

Grow out of greater amberjack

- Temperature tolerance ranges
- Husbandry in sea cages

HCMR: N. Papandroulakis, P. Pereira, A. Tsalafouta, M. Henry, P. Anastasiadis
FCPCT: A. Fernandez-Montero, M. J. Caballero, S. Torrecillas, L. Robaina, D. Montero
FORKYS SA: A. Ploumis,
Argosaronikos SA: T. Raftopoulos



**Workshop on greater amberjack (*Seriola dumerili*) aquaculture:
Results from the DIVERSIFY project.
18th September 2018, Electra Metropolis Hotel, Athens (Greece)**



- The definition of the appropriate temperature ranges is of great importance in order to properly select the geographical areas for industrial production
 - 14-17°C representing the lower temperatures observed in Mediterranean open sea and
 - 26-29°C representing the upper temperatures observed in Mediterranean open sea

- Cage rearing is essential for the industrial application, but appears to be challenging
 - performed in industrial scale to define the rearing conditions and develop appropriate methodologies and practices



Temperature tolerance ranges

A. Juveniles

A. Fernandez-Montero, M. J. Caballero, S. Torrecillas, L. Robaina, D. Montero

- Three temperature treatments 17, 22 and 26 °C, in triplicate.
- 9 cylindroconical 500 l tanks
 - 3x3 tanks RAS
 - D.O. $\sim 7.8 \text{ mg l}^{-1}$
- 225 juveniles of $19.5 \pm 4.1 \text{ g}$
 - 25 individuals per tank
- Feeding
 - to apparent satiety $3 \times \text{d}^{-1}$
 - commercial diet (52% protein and 20 % lipids)
- Duration 120 days

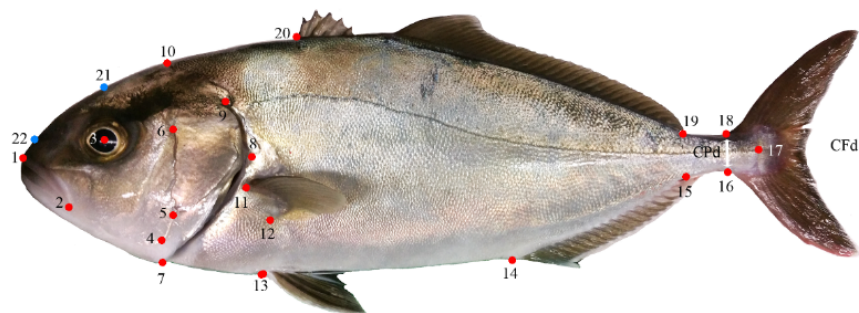


■ Monitoring

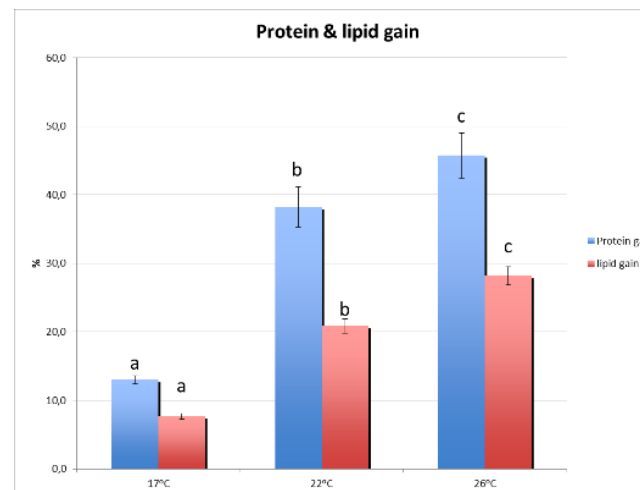
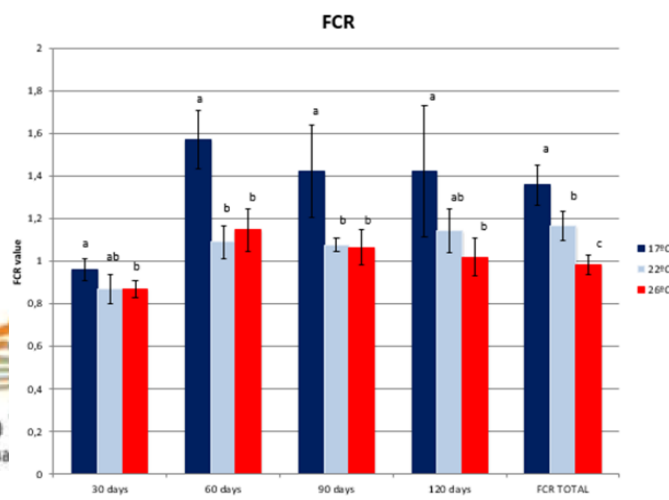
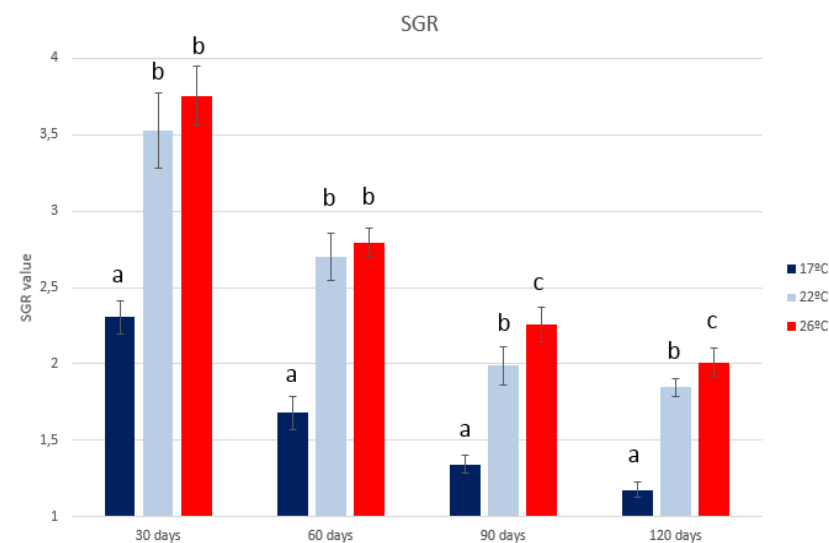
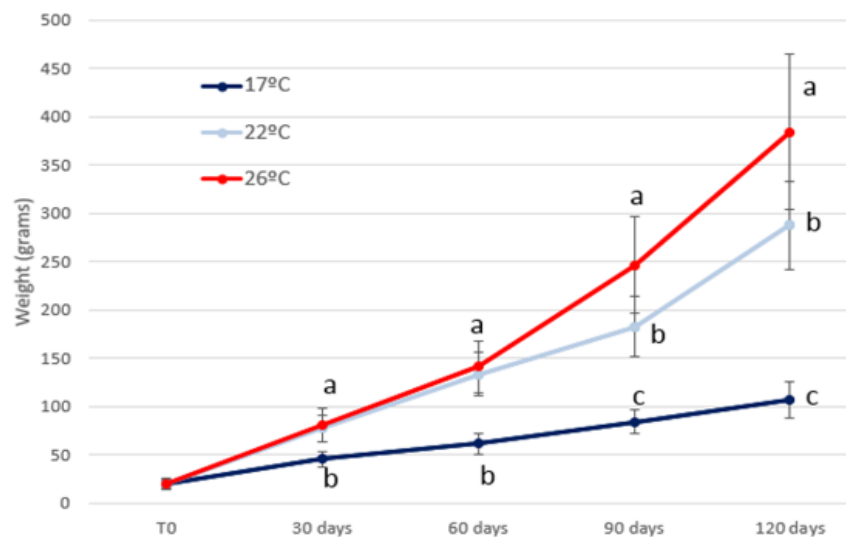
- Biological performance

