Growth and Welfare of Nile Tilapia (*Oreochromis niloticus*) Cultured in Indoor Tanks using BioFloc Technology (BFT)

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Background

- BioFloc Technology has been tested mainly in open ponds where both aoutotrophic and heterotrophic microorganisms interact each other
- Since the technology encourages heterotrophic microbial production which is organic-substrate dependent, would be applicable in light limited indoor systems

Background

- Tilapia fed suspended particles in BFT system and grew well on low protein feed, leading to additional savings in feed cost and increase in water use efficiency
- Contribution of biofloc to fish production as compared to contribution of feed has not been quantified so far

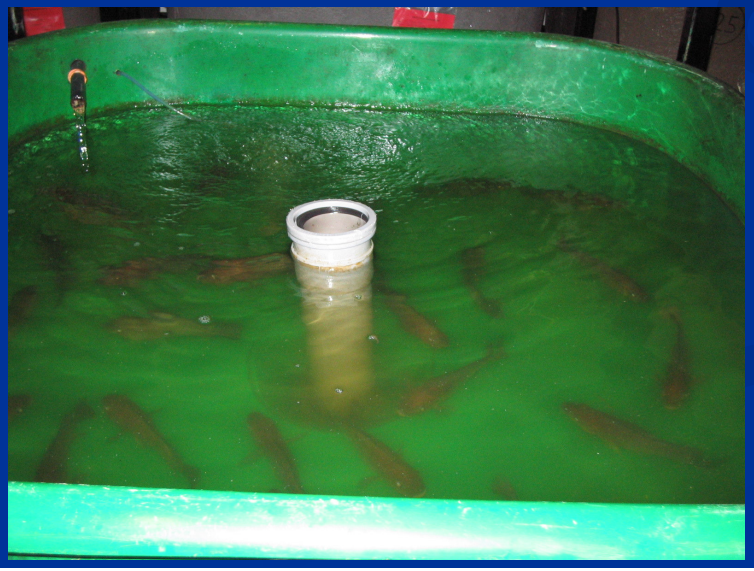
Objectives

- To quantify contribution of biofloc to fish growth and production in indoor tanks
- To test the effects of protein level (24% and 35% CP) on fish production and biofloc quality
- To check fish welfare parameters due to biofloc turbidity
- To compare inorganic nitrogen dynamics

Experimental Design

BFT 35% CP fed (3 replications)

BFT 24% CP fed (3 replications)



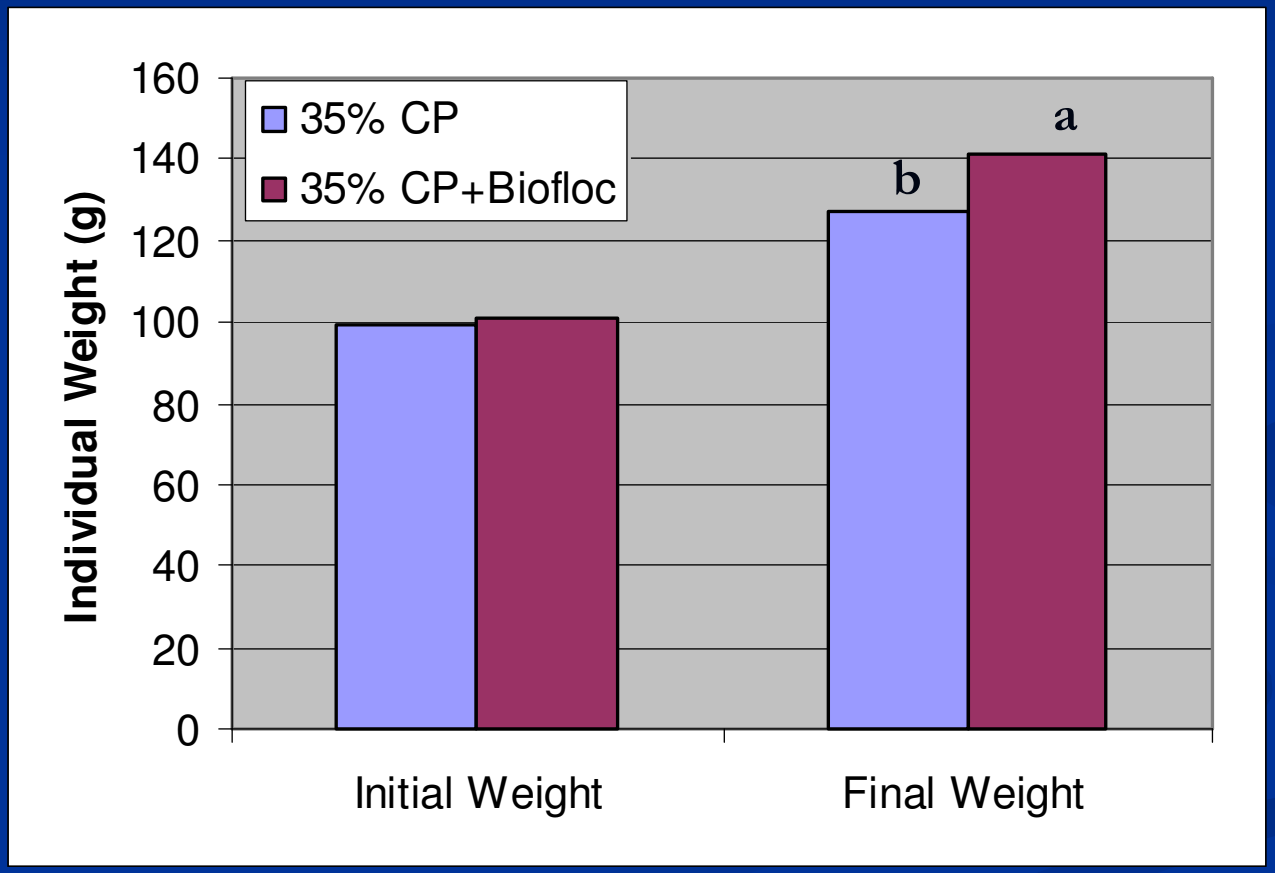
Clean water RAS Tank
35% CP fed (2 replications)

Tank Management

- Dome diffuser were used to aerate and agitate water in BFT tanks
- Stocking: 3 kg/tank (12 kg/m^3), mixed sex, average weight 100 g
- Feeding: Pelleted vegetarian feed, combination of soymeal, wheatmeal, vegetable oil and molasses, same amount feed (@1.5% bw/day)
- C-addition: Wheat flour @ 60% of feed applied
- Floc removal: If TSS level >500 mg/l using a separator
- Addition of $NaHCO_3$: If pH <6.5
- Temperature 28-30 C
- Culture period: 12 weeks

