

# THE EFFECT OF DIFFERENT STIMULI ON MEAGRE (*Argyrosomus regius*) FEEDING BEHAVIOUR.



**Ioannis E. Papadakis<sup>1</sup>, Nikos Papandroulakis<sup>1</sup>, Alkioni Sfendouraki<sup>2</sup>,  
Veronica Camporesi<sup>3</sup>, Manolis Vasilakis<sup>1</sup>, Constantinos C. Mylonas<sup>1</sup>**

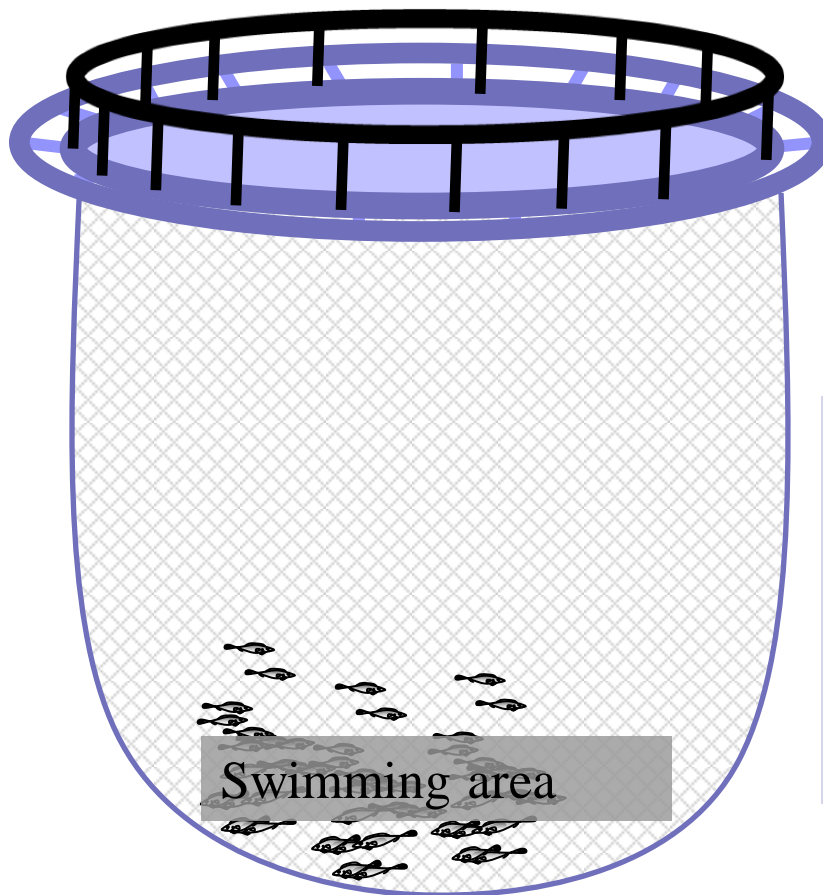
<sup>1</sup>Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Center for Marine Research, Aqualabs, Thalassokosmos, P.O.Box, 2214, Iraklion Crete, 71003. Email: [papad@hcmr.gr](mailto:papad@hcmr.gr)

<sup>2</sup>Biology Department, University of Crete, P.O. Box 2208 Heraklion 714 09 Crete, Greece.

<sup>3</sup>University of Bologna, Dipartimento Di Scienze Mediche Veterinarie. Via Tolara di Sopra, 50- 40064



## The study examines the effect of different stimuli on feeding behavior.



In nature meagre inhabit areas close to the sea bottom.

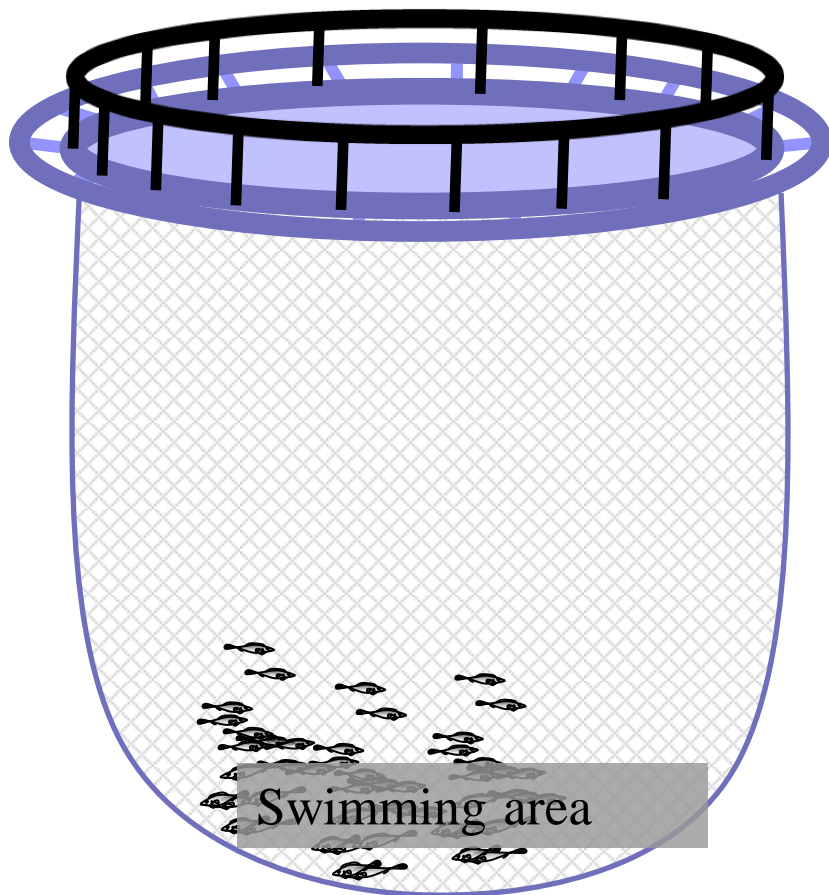
Related to:

- Mouth position.
- Slow swimming activity.
- Visual system (2D vision).

