

# COCKLES

Co-Operation for Restoring Cockle Shellfisheries  
and its Ecosystem-Services in the Atlantic Area

## Opportunities from progress in culture techniques

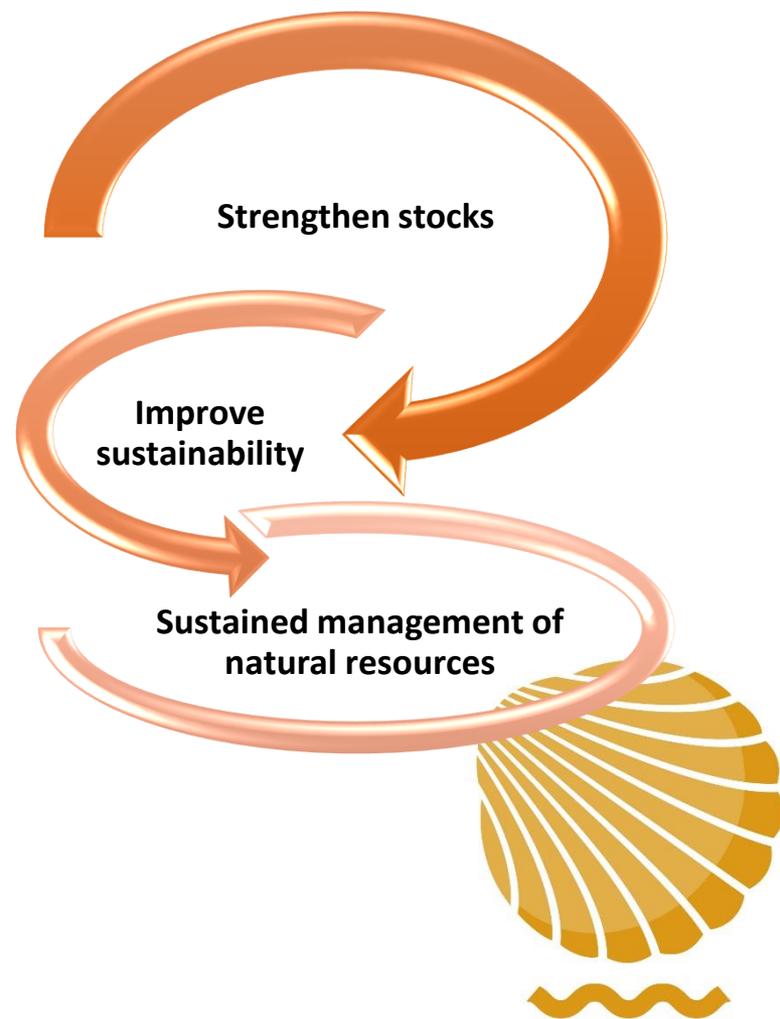
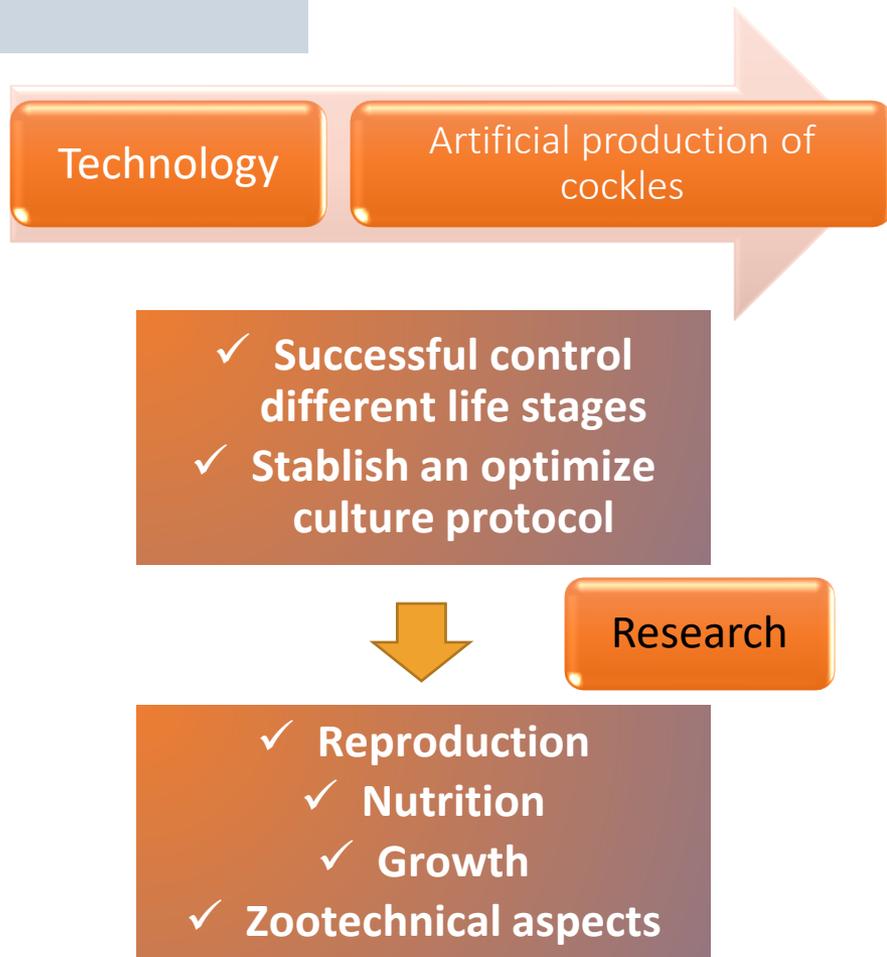
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**FINAL VIRTUAL CONFERENCE**

