

First review of recent records of sturgeons and paddlefishes (Acipenseriformes) in the Danube River basin in Slovenia

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Abstract. We present recent records of sturgeons and paddlefishes from the rivers in Danube basin in Slovenia after 2000. Strictly, only confirmed and unambiguous records (specimen, picture) were taken into account. The sterlet and the Siberian sturgeon have been occasionally found in rivers and Russian sturgeons in gravel pits, while sterlets, Siberian sturgeons, Russian sturgeons and the paddlefish are still farmed in some ponds. The Siberian sturgeons were released in the Mura and Sava River in 2016, but the species is as »exotic pet fish« present in more water bodies. The presence of sturgeons in gravel pits is unknown. The Siberian sturgeon can be relatively easily misidentified with the sterlet, so the catches in the Mura and Sora Rivers in 2009 were misidentified as sterlet, while the Siberian sturgeon was actually captured. The last sterlet in Slovenian rivers was captured in the Drava River in 2001, and even this individual had probably been released in Austria. The occurrence of sturgeons in Slovenian rivers in the last eighteen years does not seem to be connected with migration and revival of natural populations in the lower part of the Drava and Sava Rivers.

Key words: sterlet, nonindigenous sturgeons, Sava River, Drava River, Mura River, Slovenia

Izvleček. Prvi pregled recentnih podatkov o jesetrovkah (Acipenseriformes) iz donavskega porečja Slovenije – V prispevku predstavljamo najdbe jesetrov v donavskem porečju Slovenije po letu 2000. Rezultati temeljijo izključno na dokaznih fotografijah ali primerkih. V rekah so bili ujeti kečiga in sibirski jeseter, v gramoznicah ruski jeseter, v ribnikih pa so gojili oziroma še gojijo kečige, sibirske jesetre, ruske jesetre in ameriškega veslokljuna. Sibirski jesetri so bili spuščeni v reko Muro in Savo leta 2016, kot okrasne ribe pa jih imajo v precej več vodah. Pojavljanje jesetrov v gramoznicah je velika neznanka. Sibirskega jesetra zlahka zamenjamo s kečigo, tako da so bili ulovi v Muri in Sori v letu 2009 napačno pripisani kečigi, medtem ko je bil dejansko ujet sibirski jeseter. Zadnjo kečigo so v slovenskih rekah ujeli leta 2001, in sicer v reki Dravi, pa še ta je bila verjetno izpuščena v Avstriji. Pojavljanje jesetrov v slovenskih rekah po letu 2000 se ne zdi povezano z migracijo in izboljšanjem stanja populacij v spodnjem toku reke Drave ali Save.

Ključne besede: kečiga, tujerodne jesetrovke, Sava, Drava, Mura, Slovenija

Introduction

Six species of sturgeons (Acipenseriformes) are indigenous to the Danube River Basin: beluga (*Huso huso* Linnaeus, 1758) (Slovenian: beluga), Russian sturgeon or Danube sturgeon (*Acipenser gueldenstaedtii* Brandt & Ratzeburg, 1833) (Slo: kašikar), ship sturgeon (*A. nudiiventris* Lovetsky, 1828) (Slo: sim, gladki jeseter), stellate sturgeon or starry sturgeon (*A. stellatus* Pallas, 1771) (Slo: pastruga), European sturgeon or common sturgeon (*A. sturio* Linnaeus, 1758) (Slo: atlantski jeseter) and sterlet (*A. ruthenus* Linnaeus, 1758) (Slo: kečiga) (Holčík 1989, Hensel & Holčík 1997). European sturgeon has always been the rarest species in the Danube River Basin and restricted to the Lower Danube, whereas others have been more common (Hensel & Holčík 1997). Three anadromous species (beluga, Russian and stellate sturgeon) migrated to the Middle and sometimes to the Upper Danube River and to some of its larger tributaries including Drava and Sava, while two are potamodromous species (ship sturgeon, sterlet) (Hensel & Holčík 1997). Sturgeon overharvesting and habitat destruction have caused dramatic population declines worldwide (Ludwig et al. 2009). The Danube River sturgeon populations began to decline in the 16th century, i.e. a long time before severe pollution and changes in the habitat affected the stocks (Debus 1997, Hensel & Holčík 1997). Destruction of spawning grounds, obstructions to migration, deterioration of the water quality followed in the next few centuries (Debus 1997). During the 18th century, the fishing of migratory sturgeons in the Upper and Middle Danube River started to collapse (Reinartz 2002). Remnants of anadromous sturgeon populations in the Danube have vanished due to the blocking of their spawning migratory routes since the construction of 'Iron Gate I' (1970) and 'Iron Gate II' (1984) hydroelectric dams (Hensel & Holčík 1997). Today, only four species (Russian and stellate sturgeons, sterlet, beluga) still reproduce in the Lower Danube and stocks have been drastically decreasing, while only sterlet still persists in the Upper and Middle Danube. The European sturgeon is extinct, while the ship sturgeon is considered functionally extinct in the Danube River Basin (Reinartz 2002).