In farming cages fish express the same behavioral pattern inhabiting the lower section of the cage.

Modification by:

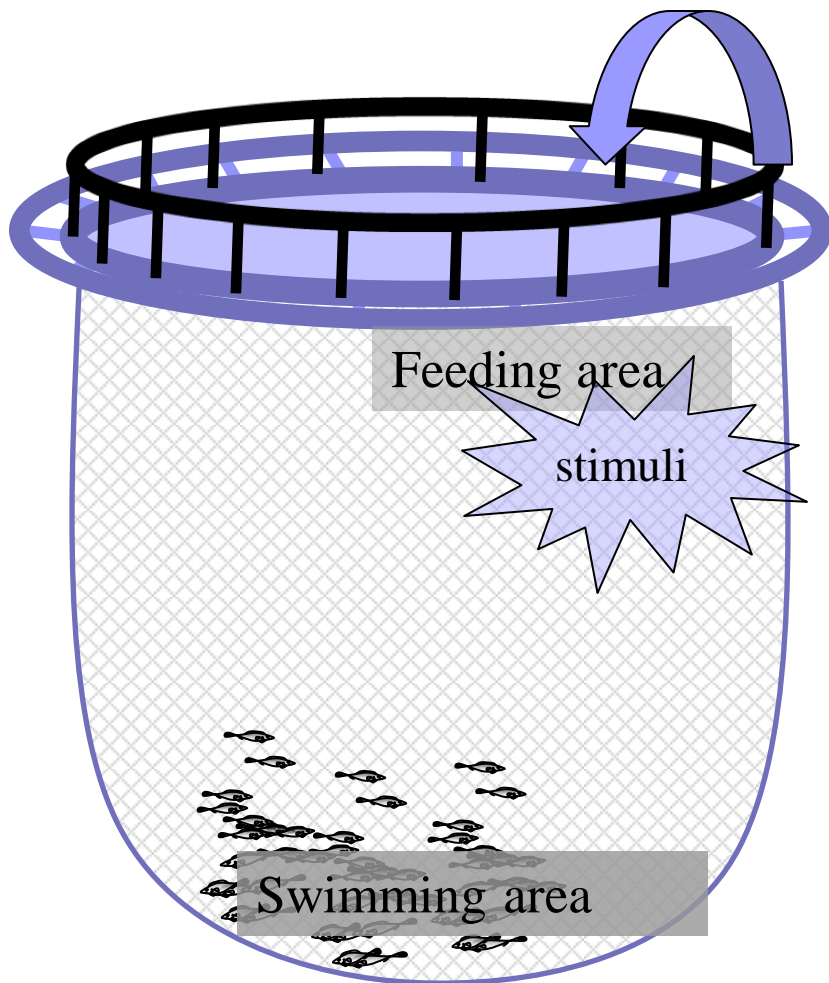
- Light conditions.
- Availability of food.



Feeding in cages is **problematic** because the farmers do not see the fish during the feeding procedure.

**Resulting in:**

- **Loss of food .**
- **High Food Conversion Ratios (FCR).**
- **Increased production costs.**



## Objectives:

Develop a feeding method for cage farming, attracting the population to a **specific feeding area**, where management will be more effective.

The methodology is based on three steps:

1. “**Stimulus**” for the feeding time
2. “**Attraction**” to the feeding area
3. Actual “**Feeding**”

