

# Introduction and objectives

Since the 60's, the fisheries capture production has reached its limit. All the increase in the global fish production from then has been and has to be due to aquaculture. However this increase can not be at any cost, it has to be sustainable at all levels.

The aim of this review is to present and show the biofloc technology (BFT) as a sustainable aquaculture system.

# The BIOFLOC

The BFT is an alternative method of waste management inside the pond. The system relies on heterotrophic bacteria to transform the waste into feed for the harvested organisms with minimal water exchange.

A biofloc is a macroaggregate of heterotrophic bacteria, algae, diatomea, protozoa and other organic matter.

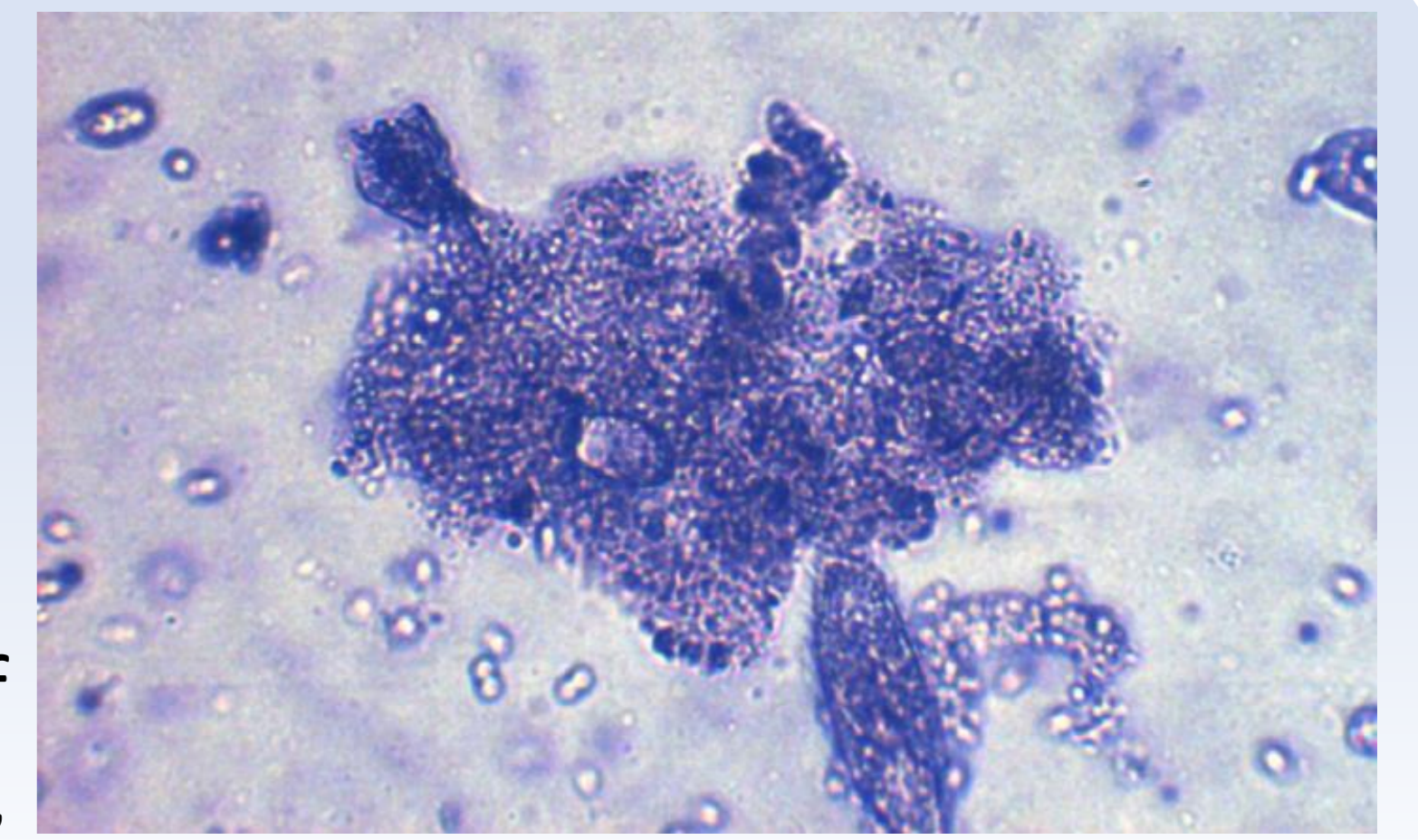


Fig 1. Biofloc (Hargreaves 2013)