In Slovenian books, all six sturgeon species are usually listed (*H. huso*, *A. gueldenstaedtii*, *A. ruthenus*, *A. stellatus*, *A. nudiiventris*, *A. sturio*) that have been historically present in at least one of the Danube's tributaries (the Sava, Drava, Mura Rivers) in Slovenia (Povž & Sket 1990, Veenvliet & Kus Veenvliet 2006, Povž et al. 2015). This information is based mostly on old papers (Freyer 1842, Heckel & Kner 1858, Franke 1892, Glowacki 1885, 1896) without critical judgment. However, in line with other recent assessments of historical records in the Danube catchment (Schmall & Friedrich 2014a, b) as well as with the known range of European sturgeon in the Danube (Holčík 1989), the occurrence of European sturgeon in Slovenia at least is probably either based on misidentification or identification not going down to the species level. Unambiguous are records for the Sava River, while information for the Drava and Mura Rivers is based also on caught specimens in Austria or Croatia. Hensel & Holčík (1997) mentioned only the Russian sturgeon and sterlet for the Slovenian section of the Drava, Mura and Sava Rivers, while some other sturgeon species were caught in the vicinity (beluga in the Sava River close to Zagreb in Croatia). Last review for the Drava and Mura Rivers even shows that there is no other evidence of the historic appearance of other sturgeon species than sterlet in the Austrian Drava and Mura Rivers (Schmall & Friedrich 2014b). However, there is very little exact historic information, and a review of literature in Slovenia has never been done. Especially mediaeval documents from the Slovenian territory should

implicitly be reviewed. Historic distribution or even presence of various sturgeon species in the Drava, Sava and Mura Rivers in Slovenia still needs to be clarified.

In the eighties and nineties of the 20th century, sterlets were caught in the Sava, Drava, Mura and Kolpa Rivers (Povž 1984, Jaš 1996, Jeremko 1998, Povž et al. 1998, Povž & Sket 1990). Consequently, sterlet was the only sturgeon species listed in Slovenian freshwater fish species list (Povž & Sket 1990). Two years later, sterlet was assessed as »extinct« in the national Red list of freshwater fish (Povž 1992) and fully protected (Ur. l. RS 1993). In 2003, its status was changed to »rare« (Ur. l. RS 2002) and remained protected (Ur. l. RS 2004). Other Danube sturgeons were not assessed in both Red lists and are thus not protected either. The European sturgeon is included in the list of sea fishes as endangered (Ur. l. RS 2002).

With the decreasing natural populations, aquaculture of sturgeons has undergone a dynamic development worldwide (Bronzi et al. 1999). The Siberian sturgeon (*A. baerii* Brandt, 1869), assessed as endangered in its native range (Ruban & Bin Zhu 2010), has become the preferred species in European aquaculture (Bronzi et al. 1999). In the last few decades, the occurrence and spreading of several nonindigenous sturgeon species (Siberian sturgeon, white sturgeon (*A. transmontanus* Richardson, 1836), paddlefish (*Polyodon spathula* Walbaum, 1792), etc.) as well as various hybrids have been observed in the Danube River basin (Friedrich 2009, 2013, Weiperth et al. 2014). The increasing catches of nonindigenous Siberian sturgeon in European rivers correlates strongly with their increasing number represented in hatcheries (Ludwig et al. 2009). Unintentional escape of sturgeons from hatcheries located near rivers is quite common and documented (Ludwig et al. 2009). Nonindigenous sturgeons can escape into natural waters during floods from large gardens, angling ponds or aquaculture facilities in the drainage area during the flood events and can drift into the main river channels (Weiperth et al. 2014). Hybridization poses a serious threat for the survival of sterlet populations. Also, natural reproduction of the Siberian sturgeon has already been observed in Europe (Ludwig et al. 2009). Additionally, intentional stocking is taking place, both illegally (ornamental fish becoming too large, attraction stocking for anglers) as well as legally with unchecked or misidentified stocks.

