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New species for EU aquaculture

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Reproductive cycle of wreckfish *Polyprion americanus* in captivity

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DIVERSIFY

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Wreckfish reproduction (2013)

- ✓ Poor knowledge available on the process of gametogenesis, either in wild or captivity
- ✓ Spawning rare and limited egg production with strip-spawning (*in vitro* fertilization)

Description of the reproductive cycle

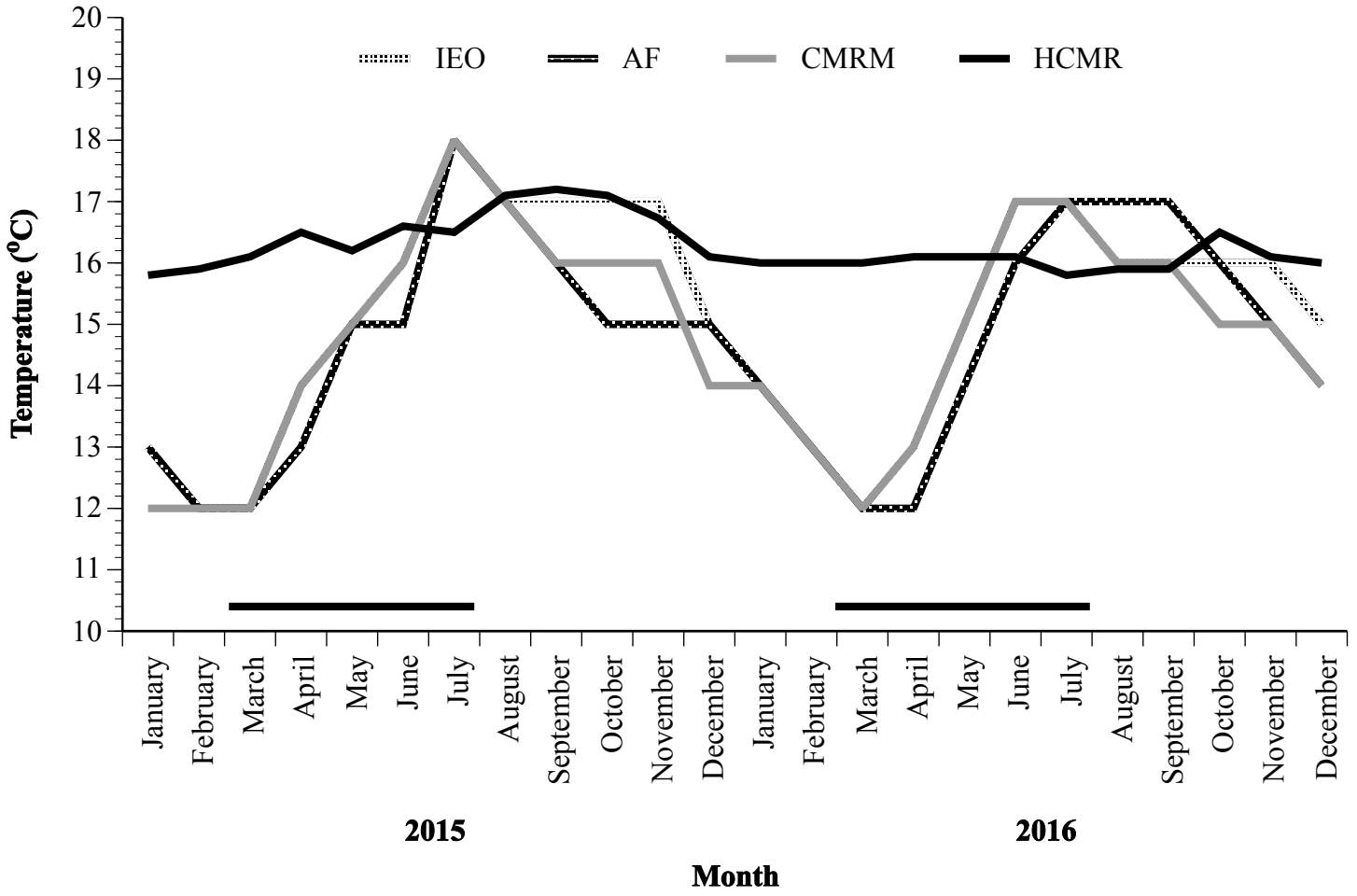
- ✓ Recognize possible reproductive dysfunctions
- ✓ Establish broodstock manegement procedures
- ✓ Implement spawning induction protocols

Wreckfish broodstocks

Wreckfish broodstocks

Broodstocks	IEO	CMRM	MC2	HCMR
Number of fish	13	21	11	3
Females	10	12	8	1
Males	3	9	3	2
Tank	110 m^3	35 m^3	180 m^3	15 m^3
Photoperiod	Natural	Simulated natural	Natural	Simulated natural
Temperature	Natural	Natural	Natural	16° C

