



The pikeperch (*Sander lucioperca*): Objectives and progress



Pascal FONTAINE, Species leader



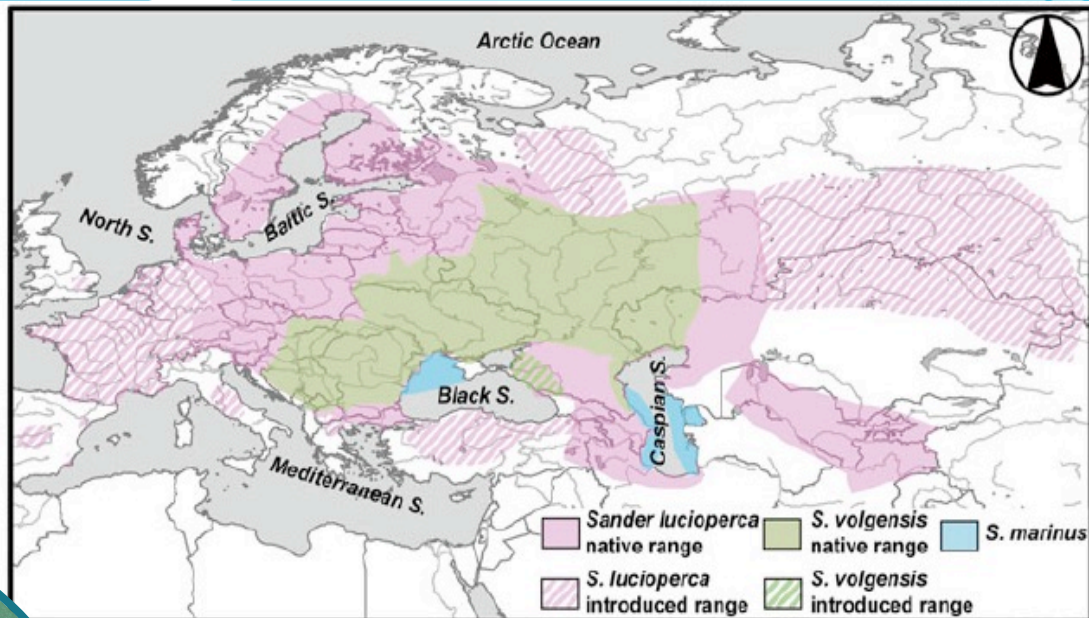
Co-funded by the Seventh Framework Programme of the European Union



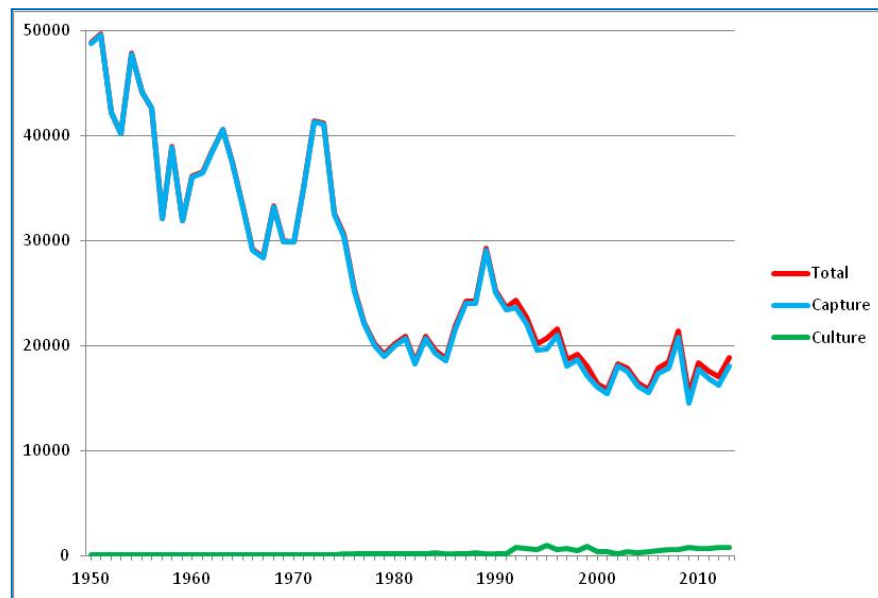
A common species in Eurasia



A strong decline of the captures from fisheries!



Stepien and Haponski, 2015



FAO, 2016

Which bottlenecks as priorities?

State of the art and survey done in 2012!!

- Lack of knowledge of the **genetic variability** of the domesticated broodstocks
- **Low larval survival** (typically 5%) and **high incidence of deformities**
- **High sensitivity to stressors, handling and husbandry practices** that result in **high and sudden mortalities**



Which objectives and tasks (DoW 2013)?

