



AQUACULTURE DEPARTMENT
Southeast Asian Fisheries Development Center
www.seafdec.org.ph

Lessons on Sustainable Mariculture



Evelyn Grace de Jesus-Ayson
SEAFDEC Aquaculture Department
Tigbauan, Iloilo, Philippines

Aquaculture

- ❖ Fast-growing food production sector
- ❖ More than half of fisheries production comes from aquaculture

Philippine Fisheries Production (x1000 MT)

	2011	2012	2013	2014	2015
Total	4933.5	4865.1	4705.4	4689.1	4649.3
Aquaculture	2608.1	2542.8	2373.4	2337.6	2348.2

Traditional Culture Areas

- ❖ Brackishwater ponds
- ❖ Freshwater bodies



Mariculture

- culture of marine fish like milkfish in sea cages, farming of seaweeds, oysters and mussels; aquasilviculture, and others that may be developed through R&D programs





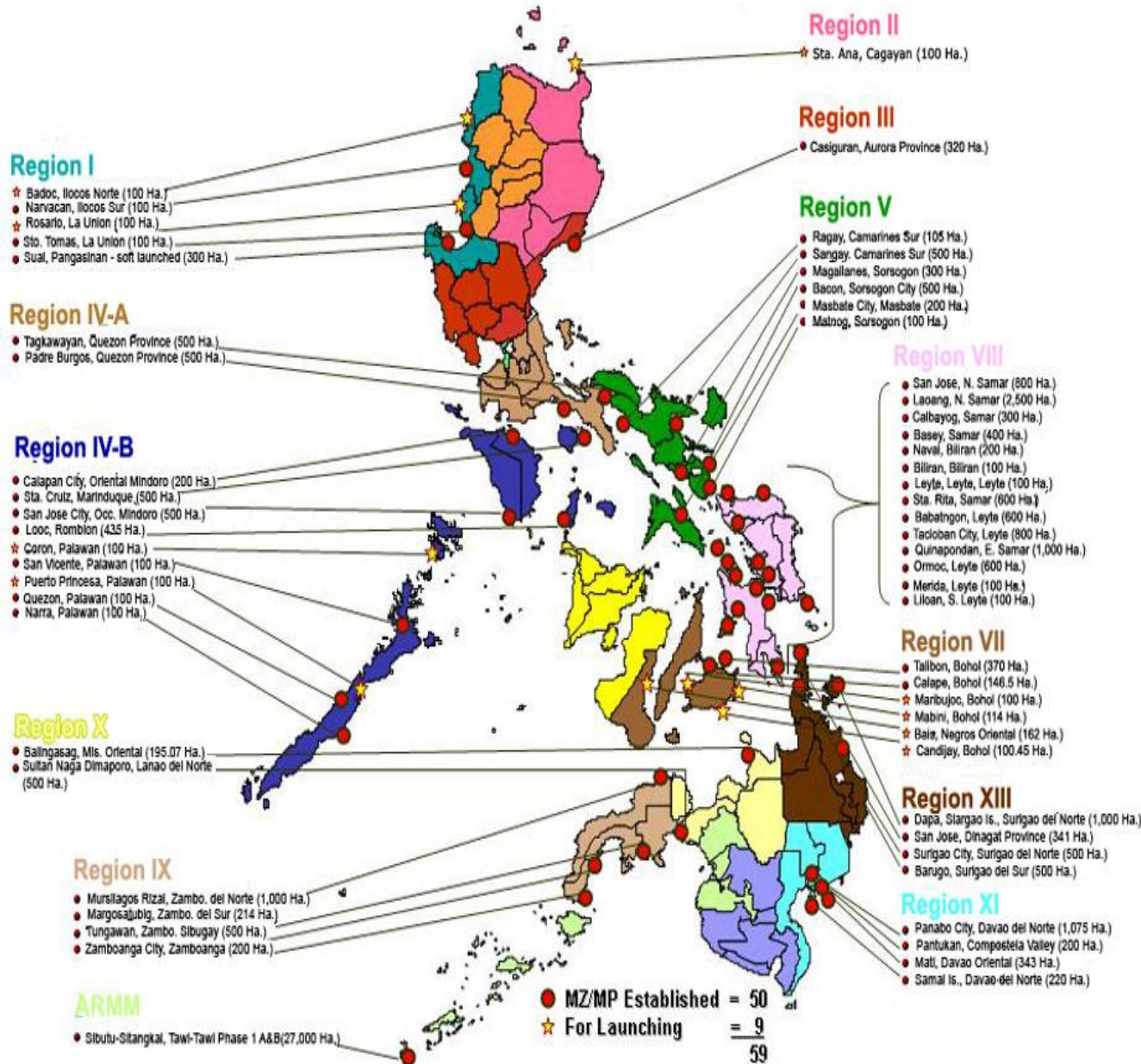
Mariculture Park Concept

Objectives:

- ❑ Provide employment and alternative source of livelihood for marginalized and sustenance fisherfolk
- ❑ Develop an area with appropriate infrastructure that will allow fishermen, fish farmers and investors to operate cost-effectively and securely
- ❑ Develop skilled and technically capable fisherfolk to support the mariculture industry
- ❑ Promote the use of environment-friendly inputs and farm management practices

Location of Existing Mariculture Park/Zone

(As of April 20, 2010)



Philippine Aquaculture Production (x1000 MT)

	1996	2000	2005	2010	2015
Total Production	1007.7	1100.9	1895.8	2543.7	2348.2
Milkfish	150.2	210.0	289.2	349.4	384.4
% of Total Production	15.0	19.1	15.2	14	16.4
BW Ponds and Pens	139.4	186.6	219.9	219.4	246.1
% of Total Milkfish	92.8	88.9	76.1	62.8	64.0
FW Pens and Cages	10.8	14.5	25.3	42.8	21.5
% of Total Milkfish	7.2	6.9	8.7	12.2	5.6%
Marine Cages	.03	8.9	44.0	87.2	116.8
% of Total Milkfish	0.02	4.2	15.2	25.0	30.4

Why milkfish ???

- ❖ Very important food fish in the Philippines
- ❖ Breeding and culture technologies are well developed
- ❖ Low trophic level fish
- ❖ Thrives in FW, BW and SW
- ❖ **Seedstocks are available**





Some constraints to sustainable aquaculture

- ❖ **Reliable supply of good quality seeds**
- ❖ Good quality feeds
- ❖ Incidence/outbreaks of diseases
- ❖ Degradation of aquaculture environment
- ❖ Markets, economics and other issues

Philippine Aquaculture Production (x1000 MT)

	2011	2012	2013	2014	2015
Aquaculture	2608.1	2542.8	2373.4	2337.6	2348.2
A-Milkfish	372.6	386.7	401.1	390.2	384.4
A-Others	7.8	11.5	17.7	13.1	13.7

The Philippine Milkfish Hatchery Industry

**Annual Production
(350,000 MT)**



**Fry Requirement
2.3B**



**Hatchery-produced
(1.2B)
Wild-caught/Imports
(1.1B)**





Some constraints to sustainable aquaculture

- ❖ Reliable supply of good quality seeds
- ❖ Good quality feeds
- ❖ Incidence/outbreaks of diseases
- ❖ **Degradation of aquaculture environment**
- ❖ Markets, economics and other issues

Philippine Aquaculture Production (x1000 MT)

	2011	2012	2013	2014	2015
Aquaculture	2608.1	2542.8	2373.4	2337.6	2348.2
A-Milkfish	372.6	386.7	401.1	390.2	384.4
A-Others	7.8	11.5	17.7	13.1	13.7

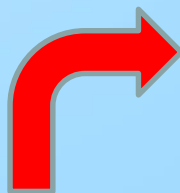
Uncontrolled expansion/
intensification of aquaculture
activities



