Building with Nature

EcoShape

Method of Coastal Field School (CFS) and Outcome on Aquaculture Farmers in Indonesia

Woro Yuniati, Ratnawaty Fadilah & Weningtyas Kismorodati

Blue Forests-Indonesia

EcoShape

Outline

- A brief introduction to Coastal Field School (CFS) program within the BwN project
- What is CFS Approach?
- CFS Principles
- CFS learning process
- Achievement of CFS program
- Conclusion

Overview of Building with Nature (BwN) Project

- BwN is Dutch-Indonesia cooperation program which aims at securing the severely eroding Northern Java’s delta coastlines, which is driven by loss of mangrove and land subsidence, from 2015-2020.

- This project provides a combined sustainable solution of mangroves and aquaculture to restore the degraded ecology and economy.

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BwN Socio-economic Target

- The majority of coastal Demak livelihoods are capture fisheries and aquaculture.
- Those who mainly affected by the coastal erosion and floods are brackishwater aquaculture farmers.
- In addition to the aforementioned problem, poor management capacity of the farmers causes low aquaculture productivity
- The BwN project is targeting to revitalise the aquaculture productivity by **50 % by 2020**
- To achieve the successful aquaculture revitalisation and ensure the long term success, the project provides capacity building for the farmers in sustainable aquaculture management using **coastal field school** (CFS) approach.

What is Coastal Field School ?

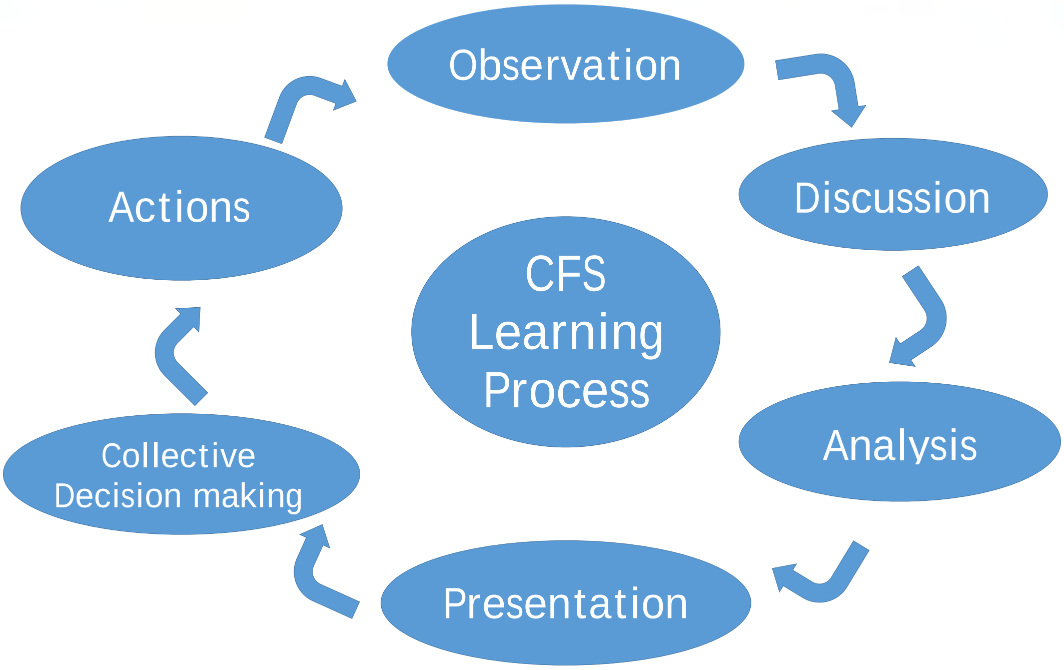
Concept:
- experiential
- participatory
- problem solving based
- discovery based
- One production cycle

Objective:
- To build farmers’ capacity to critically analyse their production system, identify problems, test possible solutions that most suitable to the local condition and farming system (FAO, 2003)
- To provide small farmers with practical experiences in ecology and agro-ecosystem analysis to enable them to grow a healthy produce sustainably and in sovereignty in the context of integrated coastal resource management

CFS principles:

- The CFS activity covers **one production cycle**
- The primary learning place is **the field** (pond)
- **Equity**, no hierarchy
- **Facilitating** instead of teaching
- The farmer as **expert**
- **Hands-on** and **discovery-based** learning
- **Comparative experiment** (low external input sustainable aquaculture (LEISA) vs traditionally managed pond)
- Typical activities: the 1) **agroecosystems analysis**, 2) **special topic**, and a 3) **group dynamics**
- **Integrated and learner-defined** curriculum

CFS Learning Process



CFS Learning Process

CFS monitoring and evaluation method

- Participants were given a questionnaire eliciting a list of knowledge and skills that they already have before the CFS activity and the same questionnaire at the end of the CFS cycle
- Focussed Group Discussion (FGD) on the participants change
- Pond management logbook recording

Outputs:

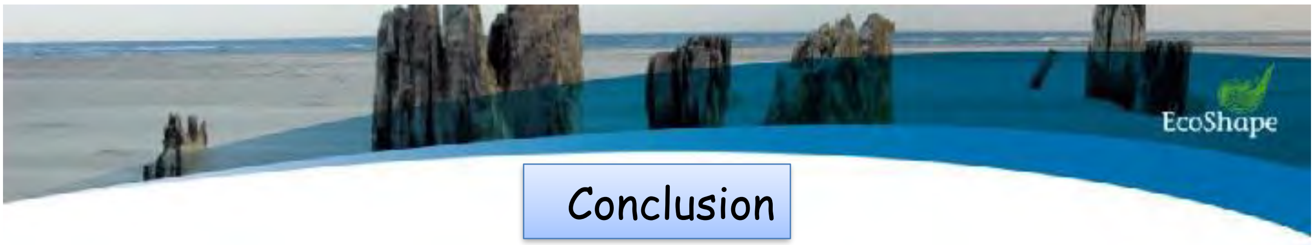
No	Increased Knowledge	Pre test	Post test	%
1	Low External Input Sustainable Aquaculture system	0	14	70
2	Diseases and its prevention measures	1	10	50
3	Economic analysis of pond production	5	12	60
	Increased Skill			
1	MOL and Compost making	0	14	70
2	Feed making from locally available ingredients	0	12	60
3	Conducting agroecosystem analysis	0	13	65
	Increased Confidence			
1	Public speaking	9	10	50
2	Problem solving	0	6	30
3	Decision making	0	10	50

Outcome:

1. 50% participants adopt LEISA system in their own farms
2. 2 local champion use their improved knowledge and skill to provide technical assistant on pond management for their farmer colleagues
3. 50% participants are capable of making local microorganism (to degrade the remaining organic matters in the pond) from locally available ingredients
4. The participants (in group) are capable of producing fish/shrimp feed from locally available ingredients
5. The CFS alumni are inspired and has their independent comparative experiment to improve pond management with their group
6. The participants are more critical and confident in negotiation (having a voice) with other party or new technology intervention

Achievement

1. Adoption of Coastal Field School approach by the local government (in the Mid-term District Development plan)



Conclusion

1. Strengthening observation capability and increasing knowledge ownership through discovery based learning

2. Building self-confidence and enhancing decision-making capacity

3. Minimizing risks in experimenting with new practices

4. Changing deep-rooted beliefs and practices

5. Developing problem-solving capabilities

Reference

Brown, Benjamin. 2015. Coastal Field School Prospectus. Blue Forests. Unpublished document

Hagiwara, T., Ogawa, S., Kariuki, P. M., Ndeti, J. N., and Kimondo, J. M. 2011. Farmer Field School Implementation Guide. Farm Forestry and Livelihood Development. FAO, JICA and Kenya Forest Service.

Thank You

Building with Nature - Indonesia

The Impact of Coatal Field School (CFS) on Pond Production in Demak Central Java, Indonesia

Sri Rejeki
Roel Bosma
Restiana Wisnu Ariyati
Lestari Laksmi Widowati

Introduction

- Coastal Abrasion
- Destruction of mangrove forest for brackish water ponds
- Ground-water extraction
- Climate change

→

- Degradasion
- Physically
- Chemically &
- Biologically

→

Loss of land and livelihoods.

Demak District, Central Java, is one of the areas where brackish water pond production, i.e. shrimp and milk fish, provided a source of wealth for the local community

Yield decreasing: 2015

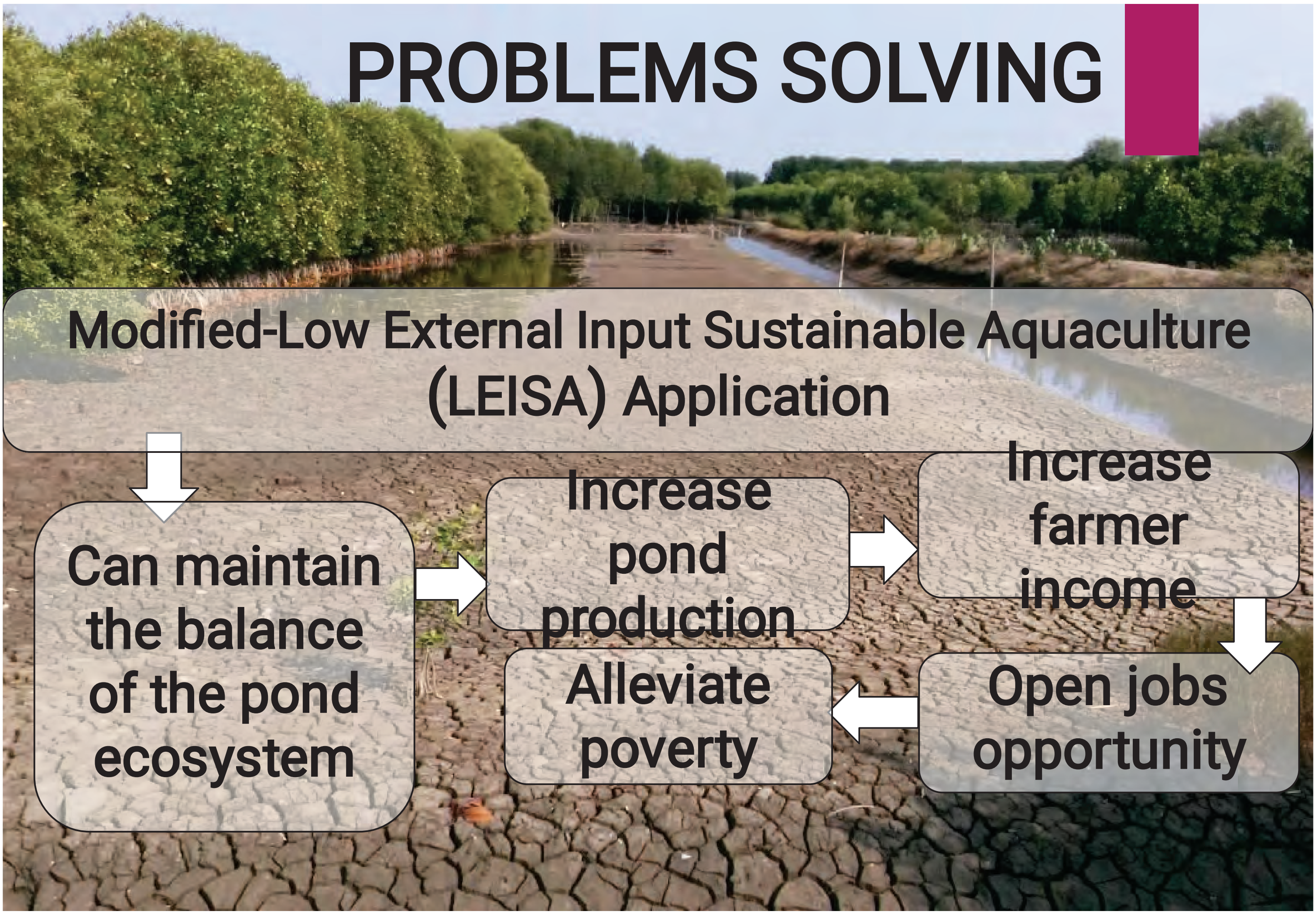
- 200 kg/ha/year milk fish
- 43 kg/ha/year of white leg, tiger and local shrimps

PROBLEMS IN AQUACULTURE

Degradation of brackishwaterpond environments:

- Extreme degradation: loss of the pond→ broken dykes
- Mild degradation: decrease in the pond environmental quality of physical, chemical and biology:
  - Pond management problems,
  - Decrease in pond carrying capacity,
  - Decrease in pond production,
  - High operational costs