In Austria between 1982 and the early 1990s, a stocking program of sterlet was carried out in the Drava River, although it was very unlikely that the species ever occurred in this section of the Drava River (Friedrich & Schmall 2014). Until 1995, around one thousand sterlets were released (Honsig-Erlenburg & Friedl 1999), also close to Lavamünd, near the Slovenian border (Friedrich 2009). Between 1988 and 1998, seven sterlets were caught in the Lavamünd area in Austria (Honsig-Erlenburg & Friedl 1999). Regular recoveries showed that the animals have grown well in the river and that some migrated downstream through the turbines (Honsig-Erlenburg & Friedl 1999). Catches of sterlets in the Drava River in Slovenia (Jaš 1996, Jeremko 1998) probably originate from the stocking program in Austria. Catches of eels (*Anguilla anguilla*) and whitefishes (*Coregonus* spp.) in the Drava River in Slovenia (Povž et al. 2015) originate from Austrian stocking programs as well. Release of sterlets into the Mura River in Austria has been conducted sporadically. In 2001, sturgeons were released into the Mura River close to Graz. Later on, however, it was established that nonindigenous Siberian sturgeons had most probably been released (Friedrich 2013). In 2005, one Siberian sturgeon was found dead in the upper section of the Mura River, and additionally two Siberian sturgeons were caught in 2010 close to Spielfeld (Šentilj) (Friedrich 2013). There are no

proven records of sterlets being caught in the Austrian section of the Mura River (Friedrich 2013).

Slovenian hatcheries breed at least three sturgeon species: indigenous sterlet, nonindigenous Siberian sturgeon and paddlefish (Zabrc et al. 2006, Vogrin 2007, Urbas 2011, Povž & Gregori 2014, Povž et al. 2015, Omerzu 2017). In Slovenia, at least two »sterlets« have been caught in the 21st century, particularly in the Sora (ZZRS 2009) and Mura Rivers (Povž 2016). In 2016, »sterlets« were released into the Mura (Pojbič 2016) and Sava Rivers (Mavsar 2016a, b). Soon it was established, however, that a Siberian sturgeon was actually released. On web forums, information on more »sterlets« caught in Slovenia can be found, not only from rivers but gravel pits as well. We decided to investigate this information and present the first review of sturgeon records in Slovenian rivers of the Danube drainage area after 2000.

Materials and methods

In this paper we gathered records of sturgeons of the Danube river basin in Slovenia after 2000. Web forums, photo galleries and other local newspapers were surveyed for information. Additionally, information from anglers was gathered. Fish were identified using combination of different characters that are preserved on stuffed fish or visible on pictures (Holčík 1989, CITES 2001).

Results

Despite several »anecdotal« pieces of information on caught sturgeons, it is very hard to find primary sources of information. Only proved and unambiguous record (specimen, picture) after 2000 were therefore strictly taken into account.



Figure 1. Sturgeons from Danube River basin in Slovenia after year 2000. For detailed information see Tab. 1 (letters correspond to ID letters in Tab. 1).

Slika 1. Jesetri iz donavskega porečja Slovenije po letu 2000.

Table 1. Data on Sturgeons from the Danube River basin in Slovenia after 2000.**Tabela 1.** Podatki o jesetirih iz donavskega porečja Slovenije po letu 2000.