## The stimuli used rely on *vision and mechanoreception.*

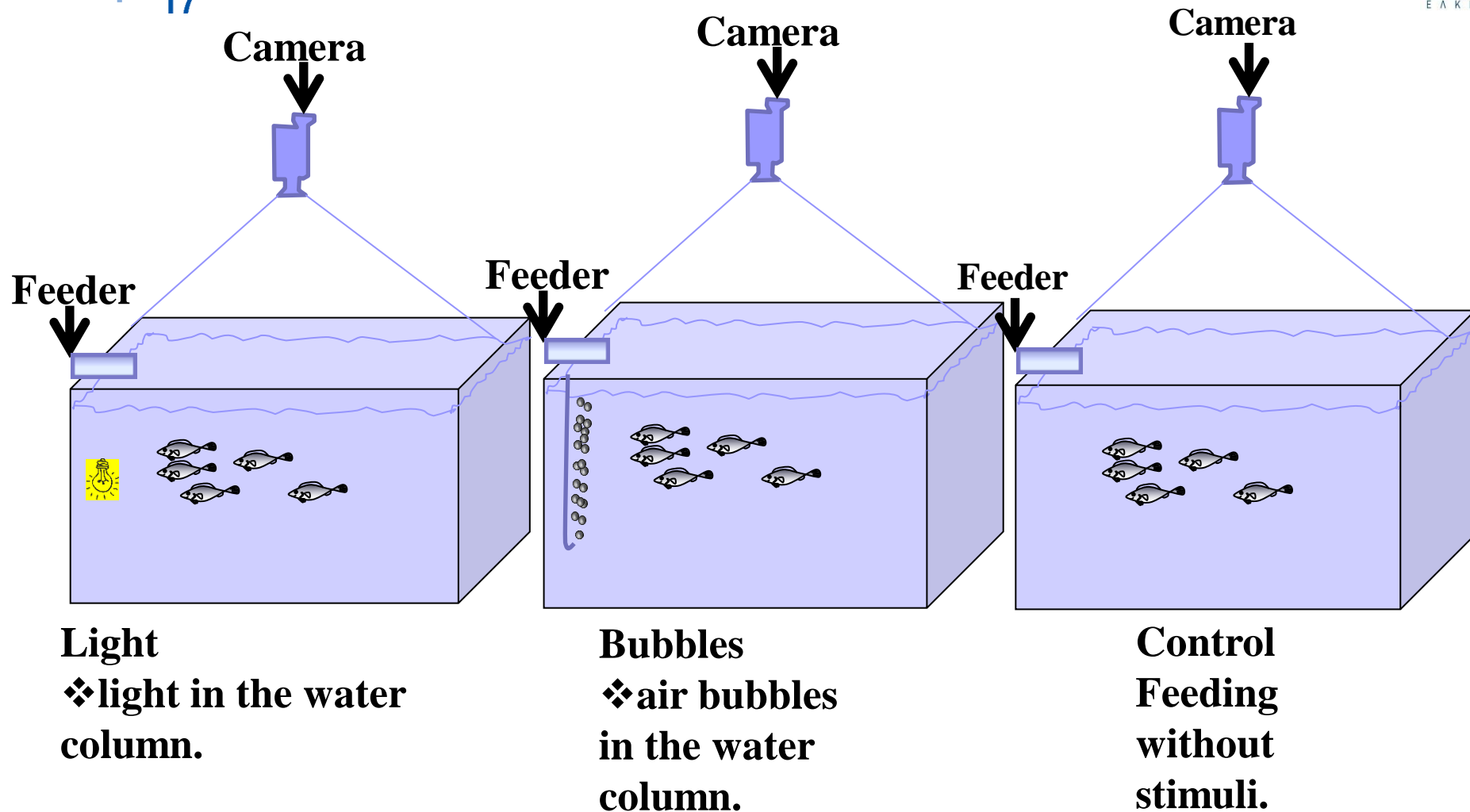
### Stimuli

### Sensory system

- Light (fading) → Vision
- Air bubbles → Mechanoreception and vision

❖ Experiment duration of 60 days.

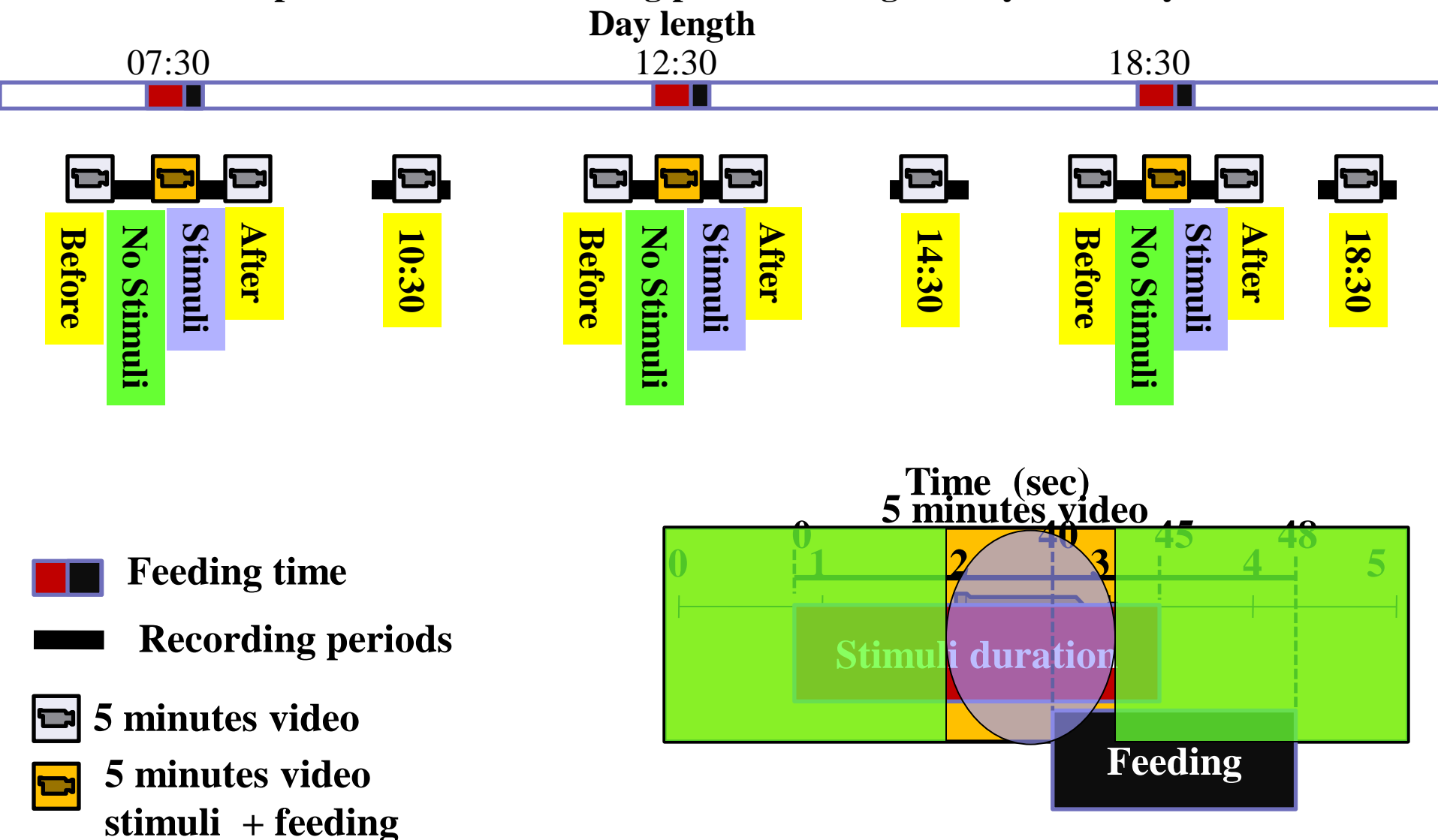
The effect of stimuli on feeding behavior of meagre in natural light conditions.



