



Interreg



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The EU Interreg Project “GEREMIA” on waste management for the improvement of port waters: results on monitoring the health status of fish as bioindicator

Anna Reboa, Giovanni Besio, Laura Cutroneo, Irene Geneselli, Stefania Gorbi, Alessandro Nardi,
Maria Elena Piccione, Francesco Regoli, Marco Capello

University of Genoa and Polytechnic University of Marche



9th International Conference on Sustainable Solid Waste Management



The GEREMIA Project

Partners

Goals



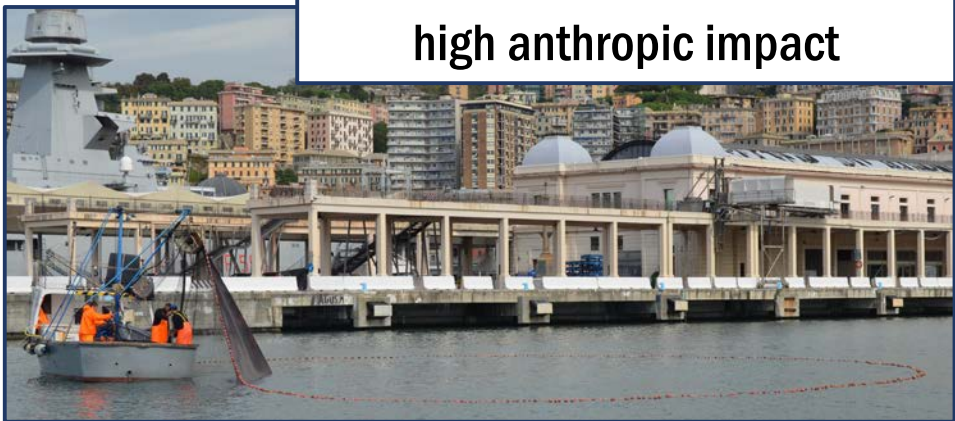
- Monitoring of biotic and abiotic matrices for the development of an integrate index for quality of port waters
- Creation of a Decision Support System for the management of environmental emergencies in ports
- Application of mycoremediation for improving the quality of port waters



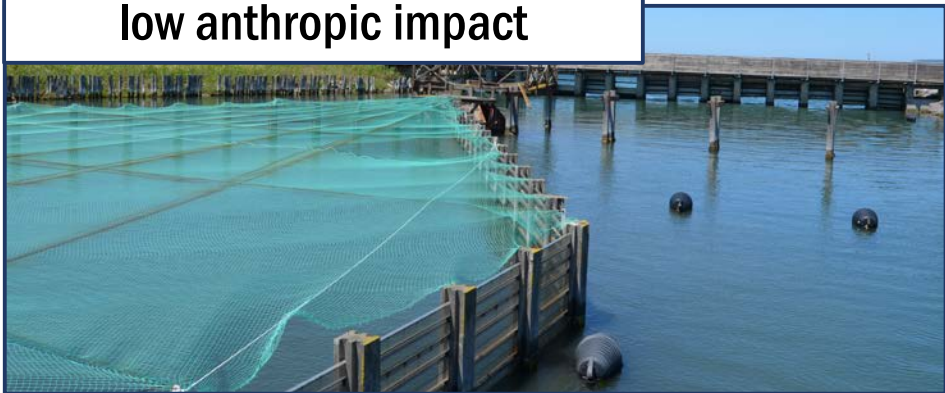
The Study

Sites

**Port of Genoa:
 high anthropic impact**



**S'Ena Arrubia Fishpond:
 low anthropic impact**



Bioindicator: Mugilidae



Biomarkers



**Heavy metals
 content in gills, liver
 and muscle**



**Histopathology on
 gills and liver**



**EROD and PAHs
 metabolites analysis
 (liver and
 gallbladder)**



Histopathology: tissues alterations analysis method

Gills

- Secondary lamellae (SL) blood vessels congestion
- Haemorrhage
- Aneurysms
- Granulocytes infiltration
- SL epithelial hypertrophy
- SL epithelial hyperplasia
- Primary lamellae (PL) epithelial hyperplasia
- SL shortening
- SL adhesion
- SL fusion
- SL epithelial lifting
- Necrosis

Extent evaluation (a)

absence (0)
 mild occurrence (2)
 moderate occurrence (4) severe occurrence (6)



