Research on Juvenile Rearing and Health and Outplanting

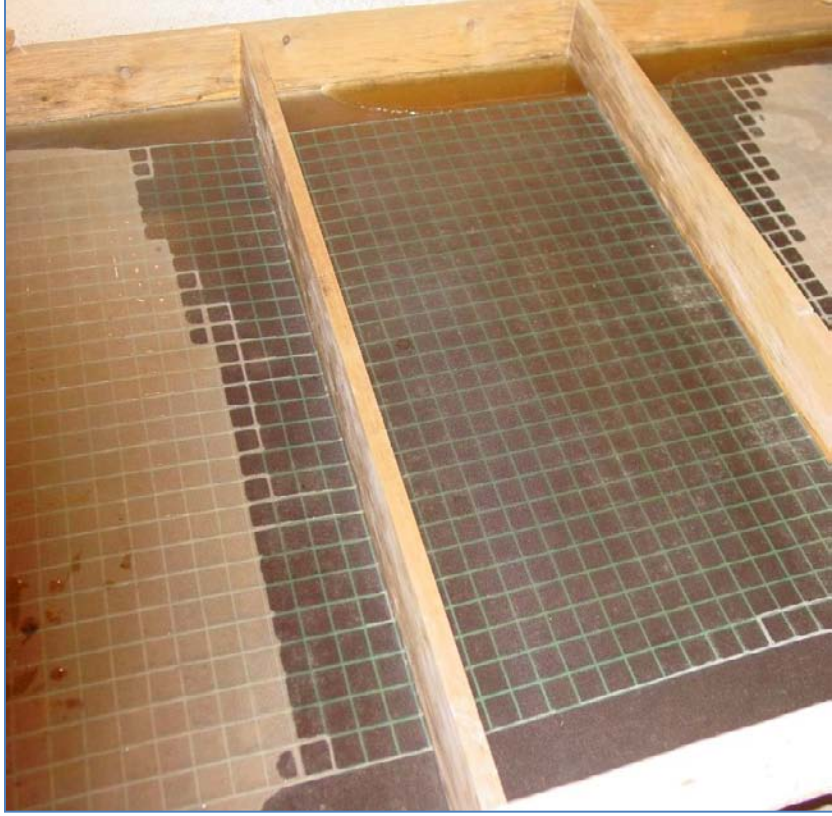
Experiences from west and north Finland with river lamprey (*Lampetra fluviatilis*).

Outline of the presentation

- Juvenile rearing
  - Rearing plates
- Larval development
- Packing the larvae
- Outplanting
- Problems and development needs
- Costs

Juvenile rearing

- After all or most of the larvae have hatched, they are moved from the funnels to the rearing plates.
- Larvae are spread on the plates evenly as a thin layer, about 5l/m^2
- Purpose of rearing plates is to separate dead eggs and empty shells from larvae mass
- If the dead eggs and shells are not removed after hatching , mortality increases very rapidly (mold)
- It takes about few hours for larvae to fall trough plates. With help of additional lights larvae go though plates much faster



Rearing plates

- Rearing plates are made of light wooden support frames, plastic coated wire net and plastic mesh (600 µm). Any direct prolonged contact with aluminum (metal?) surfaces kills the larvae.

- Wooden frame is divided into smaller screens.

- Bottom of the plate is covered with plastic mesh, which is supported and protected with plastic coated wire net.

- Bottom of the frame is sealed with silicone.

- Rearing plates are placed in shallow rearing pools or deeper holding tanks and held under water with weights

- Water level of pools is adjusted so that water runs slowly over and under the plates

•Rearing plates and pools can be stacked on top of one another or they can be placed into the holding tanks

•Surface area is more important than water depth

•Water flow is very slow (10 l/min) so it does not wash away larvae or clump them together too tight. Flow should be directed evenly to the pool