Wreckfish broodstocks - temperature



Biopsy collection

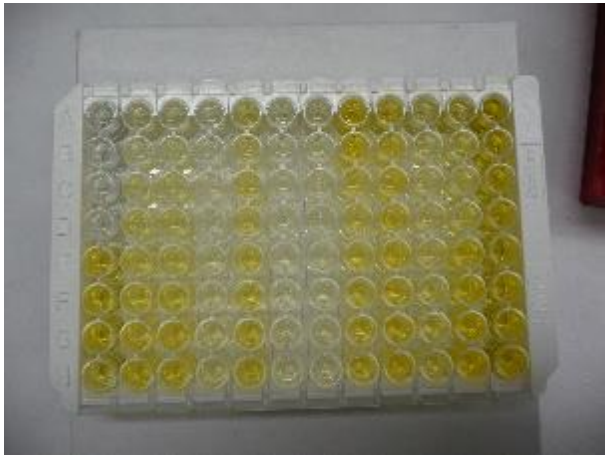
Sperm collection

Blood collection

- **Bimonthly from August until January**
- **Monthly from February until July**

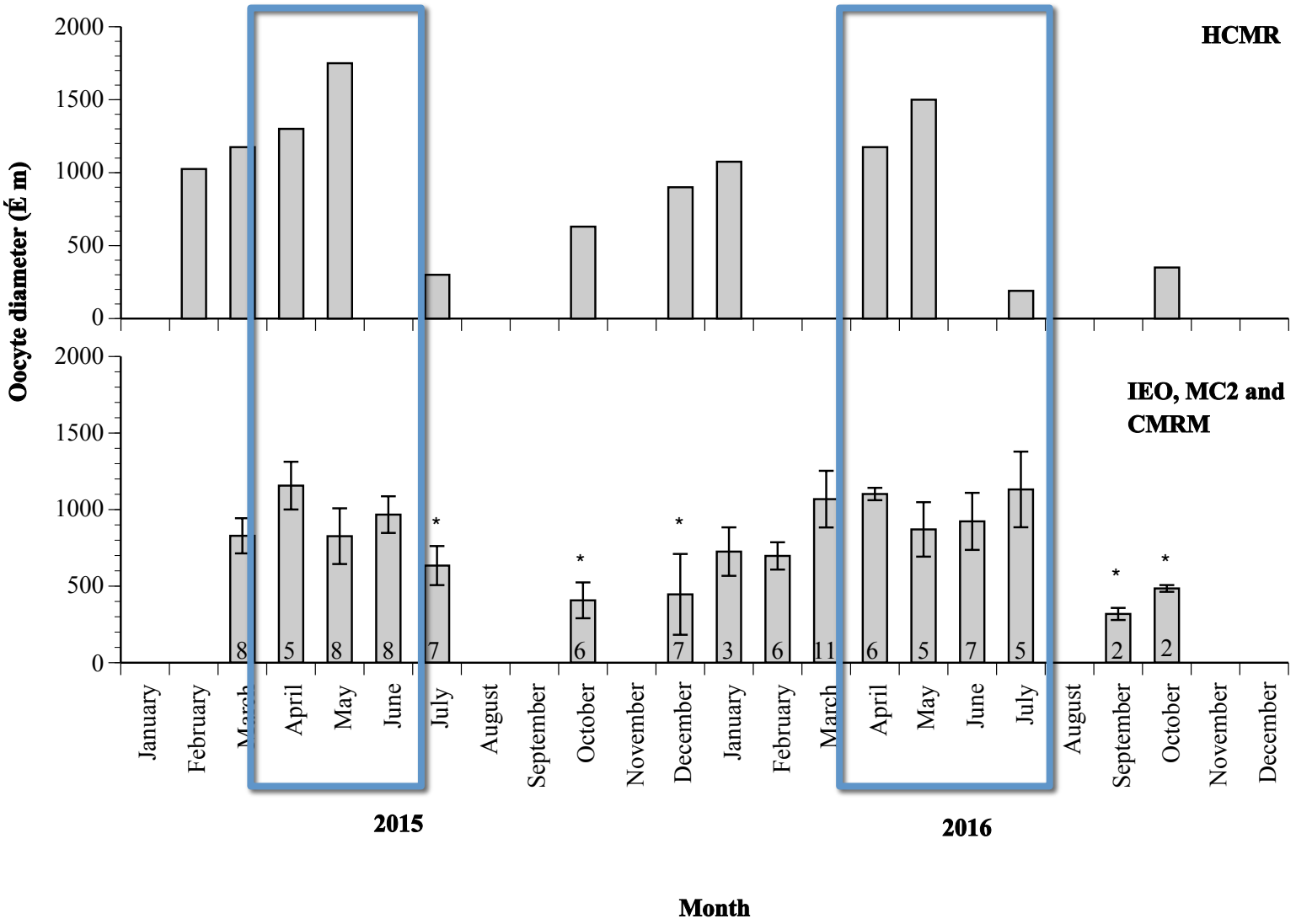
Histological analysis

Sperm evaluation



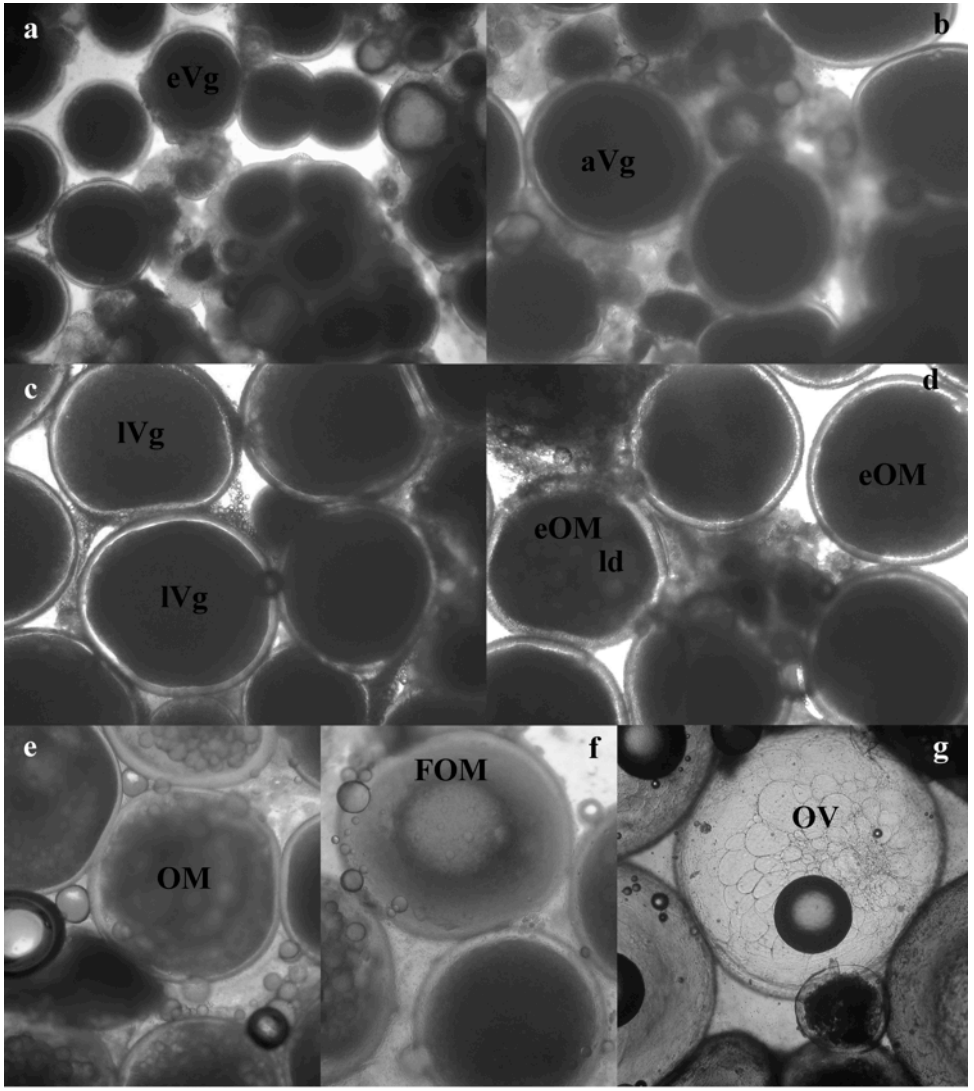
Sex steroid hormones

Reproductive cycle – max oocyte diameters



Reproductive cycle – oogenesis

Ld-lipid droplets
eVg-early vitellogenesis
aVg-advanced vitellogenesis
lVg-late vitellogenesis
eOM-early oocyte maturation
FOM-final stages of OM
OV-ovulation

