SKRETTING
WORLD AQUACULTURE ADELAIDE 2014
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7-11 June

BIOFLOC AS BIOSECURITY

A possible solution in preventing shrimp disease

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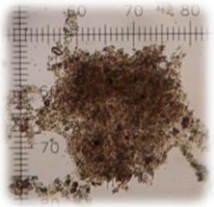
Blue Archipelago
Quality | Safety | Ecology

Adelaide Convention Centre,
Adelaide, South Australia
8 June 2014



INTRODUCTION

The biofloc technology was used in Indonesia without incidents of WSSV where it was a threat to shrimp farmers during early 2000s (Taw, 2005 & 2011; Taw et al, 2010, 2011 & 2013). During late 2000s the IMNV outbreaks in Indonesia caused a huge lost to Indonesian shrimp farmers. During the period a small shrimp farm in Northern Bali using biofloc technology survived by using biofloc technology (Taw & Setio, 2014). In Malaysia biofloc technology has been applied at iSHARP Blue Archipelago shrimp farm since October 2011 and has been operating successfully (to date March 2014) without any incident of EMS/AHPND (Taw, et al. 2013 & 2014). Recently, according to In-Kwon (2012 &2014) there were more than 2,000 bacterial species in well-developed biofloc water. This biofloc may enhance immune activity based on mRNA expression of six immune-related genes – ProPO1, ProPO2, PPAE, ran, mas and SP1. Very recent study at Bogor University, Indonesia and Ghent University, Belgium revealed that biofloc system contributes to the enhancement of immune response and survival after IMNV challenge regardless the carbon source. The application of BFT brings about beneficial effect in disease control and management in shrimp culture (Ekasari, et al., 2014).

With emerging new viral diseases such as EMS/AHPND in Asia, a preventive solution has become essential for sustainable production in shrimp farming. Biofloc technology, a very recent technology seem a very promising for stable and sustainable production as the system has self-nitrification process within culture ponds with zero water exchange.

SHRIMP DISEASES

Bamboo Shrimp Syndrome - recent

Juvenile *Penaeus vannamei* from Vietnam. Left with EMS; right appears normal.

Shrimp - Major Current Diseases

- Yellow Head Virus (YHV)
- Infectious Hypodermal and Hemalopoietic Necrosis Virus (IHHNV)
- Infectious Micro-necrosis Virus (IMNV)
- White Spot Sydnrome Baculovirus complex (WSSV)
- White Feces
- Bamboo Shaped Disease
- Acute Hepatopancreatic Necrosis Syndrome(EMS/AHPNS)

EMS/AHPNS Spreading in Asia & SE Asia

29-day old ***P. monodon***

Dr Subasingle GAOL 2012

EMS/ AHPNS to Mexico 2013

EMS (Early Mortality Syndrome)/ AHPNS (Acute Hepatopancreatic Necrosis Syndrome)

Gross Signs of EMS/AHPNS

- Significant atrophy of the hepatopancreas (HP).
- Often pale, yellowish or white within the HP connective tissue capsule.
- Black spots or streaks sometimes visible.
- HP does not squash easily between thumb & finger.

Juvenile *Penaeus vannamei* from Vietnam.
Left with EMS; right appears normal.

Dr. Lightner, GOAL 2012

EMS/AHPNS update 9 July 2013

Vol. 105: 45–55, 2013
doi: 10.3354/dao02621

DISEASES OF AQUATIC ORGANISMS
Dis Aquat Org

Published July 9

Determination of the infectious nature of the agent of acute hepatopancreatic necrosis syndrome affecting penaeid shrimp

Loc Tran[1,2], Linda Nunan[1], Rita M. Redman[1], Leone L. Mohney[1], Carlos R. Pantoja[1], Kevin Fitzsimmons[2], Donald V. Lightner[1,*]

The results from this research also indicated that the bacteria-free supernatant of the broth media could induce AHPNS pathology in the reverse gavage experiment. This evidence strongly suggests that AHPNS lesions are caused by bacterial toxin(s), as was suggested in a previous paper on AHPNS pathology (Lightner et al. 2012).

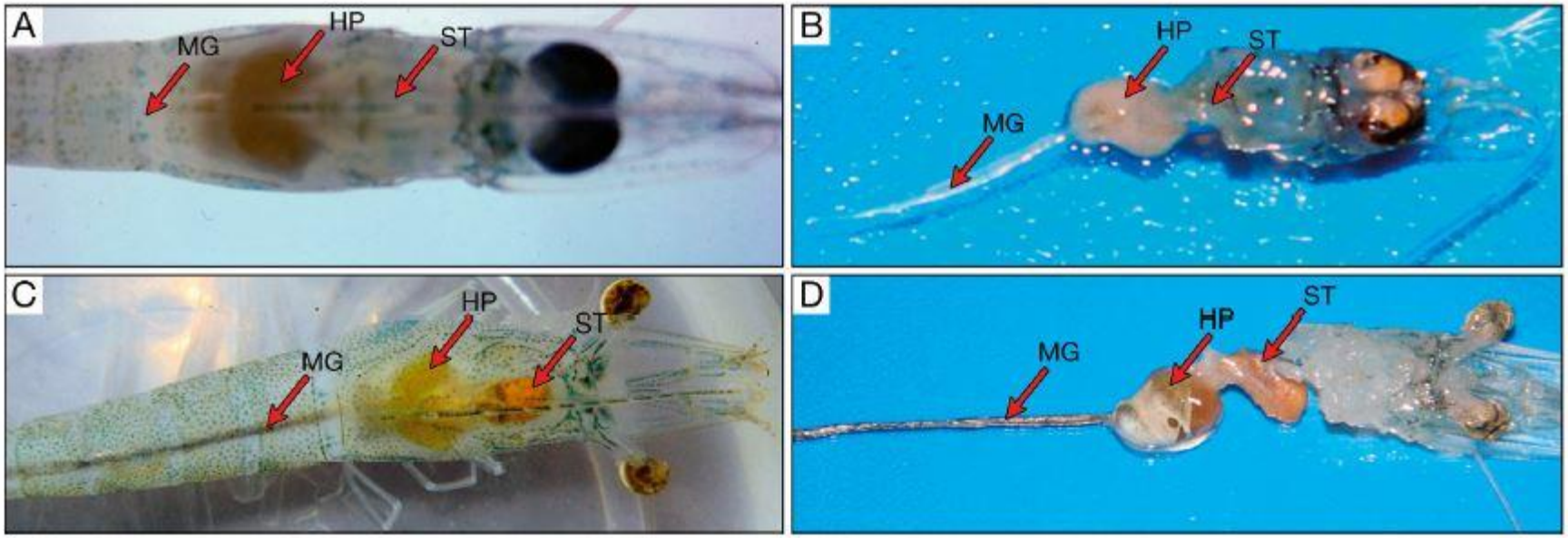
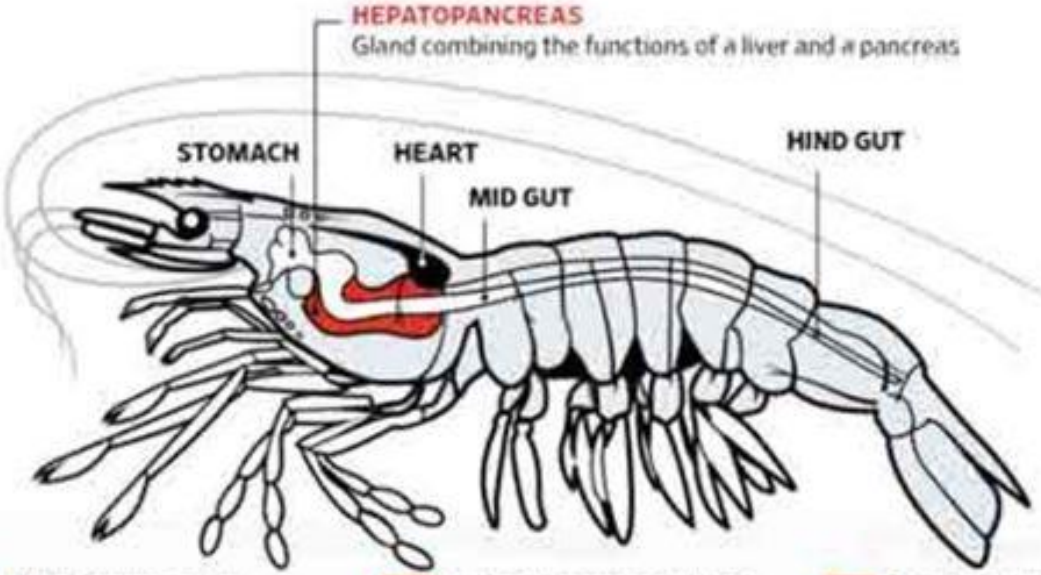


