BLUE ECONOMY AQUACULTURE FORUM

SAN GROUP

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Technology & Water Quality Management in RAS - SUMMARY

Dr Anthony J. Dinning, Abu Dhabi, 25th of May 2023

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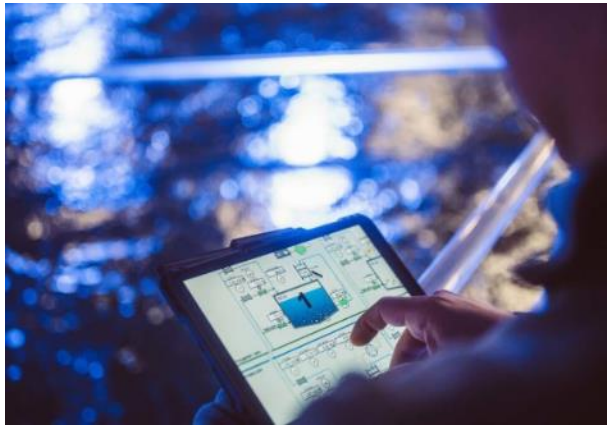
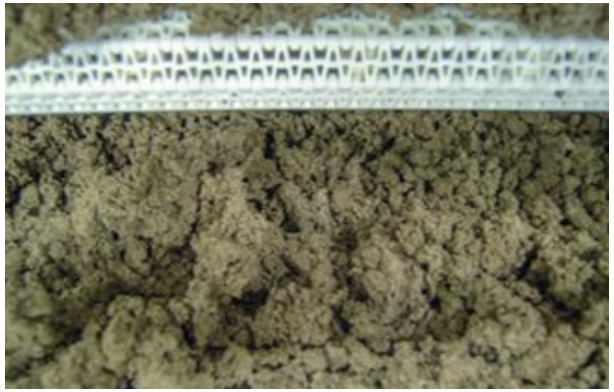
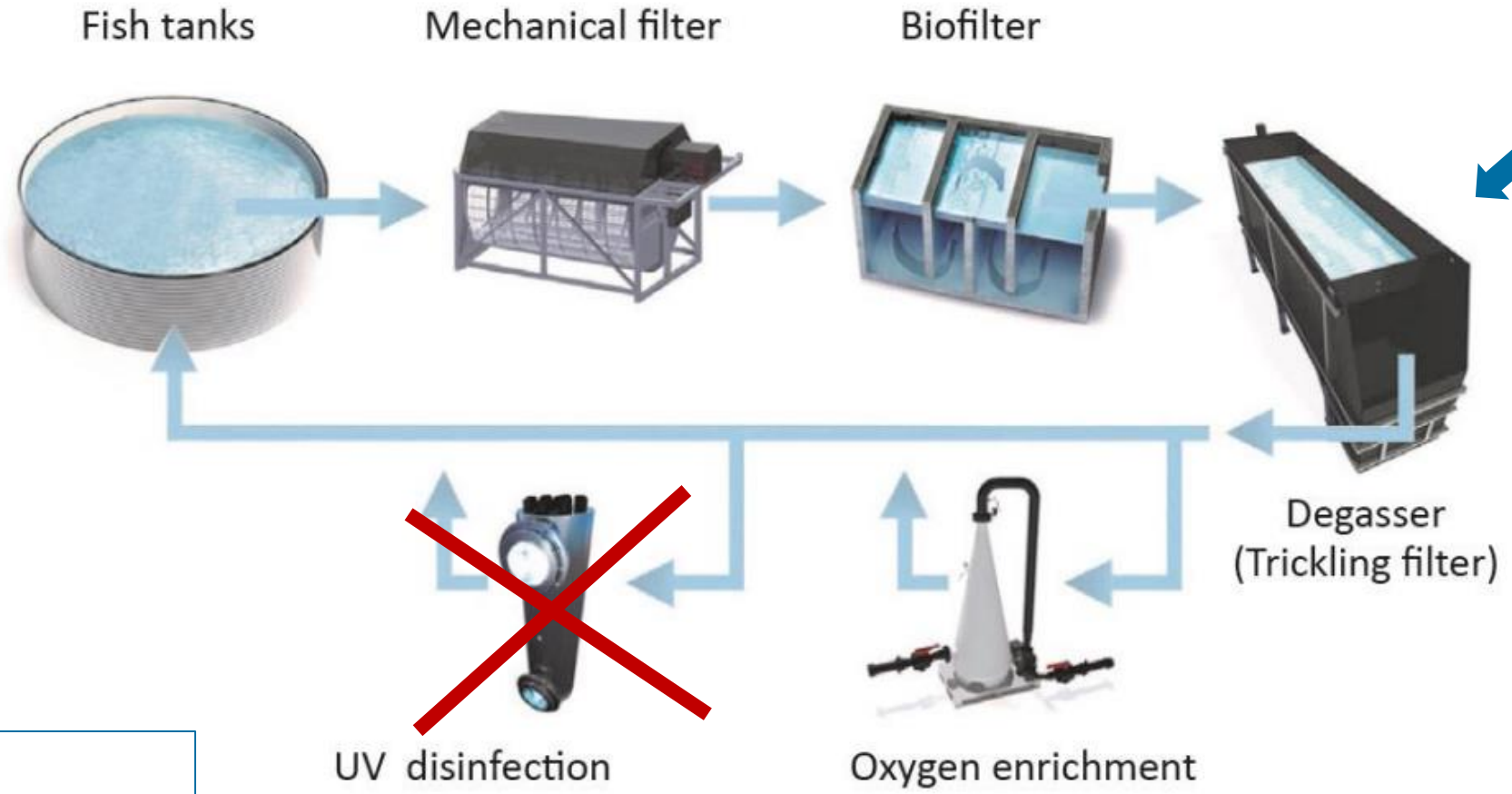
Agenda