PROBLEMS SOLVING



PROBLEMS SOLVING continued

Modified-Low External Input Sustainable Aquaculture (LEISA) Application

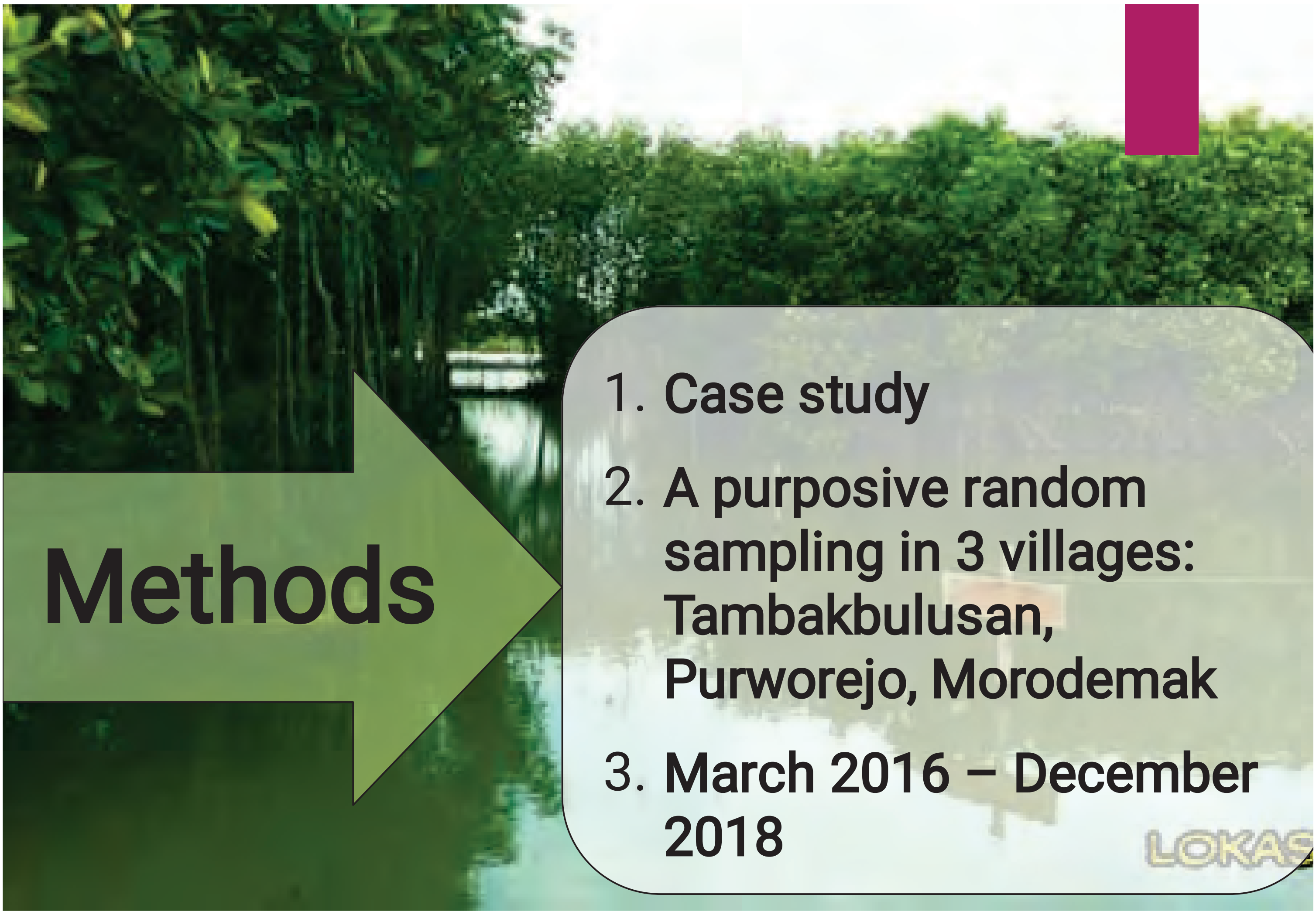
Coastal Field Schools (CFS)

- Trains farmers on good management practice in aquaculture: Improving pond management
- Application of the home-made fermented organic fertiliser, called MOL

The achievements in three of the villages that applied LEISA were monitored monthly

Objectives

1. Increase pond production
2. Improve the quality of safe and healthy aquaculture products
3. Maintains the balance of ecosystems by organic materials application in the system



Methods

1. Case study
2. A purposive random sampling in 3 villages: Tambakbulusan, Purworejo, Morodemak
3. March 2016 – December 2018

MATERIALS

Monitored ponds from 3 villages

Where the farmers implemented the learning from CFS in their ponds during the same season as the training was given, no individual baselines were measured.

1. Tambakbulusan: 5 ponds
2. Purworejo: 5 ponds
3. Morodemak: 6 pond farmers,

1. Local made Probiotic: Local Micro Organisms (LMO)
2. WQC
3. Shrimp Juveniles
4. Milk fish fry

Data Collection

Water Quality Parameters

- Chemis: DO, TAN-NH3, Nitrit, Salinity
- Physics: temperature, Transparancy; Colour
- Biology: Plankton

→ **Shrimp and Milkfish Yield**

↓

- Revenue
- Benefid Cost Ratio

RESULTS

Water quality monitoring

The higher shimp yiled in volume and size from the pond with M-LEISA concept

Water Quality

- Mostly acceptable
- Nitrate and phosphate levels were good for plankton growth
- The ammonia levels in these ponds mostly stayed within the safe range
- In some ponds the pH was beyond the optimum range
- At the turn of the seasons the salinity & water temperature changed drastically
- At most sampling days the observed ponds had sufficient plankton abundancy.

The water quality parameters of Monitored Pond M-F

Date	Physical			Biological	Chemical					
2018	Clarity (cm)	T (°C)	Water Color	Plankton ($*10^3$ ind/L)	DO (ppm)	pH	Salinity (ppt)	N (ppm)	P (ppm)	Ammonia (ppm)
25/7	50	29,3	Greenish Yellow	8,36	5,81	8,7	32	1,63	0,20	0,04
14/8	40	34,2	Greenish Yellow	15,2	5,9	8,6	30	2,02	0,09	0,01
14/9	35	31	Green	16,1	4,8	8,6	35	2,82	0,17	0,01
26/10	30	33,4	Brown	20,2	5,8	8,3	30	3,6	0,02	0,18

Shrimp and Milkfish Yield; The pond's average areas and the average operational cost (OC), yield, revenues and benefit per ha , and the Benefit/Cost ratios, for farmers applying MOL or not.

