Press Release

Packaging transfers plastic additives to fish stored in the refrigerator or freezer

- **This is the conclusion of a study by IDAEA-CSIC that analyses for the first time the migration of four families of chemical compounds into fish under real domestic cold-storage conditions.**

- **This transfer depends on the packaging, contact time, the characteristics of the additive, and the properties of the fish, such as its fat and water content.**

- **The scenarios studied identified bisphenol A as responsible for exceeding the risk thresholds established by European authorities, while the contribution of the remaining contaminants was minimal.**

The experiments were carried out with salmon, tuna and hake. | iStock

Madrid / Barcelona, 11 June 2026. A study by the Institute of Environmental Assessment and Water Research (IDAEA-CSIC), in collaboration with the University of Florence, has demonstrated that different plastic additives present in common food packaging can migrate into fish during domestic storage in refrigerators and freezers. The research, published in *Environment International*, evaluated this transfer for the first time under real cold-storage conditions and found that migration increases with storage time.

The study analysed the migration of phthalates, organophosphate esters, bisphenols and alternative plasticisers to phthalates from packaging commonly used for storing

fresh fish. These chemical substances are used to provide flexibility, resistance and stability to plastics. Among the materials studied by the IDAEA team were packaging used for fresh fish preservation, including polystyrene trays, compostable trays, films and freezer bags. The experiments were conducted using salmon, tuna and hake stored under refrigeration (+4 ºC for 48 hours) and freezing (-18 ºC for 30 days).

“Until now, most studies assessed the presence of these contaminants directly in food after purchase. For this work, we wanted to approach a more realistic scenario and investigate what happens when consumers store fish at home for several days or weeks under cold conditions before consumption,” explains **Maria Vittoria Barbieri**, researcher at IDAEA-CSIC and lead author of the study. “Furthermore, studies related to the possible migration of additives from packaging into food have focused on evaluating the effect of heat as a variable that accelerates migration; however, there are no studies assessing this process under cold conditions.”

The results show the presence of additives from all four chemical families in the packaging analysed, including bisphenol A, as well as their migration into fish under both refrigeration and freezing conditions. In this process, contact time with the packaging emerged as a factor that significantly contributes to the transfer of plastic additives. Of the 49 contaminants studied, migration rates of up to 100% were observed for certain compounds, such as bisphenols. Some substances, such as di(2-ethylhexyl) adipate (DEHA), used as an alternative plasticiser, showed very high migration rates in all fish species analysed and reached more than 95% in salmon.

The behaviour of the contaminants varied according to fish characteristics. More lipophilic compounds (fat-soluble) migrated more easily into fatty fish such as salmon, whereas other compounds, such as some bisphenols, showed greater transfer in species with higher water content, such as hake.

Assessment of human exposure

Several studies have shown that some plastic additives have toxicological effects on human health, including endocrine disruption and carcinogenic potential. In recent years, organisations such as the European Food Safety Authority (EFSA) have revised and lowered the levels of daily exposure considered safe for the population, particularly for bisphenol A. In 2023, EFSA reduced its safety threshold by 20,000-fold—from 4,000 nanograms per kilogram of body weight per day to 0.2 nanograms—reflecting growing concern about its impact on health and food safety.

The study includes an assessment of dietary exposure to these additives for adults, children and infants. To estimate how many plastic additives each population group ingests through fish consumption, the researchers combined concentration data for each substance detected in fish with official data on fresh fish consumption in Spain. The result was then divided by the average body weight of each group: 5 kg for infants aged 6–12 months, 12 kg for children aged 1–3 years, and 70 kg for adults. This made it possible to calculate an estimated daily intake per kilogram of body weight for these three consumer profiles. Finally, risk was assessed by comparison with reference values established by international authorities such as EFSA.

The results indicate that fish stored in plastic packaging presents higher exposure levels than freshly purchased fish. The highest risk estimates were observed for hake frozen

for 30 days in compostable trays. By contrast, the lowest-risk scenarios corresponded to refrigeration in plastic bags.

In almost half of the scenarios analysed, the established risk threshold was exceeded. This exceedance was mainly determined by the presence of bisphenol A, which accounted for almost 100% of the risk index. In contrast, the contribution of the other detected contaminants was minimal. “Considering only dietary exposure through fish consumption, the recommended value for bisphenol A is exceeded. However, it should be taken into account that exposure levels are even higher when considering the intake of other foods, as well as exposure through inhalation and dermal contact,” notes IDAEA-CSIC Director and co-author of the study **Ethel Eljarrat**.

“The study highlights that real domestic storage conditions should be given greater consideration in food safety assessments and in the design of food-contact materials, paying particular attention to compounds such as bisphenol A and certain alternative plasticisers such as DEHA, which have shown high transfer rates into food,” adds Eljarrat. Furthermore, “there is an urgent need for toxicological data on the new additives being introduced to the market so that their impact on health can also be assessed.”

In this context, the European Union approved a new regulation in 2024 to progressively restrict the use of bisphenols, including bisphenol A, in food-contact materials. The measure entered into force in January 2025 and provides a transition period of thirty-six months for its full implementation. The authors stress the importance of continuing progress in replacing these compounds and evaluating new alternative substances.

Sforzi, L., Araya Piqué, V., Martellini, T., Cincinelli, A., Eljarrat, E., & Barbieri, M. V. (2026). **Storage-driven migration of plastic additives from packaging to fish: influencing factors and human exposure assessment**. *Environment International*, 211, 110261. DOI: doi.org/10.1016/j.envint.2026.110261

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