



Effect of arachidonic acid on prostanoïd synthesis and reproductive physiology in Atlantic cod

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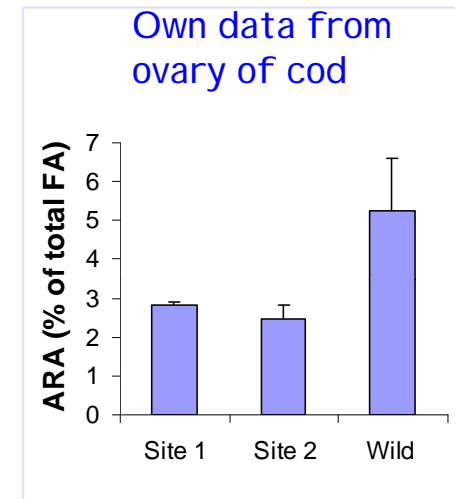
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Why arachidonic acid (ARA)

- ARA is lower in
 - Eggs from farmed fish compared to wild fish
 - Eggs from fish fed compound diets vs trash fish (Bell&Sargent 2003; Cejas et al. 2003)



- Studies in Japanese flounder and Atlantic halibut show that there is an optimum level of ARA, where higher or lower levels give reduced spawning performance (Furuita et al. 2003; Bromage et al. 2001; Mazorra 2000; Alorrend 2004)



Arachidonic acid in reproduction

- Precursor of prostaglandins (PG)
 - ✓ Modulate steroidogenesis
 - ✓ Regulation of ovulation and oviposition
 - ✓ Some PGs can act as pheromones
 - Stimulate male sexual behaviour
 - Synchronise male and female spawnings
 - ❖ Effect on fertilisation
- Other functions suggested are their involvement in
 - ✓ Embryogenesis
 - ✓ Hatching and early larval performance
 - ✓ Development of the immune system



Trial design to study effect of ARA in Atlantic cod



- Atlantic cod (n=3200; bw=2.3kg; age 2 yrs) distributed in 8 sea net pens (5x5x5m) at Austevoll Aquaculture Research Station in May 2005, after first spawning
- Fish fed diets with increasing levels of ARA: 0.5, 1, 2, 4% of total FA, in duplicate



Sampling

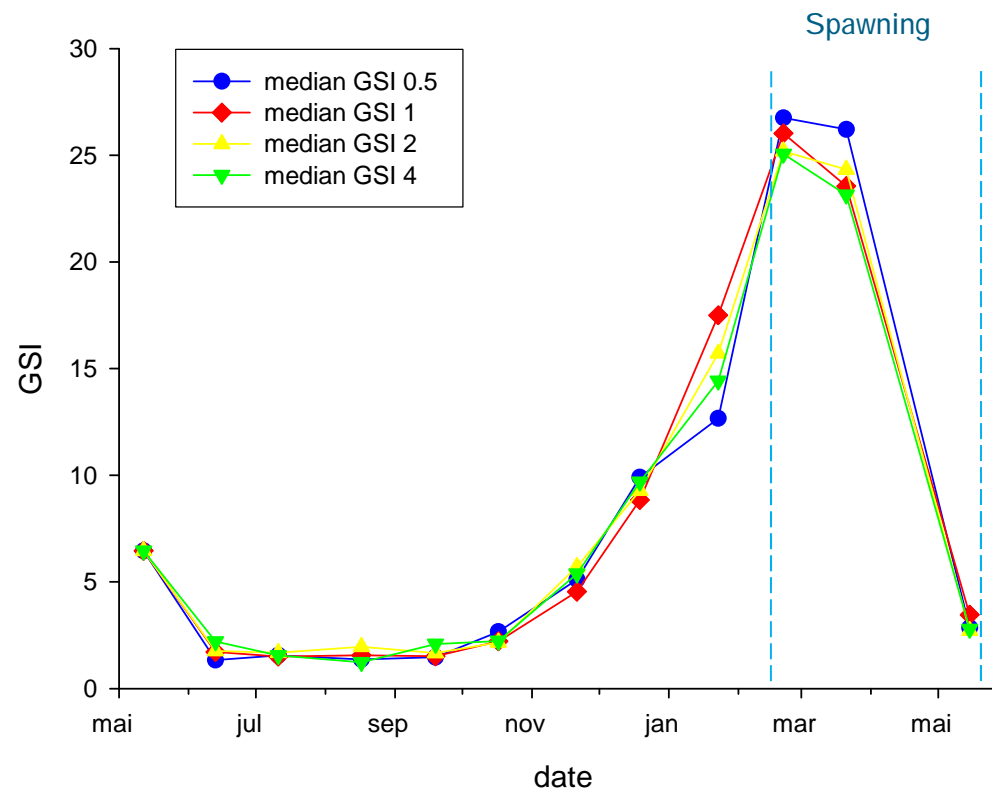


Each month, length weight and organindices were registered and samples were taken for analyses





