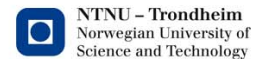


Microbial Resource Management for improved viability of marine fish larvae by community level selection of microbiota

Olav Vadstein

Co-authors: J. Skjermo*, K. Attramadal, I. Bakke, Y. Olsen
Norwegian University of Science & Technology (NTNU),
Departments of Biotechnology and Biology
* SINTEF Fisheries and Aquaculture

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Problems in larval rearing: The symptoms

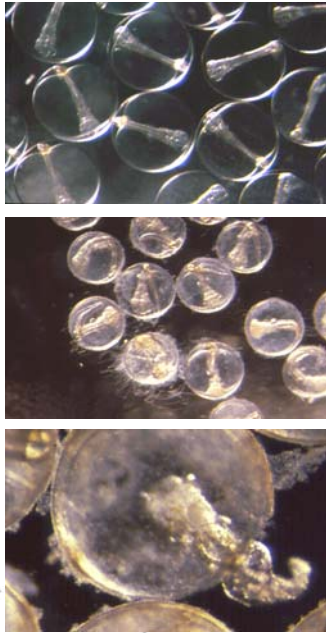
- The larvae do not start to eat properly
- The larvae grow slowly
- Normal development stop at a critical stage
- Abrupt mortality is a normal phenomenon
- Poor reproducibility between replicates

Or in one point:

Poor results and Lack of reproducibility

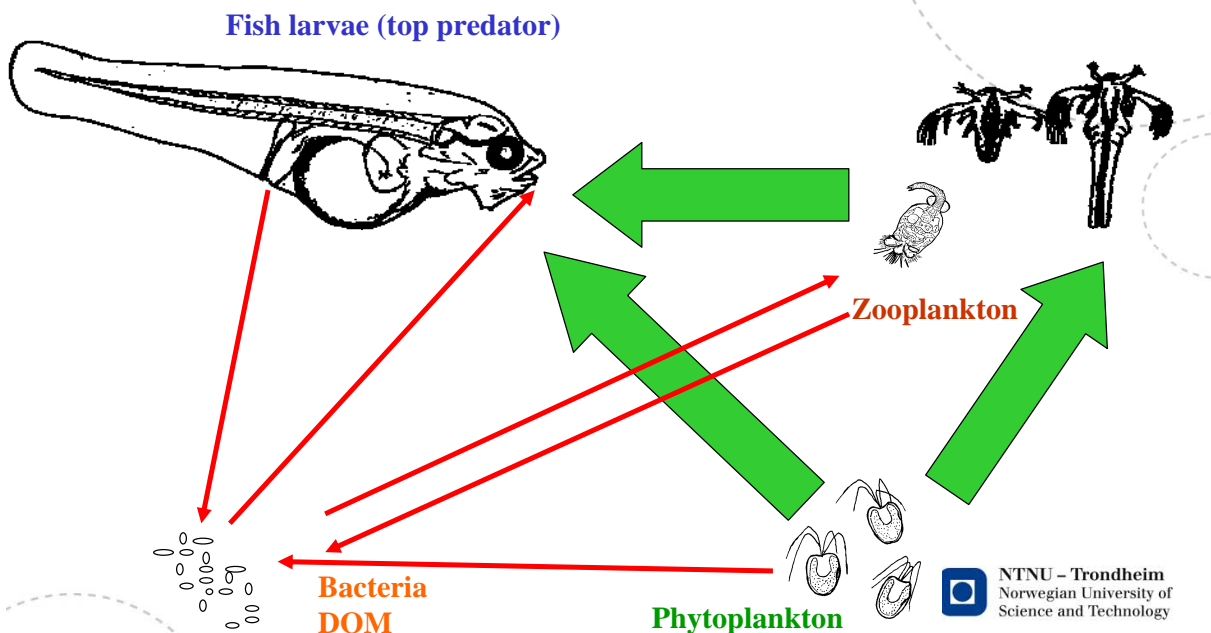


The possible causal connections:



- Egg quality (developmental and biochemical aspects)
- Nutrition
- Microbial conditions

The first feeding ecosystem



Requirements for a functional microbiota: Who/Names

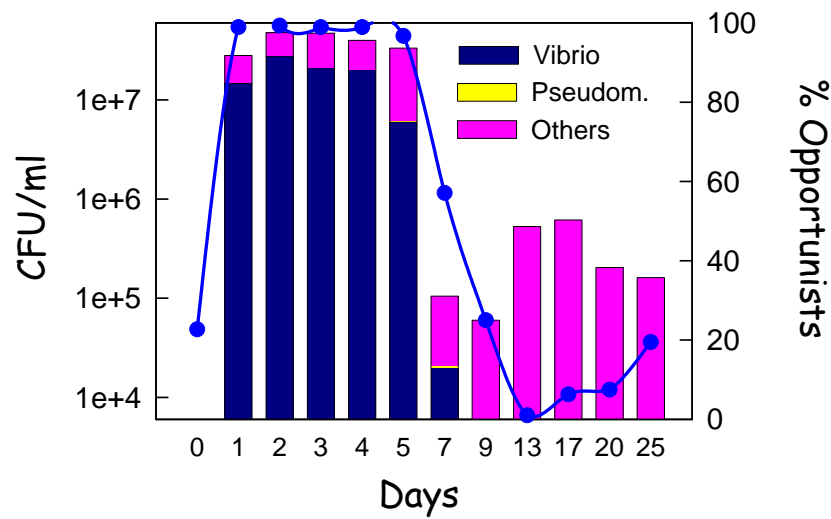


The alternative Black-box approach:

- We know more about what we do not want
- It is possible to set up selection regimes to avoid opportunist
- K-selection, contrary to r-selection, will serve such a purpose
- K-selection can be set up by securing competition for resources
- Competition is a result of low nutrient supply per microbe

¡Controlled (re)colonization!

What happens after disinfection of seawater:



The hypothesis:

- Larvae who are reared in water dominated by K-strategist (mature microbial communities) will perform better ...

... because they are less likely to encounter opportunistic (r-selected) microbes and detrimental host/microbe interactions

Two approaches for K-selection

1. Microbially matured water:

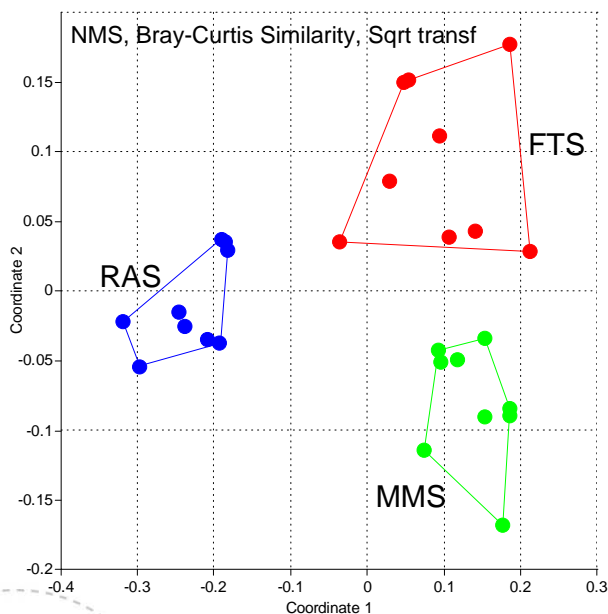
- Flow-through system
- Disinfection
- Controlled re-colonization in a biofilter

2. Re-circulated cultivation systems:

- Particle removal
- \pm Disinfection
- Consumption of ammonia and organic matter in biofilter

