ASSESSMENT DELL'IMPATTO IN ACQUACOLTURA MARINA: CASI STUDIO

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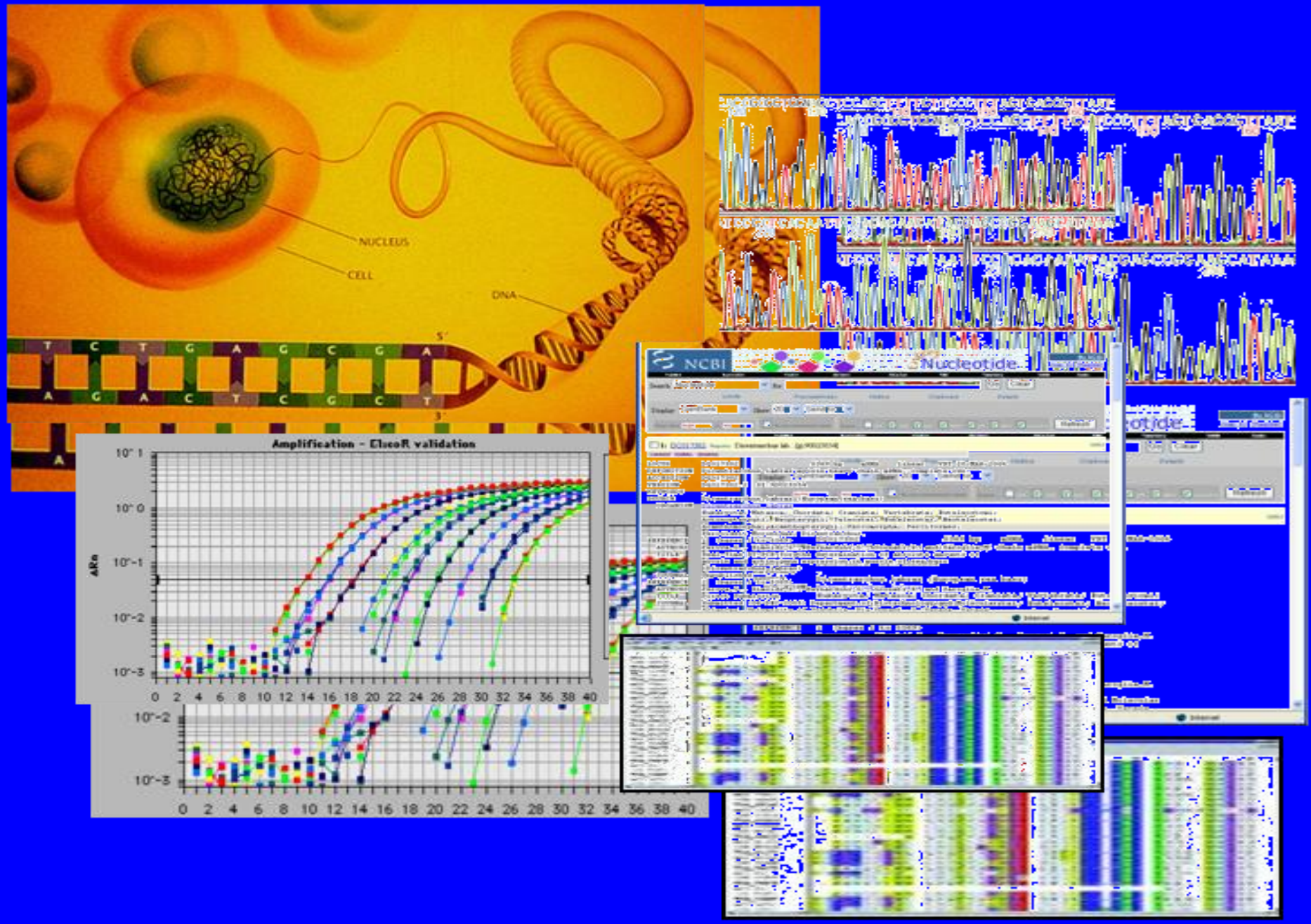
Diversi approcci per lo studio dell'impatto in ambienti differenti

About the Uninsubria/DBSM approach:

And, as research fields…

Modelling of benthonic faecal pellets deposition (g/m²/y)


NUCLEUS
CELL
DNA
5'
3'
Amplification - ElscoR validation
ΔRn
NCBI
Nucleotide

NATURAL RESERVE Diaccia-Botrona (Grosseto)

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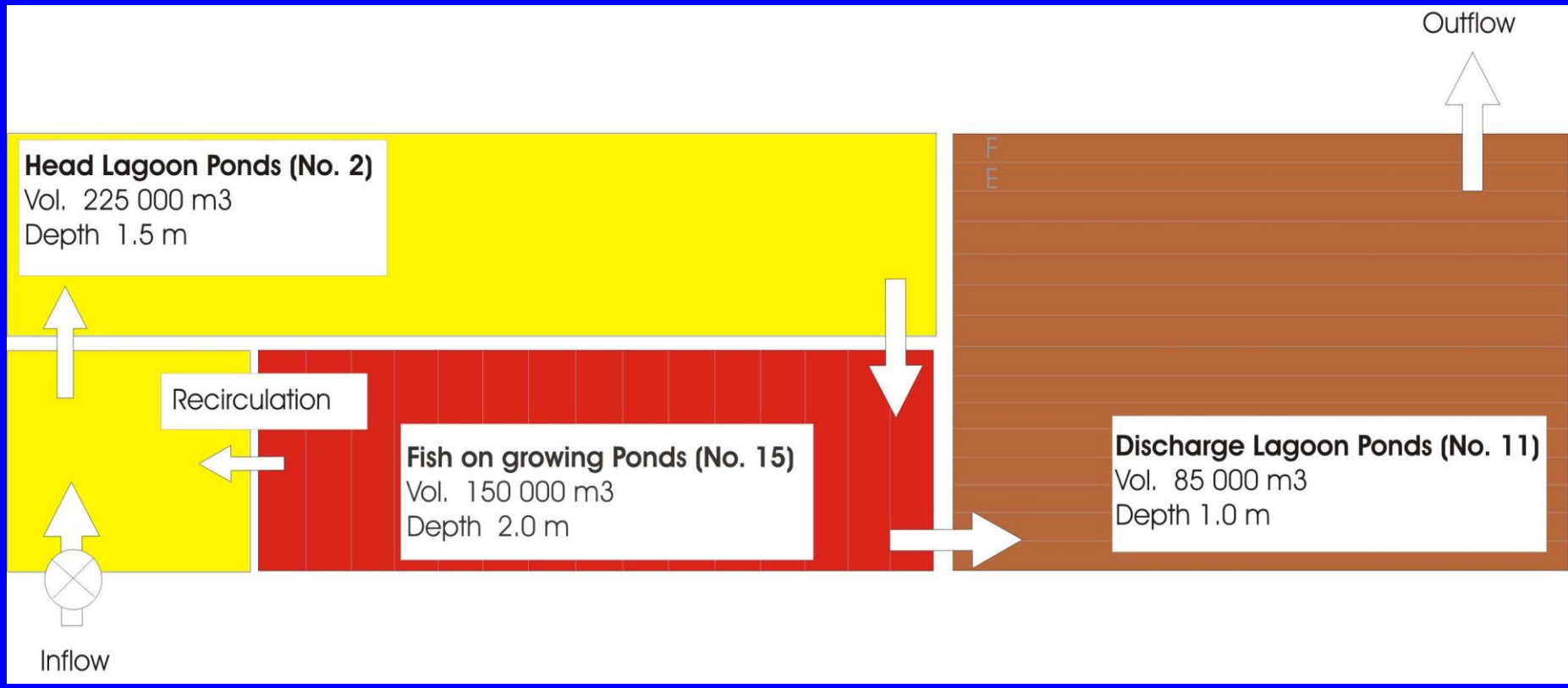
FISH FARM: *"IL PADULE"*



Fish Farm Sampling :

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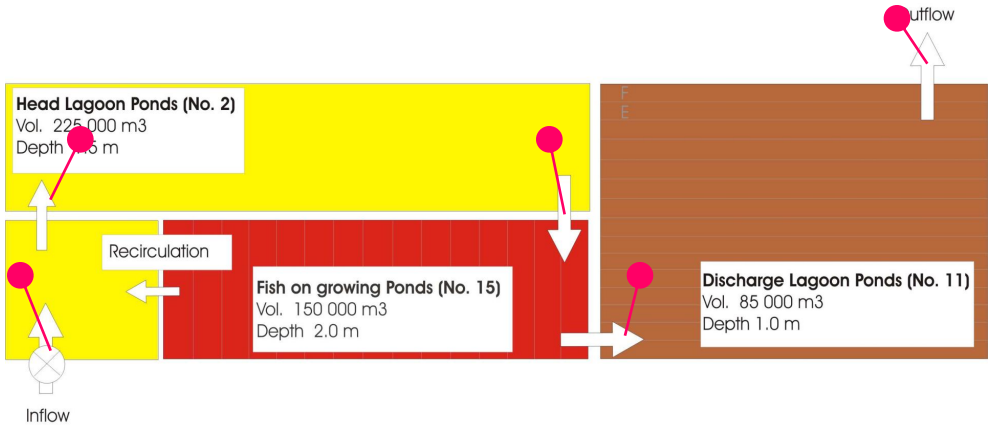
Daily and *nictemeral* sampling (Spring and Summer periods)

- Temparature
- pH,
- dissolved oxygen,
- TSS
- Salinity
- $N\text{-}NH_4^+$, $N\text{-}NO_2^-$, $N\text{-}NO_3^-$, N tot,
- SRP ($P\text{-}PO_4^{3-}$) , P tot,
- COD
- Trasparency
- Chlorophyll



Fish Farm Sampling :

