



Food and Agriculture
Organization of the
United Nations



THE WORLD BANK
IBRD • IDA

Stakeholder Consultation on Progressive Management Pathway (PMP) to Improve Aquaculture Biosecurity

World Bank Headquarters, Washington, D.C. 10-12 April 2018

Aquaculture Biosecurity in the Kingdom of Saudi Arabia A Public Private Partnership success story

Victoria Alday-Sanz, D.V.M., M.Sc., Ph.D.

National Aquaculture Group (NAQUA)

alday@naqua.com.sa

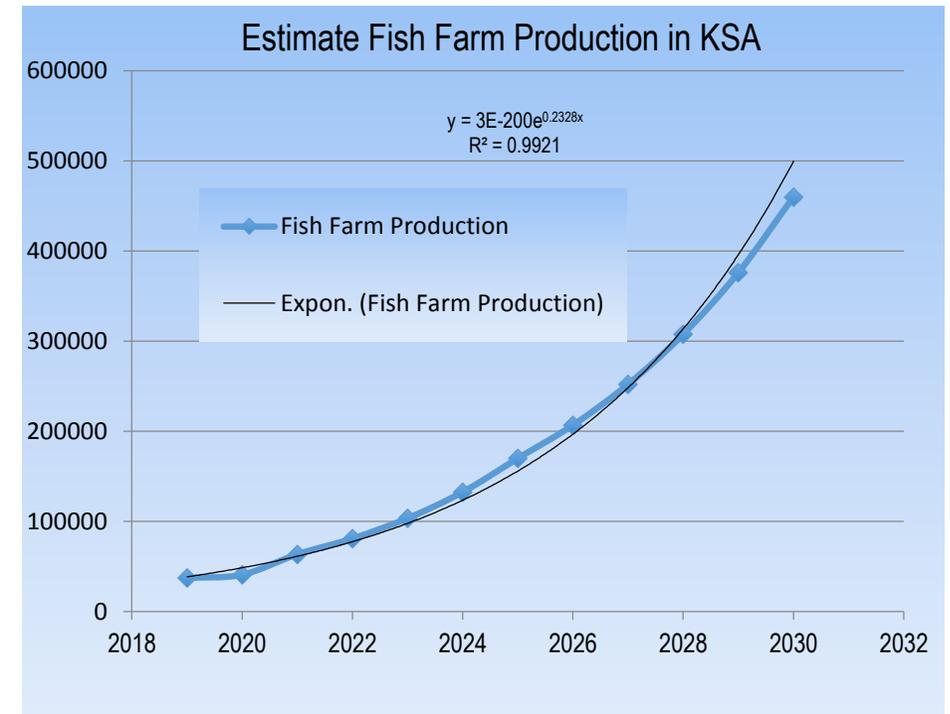
KSA aquaculture

- Shrimp: *Penaeus vannamei*
- Fish:
 - Freshwater: tilapia
 - Marine: Barramundi, seabream, seabass
- Growth plans:
 - New species: marine tilapia, meager, seriola, red sea bream

NAQUA represents over 90% of the national production.

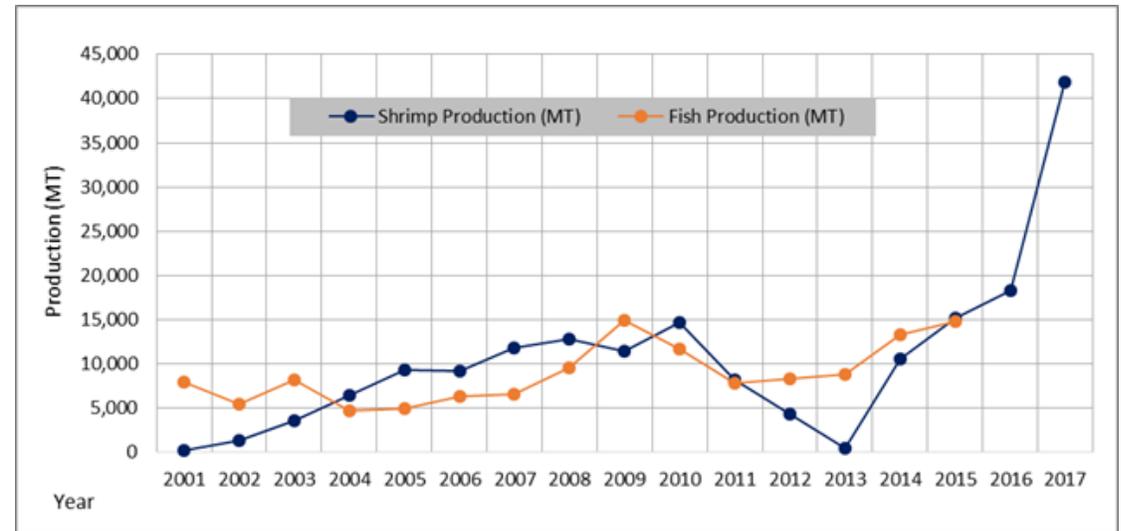
Planned biomass for 2018:

- *P. vannamei*: 65,000tn
- Fish: 25,000tn



White Spot Syndrome Virus epidemic 2010-2011

- Keys for the spread:
 - Broodstock got infected (vertical transmission)
 - No exclusion of viral carriers (inadequate filtration at pond level)
 - *Penaeus indicus* highly susceptible to WSSV
 - Weather conditions ideal to trigger disease
 - No coordination between farmers



Public Private Partnership (PPP)

Minister of Environment, Water
and Agriculture (MEWA)

Saudi Aquaculture Society (SAS)

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية



National Biosecurity implementation



**HEALTH SHOULD NOT BE CONSIDERED A COMPETITIVE ADVANTAGE
FARMERS HAVE THE HIGHEST INTEREST TO AVOID DISEASE**

Biosecurity strategy at National Level

- National Reference Diagnostic Laboratory (JFRC):
 - PCR, histology, microbiology, ELISA
- List of pathogens: “Dynamic” OIE +AHPND+EHP
- National surveillance program:
 - Endemic and emerging pathogens
 - Farm and wild samples
- Health certificate for animal movement (domestic and imports)
- Zoning and compartmentalization
- Compulsory reporting of disease outbreaks
- Emergency response and contingency plan
- Pre-approved supplier of any live imported aquatic animals (on site audit)
- Quarantine and testing on reception
- No wild broodstock allowed
- Restriction on aquatic products based on the SPS agreement of the WTO

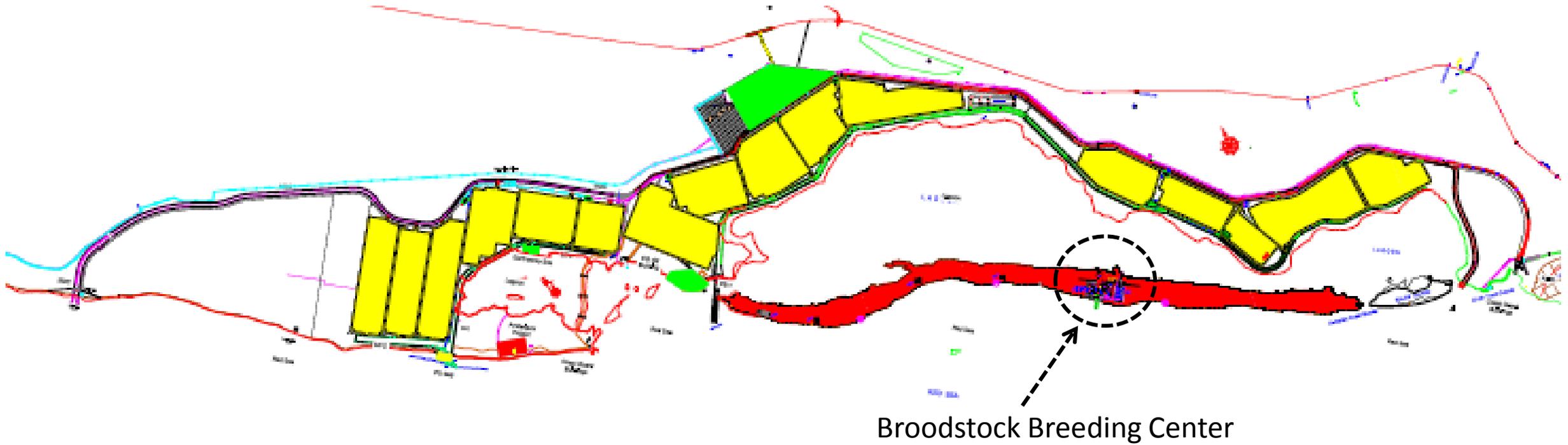
National Surveillance program 2017

Company	Location	Total PCR samples processed 2017						Histology
		WSSV	WSSV+	TSV	IHHNV	AHPND	NHP	
NAQUA	Al Lith	27		27	27	27	27	66
IPC	Al Lith	30		30	30	30	30	40
Sharq	Al Lith	28		28	28	28	28	31
JFRC	Jeddah	0		0	0	0	0	0
Jazadco	Jizan	7		7	7	7	7	12
RSACO	Jizan	1		1	1	1	1	0
Saudi Fisheries company	Al Horuidah	0		0	0	0	0	0
Saudi Coast company	Jizan	10		10	10	10	10	0
Al Refai farm	Umluj	0		0	0	0	0	0

