INTENSIVE REARING OF EURASIAN PERCH
(Perca fluviatilis L.)

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Szarvas, Hungary, 2010
- Reproduction
- Incubation of eggs
- Rearing from larvae to commercial fish
Perca

\[ \text{\textcolor{black}{\textit{Perca flavescens}}, \textcolor{red}{\textit{P. fluviatilis}} \text{ and } \textcolor{green}{\textit{P. schrenki}}.} \]
S. vitreum
S. lucioperca
P. fluviatilis
P. flavescens

hmotnost (g)

věk (dny)
Present state of perch culture in Czech republic

- **Czech Republic:**
  Previous: it was considered as unwelcome pest fish
  At present: it is using as additional species in extensive culture (in polyculture with carp (*Cyprinus carpio*)
  It is using in biomanipulation for suppression of cyprinids (*Pseudorasbora parva*)

- **Europe:**
  The most importance market is in Switzerland (before 6000 ton of filets = 20 000 ton of perch). 90 % is import from the whole Europe
Artificial and semiartificial propagation of perch

HORMONAL PREPARATE:

**KOBARELIN**
synthetic analogue of mammalian GnRH
(D-Ala6, ProNHEt9 mGnRH)

**LECIRELIN**
synthetic analogue of mammalian GnRH
(D-Tle6, ProNHEt9 mGnRH)

**OVOPEL**
synthetic analogue of mammalian GnRH
(D-Ala6, ProNHEt9 mGnRH)
+ dopaminergic inhibitor

**DAGIN**
synthetic analogue of mammalian GnRH
(D-Ala6, ProNHEt9 mGnRH)
+ dopaminergic inhibitor
Semiartificial propagation of perch with hormonally induced of GnRH analogue Kobarelin in temperature 15.4 °C
Semiartificiale propagation of erch with hormonally induced of GnRH analogue Kobarelin (GnRHa) in temperature 15,4 °C

<table>
<thead>
<tr>
<th>Dose µg.kg⁻¹</th>
<th>Stripped females %</th>
<th>Stripped egg mean ± SD 10³ ind. kg⁻¹</th>
<th>Interval of latency time D °D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>11,0 ± 19,1 a</td>
<td>68</td>
<td>3,90 60,1</td>
</tr>
<tr>
<td>25</td>
<td>27,6 ± 9,2 a</td>
<td>48 ± 19</td>
<td>4,30 ± 1,40 66,7 ± 22,2</td>
</tr>
<tr>
<td>125</td>
<td>78,0 ± 19,1 b</td>
<td>57 ± 31</td>
<td>4,38 ± 0,21 74,4 ± 2,3</td>
</tr>
</tbody>
</table>
ANAESTHESIA

Clov oil conc. 0.03-0.04 ml.l⁻¹
Artificial propagation
Comparison of the results from four experiments with semiartificial and artificial propagation after a single dose of KOBARELIN 100 µg/kg in different temperatures.

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>Ovulation of females</th>
<th>Interval of latency time (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>semiartificial</td>
<td>artificial</td>
</tr>
<tr>
<td></td>
<td>injected ind.</td>
<td>ovul. %</td>
</tr>
<tr>
<td>12.3 ± 1.6</td>
<td>9</td>
<td>78</td>
</tr>
<tr>
<td>13.2 ± 1.7</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>17.0 ± 1.0</td>
<td>7</td>
<td>57</td>
</tr>
<tr>
<td>17.2 ± 1.6</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Mean</td>
<td>53 ±16</td>
<td>86 ± 18</td>
</tr>
</tbody>
</table>
Dependence on latency time of temperature

![Dependence on latency time of temperature graph](image)
Artificiale propagation of perch females
(induction of ovulation with Kobarelin, 100 µg/kg)
(mean±SD)

<table>
<thead>
<tr>
<th>Weight of females (g)</th>
<th>Females inj. ind.</th>
<th>Mean amount spawned of eggs (10^-3 ind.kg^-1 H° H)</th>
<th>Interval of latency time (H °H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>387 ± 177</td>
<td>35</td>
<td>98.5 ± 38.9</td>
<td>106 ± 11 1715 ± 185</td>
</tr>
</tbody>
</table>
## Minimal effective dose of LECIRELIN (SUPERGESTRAN)

