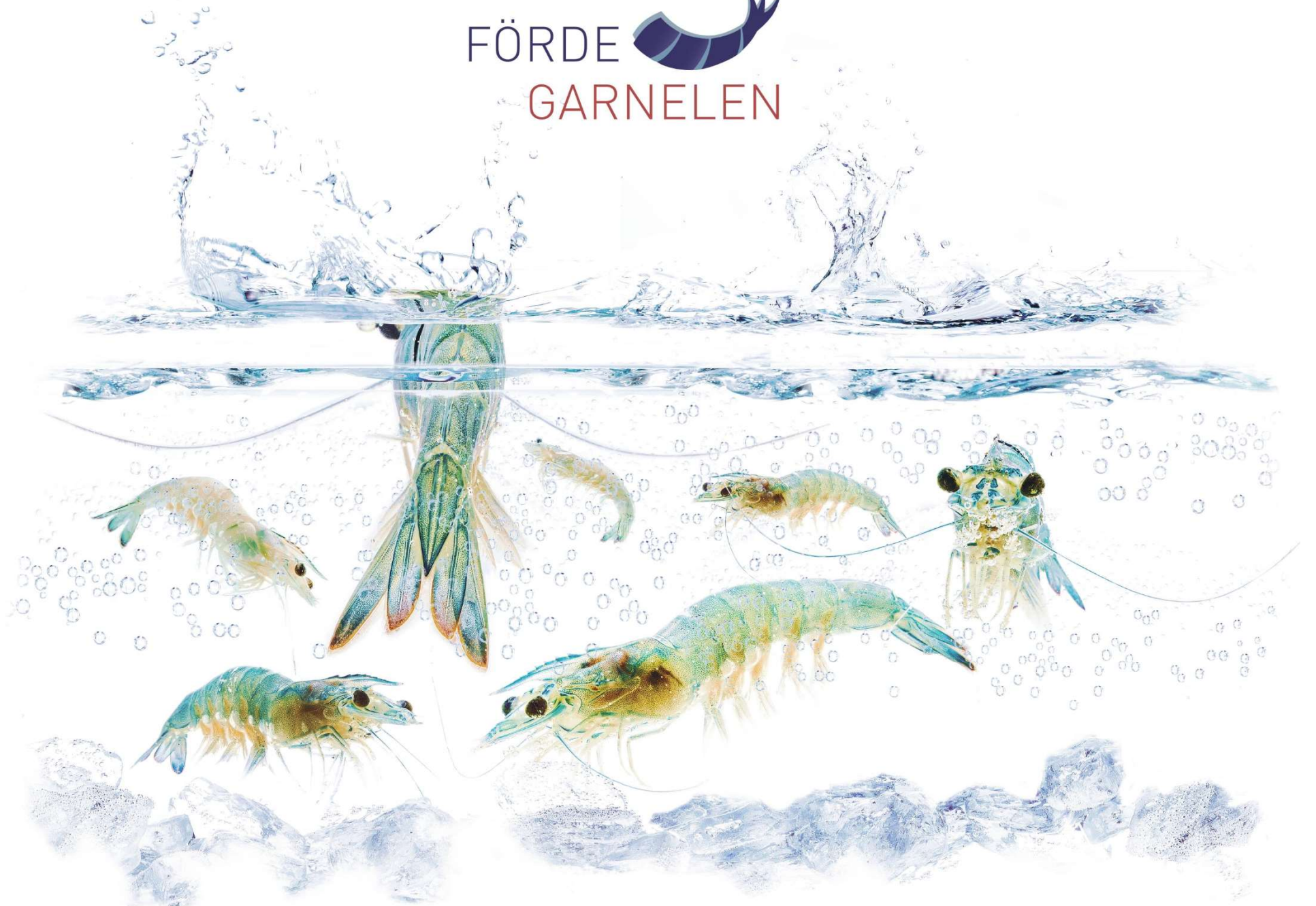
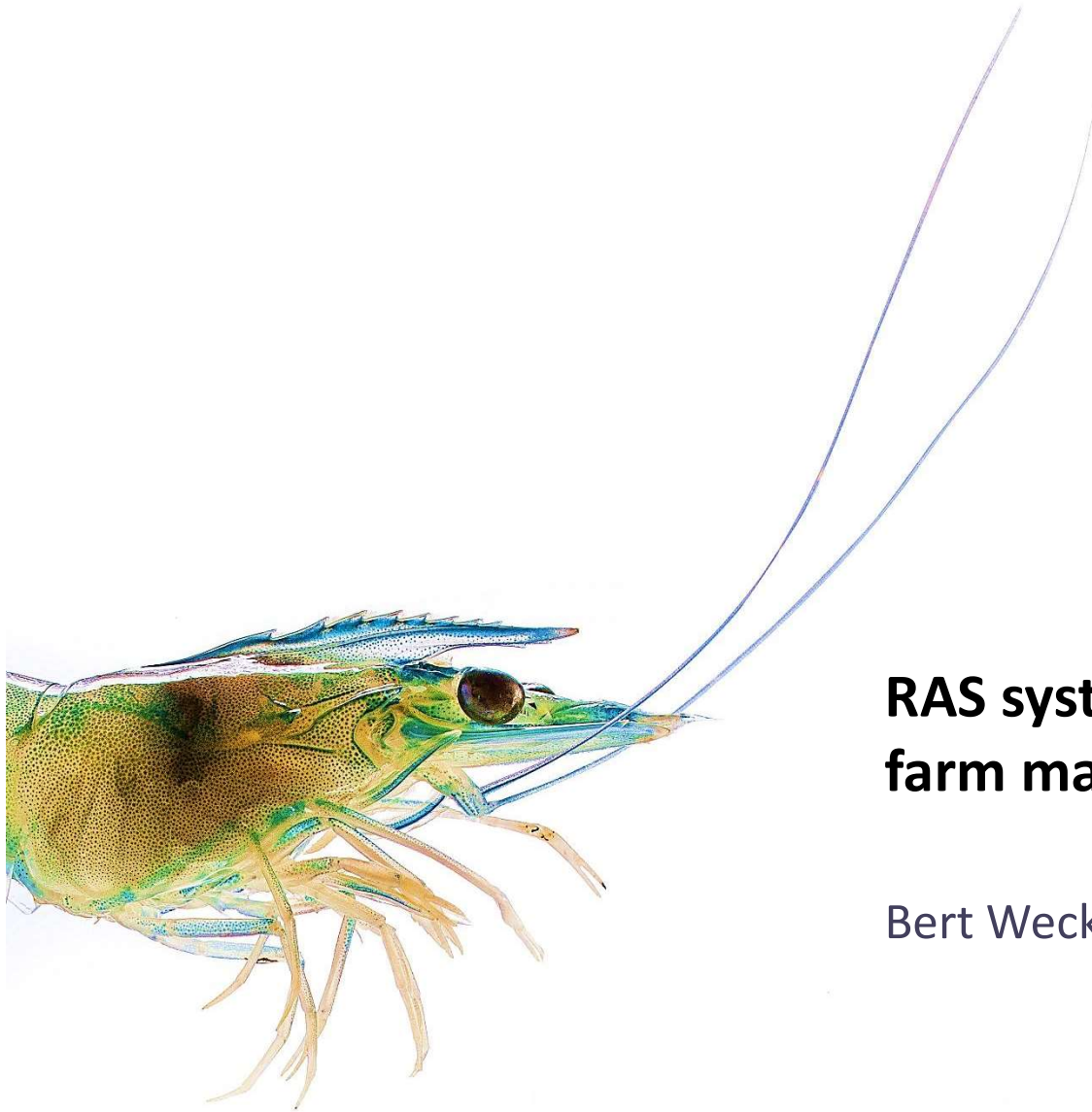


FÖRDE 
GARNELEN





RAS systems for shrimps and their farm management strategies

Bert Wecker

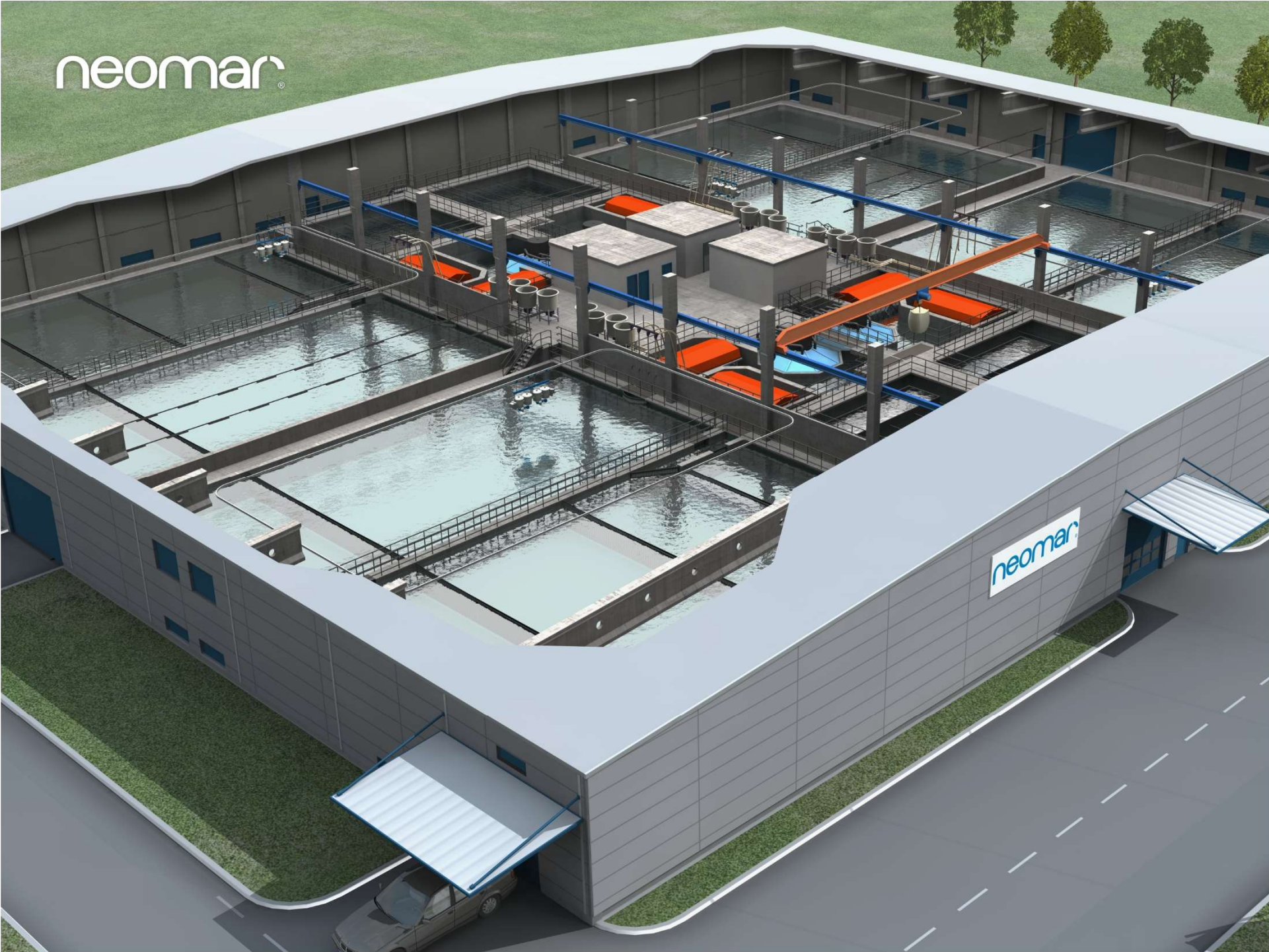
neomar[®]

