AquaPark – Norad funded project

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

www.aqua-park.asia

Mariculture park management

- Mooring trial
- Oil spill contingency planning
- Better Management practices
- Socio economic survey
- Economic analysis
- Layout optimisation
- Integrated Aquaculture

AQUA PARK

Mooring Trial

Mooring Scale Model

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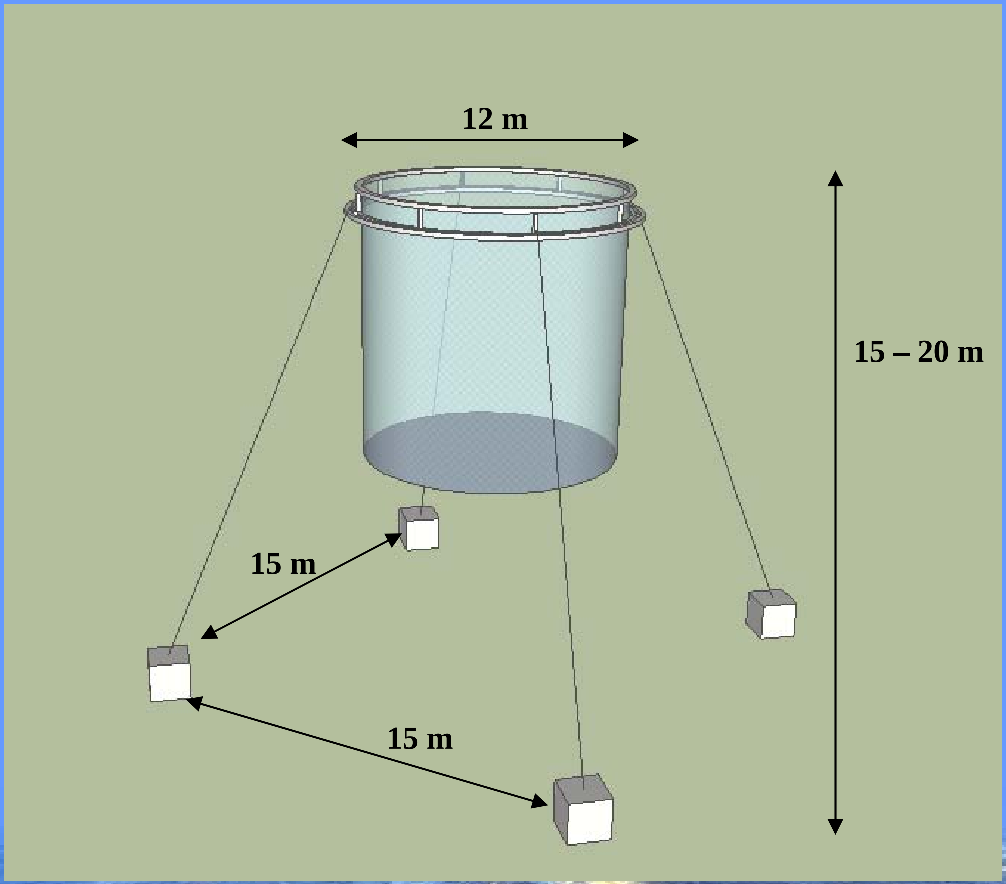
Typical cage mooring



Mooring Scale Model

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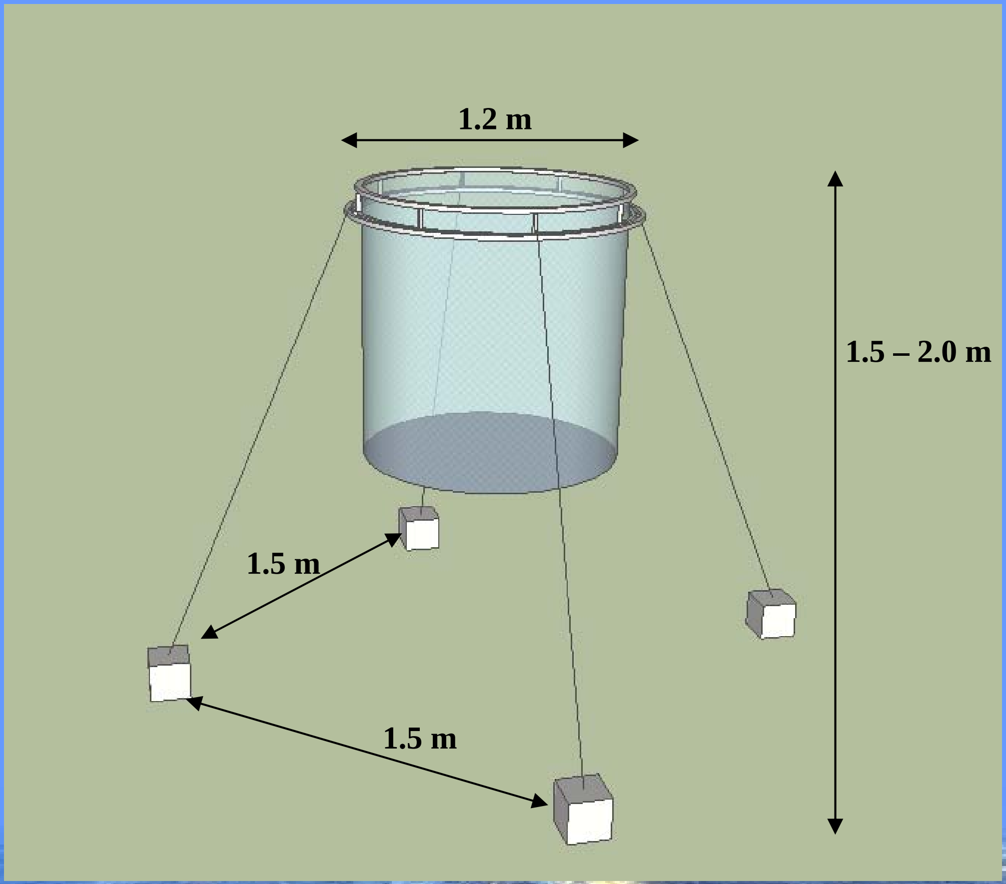
Mooring trial - scale model



Mooring Scale Model

Mooring trial - scale model

Mooring Scale Model

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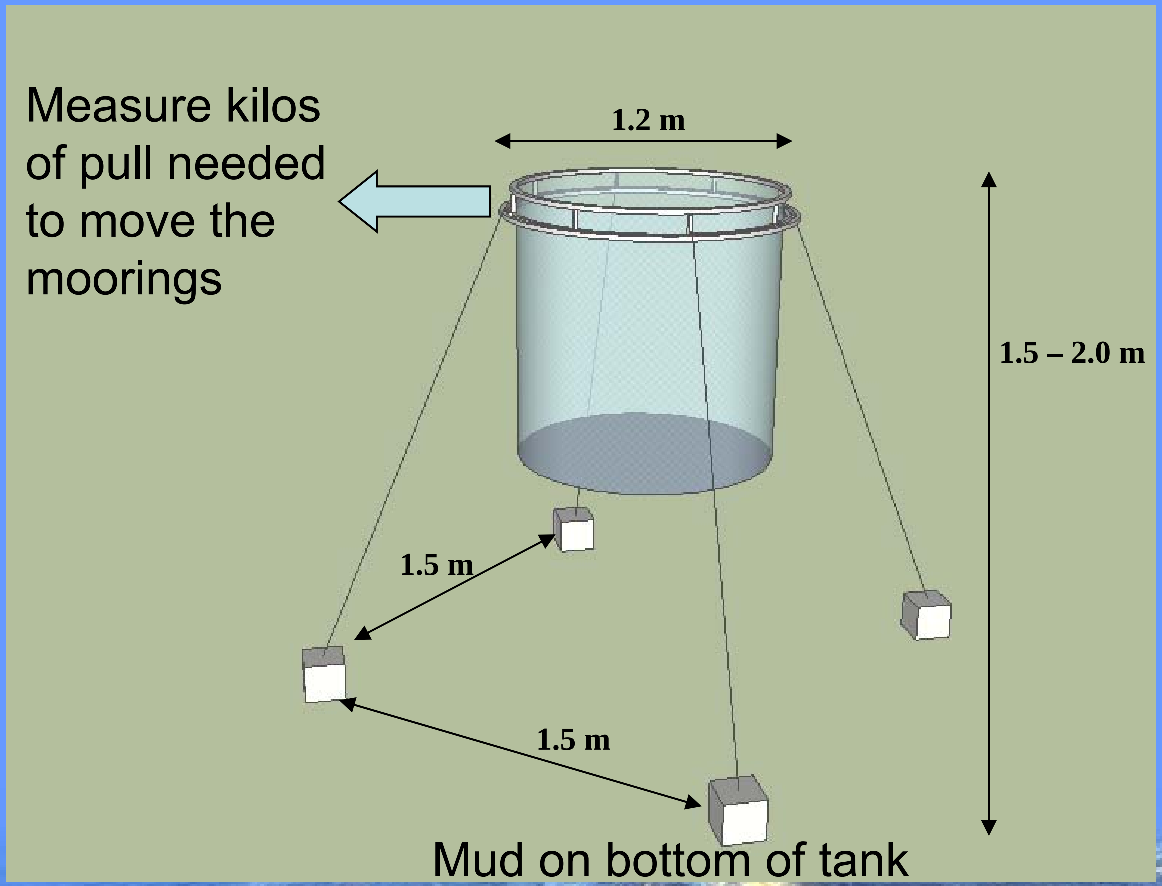
Mooring trial - scale model



Mooring Scale Model

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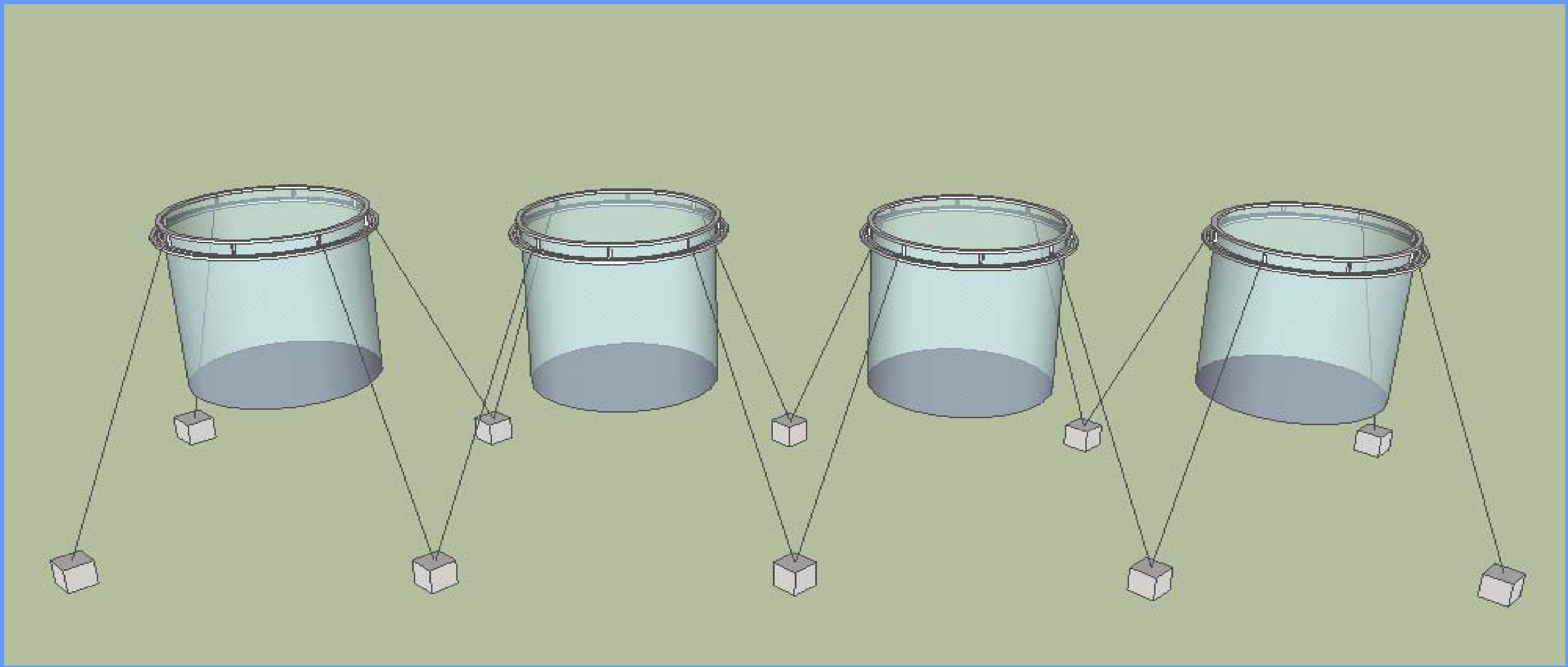
Improved Mooring System



