



Management of energy consumption in aquaculture – every little bit helps!



Anders Erlang Østergaard, Ph.D., Sustainability and technical advisor, BioMar

3rd April 2025 | 15th International Aquaculture Conference, Vukovar, Croatia

Agenda

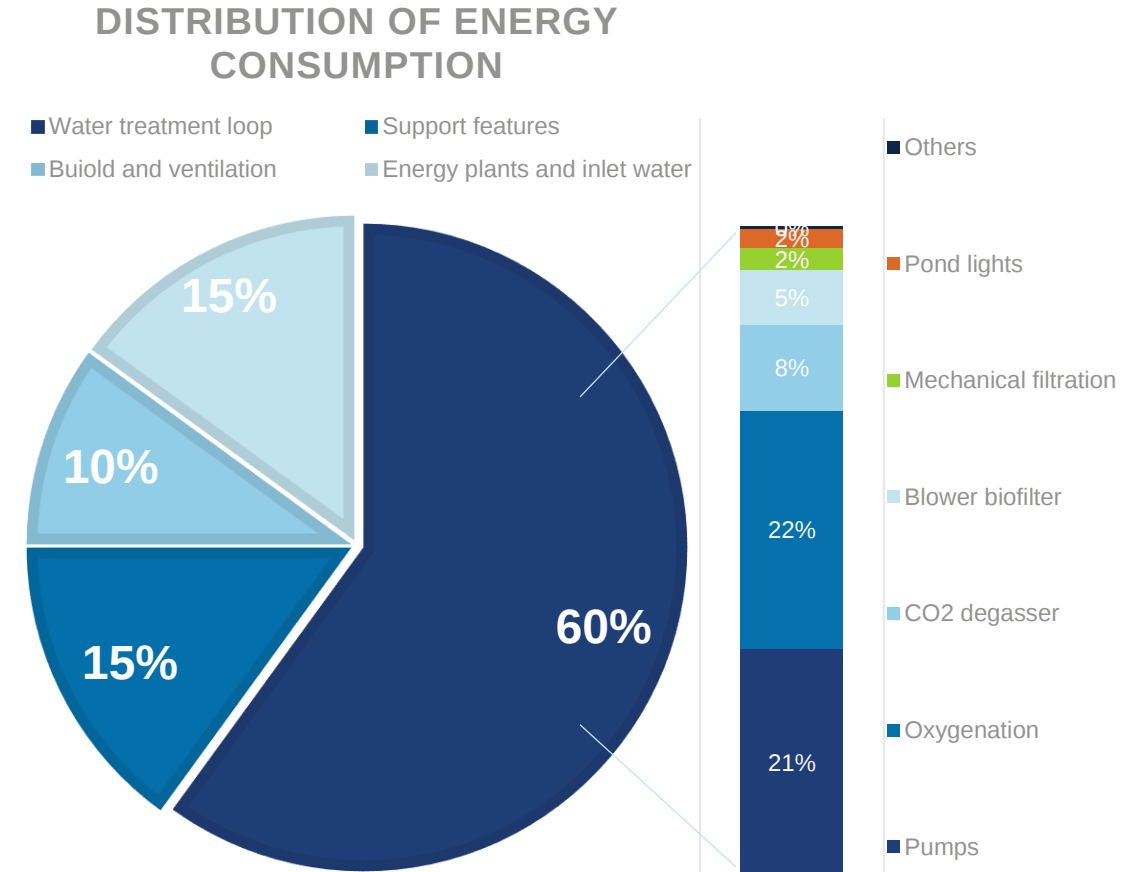
Special of interests:

- Energy distribution RAS
- Degasser
- Pumps
- Oxygen

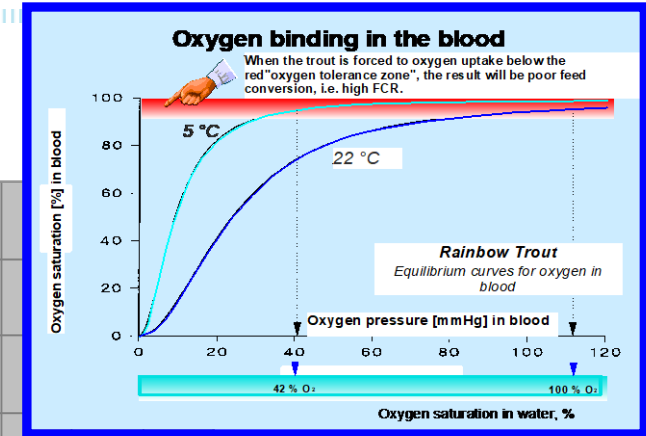
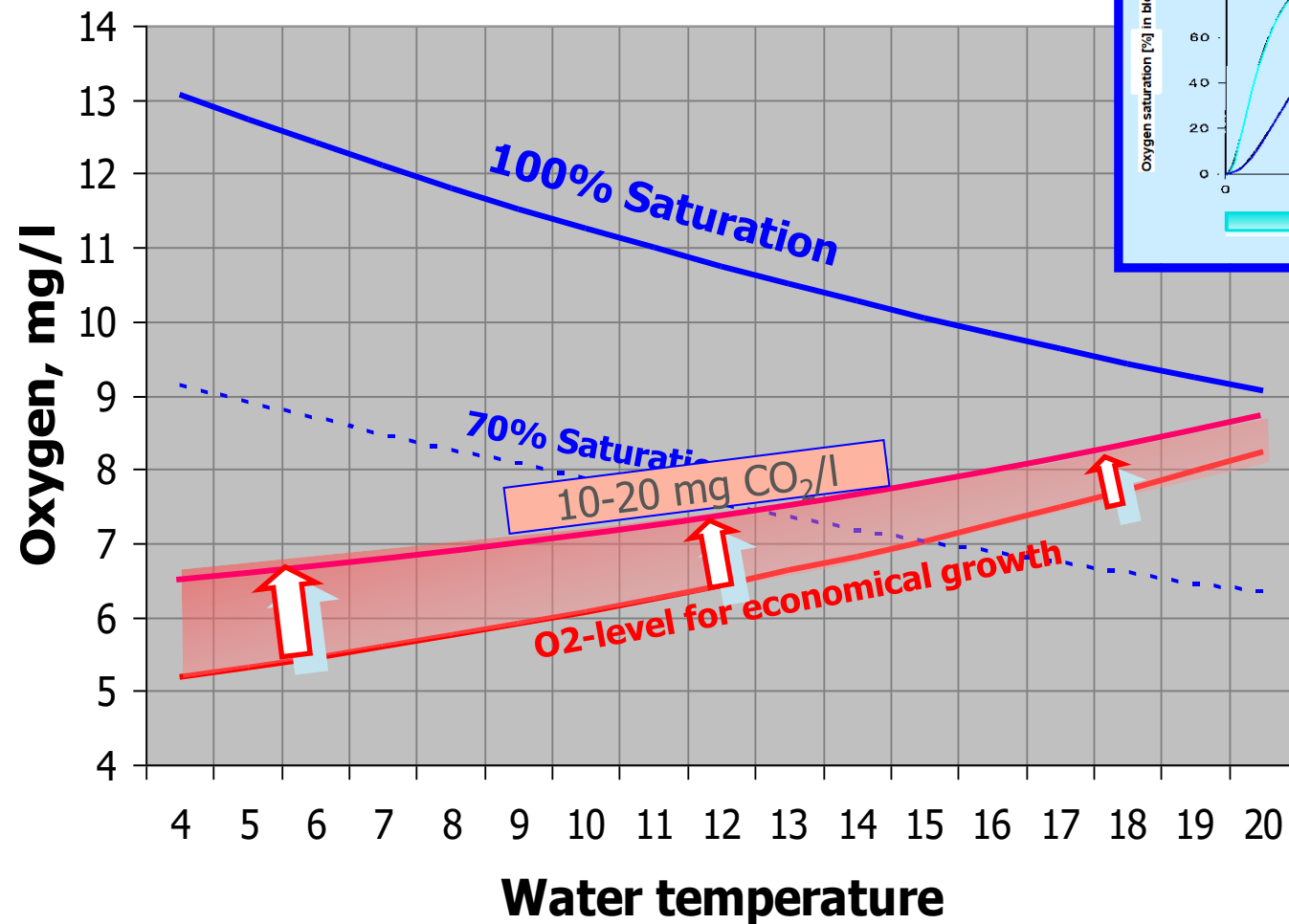
Power-intensive RAS systems