- Introduction
- What is a RAS?
- RAS design & risks
- What does Sterner do that is different?
- Modified design
- Proof in numbers





Traditional RAS design – Supplier dependent



OZONE?
PROTEIN SKIMMING

The publicised losses

- H_2S was observed as the significant but silent killer in RAS
  - Poor design
  - Inefficiency in particle removal
  - Increased solids & sedimentation
  - Sedimentation in RAS

ATLANTIC SALMON | WELFARE | WATER QUALITY +7 more 12 July 2021, at 11:09am

Atlantic Sapphire reports another mass mortality

NIVA has produced a kit box to allow farmers to take a variety of samples in the event of fish mortality. Photo: NIVA

Researchers highlight hidden killers in RAS water

Norwegian firm retains faith in RAS as hydrogen sulphide confirmed as cause of cod deaths

Havlandet lost almost all of the fish at a pilot recirculating aquaculture system overnight in December, and has now confirmed the reasons behind the event

By Undercurrent News | Jan. 9, 2023 10:16 GMT

Egeland 2019 – (Gjensidige Insurance) 25% mortalities due to H_2S

Sulphide (H_2S), biofilm & TSS

Drum filter inlet

192ppm S^{2-}

Pump sump

> 1000ppm S^{2-}

Distribution header

204ppm S^{2-}

Bioblock CO_2 degasser

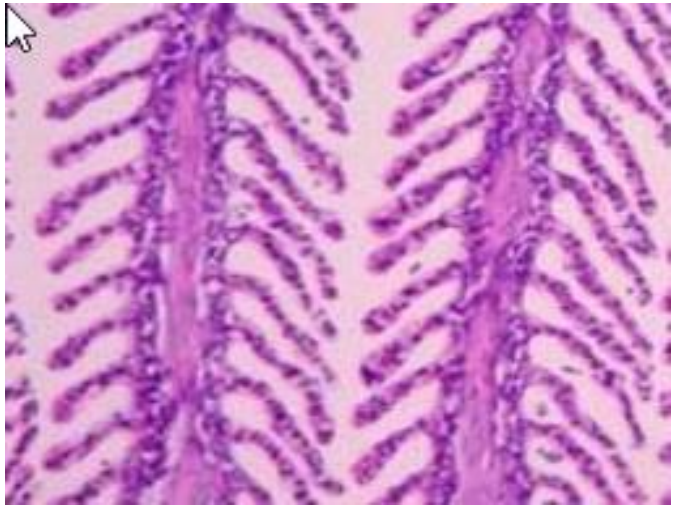
> 500 ppm S^{2-}

Fixed bed lid

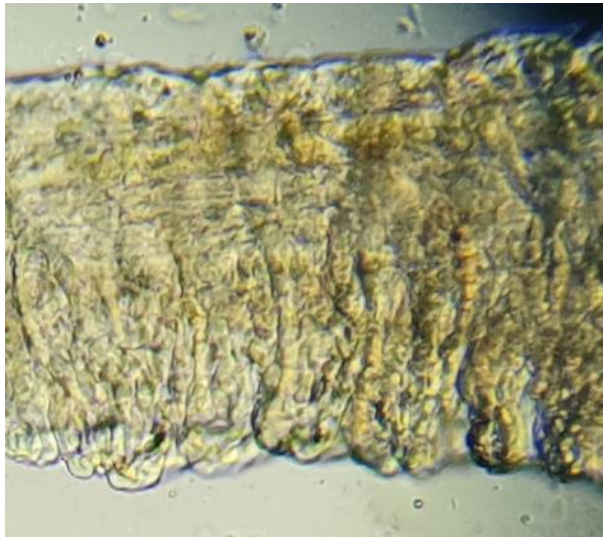
20 ppm S^{2-}

TSS and gill physiology

Low particle loading



Erroded lamellae – high particle loading



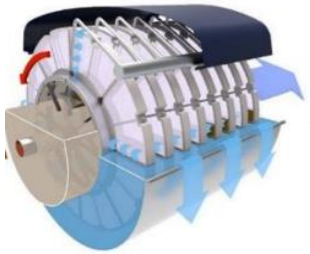
What makes Sterner different?

- Quick and consistent particle removal from the tank
- Minimal flow in design
- Low solids concentrations
- High efficacy MBBR → minimal biological sludge
- Positive control of RedOx (ozonation)
- Hygienic bio block design

→

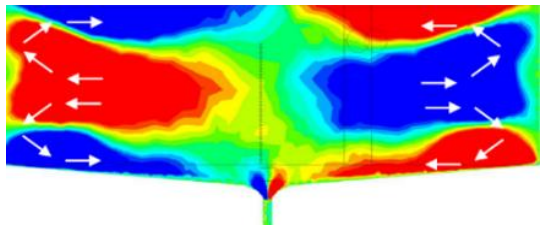
- Low solids loading
- Low ozone demand
- Almost zero H_2S risk
- Healthy stock