Independent block moorings, upward lift

Mooring Scale Model

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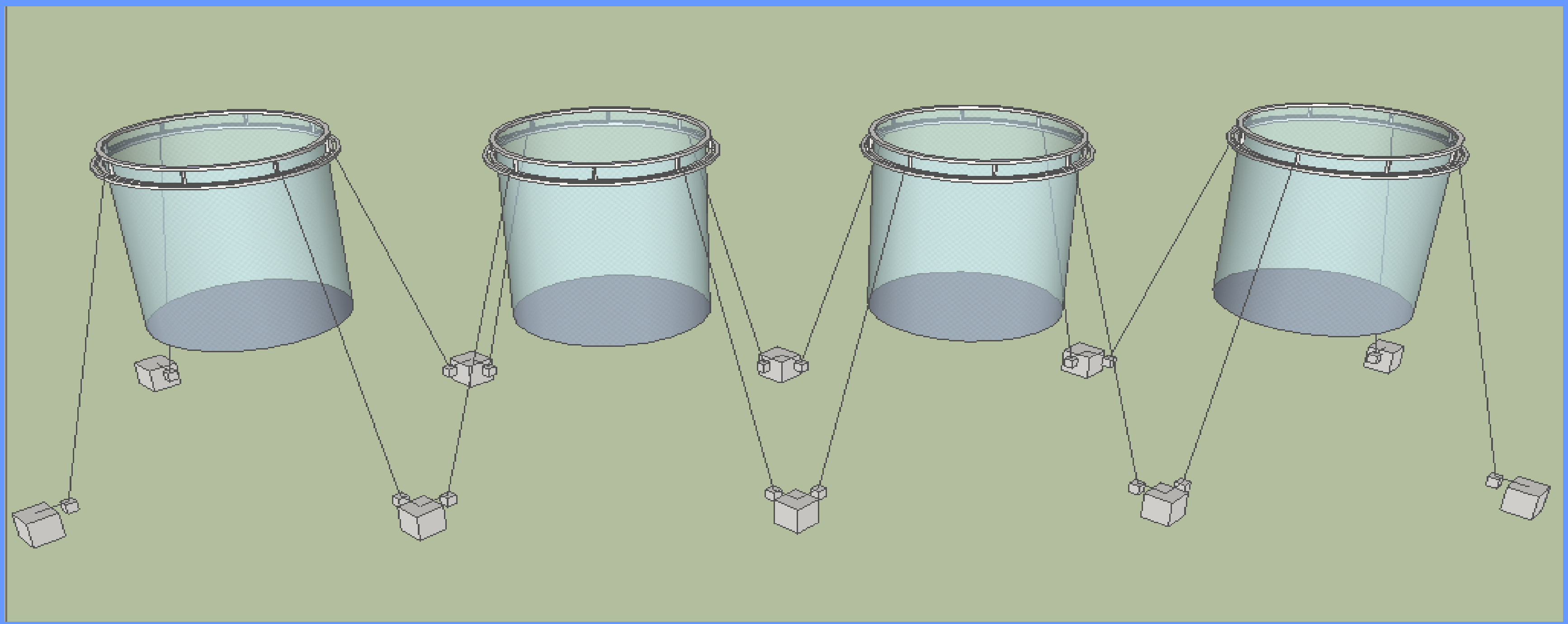
Improved Mooring System



Independent block moorings, sideways lift

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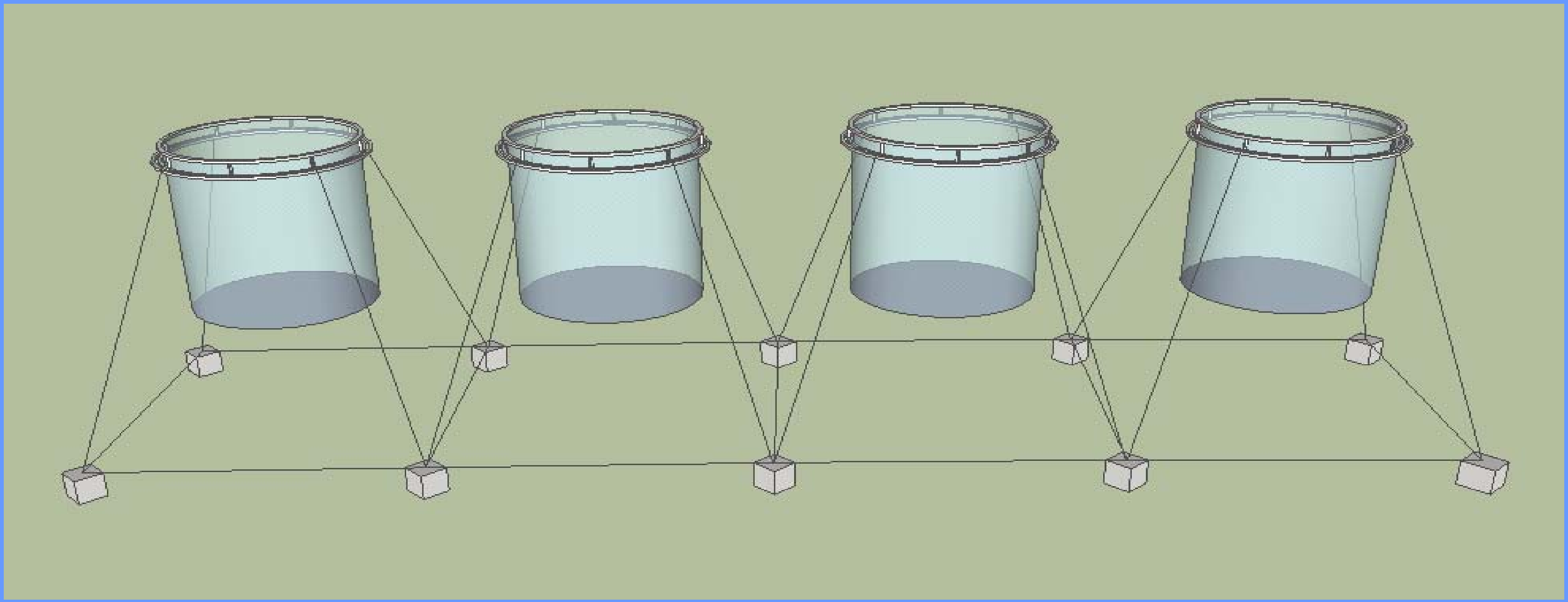
Improved Mooring System



Interlinked block moorings, upward lift

Mooring Scale Model

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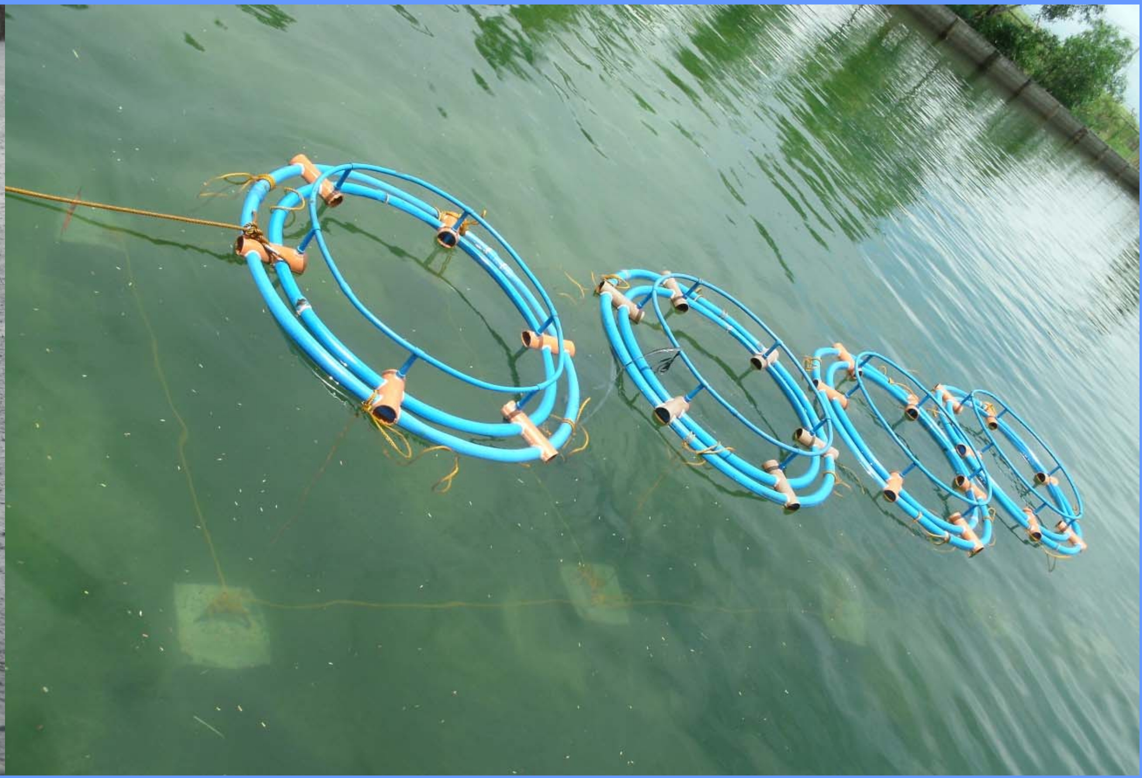
Scale Model Set-up



Mooring Scale Model

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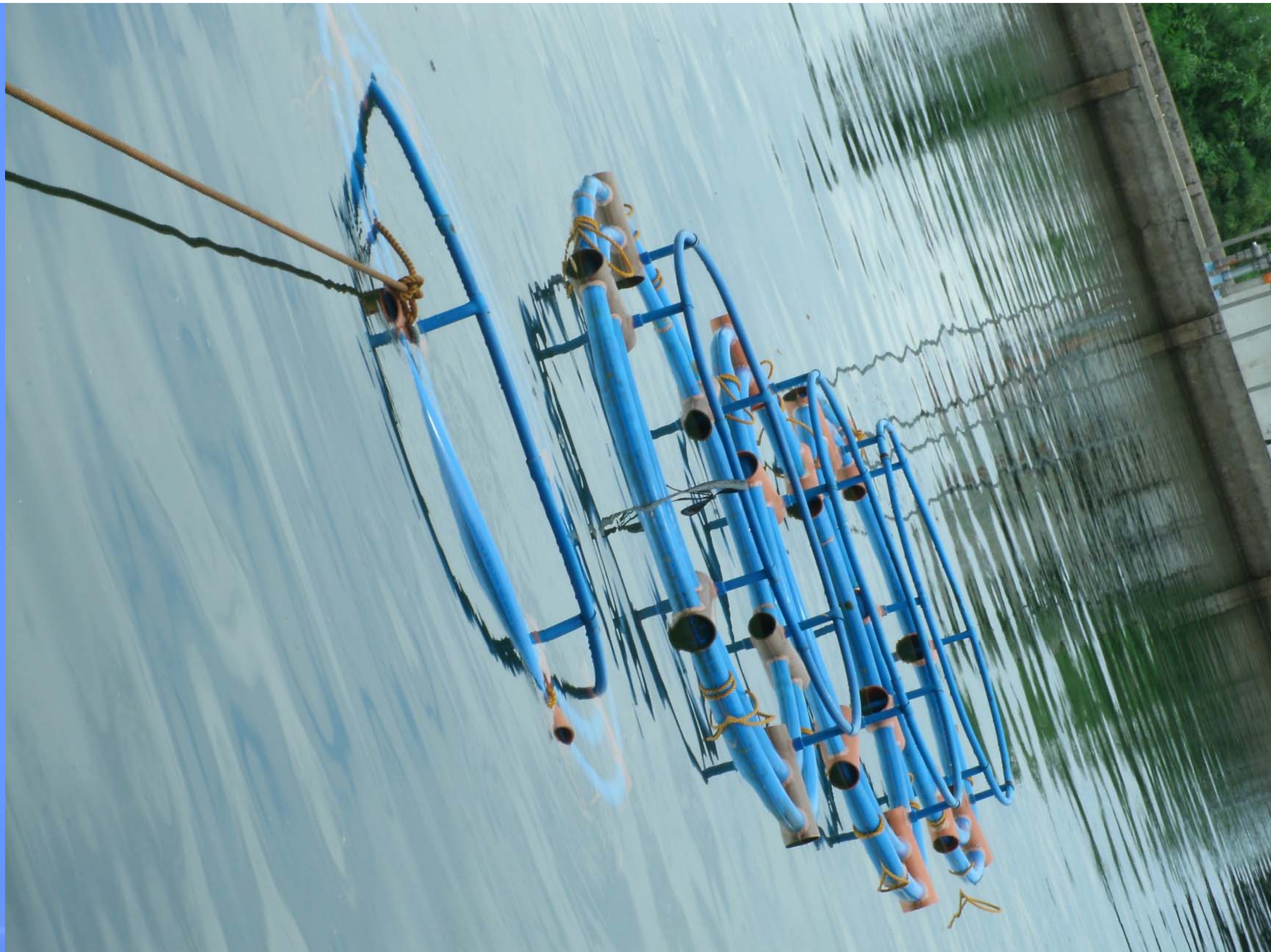

Mooring Scale Model

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Mooring Scale Model

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Results – oil spill contingency

This working report attempts to summarise the measures that Mariculture parks can take to be prepared to deal with oil spills.

