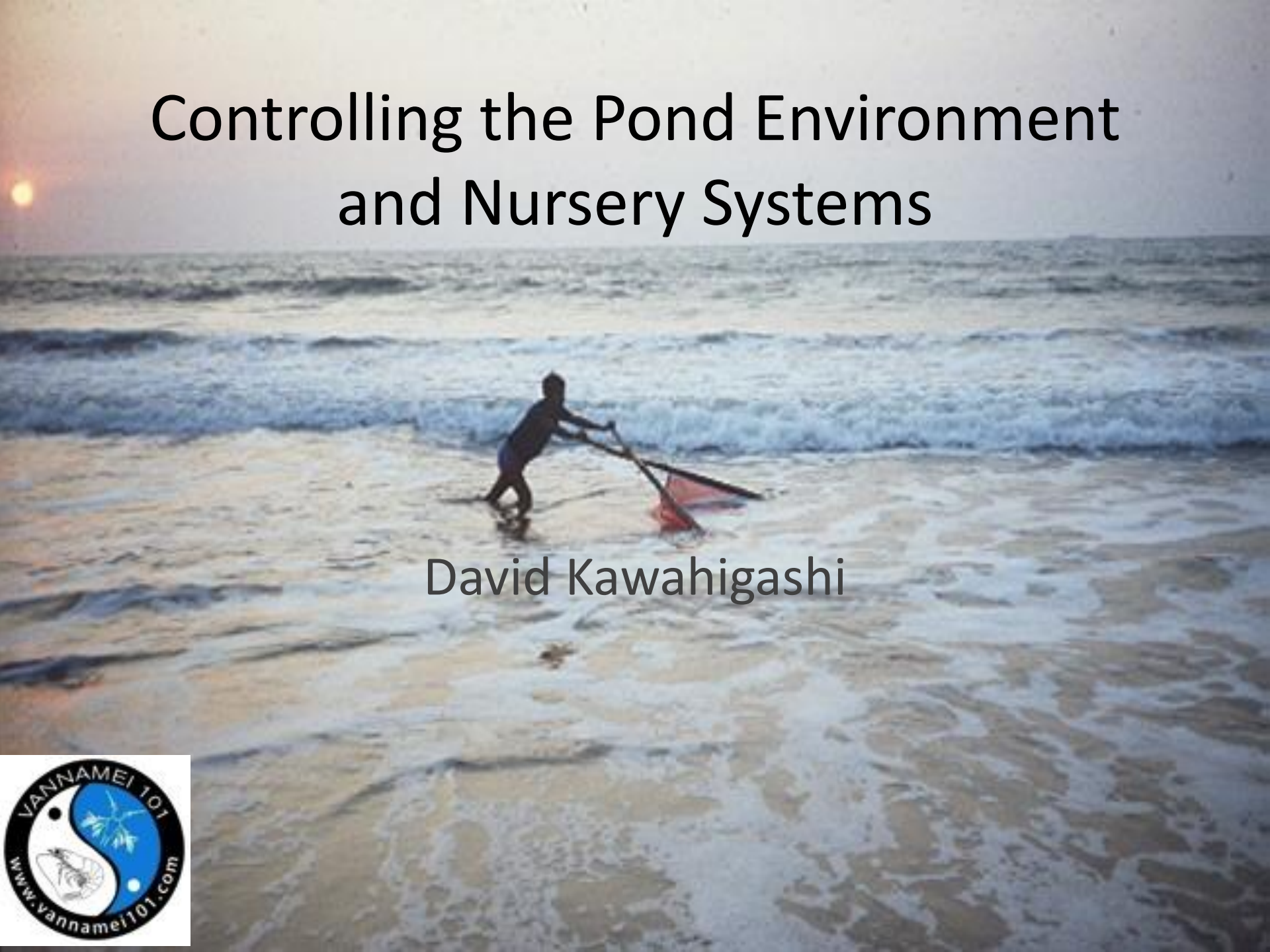
Controlling the Pond Environment and Nursery Systems



David Kawahigashi

"Crisis drives technology…Change!"

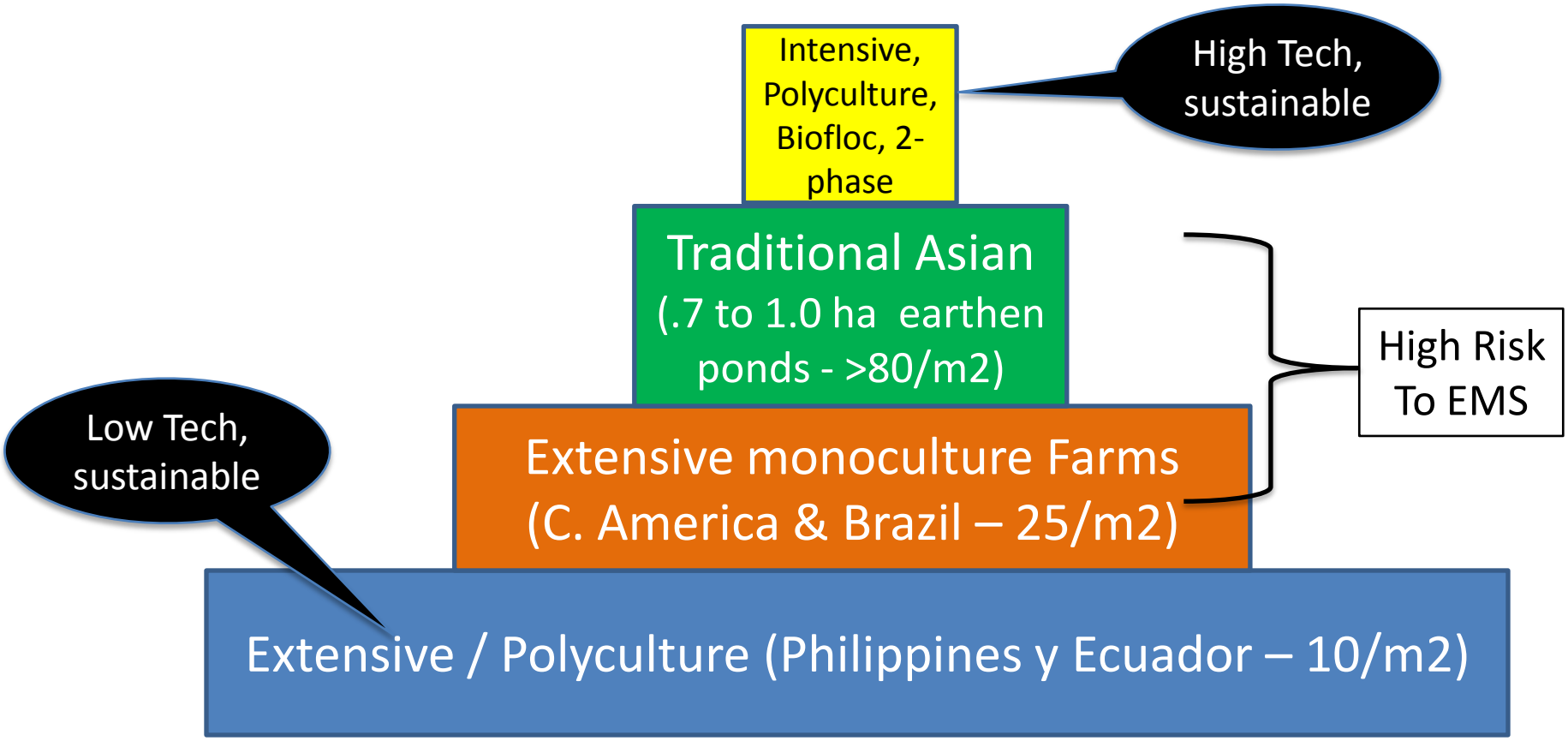
New Era of Crisis and Change

- Climate change - drought, flooding, typhoons, red tide
- Pollution – water resources, coastal areas, pesticides
- New Diseases – bacterial/fungal, not viral
- Economic crisis – increasing cost of production; unfavorable currency exchange rates

Estatus de Produccion por Pais 2016

Pais	Mejorando o Bajando?	Target Market (majority)	Razon
Mexico		Domestic	Vibrio, EMS, WSSV
Brazil		Domestic	WSSV
China		Domestic	EMS, EHP
Indonesia		Export	EHP, white feces
India		Export	EHP
Thailand		Export	Sistemas y geneticas
Vietnam		Export	EMS, EHP
Ecuador		Export	Vibrio in hatcheries