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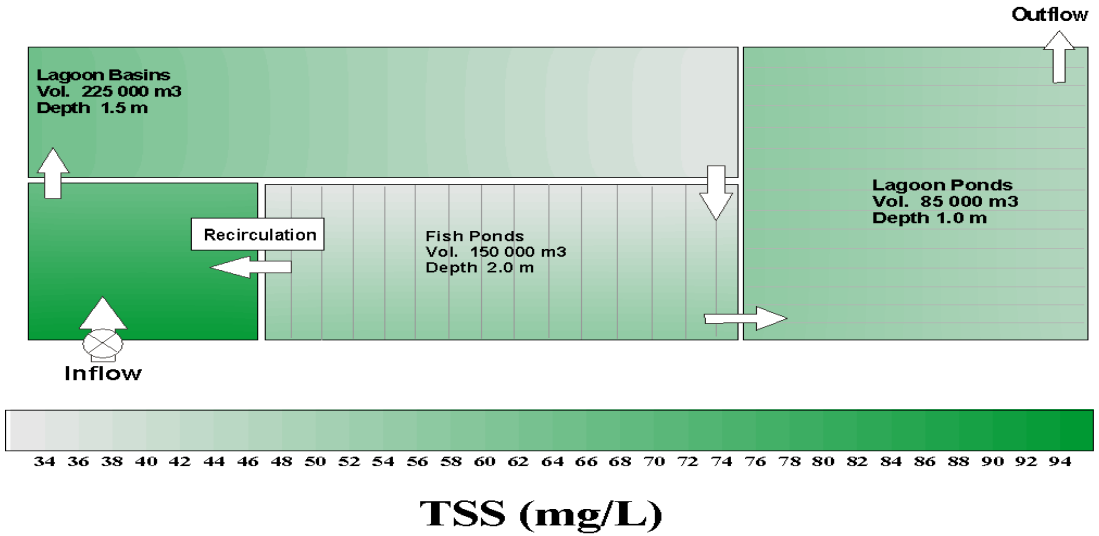
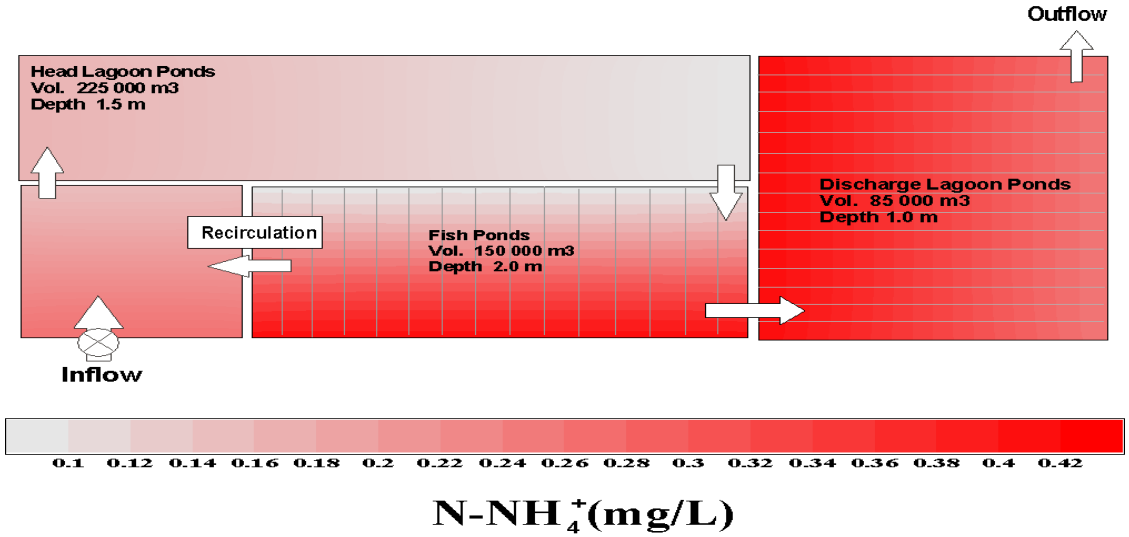
SPRING





Fish Farm Sampling :

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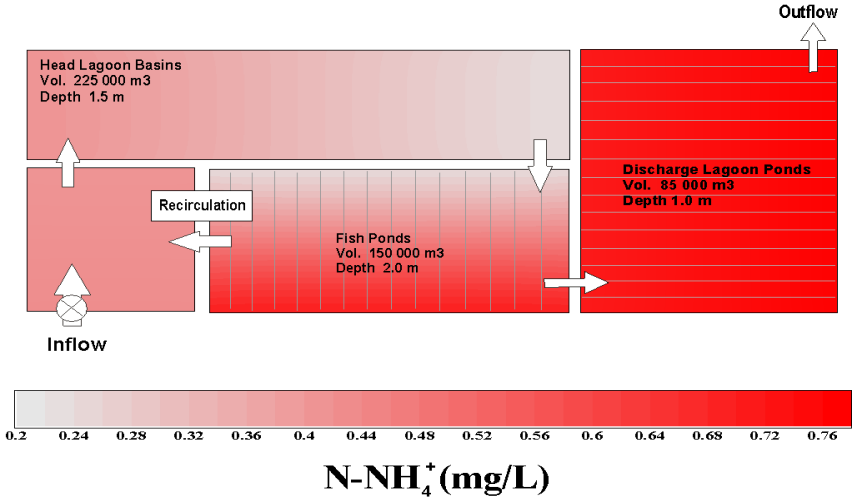
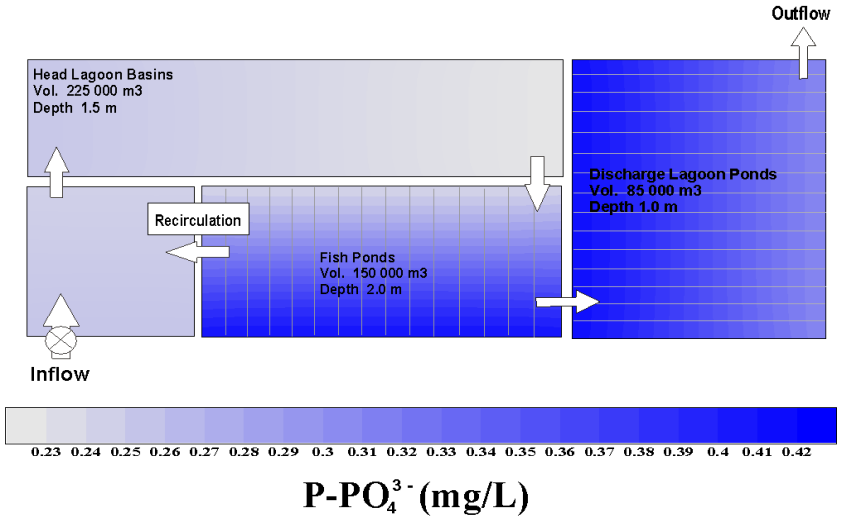
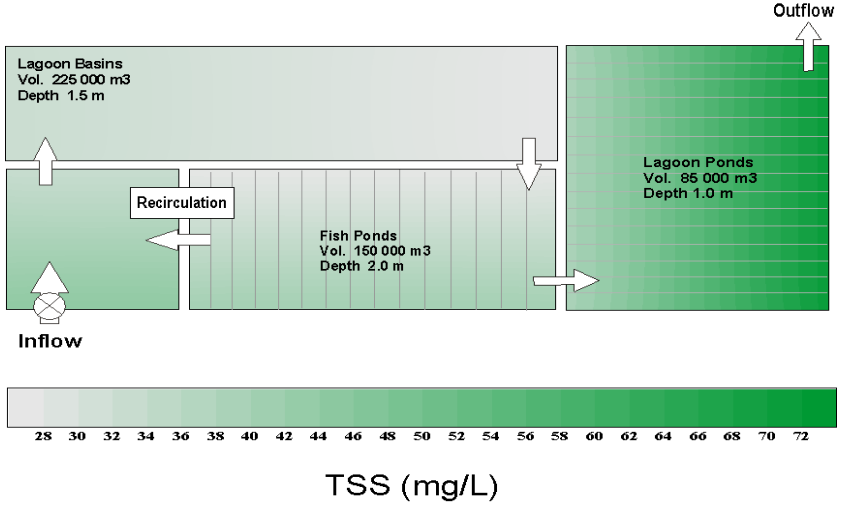
SUMMER





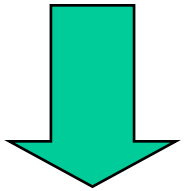


Un-settleaded → **Phytoplankton**

Settleaded → **Hypothesis: Algae decomposition**

QUALITY OF EFFLUENTS

Study of improvement to treatment processes in the final lagoon basins



Study of approaching model for evaluation of nitrogen ammonia level in outflow from the lagoon pond(s), in different seasons.

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Model Approach:

Model applied is extracted from a modelling nitrogen cycling in a French mariculture (Lefebvre, 2001), and represents the total ammonia nitrogen mass balance of the lagoon system (gN h^{-1}).

$$dNH_4lg/dt = W_{lg}([NH_4]vp - [NH_4]lg) + JNH_4S_{lg} + am(DON_{lg} + UREA_{lg}) - ni[NH_4]lg - nloss[NH_4]lg$$

- W_{lg}: Water flow
- $([NH_4]vp - [NH_4]lg)$: N ammonia concentration in lagoon compartments
- JNH_4S_{lg}: N-ammonia diffusive flux from the sediment
- $am(DON_{lg} + UREA_{lg})$: ammonification of organic dissolved N-ammonia and Urea
- $ni[NH_4]lg$: nitrification rate
- $nloss[NH_4]lg$: other N loss

To compare analytical data with the model forecast, the mass balance values were converted in a concentration with the value of water flow (L h-1).

Results:

	Eu			Fu			
	mean	d.s.	min-max	mean	d.s.	min-max	Teoric (*Lefebvre*)
$N\text{-}NH_4$ April (g/m^3)	**0.25**	0.06	0.17-0.39	**0.16**	0.10	0.06-0.43	**0.12**
$N\text{-}NH_4$ July (g/m^3)	**0.82**	0.13	0.55-1.07	**0.67**	0.14	0.37-0.94	**0.20**

The values of N-ammonia forecasted by the model, were similar to the spring analytical data, while resulted partially underestimate respect to the summer data.

Hypothesis : $N\text{-}NH_4^+$ released from Algae decompositions

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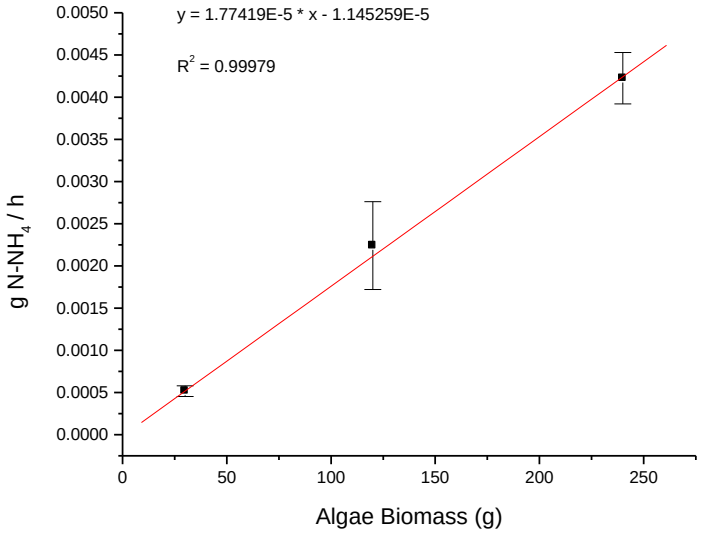
N-NH_4^+ released from Algae decompositions

Algae : 30, 120 and 240 g (ww)

Temperature = 26°C

Salinity = 22 g/L



dNH_4lg/dt = Lefebvre model + ***[(1.77419E-5 * Algae)- 1.45259E-5]***

Max value of *Algae recorded in discharge lagoon ponds (Summer)* = 1.81 kg/m^2 (ww)

	Eu			Fu				
	mean	d.s.	min-max	median	d.s.	min-max	Teoric (*Lefebvre*)	New Teoric
N-NH_4 April (g/m^3)	**0.25**	0.06	0.17-0.39	**0.16**	0.10	0.06-0.43	**0.12**	-
N-NH_4 July (g/m^3)	**0.82**	0.13	0.55-1.07	**0.67**	0.14	0.37-0.94	**0.20**	**0.45**

