

Preliminary study on the regeneration of the operculum complex in sea bream (*Sparus aurata*) juveniles

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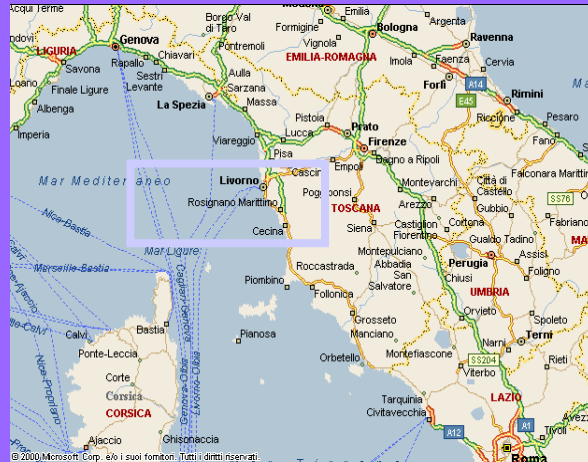
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Workshop “Deformities in Fish Larvae”

11 March 2005, Brussels, Belgium

MARICOLTURA di ROSIGNANO SOLVAY (MRS) is a modern medium size hatchery located in Tuscany close to Livorno 120 Km from Firenze.

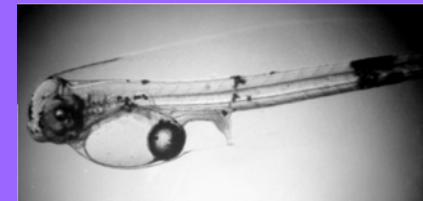
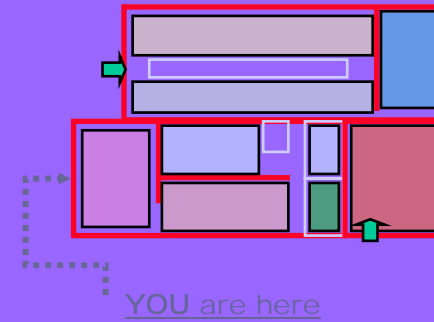
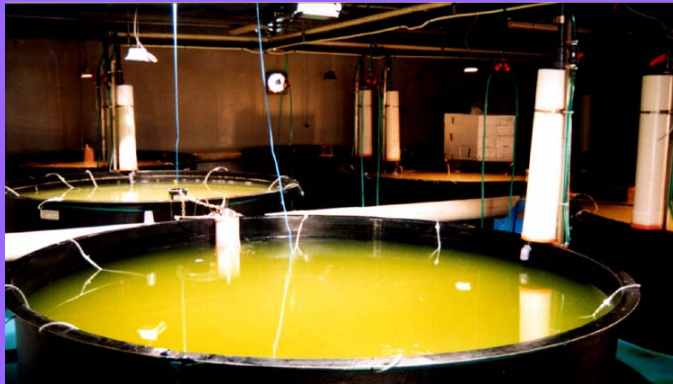


The farm has been built in '95 and insist on a total surface of 11.000 sq meters with an annual capacity of around 4 million fry.

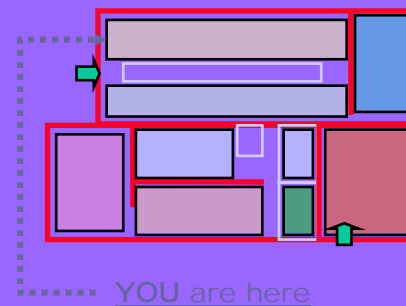


MARICOLTURA DI ROSIGNANO SOLVAY

Larval rearing unit consisting of 8 x 6000 litre tanks.
All tanks are automatically temperature and D.O.-
controlled and semi-closed circuits are available with
heated and cooled water



Nursery and weaning unit both with flow-through and semi closed opportunities consisting of 10 tanks of 10.000 litres and 7 tanks of 20.000 liters with automatic temperature, automatic feeding system and D.O. control



Deformities

- Operculum *
- Skeletal
- Head

Causes

Nutrition

- Vitamin C
- Vitamin D
- Vitamin A
- PL
- FA
- Peptides & AA

Mechanical

- Hydrology
- Crowding
- Particle size
- Hyperventilation

Temperature

Light

Salinity

pH

Gas saturation

Infections

Hormones

Genetics

...