Modelos de Cultivo Camaron



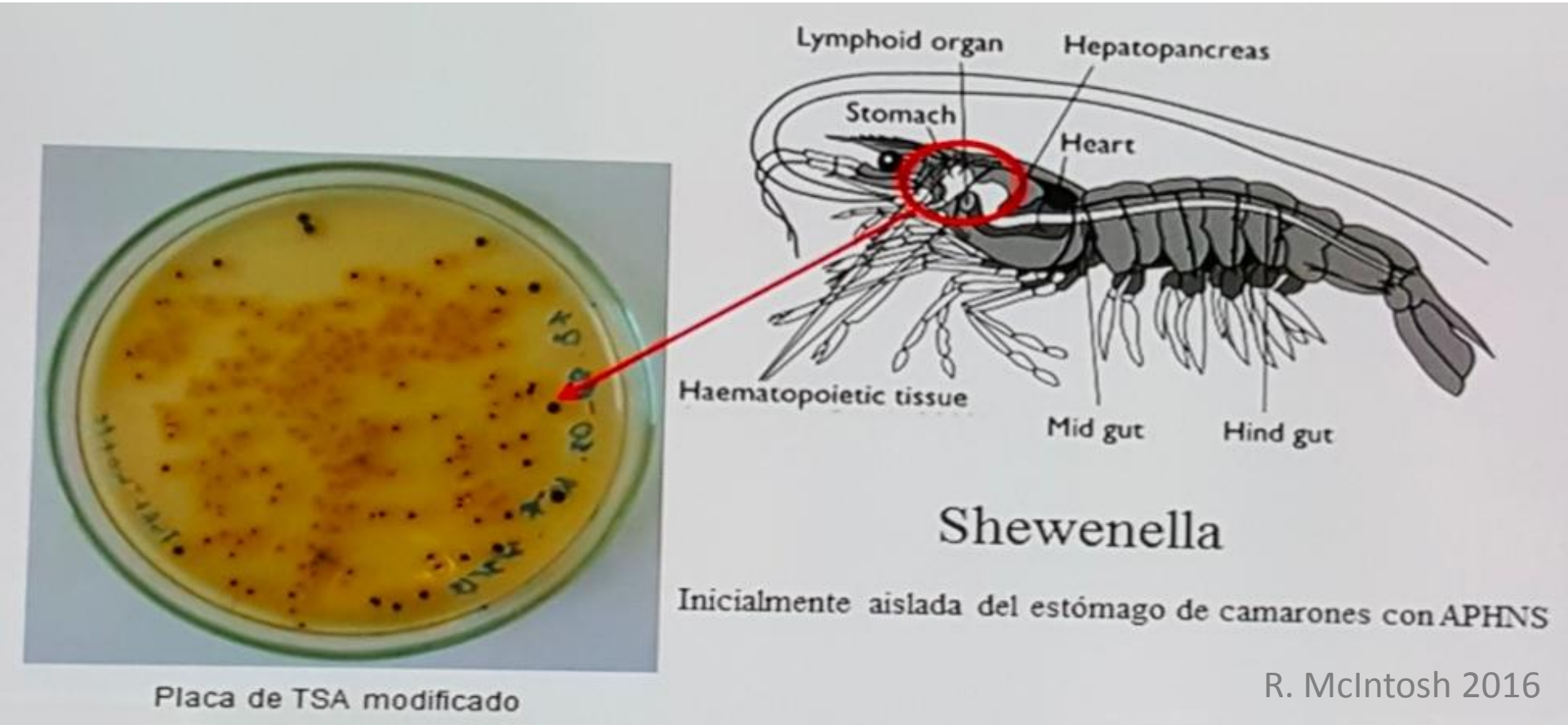
Temas

1. Importancia de calidad de post-larvas
2. Multi fasicos en Asia
3. Multi fasicos en las Americas
4. Metodos del transferencia
5. Technologias nuevos

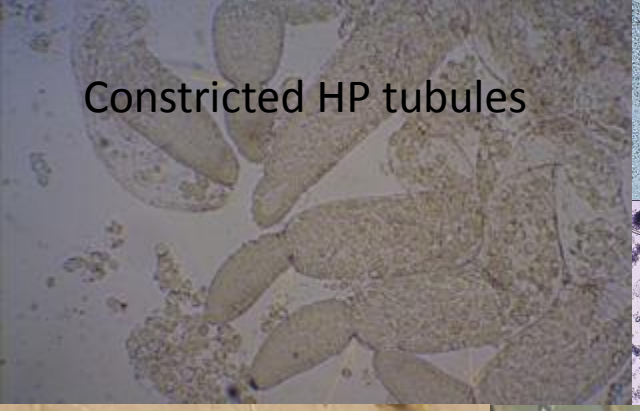
"Cocktail" of Vibrio species has impacted the hatcheries in Asia and the Americas…*Zoea Syndrome*, high Vibrio counts, low survival (20-30%)

Country	Vibrio sp. impacts hatcheries
China	2004 (since vannamei arrived)
Vietnam	2014 - 2016
Mexico	2016 (since February)
Ecuador	2016 (since July)

Pathogenic Vibrio sp. have been associated with "triggering" outbreaks of WSSV and other diseases.



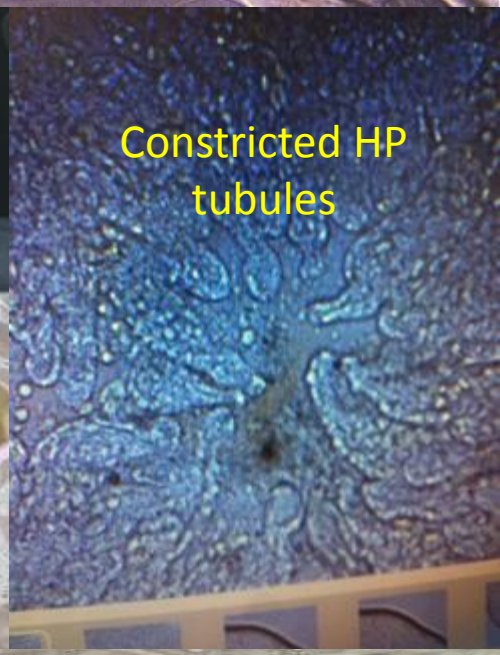
Several etiological agents include *V. harveyi, V. vulnificus, V. parahaemolyticus, V. alginolyticus, V. mimicus, Shewenella*

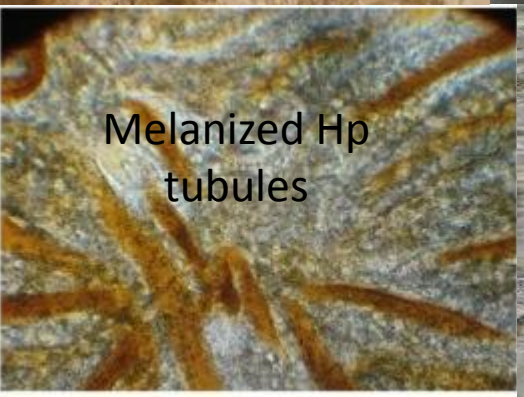

Constricted HP tubules


Gregarines


Vibriosis


Zoothanmium
and
protozoans


Constricted HP
tubules


Melanized Hp
tubules


Filamentous bacteria

Vibrio Monitoring Protocol

All PL tanks should be sampled for Vibrio counts to validate the efficacy of the biosecurity protocols

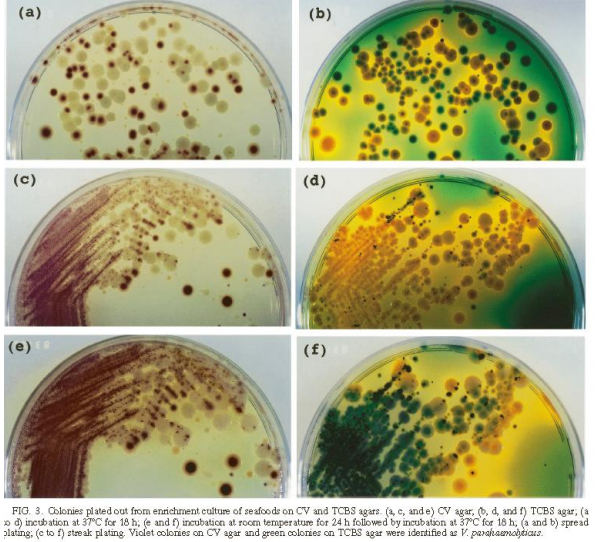


FIG. 3. Colonies plated out from enrichment culture of seafoods on CV and TCBS agars. (a, c, and e) CV agar; (b, d, and f) TCBS agar; (a to d) incubation at 37°C for 18 h; (e and f) incubation at room temperature for 24 h followed by incubation at 37°C for 18 h; (a and b) spread plating; (c to f) streak plating. Violet colonies on CV agar and green colonies on TCBS agar were identified as *V. parahaemolyticus*.