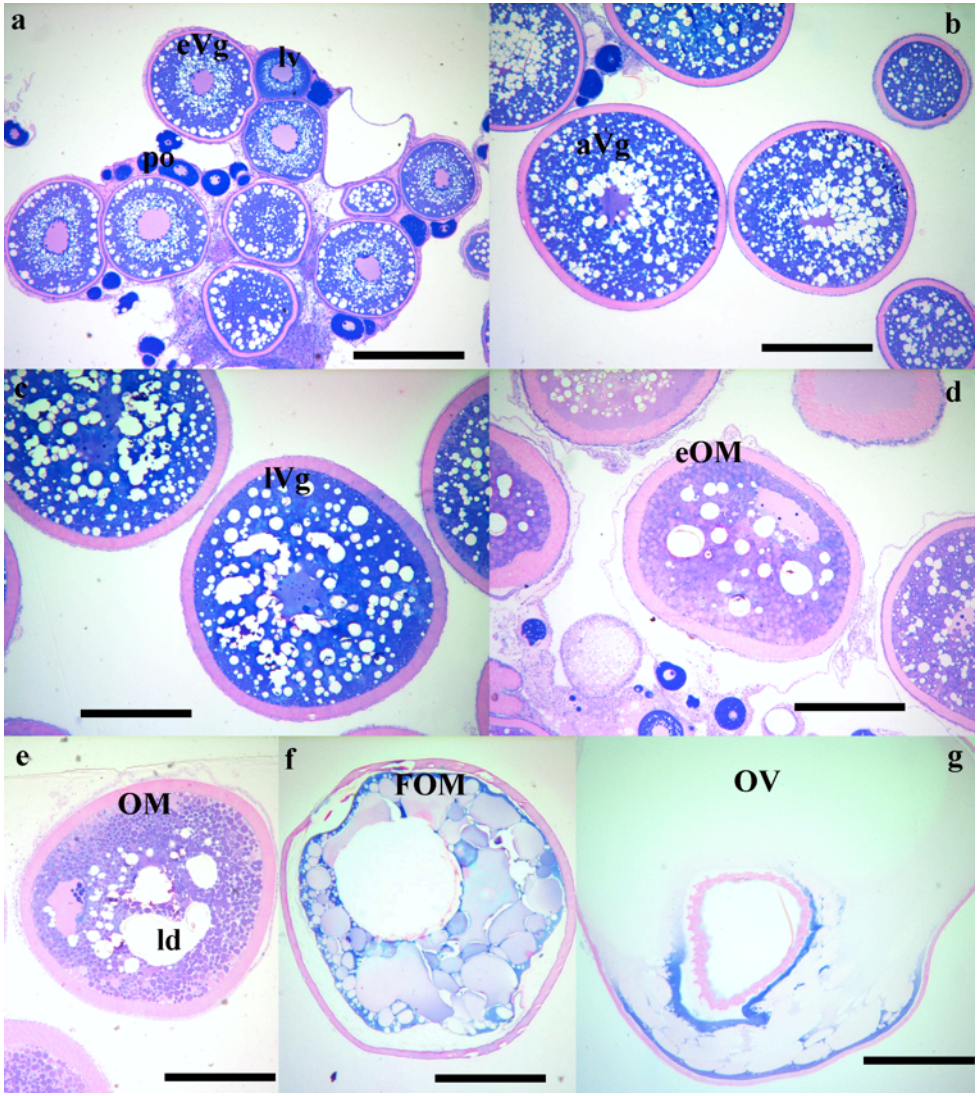


Vitellogenesis in Winter
Maturation in Spring
Vg oocytes 1400 µm
Eggs 2000 µm

Reproductive cycle – oogenesis

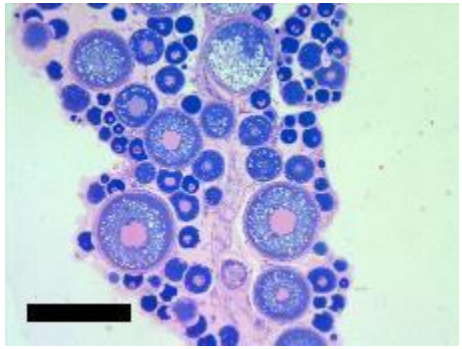
Bar: 500 µm

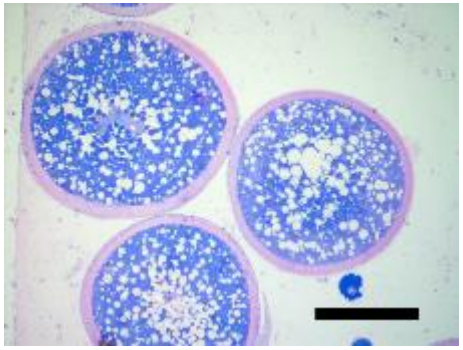
po-primary oocytes
ca-cortical alveoli
Ld-lipid droplets
eVg-early vitellogenesis
aVg-advanced vitellogenesis
lVg-late vitellogenesis
eOM-early oocyte maturation
FOM-final stages of OM
OV-ovulation