Pacific White Shrimp
Litopenaeus vannamei



neomar[®]

neomar



neomar[®]



neomar[®]

Yellowtail kingfish
Seriola lalandi

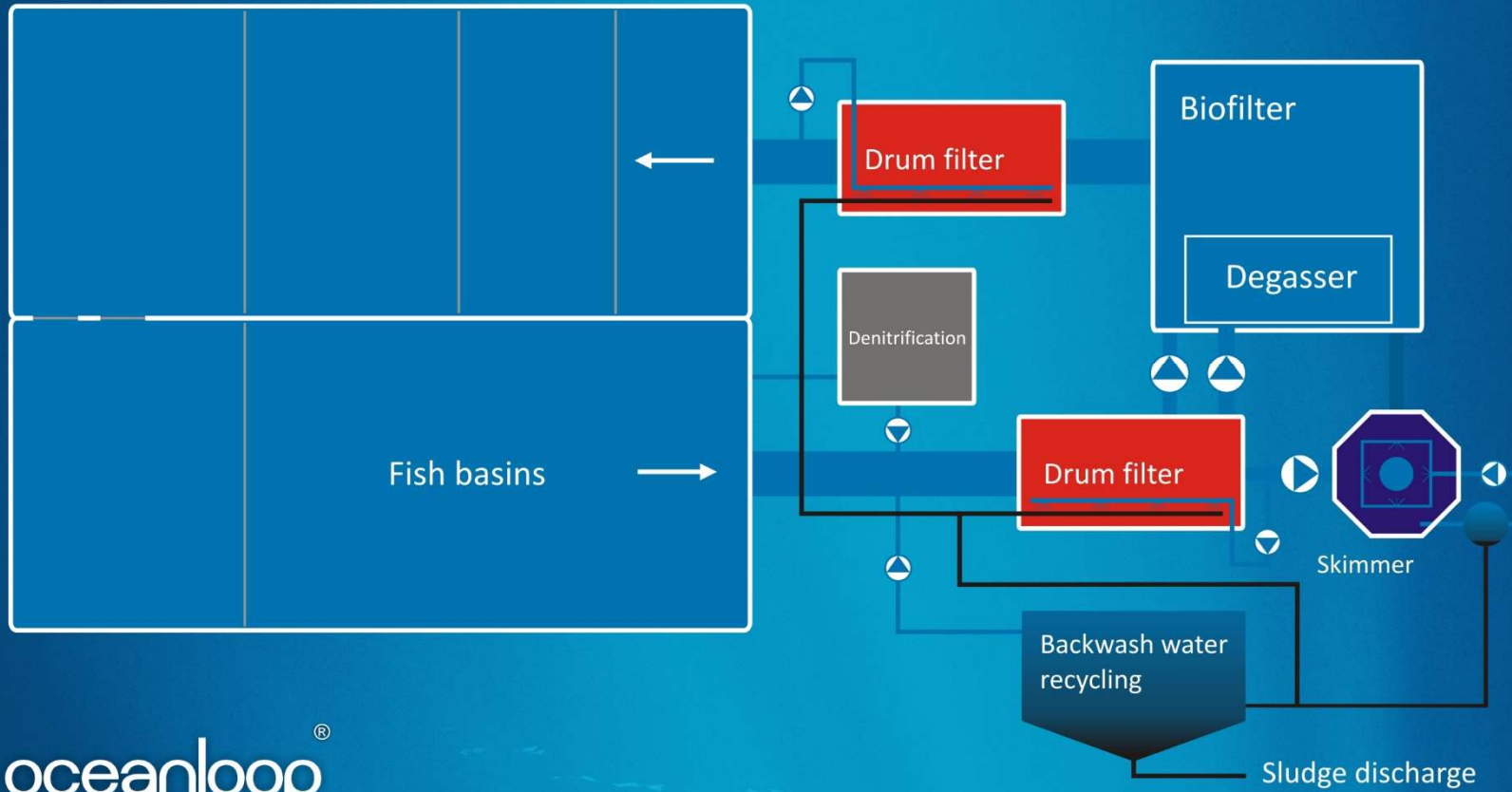


A large number of translucent shrimp with orange-yellow hepatopancreas, held in a fine-mesh net. The shrimp are densely packed and appear to be in a controlled environment, likely a RAS (Recirculating Aquaculture System) setup. The background is a dark, textured surface, possibly the net or a container wall.

Clear Water RAS Shrimp Farming

- **Constant and Reliable Product Quality**
- **Controlled Hygienic Condition**
- **In Situ-Control of Behaviour & Health**
- **Better Feeding Management**
- **Easier Biomass Determination**