Sample post-larvae before harvest and sales:

- 100-200 PL sample size
- Macerate PL's in sterile water
- 0.1 gram of sample on TCBR agar

Criteria for Vibrio counts in Asia:

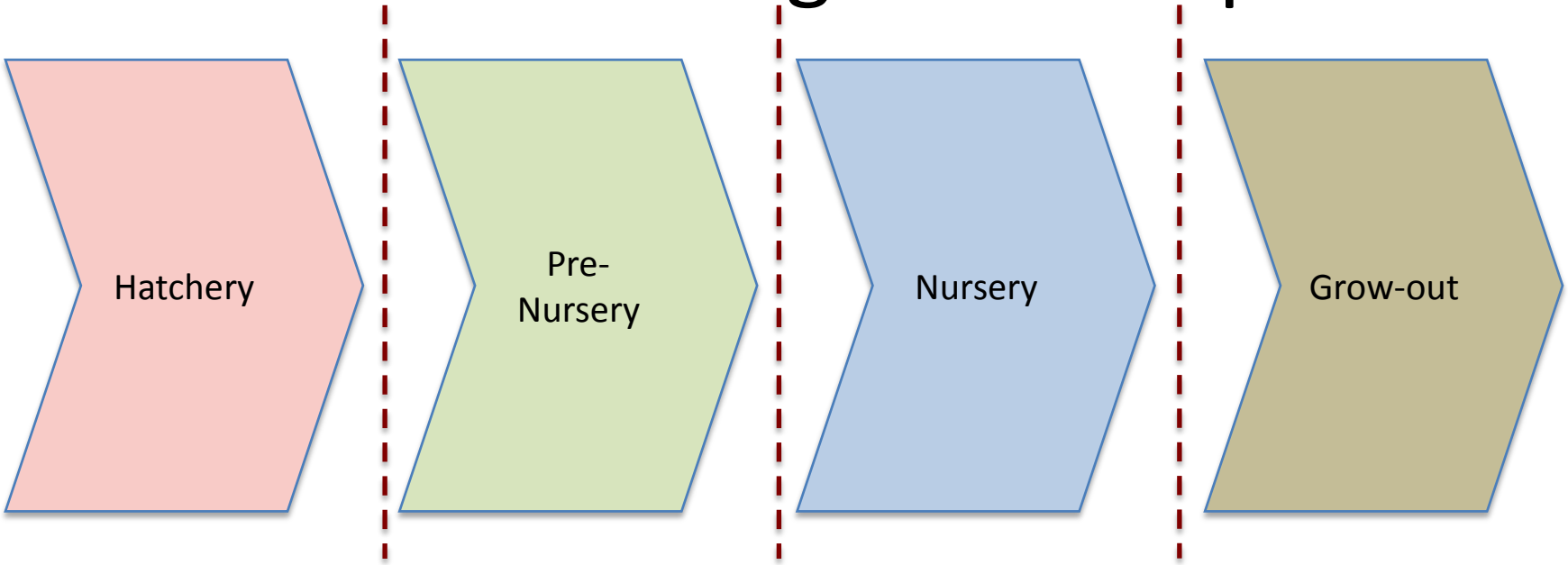
- Green colonies >1,000 per gram => reject
- Yellow colonies >10,000 per gram => reject

Solutions for the Hatchery

- Lower salinity down to 25 ppt
- Probiotics + enzymes + minerals
- Brine water => high alkalinity and minerals
- Broodstock health => screened before maturation
- Broodstock feeds => not from local polychaetes
- Disinfection and hatchery dry-outs => frequent
- Tilapia conditioned water => during PL stages
- Monitor for Vibrio and constricted hepatopancreas

Vibrio cell can double every 10-20 minutes!

Disease monitoring between phases



* Sample 200 animals for disease check between each phase

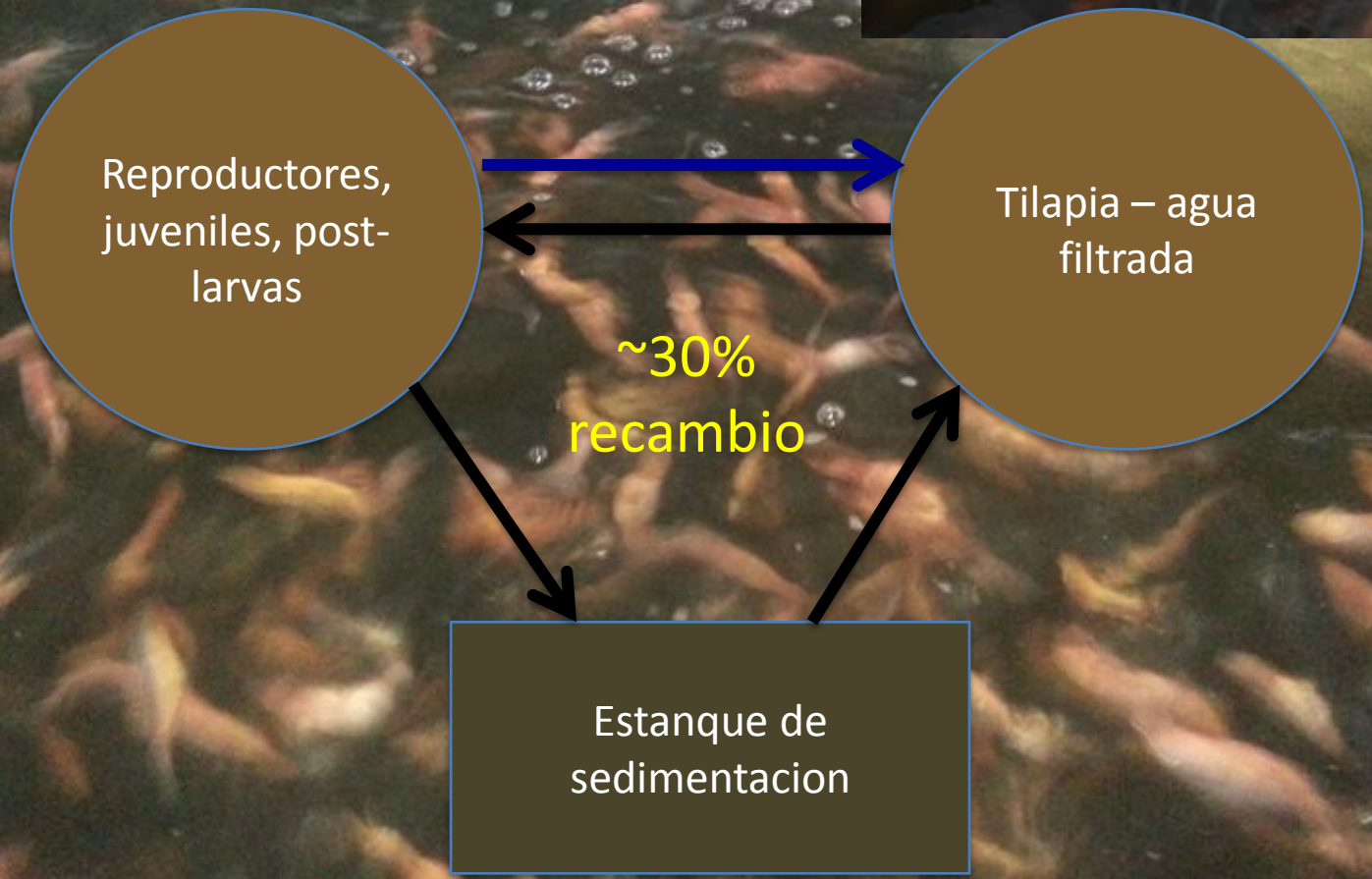
Pathogenic Vibrio sp. have been associated with "triggering" outbreaks of WSSV and other diseases

Screening Large Post-larvae

Large PL => screening

- Lower survival
- more size variation
- SPR animals only, SPF are uniform

- Tilapia in larviculture (PL6-12)
- Tilapia in nursery phase
- Tilapia in grow-out
- Tilapia in broodstock



Beneficios de Maternidades

1) Aseguranza de Salud, 2) Aumentar Productividad

- Seleccion de los PL's mas saludable; eliminar debeles
- Periodo de aclimacion al engorda es mas largo
- Reducir reisgo de enfermidades en engorda
- Optimazar nutricion con dietas artificials
- Control de poblacion al engorda
- Control de Temperatura durante la epoca frio
- Mas ciclos / cosechas por ano
- Crecimiento compensatorio despues la transferencia
- Reducir requerimiento del renovacion del agua

Desventajas de Maternidades

Disadvantages
Location of nursery raceways important
High initial investment
High energy demand
Power loss risk – need back-up power
Transfer of animals is difficult
Requires more management

