PRESUMPTIONS AND THE RESULTS OF RESTITUTION OF THE BALTIC STURGEON *ACIPENSER OXYRHYNCHUS OXYRHYNCHUS* MITCHILL IN POLAND

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OČEKIVANJA I REZULTATI PONOVNOG NASELJAVANJA BALTIČKE JESETRE *ACIPENSER OXYRHYNCHUS OXYRHYNCHUS* MITCHILL U POLJSKOJ

Abstrakt

Genetička ispitivanja su ukazala da je pre nastajanja jesetre basen Baltičkog mora bio naseljen sa Acipenser oxyrhynchus, a ne sa A.sturio, kako je ranije smatrano. Potvrda o vrsti i poboljšani uslovi sredine su omogućili preduzimanje procesa ponovnog naseljavanja. Ikra uvezena iz Kanade je gajena u ribnjačkim uslovima do stadijuma mlađi i zatim do stadijuma za selekciju. Deo mlađi je korišćen u ogledima nasađivanja da bi se posmatralo ponašanje riba u prirodnim uslovima. Tehnika telemetrije je korišćena za ispitivanje migracije mlađi.

Ključne reči: *Acipenser oxyrhynchus, Baltička jesetra, status vrste, ponovno naseljavanje, ponašanje.*

INTRODUCTION

The Baltic sturgeon was one of the diadromous representatives of the genus *Acipenser* inhabiting the Baltic Sea basin. Mature individuals ascended the Neva, Volkhov, Daugava, Neman, Pregola, Vistula and Oder rivers in the eastern and southern Baltic on migrations to spawning grounds located in the upper reaches of these rivers or in their tributaries (W a ł e c k i 1864, B e r g 1911, K u l m a t y c k i 1933, K u d e r s k i i 1983).

Until recently, it was widely believed that the Baltic Sea had been inhabited by the western sturgeon, *Acipenser sturio* L. (B e r g 1911, 1948, K u l m a t y c k i 1933, M

a r t i 1939, M a g n i n 1963, N i n u a 1976, H o l c i k et al. 1989). However, some researchers confirmed long ago significant differences among the meristic characters of representatives from the Baltic population and the other European populations from the Black Sea and the Atlantic (T i k h i i, 1923; M a r t i 1939; D e b u s 1993, 1999) (Table 1). These data prove that the Baltic population differed distinctly from the other European populations, while with regard to the number of dorsal and lateral scutes, the contour of the scutes, and the abdominal color it is similar to the North-American population of the Atlantic sturgeon, *Acipenser oxyrhynchus oxyrhynchus* Mitch. (A r t i u k h i n and V e c s e i 1999). There differences are not, however, sufficient to prove that the Baltic Sea was inhabited by a species other than *Acipenser sturio* (H o l č i k, 2000).

Table 1. Comparison of selected morphological characters of different populations of the western sturgeon, *Acipenser sturio* L. and the Atlantic sturgeon, *A. oxyrhynchus oxyrhynchus* Mich.

Character	**A. sturio** Gironde (Artiukhin and Vecsei 1999; Magnin 1963)	**A. sturio** Rioni (Marti 1939; Ninua 1976)	**A. sturio** Baltic sturgeon (Artiukhin and Vecsei 1999; Debus 1999)	**A. oxyrhynchus** St. Lawrence River (Artiukhin and Vecsei 1999)
Scute surface	Tubercural	Tubercural	Aleveoral	Aleveoral
Abdomen color	gray	gray	light	light
Number Sd	12.74	14.3	10.18	9.76
Number Sl	35.13	32.8	28.15	28.67
Number Sv	11.3	10.8	10.2	9.8
Number S.br.	20.19	24.89	20.17	21.54

Sd – dorsal scutes; Sl – lateral scutes; Sv – lateral scutes; S.br. – Gill rakers

RESULTS

The results of genetic studies led to a breakthrough regarding the systematic status of the Baltic sturgeon. The comparison of the base-pair sequences of cytochrome "b" in sturgeon from the mouth of the Gironde, the Mediterranean and North seas, and the Baltic (caught in 1996) indicated that sequences from the last two are identical, that they differ from the others, and that they are more similar to the Atlantic sturgeon (B i r s t e i n et al., 1998).

Comparative studies of mitochondrial DNA of the Atlantic, North Sea, and Baltic populations of *A. sturio* and *A. oxyrhynchus* identified mitochondrial haplotype "*A. sturio"* in western sturgeon representatives from the North Sea and the Atlantic, while the Baltic specimens were carriers of the "A" haplotype characteristic of the northern population of *A. oxyrhynchus*, of which *A. oxyrhynchus oxyrhynchus* is a sub-species (L u d w i g et al. 2002).