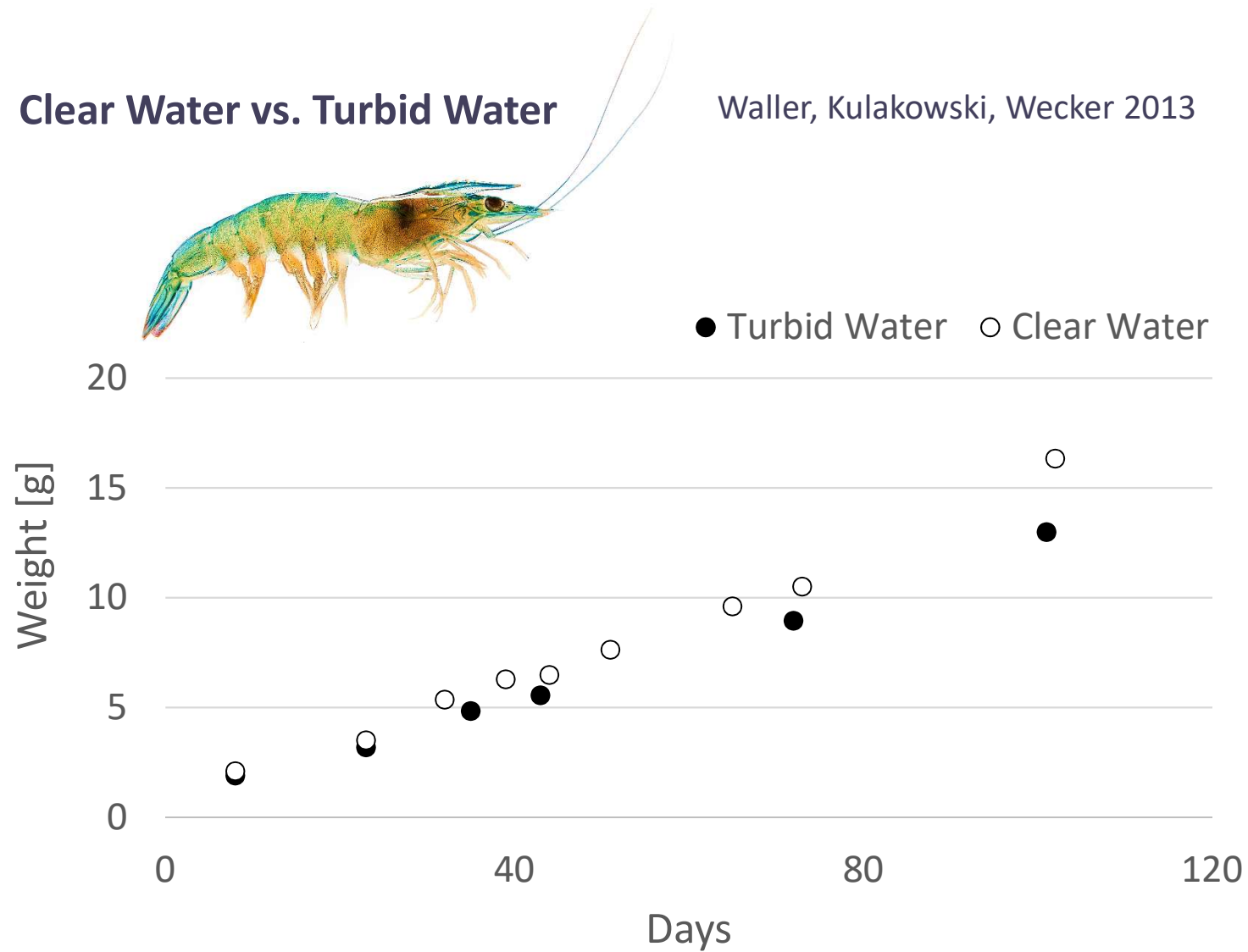
neomar®



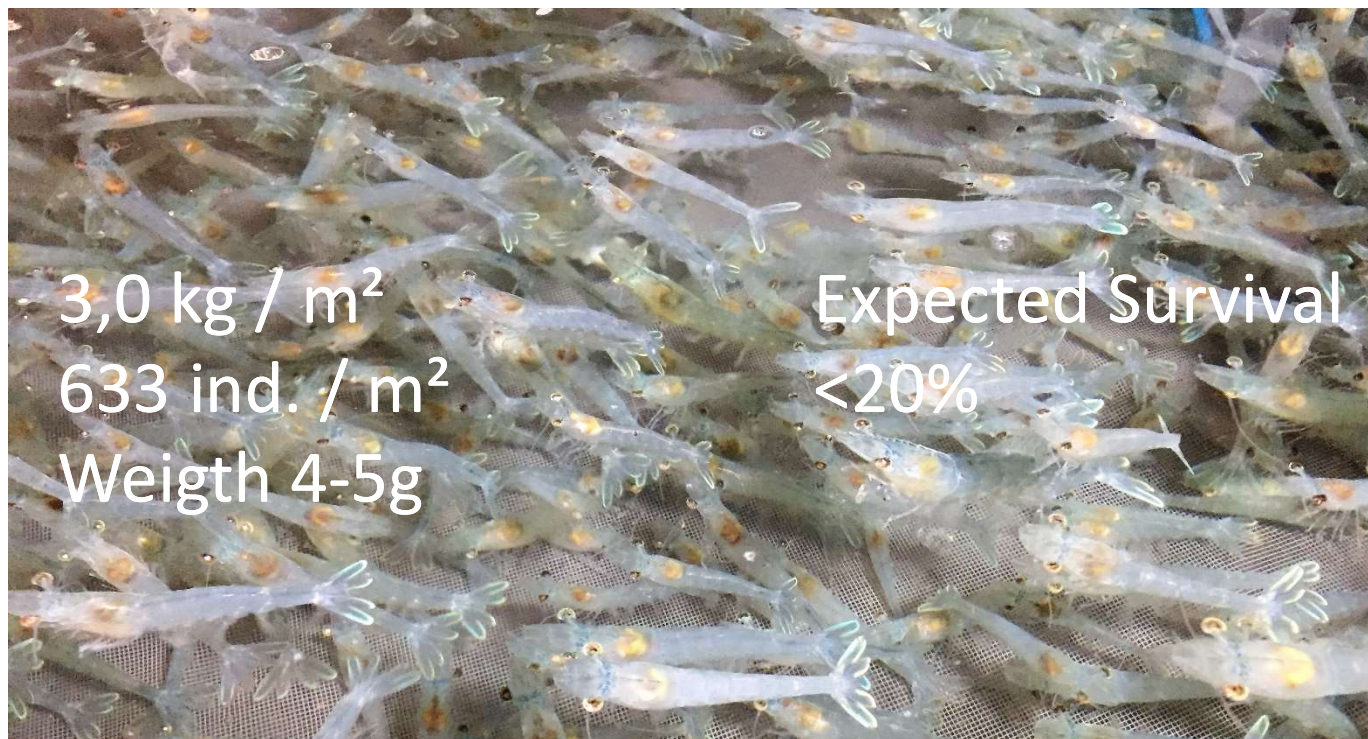
oceanloop®

Clear Water vs. Turbid Water

Waller, Kulakowski, Wecker 2013



Challenge Production Efficiency

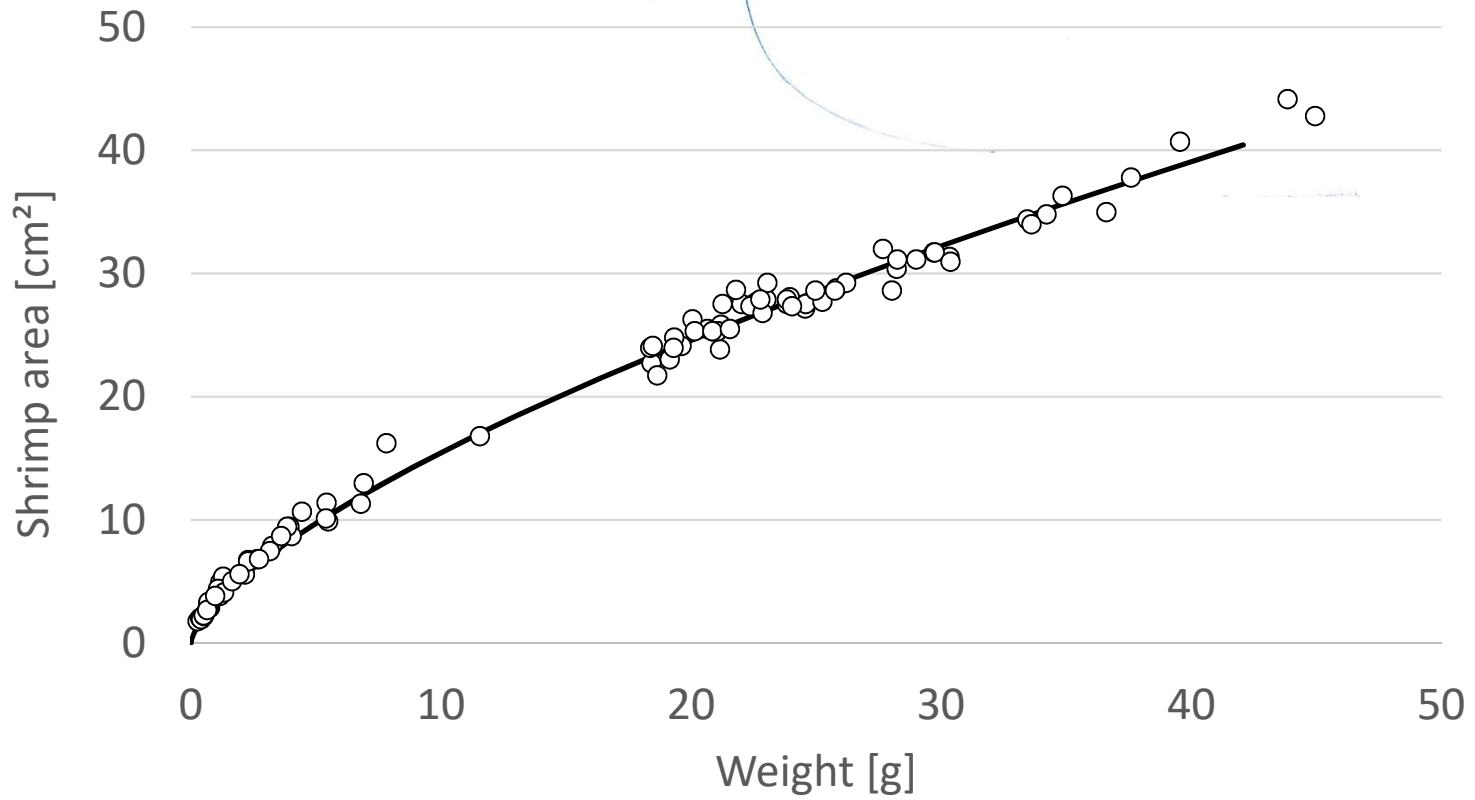
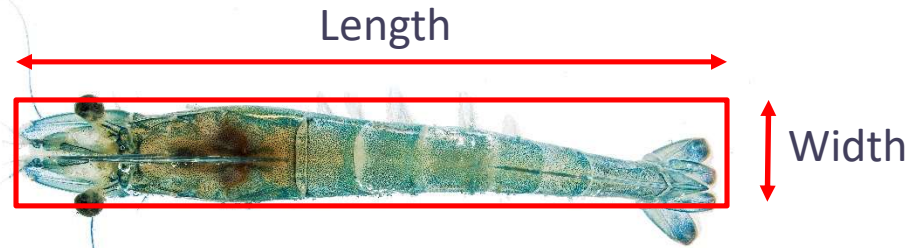


How much space is needed?

