RAS and associated technologies to improve tilapia juveniles production

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Fenacam 2018
Natal, November, 14th 2018

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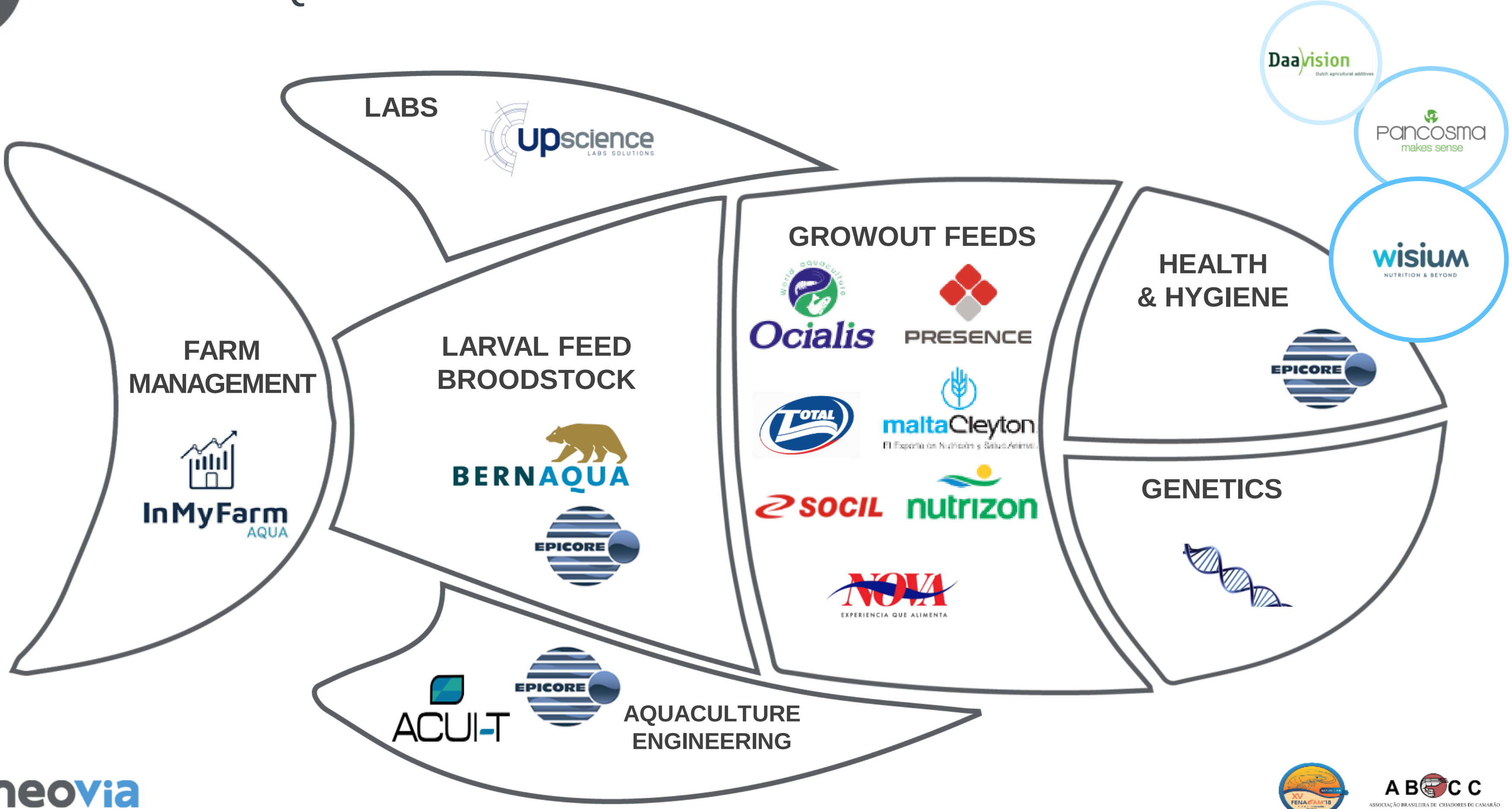
NEOVIA AQUACULTURE: THE HOLISTIC APPROACH



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ACUI-T EXPERTISE ON AQUACULTURE ENGINEERING

- Recirculating systems (RAS)
- Ozone treatment
- Biofiltration
- Oxygen production and transfer
- CO2 degassing
- Mechanical filtration
- Sludge concentration
- Automatic Feeding
- Pumps/pumping stations








State of the art

Traditional structures:

Happas in ponds

Earth ponds

Low density

Huge dependency to climate

Brasil

Thaïland

Indonesia

Vietnam

State of the art

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Traditional cycle:

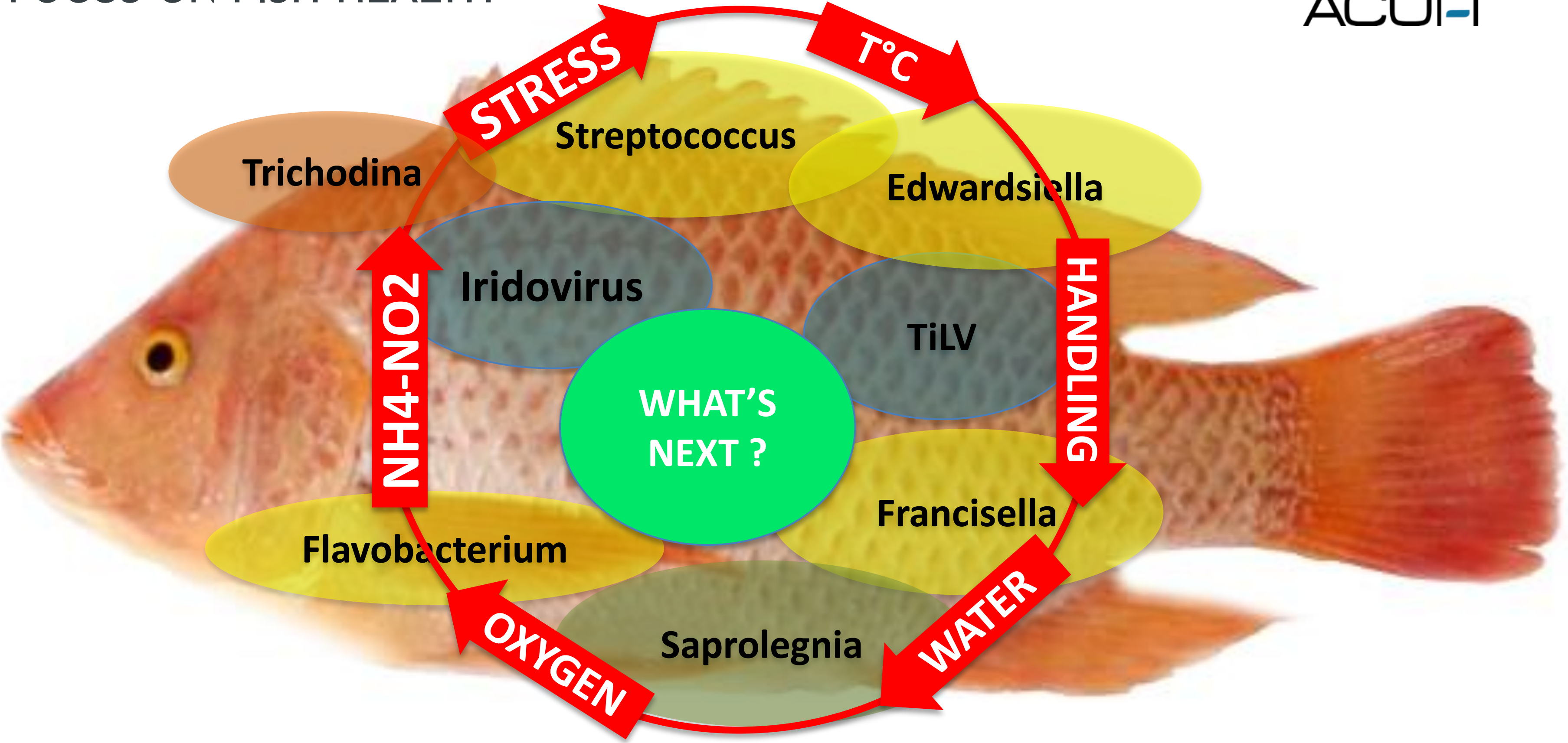
From first feeding to size 1-3 grams

- ❑ Same pond
- ❑ Low density
- ❑ Feeding control is difficult
- ❑ No oxygen control
- ❑ High disease risk
- ❑ No water treatment
- ❑ Labour intensive

