little Ringed Plover was found in the upper part of Mura (49 rkm - 40 rkm), where 8 pairs nested, that is, almost half of the population of these birds on Mura. In 2022, the highest density of Little Ringed Plover was found in the upper part of Mura (49 rkm - 40 rkm), where 6 out of 10 pairs of Little Ringed Plover nested. The main threat to these birds is channelization of the river and lack of sediment. Considering the long period of high water and the late appearance of the river bars, the number of pairs that nested during the 2021 nesting season is higher than expected, and in 2022 it is as expected. The positions for individual pairs are shown in table 37.

Table 37. Distribution of pairs of Little Ringed Plover by individual sections of the Mura River during 2021 and 2022

Location rkm	Pairs 2021	Note 2021	Pairs 2022	Note 2022
49-40	2	Island	1	Island
49-40	1	Island	3	Island
49-40	2	Island	2	Island
49-40	1	Island		
49-40	2	Island		
33-30	1	Island		
30-20	1	Island		
30-20	1	Island		
30-20	2	Island		
20-10	1	Gravel bar, left side		
20-10	1	Island		
10-0	1	Island	2	Island
10-0	2	Island	2	Island

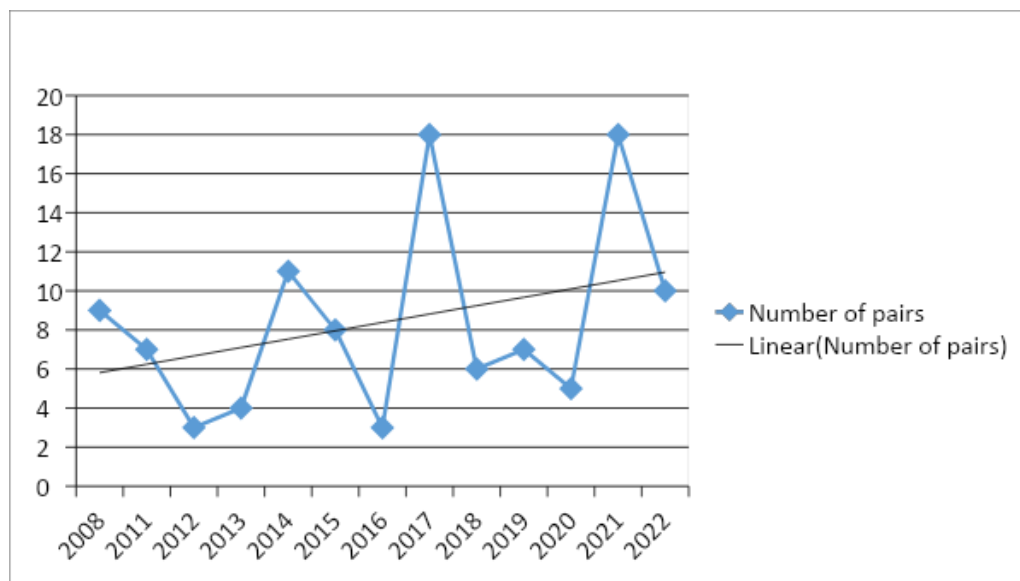
Table 38 and Graph 24 show the number of Little Ringed Plover and its trend on the Mura from 2011 to 2022.

Table 38. Number of pairs of Little Ringed Plover on the Mura River from 2008 to 2022

Year	Number of pairs
2008	9
2011	7
2012	3
2013	4
2014	11
2015	8
2016	3
2017	18

Year	Number of pairs
2018	6
2019	7
2020	5
2021	18
2022	10

Graph 24. Number of pairs of Little Ringed Plover on the Mura River from 2008 to 2022, trend



Common Sandpiper

On the Mura River during the nesting season of 2021 on the section of 49 rkm - 0 rkm, a total of 31 pairs of Common Sandpiper were recorded, and during the nesting season of 2022 on the same section, 16 pairs were recorded.

In 2021, out of a total of 31 pairs, 24 of them nested on island bars, and 7 on the river bars that had contact with the land. In 2022, out of 16 pairs, 14 nested on island bars, and only 2 on 7 on the river bars in contact with land. The highest density of Little Ringed Plover is found in the upper part of the Mura (49 rkm - 40 rkm), where 14 pairs nested in 2021, and 8 pairs in 2022, i.e. almost half of the population of these birds on the Mura. As with the Little Ringed Plover, the main threat to these birds is the channeling of the river and the lack of sediment. Given the long period of high water in 2021 and the late emergence of river bars, the number of pairs that nested during the 2021 nesting season is higher than expected, and during 2022 the number of pairs is within the expected range. The positions for individual pairs are shown in table 39.