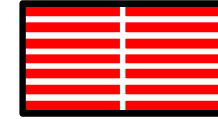
Comfort-Zone
? %



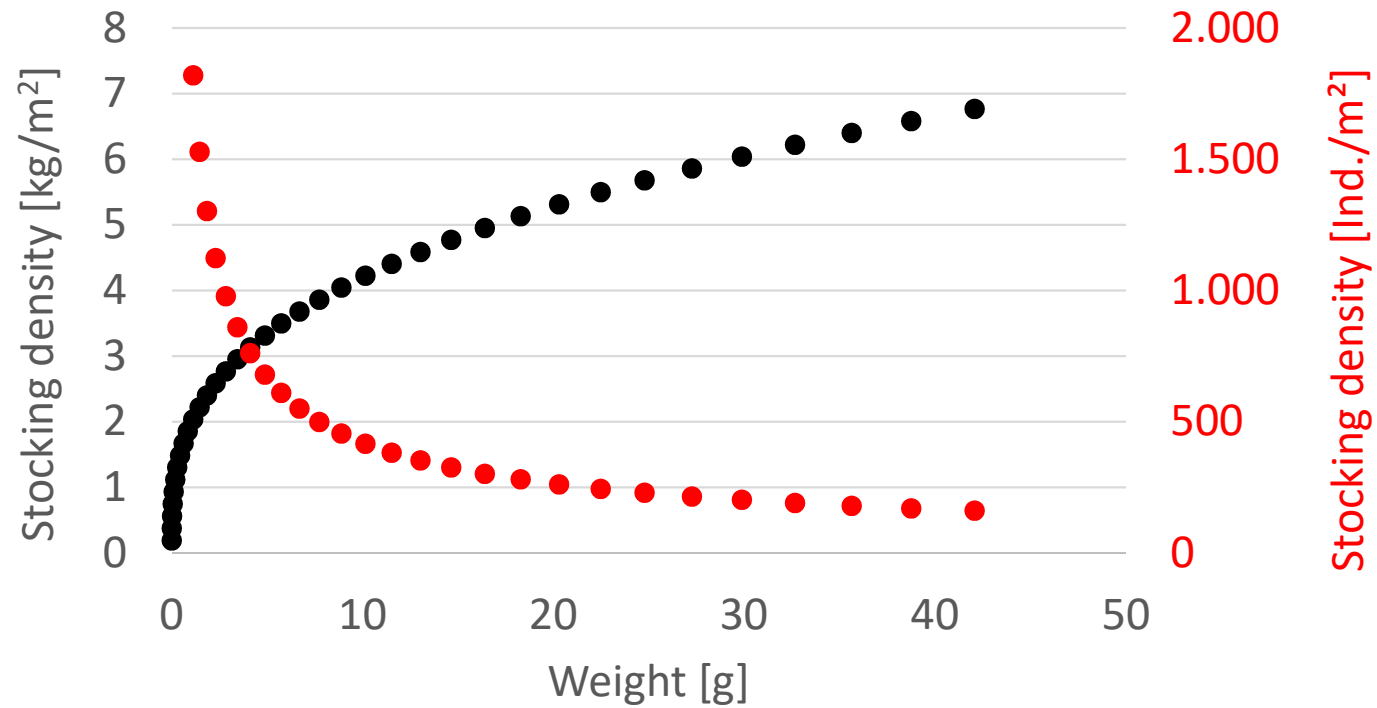
Modelling Shrimp Area

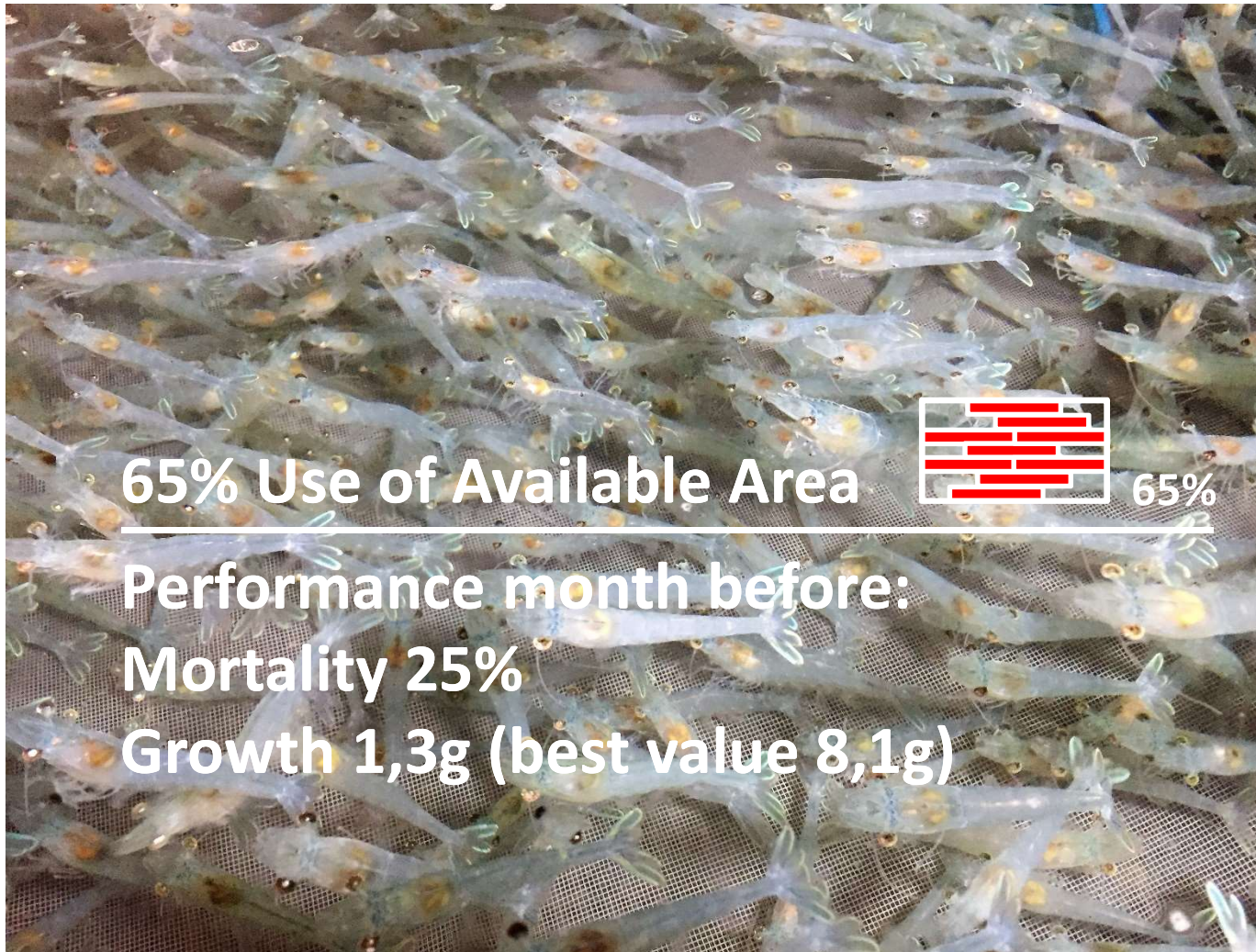


100% Use of Available Area (no real comfort zone)



100%





65% Use of Available Area



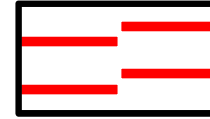
65%

Performance month before:

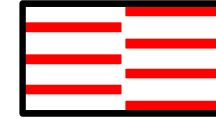
Mortality 25%

Growth 1,3g (best value 8,1g)