Biosecurity strategy at NAQUA level

- **Switch from *Penaeus indicus* to SPF+WSSV SPT *P. vannamei* (IRA)**
 - Only stocks used in the country
- Viral exclusion strategy up to pond
- Reduction of viral carriers and filtration at pond level (nurseries and grow-out)
- Zoning for the control of staff and vehicles
- List of pathogens: OIE+++ (13)
- Targeted Surveillance Program
- Animal Health Monitoring program
- Syndromic surveillance
- Updated Diagnostic Laboratory
- Emergency response (24h/7days/week)
- Contingency plan (nurseries and 3 stage culture)
- Treatment of Processing Plant effluents

NAQUA ZONING



NAQUA Surveillance Program - Shrimp Business Unit						
Process	Animal stage	Target sample	Target pathogen	Frequency	Diganostic method	# animals or tanks tested
Quarantine	Broodstock	random	WSSV	Once per shipment	PCR	30
		random	IHHNV, TSV, YHV, IMNV, NHP, EMS, EHP	Once per shipment	PCR	30
		standard mortalities	WSSV	N/A	PCR	75
		Symptomatic	All	Once per shipment	Histology	5
		Symptomatic	All	N/A	Histology	15
NBC : SPF Status	Broodstock after spawning (commercial batch)	5%	IHHNV, BP,EHP	N/A	PCR	10
		histology	All	N/A	Histology	10
	Juveniles (tagged)(cold challenge)	random	WSSV, IHHNV, BP, IMNV,TSV, YHV, NHP, CMNV, EMS, EHP, MBV, HPV	Once per batch	PCR	150
		random	All	Once per batch	Histology	30
		random	DNA extraction	Per batch	DNA extraction, Qiagen	2000
NBC Health status verification	Broodstock (NBC)	random	All	once per month (10% tanks)	Histology	6
		random			AHM & wet mount	6
		random	EHP, BP		PCR(feces)	6
		Symptomatic	All	N/A	Histology	250
LRU3 BS health verification	Broodstock	random	All	once per month (10% tanks)	Histology	6
		random			AHM & wet mount	30
		random	EHP, BP		PCR(Feces)	6
		Symptomatic	All	N/A	Histology	250
Broodstock at NPU	Faeces from BS tanks	100% tanks	EHP	biweekly	PCR	77
NPU	Broodstock	standard mortalities	WSSV	N/A	PCR	2000
		Symptomatic	All	N/A	Histology	200
		Routine	AHM	once per week (3% tanks)	AHM & wet mount	600
LRU 3	PLs	Symptomatic	AHM	N/A	AHM & wet mount	30
		Symptomatic	All	N/A	Histology	30
		Routine (cold challenge)	WSSV ,EHP, BP and TSV	Once per tank	PCR	100
Nursery	Juveniles	Routine (cold challenge)	WSSV	Once per cycle	PCR	150
		Routine	EMS, EHP	5% of nurseries	PCR	8
		Routine	AHM	Once per cycle (25% nurseries)	AHM & wet mount	38
		Symptomatic	AHM	N/A	AHM & wet mount**	23
		Symptomatic	WSSV	N/A	Rapid Test/PCR	15
		Symptomatic	All	N/A	Histology**	23
Super-intensive ponds	Juveniles-Adults	Routine	AHM	biweekly	AHM & wet mount	30
		Routine	EMS, EHP	10% ponds/Cycle	PCR	3
		Routine	All	Monthly (10%)	Histology	3
		Symptomatic	AHM	N/A	AHM & wet mount**	3
		Symptomatic	WSSV	N/A	PCR	3
		Symptomatic	All	N/A	Histology**	3
Grow out	Adults	Routine (faeces/HP)	EMS, EHP	5% ponds/Cycle	PCR	25
		Symptomatic	AHM	N/A	AHM & wet mount**	75
		Symptomatic	WSSV	N/A	PCR	75
		Symptomatic	WSSV	N/A	Rapid Test**	75
		Symptomatic	All	N/A	Histology**	50
SBU R&D (Tilapia)	Juveniles/Adults	Routine	AHM	Monthly	Necropsy, OI and haemetology	10
		Routine	All	Quarterly	Histology	5
		Symptomatic	AHM	N/A	Necropsy, OI and haemetology	1
		Symptomatic	<i>Strep. iniae</i> & <i>Strep. agalactiae</i>	N/A	PCR	1
		Symptomatic	All	N/A	Histology	1
Fresh feed* (Artemia Biomass, mussels, polychaete)	Adults	Routine	WSSV, IHHNV, EHP, EMS	Once per batch	PCR	12
Wild crustacean (farms,canals, intakes)	Zooplankton	Routine	WSSV	Monthly	PCR	N/A
	Shrimps/crabs	Routine	WSSV	Monthly	PCR	N/A
Wild crustacean - harvest material	Crabs/shrimps	Routine	WSSV	N/A	PCR	100

