WP4 Abiotic Factors of Tank Environment

Temperature limits for early development of sea bream and sea bass

Rearing performance

Dr. Pantelis Katharios
Institute of Aquaculture, HCMR

Sea bream

OBJECTIVE

- Identify the effect of temperature on sea bream deformation response under industrial conditions

APROACH

- Sea bream culture under 6 different temperature schemes (HCMR)
- Samplings at certain developmental stages
- Sample analysis by UoP and RVC

Experimental design

Experimental scheme	16°C	19°C	22°C
A	Autotrophic phase	Exotrophic phase	
B		Autotrophic phase	Exotrophic phase
C		Exotrophic phase	Autotrophic phase
D	Auto & Exotrophic		
E		Auto & Exotrophic	
F			Auto & Exotrophic

The hatchery

- 6 close systems
- 12 tanks stocked with 50000 eggs each
- Temperature control
- Cooling device
- Heater
- Electronically controlled

Rearing methodology

- Pseudogreen technique

Papandroulakis, N., Divanach, P., Anastasiadis, P. & Kentouri, M. 2001. The pseudo-green water technique for intensive rearing of sea bream (Sparus aurata) larvae. Aquaculture International 9: 205-216.

Rearing methodology

- 500-L tanks
- 8-10 L microalgae (*Chlorella minutissima*)
- Water circulation through biological filters until first feeding – autonomous thereafter.
- Water renewal 3% daily (early stages), 50% daily (7 mm), >100% (artificial food)
- Borehole water
- Salinity: 35 ppt
- 24-h photophase
- Enriched rotifers, enriched artemia, artificial food

Feeds and Enrichments

Rotifers — DHA PROTEIN SELCO

Moisture	5%	Vit. A	1,500,000 IU/kg
Crude protein	27%	Vit. D3	100,000 IU/kg
Crude lipids	28%	Vit. E	7,200 mg/kg
Crude ash	7%	Vit. C	20,000 mg/kg
		Sum ω3 HUFA	5 mg/g dwt

Artemia

EASY DHA SELCO

Moisture	30%
Crude Lipids	67%
Crude Ash	1%
Crude Fiber	1%
Phosphorus	0.2%
Vit. A	1,500,00 IU/kg
Vit. D3	150,000 IU/kg
Vit. E	3,600 mg/kg
Vit. C	800 mg/kg
Antioxidants	Ethoxyquin, BHA
DHA/EPA	2.5
Sum(n-3)HUFA	min. 200 mg/g dwt

EASY SUPER SELCO

Moisture	30%
Crude Lipids	67%
Crude Ash	1%
Crude Fiber	1%
Phosphorus	0.2%
Vit. A	1,500,00 IU/kg
Vit. D3	150,000 IU/kg
Vit. E	3,600 mg/kg
Vit. C	800 mg/kg
Antioxidants	Ethoxyquin, BHA
DHA/EPA	1
Sum(n-3)HUFA	min. 400 mg/g dwt

Artificial feeds

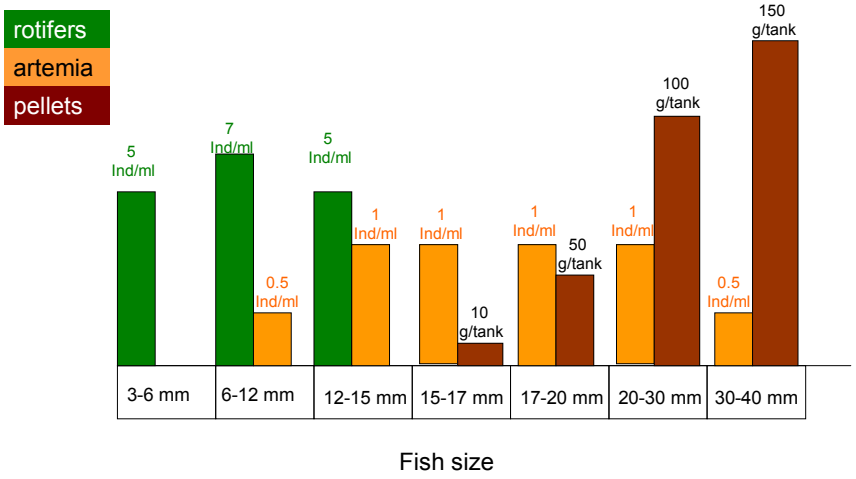
PROTON

Moisture	7%	Vit. A3	30,000 IU/kg
Crude protein	54%	Vit. D3	2,500 IU/kg
Crude lipids	15%	Vit. E	700 mg/kg
DHA/EPA	2	Vit. C	2,000 mg/kg
Sum ω3 HUFA		Antioxidants	ethoxyquine, BHT, propylgallate