ID letter/ ID oznaka	Species/ Vrsta	Locality/ Lokacija	Date/ Datum	Photo/ Foto
a	<i>A. ruthenus</i>	Drava River (Trbonje)	17.7.2001	Anonymus
b	<i>A. ruthenus</i>	Požeg reservoir	2005	Stane Omerzu
c	<i>A. ruthenus</i>	Turnovi ribniki	2008	Milan Vogrin
d	<i>A. ruthenus?</i> (<i>A. ruthenus</i> × <i>Huso huso?</i>)	Tržec gravel pit	2014	Uroš Lovrec
e	<i>A. gueldenstaedti</i>	Požeg reservoir	8.11.2003	Stane Omerzu
f	<i>A. gueldenstaedti</i>	Požeg reservoir	6.11.2004	Stane Omerzu
g	<i>A. gueldenstaedti</i>	Požeg reservoir	5.11.2005	Stane Omerzu
h	<i>A. gueldenstaedti</i>	Požeg reservoir	7.11.2009	ZZRS archive
i	<i>A. gueldenstaedti</i>	Rače	2015	Silvo Koren
j	<i>A. baeri</i>	Sora River	23.2.2009	ZZRS archive
k	<i>A. baeri</i>	Mura River (Veržej)	summer 2009	Anonymus
l	<i>A. baeri</i>	Drava River (Vuzenica)	June 2018	Anonymus
m	<i>A. baeri</i>	Požeg reservoir	7.11.2009	ZZRS archive
n	<i>A. baeri</i>	Požeg reservoir	25.11.2016	Slavko Prijatelj
o	<i>A. baeri</i>	Mura River (Ceršak)	1.6.2016	Marjjan Gaber

Sterlet *Acipenser ruthenus* Linnaeus, 1758 (Slo: kečiga)

Single proved unambiguous catch in this century dates to 2001. The sterlet (80 cm total length; Fig. 1a) was caught on 17. 7. 2001 in the Drava River close to Trbonje between Dravograd and Vuzenica hydropower plant, 11 km downstream from Austria. The sterlet was probably released within the reintroduction program in Austria. It coincides with the catch of the sterlets every few years in the Drava River in Slovenia (Jaš 1996, Jeremko 1998) and Austria (Honsig-Erlenburg & Friedl 1999). We could not confirm any other rumours from the Drava River in Slovenia, although it is possible that more sterlets were caught there. Honsig-Erlenburg & Friedl (1999) concluded that sterlets migrated downstream through turbines, but it should not be neglected that during high discharges spill gates at hydropower plants are open. No other record of sturgeon from Slovenian rivers after year 2000 can be identified as sterlet. Records from the Sora (ZZRS 2009) and Mura Rivers (Povž 2016) have to be discarded due to misidentification.

Sterlets have been reared in Požeg water reservoir (Zabrc et al. 2006, Urbas 2011). Urbas (2011) also published a picture of a sterlet, but one from 2005 was also found by us (Fig. 1b). Sterlets have been reared also in Turnovi ribniki (Turn ponds) in the area of Rače (Vogrin 2007; Fig. 1c).

In a gravel pit close to Tržec near Ptuj one sturgeon was caught in 2015, which, however, cannot be identified with total certainty as sterlet due to the poor quality of the pictures. It is possible that it was a hybrid between sterlet and beluga (Fig. 1d).

Paddlefish *Polyodon spathula* (Walbaum, 1792) (Slo: ameriški veslokljun)

This species has an unusual external appearance, so its misidentification is not expected. Paddlefish were cultivated in a facility close to Rogaška Slatina (Povž 2012, Povž & Gregori 2014, Povž et al. 2015). There is no information that paddlefish is present or was caught in lakes or rivers in Slovenia.

Russian sturgeon *Acipenser gueldenstaedtii* Brandt & Ratzeburg, 1833 (Slo: kašikar)

On web forums we found pictures of specimens with unambiguous morphological characters that can be recognised as those of the Russian sturgeon. In 2003, 2004, 2005 and 2009 at least, the Russian sturgeon was reared in Požeg water reservoir (Fig 1. e, f, g, h). In 2005, it was also caught in a gravel pit close to Rače (Fig. 1i). There is no information that Russian sturgeon is present or was caught in Slovenian rivers after 2000.

Siberian sturgeon *Acipenser baerii* Brandt, 1869 (Slo: sibirski jeseter)

Siberian Sturgeon is cultivated in an aquaculture facility at Dvor in the Dolenjska region along the Krka River (Omerzu 2017). These fish can be bought at fish markets in large supermarkets.