## Main purposes of the BFT

## Reutilization

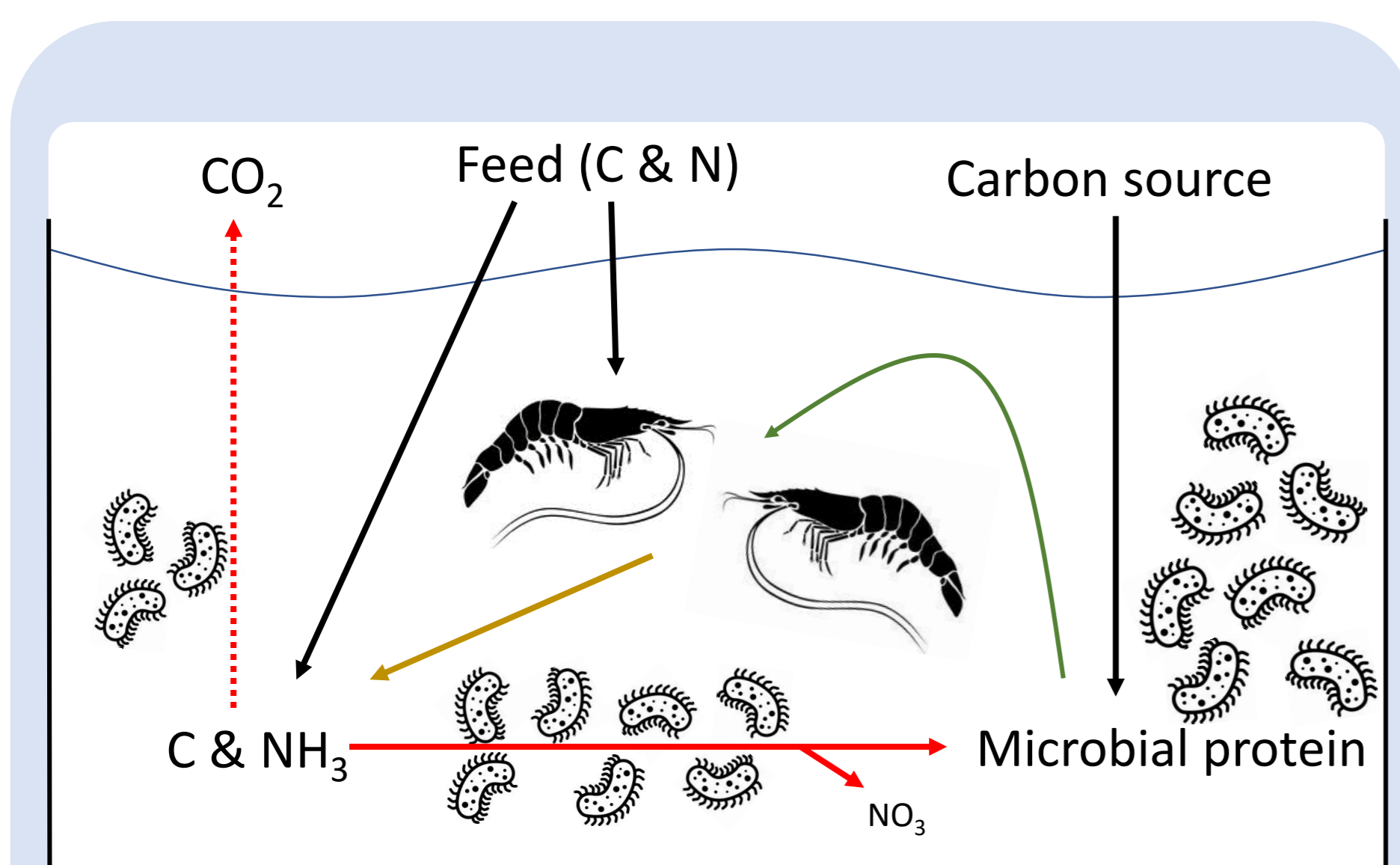
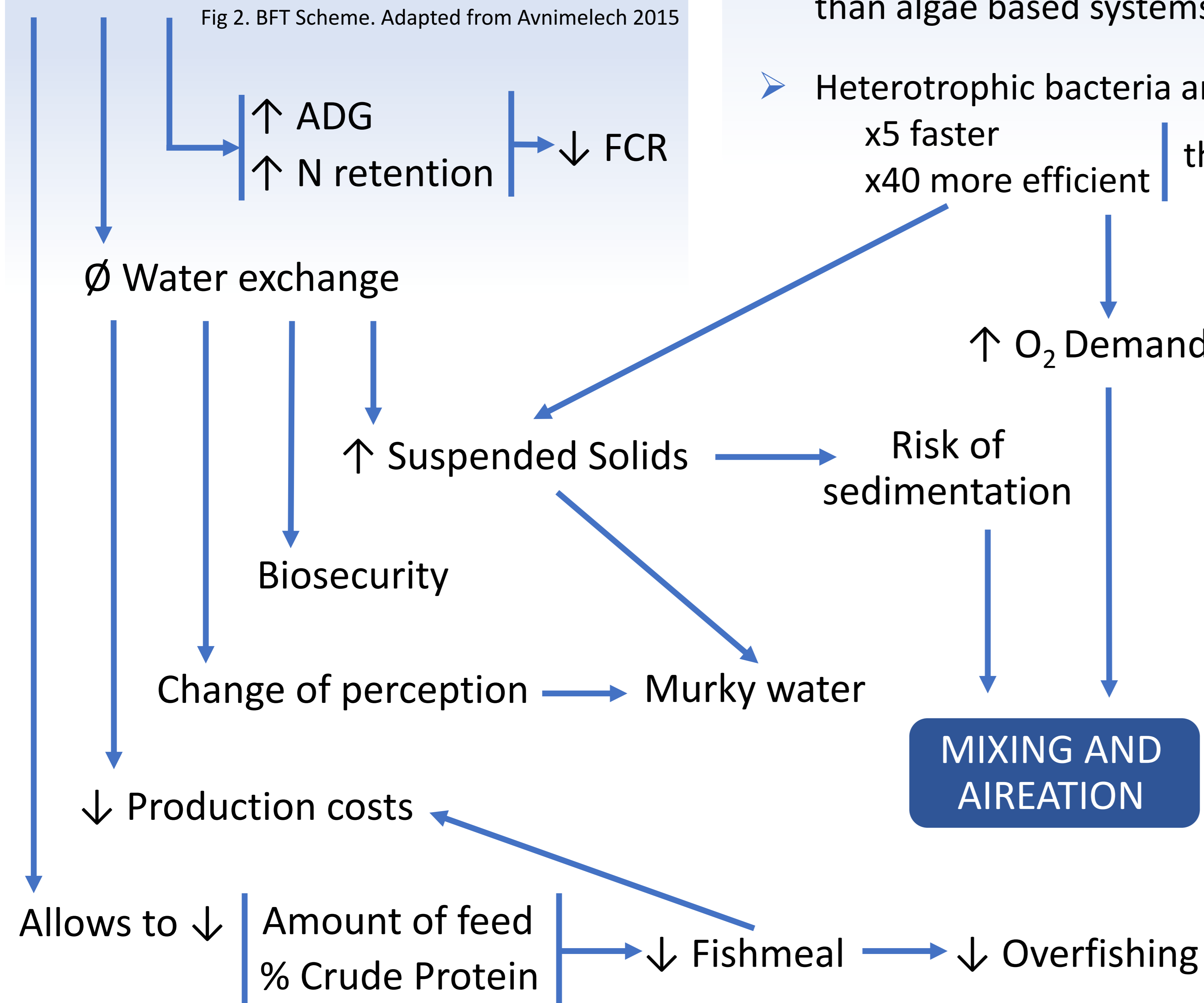


