Gamete Biology: perspectives for tuna aquaculture

[1]C. FAUVEL,[2] M. SUQUET, [3]F.de la GANDARA, [4]A.MEDINA, [4]F.ABASCAL& [5]C.MYLONAS

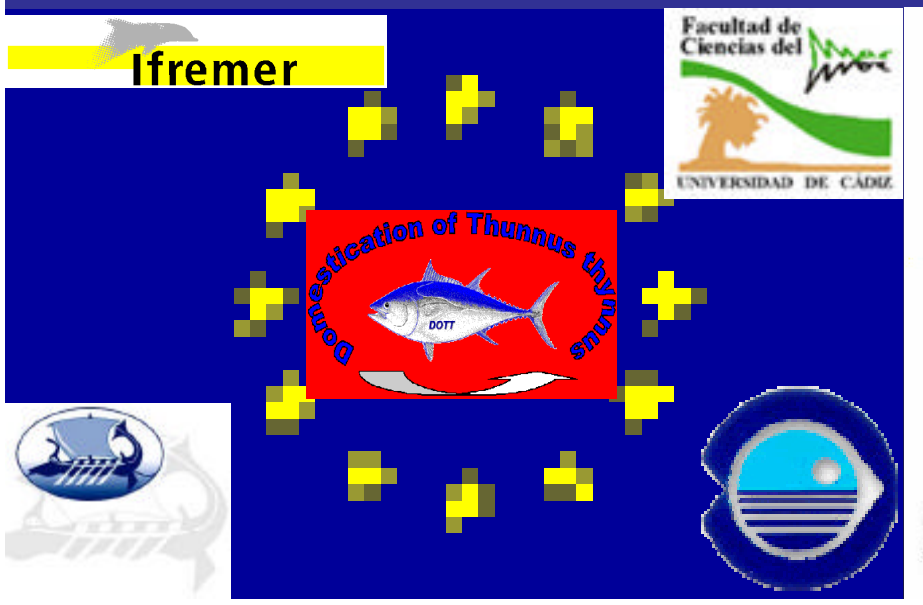
[1]*Ifremer, Station Expérimentale d'Aquaculture, Chemin de Maguelone, 34250, Palavas, France*

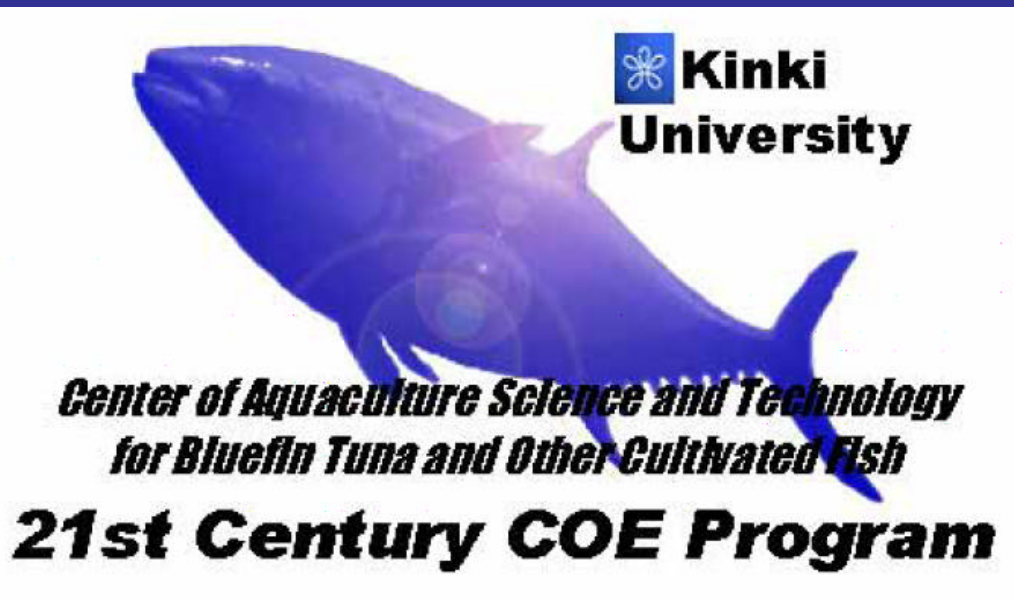
[2]*Ifremer, Centre de Brest,BP70, 29280 Plouzané, France*

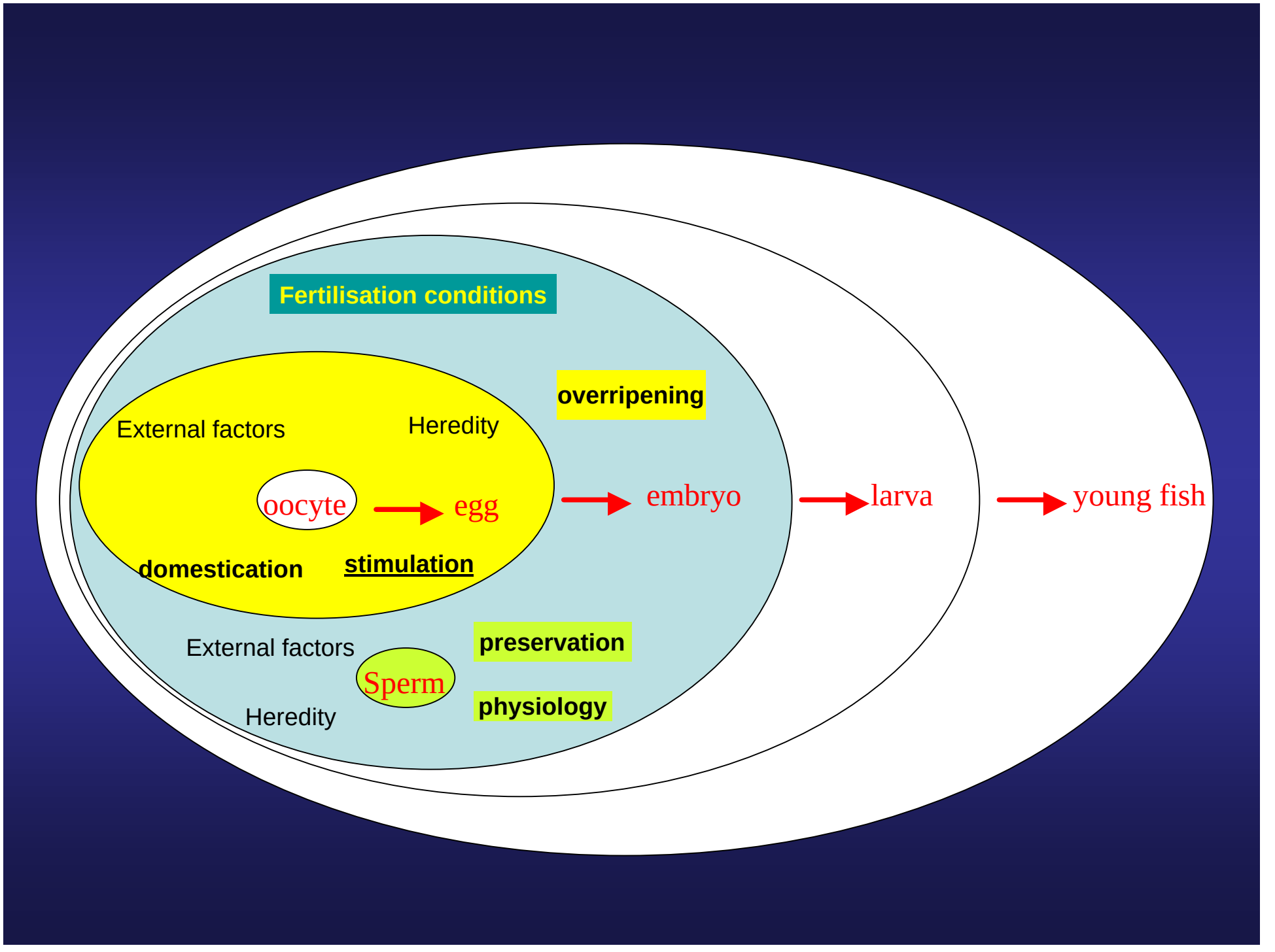
[3] *IEO Laboratorio de Cultivos Marinos, 30860, Puerto de Mazzaron, Spain*

[4] *Universidad de Cadiz, Departamento de biologia,11510, Puerto Real, Cadiz, Spain*

