



SUMMARY

This output evaluated the effects of oestrogen (E2) on the immune system of sea bass (*Dicentrarchus labrax*). It was found that oestrogens affect thymus plasticity and T cell maturation, particularly during immune system ontogenesis, therefore affecting the animals' immunocompetence and resistance to pathogens. Increasing our understanding of the impact of environmental contaminants on aquatic life lays the foundation for the enactment of stricter legislation to ensure safer aquatic environments for fish and humans.

KNOWLEDGE NEED

Endocrine Disrupting Chemicals (EDCs) can interfere with hormonal regulation in vertebrates and may disrupt their endocrine systems. A growing body of evidence indicates that many EDCs affect the immune systems of marine organisms, increasing their susceptibility to disease. Natural and synthetic oestrogens are among the most common EDCs. They are frequently found in surface waters, at disrupting concentrations, to which aquatic organisms are directly exposed. There is a clear need to gain further insight into the mechanisms of oestrogenic effects on aquatic animals, such as sea bass. Specifically, little is known about effects of exposure to exogenous oestrogens during immune system ontogenesis and how this affects later immunocompetence.



POTENTIAL IMPACT

- Results provide evidence for the need for improved water quality for aquaculture species, which could lead to strengthened legislation, better sewage treatment, and reduction of farm runoff.
- A focus by the aquaculture industry on testing for and maintaining water quality, which will lead to improved overall stock health, in turn improving the economic viability of fish farming for certain species or in certain areas.

EATiP - Strategic Research and Innovation Agenda (SRIA) Thematic Area 2; Knowledge and Systems, Goal 1. To see the full list and descriptions of the thematic areas and goals, please visit: : eatip.eu/?page_id=46

UNDERLYING SCIENCE

This research examined if critical windows during the development of the immune system could be identified and if fish exposed to oestrogens during the immune system development would exhibit differences in immunocompetence when they reach maturity. Sea bass were exposed to E2 (oestrogen) 20 ng·L⁻¹ during different phases of the early life stages (corresponding to when the immune system develops); one group from 47 day post-hatching (dph) to 54 dph, and the second group from 60 to 90 dph. The fish were continuously exposed to E2 until their immune system was mature. Animals were brought back to clean water after the exposure (depuration period) before exposing them to bacteria (*Vibrio harveyi*, 2.6 x 10⁴ cfu/fish) to test their immunocompetence.

RESULTS

- Mean increase of fish survival exposed to E2 at the age of 60 to 90 dph and challenged with *Vibrio harveyi* was observed, indicating an immunostimulating effect of the exposure. In fish exposed at the age of 47-54 dph to E2 and challenged with *Vibrio harveyi*, one group showed severely decreased survival, indicative of immunosuppressive effects of E2, whereas the other displayed a moderate reduction survival rate comparable to controls.
- Oestrogens affect thymus plasticity and T cell maturation, especially during the ontogenesis of the immune system. Depending on the developmental stage of the animal, immunocompetence and resistance to pathogens can be negatively or positively affected.
- Endogenous oestrogens may have a negative effect on immune system development, when exogenous oestrogens are present during critical windows. This effect seems to be reversible when there is no more exposure to exogenous oestrogens.
- Some key immune genes involved in T cell differentiation and maturation are affected by oestradiol and the pathways triggered are dependant of the tissue and the receptor(s) involved in the signalling pathway.

END-USERS & POTENTIAL APPLICATIONS

END-USER 1: Policymakers

APPLICATION: Policymakers could apply the output as evidence for defining a more restrictive concentration of compounds with oestrogenic activities allowed in aquatic environments.

END-USER 2: Sea bass farmers

APPLICATION: Greater awareness of how EDCs such as oestrogen may affect fish health. In fish farms, the juvenile fish may be affected by oestrogens in the water depending on their age and special care should be taken for early post-hatch stages.

STATUS

Technology Readiness Level (TRL) 1 - basic principles observed

- Similar work has been carried out in parallel by researchers in Switzerland working on zebra fish (*Danio rerio*). Their results also point to an immunomodulation triggered by exogenous oestrogens present in the water. In the coming months, a review will be written, which deals with the impacts of oestrogens on the immune system from an ecophysiological standpoint.
- A publication is currently underway.

AT A GLANCE

TITLE: Effect of oestrogen on the immune system of sea bass

KNOWLEDGE TYPE: Exploitable scientific result

WHERE TO FIND IT: The research will be published

STATUS: Publication in progress

TNA FACILITY USED: Consejo Superior de Investigaciones Científicas (CSIC), Spain

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