Hellenic Centre for Marine Research
Institute of Marine Biology, Biotechnology & Aquaculture

EFFECT OF BACKGROUND COLOR and PHOTOPHASE DURATION ON PERFORMANCE OF GREATER AMBERJACK (*Seriola Dumerili*) AND EXPRESSION OF GENES RELATED TO THE GH/IGF AXIS AT EARLY DEVELOPMENT

A. Tsalafouta, N. Mitrizakis, N. Papandroulakis

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regions at the centre of development
Co - financed by the Hellenic Republic and the European Union - European Regional Development Fund, in the context of the O.P. Competitiveness and Entrepreneurship (OPC II) and the R.O.P. Attica, R.O.P. Macedonia - Thrace

INTRODUCTION: *The Greater Amberjack*

- Important commercially

  - Global distribution
  - Fast growth (6 Kg in 2.5 years)
  - Excellent flesh quality
  - global market

- Innovative products with added value

  - The size attained can be marketed as whole or as processed food (fillets)

- Efforts to develop/improve aquaculture methods

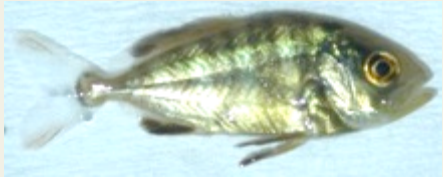
LARVAL REARING

INTRODUCTION: *Background colour & Photoperiod*

COLOR

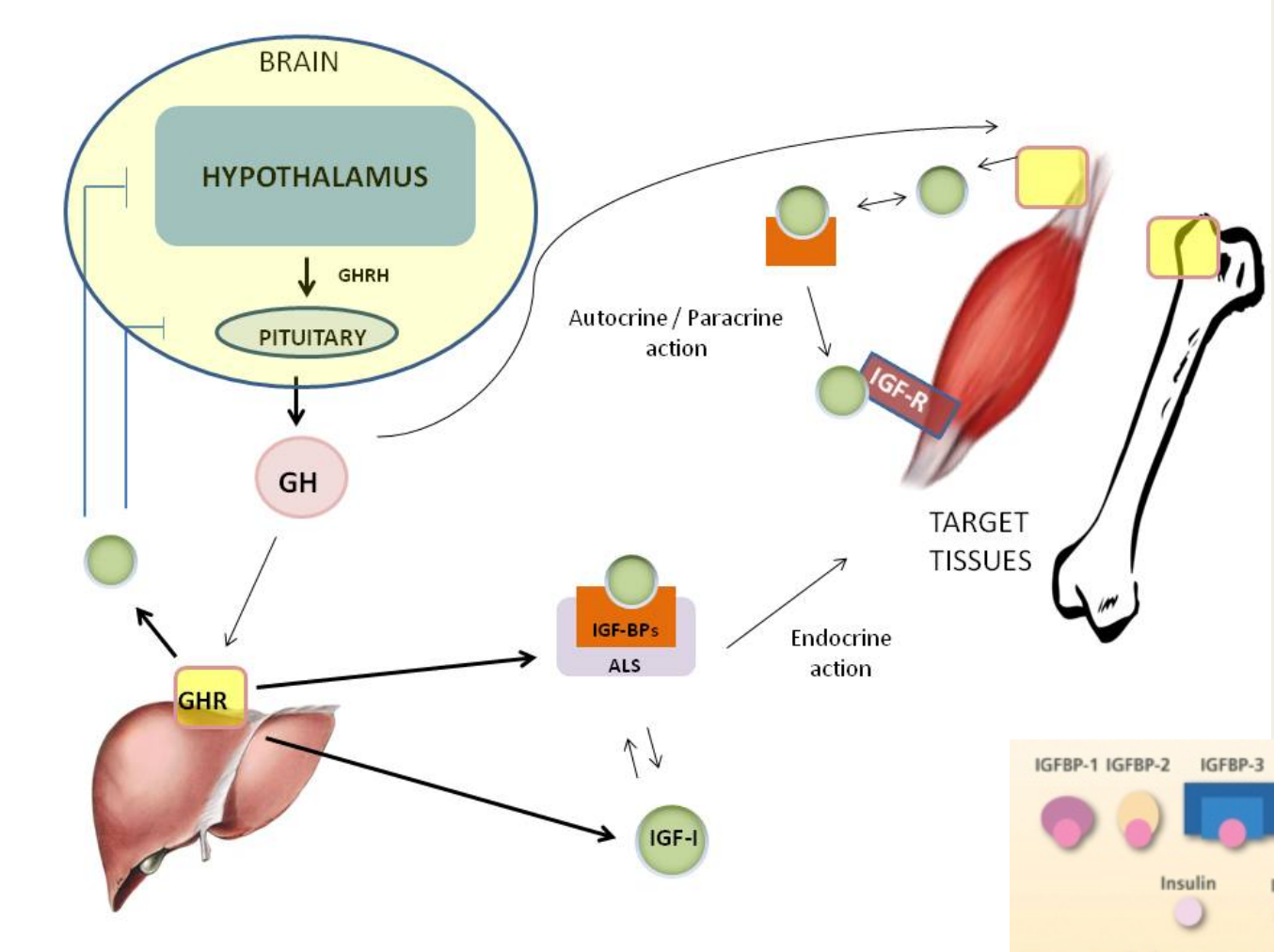
Physiological condition
Stress response

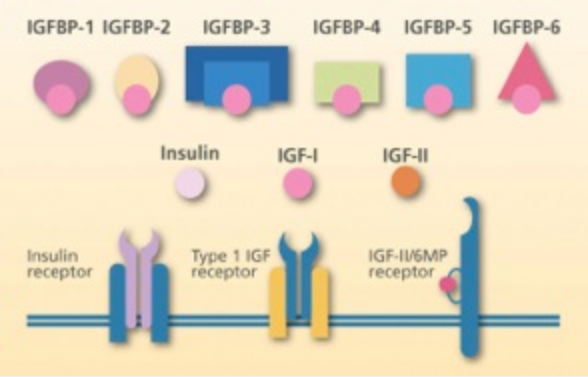
Food intake
Growth
Survival



Overall Production Performance

INTRODUCTION: *Growth Hormone/ Insulin-like Growth Factor axis*





http://www.clinsci.org/content/125/6/265

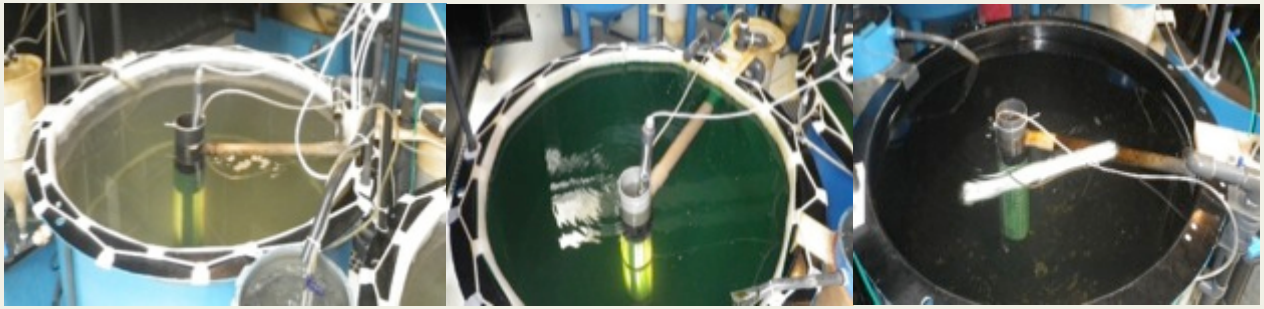
Barton, Integ. and Comp. Biol., 42:517–525 (2002)