[5] *HCMR, Institute of Aquaculture, Heraklion, Crete 71003, Greece*



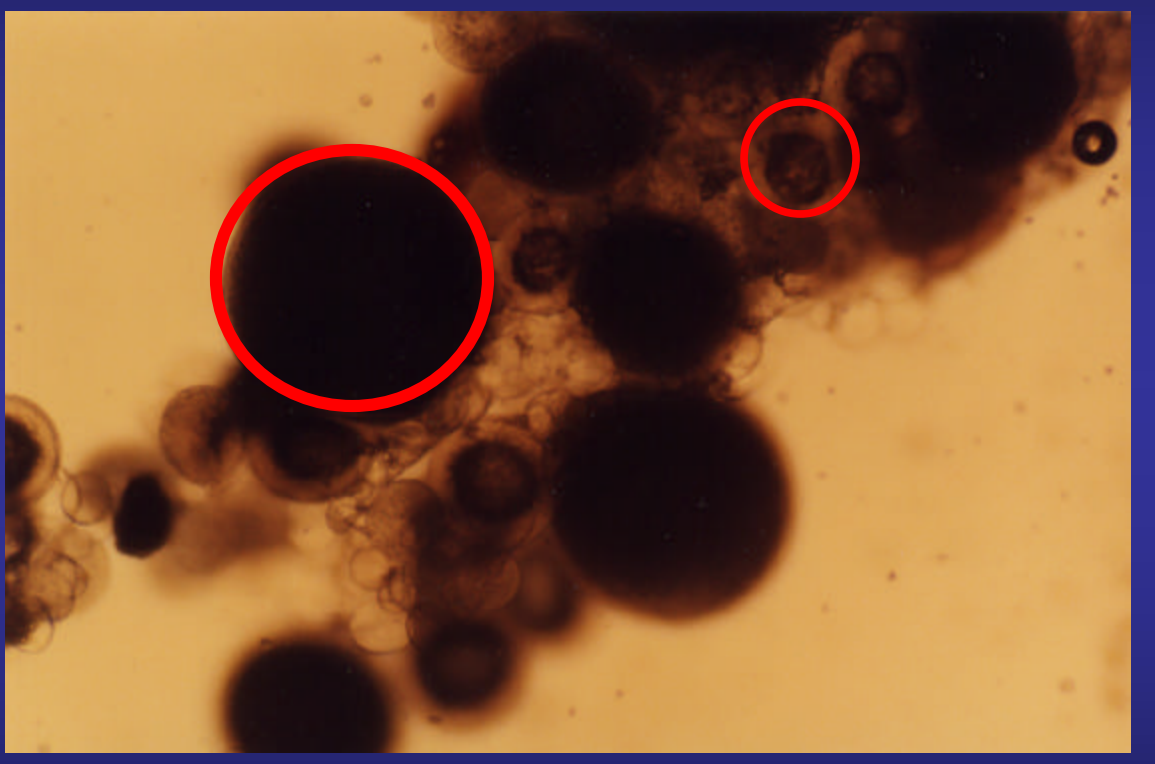



Fertilisation conditions
overripening
External factors
Heredity
oocyte
egg
embryo
larva
young fish
domestication
stimulation
External factors
preservation
Sperm
physiology
Heredity

oocytes (biopsy)