Sterner RAS design



Mechanical filtration

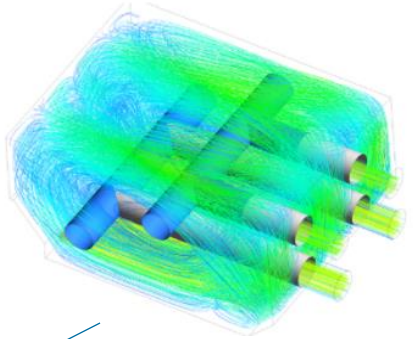
Ozonation



Fish Tanks

MINIMALISTIC PIPE RUNE

MINIMALISTIC PARTICLE SHEARING

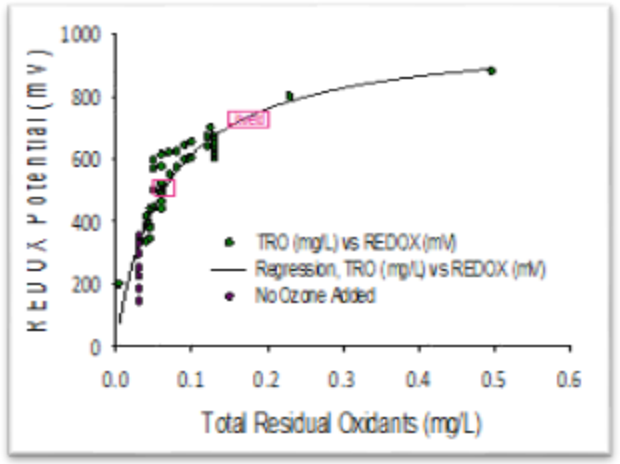


MBBR

CO_2 removal

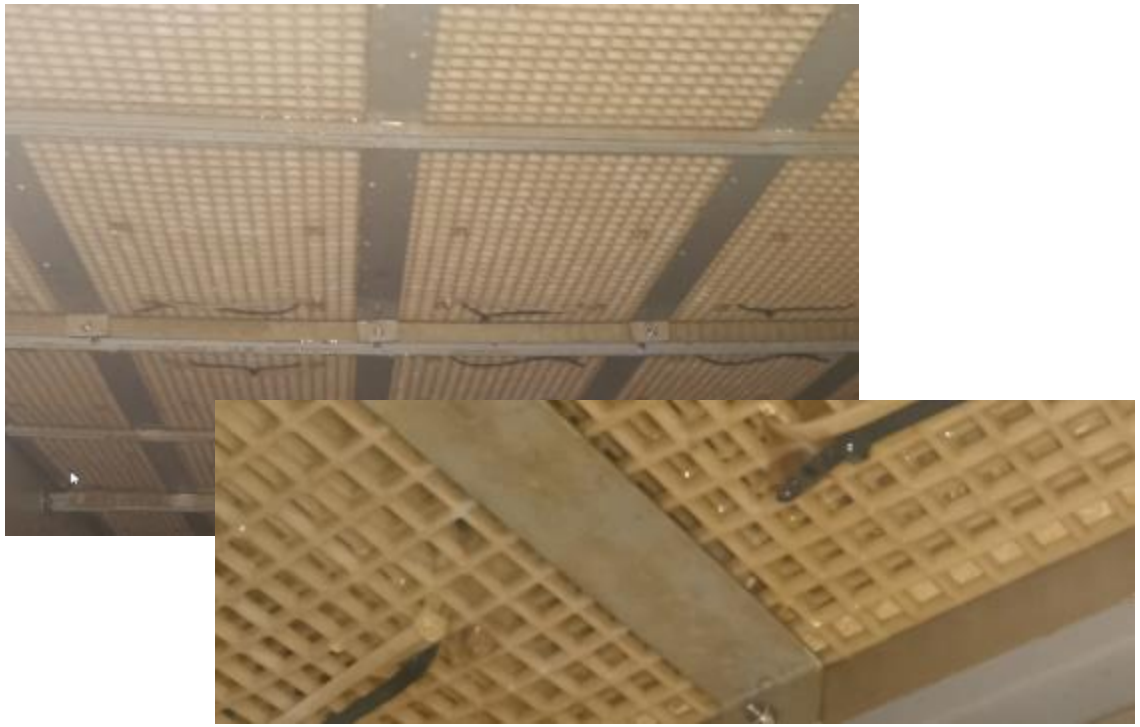
The numbers: Ozone dosing

- Rule of thumb 13 – 24g/kg feed (Timmons *et al*)
- **Sterner dose** = 7 to 15g/kg feed (0,65g O_3/h/kg feed)
- ORP (RedOx) +250 → +300mV



- Oxidation of proteins and fats → availability for MBBR
- Fines removal → micro flocculation
- Maintain control over unwanted bacteria (SRB, H_2S) due to increased ORP
- Result → improved filtration effect → reduced organic build up in the system

Low H_2S risk



Sterner Degasser system
- 6 months in use
- No biofouling
- Colouration from humic acid in the water

Bioblock type system
- 6 months in use
- Extreme biofouling
- Biofilm contains sulphide
- Risk to fish health
- Difficult to clean

Sterner Design → Low TSS

- Very little biofilm growth in the system
- CO_2-degaser is clean after 3 to 6 months
- Safer environment for the fish
