



TILAPIA PRODUCTION IN BIOFLOC SYSTEMS

YORAM AVNIMELECH

TECNION, ISRAEL INST. OF TECHNOLOGY

agyoram@technion.ac.il

Tilapia production, a growing industry

Tilapia is becoming a very popular fish and its production an important aquaculture industry



Tilapia, an ideal fish for Biofloc Technology

Grow well in dense cultures

Resistant •

FILTER FEEDER •

**Very few studies as •
compared with
shrimp**



Fish Biomass

Normally, 20-30 kg/m²

10 times higher than shrimp BFT ponds!



Implications:

- High Biomass 20-30 kg/m³
- High feeding (ca 500 g feed/m³ per day!)
- Very high microbial activity
- High floc volume (20-50 ml/l).
- Very high natural feed storage.
- High levels of feed residues
- Need to drain out daily (or twice daily) excessive sludge.
- Pond constructed to facilitate sludge draining and perfect mixing.
- High and effective aeration: 10-20 hp/1000 m² pond



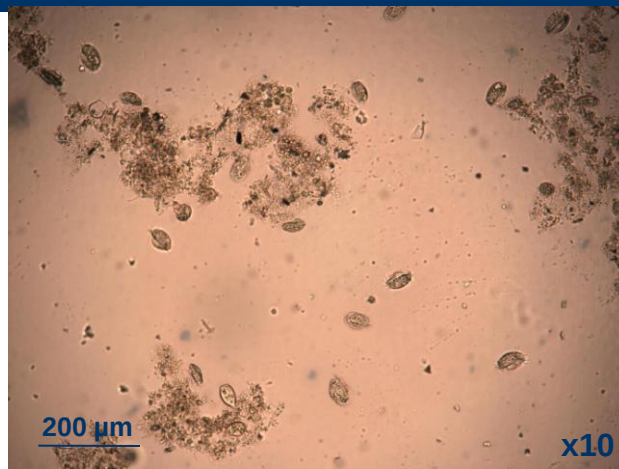
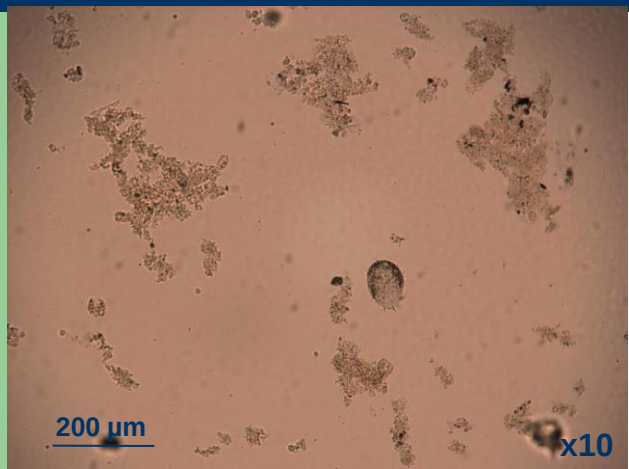
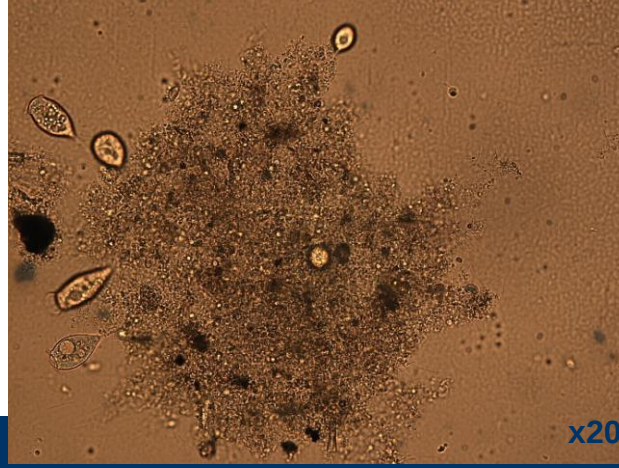
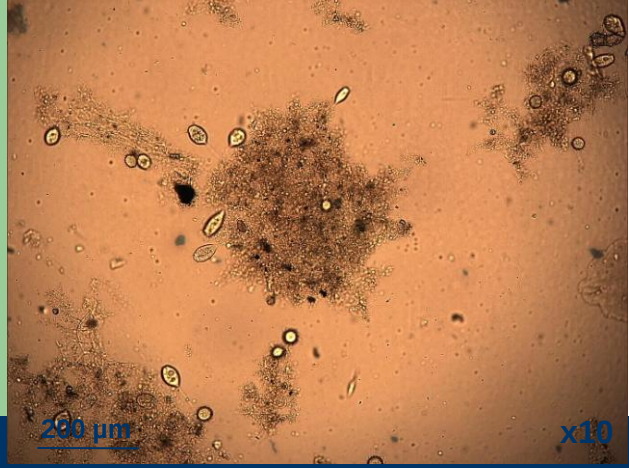


Bioflocs and Floc volume

- Bio flocs are made of bacteria, protozoa, feed residues etc.
- Bioflocs size may reach
A few mm diameter
- Effectively harvested
by tilapia







Bio flocs are made of bacteria, protozoa, etc. Typicaly their diameter is 0.1-2 mm.

