Scientific Papers. Series D. Animal Science. Vol. LX, 2017
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

THE IMPORTANCE OF THE CHILIA BRANCH FOR PROTECTING AND CONSERVATION OF THE ANADROMOUS MIGRATORY STURGEONS

Tiberius-Marcel DANALACHE[1], Stefan DIACONESCU[1], Alin Marius BADILITA[2], György DEÁK[2], Elena HOLBAN[2], Carmen Georgeta NICOLAE[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania
[2]National Institute for Research and Development in Environmental Protection, Bucharest - INCDPM, Spl. Independentei, 294, 6th District, Code 060031, Bucharest, Romania

Corresponding author e-mail: tiberiusdanalache@yahoo.com

Abstract

The hydrotechnic works often generate aquatic ecosystem disturbances. Sometimes they are local and short-term, but sometimes they cause significant long-term impact that may be irreversible. The present paper aims to analyze the possible impact of the maintenance works performed on Bastroe channel fairway on the populations' dynamics of migratory anadromous fishes, sturgeon.
The methodology implied sturgeon tagging and migration monitoring using ultrasonic telemetry technique during 2011-2014. The tags were inserted into the abdominal cavity through a simple surgical intervention, being set to transmit data related on swimming depth and water temperature towards receiver stations fixed on Chilia branch, upstream and downstream of Bastroe channel, Tulcea and Old Danube branches.
The results showed that the distribution of the adult specimens during migration on Chilia and Tulcea branches was 53% - 47% (spring 2012/2014) and 31% - 69% in autumn 2013. A possible progressive warping of the Old Stambul and especially Musura branch, as well as an increase of the naval traffic on Bastroe channel will have major negative effects on upstream sturgeon migration for breeding.

Key words*: fish migration, monitoring, Old Danube, sturgeon conservation.*

INTRODUCTION

Chilia branch and Bastroe channel are parts of the Danube Delta Biosphere Reserve, having great importance due to the many types of aquatic and terrestrial habitats existing here. The universal value of the reserve has been recognized by its inclusion in the international network of the Biosphere Reserves (1990), within the Program "Man and Biosphere" (MAB) launched by UNESCO in 1970. Bastroe channel was formed naturally and makes the connection between Chilia branch and the Black Sea. Although the area benefits of full ecological protection regime, according to which any human activity in the region is forbidden, in the area have been conducted a series of works for the riverbed arrangement through which is seeking the direct access of commercial ships in the Black Sea (Șofineți and Dobrotă, 2004). An effect of the channel arrangement will be an overall disturbance of the habitats, due to the banks transformations by digging the channel, which will cause the water flow's system change and a new way of sedimentation in the area of the Bastroe estuary. The impact on ichtyofauna may be a temporary one, generated by high mortality among fish species caused by dredging activities or their withdrawal from the area, and also a permanent impact, irreparably through the disappearance of species due to changes of habitual requirements.

One category of fish species sensitive to hydro-morphological changes of the watercourse is represented by sturgeon. It is proved the fact that human activities related to the change of the natural watercourses led to a decline of this species population over time. The best example are the dams built for the Iron Gates I and II Hydropower plants (Bacalbasa-Dobrovici, 1993, 1997; Ciolac, 2004; Reinartz, 2002). The interruption of the longitudinal connectivity of watercourses leads to the impossibility of reproduction in case these species cannot reach to specific habitats located upstream and thus, the number of specimens decreases alarmingly from one year to another (Kerr et al., 2010; Yi et al., 2010).

Sturgeon are cartilaginous bony fish species that migrate from the Black Sea on the Danube River only for reproduction, and then return into the sea (Oţel, 2007; Antipa, 1909; Bănărescu, 1964). National legislation protects sturgeon species by prohibiting fishing and their commercialization (Order no. 330/2006) and by Danube programs for restocking with juvenile sturgeon specimens. Internationally, many non-governmental organizations take action for saving sturgeon species.

Sturgeons are important due to the fact that their presence on the Danube River was confirmed since ancient times and represented a source of food for coastal communities. Greek orator, Claudius Elian in his papers from the second century b.h. describes a technique for beluga capturing in the Danube River through the use of lines with hooks attached to a rope distributed transversely on the watercourse, a technique very similar to lining fishing (Palatnikov, 2010). On Chilia branch, Bacalbaşa-Dobrovici (1997) recalls the Italian monk Niccolo Barsari's visit during 1633-1639 who noted that fishermen captured daily between 1000 and 2000 sturgeon specimens.