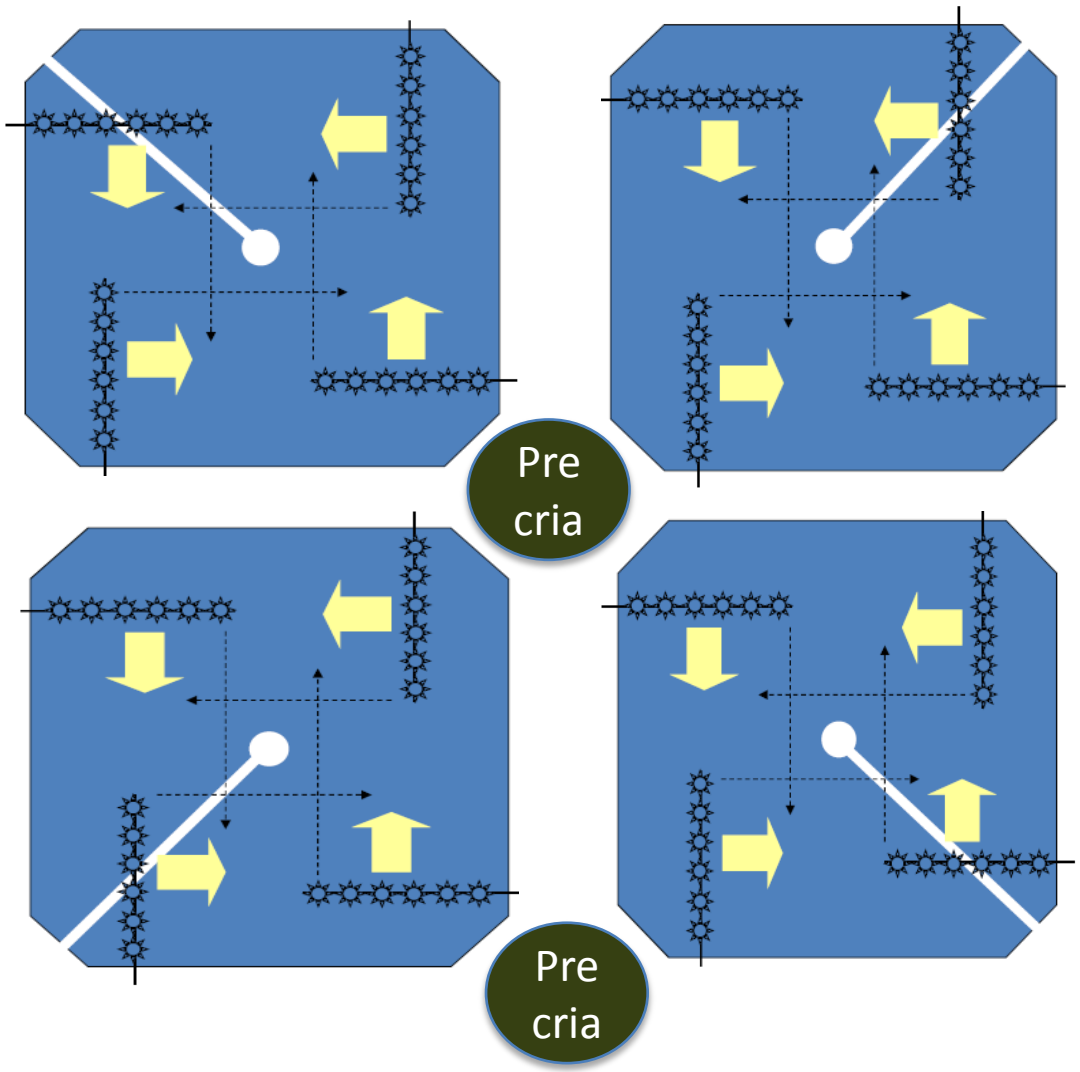
La mayoria de las granjas en Tailandia tienen maternidades. Pero India y Indonesia siguen con un solo fase. Vietnam y China estan cambiando a dos fases pero mas lento.

Asia Phase 1 Nursery Criteria

Nursery Tank	Criteria
Area	70 to 100 m2
Volume	70 to 100 m3
Shape	Round (10 meter diameter); Raceway
Stocking density	2,000 to 10,000/m2 (average 5,000/m2)
Days of culture	22 to 25 days (maximum is 30 days)
Survival	90-95% survival
Aeration	Diffusers, air stones, venturi aspirator
Water exchange	50-70% exchange over last 2-3 days before transfer; low or zero water exchange prior
Feeding frequency	Every 2-4 hours (6-12 times per day)