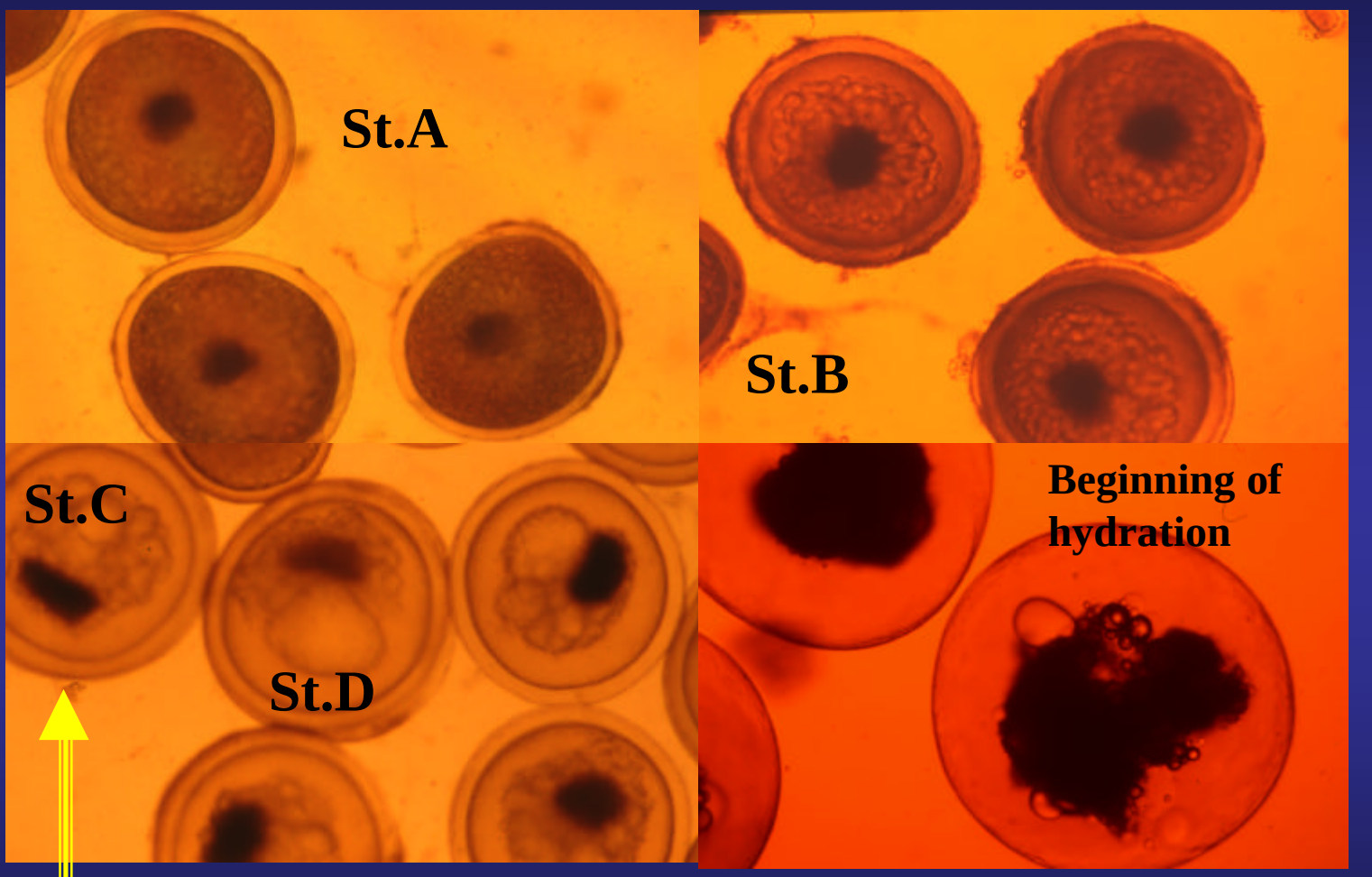
Vitellogenesis

250µm



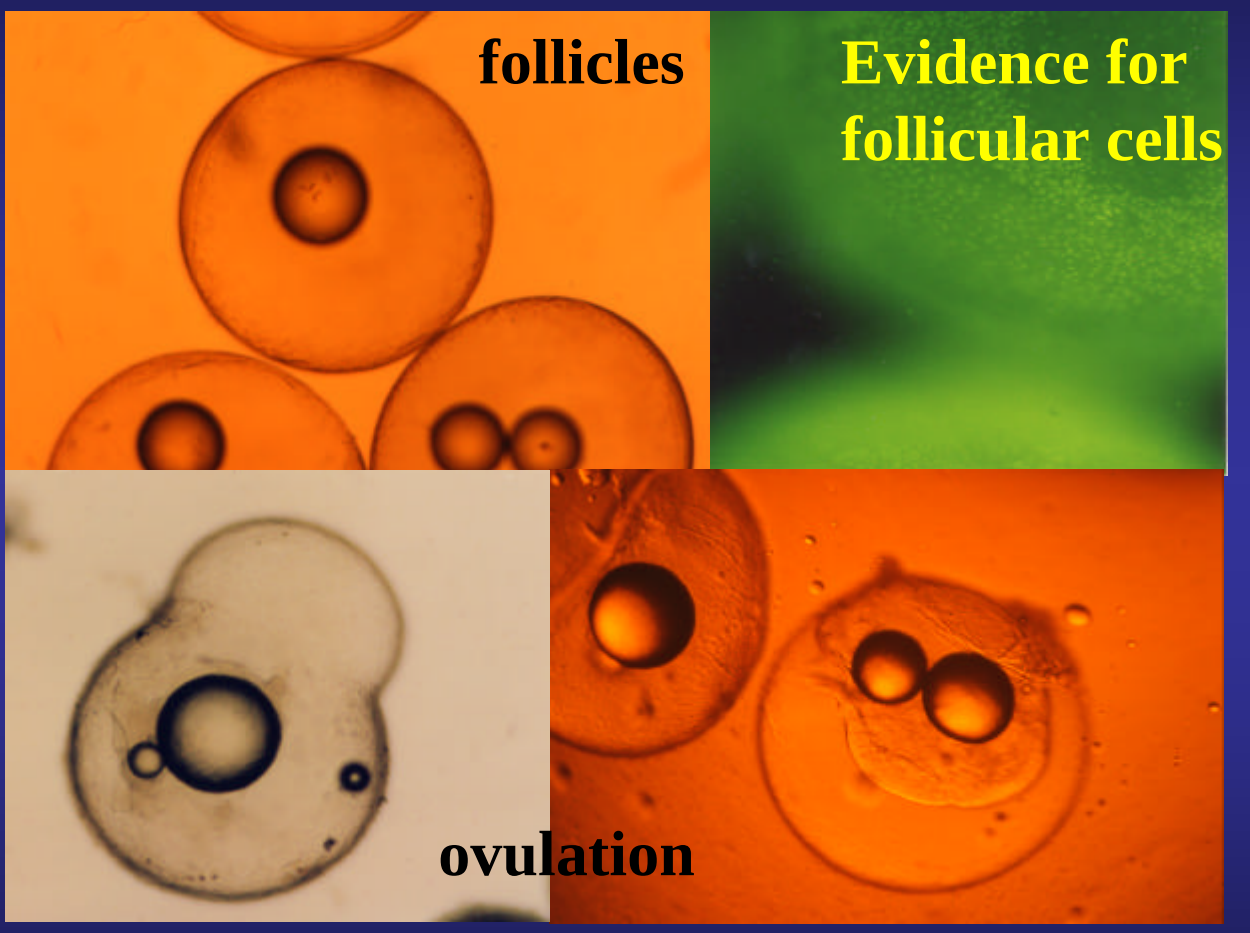
800µm

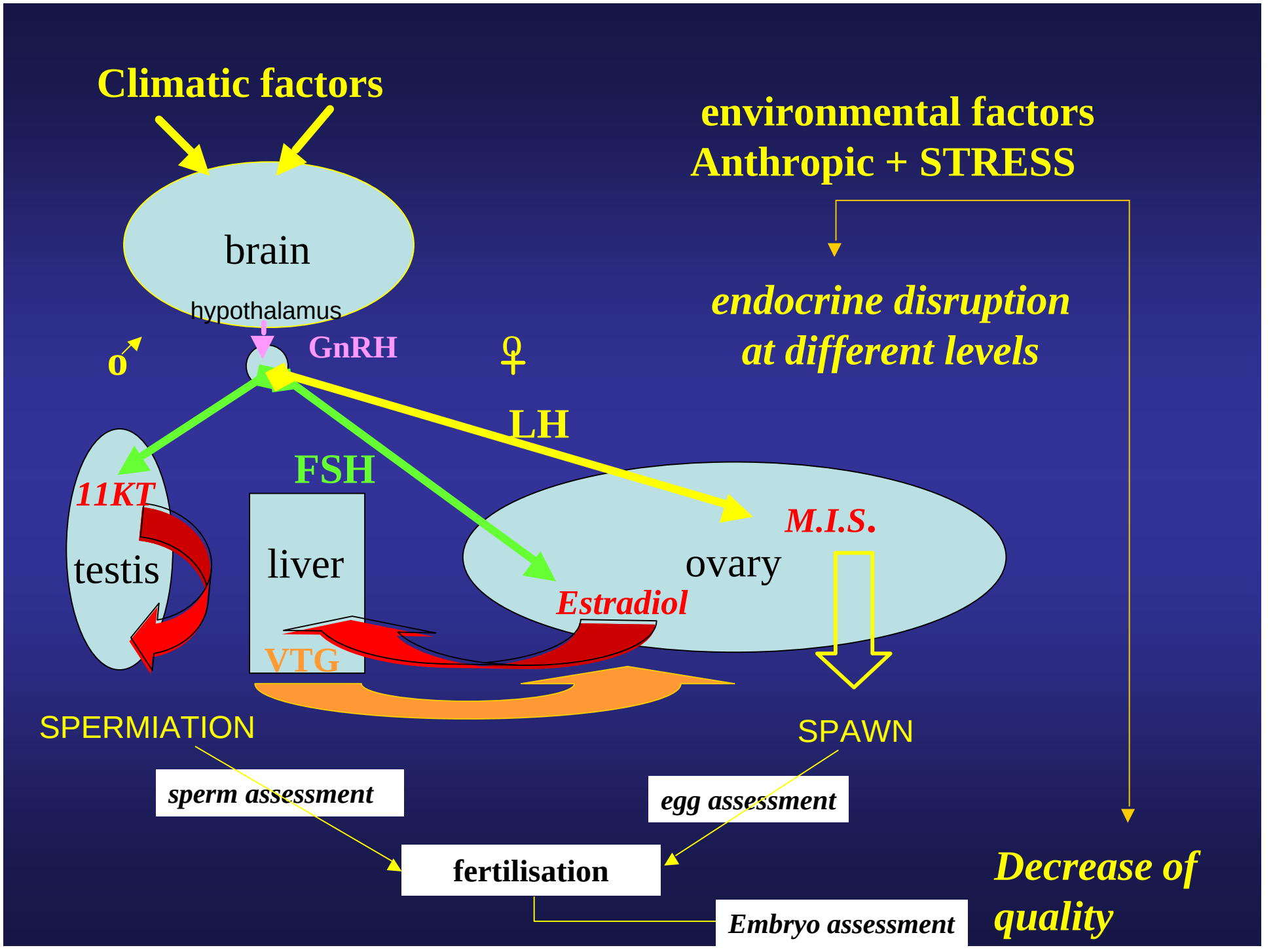
Postvitellogenesis (after clearing)



Best stage for hormonal stimulation of spawn

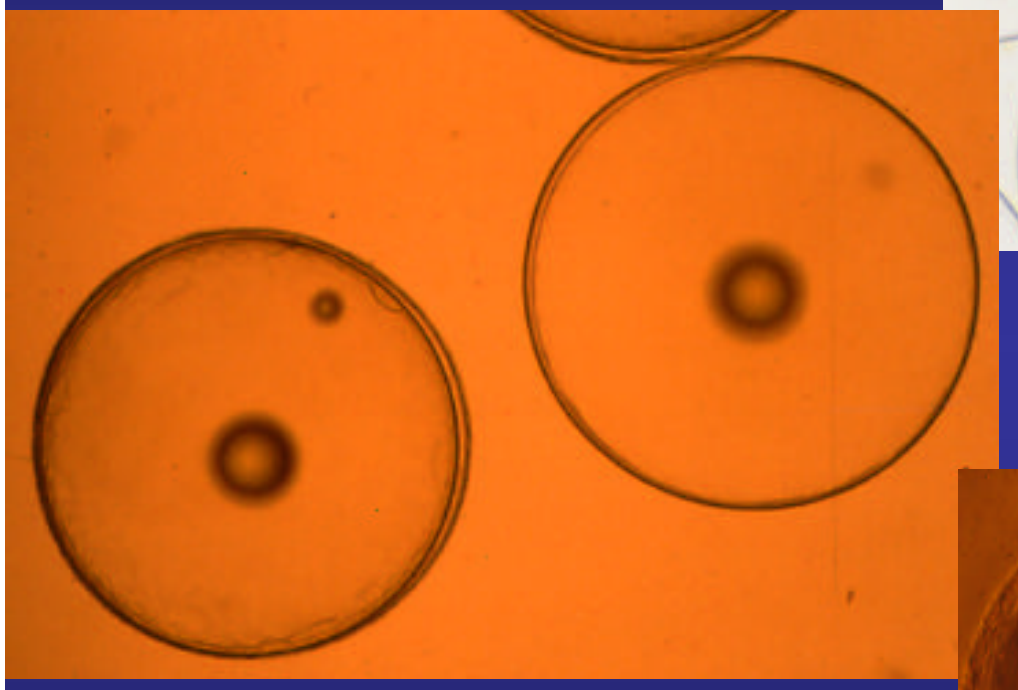
Hydration-ovulation

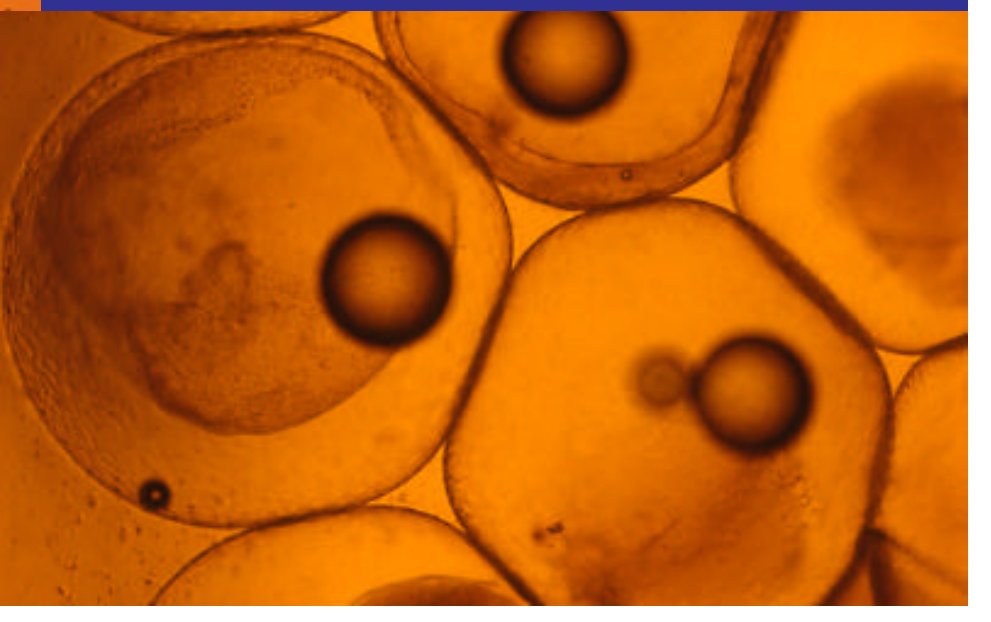



Climatic factors
brain
hypothalamus
GnRH
♂
♀
LH
FSH
11KT
testis
liver
ovary
M.I.S.
Estradiol
VTG
SPERMIATION
SPAWN
sperm assessment
egg assessment
fertilisation
Embryo assessment
environmental factors
Anthropic + STRESS
endocrine disruption
at different levels
Decrease of
quality