- Mapping of RAS facilities (feed and energy consumption)
- Mapping of energy saving (according to model)
- Current energy consumption: 8.8 kWh/kg smolt
 - **Model farms in Denmark current consumption: 1,7 kWh/kg trout.**
- Greatest energy use in water treatment (60%) - from 5 different RAS facilities. **Similar in Model farms.**
- Savings potential: 20-30%. How? - switching to heat pump, optimal utilization of production volume, LED lights, energy management (systematization of data)
- Greater focus on energy consumption in RAS is required. Not included sludge treatment



High blood CO₂ level obstruct trout respiration



How to optimize?

Oxygen levels can fluctuate hugely!

Economic growth rates can only be achieved with an appropriate oxygen supply
Suggestions on how to measure oxygen content and how to add oxygen to water

Methods of oxygen enrichment

- Surface aeration
- Low-pressure systems (<70 cm depth)
- Airlift (>70 cm depth) vs column aerator
- Oxygen boxes (low-head)
- Liquid oxygen via high-pressure cones
- etc.



from 0.6 kg O₂ per kWh



to 1.0 kg O₂ per kwh



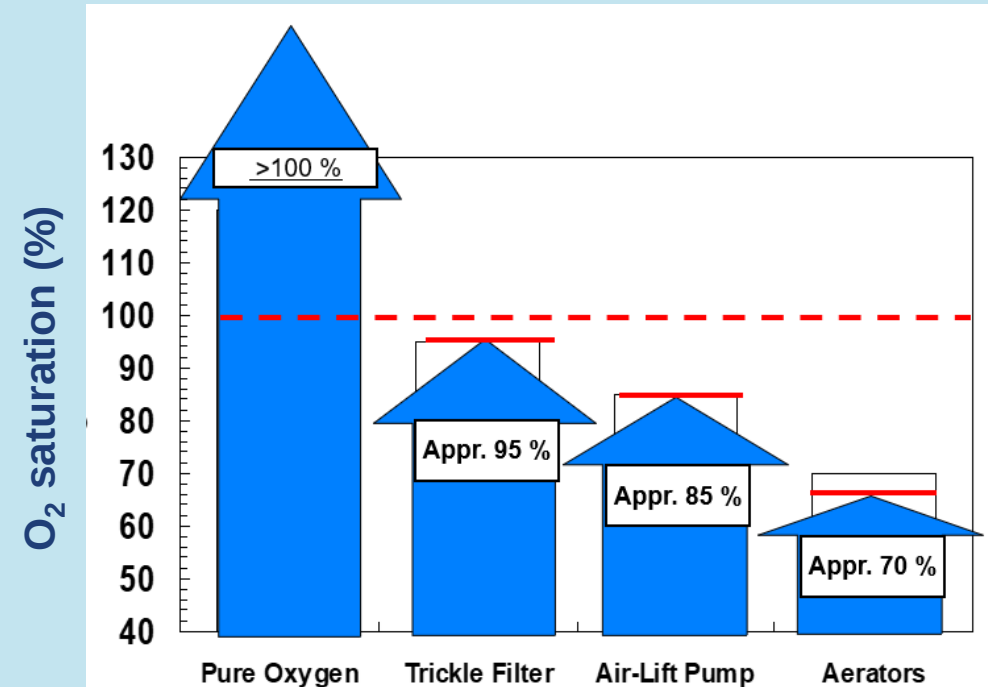
How to optimize?