Congestion
Overstocking
Overfeeding



Pollution
Eutrophication
Harmful Algal Blooms

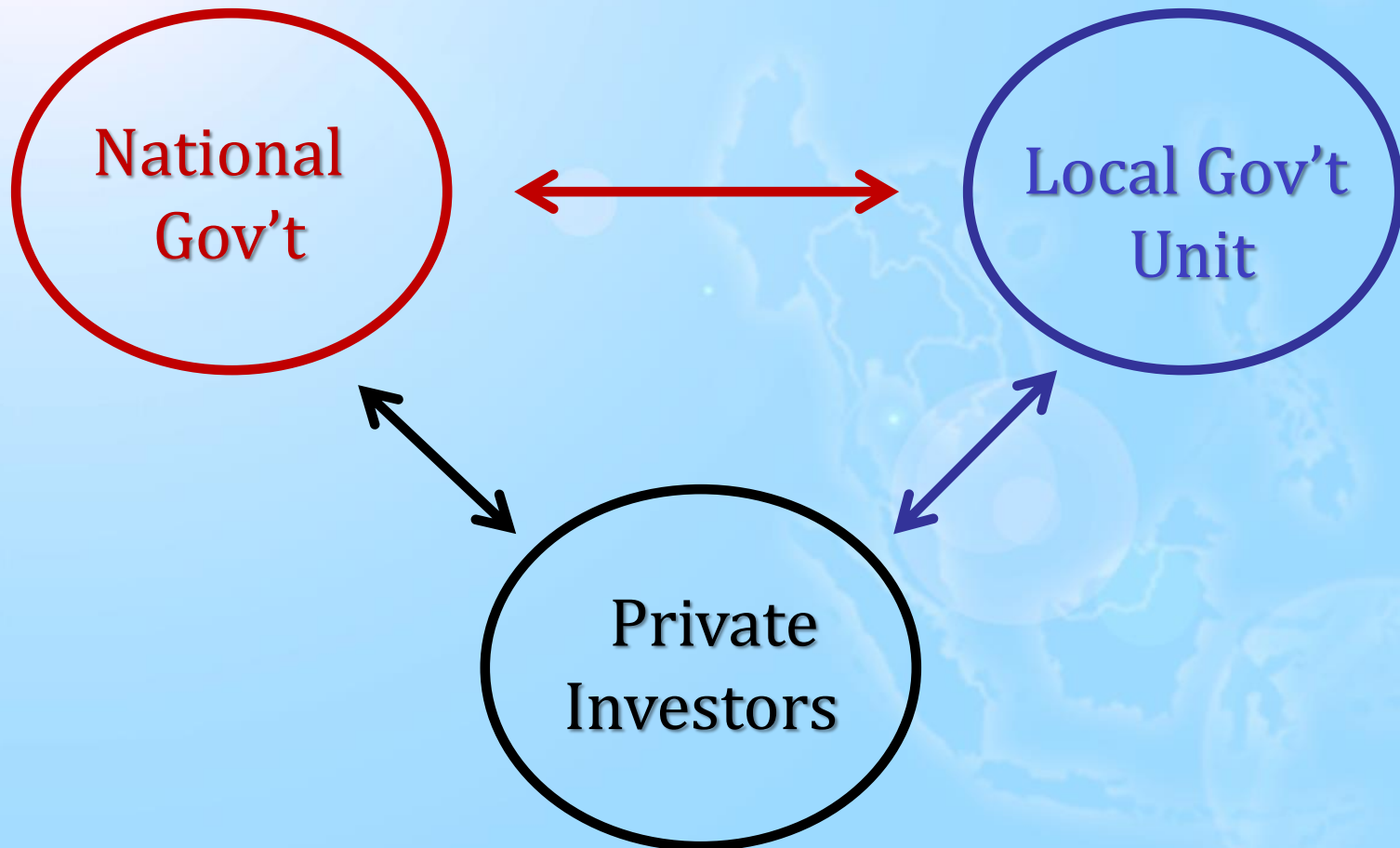




Problems and Issues

- Environmental pollution due to poor feeding management
- Requires large investments limiting participation of small-scale operators and fishfarmer groups
- Limited access of small-scale operators to financial sources

Panabo Mariculture Park: A successful case of PPP



Panabo City Mariculture Park

- ❖ Started in 2006 with just 3 cages
- ❖ In May 2015 - there were 372 units of fish cages
 - 314 cages - operated by 76 private investors
 - 42 cages - operated by fisherfolk families
 - 16 cages - BFAR-NMCs techno-demo projects



Role of LGU – *provides legislative support and enabling mechanisms for the MP*

- ❖ **City ordinance 02-06** - specifies the scope, development zone and project administration, members of the executive management council
- ❖ Issues permit to operate on an annual basis
- ❖ Provides necessary support to MP operations like provisions of security staff
- ❖ Collects business taxes
 - annual application fee of PhP 1,100/cage
 - business tax of 0.03% of gross sales/cage/harvest

Role of National Government



Bureau of Fisheries and Aquatic Resources – National Mariculture Center (BFAR-NMC)