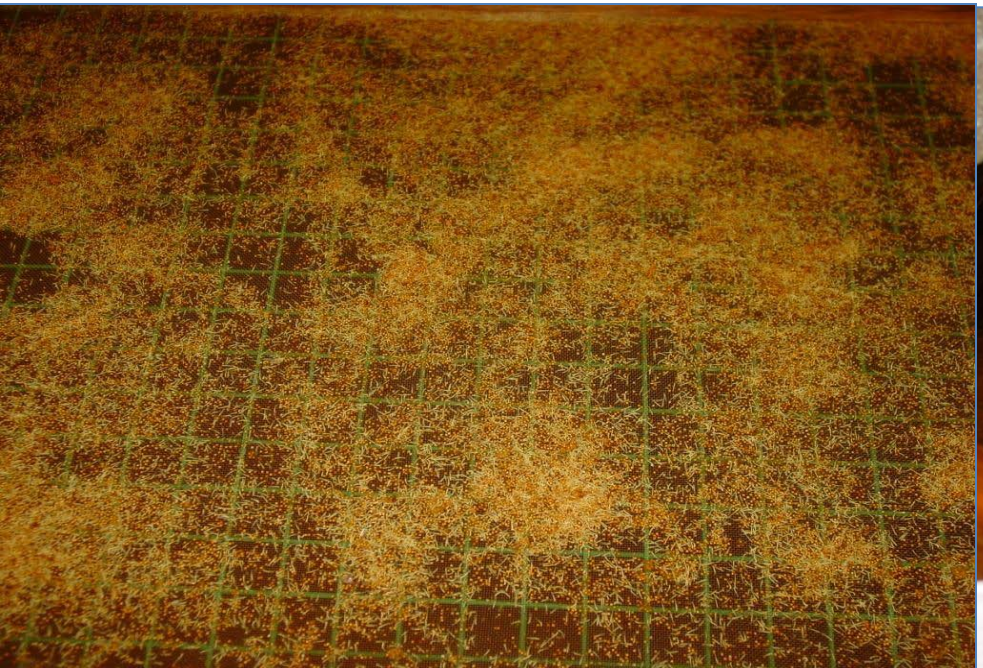
•Flat silicone stripes are glued in to the bottom of the pools. Stripes prevent the larvae from clumping together

•Mesh filter (200 µm) in outflowing water stops the larvae from escaping.

•Plates should not be used longer than is necessary, even though there is some larvae left in the plates. Plates, along with larvae and dead eggs still left in the plates are removed as soon as possible. Millions of larvae under the plates can not be looked after if the plates are not removed.

•Larvae need constant maintenance and dead larvae should be removed immediately.

•Mortality increases fast if maintenance is neglected.



Larval development

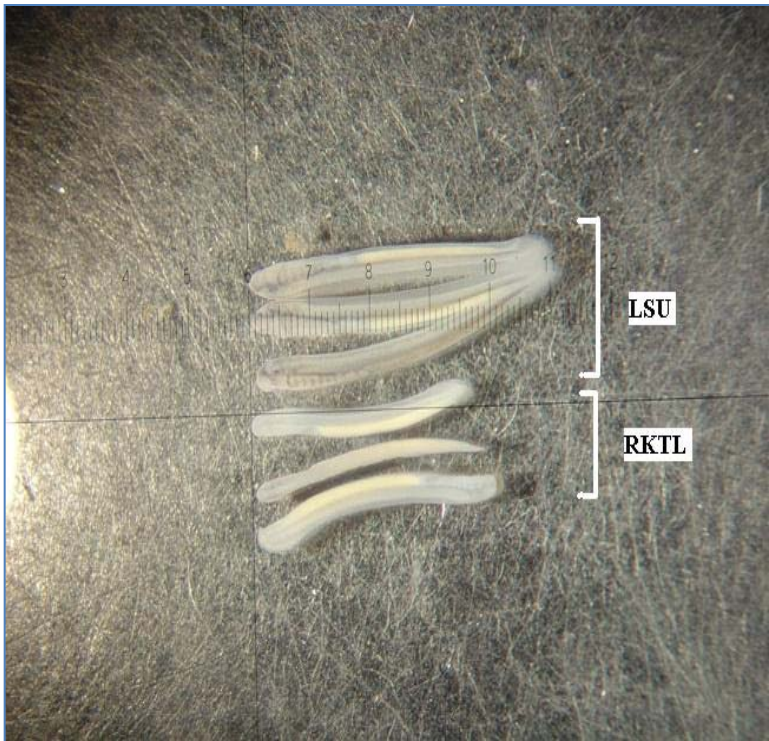
- Size and behavior

  -After hatching 3-4 mm (motionless)

  -After about 100 dd 5 mm (motionless)

  -After about 200 dd 7 mm
    - Start to swim and block the outlet mesh

  -After about 250 dd 7,5- 8 mm
    - Swim and are able to burrow
    - Need for additional feeding?
    - Optimal outplanting size?



- Some observations indicate that larvae which are bigger than 9 mm during outplanting but have not received additional food, will not survive after outplanting.

Packing

• Lampreys are sucked out of the pool with siphon hose into a big bucket.

• Water is removed from the bucket by using meshfilter. Larval density is very high at this point.

• The amount of larvae/bucket is estimated by taking 2-3 samples (30 ml) from bucket (60 l). Samples are counted manually later.