Contribution of BioFloc

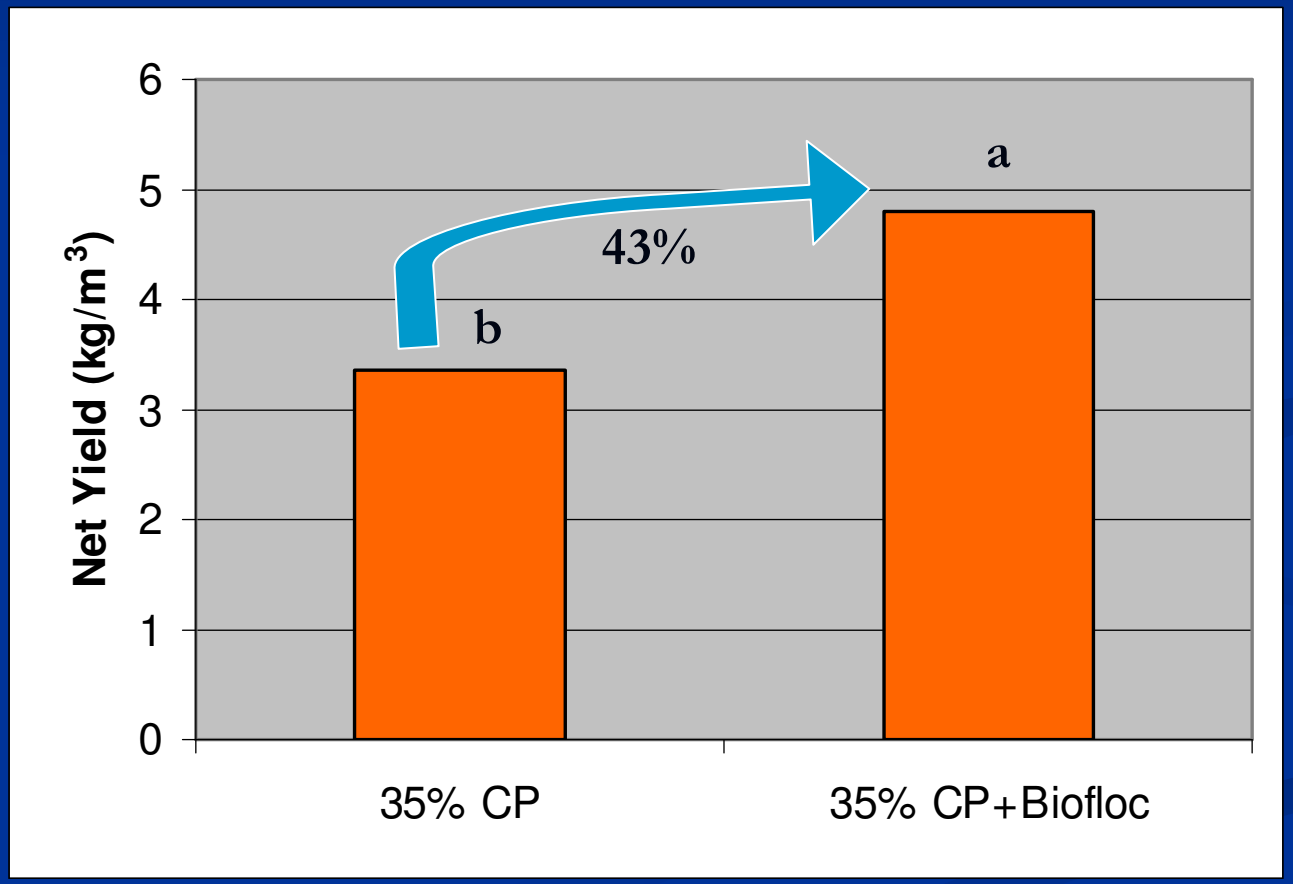
Individual Weight



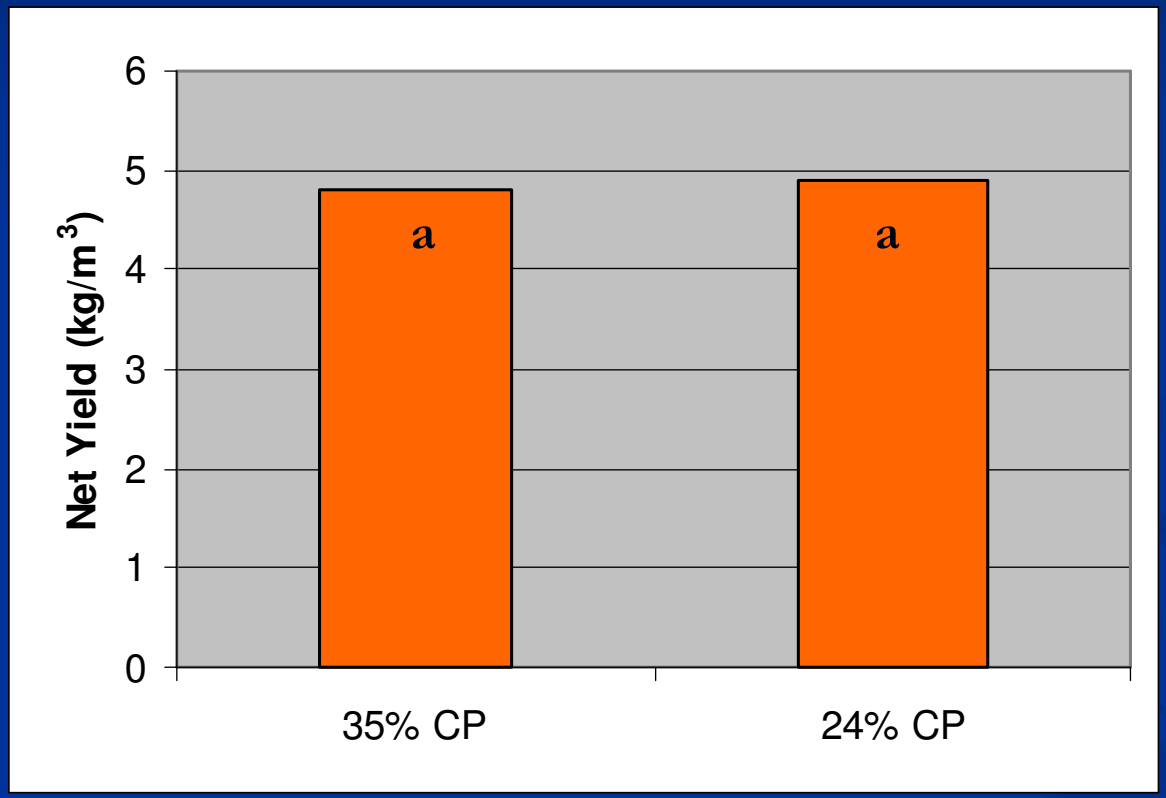
100% Survival

Contribution of BioFloc

Net Production



Effects of Protein Level on Fish Production



Effects of Protein Level on Biofloc Quality

Proximate Composition

	35% CP	24% CP
Protein (%DM)	38	38
Lipid (%DM)	3	3
Ash (%DM)	13	12
Fiber (%DM)	6	6
Energy (kJ/g DM)	19	19
C:N ratio	7.2	7.3

Effects of Protein Level on Biofloc Quality

Fatty Acid Profile (% Lipid)

	35% CP	24% CP
Saturated	35	30
Monounsaturated	28	29
n-6 PUFA	**24**	**26**
n-3 PUFA	**1.9**	**1.4**
Total PUFA	27	28
Unknown	10	12