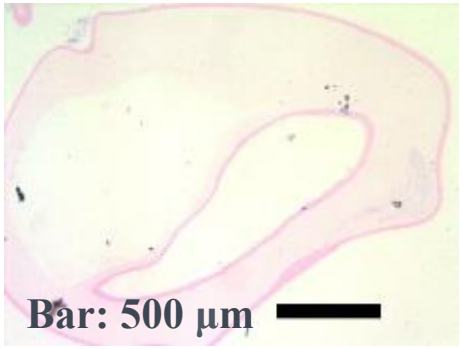


Vitellogenesis in Winter
Maturation in Spring
Vg oocytes 1400 µm
Eggs 2000 µm

Reproductive cycle – oogenesis

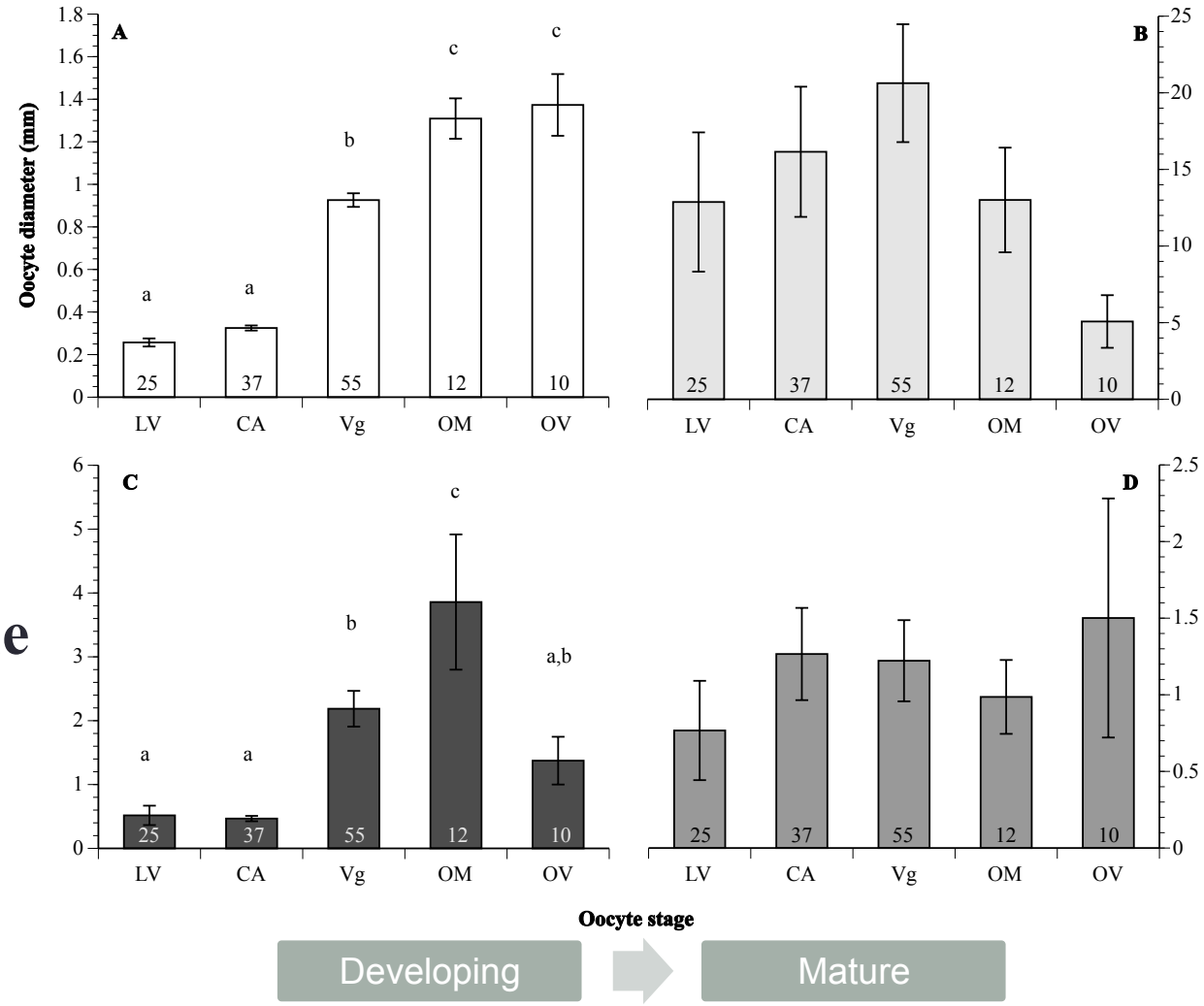






- 19% of the females with arrested oocyte development at the cortical alveoli stage (350 µm)
- 65% of the females with complete vitellogenesis, but no maturation (~1200 µm)
- 16% of the females spawned spontaneously (2000 µm)