- Body shape

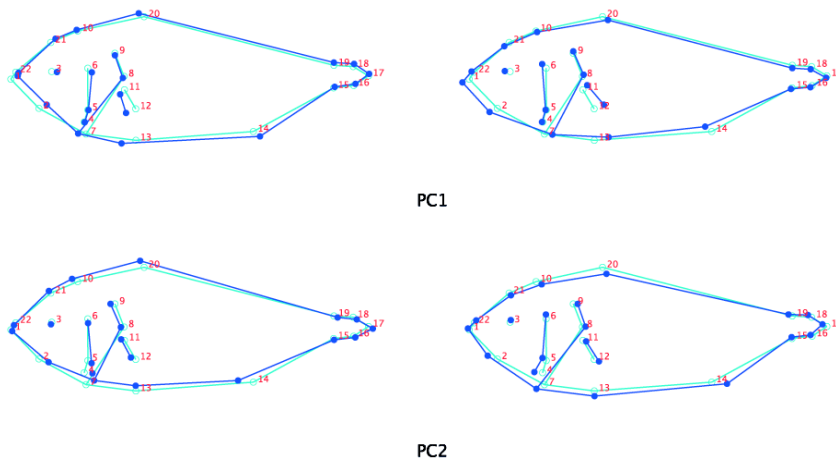
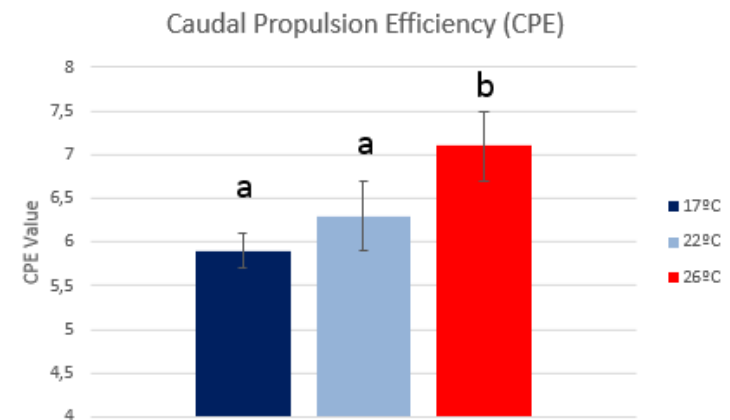
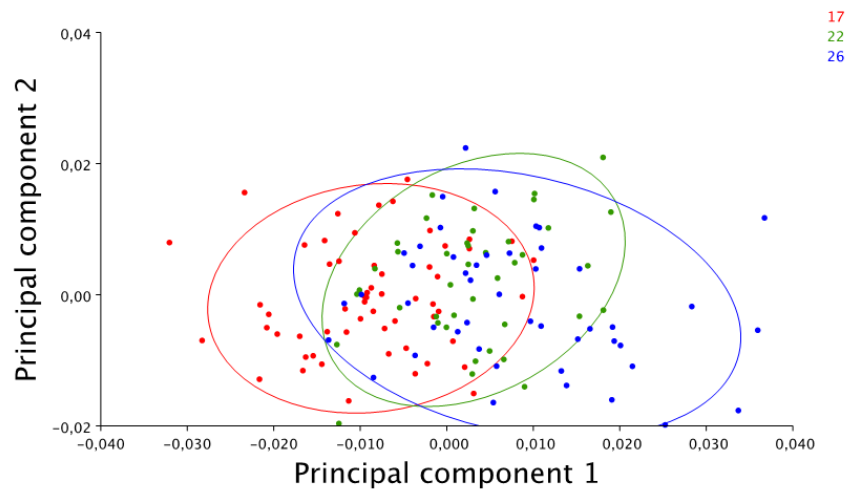
- Estimate the caudal propulsion efficiency



Results (1)



Results (2)



