A New Method for Out-of-Season Propagation for Northern Pike (*Esox Lucius*, L.)

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Abstract
Being a valuable fish specie for aquaculture, the pike is getting more attention from the scientists and the farmers. Normally, intensive pike farming involves the feeding of pikes with pellets up to the size of 250-300 grams, followed by culture in traditional policulture in earth ponds. In intensive pike farming, having the fingerlings sooner means that the pike will have a bigger size at the end of the growing season. Therefore out-of-season propagation for this specie is important if we need large size pike at the age of one summer. In current practice, out-of-season propagation for pike involves quick wintering followed by thermal shocks. We propose a simple method which consists in lack of wintering and allows the farmer to artificially reproduce the pike almost in any period of winter or spring

Keywords: Northern pike, out-of-season, propagation.

1. Introduction

Out-of-season propagation is a very useful tool for aquaculturists in order to obtain larger individuals at the end of the growing season (if the subjected fish will be cultured in out-door systems) or to have continuous production year-round (if culture will be made in closed recirculated systems or systems with constant physical and chemical parameters) [1].
The Northern Pike (*Esox lucius*) is the best well known predatory fish in Eastern Europe [2] and very well known in the Northern Hemisphere [3]. It's value is dependent on the local market, on the traditional cuisine and the preferences of anglers in certain areas. Anyway, the Northern Pike is a valuable fish from many points of view [4].
It cannot be said that the market for this fish is rapidly increasing, but constant supply of pike at all sizes is needed in many areas.

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The main consumer for Northern pike is still the angler which is always looking for bigger trophies, a reason for fish farmers to try to supply the angling clubs with this product as large as possible. The Northern pike can attain large sizes in relatively short time compared to other fishes from its habitat, but in policulture it cannot reach high productivity due to its bad FCR when fed with live fish or other aquatic animals [4]. The production of pike in policulture is limited and this is the reason of developing intensive farming techniques for culture [2]. The out-of-season reproduction is a method in this case to supply with weaned fingerlings on dry feed sooner or even after the normal propagation season [4].

2. Materials and methods

The experiment consisted in verifying the hypothesis that the Northern pike can be ready to ovulate anytime after the end of the growing season (late autumn) and can spawn if hormonal stimulation is conducted [2].

The experiments were conducted starting with October 2010 and stopped in March 2011 at the G2O fish farm in Rogaska Slatina, Slovenia.

A number of 30 females at the age of two summers weighing 2.6 kg ±0.5 and 25 males at the same age and weighing 2.1 kg ±0.2 were harvested from the earthen ponds where they grew for 2 summers. The fish were moved in a trout farm in the vicinity of this earthen pond where water temperature is constant throughout the year at 10°C with very low variations during the hot summers.

The holding tanks were supplied with spring water from underground. The pikes were rarely fed with Pseudorasbora at one week intervals.

Photoperiod was normal for the respective season and location, no artificial light was applied.

The hormonal stimulation was made with GNRH analogues, commercially known as Ovopel. The dosage of the hormone was as follows: 1.5 grains per kg for females in single dose, 1 grain per kg for males also in single dose.

The egg and sperm stripping was attempted 36 hours after intra-peritoneal injection.

Before propagation procedure started there was no change in water quality, just that the injected fish were separated by sex in different tanks.

The procedure was conducted 3 times, at every month at the year's beginning: January 4th, February 1st, March 1st.

Incubation and monitoring of developing eggs was conducted in the farm's hatchery at temperature of 12°C.

3. Results and discussion

First attempt of obtaining fertilized eggs from Northern pike was in the morning January 4th when Ovopel was injected to 3 females and 3 males intra-peritonealy. After 36 hours, in the evening of January 5th, first the males were stripped by milts using a syringe without needle and abdominal massage. The semen was collected in the syringe and stored in the refrigerator until all the males were stripped. The sperm was easily harvested.

After that, one by one, the females were stripped easily by normal procedures in dry plastic bowl. The eggs were weighted, resulting the following data (see table 1).

The fecundation was dry, after mixing the eggs of each female with sperm from all males small amount of water was added to complete the fecundation.

Incubation was made in Zugg-Weiss jars in a small recirculated hatchery belonging to G2O farm. The eggs from the three tested females were put in different jars.

The incubation took 8 days at constant 12°C in all three incubation jars, and fertilization rate and hatching percentage can be followed in the below table.

The second and third attempt of propagation was done using exactly the same protocol, the results were the same, and the statistic data can be studied in the table.