This utilization of the algorithm is a strong tool for N-ammonia control, as it may be utilized to program focused interventions, either:

- **in the water column**
- **in the sediment**

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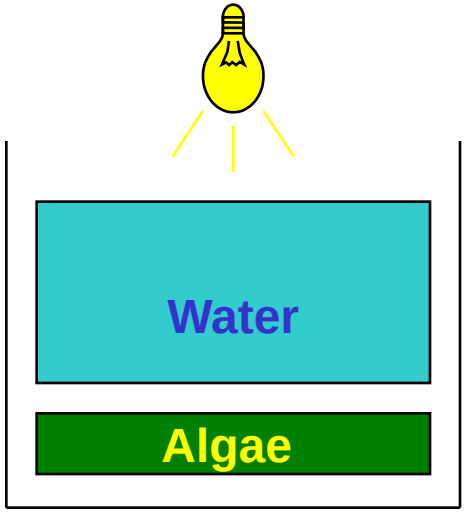
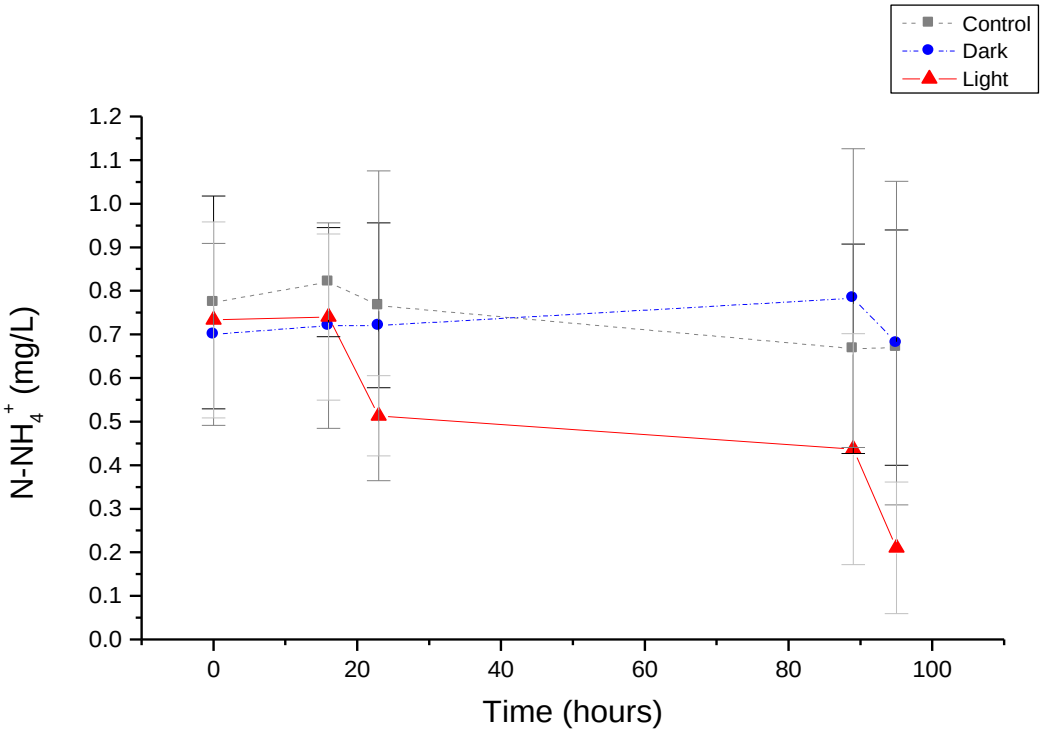
Intervention in the water column:

Macroalgae (*Gracilaria verrucosa*) pilot trials in an artificial system: temperature, salinity and nutrient level are controlled





Salinity = 22 g/L

Temperature = 25-26 °C

***G. verrucosa* = 162** mgN/Kg/day (d.W.)

***(C. linum* = 203** mgN/Kg/day (d.W.)**)**

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Intervention in the sediment:

Study of system to improve natural nitrification processes.

Bacterial-enzyme bio-promoter application

Eurovix S.r.l.

Enzimi alfa-amilasi	Enzimi emicellulasi
Enzimi beta-amilasi	Enzimi pectinasi
Enzimi pentosanasi	Microrganismi utili selezionati da fermentazione controllata
Enzimi lipasi	Estratti vegetali
Enzimi gluco-amilasi	Carboidrati
Enzimi beta-glucanasi	Fattori di crescita naturali
Enzimi cellulasi	Principi attivi di *Focus laminaria*
Enzimi proteasi	Terreno colturale Agar
Enzimi fosforilasi	Alghe *Lithothamnium calcareum*
Enzimi pullulanasi	Biocatalizzatori minerali ricchi di oligoelementi

OGM Free

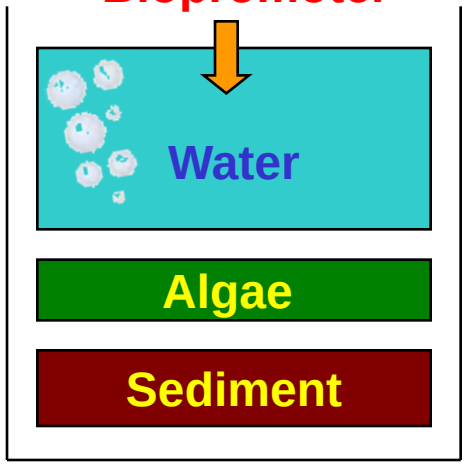
Bioprompter application: N-NH_4^+ and P-PO_4^{3-}

