Arch. Pol. Fish. (2011) 19: 123-128
DOI 10.2478/v10086-011-0015-6

SHORT COMMUNICATION

A simple method for collecting sturgeon eggs using a catheter

Received – 13 March 2011/Accepted – 04 April 2011. Published online: 30 June 2011; ©Inland Fisheries Institute in Olsztyn, Poland

Mirosław Szczepkowski, Ryszard Kolman

Abstract. The paper describes a method for collecting eggs from sturgeon using a catheter. A catheter made of artificial material is introduced through the urogenital opening into the body cavity of the female, and this permits opening the ovarian funnels. Next, exterior abdominal massage creates pressure that forces eggs into the catheter through which they flow into a collection receptacle. This method has been applied since 2004 to culture Siberian sturgeon, *Acipenser baerii* Brandt, Russian sturgeon, *Acipenser gueldenstaedti* Brandt, a hybrid of Siberian sturgeon with Russian sturgeon and bester (*Huso huso* L. × *Acipenser ruthenus* L.). It is compared with the Podushka egg collection method that requires cutting the end section of the oviduct. The quantity of eggs collected in proportion to female body weight was higher with the Podushka method at about 12.5% than it was with the catheter method at 12.1% of the female body weight. Using the catheter method, the eggs collected in fewer portions than with the method in which the oviduct was cut. The catheter method of collecting eggs can be an alternative method thanks to its low invasiveness and ease of application.

Keywords: sturgeon, artificial reproduction, eggs

M. Szczepkowski [✉]
Department of Sturgeon Breeding in Pieczarki
Inland Fisheries Institute in Olsztyn, Poland
Pieczarkach 50, 11-610 Pozezdrze
Tel. +48 87 428 3666, e-mail: szczepkowski@infish.com.pl

R. Kolman
Department of Ichthyology
Inland Fisheries Institute in Olsztyn, Poland

Sturgeon aquaculture has been developing dynamically since the 1990s and has been focused on obtaining eggs for caviar as well as meat (Steffens et al. 1990, Bronzi et al. 1999). This has become possible thanks to the relative plasticity of sturgeon that allows them to adapt to various environmental conditions and also thanks to the development of effective rearing technologies (Gershanovich and Burtsev 1993). Among the many issues linked to implementing a full culture cycle under controlled conditions, one of the most significant was to develop an in vivo and readily applicable method for collecting eggs. This is because the physical structure of the sturgeon reproductive system does not permit applying egg stripping methods used with other fish species, which requires simple abdominal massage and pressure. In sturgeon, the oviducts are shaped like funnels that open into the abdominal cavity and the inlet to which is located far from the urogenital opening (Conte et al. 1988). The portion of mature eggs ready for fertilization are released into the abdominal cavity and then reach the widened ends of the oviducts. After the portion of eggs is released, they close slightly, and then, after a period, the whole cycle is repeated. The anatomical adaptation for batch spawning allows the spawn to be widely distributed throughout the spawning grounds, which is beneficial to natural spawning, but presents serious challenges for the artificial reproduction of sturgeon. This paper presents a description of a non-invasive method for collecting eggs from sturgeon by introducing a polyethylene catheter into the urogenital opening.

Photo 1. Collecting eggs from sterlet, *Acipenser ruthenus*, by cutting the end segment of the oviduct – the Podushka method (1999).

Photo 2. Introducing the catheter (polypropylene tube) into the oviduct of a Russian sturgeon, *Acipenser gueldenstaedti*.

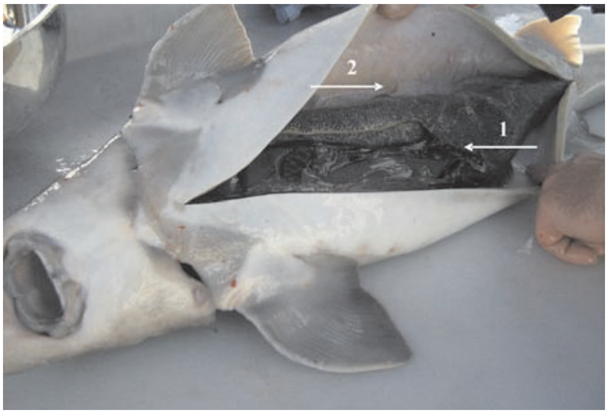

Photo 3. Section of gonad (1) and the oviduct funnel inlet (2) in Siberian sturgeon, *Acipenser baerii*, females.