**March 2021**



## Opportunities from progress in culture techniques



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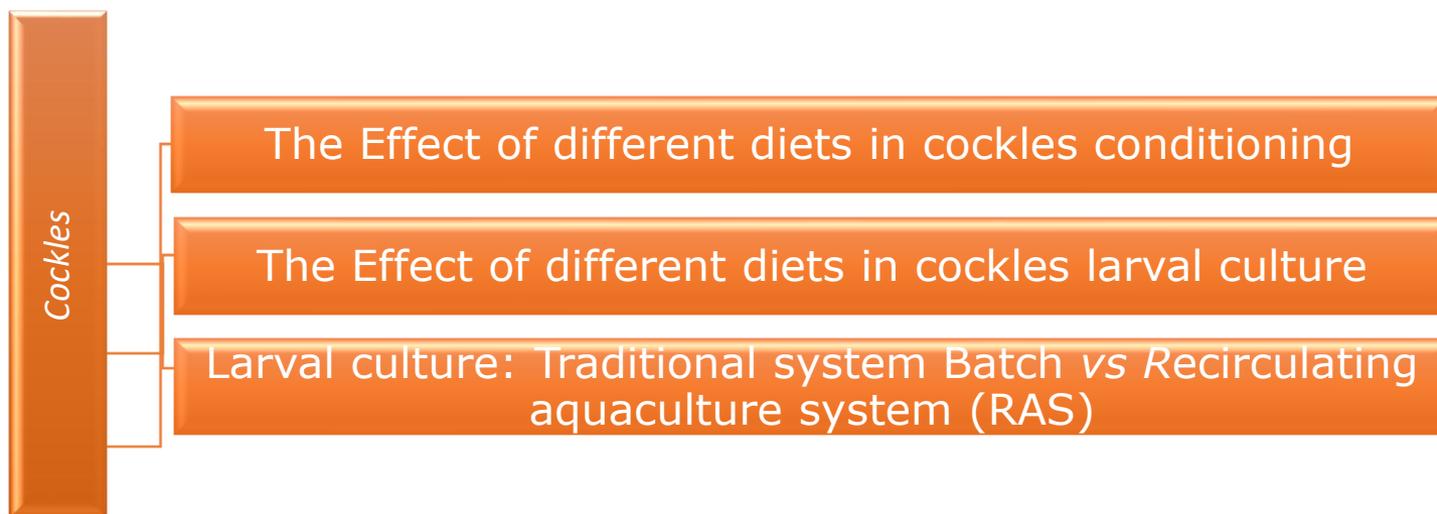
- Objective

Cost-effective procedures will be settled to produce cockle seed in hatchery facilities and to grow outdoor up to market size, minimising the impact on the ecosystem.