Table 1. Results of out-of-season propagation for Northern Pike

Variant	Female's weight kg	Harvested eggs kg	Fecundation rate (estimation) (%)	Hatching rate (from fertilized eggs) (%)
Lot from January 4th				
Female 1	2.9	0.35	75	60
Female 2	2.3	0.26	75	65
Female 3	2.7	0.34	80	60
average	*2.63*	*0.31*	*76.6*	*61.6*
Lot from February 1st				
Female 1	2.8	0.33	80	60
Female 2	2.4	0.25	70	60
Female 3	2.9	0.4	70	60
average	*2.7*	*0.32*	*73.3*	*60*
Lot from March 1st				
Female 1	2.7	0.3	75	70
Female 2	2.5	0.31	75	55
Female 3	2.4	0.29	80	65
average	*2.53*	*0.29*	*76.6*	*63.3*

The analyse of the above table shows that between the propagation lots there are no differences regarding the hatching rate, which in fact is the main result of our experiment. All females at all periods released eggs adding up to 13% of body weight which is normal for this specie. A satisfactory fecundation rate of above 73% and a estimated hatching rate of over 60% shows that out-of-season propagation by this method is a useful tool for aquaculturists that can hold pike broodstock over winter in water with constant 10°C.

Further study on the development of larvae (Figure 1, 2 and 3) showed that there were no negative effects of this method of propagation.

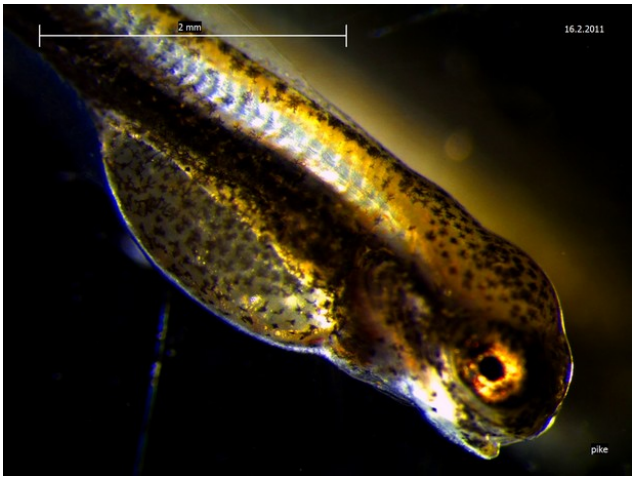

Figure 1. Northern pike larvae at 6 days post hatch. Visible yolk sack

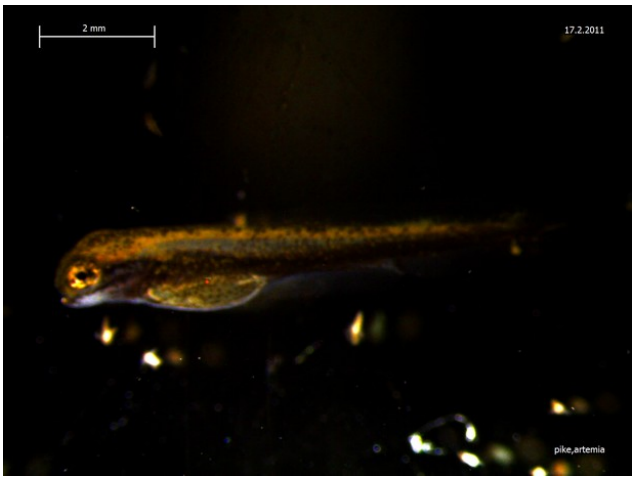

Figure 2. Northern pike larvae at 7 days post hatch Smaller yolk sack

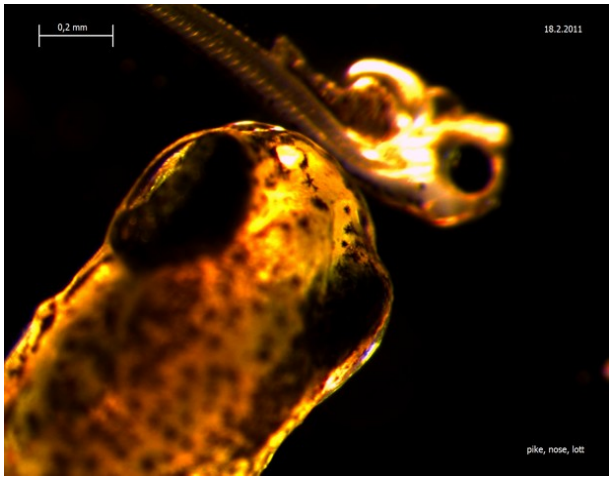

Figure 3. Northern pike larvae at 8 days post hatch (already showing interest for a burbot (*Lota lota*) larvae, although yolk sack is not fully resorbed)

Further study in this area is needed in order to obtain year-round production of Northern pike fry and fingerling. Probably that if the pikes are introduced sooner in the water with constant temperature of 10°C, they can spawn as early as October, or on the other side if wintering in the described conditions starts later or at lower temperature at the beginning spawning can be obtained as late as June.

Anyway, further methods or improving the one described in this article are needed for year-round spawning.

4. Conclusions

Northern pike can be easily artificially reproduced in out-of-season if wintering is done in water with constant temperature of 10°C.

The propagation was successful judging by the fecundation rate of above 73% and estimated hatching rate of over 60%, normal for this specie [5, 6, 7].

Larval development is normal identical to any other spawning [3, 8, 9, 10].

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