NAQUA surveillance since introduction of *P. vannamei* (1)

Year	Source	WSSV	Positive	BP	Positive	TSV	Positive	IHHNV	Positive	AHPND	Positive	EHP	Positive
2013	SBU-BBC	291	0			12	0	16					
	SBU-GO	407	0			8	0						
	SBU-HAT	1494	0			9	0						
	SBU-R&D		0				0						
	Total	2192	0	0	0	29	0	16	0	0	0	0	0
2014	SBU-BBC	10908	0			3140	0	70					
	SBU-GO	191	0			37	0	16	0				
	SBU-HAT	2224	0			569	0						
	SBU-R&D		0				0						
	Total	13323	0	0	0	3746	0	86	0	0	0	0	0
2015	SBU-BBC	421	0	3596	456	2	0	3650		59			
	SBU-GO	477	0	1		1	0	13	0	51		4	
	SBU-HAT	1964	0	473	65	454	0	10		3		11	
	SBU-R&D		0				0						
	Total	2862	0	4070	521	457	0	3673	0	113	0	15	0
2016	SBU-BBC	1370	0	4282	25	64	0	1487		64		204	
	SBU-GO	585	0	1		185	0	22		193		25	
	SBU-HAT	961	0	509	1	432	0	13		14		50	
	SBU-R&D	2	0				0	2		2			
	Total	2918	0	4792	26	681	0	1524	0	273	0	279	0
2017	SBU-BBC	52	0	93		45	0	75		45		92	
	SBU-GO	246	0				0			73		72	1
	SBU-HAT	298	0	163			0			14		132	
	SBU-R&D	4	0				0	1		1			
	Total	600	0	256	0	45	0	76	0	133	0	296	0
Total	21895	0	9118	547	4958	0	5375	0	519	0	590	0	

NAQUA surveillance since introduction of *P. vannamei* (2)