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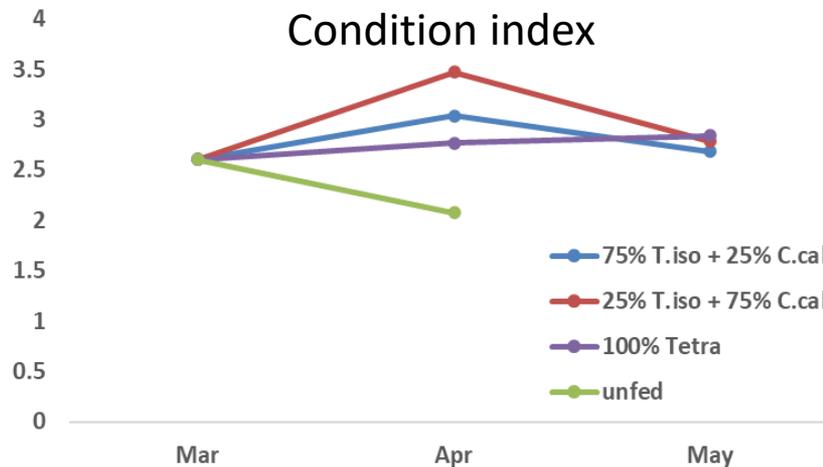
### Hatchery



## Opportunities from progress in culture techniques

### Conditioning

- **Diet 1** – *Isochrysis aff galbana* (T-iso) 75%+ *Chaetoceros calcitrans* (C.cal) 25%
- **Diet 2** – *Isochrysis aff galbana* (T-iso) 25%+ *Chaetoceros calcitrans* (C.cal) 75%
- **Diet 3** – *Tetraselmis suecica* 100% (Published results)



### Best diet

*Isochrysis aff galbana* (T-iso) 25%+ *Chaetoceros calcitrans* (C.cal) 75%



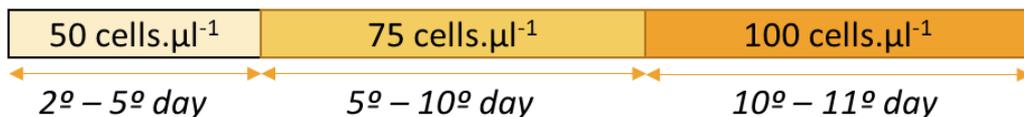
# Opportunities from progress in culture techniques

## Larval rearing

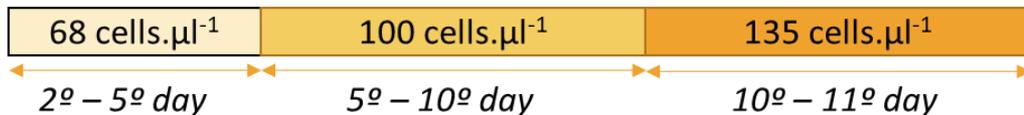
### The effect of different diets in larval rearing

#### Feeding plans

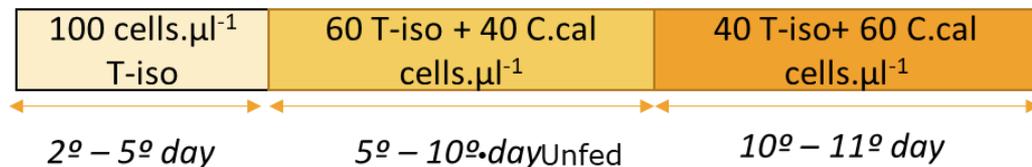
- Diet 1 – *Isochrysis aff galbana* (T-iso)



- Diet 2 – *Chaetoceros calcitrans* (C.cal)



- Diet 3 – *Isochrysis aff galbana* + *Chaetoceros calcitrans* (Tiso+Ccal)