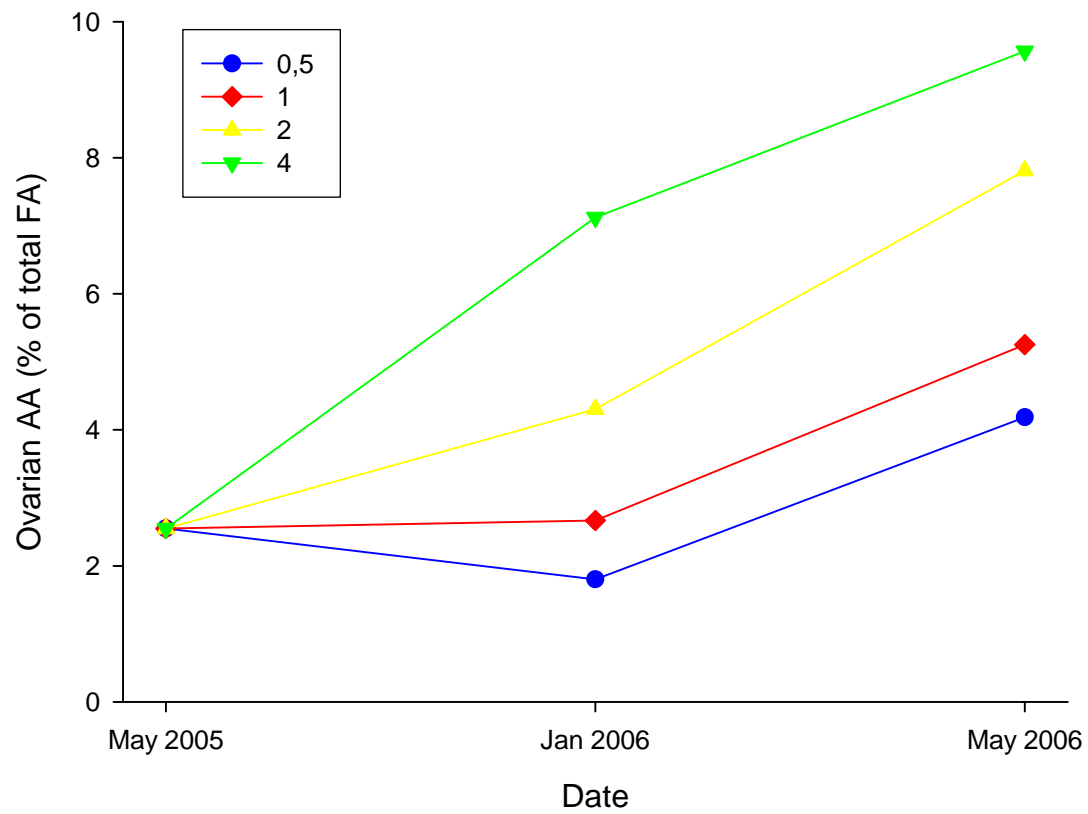
Development in GSI



Median GSI in female cod through the feeding trial

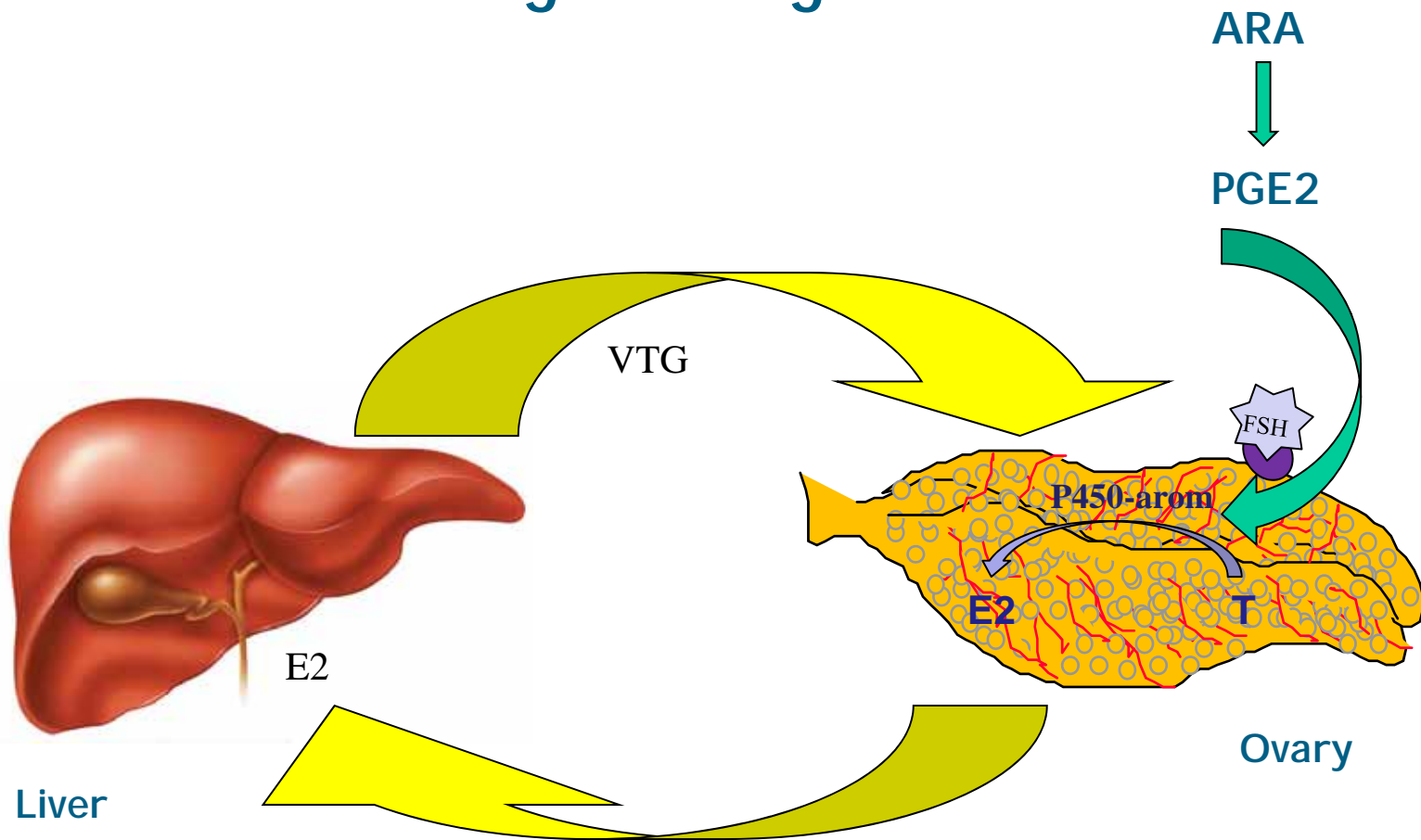


Ovarian incorporation of ARA



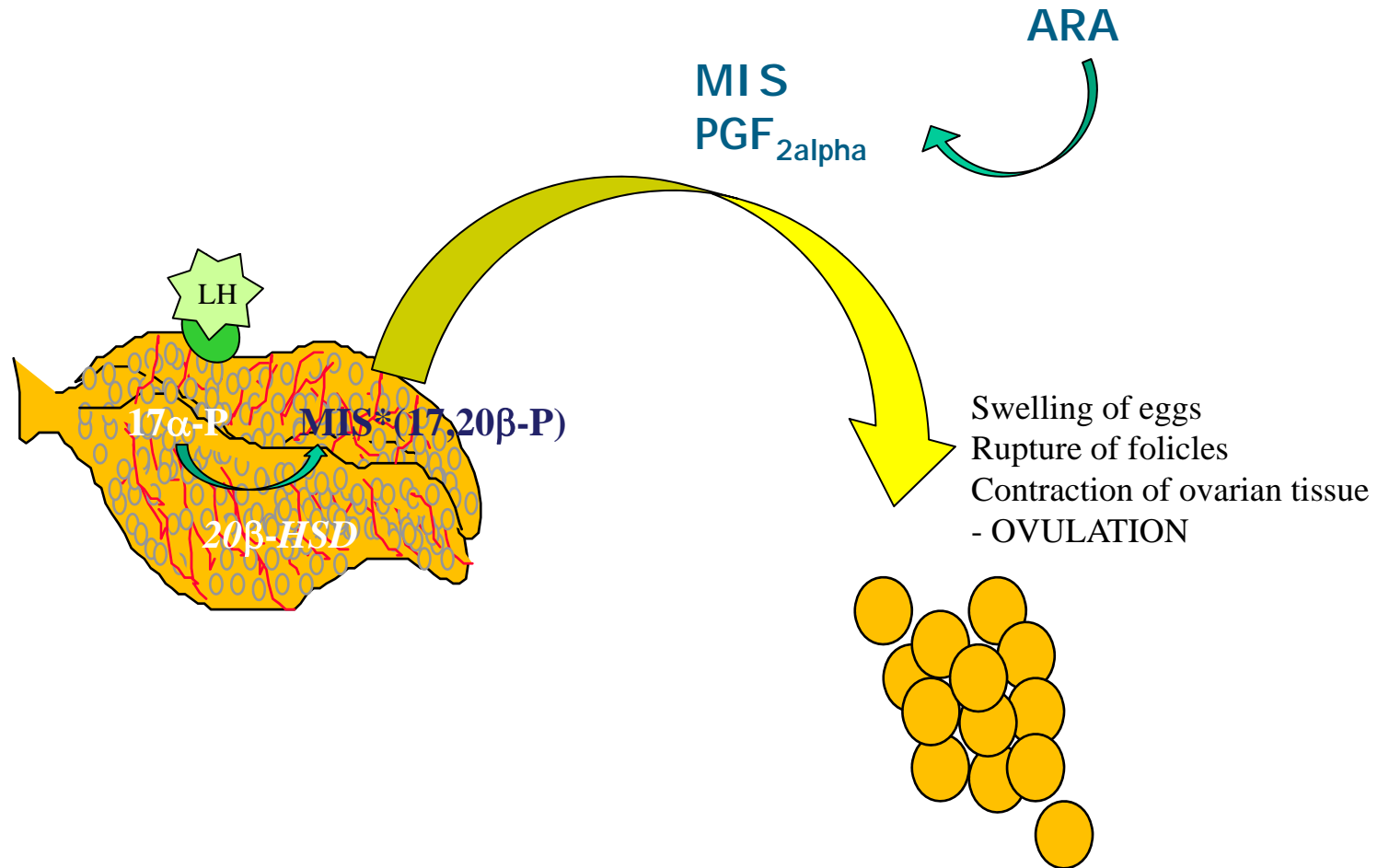


Role of PGs during vitellogenesis





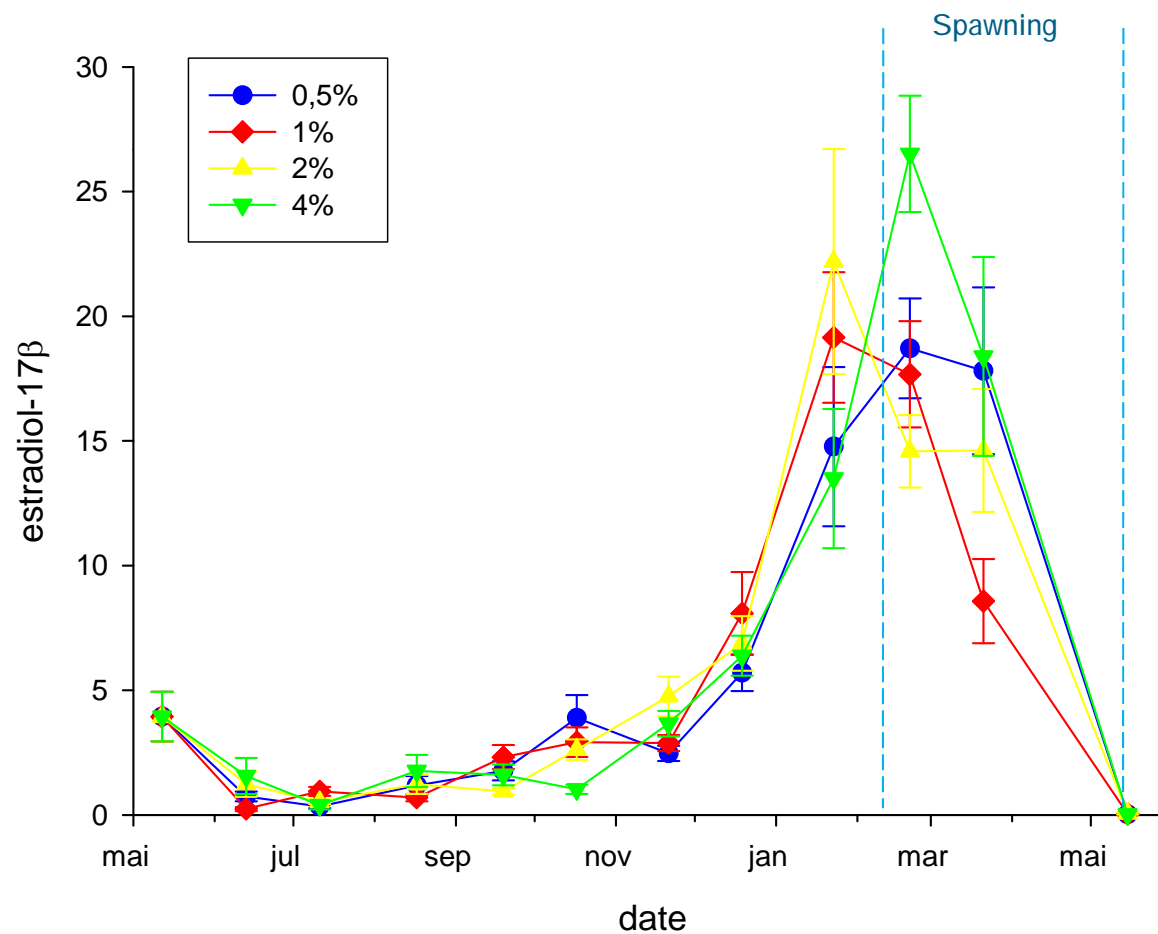