EXPERIMENTAL DESIGN : PART A & PART B

Samples = 5 pooled samples flash frozen in liquid N_2

DPH 0 2 5 10 17 20 25 30 Development…

PART A: *Background colour*



PART B: *Photophase duration - 18L:06D vs 24L:00D*

EXPERIMENTAL DESIGN:

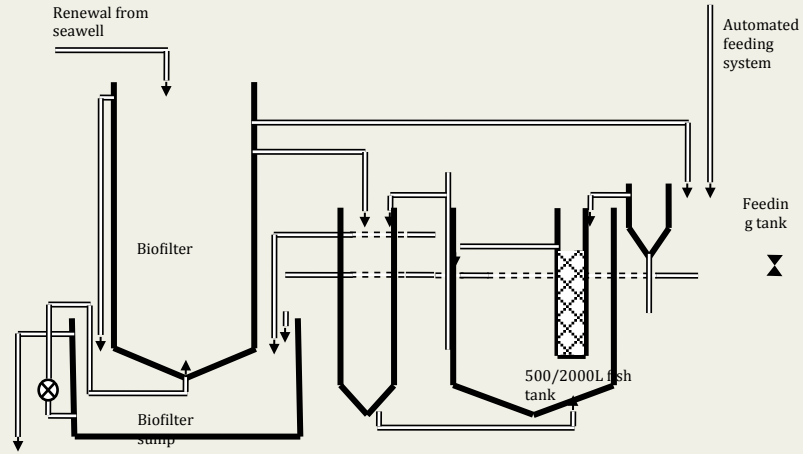
Performance monitoring

- Growth Rate
  - Body weight
  - Total Length
- Survival

EXPERIMENTAL DESIGN :

Larval rearing method

- Pseudogreen water
- Closed water system



2015
2016

- mechanically filtered borehole water of 35 psu
- T: 22±0.5 °C (autotrophic stages) 24±0.5 °C (23.9±0.8 °C)
- pH 8.3 to 8.5 (7.81 to 8.18)
- DO 5.6 to 7.4 mg l^{-1} (4.92 to 7.42 mg l^{-1})

- Light intensity 200 - 800 lux during day, 200 lux during night.
- Feeding:
  - enriched rotifers (from 3-21 dph), 3.0 individuals ml^{-1},
  - Instar II *Artemia* nauplii (from 12 dph onwards), 0.1 individuals ml^{-1}
  - artificial diet (from 21 dph).
  - Phytoplankton from 3 to 22 dph at 300 ± 100 x 103 cells ml^{-1}.