Protein Recycling

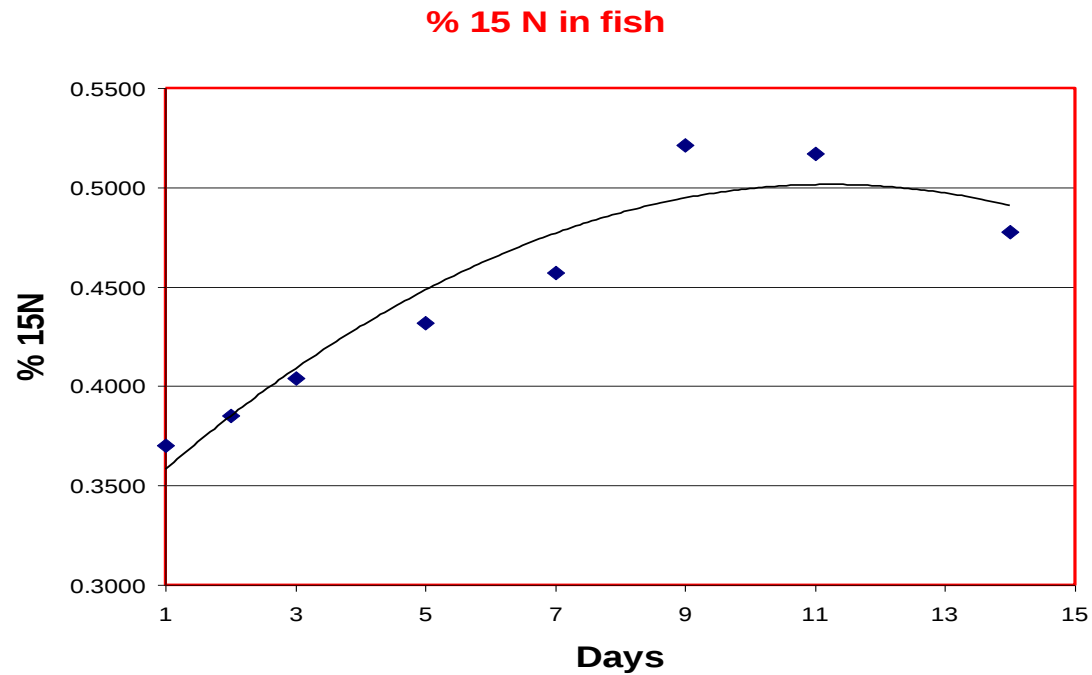
- Normally, fish or shrimp recover just ~25% of feed protein.
- In bacterial controlled ponds, they eat the protein twice; Once in the feed and then they consume microbial protein. The protein recovery reaches **almost 50%**.
- **Protein is the most expensive part of the feed.**

Expt. # 1	control	<i>BFT</i>
51 days		
FEED C/N	11.1	<u>16.6</u>
Daily Gain (%)	1.59 ^a	2.0 ^b
FCR	2.62	2.17
PCR	4.38	2.42
FEED COST (US\$/Kg fish)	0.848	0.583
Exp. # 2 (30 days)		
<u>C/N</u>	11.1	16.6
Daily gain (%)	1.63 ^a	2.22 ^b
FCR	2.62	2.02
PCR	4.35	2.18
Feed cost (US\$/Kg fish)	0.848	0.543

Preparing an ^{15}N tagged bioflocs:

- 1. Prepare large enough batch of biofloc suspension (water + feed, mix & aerate).
- 2. Add ^{15}N salt.
- 3. Add starch, at a C/N ratio of > 15
- 4. After a few hours, practically all ^{15}N is in the bioflocs.

Results 1: % ^{15}N in fish



Residence time of bioflocs

- Bioflocs were taken up by fish and degraded biologically. Yet, the amount of bioflocs stayed almost constant. This implies that new flocs are constantly produced (using the excreted N).
- The residence time of bioflocs was calculated to be around 8 hours. The flocs seem to be a very dynamic system.
- most cells in the flocs are young and active.

