Environmental Science and Pollution Research
February 2013, Volume 20, Issue 2, pp 599-600
http://dx.doi.org/10.1007/s11356-012-1324-z

Contaminant exposure and ecotoxicological impacts in estuaries

Thierry Burgeot[a, *], François Gagné[b]

[a] Ifremer Research Unit of Biogeochemistry and Ecotoxicology, Rue de l'Ile d'Yeu, BP 21105, 44311, Nantes, France
[b] Laboratory of Biochemical Ecotoxicology Research, Emerging Methods Section, Environment Canada, 105 McGill Street, Montreal, QC, H2Y 2E7, Canada

*: Corresponding author : Thierry Burgeot, email address : thierry.burgeot@ifremer.fr

Estuaries are highly dynamic geohydrological systems that form a transition zone between continental rivers and marine environments. They are subjected to many influences such as tides, waves, and influx/efflux of saline water and freshwater. The dynamic mixing of these types of waters provides nutrients in surface waters and sediments making estuaries among the most productive habitats of coastlines. Organisms dwelling in these environments are thus subjected to many combined stresses (salinities, tides and temperature fluctuations) and are particularly at risks to the influence of anthropogenic activity leading to pollution, climate changes and habitats perturbations. Hence, estuaries are area of choice to study the cumulative impacts of pollution in transition zones.

A "sustainable partnership" was set up by a France–Quebec initiative in 2003 with the goal to promote and disseminate studies on the wide range of biological responses from organisms exposed to pollution gradients in estuaries of the Atlantic Ocean. This network combines stakeholders involved in both research, teaching, conservation, and protection activities pertaining to science of estuarine ecotoxicology. The success of this endeavor resided on the comparative examination of the impacts of pollution in estuaries from both the Canadian and European coastlines using similar species some cases and focusing on common objectives on either side of the Atlantic in France and Canada (Quebec). The EXECO International Consortium (contaminant exposure and ecotoxicological effects along continental–coastal continuums: http://wwz.ifremer.fr/pollution/Collaborations/GDR-I-EXECO) launched in 2009 has consolidated this important undertaking by combining the actions of two strategic networks: the Canadian (Quebec) CIRE network (Inter-Institutional Ecotoxicology Research Center: http://www.ecotox.uquebec.ca/programmes/htm) and French IMOPHYS network (Integration of Molecular and Physiological Responses to Chemical Contaminants in the Coastal Environment).

This special edition on the impacts of pollution in estuarine organisms features a series of articles on work conducted on either side of the Atlantic in the common purpose to gain a better understanding on ecotoxicological effects of anthropogenic activities along the estuarine continuum. These studies featured a blend of both laboratory and field studies at different levels of biological organization and trophic levels. The studies on regulation and adaptation mechanisms were conducted on a molecular basis, e.g., DNA and immune defense alterations, the alteration of physiological functions such as reproduction, and the epidemiological study of chemical contaminant-related tumors. Many papers are based on fish (Platichthys flesus, Microgadus tomcod, Scophtalmus maximus, Limanda limanda, Alosa alosa, Liza ramada), which possess a strong metabolic capacity but the reader will also find papers on bivalve mollusks: the Mytilus edulis mussel and soft shell clam Mya arenaria

Mollusks are less able to metabolize xenobiotics compared to fish hence their tendancy to bioaccumulate more than to fish. These characteristics make them valuable and complementary sentinel species to monitor the water quality of estuaries. Notwithstanding, the toxic impact of contaminants on other phyla, studies on amphibians and phytoplankton have also been included in this special issue.

Our intention was to acquire a better understanding on the fate of chemical contaminants and pathways of toxicity in organisms living in such dynamic and complex geographical habitats. Climate change will certainly affect estuaries and we think that estuaries offer a unique platform to understand these impacts on aquatic life. These studies should also contribute to the proposition of useful indicators for monitoring chemical pollution in the aquatic environment. Indeed, future integration of ecotoxicological indicators in the European legislation framework, e.g., the Water Framework Directive or the Marine Strategy Framework Directive, is an ongoing objective.

Studies combining a hierarchical approach starting at the chemical (exposure), genomic, biochemical, immune, neuroendocrine, and ecophysiological levels in representative key species is a major endeavor surpassing the capacity of single research laboratories, hence the urgent need to maintain an open access transatlantic network dedicated in multidisciplinary studies. In addition to current international programs, which have only 3- to 4-year lifetime, the maintenance of science networks over a larger period in time (5–10 years) now appears necessary if we are to achieve "sustainable partnerships" for the study a such complex ecosystems. This type of long-term partnership would allow us to tackle the many challenges to establish a comprehensive and updated monitoring program for the protection of estuaries. We are proud to present the following research articles in this special issue on the ecotoxicology of estuaries under anthropogenic stress. These studies will certainly help the scientific community to develop the necessary knowledge to better understand these fragile ecosystems. Good reading !

Thierry Burgeot is a marine ecotoxicology researcher and Director of the Ifremer research Unit of Biogeochemistry and Ecotoxicology. He has coordinated two marine ecotoxicology research groups, the IMOPHYS (Integration of molecular and physiological responses to chemical contaminants in the coastal environment) national research consortium (2003–2008) and the EXECO (contaminant exposure and ecotoxicological effects along the continental-coastal environment continuum) international consortium (2009–2013). A member of numerous national and international scientific committees, T. Burgeot has also worked as an expert for the CIEM group (Working Group on Biological Effects of Chemical contaminants) for the last 20 years or so, where he conducts applied research aimed at integrating monitoring biomarkers and bioassays for the European coasts of the North Atlantic and Mediterranean Sea. Dr. Burgeot has developed research on the metabolic activities of the P450 cytochrome and the genotoxicity of PCBs, PAHs and pesticides in fish and bivalve mollusks living in the coastal environment.

François Gagné has been a research scientist in biochemical ecotoxicology at Environment Canada since 1994. He passed his PhD (1996) at the University of Metz in France. He has published over 150 papers on ecotoxicology in international scientific journals and books. He is also the Editor-in-Chief for the Journal of Xenobiotics. He has worked alongside professors from the INRS-Armand-Frappier Institute and the Marine Science Institute at the University of Québec in Rimouski.

His lines of research include the molecular activity of miscellaneous emerging substances in non-target aquatic organisms, such as derivatives of oil sands (naphthenic acids and steranes), toxins (cyanobacteria) and pharmaceuticals, plus nanotechnology. He has also been involved in the development of new methods (metabolomics and transcriptomics) for the development of novel toxicity indicators for risk assessment and studies on the cumulative effects of multiple stressors.