Real images of specimens reared at 17°C and 26°C

Temperature tolerance ranges

B. Individuals of 350g

N. Papandroulakis, P. Pereira, A. Tsalafouta, P. Anastasiadis

- Three temperatures 16, 21 and 26 °C, in triplicate
- 9 cylindroconical 500 l tanks
 - 3x3 tanks RAS
 - S: 38 psu, pH: 7.6 – 8.0, D.O. ~7.8 mg l⁻¹
 - photoperiod 12L/12D
- 108 individuals of 325.6 ± 24.2g
 - 12 individuals per tank
- Feeding
 - ad libitum 2x d⁻¹ (09.30 - 12.30 h) and with a belt feeder (14.30 - 20.00 h)
 - commercial diet (52% protein and 20 % lipids)
- Duration 100 days



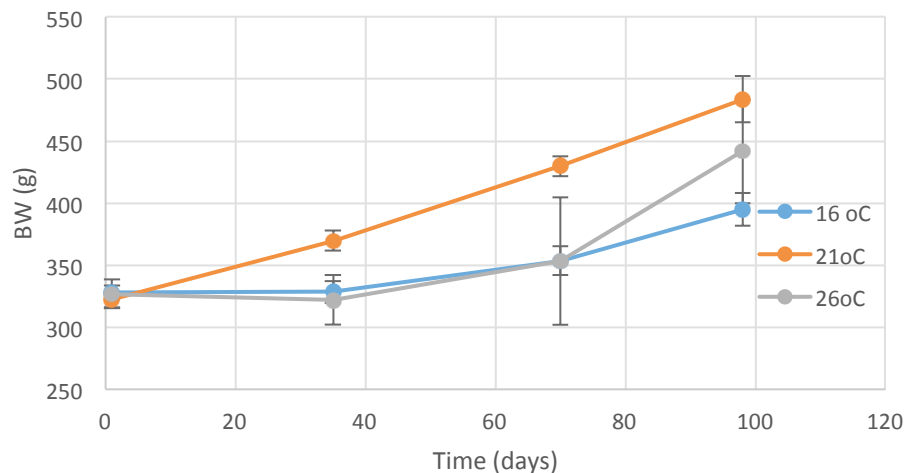
■ Monitoring

- Biological performance
- Physiological parameters
 - Hematological
 - Biochemical
 - Hormonal

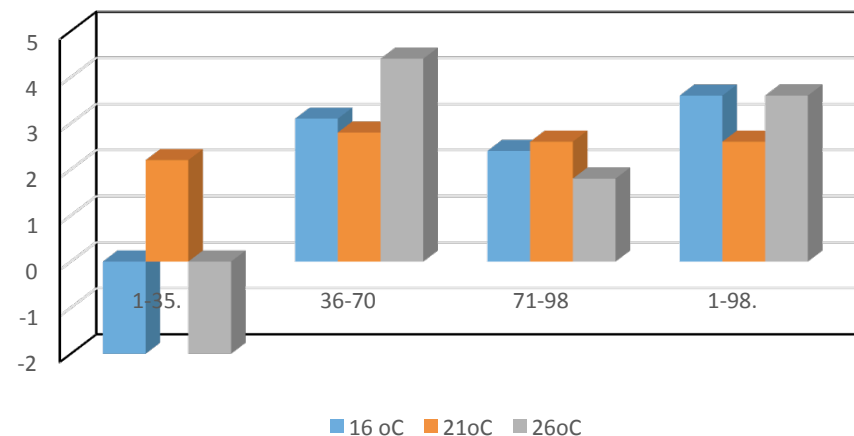


Results (1)

Body weight

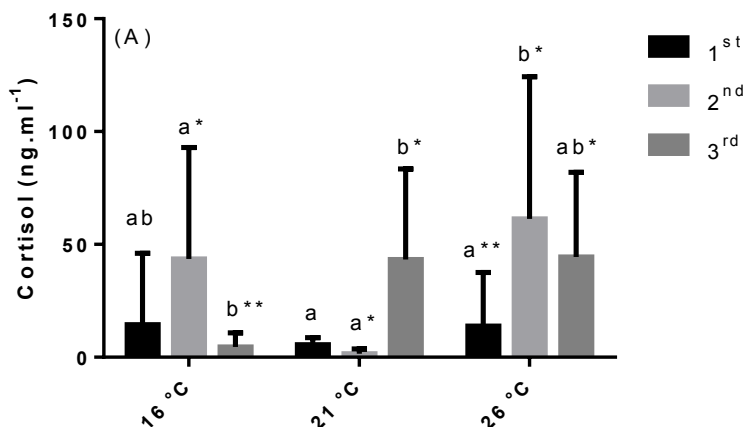


FCR



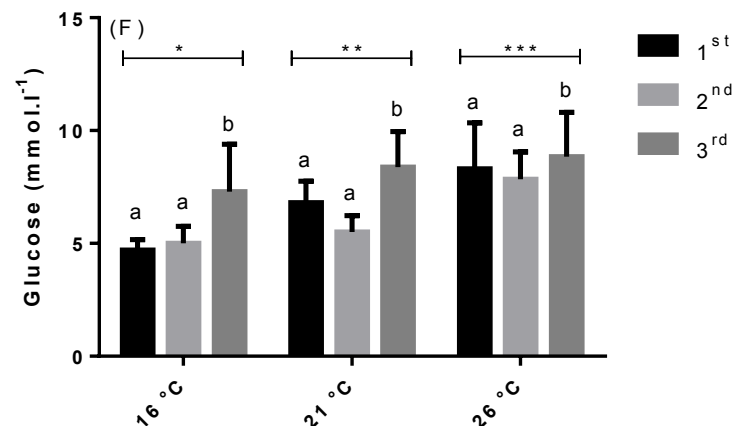
	16°C	21°C	26°C
Survival Rate (%)	94.4 ± 4.8	83.8 ± 8.3	75.0 ± 14.4

Results (2)



