

Oral Communication 1

Dynamics and effects of plastic contaminants' assimilation in gulls

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Abstract

Background: Opportunistic animals such as gulls are often associated with anthropogenic activities [1,2], and therefore highly susceptible to plastic ingestion and stomach chemical leaching [3]. Yet, such chemical process is still poorly studied and there is almost no information regarding potential hazardous effects in animal physiological processes. Even though it was already reported that gulls accumulate Polybrominated Diphenyl Ethers (PBDEs) [4], there is no information linking plastic ingestion with leaching and accumulation of these chemicals in different tissues. Moreover, it is still not fully known how PBDEs affect gulls' health and stress parameters. **Objective:** To evaluate: 1) how BDE99 leaches from ingested plastics into tissues, and 2) how this leaching will impact the individuals' immune status, nervous transmission and physiological stress parameters. **Methods:** We fed yellow-legged/black-backed gulls (*Larus michahellis*/*Larus fuscus*) in captivity with plastic pellets containing BDE99 (PBDE congener). BDE99 was measured in gulls' brain, preen oil, liver and fat tissues. Erythrocyte sedimentation rate, glutathione peroxidase activity, plasma antioxidant capacity and reactive oxygen metabolites and levels of cholinesterase and acetylcholinesterase activity were measured in blood samples. Cholinesterase activity levels were measured in the brain. **Results:** Gulls fed with plastics showed significantly higher concentrations of BDE99 in their fat and brain. There was a tendency for plastic-fed gulls to exhibit a more impaired health, yet only values of cholinesterase and acetylcholinesterase in plasma were significantly reduced at the end of the experiment. Cholinesterase in brain also tended to decrease in plastic-fed gulls. **Conclusions:** Our results indicate a clear relation of plastic ingestion with chemical leaching, a process occurring even if plastic stays in the stomach for a short period of time and that gulls' health can be affected, particularly gulls' neurofunction. Our results should have wider implications to understand the impacts of plastic contaminants' assimilation in vertebrates.

Keywords: *Larus* spp.; plastic ingestion; polybrominated diphenyl ethers (PBDEs); chemical leaching; toxicity

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References

1. Calado, J.G., Veríssimo, S.N., Paiva, V.H., Ramos, R., Vaz, P.T., Matos, D., Pereira, J., Lopes, C., Oliveira, N., Quaresma, A., et al. Influence of fisheries on the spatio-temporal feeding ecology of gulls along the western Iberian coast. *Mar. Ecol. Prog. Ser.* (2021) 661, 187–201. 10.3354/meps13601.

2. de Faria, J.P., Vaz, P.T., Lopes, C.S., Calado, J.G., Pereira, J.M., Veríssimo, S.N., Paiva, V.H., Gonçalves, A.M.M., and Ramos, J.A.. The importance of marine resources in the diet of urban gulls. *Mar. Ecol. Prog. Ser.* (2021) 660, 189–201. 10.3354/meps13599.
3. Tanaka, K., Watanuki, Y., Takada, H., Ishizuka, M., Yamashita, R., Kazama, M., Hiki, N., Kashiwada, F., Mizukawa, K., Mizukawa, H., et al.. In Vivo Accumulation of Plastic-Derived Chemicals into Seabird Tissues. *Curr. Biol.* (2020) 30, 723–728.e3. 10.1016/j.cub.2019.12.037.
4. Técher, R., Houde, M., and Verreault, J.. Associations between organohalogen concentrations and transcription of thyroid-related genes in a highly contaminated gull population. *Sci. Total Environ.* (2016) 545–546, 289–298. 10.1016/j.scitotenv.2015.12.110.



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