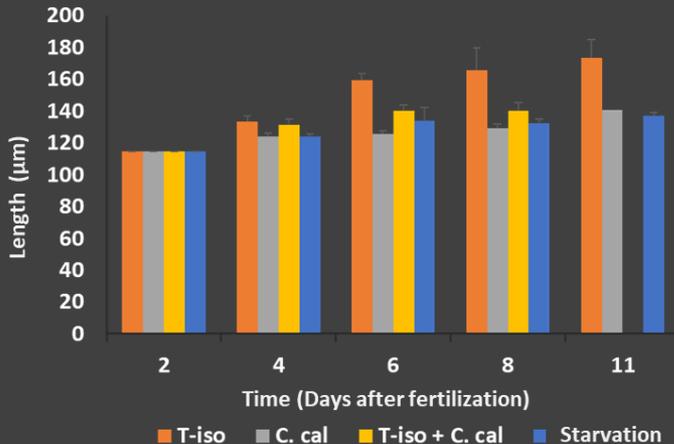
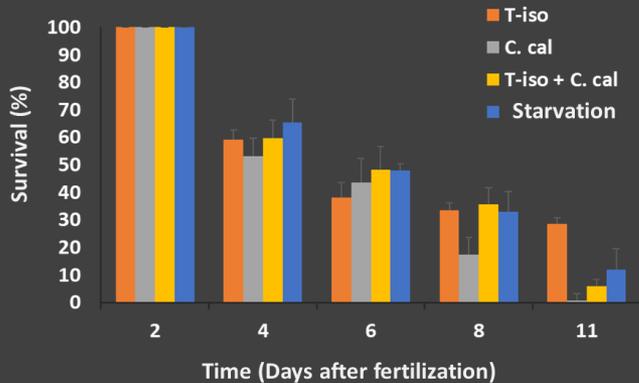


\* Larvae were fed daily to provide equal biomass proportions of T-iso and C. cal in a ration cell number

## Opportunities from progress in culture techniques

### Larval rearing

### *The effect of different diets in larval rearing*



✓The mono-specific diet T-iso is the most suitable diet for larval rearing;

✓The settlement was initiated at 11th days of culture only with diet 1;

✓Clearly, the diets with C. cal microalgae was not adequate for cockle larval.



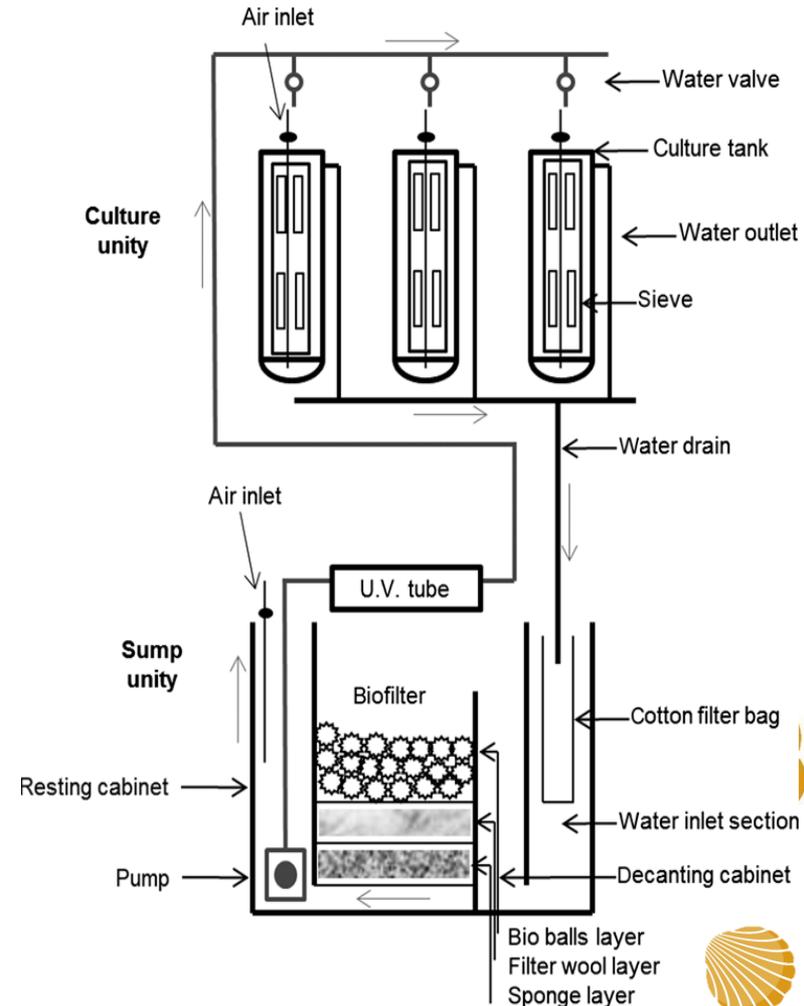
## Opportunities from progress in culture techniques

### Larval rearing

#### *Batch vs RAS*

#### Experimental design:

- ✓ Laboratory-scale closed recirculating system – RAS
  - 5-l tanks with natural filtered (0.45  $\mu\text{m}$ ) and UV- sterilized seawater
  - 10% of water changed daily
  - Initial Larvae density of 7, 10 and 30 larvae  $\text{ml}^{-1}$
  - 4 Replicates
  - Food (T-iso) was added daily to each sump unity
  