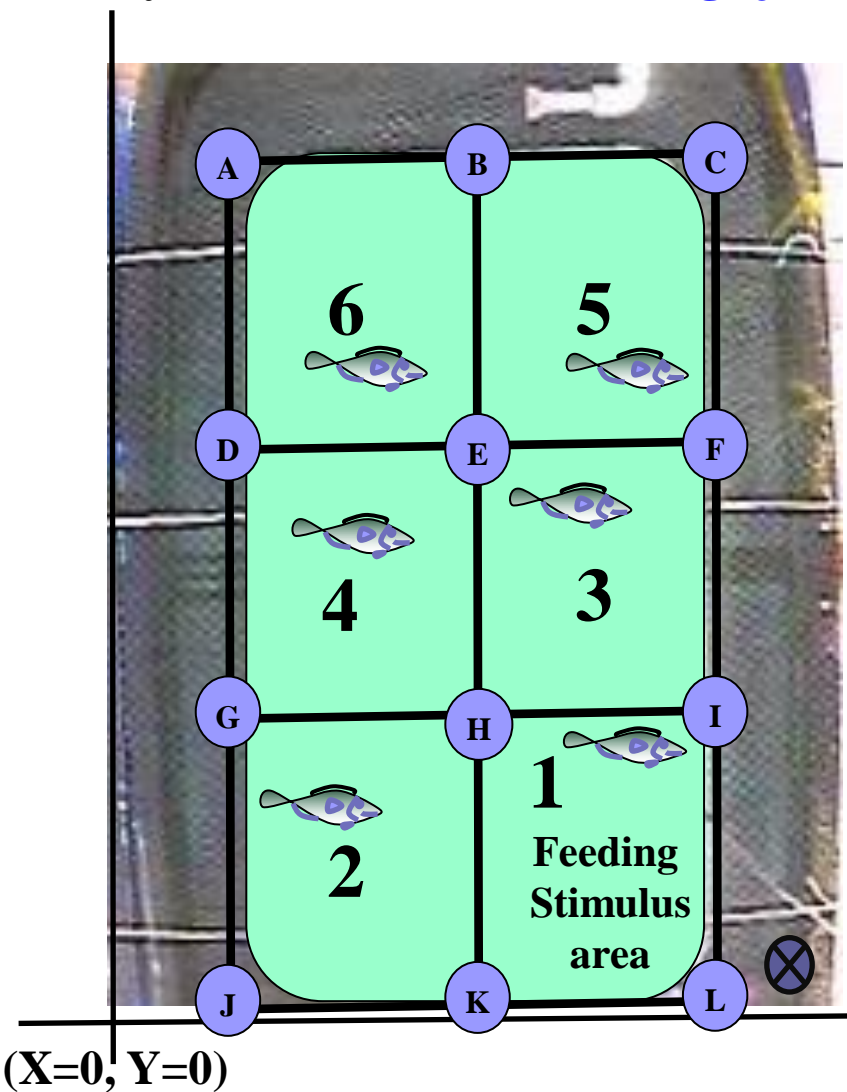
## Experimental conditions:

- 5 m<sup>3</sup> outdoor tanks
- Initial fish weight ( $636 \pm 56$ g)
- 10 individuals in each tank

## Schematic representation of recording periods during the day and analysis of stimuli



## Analysis with Kinovea and Image j



⊗ Place of feeder and stimuli

- Analyzed 70 pictures for each 5 minute video at different times per day.
- The tank was divided in 6 areas.
- The coordinates from the corners from each square were marked.
- ⊙ A = (X<sub>A</sub>, Y<sub>A</sub>), ⊙ B = (X<sub>B</sub>, Y<sub>B</sub>) .....etc.
- Each fish coordinates were extracted using image J: F<sub>n</sub> (X<sub>n</sub>, Y<sub>n</sub>)