	Pond	Area (Ha)	OC (*1,000 IDR)	Yield (kg)		Income (*1,000 IDR)		Total Revenue (*1,000 IDR)	Benefit (*1,000 IDR)	Benefit / Cost ratio
				Milkfish	Shrimp	Milkfish	Shrimp			
No MOL applied	T-F	4	1,700	75	190	900	15,200	16,100	14,400	8.5
	T-H	0.75	3,037	900	261	10,800	20,907	31,707	28,670	9.4
	M-B	1	1,891	750	-	9,000	-	9,000	7,109	3.8
	M-C	4	974	600	-	7,200	-	7,200	6,226	6.4
	M-D	3	1,369	500	-	7,000	-	7,000	5,631	4.1
	M-E	3	1,692	750	-	9,000	-	9,000	7,308	4.3
	M-F	3.5	866	857	-	10,286	-	10,286	9,420	10.9
	Average	**2.75**	**1,647**	**633**	**226**	**7,741**	**18,053**	**12,899**	**11,252**	**6.8**
Farmers appield MOL	T-B	2.5	2,850	900	338	10,800	27,008	39,008	36,158	12.7
	T-D	2	2,140	1,050	291	12,600	23,240	35,840	33,700	15.7
	T-G	4	907	825	-	9,900	-	9,900	8,994	9.9
	P-A	0.5	8,440	1,000	300	14,000	25,500	39,500	31,060	3.7
	P-B	0.25	15,180	840	480	11,760	33,600	45,360	30,180	2.0
	P-C	3	1,539	600	220	7,200	17,600	25,133	23,594	15.3
	P-D	0.75	5,967	500	220	6,000	17,600	23,600	17,633	3.0
	P-E	1.5	1,637	67	55	800	4,427	5,227	3,589	2.2
	P-F	1	4,250	900	240	10,800	19,200	30,000	25,750	6.1
	M-A	0.6	3,200	1,000	-	12,000	-	12,000	8,800	2.8
	Average	**1.61**	**4,611**	**768**	**268**	**9,586**	**21,022**	**26,557**	**21,946**	**7.3**

Most farmers in Morodemak pursued using an-organic chemicals

Most farmers of Tambakbulusan and Purworejo implemented the LEISA they learned at the CFS:

1. Application of the home-made fermented organic fertiliser, called MOL.
2. Water quality improvement through
   - drying of the ponds for at least 5 days,
   - mixing composted goat manure to the sediment,
   - adding MOL before stocking.
   - Applying smaller dose of MOL weekly during the culture period

- All 17 farmers stocked milkfish and
- more than half did 1, 2 or 3 cultivation cycles of shrimp.
- The production of milkfish 1 cycle of 5-6 months
- the tiger or whiteleg shrimp were cultured in cycles of 2-3 months.

Tambakbulusan &Purworejo,

- Cultivated both milkfish and shrimp, and applied MOL,
  - the average shrimp yield ± 260 kg/ha (6x the baseline).
  - The average milkfish yield was around ± 712 kg/ha (3x the baseline).

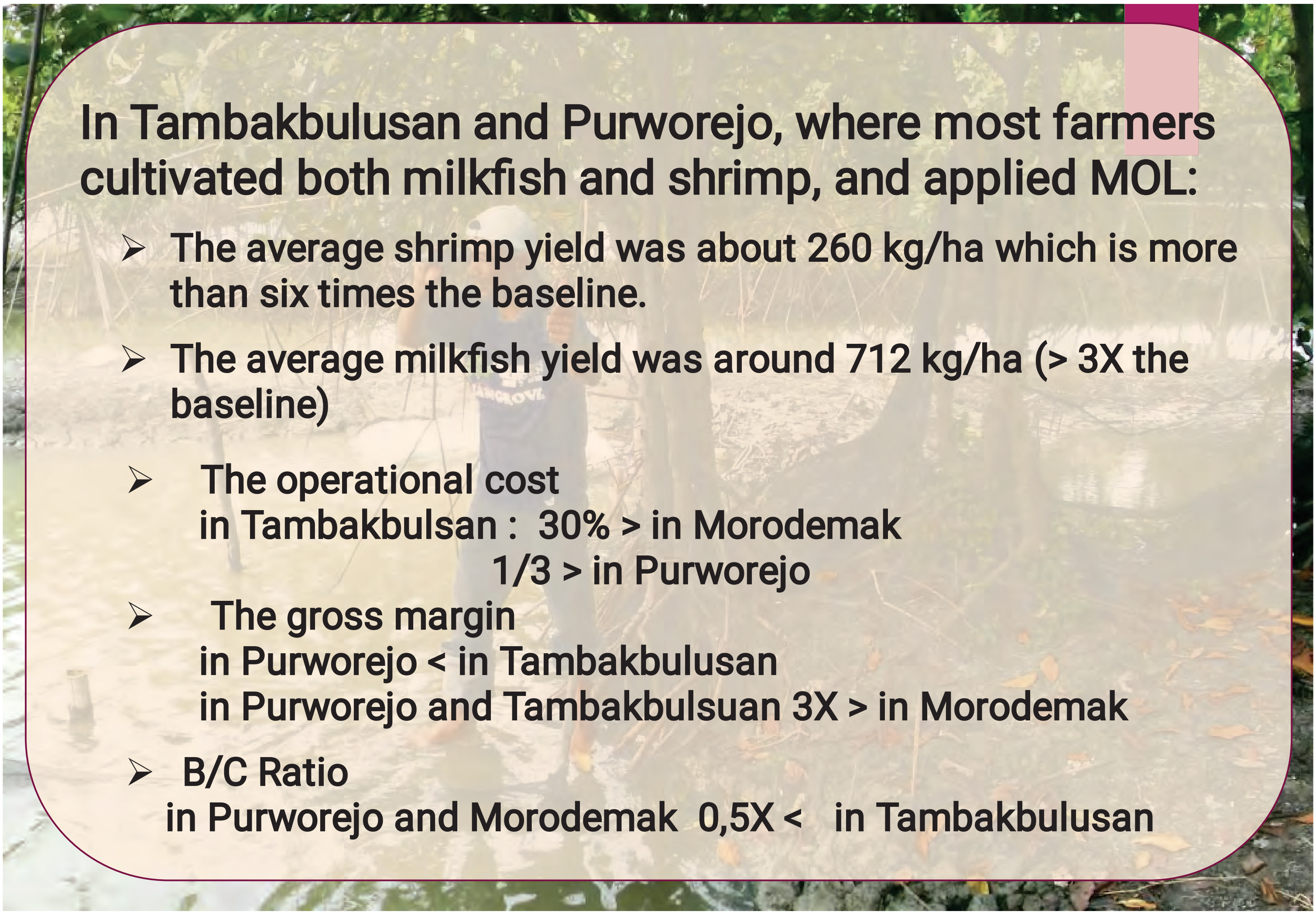
Morodemak

- Farmers cultivate milkfish only
- Not applying MOL,
- harvested 743 kg/ha (slightly higher than in the two other villages.)