• Excess water is removed from bucket and larvae is divided into “oxygenbags”, clean water and pure oxygen is added to the bag and it is sealed with tight knot. 300 000- 400 000 larvae/bag

• Bags are kept in horizontal position during transport to ensure supply of oxygen.

• After packing there is about 2-3 hours to transport larvae in to the destination areas. (cold water/warm air)

• Sufficient cooling is provided by using wet blankets, ice or snow.

Outplanting

- Outplanting site is determined by the size of the larvae
  - 6-7 mm larvae into the fast flowing stream sections
  - >8 mm larvae are outplanted into the slow flowing pool sections under the rapids

•Basic idea is to get the larvae as close to bottom as possible. This is done by using bucket full of larvae and thick siphon hose which has weight on other end. Other way is to spread the larvae manually with bucket and scoop.

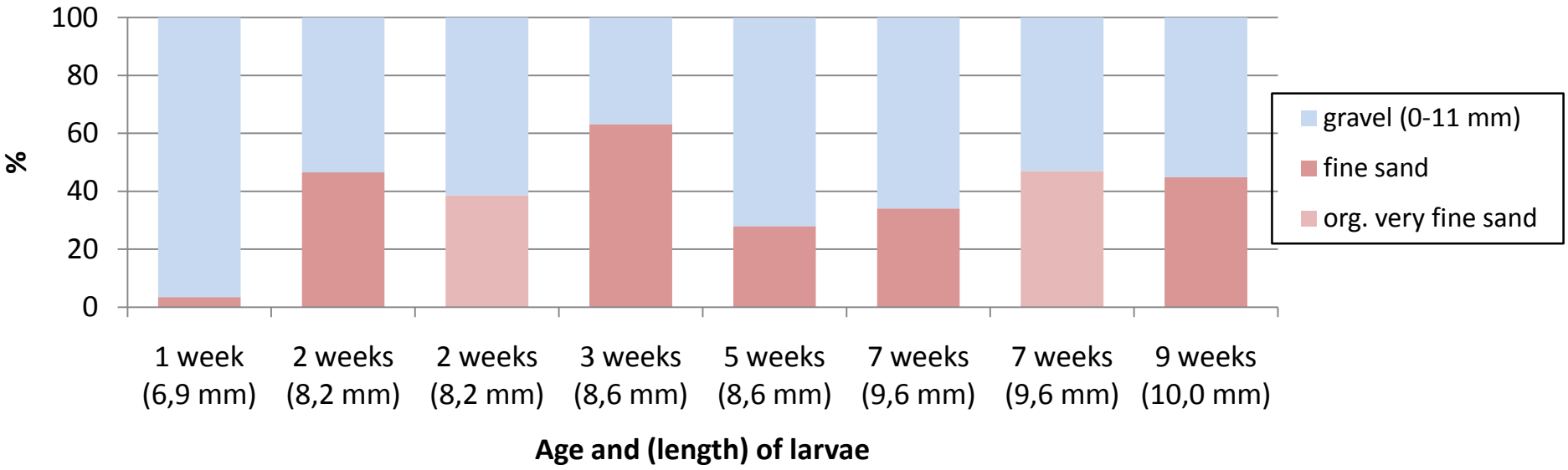
• Outplanting sites should be carefully selected in advance. Once the larvae are packed and transported close the outplanting site there is no time to waste. Sudden changes in temperature and lack of oxygen kills larvae easily.

•Earlier larvae was outplanted by boat in pool sections

Outplanting

- Sediment selection of YOY lamprey larvae
  - Burrowing ability is developed between 120- 225 dd and habitat selection is based on this ability
  - Larvae should not be outplanted before 200 dd after hatching
  - If there is a need to outplant the larvae earlier they should be released in gravel areas below rapids where the water velocity is moderate
  - Results also indicate that the multiple factors effect the habitat selection of young larvae, but outplanting area has a key role