The reports summarises

- Biological impacts of spills on fish, shellfish and sensitive environments
- Oil spill contingency planning and response
- Cleanup
- Compensation.

Results – Better Management Practices

Draft BMPs which follow the culture process as follows

Crosscutting issues

1. Planning and siting
2. Farm design and construction
3. Fry and Fingerling purchase or collection
4. Nursery production

4 Production management

5 Fish health

6 Fish quality and food safety

7 Harvest and post harvest management

8 Monitoring and record keeping

9 Social (staff training, health and safety)

10 Environmental management

11 Dive Operation in Marine Farms

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Socio-economic survey

Undertook socio-economic analysis (positive & negative) either perceived or verifiable impacts of implementing Mariculture Parks for

- farmer-beneficiaries,
- Upstream and downstream stakeholders and
- Local communities and LGUs.

SOCIOECONOMIC FRAMEWORK - ADVANTAGES & BENEFITS

UPSTREAM OPPORTUNITIES /ACTIVITIES:

- Feeds Suppliers; Fry / Fingerlings Suppliers
- Development of Fish Hatcheries/Fish Nurseries
- Sellers/Suppliers of Bamboos, Nets, Ropes, Twines , boat makers
- Create employment (support staff)

MARICULTURE PARK

ADDITIONAL REVENUE TO LGUs (permitting, licensing system)

EFFECTS / DIRECT BENEFITS :

- Create employment opportunities to local communities; Livelihoods
- Incremental change of income for marginal fishing families – as caretakers, harvesters, cage makers, feeders, cage repairers, security guards, net washers, etc.

DOWNSTREAM OPPORTUNITIES/ ACTIVITIES:

- Fish Traders, Fish Vendors
- Fish Processors; Ice Sellers
- Transport rentals
- Marketing channels and locations

PERIPHERAL EFFECTS / INDIRECT BENEFITS:

- Establishments of General Merchandise (sari-sari) Stores; Bakeshops
- Establishments of coffee shops, restaurants, etc.

Economic survey

- Investigate the economics and economic benefits of mariculture parks for the different types of locators and for the local Government/BFAR MP development, technical and infrastructure support in case study areas.
- Assess and compare the economic influence of MPs in the case study locations and the comparative regional differences for input costs and market prices

Economic survey

The key components of this investigation are to assess the economics of:

- Different aquacultural farming systems in the MPs;
- LGU and BFAR support for setting up and providing support of the MP
- Differences in regional input cost comparisons,
- Cost/benefit and breakeven analysis for support infrastructure
- Local and regional market analysis comparisons.

LOCAL GOVERNMENT UNITS

1. Investment on infrastructure (e.g. roads, markets, etc,
2. Investment on services
3. Power supply, etc.

GOVERNMENT AGENCIES
BFAR, DAR, DENR, etc.)

1. Technical services
2. Legal services
3. Manpower development

PRIVATE SECTOR

1. Feed companies
2. Fish seed production
3. Laboratory services (fish disease lab, analytical lab, etc.)

*How can these infrastructures and services improve the life of the stakeholders?
Are these investments economically viable?

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Table 1. Results of Financial Analysis

Criteria	Less than 10 Cages	10-20 cages	More than 20 Cages
Average Fixed Expenses (% of sales)	24%	17%	17%
Average Variable Expenses (% of sales)	50%	26%	29%
Average Other Operating Expenses (% sales)	6%	14%	5%
Recovery from Depreciation	(4%)	(3%)	(2%)
Average Net Profit (% of sales)	24%	46%	51%
Average Net Profit Per cage (Php)	185,741	230,507	287,776
Average Return on Investment	72%	117%	112%

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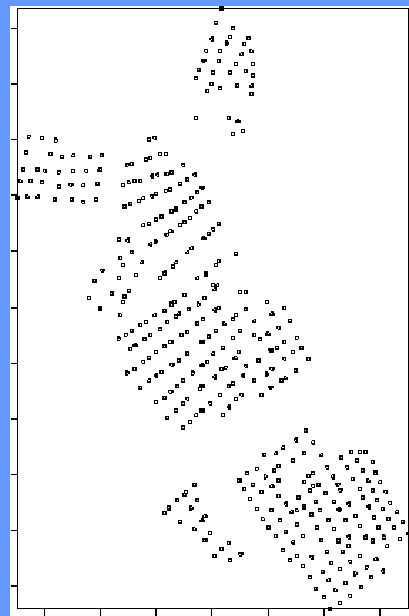
Mariculture park optimisation

- Started work on trying to optimise Sual production
- Chris Cromey presentation

TROPOMOD cage layouts

Scenario A3 –
existing cage
layout

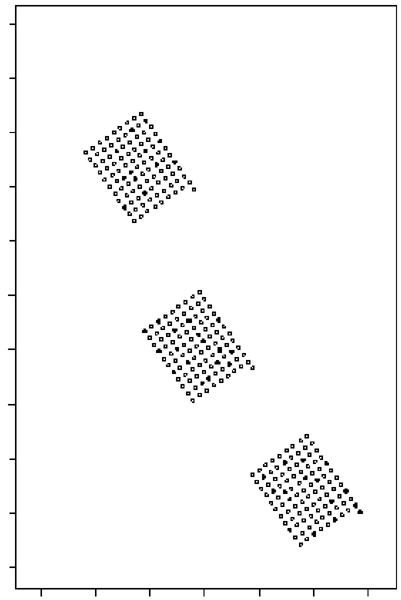


Scenario B1 – AquaPark scenario

Three 10 ha areas

100 cages per 10 ha

No space in the middle of the zone

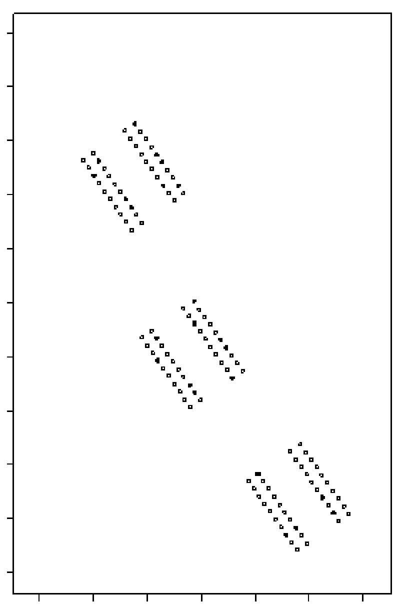


Scenario B2 – AquaPark scenario

Three 10 ha areas

40 cages per 10 ha

100 m space in middle of blocks to allow flushing

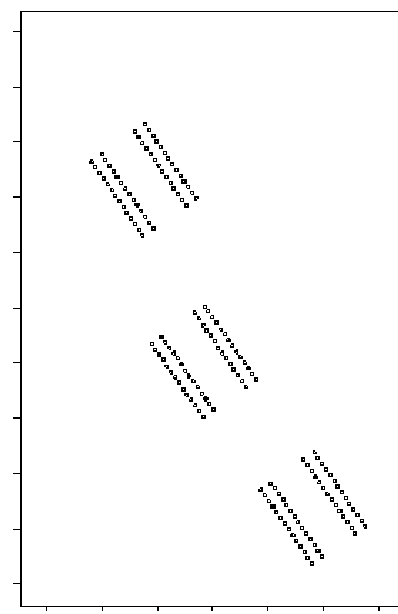


Scenario B3 – AquaPark scenario

Three 10 ha areas

56 cages per 10 ha

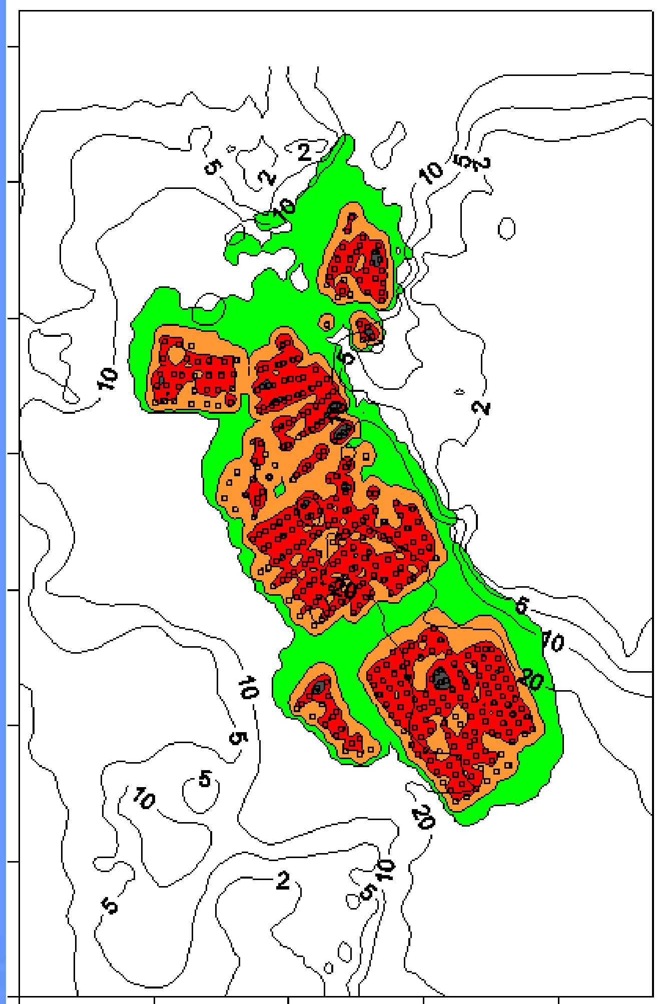
100 m space in middle of blocks to allow flushing