ALFA

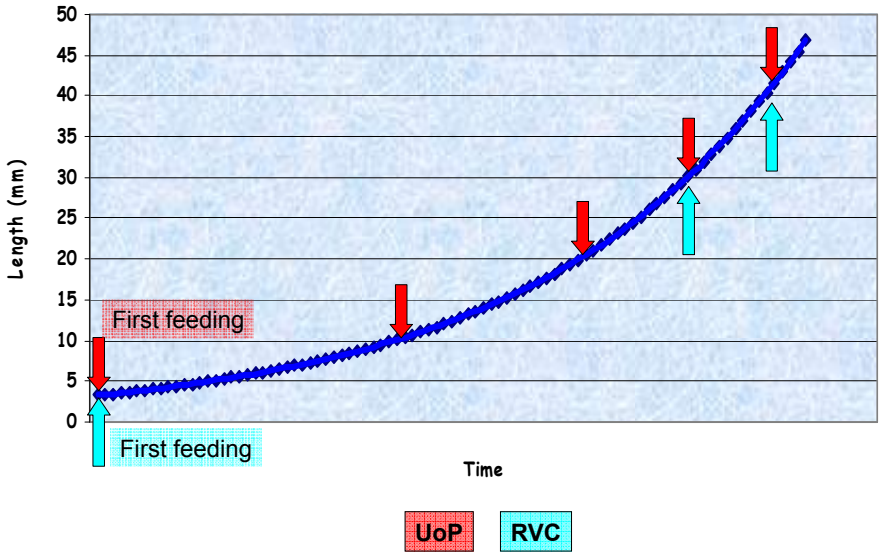
Moisture	7%
Crude protein	54%
Crude lipids	14%
Vit. A	12,500 IU/kg
Vit. D3	2,500 IU/kg
Vit. E	350 mg/kg

Feeding regime



Sea bream

Samplings



Samplings

University of Patras

First feeding 10 mm 20 mm 30 mm	200 individuals Formalin fixed
1 g	100 individuals frozen

Royal Veterinary College

First feeding	30-50 individuals Glutaraldehyde and RNAlater
30 mm 1 g	10 individuals Glutaraldehyde RNAlater

Rearing performance

- Growth
- Survival

Rearing performance

- No statistical differences between replicates
- Significant differences among treatments

Treatment	*Growth rates*	*Survival*
22ºC	3.375	9.80 (1.32)
19→22ºC	3.210	17.10 (1.53)
19ºC	3.015	13.03 (1.74)
16→19ºC	2.950	29.6 (4.35)
22→19ºC	2.760	7.42 (0.35)
16ºC	2.230	12.08 (2.28)

CONCLUSIONS

Higher temperatures ……higher growth rates
Highest growth: 22ºC
Lowest growth: 16ºC

Highest survival: 16-19ºC
Lowest survival: 22-19ºC

Sea bass

OBJECTIVE

- Identify the effect of temperature on sea bass deformation response under industrial conditions

APROACH

- Sea bass culture under 6 different temperature schemes (HCMR)
- Samplings at certain developmental stages
- Sample analysis by UoP

Experimental design

Common conditions
>16-18 mm …. 19ºC

Experimental scheme	15ºC	18ºC	21ºC
A	Autotrophic phase	Exotrophic phase	
B		Autotrophic phase	Exotrophic phase
C		Exotrophic phase	Autotrophic phase
D	Auto & Exotrophic		
E		Auto & Exotrophic	
F			Auto & Exotrophic