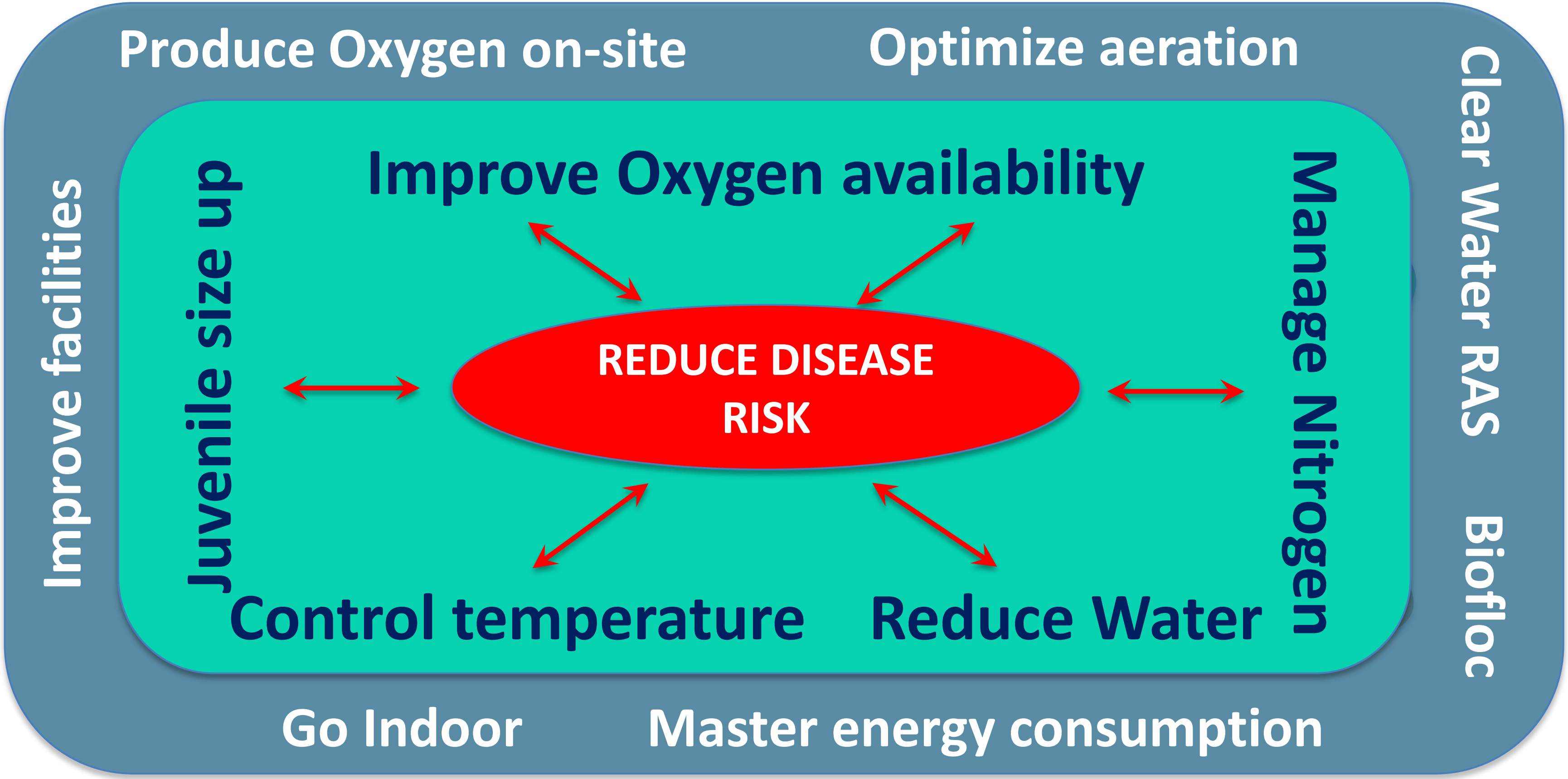
Trichodina
Dactylogyrus
Streptococcus
Francisella
Flavobacterium
Edwardsiella
Nocardia
Iridovirus
TiLV
Saprolegnia
Branchiomyces
Others