Technical evaluation of the area – *basis for development*



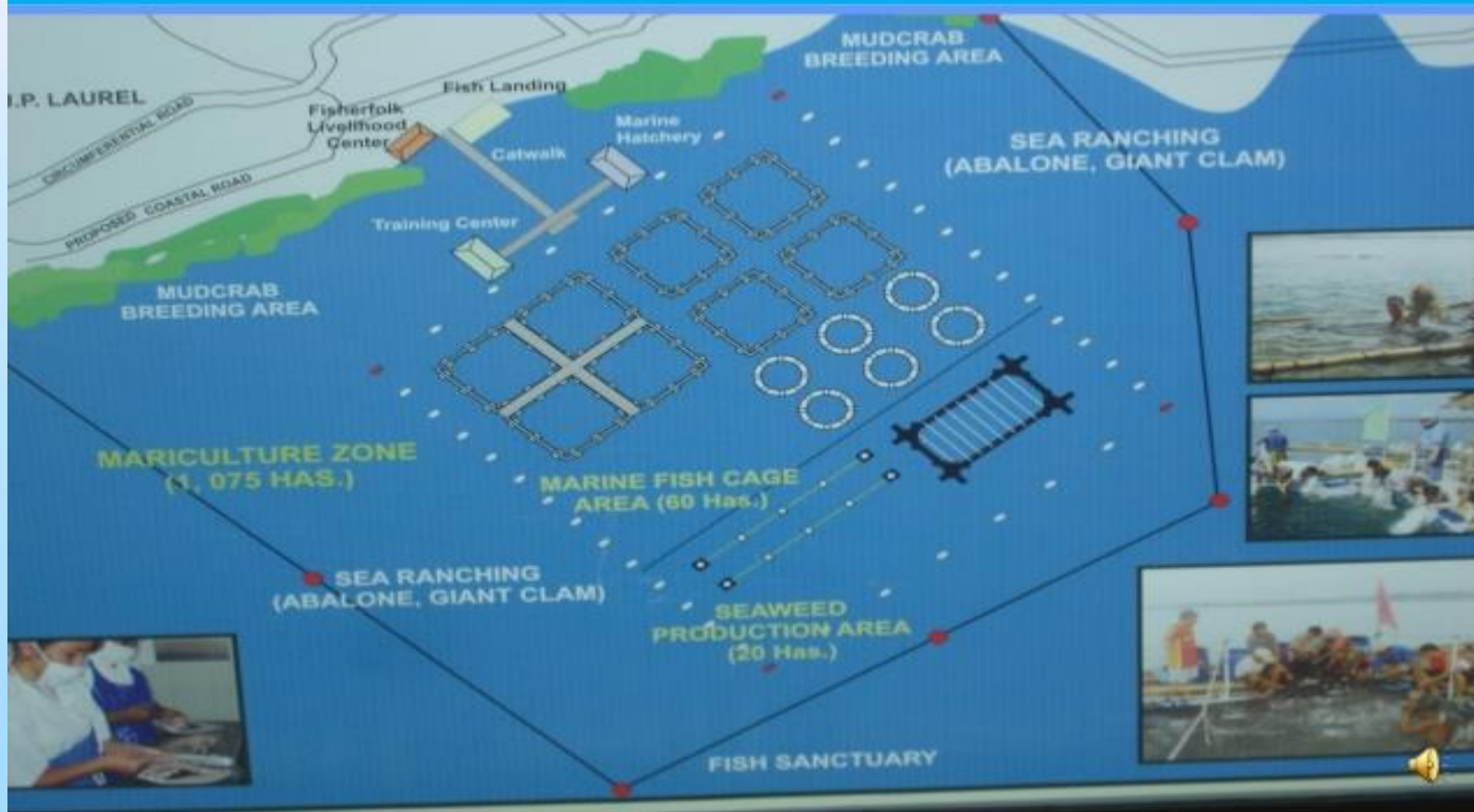
Planning and management of
aquaculture parks for
sustainable development of
cage farms in the Philippines

Partners

BFAR, NIFTDC, Map and Marine, Akvaplan-niva

Technical evaluation of the site

LAYOUT PLAN OF Panabo MP



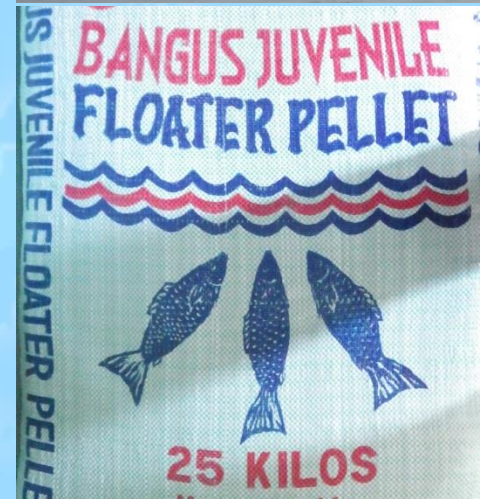
BFAR-NMC staff do the following tasks

1. Sampling for growth every 15 days
2. Compute feeding rates for the caretakers
3. Regular monitoring of environmental conditions and health status of the stocks
4. Conduct weekly meeting and refresher courses for caretakers



Technical aspects of the operation

- 10 x 10 x 4 m - cage dimension
- 400 m³ - water volume
- 5-6 inches - milkfish fingerlings size for stocking
- 15,000 pcs/cage; 37.5 pcs/m³ - stocking density
- feeds are floater and slow-sinking types
 - starter feeds (1st mo, 31% CP)
 - grower feeds (2nd and 3rd mos, 29 % CP)
 - finisher feeds (4th mo, 27 % CP)



Technical aspects of the operation - 2

- feeding rates
 - 6 % BW (1st mo)
 - 5 % BW (2nd mo)
 - 4 % BW (3rd mo)
 - 3 % BW (4th mo)
- feeding frequency is 6-7 times a day starting at around 7 AM
- change of nets after 2 months of culture
- 400-500 g BW - harvest size
- 1.9 – 2.2 - FCR