Fig. 2. *Penaeus vannamei*. (A,B) Gross signs of AHPNS-infected shrimp. Pale, atrophied hepatopancreas (HP), and an empty stomach (ST) and midgut (MG), which was induced by immersion bioassay. (C,D) Normal shrimp in the negative control group, showing a normal size HP with dark orange color and a full stomach and midgut. (B) and (D) are dissected individuals from (A) and (C), respectively

EMS/AHPNS IN WALL STREET, USA 2013

A Punch to the Gut

Shrimp farmed in Thailand and elsewhere in Asia are dying from a bacterial disease called early mortality syndrome or acute hepatopancreatic necrosis syndrome.



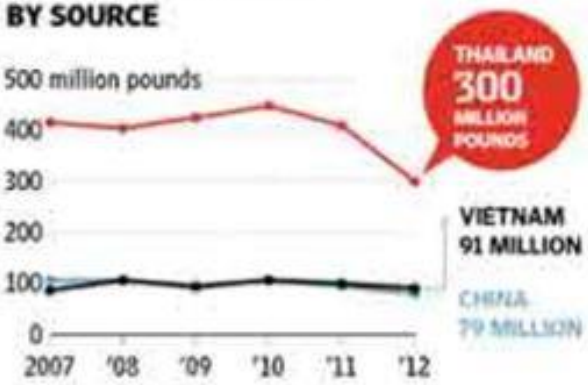
SPECIES AFFECTED

Pacific white shrimp
Black tiger shrimp

WHAT HAPPENS

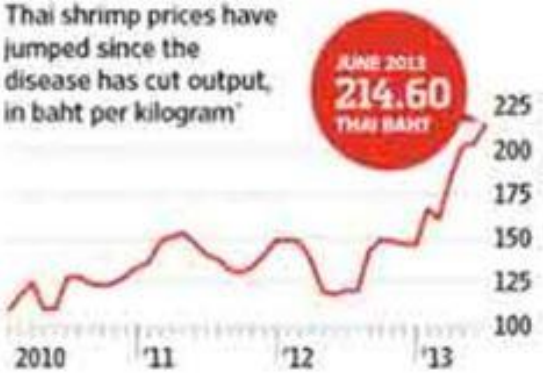
1. The disease usually occurs within 45 days in ponds with newly stocked postlarvae shrimp.
2. Vibrio bacteria in the stomach prompt shrimp to stop eating and release toxins that damage the hepatopancreas.
3. As hepatopancreas cells die, secondary bacteria attack the gland. Mortality in ponds can approach 100% in a few days.
4. The disease is inactivated by freezing and thawing. Affected shrimp pose no concerns to human health.

U.S. SHRIMP IMPORTS, BY SOURCE



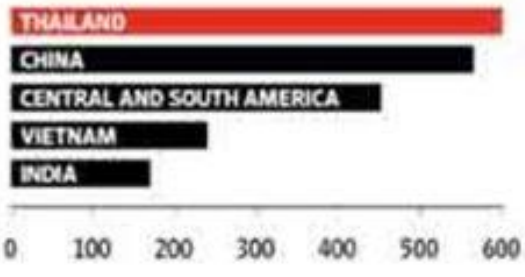
PRICES

Thai shrimp prices have jumped since the disease has cut output, in baht per kilogram*



PRODUCERS

World's top shrimp producers in 2011, in thousands of tons



SOME ARTICLES ON EMS/AHPNS

challenge: ems/ahpns

EMS/AHPNS: Infectious Disease Caused By Bacteria

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production

Early Mortality Syndrome Affects Shrimp In Asia

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B. L. Noble
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Summary:
Early mortality syndrome is a new disease that has been detect... farms in Asia. It appears within 30 days of stocking and causes ... include lethargy; soft, darkened shells and molting of the cau... ological effects of EMS appear to be limited to the hepatopan... terminal stages of the highly fatal disease, secondary bacterial ... damages the hepatopancreas. The cause of EMS is under inv...

challenge: ems/ahpns

Ongoing Vietnam Studies Find *Vibrio* With Phage Transmits EMS/AHPNS

The hepatopancreas organs of AHPNS-affected shrimp have a pale or white color, along with discontinuous contents in the gut (left) or an empty gut.

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... of a fresh smear of hepatopancreatic tissue from an affected shrimp ... of Gram-negative, rod-shaped bacteria. The image on the ... cells, tubule sloughing and hemocytic inflammation.

farms in Tra Vinh, Soc Trang, Bac Lieu, Ca Mau and Kien Gang Provinces in the Mekong Delta from March to September 2012. However, only 56 of the ponds were recorded as affected by AHPNS.

challenge: ems/ahpns

Environmental Trigger For EMS/AHPNS Identified In Agrobest Shrimp Ponds

Shrimp held in aquaria with pH within the "safe zone" behaved normally, while those in aquaria outside the safe zone exhibited AHPNS symptoms and mortality.

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Nara, Japan

Environmental Interaction?

In an initial trial, stressed shrimp from an affected pond were transferred to aquaria with clean pond water. During the morning of their transfer, the shrimp were severely stressed, exhibited opaque muscle tissue and were inactive on the bottom. High mortality was expected.

However, by that afternoon, the shrimp in the aquaria had recovered normal coloration and activity. They continued to behave normally for an additional week, when the trial was discontinued.

In a second trial, non-infected shrimp

Summary:
In studies of early mortality syn... drome (AHPNS), appeared at Agrobest in early January 2011 in five ponds that were stocked with postlarvae from the same hatchery about one month earlier

Development Of 1-Monoglycerides Against AHPN

Varied Trials Mark Continued Advances

This image from an electron microscope shows the membrane alteration caused by 1-monoglycerides, which disturbed homeostasis and led to the death of the *E. coli* bacteria cell. Photo courtesy of Dr. Morten Hyldgaard, Aarhus University.

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Summary:

Vibrio parahaemolyticus is spread via many different vectors, such as phytoplankton, zooplankton or detrimental pond residues. The chitin exoskeletons of shrimp are also suspected to serve as carriers for *Vibrio* bacteria. With so many vectors involved, eradication of *Vibrios* is not possible nor desired, since *Vibrios* also have beneficial purposes in pond ecosystems alongside other organisms.

SHRIMP NEWS INTERNATIONAL

April 5, 2014
Thailand

Diversity in Isolates That Cause EMS

From Abstract: In this study, researchers describe the isolation and characterization of bacteria isolated from the hepatopancreas of shrimp collected from a farm in Thailand that experienced early mortality syndrome (EMS). Four independent bacterial isolates were identified as Vibrio parahaemolyticus by BLAST analysis and by gene-specific marker detection of a lecithin dependent hemolysin considered being specific for the species. Immersion challenges with three of these and a reference isolate obtained from China in 2010 caused very high mortality accompanied by characteristic histopathology in the hepatopancreas. Tests with one of these isolates revealed that the rate of mortality was dose dependent. Using the same challenge protocol, another isolate also caused high mortality, but it was not accompanied by EMS histopathology. Instead, it caused a different histopathology of the hepatopancreas, including collapsed epithelia and unique vacuolization of embryonic cells. **These results revealed the possibility of diversity in isolates of V. parahaemolyticus that may cause EMS.**

Source: Aquaculture. Variation in Vibrio Parahaemolyticus Isolates from a Single Thai Shrimp Farm Experiencing an Outbreak of Acute Hepatopancreatic Necrosis Disease (AHPND). Jyoti Joshi, Jirapom Srisala, Viet Truong Hong, I-Tung Chen, Bunlung Nuangsaeng, Orasa Suthienkul, Chu Fang Lo, Timothy W. Flegel, Kallaya Sritunyalucksana and Siripong Thitamadee (email siripong.thi@mahidol.ac.th, Centex Shrimp, Faculty of Science, Mahidol University, RamaVI Road, Bangkok, Thailand). In Press, Accepted Manuscript. Available Online on March 28, 2014.