The National Institute for Research and Development in Environmental Protection has analyzed the migration of sturgeons in the period of 2011-2014 and has noticed the possible negative effect of the arrangement works on Bastroe channel on these species.

MATERIALS AND METHODS

The monitoring of sturgeon species migration conducted by the National Institute for Research and Development in Environmental during 2011-2014 has been performed by using ultrasonic telemetry. The method involves the use of tags attached to sturgeon specimens which transmits the information through water, with the help of ultrasounds, to a series of receiver stations fixed at certain strategic points (Badilita et al., 2013; Deák et al. 2013, 2014a, 2014b; Raischi et al., 2016a, 2016b).

Before assembling the systems, a riverbed in situ analysis has been performed. With a boat on which was installed a device for bathymetric measurements (single beam and multibeam), sections from one side of the riverbed to the other were made, on a sector of approximately 600 m (300 m downstream the location where the monitoring system was mounted and 300 m upstream). The measurements result was a 3D representation of the river morphology. For the assembly, it has been chosen only the areas with slight slope, without deep thresholds or holes, which may screen the signal transmitted by the ultrasonic mark attached to sturgeon specimens.

The ultrasonic tagging of sturgeon specimens has been conducted after a procedure with minimal stress on specimens. Thus, fish have been placed in a contention floating tube, directly into the water body provided with slots for a good oxygenation (Badilita et al., 2012). Before the tagging surgery, biometric measurements have been performed (total length, standard length, weight), the genre of the fish has been determined with an endoscope and DNA samples have been taken for each specimen. Then, the fish have been anesthetized through electro-narcosis and on the incision area has been locally injected xiline. The size of an incision was of approximately 3 cm and has been done with a sterile surgical material. The closure of the area, after ultrasonic marking, it has been done with an absorbable suture thread. The area has been swabbed with Betadine and then, a special medical adhesive that hardens in seconds and do not allow water to enter in the abdominal cavity has been applied. Finally, an "anti-poaching" spaghetti tag has been fixed, on the dorsal flipper, with a special pistol. All the identifycation data of each sturgeon specimen have been noted on the catch sheet. On every operation, a veterinarian specialist was present, who monitored the development of each phase of tagging procedure.

RESULTS AND DISCUSSIONS

In 2011-2014 frame times, sturgeon catching, tagging and releasing was performed on the Danube River between Calarasi and Braila. During this period were studied 253 specimens of beluga, Russian sturgeon, Stellate sturgeon and Sterlet sturgeon, 186 being tagged both with ultrasonic and anti-poaching (T-bar) tags, while 67 were only tagged with anti- poaching tags.

In order to have a general overview of the sturgeon migration on Chilia branch and to perform a comparison with their behavior on Tulcea branch, the research team mounted reception systems for ultrasonic signal on Danube River at km 100, on Tulcea branch at km 70 and on Chilia at Bastroe confluence (Fig. 1).

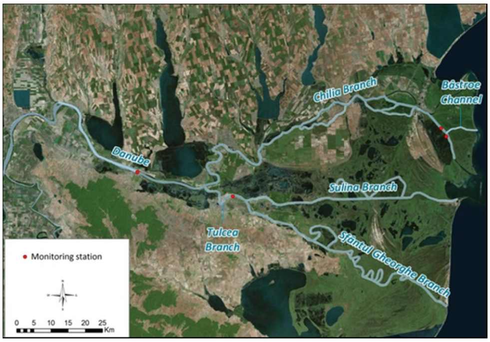

Figure 1. Location of the monitoring stations

On Chilia branch were not reported any catches of the T-bar tagged sturgeons in the studied period. Regarding the ultrasonic tagged specimens, the receivers' recordings showed that in 2012 spring 53% of the specimens that migrated towards the Black Sea used Chilia branch, while during 2013 autumn the percentage decreased at 31% and in 2014 spring reached again the value of 53% (Fig. 2).

