Annuaire de l'Université de Sofia "St. Kliment Ohridski"
Faculte de Biologie
First National Conference of
Reintroduction of Conservation-reliant Species, Sofia 2015
University Press 2016, pp. 79-84

CAN ARTIFICIALLY BREED STURGEONS SURVIVE IN LOWER DANUBE?

APOSTOLOU A[1]., STEFANOV T[2]., TSEKOV A[3]., VELKOV B[1]., KOEV V[4]., MARGARITOVA B[5]., MIHOV S[5].

1. Institute for Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
2. National Museum of Natural History, Bulgarian Academy of Sciences
3. University of Plovdiv "Paisii Hilendarski", department of Ecology
4. Persina Nature Park
5. WWF-Bulgaria
**Corresponding author: apostolosfish@abv.bg*

Keywords: conservation species, sturgeons, stocking, recapture, lower Danube

Abstract: Black Sea sturgeon stocks are rapidly decreasing during the last decades; this decline resulted from over exploitation and environmental degradation. Mainly because of their high economic value, they were and are fishes of high public interest. Their long and complex life cycles (in freshwater, brackish, and marine habitats) require global conservation programs spanning across several ecosystems of different nations. The protective measures for the conservation of the most endangered species include mainly fishing regulations, habitat restoration, juvenile stocking. Recently, registrations of reintroduced sturgeons in lower Danube and Black Sea prove that introductions are effective, at least partially.

INTRODUCTION

Most of the 27 recognized extant species of sturgeons and paddlefish, all characterized by limited adult abundance, are threatened in their entire range of distribution (Billard and Lecointre, 2001). Black Sea sturgeon stocks are rapidly decreasing during the last decades; this decline resulted from over exploitation and environmental degradation. Mainly because of their high economic value, they were and are fishes of high public interest. Their long and complex life cycles (in freshwater, brackish, and marine habitats) require global conservation programs spanning across several ecosystems of different nations (Ludwig, 2006). Only a combination of alternatives integrating habitat protection and recovery with harvest restrictions and supplementation can be expected to sustain sturgeon populations (Birnstein et al*.,* 1997a). Several authors consider that stocking of juveniles contributes significantly to sustained populations. Birstein, 1993 recommended immediate breeding of some threatened species. Ex situ conservation (keeping and reproducing live sturgeon in fish farms as a mean of conservation) is carried out in several countries. Collection of rare and endangered sturgeon species is established in some places: the Moscow region, the Far East, Krasnodar, and the Federal Genetic Collection of the Black and Azov Seas (Chebanov et al., 1998; Artyukin et al., 1999). Breeders of several sturgeon species are presently reared in fish farms or in experimental facilities in some other European countries.

Lower Danube below the Iron Gates represents the last breeding refuge for Black Sea sturgeons after the damming of Dnieper and Dniester Rivers, during 50's (Ambrose, 1964; Vassilev, 2006). The protective measures for their conservation include mainly fishing regulations, habitat restoration, juvenile stocking. Such stockings have been executed in Bulgaria since 1998 (Tsekov, 2007), mainly by the government and during 2014-2015 by an NGO. The survival of stocked sturgeons has been estimated in some cases (Chebanov et al*.,* 2002), but about lower Danube there are no data concerning the status of such fish: the aim of the current study is to bring first evidence about registrations and growth of artificial breed sturgeons introduced in the Bulgarian Danube sector during the last years, and compare the results with other cases of known recaptures.

MATERIAL AND METHODS

The strategy for registration of previously tagged fish was based on three aspects:

1. Continuous support of a circumpontic scientific web of sturgeon specialists, which exchange information about tagged specimens' captures, to establish easily their origin.
2. Additionally information from questionnaires, periodically given to local fishermen about sturgeon registrations and
3. Direct sampling before Vetren Island (Danube 356 to 355 km) during summer – from 2013 to 2015, where there have been used drifting gill nets with 20mm eye diameter, height 2m and length100m. Sampling depth varied from 4 to 14m. Length and weight were measured *in situ* and then the fishes were released immediately, tag also was described.

The relative average fish weight gain (RGR, in %d^{-1}) was determined according to Pyka and Kolman, 2003.

RESULTS

Four artificially breed and tagged specimens have been captured in Black Sea from 2002 to 2012, other eight in Danube River from 13th of June to 26th of July, this year (table 1). A Russian sturgeon released in Danube and captured near Trabzon (fig. 1), showed remarkable growth rate – about 1.4 kg for a year. From three individuals introduced in Sakkarya R. estuary, a stellate sturgeon (fig. 2) and a Russian sturgeon have not showed growth at all during their capture, whereas calculations for another stellate sturgeon registered near Kiten could not be performed, since the only evidence is a photo, send by a local fisherman. From the eight sterlets captured 1-42 days after their introduction, the latest registered specimen showed clearly weight increase. RGR for the sterlets caught only few days after stocking was not calculated, because individual weight fluctuations could be higher than final weight, and thus give false estimations.