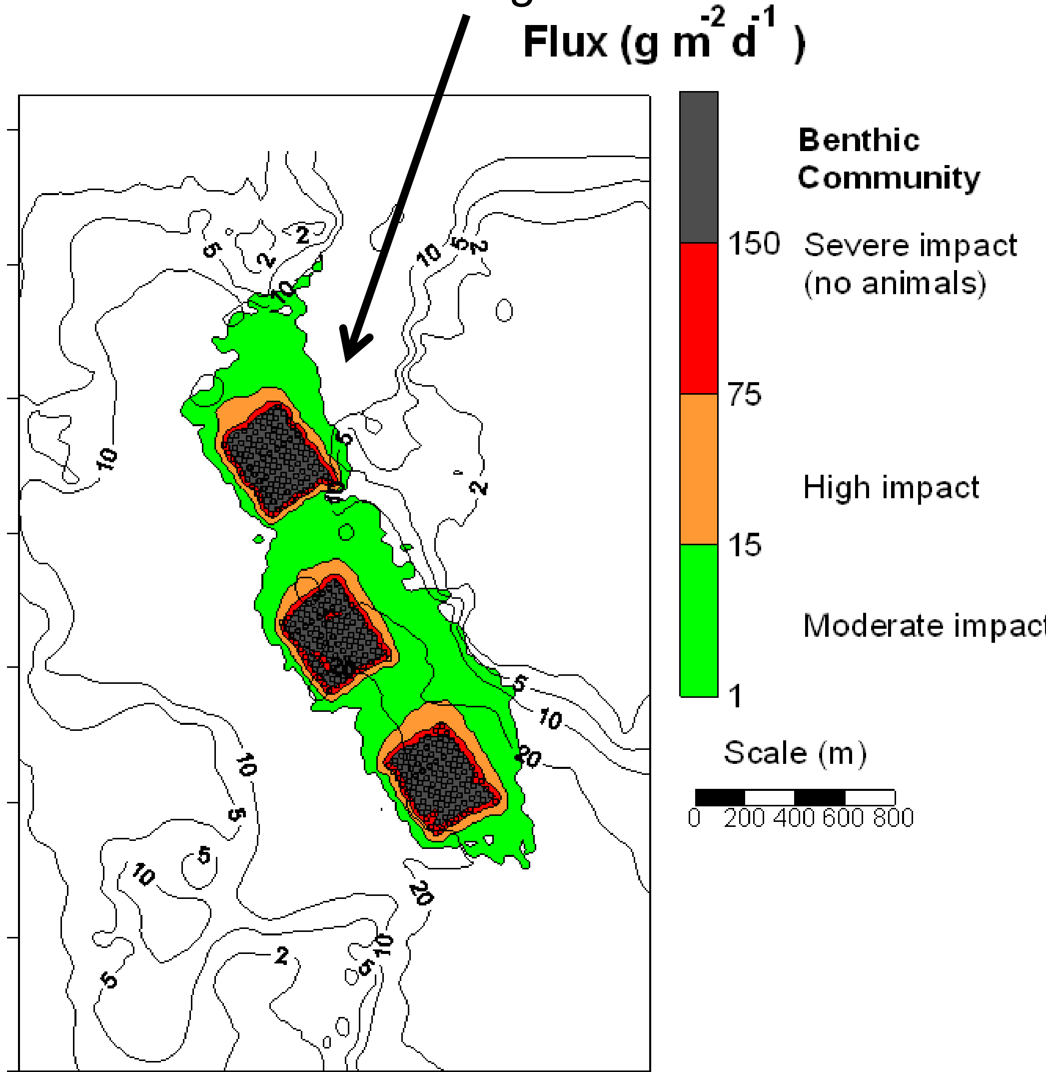


Scenario A3 – existing situation at Sual

Scenario B1 – AquaPark – three 10 Ha areas with 100 cages (11 rows by 9 columns) in each

Impact is very severe under cages and predicted to be worse than existing situation

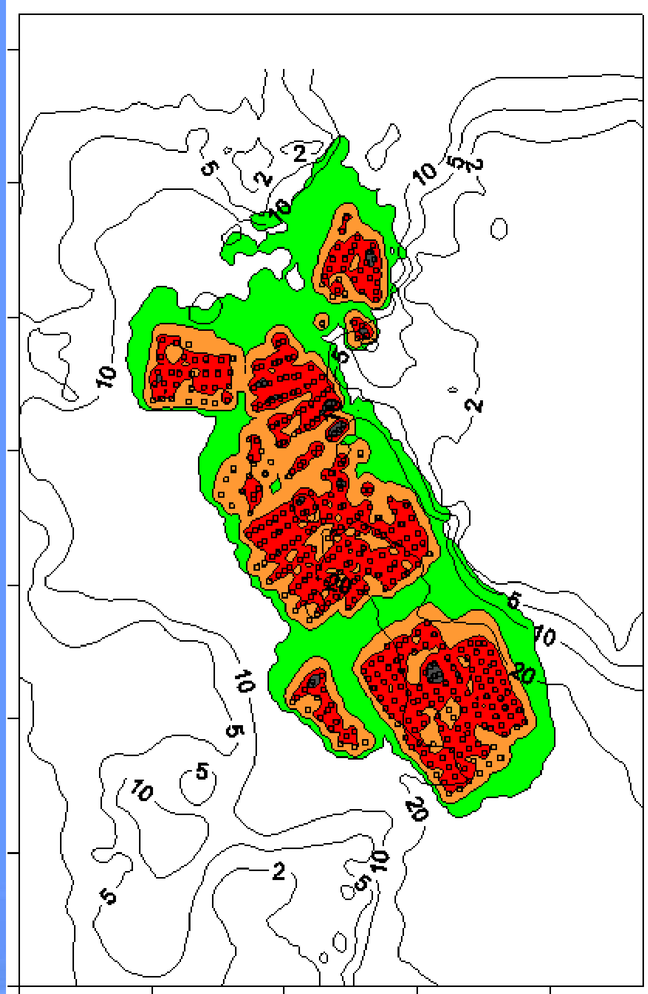




To attempt to improve on the severe predicted impact in scenario B1, we maintain the 30 ha areas and reduce the numbers of cages in each area.

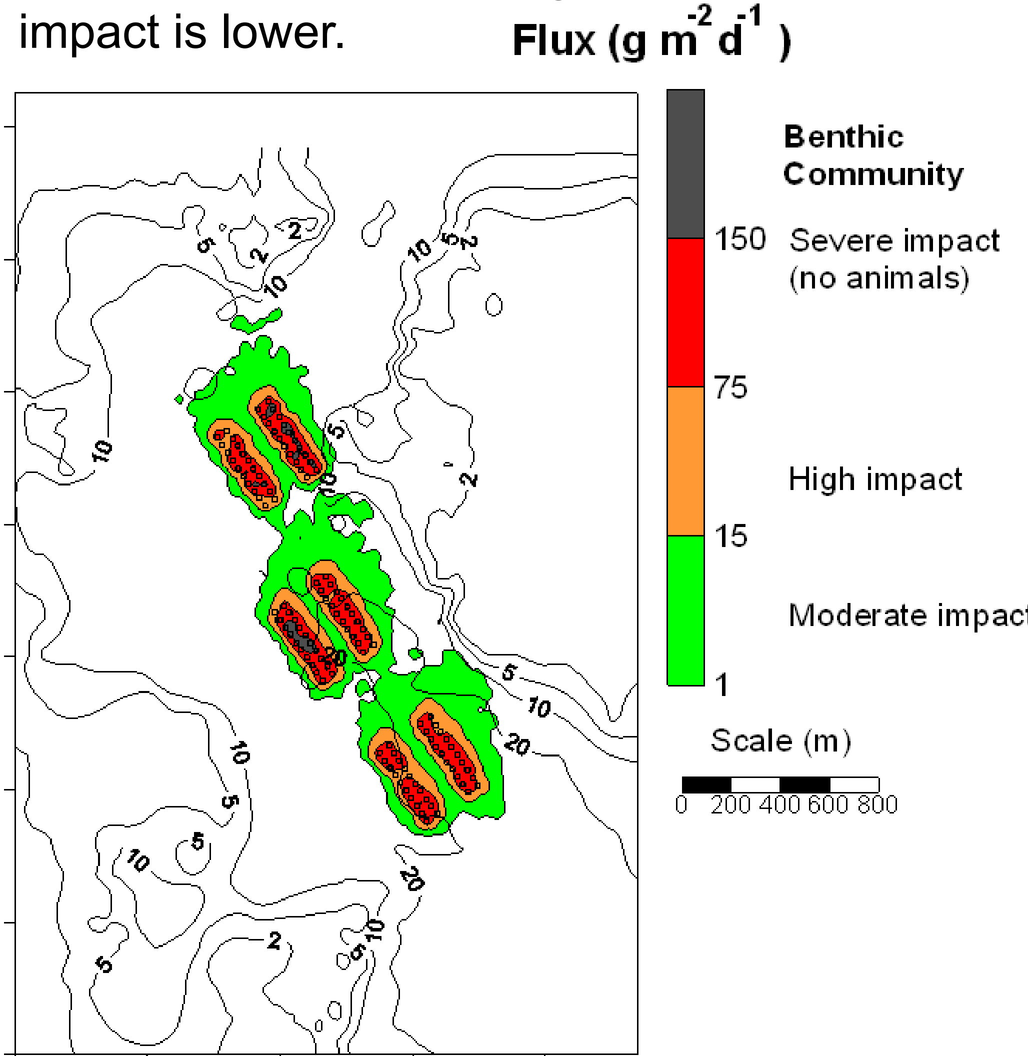
	Existing area to the SE	Proposed	Proposed	Proposed (with careful feeding)
Area	26.7 hectares	30 ha	30 ha	30 ha
Number of cages	122	300	120	168
Area per cage	2188 m^2	1000 m^2	2500 m^2	1786 m^2
TROPOMOD scenario	A3	B1	B2	B3

Scenario A3 – existing situation at Sual



Scenario B2 – AquaPark – three 10 Ha areas with 40 cages each (2 blocks of 20 cages)

Predicted impact is much improved, with lanes between the blocks of cages where predicted impact is lower.



To attempt to improve on the predicted impact in scenario B1, we examine the husbandry practices.

In the model, we waste less feed, use a higher quality feed with better digestibility. This means we can also feed less.

As husbandry practices are better, we can increase the number of cages in the three 10 ha areas from 40 per area to 56 cages.

	Existing area to the SE	Proposed	Proposed	Proposed (with careful feeding)
Area	26.7 hectares	30 ha	30 ha	30 ha
Number of cages	122	300	120	168
Area per cage	2188 m^2	1000 m^2	2500 m^2	1786 m^2
TROPOMOD scenario	A3	B1	B2	B3

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TROPOMOD model input data – scenarios of husbandry practices

Husbandry data obtained from production surveys at Sual used in the scenarios.

Model input data	**Scenario B2** **Poor feeding** **Low digest.**	**Scenario B3** **Careful feeding** **Better digestibility** **Less feed needed**
Feed wasted	27%	10%
Feed digestibility	49%	56%
 Empty Starter Grower Finisher	Feed input 0 kg/cage/d (5 % cages) 159 kg/cage/d (23 % cages) 337 kg/cage/d (23 % cages) 526 kg/cage/d (49 % cages)	Feed input 0 kg/cage/d (5 % cages) 114 kg/cage/d (23 % cages) 241 kg/cage/d (23 % cages) 376 kg/cage/d (49 % cages)