Photo 4. Collecting eggs with a catheter from a bester, *Huso huso* × *Acipenser ruthenus*.

Until recently, the primary method for collecting eggs was surgical; an incision was made in the abdomen and the eggs were removed manually form the body cavity with a spoon or other instrument (Burtsev 1969, Conte et al. 1988, Williot et al. 2000). After the eggs were collected, the incision was sutured with surgical thread. The drawbacks of this method are that it is labor intensive and the risk of fish death is high. Substantial improvement in egg collection was not made until the method developed by Podushka (1999), which involves cutting the end of the oviduct very precisely with a specially-devised surgical scalpel (Bani and Banan 2010). Thanks to this cut, the eggs do not have to go through the entire oviduct, but only its final segment. This permits collecting all of the eggs that were ovulated (Photo. 1). The drawback of the Podushka method is the possibility of scarring the delicate oviducts, which could interfere with subsequent egg collection. Additionally, the person performing the procedure must be experienced or the fish could be injured and die.

The method presented in this paper does not require making incisions in either the abdomen or oviducts. It is based on introducing a polypropylene catheter into the urogenital opening (Photo. 2). Two types of catheters were used depending on the size of the fish – either with an external diameter of 13.8 mm and an internal diameter of 12.1 mm or with an external diameter of 10 mm or an internal diameter of 7.9 mm. The length of the catheter should be about one third the length of the fish. The key of the method is to introduce the catheter so that the end of it is in the abdominal cavity and that it permits opening the oviduct inlet (Photo. 3). Next external abdominal massage is applied to create pressure that pushes the eggs into the catheter, and then they flow through it to the

Table 1
Comparison of results from two methods of collecting eggs from sturgeons. Cutting the oviduct was performed according to the method described by Podushka (1999). Bester – beluga × sterlet hybrid, SBS – sterlet × bester hybrid

Species	Body weight (kg)	Quantity of eggs (kg)	Quantity of eggs in relation to fish body weight (%)	Number batches of eggs collected
Cutting oviduct				
Siberian sturgeon	18.6	2.002	10.76	2
	15.6	1.628	10.44	2
	10.0	0.887	8.87	2
	15.1	1.429	9.46	3
	21.0	2.244	10.69	3
	20.7	2.760	13.33	1
	25.3	3.581	14.15	2
	27.9	2.750	9.86	2
	15.4	1.500	9.74	2
	13.5	2.360	17.55	1
	21.2	1.640	7.74	1
Russian sturgeon	16.5	2.011	12.22	1
	13.0	2.649	20.38	2
Siberian x Russian	11.8	2.210	18.76	1
Bester	13.9	1.871	13.46	1
	15.5	2.200	14.24	1
SBS	5.6	0.615	10.92	1
Mean (N = 17)	16.5	2.020	12.50	1.7
Catheter egg collection				
Siberian sturgeon	18.1	2.506	13.85	2
	32.0	4.136	12.93	2
	16.4	1.572	9.59	1
	12.7	1.485	11.69	2
	17.4	1.830	10.52	1
Russian sturgeon	22.5	2.650	11.78	2
Siberian x Russian	8.5	0.700	8.24	1
	11.0	1.720	15.64	1
	11.2	1.875	16.74	2
	19.1	2.676	14.05	1
	15.8	2.643	16.78	1
	17.9	2.550	14.25	1
Bester	12.7	0.950	7.46	1
	16.1	1.170	7.27	1
SBS	6.7	0.694	10.36	2
Mean (N= 15)	15.9	1.944	12.07	1.4

receptacle (Photo. 4). It is important that the end of the catheter is lower than the body of the female as this makes obtaining the eggs easier. Raising the head of the fish up makes collecting the eggs even easier.