### Calculations

IF (X,Y) were between

IF (X,Y) were between

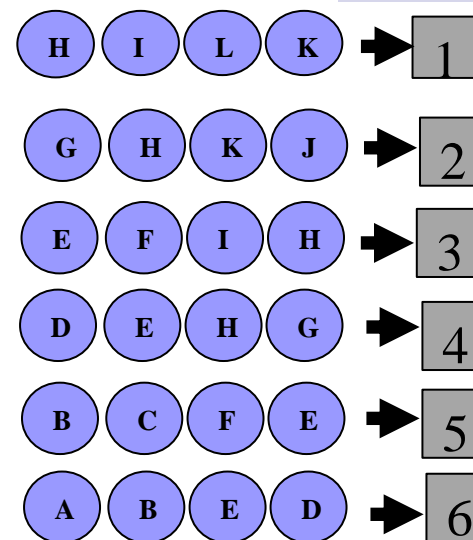
IF (X,Y) were between

IF (X,Y) were between

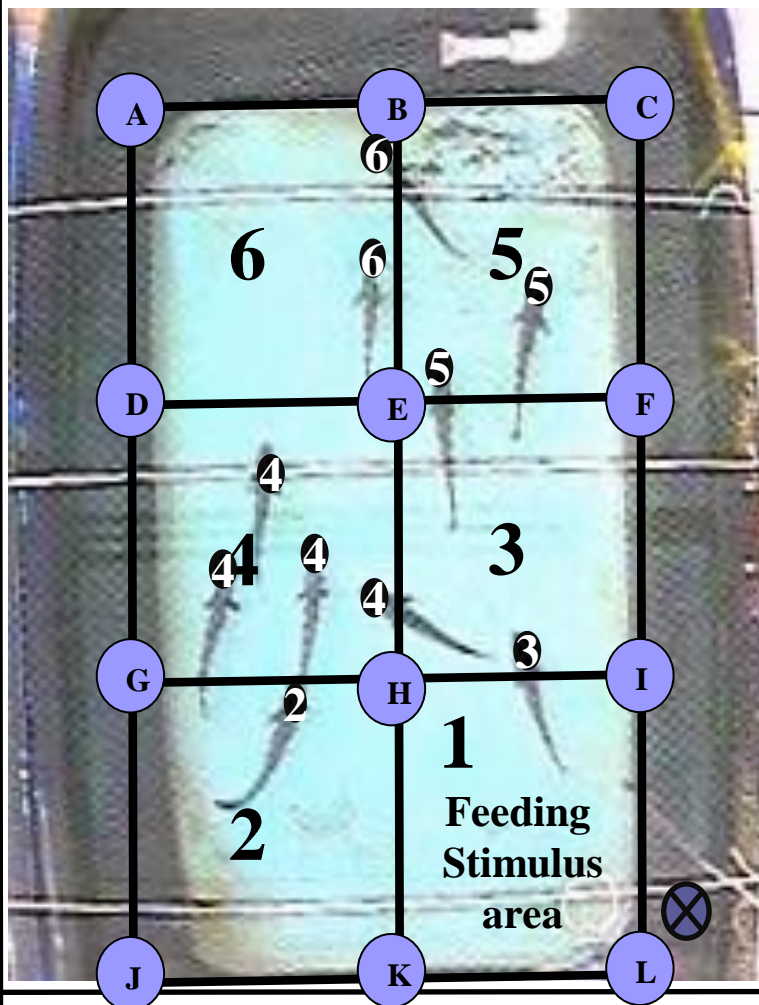
IF (X,Y) were between

IF (X,Y) were between

Area  
number



## Analysis with Image j



(X=0, Y=0)



Place of feeder and stimuli



Place of head of the fish

| Number of area | Number of fish in Each area | % distribution of the fish in each area |
|----------------|-----------------------------|---|
| 1              | 0                           | 0 %                                     |
| 2              | 1                           | 10 %                                    |
| 3              | 1                           | 10 %                                    |
| 4              | 4                           | 40 %                                    |
| 5              | 2                           | 20 %                                    |
| 6              | 2                           | 20 %                                    |

The statistic was performed using the percentages after their transformation in arcsine square root values

(3) 10:30

(4) 12:30

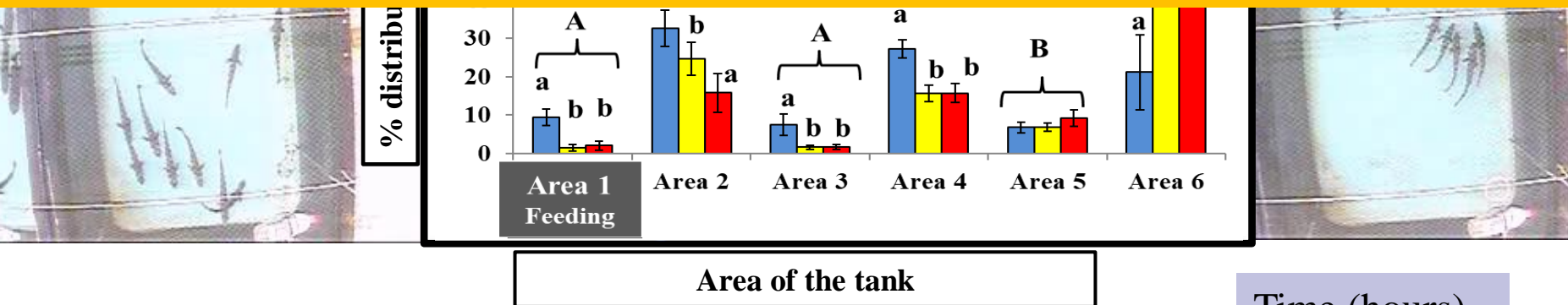
(5) 15:30



❖ Light conditions affect the behavior of meagre.