All cages – circular 20 m diameter by 12 m depth with Milkfish

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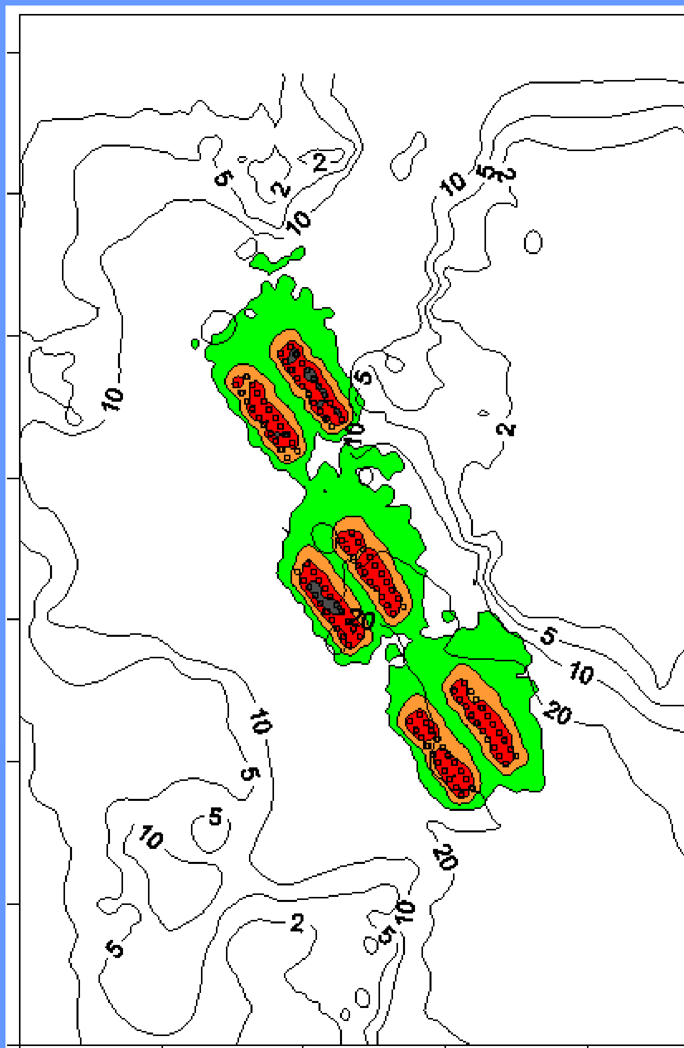
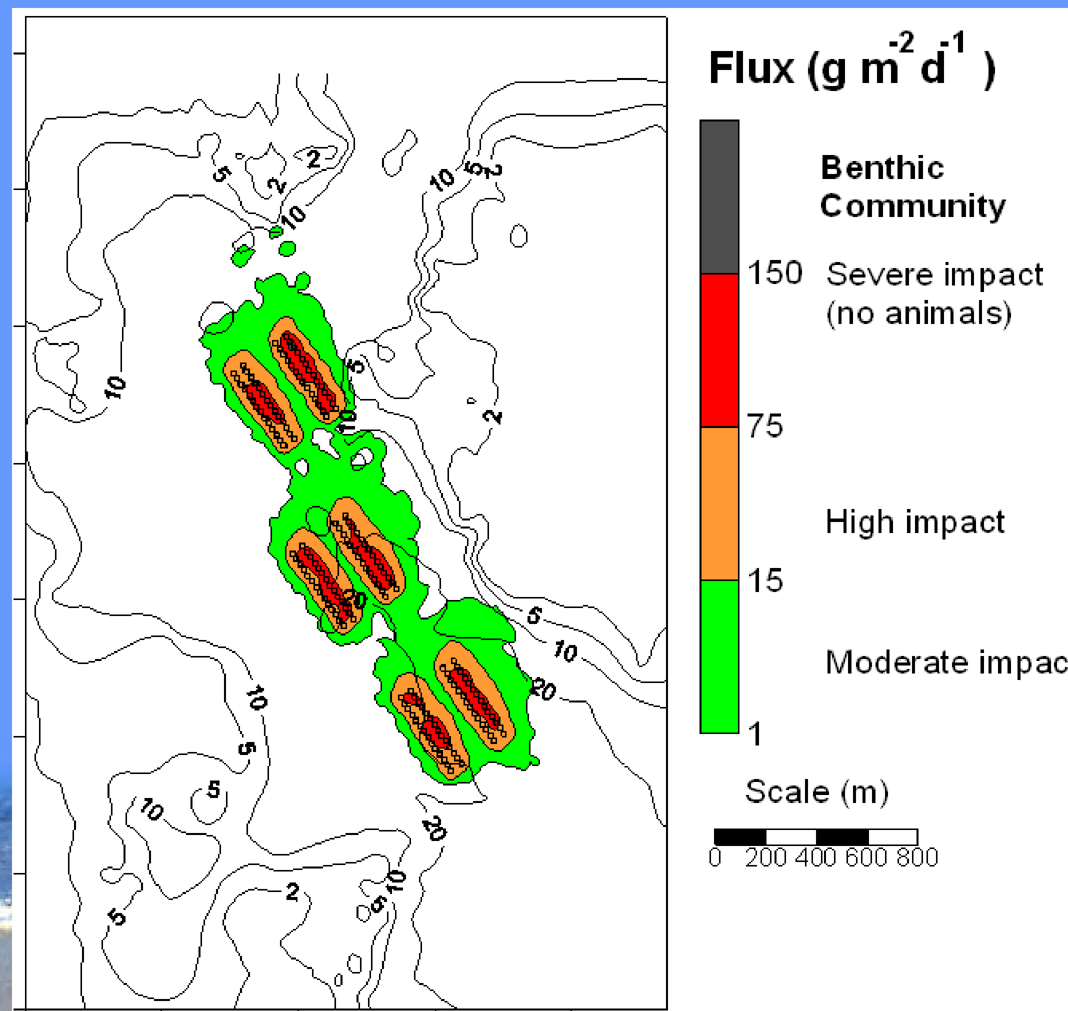
Scenario B2 – AquaPark – three 10 Ha areas with 40 cages each (2 blocks of 20 cages)



Scenario B3 – AquaPark – three 10 Ha areas with 56 cages each.

By improving husbandry, an additional 16 cages could be included per 10 ha



TROPOMOD model – summary of scenarios

	Scenario B1	Scenario B2	Scenario B3 (improved husbandry)
No of cages per 10 ha	100	40	56
Biomass per cage (tonnes)	34	34	34
Biomass per 10 ha (tonnes)	3400	1360	1904

Average stocking density = 8.9 kg m^{-3}
Target FCR (wet weight) = 2.2
Specific Feeding Rate (SFR) = 1.6 (scenarios B1 and B2) and 1.2 (scenario B3)

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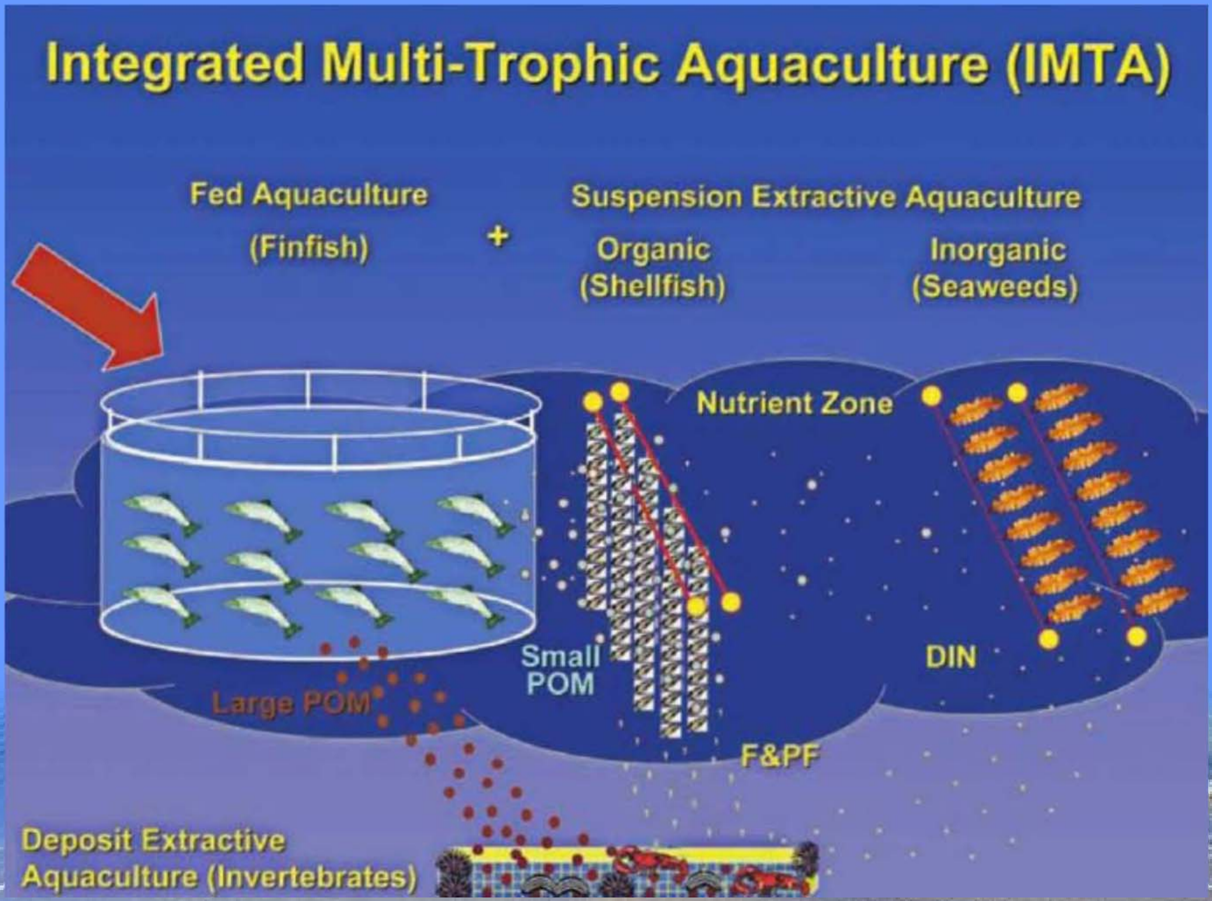
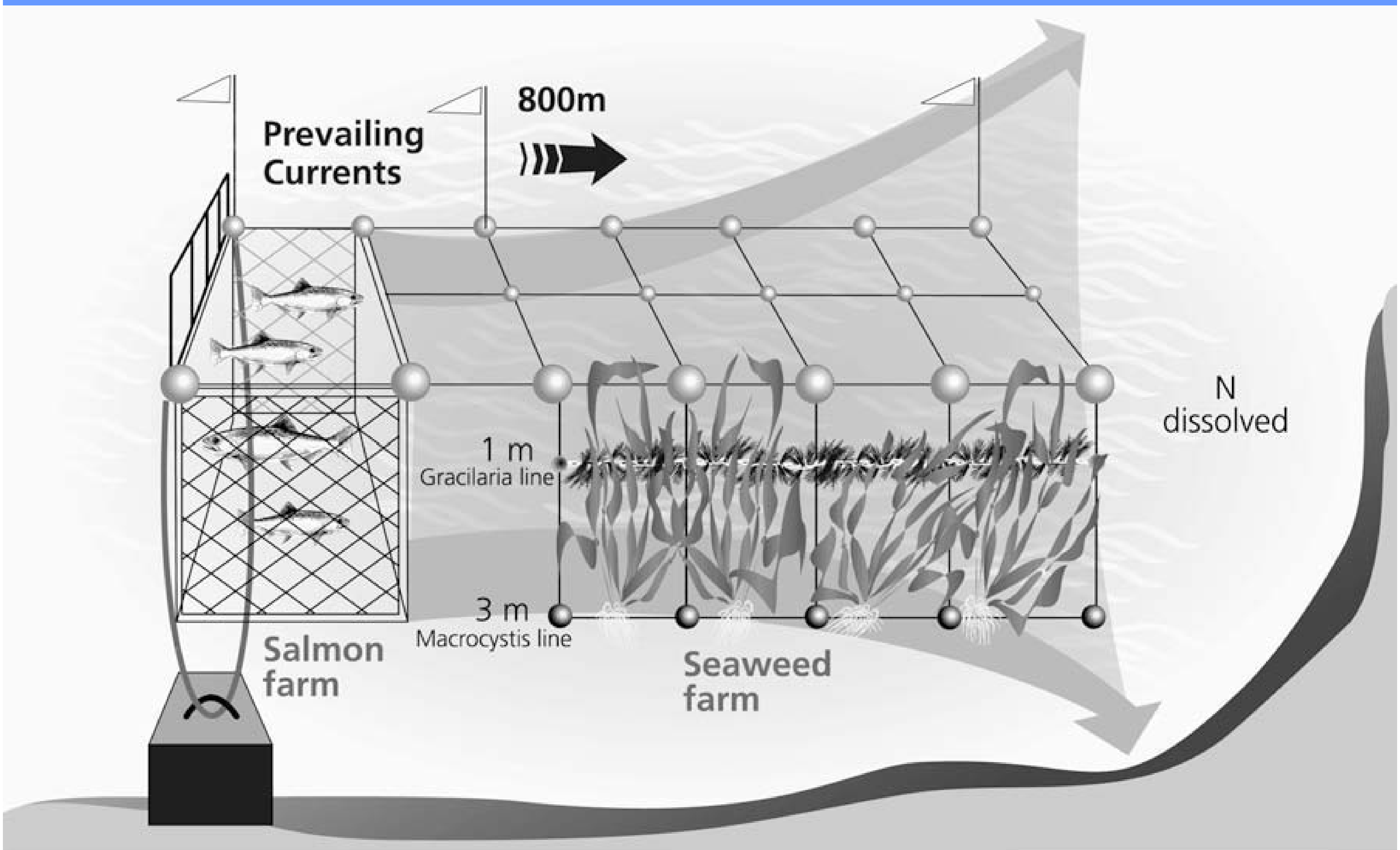
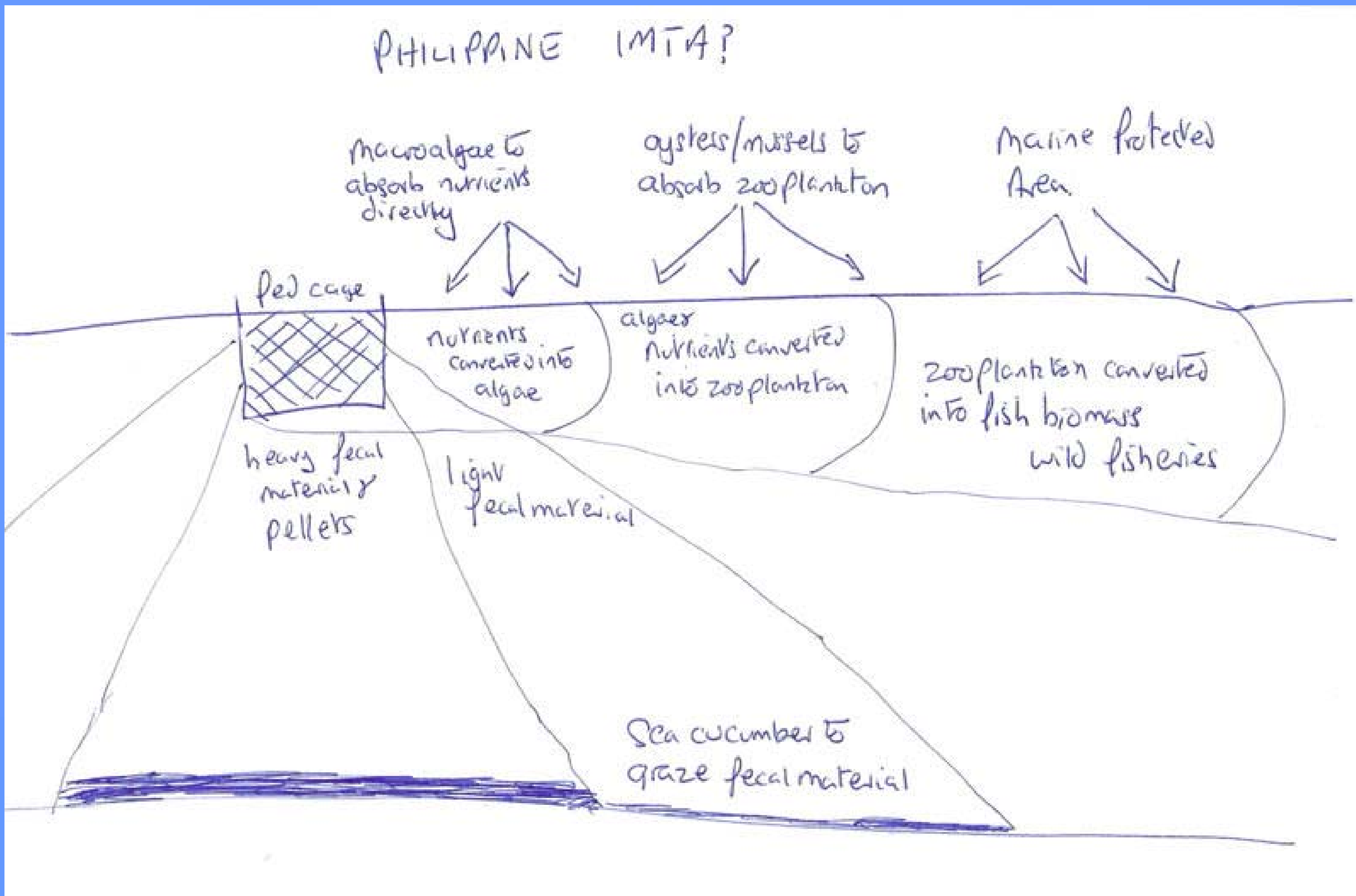
Integration of IMTA