Table 1. Recent captures of artificially breed and tagged sturgeons in Black Sea and Danube River.

Species	*A. gueldenstaedti*			*A. stellatus*	*A. ruthenus*	
Number of tagged fish	30	No data	No data	No data	2000	
Parental origin	No data	Russia, not Danubian	Russia, not Danubian	Russia, not Danubian	Danubian	
Place of introduction	Russe Danube BG	Sakkarya R. estuary TR	Sakkarya R. estuary TR	Sakkarya R. estuary TR	Vetren Danube BG	
Initial weight kg	0.3	1.7	0.1	0.1	**Average** 0.008	
Date	1.10.2001	6.2006	11.2011	11.2011	12.6.2015	
Place of capture	Trabzon Black Sea TR	Galata/ Varna Black Sea BG	Burgas Black Sea BG	Kiten Black Sea BG	Vetren Danube BG	Vetren Danube BG
Captured fish	1	1	1	1	7	1
Final weight kg	1.7	1.7	No data	0.1	**Average** 0.018	0.048
Date	10.2002	11.2006	3.2012	14.4.2012	13-26.06.2015	23.7.2015
RGR	0.225	0	No data	0	**Calculation innacurate**	1.98

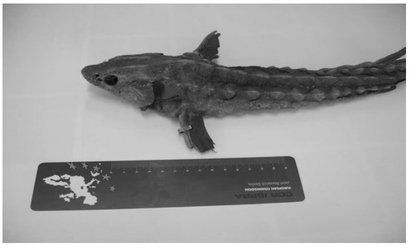


Fig. 1. Russian sturgeon released in Bulgarian sector of Danube in 2001 and captured near Trabzon (Turkey) in 2002.

Fig. 2. Stellate sturgeon released in Sakarya R. estuary-Turkey and captured near Varna/Galata-Bulgaria in 2012.

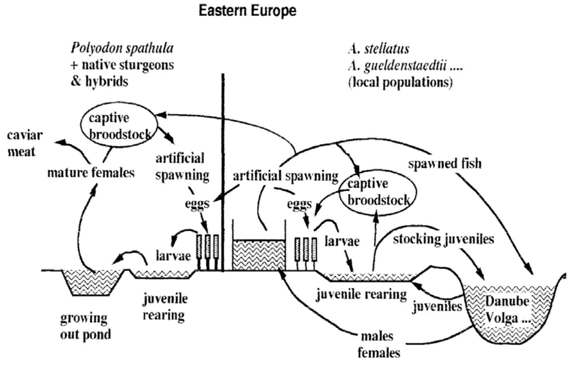
The survivorship of stocked sturgeons has been calculated in some cases (table 2). On the basis of these data, 20-40 tagged sterlets from the specimens introduced during 2014-2015 could survive, and potentially recaptured. Although the success of stocking efforts is difficult to assess and requires marking techniques that are not widely available, previous works on population dynamics showed that in Volga River the proportion of hatchery propagated beluga in the captures was 9.3% in 1971–1975, 77% in 1981–1985 and 96% in 1991–1995 (Khoderevskaya et al., 1999).

Table 2. Correlation between weight in gr. and survivorship in % for some sturgeon species according to Chebanov *et al.,* 2002.

Species	**0,5-1,5**	**2-7**	**8-10**	**11-20**	**21-30**	**31-40**	**41-50**	**> 50**
Ac. gueldenstaedti	0,4	0,6-1,3	2,5	5,0	20	32	51,6	100
Ac. stellatus	0,4	0,6-1,3	2,5	5,0	20	32	51,2	100
Huso huso	0,4	0,6-1,3	2,5	5,0	20	32	51,2	100
Ac. ruthenus	0,2	0,4-00,9	2,1	4,2	16,8	26,9	43,0	100

Considering the outcome of sturgeon translocation efforts, it is strongly recommended to use only native specimens for stocking programs, if available (Ludwig 2006). The proper introduction scheme is given by Billard and Lecointre, 2001 (fig. 3). This has been taken in mind during the introductions 2014-2015, whereas for older ones, no concrete data could be obtained.

Fig. 3. Schematic representation of two systems of sturgeon culture according to Billard, ecointre 2001. One (right) is for the production of juveniles of local populations for stocking; The other system (left) is for the production of sturgeons (local or exotic species and hybrids) for meat and caviar. Production is extensive (polyculture more common in Eastern Europe). These cultured sturgeons should not escape into the wild.