The results were obtained during artificial sturgeon reproduction performed at the Department of Sturgeon Breeding in Pieczarki, Inland Fisheries Institute from 2004 to 2010. In 2006, all of the sturgeon comprising the broodstock were tagged individually with electronic tags (PIT), which permitted tracking their life histories and observing subsequent spawning. To compare the effectiveness of the proposed method of egg collection artificial spawning of Siberian, *Acipenser baerii* Brandt, Russian sturgeon, *Acipenser gueldenstaedti* Brandt, and hybrids of Siberian × Russian and bieluga × sterlet – bester × SBS (*Huso huso* L. × *Acipenser ruthenus* L.) with body weights ranging from 5.6 to 32 kg. In general, eggs were collected from 17 females with the Podushka method and from 15 females using catheters (Table 1). Before reproduction the fish were held in earthen and concrete ponds where they were fed with commercial feed for sturgeon spawners (E-XL Stella, Skretting and REP Sturgeon, Aller-aqua). Immediately before spawning, the fish were caught and placed in recirculating systems for the final phase of maturation with the application of thermal and hormonal stimulation. The maturity stage was determined based on the degree of oocyte nuclear polarization according to the method described by Kazanski et al. (1978). Mature females were administered hormonal injections of carp pituitary extract at doses of 5-7 mg kg^{-1} body weight or a synthetic LH-RH analog at doses of 0.1 mg mg kg^{-1} body weight (Doroshov and Lutes 1984). The hormone dose was divided into two applications administered at a 12-hour interval, the first of which was 10% of the dose for a given fish while the second was 90% of this dose.

After the second injection, the tanks were observed for the presence of ovulated eggs. If none were noted 20 hours following the second injection, the fish were examined on spawning tables to confirm the presence of oocytes in the oviducts. Artificial spawning was begun when eggs were noted either in the tanks or during examinations. Before being examined or egg collection, the fish were anesthetized in a aqueous solution of the anesthetic Propiscin (Kazuń and Siwicki 2001) at a concentration of 20-30 ml dm^{-3} applied to the gills using a spray bottle.

The time required to collect eggs during the first (and main) attempt was similar for both methods and ranged from 8 to 15 minutes. The quantity of eggs collected with the Podushka method from a single female was greater both absolutely and relatively (Table 1). The differences were, however, not great and could have been linked to the greater body weight of the sturgeon from this group. It is known that larger fish produce greater quantities of eggs and that the ratio of egg quantity to body weight is usually higher (Sanders et al. 2003, Burtsev et al. 2008). Differences could have also been caused by the greater number of portions collected when the oviduct is cut. It is true that the quantity of eggs obtained in subsequent portions is much lower than that of the first collection, and that it usually does not exceed 10 to 20% of the overall quantity; still, this could have caused the differences noted. In turn, the difference in the number of portions obtained could have resulted from the fact that it is more difficult with the catheter method to collect the final portion of the eggs in the lower part of the gonad. With the oviduct cutting method, this portion of the eggs is relatively easy to collect.

The advantage of the catheter method is it is less invasive since it is not a surgical procedure performed with a scalpel. While it is true that introducing a catheter quite deep into the body has to be done very carefully, it does not, as in the case of the oviduct cut, cause any internal bleeding. Thanks to this the fish are better able to withstand the stress of artificial spawning and return to good condition more quickly. Confirmation of the safety of the procedure is the fact that it has been applied successfully three times in a row on the same fish. No fish deaths have been noted to date during the post-spawning period among the fish subjected to catheter egg collection. Collecting eggs using a catheter is also easier for those technicians who are less experienced in sturgeon reproduction.

The method applied for egg collection using a catheter is made more difficult by the occurrence in the gonads of clots, fat deposits, or membranes, all of which are observed most frequently among females maturing for the first time or those which are not properly prepared for spawning (e.g., fed too intensively). However, these same difficulties are encountered with the oviduct cutting method. Another limitation includes the fish size required for this method; this is why it cannot be applied with sterlet as the diameter of the catheter that can be introduced into the oviduct is too small to permit the eggs to travel freely through them. Eggs with a high density and little ovarian fluid also cannot flow easily through the catheter.

However, the indications are that the catheter method for collecting eggs can be used in sturgeon culture. It can be useful with very valuable fish (e.g., when there are but a few individuals of a species being restored), when it is very important that they are in good condition following spawning. Collecting eggs with a catheter might also be used to collect eggs prior to ovulation for caviar production.

References

Bani A., Banan A. 2010 – Comparison between microsurgery and traditional egg removal from starry sturgeon, *Acipenser stellatus*, broodstock – J. World Aquacult. Soc. 41: 144-148.

Bemis W.E., Findeis E.K., Grande L. 1997 – An overview of Acipenseriformes – Environ. Biol. Fish. 48: 25-71.

Birstein V.J., Bemis W.E., Waldman J.R. 1997 – The threatened status of acipenseriforms species: a summary – Environ. Biol. Fish. 48: 427-435.

Bronzi P., Rosenthal H., Arlati G., Williot P. 1999 – A brief overview on the status and prospects of sturgeon farming in Western and Central Europe – J. Appl. Ichthyol. 15: 224-227.