- To **characterize genetically wild and available cultured broodstocks** and to provide **tools for further genetic breeding programs** (WP6)
- To study the **effects of selected dietary nutrients** on pikeperch **larval development** and performance, and particularly of EFA on **long-term stress sensitivity** (WP10)
- To develop **effective larval rearing and weaning protocols** that **reduce cannibalism and mortality** while improving growth (WP16)



C. Tsigenopoulos



I. Lund



P. Fontaine

Which objectives and tasks?

- To study the effects of (i) **husbandry practices and environmental factors on growth, immune and physiological status** and (ii) of **domestication level and geographical origin** on growth and stress sensitivity and immune performances (WP22)



P. Kestemont

- To **analyze the consumer market and to develop new products** ending with physical prototypes, accompanying **marketing and communication strategies** for these products, and **market and business models** for the introduction of these products in the market (*WP27-30, see presentations of G. Tacken and L. Guerrero*)



G. Tacken

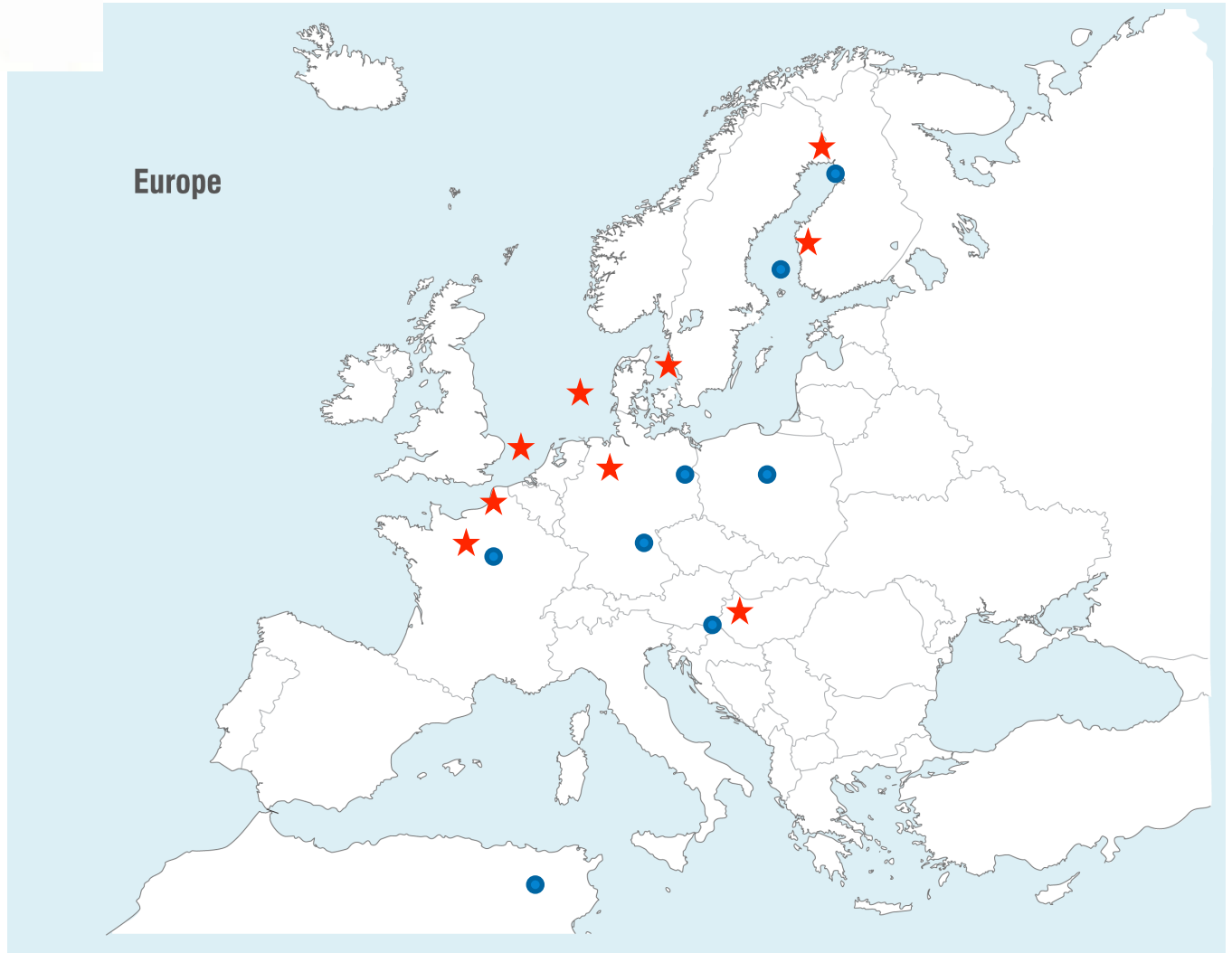
WP 6 – Analysis of genetic variability of wild and domesticated populations