In Table 1 is presented the distribution of sturgeon specimens detected between 2013-2014 on Chilia branch in respect with the migration direction (upstream or downstream). Therefore, for the upstream migration from the Black Sea to the spawning areas were identified also specimens tagged before 2011-2013.

The male Stellate sturgeon specimens with codes 2S5 and 3S48 came again for a new reproduction cycle after 2 years and 2 years and a half, respectively, from the tagging moment. This observation is in accordance with the previous research which showed that sturgeon do not perform reproduction actions every year (Hochleithner and Gessner, 1999). Gonads' maturation is directly influenced by the species, age, gender and hydro-climatic conditions (Reinartz, 2002). A second example is Stellate sturgeon 5S9 tagged in 2013 spring which came back after one year, in 2014 spring. An explanation for this behavior may be that the specimen did not reproduced in the previous year and intended to accomplish this action in 2014.

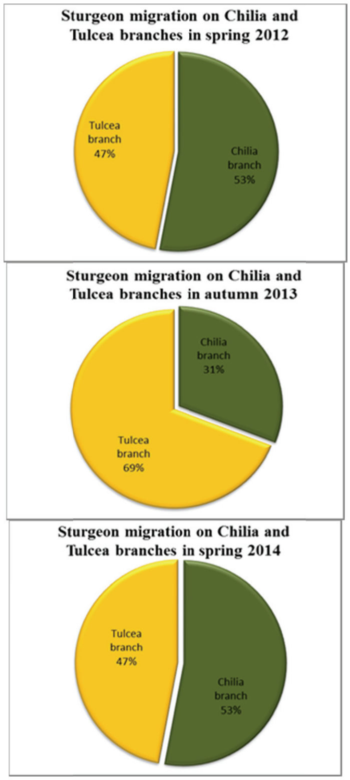

Figure 2. Distribution of sturgeon migration on Chilia and Tulcea branches between 2012 - 2014

Even that a lot of research works consider that sturgeon specimens migrate upstream during autumn and remain until the next spring migration season for reproduction purposes (Chebanov and Galich, 2011), our research revealed that some specimens have a different behaviour returning to the Black Sea in the same season (E.g.: 6S12, 6S14, 6S21, 6S22). From the 5 specimens of beluga tagged during 2013 autumn, only the 6S11 specimen was recorded on Chilia branch also in 2014 spring season.

The 7S1, 7S28, 7S32, 7S33, 7S2 specimens were tagged in 2014 spring on Calarasi-Braila sector of the Danube River and were recorded by the two receiving-recording systems mounted on the Chilia branch (upstream and downstream of the Bastroe confluence), at the end of the reproduction season when they migrated back to the Black Sea.

Table 1. Sturgeon migration routes on Chilia branch at the confluence with Bastroe channel

Nr. Crt.	Sheet number	Tagging period	Species	Gender	Records Chilia branch	Migration Type
1	2S5	A. 2011	Stellate sturgeon	male	24.03.2014	
2	3S48	S.2012	Stellate sturgeon	male	24.04.2014	
3	5S9	S.2013	Stellate sturgeon	male	04.05.2014	
4	6S11	A. 2013	Beluga	male	02.05.2014	
5	6S12	A. 2013	Beluga	male	15-16.11.2013	
6	6S14	A. 2013	Beluga	male	13-14.11.2013	
7	6S21	A. 2013	Beluga	male	24.11.2013	
8	6S22	A. 2013	Beluga	male	03.12.2013	
9	7S1	S. 2014	Beluga	male	07.05.2014	
10	7S28	S. 2014	Stellate sturgeon	male	23.06.2014	
11	7S32	S. 2014	Stellate sturgeon	male	01.05.2014	
12	7S33	S. 2014	Stellate sturgeon	male	24.06.2014	
13	7S42	S. 2014	Stellate sturgeon	male	13.05.2014	

Spring migration 2014 (Returning of sturgeon specimens tagged in 2011, 2012, 2013)

Autumn migration 2013 (Sturgeon specimens tagged in 2013)

Spring migration 2014 (Sturgeon specimens tagged in 2014)