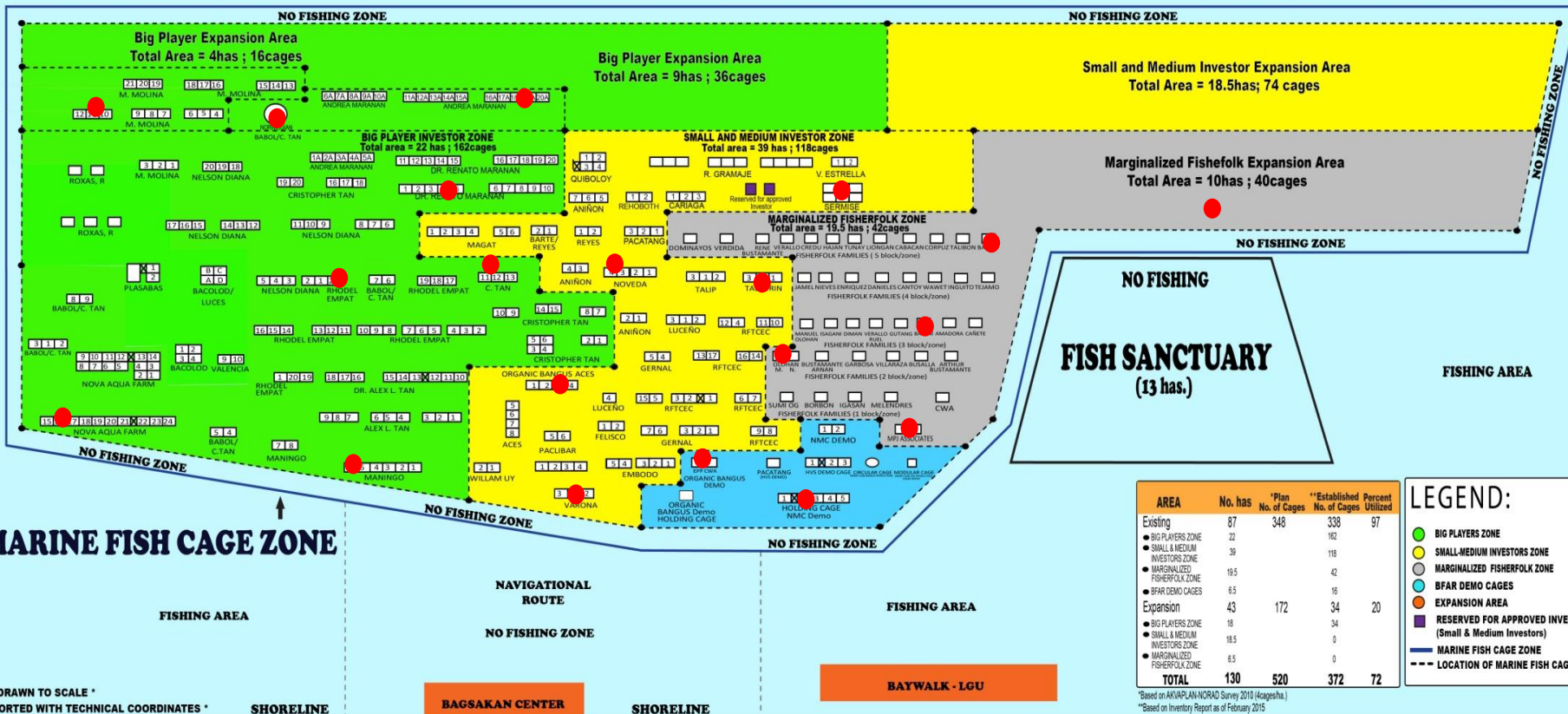
PANABO CITY MARICULTURE PARK

MARINE FISH CAGE DEVELOPMENT PLAN (2006-Present)

FISHING AREA

FISHING AREA

NAVIGATIONAL LANE



MARINE FISH CAGE ZONE

FISH SANCTUARY
(13 has.)

Legend: ● = Water Quality Sampling Stations at Panabo City Mariculture Park

Environmental mpacts – *Water quality monitoring*

Parameter	PCMP	MP-X
Depth (m)	7.4-22.3	20.1-38.3
DO (ppm)	4.87-6.03	3.1-3.7
NH₃ (ppm)	0.024-0.072	0.075-0.093
NO₂ (ppm)	0.009-0.025	ND
PO₄ (ppm)	0.039-0.060	0.104-0.192
OM (%)	1.65-3.54	11.19-12.78
Transparency	1.45-2.5	>0.5-5.75
Sediment color	Brown-black	Black
H₂S smell	None	Yes
Benthic fauna	None	None

Water quality criteria for marine fish culture

LIMITS

Temperature	2°C above maximum ambient temperature; 27-31°C
Salinity	15 - 34 ppt
pH	6.5 - 8.5
Dissolved oxygen	> 4 ppm
NO ₂	< 4 ppm
NH ₃	< 0.5 ppm
PO ₄	< 0.045 ppm for estuaries < 0.015 ppm for coastal waters
Transparency	> 30 cm

Source: ASEAN Marine Environmental Criteria – ASEAN Canada Program on Marine Science (1999). FAO Doc. NACA-SF/WP/89/13.