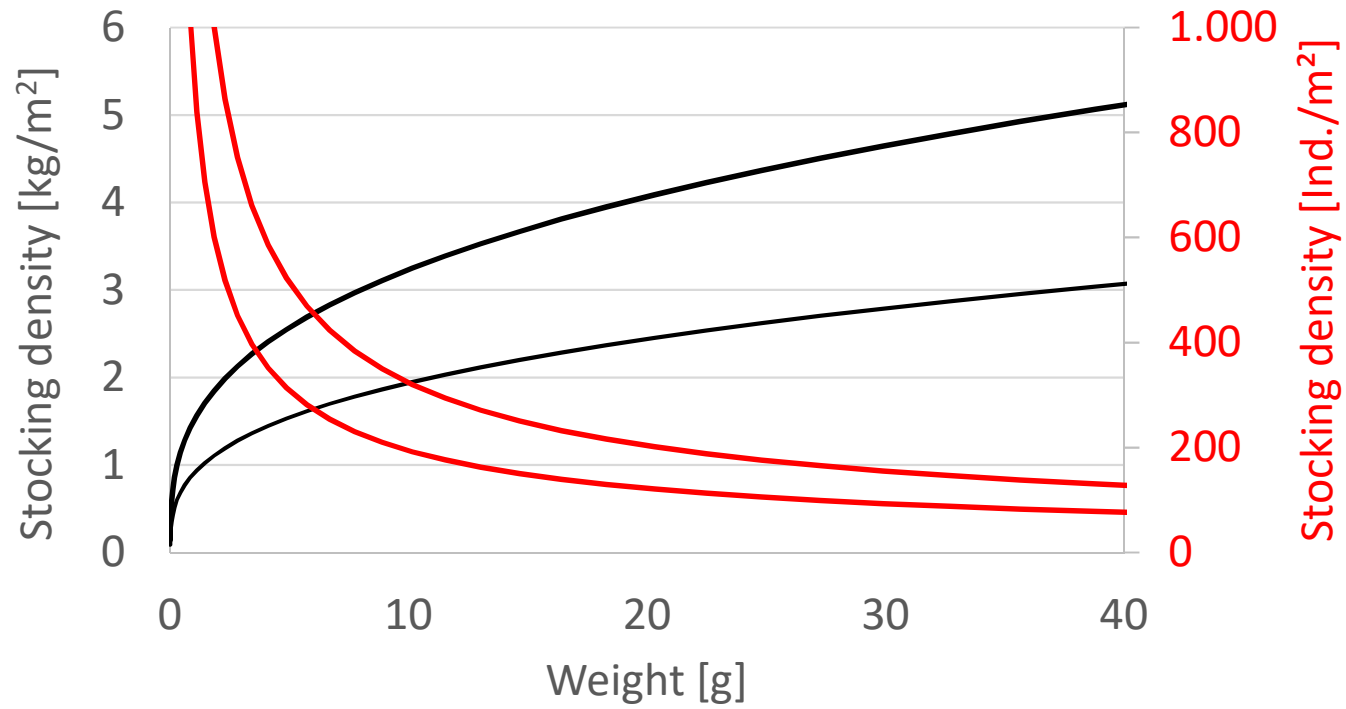
30-50% Use of Available Area



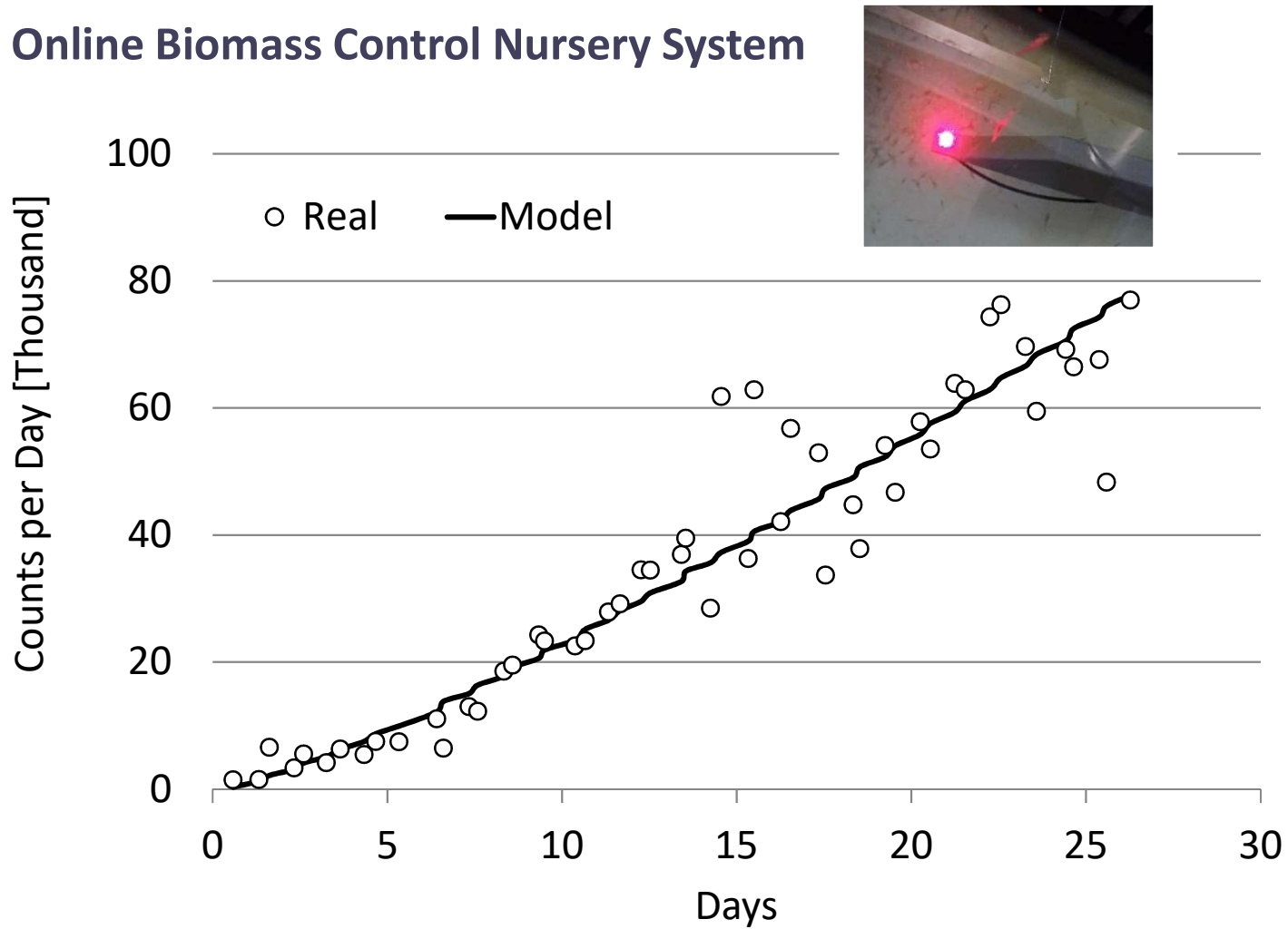
30%



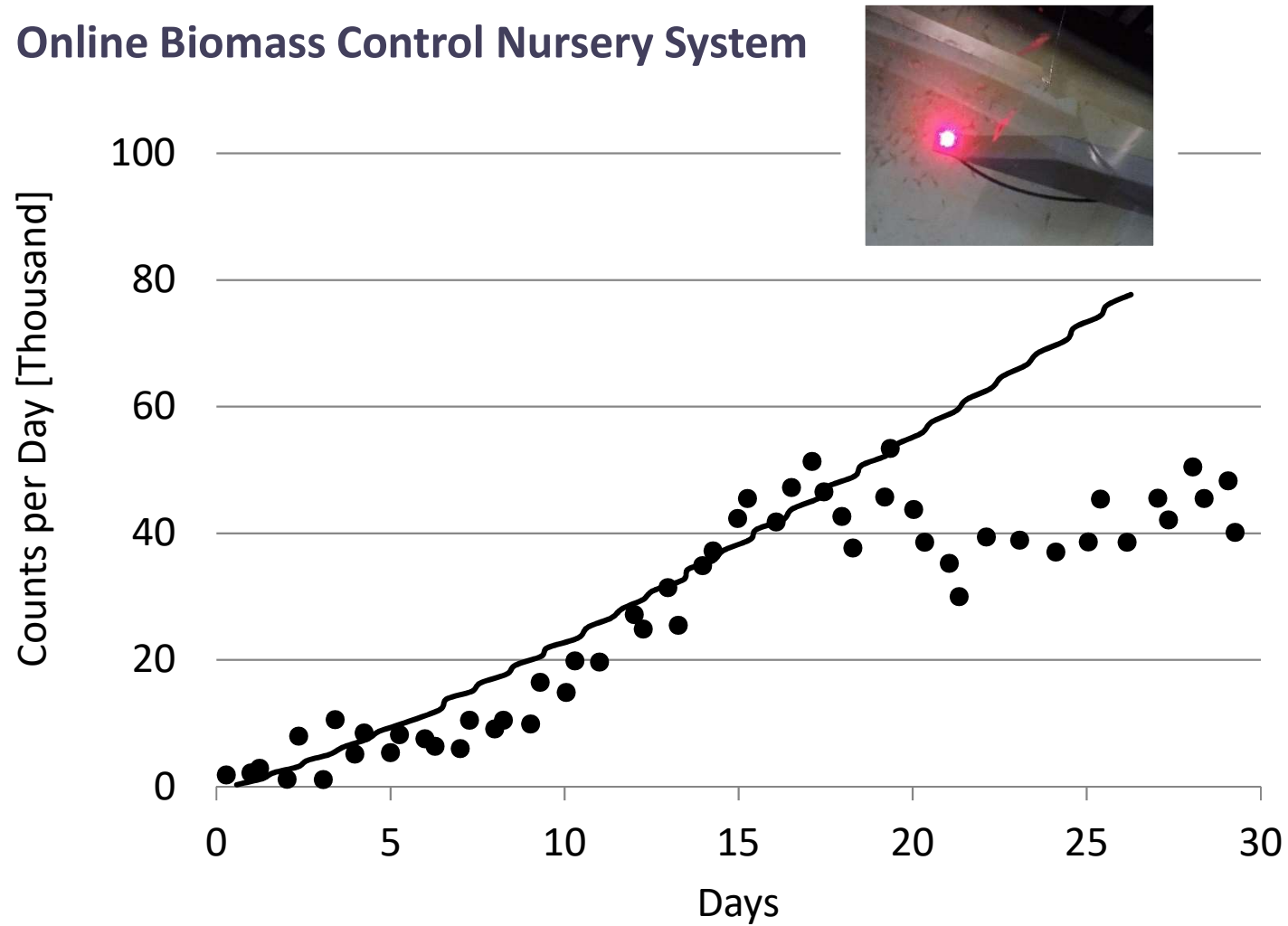
50%



Online Biomass Control Nursery System



Online Biomass Control Nursery System



Biomass Control Production System

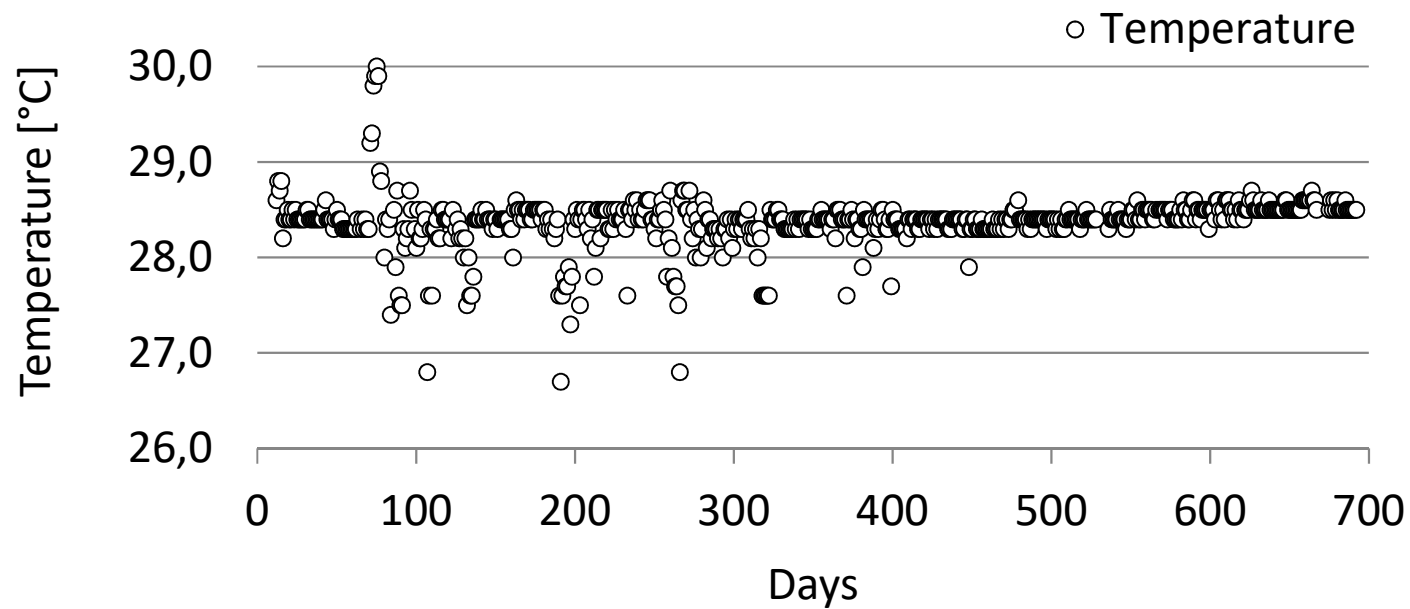


Important Production Criteria

- Sufficient Area
- Quality of Post Larvae
- Water Quality / Abiotic Conditions
- Good Feed and Feeding Practices
- Shrimp Handling

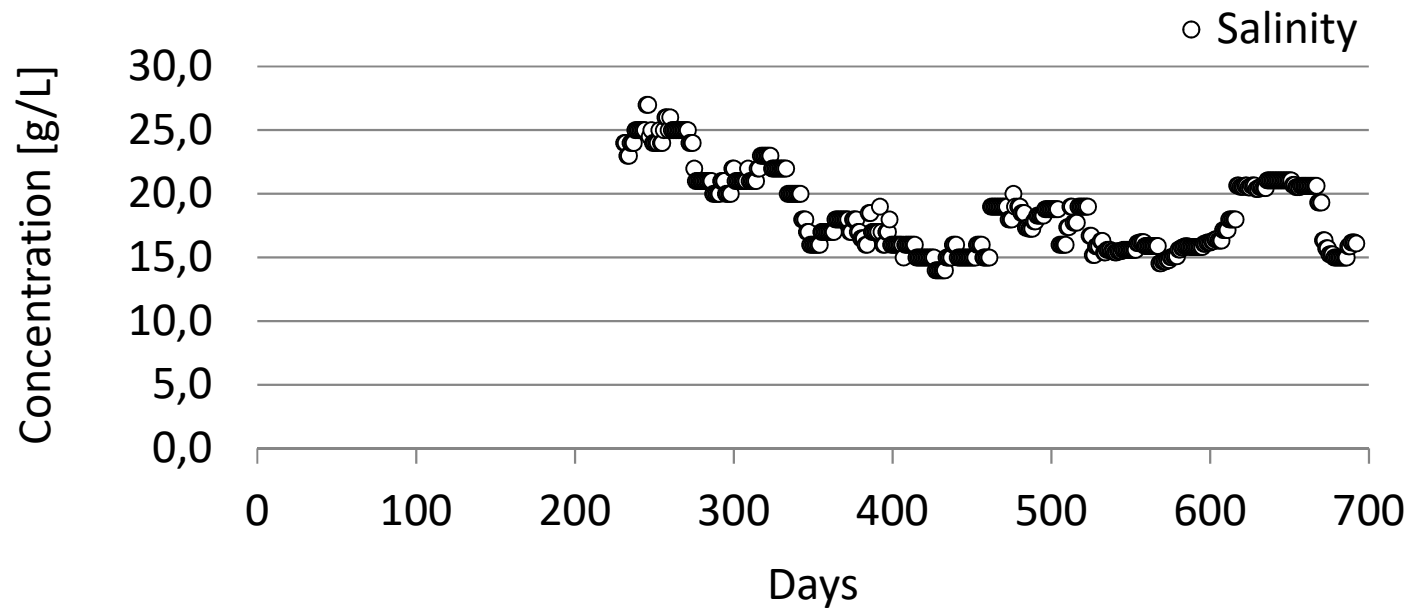
Water Quality Parameter: Temperature

Optimum range 26 – 30 °C (Wickins & Lee 2002)