PROPOSED ACTIONS FOR EMS

Action by CP Against EMS

- CP Malaysia (Asia Aquaculture
  - Fry
  - Nursery
  - Probiotic
  - Fermentation Method
  - oly culture with tilapia
  - & Semi Bio-Floc & Brown wat
  - ncer & Chlorella domin

DOF Malaysia Jan

BIO-FLOCK VS Green water plankton

BFT - Courtesy of Yoram, 2012

What is BFT?

- 1. We limit water exchange
- 2. Organic residues accumulate
- 3. We mix and aerate.
- 4 Ideal conditions for bacteria
- 5 Bacteria control water quality.
- 6. Fish eat bacteria
- 7. Feed is recycled

Poly culture with Tilapia

- Direct stocking fish fry and mix together with shrimp

Fermentation Method

To reduce the pH

Nursery System

1) Pump water from reservoir into sediment pond

2) Wa

DOF Malaysia
March

Semi Bio-Floc

Bio-Floc System

Brown

'Caveat Emptor' Recommended For EMS/AHPN Management Solutions

Summary:
Disease is a result of interrelated interactions among the host, the environment and the pathogen. As with other diseases, early mortality syndrome/acute hepatopancreatic syndrome in shrimp does not involve a simple disease process, so a single, all-encompassing solution is unlikely. The development of polymerase chain reaction testing to detect the bacteria that cause EMS is important, but until further testing confirms its specific identification of the EMS *Vibrio*, confirmation by bioassay of presumptive positives to ensure pathogenicity is a prudent intermediate step.

requirements, as an example, that ensure buyers understand there may be risks associated with the use of some products. Nonetheless, this adage remains very much a truism in today's world.

Disease Solutions

With every major disease outbreak in shrimp farming, there have been those who are understandably drawn to the large profit potential that a widespread solution would offer. Yet I am not aware of a single instance where the tools offered significantly impacted the disease process in the long run and remained in common use. Tools that provide long-lasting and broad-reaching solutions are not the norm for controlling diseases in farmed shrimp.

Many compounds kill bacteria and viruses, and more are being found all the time. Disinfectants – chemicals and ion-

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If killing the bacteria was all that was needed to prevent or stop infection, the use of chlorine might have prevented the AHPN problem from developing in the first place. Some have speculated that the overuse of some of the routinely used disinfection tools may have created niches that have allowed bacteria such as the etiologic agent of AHPN to evolve and thrive. Wholesale attempts at disinfection of large

Development Of 1-Monoglycerides Against AHPN

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Summary:

Raceway Systems Offer Tools For EMS/AHPN Management

Summary:
Highly controlled tank and raceway systems can hel
shrimp to larger sizes before stocking in
and zero water exchange of
high-quality feeds,
recently

raise postlarval
higher densities
biosecurity,
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hatcheries
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they are

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temperature control, greenhouse struct
and better feeds – all with the objective
keeping a stable environment for strong
healthy animals.

SOLUTION – At Farm

- BioSecurity
- From pond construction
- Every employee - education
- Take every precaution
- Limit all risk
- Prevention with Verification
- **CERTIFICATION**

POSSIBLE SOLUTION FOR EMS/AHPNS AT FARM LEVEL
(EMS Panel GOAL 2012 Bangkok)

Biosecurity at pond/farm level

- Avoiding high risk practices (live feeds; co-cultivation, unregulated movement)
- Implementing pathogen exclusion practices (SPF broodstock, water treatment e.g., filtration, disinfection)
- Reduce stress in production practices
- Employ disease containment practices (good sanitation, bird netting)
- Implement BMPs (stocking larger sizes, probiotics, bioflocs)

BIOFLOC as possible solution for EMS/AHPNS control at farm level

RECENT DEVELOPMENTS

SHRIMP NEWS INTERNATIONAL

November 18, 2013
United States

Arizona—PCR Detection of Acute Hepatopancreatic Necrosis Disease (AHPND/EMS) Available!!!

Linda Nunan, Assistant Staff Scientist at Dr. Donald Lightner's shrimp pathology laboratory at the University of Arizona, posted the following information to The Shrimp List, a mailing list for the shrimp farming industry:

PCR for EMS/AHPND

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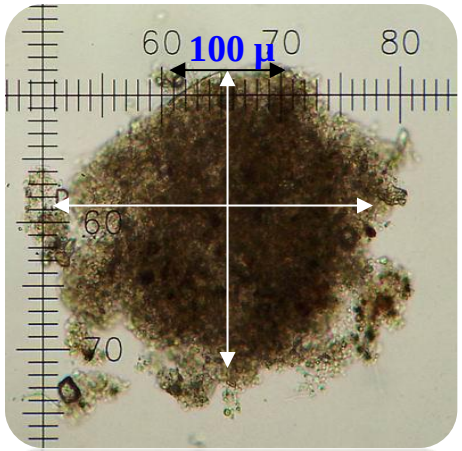
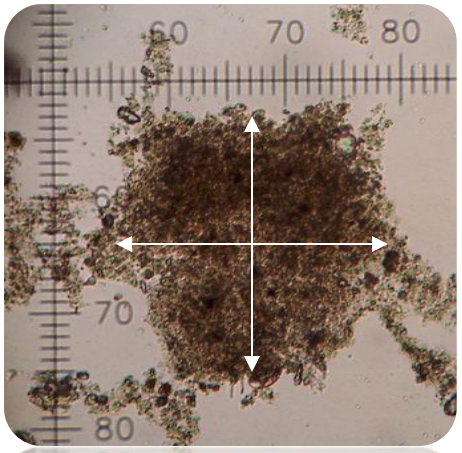
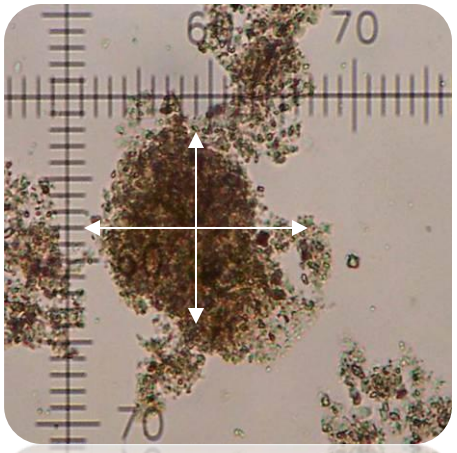
BIOFLOC as possible solution for EMS/AHPNS control at farm level