The reason for zero growth of the Turkish specimens could be alien origin; another hypothesis could be releasing near estuary, but not upstream. Notwithstanding, no solid evidence can be redounded from the material. As poikilothermic animals, the body temperature, metabolic rate and growth of sturgeons are affected by water temperature. Therefore, their optimum feeding rates reared at different water temperatures are different. Moreover, in aquaculture the size and shape of rearing tanks, age and size of fish, stocking densities, water flow rate, feed placement and feeding strategy are also factors that have some effect on the optimum feeding rate of sturgeons (Hung and Lutes, 1987). These facts – as well as the sturgeon RGR in controlled conditions which was determined as minimum 0.2 (Pyka and Kolman, 2003), point out that the established growth rates of the recaptured, tagged and released in Danube specimens can be determined as satisfactory.

As a whole, the sturgeon stocking for conservation purposes arises two questions: about survivorship and returning. Additional risk for release programs arrives from the homing of anadromous species. In contrast to salmon, only limited data is available for sturgeons (for example Schram et al., 1999). Nevertheless, the released for the purpose specimens should be stocked as young as possible (fertilized eggs, fingerlings) to increase return rates (Ludwig 2006). This is controversial to table 2; the best size for the conditions of the Lower Danube has not been estimated yet. From the same point of view, sterlet introductions could be more successful than these of other species, since it is potamodromous, but not migratory as beluga, stellate or Russian sturgeon – but such conclusions could be made after multiannual stocking in Danube with various age groups.

CONCLUSIONS

Artificially breed and stocked sturgeons can survive in lower Danube; all specimens released in the river showed growth when recaptured, if calculations possible. Survivorship is difficult to be established; the returning rate is much more difficult and is resource-consuming. In any case, sturgeon reintroduction must be performed only with proved local parental origin.

Acknowledgements: The preparation of the manuscript has been performed under the support of the project No 5103020-C-012 with beneficiary WWF-Bulgaria.

REFERENCES

1. Ambrose A. 1964. Sturgeons of North-western Black Sea. *Proc. VNIRO*, 52: 287-347 (in Russian).
2. Artyukhin, E.N., Vecsei, P. 1999. On the status of Atlantic sturgeon: conspecificity of European Acipenser sturio and North American Acipenser oxyrinchus. *J. Appl. Ichthyol*., 15: 35–37.
3. Billard R., Lecointre G. 2001. Biology and conservation of sturgeon and paddlefish. *Reviews in Fish Biology and Fisheries*, 10: 355–392.
4. Birstein, V.J. 1993. Sturgeons and paddlefishes: threatened fishes in need of conservation. *Conserv. Biol,*. 7: 773–787.
5. Birstein, V.J., Waldman, J.R., Bemis, W.E. (eds.) 1997a. Sturgeon biodiversity and conservation. Kluwer Academic Publisher Dordrecht, 444 pp.
6. Chebanov M.S., Savelyeva E.A., Galich E.V., Chmyr Yu.N. 1998. Reproduction of sturgeons under the conditions of the flow regulation of rivers. In: Rauta M., Bacalbasa-Dobrovici N., Vasilescu G., Oprea L. (eds.) Fisheries Management in the River Danube Basin Galati, Romania, pp. 58–59.
7. Chebanov M.S, Karnaukhov G.I., Galich E.V., Chmyr Yu.N. 2002. Hatchery stock enhancement and conservation of sturgeon, with an emphaseis on the Azov Sea population// *J. Appl. Ichthyol*., 18: 463 469.)
8. Hung S., Lutes P. 1987. Optimum feeding rate of hatchery produced juvenile white sturgeon (Acipenser transmontanus) at 20 °C. *Aquaculture*, 65: 307-317.
9. Khodorevskaya R.P., Krasikov Ye.V. 1999. Sturgeon abundance and distribution in the Caspian Sea. *J. Appl. Ichthyol*., 15: 106–113.
10. Ludwig A 2006. A sturgeon view on conservation genetics. *Eur. J. Wildl. Res*., 52: 3–8.
11. Julian P., Kolman R. 2003. Feeding intensity and growth of Siberian sturgeon *Acipenser baeri* Brandt in pond cultivation. *Arch. Pol. Fish*., 11: 287-294.
12. Schram S.T., Lindgren J., Evrard L.M. 1999. Reintroduction of lake sturgeon in the St. Louis River, western Lake Superior. *North Am J Fish Manage.,* 19: 815–823.
13. Tsekov A. 2007. Natural water bodies restocked with farmed sturgeon in Bulgaria. *Eurofish*, 3: 51.
14. Vassilev M. 2006. Lower Danube – the last refuge for surviving of sturgeon fishes in the Black Sea Region. In: Hubert P (ed). Water observation and information system for decision support. Conference Proceedings, Balwois, Ohrid, Macedonia.