Oxygen levels can fluctuate hugely
Economic growth rates can only be achieved with an appropriate oxygen supply
Suggestions on how to measure oxygen content and how to add oxygen to water

Methods of oxygen enrichment

- Surface aeration
- Low-pressure systems (<70 cm depth)
- Airlift (>70 cm depth) vs column aerator
- Oxygen boxes (low-head)
- Liquid oxygen via high-pressure cones
- etc.



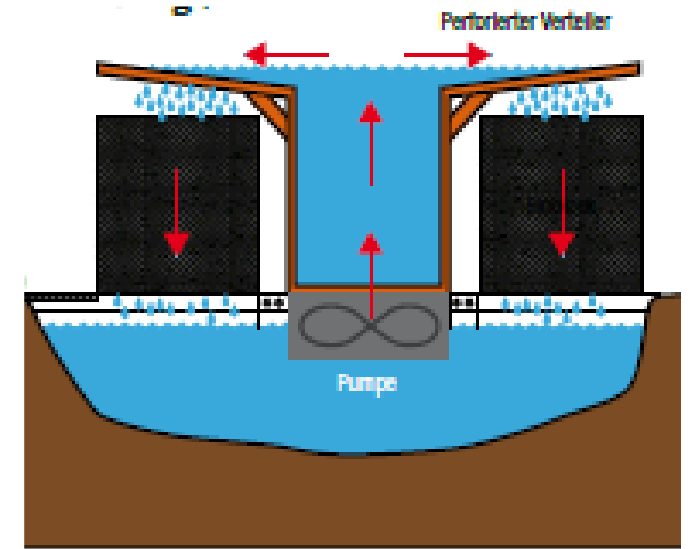
Establishing oxygen levels and the possible response of the fish farmer



Aeration columns



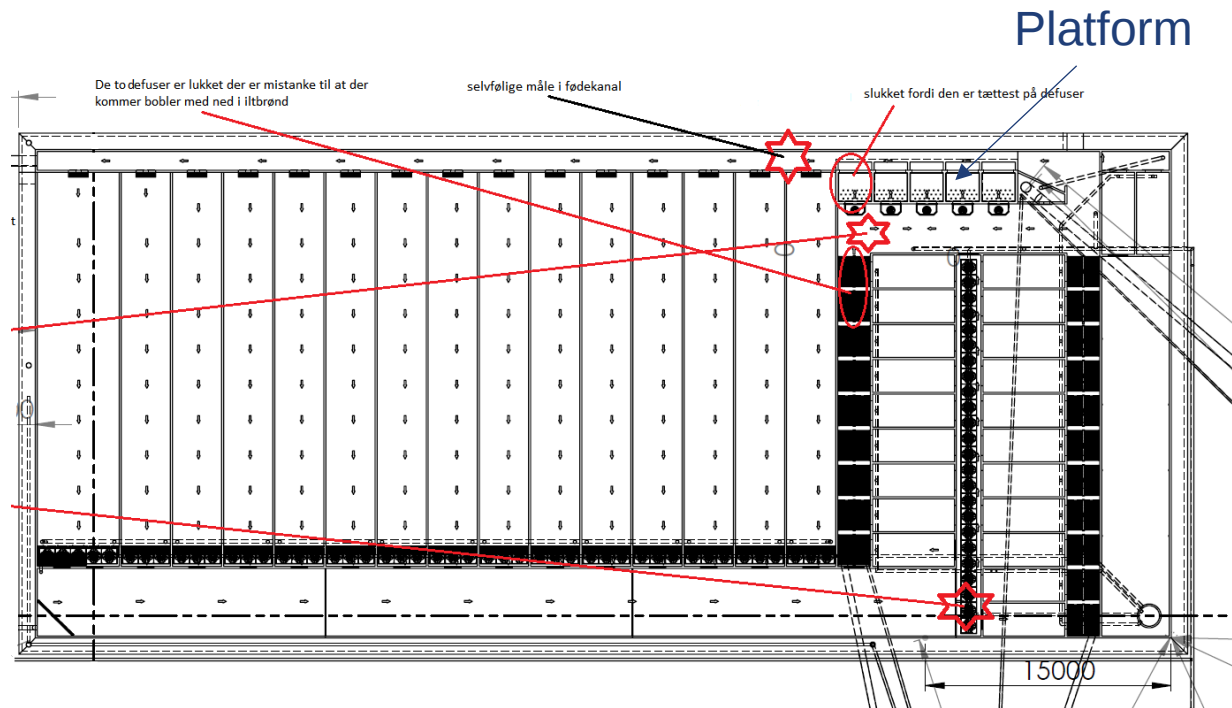
- One farm circulating 1100 l/s must upgrade on degassing. 140 tons in stock instead of 100 tons.
- Saved 20.000 kWh per year by pump with column instead of separated pump and low head diffusers.
- Feeding increased from 500 kg to 900 kg/day.