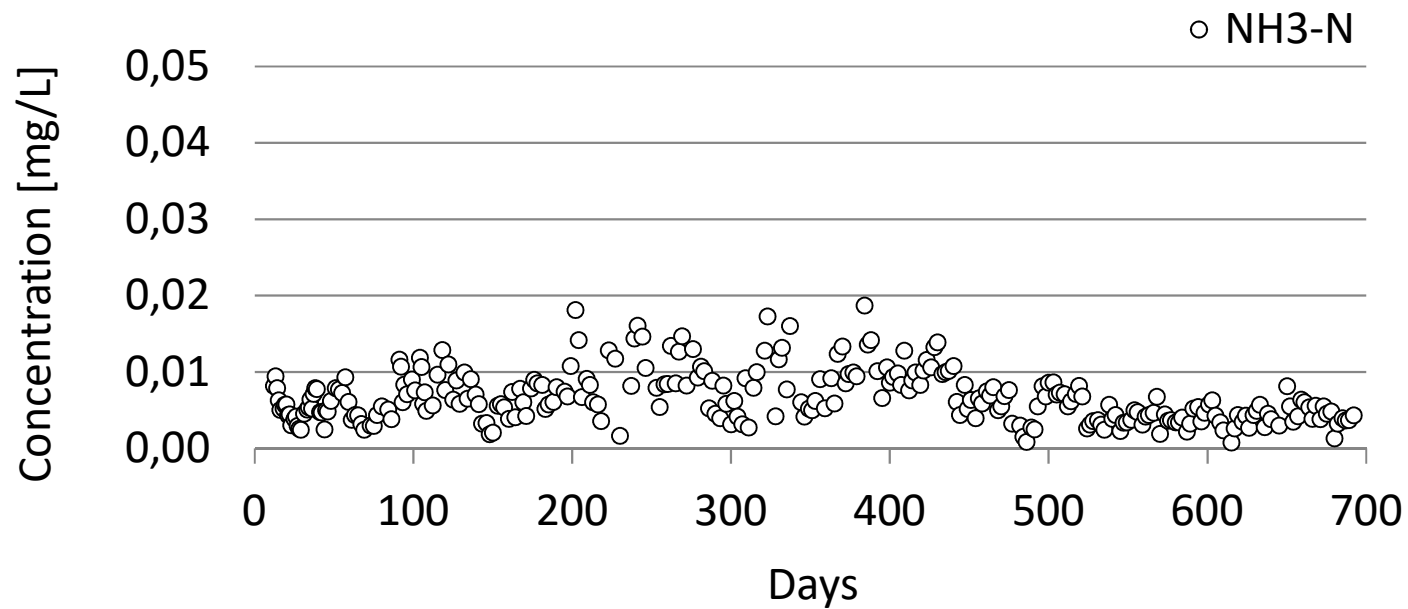
Water Quality Parameter: Salinity

Optimum range 15-25 g / L (Boyd 1989); 10-15 g / L (Briggs et al. 1991)



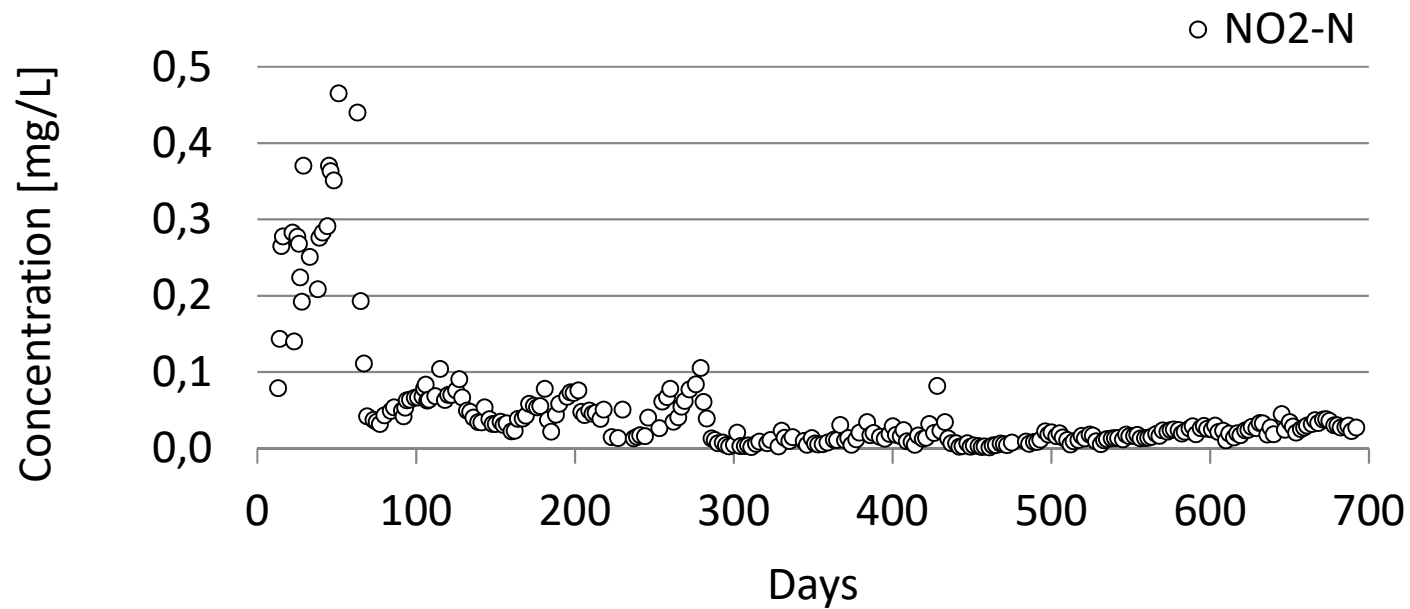
Water Quality Parameter: Ammonia nitrogen

Optimum range $<0,03$ mg N / L (Van Wyk et al. 1999)



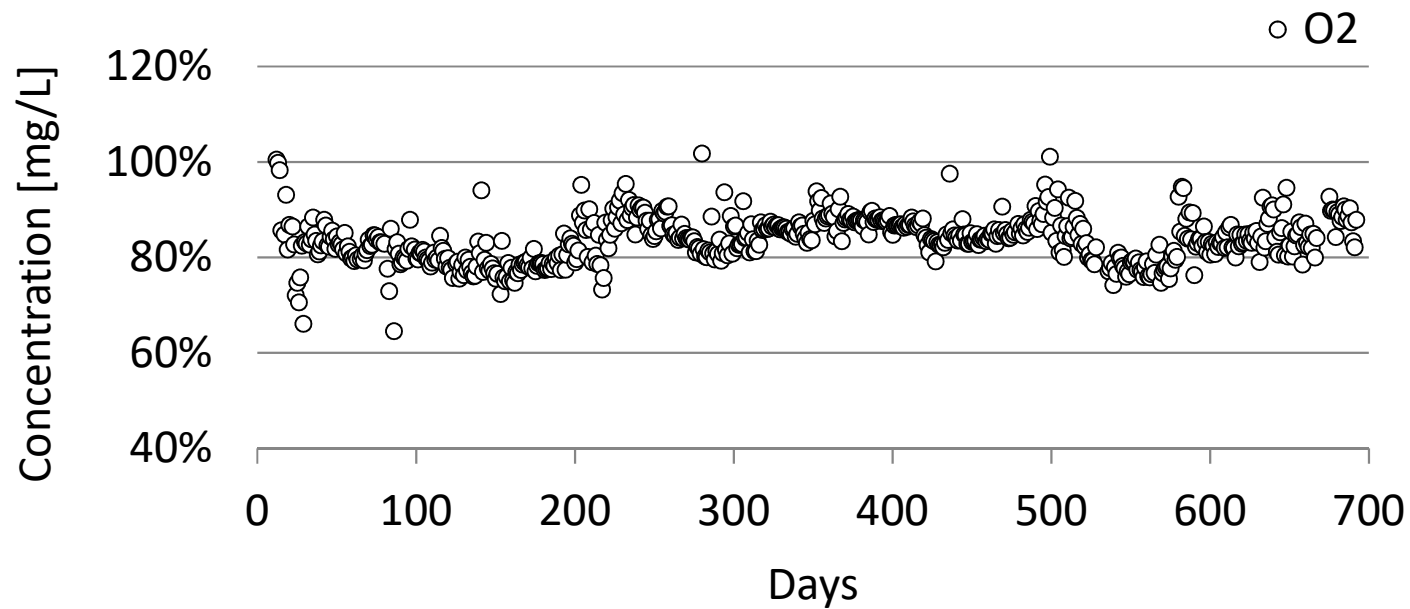
Water Quality Parameter: Nitrite nitrogen

Optimum range <0,3 mg N / L (Elovaara 2001)