Importance factor (w)

easily reversible (1)
 reversible in most cases (2)
 irreversible (3)



Tissue index

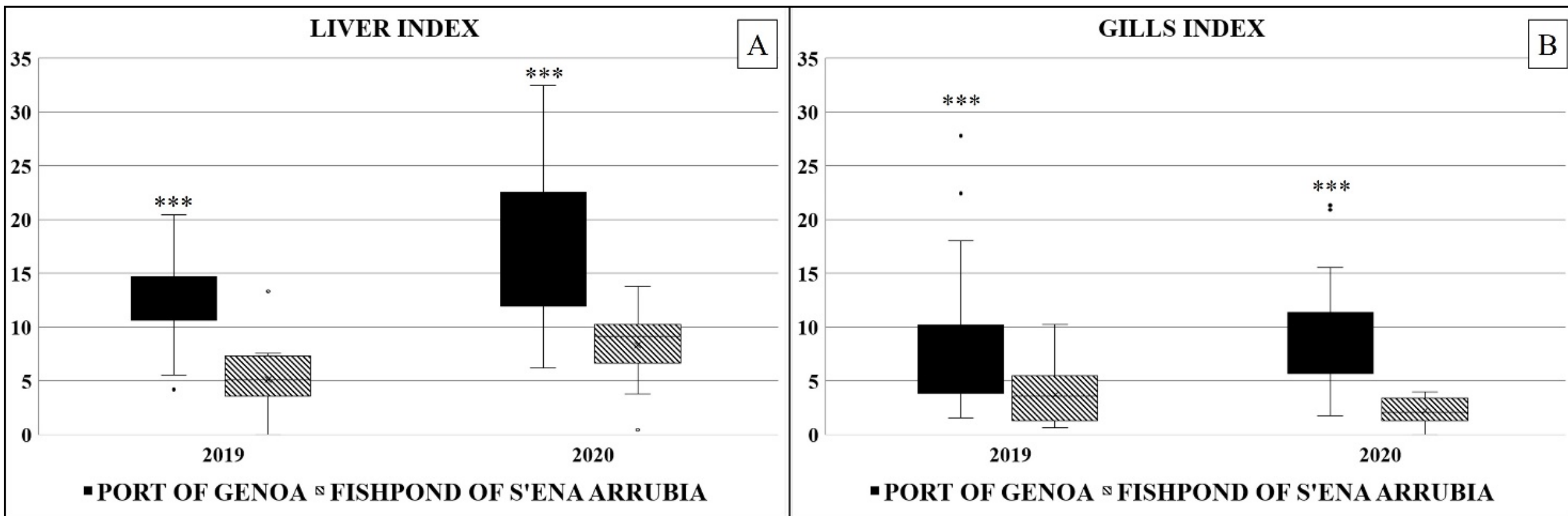
$$I = \sum alt(a \cdot w)$$

Liver

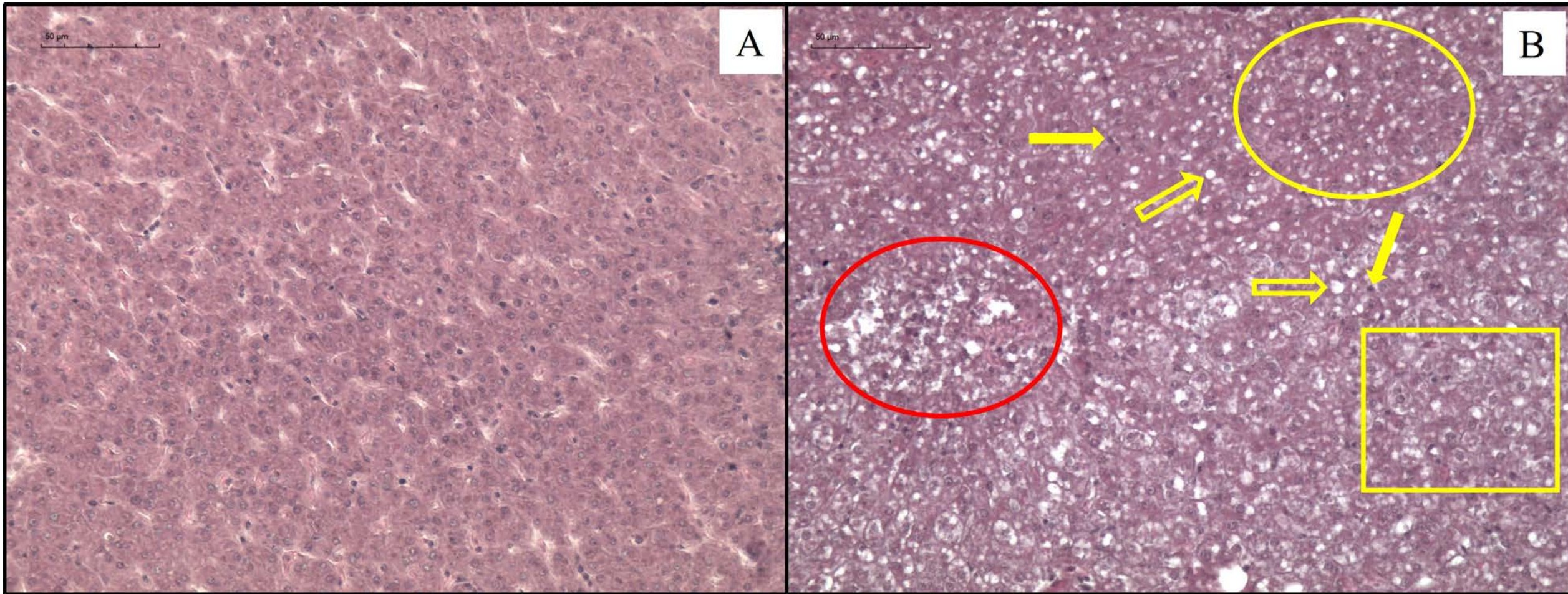
- Blood vessels congestion
- Haemorrhage
- Melanomacrophage centres
- Granulocytes infiltration
- Micro and macro steatosis
- Steatosis foci
- Hyalinization
- Hydropic change
- Loss of cord structure
- Nuclei pyknosis
- Tissue degeneration
- Cellular necrosis
- Necrosis foci