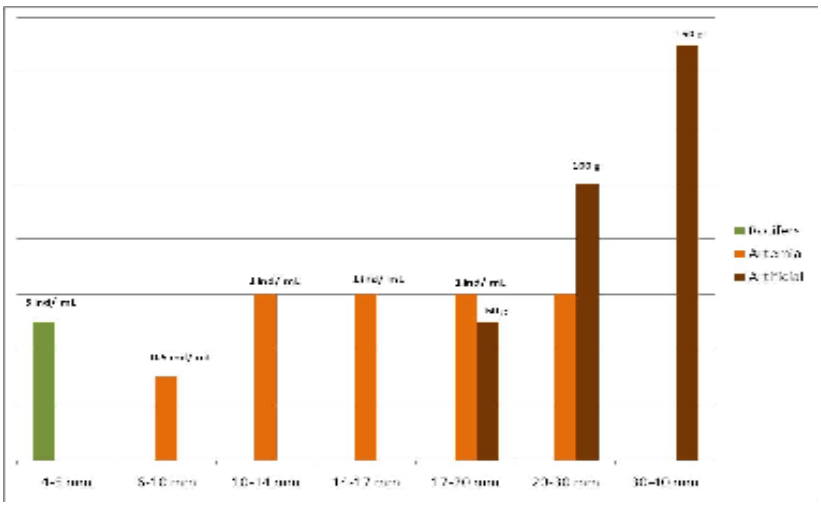
Rearing methodology

Divanach, P., Papandroulakis, N., Anastasiadis, P., Koumoundouros, G & Kentouri, M. 1997. Effect of water currents on the development of skeletal deformities in sea bass (*Dicentrarchus labrax* L.) with functional swimbladder during postlarval and nursery phase

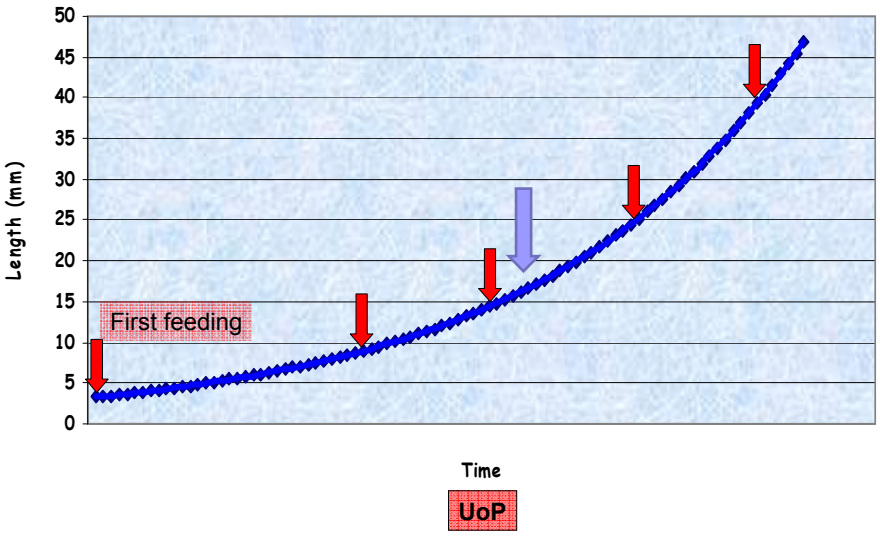
Rearing methodology

- 500-L tanks / 50.000 eggs
- 0.5/ L dense microalgae (*Chlorella minutissima*)
- Water renewal 3-5% daily (early stages), (20% - 50%)
- Borehole water
- Salinity: 35 ppt
- 12L:12D photophase
- Enriched rotifers, enriched Artemia, artificial food

Feeding regime



Samplings



Samplings

University of Patras

■ First feeding ■ 9 mm ■ 15 mm ■ 25 mm	100-200 individuals Formalin fixed
■ 1 g	100 individuals frozen

Rearing performance

- Growth
- Survival

Rearing performance

- No statistical differences between replicates
- Significant differences among treatments

Treatment	*Growth rates*	*Survival 1*	*Survival 2*
21ºC	0.365	18.7	52.1
18→21ºC	0.365	22.5	63.2
18ºC	0.34	30.6	73.6
15→18ºC	0.33	43.2	72.6
21→18ºC	0.33	21.7	62.1
15ºC	**0.26**	42	73.8

CONCLUSIONS

No statistical differences between replicates (except D1-D2)

Higher temperatures ……higher growth rates
Highest growth: 21ºC
Lowest growth: 15ºC

CONCLUSIONS

Survival 1: Until common conditions (<16-18 mm)

Lower temperatures…..higher survival
Best scheme ……. 15 >18ºC

Survival 2: Common conditions (>16-18 mm)

Lower temperatures…..higher survival
Best scheme…….. 15ºC

END OF PART 1

….to be continued (by Giorgos Koumoundouros)