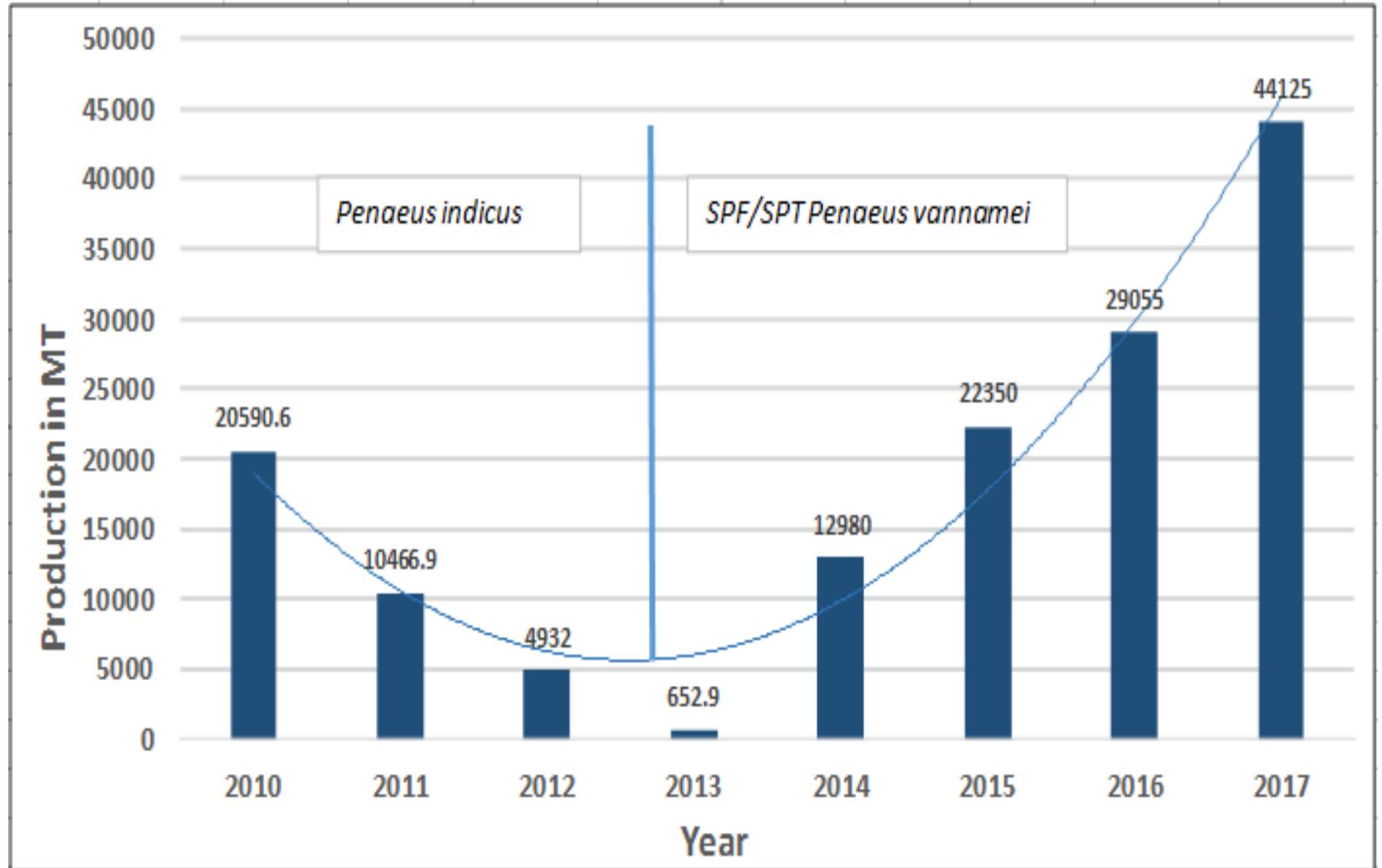
Year	Source	YHV	Positive	IMNV	Positive	CMNV	Positive	NHP	Positive	MBV	Positive	HPV	Positive	Muscle Microsporidia	Positive
2013	SBU-BBC	12	0	12	0		0	12	0		0		0		0
	SBU-GO		0		0		0		0		0		0		0
	SBU-HAT		0		0		0		0		0		0		0
	SBU-R&D		0		0		0		0		0		0		0
	Total	12	0	12	0	0	0	12	0	0	0	0	0	0	0
2014	SBU-BBC	42	0	42	0		0	42	0		0		0		0
	SBU-GO		0		0		0		0		0		0		0
	SBU-HAT		0		0		0		0		0		0		0
	SBU-R&D		0		0		0		0		0		0		0
	Total	42	0	42	0	0	0	42	0	0	0	0	0	0	0
2015	SBU-BBC		0		0		0		0		0		0		0
	SBU-GO		0	3	0		0		0		0		0		0
	SBU-HAT		0		0		0		0		0		0		0
	SBU-R&D		0		0		0		0		0		0		0
	Total	0	0	3	0	0	0	0	0	0	0	0	0	0	0
2016	SBU-BBC	64	0	63	0	63	0	63	0	48	0	48	0	63	0
	SBU-GO		0		0		0		0		0		0		0
	SBU-HAT		0		0		0		0		0		0		0
	SBU-R&D		0		0		0		0		0		0		0
	Total	64	0	63	0	63	0	63	0	48	0	48	0	63	0
2017	SBU-BBC	45	0	25	0	45	0	25	0	50	0	50	0	45	0
	SBU-GO		0		0		0		0		0		0		0
	SBU-HAT		0		0		0		0		0		0		0
	SBU-R&D		0		0		0		0		0		0		0
	Total	45	0	25	0	45	0	25	0	50	0	50	0	45	0
Total	163	0	145	0	108	0	142	0	98	0	98	0	108	0	

Successful biosecurity implementation

-2 WSSV detections
in the South:
2015 and 2016
(>70% survival)