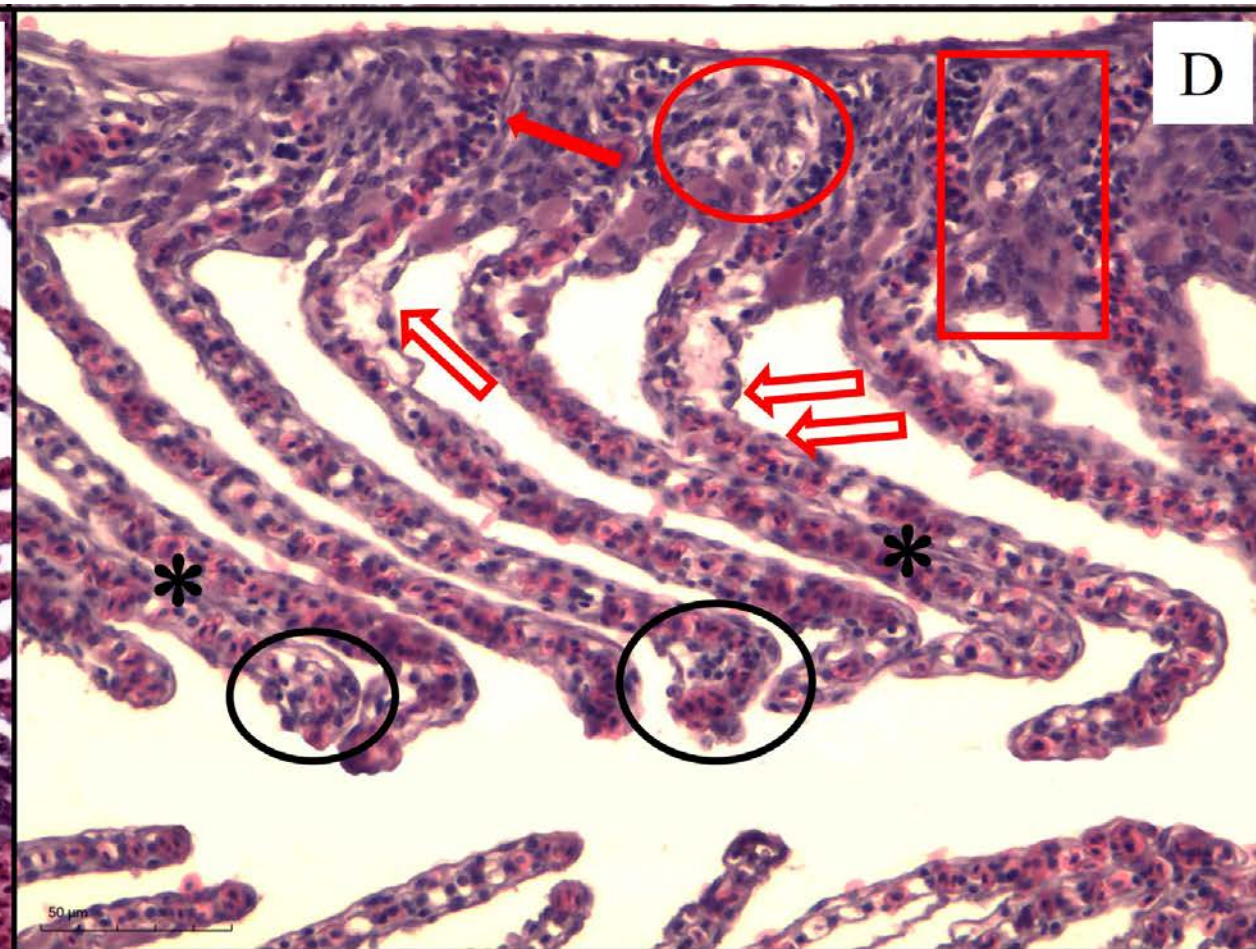