Pathobiome

FOCUS ON FISH HEALTH



IMPROVE CONDITIONS TO IMPROVE PRODUCTIVITY

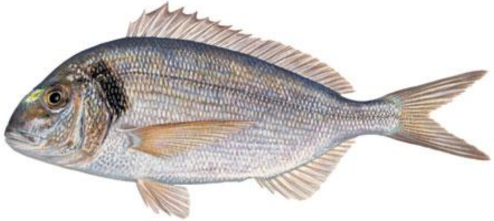


LAND BASED PREGROWING BEFORE SEEDING PONDS AND CAGES

200g ← > 70 g

Larger size

25g ← > 15 g

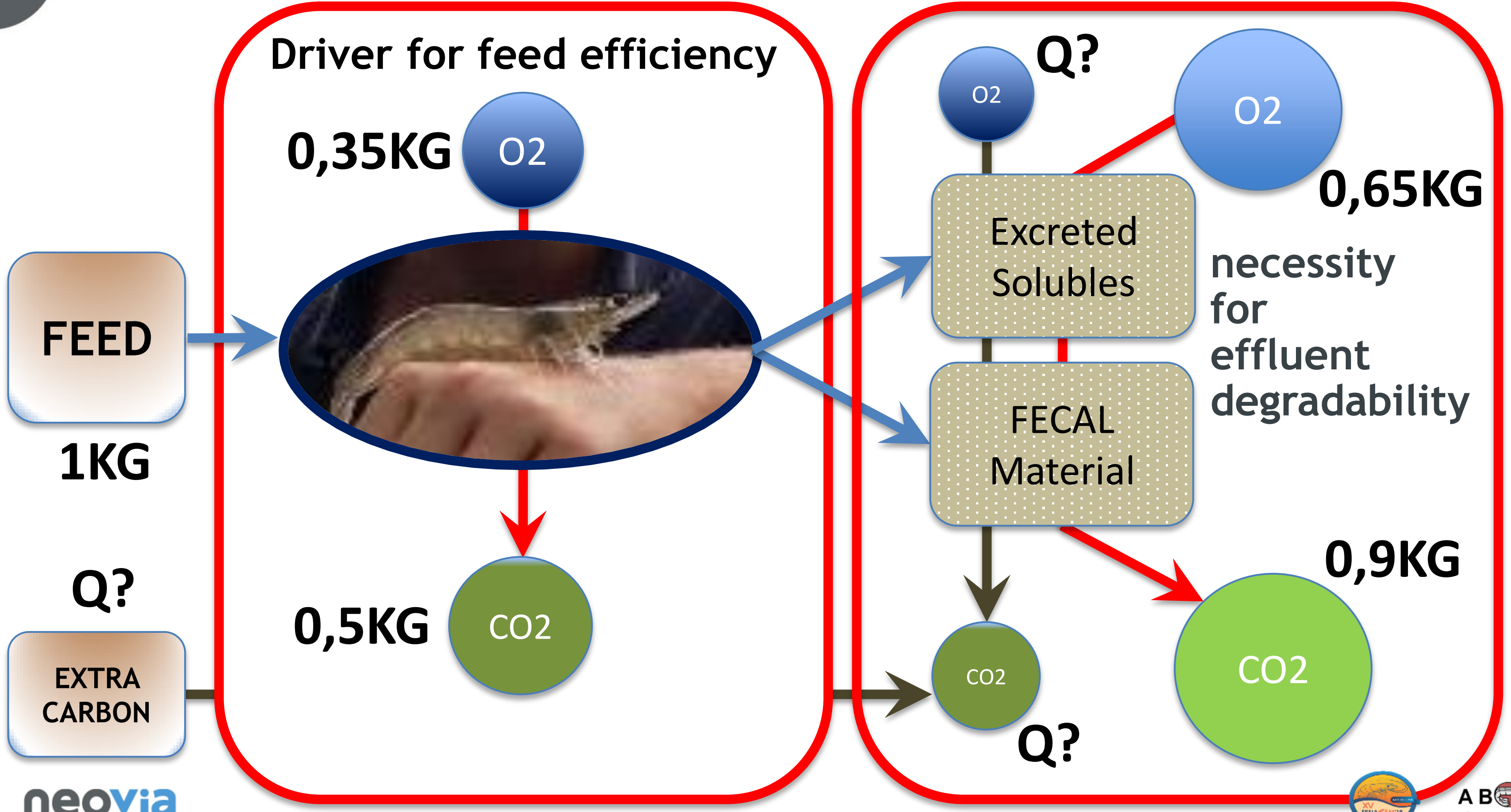


30g ← > 7 g

Land-based tanks

20g ← > 1 g

OXYGEN DEMAND:



AERATION IN TANKS AND PONDS