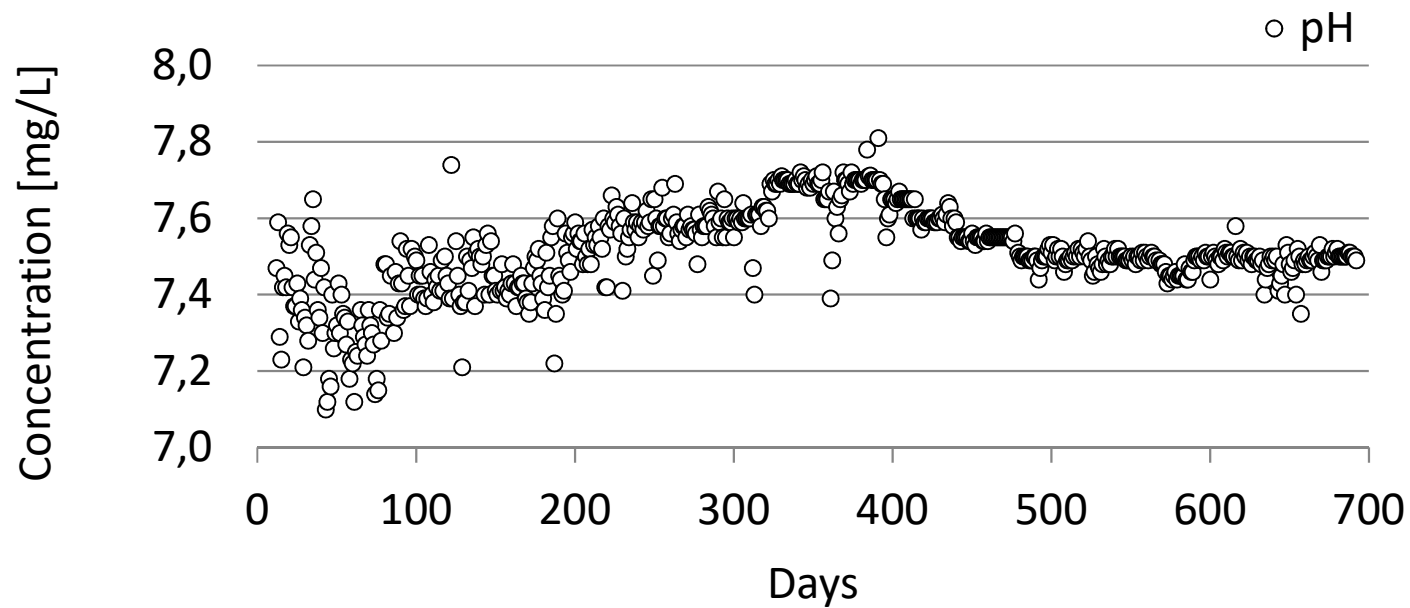
Water Quality Parameter: Oxygen

Optimum range >80 % (Van Wyk et al. 1999)



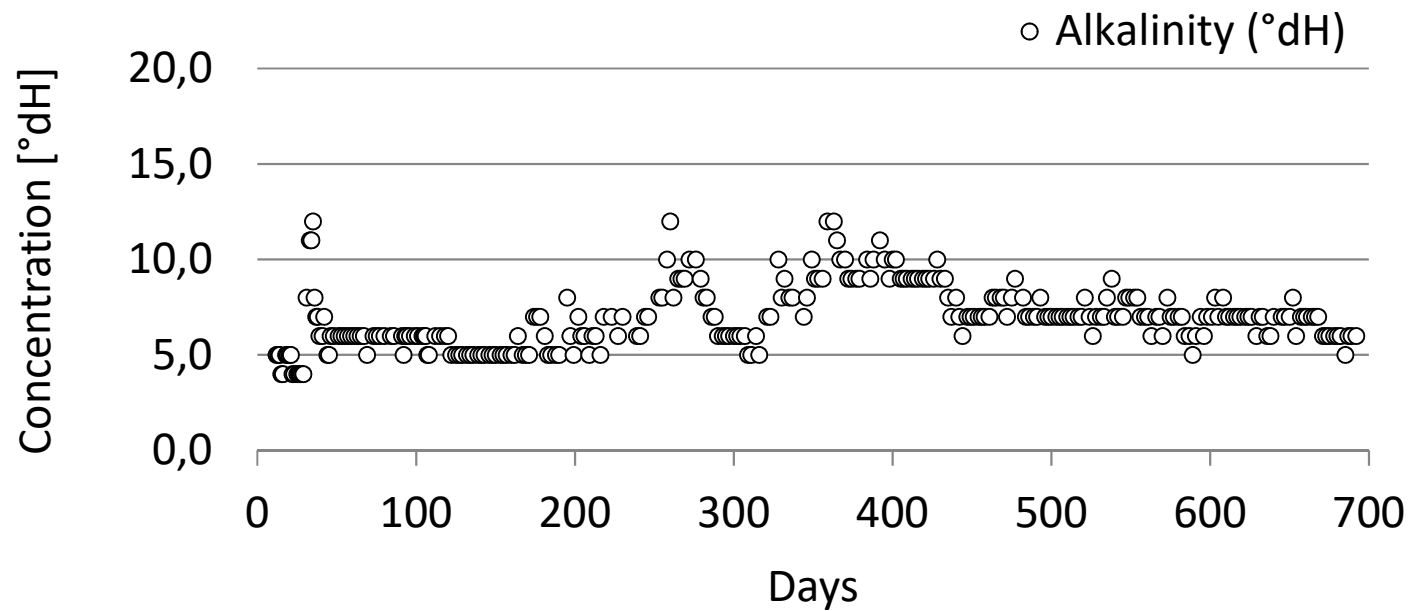
Water Quality Parameter: pH Value

Optimum range 7,0 – 8,3 (Elovaara 2001)



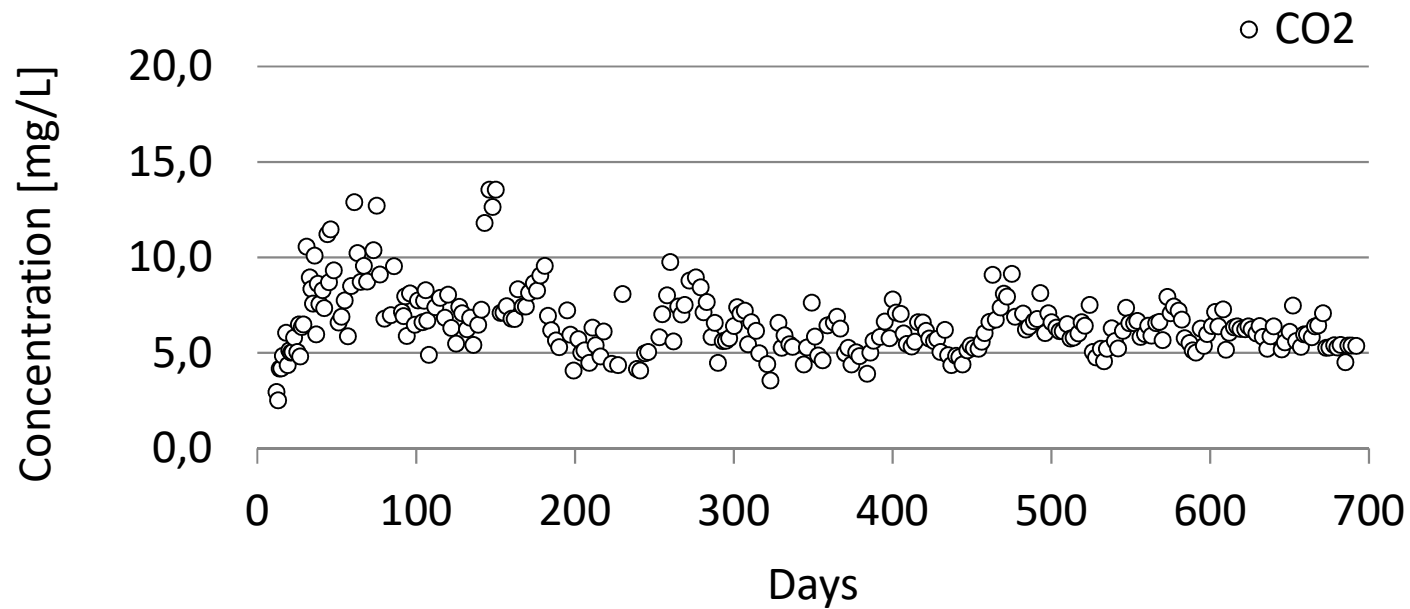
Water Quality Parameter: Alkalinity

Optimum range 5,6 - 8,4 (Ebeling et al. 2006)



Water Quality Parameter: Carbon dioxide

Optimum range <6,2 mg/L (Wasielesky et al. 2014)




Relation between CO₂, pH & Alkalinity (28°C, 15 g/L Salinity)

CO ₂ [mg/L]		Alkalinity [°dH]								
		4	5	6	7	8	9	10	11	12
pH-Value	7,00	9	12	14	16	19	21	23	26	28
	7,10	7	9	11	13	15	17	19	20	22
	7,20	6	7	9	10	12	13	15	16	18
	7,30	5	6	7	8	9	11	12	13	14
	7,40	4	5	6	7	7	8	9	10	11
	7,50	3	4	4	5	6	7	7	8	9
	7,60	2	3	4	4	5	5	6	6	7
	7,70	2	2	3	3	4	4	5	5	6
	7,80	1	2	2	3	3	3	4	4	4
	7,90	1	1	2	2	2	3	3	3	4
	8,00	1	1	1	2	2	2	2	3	3
	8,10	2	2	3	3	4	4	5	5	6
	8,20	1	2	2	3	3	3	4	4	4