Fig 2. BFT Scheme. Adapted from Avnimelech 2015



## Nitrogen Removal

Table 1. Comparison of production and consumption of O<sub>2</sub>, CO<sub>2</sub>, alkalinity and biomass for each NH<sub>3</sub> gram transformed. Adapted from Ebeling et al. 2006

For each NH <sub>3</sub> gram transformed to:	O <sub>2</sub>	CO <sub>2</sub>	Alkalinity (carbonate)	Biomass
Algal biomass	15,4g	- 18,07g	/	15,85g
Nitrate	- 4,18g	5,85g	- 7,5g	0,2g <sup>1</sup>
Microbial biomass	- 4,71g	9,65g	- 3,57g	8,07g <sup>2</sup>

- Bacterial based systems are much more stable than algae based systems
- Heterotrophic bacteria are
  - x5 faster
  - x40 more efficientthan autotrophic bacteria

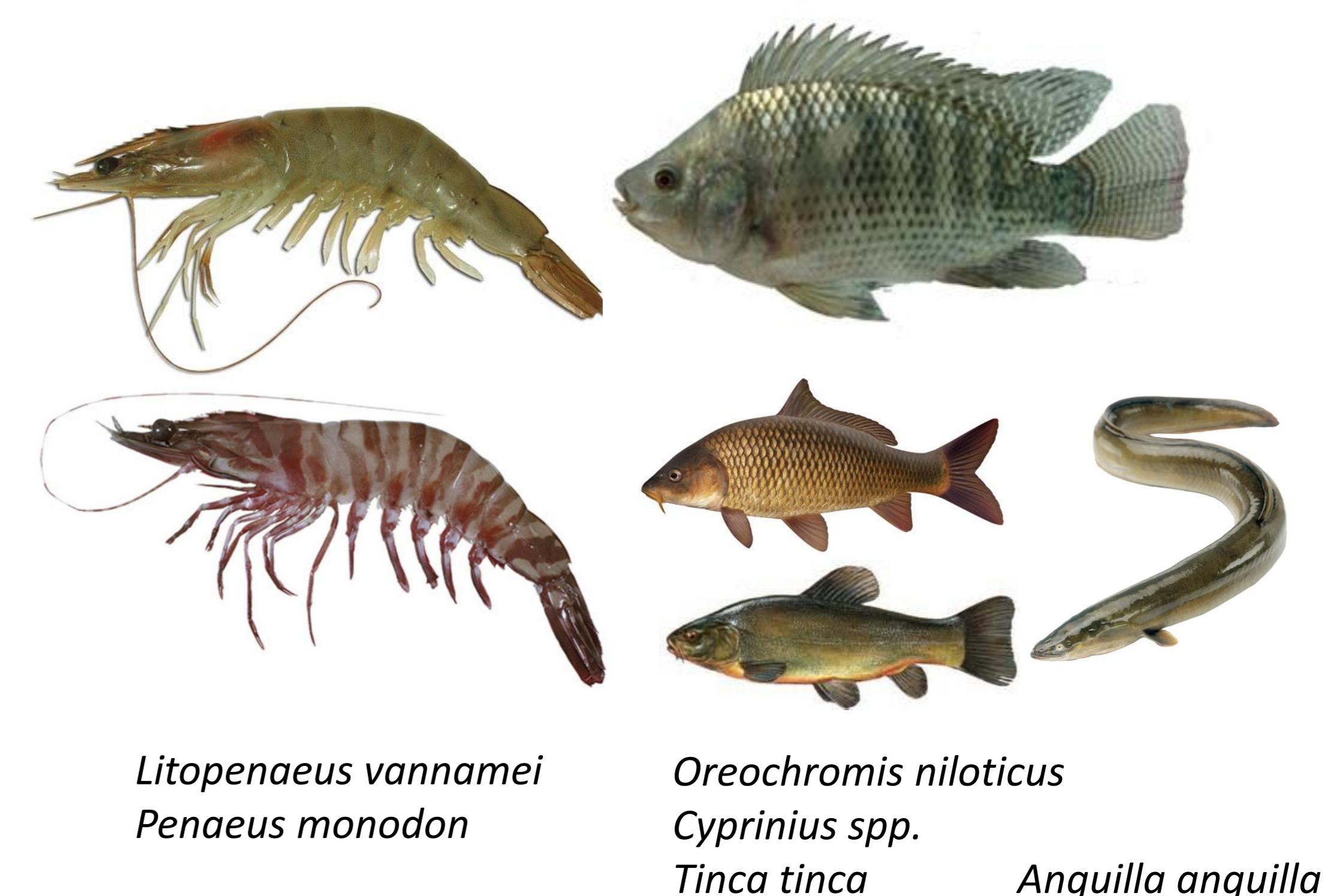
## Probiotic

- Competition of space, substrate and nutrient against pathogenic bacteria.
- Immunostimulation
- Upregulation of 6 immunity related genes

## Applications of the BFT

- Full Biofloc
  - 130-150 PL/m<sup>3</sup> 20-25 Tm/ha & cycle
  - 250-500 PL/m<sup>3</sup> up to 50 Tm/ha & cycle
- Semi-Biofloc
  - up to 15-16 Tm/ha & cycle

## Suitable culture species



## Conclusions

The BFT is more efficient and sustainable system than the conventional ones in aquaculture when it comes to waste and nitrogen management.

The BFT implies a better biotransformation for the reared organisms and allows to reduce the fishmeal amount in the formulated diets

It is essential a constant mixing and aeration of the ponds.

The BFT has a probiotic effect on the reared organisms. This fact and the reduction of the water changes enhance the biosecurity.

Despite its proven advantages, there is a need for the producers and the consumers to change their perception about the turbid waters and feeding with microorganisms.

## References

Avnimelech, Y., 2015. *Biofloc Technology - A Practical Guidebook* 3rd Editio., Baton Rouge, Louisiana: World Aquaculture Society.

Ebeling, J.M., Timmons, M.B. & Bisogni, J.J., 2006. Engineering analysis of the stoichiometry of photoautotrophic, autotrophic, and heterotrophic removal of ammonia-nitrogen in aquaculture systems. *Aquaculture*, 257(1–4), pp.346–358.

Hargreaves, J.A., 2013. Biofloc production systems for aquaculture. *SRAC Publication*, 4503. pp.1–12.