A.	= autumn
S.	= spring
	= upstream migration
	= downstream migration

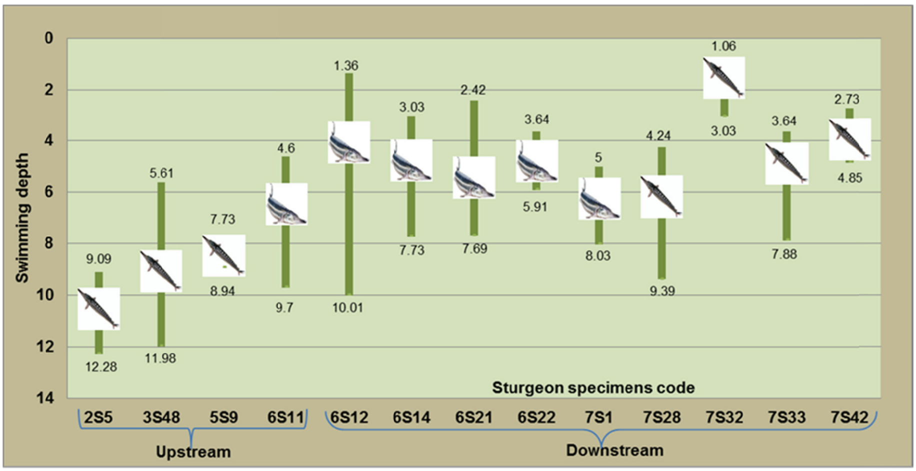

Figure 3. Swimming depths of sturgeon specimens recorded on Chilia branch

The research performed on sturgeon swimming behavior showed that they prefer deep water for upstream migration (Hochleithner and Gessner, 1999) because the water velocity is lower than in shallow water, decreasing the energy consumption. For the downstream migration they prefer the shallow water because of the high water velocity.

The graph presented below highlights the sturgeon specimens that passes through Chilia branch for both upstream and downstream migration. For downstream swimming depth it can be seen a minimum value of 1.06 m, while for downstream swimming depth the minimum value is 4.6 m (Fig. 3).

CONCLUSIONS

The results of the research performed by the INCDPM team showed that Chilia branch has a high importance for sturgeon migration being used in both migration seasons (spring-autumn) both for upstream migration in reproduction purposes and for downstream migration to the Black Sea.

Therefore, the results revealed that in the spring season of 2012 and 2014, 53% of the monitored specimens used Chilia branch, while in the 2013 spring season only 31% used the same branch. On Chilia branch, at Bastroe confluence, the minimum sturgeon swimming depths was 1.06 m for upstream migration and the maximum value was 12.28 m.

These swimming depths are in accordance with the previously reported ones, sturgeon specimens preferring a lower water velocity at upstream migration (swimming close to the riverbed) for energy saving purposes and a higher water velocity at downstream migration.

The dredging works performed upstream on Chilia branch, including Bastroe channel, may have harmful effects such as: habitats losing or disturbing through elimination of the sediment used for reproduction, destroying macroinvertebrates fauna which constitute the main food for sturgeon species, and also increasing sturgeon larvae and juvenile death.

Knowing that at the end of 19th century was emphasized the negative effect of the dredging works on Sulina branch consisting of hampering sturgeon migration on this branch, there is a major risk for the sturgeon migration caused by the works performed on Chilia and Bastroe branches for fairway improvement.

A possible progressive clogging of the Old Stambul branch and especially of Musura branch may have a further major impact on sturgeon upstream migration.

Therefore, is necessary to undertake further research and monitoring activities for revealing the issues that may have a harmful effect on sturgeon species in order to implement, in time, the necessary measures to reduce the associated risks.

ACKNOWLEDGEMENTS

This research work was carried out with the support of National Institute for Research and Development in Environmental Protection, Bucharest, Contract no. 140, (2013), Study regarding the quality monitoring of the physical-chemical and biological components from Danube Delta and the adjacent coastline considering the transboundary impact of the Bastroe Channel, during 2010-present, and the environmental consequences analysis in the Danube Delta Biosphere Reserve and in the adjacent coastline determined by the Bastroe project.

REFERENCES

Antipa Gr., 1909. Fauna Ihtiologică a României, Academia Română, Publicațiunile Fondului Vasile Adamachi, București.

Bacalbasa-Dobrovici N., 1993. The romanian sturgeon salvation needs a consequent strategy and tactics, Scientific Annals of the Danube Delta Institute.