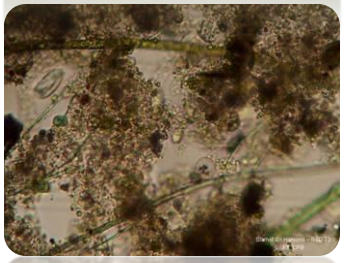
BIOFLOC

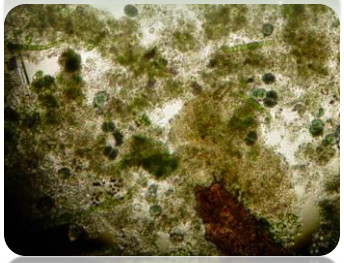
FLOC COMMUNITIES AND SIZE











Brown **Green**

The biofloc

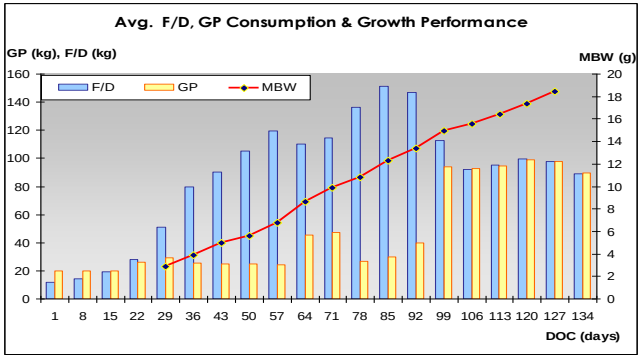
Defined as macroaggregates – diatoms, macroalgae, fecal pellets, exoskeleton, remains of dead organisms, bacteria, protest and invertebrates.
(Decamp, O., *et al* 2002)

As Natural Feed (filter feeders – *L. vannamie* & Tilapia) : *It is possible that microbial protein has a higher availability than feed protein (Yoram, 2005)*

SHRIMP FARMING IN BIOFLOC SYSTEM

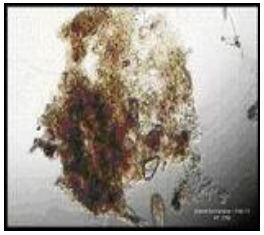
SUMMARY

1. **High stocking density - over 130 – 150 PL10/m2 (80-100PL10/m2)**
2. **High aeration – 28 to 32 HP/ha PWAs (20--24HP/ha)**
3. **Paddle wheel position in ponds (control biofloc & sludge by siphoning)**
4. **Biofloc control at <15 ml/L (<5 ml/L)**
5. **HDPE / Concrete lined ponds** (Earthen ponds)
6. **Grain (pellet)**
7. **Molasses**
8. **C&N ratio >15**
9. **Expected production 20–25 MT/ha/crop with 18-20 gms shrimp (13-16 MT/ha)**



Feed & grain application & Growth

Grain pellet



Bioflocs

Dark Vannamei

Red Vannamei

BIOFLOC TECHNOLOGY CONCEPT

Figure 2.3: Scheme of recirculating aquaculture system (RAS)

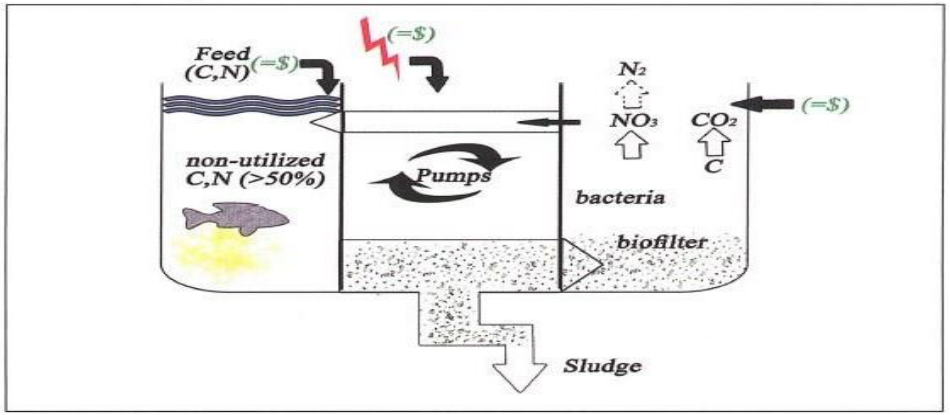
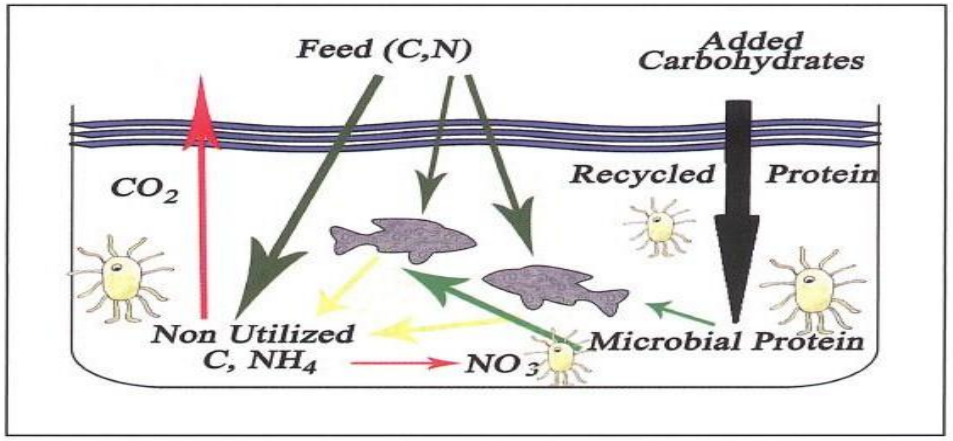


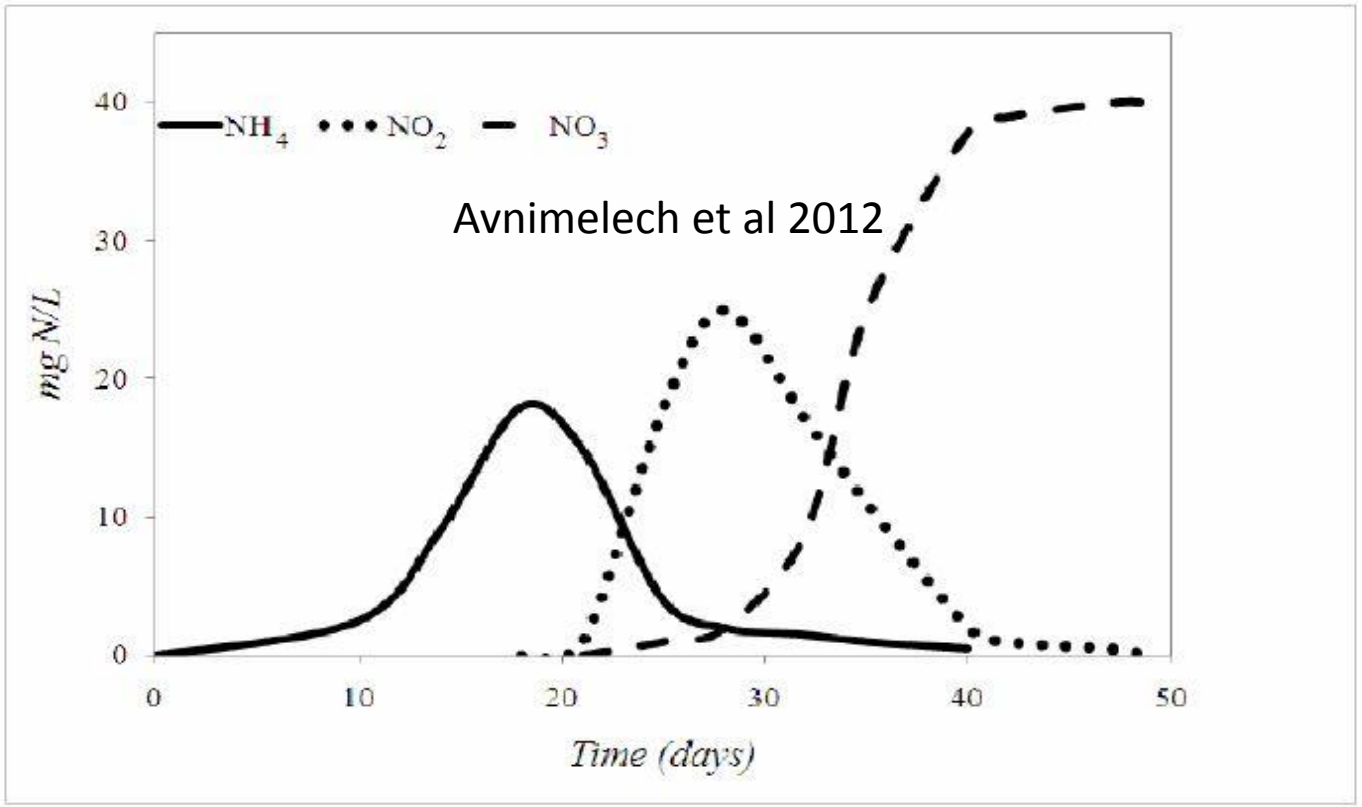
Figure 2.4: Scheme of Biofloc technology (BFT) system



