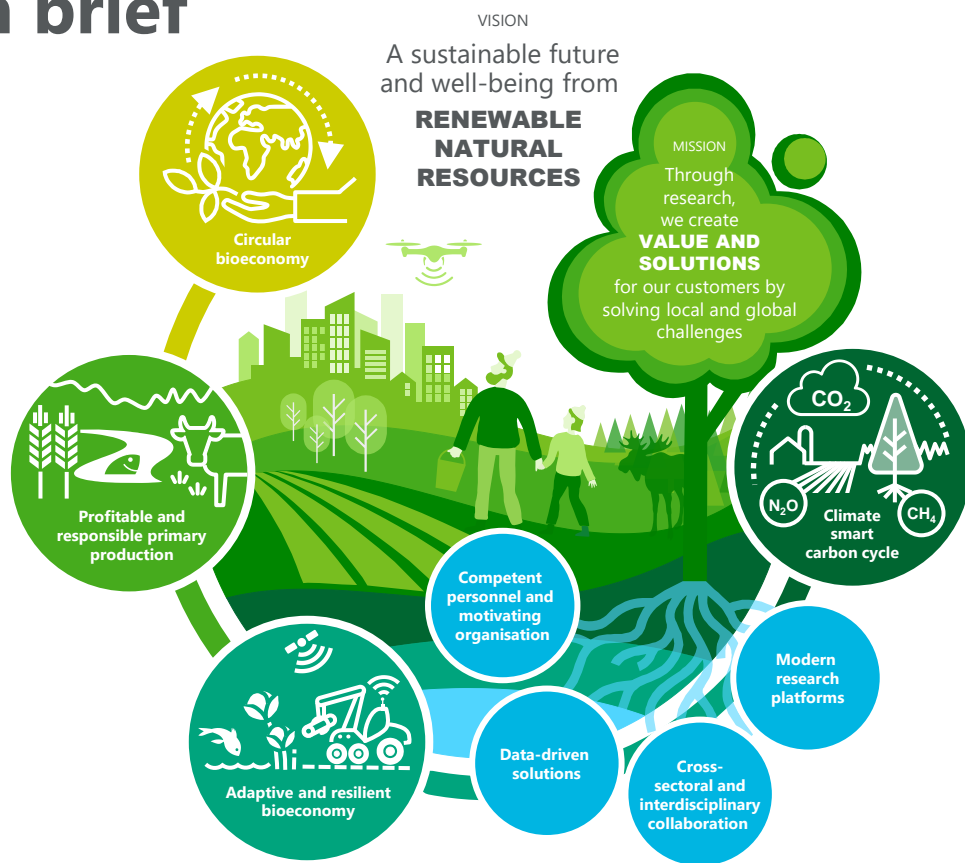


Current status of recirculation aquaculture systems (RAS) and their profitability and competitiveness in the Baltic Sea area

Internal working report for CG Aquaculture

Jouni Vielma, Markus Kankainen, Jari Setälä

Luke in brief



125 M€

Turnover

73 M€

Budget funding

52 M€

External funding

25

Locations in Finland

HQ in Helsinki

Present in 12 campuses with universities, research institutes and polytechnics

1288

Employees

46 research professors

622 researchers

We are one of the four Statistical Authorities in Finland.

16.6.2021

Report outline

1. Background
2. Status of the global RAS sector
3. Status of the RAS sector around the Baltic Sea countries
4. RAS technologies
5. Cost structure of RAS farming
6. Economic performance of existing RAS farms in the Baltic Sea area
7. Financial statement analysis
8. Discussion

Background

- Report by AquaBioTech Group on various sustainability issues
- Finland offered to produce a more detailed working report on RAS for further discussion