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Introduction

Operculum deformities

What?

- Most common cephalic deformity in gilthead Sea bream.
- Folding of the operculum towards the gill cavity
- Reduction of the commercial value



When?

- Earliest observations day 17-20 (Galeotti et al, 2000)
- All stages until adult, with peak around 70-80 days (less than 0.8g)



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Introduction

- Incidence? Slight to very heavy, unilateral or bilateral
- Causes?
- Mechanical factors?
 - Abnormal mineralization (Galeotti et al., 2000)?
 - Environmental factors during (post) embryogenesis? (Adams and Niswander, 1967) and larval rearing?
 - Nutritional factors during larval rearing? (Calcium salts, vitamin C, D, (n-3) HUFA...)
- Recovery: Factors enhancing the regeneration of the operculum?

What do we know so far on the regeneration?

Presentation at EAS2004:

The influence of light conditions on the operculum regeneration of Sea bream fry

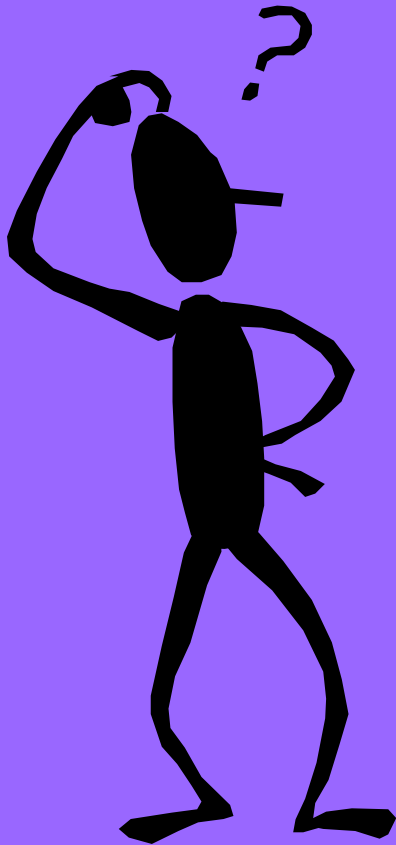
De Wolf T. et al. (2004)

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CONCLUSIONS EAS 2004

- Sea bream fry, showing operculum deformities in early stages (<1g), are able to recover to a great extent the opercular complex, achieving again a “normal” aspect
- Recovery takes place at a large range of light intensities
- Best recovery takes place under conditions of natural, shaded sunlight (5000lux)
- Histological examinations are confirming the good recovery of the opercular complex



What is happening during the “regeneration” of the operculum cover?

Materials and Methods

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Test set-up

Selection of Seabream fry:

- Selected deopercolated fry with heavy monolateral operculum lack (>80% of gills exposed)
- 180 fish of 5g initial weight were stocked in a 500l tank with flow through, natural, filtered seawater (15/07/04). Last evaluation was done on 20g fry
- Regular check of individuals that “recovered” the operculum up to different degrees
- Selected a “series” => histological analyses

Analyses on the Fry

Histological examination:

- Fishes were fixed in 10% buffered neutral formalin, decalcified with 5% nitric acid and embedded in a glycol methacrylate resin (J-B4, Polysciences, Inc.). Sections of 5 μm were cut and stained with methylene blue and toluidine blue
- Analyses on different stages of operculum recovery



6

5

4

3

2

1

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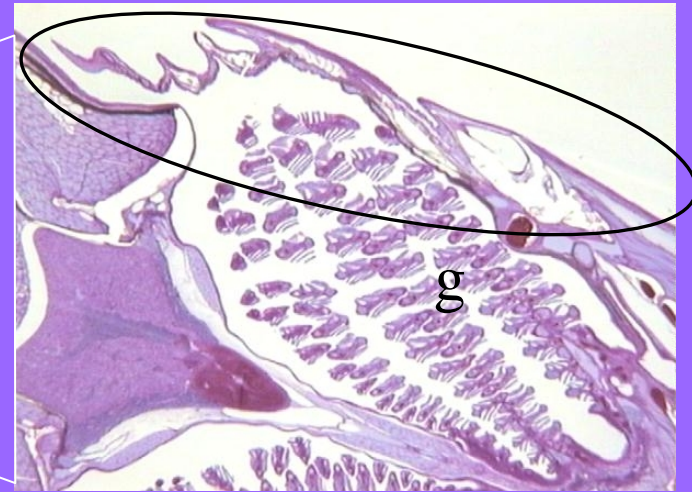
Results

