Sturgeons in the Lower Danube River

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Introduction

Six species of sturgeon once migrated in the Danube River for spawning: the anadromous species beluga, *Huso huso;* Russian sturgeon, *Acipenser gueldenstaedtii;* stellate sturgeon, *A. stellatus,* and the European Atlantic sturgeon, *A. sturio,* and the river resident ship sturgeon, *A. nudiventris* and sterlet, *A. ruthenus* (Bacalbasa-Dobrovici 1997). Although considered as critically endangered, beluga – Russian – and stellate sturgeons still survive in the North-Western Black Sea and enter for spawning in the Lower Danube River (LDR), while the resident sterlet is considered only as vulnerable (IUCN 2010).

During the 20th Century, world demand for sturgeon meat and caviar has inflated the economic value of sturgeon fishing, with the value of beluga caviar estimated at US $ 1000 per 100 grams (Suciu 2008). This, when coupled with the development of intense fishing pressure following a lack of fishing controls after the Romanian revolution in 1989 (Kynard et al 2002), has caused, despite listing in year 2009 of all remaining LDR species in Annex II of the Convention on International Trade with Species of Endangered Fauna and Flora (CITES), the sharp decline in recent documented catches of sturgeon *(Table 1).*

Despite these problems, Lower Danube River remained the only and the last possibility of natural spawning of sturgeons in the Black Sea region (Vassilev 2006; Bronzi et al. 2011; Smederevac-Lalić, Jarić et al. 2011).

Table 1. CITES catch quota and actual catches of sturgeons in the LDR / Romania during 2002–2005

Year	Species	CITES approved catch quota (kg)		Catch reported (kg)		Percent of achievement of approved quotas (%)	
		Total	Caviar	Total	Caviar	Total	Caviar
2002	H huso	25000	2180	21343	2628	85.37	120.55
	A. gueld.	13800	1200	3736	579	27.00	48.28
	A. stell.	17000	1470	12471	1148	73.36	78.12
	A. ruth.	500	45	0.00	0.00	0.00	0.00
	Total	**56300**	**4895**	**37541**	**4355**	**66.63**	**88.96**
2003	H huso	28500	2430	24007	2942	84.24	121.09
	A. gueld.	11700	1000	1499	280	12.82	28.07
	A. stell.	14000	1190	4306	269	30.76	22.65
	A. ruth.	800	50	0.00	0.00	0.00	0.00
	Total	**55200**	**4670**	**29813**	**3432**	**54.01**	**73.49**
2004	H huso	28500	2430	13293	1244	46.64	51.19
	A. gueld.	1500	220	440	46	29.33	20.90
	A. stell.	12600	1060	3786	192	30.04	18.11
	A. ruth.	2000	200	0	0	0	0
	Total	**44800**	**3910**	**17518**	**1482**	**39.10**	**37.90**
2005	H huso	24225	2066	8396	639	34.65	30.93
	A. gueld.	1500	220	37	0	2.50	0
	A. stell.	12600	1060	3430	124	27.20	11.70
	A. ruth.	2000	200	12	0	0.60	0
	Total	**40525**	**3546**	**11875**	**736**	**25.52**	**20.75**

Moratorium on commercial catches

To prevent extinction of sturgeons spawning in the LDR, in May 2006 Romania declared unilaterally a 10 year moratorium on commercial catches of sturgeons, while starting to implement in the same year a supportive stocking programme (SSP). A few years later all other LDR countries followed this catch moratorium. To obtain young-of-the-year (YoY) sturgeons for the SSP implemented by Romania capture of wild brood stock was allowed with special permit. After controlled propagation all wild brood stock was individually tagged with passive integrated transponder (PIT) tags and released back in the LDR, preserving this way the wild gene pool represented by adult specimens. When recaptured in subsequent year adults sturgeons carrying a PIT tag will not be used again for controlled propagation, avoiding this way deterioration of genetic diversity of the overall population by repeated use of the same brood stock. Due to lack of compensation measures and overall weak involvement of traditional fishermen communities by the fishery management authorities, in understanding the reasons of and respecting the moratorium illegal fishing became rather common in many of these communities.