Burtsev I.A. 1969 – Obtainment of offspring from indigenous hybrid of beluga and sterlet – In: Genetics, selection and hybridization of fish (Ed.) B.I. Cherfas, Izd. Nauka, Moskva: 232-242 (in Russian).

Burtsev I.A., Krylova V.D., Nikolaev A.I., Safronov S.A., Filippova O.P. 2008 – The complex of breeds of Bester (*Acipenser nikoljukinii*) – In: The breeds and domesticate forms of sturgeon fish (Acipenseridae) (Ed.) A.K. Bogeruk, Moskva: 4-22 (in Russian).

Conte F.S, Doroshov S.I., Lutes P.B., Strange E.M. 1988 – Hatchery manual for the white sturgeon *Acipenser transmontanus* R. with application to other North American Acipenseridae – Div. Agric. Nat. Res., University of California, Oakland: 89.

Doroshov S.I., Lutes P.B. 1984 – Preliminary data on the induction of ovulation in white sturgeon (*Acipenser transmontanus* Richardson) – Aquaculture 38: 221-227.

Gershanovich A.D., Burtsev I.A. 1993 – Will sturgeon live in the XXI century – Rybn. Khoz. 4:18-20 (in Russian).

Kazanski B.N., Feklow J.A., Podushka S.B., Molodtsov A.N. 1978 – Fast method for determining the degree of maturity of the gonads of sturgeon spawners – Rybn. Khoz. 2: 24-27 (in Russian).

Kazuń K., Siwicki A.K. 2001 – Propiscin – a safe new anesthetic for fish – Arch. Pol. Fish. 9: 36-43.

Kolman R., Kapusta A., Szczepkowski M., Duda A., Kapusta-Bogacka E. 2008 – The Baltic sturgeon, *Acipenser oxyrhynchus oxyrhynchus* Mitchill – Wyd. IRS Olsztyn: 5-73 (in Polish).

Podushka S.B. 1999 – Obtainment of sturgeon eggs with the maintenance of living spawners – Bulletin of Science and Technology of Ichthyology Laboratory INENKO, St. Petersburg 2: 4-19 (in Russian).

Sanders B.J., Fadel J.G., Wade E.M. 2003 – Economic optimization modeling of white sturgeon (*Acipenser transmontanus*) caviar and meat production under different management conditions – Aquaculture 217: 409-430.

Steffens W., Jähnichen H., Fredrich F. 1990 – Possibilities of sturgeon culture in Central Europe – Aquaculture 89: 101-122.

Streszczenie

Prosta metoda pobierania ikry jesiotrowatych przy użyciu cewnika

W pracy opisano pobieranie ikry ryb jesiotrowatych za pomocą cewnika. Polega ona na wprowadzaniu do otworu płciowego rurki wykonanej z tworzywa sztucznego w ten sposób, aby jej koniec znalazł się w jamie ciała samicy i umożliwił otwarcie lejka jajowodu. Następnie poprzez masaż powłok brzusznych, w wyniku powstałego ciśnienia ikra jest wtłaczana do rurki, którą przepływa do naczynia zbiorczego. Metoda jest stosowana od 2004 roku w rozrodzie jesiotra syberyjskiego (*Acipenser baerii* Brandt), jesiotra rosyjskiego (*Acipenser gueldenstaedti* Brandt), krzyżówek jesiotra syberyjskiego z jesiotrem rosyjskim oraz bestera (*Huso huso* L. × *Acipenser ruthenus* L.). Porównano wyniki pobierania ikry z metodą polegającą na nacinaniu końcowego odcinka jajowodu (metoda Podushki). W tym celu przeprowadzono rozród jesiotra syberyjskiego, jesiotra rosyjskiego oraz krzyżówek jesiotra syberyjskiego z jesiotrem rosyjskim i bieługi ze sterletem – bestera i SBS (*Huso huso* × *Acipenser ruthenus*) o masie ciała od 5,6 do 32 kg. Ilość pobieranej ikry w stosunku przeliczeniu do masy ciała samicy była większa przy stosowaniu metody Podushki i wynosiła przeciętnie 12,50%. Stosując tylko cewnik masa pobranej ikry stanowiła 12,07% masy ciała samicy. Przy użyciu cewnika ikrę pobierano w mniejszej liczbie porcji niż przy nacinaniu jajowodu. Pobieranie ikry za pomocą cewnika może być alternatywną metodą ze względu na małą inwazyjność i łatwość stosowania.