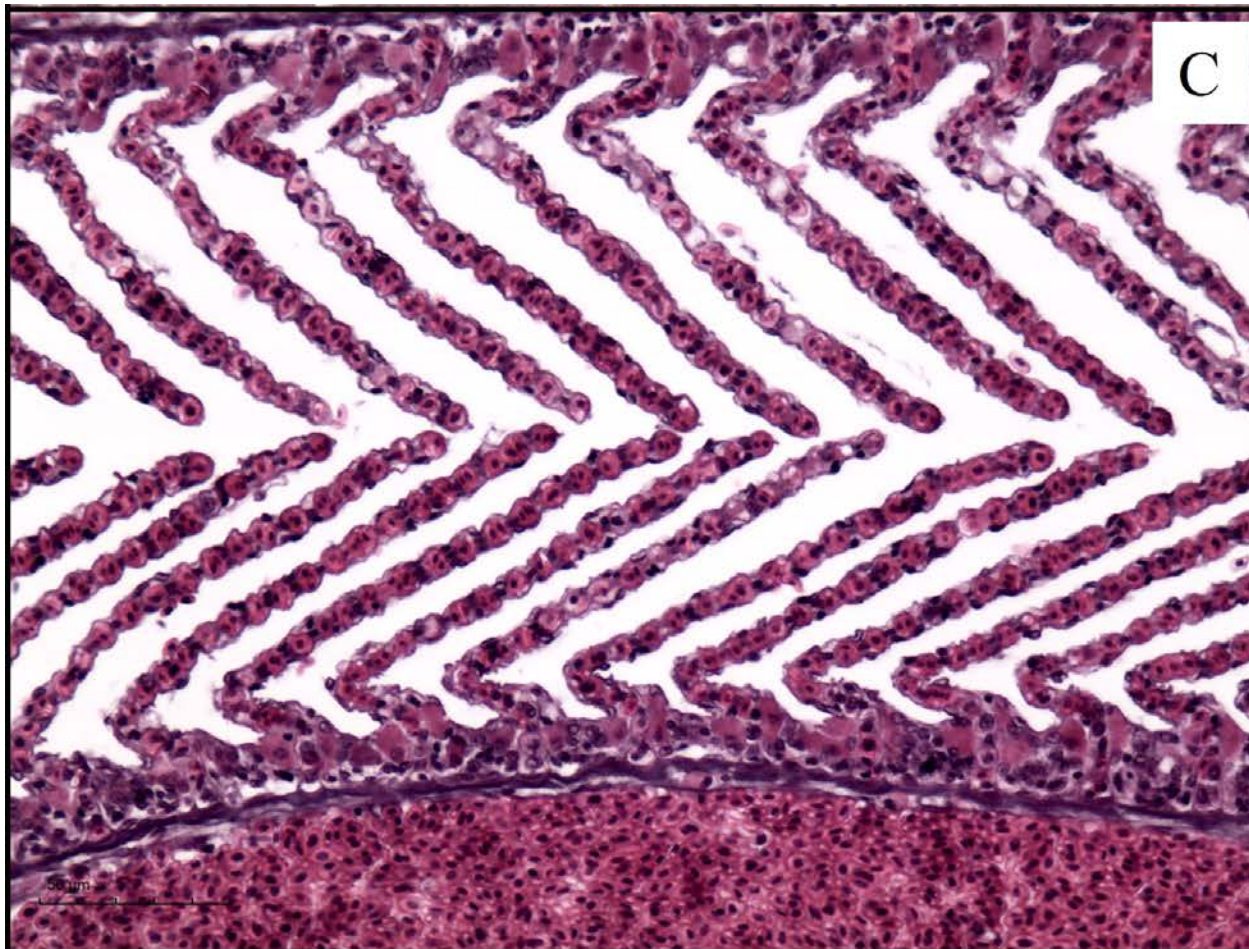
Histopathology: indices results