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Histological examination

Frontal sections (intro)

Normal operculum



Gill cavity is completely covered by the operculum complex

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Histological examination

Frontal sections (intro)

Altered operculum



Operculum is folded towards the gill cavity and exposing the gills to the environment

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Histological examination

Frontal sections (intro)

“Recovered” operculum



Opercular complex is re-formed and closing the gill cavity

Macroscopical examination of the different degrees of operculum recovery



6

5

4

3

2

1

95%

85%

60%

30%

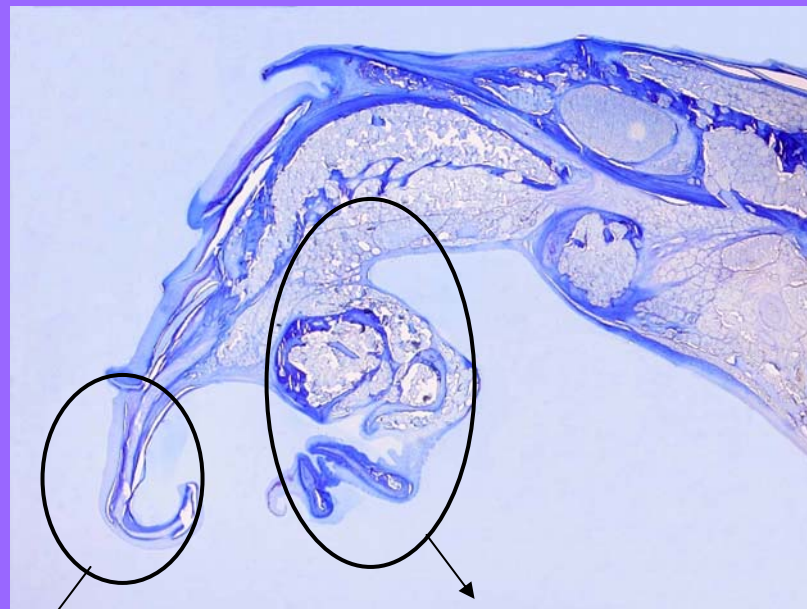
20%

10%

Histological examination of the different degrees of operculum recovery



Covering 10% of operc. cavity



“old” operculum structure, folded inwards, compressed

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Histological examination of the different degrees of operculum recovery

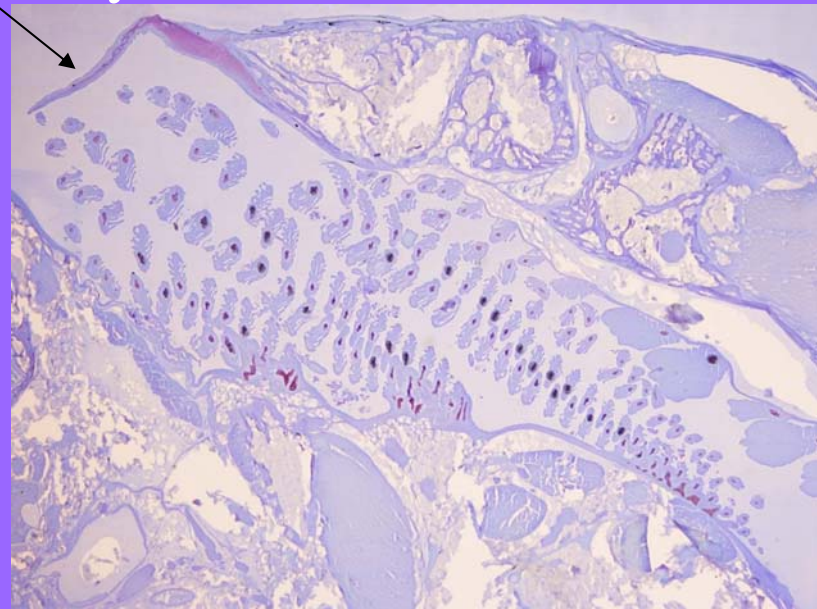


Elongation-extension of the apical part (connective tissue)