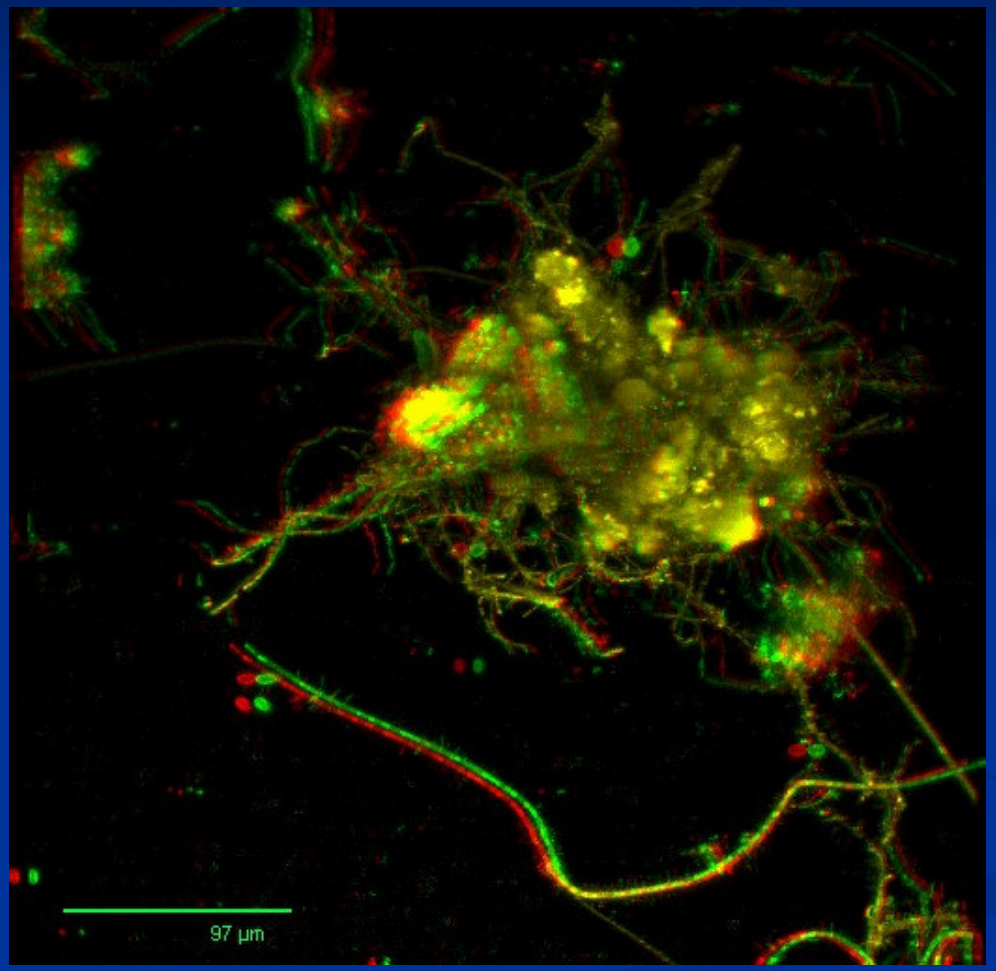
Effects of Protein Level on Biofloc Quality

Amino Acid Profile

APOLOGY

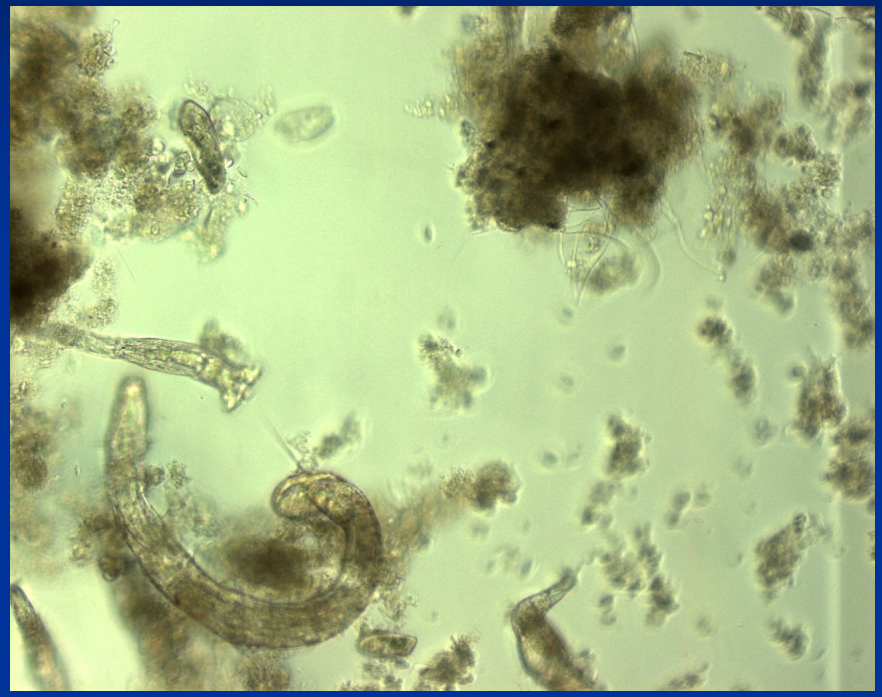
(Yet to be analysed)