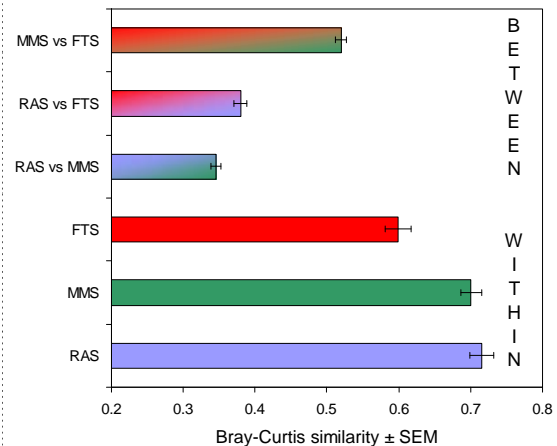
- Both secure K-selection because the populations in the biofilters are large compared to resource supply

The selection gives different community composition: In-flowing water



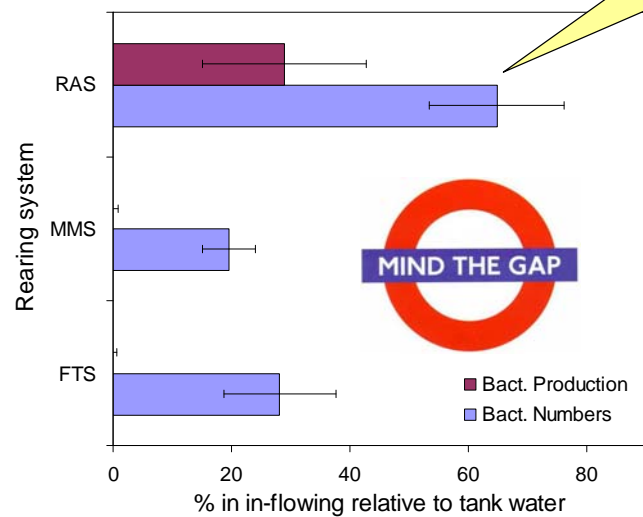
ANOSIM analysis:

$R = 0.894, p < 0.0001$



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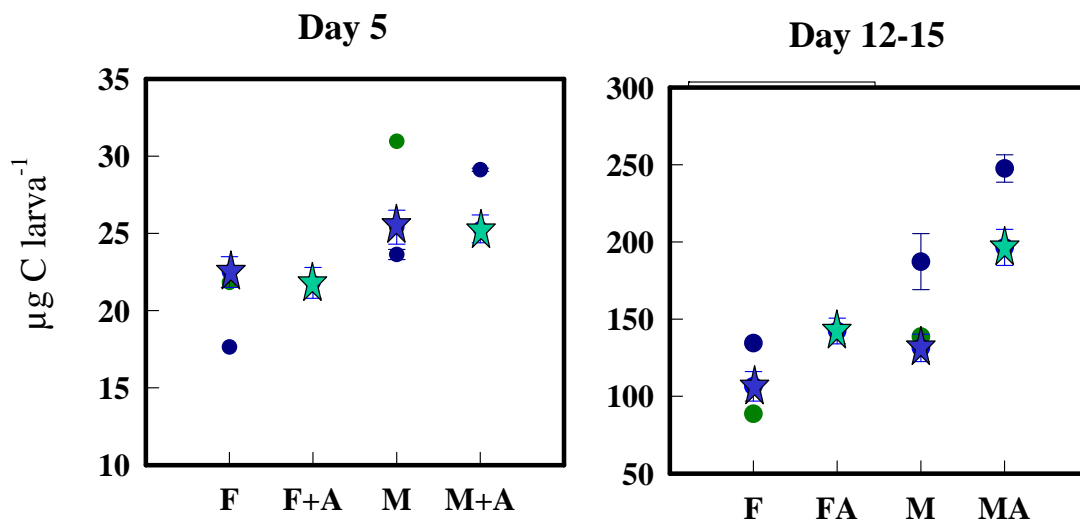
Different communities give different stability



Recirculation partly closes the gap

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The effect on larvae 1: Flow-through *versus* Microbially Matured