Modelo Tailandez

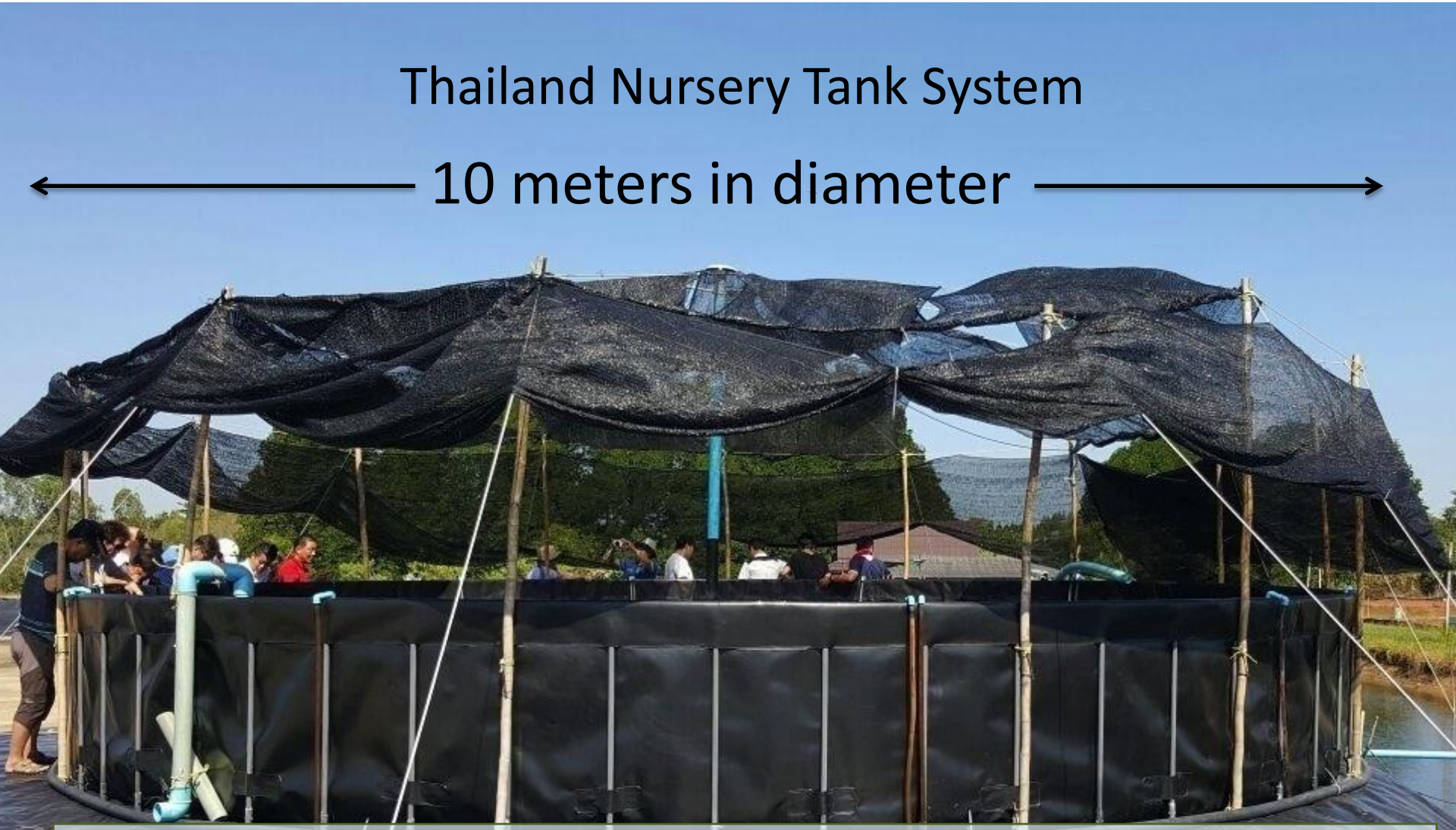
Grow-out ponds are up to 5,000 m2



One nursery tank for two grow-out ponds

Thailand Nursery Tank System

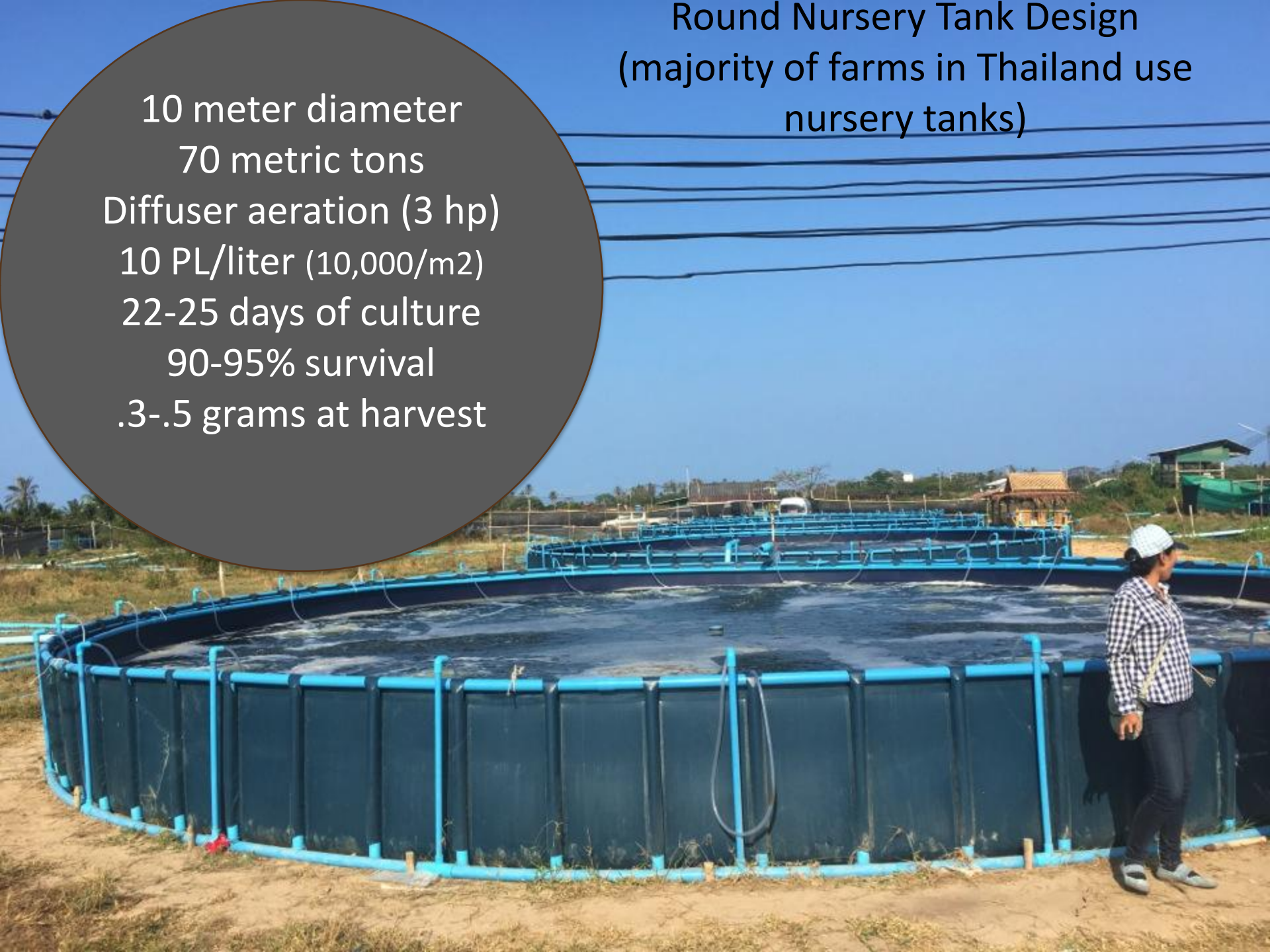
← 10 meters in diameter →



- Agua sin esterilizar; 7 dias antes del siembra, filtrada; probioticas
- Baja renovacion del agua; flujo abierto (no recirculacion)
- Aeracion fuerte – diffusers, air stones, or aspirator
- Recambio del agua - 50-70% para los ultimos dias del cultivo

Round Nursery Tank Design (majority of farms in Thailand use nursery tanks)

10 meter diameter
70 metric tons
Diffuser aeration (3 hp)
10 PL/liter (10,000/m2)
22-25 days of culture
90-95% survival
.3-.5 grams at harvest



Round Greenhouse Structure for Nursery Tank

1,000,000/25 m2
40 PL12 per liter
DOC = 10 to 14 days
95% survival
Surat Thani, Thailand

Nursery Vietnam: 10/liter density – up to 50% mature biofloc inoculation (new tanks)

Automatic feeder…or hand feeding is every 3 hours

Fermented probiotic treatment

Nursery Korea

Density: 2-5 PL per liter

Days of culture: 30-45 days

Survival: 85-90%

Size at harvest: 1-3 grams

Pure biofloc protocol (inoculation)

Biomass: 2-3 kilos/m3 juveniles

Feed Management in Nursery

2-3 feeding trays per nursery tank. The feeding tray is checked 2 hours after feeding

- Feed every 3 hours
- Adjust amounts according to feed tray and sampling
- 38-42% protein feed; live Artemia for Day 1-2
- Probiotics/enzymes in water and top coat on feed

Floating Nursery

- Area: 5 x 10-14 meters; 1.5 m deep
- Volume: 75 to 105 m3
- Days of culture: 20-25 days
- Feeding every 3 hours by hand
- Juvenile size: 1,000-600 /kg or .6 to 1.0 gram

Density: 2,400 PL12/m2
120,000 PL12/pen
Survival rate 90-95 %
Weigh and transfer





Aeration

Lineas de Aeracion


Nursery ponds in West Java, Indonesia
aetec

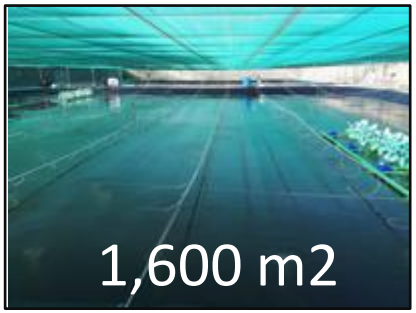
Gravity transfer: Phase 2 to Phase 3 Indonesia

3-Phase Grow-out System (Thailand – One Set)

1.5 million PL12
7 days; 95%

6 mt

30 days;
1-2 grams

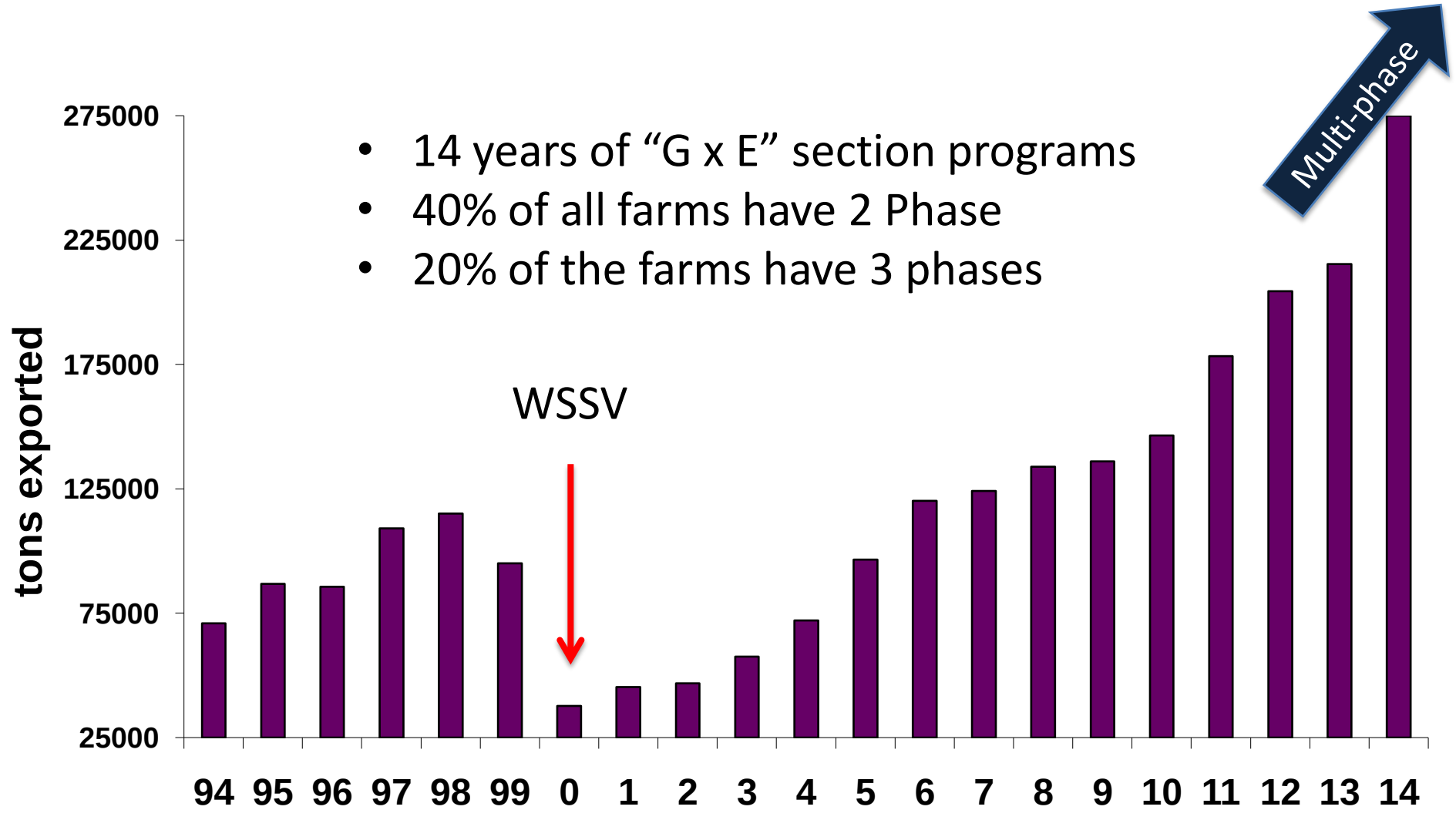


60days

4,000 m2 x 3.5 kg =
14 metric tons/crop
With shrimp toilet

- 3.5 kilos/m2 production; 35 metric tons per hectare
- Survival: 95/90/70% per phase; overall survival around 60%
- Recirculating water management; Tilapia and milkfish 2 kg/m2
- Aeration: 32 hp per grow-out pond (80 hp/hectare)