- ✓ Traditional larval rearing system – Batch.
  - 20-l tanks with natural filtered (0.45  $\mu\text{m}$ ) and UV- sterilized seawater
  - Water changed every other day
  - Initial Larvae density of 7 larvae  $\text{ml}^{-1}$
  - 3 Replicates
  - Food (T-iso) was added daily to each sump unity

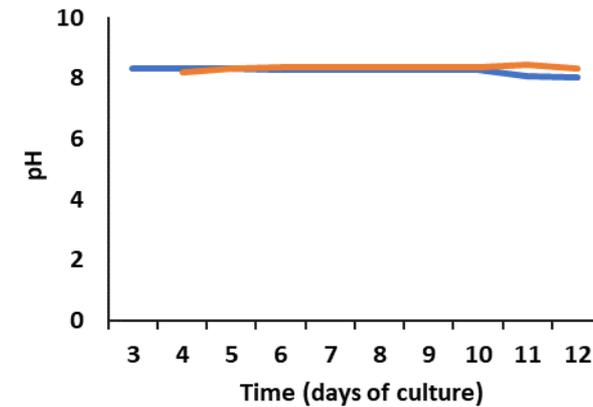
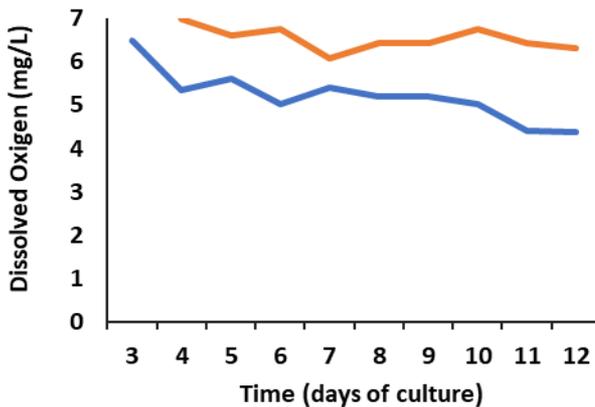
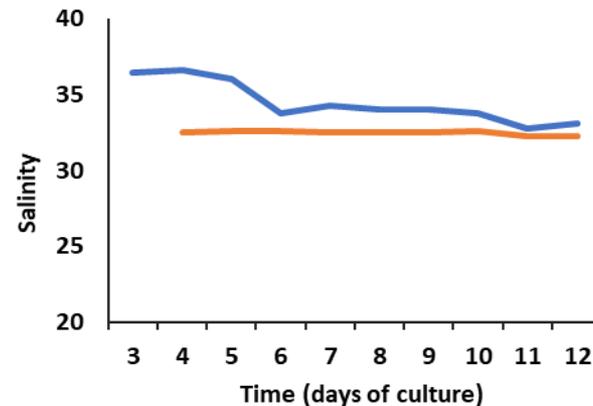
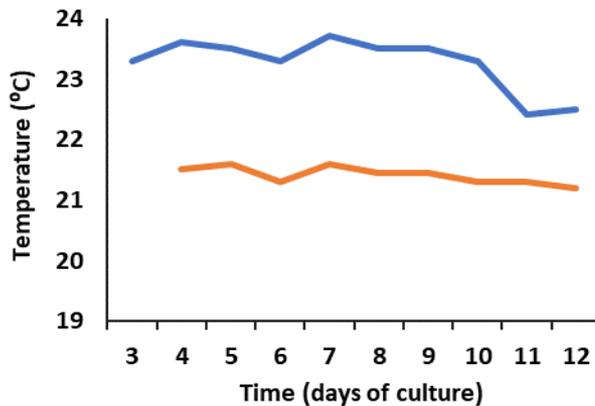