EXPERIMENTAL DESIGN: *Primer design*

- Study of the Somatotropic axis

Results after primer check with 2% agarose gel electrophoresis and sequencing

- **IGF-I**

FWD 5′ TGTTGACGAATGCTGCTTCC 3′
REV 5′ GTCTTGTCTGGCTGCTGTG 3′ Tα = 60 °C

- **IGF-II**

FWD 5′ GTGGGATCGTAGAGGAGTGTTGT 3′
REV 5′ CATCACGGGAATGACCTGTAGAGA 3′ Tα = 60 °C

- **IGF_Binding Protein 1**

FWD 5′ CCCTTTGACCACCATGACACT 3′ Tα = 60 °C
REV 5′ GGGTCCCTGTTGTTCCAGTTT 3′ Pedroso et al. 2009

- **IGF_Binding Protein 2**

FWD 5′ TCCAGGGTTTAGGTCGATGTG 3′ Tα = 60 °C
REV 5′ GTTGCCTGGTGGTCCAGACT 3′ Pedroso et al. 2009

IGF_Binding Protein 3

FWD 5′ CCGAGAGGCTTCCGCATA 3′ Tα = 60 °C
REV 5′ ACGGCACTGTTTTTTCTTGTAGAA 3′ Pedroso et al. 2009

- **IGF_Binding Protein 5**

FWD 5′ GCCCATCGACAAGCATGAT 3′ Tα = 60 °C
REV 5′ CGTCCTTCATCCCCTGAATG 3′ Pedroso et al. 2009

- **Growth Hormone**

FWD 5′ CTGAACCAGAACCTGAACTTGAAC 3′
REV 5′ CTGTCTGTGATTGGCTGAGA 3′ Tα = 60 °C

- **Growth Hormone Releasing Hormone**

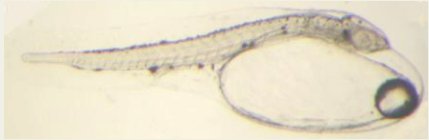
FWD 5′ GCATTCTCTGATGGCAAA 3′
REV 5′ CTGTAGCTGTCTGTGAAG 3′ Tα = 59 °C

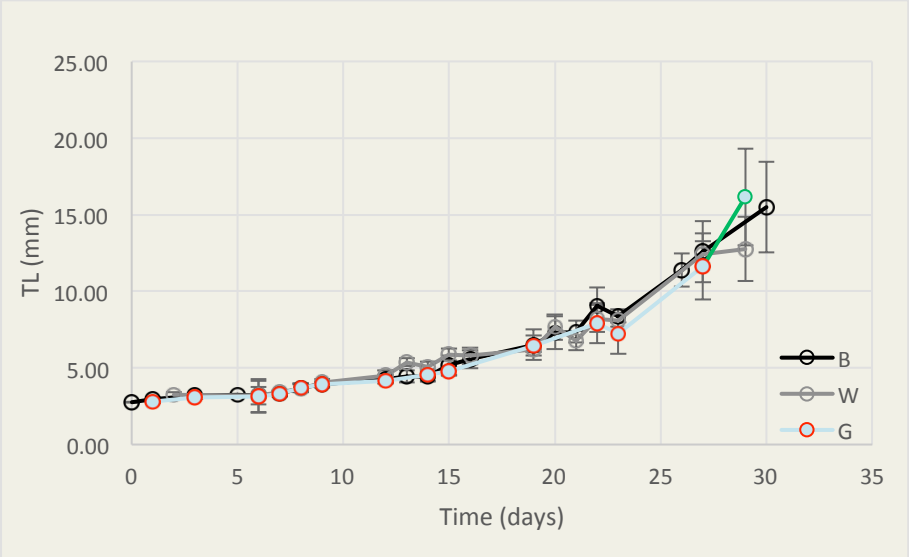
RESULTS 2015/2016

Part A

BACKGROUND COLOUR

2015 Results: *Performance*



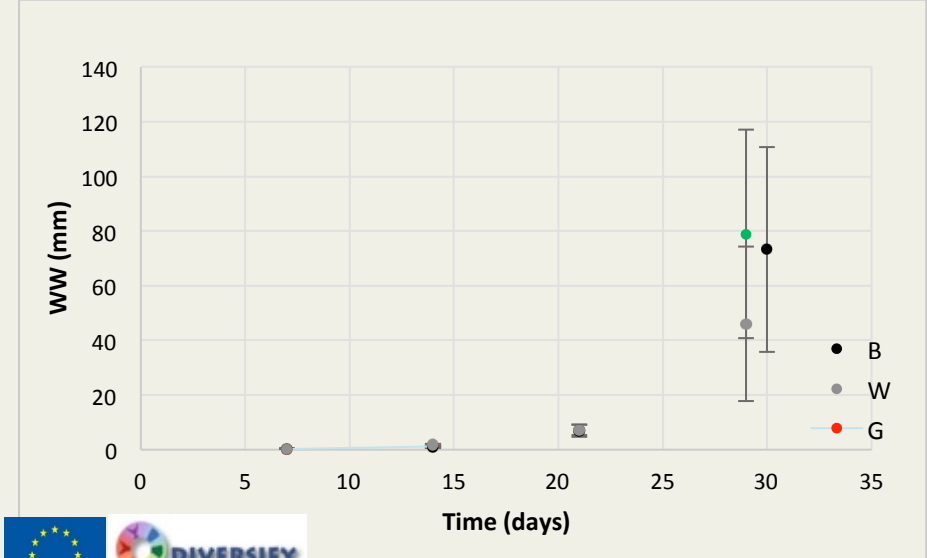


TL Exponential growth rates: Black: 0.0568 d^{-1}
White: 0.0549 d^{-1}
Green: 0.0578 d^{-1}

NSD

WW Exponential growth rates: Black: 0.2482 d^{-1}
White: 0.2165 d^{-1}
Green: 0.2695 d^{-1}

NSD



SURVIVAL

No satisfactory in any group

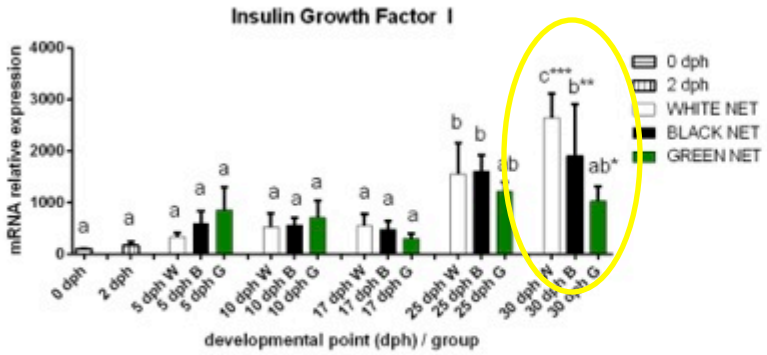
WHITE: 1,30%
BLACK: 0,53%
GREEN: 0,02%

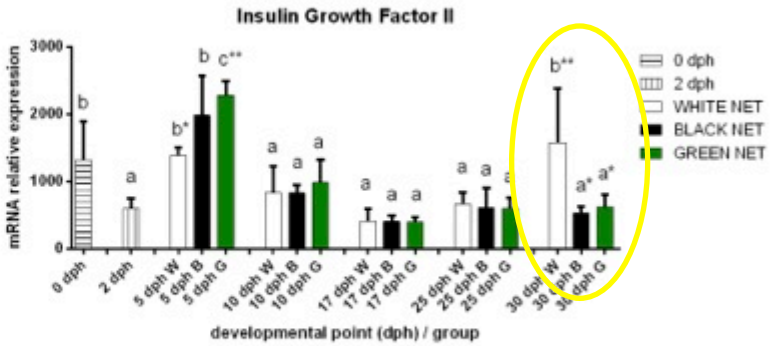
INITIAL EGG QUALITY ?

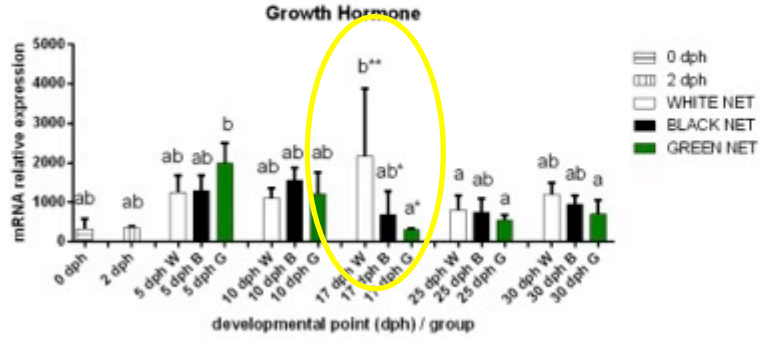
NEED FOR **REPEAT** ?

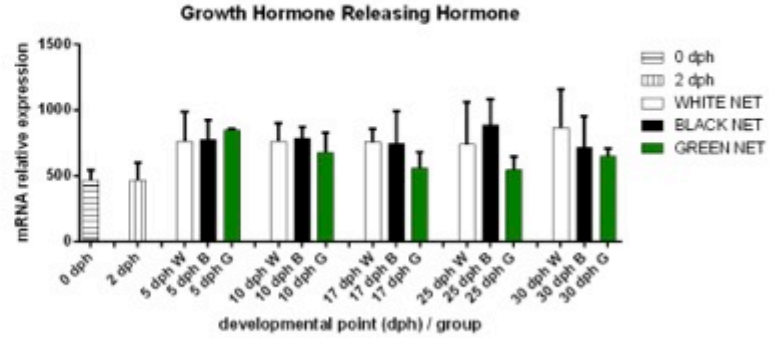
2015 Results:

IGF-I, IGF-II, GH, GHRH expression throughout development /different background





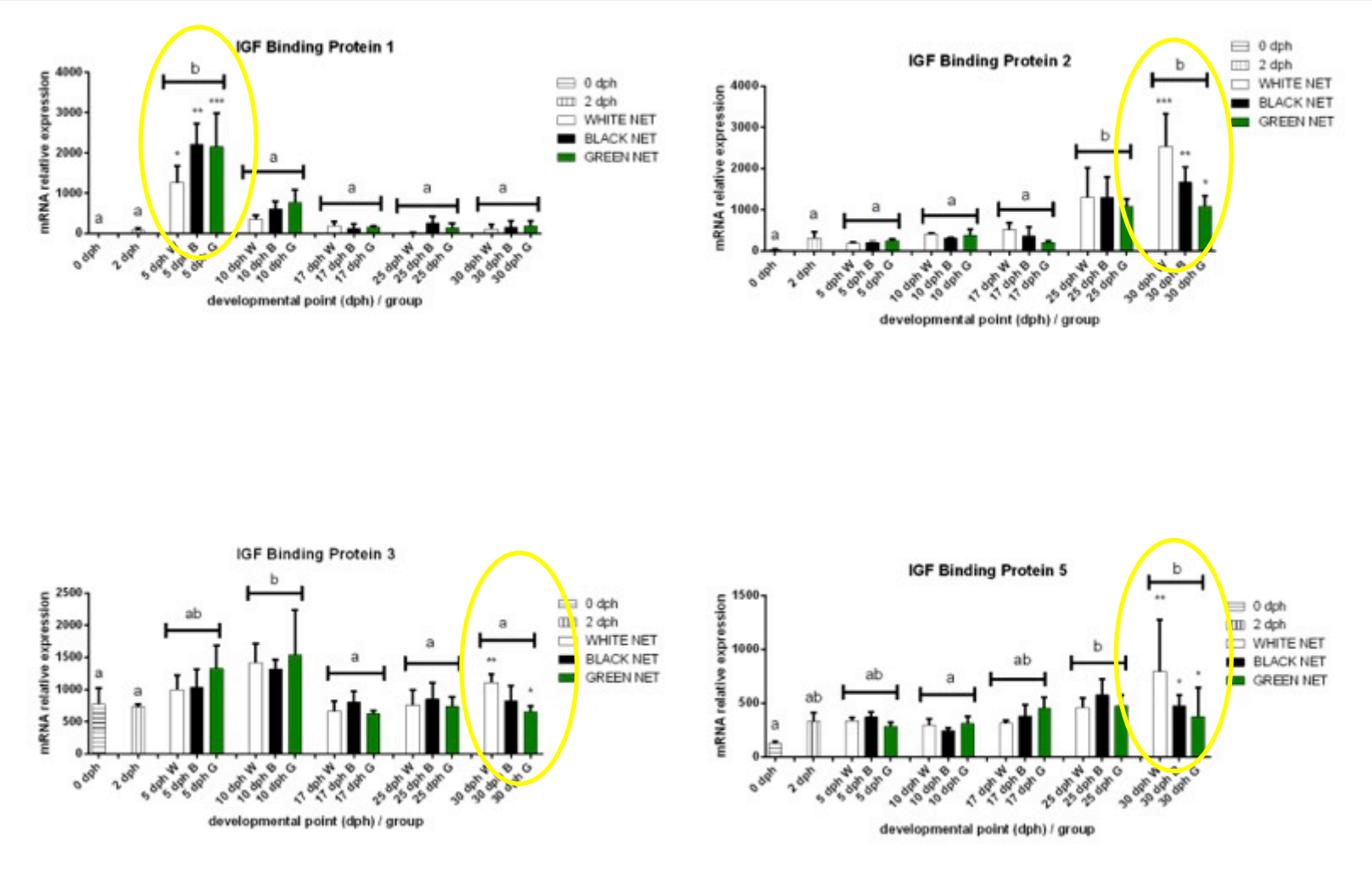




LETTERS: Differences between the different sampling points of development
ASTERISKS: Differences between groups of different background

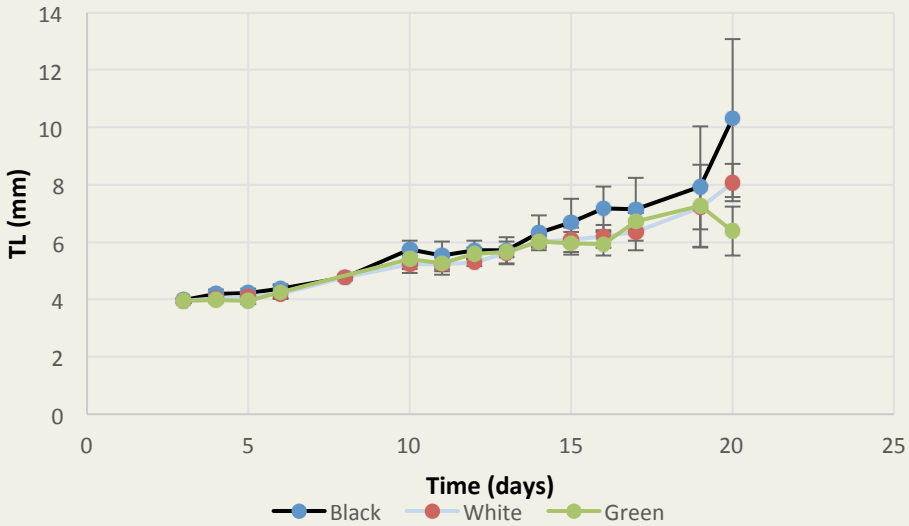
2015 Results:

IGF-BPs expression throughout development /different background



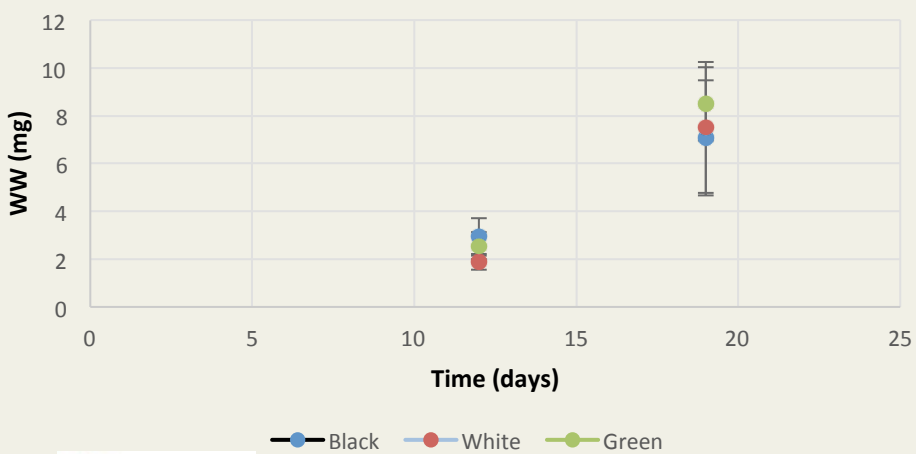
LETTERS: Differences between the different sampling points of development
ASTERISKS: Differences between groups of different background

2016 Results



TL Exponential growth rates: Black: 0.0481 d^{-1}
White: 0.0393 d^{-1}
Green: 0.0355 d^{-1}

NSD



WW Exponential growth rates: Black: 0.1260 d^{-1}
White: 0.1970 d^{-1}
Green: 0.1713d^{-1}