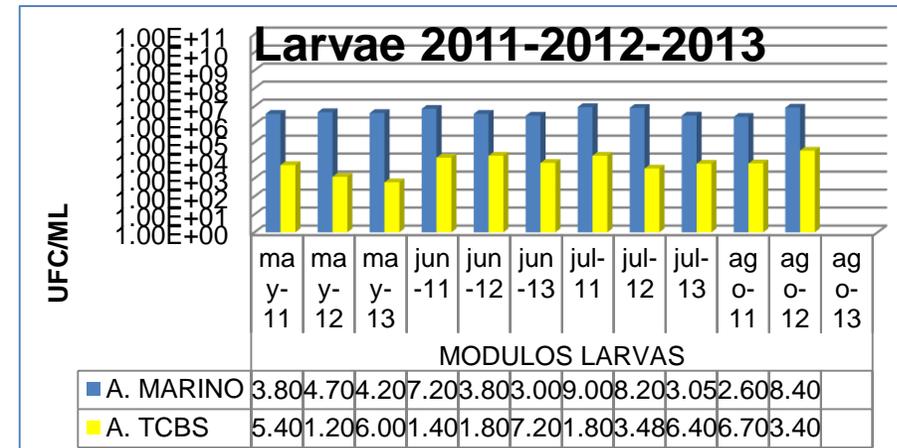
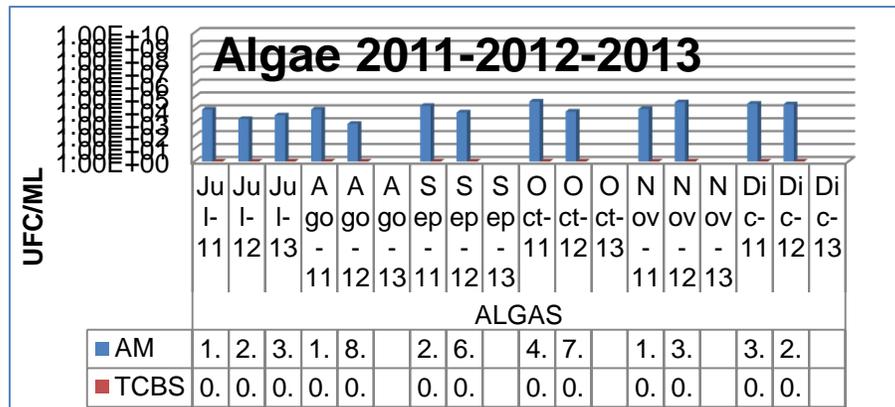
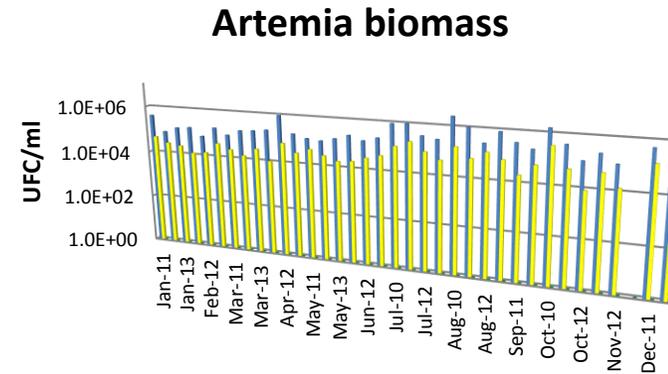
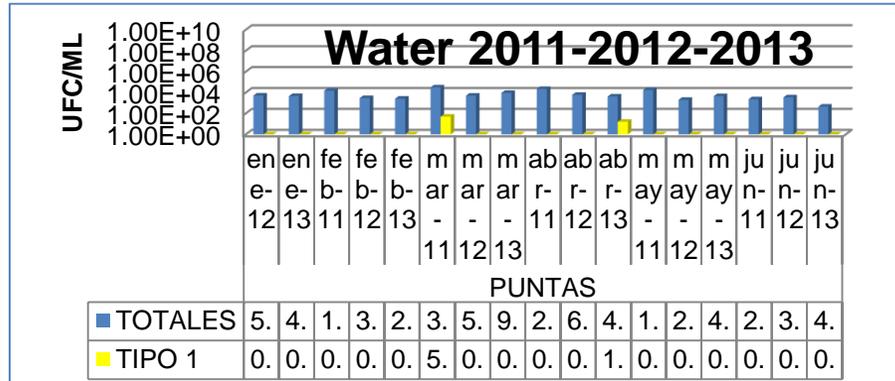
-Eradication from
wild populations
except in a lagoon in
the South

-Free from WSSV,
TSV, IHNV, BP and
all other known
pathogens



ZERO ANTIBIOTICS

Hatchery vibriosis-HYGIENE (live feeds)