➤ Meagre during the morning and the afternoon (low light intensity) moved continually and were distributed in all the areas of the tank.

➤ During the other periods of the day (high light intensity), they prefer to inhabit the dusky areas of the tank.



(ANOVA, Duncan test,  $P < 0.05$ )

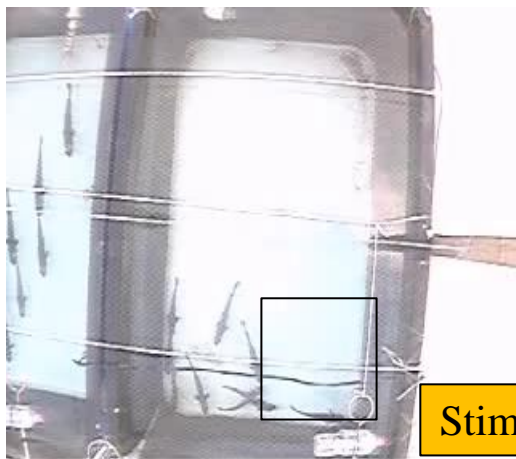
Uppercase letters = differences between areas

Lowercase = differences between conditions for each area

Time (hours)

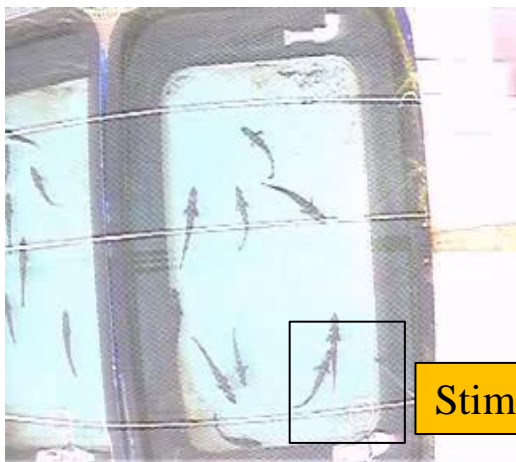
Sun light intensity > 1,000 lux

Light stimulus



Stimuli

Air bubbles stimulus

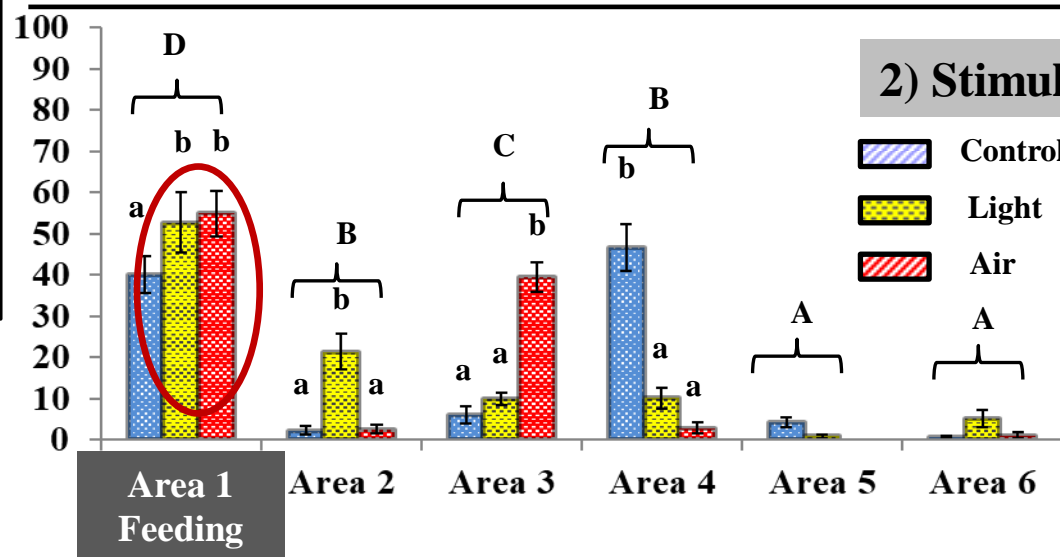
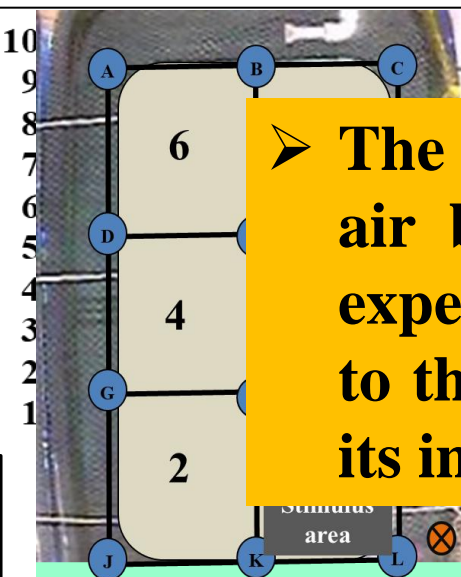


Stimuli

1) Before stimulus

➤ The stimulus of light and air bubbles attracted the experimental population to the feeding area during its implementation.