The species status of the sturgeon inhabiting the Baltic Sea basin was confirmed by the results of studies of DNA sequences isolated from archaeological and museum materials collected within the territory of Poland (S t a n k o v i č et al. 2007), which indicated conclusively that from the forth or fifth centuries this region was inhabited by the Atlantic sturgeon.

Sturgeon from the Baltic was still of commercial significance in the early twentieth century, and catches of it exceeded 200 tons, more than half of which came from the Gdańsk Bay and the Vistula River (Fig. 1). In the first decades of the twentieth century,

the decrease in sturgeon abundance in this region was drastic enough that by the 1920s annual catches were recorded by counting individuals caught (K u l m a t y c k i 1933; G r a b d a 1968). In the second half of the twentieth century, when this species was placed under strict conservation protection, 27 sturgeons were caught in Polish territory (Fig. 2). The last Baltic sturgeons from the Vistula population were probably those caught in the Vistula River upstream from Toruń in 1965 and in the Vistula delta in 1972. A female sturgeon weighing 135 kg and measuring 2.7 m was caught in Estonian territorial waters near Saarema Island in fishing nets (P a a v e r 1996). This was the last documented catch of the sturgeon species in the Baltic and may confirm the extinction of this population.

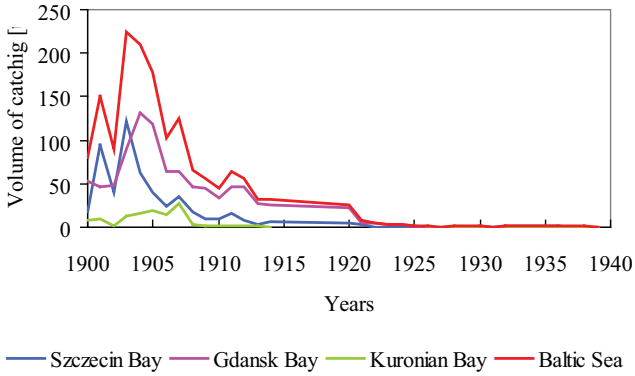

Figure 1. Decreases in the size of Baltic Sea sturgeon catches in the twentieth century (according to K o l m a n 2003)

Figure 2. Sites where Baltic sturgeon were caught in the second half of the twentieth century.

Positive environmental changes in the southern regions of the Baltic basin and the resolution of the issues regarding the identification of the Baltic sturgeon species have prompted the Inland Fisheries Institute in Olsztyn to undertake introductory work on a program to restore sturgeon to the Baltic. Currently, these efforts are focusing on the following:

- using aquaculture methods to rear fry and then selects from which a brood stock will be created to provide stocking materials for the restoration program;
- pilot stocking program to determine the adaptive capabilities and behavior of sturgeon fry reared under controlled conditions.

Since 2004, various forms of initial material (hatch, fry, fertilized spawn) have been imported from Canada. This material comes from spawners from the wild population in the St. John River. In the past four years, fertilized spawn obtained through artificial reproduction using materials from sturgeon caught in the river just prior to spawning has been imported. Samples of biological material are collected from the spawners for genetic analysis. Older selects reared in Poland that were raised from Canadian hatch and fry are also subjected to genetic analysis, which, in future, will permit developing a matrix for cross-breeding particular individuals from the established brood stock in order to maintain the high genetic variation of their progeny (S t a n k o v i č et al. 2007).

Alongside the ichthyological work aimed at building a brood stock, investigations of the behavior of Atlantic sturgeon fry in natural conditions are being conducted. To this aim, pilot stocking programs have been in operation since 2006 in the Drwęca River in the Vistula basin and the Drawa, Warta, and Gwda rivers in the Oder basin, which were formerly sturgeon rivers and currently meet requirements for fry growth and later for sturgeon spawning. Stocking activities and research in the Oder basin are being conducted jointly with German scientists under the auspices of an agreement between the Inland Fisheries Institute in Olsztyn and the Institute of Hydrobiology and Fisheries in Berlin.

Within the framework of this agreement, more than 7,000 individuals of various types of Atlantic sturgeon stocking material have been released into the rivers (Table 2).