Substrate selection between gravel and fine sand/org. very fine sand



Problems and Development needs

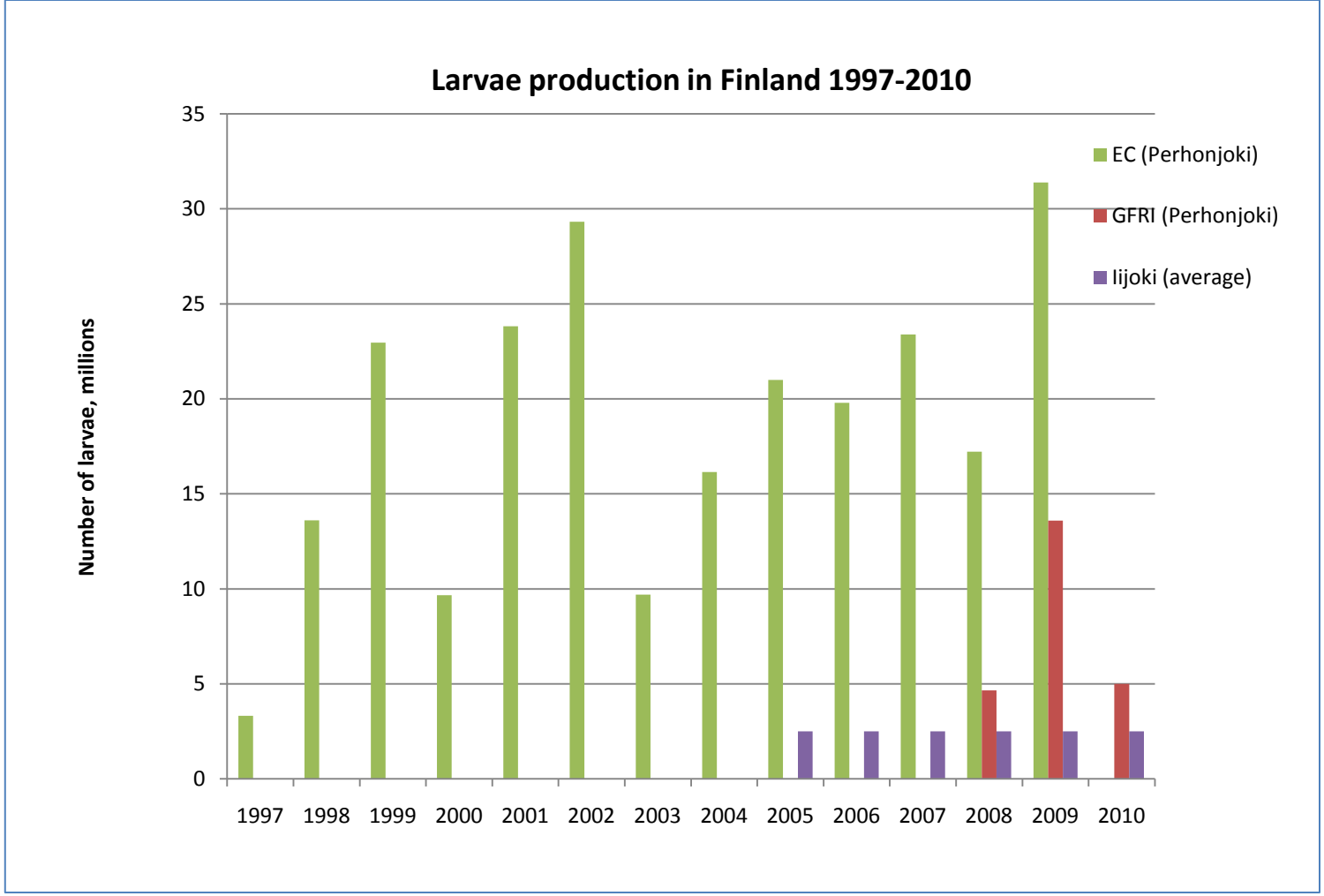
- The amount of adult females varies a lot during the catch season and it is almost impossible to distinguish the sex. This has to be compensated by buying extra amount of lampreys and early season lampreys

- Changes in water quality. Filtering and temperature control would stabilize the process

  - Chemical quality
    - Filtering bigger particles
    - Removal of metals
    - pH- control

  - Water temperature control
    - Ability to regulate water temperature would benefit most parts of the process and make it more stable and less dependent on weather. Timing of hand spawning, incubation period, juvenile rearing and outplanting.

- The whole process should take place in a proper fish hatchery facilities with overall control of water quality and plenty of working space



• In Perhonjoki the amount of adult lampreys bought from fisherman has declined during years due to development of methods and experience.

- 1997- 2002 over 8 000 individuals (over 400 kg)
- 2003- 2006 5 000-7 000 individuals (250-350 kg)
- 2007- 2009 1 600- 5 000 (80-250 kg)