Status of the global RAS sector

Land-based salmon projects per country



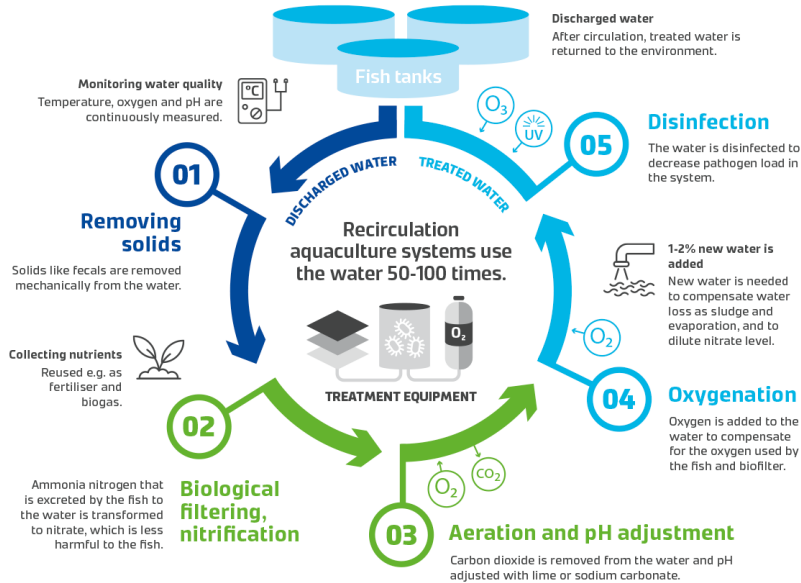
- Salmon smolt industry is the technology driver, but also numerous projects for market size salmon ongoing
 - Global interest and debate how these projects will succeed
 - Few large salmon RAS farms ramping up the production, most projects still on the drawing table

Status of the RAS sector around the Baltic Sea countries

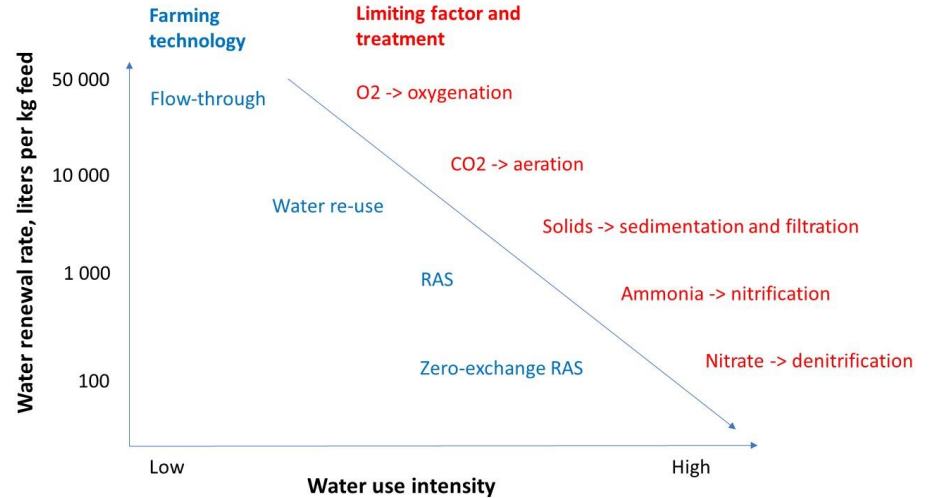
- As comprehensive information as possible from public information and personal communications
 - Denmark
 - Finland
 - Sweden
 - Less detailed information for Germany, Poland, Estonia, Russia, Latvia
- Comments and additional information welcome

RAS technologies

Recirculating Aquaculture System (RAS)



SOURCE | Natural Resources Institute Finland (Luke)



Nutrient discharge reductions vary with the technologies employed Even RAS farms discharge nutrients

Table 2. Typical phosphorus and nitrogen discharge estimates for cage farming, Danish model fish farming and intense RAS. Discharge reduction efficiencies are compared to cage operations. Data sources are provided in footnotes.

	Cage farming ¹	Model fish farm 3 ²	Intense RAS
P discharge, kg/tn production	4-5		
Reduction, %		76	70-90
N discharge, kg/tn production	35-40		
Reduction, %		50	30-90