Basis for further breeding programs



Co-funded by the Seventh
Framework Programme
of the European Union





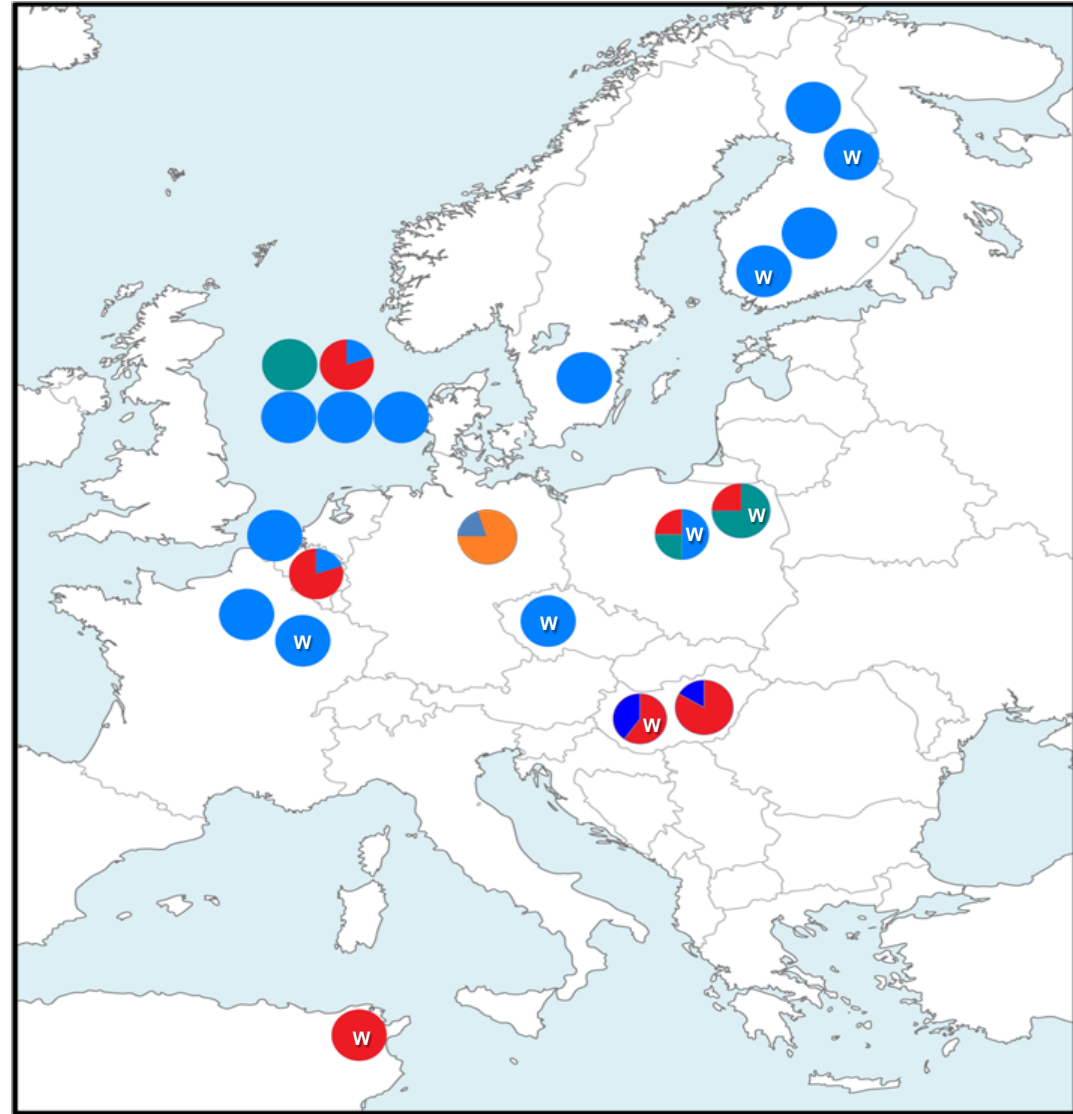
8 wild

13 captive

**45 ind. /
sample**

Main results and conclusions

- Genetic origin of captive populations is known
- Few domesticated populations indicate some level of inbreeding
- The number of alleles in domesticated populations is slightly higher than that in the wild