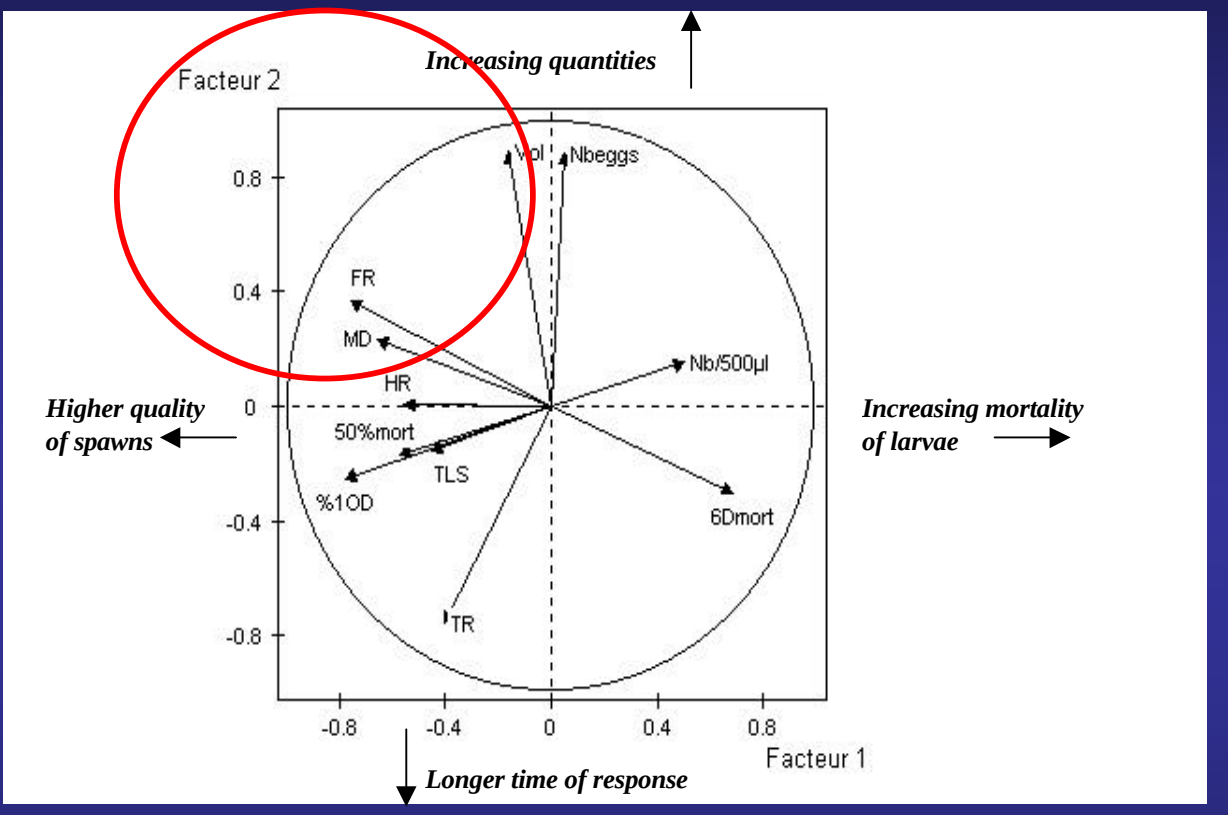
Egg collection

Egg quality?