Biofloc technology is a system that has a self-nutrification process within culture pond water with zero water exchange (Yoram, 2012)

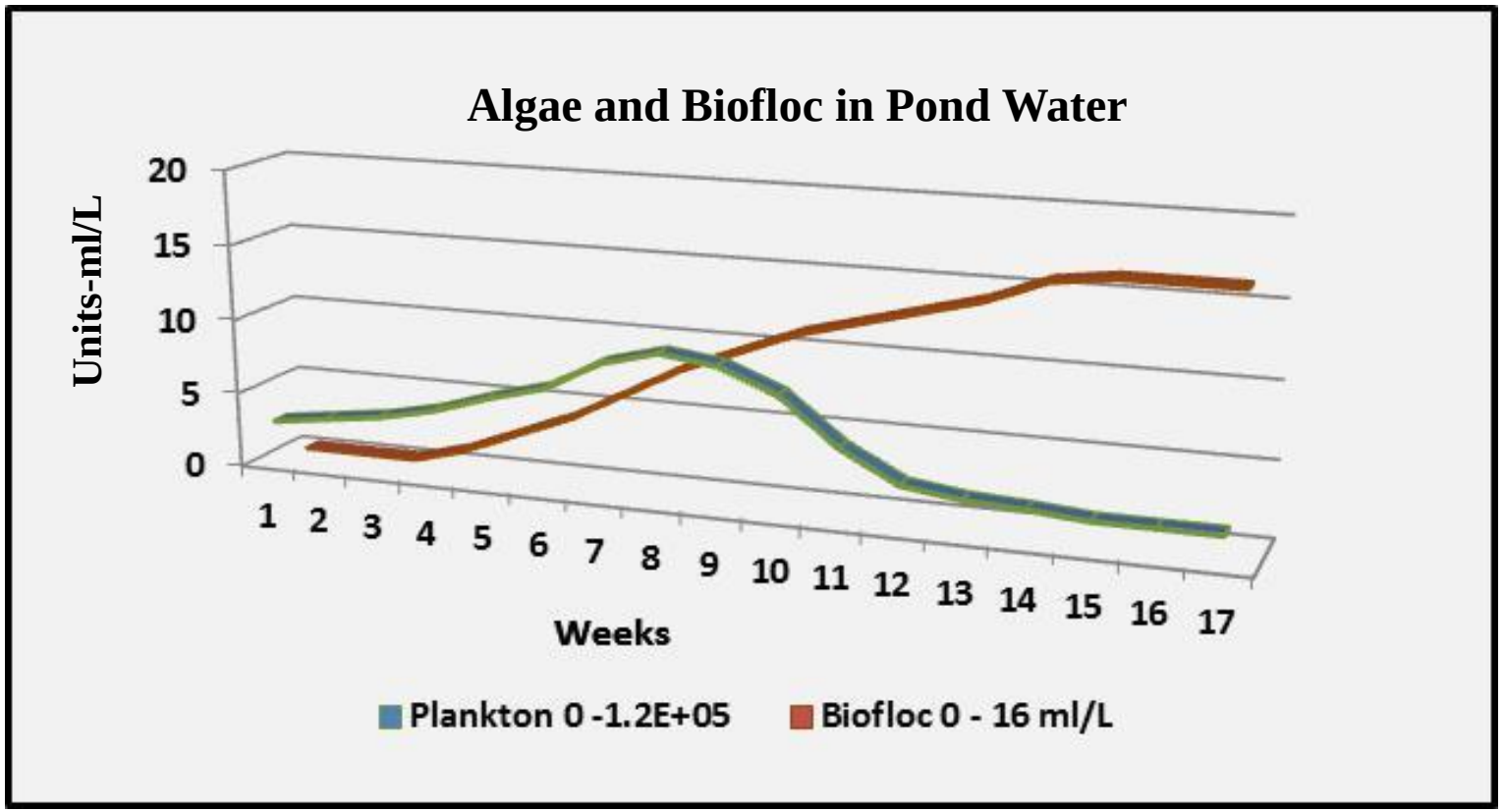
NITRIFICATION SEQUENCE

Nitrification sequence in BFT pond



Avnimelech et. at, 2012 (data from experimental pond Dor, Israel)

ALGAE TO BIOFLOC IN POND WATER

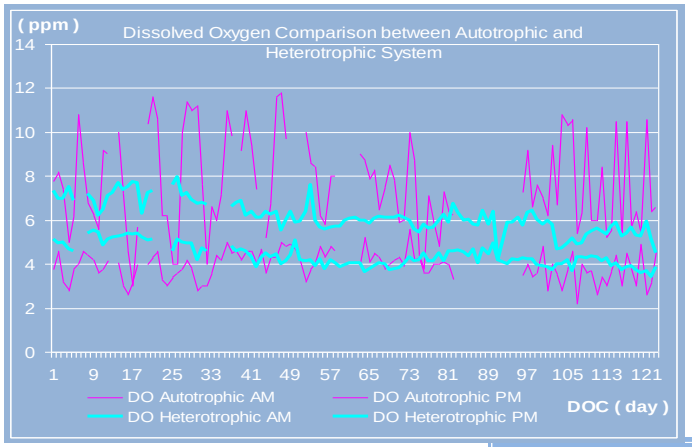


Development of biofloc system

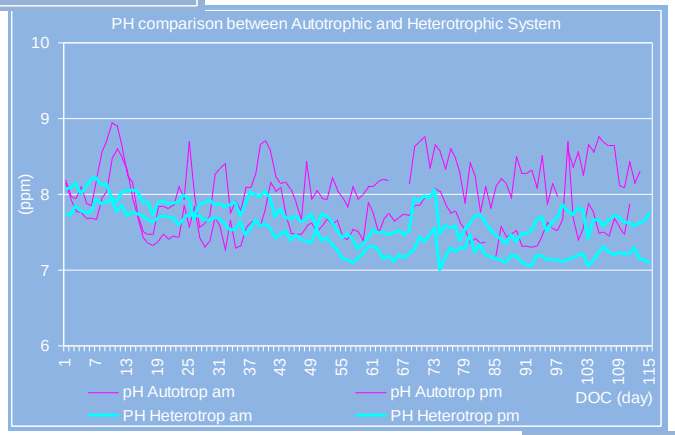
- It may take a few weeks, depends on the biomass.
- First algae develop. Transition, foam formation then it get brown.
- Transition is fast with tilapia, longer with shrimp
- Add carbon if TAN is above ~2 mg/l

Algae is well known to control *Vibrio* in seawater. Possibly control Vibrio at early stage of BFT system.