Aerobic conditions

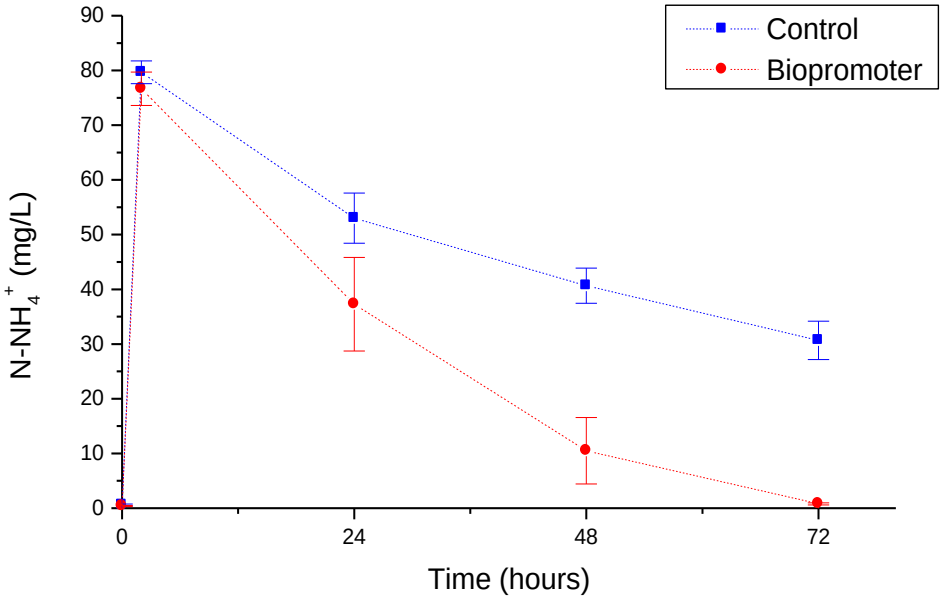
Oxygen

6.5 mg/L

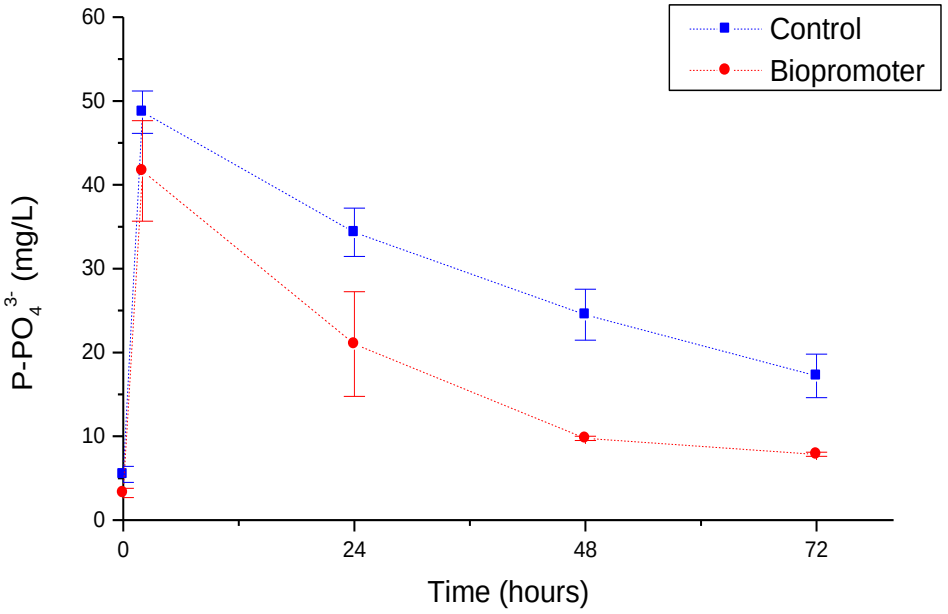
Biopromoter



Add N-NH_4^+

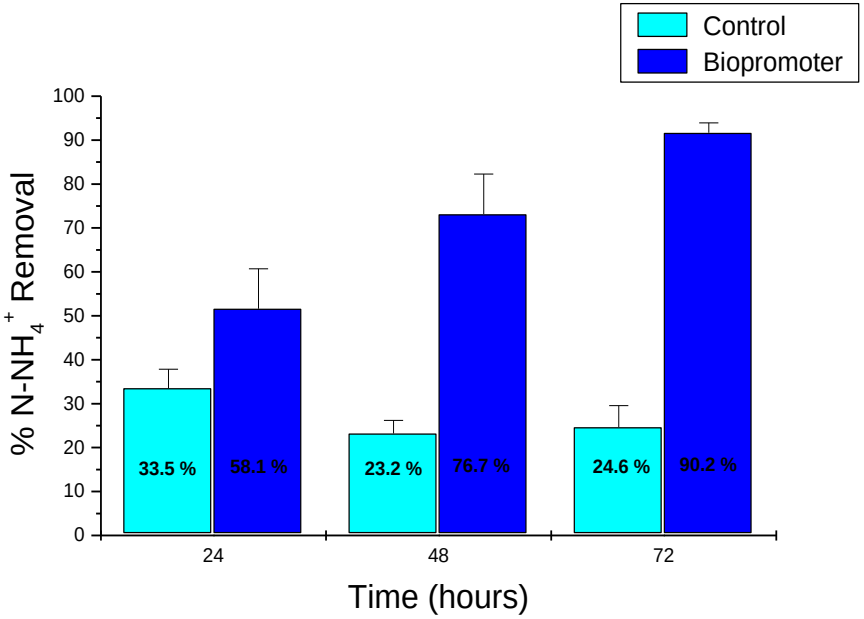


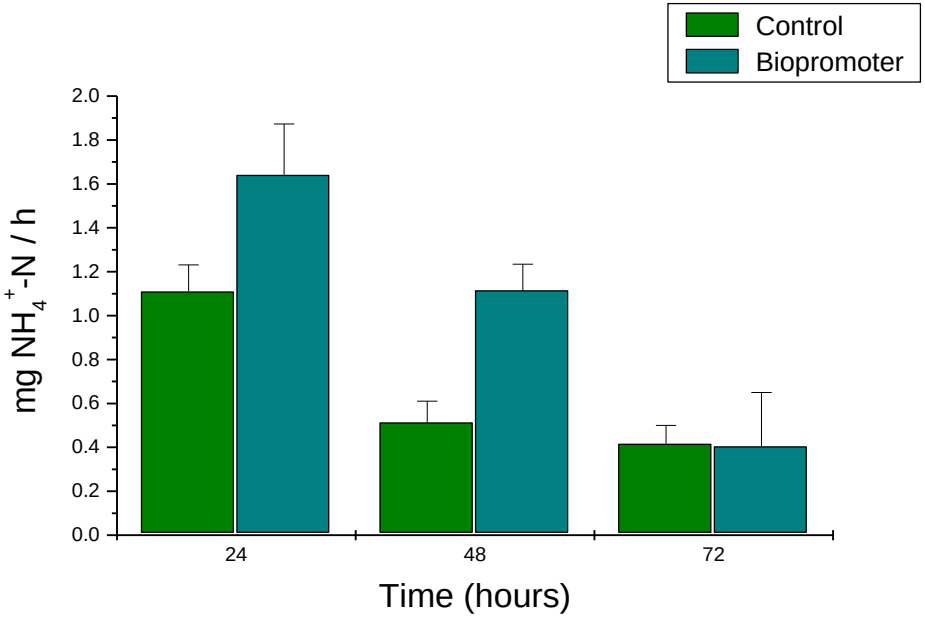
Add P-PO_4^{3-}

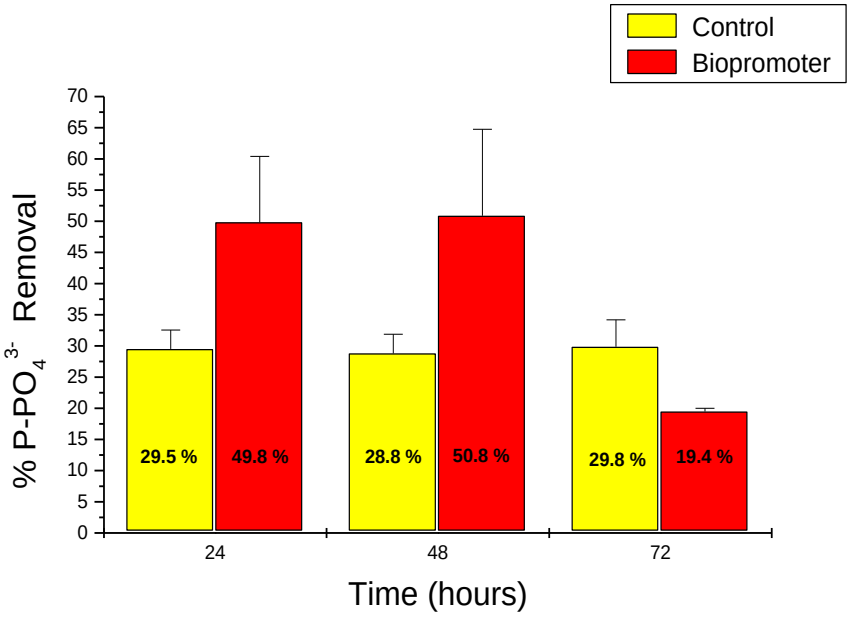


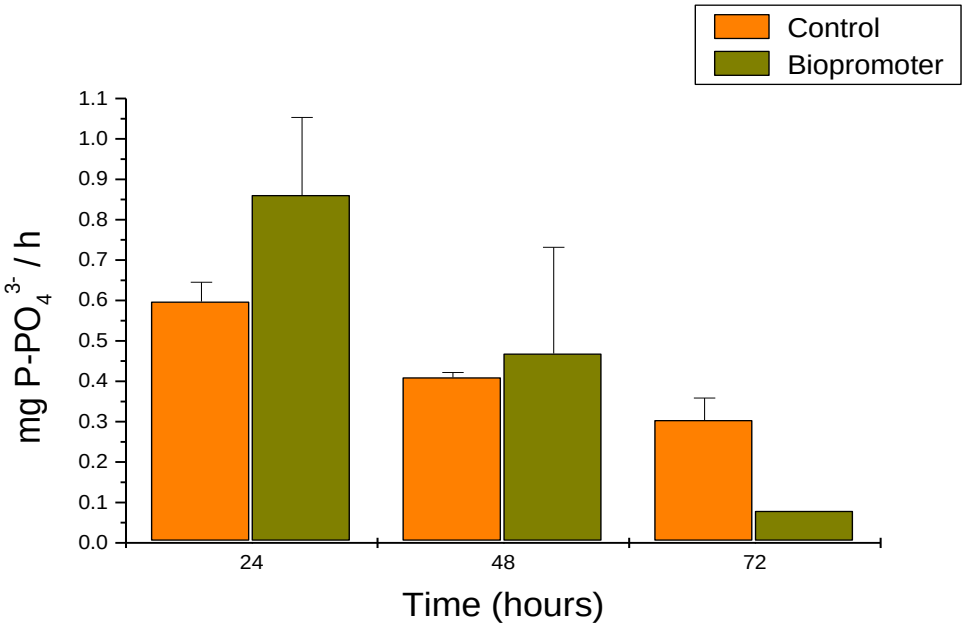
DBSM

Biopromoter application: N-NH_4^+ and P-PO_4^{3-}









Biopromoter application: N-NH_4^+ and P-PO_4^{3-}

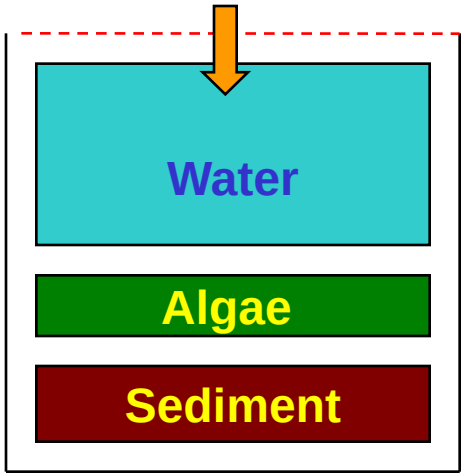
Partially anoxic conditions

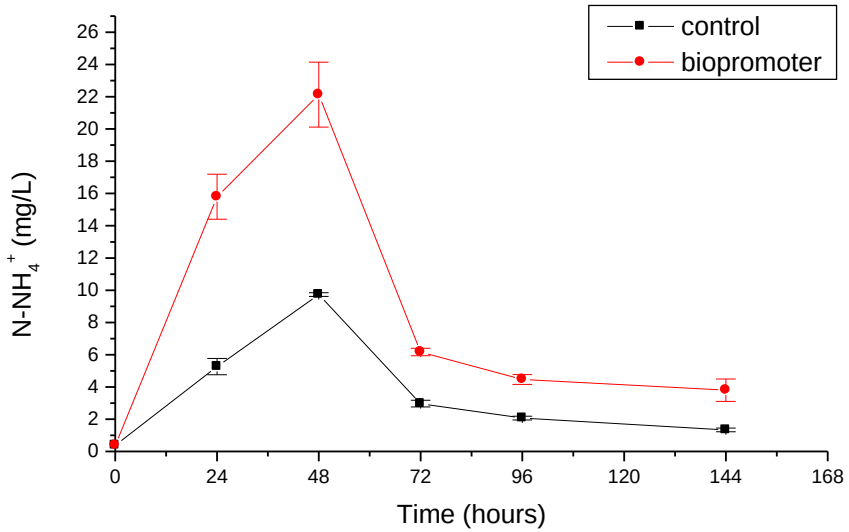
Oxygen

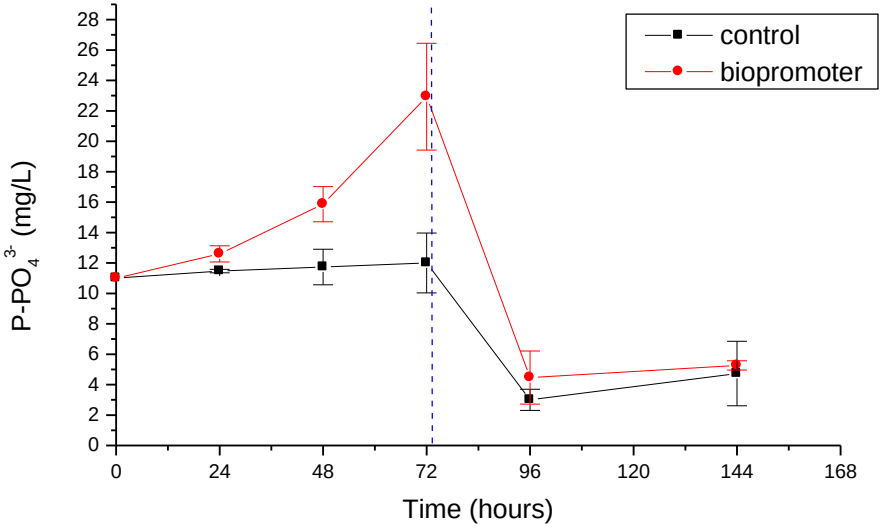
7.1=>0.52 mg/L

(24H)

Biopromoter







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Fish Farm and Surroundig Basin

Define a tool for assess water quality in land based aquaculture and surrounding basin.