The pond's average area, the operational cost (OC), yield, revenues and benefit per ha, and the Benefit/Cost ratio.

	Area (ha)	OC (*10^6 IDR / ha)	Yield (kg/ha)		Income (*10^6 IDR/ha)		Total Revenue (*10^6 IDR/ ha)	Benefit (*10^6 IDR/ha)	Benefit / Cost ratio
			Milkfish	Shrimp	Milkfish	Shrimp			
Tambakbulusan	2,65	2,1	750	216	9,0	17,3	26,5	24,4	11.3
Purworejo	1,17	6,2	651	253	8,4	19,7	28,1	22,0	5.4
Morodemak	2,52	1.7	743		9.1		9.1	7.4	5.4

The farmers in Purworejo invested more in an attempt to make a decent income from the smaller area



In Tambakbulusan and Purworejo, where most farmers cultivated both milkfish and shrimp, and applied MOL:

- The average shrimp yield was about 260 kg/ha which is more than six times the baseline.
- The average milkfish yield was around 712 kg/ha (> 3X the baseline)
- The operational cost
  in Tambakbulsan : 30% > in Morodemak
  1/3 > in Purworejo
- The gross margin
  in Purworejo < in Tambakbulusan
  in Purworejo and Tambakbulsuan 3X > in Morodemak
- B/C Ratio
  in Purworejo and Morodemak 0,5X < in Tambakbulusan

SUM-UP

1. After Coastal Field School most Farmers apply pond management following LEISA concept
2. Some farmers continue semi-intensive system.
3. Average gross income:
   - Baseline (2015): about 10 million IDR per year.
   - For one cycle after CFS: 20 million IDR.
4. Farmers can do at least two cycles per year and thus can double their income when implementing the LEISA system learned during the CFS.

Constraints to Aquaculture Innovations in Demak and Brebes, Indonesia

Tita Elfitasari, Laurens Klerx, Olivier Joffrey, Roel H. Bosma
Sri Rejeki, Lestari Lhaksmi W, Restiana Wisnu A,

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Background

- Northern coast of Java,
  - mangrove forest converted to brackish water ponds
  - ground-water extraction,land subsidence,
  - sea water rise and tidal floods

Resulting in loss of land, aquaculture ponds became submerged and disappeared affecting local livelihood

2

Background

Integrated Multi-trophic Aquaculture (IMTA) concept the utilization of waste from higher trophic to be used as feed for species of the lower trophic

The concept of Integrated Multi Trophic aquaculture (IMTA) was suggested as a promising strategy to recover aquaculture in areas impacted by coastal abrasion.

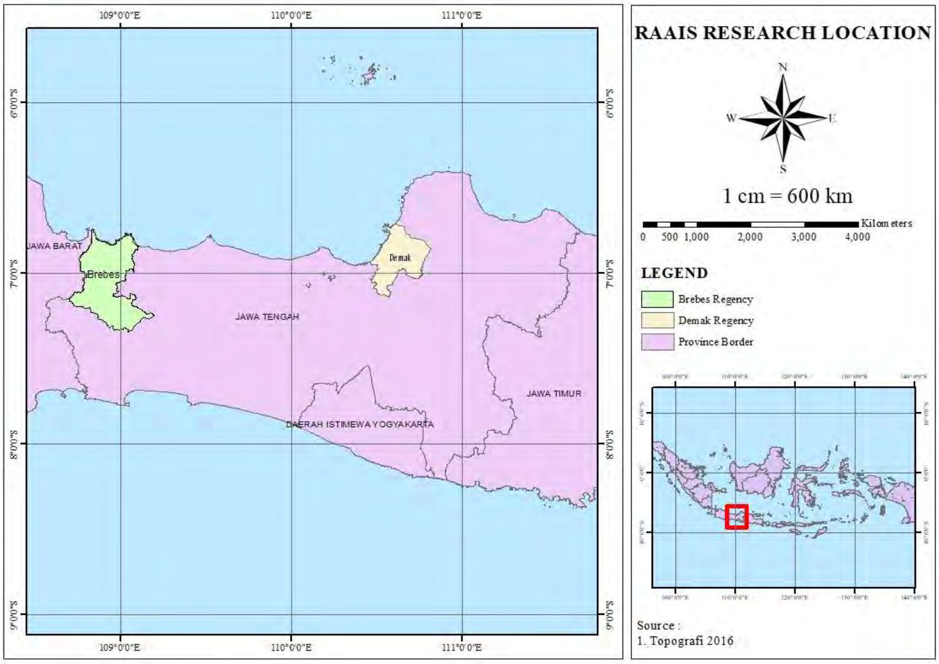
Environmental technology for increasing the shrimp production, as well as the product diversivication

Question & Approach

What are the constraints to adopt IMTA system in area with high coastal erosion?

System Approach :

- Multi-dimensions (technical, institutional, biophysical, political, socio-cultural)
- Multi-stakeholder involvement
- Multi level – understanding if the constraints are operating at local level (pond farm village) or at higher level



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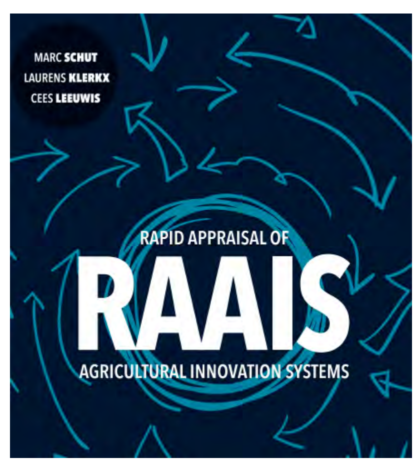
Methodology

Rapid Appraisal of Aquaculture Innovation System (RAAIS) – in two location : Demak and Brebes

RAAIS :

- Multi-stakeholder process to identify constraints to innovation and entry point for action

- Used in agriculture (and aquaculture)



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Stakeholder

- Farmers
- Government & Extension services
- NGO
- Academic
- Private Sector

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DEMAK
Top 5 constraints identified by