Without pictures of caught specimens we would be still convinced that the Siberian sturgeon is present in Slovenia only at fish farm Dvor. On 23. 2. 2009, Siberian sturgeon was caught in the Sora River (Fig. 1j). It was misidentified as sterlet (ZZRS 2009), and therefore released, as protected species, back into the river. In 2009, nobody paid enough attention to species determination and the sturgeons were simply attributed to the sterlets. The Sora River is not a suitable habitat for sturgeons and neither was it expected that sterlet could occur there. As no »sterlet« was introduced by the Angling Society that manages the area, the only logical conclusion was that it was released by some amateur. Due to the habitat type, which is typical of the pre-alpine Sora River, sturgeons cannot survive there for a long period of time.

In summer 2009, one Siberian sturgeon was caught and taken from the Mura River close to Veržej, 43 km downstream from the Spielfeld hydropower plant in Austria (Govedič & Miličič 2018). At first it was misidentified as sterlet (Povž 2016) but photographs show that it was actually a Siberian sturgeon (Fig. 1k). The catch coincides with two Siberian sturgeons in 2010 close to Spielfeld (Šentilj) in Austria (Friedrich 2013). Additionally, one Siberian sturgeon was caught in the Drava River below Vuzenica hydropower plant in June 2018 (Fig. 1l).

Pictures from the Požeg water reservoir during fish harvesting in 2009 (Fig. 1m) and 2016 (Fig. 1n) prove that Siberian sturgeon has been reared there as well. Even more photos featuring Siberian sturgeons can be found on Facebook. So it seems that Siberian sturgeon is kept as exotic species in some private ponds (Benda 2018) and small fish farms (Anonymus 2014).

In 2016, the Slovenian state authority issued permission for additional stocking of the Mura and Sava River with sterlets without any previous survey on the presence of indigenous sturgeons. 15 fish were released in the Mura River close to Ceršak (3 km downstream from Spielfeld hydropower) on 1. 6. 2016 and 93 of them in the dammed Sava River close to Brestanica between Blanca and Krško hydropower plants on 5. 6. 2016 (Mavsar 2016a, b, Pojbič 2016). Due to good media cover of these events, pictures circulated on web and soon after it was discovered that the stocked fish were in fact nonindigenous Siberian sturgeons (Fig. 1o).

Due to the release of nonindigenous sturgeons into the Mura and Sava Rivers, the government changed regulations on supplemental stocking (Ur. l. RS 2016). As sterlet was not officially extinct in Slovenia (Ur. l. RS 2002), permission for supplemental stocking was issued. For extinct species, permission for resettlement should be issued. Today, authorities have to follow the same procedure for supplemental stocking and resettlement of protected species, and their genetic origin has to be checked as well. But the authorities face a new challenge; what are anglers supposed to do when they catch sturgeons? It is very hard to differentiate between sterlet and Siberian sturgeon, especially for anglers, since they often lack special knowledge. The first species should be immediately released as a protected species, while the nonindigenous one should be taken from the site. In the last century, sturgeons usually considered sterlets were caught, but this simplified method is not possible any more due to 10 species and various hybrids being traded in Europe. All caught fish should be verified directly with the specimen or photograph in order for experts to identify the species. In Austria, a hotline was established where anglers can send their photos via WhatsApp and immediately they get feedback on the species identification.

Sturgeons are very popular for sport fishing. Following the example in other European countries, there are probably more and more gravel pits in Slovenia stocked with sturgeons from aquaculture. And further intensification of sturgeon aquaculture will increase this trend. In Slovenia, the trade and origin of sturgeons are not sufficiently controlled. Due to intentional and unintentional stocking of sturgeons, more catches of sturgeons are expected in Slovenia in near future.

The occurrence of sturgeons in Slovenian rivers in the last eighteen years seems not to be connected with migration and revival of natural populations in the lower part of the Drava and Sava Rivers, but rather with human activities, illegal and misidentified stockings as well as escapees from commercial fish farms. This sturgeon review is not complete. Information on caught sturgeons is still circulating around and waiting to be confirmed. We hope that this paper will encourage anglers to disclose their catch.