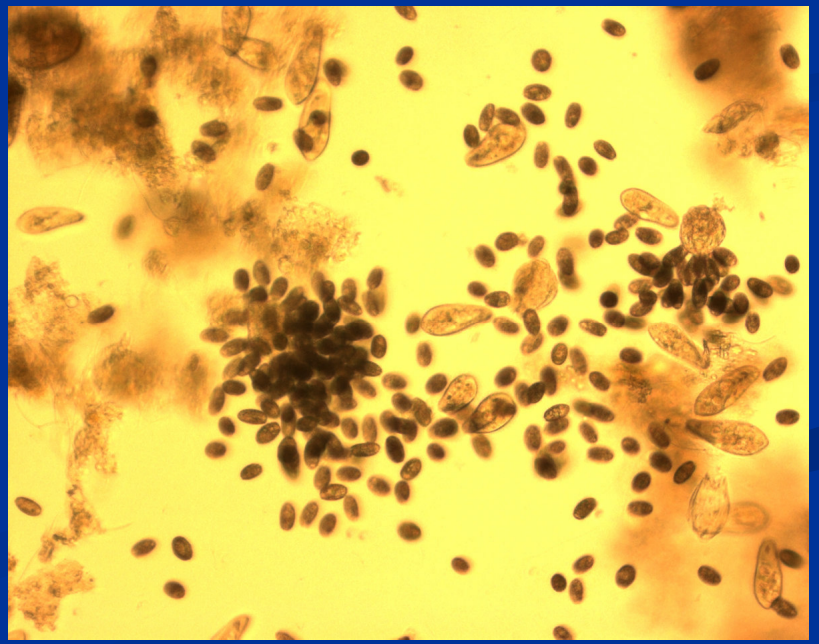
Biofloc Composition



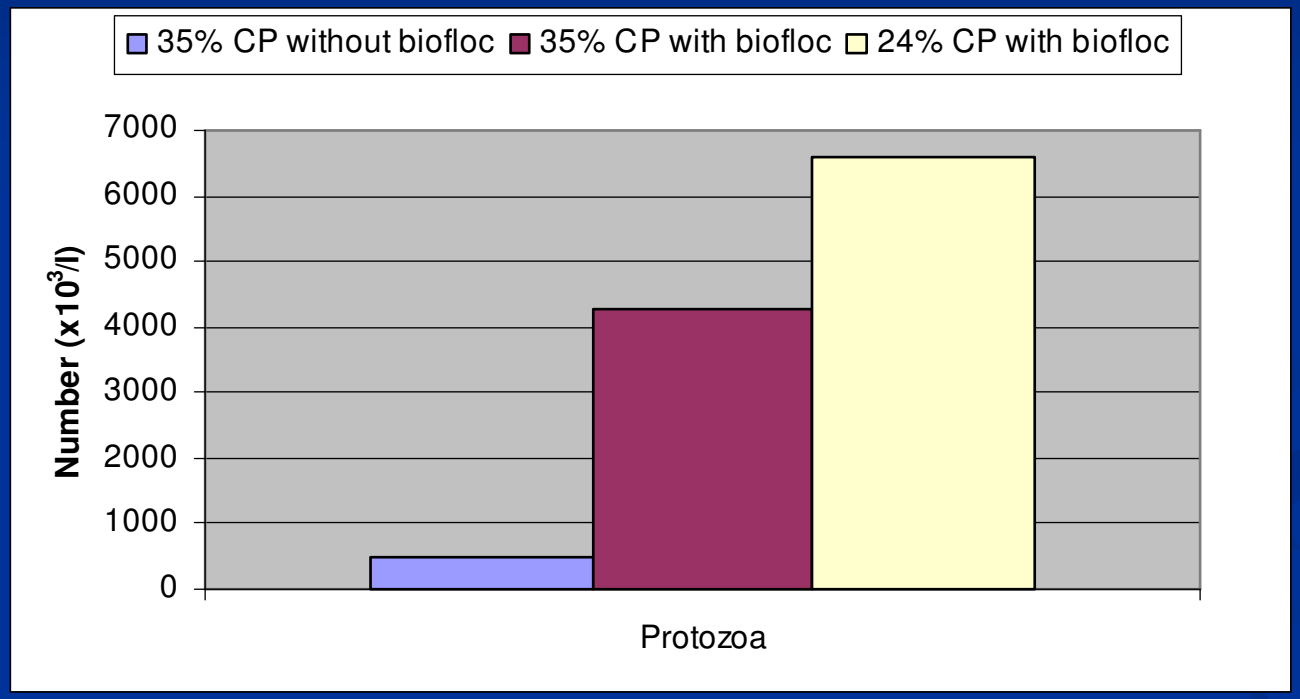
A 3-D bacterial floc (Confocal Microscopy)