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0,2- 0,56

USD/Kg CROP

0,5 - 1,4

Cent USD per fish @25g

USD/KWH: 0,08

MIXING

Coarse bubbles

OXYGEN TRANSFER

TWO FUNCTIONS

ENERGY CONSUMPTION

RANGE 2,5-7 KWh/Kg CROP

GOAL: < 3KWh/Kg CROP

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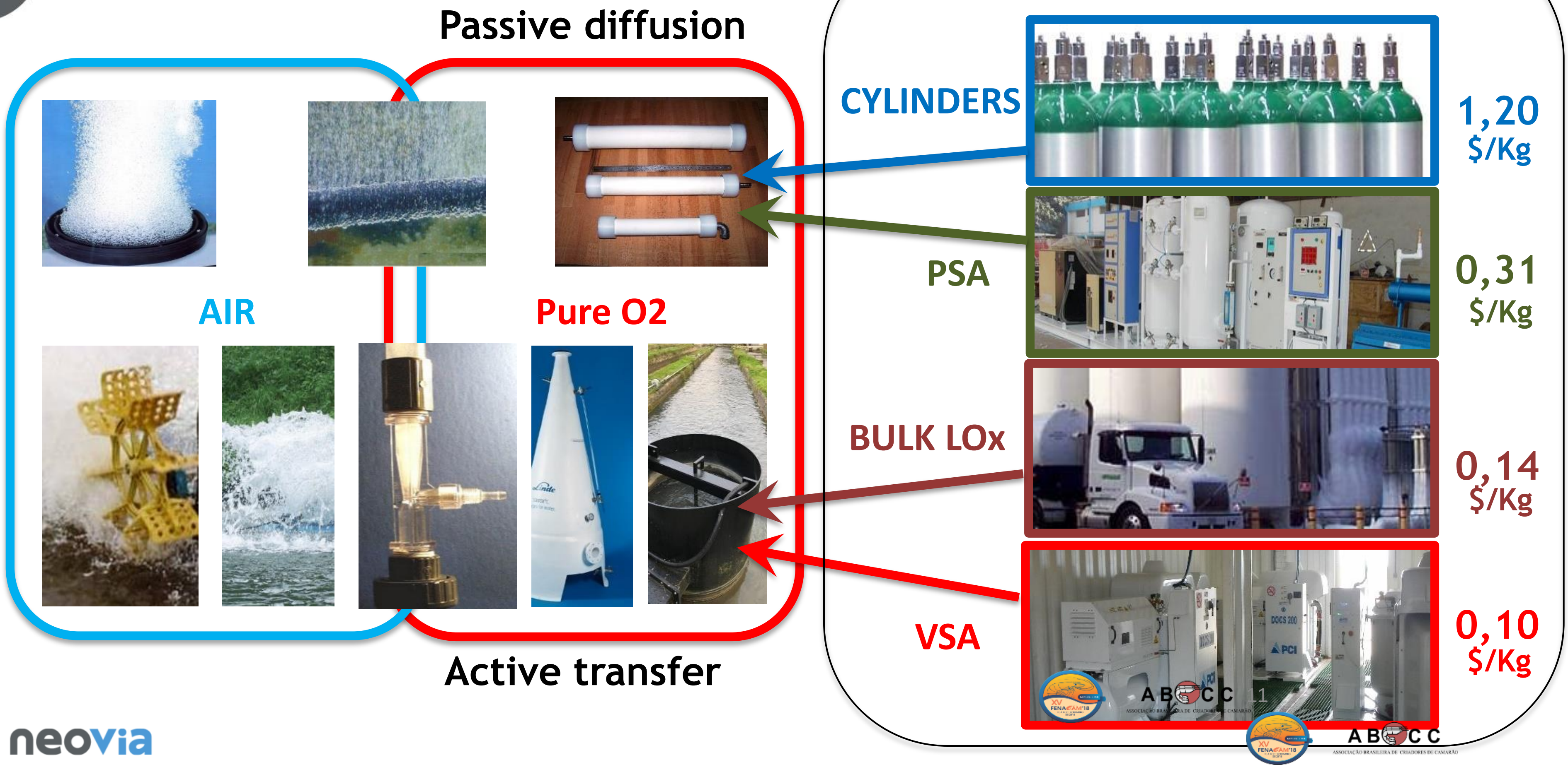
OXYGEN SUPPLY:



FOCUS ON OXYGEN: The effect on production cost

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Evaluation of Oxygen cost per Kg **additionnal** crop

PRODUCTION SYSTEM	OPEN FLOW		RAS		BFT	
Diffusion System	ACTIVE LHM		ACTIVE LHM		PASSIVE/CERAMICS	
Dissolution rate	85%		85%		40%	
Kg O2 /Kg feed	**0,4**		**0,6**		**1,3**	
FCR	VSA	Bulk Lox	VSA	Bulk Lox	VSA	Bulk Lox
0,8	0,06	0,08	0,09	0,11	0,11	0,15
0,9	0,07	0,09	0,10	0,12	0,12	0,16
1	0,08	0,10	0,11	0,13	0,13	0,18
1,1	0,09	0,10	0,12	0,15	0,14	0,20
1,2	0,09	0,11	0,13	0,16	0,16	0,22
1,4	0,11	0,13	0,15	0,19	0,18	0,25
1,8	0,14	0,17	0,20	0,24	0,23	0,32

Price Lox:	0,14	USD/Kg		Depreciation equipment for diffusion	0,005	USD/Kg fish
Price VSA:	0,1	USD/Kg		Energy expenditure for diffusion	0,08	USD/Kg O2

0,1 USD/Kg Crop

Impact: 0,3 cent USD per fish @25g

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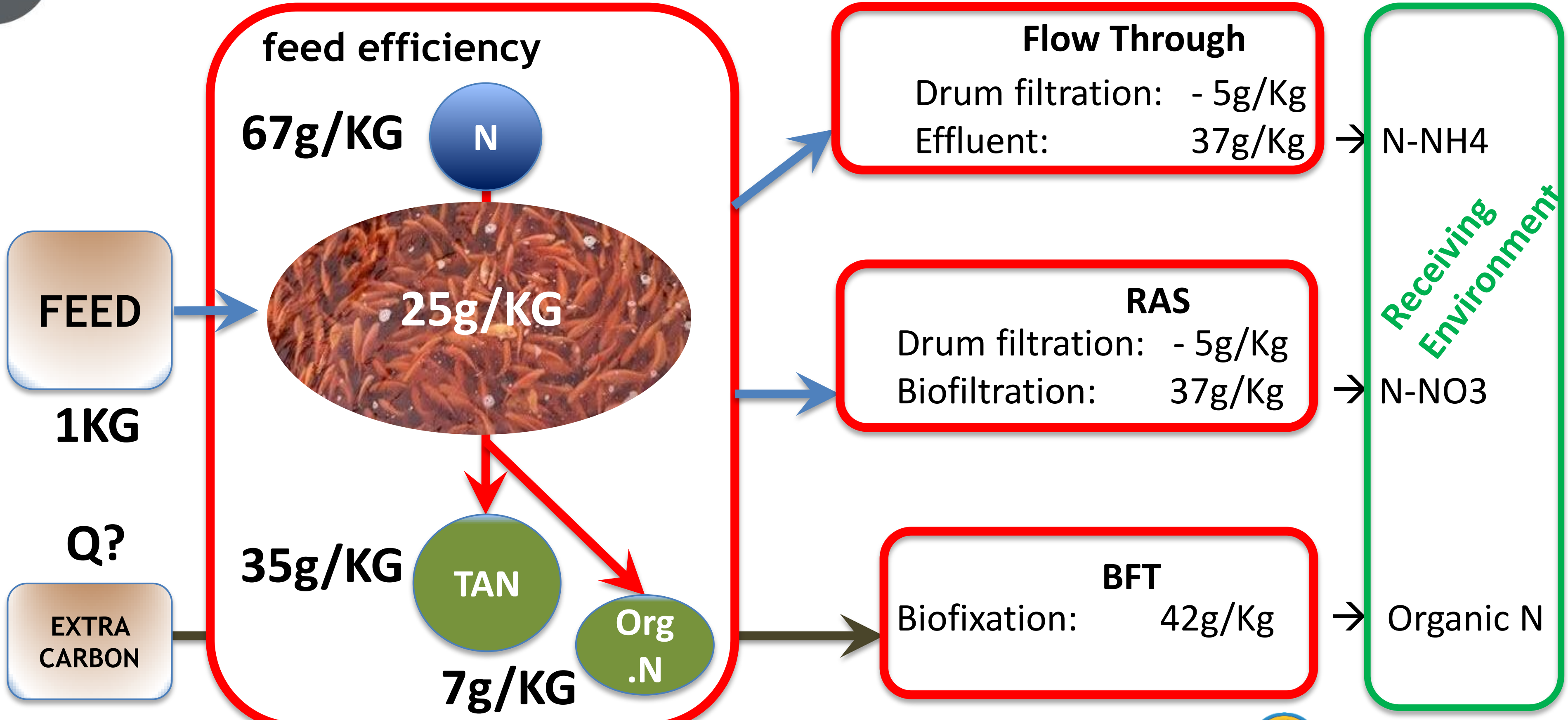
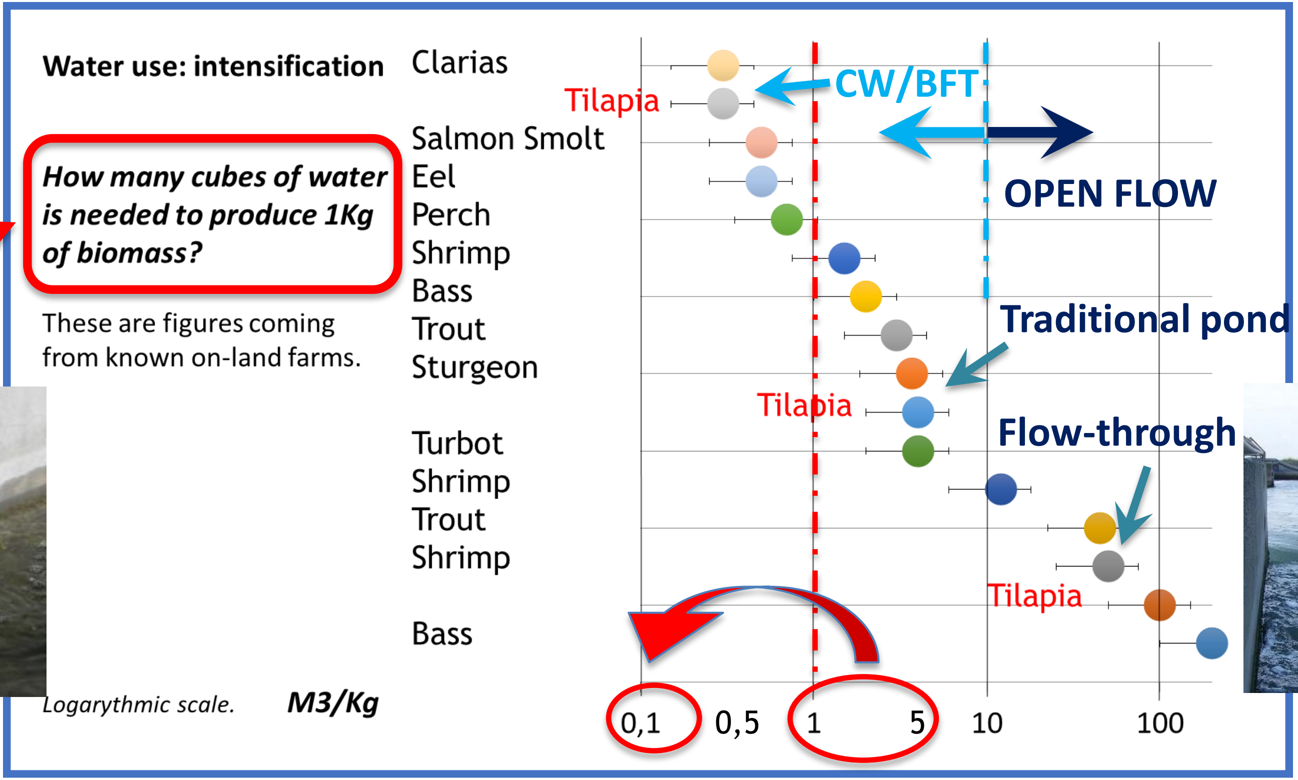
FOCUS ON NITROGEN:



FOCUS ON WATER: a key parameter to progress



CW = Clear Water RAS
BFT = Biofloc Technology

INDOOR *versus* OUTDOOR

- Footprint makes the cost of indoor structures
- Number of cycles per year provides for pay back
- Temperature control is easier when protected from cold air, wind, rain…
- Light control: below 2000 Lx to reduce phytoplankton growth.
- Heavy rain falls disturbs fish and workers.
- Indoor reduces contamination risks and offers means of control

More intensification makes easier to control parameters

RECYCLING TECHNOLOGIES: Biofloc versus Clear Water RAS

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What are the costs for control?

BFT versus CW-RAS		BFT Ponds	BFT Tanks *+ settler*	CW-RAS
Cycles per year		4	6	10
Tank volume for 1M per year @ 25g	m3	2000	500	80
Brut Foot print for 1M per year @25g	m^2	3000	850	176
Water requirement	m3/Kg	0,35	0,2	1
Max Biomass	Kg/m3	3	9	30
Temperature control		No	Yes	Yes
Light control		No	Yes	Yes
Nitrogen control		Heterotrophic.	Heterotrophic	Autotrophic
Organic carbon addition		Yes	Yes	No
Alcalinity control NaHCO3		Yes	Yes	Yes
Aeration		Yes	Yes	Yes (biofiltre)
Pure Oxygen		No	No (Yes)	Yes
Automatic feeding		No	Yes	Yes
Labour intensive		+++	++	+

FOCUS ON WATER MANAGEMENT

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Is energy consumption differentiating models ?

For a production cycle from 1g to 25g		BFT Ponds	BFT Tanks *+ settler*	CW-RAS
Initial density	*Kg/m3*	0,13	0,40	1,33
Final Density	*Kg/m3*	3,0	9,0	30,0
Initial feeding rate	*%*	7,0%	7,0%	7,0%
Final Feeding rate	*%*	4,5%	4,5%	4,5%
Initial feed/m3/day	*Kg/m3*	0,01	0,03	0,09
Final Feed/m3/day	*Kg/m3*	0,13	0,41	1,35
FCR	*Kg/m3/day*	1,4	1,4	1,1
Net production	*Kg/m3/cycle*	2,9	8,6	28,7
Net production average	*Kg/m3/day*	0,05	0,14	0,48
Net production maximum	*Kg/m3/day*	0,10	0,29	1,2
Aeration	*watt/m3 tank*	10	30	
Water process	*watt/m3 tank*	0	5	100
Energy cost per Kg juvenile	*KWh/Kg*	5,0	5,9	5,0
@ 0,08USD/KWh	*USD/Kg*	0,40	0,47	0,40
Energy Cost per piece @25g	*USD cts/juvenile*	1,0	1,2	1,0

CW-RAS COMPONENTS

- DRUM FILTRATION for particulate matter extraction
- MOVING BED BIOFILTRE for nitrification, COD/BOD reduction and CO2 removal
- OPTIONAL CO2 DEGASSING for intermittent additional treatment
- LOW HEAD PROPELLER PUMPS
- OXYGEN VSA PRODUCTION ON SITE
- LOW HEAD MIXING SYSTEMS FOR O2
- pH CONTROL
- UV lamps – Channel type- to control Bacterial load