ZERO ANTIBIOTICS

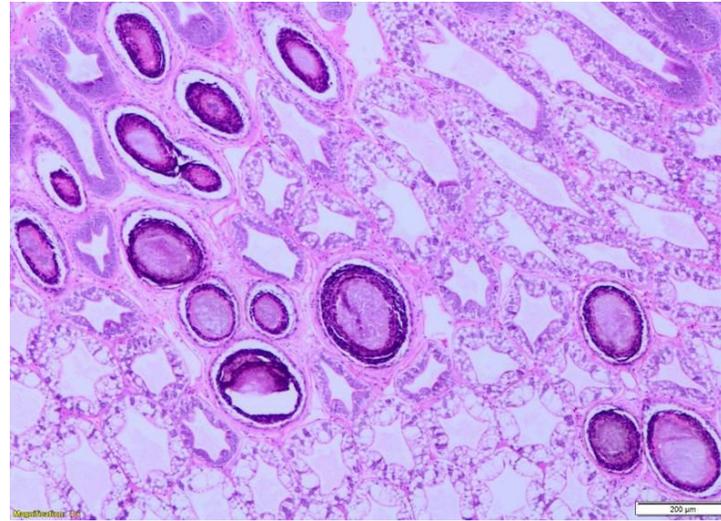
Shrimp pond bacterial disease expression

WATER QUALITY

Septic hepatopancreas

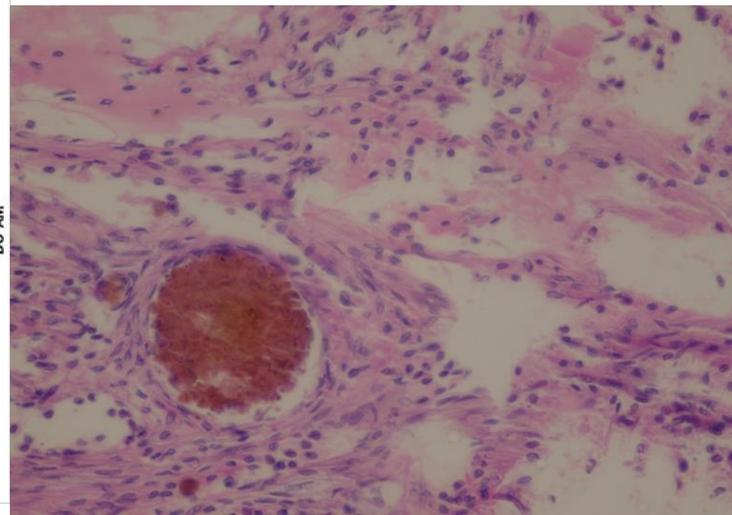
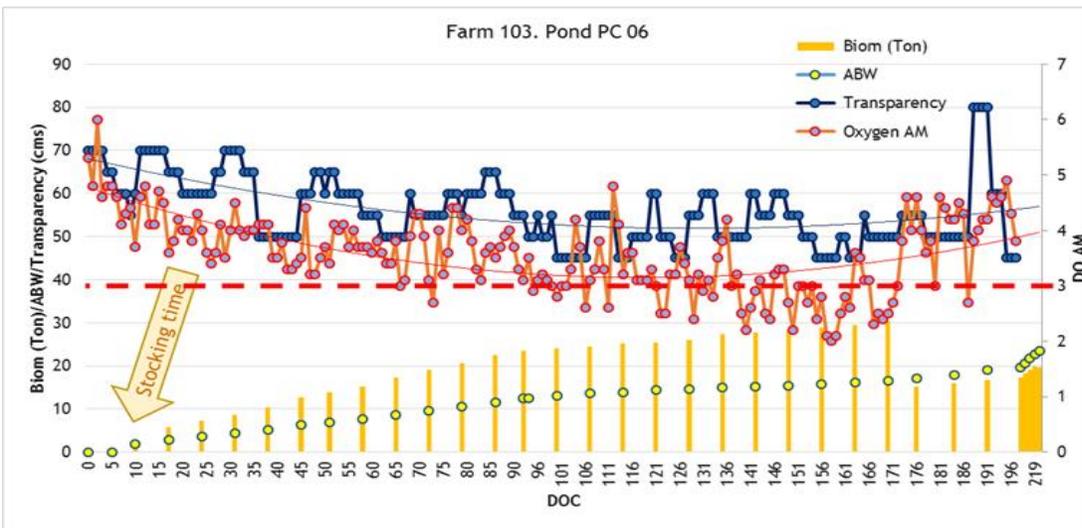
Poor bottom condition

