PRODUCTION OF SHRIMP Litopenaeus vannamei WITHOUT MARINE PROTEINS IN A BIOFLOC SYSTEM

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Introduction

Production of shrimp without water exchange with the utilization of bioflocs has gained a lot of interest recently. The presence of bioflocs in the shrimp farming system not only maintains a good water quality, but will also provide essential and high quality nutrients to the shrimp. This additional feed makes it possible to obtain fast growth and low FCR.

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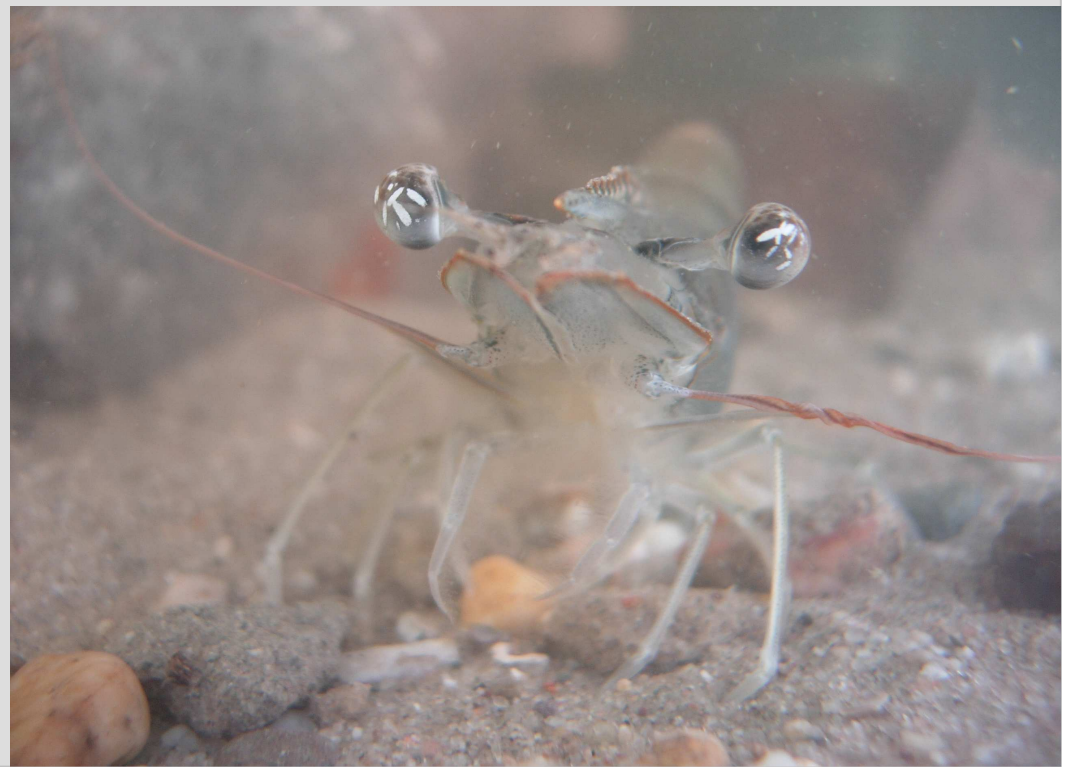
Introduction

Shrimp differ from fish in their feeding habits.
They shew their feed outside their mouth.
They can eat half digested feed from each other (coprophagic)
They live mainly on the bottom
The molt frequently to grow
They eat slowly
They are omnivorous
They consume detritus
They filter passively
algae and bacteria
from the water



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Introduction

Fish meal has become a valuable and expensive ingredient and its utilization should be minimized as much as possible. The future of aquaculture will depend on the possibility to produce seafood with a limited availability of this raw material.

Bioflocs

At intensive aeration the faeces of shrimp are assimilated by bacteria
These bacteria form colonies
Also rest products (fibers etc) and micro-organisms are part of these bioflocs
These bacteria take pollutants out of the water (ammonia) and convert them into proteins
Shrimp consume these bioflocs actively or passively
We thus obtain recycling of feed (similar to nature)

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Goal

Produce shrimp without the utilisation of marine proteins (no fish meal, no squid meal, no shrimp meal)
Use bioflocs to recycle waste protein and nitrogen in the shrimp tank to complement the pellets feeds with live organisms.

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Material & Methods - diets

A diet was formulated with not a single marine protein meal and compared with 3 traditional and proven formulations with 20 % Danish fish meal.

	Diet WG	Diet PBP	Diet UF	No FM
Danish fish meal	20	20	20	
Corn Gluten	11	11	12,5	12
Soybean meal	16	16	16	16
Hemoglobin powder				6
Wheat flour	31	31	31	24,3
Canola	12	12	12	12
Fish oil & Lecitihn	6	6	6	6,8
Wheat gluten	2			2
Other		2	0,5	2
Amino acid mix				7,4
Premix	2	2	2	2