Schematic cross-section of an aeration column. An advantage of this system lies in the simultaneous partial removal of undesirable gases.



Save energy in RAS



Setup 3 x 250 l/s



Setup 1 x 250 l/s



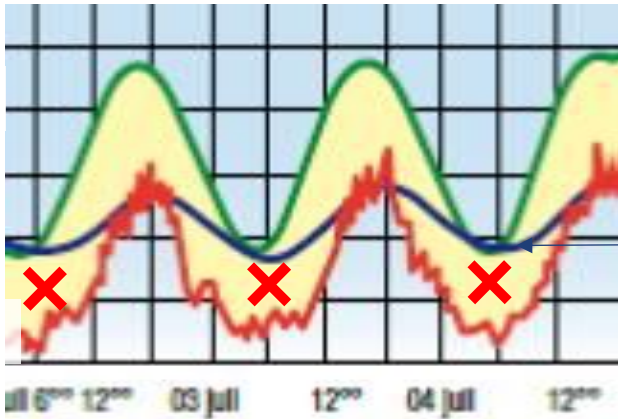
Water in →

Cylinder with hole plates
in rotation for self cleaning

The possible response of the fish farmer

Introduction of liquid oxygen with controller

O₂ level in inflow

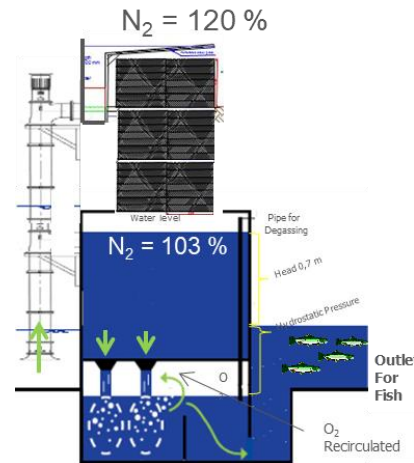
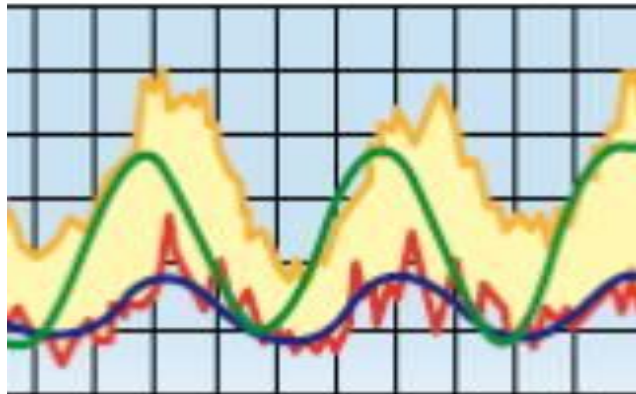