WP 10 – Nutritional requirements and feed optimization for pikeperch larvae

Effects of lipids, vitamins and minerals



Co-funded by the Seventh
Framework Programme
of the European Union

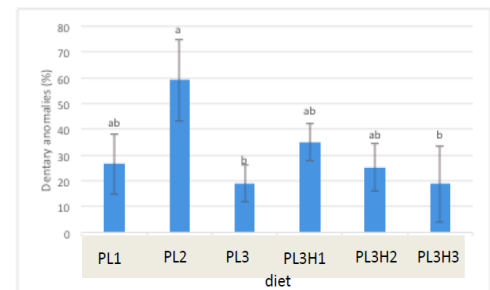
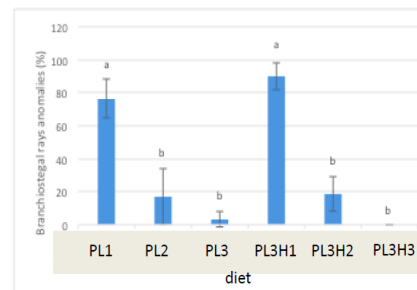
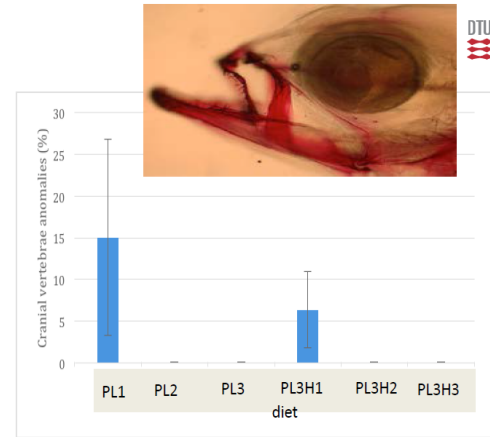
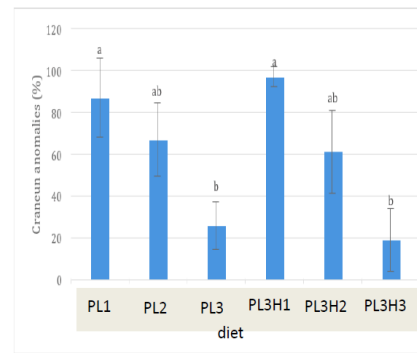


1. Influence of levels of phospholipids and essential fatty acids in formulated diets on growth performances, stress sensitivity and digestive tract ontogenesis

Increase in phospholipids and n-3 HUFA levels significantly **reduced the frequency of severe anomalies**

DHA (+ EPA) **must be** supplied in diets of pikeperch larvae for normal development and to reduce stress sensitivity

Larval anomalies

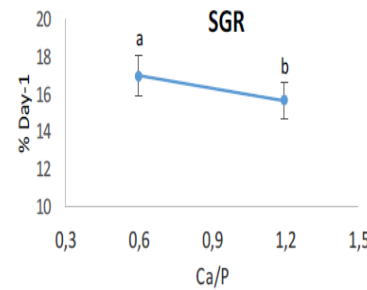


2. Importance and interaction of dietary levels of EFA, vitamins (A,C, D, E) and minerals (Ca, P)

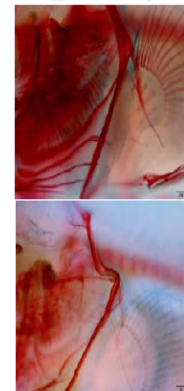
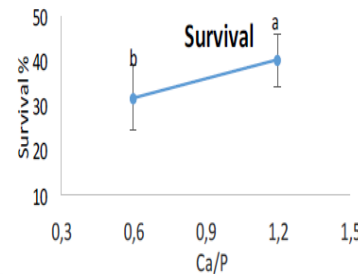
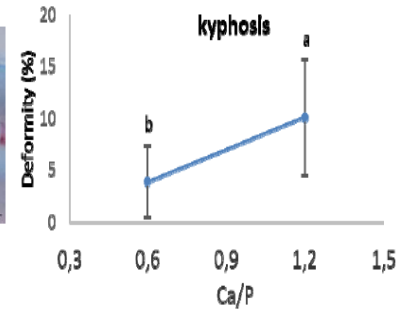
Low Ca/P ratio induces similar effects as for high PL + EFA levels