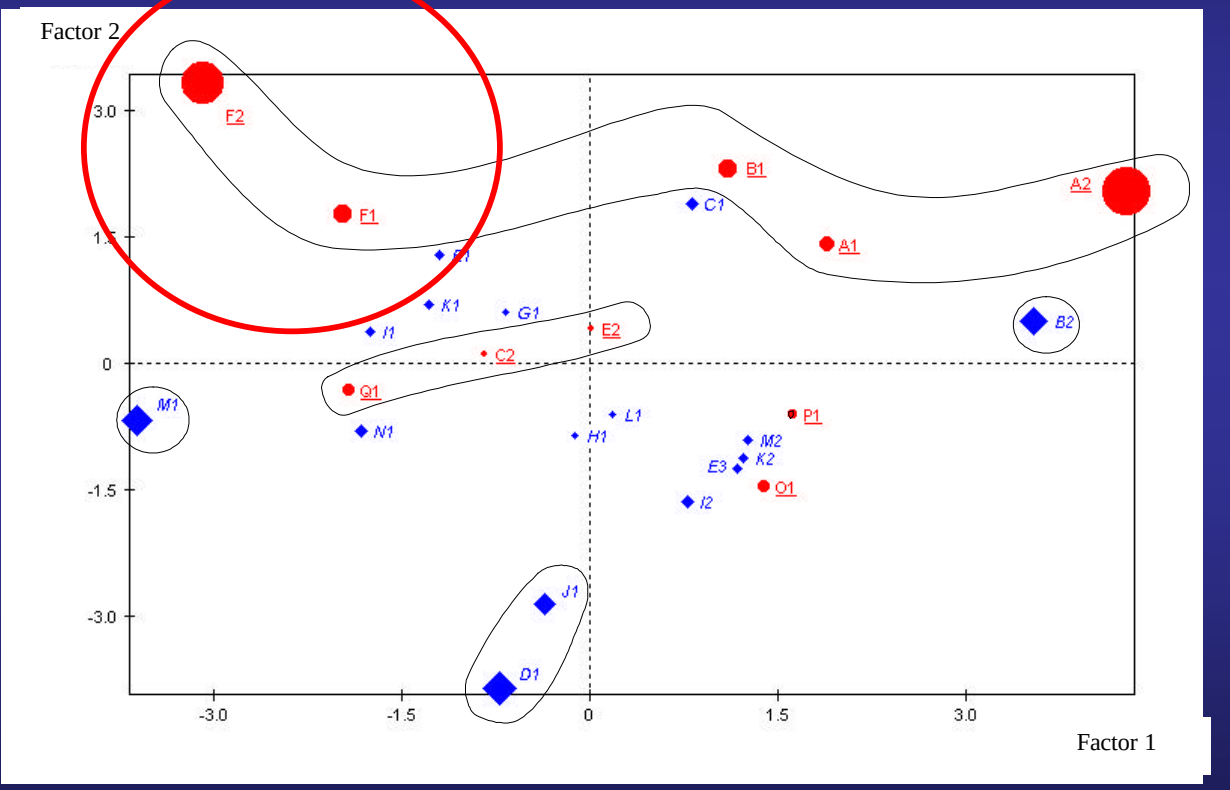




Heterologous Hormonal Supply

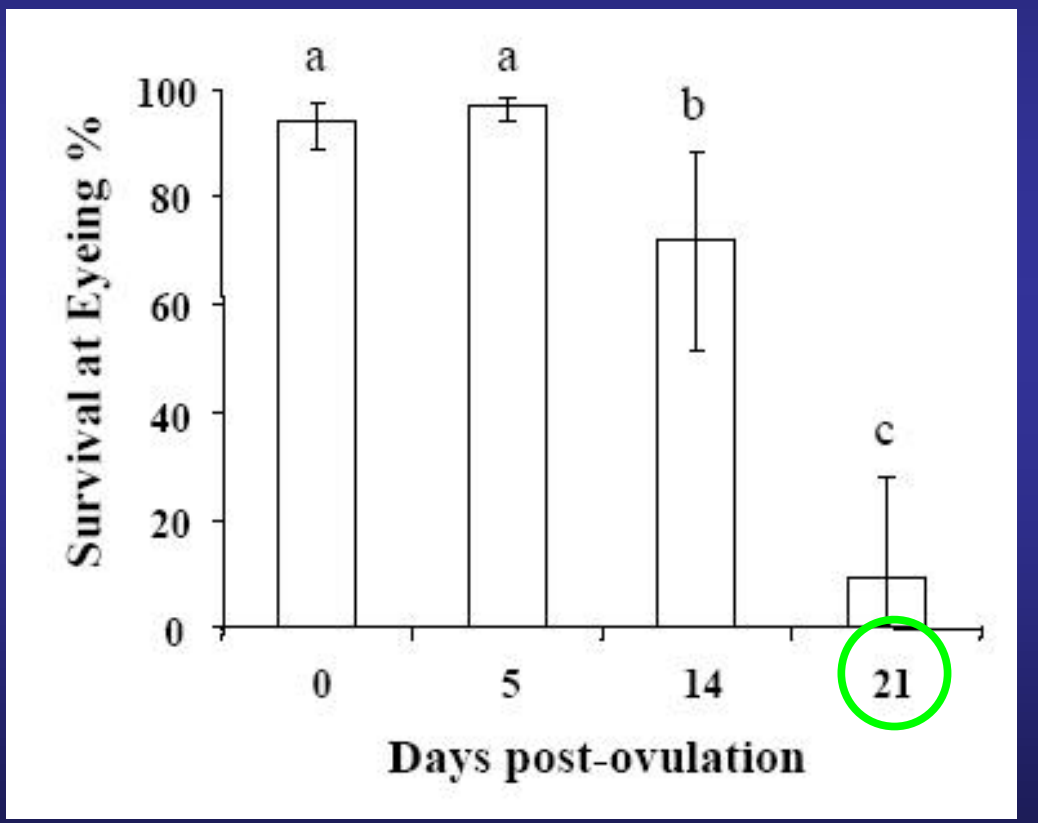


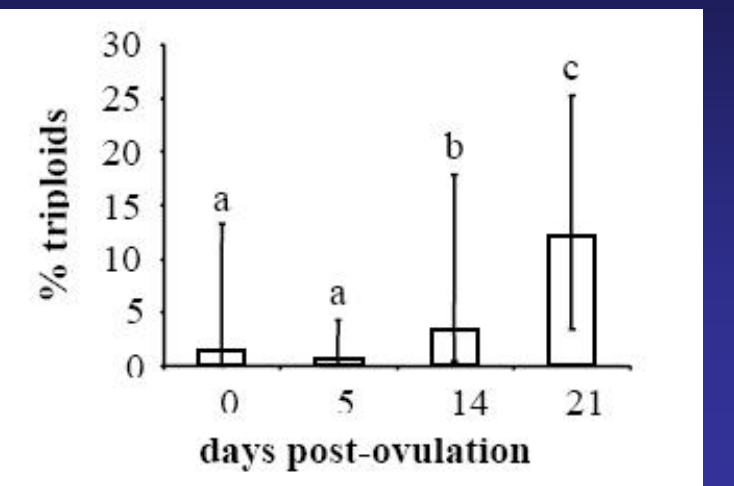
Dose effect : 20 µg LHRH (◆) vs 50 µg.Kg^{-1} (●)

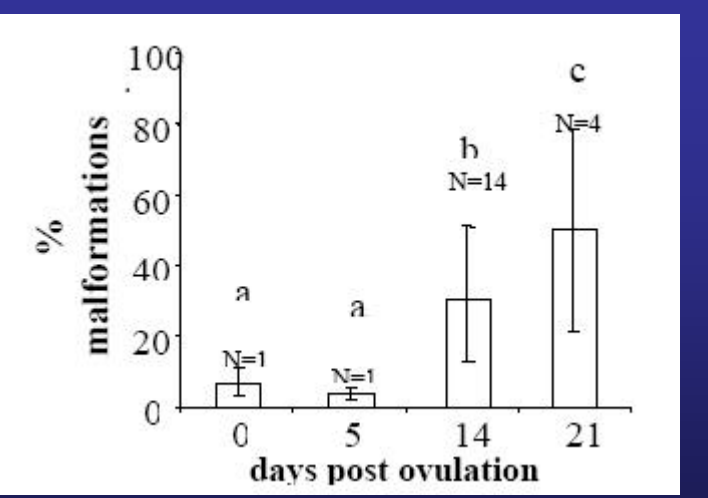


Stage at stimulation: B (◆) vs C (●)