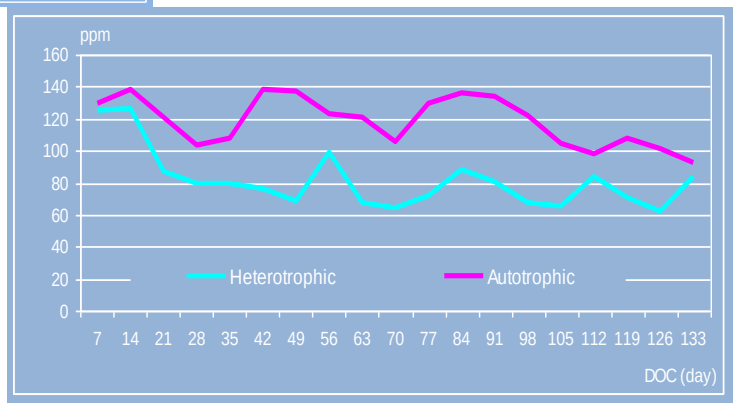
POND WATER ENVIRONMENT



DO – Algae & Biofloc



pH – Algae & Biofloc



Alkalinity – Algae & Biofloc

Chandaeng, S. et al.(2005): Taw, N (2006)

BIOFLOC AND PARTIAL HARVEST

Medan, Indonesia

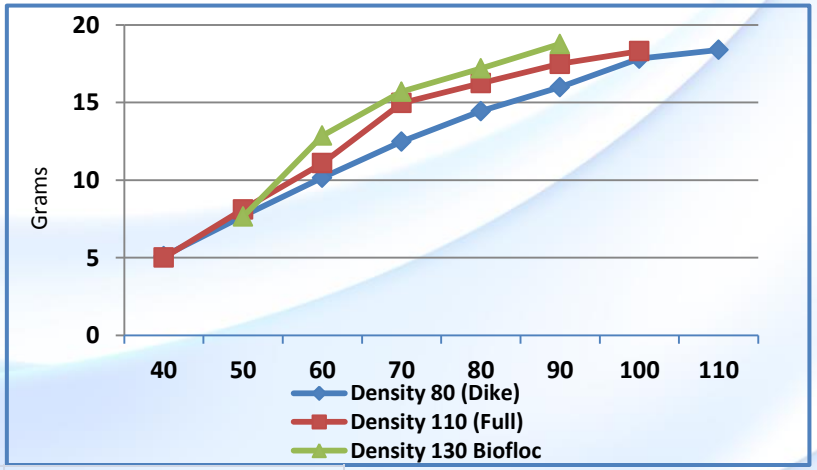
Partial Harvest Performance with Bio Floc Technology (February - July 2008)

Pond/size	System	Energy Input		Density	Partial	Harvest				Production		FCR		SR	Energy Efficiency -kg/HP	
		(Pond)	(Ha)	(M2)		DoC	Biomas (Kg)	Size No/kg	MBW (gr)	Kg/Pd	Kg/Ha	GP	Feed	(%)	Std Capacity	Efficiency
1 5896 m2	Phyto	16 (PW)	27 (PW)	100	1	118	434	47	21.28							
					Final	127	11,027	43	23.26	11,461	**19,439**	0	**1.60**	75.72	560*	**720**
2 5896 m2	Bio Floc	18 (PW)	31 (PW)	145	1	108	2,092	59	16.95							
					2	121	1,016	55	18.18	13,508	**22,910**	0.59	**1.20**	84.07	680*	**739**
					Final	131	10,400	52	19.23							
3 5940 m2	Bio Floc	18 (PW)	30 (PW)	146	1	109	2,108	56	17.86							
					2	122	999	50	20.00	14,386	**24,219**	0.56	**1.14**	80.95	680*	**807**
					Final	130	11,279	47	21.28							
4 4704 m2	Bio Floc	16 (PW)	34 (PW)	257	1	85	1,962	93	10.75							
					2	99	1,896	75	13.33							
					3	113	1,871	62	16.13							
					4	127	2,587	56	17.86	17,963	**38,229**	0.58	**1.12**	86.54	680*	**1,124**
					5	134	2,475	53	18.87							
					Final	155	7,192	47	21.28							
5 2,500 m2	Bio Floc	9 (PW) 3 (BL)	36 (PW) 12 (BL)	280	1	84	924	86	11.63							
					2	99	1,455	74	13.51							
					3	113	1,324	61	16.39							
					4	127	1,448	57	17.54	12,371	**49,484**	0.48	**1.11**	102.35	680*	**1,031**
					5	134	1,043	54	18.52							
					Final	155	6,177	50	20.00							
6 2500 m2	Bio Floc	7 (PW) 3 (BL)	28 (PW) 12 (BL)	145	1	110	1,166	51	19.61							
					2	124	367	49	20.41	6,545	**26,180**	0.50	**1.10**	86.35	680*	**655**
					Final	127	5,012	47	21.28							
7 2500 m2	Bio Floc	9 (PW) 3 (BL)	36 (PW) 12 (BL)	145	1	110	892	61	16.39							
					2	124	323	57	17.54	6,615	**26,460**	0.50	**1.10**	100.8	680*	**551**
					Final	130	5,400	54	18.52							
										82,849	**29,560**	0.53	**1.13**	88.1		

Nyan Taw, *et al*, GAA Sep/Oct2008
Nyan Taw *et al*, WAS 2009 Mexico

PERFORMANCE –BIOFLOC & SEMI BIOFLOC

Acar Beru, Blue Archipelago, Malaysia

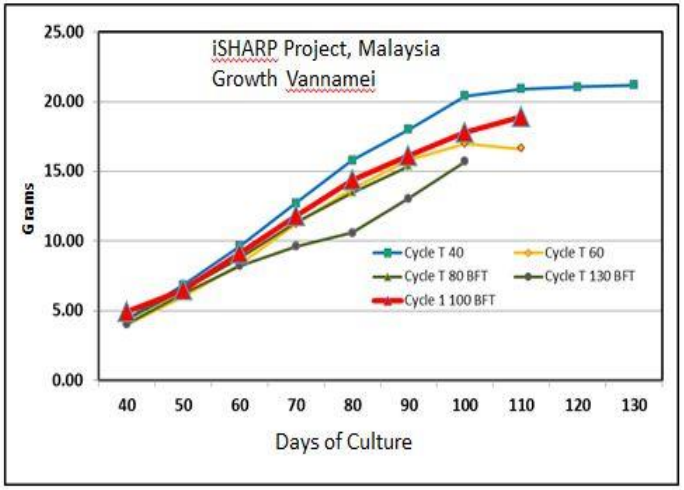


PRODUCTION PERFORMANCE OF ARCA BIRU FARM

Production Parameter	System/size/type		
	Biofloc 0.4 ha HDPE	Semi-Biofloc 0.8 ha HDPE	Conven 0.8 ha HDPE Dyke
No of Ponds	2	19	119
PWA Energy (Hp)	14	24	20
Stocking Density	130	110	83
DOC (days)	90	101	111
SR (%)	89.16	81.35	83.19
MBW (gr)	18.78	18.31	17.80
FCR (x)	1.39	1.58	1.77
ADG (gr/day)	0.21	0.18	0.16
Avg Harvest tonnage (kg)	9,006	12,950	9,616
Production (Kg/Ha)	22,514	16,188	12,019
Prod per power input (Kg/Hp)	**643**	**540**	**481**

Nyan Taw, *et.al.* GAA March/April 2011

ISHARP BLUE ARCHIPELAGO, MALAYSIA
SEMI-BIOFLOC PERFORMANCE

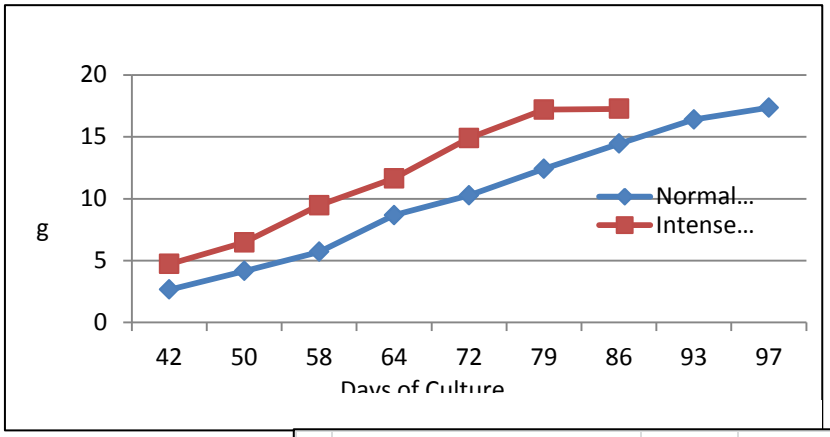


Nyan Taw *et. al. GAA Jan/Feb* 2013

Production Performance CYCLE Trial & 1 for Modules 1 & 2

Production Parameter	CYCLE Trial - Modules 1 & 2				CYCLE 1 -Modules 1 & 2	
	Density 40/m2	Density 60/m2	Density 80/m2	Density 130/m2	Density 100/m2	Density 100/m2
No of ponds	20	16	8 BFT	4 BFT*	24 BFT	24 BFT
Paddle Wheels Aerators (HP)	12	12	12	16	12	12
Days of Culture (DoC)	113	108	94	88	100	99
Survival Rate (%)	112.23	101.22	106.05	69.56	97.30	104.92
MBW (grams)	21.65	17.41	13.86	12.56	16.05	16.31
FCR	1.34	1.47	1.32	1.74	1.39	1.26
Average Production (kg/pond)	4,875	5,294	5,828	5,677	7,714	8,547
Average Production (kg/ha)	9,749	10,587	11,655	11,354	15,428	17,093
Prod per power Input (Kg/Hp)	406	441	486	355	643	712