<table>
<thead>
<tr>
<th>Fish</th>
<th>Dose (µg/kg)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbel, <em>Barbus barbus</em></td>
<td>100</td>
<td>Kouřil at al. 2006, 2007</td>
</tr>
<tr>
<td>Pikeperch, <em>Sander lucioperca</em></td>
<td>20</td>
<td>Kouřil and Hamáčková, 2005</td>
</tr>
<tr>
<td>African catfish, <em>Clarias gariepinus</em></td>
<td>20</td>
<td>Brzuska, Kouřil et al. 1990</td>
</tr>
<tr>
<td>European catfish, <em>Silurus glanis</em></td>
<td>20</td>
<td>Kouřil et al. unpubl.</td>
</tr>
<tr>
<td>Ide, <em>Leuciscus idus</em></td>
<td>5 - 10</td>
<td>Kouřil et al. 1990</td>
</tr>
</tbody>
</table>
Incubation of eggs
Habituation of pond-nursed fingerlings and following rearing in recirculation system

ADVANTAGES
- Lower costs and labour consumptions in rearing of early life stages
- Working with larger fingerlings (easier manipulation)
- Higher quality of fingerlings

DISADVANTAGES
- Less control during rearing of perch in fishpond
- 1 critical point = harvest of pond
- 2 critical point = weaning period
Methods of perch culture (Ljunggren, 2002)

Semi-extensive system

Summer fry

Autumn fry

Market size

Intensive system
Basal feed Dana Feed DAN-EX 1352 (vit.E. BHT) 1.5mm
Group A – fed on moistened diet with 50 % fish meat for 7 days
Group B – fed on moistened diet with 30 % potato amyloid paste for 7 days
Control group C – non-modulated feed
Feeding frequency 15 meals /day after 7th day 5 meals/day
Density =1.2 individuals·L⁻¹
Biomass =1.4 g·L⁻¹

IBW: 1.2 ± 0.6 (g ± S.D.)
- 60 individuals per aquarium

9 tanks (50 L)
Results

Effect of diet on survival, one-way ANOVA (df = 2; F = 7.911; p = 0.020)

<table>
<thead>
<tr>
<th></th>
<th>A (Fish meat)</th>
<th>B (amyl)</th>
<th>C (non-modulated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival (%) ± S.D</td>
<td>53.3 ± 5.9a</td>
<td>52.2 ± 2.0a</td>
<td>35.0 ± 3.6b</td>
</tr>
</tbody>
</table>
Effect of initial body weight

Pond pre-reared perch was separated according to body weight. Biomar Bio-optimal Start (18T. 56P) with etoxyquin was used as basal diet. Fish was separated into three groups according to IBW (g): 1.0 ± 0.2 g (L); 0.6 ± 0.1 (M); 0.4 ± 0.1 (S) (mean ± S.D.).

Semi-moist feed (without agglutinant) was fed for 7 days. Feeding rate was calculated according to Fiogbé and Kestemont (2003).
Addition NaCl (0.3g · L⁻¹) into water before use.
Data are presented as mean ± S.D.

<table>
<thead>
<tr>
<th></th>
<th>S (small)</th>
<th>M (medium)</th>
<th>L (large)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative survival (%)</td>
<td>89.1 ± 3.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>83.5 ± 2.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>90.3 ± 2.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total survival (%)</td>
<td>87.3 ± 1.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>79.0 ± 2.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>86.8 ± 2.0&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Canibalism (%)</td>
<td>3.0 ± 0.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.5 ± 1.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.5 ± 0.8&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Final weight (g)</td>
<td>0.70 ± 0.31</td>
<td>1.22 ± 0.96</td>
<td>1.54 ± 0.52</td>
</tr>
</tbody>
</table>
Habituation of autumn fingerlings

Temperture adaptation for 5 days
Density = 3.3 ind·L⁻¹, Biomass = 12.1 g·L⁻¹
Asta (A) and Coppens Karpico Prime- 6EX (C) was used as basal feed
Semi-moist feed (50% fish meat) was prepared
Food was distributed manually every 30 minutes during the daylight period (from 07:00 to 19:00) in *ad libitum*.
After 7th experimental day, the fish was fed automatically with non-modulated feed

3.63 ± 0.47 (B.W. ± S.D.)

2 X 3 (700l)
n = 2000 ks
Results

Data are presented as mean ± S.D.