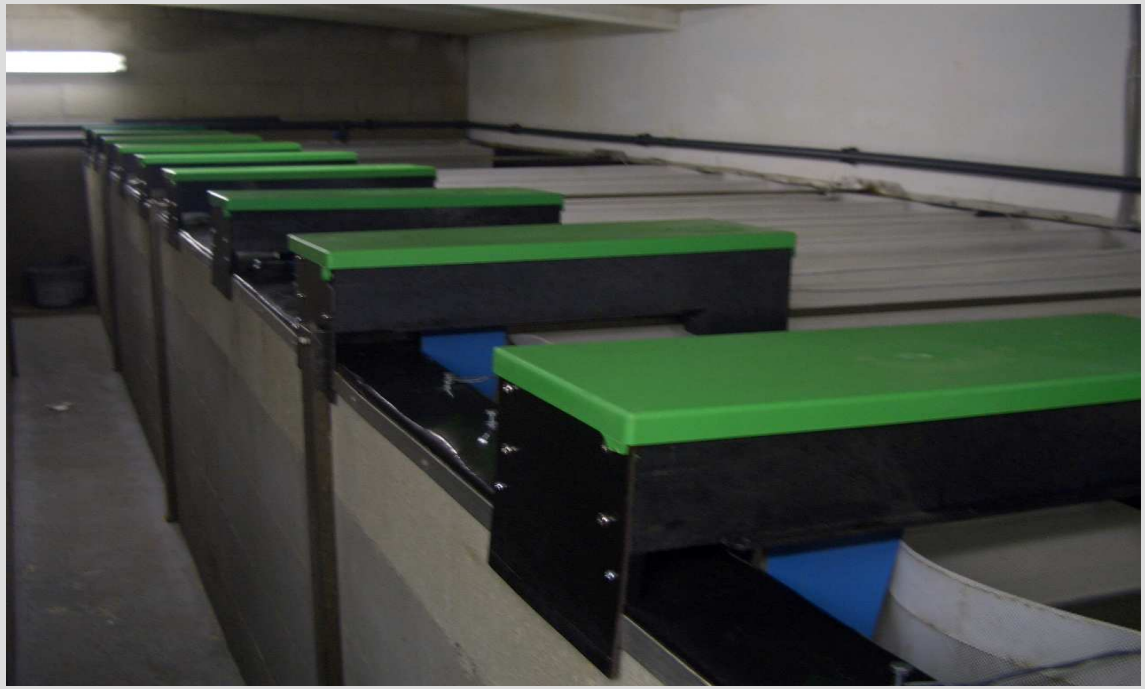
Material & Methods - diets

Diets were pelleted on a 2mm die

	Diet WG	Diet PBP	Diet UF	No FM
Crude Protein	**37,74**	**38,00**	**37,07**	**38,43**
Lipids	**8,61**	**8,66**	**8,63**	**8,54**
HUFA	**0,89**	**0,89**	**0,89**	**0,76**
Crude Fibre	**2,92**	**2,91**	**2,94**	**3,42**
Ash	**6,44**	**6,48**	**6,47**	**5,66**
Raw material (Euro/MT)	**690**	**707**	**690**	**530**

Material & Methods - shrimp

Shrimp were put in 12 nets of 150 L. The nets are submerged in a bigger tank, which is connected to a biofloc reactor. Water quality is maintained through bioflocs. Each net was stocked with 25 shrimp (*Litopenaeus vannamei*) of 12-13 g each. The shrimp trial lasted for 6 weeks.



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Material & Methods: in vitro digestibility

Protein digestion in shrimp digestive tract was simulated through the reaction of ingredient protein and shrimp proteolytic enzymes. Enzymes from the hepatopancreas of *Litopenaeus vannamei* (average weight 6 g) were employed.

Protein hydrolysis => release H^+ (drop in pH)

Automatically corrected by addition of NaOH

Over the reaction time: volume of NaOH expended proportional to degree of protein hydrolysis (DH%) ~ hydrolisable protein (= *in vitro* digestibility) => **index of hydrolysable protein**

Positively related to apparent protein digestibility (Lemos et al., 2009).

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Results: in vitro digestibility

Shrimp showed a similar growth with all diets.
Although the shrimp with the diet without fish meal had a slightly better growth and FCR, these results were not statistically different.

	Diet WG	Diet PBP	Diet UF	No FM
In vitro protein hydrolysis (DH%)	*4,69*	*4,78*	*3,89*	*4,61*
Predicted protein digestibility (%)	*91,9*	*92,0*	*90,7*	*91,8*

Feed samples with PPD from 90.7 to 92.0% may be considered of high to very high protein digestibility diets

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Results: growth

Shrimp showed a similar growth with all diets.
Although the shrimp with the diet without fish meal had a slightly better growth and FCR, these results were not statistically different.

	Diet WG	Diet PBP	Diet UF	No FM
Initial ind. weight (g)	***13,05***	***13,13***	***12,80***	***12,85***
Final ind. weight (g)	***22,44***	***22,7***	***22,09***	***22,63***
Average growth (g/week)	***1,565***	***1,595***	***1,550***	***1,629***
FCR	***1,81***	***1,60***	***1,66***	***1,44***
Survival	***77%***	***90%***	***92%***	***83,00%***

Discussion

It is unknown but certainly doubtfull if the same results would have been obtained in clear water (no bioflocs).
Research in the past has proven that the presence of bioflocs can increase growth by 15 % and decrease FCR by 40 %, which means that shrimp can benefit from the nutritional quality of bioflocs.
A good balanced feed can be produced without the utilisation of marine proteins, as long as digestible protein sources are used and amino acids are balanced.

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Conclusion: Sustainable Production !

- No water exchange during farming
- Recuperation of water for next cycli
- Recycling nutrient faeces via bioflocs
- Limited utilisation of natural resources

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Thank you for you attention !