Females



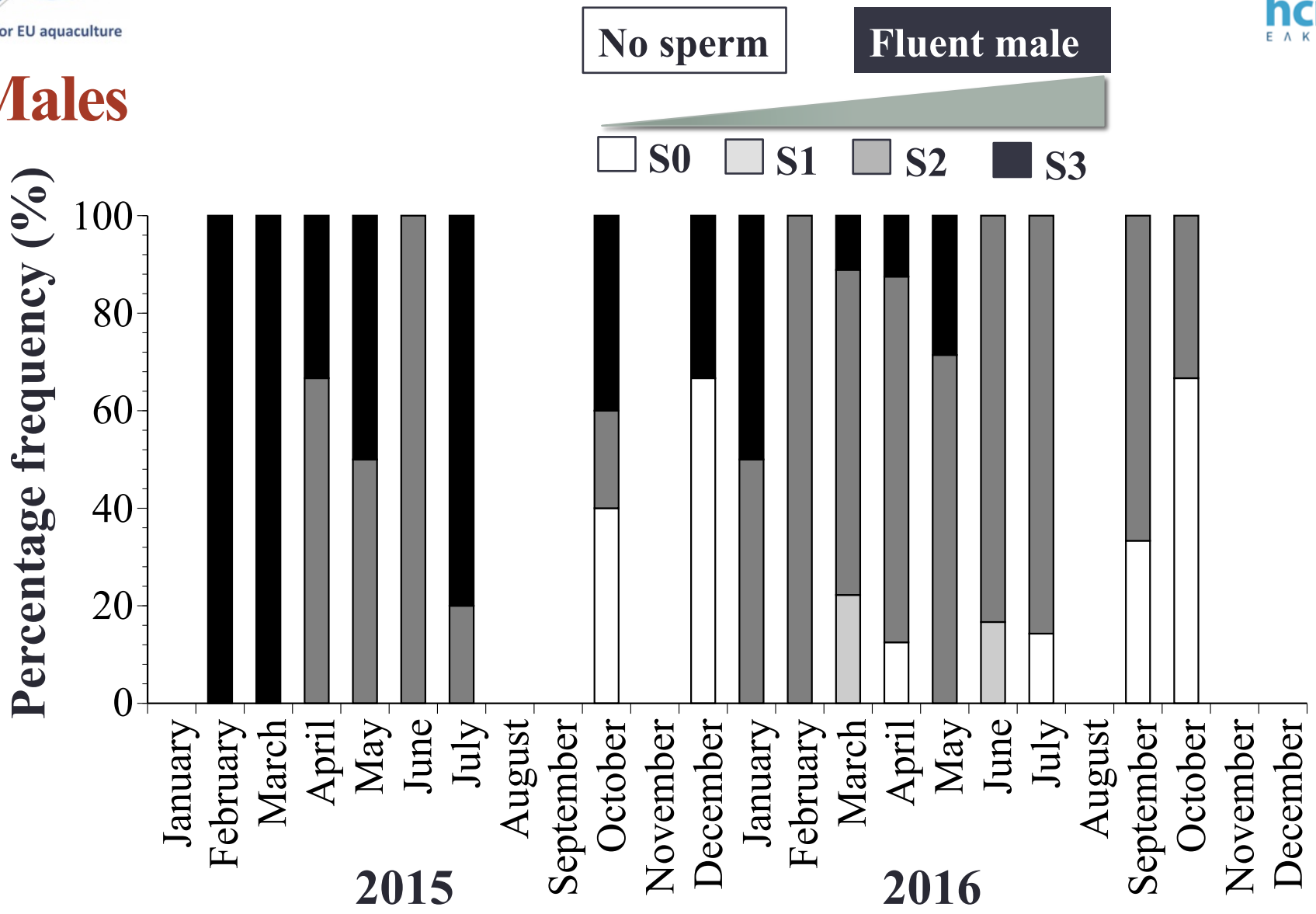
E_2 (ng/ml)

Testosterone (ng/ml)

DHP (ng/ml)

- Estradiol high during vitellogenesis
- Testosterone peaked at maturation
- 17a,20β-DHP low and unchanged (irrelevant as MIS?)

Males

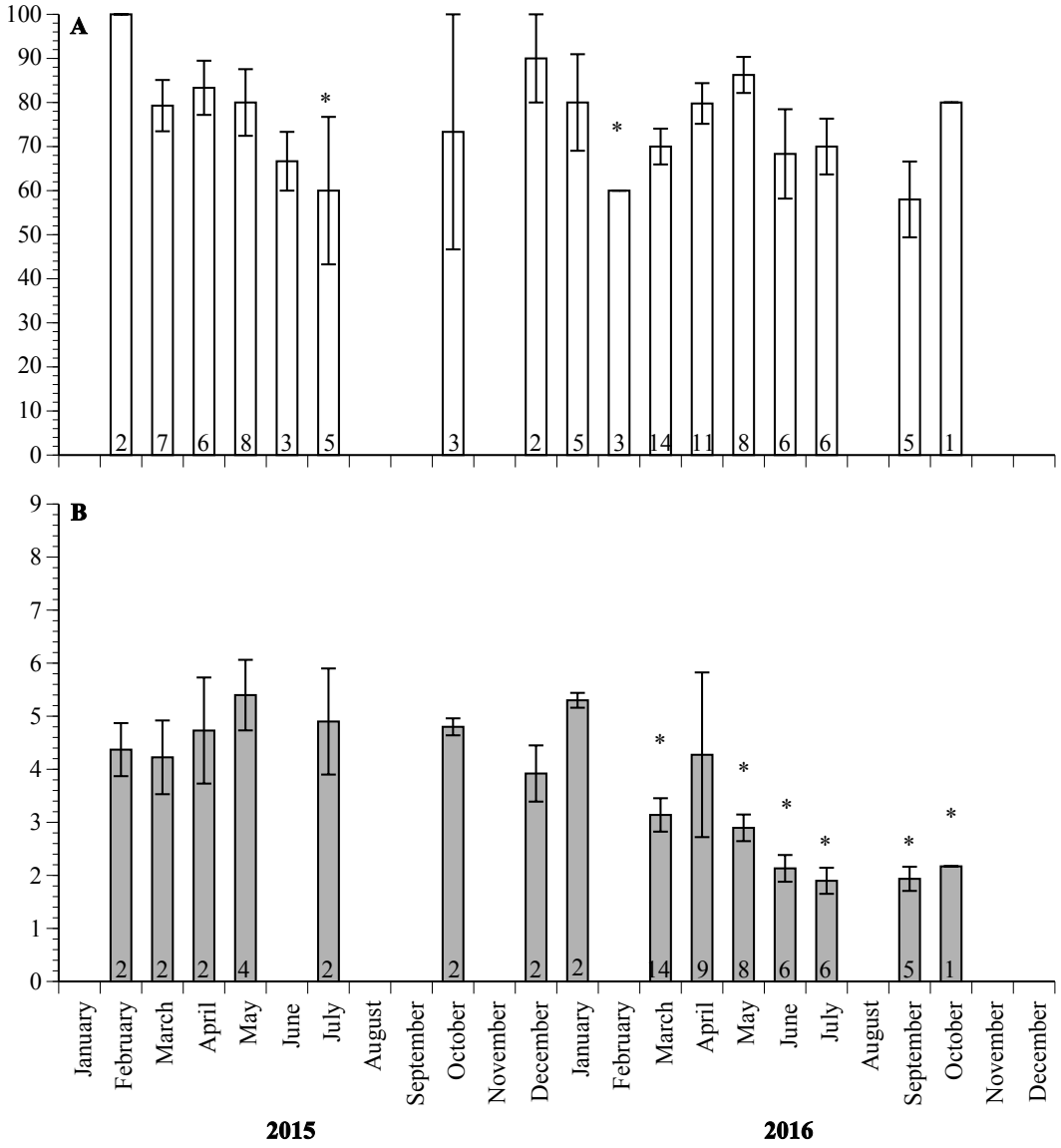


- Sperm was produced almost all year

Sperm quality

Sperm motility (%)

Duration of motility (min)