Recruitment from natural spawning

By capturing larvae downstream of potential spawning grounds, the Sturgeon Research Group (SRG) of the Danube Delta National Institute (DDNI) Tulcea has identified during 2004–2008 two sites in the LDR, at river Km (rKm) 311/Rasova and rKm 100/Isaccea, were beluga sturgeons and sterlets were spawning on rocky substrate. The existence of other spawning sites used by sturgeons was further documented in the Bulgarian sector of the LDR by Vassilev (2006).

To monitor abundance of YoY sturgeons born annually in the LDR the DDNI SRG identified a suitable nursing ground at rKm 123 and developed there a fishing gear (bottom drifting trammel net) and standardised fishing procedure which was followed since year 2000, resulting today in a 14 year long record called the juvenile production index (JPI) of LDR sturgeons (Suciu & Guti 2012) *(Figure 1).*

A total number of 2766 YoY of the four sturgeon species were captured during the period of 14 years. The largest number were sterlets (N= 1778), followed by beluga sturgeons (N=887), stellate sturgeons (N= 75) and Russian sturgeons (N=26). Catch data were used to construct the JPI graphs *(Figure 1)*, showing the relative abundance of YoY, at an age of about 30 – 45 days and total body length of 4 – 26 cm, having direct relevance to the size of annual recruitment from natural spawning in the LDR of each species. All species showed a marked variation of annual recruitment. The years with the best recruitment in beluga sturgeon were 2000, 2005, 2010 and 2013. Estimates of YoY abundance derived from catch data help to evaluate the health of stock and might be used in predicting future commercial abundance. To our knowledge this is worldwide the longest series of JPI recorded in any species of sturgeon in the wild.

Distribution in the Black Sea

In year 2012 investigations in cooperation with the Romanian Marine Research Institute of Constanta the distribution of juvenile sturgeons in the Black Sea coastal waters in front of the Danube delta were conducted. Two areas, Sahalin and Zatoane, were identified as feeding grounds especially for stellate sturgeons, requiring special consideration as marine protected areas (MPAs). Further studies should continue to investigate the dynamics of sturgeon population along the Black Sea coast as well as behavioural, ecological factors influencing the seasonal distribution as a prerequisite for improved management and sustainable use of these most valuable resources of the Black Sea (Holostenco et al. 2013).

Bio-contamination with heavy metals

Fish as part of the aquatic food web are the most likely route of human exposure to contaminants. Due to urbanization, industry, agriculture or mining, human activities dictate the frequency and intensity of water contamination by heavy metals (Zrnčić et al., 2013). The high content of lipids in sturgeon body makes them prone to bio-accumulation of heavy metals in their organs, including the gonads.

Due to the species ecology, stellate sturgeon and Russian sturgeon prefer marine habitats located close to the Danube River mouths, feeding mainly on bottom fauna. After downstream migration to the sea during the first year of their life, beluga sturgeons feed mainly on pelagic fish, such as anchovy, horse mackerel, Pontic shad and sprat shoals, which feed on other pelagic organisms as well. As a consequence beluga sturgeons show less heavy metal bio-accumulation of tissues (Onără et al. 2013).

On the other hand, males of all anadromous species seem to accumulate more heavy metals in their tissues than females. We explain this to be the effect of more frequent spawning migration of males in the LDR, the major contamination source (Wachs 2000). However confirmation of this hypothesis needs further investigations (Onără et al., 2013).

Supportive Stocking Programme

Hatchery supplementation programme is one of the approaches used for restoring of endangered sturgeon stocks. Although there is evidence of sturgeon natural spawning in the LDR, it is mandatory to estimate the annual recruitment and to support the population with hatchery produced young sturgeons, when necessary.

For supportive stocking of LDR with young sturgeons produced by controlled propagation, over 400 000 young sturgeon of the four native species of the Lower Danube were released into the River by the Romanian Fishery Agency during 2006 – 2009. This SSP was stopped in year 2010 for three years due to financial issues. However, in September 2013, within a project funded by the EC Fishery Operational Programme of Romania, 90 000 young sturgeons were released into the river in 5 locations in order to estimate in year 2014 their survival – and growth rate, as well as their distribution in the river and in the sea, involving experts from all Black Sea countries.