Biofloc Composition

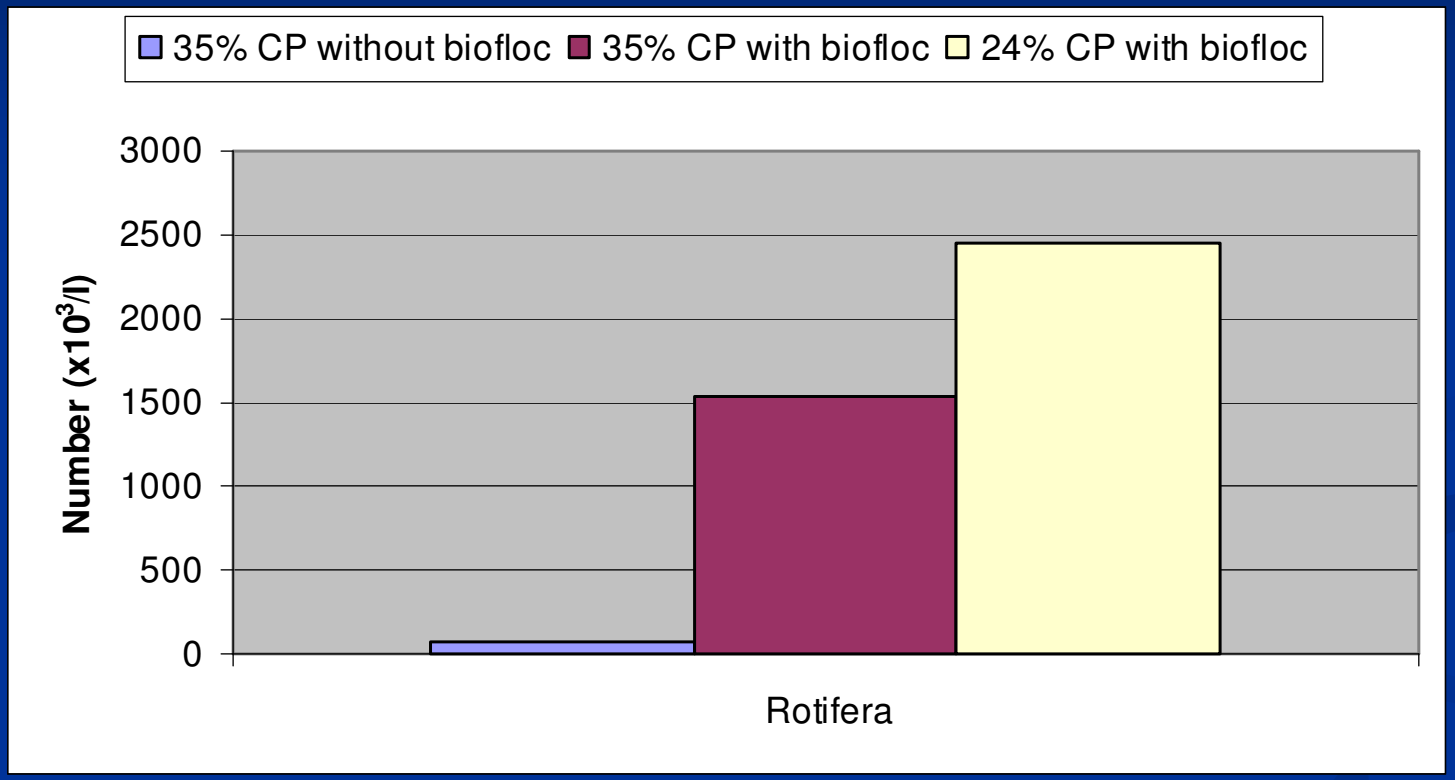




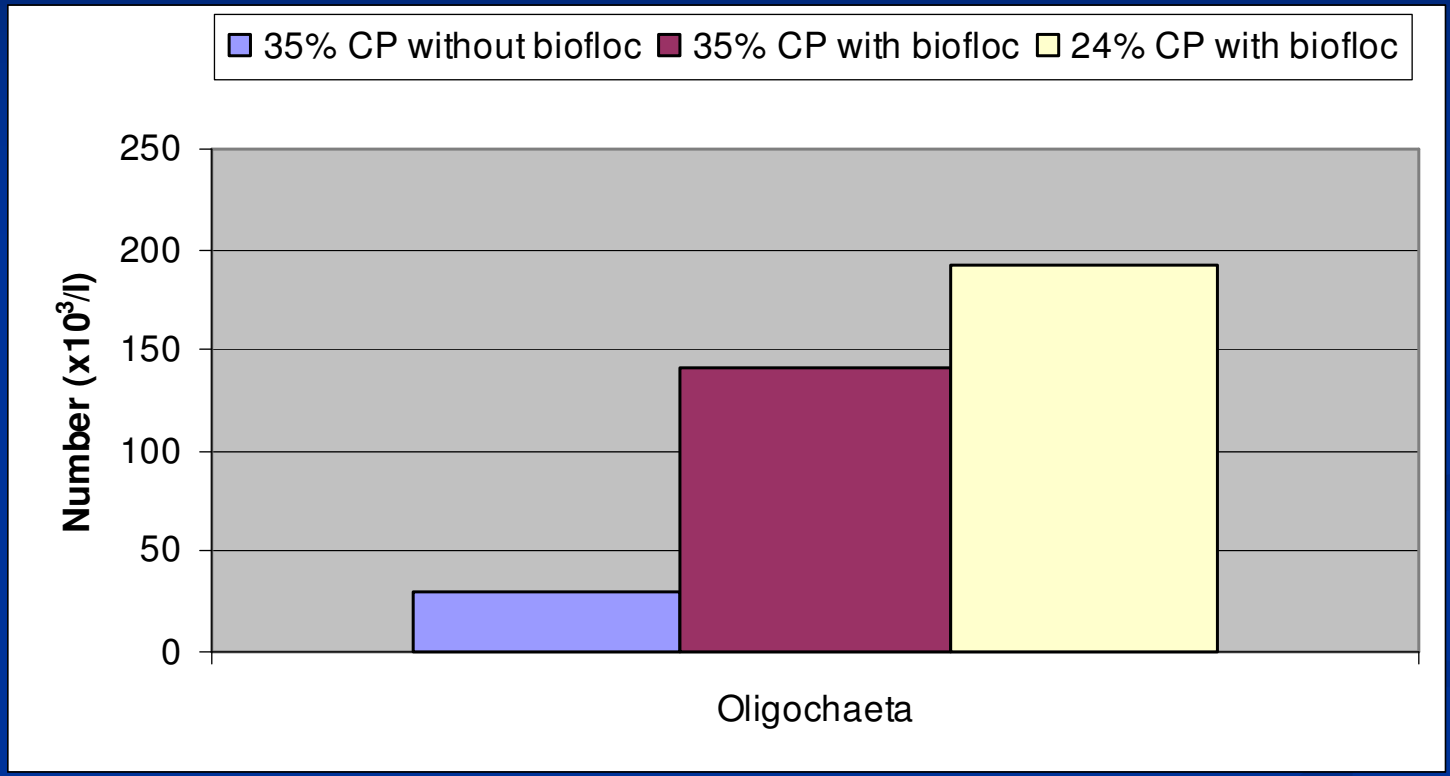
Biofloc Composition



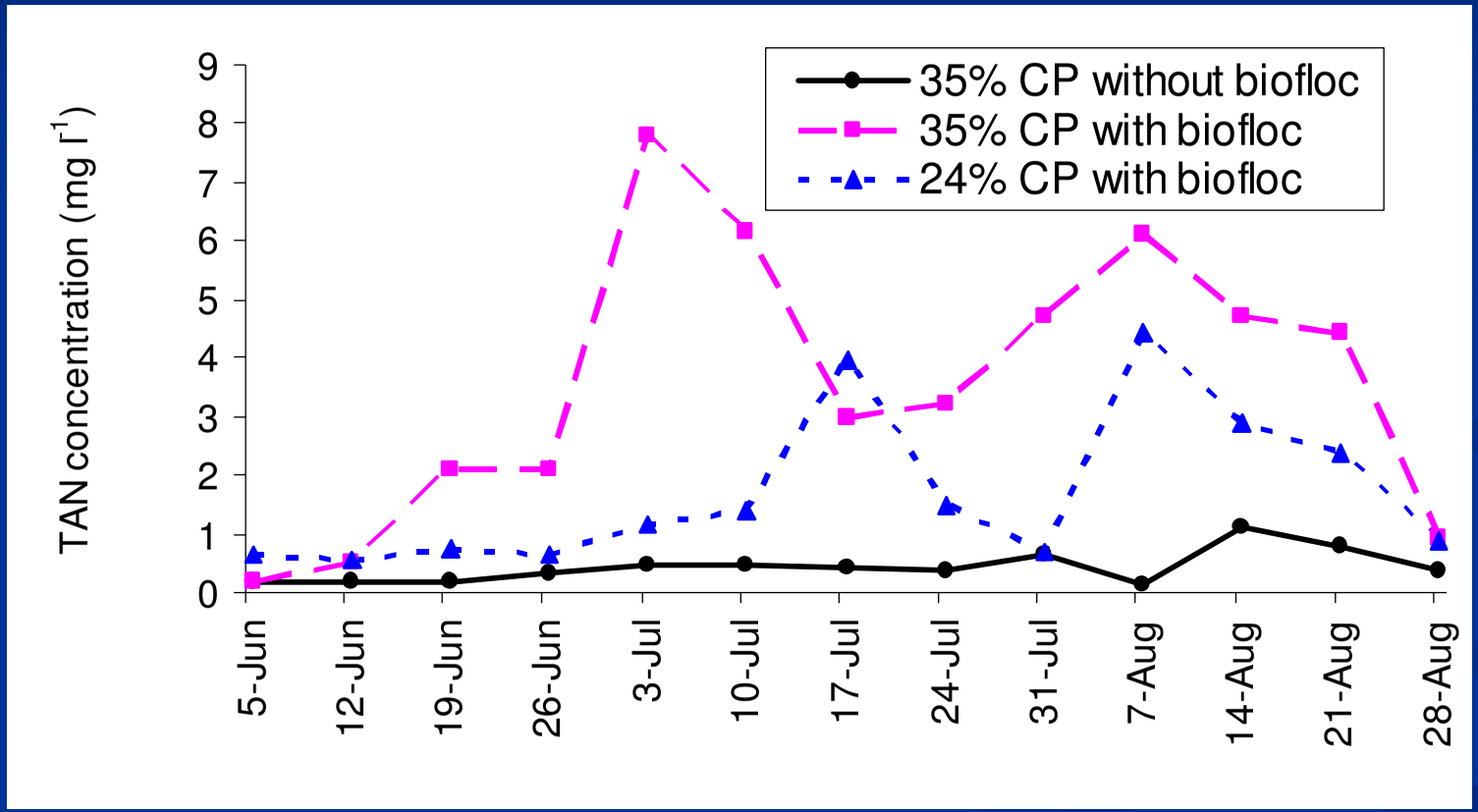
Biofloc Composition



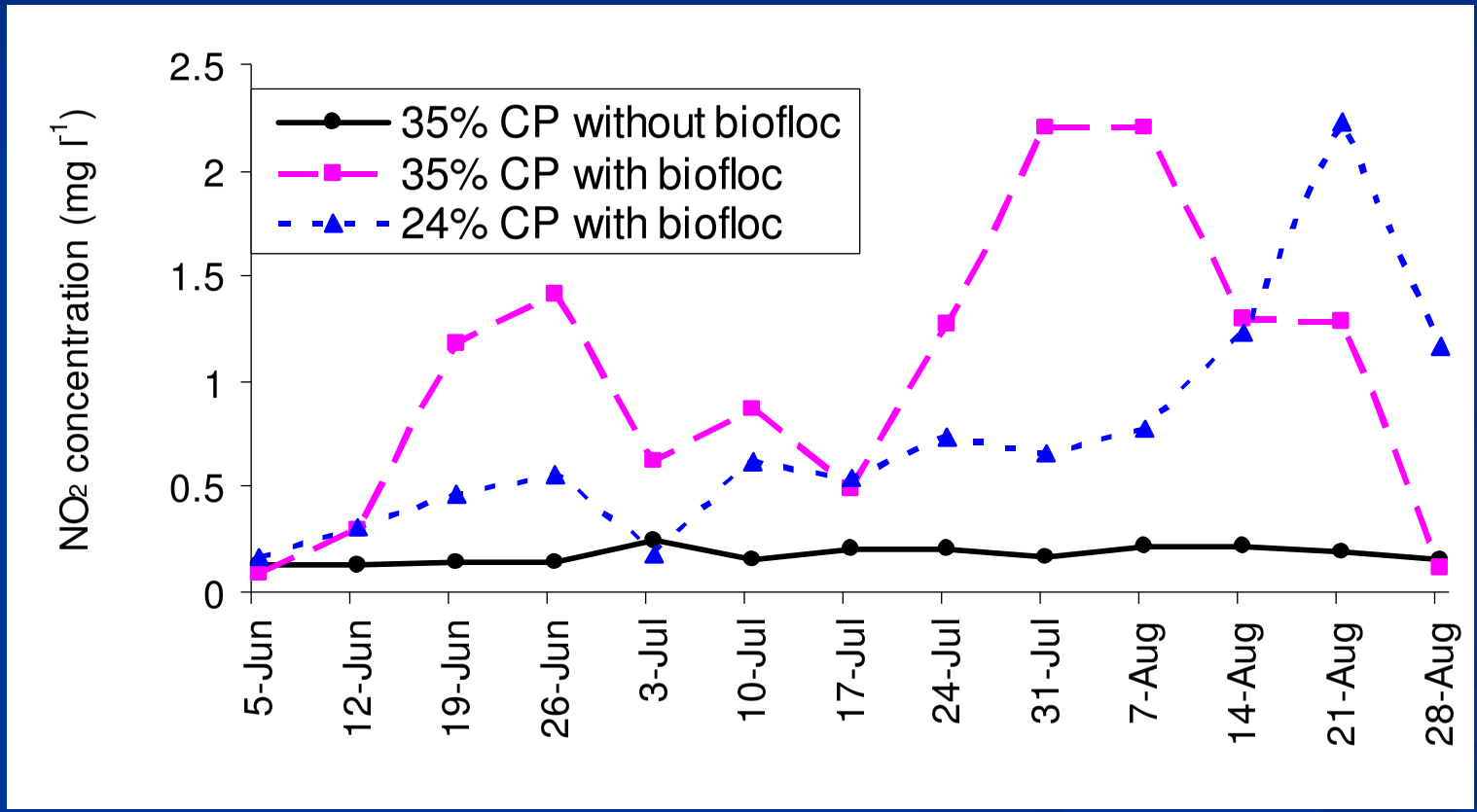
Biofloc Composition



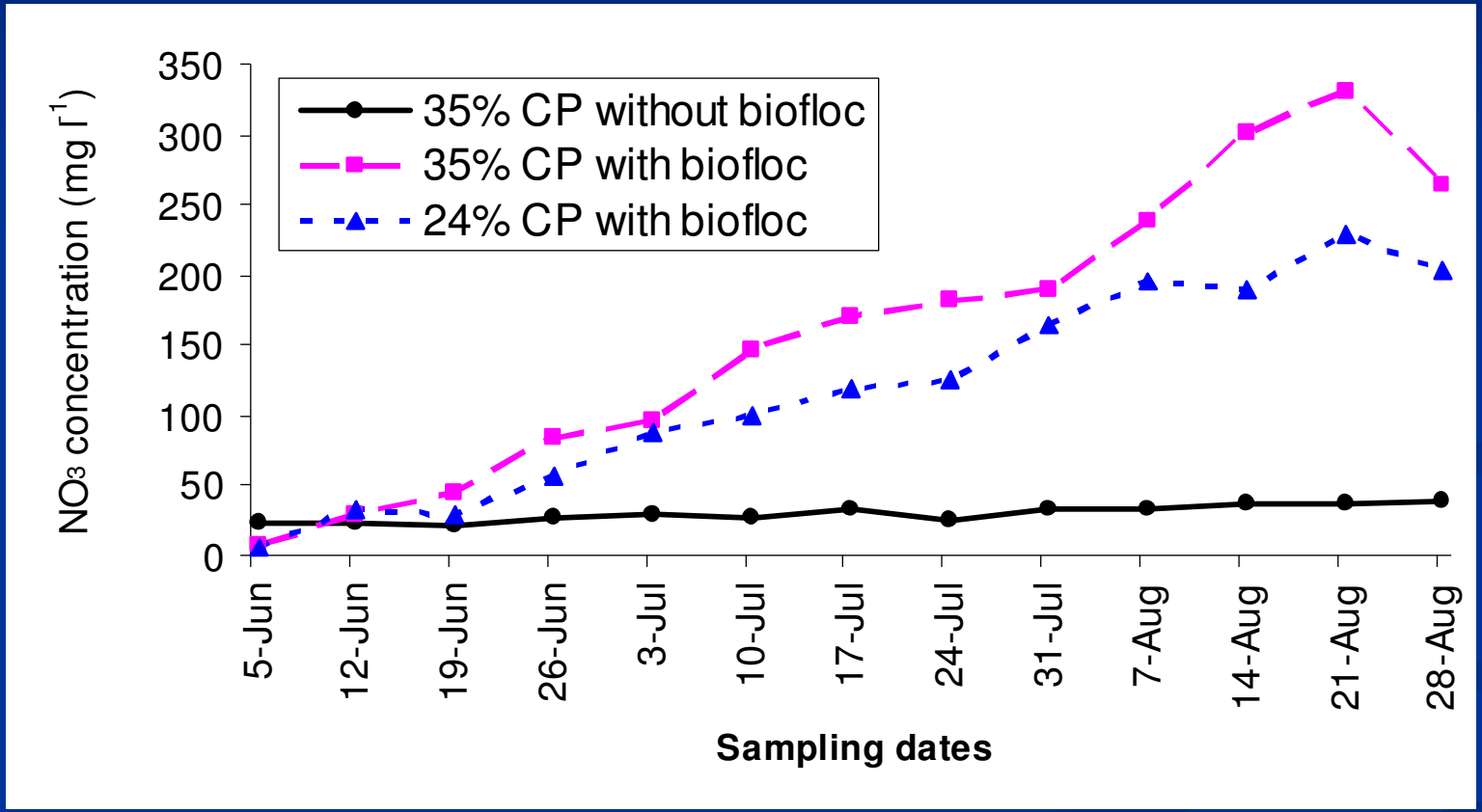
Effects on DIN



Effects on DIN

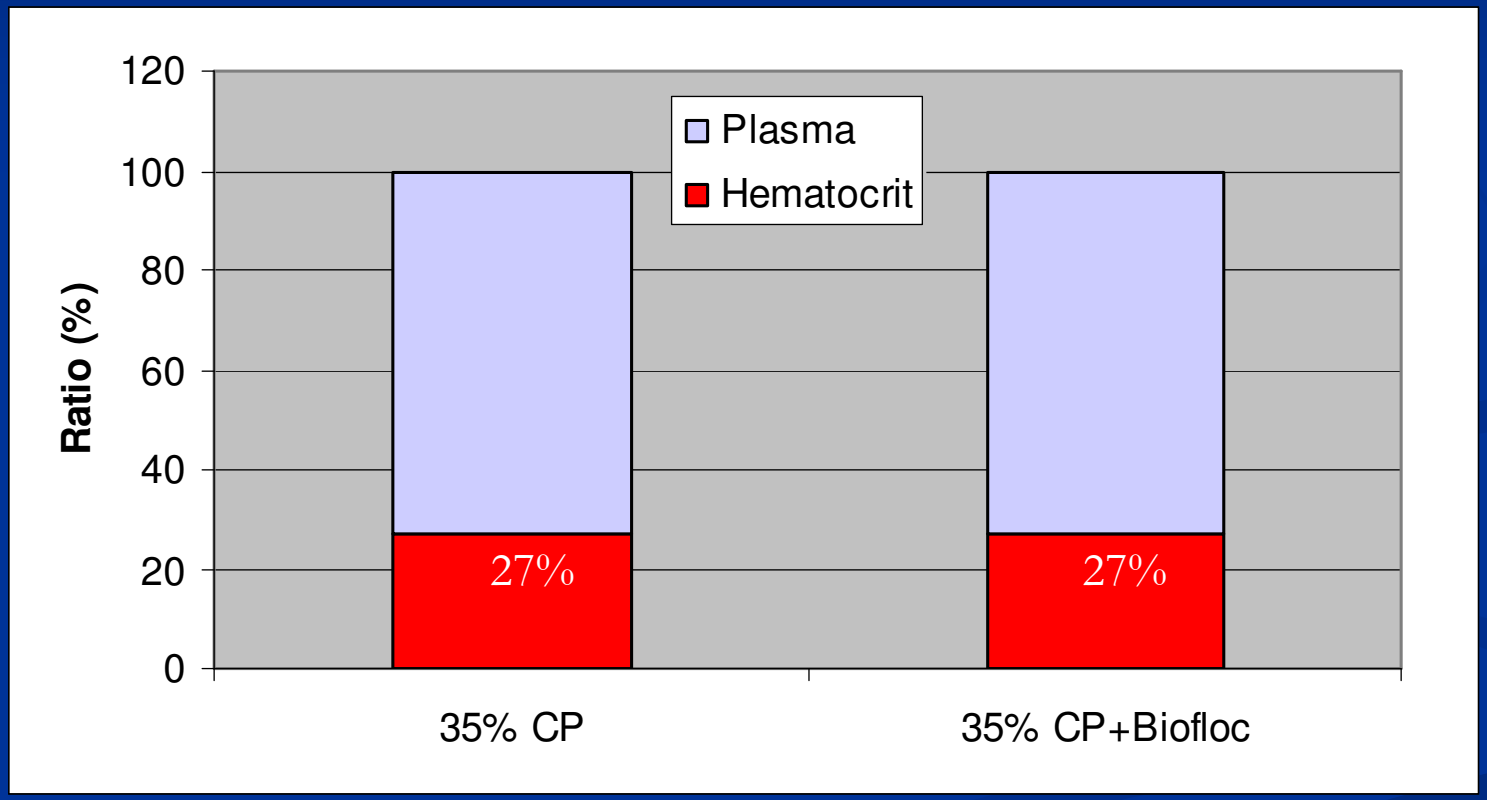