The data presented in Table 2 indicate that stocking was performed at various times of the year and with variously sized materials. Some of these fish were reared under natural conditions (flow-through ponds) with access to natural food, while others were reared in tanks on commercial feed. The differences in stocking material and environmental conditions permitted interesting observations of fish behavior in the rivers. This was aided by the application of telemetric techniques. Some of the fry released into the river were fitted with both external Carlin tags and internal micro radio transmitters (Table 2). This permitted following the movements of the fish in the rivers. The daily distances covered by the juvenile sturgeon were highly varied. Observations from the Drawa River indicated that the maximum distance covered by the fish in a 24-hour period was 18 km (F r e d r i c h et al., 2008). The record holder from the Drwęca River covered 64 km within 16 hours. Another specimen moved about 400 km from the release site in the Drwęca River to the catch site in the Gdańsk Bay within 10 days (K a p u s t a et al., 2007). These observations confirm that the migration rate of sturgeon depends on its body size and water temperature. Generally, larger fish move faster, and increases in water temperature spur a faster migration rate (K o l m a n et al., 2008).

Table 2. Characteristics of the Atlantic sturgeon stocking material released into Polish rivers.

River basin	River stocked	Date	Type of material age/weight (g)	Quantity (ind)	Tag type
Vistula	Drwęca	9.10.2006	0+ / 7-9	1500	-
	Drwęca	12.06.2007	1+/ 400-500	12	Carlin+T-M
	Drwęca	15.06.2007	1+/ 400-500	200	Carlin
	Drwęca	29.10.2007	0+ / 7-9	700	-
	Drwęca	30.10.2007	0+/ 20-40	250	Carlin
	Drwęca	30.10.2007	0+/ 30-50	20	Carlin+T-M
	Drwęca	30.10.2007	1+/ 500-650	10	Carlin+T-M
	Drwęca	3.06.2008	1+/300-400	370	Carlin
	Drwęca	3.06.2008	1+/300-400	30	Carlin+T-M
	Drwęca	15.10.2008	1+/400-500	30	Carlin+T-M
Oder	Drawa	10.05.2007	0+/150-250	10*	Carlin+T-M
	Drawa	28.10.2007	2+/1600-1800	200	Carlin
	Gwda	29.10.2007	2+/1600-1800	238	Carlin
	Warta	29.10.2007	2+/1600-1800	200	Carlin
	Warta	29.10.2007	0+/5-7	4000	-
	Gwda	19.03.2008	1+/200-400	550	Flytag+T-M
	Wisłoka	05.05.2008	0+/100-200	103	Carlin
	Barycz	21.10.2008	0+/7-12	2000	-
	Warta	05.11.2008	0+/7-12	500	-
	Warta	05.11.2008	0+/30-50	100	-
	Warta	05.11.2008	0+/300-500	100	-

Carlin, Flytag – internal identification tag; T-M – radio telemetry tags

All of the tagged sturgeon exhibited a tendency to swim downstream to the river mouth zones where they remained for about two weeks. Here they fed intensely as is demonstrated by their increased body length and weight (Table 3).

Table 3. Characteristics of Atlantic sturgeon caught in Gdańsk Bay (from the Vistula basin).

Tag number	Total length (cm)		Body length (cm)		Body weight (g)		Site caught
	stocking	catches	stocking	catches	stocking	catches	
P620AC	66.5	67.5	52.0	54.5	925	931	Vistula mouth
P891AC	58.0	59.0	45.5	48.5	465	502	Vistula mouth
P934AC	53.0	53.5	42.0	42.5	400	396	Vistula mouth
P862AC	66.0	-	51.5	-	589	-	Vistula - Grudziądz
P808AC	59.0	81.0	46.5	-	536	2450	Gdańsk Bay near Mikoszewa
-		71.0		57.0	about 520	1700	Gdańsk Bay near Junoszyna
P675AD	59.0	65.0	40.5		312	870	Vistula mouth

CONCLUSION

An especially spectacular example of high growth rate is the specimen caught in mid November in Gdańsk Bay near Mikoszewo at a depth of 30 m. For the six month period between release and capture, its weight increased by about 360%. According to information obtained from fishers operating in the Vistula mouth vicinity of the Gdańsk Bay, by December 2008 a total of 27 sturgeon were caught in nets. However, most were released back into the water.

The results obtained to date indicate that the restoration programs will be successful. Atlantic sturgeon fry exhibits the ability to adapt to the natural environment in the rivers, while conditions in Gdańsk Bay appear to be advantageous. As is evidenced by the good condition they maintain and the rapid growth rates they achieve.

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