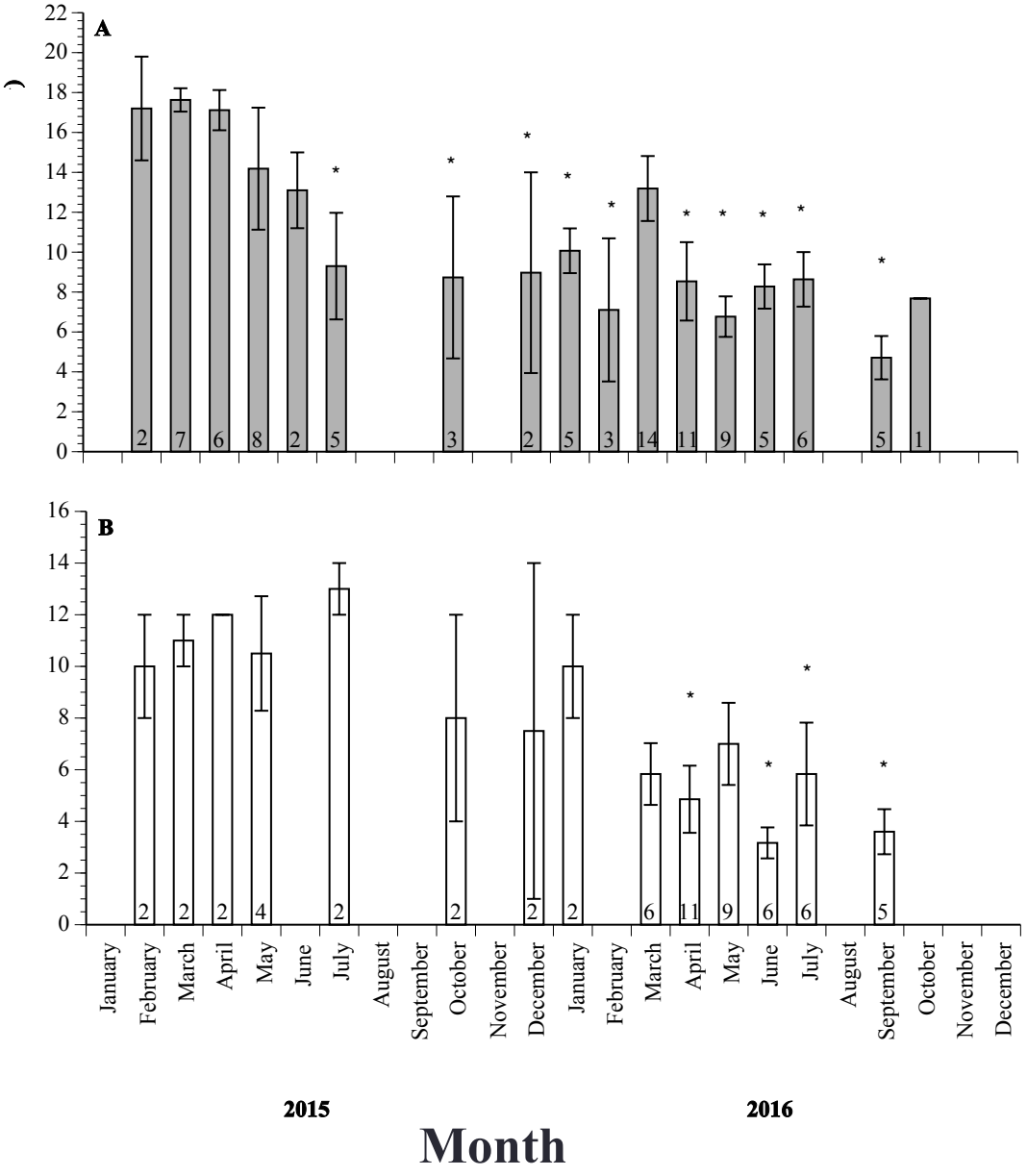


Month

Sperm quality

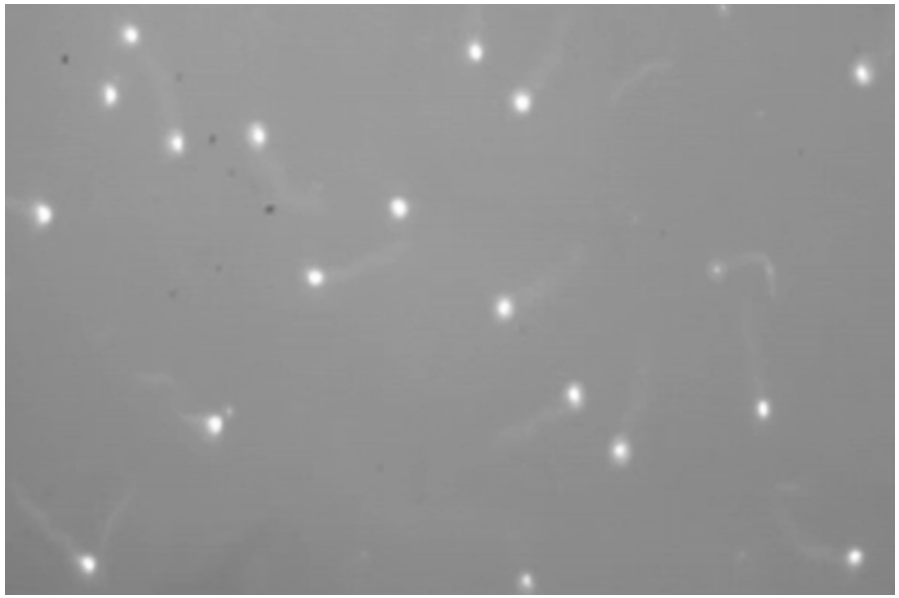
Szoa density ($x10^9$ ml^{-1})

Sperm survival (days)