<table>
<thead>
<tr>
<th></th>
<th>A (Asta)</th>
<th>C (Coppens)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative survival (%)</td>
<td>12.9 ± 1.4</td>
<td>18.9 ± 0.5</td>
<td>5.15</td>
<td>0.006</td>
</tr>
<tr>
<td>Cannibalism (%)</td>
<td>1.2 ± 0.8</td>
<td>2.0 ± 1.2</td>
<td>-0.14</td>
<td>0.893</td>
</tr>
</tbody>
</table>
**summer fingerlings**

IBW (g) 0.6 ± 0.2 (2005)
0.7 ± 0.2 (2006)

**Experiment 1 (2005)**
Basal feed Asta (A) and Biomar Ecolife 15 (B) → Semi-moist feed (50% fish meat)
Feeding frequency 16 meals/day.
Density = 4.3 ind·L⁻¹

**Experiment 2 (2006)**
Biomar Bio-optimal Start (18T;56P) with *etoxyquin* as basal feed → Semi-moist feed without agglutinant
Additon of NaCl (0.3g·L⁻¹), Density = 6 ind·L⁻¹
Results of experiment 1

Data are presented as mean ± S.D.

<table>
<thead>
<tr>
<th></th>
<th>A (Asta)</th>
<th>B (BioMar-Ecolife)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative survival (%)</td>
<td>12.9 ± 3.0</td>
<td>41.0 ± 4.6</td>
<td>7.16</td>
<td>0.002</td>
</tr>
<tr>
<td>Cannibalism (%)</td>
<td>2.7 ± 1.1</td>
<td>6.9 ± 2.4</td>
<td>-0.38</td>
<td>0.717</td>
</tr>
</tbody>
</table>
Results of experiment 2

- Cumulative survival (%) = 71.9 ± 6.4 (mean ± S.D.)
Conclusions

- Using of semi-moist mixture have significant influence on habituation succes.
- The addition of salt affected the occurrence of fungi and resulted in higher survival.
- Eurasian perch is particularly sensitive to lipid peroxidation.
- Second amount of loses become after 35 – 45 days with feeding mixture without etoxyquin (Dana Feed, Asta, Coppens,). It wasn’t occurred in rearing with BioMar BioOptimal 60 which content etoxyquin.
- Any effect of body size on habituation succes in interval 0.4 ± 0.1; 0.6 ± 0.1; 1.00 ± 0.2 (g; mean ± S.D.)
Experiment: Growth performance of all-female perch

- All female population:
  20 neomales (maskulizatio of females)
  x 10 females normal population

- Normal population:
  15 males x 10 females (normal population)
Průměrná hektarová produkce plůdků all female a normální populace
Kumulativní přežití Oř během odchovu
Hmotnostní růst all female a normální populace

* p=0,05; ** p=0,01
Relativní rychlost růstu a krmný koeficient v průběhu odchovu
Hmotnostní rozdělení obsádek all female a normal na konci odchovu.

<table>
<thead>
<tr>
<th>Hmotnost (g)</th>
<th>Počet pozorování</th>
</tr>
</thead>
<tbody>
<tr>
<td>9,700</td>
<td>5</td>
</tr>
<tr>
<td>16,222</td>
<td>10</td>
</tr>
<tr>
<td>22,744</td>
<td>15</td>
</tr>
<tr>
<td>29,266</td>
<td>20</td>
</tr>
<tr>
<td>35,788</td>
<td>25</td>
</tr>
<tr>
<td>42,310</td>
<td>30</td>
</tr>
<tr>
<td>48,832</td>
<td>35</td>
</tr>
<tr>
<td>55,354</td>
<td>40</td>
</tr>
<tr>
<td>61,876</td>
<td>45</td>
</tr>
<tr>
<td>68,398</td>
<td>50</td>
</tr>
<tr>
<td>74,920</td>
<td>55</td>
</tr>
</tbody>
</table>

Počet pozorování
Hmotnostní růst 2 velikostí all female a normal populace

* p=0,05; **p=0,01; ***p=0,001

![Graph showing the weight growth of two sizes of fish, all female vs normal population.](image)
Obr. 6. Vztah mezi hmotností filetů a celkovou hmotností běla u obou skupin (M,B)
Other results

- Sensitivity of clov oil to perch
- Effects of four fish anaesthetics on biochemical blood profile of perch
- Size-related oxygen consumption and ammonia excretion of perch
- Intensive culture of perch in recirculating systems
- Toxicity of ammonium to perch
- Pathology of intensive rearing of perch
- Quality of perch flesh from extensive pond culture and intensive recirculation system
- NEXT…
Literature 1997-2002

Literature 2002-2008


Holandsko:
Excellence Fish (100 t)

Irsko: Clune Fisheries Ltd.
(100 t)
Možnosti zvýšení růstu okouna podle Kestemonta a kol., 1999
THANK YOU FOR YOUR ATTENTION
СПАСИБО ЗА ВАШЕ ВНИМАНИЕ