% distribution of the fish



2) Stimulus

Control  
Light  
Air

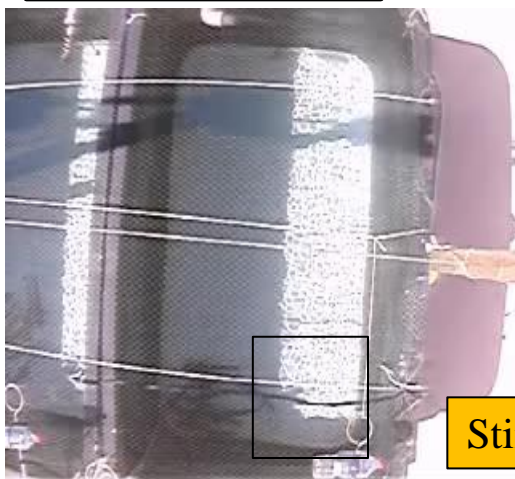
Area of the tank

(ANOVA, Duncan test,  $P < 0.05$ )

- Uppercase letters = differences between areas
- Lowercase = differences between conditions for each area

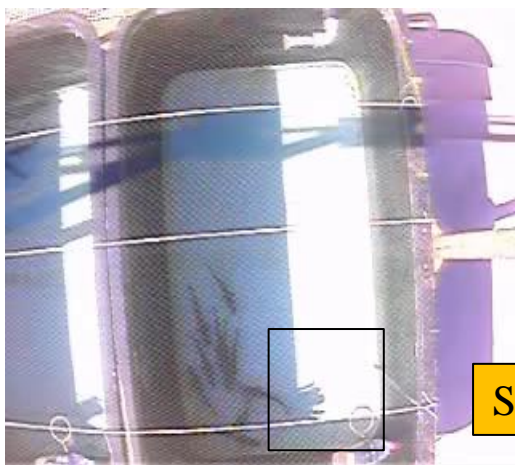
Sun light intensity < 30,000 lux

Light stimulus



Stimuli

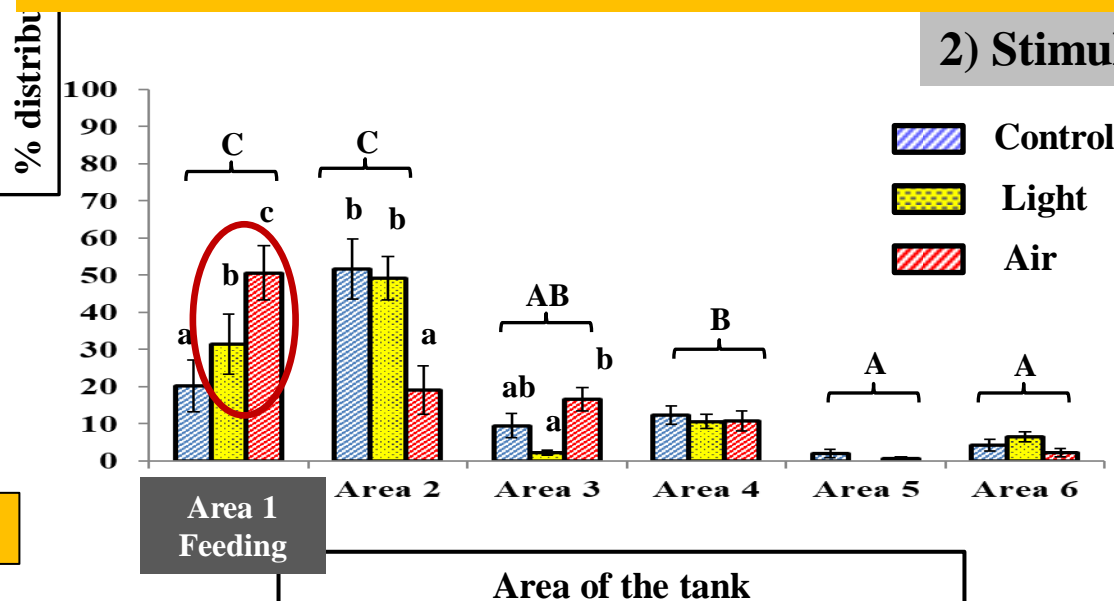
Air bubbles stimulus



Stimuli

- The stimulus of air bubbles attracted the experimental population to the feeding area during its implementation, more than the light.
- The sun light intensity overlapped the light stimulus intensity and the stimulus became not visible.

2) Stimulus



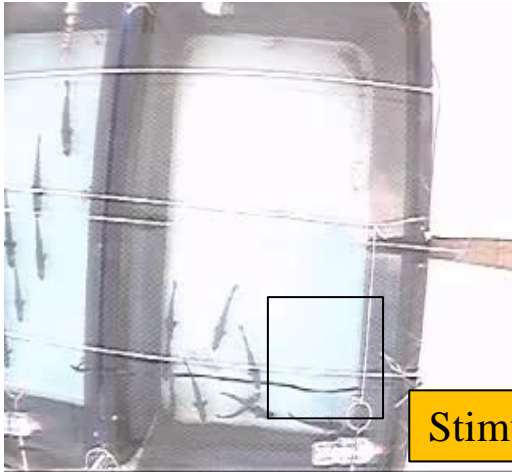
(ANOVA, Duncan test,  $P < 0.05$ )

- Uppercase letters = differences between areas
- Lowercase = differences between conditions for each area