Histopathology: liver



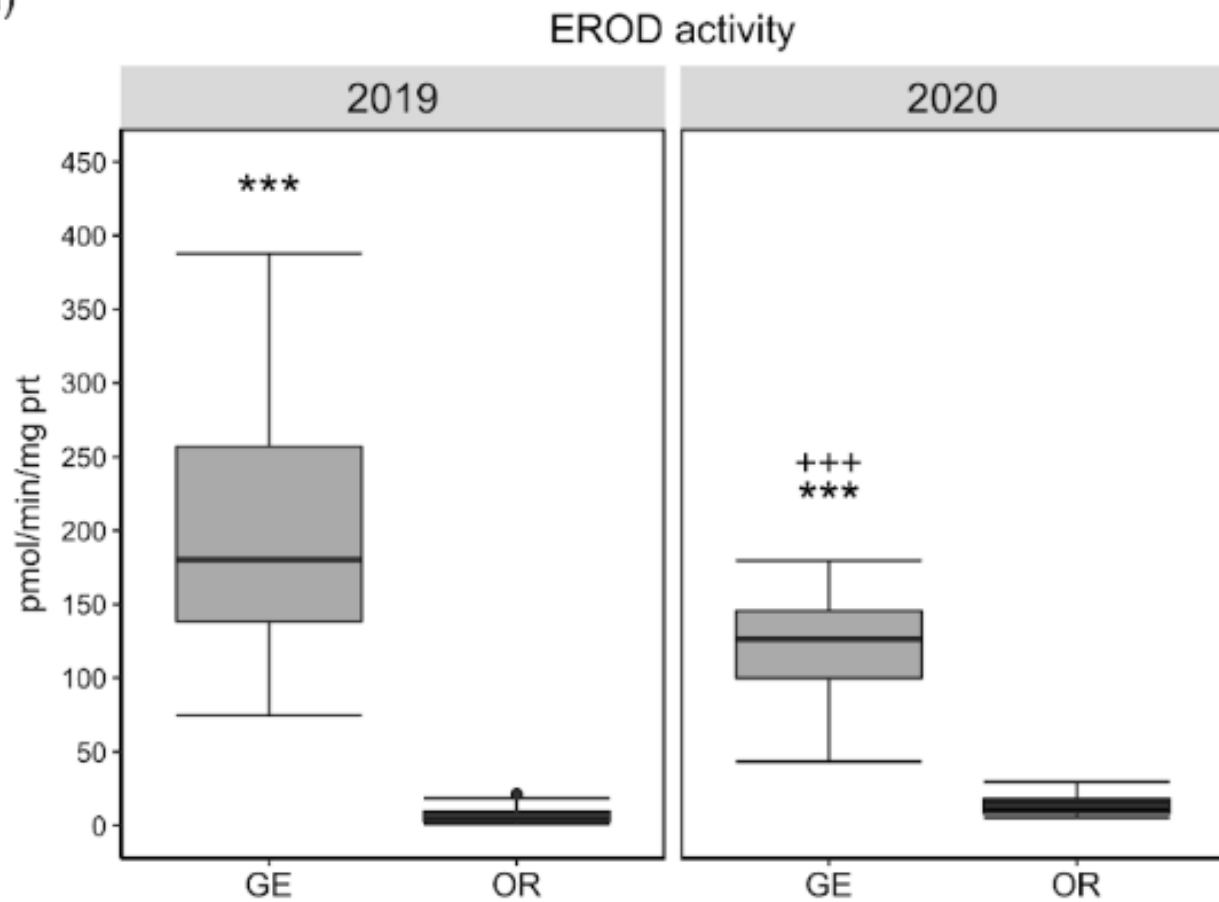
Histopathology: gills



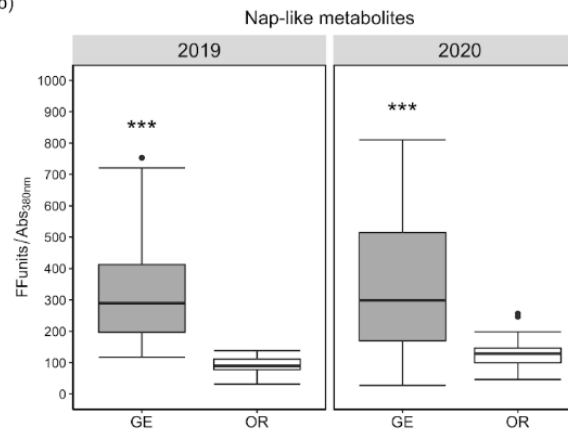