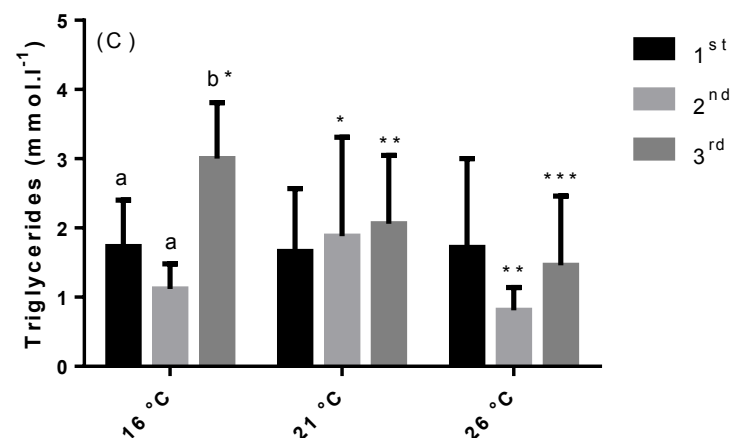
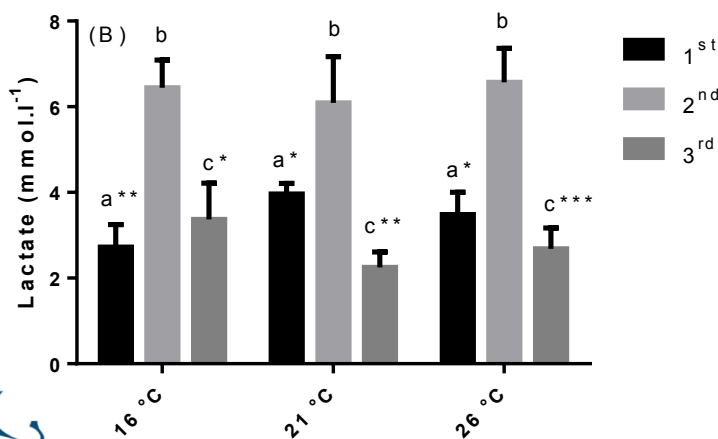
Cortisol

- high inter-individual variability
- existence of LR /HR individuals?



Glucose

- increased values with increasing temperatures,
- physiological response to cope with increasing metabolic demand



Low triglyceride levels in relation to high glucose

- individuals at a good nutrition level

Temperature tolerance ranges

☐ Juveniles of 20-300 g

- perform better at 26 than 21 and 17 in terms of growth and body morphology
- fish at 26°C presented elongated body (similar to wild fish)
- fish at 17°C showed a more rounded head.
- higher caudal propulsion efficiency index (CPE) in fish at 26°C
 - ☐ improved movement efficiency during swimming



Temperature tolerance ranges

- Individuals of 350g
 - perform better at 21°C than 26°C and 16°C
 - individuals at 26°C seemed to display compensatory growth throughout the last month

- A shift in optimum temperature according to changes in body size is common in most ectotherms



Development of rearing method in cages

Nikos Papandroulakis, Aleka Tsalafouta, Morgane Henry, Panayiotis Anastasiadis, Antonis Ploumis, Tassos Raftopoulos

- Two trials in commercial cages for 12 months
- Initial objective: effect of cage volume

FORKYS (2016)

- 12,000 ind at 10g
- Two cages 2,800 and 1,600 m³

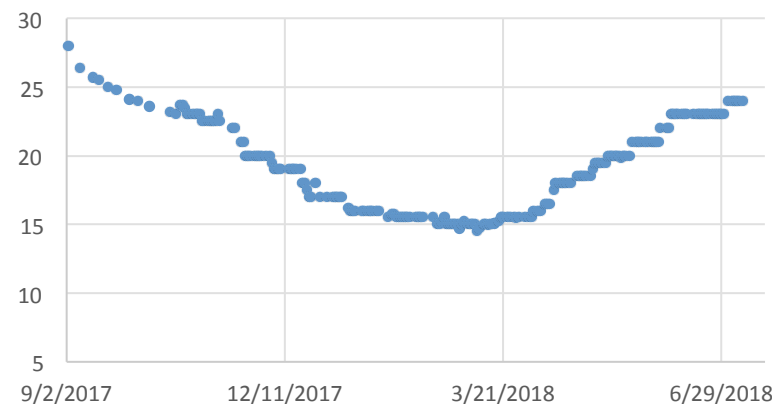
ARGOSARONIKOS (2017)

- 12,000+14,500 ind at 23g and 15g
- Two cages 1,300 and 900 m³

Temperature (oC)

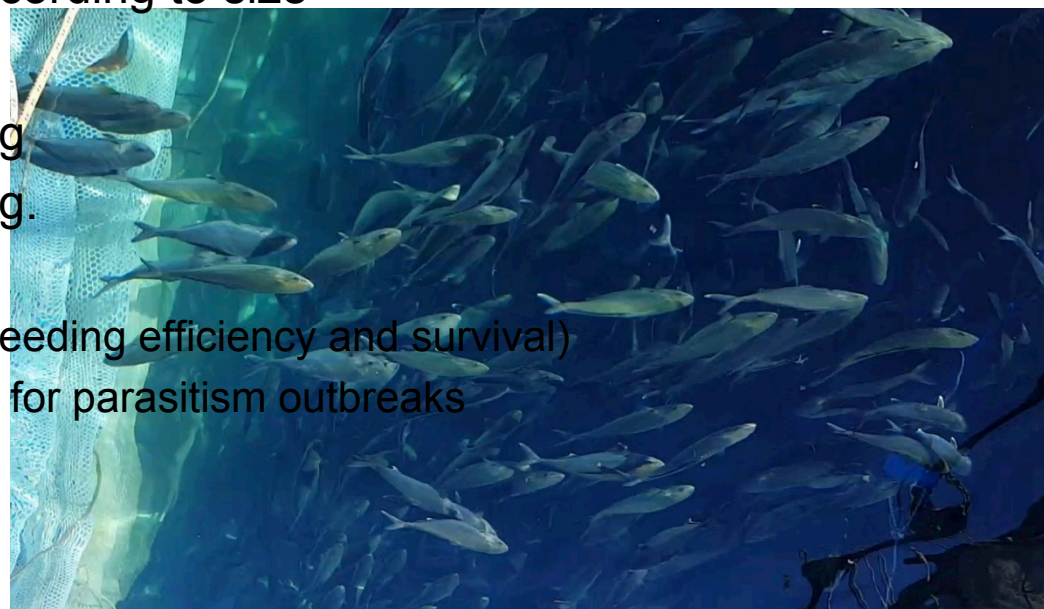


Temperature (oC)