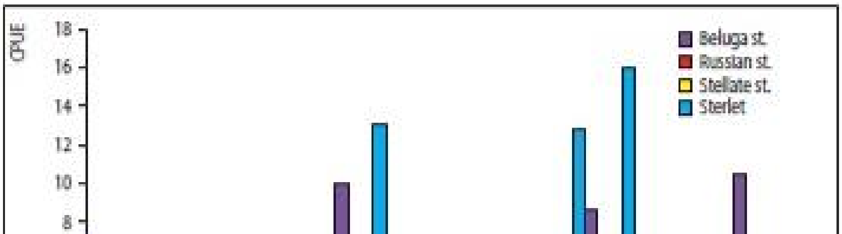

Figure 1. Juvenile production index YoY sturgeons born in the LDR during 2000–2013, expressed as catch per unit of effort (CPUE). The mean number of YoY sturgeons captured in a 96 m long trammel net with 20 mm mesh size, while drifted over a 850 m long stretch of the bottom of LDR at rKm 123*

Perspective of re-opening migration route at Iron Gates dams

The Danube river system has long been subjected to anthropogenic influence from a number of sources altering the entire ecosystem. The fish community, in particular sturgeon species, has been greatly impacted by these changes. Loss of habitat has occurred throughout the system and in particular, historical spawning grounds are no longer accessible due to the construction of the hydroelectric dams Iron Gate I & II at river kilometres 942 and 863 in 1970 and 1984 respectively (Hensel & Holcik 1997). These barriers divide the lower and mid

Figure 2. YoY Beluga captured at Danube rKm 118 (May 31, 2007). Photo: Suciu

Danube halving the historic spawning migrations of sturgeons which were documented extending as far upstream as Vienna (Bacalbasa- Dobrovici 1997). Recently (Sept. 2013) a first pilot feasibility study to construct fish passage facilities at Iron Gate II HP dams is underway with financial support from the Dutch Partners for Water Programme and ICPDR Vienna.

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Danube Sturgeon Actions – an issue of implementation

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The actual basis for sturgeon actions

The preceding review articles provide an updated scientific survey about the current populations and problems of sturgeons, globally and in the Danube River Basin (DRB). Without doubt, the status of sturgeon populations is still worsening (http://www.iucnredlist.org), particularly in the DRB. The corresponding political framework for sturgeon protection was created by the Sturgeon Action Plan SAP (Bern Convention; Bloesch et al. 2005), CITES and TRAFFIC regulations, the Bonn Convention, IUCN Red List (1996), sturgeon fishery bans of Romania (2006), Serbia (2009) and Bulgaria (2011), regulations of the UNESCO Biosphere Reserve in the Danube Delta, the EU Strategy for the Danube Region (EUSDR), and the newly founded Danube Sturgeon Task Force (DSTF; www.dstf.org, see Danube News 27) with the Program "Sturgeon 2020" (Sandu et al. 2013). However, most of these valuable contributions to achieve the common goal of Danube sturgeon rehabilitation and conservation *(Figure 1)* have not yet been fully implemented. Action means the timely implementations of ideas and concepts into reality and in situ; it requires considerable amounts of money and the willingness of responsible people. For example, restocking programs in the DRB were not coordinated and the money for extended field studies was not available. Sturgeon actions are urgently needed across the DRB and the adjacent Black Sea (BS). They can only be successful with governmental support and long-term commitment of all stakeholders involved.

What does 'sturgeon actions' mean?

Danube sturgeon actions can be reactive or proactive. The first approach is mainly related to interventions in large infrastructure projects of the key pressures navigation, hydropower and flood protection schemes to prevent or mitigate adverse effects on sturgeon populations and their habitats. Another significant pressure is overfishing and inherent poaching requiring adequate law enforcement and regulations for sturgeon protection (e.g. bans). The second approach implies initiating and conducting field studies to gain a sound basis for the implementation of sturgeon protection and restoration measures. In this context, it is important to note that we need basic and applied transdisciplinary research; e.g. on the life cycle of different sturgeon species (in-situ conservation, focused on habitats and migration routes), support for hatchery concepts and restocking programs (ex-situ conservation providing gene banks), and socio-economic problems of local communities including sturgeon poaching and caviar black market. Raising public awareness by actions of public relations will bridge the gap between theory and practice. Despite considerable gaps in knowledge, we know enough to act now and to proceed step-by-step towards truly sustainable Danube sturgeon management.