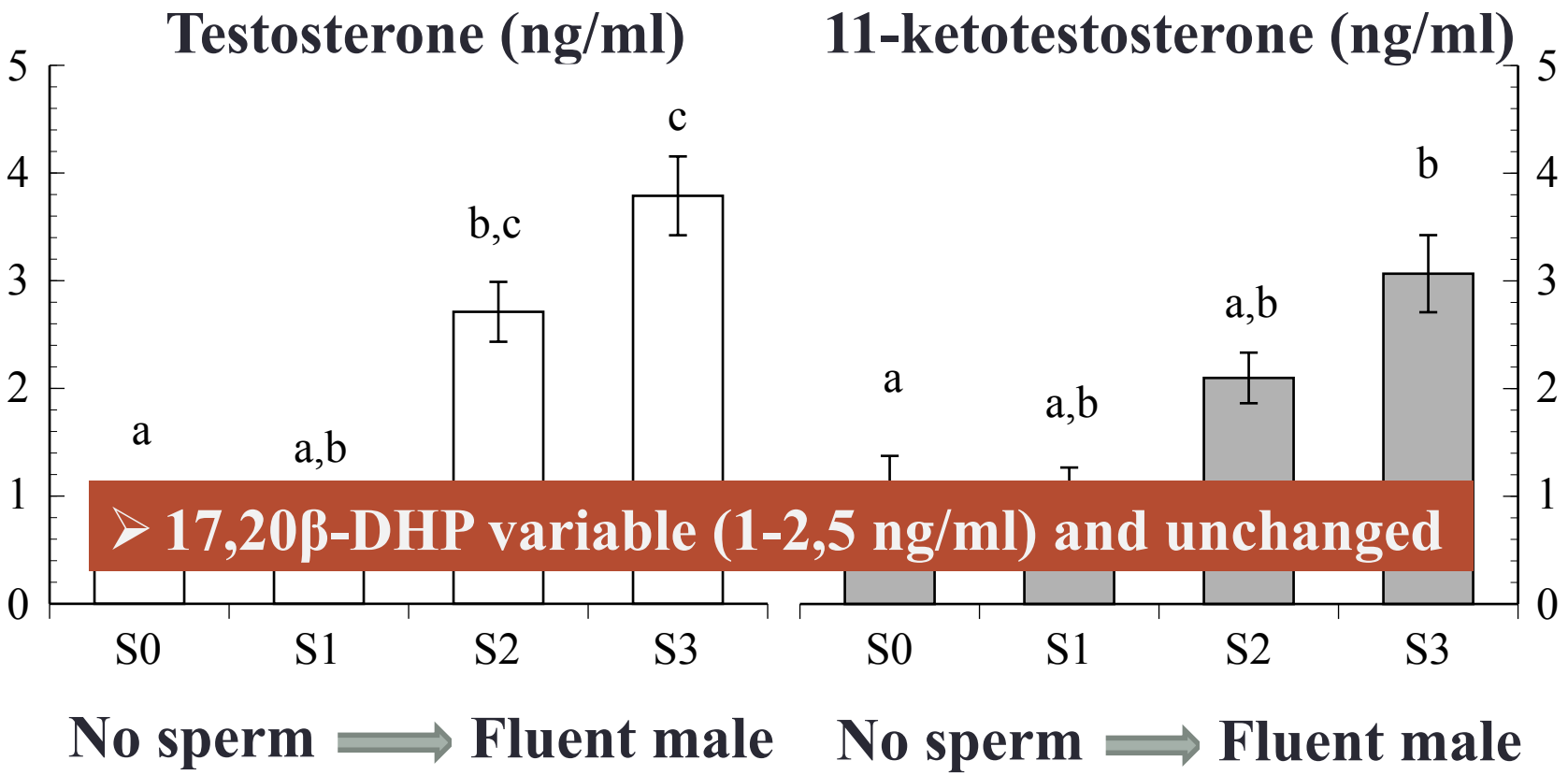


Sperm quality - summary

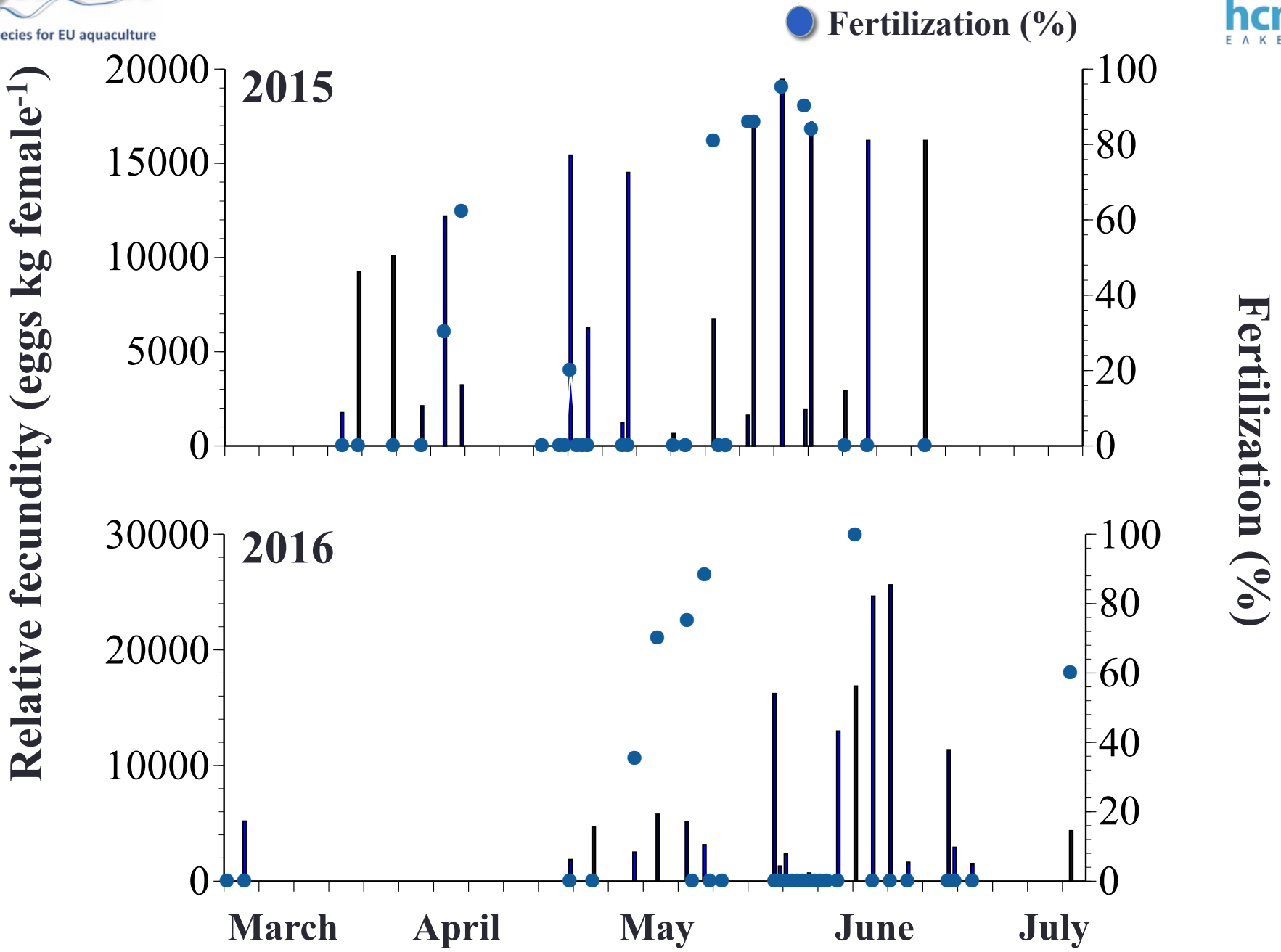
- sperm density between 4.5 - 11.5 x 10^9 szoa ml^{-1}
- sperm motility always >60%
- motility duration 1.5 - 6 min
- survival of sperm at (4°C) for 3 - 10 days