Overripening in rainbow trout







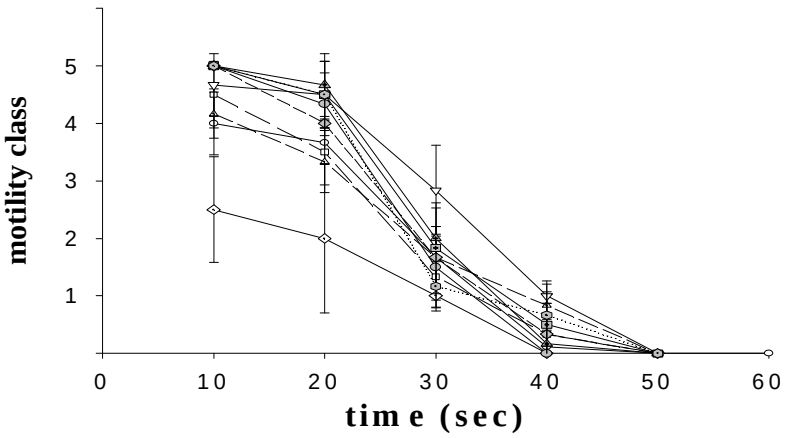
Aegerter 2004

Sperm collection

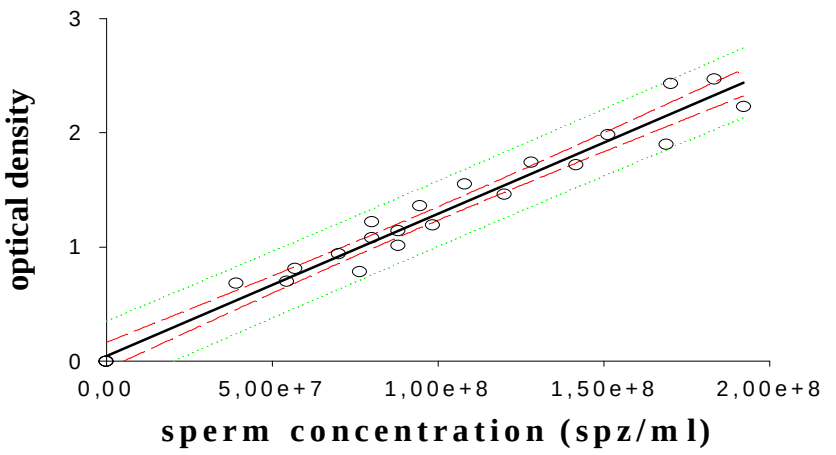
Sperm characterisation

Volume

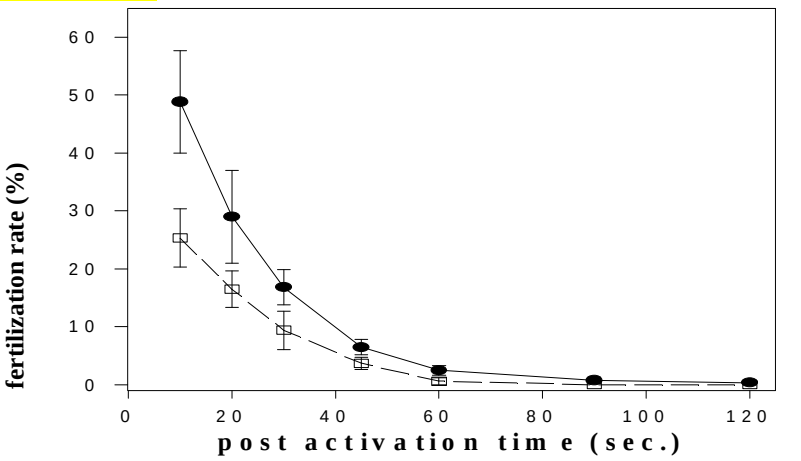
Motility



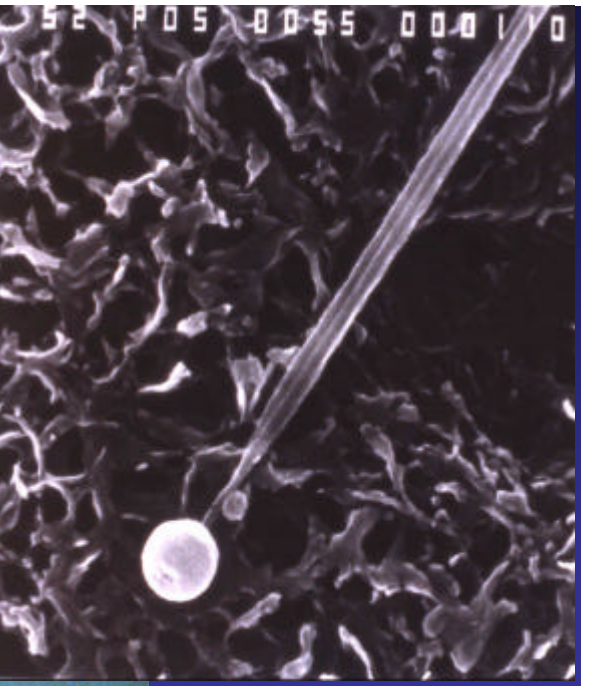
Concentration



Fertility



fertilisation



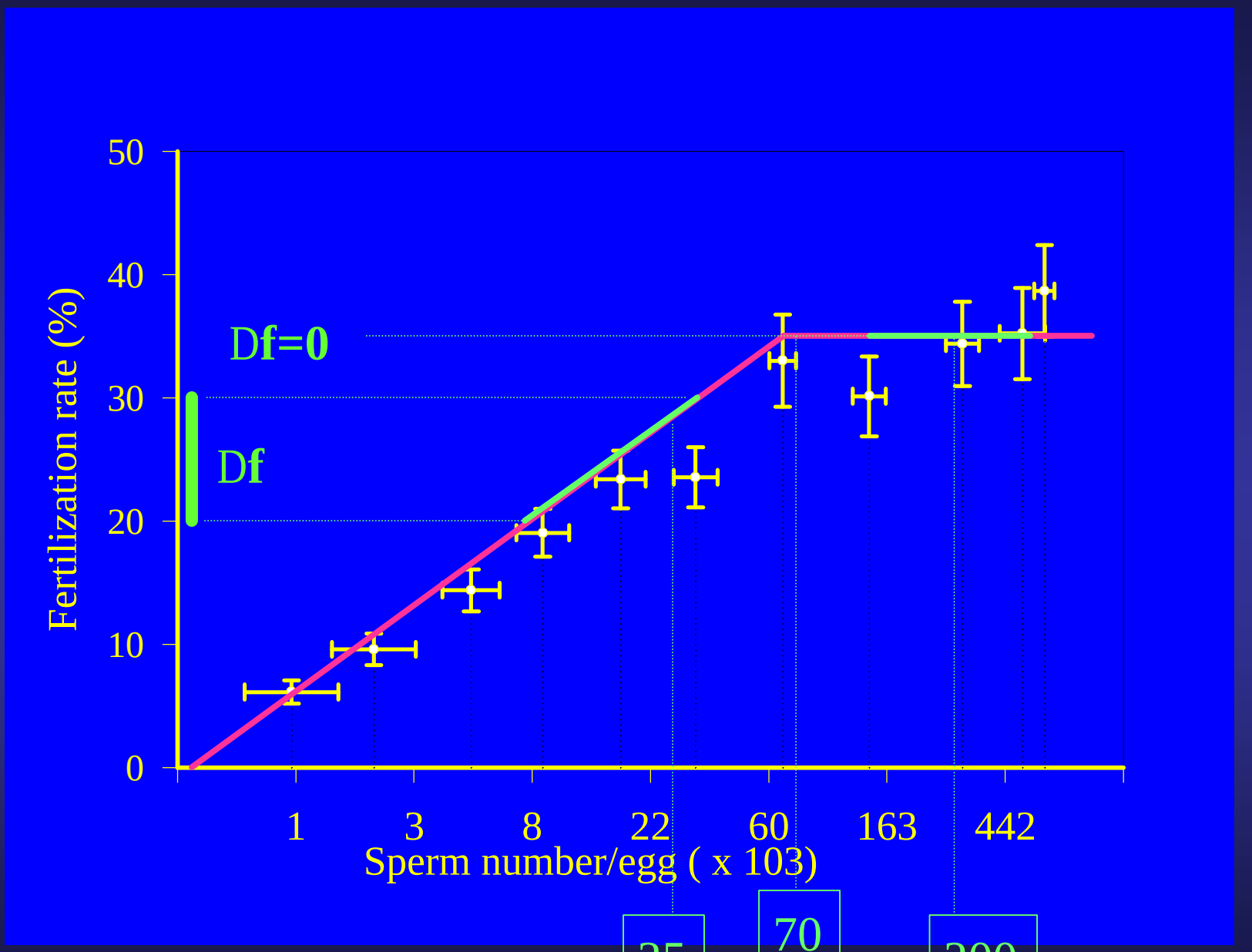
insemination

1 vol egg + 0.05 vol sperm

+

0.5 vol sw

Number of sperm cell per egg

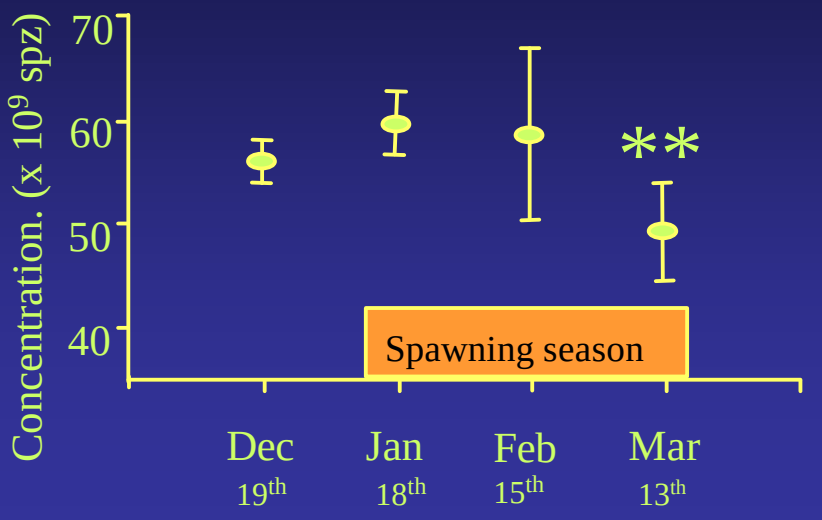


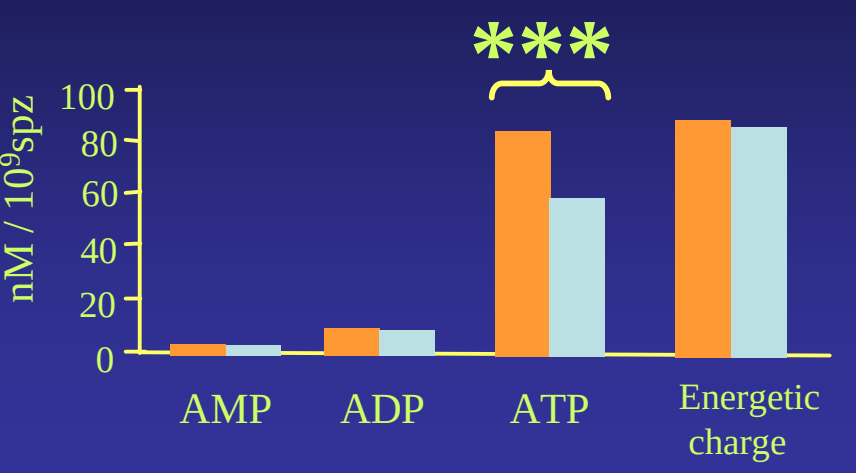
35 — **experimental**

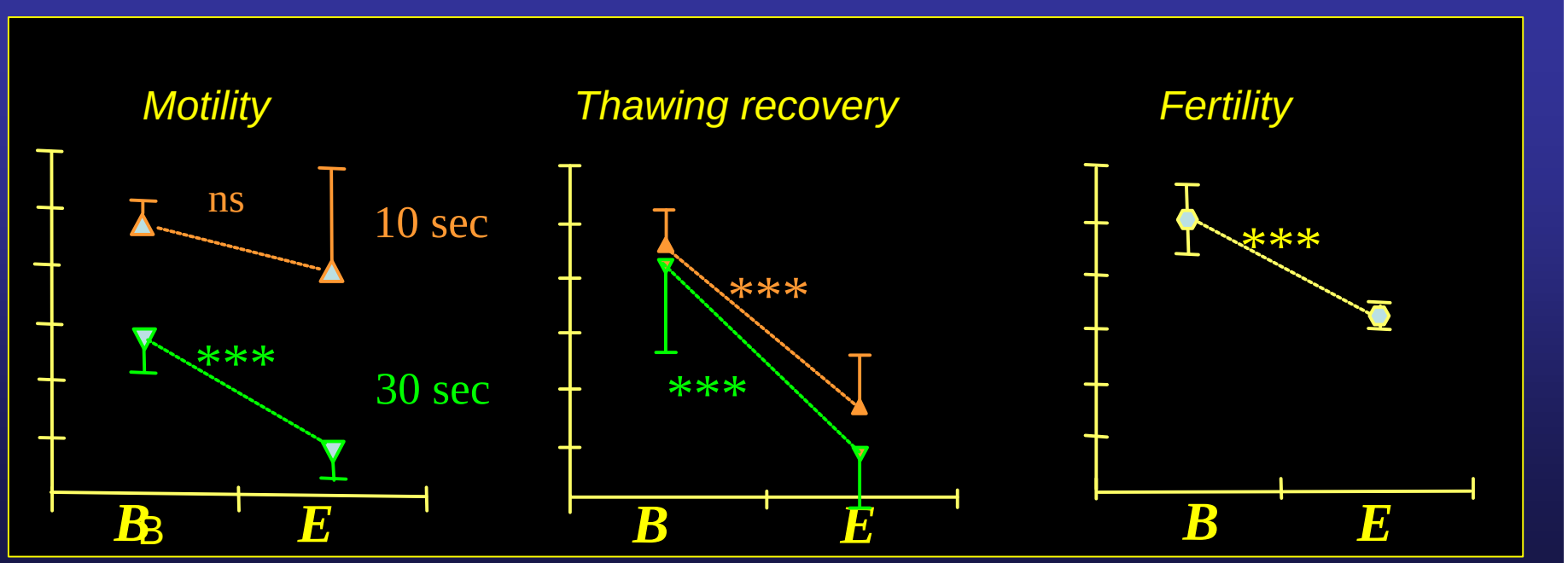
70 — **optimised**

200 — **secured**

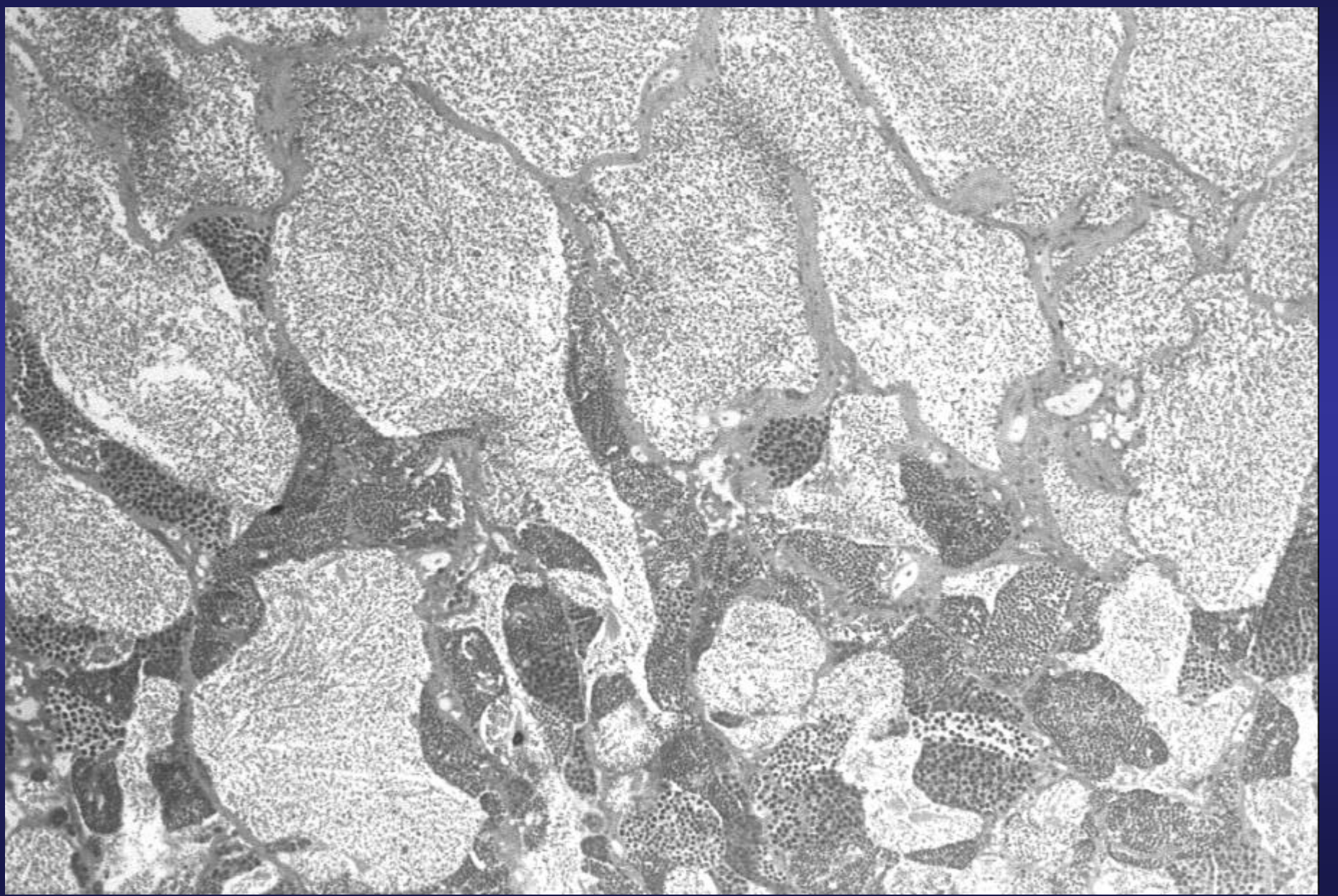
Sperm ageing

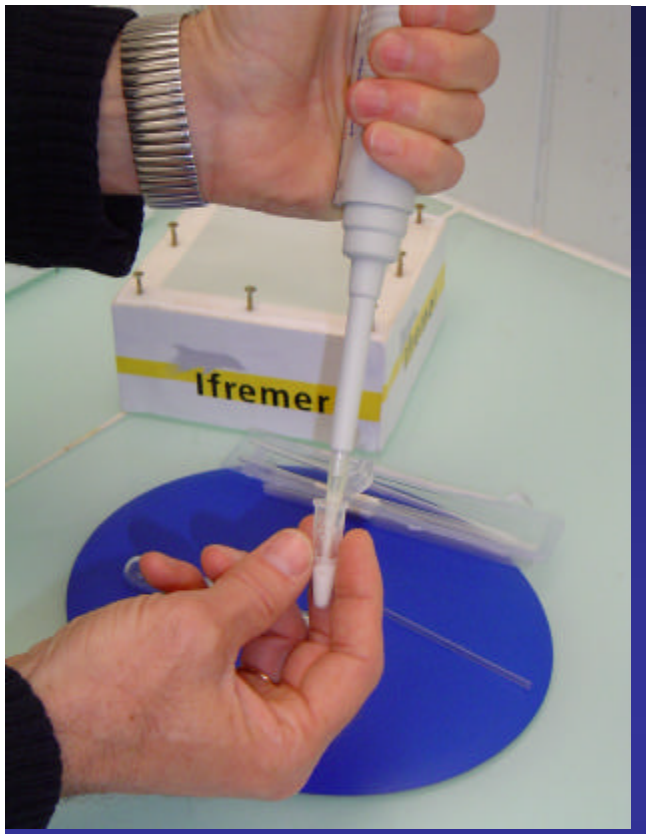




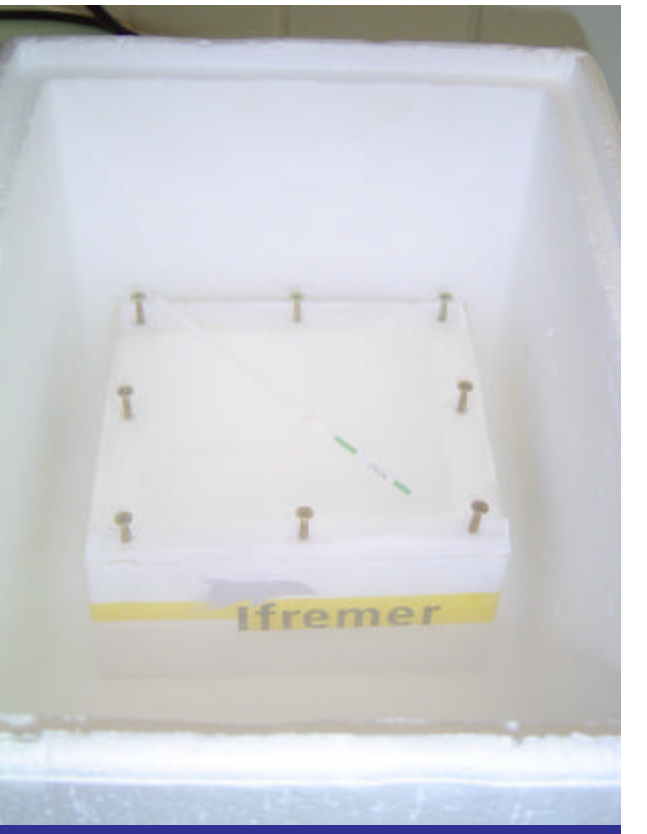


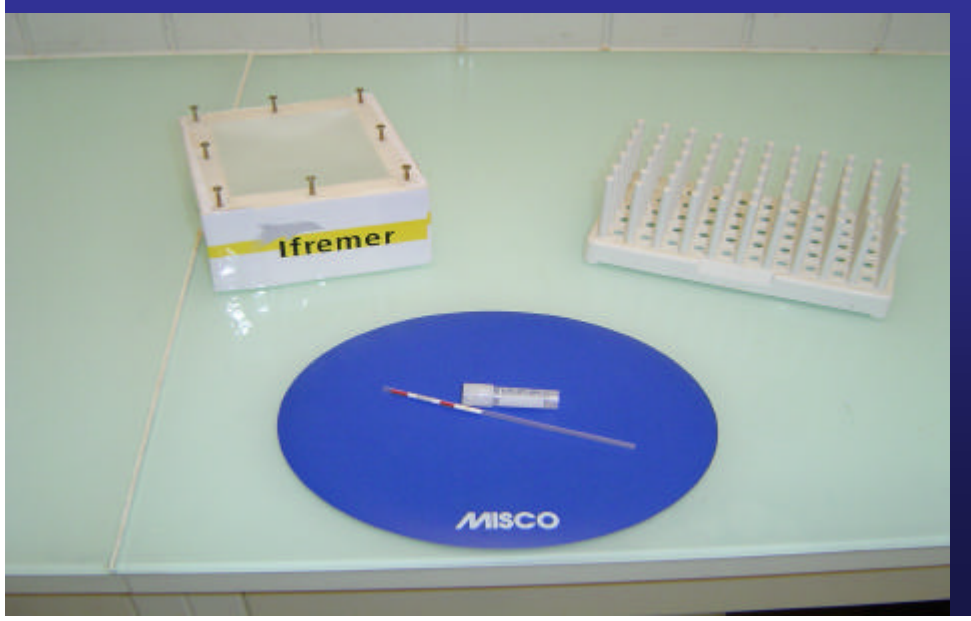
Male gametogenesis

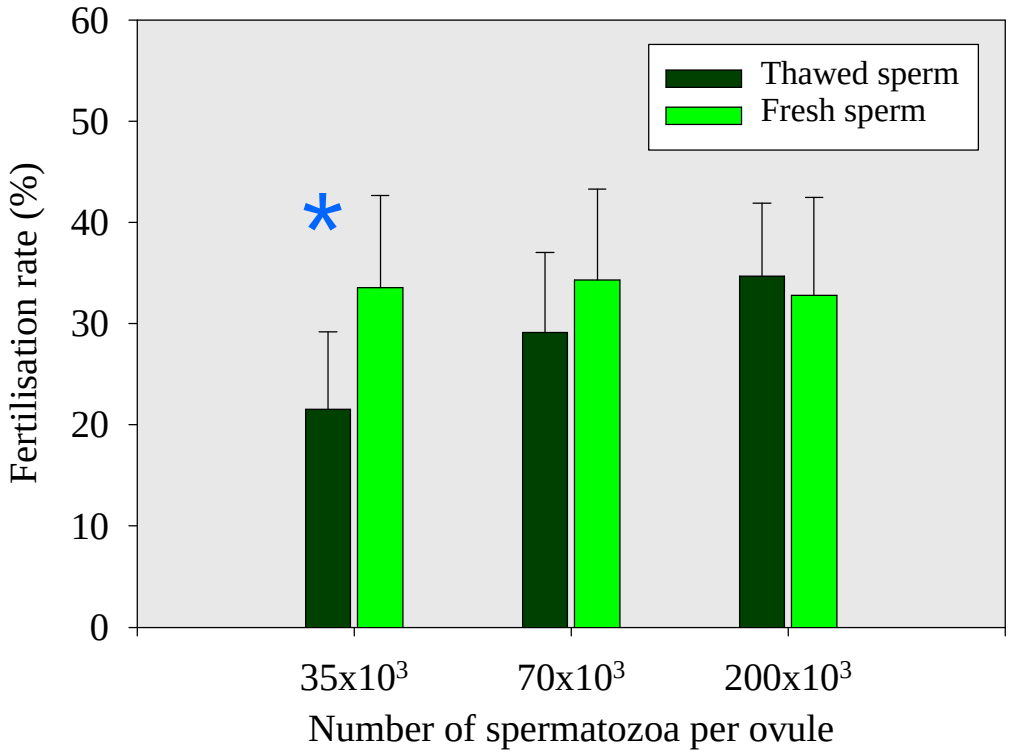



Ifremer


Ifremer


Ifremer


Ifremer
MISCO



	mâle1	*mâle2*	*mâle3*	*mâle4*	*mâle5*	*mâle6*
35*103spz/w	* p<0,05	**p<0,01	* p<0,05	p=0,21	p=0,15	p=0,74
70*103spz/w	* p<0,05	p=0,25	p=0,19	p=0,82	p=0,47	p=0,63
200*103spz/w	p=0,4	p=0,25	p=0,45	p=0,34	p=0,11	p=0,16

	FRESH			FROZEN/THAWED		
	MALE C	MALE D	MALE E	MALE C	MALE D	MALE E
