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Location Is Everything: The Pollutants in Yellowfin Tuna Depend on Where It's Caught

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Fish is a highly nutritious food, but it can also be a dietary source of persistent organic pollutants (POPs).[1] In a new study in *EHP*, researchers investigated the extent to which contaminant levels within a single commercially important fish species varied depending on where the fish was caught.[2] Their results suggest that capture location may be an important yet overlooked variable when assessing the risk of exposure to POPs from eating wild fish.

Governmental fish consumption advisories suggest limiting intake of certain fish species to reduce human exposures to POPs.[3] These potentially harmful chemicals accumulate in body fat, and larger animals farther up the food chain tend to have higher levels. That is why characteristics, such as a fish's species, fat content, body size, and trophic level, are used as predictors of pollutant load.[4]

However, pollutant levels are not uniform across the world's oceans. Instead, POPs form a patchy distribution. Many of the fish species widely consumed in the United States, such as tuna, are harvested throughout the world's oceans, says the study's senior author Amro Hamdoun, a professor of biology at the Scripps Institution of Oceanography, University of California, San Diego. Geographic variation in pollutant levels in ocean waters could therefore affect the safety of fish that people eat.

Researchers from the Scripps Institute of Oceanography, led by Sascha Nicklisch, analyzed POPs in the dorsal muscle fillets of 117 wild-caught yellowfin tuna from 12 capture locations in the Atlantic, Eastern Pacific, Western Pacific, and Indian oceans. These commonly eaten fish are found around the world, but they do not travel far,[5] making them a likely sentinel of geographic variation in POP levels.[2]

The authors found that levels of pollutants in tuna varied between sites by a factor of 36. Fish caught in the offshore waters of North America and Europe had pollutant levels that were, on average, more than an order of magnitude higher than fish caught in the waters of Asia and Oceania. The 10 most contaminated fish, which were found in the Northeast Pacific Ocean, the Gulf of Mexico, and the Northeast Atlantic Ocean, had POP levels of 20–29 ng/g wet weight of fish. The 10 least contaminated fish, taken from the Northwest and Southwest Pacific Ocean, the South China Sea, and the Indian Ocean, had pollutant levels of 0.2–0.4 ng/g wet weight.[2]

The researchers also measured specific POPs belonging to a group of chemicals they have dubbed transporter interfering compounds (TICs). In earlier work, they identified TICs as compounds that may interfere with transporter proteins, hampering their ability to eliminate foreign substances from the body.[6] In the current study, the researchers found that the concentrations and distribution of TICs reflected those of total POPs. Hamdoun says, "TICs could help explain why certain chemicals are so persistent in body tissue," although future research is needed to better understand the connection.

To assess the impact of geographic variation on risk-based consumption advice, the researchers calculated monthly meal recommendations based on POP levels in individual fish. Based on their estimates, most of the yellowfin tuna they caught would have been safe to eat in unlimited quantities, says Hamdoun. However, 9 of the 10 fish captured in the Northeast Atlantic

A fisherman unloads yellowfin tuna at a market in Semporna, Malaysia. Because these large predators do not migrate widely, their body burdens of persistent organic pollutants (POPs) are a good indicator of how polluted their home waters might be. © shahreen/Shutterstock.

Ocean and 5 of the 8 fish caught in the Gulf of Mexico contained POP levels that would trigger health advisories even for people who eat less fish than currently recommended by the American Heart Association (AHA) and U.S. Department of Agriculture (USDA). USDA dietary guidelines suggest that people eat 12 ounces of cooked fish per week,[7] while the AHA recommends two 3.5-ounce servings of cooked fish each week.[8]

The new findings expand on earlier studies that pointed out that capture location might be an important factor in the contaminant load in fish. In one study, researchers used skipjack tuna to assess the distribution of POPs, including polychlorinated biphenyls and organochlorine pesticides in different parts of the Pacific Ocean.[9] In another, farm-raised salmon from Europe had higher levels of organochlorine pesticides than those raised in North or South America.[10] However, these studies were limited geographically, compared with the current study.

Unlike previous studies of farmed and wild-caught fish, Hamdoun and colleagues did not always find that POP levels correlated with the size or body fat percentage of the fish; in many cases, he says, fatty fish from a clean site were found to have lower levels of POPs than lean fish from a more polluted site. Based on these findings, Hamdoun concludes that lipid content alone is not enough to predict pollutant load when comparing fish from different sites.

According to David Carpenter, a public health physician at State University of New York at Albany who has studied POPs in farmed and wild-caught salmon and Great Lakes fish, these results are unexpected, since POPs accumulate in lipids. Carpenter, who was not involved in the current study, says it is possible that too few fish were captured at each location to suss out statistically significant differences between bigger and smaller fish at each site.

Overall, says Carpenter, the new study adds to mounting evidence that "where a fish comes from is an important factor to consider in determining likely contaminant loads and fish consumption advisories." Unfortunately, he adds, the new findings are likely to frustrate consumers who seldom receive information about capture location when purchasing seafood at supermarkets and restaurants.

Lindsey Konkel is a New Jersey–based journalist who reports on science, health, and the environment.

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