Visual Observation of sediments

CHARACTERISTICS

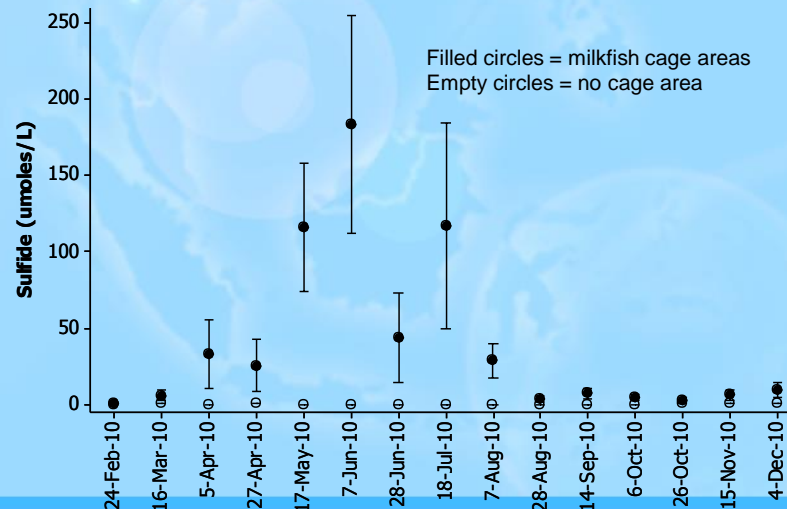
	GOOD	FAIR	BAD
Color	Brown	Brown – black	Black
Odor	None		Strong (rotten egg/H ₂ S odor)
Texture	Sandy (not sticky)		Clay/muddy (fine and smooth)
Benthic organisms	Present		None
Seagrasses and corals	Present		None

Source: ASEAN Marine Environmental Criteria – ASEAN Canada Program on Marine Science (1999). FAO Doc. NACA-SF/WP/89/13.

Fallowing

Breaks or rest periods
between production
cycles

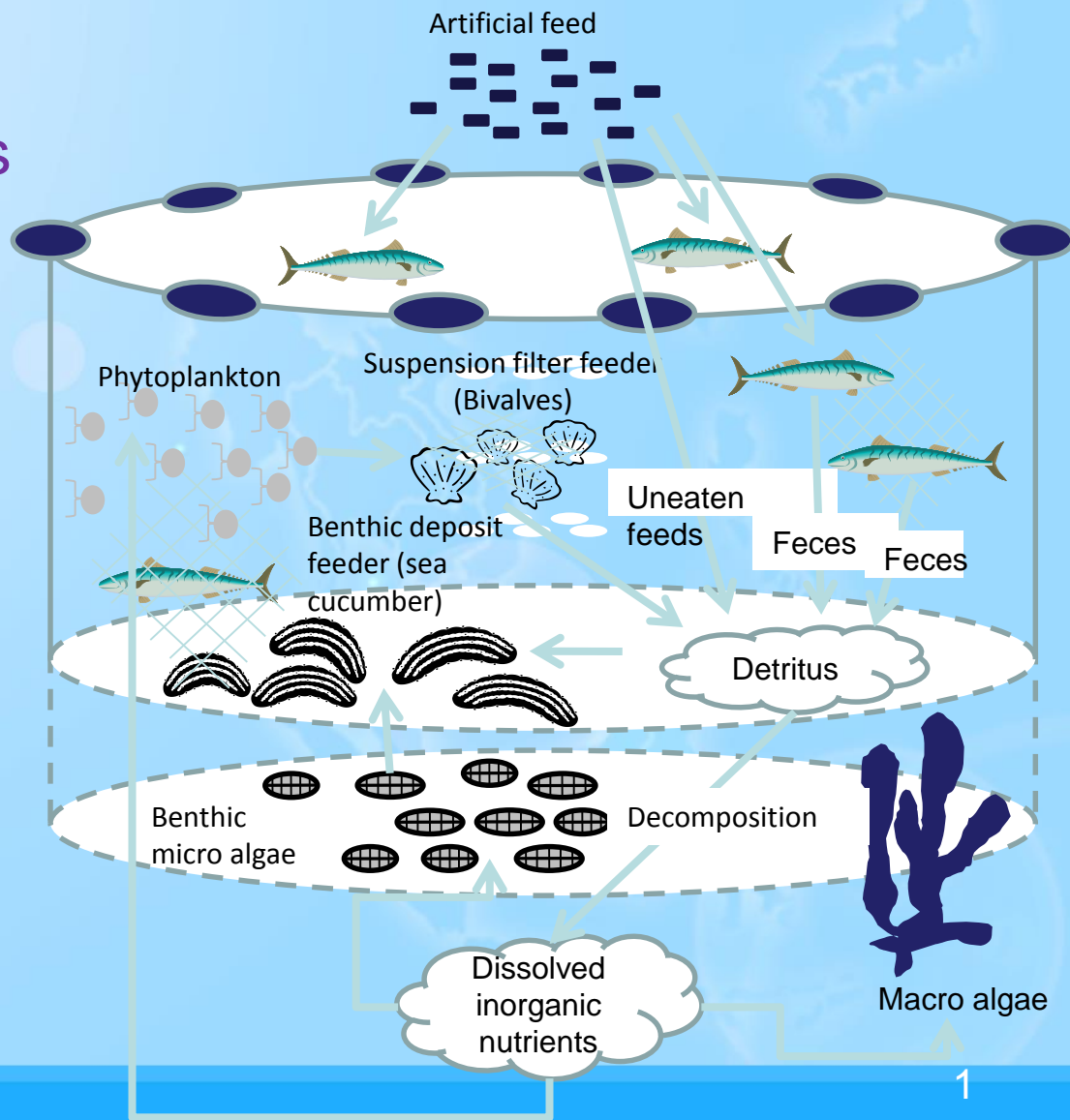
- a. restore the local environment
- b. break infection/re-infection cycles