P levels should also be considered

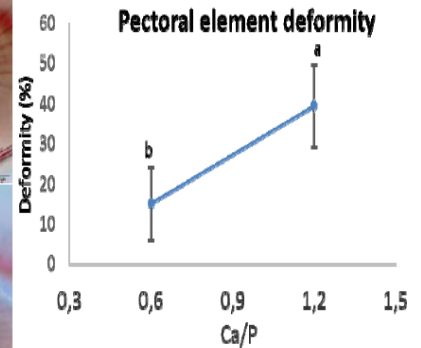
Ca/P effects



Cephalo-prehaemal kyphosis



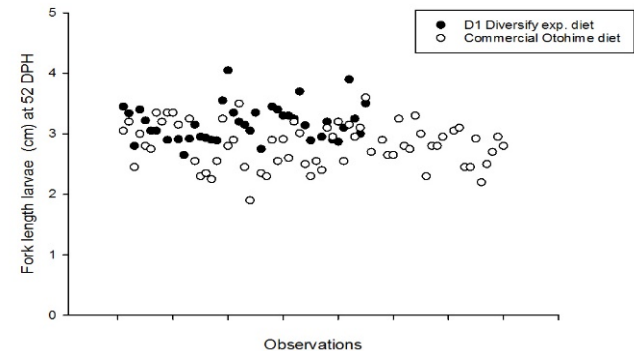
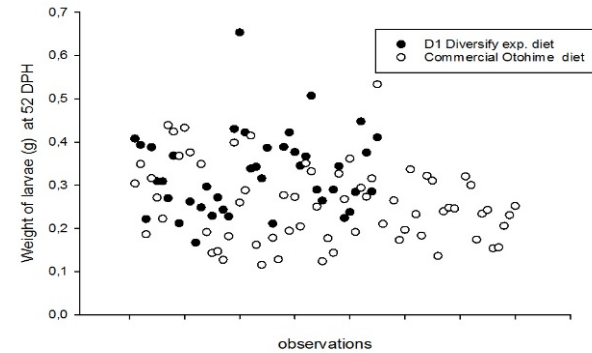
Pectoral elements



Development of an experimental diet « **Diversify optimised diet** »

Comparison between Diversify diet and commercial diet (Otohime) under farm conditions

A significantly better growth observed at 52 DPH



WP 16 - PIKEPERCH LARVAL REARING

Optimization of protocol for larval rearing in RAS

(survival, cannibalism, growth)

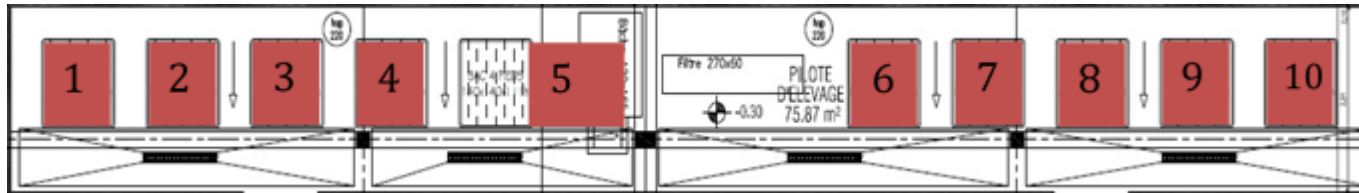


Co-funded by the Seventh
Framework Programme
of the European Union



Experimental choices :

1 – Experimental **facilities closed to farm conditions** (RAS : 10 m³, tank volume : 700 l)
=> trials at pilot scale!