BIOFLOC IN BALI, INDONESIA



NO VIRAL (IMNV or WSSV) OUTBREAKS 2009-2013

SHRIMP FARM BALI - Biofloc technology

Culture period August- November 2012

Pond	A2	A3	F1	F2	E1	E2*	B1	B2	B3	C1	C2	C3
Pond Size (M2)	2,400	2,600	2,800	2,800	1,000	750	2,000	2,000	2,000	600	600	600
PL Stocking Density (No/m2)	170	148	150	145	150	180	155	155	155	175	175	175
Aeration (hp)	18	18	16	18	6	4	12	12	12	12	6	4
Days of Culture	97	97	97	95	95	45	82	82	81	82	82	81
Body weight (gm)	18.4	18.12	15.32	17.3	16.48	4	19.5	18.5	16	14.68	19.72	18.48
Feed Conversion ratio	1.26	1.35	1.49	1.29	1.46		1.2	1.4	1.25	1.35	1.1	1.14
Survival (%)	105.8	104	101	106	94.7		103.9	94	92.9	97.4	98.5	101.9
Production (kg)/pond	7,914	7,281	6,388	7,682	2,345		6,307	5,399	4,622	1,503	2,050	1,981
Production (kg/ha)	32,976	28,004	22,814	27,436	23,450		31,535	26,995	23,110	25,050	34,167	33,017
Production/power input (kg/hp)	440	405	399	427	391		526	450	385	376	342	495

* Aeration problem - DO dropped <1.0ppm

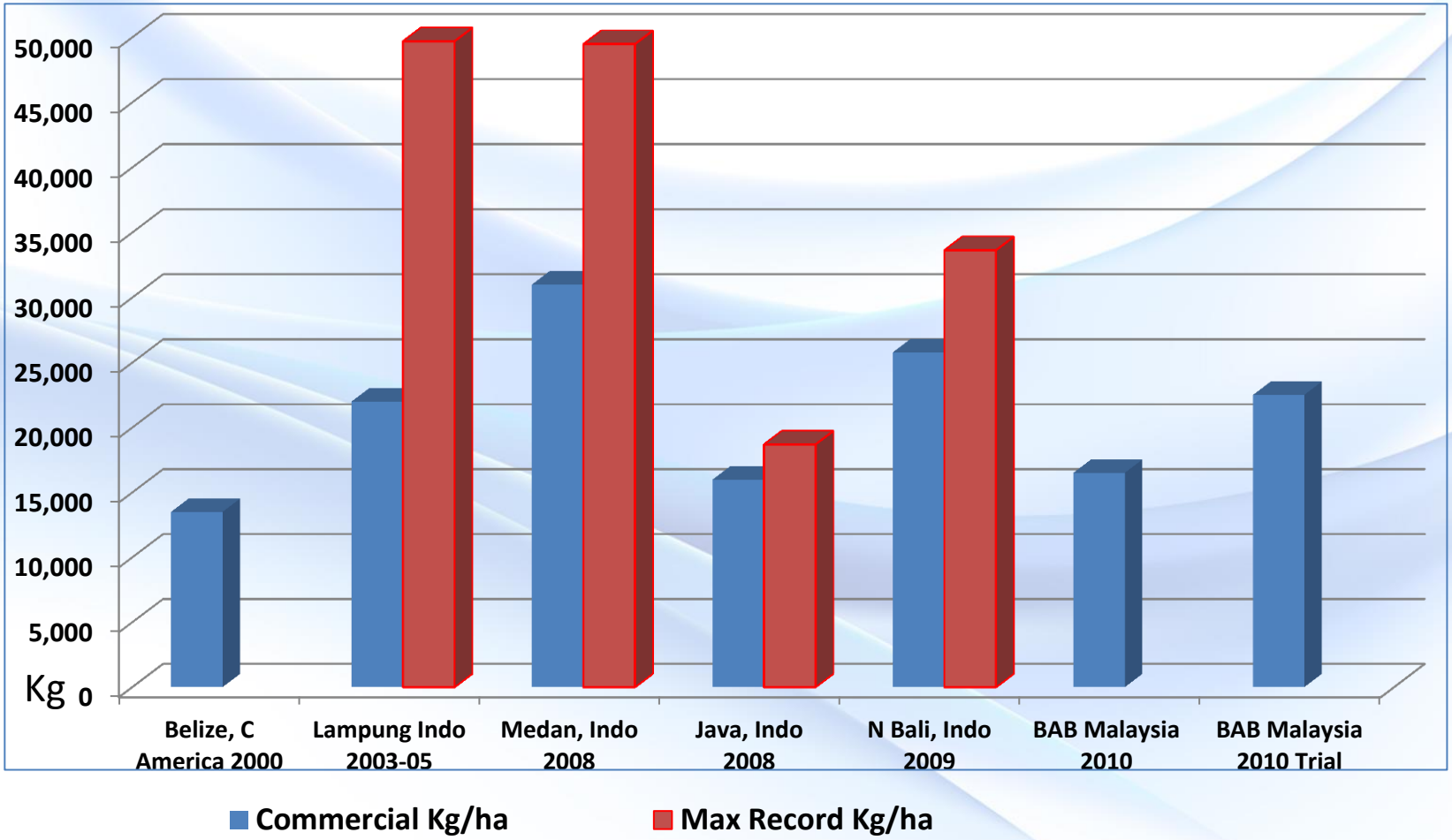
Farm total Production: 53,472 kg (26,736 kg/ha)

In this cycle ponds B1,B2, B3,C1,C2 & C3 intense control less DOC to just over 80 days- more cycles/year

Taw & Setio, 2014 (to be published in Jan-Feb GAA 2014)

BIOFLOC IN SHRIMP FARMING

Production Performance



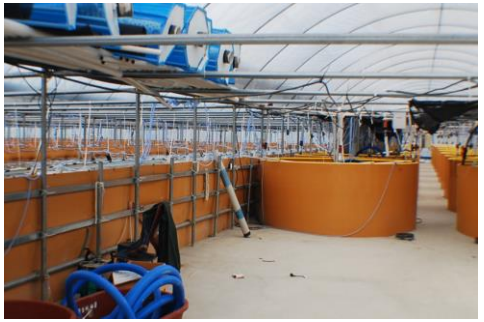
	BIOFLOC BASIC MANAGEMENT CONCEPTS FOR SHRIMP CULTURE
1	**Semi-biofloc to Full biofloc system feasible**
2	**Use treated water only**
3	**Zero water exchange (only topping up)**
4	**Earthen to HDPE full or semi-lined ponds**
5	**Aerators to have pond water (biofloc) in suspension (22-24 hrs)**
6	**Correct aerators' position and number very important**
7	**Excess sludge need to be removed –specially for full biofloc**
8	**Biofloc volume control (<15 ml/L)**
9	**Control C/N ratio to above >15**
10	**Molasses & Grain pellet required (Carbon source)**
11	**Operate in accordance with Carrying capacity of pond essential (species/stocking density/pond type/operating system)**

BIOFLOC MAY ENHANCE IMMUNE ACTIVITY

More than 2,000 bacterial species were found in well-developed biofloc water

Biolfocs may enhance immune activity, based on mRNA expression of six immune-related genes.