FISH FARMERS	NGOS
Low water quality	Regional policy depend on political party and keeps changing
Low pond soil quality	Lack of farmers' knowledge andmotivation to implement new technology without proof of success
High price of commercial feed	Lack of technology transfer
Low quality of seed	Lack of farmers' skills in adopting new innovation
Marketing problems	Lack of access to market and credit

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BREBES
Top 5 constraints identified by

FARMERS	NGO
Low quality of seed	Unpredictable condition of weather and climate
Low selling price	Limited knowledge of aquaculture technology and only adopt from parents
Unsupportive infrastructure (roads and bridges)	Unstable market
Disease and parasite problems	Lack of capital
Heavy abrasion problems	Lack of good infrastructure to support aquculture process

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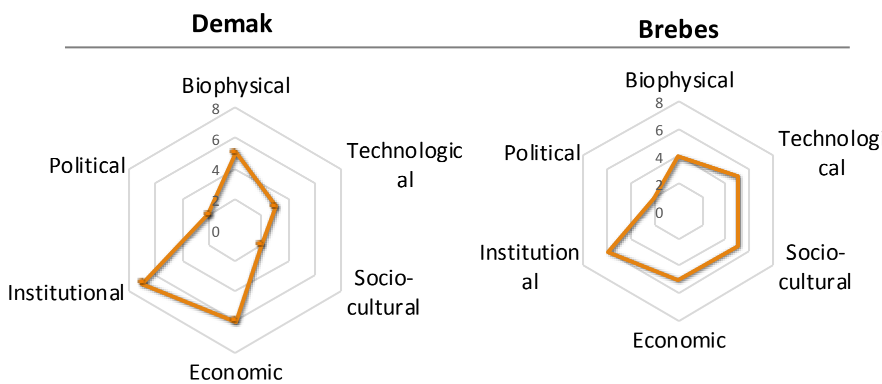
Type of Constraints



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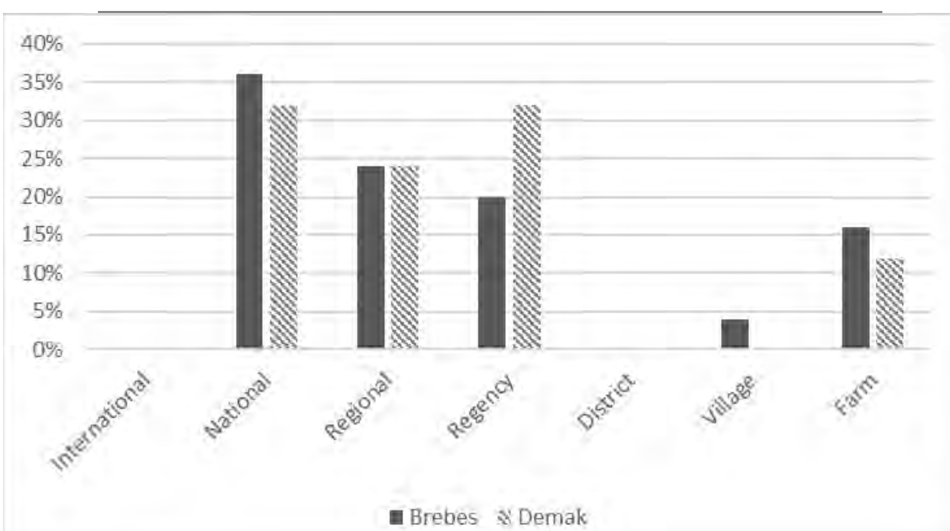
Percentage of constraints and challenges across different administrative levels



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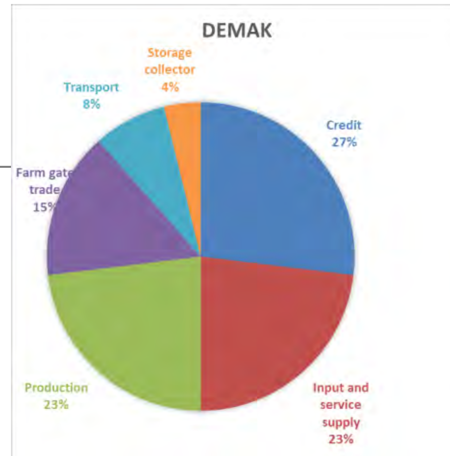
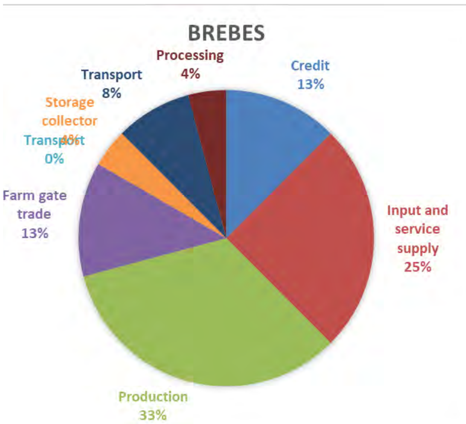
Constraints along value chain





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Conclusion

- Most constraints were institutional, rooted in laws and regulations at the national level
- Supporting IMTA development and sustainable coastal aquaculture will is dependent on improving infrastructure
- Lack of extension services and their capacity to support farmers was key to both location
- Adoption of IMTA and other innovations in the mangrove restoration areas of Brebes and Demak regency face mostly similar challenges along their value chains

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Acknowledgement

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Staffs from Wageningen University and Worldfish for assistance in RAAIS training

Brebes and Demak Region Fisheries and Marine Government Office for coordinating the stakeholders

Staff and students of Aquaculture Department, Faculty of Fisheries and Marine Sciences Diponegoro University for assisting the workshop.

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SPECIAL SESSION 1: INCLUSIVE INNOVATIONS FOR SUSTAINABLE SEA-FOOD SECURITY

12AFAF Session Theme: Aquaculture

This special session, occupying three panels, has three goals: (1) knowledge exchange between the NWO-GCP-F&B funded projects working on seafood, (2) exchange with unrelated stakeholders, and (3) identification of constraints to inclusion of small farmers and fishers in development. Support to development started under the paradigm of trickling down: invest in industries then wealth will spread through society. As this hardly reduced the number of poor, strategies with focus on communities, agriculture, good-governance and value chain followed. Most investments had some impact but lead also to the accumulation of capital of the wealthy without improving reducing poverty. Can aquaculture do better?

The three panels will discuss:

1. Challenges of Pond Aquaculture and Benefits of Bioflocs and Related Technologies.
2. Approaches to Design and Adoption of Innovations and Capacity Building in Aquaculture?
3. How can Innovations in Aquaculture Contribute to Inclusive Business and Food-Security?