SATELLITE REMOTE SENSING

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=> QuickBird Satellite Images (3rd September 2004)

=> Chromaticity coordinate method (ENVI®):

X (*redness*) = X' / (X' + Y' + Z') = Suspended solids

Y (*greeness*) = Y' / (X' + Y' + Z') = Chlorophyll

Z (*blueness*) = Z' / (X' + Y' + Z') = Transparency

X' = radiation measured in the band of red

Y' = radiation measured in the band of green-yellow

Z' = radiation measured in the band of blue-green

Qualitative data: chromatic intervall 0 – 1 (low-high)

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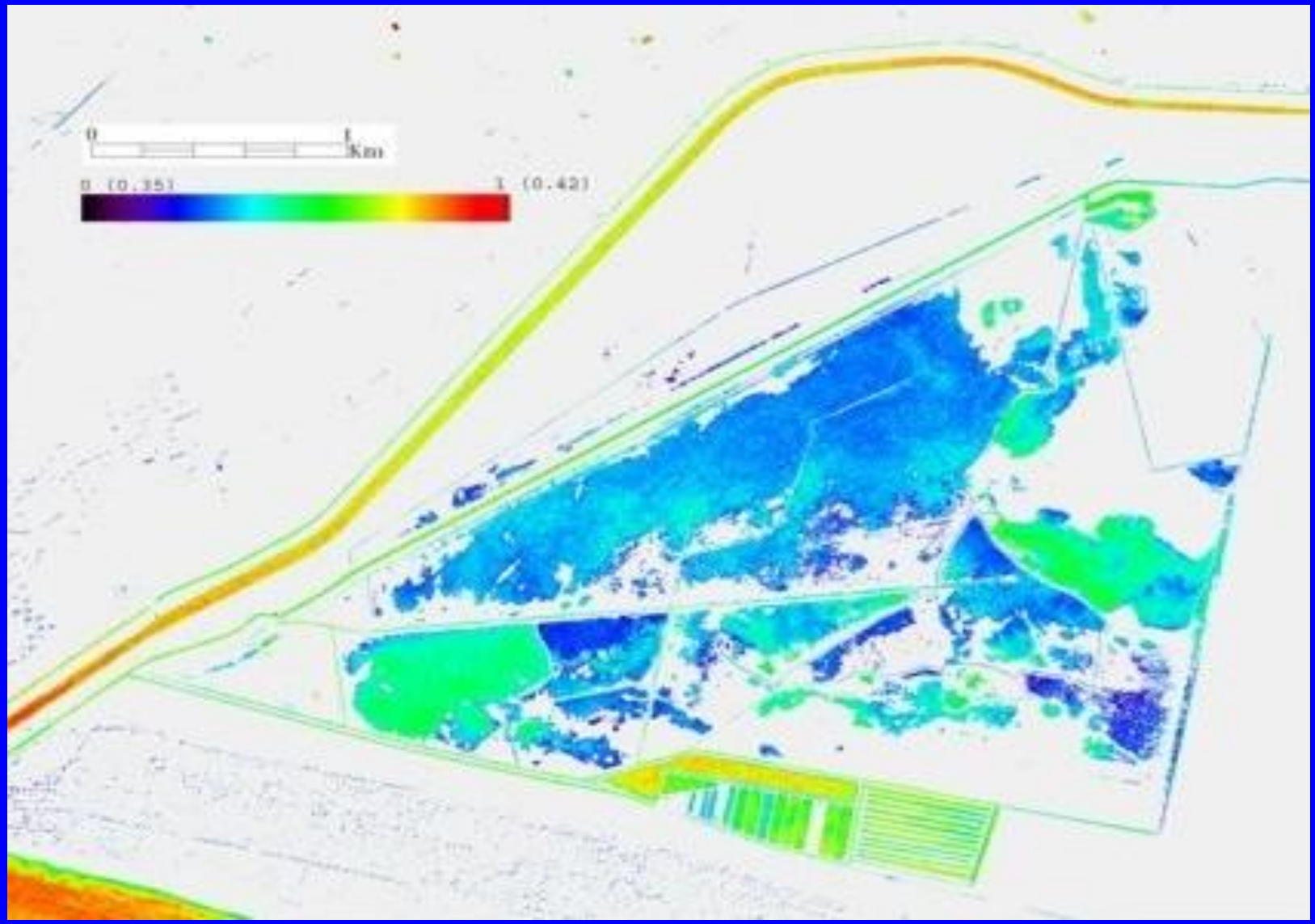
Chlorophyll Area:



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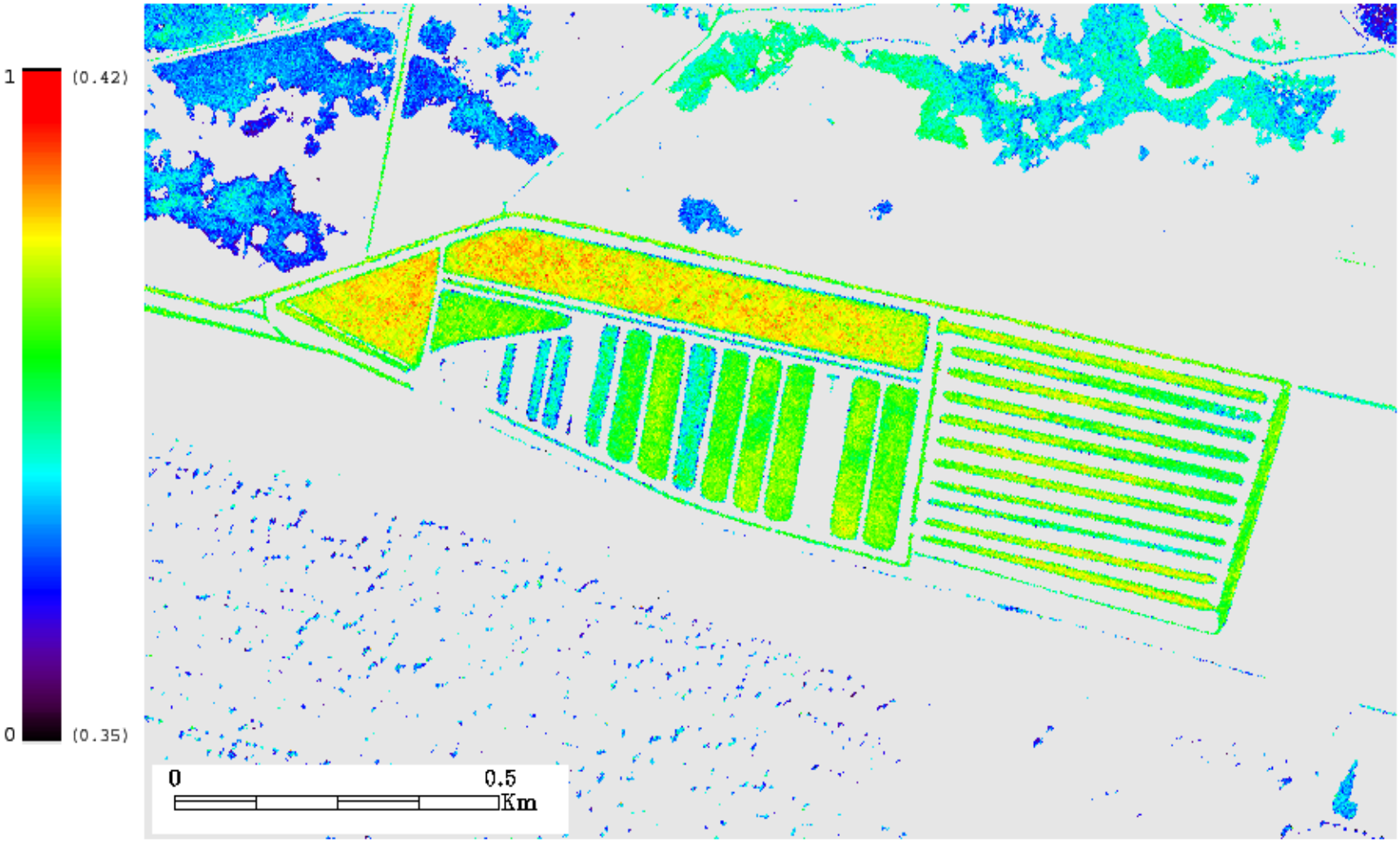
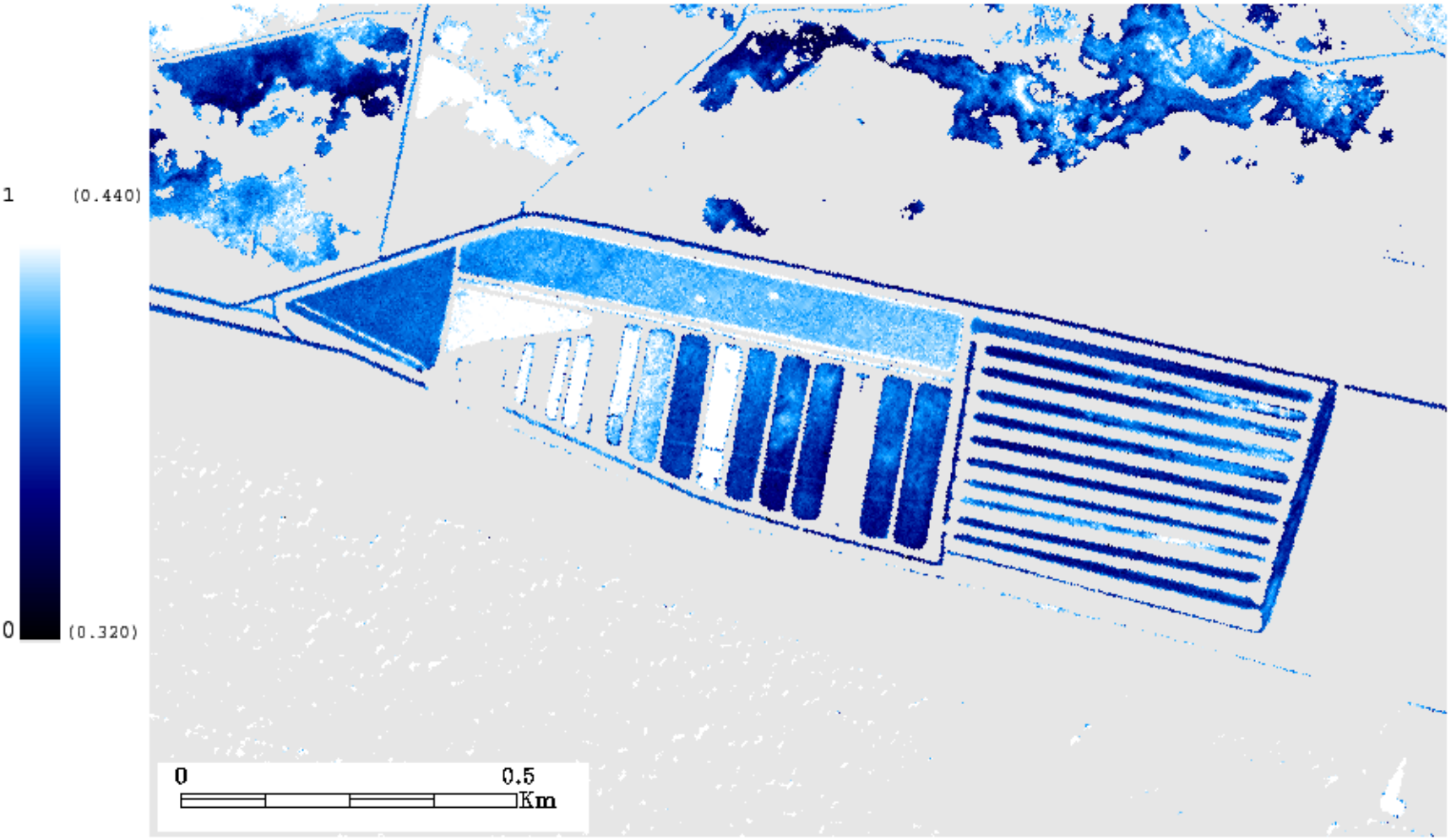
Chlorophyll Fish Farm:



Transparency Fish Farm:



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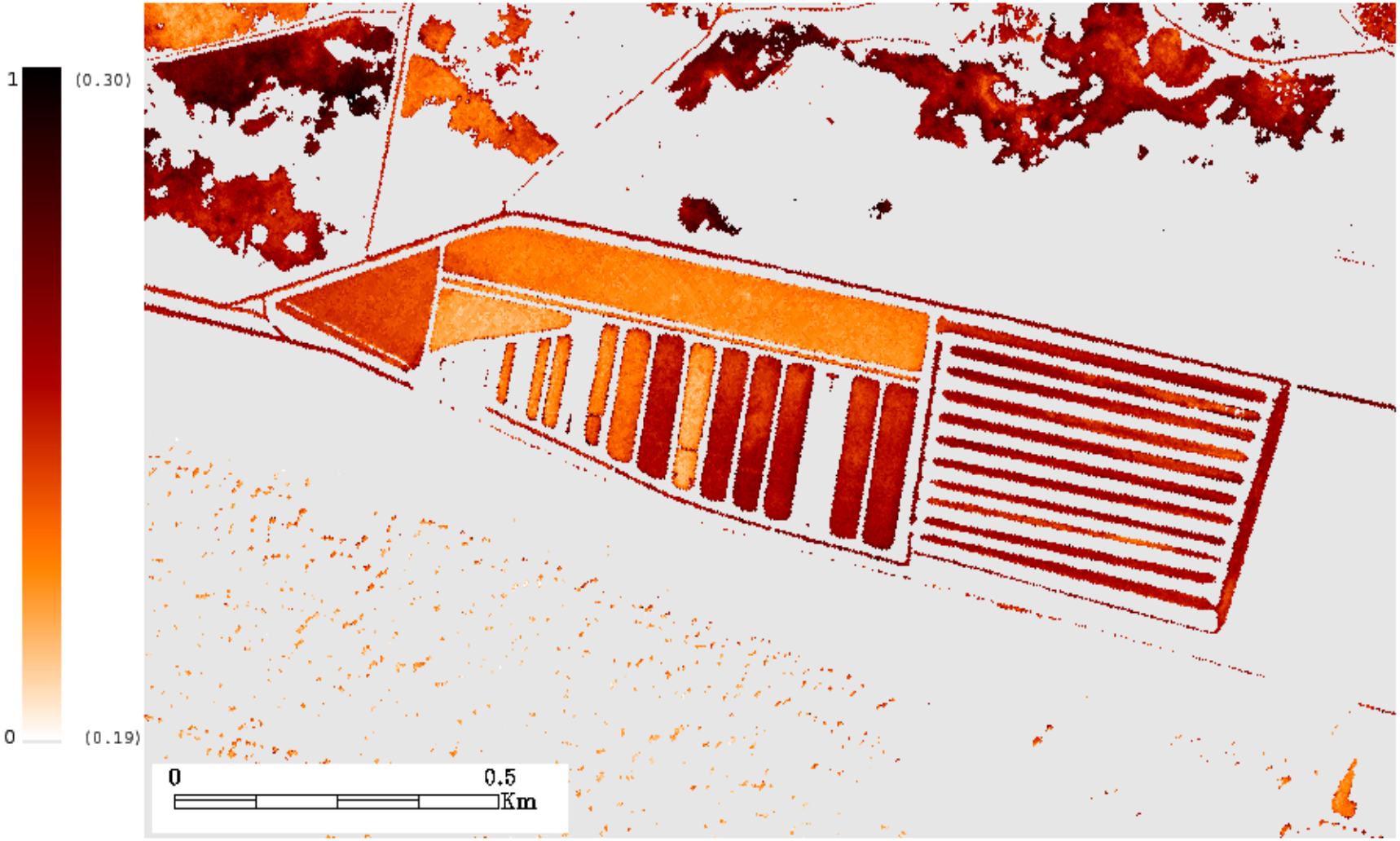
Suspended Solid Fish Farm:



PREDICTIVE MODEL : DEPOMOD

Data requested:

1. Area:

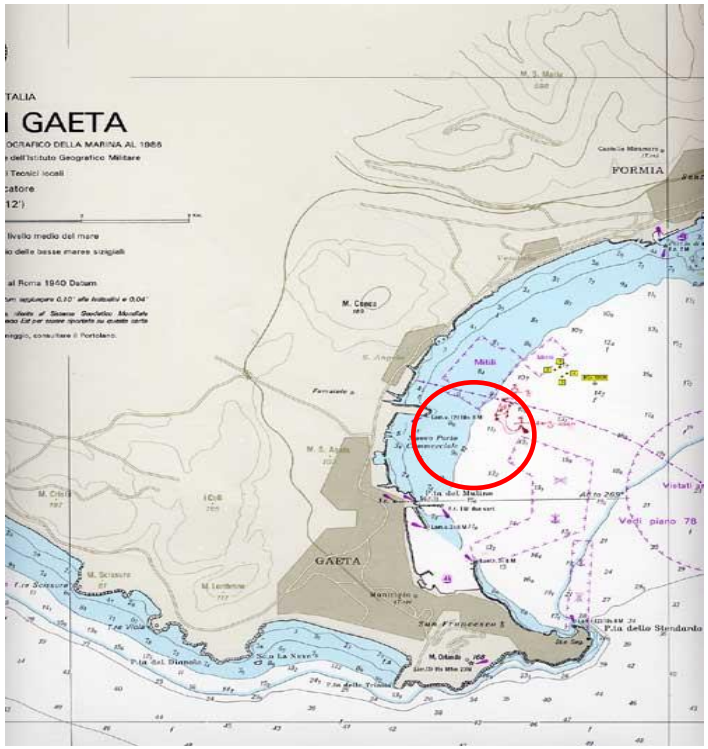
- Bathymetry
- Currents (velocity and directions)

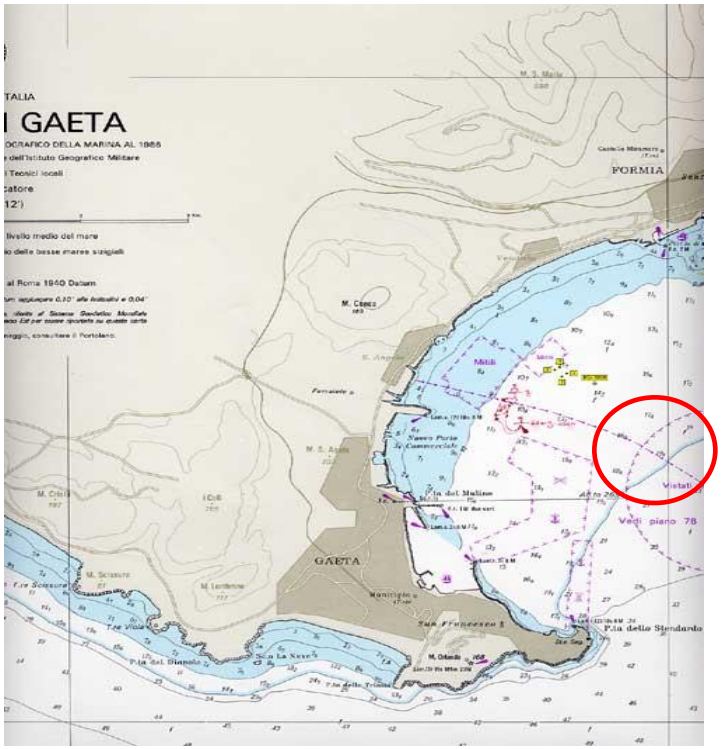
2. Fish Farm

- Number and position of cages
- Biomass or productivity
- Total feed input

DBSM

AREA OF STUDY: Gaeta Gulf





- Bathymetry: 5-10 metre
- Distance of coast: 170-869 metre
- Total surface (fish and mussel culture): 1.062.690 Mq.

- Bathymetry: 10-20 metre
- Distance of coast: 950-1770 metre
- Total surface (fish and mussel culture): 996.940 Mq.

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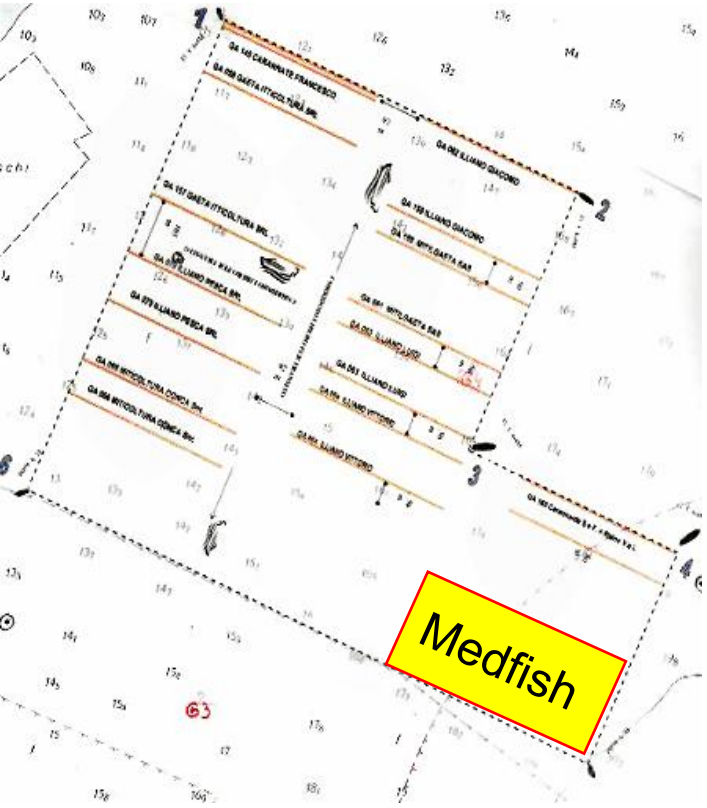
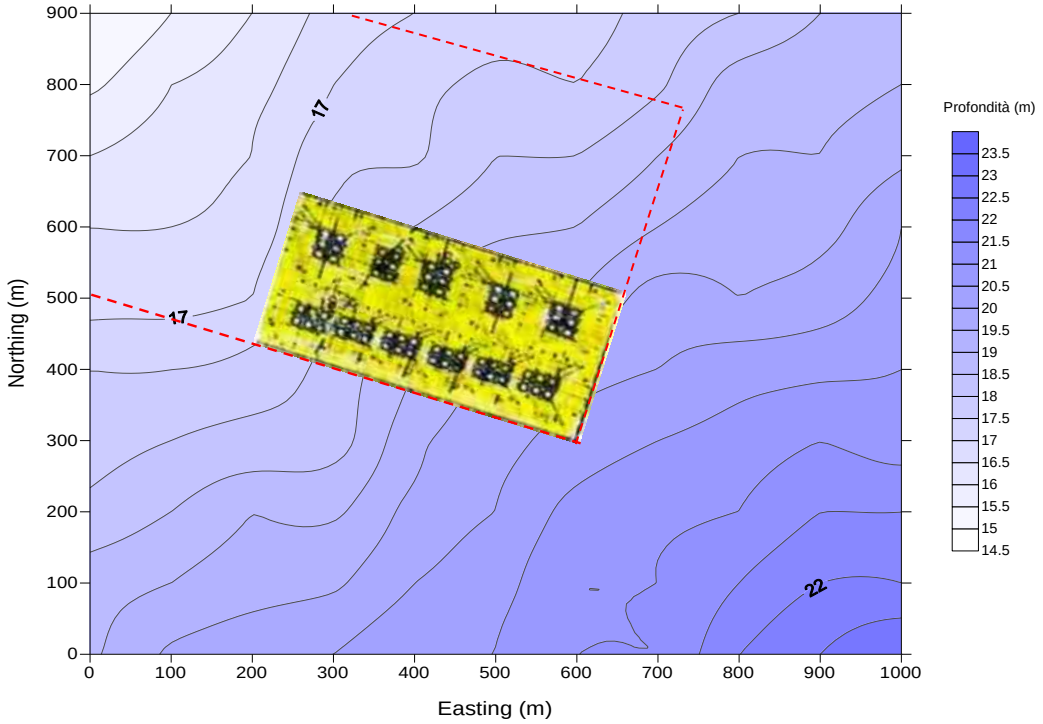
AREA Of STUDY: Medfish S.p.a.