Fertilisation rate (%)	71.3	71.6	73.3	66.3	67.0	46.0
Hatching rate (%)	84.1	79.5	81.8	76.8	67.1	64.5
Loss compared to fresh (%)				15.0	21.0	50.5
Number of larvae from 120,000 eggs	72000	68400	72000	61200	54000	35700
Total number of larvae from 360000 eggs	**212400**			**150900**		

What about reproduction of captive tuna in Europe?

ReproDOTT
Workpackage 9

- ✓Gamete description
- ✓Gamete Quality assessment
- ✓*In vitro* ovulation
- Set up of artificial insemination

3 Captive males (Spain 2003)

Only one male with small amount of testicular sperm
low GSI

Sperm:
•Very viscous
•Low concentration: 1.97 10^{10} spz ml^{-1}
•Motility: 4 min after activation

•Cryopreservation: OK (same motility at thawing as fresh)

6 Wild males in Italy, 1980 (Doi et al, 1982)

Spermiating wihout any pressure

GSI ?

Sperm:
•Very viscous
•High concentration: 4.96 10^{10} spz ml^{-1}
•Motility: 14 min after activation
•Short term storage : 3 days OK
•Cryopreservation: OK (good motility at thawing)

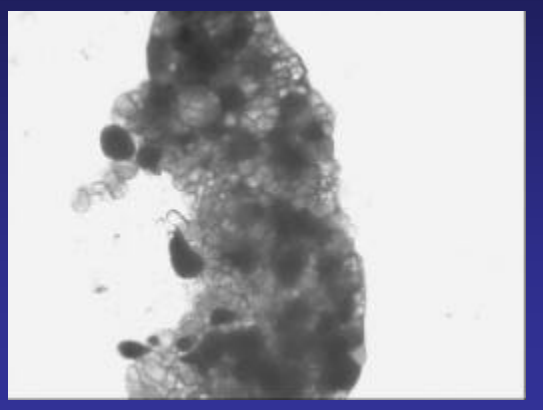
➢**Short captivity allows spermatogenesis but prevents spermiation in our cage conditions**

➢**Long captivity allows spermatogenesis and spermiation in our cage conditions**