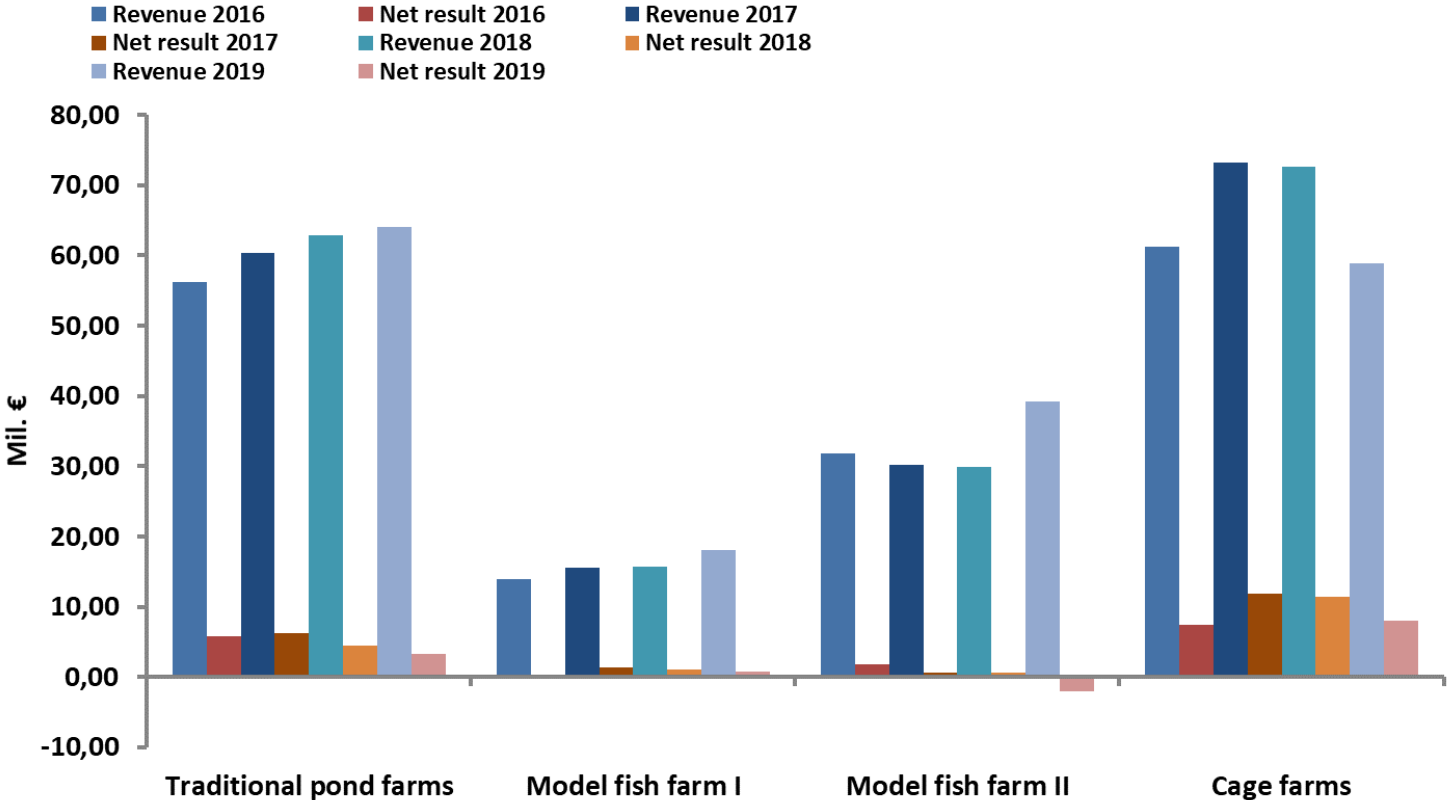
¹Data from the regional authority statistics (Centre for Economic Development, Transport and the Environment, Southwest Finland)

²Jokumsen and Svendsen (2010)