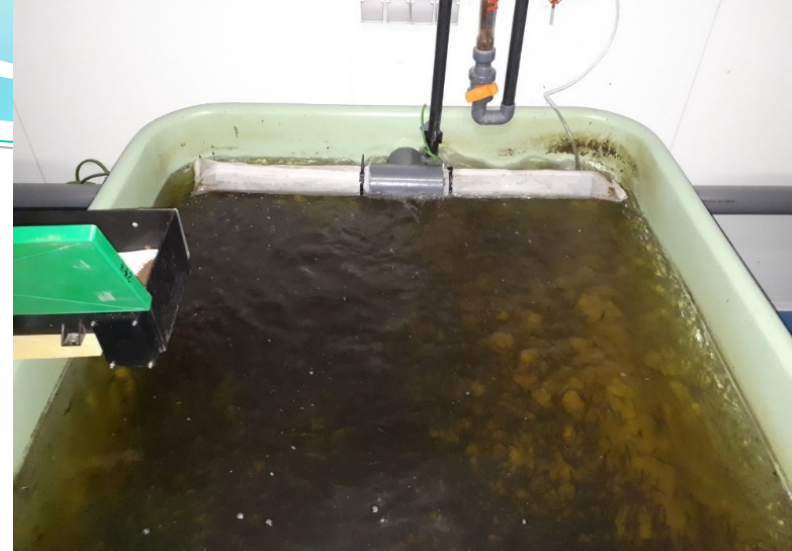
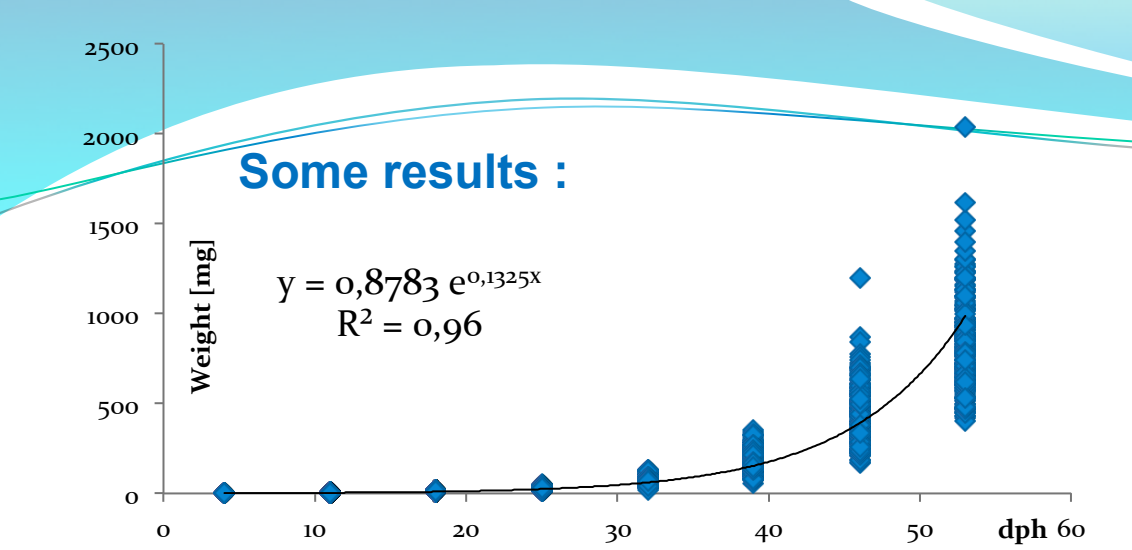


2 – **Integrative approach**, not focused on a specific step (first feeding of larvae, weaning or growth of weaned juveniles)
=> long duration : **7-8 weeks (52-53 dph)**

Study of the effects of 12 environmental, feeding or population factors using a multifactorial approach

=> Identification of an optimal combination of factors

Factor	Modality
Density	100 larvae L ⁻¹
Sorting of fish jumper	no
Sibling or not sibling	Not sibling
Female weight	Large (> 3.3 kg)
Feeding schedule	Discontinuous
Light regime	12:12
Light intensity	50 lx
Weaning start (dph)	16
Weaning duration (days)	9
Water renewal rate (tank vol./h)	1
Tank cleaning period	Morning
Tank current direction	Bottom to top



**Final
density of
14 kg. m⁻³**

**0,20 €
per 0.8 g
juvenile**

Tanks	Swim bladder inflation rate (%)	Final biomass (g)	Mean final body weight (mg)	Survival rate (%)	SGR (%/day)	FCR
1	90.8	9526	710.0 ±161.7	19.2	14.8	0.66
2	96.9	9722	938.3 ±177.4	14.8	15.2	0.65
3	88.1	9754	945.4 ±311.9	14.0	15.1	0.65
4	94.7	9638	740.6 ±258.0	13.7	14.8	0.65
5	90.4	9658	806.8 ±259.0	14.0	15.2	0.65
6	95.5	9483	827.8 ±273.6	14.7	15.9	0.66
7	91.8	9075	740.6 ±163.4	13.7	14.8	0.69
Average	92.6	9550.9	816.0 ±248.8	16.9	15.1	0.66

WP 22 - Effects of husbandry practices and environmental factors on pikeperch growth, immune and physiological status