## Opportunities from progress in culture techniques

### Larval rearing

### Batch vs RAS

## Results: Physical parameters of water



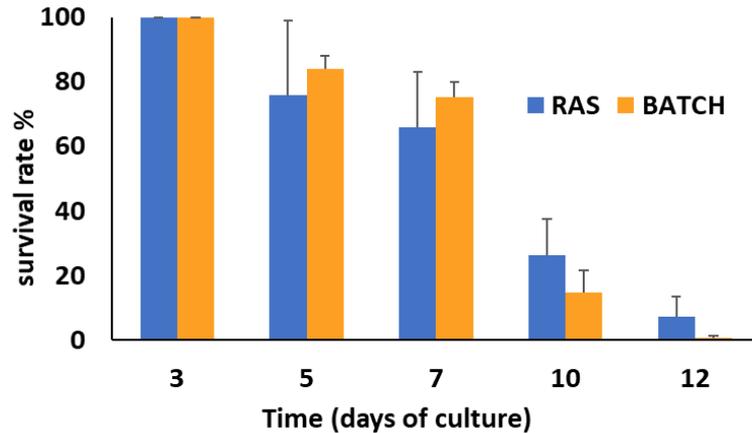
— RAS — Batch



## Opportunities from progress in culture techniques

### Larval rearing

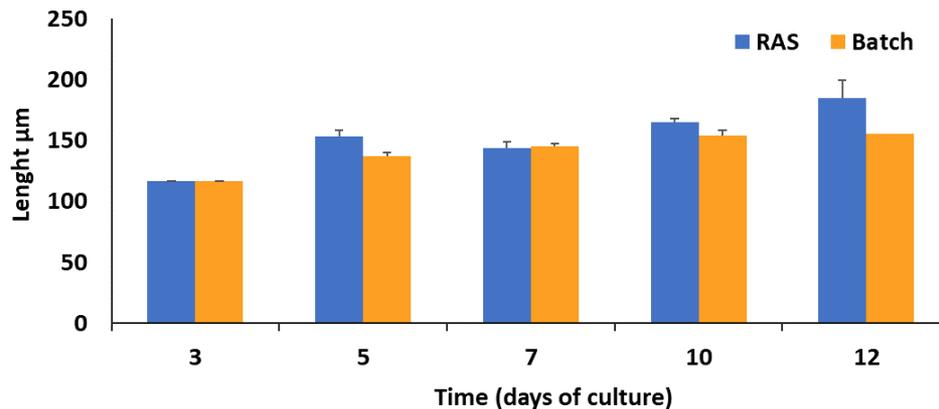
### Batch vs RAS



✓ Mortality high in both systems;

✓ Differences in growth only in the last day of culture.

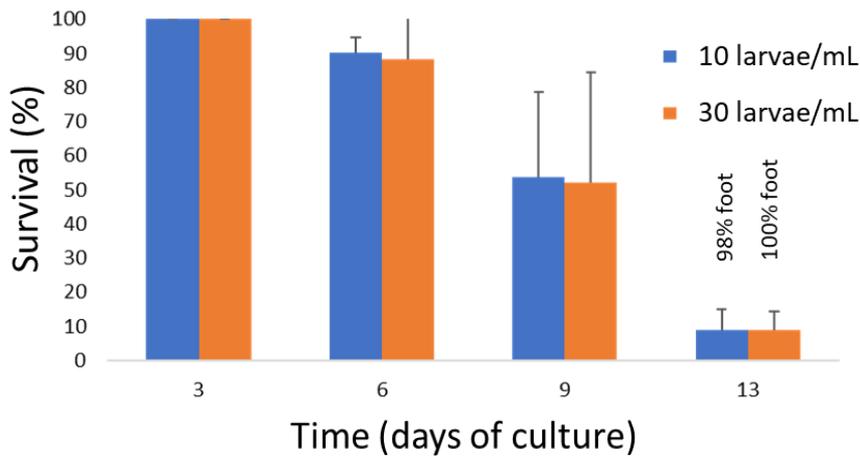
✓ Foot: RAS-70%; Batch-49%



## Opportunities from progress in culture techniques

### Larval rearing

### *Densities in RAS*



✓ No differences between densities;

✓ On 13<sup>th</sup> day of culture, all live larvae were metamorphosed.



but it is not necessary in feeding the larvae



## Opportunities from progress in culture techniques

### Hatchery

*In summary...*

- ✓ Diatoms (*C. cal*) are an important component in adults conditioning, but it is not necessary in larvae feeding.
- ✓ The mono-specific diet T-iso is the most suitable diet for larval rearing;
- ✓ No significant differences were observed between RAS and Batch systems.
- ✓ It is possible to triple the density on larval rearing in RAS.