- Developing Integrated Multitrophic Aquaculture practice into Mariculture Parks




800m
Prevailing
Currents
N
dissolved
1 m
Gracilaria line
3 m
Macrocystis line
Salmon
farm
Seaweed
farm

Concept for IMTA in Mariculture Parks



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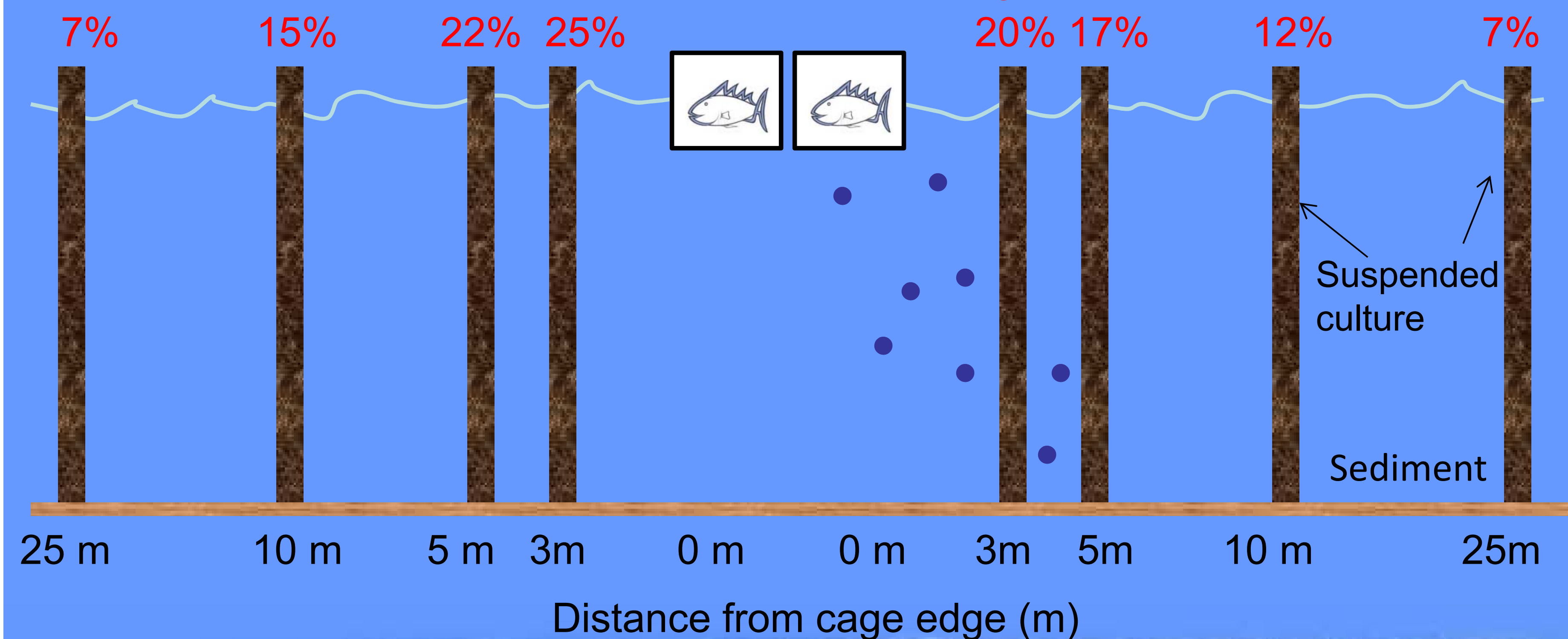
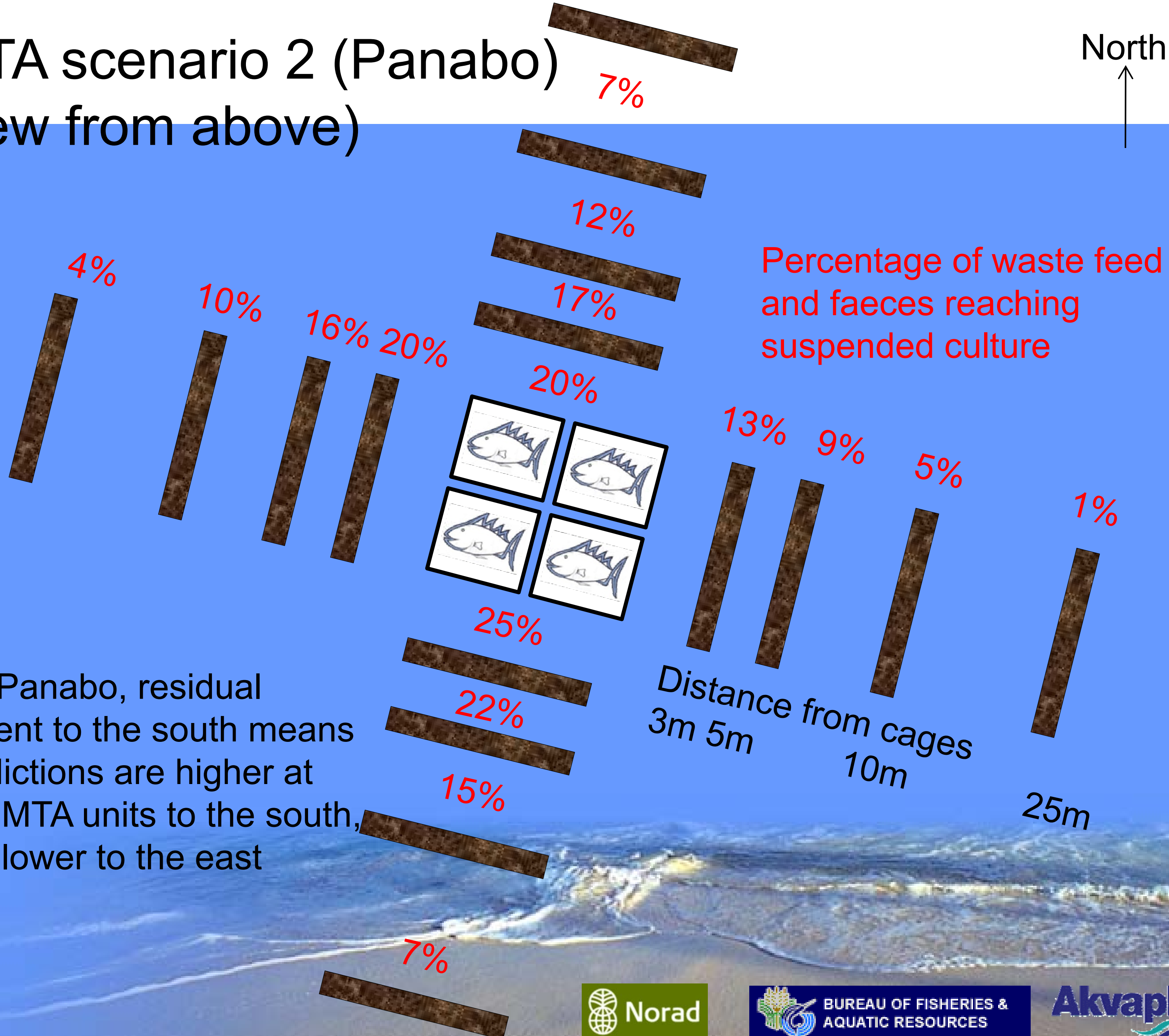
IMTA scenario 2 (Panabo) – wastes from cages reaching <u>suspended culture</u>

% of waste feed and faeces intersecting suspended culture



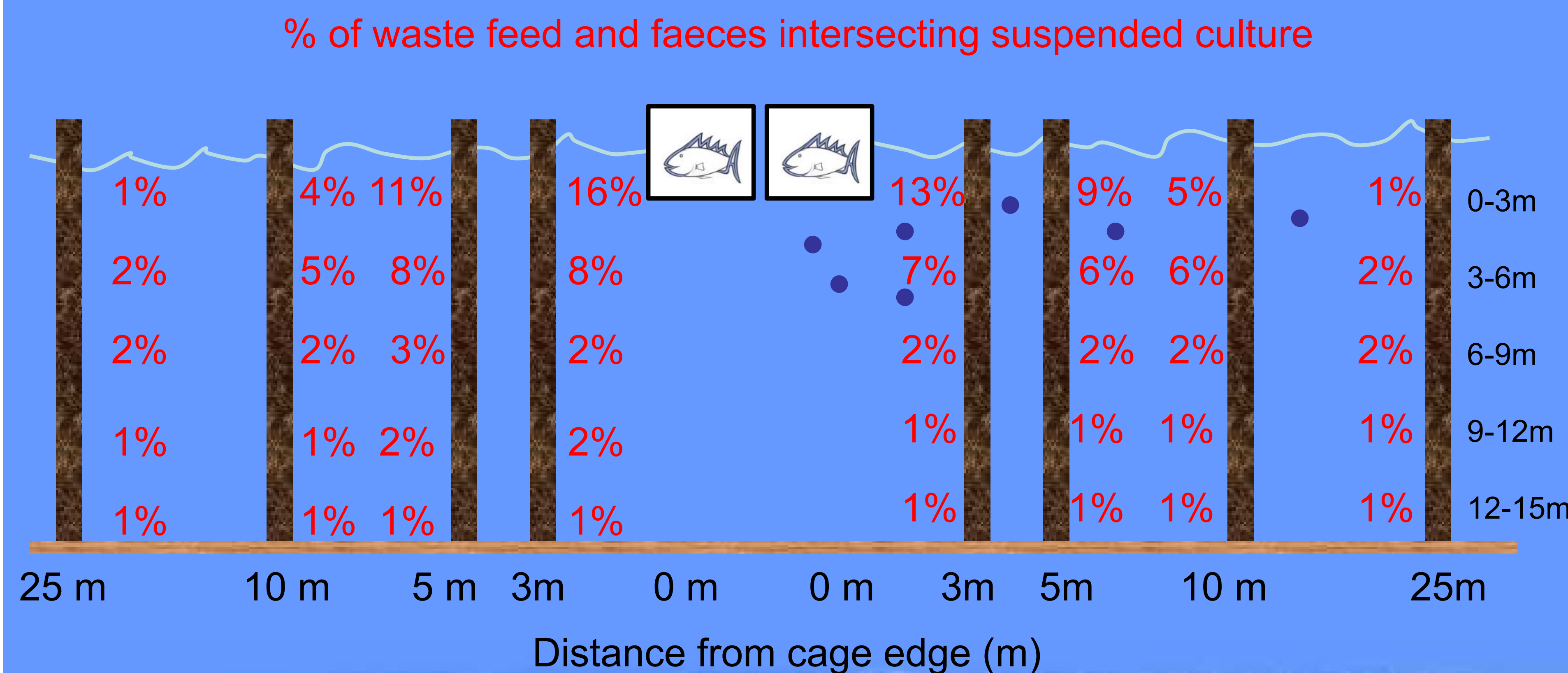
Further away from the cages (25 m), particles have settled out and do not reach the suspended culture