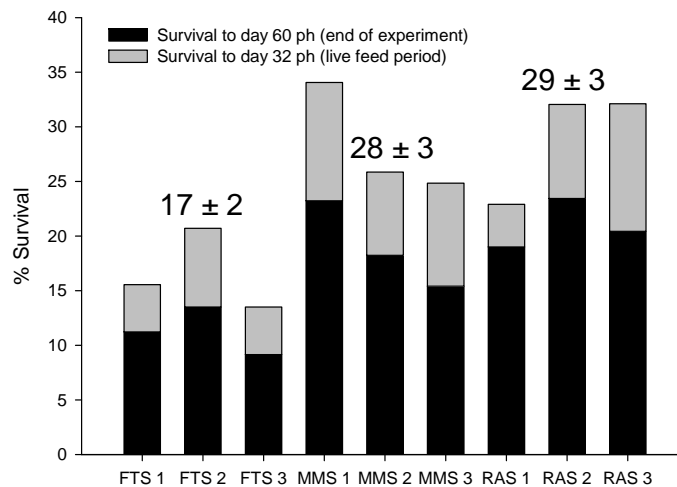


F: Flow-through

M: Microbially Matured

A: Added microalgae

The effect on larvae 2: Comparing the three water treatment systems



Conclusions:

- Community level K-selection of microbes works in aquaculture systems, ..
... but more knowledge is needed on:
 - microbial community composition under K-selection
 - systems design
- Larval stages of fish perform better when exposed to a K-selected microbial community
- Ecological theory can be used to solve practical problems

Acknowledgements:
This talk is based on
published and
unpublished work
by several PhD
students

養魚先養水

*To culture fish one has to
culture the water*

Financial support by:

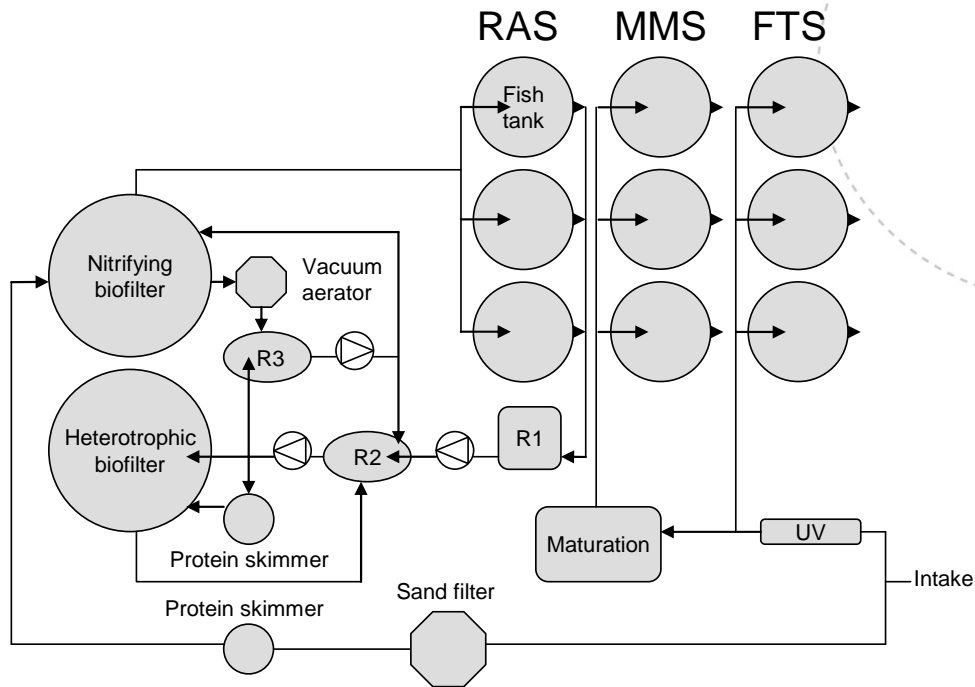
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Thank you



Flow scheme of the three systems for water treatment: flow
through system (FTS), microbial maturation system (MMS) and
recirculating aquaculture system (RAS).