- Less neutralisation of the ORP (with ozonation)
  - RedOx is easier to maintain at +250 til +300mV
  - No ozone neutralisation
  - Lower O_3 concentrations required for optimal operation

System	Sample	TSS (mg/l)	VSS (mg/l)
Eidesvik	Inlet water	0,9	0,7
	Side drain	7,3	6,6
	Clean water sludge collector	4,8	4,6
	US Drum filter	4,4	4,4
	DS Drum filter	4,8	4,6
	DS MBBR	4,6	4,5
Hallingfisk	**US Drum filter**	2,9	2,9
	Pump Sump	< 2	< 2

- TSS values < 5mg/l i RAS
- TSS LoD (NS 872) = 2 mg/l

- Samples from Eidesvik
  - Feeding = 650 – 715 kg / day
  - 40 – 400g Salmon smolt

- TSS = mg/l solids > 1,2 µm

Biomass survival & FCR

Feed Cost Ratio

0.75 FCRb (biological)

1Kg fish → 0.75Kg feed

Low Mortality

0.25% after 90 days

Industry average = 11 to 25%

*Bremnes Seashore egg → 600g, Atlantic salmon smolt

Finally

WATER QUALITY IS THE KEY

BETTER WATER QUALITY → LESS STRESS FOR THE FISH

IMPROVED GROWTH

IMPROVED ECONOMY

GIVE THE FISH THE BEST AND THEY WILL GIVE YOU THE BEST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Thank you!

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