The first two focus on knowledge updates and the last on inventories and discussions.

Organizer:

NOW-GCP projects of WorldFish, Wetlands International Indonesia, Wageningen University & Research, University of Amsterdam, Skretting, FishMARC India, Ecoshape, Diponegro University, Can Tho University, and Blue Forest.

Sub-Themes:

1. Technologies for Sustainable Intensification of Aquaculture
2. Approaches to Design & Disseminate Aquaculture Technology
3. Inclusive Value Chain Innovations for Sustainable Seafood Security

CHALLENGES FOR POND AQUACULTURE

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The majority of aquaculture production comes from ponds that pollute or occupy large areas. In spite the overwhelming importance of ponds for aquaculture production, our basic understanding of the pond ecosystem is limited while resources to expand the sector are limited. Thus, increases in global production will mainly have to be realized by raising pond productivity. The challenge is to increase yields while mitigating the environmental impacts from pond culture through e.g.: (1) improving the conversion of primary and microbial production into fish and shrimp production, (2) integrating pond technology with recirculation technology and (3) developing integrated aquaculture-agriculture systems. Irrespective of the route chosen, a better understanding of the underlying processes explaining nutrient dynamics in ponds will be instrumental. Focusing on the carbon:nitrogen balance, the nutritious pond concept provides ways to make better use of the pond's food web to feed fish or shrimp and contributes to increased production.

AQUACULTURE INNOVATION: WHAT (OR WHO) ARE WE MISSING?

Olivier M. Joffre[1] and Laurens Klerkx[2]

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Present aquaculture growth is driven by a dynamic industrial sector, while the resource poor farmers hardly evolved. However, aquaculture needs to adapt to new constraints, such as, resource limitations, environmental impact and climate change. Across the various approaches to innovation, inclusiveness is often lacking or weak. Often, innovation research is limited to donor led projects and a focus on small-scale farmers. Because of this focus, the inclusion of small and medium scale business type of producers has been limited. The agriculture sector uses multi-stakeholder platforms and approaches to design innovations, tackle complex problems and support more inclusive growth. In analogy, aquaculture should deploy multi-stakeholder platforms for action-driven innovation to stimulate joint technology and practice development. Such approaches will require changes in the planning of innovation processes and the integration of small and medium scale enterprises and poor households. The latter three constitute the core of the beneficiaries of aquaculture innovation.

ASSESSING CONSTRAINTS TO INNOVATIONS IN THE INDONESIAN AQUACULTURE VALUE CHAIN

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In Indonesia, destruction of mangroves for ponds, ground-water extraction and climate change result in loss of land and livelihoods since 2008. In Demak (Central Java) and Brebes (West Java) most farmers stopped stocking shrimp, also as water quality had reduced due to industrial and urban waste. Integrated Multi Trophic aquaculture (IMTA) might recover shrimp aquaculture. Data on the innovations in the value chain of shrimp were collected and analysed using the RAAIS tool (Schut et al. 2015; Agricultural Systems 132: 1–112). Stakeholders from different background participated. Participants agreed that most constraints were institutional, often related to infrastructure and assets, and rooted in laws and regulations at the national level. Among the top three constraints one constraint was similar: the lack of extension services. The adoption of IMTA and other innovations in the mangrove restoration areas of Brebes and Demak regency thus face mostly similar challenges.

EFFECT OF A SERVICE PROVISION MODEL ON INCLUDING BANGLADESH'S SMALL HOLDER AND LANDLESS FARMERS IN THE AQUACULTURE VALUE CHAIN

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In Bangladesh, agriculture supports more than 75% of the population; 19% of them remain food-insecure and 31% live below the poverty line. From April 2015 to March 2018, through a Local Service Providers model (LSP), the project Improving Food Security and Livelihoods aimed to develop value chains, improve agricultural productivity, enhance nutritional status, and increase women's decision-making capacity. The LSP was linked to the coordination of development, extension and research (Figure). Strengthened LSP and its associations helped the poor to enter markets and supported producers to organize into Enterprises. At project's end, 86% of the households experienced 31% rise in income, the area of land cultivated increased for landless, smallholders and LSPs, up to 96% of the households consumed three meals per day, yields increased by 32% in fish, 94% in poultry and 101% in tomato, and most of the women were engaged in household decision-making and marketing their products.

AQUACULTURE FIELD SCHOOLS AND FARMER'S SKILLS IN INDONESIA

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To train farmers on sustainable aquaculture Blue Forest developed a curriculum for Aquaculture Field-schools (AFS) using group observations, presentations, discussions and collective decision making on a demonstration plot. AFS last at least one aquaculture cycle. AFS in Demak's Building with Nature project has 16 sessions and includes improved practices following a Low External Input and Sustainable Aquaculture (LEISA) concept applying home-made fermented organic fertilizer called MOL, and sessions on understanding the coastal dynamics and mangrove recovery. The project monitors the general achievements in all ten villages. Participatory evaluation indicated that the participants improved know-how on sustainable aquaculture management, agro-ecosystem observation and analysis, and enhanced self-confidence on aquaculture decision-making. Moreover, they built confidence and skills in public speaking. The changes in yield were not well monitored by the farmers. A related study of a sample in three villages showed that LEISA increased cost, but harvested stocked shrimp doubled farmer's income.

IMPACT OF A LOW EXTERNAL INPUT APPROACH ON YIELDS OF BRACKISH WATER SHRIMP PONDS IN INDONESIA

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In Indonesia, destruction of mangrove forest for ponds, ground-water extraction and climate change resulted in loss of land and yield' reductions. Farmers in Demak harvested 200 and 43 kg/ha/year of milkfish and shrimp, respectively. Demak's Building with Nature project uses Aquaculture Field Schools to train farmers in Low External Input and Sustainable Aquaculture (LEISA) that applies compost and a home-made organic fertilizer called MOL. Our team monitored the yield and others factors in three of the ten villages. Average yields of farmers applying MOL and cultivating both milkfish and shrimp increased to about 700 kg/ha and 260 kg/ha, respectively. Farmers having small multi-species ponds made 3 times higher operational cost and reached slightly lower gross margins than those with larger. LEISA increased cost and lead to slightly higher yields, but because most farmers applying MOL successfully stocked shrimp their income was almost double: 11.3 compared to 22 million IDR/ha/yr.