Role of PGs in ovulation



*MIS = Maturation Inducing Steroid

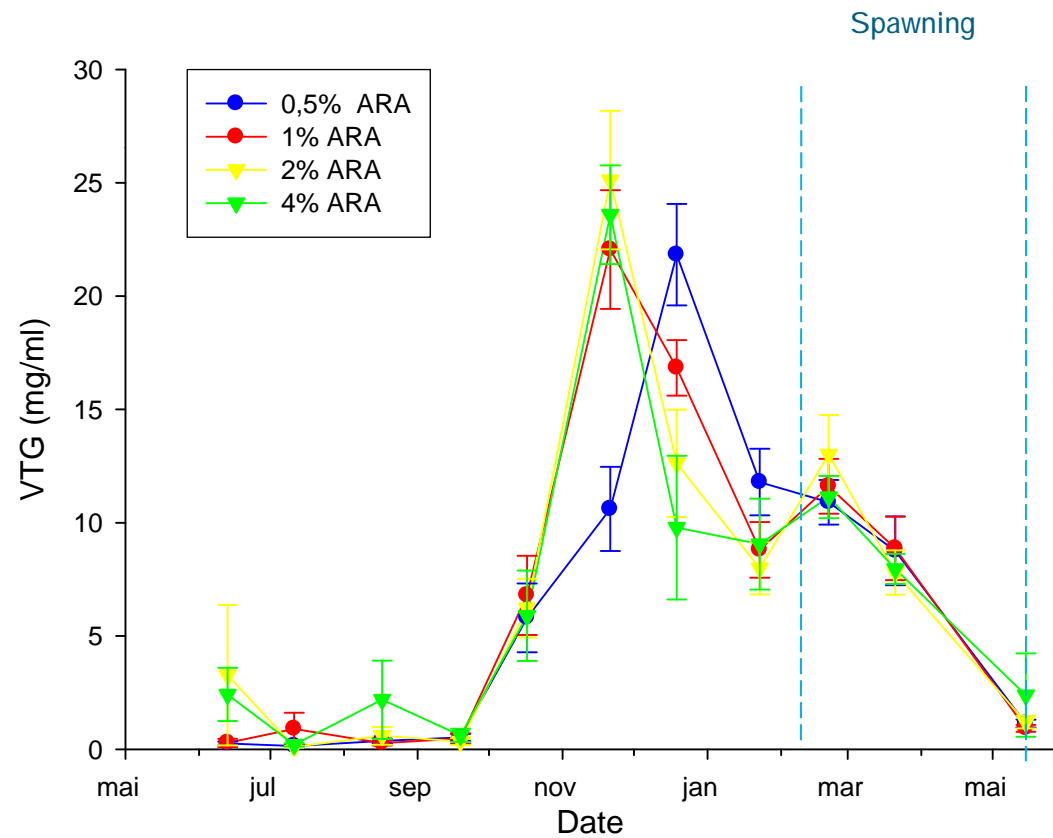


Plasma estradiol-17 β levels through the experimental feeding period





Plasma vitellogenin





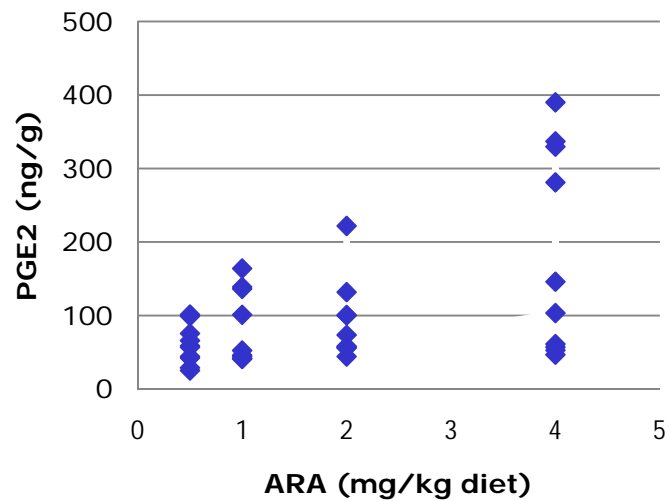
Effects of dietary ARA on spawning success