# Results – Stimuli at the afternoon (18:30)

Sun light intensity  
> 1,000 lux

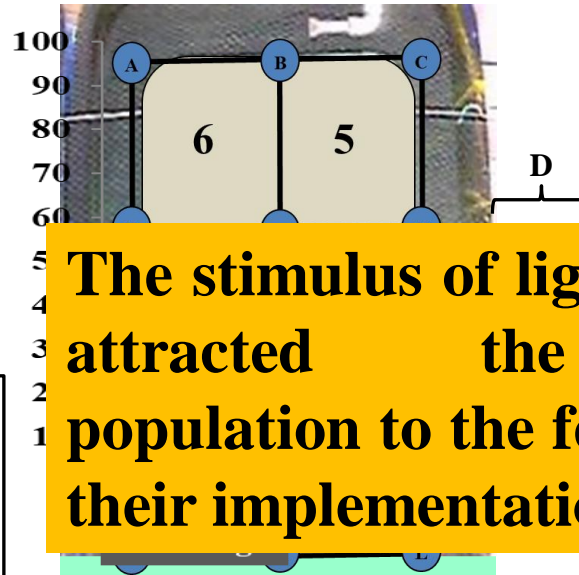
Light stimulus



Air bubbles stimulus

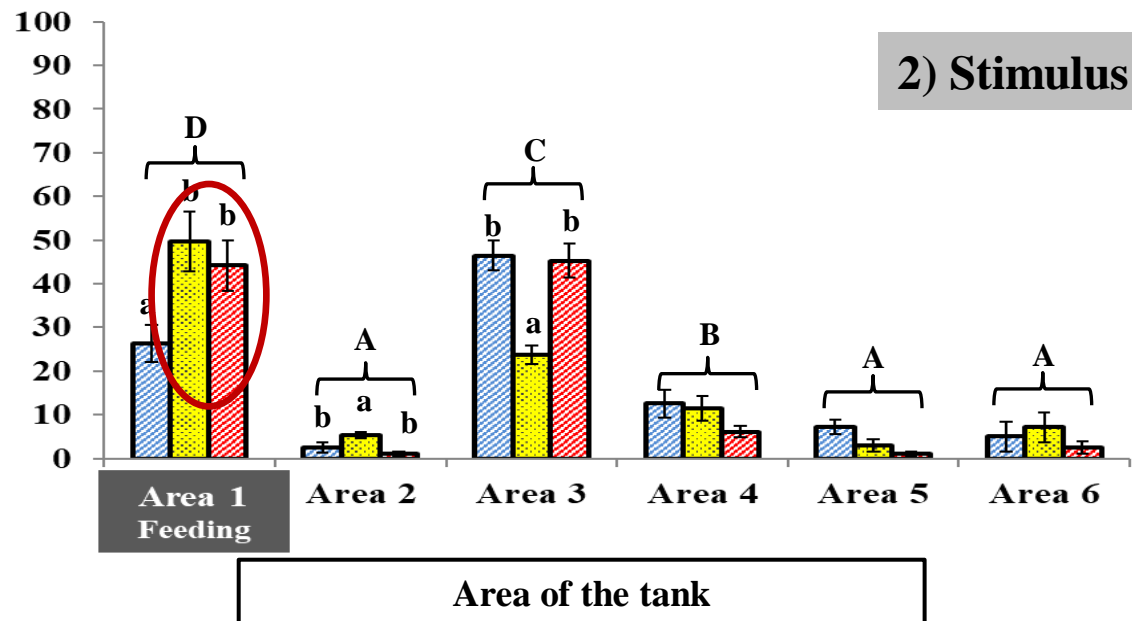


1) Before stimulus



The stimulus of light and air bubbles attracted the experimental population to the feeding area during their implementation.

2) Stimulus



(ANOVA, Duncan test,  $P < 0.05$ )

- Uppercase letters = differences between areas
- Lowercase = differences between conditions for each area

- Light conditions affect the behavior of meagre.
- Meagre without direct sunlight (morning and afternoon) present higher motility than during direct exposure (noon).
- During noon (direct sun light exposure) fish prefer to inhabit dusky areas of the tank.
- Meagre is able to learn and remember specific stimuli that are associated with feeding.
- Meagre responded to air bubbles very quickly (from the second day of application).
- Meagre responded to the light stimulus only without direct sunlight.
  - Inability to see the stimulus?
- Both air bubbles and light or combinations of them can be used in an industrial setting, as they can be manufactured, implemented and managed easily with existing technologies in sea cages.

# Thank you !!!

## THE EFFECT OF DIFFERENT STIMULI ON MEAGRE (*Argyrosomus regius*) FEEDING BEHAVIOUR.

**Ioannis E. Papadakis<sup>1</sup>** ([papad@hcmr.gr](mailto:papad@hcmr.gr))

**Nikos Papandroulakis<sup>1</sup>**

**Alkioni Sfendourakis<sup>2</sup>**

**Veronica Camporesi<sup>3</sup>**

**Manolis Vasilakis<sup>1</sup>**

**Constantinos C. Mylonas<sup>1</sup>**



<sup>1</sup>**Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Center for Marine Research, Aqualabs, Thalassokosmos, P.O.Box, 2214, Iraklion Crete, 71003.**

<sup>2</sup>**Biology Department, University of Crete, P.O. Box 2208 Heraklion 714 09 Crete, Greece.**

<sup>3</sup>**University of Bologna, Dipartimento Di Scienze Mediche Veterinarie. Via Tolara di Sopra, 50- 40064**