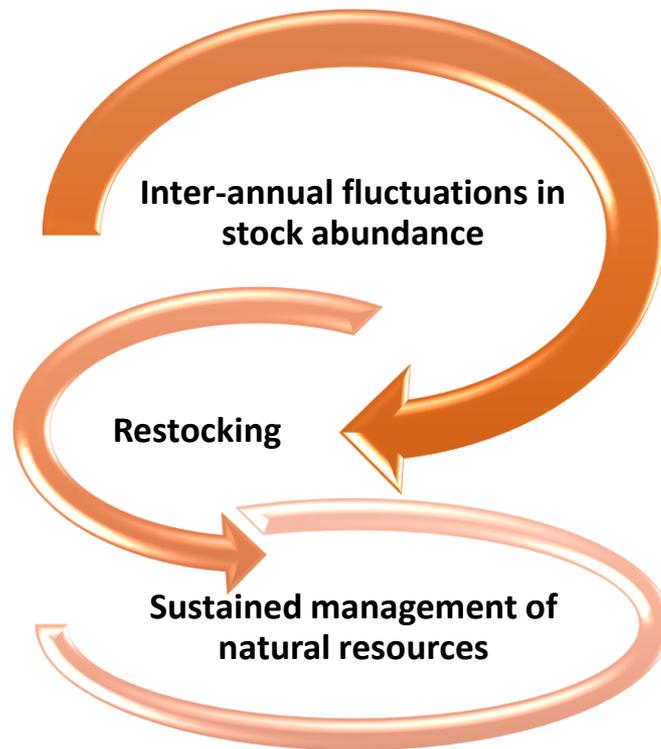


but it is not necessary in feeding the larvae



## Opportunities from progress in culture techniques

### Outdoor



## Opportunities from progress in culture techniques

### Outdoor



Shellfish plot in Ria Formosa

Integrate Multi-trophic Aquaculture System



# Opportunities from progress in culture techniques

## Outdoor

### Shellfish plot system

	2 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>
1m	2 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>
	1m					

-  With protection net
-  Without protection net

Initial length: 19 mm  
Initial weight: 2,2g



## Opportunities from progress in culture techniques

### Outdoor

### *Shellfish plot system*



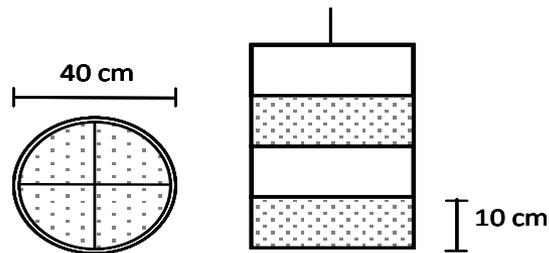
- ✓ Net protection against predators increased survival between 15 and 20% in the first month after restocking;
- ✓ Increase  $\approx 60 \mu\text{m/day}$  in 4 autumn/winter months in in both tested densities;
- ✓ Biomass yield  $\approx 1400\text{g/m}^2$  in high density.
- ✓ Growth: 26 mm of mean length and 5g of mean fresh weight.



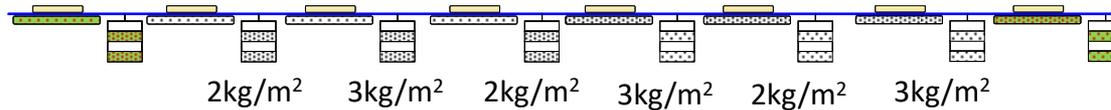
# Opportunities from progress in culture techniques

## Outdoor

### IMTA system



Oyster basket



Initial length: 19 mm

Initial weight: 2,2g



## Opportunities from progress in culture techniques

### Outdoor

#### *IMTA system*



- ✓ Increase  $\approx 85 \mu\text{m/day}$  in 3.8 autumn/winter months in high tested density;
- ✓ Biomass yield  $\approx 2500\text{g/m}^2$
- ✓ Growth: 29 mm of mean length and 7,3g of mean fresh weight.
- ✓ Results of growth better than in shellfish plots
- ✓ Shell deformations.



Processing industry



## Opportunities from progress in culture techniques

### *Conclusions*

- ✓ Potential for aquaculture;
- ✓ Short larval period = more possibility of success and decrease production costs;
- ✓ Production in low-cost systems;
- ✓ Possibility of production in IMTA systems
- ✓ Possibility of production in high densities in shellfish plots
- ✓ Sustainable stock management



Opportunities from progress in culture techniques



Thank you!