 Optimum

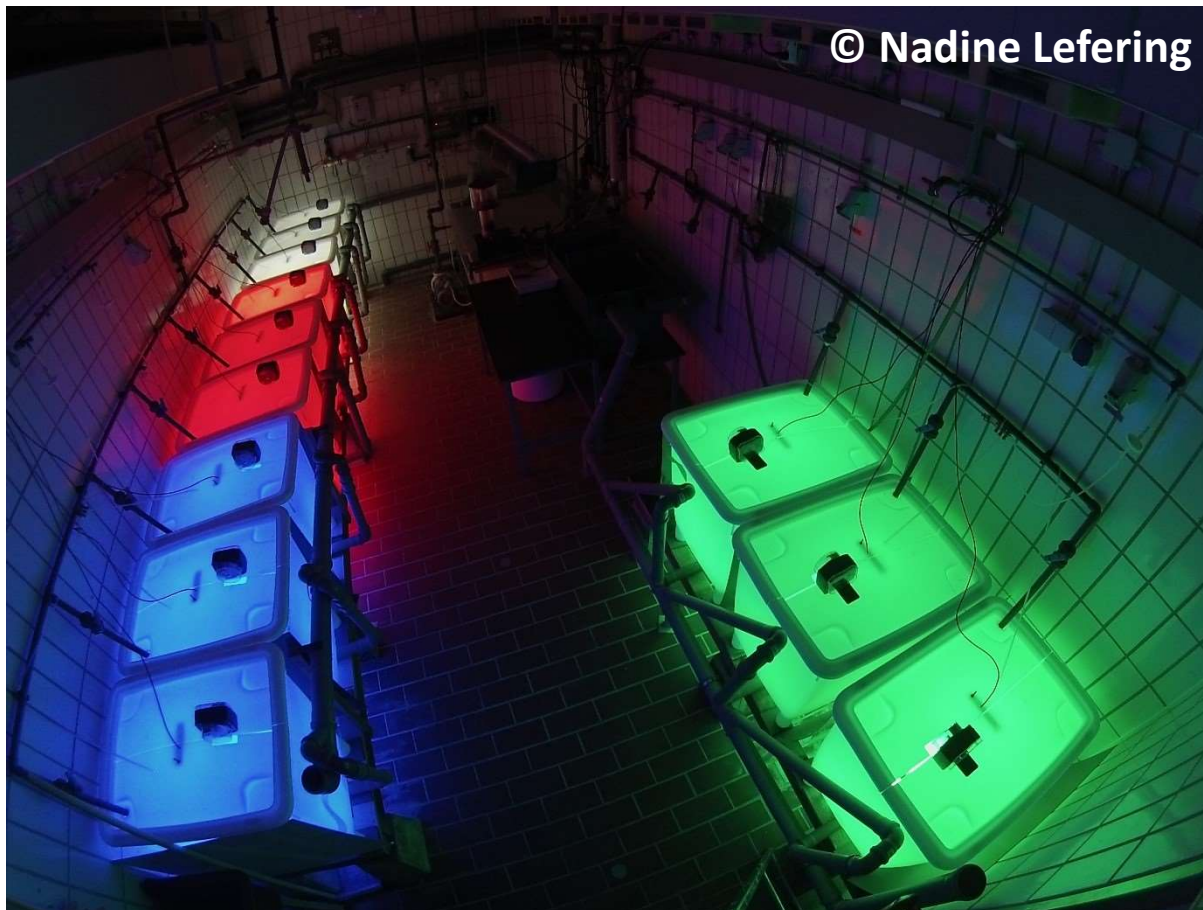
 high CO₂

 high pH

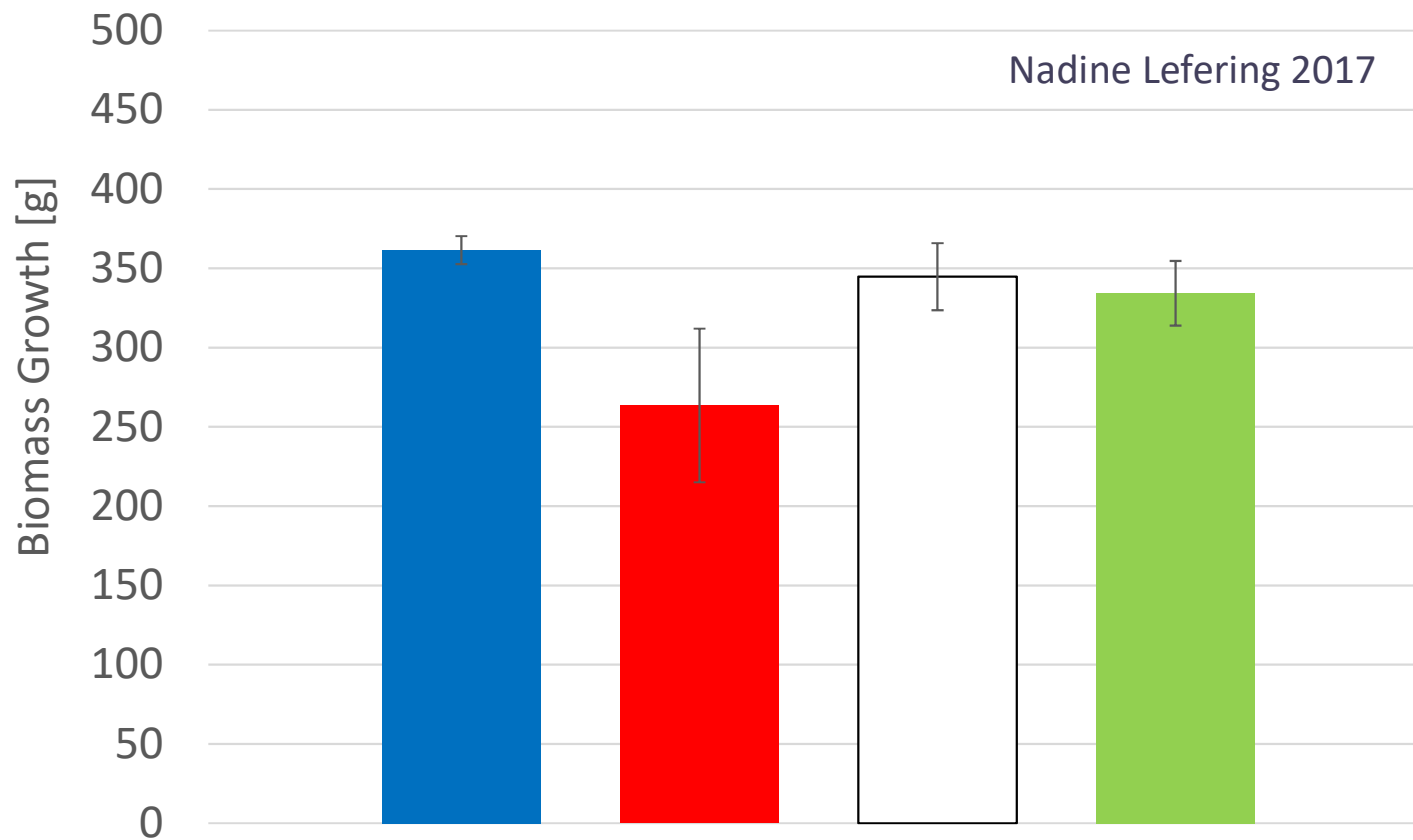
 low alkalinity

 high alkalinity

Influence of Light Wave Length on Shrimp Growth



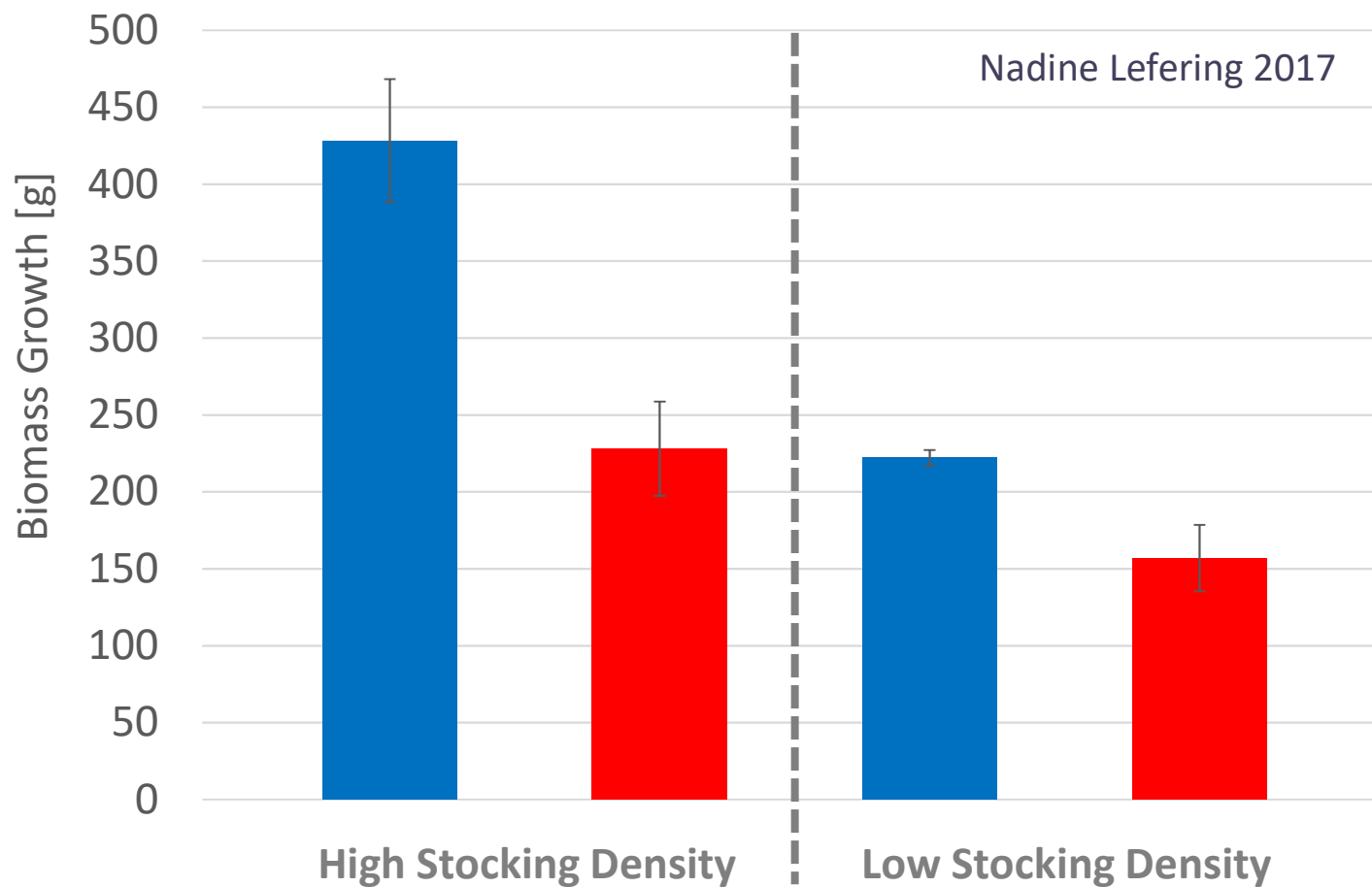
Influence of Light Wave Length on Shrimp Growth



Influence of Light Wave Length on Shrimp Growth



Influence of Light Wave Length on Shrimp Growth



Research & Development in Progress

- Influence of Carbon Dioxide on Shrimp Growth and Health (Geomar)
- Influence of Light Wave Length on Shrimp Growth (CAU)
- Grading Systems for living Shrimp
- Continous Removal of Shells and dead Shrimp
- Shrimp Harvest Systems

Thanks for your attention.