IMTA scenario 2 (Panabo) (view from above)



For Panabo, residual current to the south means predictions are higher at the IMTA units to the south, and lower to the east

IMTA scenario 2 (Panabo) – wastes from cages reaching suspended culture at different depths

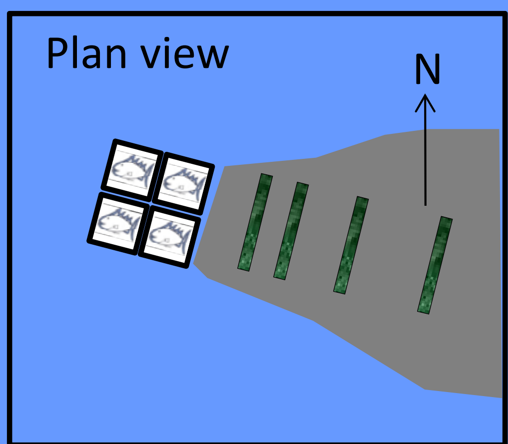


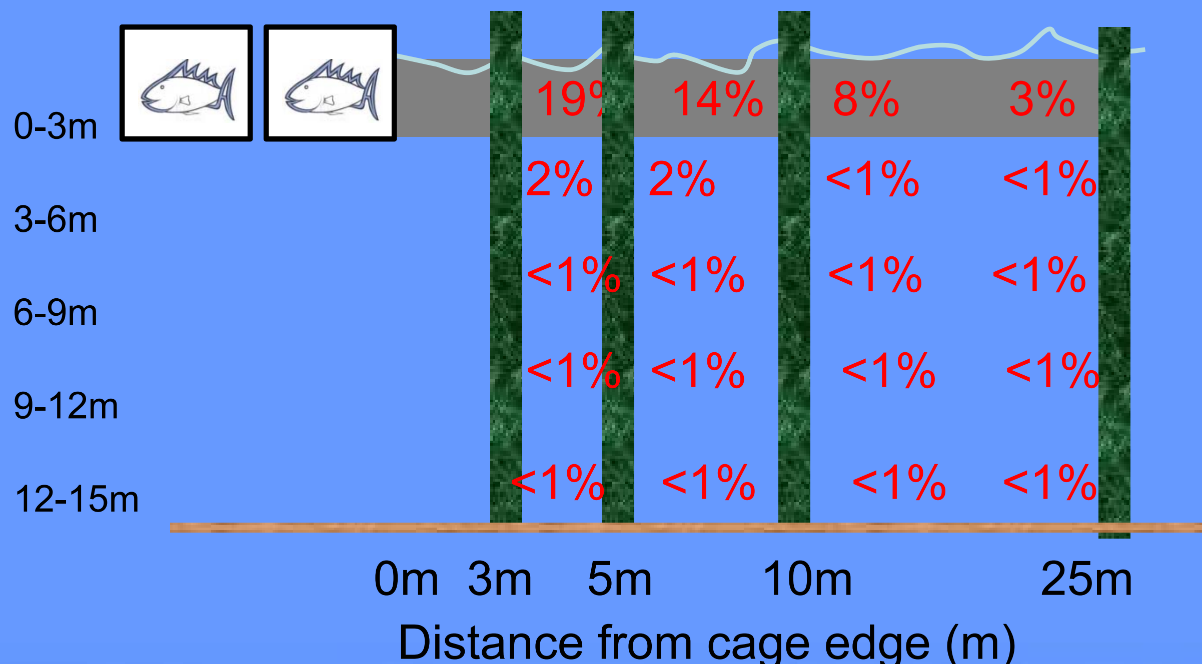
The majority of the wastes intersect the suspended culture in the top 6 m; these wastes are mostly fine and slow settling Milkfish faeces

Net depth is important when considering optimum depth of suspended culture

IMTA scenario 3 (Panabo) – plume from cages reaching seaweed culture at different depths

% of plume intersecting seaweed culture to the EAST of the cages



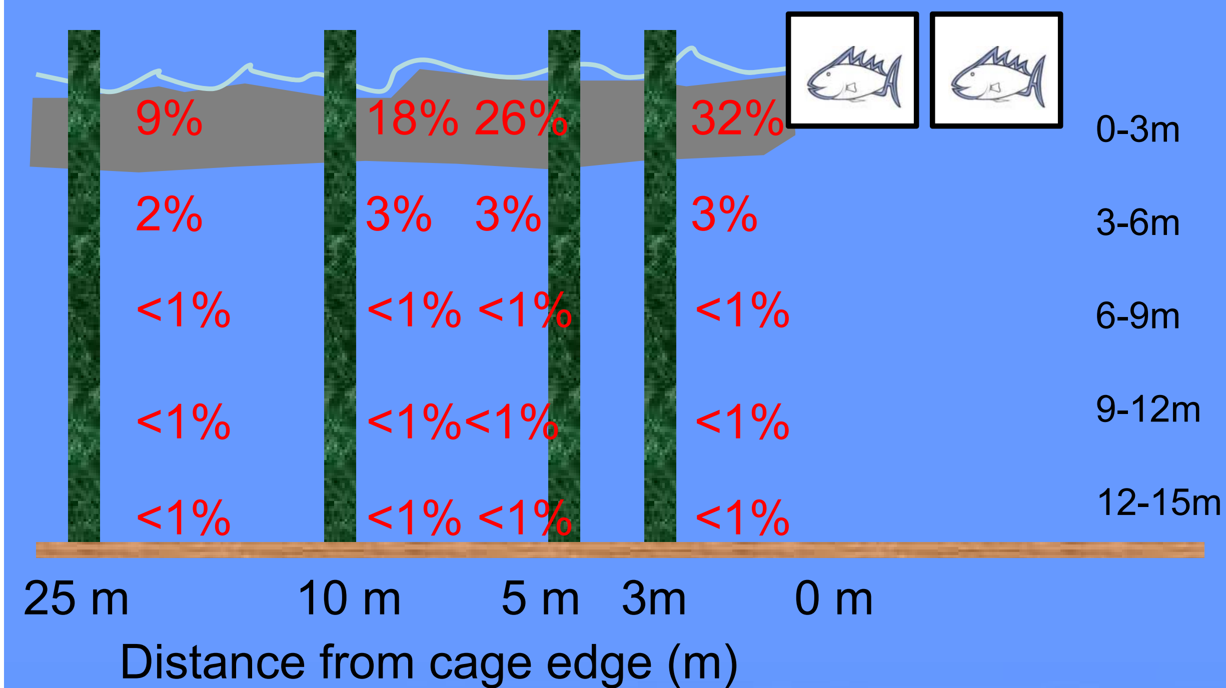


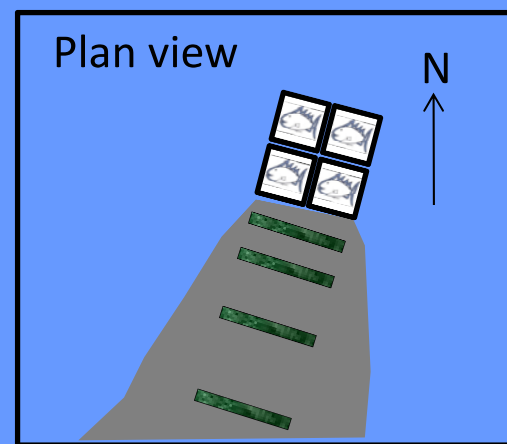
The majority of the plume containing dissolved nutrients intersects the seaweed culture in the top 3 m.

Net depth is important when considering optimum depth of seaweed culture

IMTA scenario 3 (Panabo) – plume from cages reaching <u>seaweed culture</u> at different depths

% of plume intersecting seaweed culture to the SOUTH of the cages



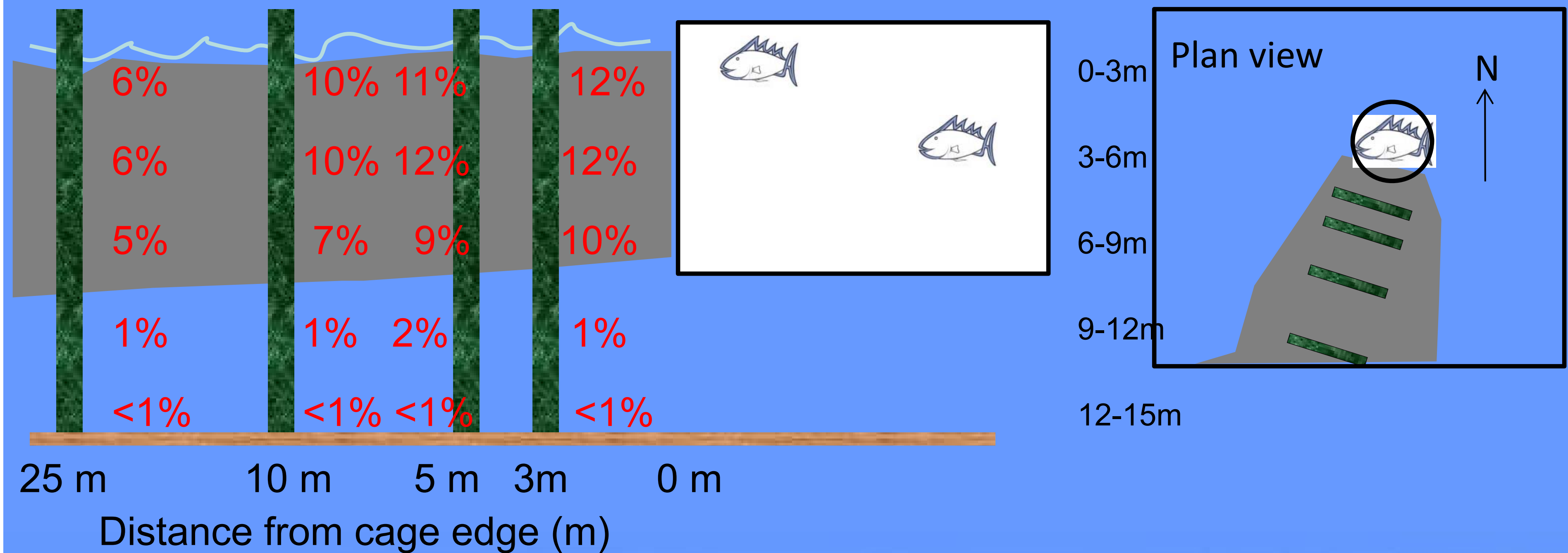


More of the plume intersects seaweed culture to the south of the cages as this is the direction of the residual current

Net depth is important when considering optimum depth of seaweed culture

IMTA scenario 3 (Panabo) – plume from a large polar circle cage reaching seaweed culture at different depths