Co-funded by the Seventh
Framework Programme
of the European Union

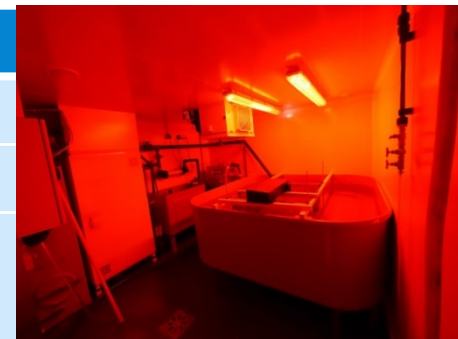


Objectives

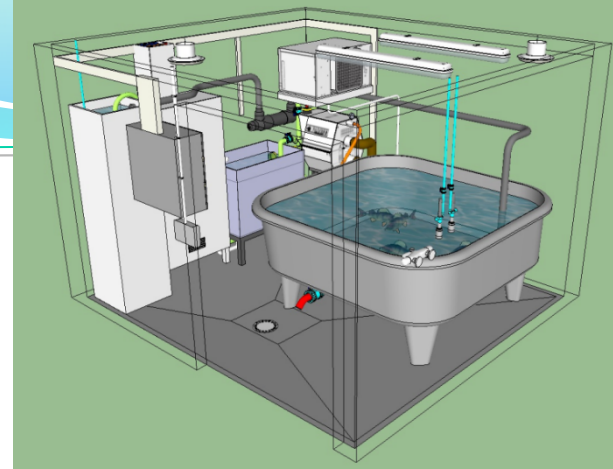
- WP22.1 – **Effects of husbandry practices and environmental factors** on pikeperch growth, immune and physiological status
- WP22.2 – Characterization of pikeperch **growth, immune and physiological status in farm conditions**
- WP22.3 – Effects of pikeperch **domestication level and geographical origin** on growth and stress sensitivity

Eight factors considered as relevant for the welfare of pikeperch

Factors	Modality	References
Photoperiod	10 L : 14 D	Pourhosein Sarameh et al., 2012
	24 L : 0 D	Teletchea et al., 2009
Light intensity	10 lux	Luchiari et al., 2006
	100 lux	
Light spectrum	White	Luchiari et al., 2009
	Red	
Rearing density	15kg/m ³	Steenfeldt et al., (2010) in Dalsgaard et al., 2013
	30kg/m ³	
Temperature	21 °C	Dalsgaard et al., 2013
	26 °C	Wang et al., 2009
Oxygen saturation	60 %	Dalsgaard et al., 2013
	90 %	
Alimentation	Semi-floating	Steenfeldt et al., (2010) in Dalsgaard et al., 2013
	Sinking	
Handling	Yes	Arlinghaus, 2007
	No	



Test of 16 combinations of factors in 16 experimental RAS

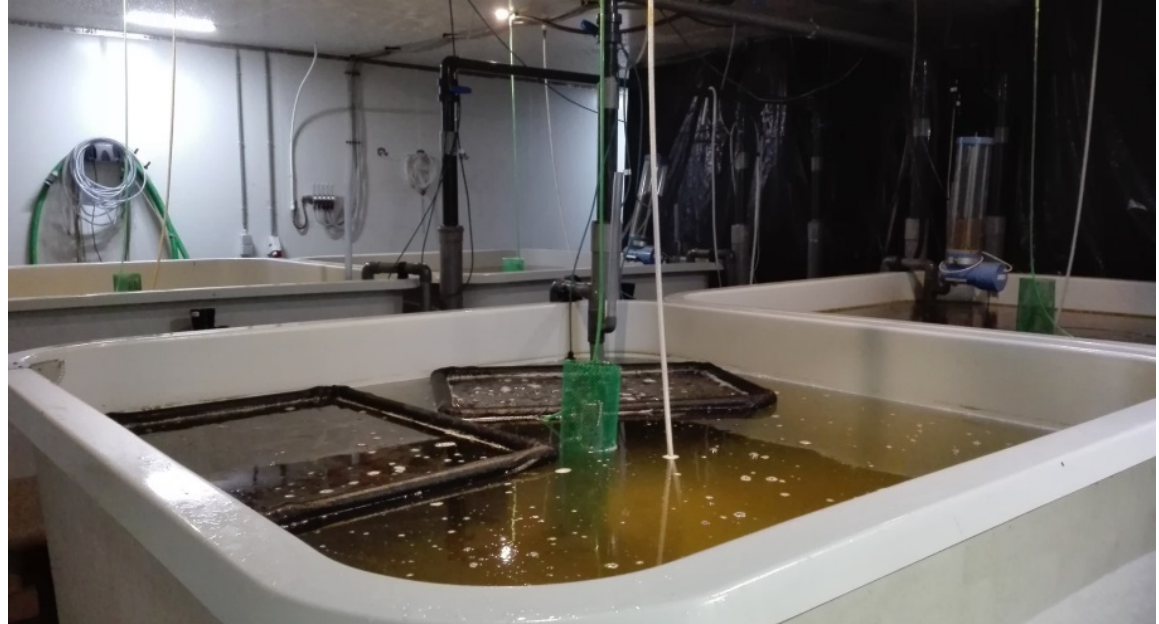


- Light characteristics and, to a lesser extent, temperature and density are directive environmental factors for pikeperch welfare
 - Low light intensity and red light spectrum seem less stressful since stress markers (cortisol, glucose, brain neurotransmitters) tended to decrease
- => 3 combinations look promising for pikeperch aquaculture (high growth and biomass gain, low mortality)**