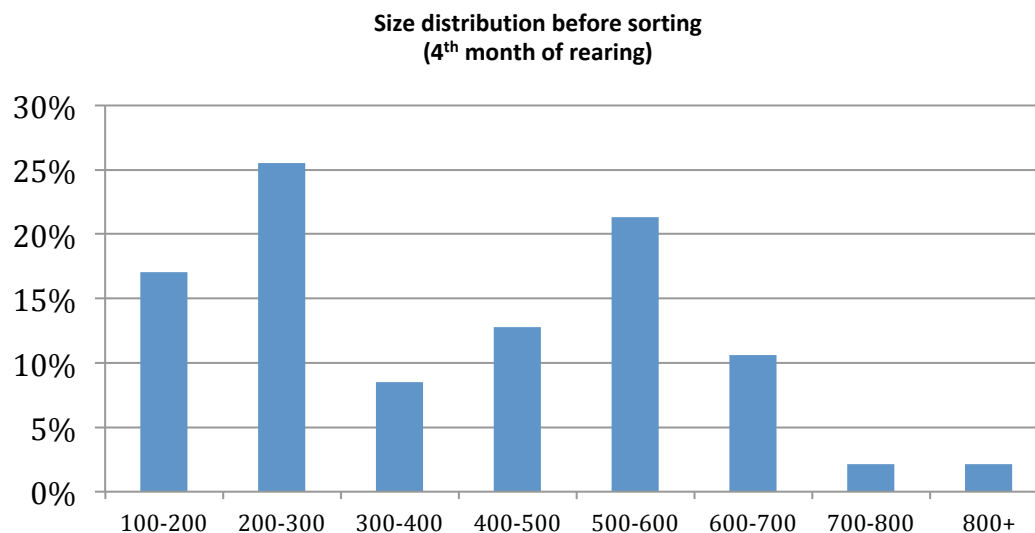
Trial 1 (Forkys)

- The first month
 - high growth rate
 - 218 ± 56 g and 205 ± 65 g for the deep and shallow cage
 - significant mortality
 - 25% and 34% at the shallow and deep cage (no observed pathology).
- A major issue: high size variability within groups
 - not permitting application of appropriate husbandry practices (feed size)
 - fish sorted in two groups according to size
- In January 2017
 - 5,000 individuals of 460 ± 20 g
 - 3,500 individuals of 263 ± 19 g.
 - Monitoring
 - the performance (growth, feeding efficiency and survival)
 - pathologies and especially for parasitism outbreaks



Trial 2 (Argosaronikos)

- During the first two months parasites outbreak resulted in loss of more than 50% of one group
 - the second was successfully treated with hydrogen peroxide.
- Both groups developed high size variability

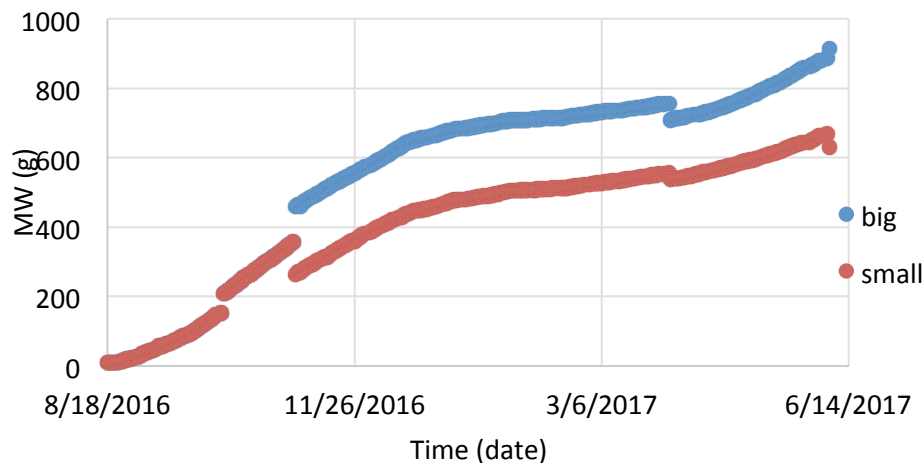


- In January 2018
 - 4,700 individuals of $406 \pm 40\text{g}$
 - 4,700 individuals of $607 \pm 23\text{g}$
- Similar stocking density 2.2 Kg m^{-3}

Results (1)

2016

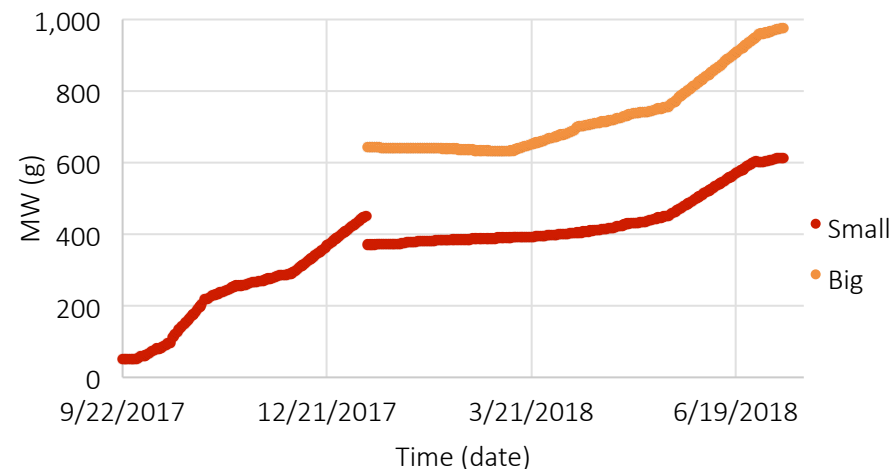
Growth performance



	Small	Big
Mortality (%)	19	17
FCR	2.03	1.86
SGR (g d ⁻¹)	2.1	2.9
Density (Kg m ⁻³) Initial / Final	0.84 / 0.8	0.8/1.3