Integrated Multi-Trophic Aquaculture (IMTA)

IMTA

- incorporation of species from different trophic levels in the same culture system
- the wastes of one species becomes the nutritional inputs of other species
- need more R&D



BFAR-NMC provides technical support for all operators – *trained skilled workers*



Fabrication of cage frame

trained skilled workers



Fabrication of mooring systems

trained skilled workers



Fabrication of net cages



trained skilled workers

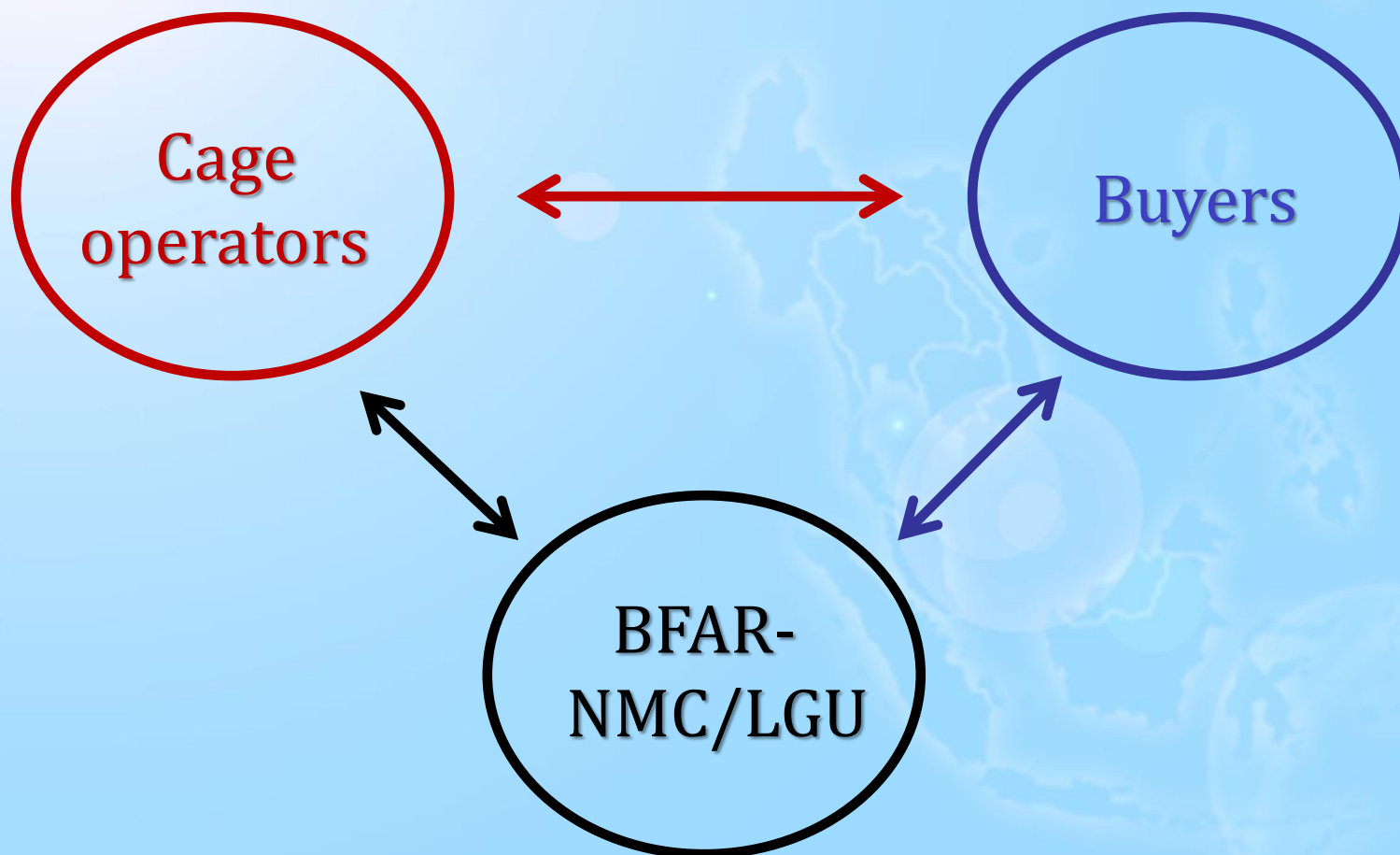


Fingerling transfer, counting & stocking

Role of the private sector - *provider of inputs*

- ❖ Milkfish hatcheries - for milkfish fry
- ❖ Milkfish nursery fishpond growers - for milkfish fingerlings
- ❖ Commercial feed companies - for milkfish artificial feeds
- ❖ Local banks - for easy financing requirements
- ❖ Other ancillary support services/inputs

Marketing arrangements



BFAR-NMC prepares list of monthly forecast of harvest based on fish growth data and posted in the bulletin board

Cage operator and buyer agree on market terms



Cage operator and buyer inform BFAR-NMC of the schedule and volume of harvest



BFAR-NMC coordinates with cage operator and buyer for the final schedule of harvest; assign harvest facilities and workers; provides support in recording



Actual harvest and marketing



Review meeting to assess results of harvest and marketing

Harvest and Marketing





Impacts - *contribution to food security*

Year	Number of cages	Production (MT)	Value (PhP)	Value (USD)
2006	3	2.90	235,837.00	5,359.90
2007	10	23.01	1,894,516.75	43,057.20
2008	171	314.42	27,011,241.50	613,891.85
2009	323	1919.00	160,459,193.02	3,646,799.84
2010	350	1803.95	155,961,144.44	3,544,571.45
2011	294	1517.55	132,472,826.69	3,010,746.05
2012	349	1683.04	144,418,591.35	3,282,240.70
2013	323	1848.42	161,964,379.06	3,681,008.61
2014	332	2967.75	270,622,494.71	6,150,511.23
Total		12,079.14	1,055,040,260.62	23,978,180.77

Contribution to employment

- 261 fisherfolks and local residents are directly employed in various jobs with an income worth PhP 551.2 M (12.5 M USD) in 2014

Contribution to investment promotion