EROD and PAHs metabolites analysis

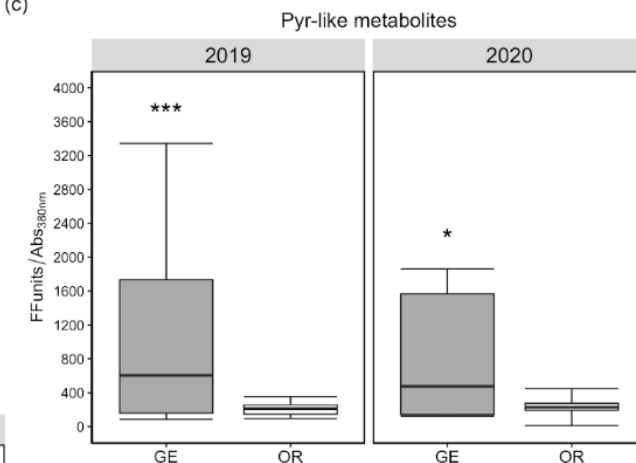
(a)



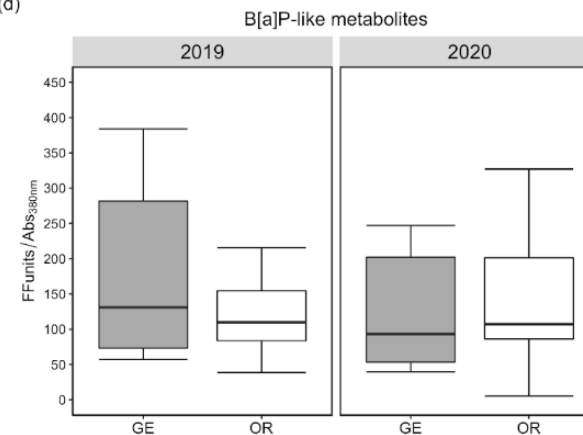
(b)



(c)



(d)

