

# Research in spawning, Fertilization and Incubation



Experiences from west and north Finland with river lamprey (*Lampetra fluviatilis*).

# Artificial propagation of lamprey in Finland

- Experimental propagation started in River Perhonjoki in 1980's.
- Some experimental propagation in 1980's in southern Finland.
- In 1997 artificial propagation became one of the mandatory measures of supplementing lamprey stock in Perhonjoki. Measures also include monitoring the success of outplanting the juveniles and developing the methods.
- In 1999 started an EU-funded project which included developing artificial propagation of lamprey as a way of managing lamprey stocks.
  - " Cookbook" by R. Wikström 2002. Manual for artificial propagation of lamprey

# Lamprey production facilities in Finland

- Kannus (1997-2009)
  - average production of 17 million larvae/year.
  - Operated by West Finland Environmental Center.
  - Whole production was outplanted in nearby Perhonjoki.
  - Whole operation was outsourced in 2010 to the Finnish Game and Fisheries Research Institute.
- Keminmaa (2008- )
  - Average production of 7,5 million larvae/year.
  - Whole production outplanted in Perhonjoki, which is 350 km south from the facilities.
  - Operated by the Finnish Game and Fisheries Research Institute.
- Iijoki (2005- )
  - Average production of 2,5 million larvae/year.
  - Whole production outplanted in Iijoki.
  - Operated by local Fishermen's association which is a non- profit organization and the work is done by volunteers.

# Outline of the presentation

- Acquiring, keeping and sorting the adult lampreys
- Hand spawning
- Egg handling (until hatching)

Environmental Center had working facilities (1997- 2009) in the basement of Korpela hydropower plant (built in 1921).



# Acquiring adult lamprey

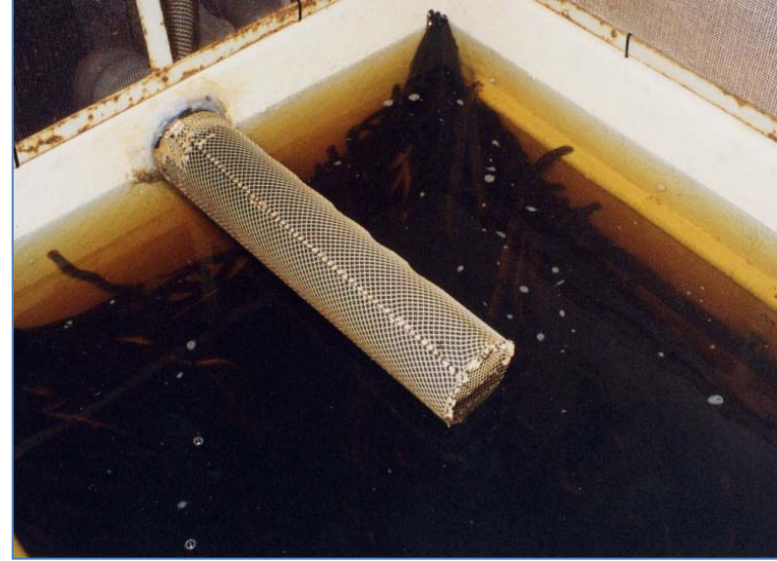
- Lampreys are bought from local fishermen
- Usually in august- september (water temp 10-15°C)
- Average weight is about 50-55 g
- Male/female ratio varies a lot during the season
- In the fall it is almost impossible to distinguish the sex
- Fishermen keep their catch under water in holding nets, stainless steel drums (washing machine) or wooden boxes
- Damaged or weak lampreys should be removed
- Lampreys should be protected from freezing air. Frost-bites

→ Careless handling causes mortality during winter



# Winter storage

- Lampreys are kept in storage tanks
  - 1-2 % mortality few days after transportation
  - Low mortality after water temperature is under 4°C
  - Very low maintenance requirements during winter, checkups every 2-3 weeks
    - Removal of dead lampreys
    - Adequate and reliable water supply
    - Disease control (BKD)



# Winter storage

- Storage tanks

- Water depth is not as important as surface area
- Air pumps for extra oxygen supply
- Dim lights. Lighting set with timer to imitate natural lighting rhythm
- Covers, fences, nets. Lampreys will escape **VERY** easily
- Density about 50-100 kg/m<sup>3</sup>
- Flow 100l/ min



# Sorting lampreys

- Increasing light and water temperature in the spring activates lampreys making sexual characteristics visible
- Males and females are sorted in different tanks
- Sorting is done manually in May when water temperature is about 9-10 °C, usually 1-2 weeks before hand spawning
- Why?
  - Timing of the spawning is easier to determine
  - Sorting makes the hand spawning process much easier



# Hand spawning process

- Changes in water temperature and lighting can delay the maturation process significantly
- Once most of the lampreys are ready to spawn, hand spawning has to be done within few days, otherwise lampreys die in storage tanks
- Timing is determined by testing and experience. Often hand spawning has to be done in parts. Immature females bleed and eggs are lumpy.
- Usually mature females release their eggs easily with one stroke. Extra strokes cause bleeding, which deteriorates egg-quality.
- Hand spawning process is hectic, laborious and also dirty and smelly job. Raingear recommended !