ProPO1, proPO2, PPAE, ran, mas and SP1



From – In-Kwon Jang, IWA International Water Congress, 2012, Busan, Korea

Aquaculture Research

Aquaculture Research, 2013, 1–10 doi: 10.1111/are.12319

Effect of bioflocs on growth and immune activity of Pacific white shrimp, *Litopenaeus vannamei* postlarvae

Su-Kyoung Kim[1], In-Kwon Jang[1], Hyung-Chel Seo[1], Yeong-Rok Cho[1], Tzachi Samocha[2] & Zhenguo Pang[1]

[1]Department of Aquaculture, National Fisheries Research & Development Institute, Incheon, Korea

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CONCLUSIONS

The dense microbial population associated with **the bioflocs induces a permanent trigger towards the development and maintenance of the shrimp immune system and thus build up a defence mechanism in the shrimp population.** This mechanism and its utilization may be a very important means to protect shrimp against drastic disease outbreaks that often lead to collapse of shrimp production systems and to huge losses.

It has to be emphasized that the present work is just a start and a trigger of needed subsequent studies. The present work was limited to a short growth phase of postlarvae.

The effects of bioflocs grown on different carbon sources on shrimp immune response and disease resistance

Julie Ekasari[1,2], Muhammad Hanif Azhar[1], Titi Nur Chayati[1], Enang H. Surawidjaja[1], Peter De Schryver[2], Peter Bossier[2]

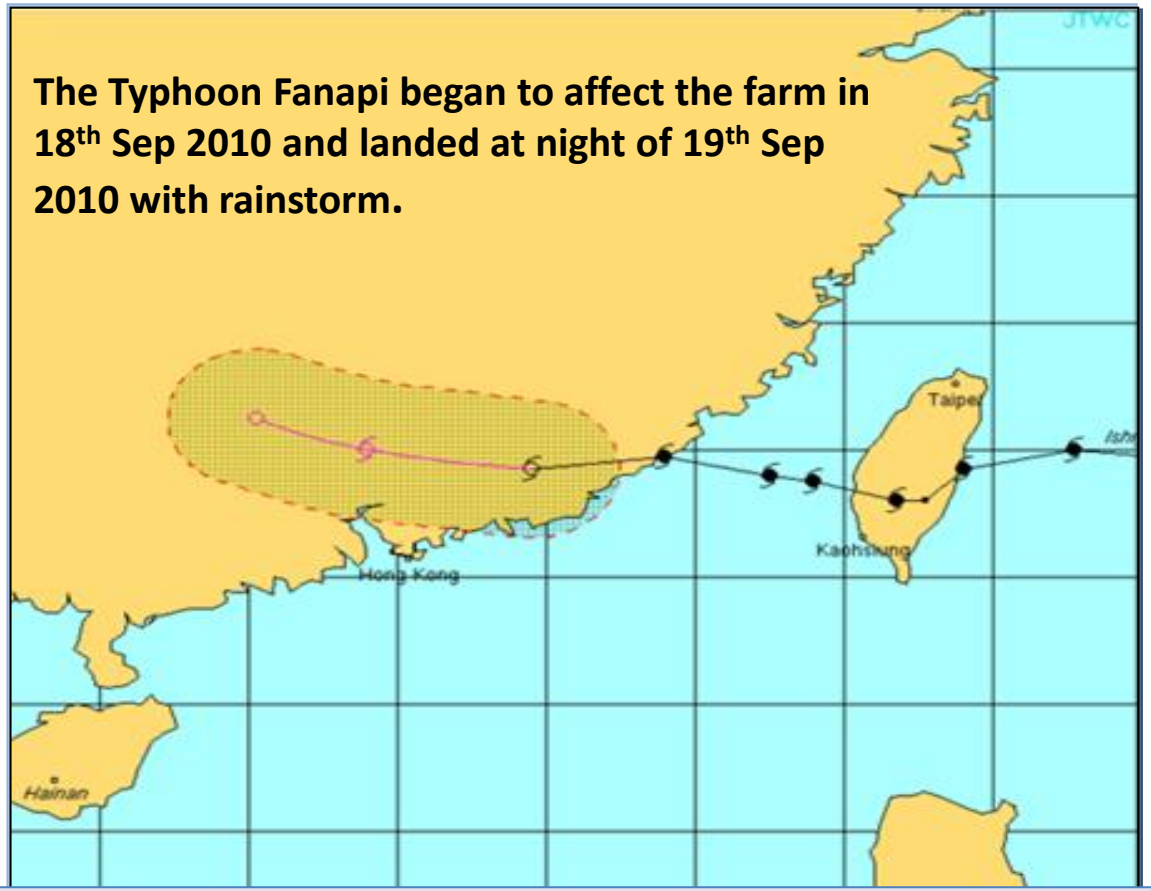
[1] Department of Aquaculture, Faculty of Fisheries and Marine Science, Bogor Agricultural University, Indonesia

[2] Laboratory of Aquaculture and *Artemia* Reference Center, Ghent University, Belgium

Conclusion

- Biofloc system contribute to the enhancement of immune response and survival after IMNV challenge regardless the carbon source
- The application of BFT brings about beneficial effect in disease control and management in shrimp culture

Heterotrophic bacteria (in Biofloc) control viral diseases ?



According to Dr. Jiasong, South China Sea Fisheries Research Institute (personal communication) - **Keeping high level oxygen concentration, and promoting heterotrophic bacteria growth are two important methods to prevent the diseases outbreak after tropical storm.**

WHY BIOFLOC AS BIOSECURITY

	BIOFLOC SYSTEM	BIOSECURITY
1.	Zero water exchange (topping up only for water lost due to siphoning & evaporation)	Low risk of virus entering culture ponds through water source
2.	Use treated water only – through reservoirs	Modular system
3.	Aeration full 22-24 hours in accordance with pond carry capacity (full or semi-biofloc) to have biofloc suspended in pond water.	Stable dissolved Oxygen (DO). Healthier shrimps
4.	Phytoplankton (algae) bloom & crash non-existent as biofloc does not depend on sun light for photosynthesis.	Stable environment. Low stress for shrimps – healthier shrimps
5.	Stable culture water environment – DO and pH.	Stable environment. Low stress for shrimps – healthier shrimps
6.	Extra natural live feed – biofloc with unicellular protein (protein 30 -50%)	Extra nutritious natural feed
7.	More than 2,000 bacterial species were found in well-developed biofloc water	Possibly a probiotic affect
8.	Biofloc contains six immune related genes	May enhance immune activity in shrimps

Aquacultural Engineering Society
Biofloc Technology Working Group

Workshop on Biofloc Technology and Shrimp Diseases

December 9-10 2013
Saigon Exhibition and Convention Center, District 7, HoChiMinh City, Vietnam

Summary

Workshop on Biofloc Technology and Shrimp Diseases

Ho Chi Minh City, Vietnam, December 9, 2013,

To summarize this discussion, the main attributes of biofloc systems that reduce the risk of shrimp disease are:

1. **Low rates of water exchange improve pathogen exclusion (biosecurity).**
2. **Continuous aeration provides stable water quality (DO and pH).**
3. **A diverse and stable microbial community stimulates the non-specific immune system and limits development of opportunistic species like Vibrio.**
4. **Regular removal of accumulated sludge controls biofloc concentration to moderate levels.**

Biofloc/EMS Conference, December 2013-
SHRIMP NEWS INTERNATIONAL 27 December 2013

RECENT BIOSECURITY & BIOFLOC TECHNOLOGY PUBLICATIONS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THANK YOU