Effects on DIN



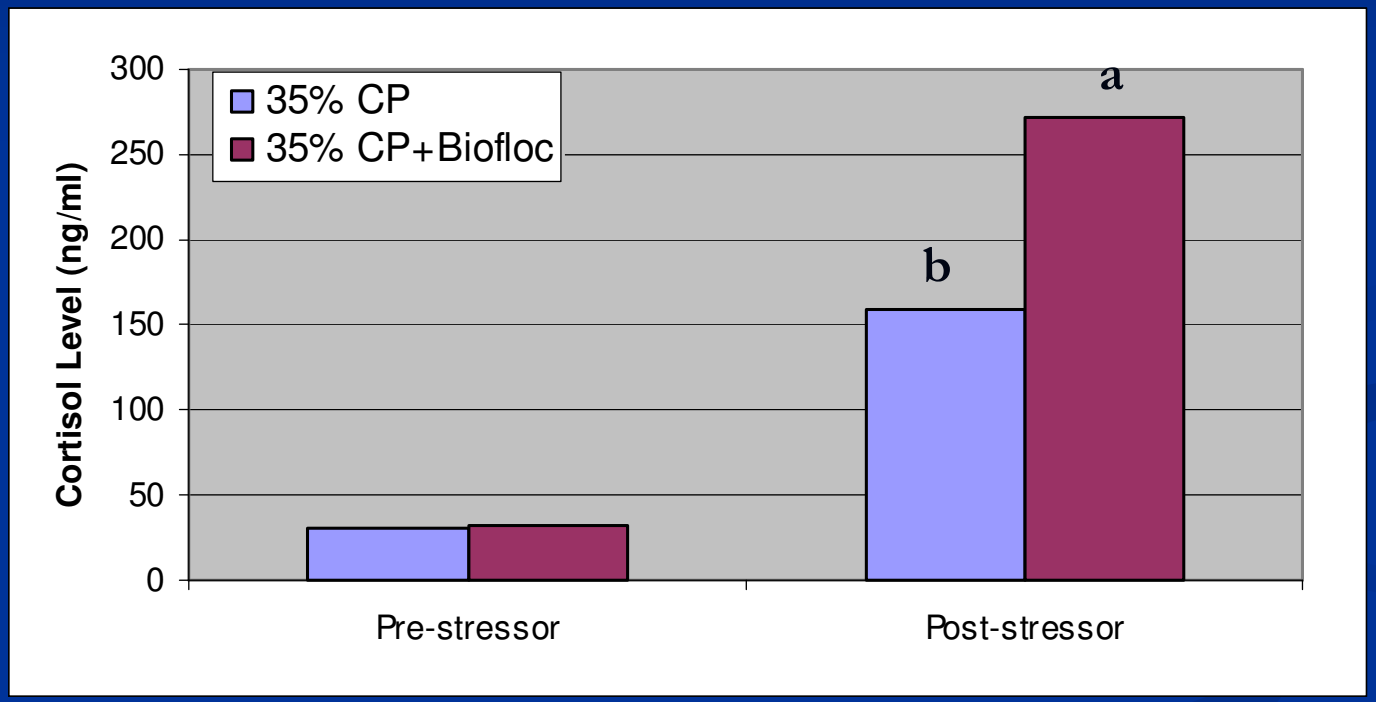
Fish Welfare

Plasma/Hematocrit



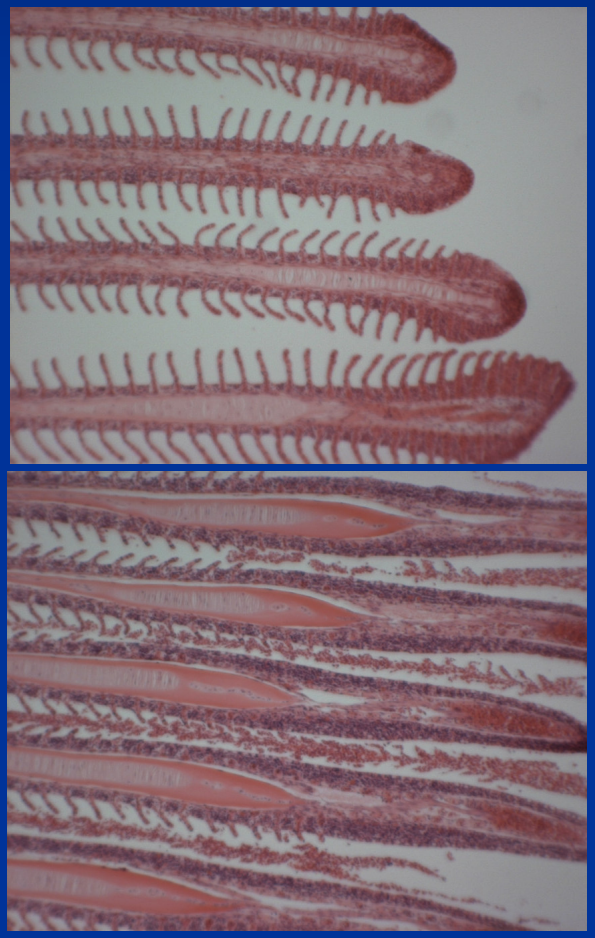
Fish Welfare

Plasma Cortisol

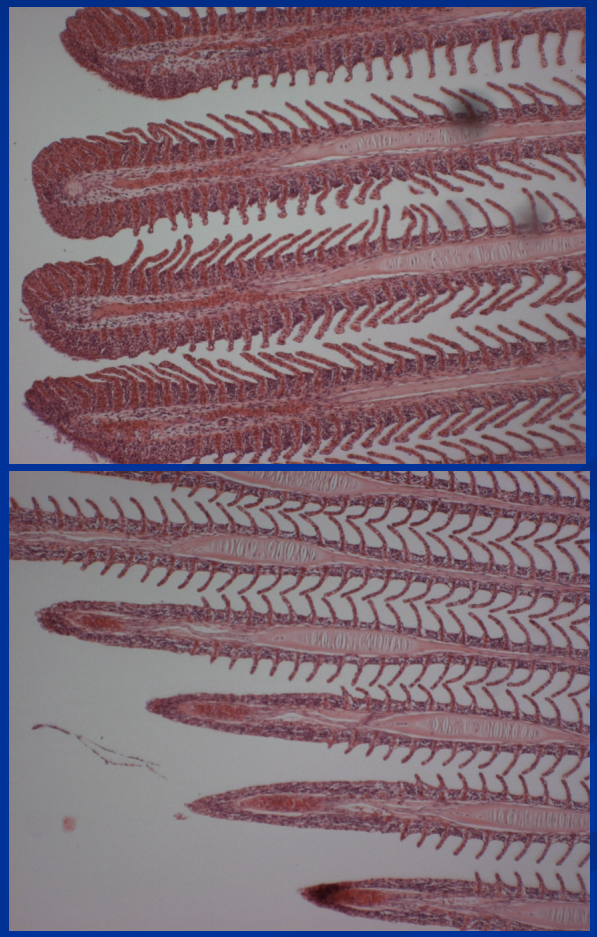


Fish Welfare

Gill Histology



Without Biofloc



With Biofloc

Conclusion/Recommendation

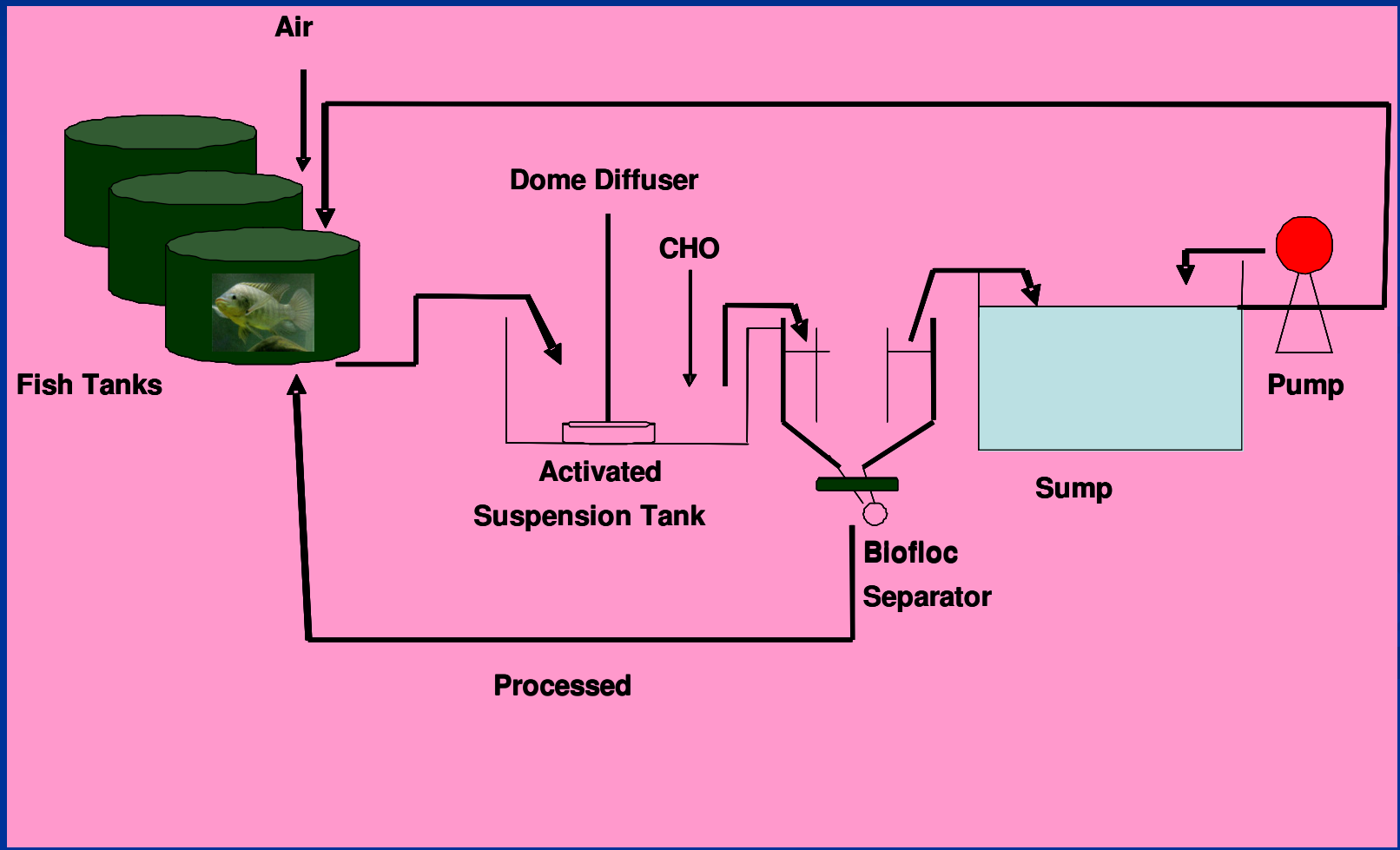
- Feed intake was lower in BFT resulting in poor fish growth
- Although biofloc contributed 43% of growth, biofloc utilization was lower compared to biofloc production
- Under BFT, protein level had no effects on growth and biofloc quality
- Nutritional quality of biofloc seem to be appropriate especially for tilapia

Conclusion/Recommendation

- Although CHO was added regularly, DIN was unstable and sometimes reached lethal concentration
- Difficult to maintain buffering capacity (noticed high fluctuations in pH and alkalinity)
- Welfare parameters indicate no stress due to biofloc
- Biofloc unit in RAS is recommended where biofloc is separated, processed and feed back to fish tank

Recommendation

BioFloc-based RAS



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