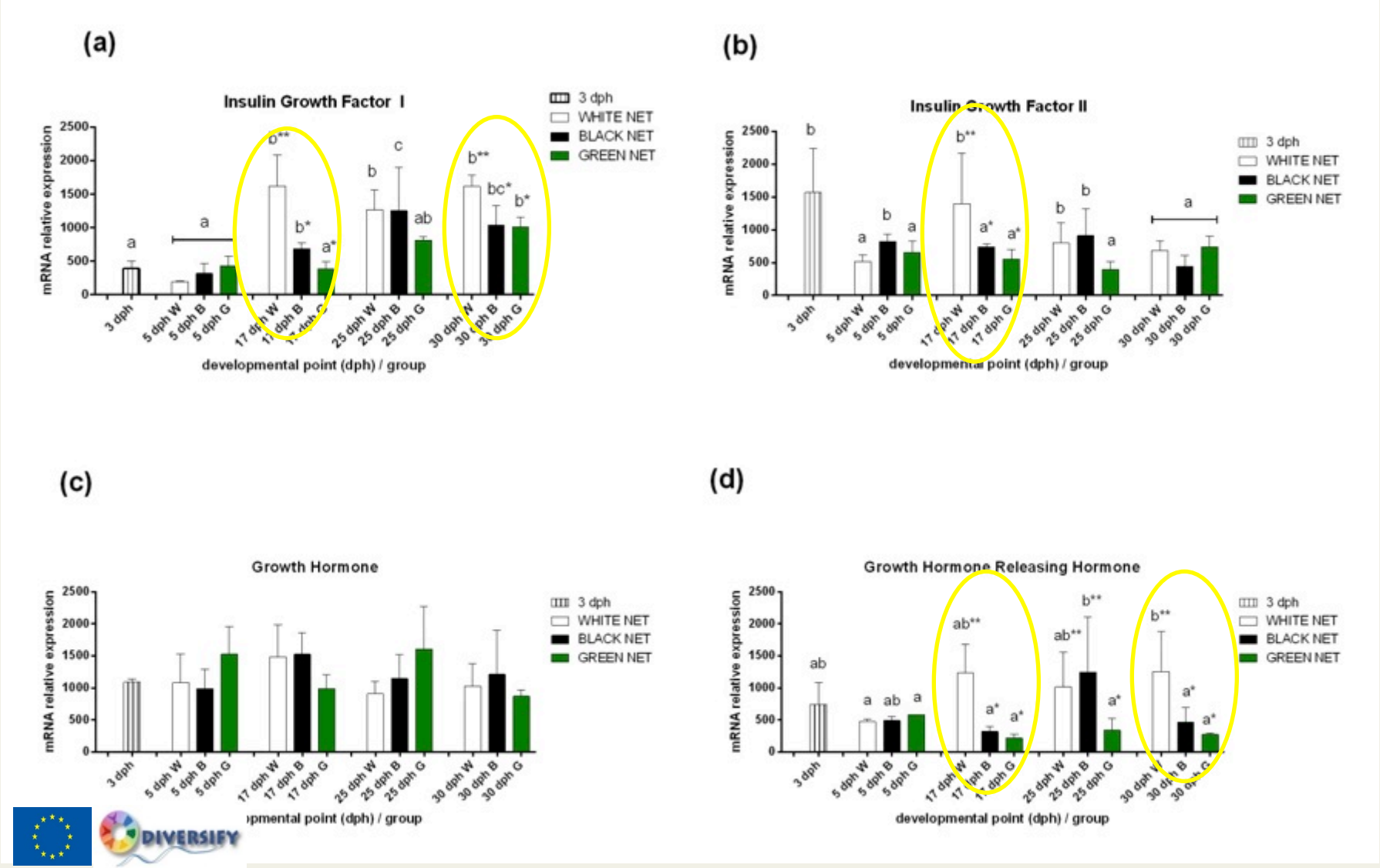
NSD

SURVIVAL

WHITE: 22,2%
BLACK: 8,2%
GREEN: 16,5%

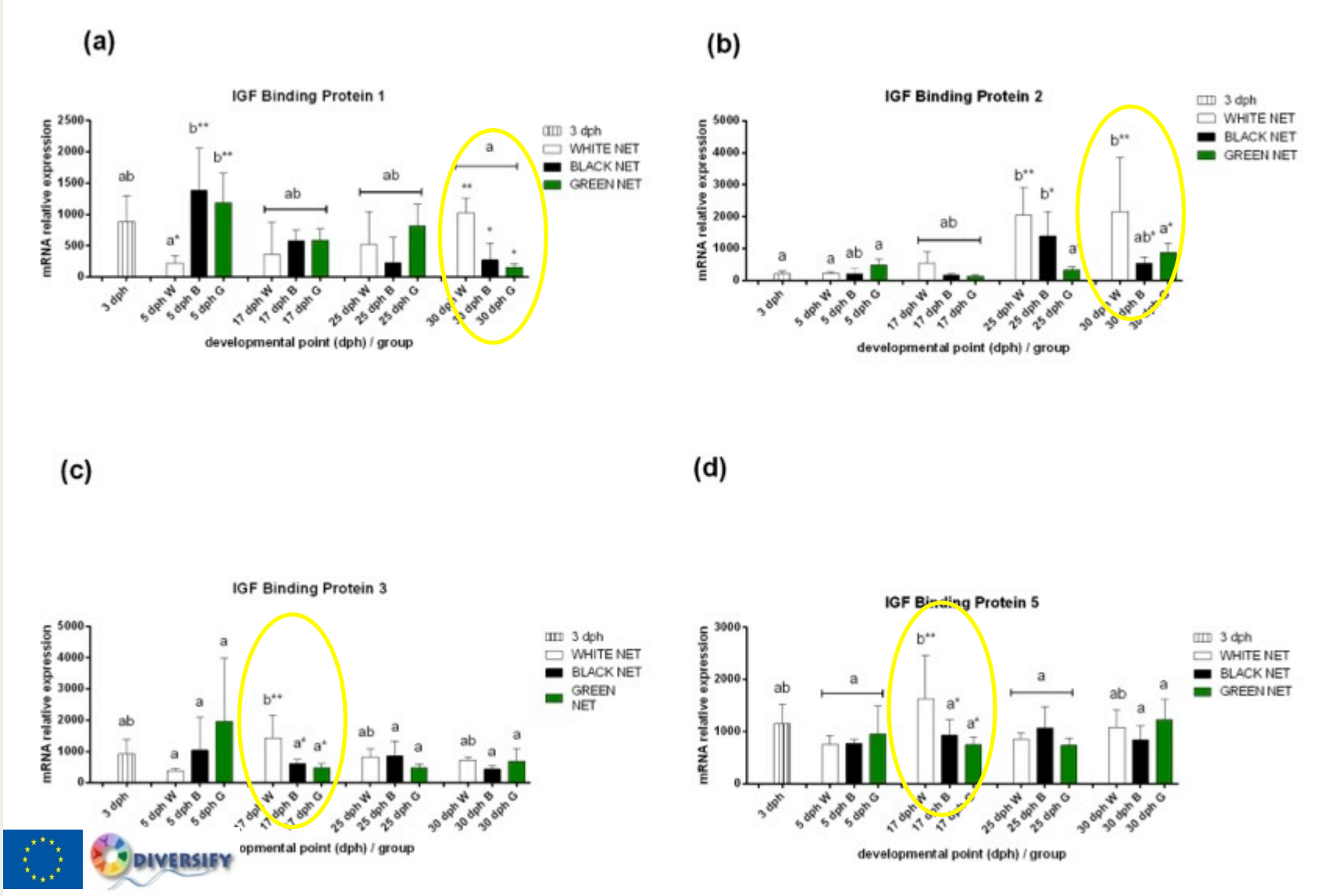
2016 Results

IGF-I, IGF-II, GH, GHRH expression throughout development /different background



2016 Results

IGF-BPs expression throughout development /different background



CONCLUSIONS (part A)

- Background colour had an effect on the survival rates of G. amberjack larvae
- Larvae in the **WHITE** background exhibited the highest survival rates compared to the green and the black background
- Statistically significant differences in the expression of genes related to the GH/IGF axis presented between larvae in the different backgrounds

→ higher levels for **WHITE** background

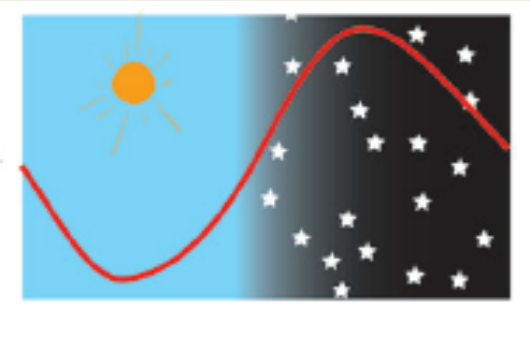
- Differences were observed at 17 dph (Flexion) and/or 30dph (formation of all fins)
- This is the 1st time the somatotropic axis is investigated in *seriola dumerili* at early development
- the achieved survival rates in 2016 are reported for first time

