IMTA DRIED BIOFLOC AS A PARTIAL PROTEIN REPLACEMENT FOR FISH MEAL IN SHRIMP DIETS

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BACKGROUND

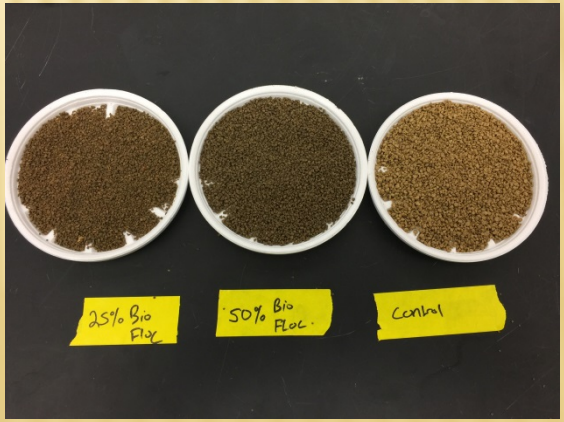
- Reducing dependence on fishmeal is necessary
  - Economic and sustainability standpoint
- FAU-HBOI uses a closed Integrated Multi-Trophic Aquaculture (IMTA) system
  - Centralized filtration system that delivers controlled amounts of selected waste streams to system components
    - By-product - ex-situ biofloc
- Ex-situ floc had a 42.5% protein content.
  - Justifies its use in balanced diets for shrimp and fish.

OBJECTIVE

Evaluate the potential of ex-situ biofloc from the IMTA bio-reactor as a protein source for diets for *Litopenaeus vannamei* in the IMTA system

EXPERIMENTAL DESIGN

- Three experimental treatments
  - Control diet (42% protein)
  - Two experimental Diets
    - 25% Biofloc diet (43% protein)
    - 50% Biofloc diet (40% protein)
- Clear Water Systems
  - 26 L tank
    - 5 replicates per treatment
      - Random block design
    - Individual bio filters
  - Styrofoam cups
    - 10 cups per treatment
      - Random block design



EXPERIMENTAL SETUP

- Stocking
  - Tanks
    - 0.5 g *L. vannamei shrimp*
      - 15 per tank
      - 5 week trial
  - Cups
    - 0.05 g *L. vannamei shrimp*
      - 1 per cup
      - 6 week trial

- Feeding
  - Tanks
    - Daily ration 2x/day
    - 9 am & 5 pm
      - Calculated rate based on tank biomass
  - Cups
    - 2x day
    - 9 am & 5 pm
      - 2-3 crumbles per cup

EXPERIMENTAL MONITORING

- Water Quality
  - Daily: Temperature, DO, Salinity
  - Twice/Week: TAN, Nitrite, Alkalinity, pH
- Growth
  - 30% of tank shrimp sampled weekly
  - Shrimp in cups weighted weekly
- Survival
  - 5-6 weeks
- Analysis of feeds, biofloc, shrimp
  - Proximate, Amino Acid, Fatty Acids

WATER QUALITY

Temperature (°C)	Salinity (ppt)	DO (%)
27.4	31.8	85.7
(26.4-27.8)	(30.8-33.8)	(80.7-98.6)

Alkalinity	TAN	Nitrite	pH
178.2	0.128	1.78	8.01
(148-216)	(0.01-0.33)	(0.10-5.37)	(7.89-8.03)

PROXIMATE ANALYSIS %

Diet	Control	25% Biofloc	50% Biofloc	*Ex-Situ Floc*
Protein	44.8	43.9	39.5	*42.5*
Fat	11.5	13.2	12.3	*2.91*
Fiber	1.59	2.11	2.82	*9.1*
Ash	9.92	18.4	21.6	*35.2*

PROTEIN CONTENT%

Diet	Control	25% Biofloc	50% Biofloc
Protein (crude)	44.8	43.9	39.5%
Arginine (1.85)*	3.55	3.28	2.46
Histidine (0.80)*	1.06	1.09	0.83
Isoleucine (1.01)*	1.67	1.84	1.55
Leucine (1.70)*	2.99	3.11	2.53
Lysine (2.08)*	2.72	3.06	2.33
Methionine (0.89)*	0.98	1.00	0.73
Phenylalanine (1.40)	1.68	1.82	1.47
Threonine (1.40)*	1.97	2.16	1.64
Tryptophan (0.20)*	0.50	0.48	0.53
Valine (1.35)*	1.55	1.60	1.42

