



DISRUPTION OF VITAMINS AND CYP SYSTEMS AND EMBRYO DEVELOPMENT IN BROOD-BEARING MARINE ORGANISMS

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Introduction

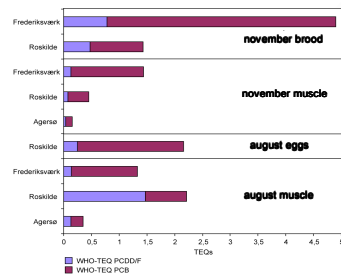
The fish eelpout (*Zoarces viviparus*), or viviparous blenny, is mainly found in the littoral zone of northwest Atlantic and in most of coastal areas of the Baltic Sea.

Persistent organic pollutants (POPs) as dioxin-like compounds (DLs) and polycyclic aromatic hydrocarbons (PAHs) can interfere with embryo development and reproduction. Previous studies have shown that some of these POPs interfere with *retinoid (vitamin A) metabolism* (Novak *et al.* 2008). Elevated levels of abnormal embryo and larvae development, e.g. skeletal and eye malformations, have been found in eelpout broods from Danish coastal waters.

In the present study, broods of eelpouts from 3 different field locations and sampling times, were investigated for malformations rates, vitamins and POPs content and CYP 450 enzymatic activity.

Hypothesis

Exposure to xenobiotics such as **DLCs** and **PAHs** lead to induction of **CYP 450 enzymatic activities**, which result in disruption of **CYP dependent retinoid metabolism**, and potentially **cause abnormal embryo development** of organisms.

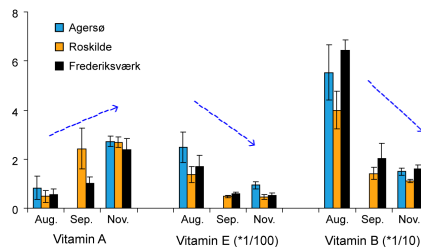


Levels of dioxin-like compounds in eelpouts in 2009, converted to toxic equivalents (TEQs) – measure of toxicity according to compounds effect on AHR-receptor in mammalian cells.

Sampling locations in Danish coastal waters, **Agersø (A)** is reference station as it is less polluted than other two stations (R and F):



Levels of vitamins A and E were highest at reference station (Agersø) in August and November.



Vitamin A, E and B content (mg/kg ww) in eggs and brood of eelpouts sampled at Agersø, Roskilde and Frederiksværk in August, September and November. Mean standard deviation.



Examples of malformations in broods from the viviparous eelpouts (Strand *et al.* 2004).



- 0.** Hatched embryo, which have not developed much further than the first stages (<10 mm)
- A.** Late dead larvae without characteristic deformations
- B.** Yolk sac or intestine defects*
- C.** Bend shape of the spinal axis*
- D.** Spiral shape of the spinal axis
- E.** Eye defects including rudimentary or missing eye(s)
- F.** Cranio-facial defects*
- G.** Siamese twins more or less separated*
- H.** Other abnormalities, including calcified larvae from previous years brood
- *morphological variations occur

Conclusions and Perspectives

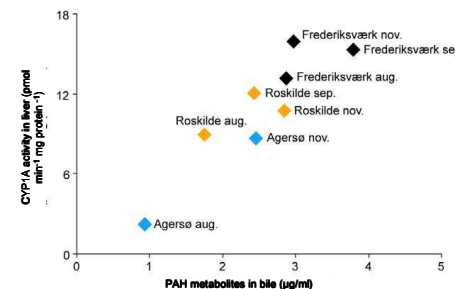
There is observed a connection between low levels of vitamins A and E, CYP1A activity and embryo malformations in eelpout broods from polluted areas.

There is found a positive correlation between levels of CYP1A activity in liver and biliary PAH metabolites.

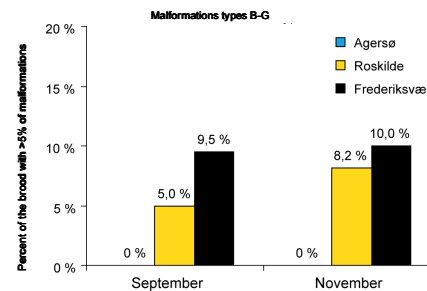
There is observed a connection between biliary PAH metabolites content and malformation rates in broods from polluted areas.

Future studies will look further into the relation between POPs, CYP systems, retinoids and embryo malformations. This will include exposure studies, seasonality field studies and exploration of the potential of **mammalian *in vitro* bioassays (AhR) as screening tools** for environmental samples and to contribute to a better integrated exposure assessment for aquatic organisms.

Relationship between levels of PAH-metabolites in bile and CYP1A activity in liver from eelpouts sampled in 2009.



The highest levels of both PAH-metabolites in bile and CYP1A activity in liver were observed in eelpouts from Roskilde fjord and Frederiksværk, two stations representing highest rates of embryo malformations.



Elevated levels of malformed fish brood found at Roskilde and Frederiksværk stations, compared to the reference station Agersø.

Acknowledgements

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Reports in Danish can be downloaded at: www.naturstyrelsen.dk

References

Strand *et al.* *Fish Physiol Biochem* (2004) 30: 37-46.
Novak *et al.* *Environment International* (2008) 34: 898-913.