RESULTS 2015/2016

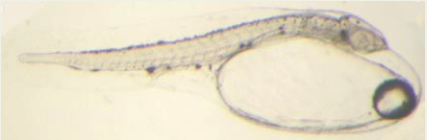
Part B

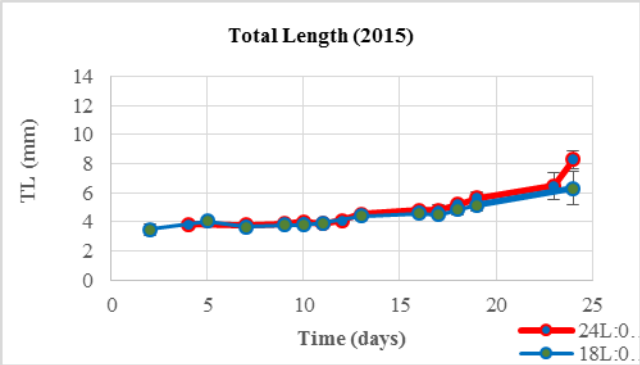
PHOTOPHASE DURATION

(18L:06D vs 24L:00D)



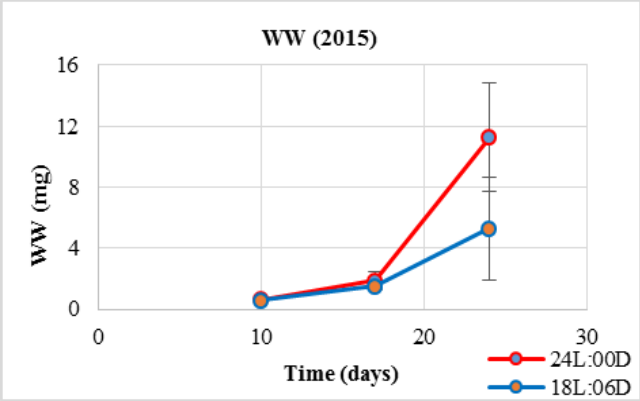
2015 Results: *Performance*





TL Exponential growth rates: 18L:06D = 0.0244 d^{-1}
24L:00D = 0.0364 d^{-1}

NSD



WW Exponential growth rates: 18L:06D = 0.16 d^{-1}
24L:00D = 0.21 d^{-1}

NSD

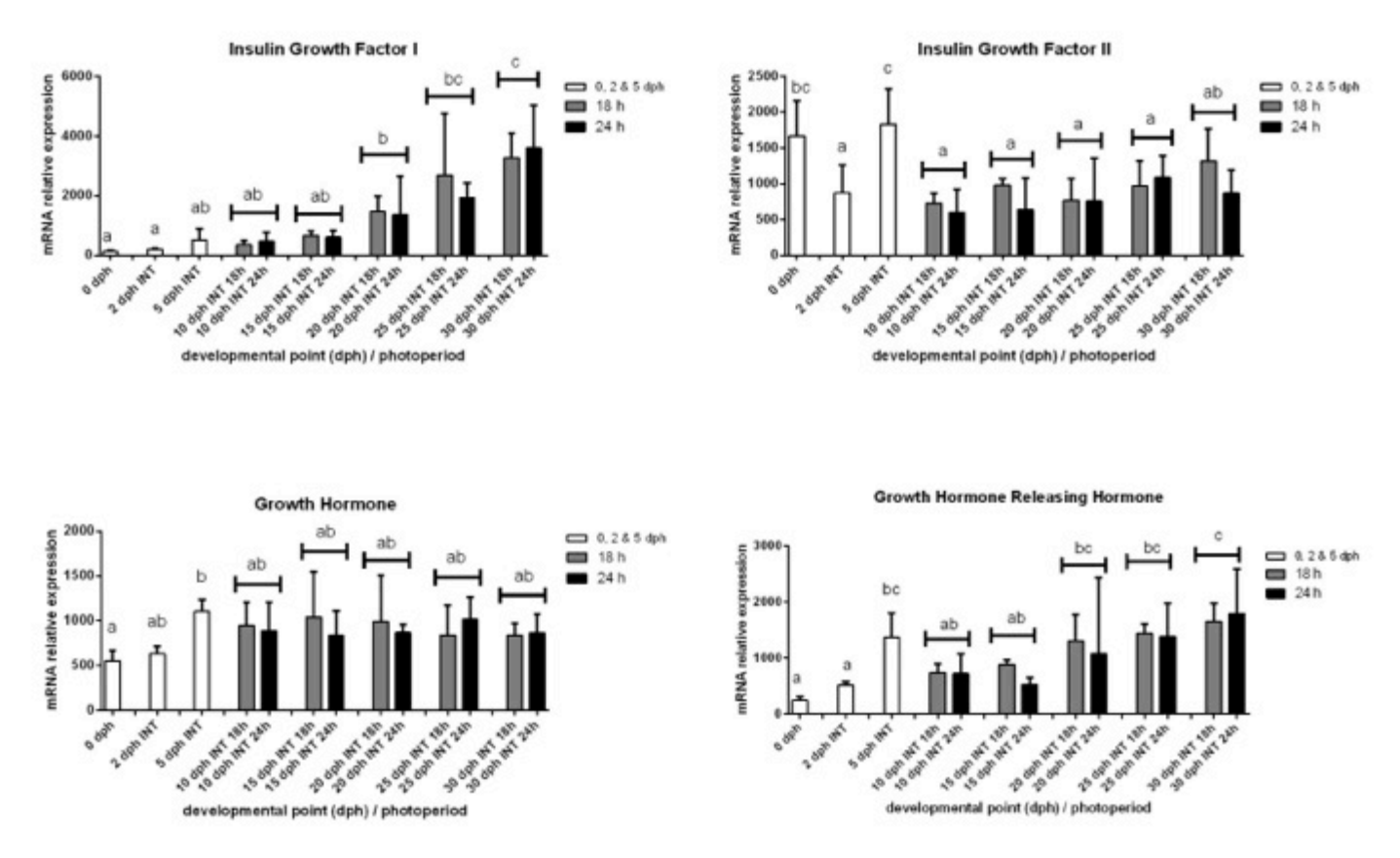
SURVIVAL

<u>Not satisfactory</u> in any group
(few individuals per group)