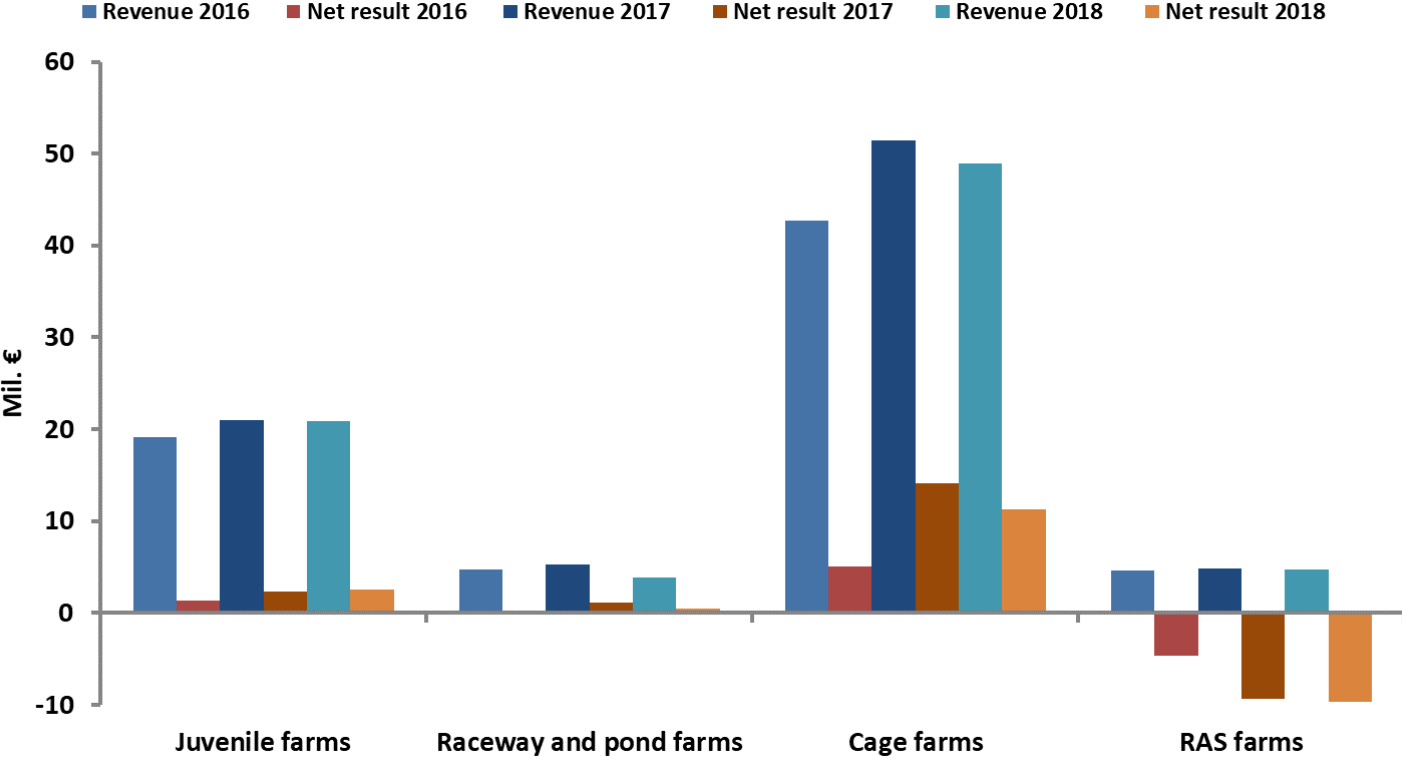
Economics of RAS farming

1. Feasibility studies for future business cases or for other purposes such as to study what cost factors should be developed
 - Tables 3-5, eight different cases
2. Economic performance of existing RAS farms

Revenue (blue bars) and netmargin (orange bars) of traditional pond farms, model fish farms and cage farms in Denmark during 2016-2019. Data from Danmarks Statistik, www.dst.dk



Revenue (blue bars) and netmargin (orange bars) of Finnish juvenile farms, inland raceway farms, Baltic Sea cage farms and RAS farms in 2016-2018 (Kärnä et al. 2018, 2019 and 2020).



Financial statements of RAS companies in Finland and Denmark

Tables 6-8

Table 7. Net results of Finnish RAS companies based on financial statements.

Company	2011	2012	2013	2014	2015	2016	2017	2018	2019
A	-602 000	-1 246 000	-954 000	-1 085 000	-648 000	-589 221	-663 672	-462 000	-844 000
B	-242 118	-769 555	-218 297	-219 728	-947 000	192 000			
C	-85 000	-265 000	-350 000	-86 700	-10 000				
D	-193 000	-230 000	-282 000	-179 000	-122 000	-121 000	-40 000	23 000	-78 000
E	-406 000	-382 000	-322 000	-649 000	-1 176 000	-594 205	-1 300 000	-273 000	-1 017 000
F			-35 000	-327 000	-492 000	-3 080 000	-4 425 000	-6 088 959	-7 038 633
G					-11 000	-57 000	-393 000	-2 985 287	-4 532 691
H							199	99	123

Table 8. Net results of Danish RAS companies based on financial statements

Company	2011	2012	2013	2014	2015	2016	2017	2018	2019
A	- 111 990	-270 437	-842 086	-2 123 173	-1 123 506	-1 565 925	-2 535 479	-2 800 748	-5 550 843
B		-36 568	-134 401	-1 948 191	-3 700 042	-1 527 215	-426 365	17 906	-336 015
C			-4	-13 798	218 699	453 778	1 167 467	1 954 025	1 321 458
D						-116 988	-277 874	-1 686 555	-1 296 091
E				-141 948	-752 275	-485 235	-608 972	-1 020 268	-629 887

Discussion

- Proven economic performance much poorer than estimated in feasibility studies
- Several companies are in bankrupt and most continuously on red
- The main reason is that RAS farms have not reached the nominal production capacity
- Danish model farm concept works ok in their climate
- Brief discussion on competitiveness
 - Technical and operational issues
 - Choice of product and location
 - Economics of scale
 - Subsidies

Thank you!