Ecuador: Trending towards multi-phase grow-out



3-Phase Systems - Ecuador

	Phase 1	Phase 2	Phase 3
Area	70 m2 (100 M3)	0.3 - 2.5 hectares	5-10 hectares
Stocking density	5-10/liter	50-250/m2	10-18/m2
Days of culture	25-30 days	20-60 days	80-120 days
Harvest size	.03-.05 grams	.3 to 3 grams	18-28 grams
Survival	95%	90%	75%

El Oro Province in Ecuador

- Farmers now building nurseries next to grow-out pond
- 1.2 to 2.0 grams/week; density up to 15 – 25/m2
- Harvesting up to 3,000 kilos/ha; average growth at 1.2 g/week
- 18 grams in 112 days at 75% survival

Phase 1 Nursery Criteria – Ecuador

- Center drain, auto cleaning, recirculation pump
- Sedimentation tank (1% volume)
- Aeration: Using venturi and diffuser grid
- Oxygen: >5 ppm
- Temperature: 30-32 C
- pH: 7.4 to 7.6
- Growth: from 350 PL/g. to 12 PL/g. in 14 days
- Survival rate: >90% on average
- Biomass: 1.5 to 2.0 kilos per m2
- Stocking density: 10-15 PL/liter
- 100 metric ton tank x 10 PL/liter = 1.0 million PL12
- Feeding: every 2-3 hours; 8 to 12 times per day


X4


X4


X2
P-130 T-030


X2
P-129 T-031

A3 Aspirator

Phase 1: Raceways in farms

- 100 metric tons; 12 m diameter
- Stocking density: 5-10 PL / liter
- Harvest 3 shrimp/gram (.3 grams per shrimp)
- Days of culture: 25 days
- Survival: 90-95% survival

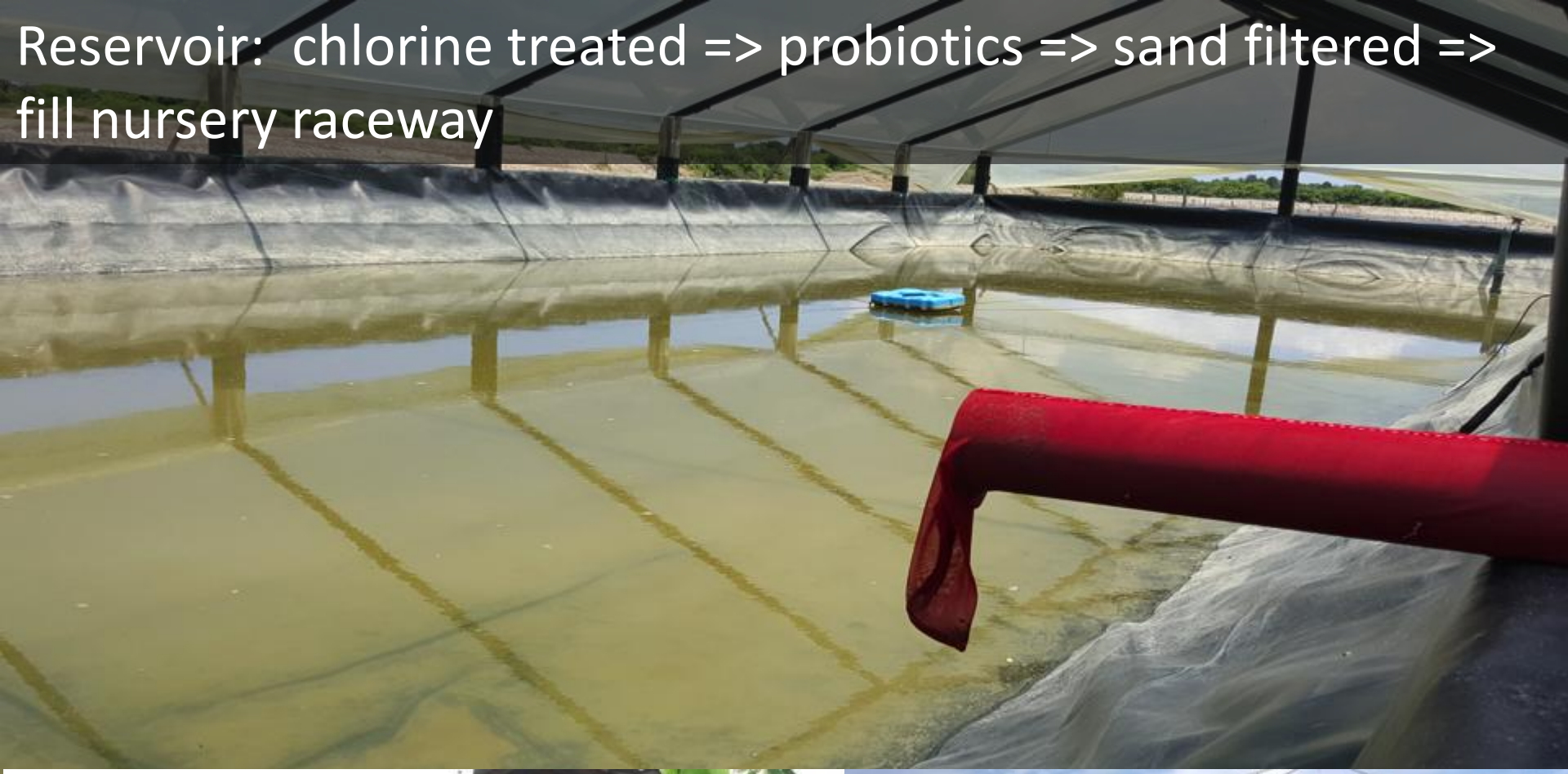
El Oro, Ecuador

Self-cleaning recirculation system

Swirl Filter

Self-cleaning recirculation system

Reservoir: chlorine treated => probiotics => sand filtered => fill nursery raceway



PREPARACIÓN PARA RACEWAYS DE 70 M CUBICOS

1. 400 litros de agua de mar filtrada
2. 100 gramos de probiotica + enzimas
3. 600 gramos de azúcar morena (opcional)
4. 600 gramos de maíz, soya o arroz molido

Se deja fermentar durante 36 horas con aireación y el contenedor donde se esta fermentado tapado para evitar contaminación
Después de ese tiempo se puede aplicar de 10 a 20 litros , a cada Raceweys .

Para mantener en un ambiente sano el cultivo de recomienda aplicar cada 3 días .

NOTA.- Se recomienda aplicar unos 100 mililitros de esta fermentación en cada alimentacion , poner este fermento 15 minutos al alimento previo a su aplicación .

Phase 2: Intermediate nursery ponds

- Earthen ponds, no liner, .1 (1,000 m) to 2.0 hectares
- Well water, low salinity (Ecuador)
- Zero to low water exchange
- Probiotics + enzymes => increase diversity
- 50-250 animals per m2 density; aeration dependent
- Higher protein feed, smaller particle size
- Difficult phase due to transfer related stress
- Transfer mortality can range from 5-10%

Ecuador Phase 2 – Intermediate Pond

Phase 2
0.3 - 2.5 hectares
50-250/m2
20-60 days
.3 to 3 grams
90% survival

Indoor Phase 2 Lined Pond (Ecuador)

Productivity: 3-Phase Grow-out

	Grow-out 1 Phase	Grow-out 2 Phase	Grow-out 3 Phase
Kilos per hectare	2,500 kg	2,500 kg	2,500 kg
Target size (ave)	25 grams	25 grams	25 grams
Harvest density	10 / m2	10 / m2	10 / m2
Grow-out DOC	160 days	120 days	105 days
Crops per year	2.0	2.5	3.0
Kilos / Ha / Year	5,000 kg	6,250 kg	7,500 kg
6/hectare/year	$30,000	$37,500	$45,000
% gain between phases	---	20% over 1 phase	33% over 1 phase

Multi-Phase Productivity (Ecuador Results)