Findings	Level of affection	Remarks
Bacterial plaque in HP	G2	Bacterial infection
Gill melanization	G trace-G3	Bacterial infection
Melanized exopodite	G2-G3	Bacterial infection
Haemocytic enteritis	G2-G3	Toxic effects of bacterial colonization



Systemic vibriosis

Water chemical
Unbalance (nitrite)



**BACTERIAL DISEASES ARE
SECONDARY TO POOR
MANAGEMENT**

NO ANTIBIOTICS NEEDED

NAQUA Fish Health

Barramundi	
Dip	<i>Tenacibaculum maritimum</i>
IP	<i>Streptococcus iniae, Streptococcus agalatae, Tenacibaculum maritimum</i>
Seabream	
Dip	<i>Tenacibaculum maritimum, VNN reassortant</i>
IP	<i>Tenacibaculum maritimum, Photobacteria damsella, Vibrio anguillarum</i>
Seabass	
Dip	<i>Tenacibaculum maritimum, VNN</i>
IP	<i>Tenacibaculum maritimum, VNN, Photobacteria damsella, Vibrio anguillarum, Vibrio harveyi</i>
Tilapia	
Dip	Multivalent vibrio
IP	<i>Streptococcus iniae, Streptococcus agalatae</i>

Diseases:

Barramundi

-*Streptococcus iniae* and *Streptococcus*

Agalactiae:

-SPF broodstock development

-Autologous vaccine

-Regular AMR assessment

-Eradicated Big Belly Syndrome

What is biosecurity?

Biosecurity – Is the sum of activities taken by a region, country, group of producers or a single facility in order to protect its natural aquatic resources, fisheries, aquaculture, biodiversity and/or culture stocks and people depending on the possible negative impact resulting from the introduction and dissemination of diseases of aquatic animals (FAO, 2007)

Whatever measures or activities taken with the target to **reduce the economic impact of diseases.**

**Biosecurity is a tool for
production cost reduction**

COST-EFFECTIVE Biosecurity

Year	Diagnostic cost in SAR	Total production (tons)	Diag.cost/Kg in SAR	Diag.cost/Kg in \$
2016	1084796	18300	0.059	0.016
2017	715764	40000	0.018	0.005

Diagnostic works include:

- Targeted surveillance for primary pathogens,
- Routine health monitoring,
- Validation of disinfections and
- Emergency response

Using:

Wet mounts, histology, microbiology and PCR tools.

SPF/SPT Broodstock production 2017:

Cost of each broodstock: 28sar/7.46\$

Cost of broodstock/kg of shrimp produced: 0.02sar/0.0053\$

**Shrimp Biosecurity cost
2017: 0.010\$/kg**

What are the important lessons have you learnt?

- Government support is fundamental for biosecurity success
 - Support, not police
 - Provides the Biosecurity frame to develop the facility Biosecurity strategy
- Joint, coordinated efforts **led by the industry**
- SPF is the way forward (for all species):
 - In order to solve a health problem in the ponds/cages, it needs to be eradicated from broodstock
 - Horizontal transmission is way less efficient than vertical transmission!!
- Biosecurity needs to be integrated into production and from the beginning
- Disease tolerance and resistance have to be integrated into breeding programs

Most challenging issues on aquaculture biosecurity

1. Lack of understanding of what BIOSECURITY is about
 1. “Text book biosecurity”: cost efficiency + production knowledge
2. Lack of industry leadership for biosecurity
 1. Health considered a competitive advantage
3. Lack/shortage of SPF stocks (SPT/SPR)
 1. Use of wild caught broodstock or broodstock exposed to the wild
 2. Broodstock fed with non biosecure feeds (AHPHND & EHP)
4. Shortage of real time on site diagnosis

Owens 1997

Virus	Wild Fisheries	Wild broodstock associated	Aquaculture
RNA proliferative syndrome	1980		
Hepatopancreatic parvovirus	1984		1988
Monodon baculovirus	1984	1986	1986
Lymphoid organ vacuolization	1988		1990
Lymphoidal parvovirus	1989		1990
IHHNV	1989	1991	
PHRV	1989	1991	1996
Gut and nerve syndrome	1993		
Spawner-isolated mortality virus		1993	1994
Lymphoid organ virus		1995	1995
Bennettiae baculovirus	1995		
Midgut caecum inclusions			1990

How do you see your company contributing to the PMP and in what way

- KSA/NAQUA has completed the PMP pathway
 - Could be used as a reference to other countries/companies
 - KSA has both large and small scale producers
- KSA would like to expand its Biosecurity strategy to regional level (Red Sea)



NAQUA
BIOSECURITY
TEAM

THANK YOU!!