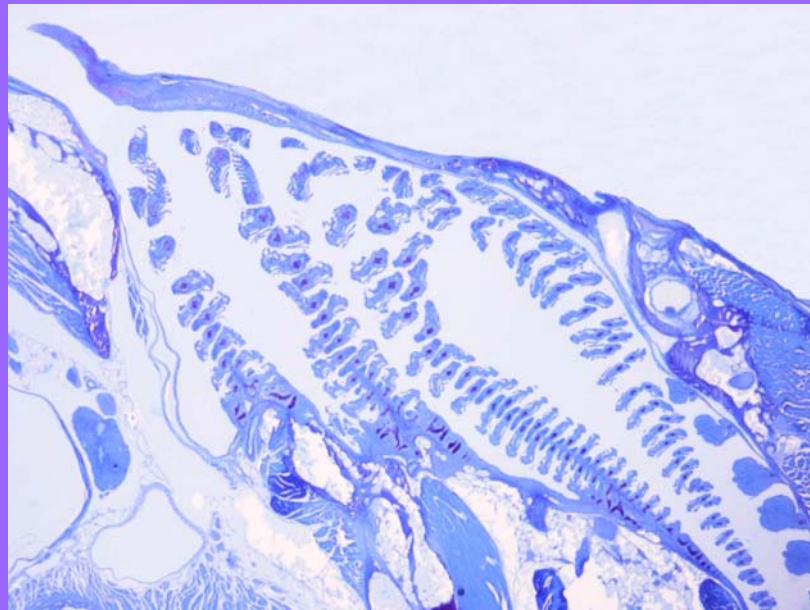
Histological examination of the different degrees of operculum recovery

Elongation-extension of the apical part, closing almost the gill cavity



Histological examination of the different degrees of operculum recovery

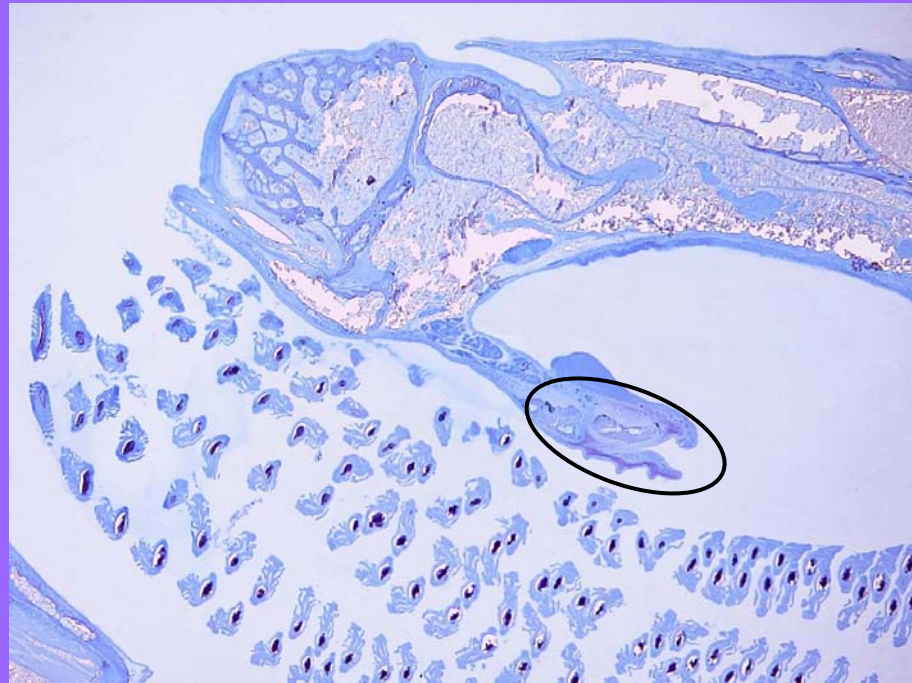
Gill cavity is closed completely, start differentiation of apical part



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Histological examination of “exceptional” cases

Apical part remains inside
operculum cavity - elongation (and
thus recovery) is very unlikely



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Conclusions

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CONCLUSIONS

- Histological examinations are hypothesising an elongation of the apical part of the operculum cover (connective tissue) until the gill cavity is covered. Afterwards a differentiation of the cells is likely
- More studies are needed to understand the causes of the malformation, in order to avoid the problem and to reduce economical losses for fry producers