% of plume intersecting seaweed culture to the SOUTH of the cages



A deeper net means more of the suspended line comes into contact with the plume

Seaweed culture at depth will be limited by light rather than nutrients

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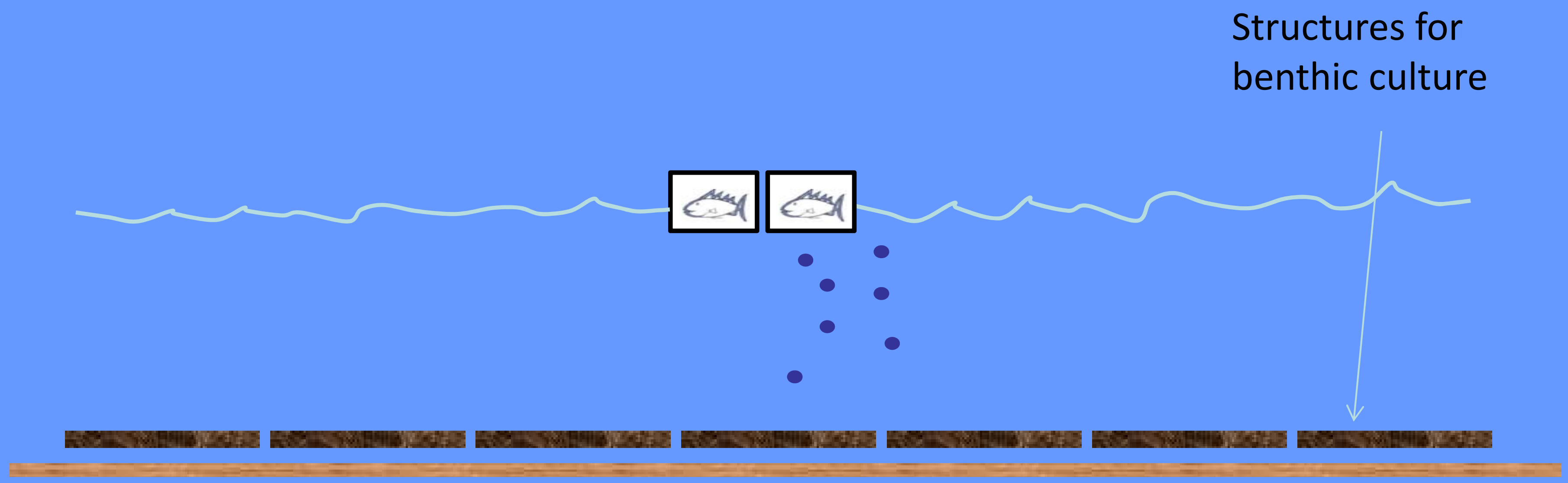
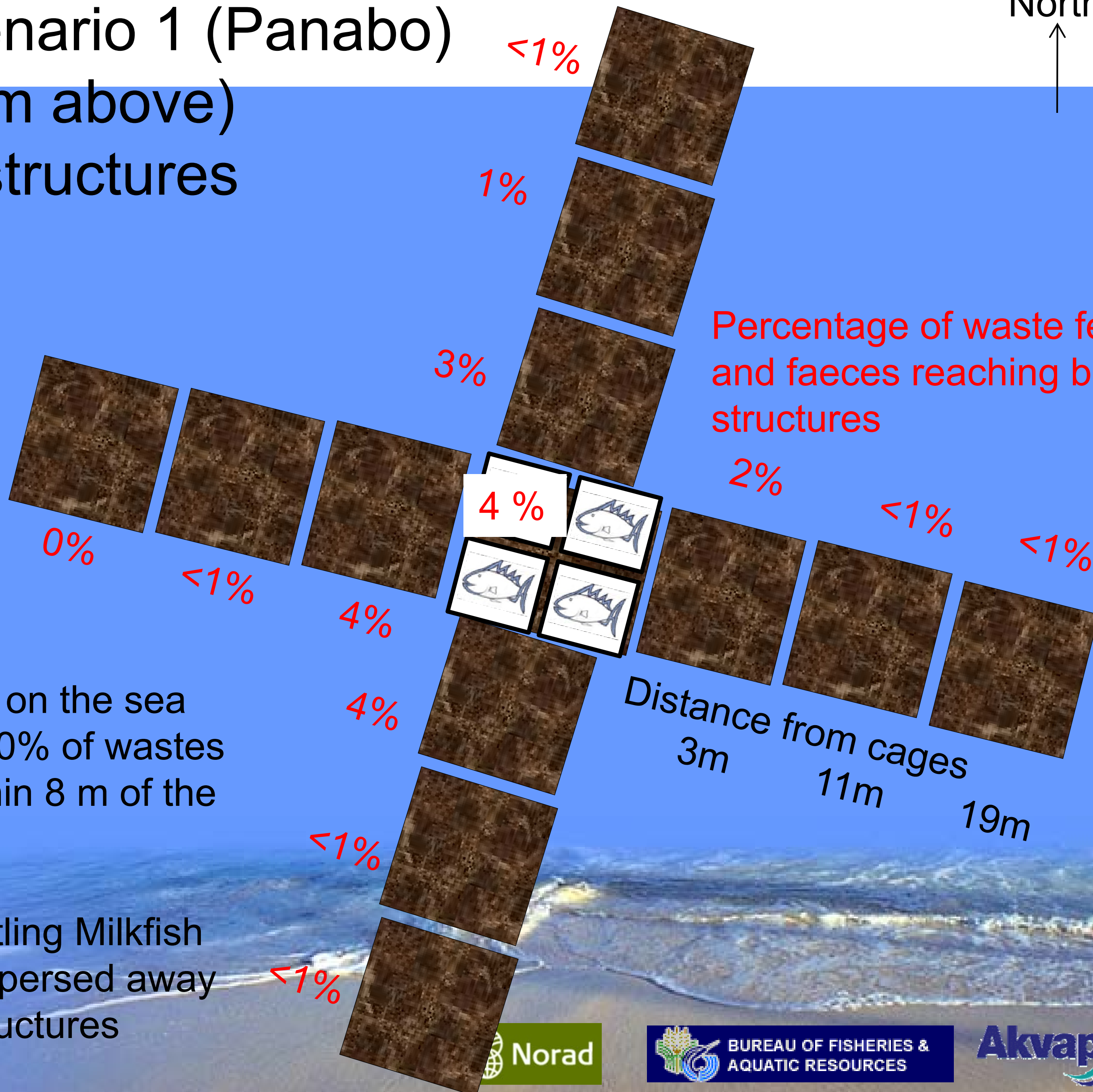
IMTA scenario 1 – benthic structures

TROPOMOD predictions of the waste feed and faeces depositing on 8 m by 8 m structures on the sea bed



IMTA scenario 1 (Panabo) (view from above) Benthic structures

North



For structures on the sea bed, around 20% of wastes deposited within 8 m of the cages

Fine, slow settling Milkfish faeces are dispersed away from these structures

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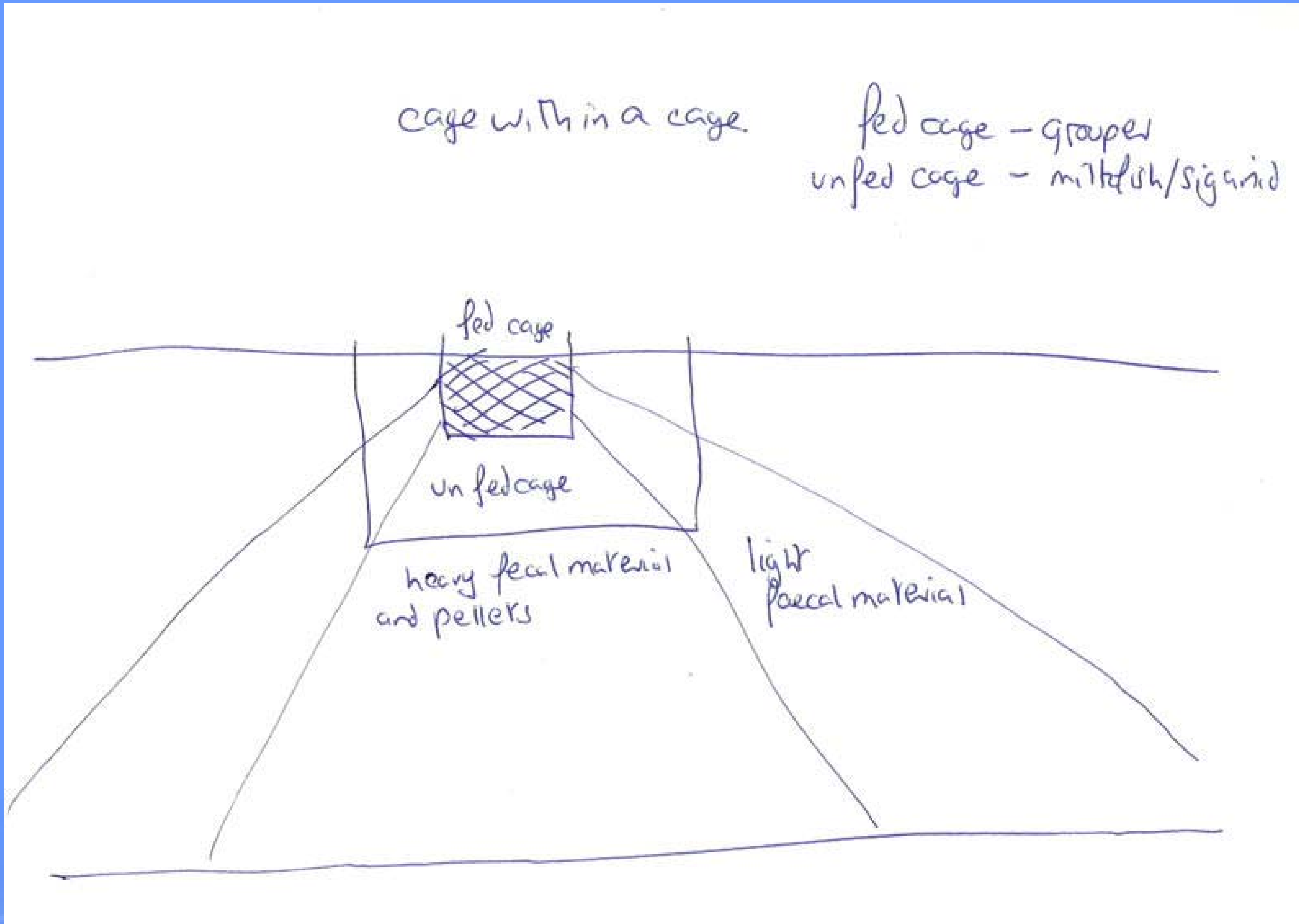
Concept of cage within a cage production



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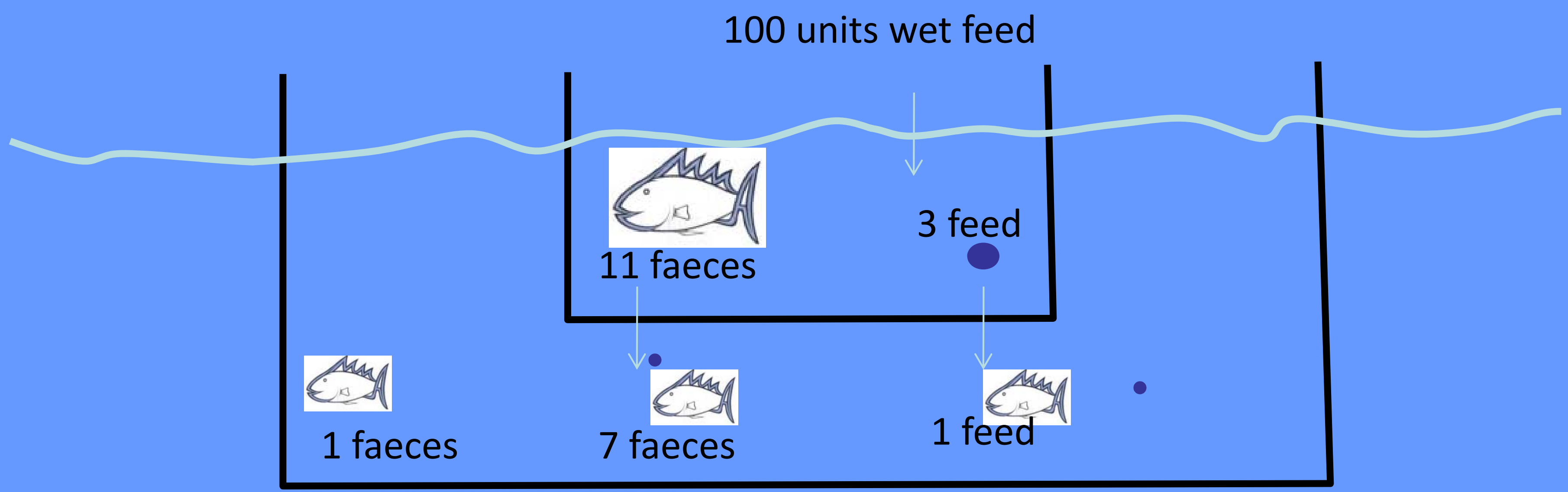
IMTA 4 – cage in a cage

Grouper are in the inner cage, Milkfish in the outer cage
Clean outer nets are essential
Assumptions – all units are dry mass except the ration



Grouper: wasted feed – 12%, digestibility – 49 %, wet FCR 7.5
Milkfish: consumes 70 % of waste feed, 30 % of waste faeces

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