	Direct Stock	2 Phases	3 Phases	4 Phases
Kilos per hectare (average)	2,500 kg	2,500 kg	**2,500 kg**	**2,500 kg**
Target size (ave)	25 grams	25 grams	**25 grams**	**25 grams**
Harvest density	10 / m2	10 / m2	**10 / m2**	**10/m2**
Grow-out DOC	160 days	120 days	**60-90 days**	**60-90 days**
Crops per year	2.0	2.5	**3.0**	**4.0**
Kilos / Ha / Year	5,000 kg	6,250 kg	**7,500 kg**	**10,000 kg**
$$$/hectare/year ($6.00/kg)	$30,000	$37,500	**$45,000**	**$60,000**
% gain over direct stocking	---	20% over single phase	**33%**	**50%**


Mexico:
Piscinas redondo; 1,000 m2 x 3 metros profundidad; 800 PL/m2 siembra directa; transferir or engordar

Transfer Methods

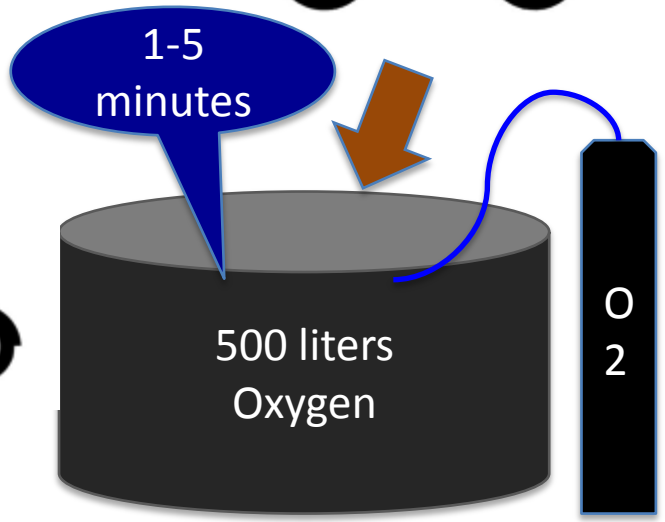
1. Gavetas sin agua; transporte por motorbike
2. Baldes – 20 litros usando agua con O2
3. Tanque transporte – 1-2 mt con aire y O2
4. Bomba transferencia – hasta 1 kilometro

El factor mas importante es para implementar lo mejor metodo para transfir los animales

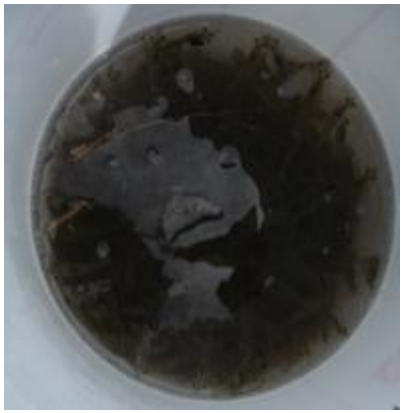
	Distancia corto	Distancia largo
Method of transfer	baldes	Tanque transporte
Volume of vessel	5 galones	1,000-2,000 litros
Juveniles / vessel	2 kilos (hasta 1 gr)	20 a 40 kilos de biomasa
Max transfer time	5 minutos	20 minutos
Oxygen	saturation	saturation
Transfer mortality	<5%	5-10% (depende talla)

Transferir por Motorbike

(5-10 minutos; sin water)

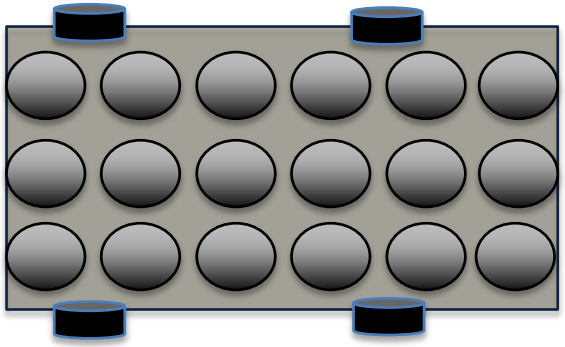


Pure Oxygen and 24 C



Distancia corto a transferir juveniles
(<5% mortalidad)

10 minutes to transfer



Distancia largo por tanque

- 100,000 juveniles per ton of water.
- Aeration and oxygen during transport
- Ice to lower water temperature
- PVC frames with nets in tanks
- Transport mortality: 5% (average)

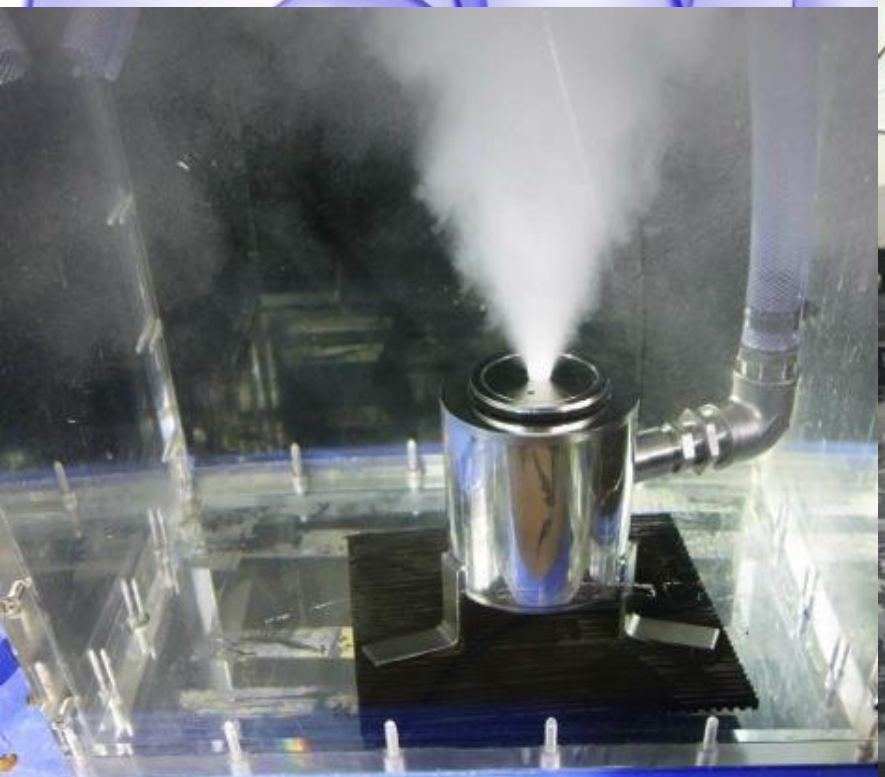
- El Heathro™ o Magic Valley pump para transferir animales hasta 3 kilometros (con booster)
- Disponible en tres modelos: electrica, gasolina y hidraulica
- Se puede inter cambiar la manguera a 6", 4" & 3”

Criteria	
Shrimp size	.3 to 10 grams
Distance	Up to 3 kilometers
Oxygen injection in tube	Every 500 mts; 8 ppm O2
Transfer time	3-6 hours
Time of transfer	night
Average mortality	<3%

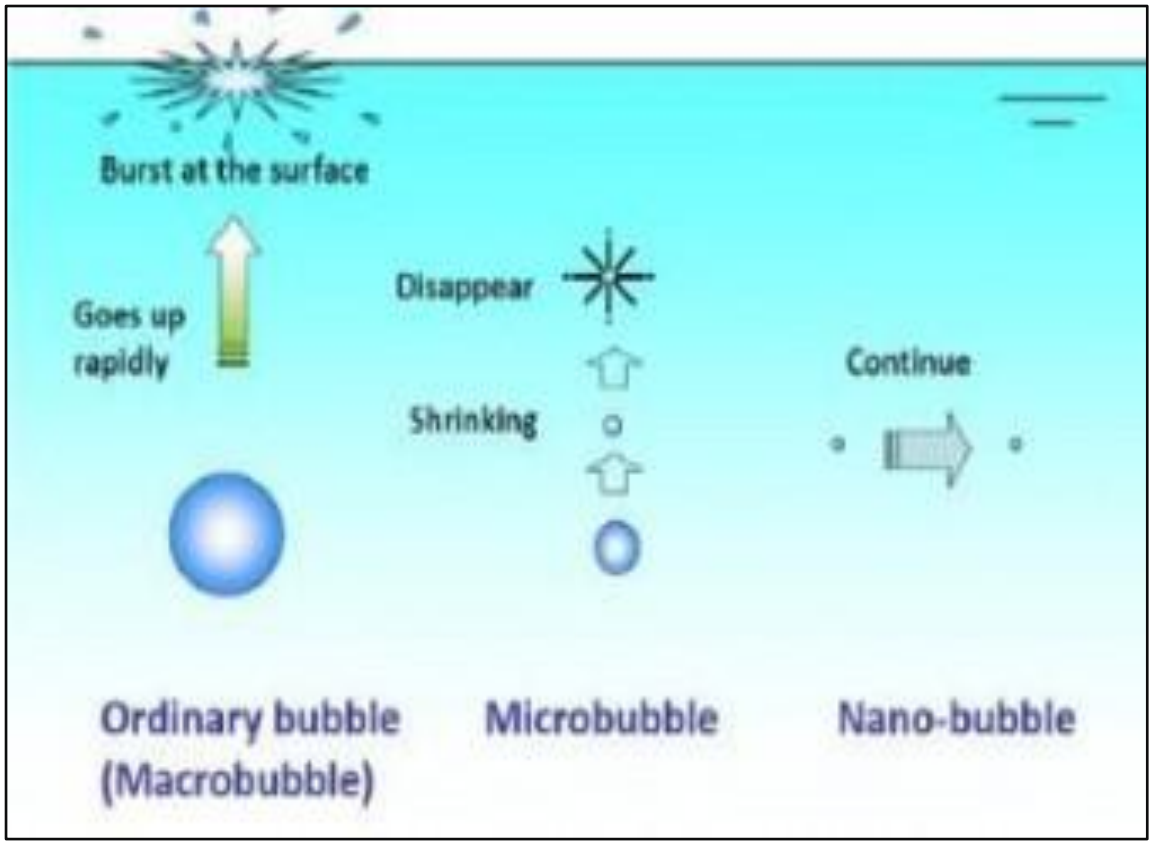
Transfer Pump ($28,000.)