NEED FOR **REPEAT**

2015 Results:

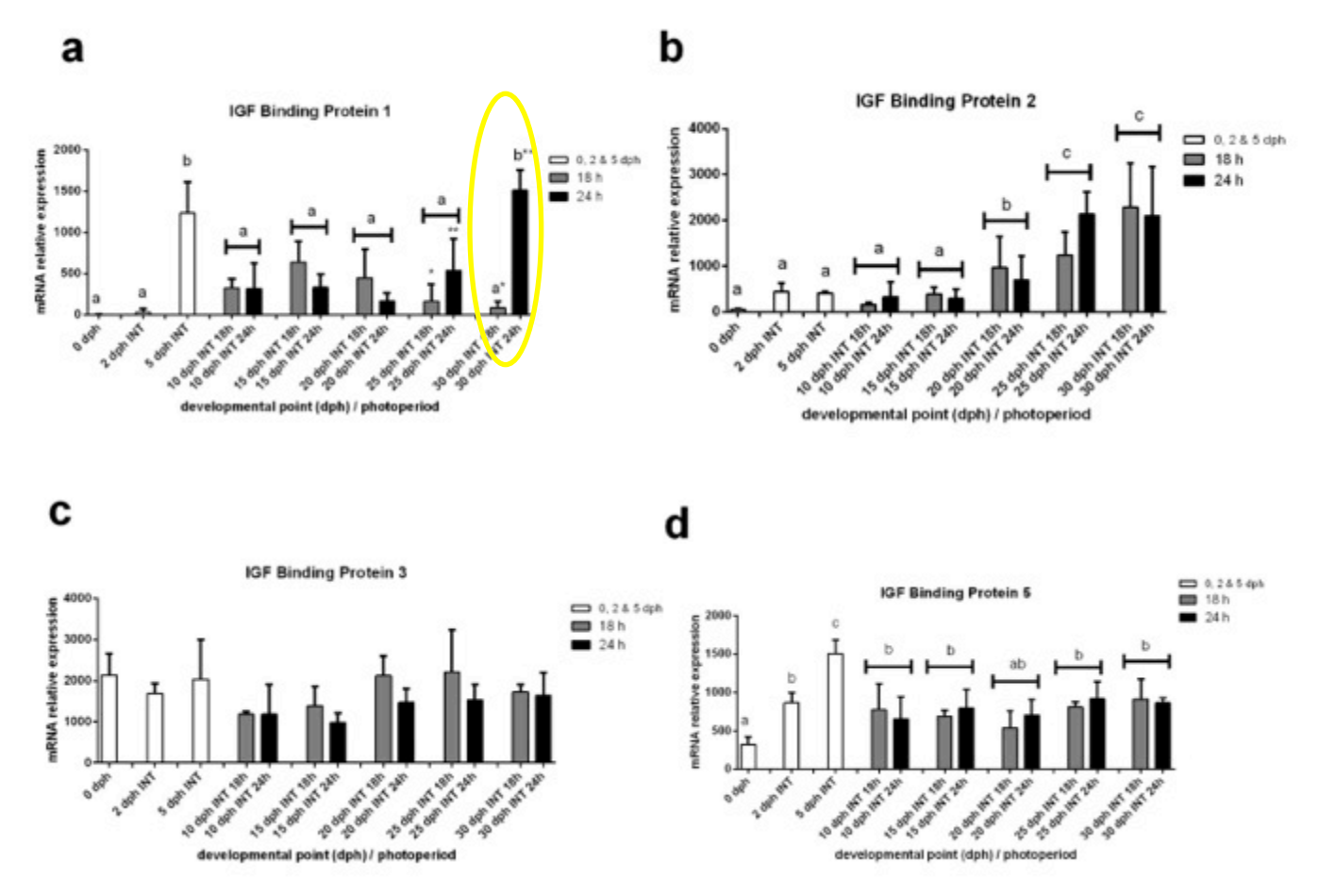
IGF-I, IGF-II, GH, GHRH expression throughout DEVELOPMENT /different PHOTOPHASE



LETTERS: Differences between the different sampling points of development

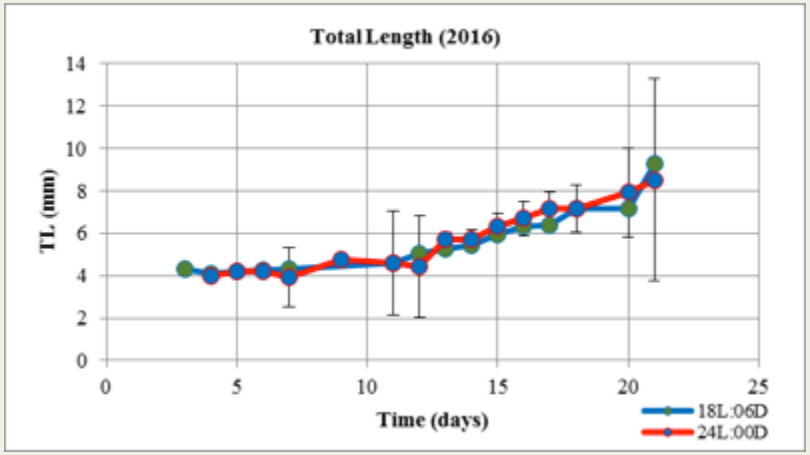
2015 Results:

IGF-BPs expression throughout DEVELOPMENT /different PHOTOPHASE



LETTERS: Differences between the different sampling points of development
ASTERISKS: Differences between groups of different photophase

2016 Results



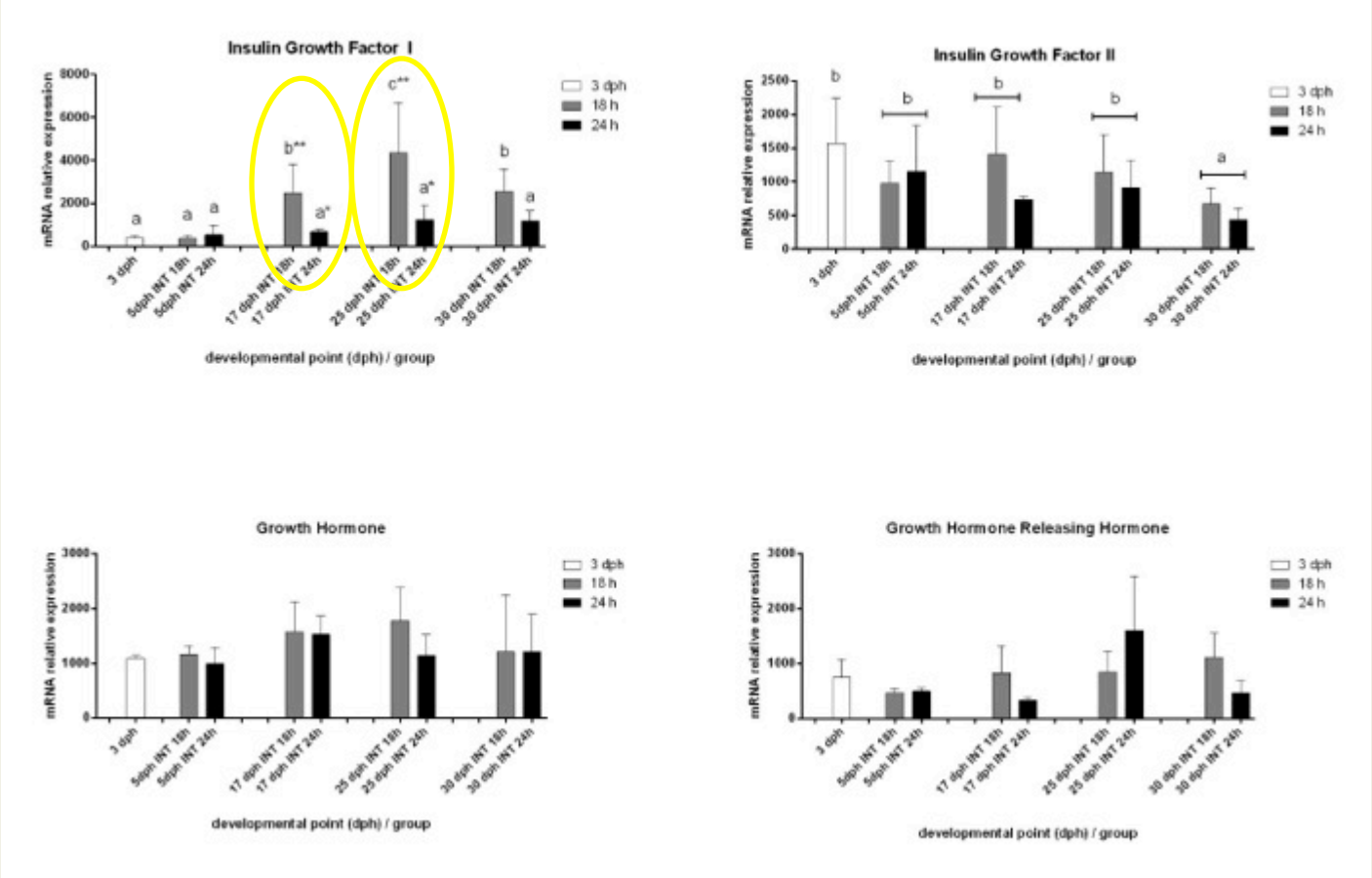
TL Exponential growth rates: 0.310 d^{-1} **NSD**