Costs of artificial propagation

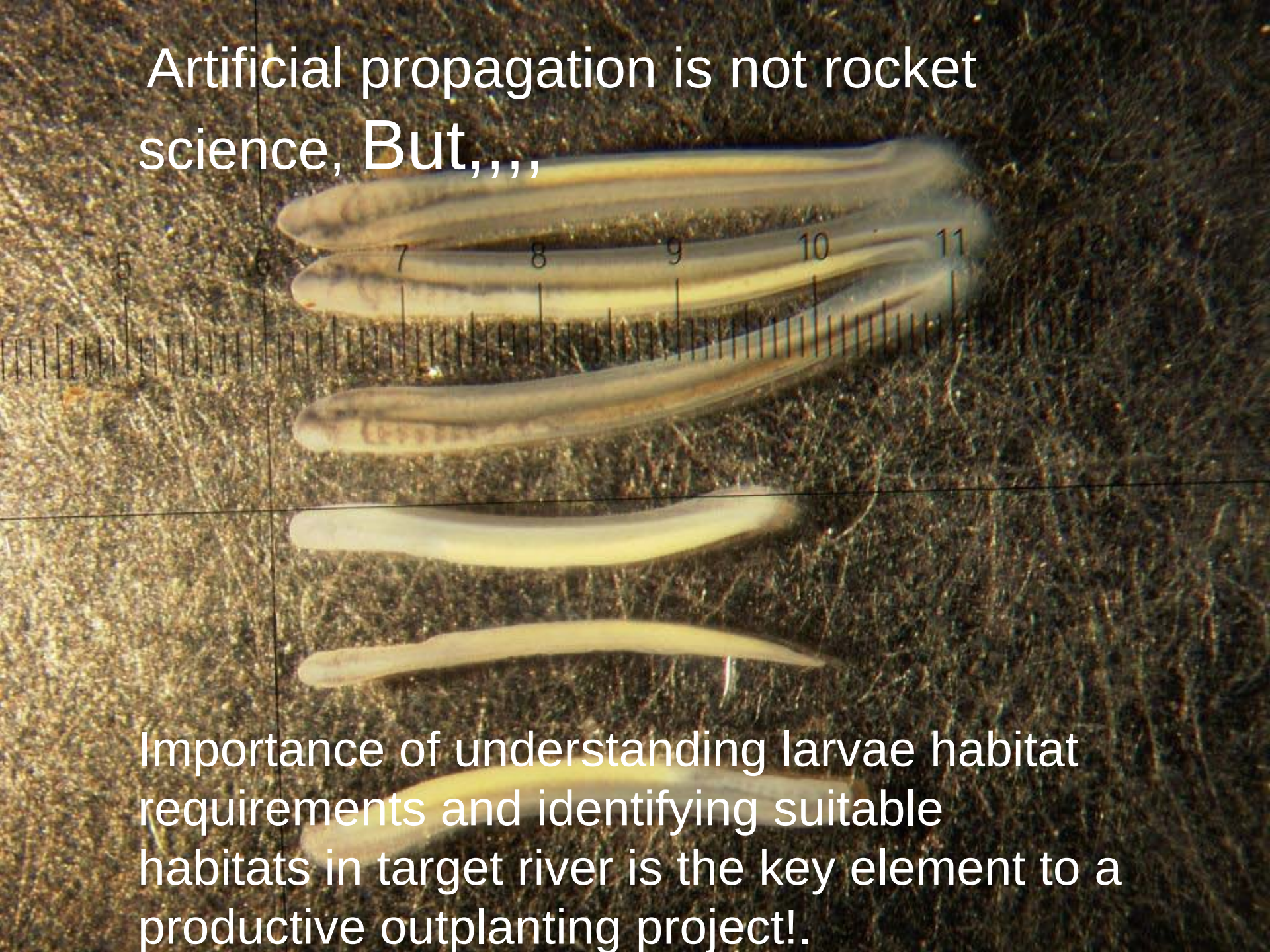
- 50 000 €/year (outsourced in 2009)
- About 9 months of work /year
- Biggest costs from labor and buying adult lampreys from fisherman
  - Catching lampreys ourselves was not cost efficient
- It takes same amount of labor to produce 10 million larvae as it does to produce 30 million.

Problems and Development needs

- Mortality (lot of seasonal variation)
  - Winter storage (adults) 2%
  - Hand spawning after fertilization (eggs) 1-10 %
  - Incubation 15-30 %
  - Juvenile rearing 1-10%
  - Overall survival from hand spawning until release is about 70-80% at its best
  - First weeks (days) after outplanting ??

Problems and Development needs

- Additional feeding of the larvae
    - Experiments with yeast and natural bottom sediment were promising.
    - Feeding 10-30 million larvae would be challenging.
- What is the right outplanting habitat for different size larvae?
    - Bottom quality?
    - Outplanting density?
    - Distance from the sea?
- What is the optimum size of larvae during outplanting. Is bigger better!?



Artificial propagation is not rocket science, But,,,,

Importance of understanding larvae habitat requirements and identifying suitable habitats in target river is the key element to a productive outplanting project!.