

Polyculture in an aquaponic system : Improving system efficiency by raising redclaw crayfish on pikeperch leftover feed

Introduction



POLYRAS

Objective:

Assess if the efficiency of an intensive aquaponic pilot can be improved by rearing redclaw crayfish on uneaten pikeperch feed, thus improving productivity while reducing environmental impact by sharing the same space, water and feed resources.

The Interreg Greater Region project **PolyRAS** aims to improve the production of fishes with local interest using **polyculture** in different intensive systems (RAS, aquaponics, biofloc), in order to **increase production while optimising resources use**.

Crayfish (*Cherax quadricarinatus*) and pikeperch (*Sander lucioperca*) were identified as interesting candidates for the Belgian market, because of their high economical value.



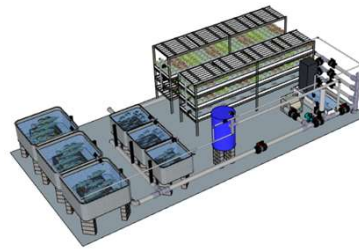
Material and Methods

- Experimental period : 6 months
- Crayfish were reared in cages at the bottom of pikeperch tanks only feeding on leftover feed from pikeperch (Le Gouessant PERCID)
- Animals as close in size as possible were housed together
- Crayfish of the same sex were housed together to avoid reproduction

Tank	B1	B2	B3	B4	B5	B6
D: 26 kg/m ² Mw: 943 g N: 56	D: 28 kg/m ² Mw: 358 g N: 58	D: 27 kg/m ² Mw: 281 g N: 204	D: 23 kg/m ² Mw: 412 g N: 56	D: 22 kg/m ² Mw: 98 g N: 229	D: 30 kg/m ² Mw: 214 g N: 140	
Tank volume: 2 m ³	Tank volume: 2 m ³	Tank volume: 2 m ³	Tank volume: 1 m ³	Tank volume: 1 m ³	Tank volume: 1 m ³	Tank volume: 1 m ³
6 ind/m ²	6 ind/m ²	6 ind/m ²	6 ind/m ²	6 ind/m ²	6 ind/m ²	6 ind/m ²
Sex: males Mw: 73,3 g N: 6	Sex: males Mw: 51,3 g N: 6	Sex: males Mw: 45,5 g N: 6	Sex: females Mw: 86,7 g N: 3	Sex: males Mw: 53,1 g N: 3	Sex: males Mw: 33,2 g N: 3	

Initial stocking of tanks at the start of the experiment. D = density, Mw = mean weight, N = number of animals.

Indoor aquaponic pilot



Total volume (m ³)	19
Aquaculture compartment	
Tank volume (m ³)	9
Sump volume (m ³)	0,5
Biofilter volume (m ³)	1,5
Hydroponic compartment	
Volume (m ³)	8
Total cultivation area (m ²)	50
LED lighting power (kW)	7,2

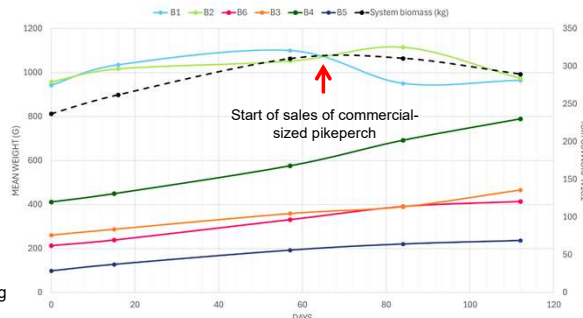
Preliminary results

1. Physico-chemical water parameters

Mean temperature	23,8 ± 1,0 °C
Mean dissolved oxygen	7,7 ± 0,3 mg/l
Mean pH	6,8 ± 0,1
NH ₄ ⁺	0,7 ± 0,2 mg/l
NO ₂ ⁻	0,4 ± 0,3 mg/l
NO ₃ ⁻	492,2 ± 90,2 mg/l

mean values ± standard deviation during the first 4 months of experimentation.

2. Pikeperch growth



- Global **survival rate** of pikeperch during the production period was **94 %**

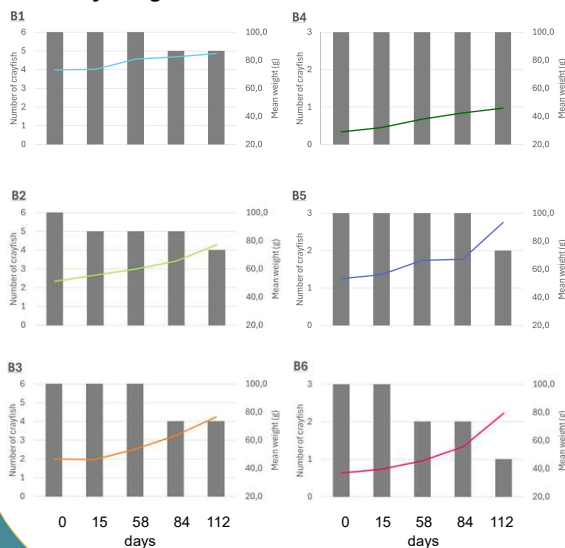
- Pikeperch **productivity** reached **438 kg/yr**

- The following table show Feed Conversion Ratio and Specific Growth Rates calculated for each cohort

Cohort	FCR	SGR
B1	1,8	*
B2	1,8	*
B4	1,2	1,2
B6	1,0	0,5
B7	0,9	0,6
B8	0,7	0,8

- The decrease of pikeperch mean weight in cohorts B1 and B2 is linked to the sale of fish that reached 1200 g or more (commercial size). This also explains the decrease in total biomass and the absence of SGR calculation for those fish

3. Crayfish growth



Line = mean weight, histogram bar = number of crayfish

- Redclaw crayfish growth was observed in every tank and **crayfish productivity** reached **1,9 kg/yr**

- **Global survival rate** of crayfish during the first 4 months was **70%**

- This reduced survival rate is still under investigation:

- water parameters stayed in the acceptable ranges for redclaw production
- cannibalism has been ruled out as the main cause of mortality because of the low density used in the experiment and the fact that most of the corpses were found untouched.
- Age of the animals used in this experiment is unknown and it is interesting to note that the only tank where mortality did not occur is the one where the mean initial weight was the lowest. It was also the only cage with females,

Conclusion

Pikeperch production performances (growth and survival) in polyculture with redclaw crayfish were similar to pikeperch monoculture production in the same system.

- Pikeperch production in polyculture was not impacted by the loss of space due to the crayfish cages on the bottom of the tanks.
- Crayfish could improve the overall productivity of the system.

Polyculture between pikeperch and redclaw crayfish is promising to improve system efficiency by producing biomass on leftover feed. The next step will be to assess the impact of this combination on waste management and animal welfare.