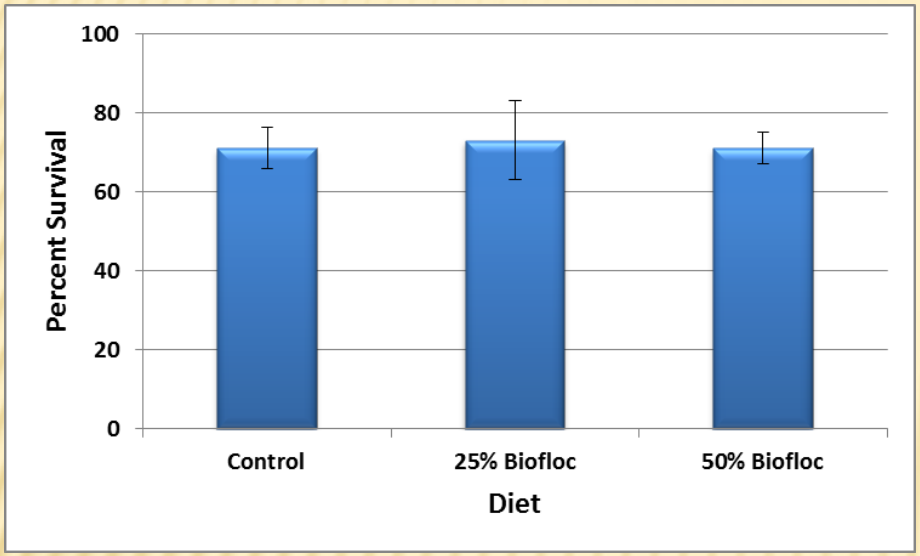
**Fox, Davis, Wilson & Lawrence. 2006.*

LIPID CONTENT

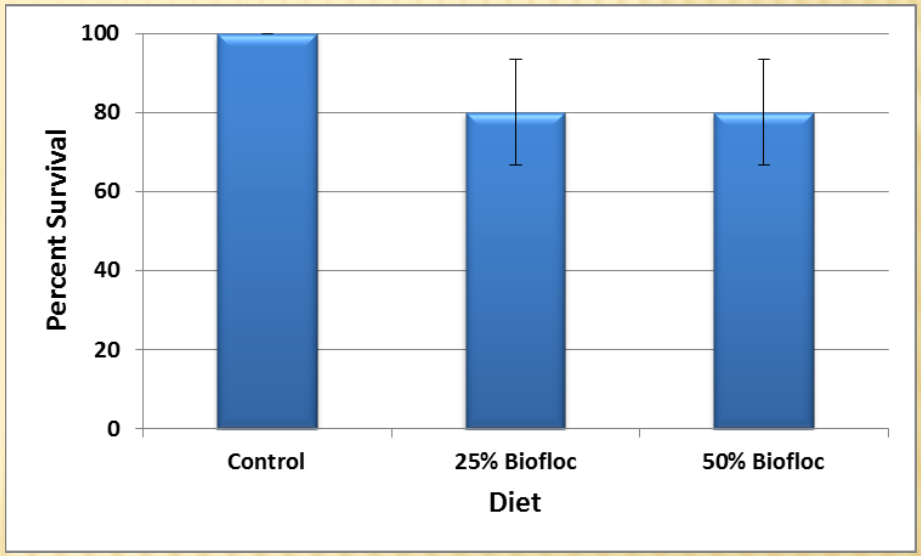
Diet	Control	25% Biofloc	50% Biofloc
Fat (crude)%	11.5	13.2	12.3
Saturated Fats (g/100g)	3.27	3.08	3.21
Polyunsaturated Fats	4.07	5.05	4.80
Monounsaturated Fats	3.16	4.08	3.20
Oleic (C18:1) 1n-9	2.16	2.77	2.25
Linoleic (C18:2) n-6	2.03	1.41	1.94
Linolenic (C18:3) n-3	0.29	0.22	0.33
Arachidonic (C20:4) n-6	0.07	0.14	0.10
Eicosapentaenoic(C20:5) n-3	0.80	1.50	1.26
Docosahexaenoic(C22:6) n-3	0.70	1.31	0.91