HIGH FLOWS

LOW HEAD

TILAPIA RAS : JUVENILES PRODUCTION 10M/year

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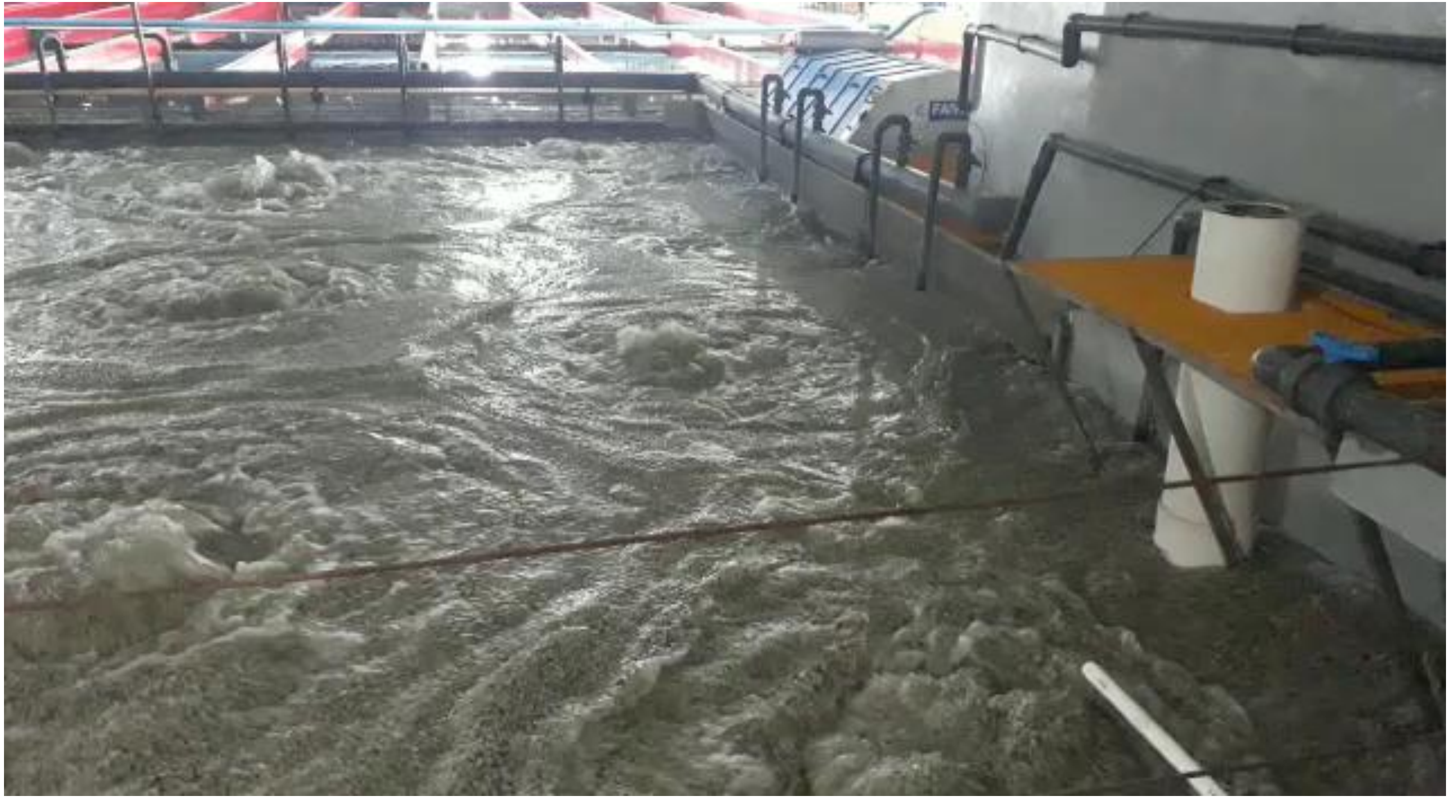


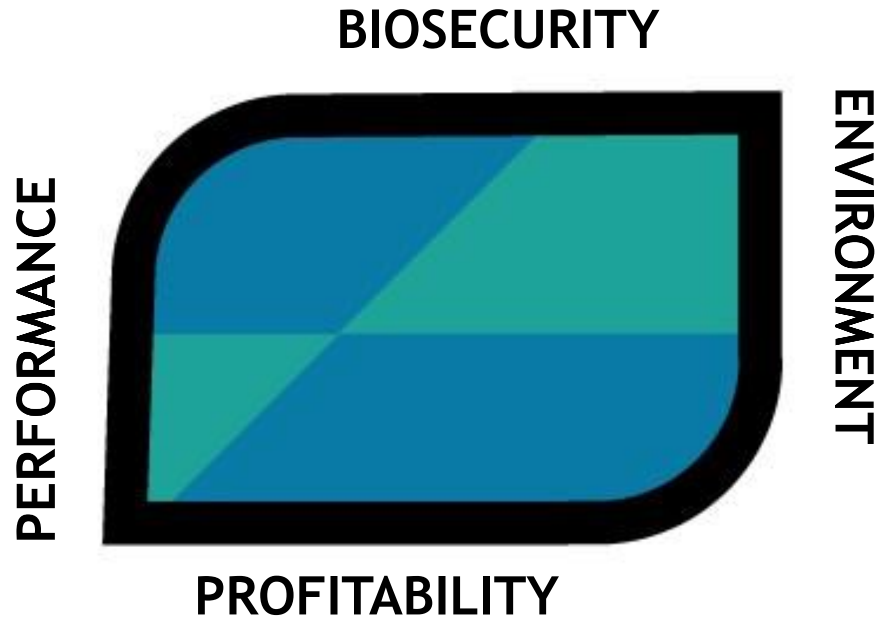
TAKE HOME MESSAGE

Traditional tilapia cultivation methods are evolving for better resilience to disease and environmental variability

Intensification: new processes emerge

- ❑ Increase juvenile size before seeding ponds and cages
- ❑ Improve aeration and get access to Oxygen
- ❑ Reduce water quantity to improve control
- ❑ Reduce footprint and increase control using Indoor possibilities
- ❑ Intensifying using BFT or RAS doesn't increase energy input per unit produced
- ❑ RAS Components are available for simple design and operation

AQUACULTURE IS OUR END



ENGINEERING IS JUST A MEAN

Thanks to NEOVIA AQUA-COMMUNITY for providing illustrations

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