Data on feed protein utilization

- Conventional fish, shrimp ponds 20-25%
- BFT Tilapia ponds (Avnimelech) 45%
- BFT Shrimp ponds (McIntosh) 45%
- Closed shrimp tanks (Velasco) 63%
- **BFT shrimp ponds, ^{15}N study 18-29% of total N consumption (Michele Burford et al.)**
- * **Tilapia, ^{15}N Study, flocs supplied about 50% of fish protein requirement. (Avnimelech).**

Feed Utilization

- Fish or shrimp growing in BFT systems eat the pellets when applied, **but eat bioflocs all the time.**
- Confirmed in a work done by Albert Tacon with shrimp.
- Observations with tilapia.
- Effects on lowering of FCR in tilapia production



Fresh results from the field:

- Tilapia fingerlings (120 g) stocked to overwintering facility on January 4, 2011.
- Feeding ~ 1% BW
- On February 18, they weighed 171 g
- Daily growth of 1.16 g/fish
- **FCR = 0.5**

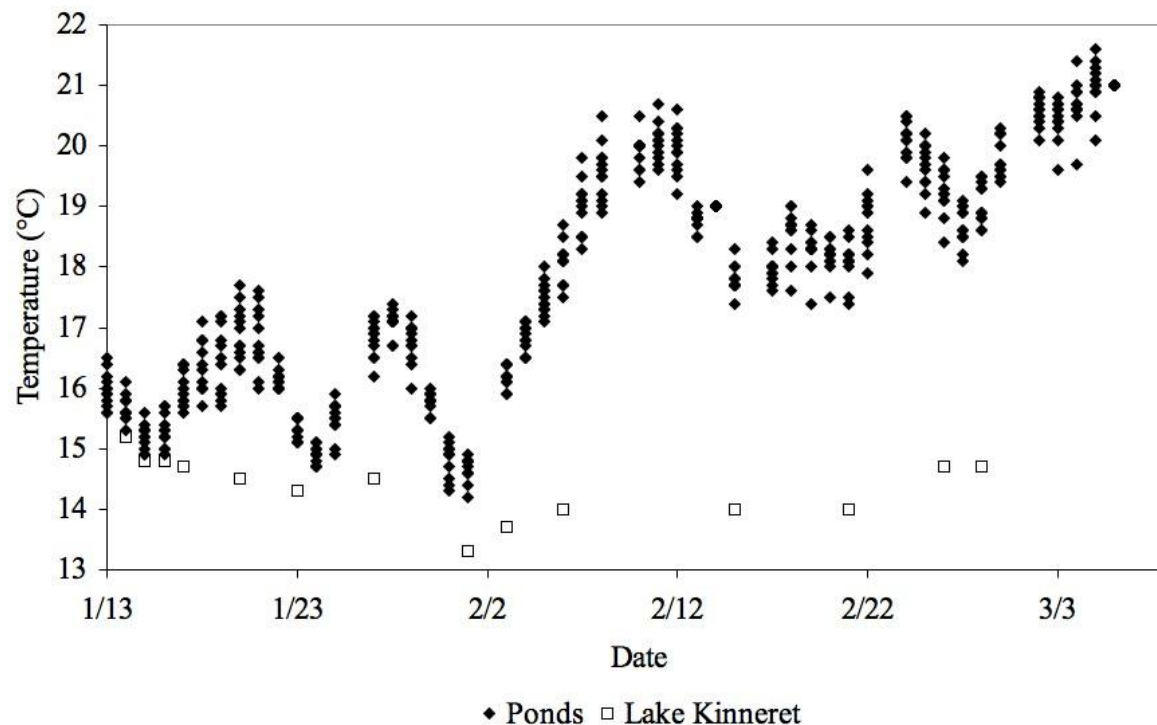
OVER-WINTERING





Results

Dissolved oxygen: 9 – 10 mg O₂/L –
Average temperature: 18 ± 2 °C –



EFFECT OF WATER EXCHANGE RATE ON PRIMARY AND SECONDARY INFECTION OF FISH BY STREPTOCOCCUS

<i>Treatment</i>	<i>Dead fish</i>	<i>Sick fish</i>	<i>Total infected</i>

**a) Injected
fish**

Control	9 (9)	2 (2)	11
BFT	12 (3)	4 (2)	16

**a) Non-
injected
fish**

Control	7 (5)	4 (1.5)	11 (4.7)
BFT	1.8 (1.7)	1.3 (1.0)	3 (1.4)

- **High water exchange = 0.5l/min per kg fish (700% per day)**
- **BFT < Limited water exchange = 10% per day**

Conclusions

- Biofloc technology is especially adapted to raise tilapia production up to 20-30 kg/m².
- This can be done using not too expensive system.
- BFT enables feed recycling, high feed quality and reduced expenses.
- BFT reduces disease.
- The system is friendly and forgiving.
- More research is needed

Thank You
Yoram



Y. Avnimelech

Biofloc Technology

A Practical Guide Book

THE WORLD AQUACULTURE SOCIETY

Biofloc Technology



A Practical Guide Book

Yoram Avnimelech

Published by

WORLD
AQUACULTURE
SOCIETY



Technion
Israel Institute
of Technology