(0;0): Lat 41°13'30,00"; Long 13°35'21,23"

Bathymetry	Dimension	Surface	N°of cages	Total Volume
18-20 m	400x213,88 m	85.552 m^2	65	122.558 m^3

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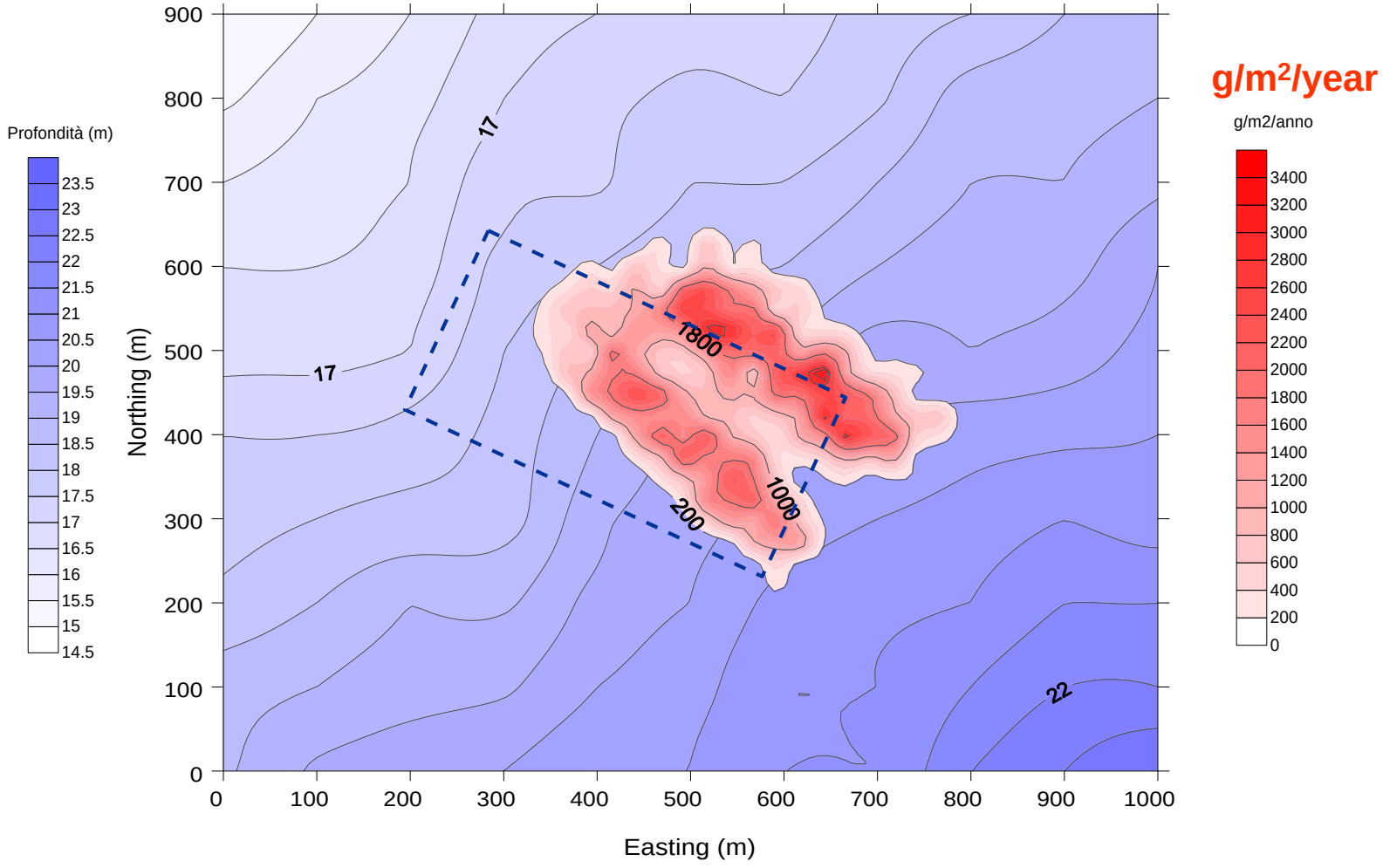
Assessment of potential enviroment impact:

2. Effects on the bottom: feces and uneaten feed

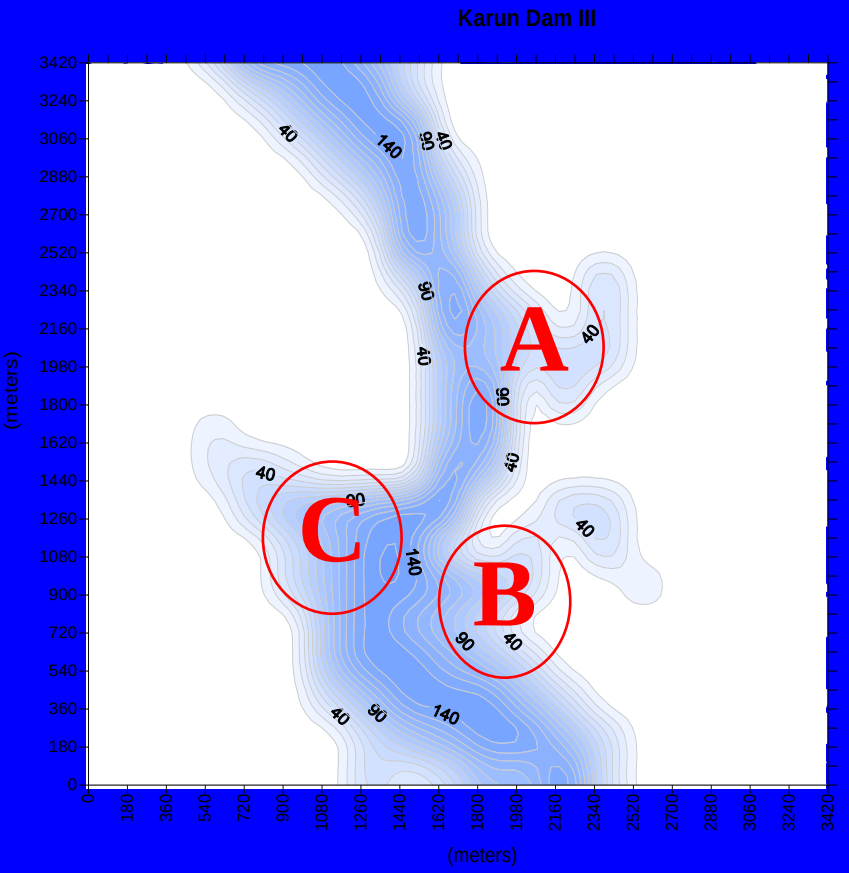


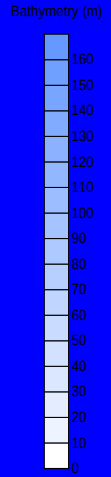
(0;0): Lat 41°13'30,00"; Long 13°35'21,23"

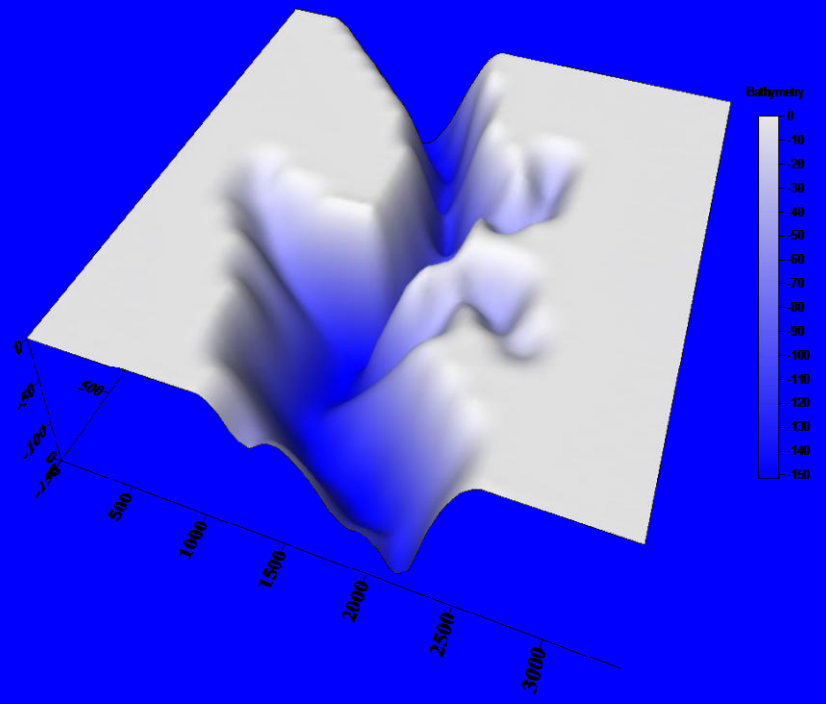
(Max: 3530,78 g/m²/year)

Case study: Karun Dam III (IRAN)

Case study: Karun Dam III (IRAN)