Table 39. Distribution of pairs of Common Sandpiper by individual sections of the Mura River during 2021 and 2022

Location rkm	Pairs 2021	Note 2021	Pairs 2022	Note 2022
49-40	2	Island	1	Island
49-40	1	Gravel bar, right side	2	Island

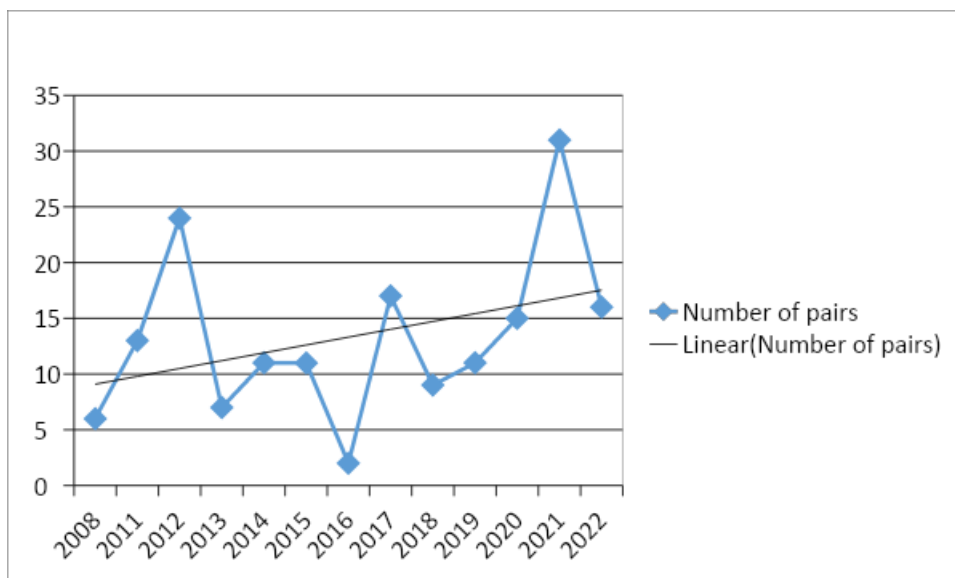
49-40	2	Island	2	Gravel bar, left side
49-40	2	Gravel bar, right side	2	Island
49-40	1	Gravel bar, left side	1	Island
49-40	2	Island		
49-40	1	Island		
49-40	3	Island		
40-33	2	Island	3	Island
40-33	1	Island	1	Island
30-20	2	Island	1	Island
30-20	2	Gravel bar, right side		
30-20	1	Island		
30-20	2	Island		
20-10	2	Island		
20-10	2	Island		
10-0	1	Gravel bar, left side	1	Island
10-0	2	Island	2	Island

Table 40 and Graph 25 show the number of Little Ringed Plover and its trend on the Mura from 2011 to 2022.

Table 40. Number of pairs of Little Ringed Plover on the Mura River from 2008 to 2022

Year	Number of pairs
2008	6
2011	13
2012	24
2013	7
2014	11
2015	11
2016	2
2017	17
2018	9
2019	11
2020	15
2021	31
2022	16

Graph 25. Number of pairs of Little Ringed Plover on the Mura River from 2008 to 2022, trend



Terns

On the Mur River during the nesting season 2021 and 2022 on the section 49 rkm - 0 rkm, not a single individual of Little and Common Tern was recorded. It is not entirely clear why the terns do not nest on Mura. They are rarely seen feeding, and not a single tern was recorded in 2022.

Black Stork

During the nesting season of 2021 and 2022, no Black Storks was recorded in the section 49 rkm - 0 rkm on the Mura River. It is not entirely clear why Black Storks rarely appear on the Mura. The probable reason for the low occurrence of the Black Stork on the Mura is the lack of shallow wetlands that serve as feeding grounds for this species.