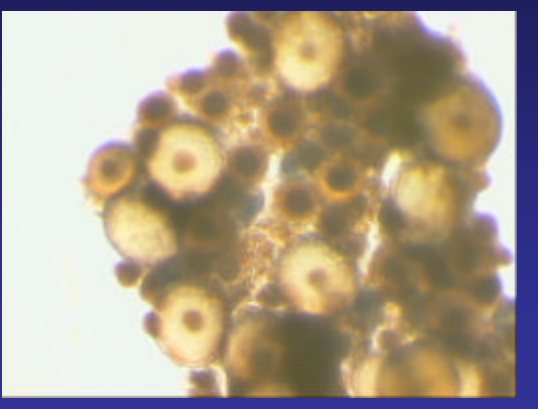
Tuna captive female

june 2004: 3 cases

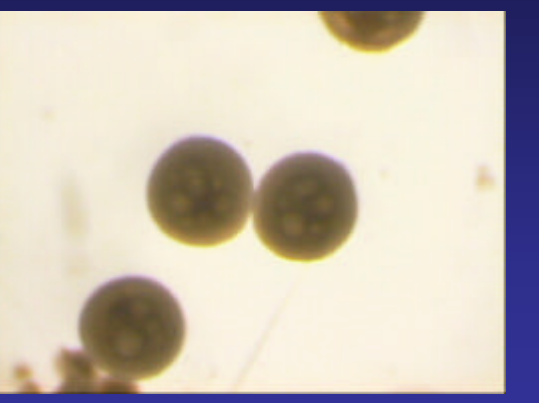
Aborted vitellogenesis



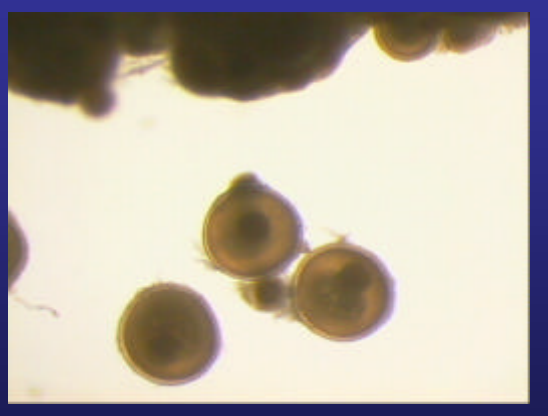
Full vitellogenesis



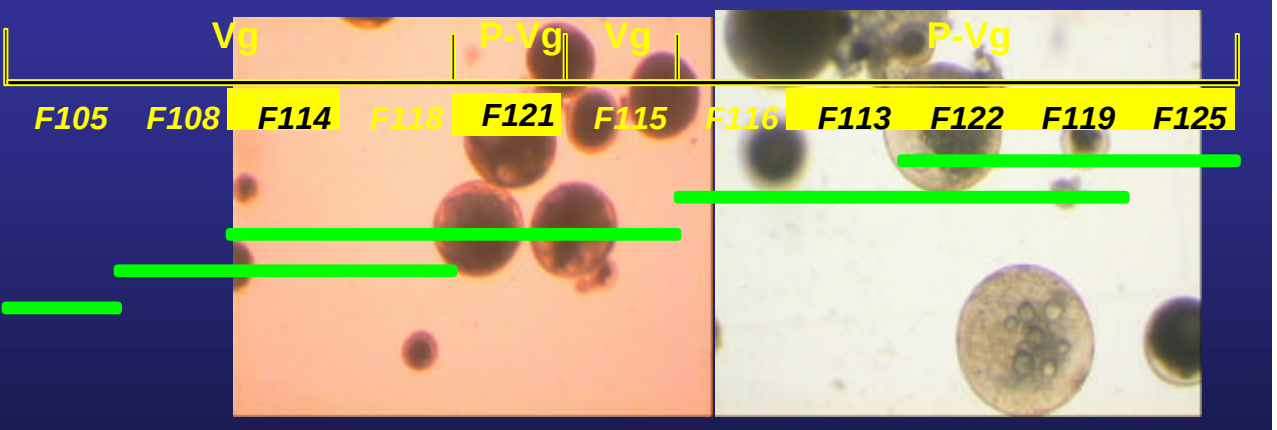
post vitellogenesis



+LHRH : Nucleus migration



Tissue incubation: Hydration or alteration?



F105 **:** Control

F114 **:** Treated

Perspectives

Sustainability of aquaculture requires trusty production of fry

This is obtained in salmonid carp, bream, bass … all domesticated species

Tuna offers interesting possibilities :

- •Reproduction in captivity observed in Japan
- •Good indications for success in Europe

But…

High mortality due to handling prevent

- •Monitoring of gametogenesis
- •Programmation of spawning or stimulation

Solutions:

- •Develop research programs for less stressful handling
- •Use of less stress-susceptible fish (domesticated)

Closing the life cycle in captivity (Kinki University, 2002) is hopeful since it provides fish subjected to first rearing selection

Such fishes shoud be of great interest for the development of domestication process and reproduction control.


どうもありがとう
ございました