2017

Growth performance



	Small	Big
Mortality (%)	2	3
FCR	2.46	2.35
SGR (g d ⁻¹)	1.25	1.83
Density (Kg m ⁻³) Initial / Final	2.1 / 3.2	2.1/3.5

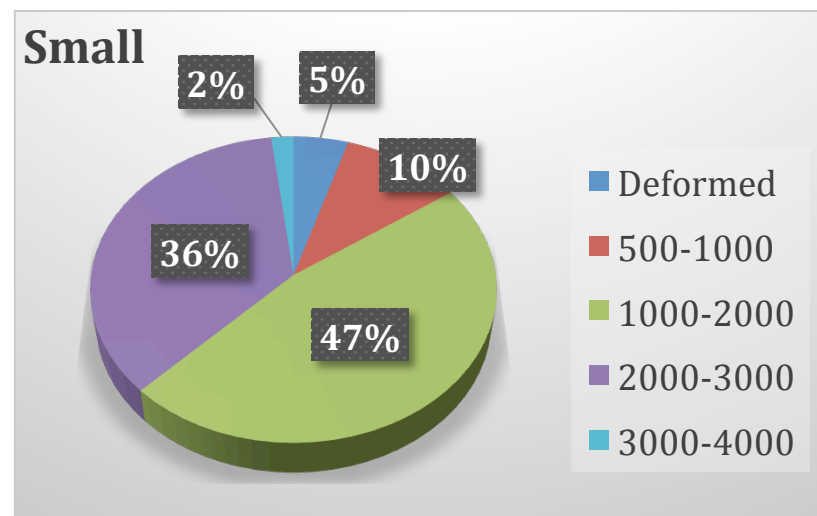
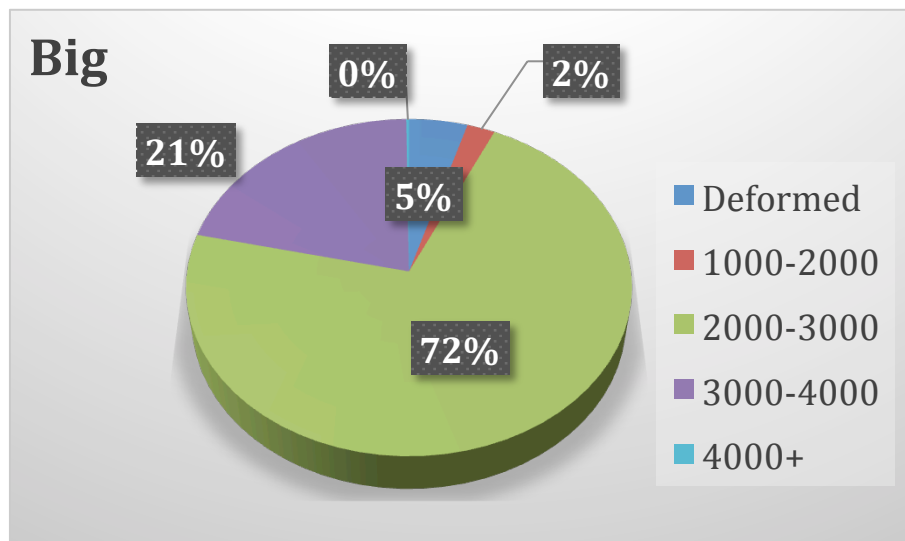
Mortality (parasites)

□ hydrogen peroxide bath



Results (2)

- The stock from the 2016 trial was the first commercialized in Greece

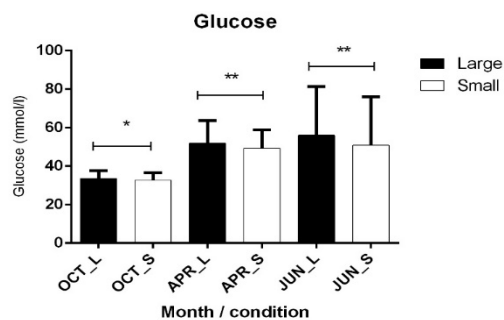
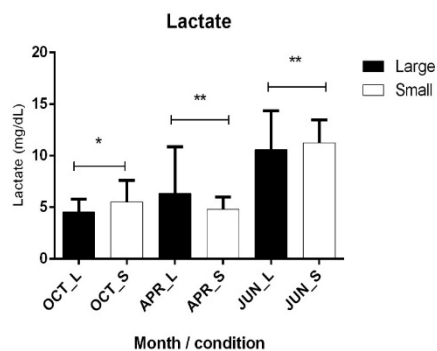
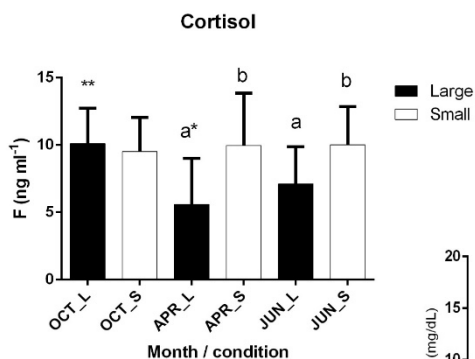