Bacalbasa-Dobrovici N., 1997. Endangered migratory sturgeons of the Lower Danube River and its delta, Environmental Biology of Fishes.

Bănărescu P., 1964. Fauna R.P.R. Vol. XIII. Pisces-Osteichtzes, Ed. Academiei R.P.R., București.

Badilita A.M., Tănase B., Deák G., Raischi M., Suciu R., Honț Ș., Diaconescu Ș., Nicolae C., 2012. Preliminary results on the lower Danube sturgeon migration monitoring. Scientific Papers. D Series. Animal Science, LV: 301-305.

Badilita A.M., Deák G., Nicolae C.G., Diaconescu Ș. 2013. Contributions to understanding the fall migration of beluga sturgeon (*Huso huso*) on the Lower Danube River, Romania. Aquarium, Conservation & Legislation International - Journal of the Bioflux Society, 6(4): 281-296.

Chebanov M.S., Galich E.V., 2011. Sturgeon hatchery manual. FAO Fisheries and Aquaculture Technical Paper. No. 558. Ankara, FAO.

Ciolac A., 2004. Study of migratory sturgeons captures in Romanian side of Danube River migration of fishes in Romanian Danube River No3, Journal of Applied Ecology and Environmental Research, 3(1), Budapest, Hungary.

Deák Gy., Badilita A.M., Popescu I., Raischi C.M., Manoliu P.A., Dorobantu G., Tănase G.S., Danalache T.M., Antohe A.G., Tudor M., 2013. Research tools and techniques for sturgeons' spawning migration monitoring. Case study: Danube River, km 375-175, Universitas, Petrosani.

Deák Gy., Badilita A.M., Danalache T., Tudor M., 2014a. Use of acoustic telemetry for providing an insight into sturgeons behavior and migration routes on Lower Danube, Journal of Environmental Protection and Ecology, 15(3): 954 – 964.

Deák Gy., Badilita A.M., Popescu I., Tudor M., 2014b. Research on sturgeon migration behavior using a new monitoring, control and alarming system, Journal of Environmental Protection and Ecology, 15, 3.

Hochleithner M., Gessner J., 1999. The Sturgeon and Paddlefishes (Acipenseriformes) of the World: Biology and Aquaculture, AquaTech Publications, Kitzbuhl.

Kerr S. J., Davison M. J. and Funnell E., 2010. A review of lake sturgeon habitat requirements and strategies to protect and enhance sturgeon habitat. Fisheries Policy Section, Biodiversity Branch. Ontario Ministry of Natural Resources. Peterborough, Ontario.

Oțel V., 2007. Atlasul peştilor din Rezervaţia Biosferei Delta Dunării, Ed. Centrul de Informare Tehnologică Delta Dunării, Tulcea.

Palatnikov G. M., 2010. Sturgeons – Contemporaries of Dinosaurs, Baku.

Raischi M.C., Oprea L., Deák Gy., Zamfir S., Ilie M., Raischi N., 2016a. Impact of the Lower Danube hydro technical works on sturgeons' migration, International Journal of Environmental Science, Volume 1, pp 213-219.

Raischi M.C., Oprea L., Deak Gy., Badilita A., Tudor M., 2016b. Comparative study on the use of new sturgeon migration monitoring systems on the lower Danube, Environmental Engineering and Management Journal 15(5): 1081-1085.

Romanian Government, 2006. Order no. 330/2006 regarding conservation of sturgeon species from natural waters and aquaculture development in Romania.

Reinartz R., 2002. Sturgeons in the Danube River, biology, status, conservation. Literature and information study on behalf of the International Association for Danube Research (IAD), Landesfischereiverband Bayern e.V. and Bezirk Oberpfalz.

Șofineți M., Dobrotă C., 2004. Controversa româno-ucraineană în problema canalului Bastroe. Revista Transilvană de Ştiinţe Administrative, 3(12).

Yi Y., Yang Z., Zhang S., 2010. Ecological influence of dam construction and river-lake connectivity on migrating fish habitat in the Yangtze River basin, China. International Society for Environmental Information Sciences 2010 Annual Conference (ISEIS). Beijing: Procedia Environmental Sciences.