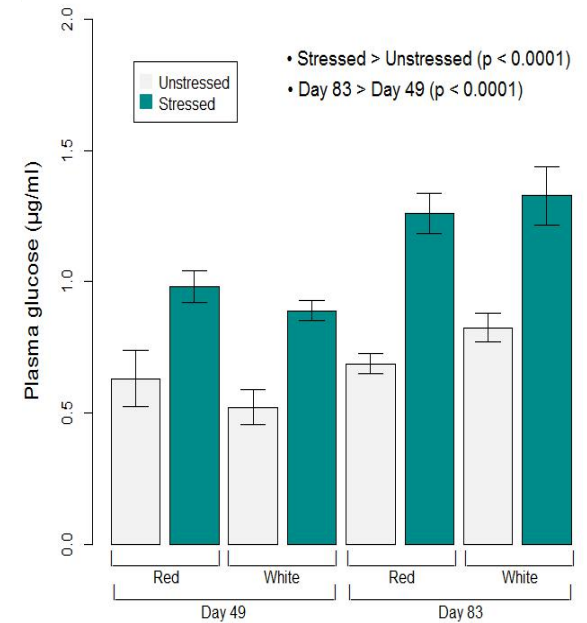
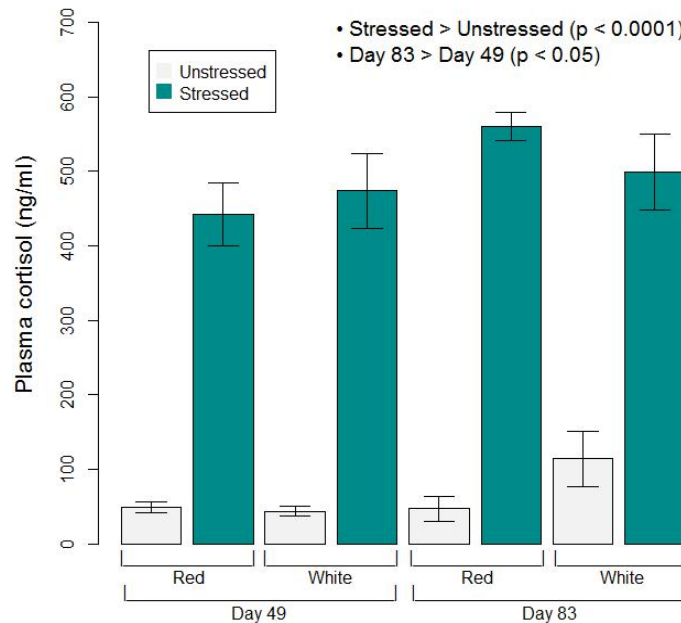
Facilities at Fish2Be



To determine the stress sensitivity of fish to grading manipulations



Strong effect of size grading on stress markers



General conclusions:

- **Genetic basis** for further breeding programs
- Improvement of knowledge about **larval nutrition (diet) and husbandry practices** => higher survival and growth, lower deformity rate
- Improvement of **husbandry practices** for the growout phase

DIVERSIFY Workshop on recent progress in pikeperch culture

Nancy, France, 27th June 2018, Faculty of Sciences and Technologies



70 participants: fish farmers,
aquaculture system designers (RAS),
consultants in aquaculture, feed producer ...

From 10 different countries

**Technical leaflets (25 pages) sent
to each participant**



A need for further R&D
to sustain farms!!

Ex : Aquapri (Dk), 600 t
(pikeperch), 2015



Main current bottlenecks :

One global target = reduction of production costs in RAS

- + Improvement of growth performances (breeding programs)
- + Improvement of a feeding strategy (decrease the feed cost)
- + Increase survival rates during the nursery period
(cannibalism = still a complex and major bottleneck!!) =>
selection of populations less aggressive, dietary timing, etc.

Main current bottlenecks :

Topic product quality / marketing

+ To label the European pikeperch product (« local product ») / imported products

Topic dissemination / organisation

+ To reinforce the exchanges between fish farmers (EFPC group?, union of producers ?)



Thank you for your attention

This project received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration (KBBE-2013-07 single stage, GA 603121, Diversify)



Co-funded by the Seventh
Framework Programme
of the European Union