Size distribution at harvesting 18 months post hatching

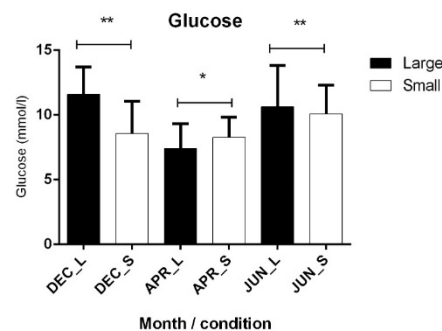
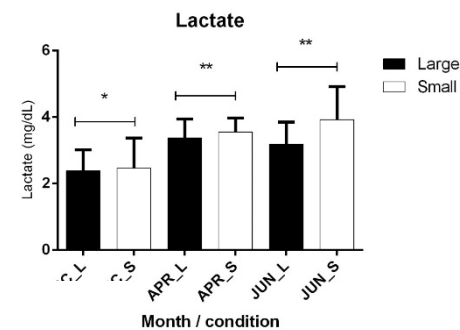
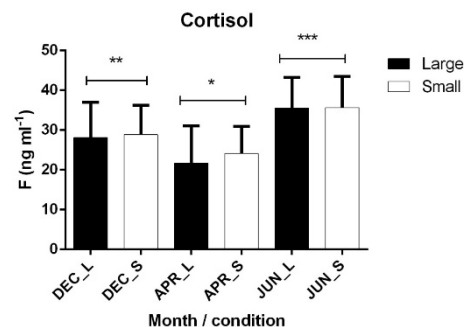
Physiological parameters

Hematological, Biochemical, Hormonal

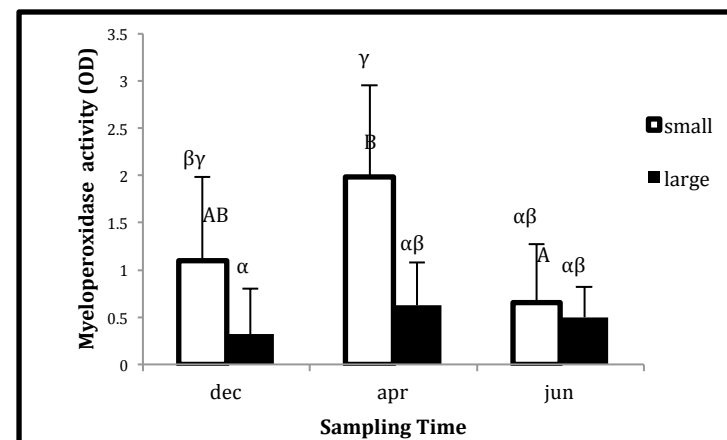
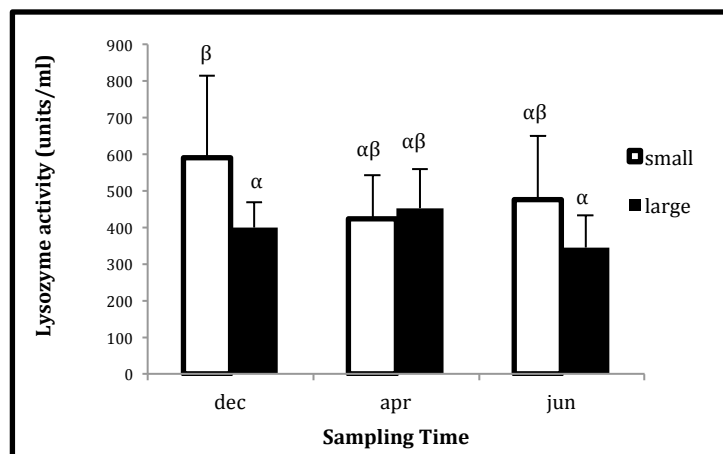
Trial 1