O₂ level in outlet

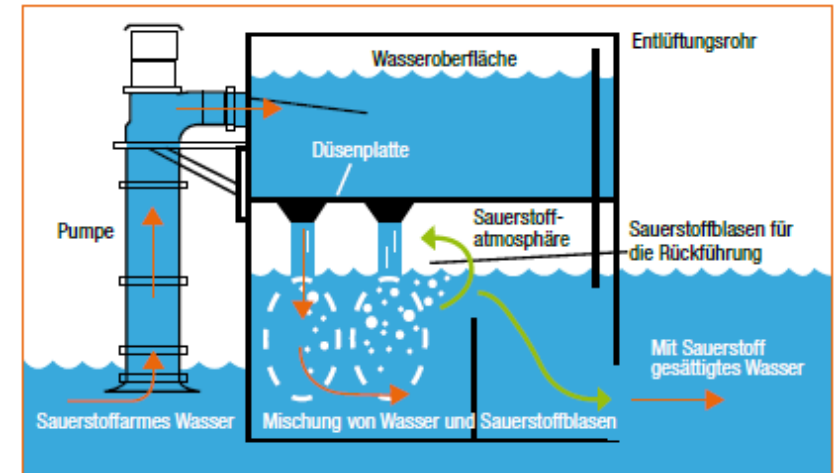


O₂ level for economical growth

O₂ introduced



- One RAS-farm circulating 1200 l/s must upgrade from manual to aut. controller for O₂ dosage.
- Saved 50 % of O₂ consumption. From 1.4 kg O₂/kg fish to 0.7 kg O₂/kg fish



Schematic cross-section of a jetplatform, that is a method of oxygen enrichment using liquid oxygen.

Oxygen Cone

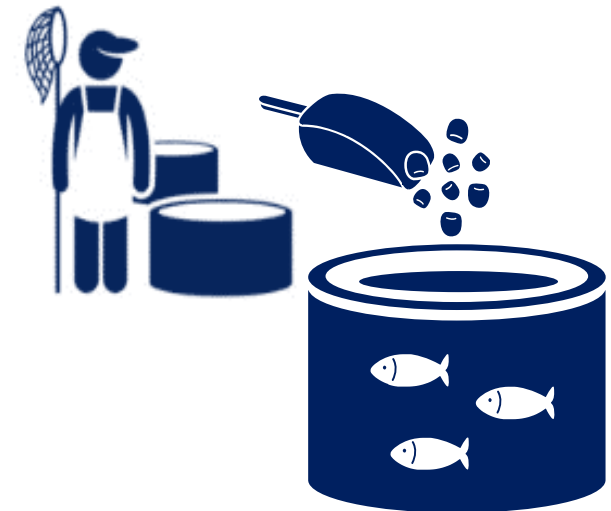
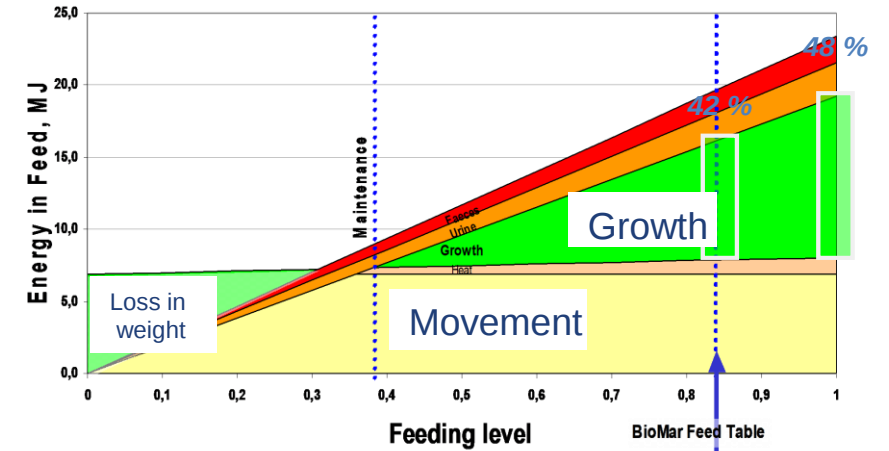


When are the water quality a challenge for fish growth?