White-tailed Eagle

On the Mura River during bird monitoring in 2021 on the section 49 rkm - 0 rkm, 2 individuals and two confirmed pairs of White-tailed Eagle were recorded, it is very likely that these are 3 White-tailed Eagle territories recorded in the researched area. During the monitoring of birds in 2022 on the section 49 rkm - 0 rkm, 6 individuals of White-tailed Eagle were recorded, one of which was a young bird, and the age of one was not determined. In the researched area, it is possible that real number is slightly higher, and according to the current research, the probable number of nesting pairs in the area of the Mura River is 4-5 pairs. The time when the monitoring was carried out is not representative for this species, so we believe that the obtained results are more than good. The ideal time for monitoring White-tailed Eagle is January and February when these birds are most active, and the surrounding forests have no leaves and are much easier to spot. According to the research carried out so far, the number of White-tailed Eagles on the Mura is stable or slightly increasing, and the reason for this is probably reduced poaching. The positions for individual individuals and couples are shown in table 41.

Table 41. Distribution of individuals and pairs of White-tailed Eagle by individual sections of the Mura River during 2021 and 2022

Location rkm	Examples 2021	Pairs 2021	Examples 2022	Pairs 2022
40-30			1	
40-30			1	
40-30			1	
40-30			1	
30-20		1	1	
10-0		1		
10-0	2		1	

Others species

All other recorded species are shown in the main table. For very rare species that are territorial, exact coordinates were taken, and for species that are only feeding or resting, a rough locality was taken, shown as a segment of the river in rkm.

CONCLUSION

Research of target bird species on the Drava, Mura and Danube rivers during 2021 and 2022 was carried out during the nesting season. It shows the actual state of preservation of these rivers. Although the year 2021 was marked by the extremely high water levels that persisted in July, the number of birds on the steep banks was very high. The high water levels resulted in increased erosion of the banks, creating new suitable habitats for nesting on steep slopes. During 2022, the water levels of the rivers were lower, and

portions of the steep banks were destroyed with newly built stone revetments or overgrown by vegetation due to the reduced erosion, thus becoming unsuitable for birds nesting on steep banks. This resulted with the decline in the number of nesting on the steep banks in 2022.

On the Drava River in 2022, a higher number of birds nesting on river bars was recorded due to the lower water levels which resulted, as expected, in a greater number of sand bars. A decline in numbers of birds nesting on Mura river bars was recorded on the in 2022, probably due to the availability of suitable nesting habitats on the Drava River.

Of the other bird species which are not directly related to typical river habitats such as steep banks and river bars, there were no significant changes in the number compared to the trend for a single species.

One of the main impacts that led to the decline in numbers and the disappearance of some species of birds in the entire research area is human activity. In addition, in recent years, the more prominent impact of climate change marked by extremely high and low water levels is evident. The negative human impact that results in the disappearance of typical river habitats or their degradation can roughly be divided into eight causes: construction of water structures, exploitation of sediment, disruption and halting of sediment transfer, increasing proportion of fine sediment from arable land, increasing water load with nutrients, pesticides and chemicals, illegal construction of buildings, disturbance and poaching.

LITERATURE

Grlica I: Monitoring bregunica, vodomara, pčelarica, kulika sljepčića i male prutke na rijeci Dravi 2020. godine. (Monitoring of Sand Martin, Kingfisher, Bee-eater, Little Ringed Plover and Common Sandpiper on the river Drava in 2020)

Grlica I: Monitoring bregunica, vodomara, pčelarice, kulika sljepčića i male prutke na rijeci Dravi u Osječko-baranjskoj županiji 2019. godine. (Monitoring of Sand Martin, Kingfisher, Bee-eater, Little Ringed Plover and Common Sandpiper on the river Drava in Osijek-Baranja County in 2019)

Grlica I: Monitoring bregunica, vodomara, pčelarice, kulika sljepčića i male prutke na rijeci Dravi u Virovitičko-podravskoj županiji 2019. godine. (Monitoring of Sand Martin, Kingfisher, Bee-eater, Little Ringed Plover and Common Sandpiper on the river Drava in Virovitica-Podravina County in 2019)

Grlica I: Monitoring bregunica, vodomara, pčelarice, kulika sljepčića i male prutke na rijeci Dravi u Osječko-baranjskoj županiji 2018. godine. (Monitoring of Sand Martin, Kingfisher, Bee-eater, Little Ringed Plover and Common Sandpiper on the river Drava in Osijek-Branja County in 2018)

Grlica I: Monitoring bregunica, vodomara, pčelarice, kulika sljepčića i male prutke na rijeci Dravi u Virovitičko-podravskoj županiji 2018. godine. (Monitoring of Sand Martin, Kingfisher, Bee-eater, Little Ringed Plover and Common Sandpiper on the river Drava in Virovitica-Podravina County in 2018)