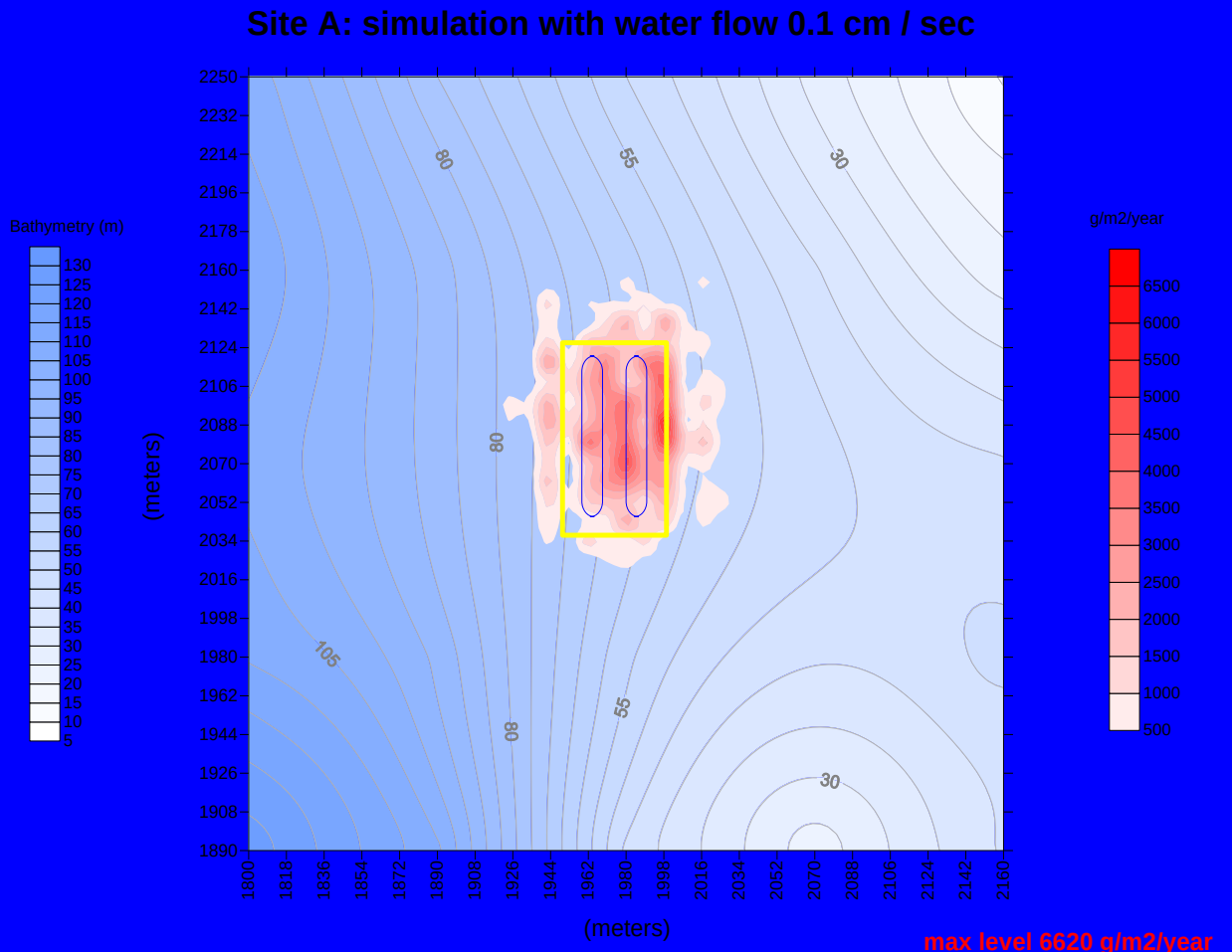
Simulation with predictive model: DEPOMOD

SITE A

0.1 cm/sec

Max level:

6620 g/m²/y



Bathymetry	Dimension	Surface	N°of cages	Total Cages Volume
50-80 m	50x100 m	5000 m^2	10	3207.5 m^3

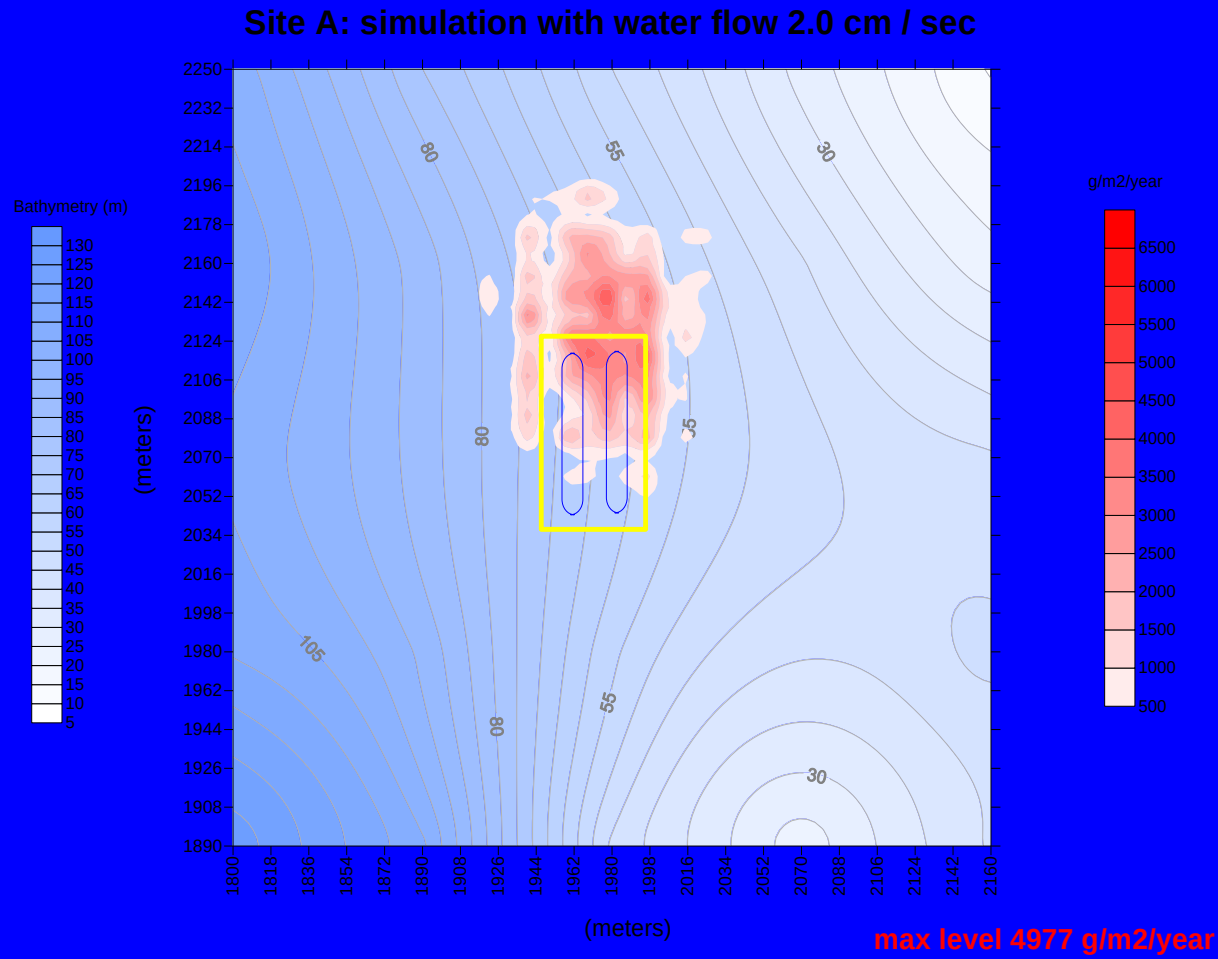
Simulation with predictive model: DEPOMOD

SITE A

2 cm/sec

Max level:

4977 g/m²/y



Bathymetry	Dimension	Surface	N°of cages	Total Cages Volume
50-80 m	50x100 m	5000 m^2	10	3207.5 m^3

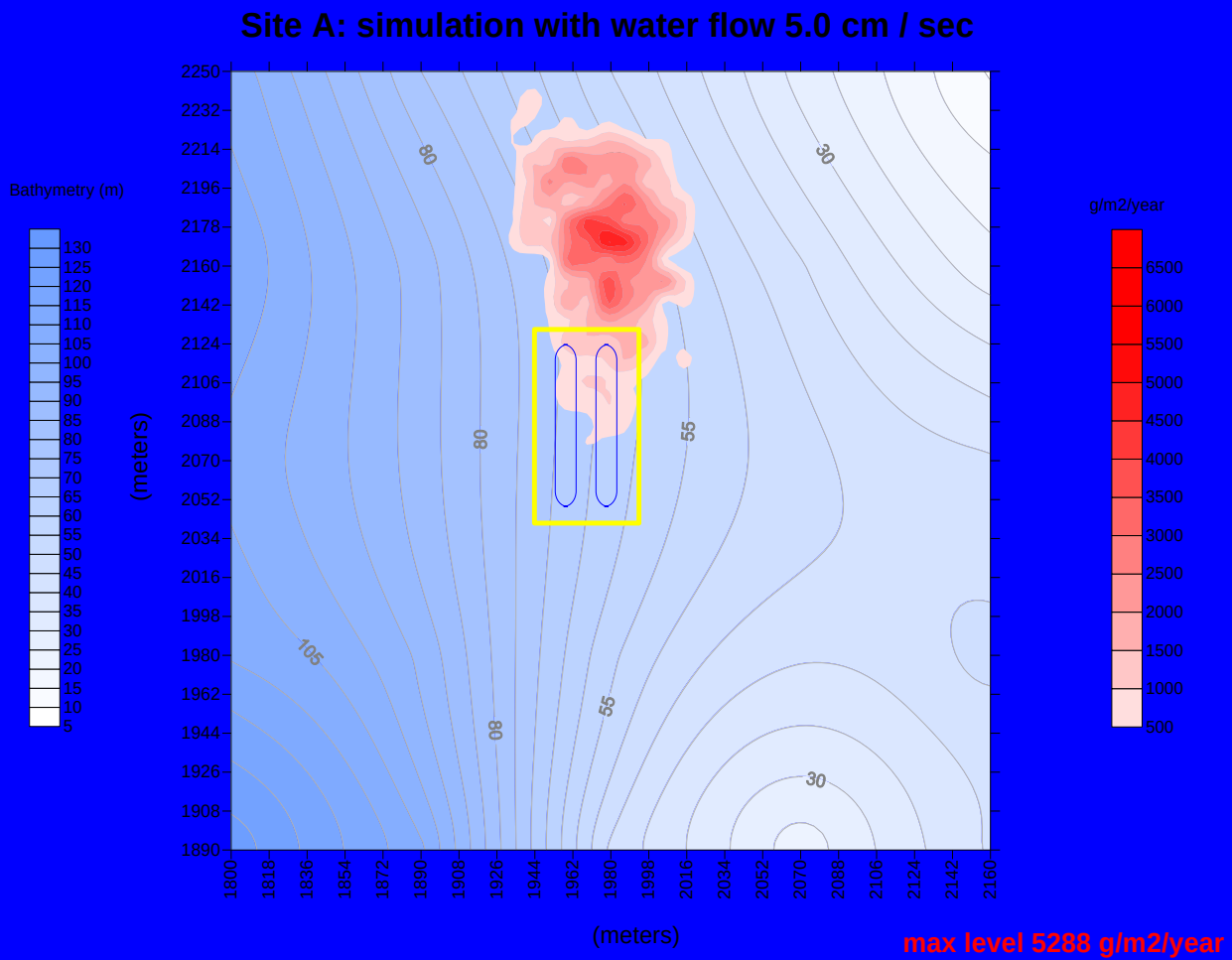
Simulation with predictive model: DEPOMOD

SITE A

5 cm/sec

Max level:

5288 g/m²/y



Bathymetry	Dimension	Surface	N°of cages	Total Cages Volume
50-80 m	50x100 m	5000 m^2	10	3207.5 m^3

Our team