# Hand spawning process

- The effects of fertilization time, amount of water used, length of rinsing time have been studied with several comparative tests to find out the most effective way of handling the process.
- Lampreys are wiped clean and dry with paper cloth before spawning
- About 20 females are hand spawned in to a clean and dry plastic bowl.
- Sperm from 10 males is hand spawned to the same bowl as well
- Eggs and sperm are mixed together with soft paint brush



- Clean river water is mixed with eggs in ratio of 1:1. (not tap water)
- Bowl is left untouched for about 8-10 minutes while eggs swell and become fertilized.
- After fertilization eggs are rinsed gently 2-4 times with clean water to remove blood, slime and litter.



# Incubation period (first 24-48 h)

- After washing fertilized eggs are poured in to the incubation funnels “tubes”
- Funnels are made out of glass or plastic. Funnels should be as big and tall as possible.
- Water comes in from the bottom of the funnel and spills out slowly from the top. Each funnel has its own adjusting valve.
- On the top of the funnel there is a fine plastic mesh (pore size 600  $\mu\text{m}$ ) which allows water to flow out but keeps the eggs inside. Mesh is tightly fitted and glued in with silicone.
- At first the eggs are sticky and form huge lumps (6-8h). The lumps block the water and oxygen from flowing evenly and eggs could “boil “ over the mesh without constant maintenance.



# Incubation period (first 24-48 h)

- Whole watering and funnel system needs to be air tight, because air bubbles can block the funnel's water supply.
- Eggs are gently mixed with brush made out of bird feathers and the plastic mesh is cleaned with soft paint brush.
- The amount of eggs/ funnel depends on the size of the funnel (about 2dl eggs/ liter).
- It is important to keep the eggs moving slowly but constantly all the time.
- Different funnels function differently depending on their size and shape and the amount of eggs in them. Right watering adjustments and amount of eggs can only be learnt by trial and error. Experience helps a lot.



# Incubation period (first 24-48 h)

- First 24- 48 hours are critical because eggs are sticky and they need around a clock maintenance.
- Attempts to remove stickiness with milk or tannin did not work.
- After a few days eggs loose their stickiness, become heavier and are easier to handle



# Incubation period

- Incubation period takes about 1-3 weeks depending on the water temperature (190-220 dd).
- It is important to keep the eggs moving slowly all the time. Too fast movement breaks the eggs.
- At this point it is impossible to separate or remove dead eggs. Egg shells are removed from the mesh.
- Eggs need daily maintenance
  - Water adjustment
  - Removal of suspended particles with siphon hose or brush



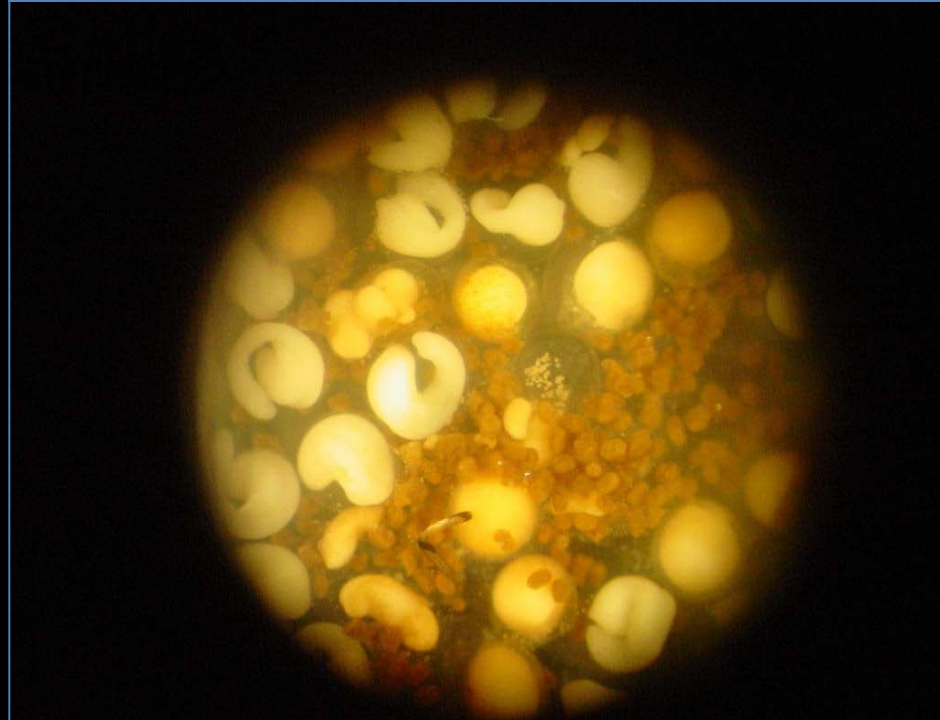
# Water filtration

- Filtration experiment was conducted in 2003. Water in the facilities is often quite humic during spring floods and heavy rains. During incubating eggs are usually rinsed and excess handling causes mortality.
- Filtration of fine solid matter did not have a significant effect on roe mortality. However water quality during the experiment was much better than it usually is during springtime.



# Water filtration

- Harmful bigger particles can be removed from incoming water by simple mesh filters.
- High iron and aluminum concentrations and low pH can be more harmful during incubation than “normal” amount of solid matter.
  - Can also affect egg development during winter and fertilization



# Hatching period

- After the first eggs start to hatch, it takes about 50 dd for rest of the eggs to hatch
- Hatching larvae are about 3-4 mm long and float around the funnel motionless
- Egg shells block the mesh and the funnels need to be cleaned often



# Hatching period

- When most of the larvae have hatched, they can be moved to the rearing plates.
- Hatching larvae can also be kept in funnels for 1-2 extra days until all living eggs have hatched. Or sometimes even 4-5 days.
- **To be continued !!!!!**