SURVIVAL

TANK STUDIES

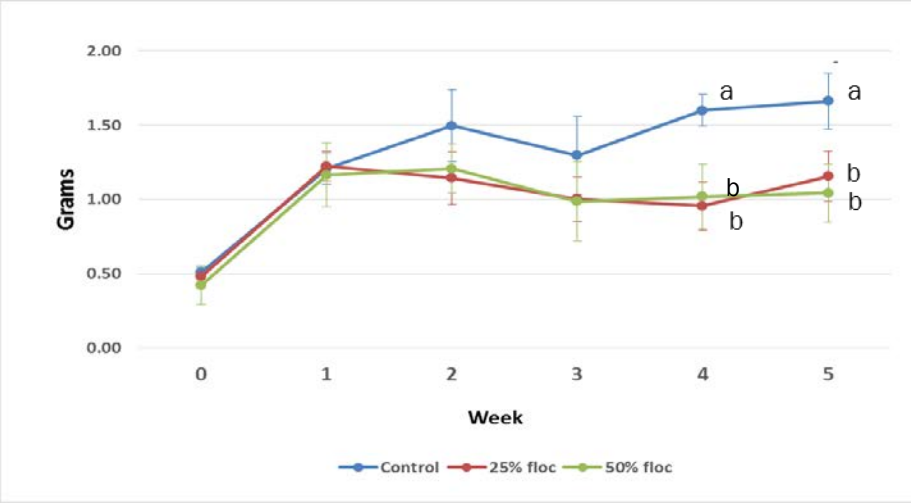


CUP STUDIES



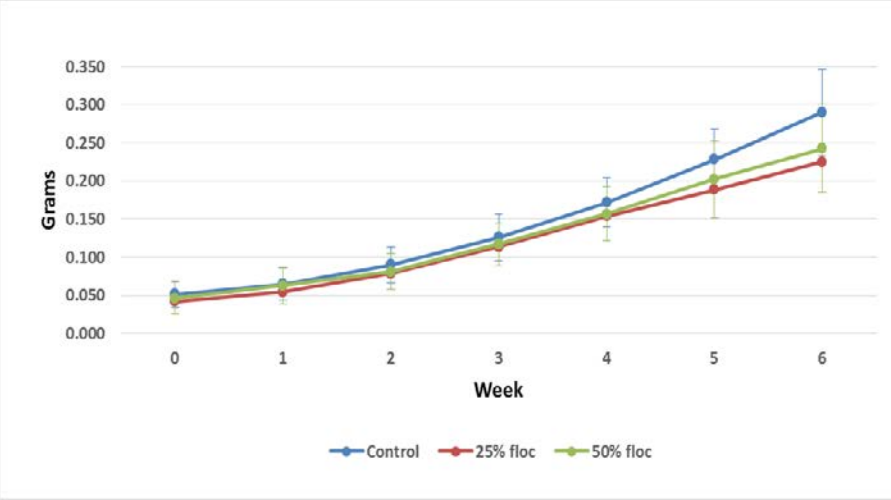
No difference in survival between treatment groups

TANK STUDIES



Growth was lower for diets that replaced fish meal with Biofloc

CUP STUDIES



Growth was similar for diets that replaced fish meal with Biofloc

GROWTH

SHRIMP NUTRITIONAL VALUE

Diet	Control	25% Biofloc	50% Biofloc
Crude protein %	78.5	69.2	72.8
Fat %	6.87	5.7	4.18
Ash %	14.8	17.8	16.0
Sulfur %	0.97	0.93	0.82
Phosphorus %	1.08	1.5	1.38
Potassium %	1.38	1.36	1.29
Magnesium %	0.36	0.42	0.47
Calcium%	2.82	3.92	3.15
Sodium %	2.31	1.92	2.11
Iron (ppm)	n.d. (< 5)	28.5	30.6
Copper (ppm)	110	76.2	48.3
Manganese	n.d. (< 5)	5.1	6.5
Zinc (ppm)	73.8	82.2	61.6

CONCLUSIONS

- Results were inconclusive
- Use of ex-situ biofloc collected from the FAU-HBOI IMTA system *may be* a viable ingredient used to replace a portion of fish meal in shrimp diets
  - Tank studies showed no difference in survival, but showed decreased growth in juvenile shrimp fed diets in which fish meal was replaced by biofloc
  - Cup studies showed no differences in survival or growth in postlarval shrimp fed diets in which fish meal was replaced by biofloc

HMMMM…….QUESTIONS

- Proximate, amino acid & fatty acid analysis did not point to any substantial deviations in nutritional value between diets….
- Pellet stability issues?
  - Binding & Leach rate
- Differences in types of systems used?
  - Water movement
  - Static systems
- Differences between postlarvae & juveniles?
  - Unlikely

POSSIBLE FUTURE FOCUS

- Longer term growth studies?
- Diets with a lower % of biofloc?
- Determine whether a more stable pellet will improve results

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QUESTIONS?