- The spawning season was extended in the high ARA group
- Fecundity was higher with intermediate than with high and low levels of ARA
- Hatching rates were highest , and incidence of early deformities were lowest at 2% ARA.
 - ARA affects reproductive physiology, fecundity and egg quality

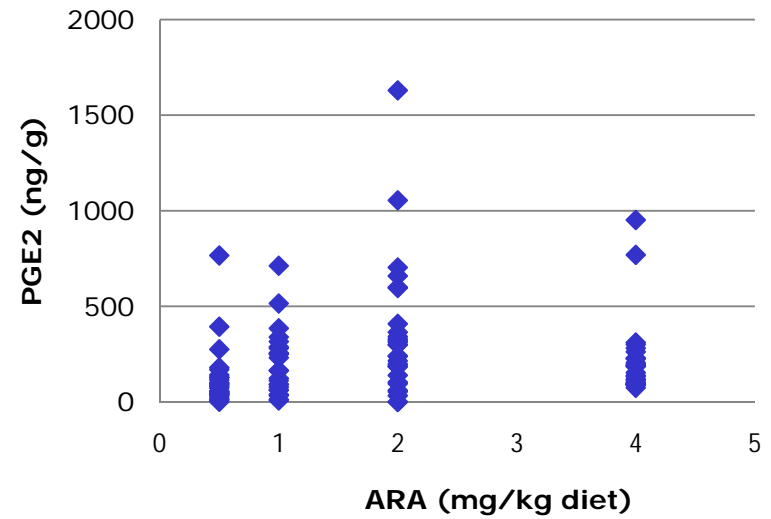


Prostaglandins (PGE2) in ovary

November



February





Regression results -PGs in ovary

	Slope	Intercept	r ²	P slope
PGE ₂				
November	0.51	-	0.26	0.001
January	0.55	-	0.21	0.004
February	-	219	0.005	n.s.
PGF ₂				
November	-	110	0.047	n.s.
January	0.46	-	0.31	3*10 ⁻⁴
February	-	173	0.02	n.s.



Conclusions

- Dietary ARA affects reproduction at several levels in Atlantic cod:
 - Prostaglandin synthesis
 - Steroid synthesis
 - Vitellogenesis
 - Fecundity
 - Egg viability
 - Larval deformities



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