Nano-bubbles

- Nursery and maturation
- Testing: Korea, Japan, Mexico
- Reduce Vibrio concentration
- Degrading of toxic compounds
- MNB => “free radicals” (OH-)
- Water disinfection, de-fouling
- Inject pure oxygen or ozone



Testing in Mexico and Vietnam



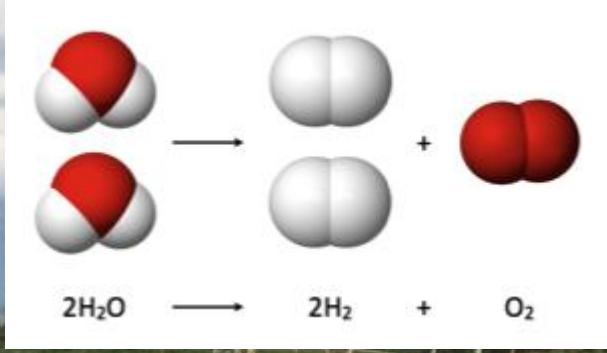
- MNBs lleve una carga ionica negativo “free radicals” (OH-) que se puede neutralizar patogenos como Vibrio

- Un Micro Nano Bubble (MNB) tiene un medida de 0.1 to 10.0 micrones

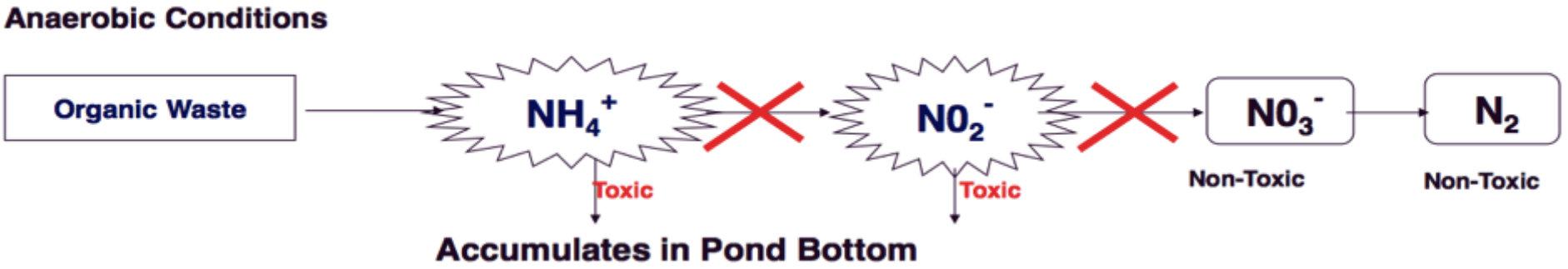
- MNBs es superior que aeracion normal porque tiene mas superfice area, alta presion internal y se mantiene en el columen del agua mas tiempo

- **Efectivo en los tanques de maduracion para eliminar el biofilm plr las paredes de los estanques**

Electrolysis



Currently being tested in 300 ponds in Thailand



Multi-Trophic or “Aquamimicry” Technology

1. Create a greater diversity of micro-organisms
2. More balanced and stable pond environment
3. Lower pathogenic Vibrio concentrations
4. Reduced incidence of disease outbreaks

Multi-trophic

Conventional protocol

Greater diversity of beneficial organisms
Balanced pond ecosystem
Natural food availability (copepods, etc)
Low pathogen levels
Inhibits quorum sensing of Vibrio

Narrow diversity of micro-organisms
Dependence on artificial feeds
Favors multiplication of Vibrio sp.
Difficult to quickly balance ecosystem
Requires continuous sludge discharge

Soil is home to billions of micro organisms…essential partners to plant rooting and growth. Number of microbes in one gram of soil (Alltech).

Viruses – 1,000,000,000

Bacteria – 100,000,000

Fungi - 1,000,000

Algae - 10,000

Protist – 10,000

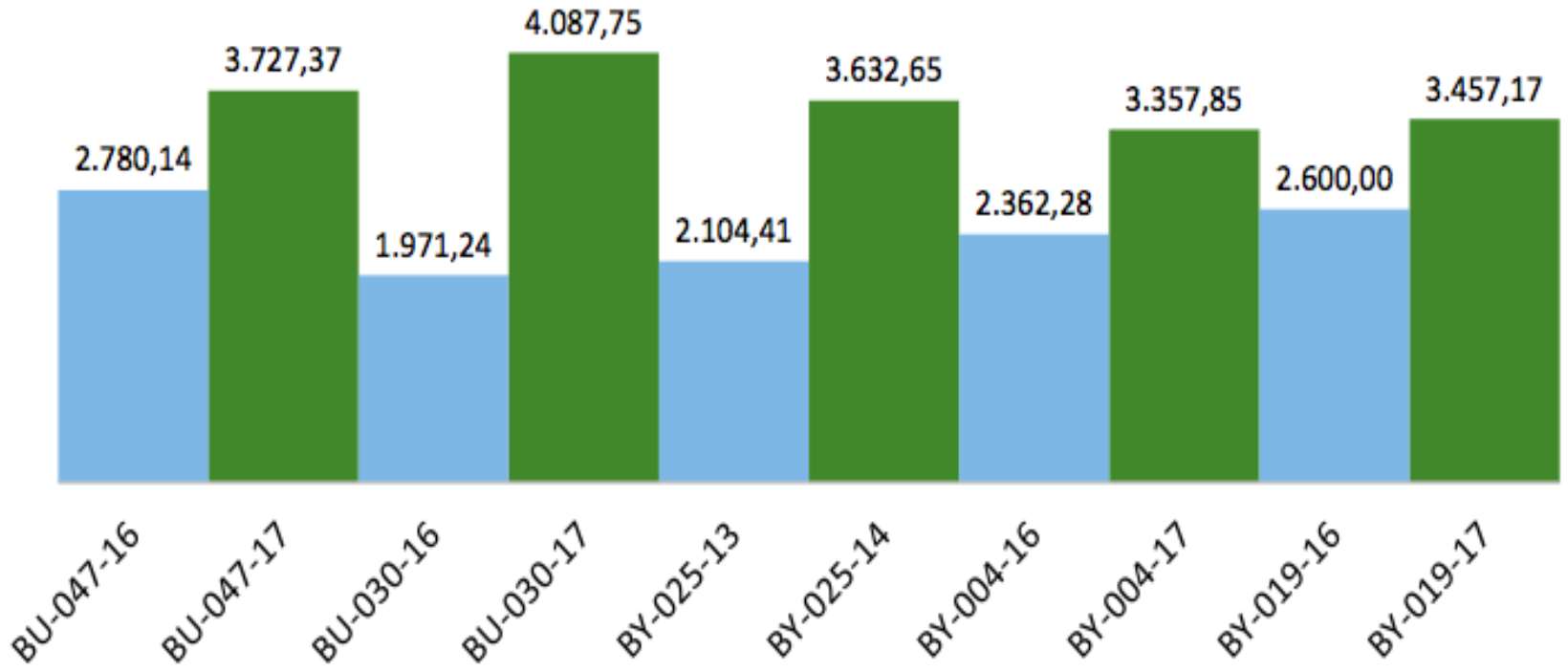
"Our soil is living, and we must nurture its natural ecosystem."

Fermentation => Screening => Add to pond

Fermented rice bran (FRB) + probiotics + prebiotics produces an abundance of live micro-organisms and beneficial bacteria within 7 days. This bio-colloid-rich water is pumped from a reservoir into the nursery raceway or pond, providing a healthy ecosystem for the post-larvae.

+58%

Productividad (lb/ha)



"Crisis drives technology…Change!"

Los Granjeros Brazilieros necesitan…

- 30% utilidades mínimo
- Crecimiento de 1.5 gramos por semana
- Sobrevivencia mas de 50%
- Densidad de siembra mas de 20/m2
- 2,000 kg por hectaria por ciclo


Muito Obrigado