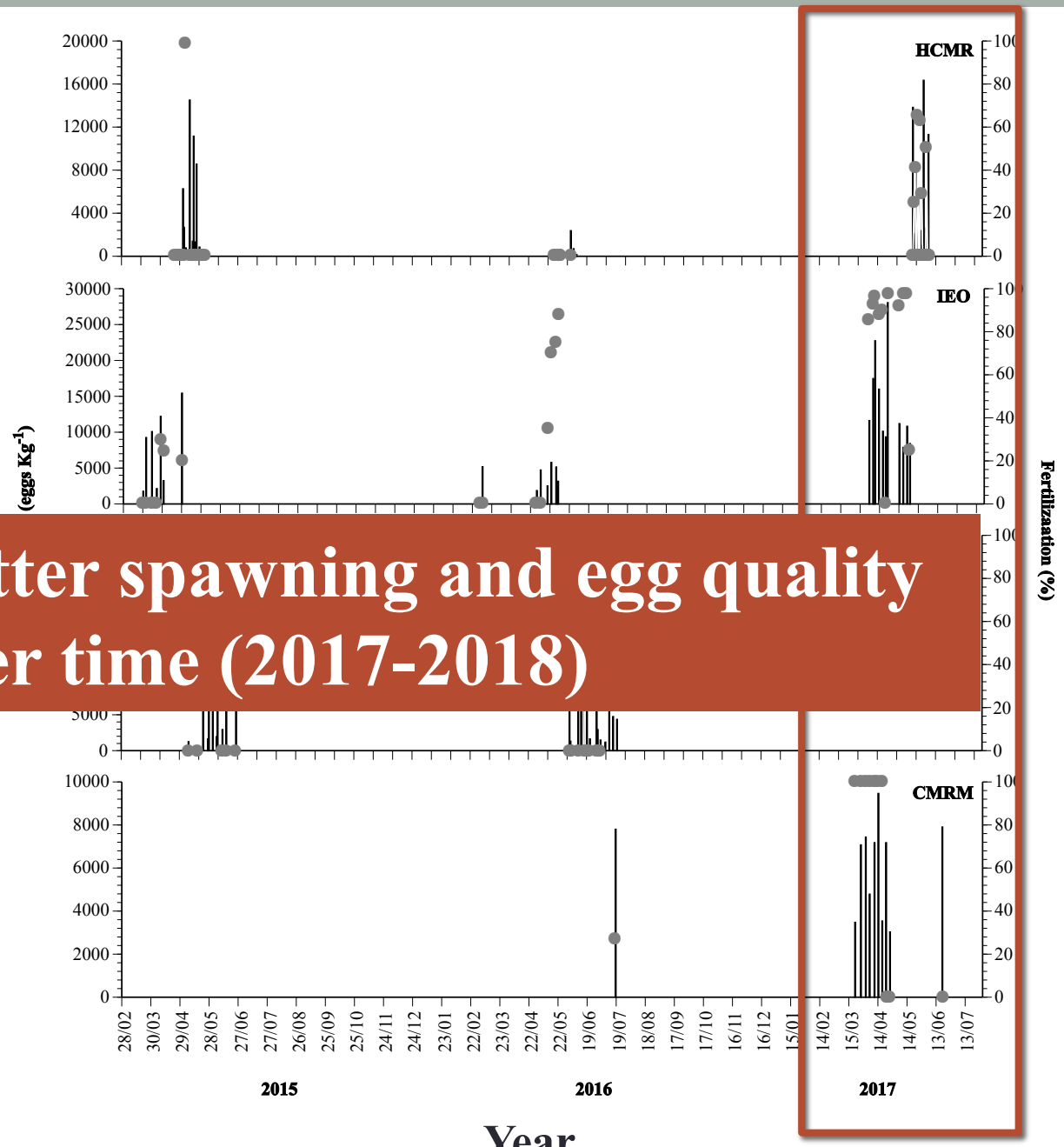


Males



➢ Testosterone and 11-ketotestosterone increased with increased sperm production


Fertilization (%)
2015
2016
Relative fecundity (eggs kg female-1)
Fertilization (%)
20000
15000
10000
5000
0
30000
100
80
60
40
20
March
April
May
June
July



Better spawning and egg quality over time (2017-2018)

Reproductive cycle in captivity – Females

1. Undergo gametogenesis, but maturation and egg production may take some years to reach adequate levels
2. Reproduction under fluctuating or constant low temperature
3. Plasma T and E_2 followed the proper fluctuations during oogenesis, but 17,20β-DHP was not correlated to reproductive stage (not the MIS?, sample timing?)

Better understanding of the required environmental conditions, to ensure that more fish complete gametogenesis and mature/spawn.

Reproductive cycle in captivity – Males

1. Produce sperm all-year round (natural or captivity-induced?)
2. Plasma T and 11-KT followed the proper fluctuations during spermatogenesis, but 17,20β-DHP was not correlated to reproductive stage (not the MIS?)
3. Sperm was of good quantity and quality

Sperm availability and quality is not limiting to reproduction in captivity, but breeding behavior may not be fully expressed. More focus on environmental requirements for successful spawning

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Many thanks to:

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