Povzetek

V povodju Donave je domorodnih šest vrst jesetrov (*Acipenseriformes*): beluga (*Huso huso*), kašikar (*Acipenser gueldenstaedtii*), sim (*A. nudiiventris*), pastruga (*A. stellatus*), atlantski jeseter (*A. sturio*) in kečiga (*A. ruthenus*), ki so pogosto tudi navedene v splošnih slovenskih knjigah o ribah. Navedbe temeljijo na starih virih, ki niso bili kritično presojani. Ta pregled je treba še narediti in razjasniti, katere vrste jesetrov so zgodovinsko živele v naših rekah.

V letih 1980–2000 je bilo v Sloveniji ujetih nekaj kečig v Savi, Dravi, Muri in Kolpi. Po letu 2000 je bilo v naših rekah ujetih nekaj jesetrov, ki so bili sprva napačno prepoznani kot kečige. Rezultati, ki temeljijo izključno na dokaznih fotografijah ali primerkih, kažejo, da so zadnje kečigo v slovenskih rekah ujeli leta 2001 v reki Dravi, pa še ta je bila verjetno izpuščena v Avstriji. Informacije o kečigah iz Sore in Mure po letu 2000 je treba zavreči zaradi napačne prepoznave. Leta 2009 je bil v Muri pri Veržeju ujet sibirski jeseter (*A. baerii*), leto kasneje pa dva pri Sentilju v Avstriji. Leta 2009 je bil v Sori ujet in nazaj v reko izpuščen sibirski jeseter. Junija 2018 je bil ujet sibirski jeseter v Dravi pod HE Vuzenica. V letu 2016 so sibirskie jesetre zaradi napake izpustili v reko Muro in Savo. Podatkov o ulovu drugih domorodnih ali tujerodnih vrst jesetrov iz naših rek po letu 2000 ni.

Gojenje jesetrov je razvito po celem svetu. V Evropi največ gojijo tujerodnega sibirskega jesetra. Tudi v slovenskih ribogojnicah gojijo ali pa so gojili domorodno kečigo in ruskega jesetra ter tujerodnega sibirskega jesetra in ameriškega veslokljuna (*Polyodon spathula*). Sibirskega jesetra gojijo v Dvoru na Dolenjskem. Leta 2007 so kečige gojili v Turnovih ribnikih pri Račah. V zadrževalniku Požeg so gojili kečige leta 2005 in 2010, v letih 2003–2005 in 2009 tudi ruskega jesetra, sibirskega pa 2009 in 2016.

Jesetri so v Evropi priljubljene ribe za športni ribolov. Tako so bili jesetri verjetno tudi v Sloveniji izpuščeni v več gramoznic in privatnih ribnikov, kot smo zbrali podatkov. V gramoznici Tržec je bil leta 2015 ujet jeseter, ki ni nujno kečiga, morebiti je bil križanec med kečigo in belugo. Načrtno gojenje križancev jesetrov je namreč pogosto. V gramoznici pri Račah je bil 2015 ujet ruski jeseter. Kot okrasne ribe jih imajo verjetno v precej več vodah.

Zaradi napak pri izpustitvi jesetrov v Muro in Savo je bila spremenjena Uredba o zavarovanih prosto živečih živalskih vrstah. Sedaj bo treba tudi za doselitev upoštevati strožja pravila, podobno kot za ponovno naselitev. Pravnih praznin na področju jesetrov ne manjka. Formalno je od živečih zavarovana le kečiga, ruski jeseter pa sploh ni zavarovan. Nobenega izmed jesetrov v rekah ni dovoljeno upleniti, hkrati pa tujerodnih vrst ali križancev ne bi smeli vračati v naravo. Ločevanje jesetrov, še posebej sibirskega in kečige, za neizkušene ni preprosto. V prejšnjem stoletju so bili ulovi jesetrov preprosto pripisani kečigi, danes pa to ni več mogoče. Za zanesljivo potrditev je nujna fotografija.

Prisotnost jesetrov v slovenskih rekah po letu 2000 ni povezana z migracijo in izboljšanjem stanja populacij v spodnjem toku reke Drave ali Save, temveč s človekovo dejavnostjo. Ribe so bile izpuščene ali pa so pobegnile iz ribogojnic.

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