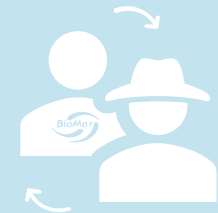
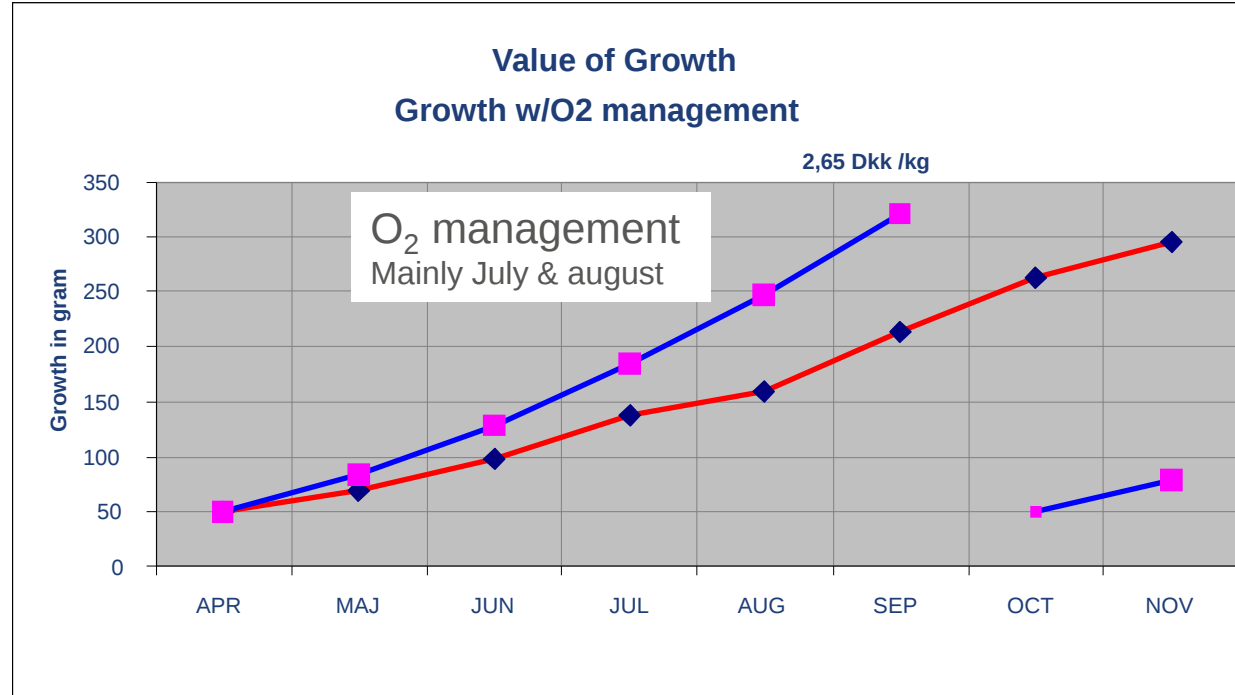


- Energy distribution RAS
- Focus Degasser
- Focus Pumps
- Focus Oxygen
- Stability-stability-stability

Utilisation of feed



High and sustainable feeding rate leads to the best economic performance in your fish farm.



BioMar assists with measuring
water parameter and estimate
on the economical profit
improving water treatments.

Thank you
Any questions?



Powered by Partnership
Driven by Innovation