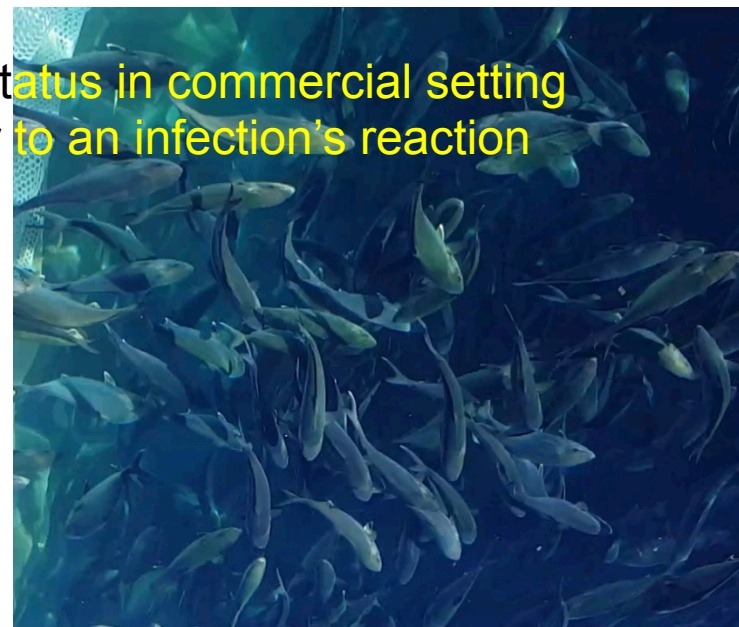
Trial 2



Innate immune status

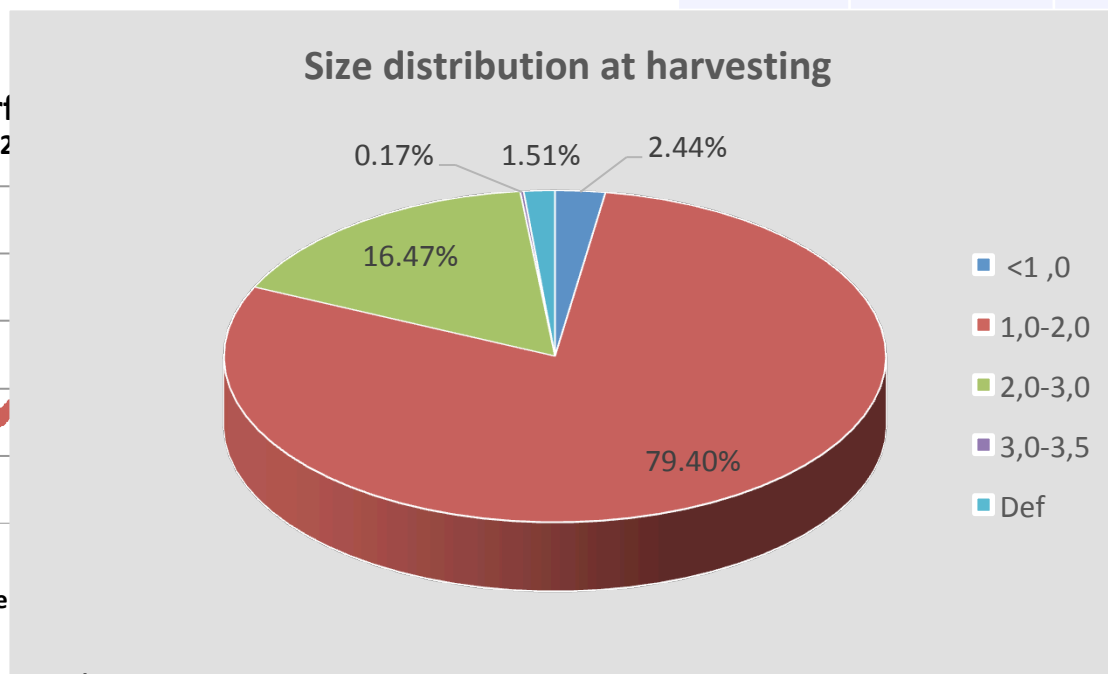
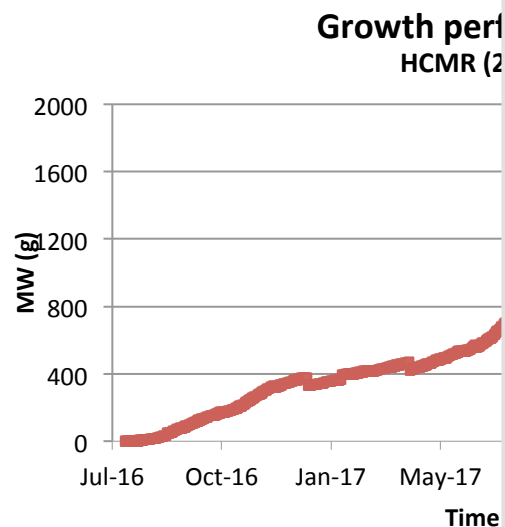


- A first estimation of the innate immune status in commercial setting
 - differences due to size of the fish or to an infection's reaction



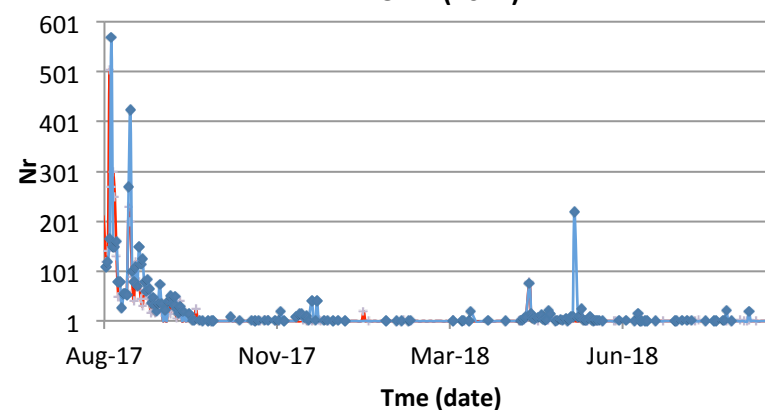
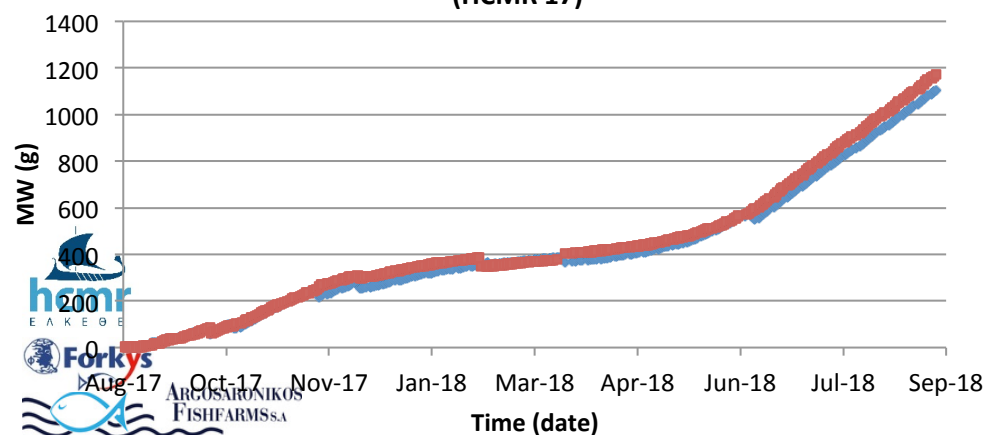
HCMR pilot sale cage rearing

	Survival (%)	FCR	SGR (g d ⁻¹)
2016	36	2.1	2.7
2017	52	1.8	2.3
2017	7	2.4	



(HCMR 17)

HCMR (2017)



The rearing of greater amberjack in commercial cages although thought to be easy remains still a challenge

- The fish accept commercial feeding of appropriate composition

- ☐ high protein (of fish origin) prepared at commercial scale

- No problem with standard husbandry practices

- ☐ net cleaning/changing and
- ☐ stocking density of max apx 5 kg m⁻³ is acceptable for a pelagic fish



- The species specific parasites

- ☐ treatment with peroxide is well established and confirmed
- ☐ application is not easy and methodologies for big cages should be developed

- The bacterial infections

- ☐ *V. harvey* causing significant mortalities (HCMR)

- There is room for further studying on-growing in cages and developing further the husbandry practices
- It exists a clear commercial potential for the species

Thank you!

