More male fish "feminized" by pollution on the Basque coast

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The UPV/EHU's Cell Biology in Environmental Toxicology group has conducted research using thick-lipped grey mullet and has analysed specimens in six zones: Arriluze and Gernika in 2007 and 2008, and since then, Santurtzi, Plentzia, Ondarroa, Deba and Pasaia. The acquisition of feminine features by male fish has been detected, to a greater or lesser extent, in all the estuaries, not only in the characteristics of the gonads of the specimens analysed but also in various molecular markers. According to Miren P. Cajaraville, director of the research group, the results show that "endocrine disruption is a phenomenon that has spread all over our estuaries, which means that, as has been detected in other countries, we have a problem with pollutants".

Some of the emerging pollutants detected are in fact responsible for the "feminization" of male fish on the Basque coast and belong to the group of endocrine disrupting chemicals. Chemically, they are very different from each other, but they all have similar effects: due to their interaction with hormones, they destroy the hormone balance and can lead to the feminization or masculinization of the organism. As they are pollutants that have appeared recently, little is known as yet about their effects on the environment and on ecosystems. According to Cajaraville, "our discoveries are significant, because they enable us to know how far these pollutants have spread in our estuaries and rivers and what effects they have; that way, we will be able to adopt methods to prevent them reaching our waters, like legal regulations governing their use."

Despite the fact that they are new pollutants in terms of their effects, the

"sources" of endocrine disrupting chemicals can be found in everyday products: plasticisers, pesticides, contraceptive pills, fragrances and detergents, among other things.

Some reach the waters after managing to get through the cleaning systems in wastewater treatment plants, and others as a result of industrial or farming activities. So, as far as the Urdaibai Biosphere Reserve is concerned, for example, "our main hypothesis," says Cajaraville, "is that they come from the water treatment plant. It was the first place we studied, and continues to be, by far, responsible for the highest percentage of recently appearing pollutants."

In any case, the UPV/EHU's research group found evidence of feminization in male thick-lipped grey mullet in all the estuaries analysed: in three out of the six estuaries (Gernika, Pasaia and Deba) appeared intersex fish, in other words, specimens whose testicles contained immature ova (depending on the area studied, the percentage ranged between 12% and 64%).What is more, all the estuaries have tested positive as far as the two main molecular indicators are concerned: most of the male fish (between 60% and 91%) had vitellogenin (a protein that, in principle, is only expressed in females) in the liver; in the brain, there were considerable levels of the gene expression that encodes Aromatase Cyp19a1b,a protein involved in oestrogen synthesising. Its expression in the male brain is a clear symptom of feminization.

Apart from measuring the feminization indicators in male fish populations, the research team also carried out a chemical analysis of the sampling areas: "All the time we worked in collaboration with analytical chemistry teams, and we characterised each spot from the chemical and biological points of view," stressed Cajaraville. During the 2007/2008 campaign they had the collaboration of the chemical team of the Institute of Environmental Diagnosis and Water Studies of the CSIC (Spanish National Scientific Research Council); later they were assisted

by the UPV/EHU's department of Analytical Chemistry. According to Cajaraville, this is a "highly significant fact, since apart from demonstrating that there are clear biological indicators of fish feminization, in each of the places studied we have measured which pollutants have appeared recently and their respective concentrations, and we have confirmed the correlation existing between the presence of the pollutants and the feminization phenomenon." The pollutants were measured in the bile of the fish, and the said correlation has shown, according to Cajaraville, that it is the pollutants that are responsible for the feminization of the male fish.

More information: C. Bizarro, O. Ros, A. Vallejo, A. Prieto, N. Etxebarria, M.P. Cajaraville, M. Ortiz-Zarragoitia. "Intersex condition and molecular markers of endocrine disruption in relation with burdens of emerging pollutants in thicklip grey mullets (Chelonlabrosus) from Basque estuaries (South-EastBayofBiscay)". *Marine Environmental Research.* In Press, Available online 5 November 2013. www.sciencedirect.com/science/ … ii/S014111361300189X

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