- seed supplies, feed supplies and other ancillary support services
- value added products



Women's group doing business in PCMP

- ❖ Cagangohan Women's Association – milkfish production, direct selling of fresh/processed milkfish.
- ❖ Milkfish Processors Women's Association - dried and smoked milkfish.
- ❖ Organic Milkfish Processors Women's Association - bottled, dried, smoked organic milkfish





Potentials for further improvement

- ❖ Supply of milkfish fry and fingerlings is sometimes limiting
- ❖ Lower feed costs
- ❖ Provision of post-harvest facilities near the MP



How can this be replicated in other areas?

- ❖ Technical assessment of the area to establish carrying capacity, and as basis for operational and management plan.
- ❖ Seriously implement technical guidelines in the operations.
- ❖ Provision of necessary support to operators particularly technical and other input services including marketing.
- ❖ Active collaboration and commitment among major players to ensure success and sustainability of the operations.

Lesson 2: Mud Crab Aquaculture

Philippine Mud Crab Production (x1000 MT)

	2011	2012	2013	2014	2015
Aquaculture	2608.1	2542.8	2373.4	2337.6	2348.2
Mud crab	15.7	16.4	15.8	16.2	16.2

- ❖ Farming becoming popular; high demand, high market price
- ❖ Seed supply mostly sourced from the wild; declining
- ❖ **Promotion of hatchery, nursery, grow-out technologies**
 - ❖ 8 private hatcheries established; 3 already producing crablets
 - ❖ 10 private farms adopted nursery technology; 4 already producing juveniles

Lesson 3: Seaweeds farming

Philippine Seaweeds Production (x1000 MT)

	2011	2012	2013	2014	2015
Aquaculture	2608.1	2542.8	2373.4	2337.6	2348.2
Seaweeds	1840.8	1751.1	1558.4	1549.6	1566.4

- ❖ Declining production
- ❖ Planting materials mostly sourced from cuttings
- ❖ **Plantlets from tissue culture field tested in 11 sites**
 - ❖ Fast growth of 4-10%/day
 - ❖ Traditional method: 1.5-2%/day

Recommendations

- ❖ Ensure availability of inputs, especially seed supply
 - ❖ Promote establishment of seed production facilities
- ❖ Ensure availability of support services

Thank you!