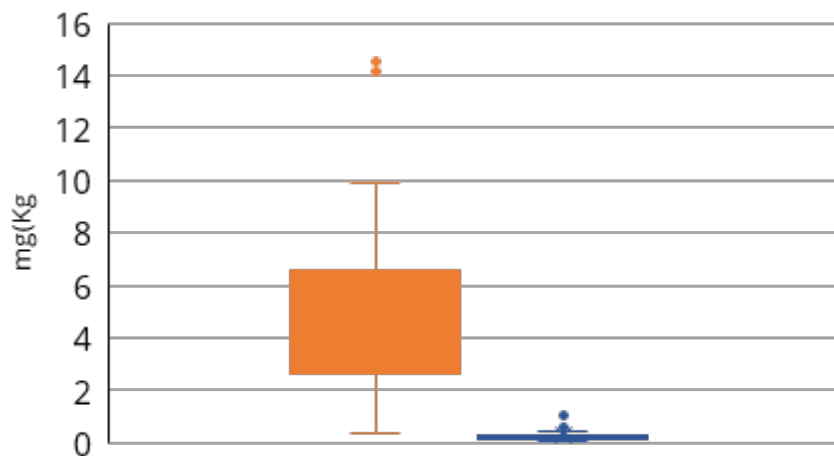




Heavy metals content: Pb

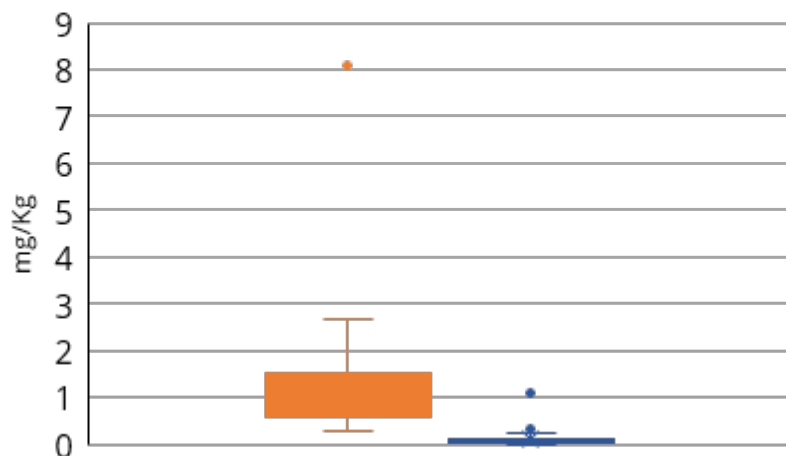
GILLS

Port of Genoa S'Ena Arrubia Fishpond



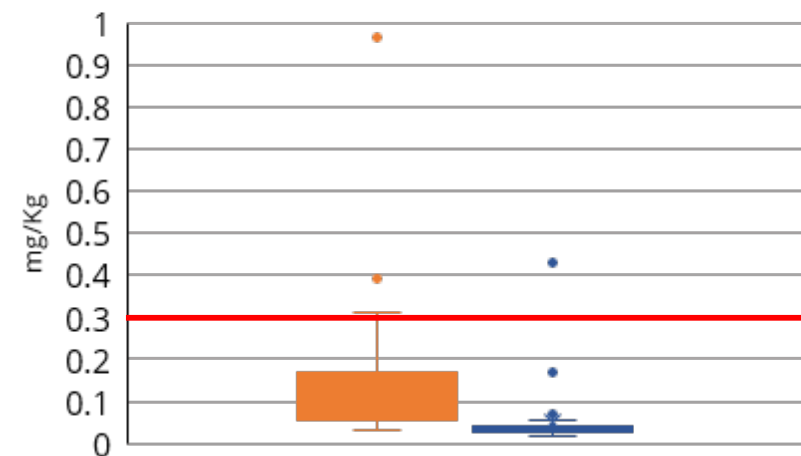
LIVER

Port of Genoa S'Ena Arrubia Fishpond



MUSCLE

Port of Genoa S'Ena Arrubia Fishpond



Legal limit 0.3 mg/kg (EU Commission, 2008)



Positive correlation found between Pb content and the presence of necrosis foci in liver ($r: 0.55$), and SL epithelial lifting in gills ($r: 0.50$)



Conclusions

- A more severe degree of histological alteration was found in both gills and liver samples from the Port of Genoa compared to the ones from the fishpond of S'Ena Arrubia
- EROD activity was induced in samples from the Port of Genoa when compared to results from the fishpond of S'Ena Arrubia; similarly, PAHs metabolites were higher in samples from the port than from the fishpond, especially Naphthalene-like and Pyrene-like metabolites
- Overall, heavy metals mostly accumulated in liver than in other tissues; an interesting exception is represented by Pb, which was more present in gills than in liver samples. As most of the analyzed metals, Pb reached the highest values in tissues of fish collected in the port, and few muscle samples also exceeded the legal limit of 0.3 mg/Kg which is established by the European Commission for human consumption



**The panel of analysis applied to Mugilidae fish as bioindicator
was assessed to be a useful tool for monitoring of environmental quality of port areas**



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Thank you for your attention!