SURVIVAL

18L:06D: 10,6 ± 4.2%
24L:00D: 8,2 ± 3.1%

2016 Results

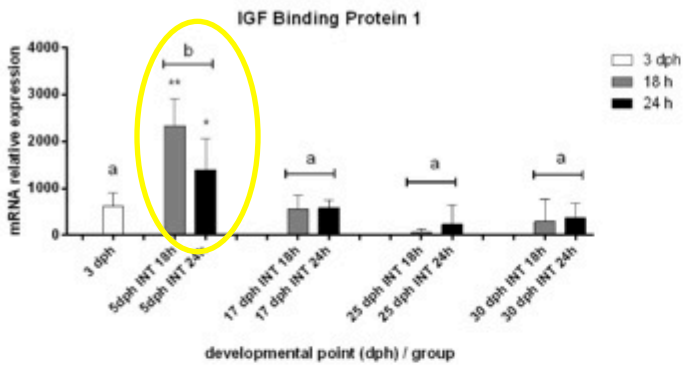
IGF-I, IGF-II, GH, GHRH expression throughout DEVELOPMENT /different PHOTOPHASE

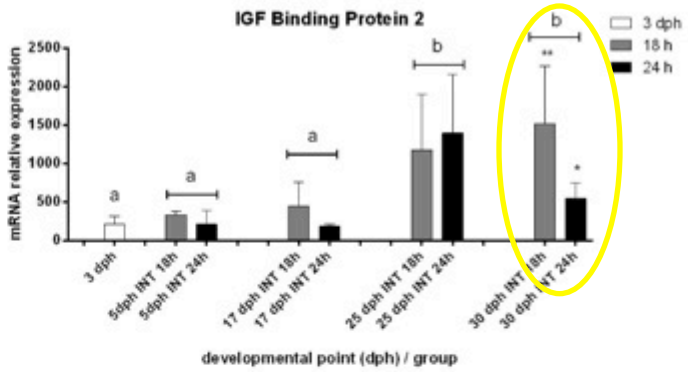


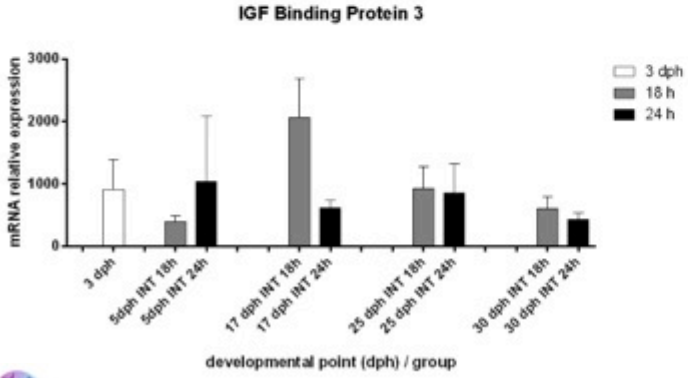
LETTERS: Differences between the different sampling points of development
ASTERISKS: Differences between groups of different photophase

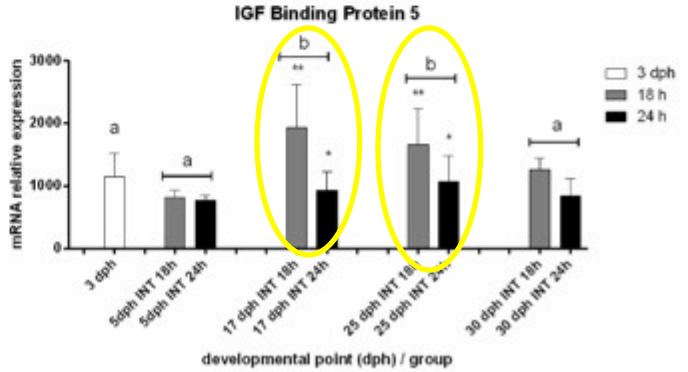
2016 Results

IGF-BPs expression throughout DEVELOPMENT /different PHOTOPHASE









LETTERS: Differences between the different sampling points of development
ASTERISKS: Differences between groups of different photophase

CONCLUSIONS (part B)

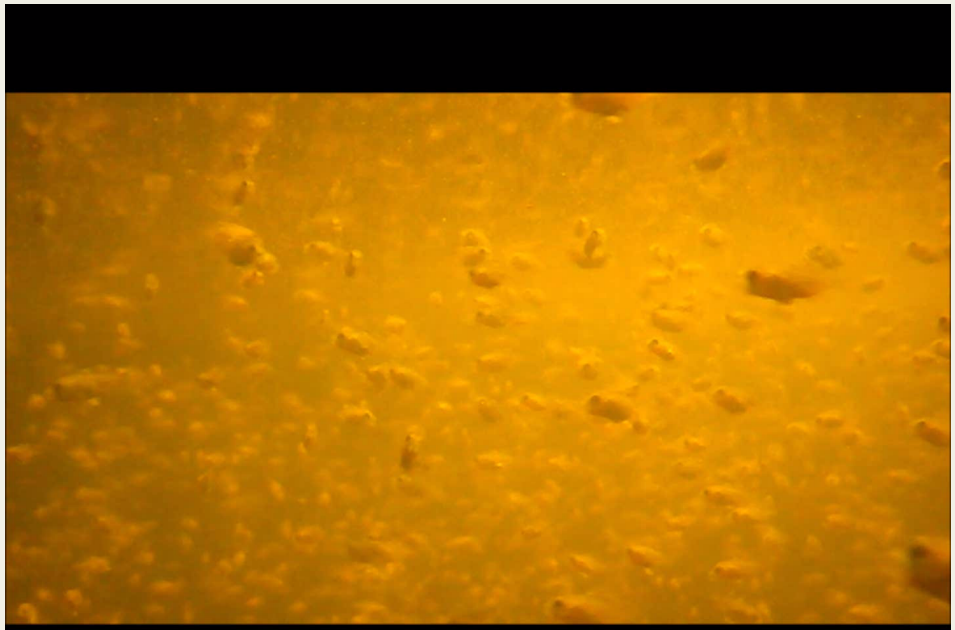
2015

- The survival was not satisfactory in either group
- No differences were observed apart from the expression of IGF-BP1 (higher in 24L:00D than 18L:06D)
- These difference may reflects the tendency observed in growth (but just few individuals …)

2016

- Higher survival rates were observed using a photophase with duration of 18L: 06D than 24L:06D
- This difference is reflected in the expression of IGF-I and IG-BPs 1, 3 & 5 (Higher levels for 18L:06D compared to 24L:00D)

Thank you!



Greater Amberjack larval rearing, HCMR 2016

Hellenic Centre for Marine Research
Institute of Marine Biology, Biotechnology & Aquaculture

regions at the centre of development
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