USING BOARD GAMES TO RAISE AWARENESS AND SKILLS FOR SUSTAINABLE SHRIMP FARMING IN VIETNAM

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Along its coast, the Vietnamese Mekong Delta has protected mangrove forests and behind this a buffer zone of Integrated Mangrove Shrimp farms (IMS). Voluntary adoption of IMS beyond the buffer zone is hampered by assumptions of farmers and policy-makers about profits compared to intensive shrimp monoculture. ALEGAMS developed a board-game allowing farmers to experience the financial consequences of their decisions in shrimp farming, and assessed the effect of playing the board-game on farmer's learning and willingness to adopt IMS. The players stated to have learned about Investment & operation costs, Management & technologies, IMS' profits, and risks of Intensive shrimp farming. Several month after having played 1-3 sessions, farmer's behavior had changed: slightly higher frequency of weekly consultations and more persons consulted on practices & diseases, but increased suspicion about veterinary salesman, and technology take-up after one training increased from 30 to 43%

10 April, 15:30-17:30: Inclusive Business

How to Make Innovations Contribute to Inclusive Business and Equal Access to Food?

Chair: Marc VERDEGEM Secretary: Roel H. BOSMA

Two short introductions to present the topic:

Principles of Inclusive Business. BOSMA Roel H., *WUR-ASG-AFI*.

Inclusive Sea-Food Value Chain for Equal Access to Food, VIVEKANANDAN Vriddagiri, *South Indian Federation of Fishermen Societies, Karamana, Trivandrum, India*.

World Café break-out with Intro on process by CALUMPANG Lorna, and 3 rounds of discussions on propositions in 3 themes:

Theme A: To limit the use of land, fresh water and fish, and increase seafood yields from ponds, priority should be to:

- ✓ Improve the feed use efficiency in ponds to RAS' levels,
- ✓ and Replace fish-meal and fish-oil in rations, by doing ….

Theme B: Overcoming Constraints to Adoption of Innovations requires that all aquaculture technologies are:

- ✓ Assessed financially through partial budget & CB analysis;
- ✓ Designed further on-farm together with the stakeholders;
- ✓ Taught to smallholder farmers through field schools, or ….

Theme C: To make Seafood Equally Available to All, the related:

- ✓ Value chains of both fisheries and aquaculture need to be considered in the regional contexts.
- ✓ Business & Trade need to … .

Plenary: Feedback from the break-out groups and **Discussion** on:

- ✓ How to innovate for better food and nutrient security?

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Special Session

Inclusiveness for Sustainable Sea-Food Security

12th AFAF - Asian Forum for Aquaculture & Fisheries.

Wednesday 10 April 2019, Iloilo, Philippines

Goals of three sessions

10:30 - 12:00 Inventory of Challenges and Opportunities of Intensive and Extensive Pond Aquaculture.

13:00 - 15:00: Approaches to Adoption of Innovations in Aquaculture by Smallholder Farmers

15:30 - 17:30: How can Innovations Contribute to Inclusiveness?

We invite Academia, Private sector, NGO and GO to meet

NWO-GCP projects of Wageningen University & Research, Wetlands International; WorldFish, University of Amsterdam, Khulna University, MMFA-Indonesia, IUCN, FishMARC-India, Solidaridad, Aqua-Spark, Diponegoro University, Can Tho University, Blue Forest and others.

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10 April, 10:30-12:00, Panel Aquaculture

Challenges and Opportunities of Pond Aquaculture

Chair: Marc VERDEGEM Secretary: Roel H. BOSMA

1. VERDEGEM Marc C.J.: Challenges for Pond Aquaculture. *Wageningen University & Research, Animal Sciences (ASG), Aquaculture & Fisheries (AFI).*
2. HERMSEN Devi: Effects of Dioflocs on Seafood Quality. *Wageningen University & Research - ASG-AFI.*
3. TRAN Huu Tinh: Effects of Carbohydrate Sources on a Biofloc Culture System for White Leg Shrimp (*Penaeus vannamei*). *Wageningen University & Research - ASG-AFI.*
4. KABIR Kazi A.: The Effect of Dietary Protein to Energy Ratio and Stocking Densities on Fish Production, Food Web Enhancement and Economic Benefit of GIFT Nile Tilapia Aquaculture In Ponds. *WorldFish - Bangladesh.*
5. HUYNH Thanh Toi: Impact of Feeding High Energy/Protein Ratios on Shrimp Farming. *College of Aquaculture & Fisheries, Can Tho University, Vietnam (CTU).*
6. Plenary: Dialogue with stakeholders on the innovations.

   Lead questions: Aquaculture production is expected to double by 2050, but depends on natural resources for fresh water, fish meal and fish oil, and agricultural (by)products (land, water & energy).

   - ✓ How can research support this production increase, while reducing pressure on these resources?
   - ✓ Which are priority topics for research?

10 April, 13:00-15:00, Panel Capacity Building

Design & Dissemination of Aquaculture Technology

Chair: Roel H. BOSMA Secretary: Olivier JOFFRE

1. JOFFRE Olivier: Aquaculture Innovation Research : What (or who) are we missing? *WorldFish - Cambodia*
2. ELFITASARI Tita. Constraints to Aquaculture Innovation in Demak and Brebes, Indonesia. *University Diponegoro, Faculty of Fisheries and Marine Sciences (UNDIP-FPIK)*
3. KHAN Nazneen, Using Service Providers to Include Smallholders in the Value Chain. *WorldFish - Bangladesh.*
4. YUNIATI Woro. Impact of Coastal Farmer Field Schools (CFS) on Farmers in Indonesia. *Blue Forest Indonesia*
5. REJEKI Sri. Impact of Coastal Farmer Field Schools on yields of brackish water ponds in Indonesia. *UNDIP-FPIK.*
6. TRAN Thi Phung Ha: Impact of games on aquaculture innovation. *School of Social Sciences & Humanities, CTU.*
7. JOFFRE Olivier / BOSMA Roel: Agent Based Modelling for Areal Policy Advices. *WorldFish - WUR - CTU.*
8. Dialogue with stakeholders on the proposed innovations.

   Lead questions: Classical transfer of technology to farmers had limited outcomes, while multi-stakeholder approaches to design and deploy technology, are perceived as resource consuming.

   - ✓ How can research convince governments and donors to invest in multi-stakeholder approaches to innovation?
   - ✓ How to mainstream the multi-stakeholder approaches to innovations?

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Sustainable Sea-Food Security

Special NWO Session at the 12th AFAF

Separate Attachments

Iloilo, 10 April 2019