Global Fish and Community Mercury Monitoring Project

Relating mercury levels in fish from potential biological mercury hotspots

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Introduction

IPEN and Biodiversity Research Institute (BRI) collaborated to conduct a global mercury (Hg) study in response to strong public interest and governmental negotiation of a mercury treaty—the first global treaty on the environment in well over a decade by the United Nations Environment Programme (UNEP). The IPEN-BRI collaboration provides a rare opportunity to compile new and standardized mercury concentrations on a global basis.

The *Global Fish and Community Mercury Monitoring Project* is the first of its kind to identify, in one collaborative effort, global biological mercury hotspots (Fig. 1). These hotspots are of particular concern to human populations and the ecosystems on which they depend.

The study generated new data on mercury concentrations in samples from fish and people to accomplish the following goals:

1. Raise awareness about global mercury pollution among the general public, and policy makers
2. Identify and characterize biological mercury hotspots around the world
3. Explore how the proposed treaty might affect mercury pollution at these hotspots

Table 1. The participating countries with sample locations, the fish species sampled with the average Hg concentration (ppm, ww) with standard deviation (Stdev) and sample size. In addition to the fish listed below, some countries sampled fish with a sample size of one, so these are not included in the table below, but are included in Fig. 4. Fish in bold font are highlighted in Figs. 2 and 3. The NGO column lists the participating NGO who collected the fish samples. Countries with an asterisks (*) are highlighted in the IPEN-BRI report that was released in January 2013.

Country	Sample Location	Fish Species, Mean Hg (ppm, ww) ± Stdev, sample size	NGO
Albania*	Vlora bay	**Mullet fish, 0.05 ± 0.021, 9** **European hake, 0.195 ± 0.076, 11** **Mullet fish, 0.364 ± 0.111, 9** **Mullet fish, 0.617 ± 0.309, 3**	EDEN Center
Bangladesh	Munshiganj	Barramundi perch, 0.029 ± 0.006, 9	Eco-Social Development Organization
Belize	Belize	**Mutton snapper, 0.165 ± 0.075, 7** **Barracuda, 0.545 ± 0.27, 3**	University of Belize
Cameroon*	Douala	Giant African threadfin, 0.018 ± 0.003, 2 Gorean snapper, 0.039 ± 0.004, 3 Smoothmouth sea catfish, 0.06 ± 0.022, 6 African red snapper, 0.075 ± 0.058, 13	Centre de Recherche er d'Education pour le Développment
Colombia	Barranquilla and Honda - Rio Magdalena	Bocachico, 0.031 ± 0.006, 3 Bloch's catfish, 0.069 ± 0.036, 5 Bagre, 0.158 ± 0.064, 3 Capaz, 0.232 ± 0.182, 4	Universidad del Norte
Costa Rica	Colorado - Gulf of Nicoya	Blood clam, 0.019 ± 0.007, 12 Red snapper, 0.043 ± 0.041, 9 Whitefin weakfish, 0.065 ± 0.043, 6	Red de Acción en Plaguicidas y sus Alter-natives para América Latina
Czech Republic*	Ústí nad Labem & Neratovice	**Freshwater bream, 0.268 ± 0.073, 6** **Crucian carp, 0.343 ± 0.226, 2** **Freshwater bream, 0.571 ± 0.435, 8**	Arnika - Toxics and Waste Programme
Ghana	Elubo	Blue tilapia, 0.042 ± 0.006, 8 Blue catfish, 0.092 ± 0.028, 10	United Nations Office for Project Services
Indonesia*	Pobya, Palu, Central Sulawesi & Sekotong, Lombok Barat, West Nusa Tenggara	Barramundi, 0.075 ± 0.035, 6 Humpback grouper, 0.088 ± 0.007, 2 Mangrove red snapper, 0.09 ± 0.097, 2 Humpback grouper, 0.088 ± 0.007, 2 Kawakawa, 0.108 ± 0.036, 9 Barramundi, 0.181 ± 0.084, 2	Balifokus Foundation and WALHI - Central Sulawesi
Italy*	Messina - Tyrrhenian Sea	**Albacore, 0.906 ± 0.353, 6**	Arnika - Toxics and Waste Programme
Japan*	Tokyo	Pacific bluefin tuna, 1.118 ± 0.243, 9	Citizens Against Chemicals Pollution
Lebanon	Selaata	Mottled grouper, 0.064 ± 0.044, 3 Dusky grouper, 0.185 ± 0.096, 10	IndyAct
Macedonia	Skopje, Veles - Lake Mladost	Pike-perch, 0.062 ± 0.015, 9	EkoSvest
Mexico*	Coatzacoalcos	Gafftopsail sea catfish, 0.239 ± 0.053, 9 Common snook, 0.268 ± 0.062, 3 Fat snook, 0.306 ± 0.096, 3-	Centro de Análisis y Acción sobre Tóxicos y sus Alternativas
Nepal	Pokhara - Kathmandu Market & Fewa Lake	Rohu, 0.004 ± 0.001, 2 Silver carp, 0.032 ± 0.006, 2 Tilapia, 0.025 ± 0.006, 5 Sahar, 0.075 ± 0.006, 2 North African catfish, 0.125 ± 0.029, 3 Swamp barb, 0.139 ± 0.062, 5	Center for Public Health and Environmental Development
Paraguay	Paso Yobái - Rio Tebicuarymi & Mariano Roque Alonso - Rio Para-guay	Barred sorubim, 0.187 ± 0.172, 2 Marbled swamp eel, 0.263 ± 0.047, 3 Catfish, 0.484 ± 0.048, 2	ALTERVIDA
Portugal - Azores*	Azores, San Miguel	**White seabream, 0.105 ± 0.045, 10** **Black scabbardfish, 0.747 ± 0.037, 2**	Arnika - Toxics and Waste Programme
Russia*	Volgograd & Raygorod	**Carp, 0.362 ± 0.138, 10** **Perch, 0.468 ± 0.157, 10** **Catfish, 0.498 ± 0.156, 10**	Information Center "Volgograd Eco-Press" and Eco-Accord
Sri Lanka	Gampaha District - Negombo La-goon	Mullet, 0.018 ± 0.004, 3 Long whiskers catfish, 0.121 ± 0.061, 10	Centre for Environmental Justice
Thailand*	Muang - Gulf of Thailand & Ta-toom - Shalongwaeng Canal	Indian mackerrel, 0.009 ± 0.002, 3 Longtail tuna, 0.035 ± 0.033, 9 Great barracuda, 0.044 ± 0.009, 3 Common snakehead, 0.341 ± 0.111, 20	Ecological Alert and Recovery
Uganda	Lake Victoria	Nile perch, 0.04 ± 0.016, 3 Tilapia, 0.006 ± 0.003, 3	PROBICOU
Uruguay*	Minas de Corrales and Montevideo	**Stripped weakfish, 0.178 ± 0.06, 3** **Wolf fish, 0.292 ± 0.03, 3** **Swordfish, 1.307 ± 0.158, 4**	Red de Acción en Plaguicidas y sus Alter-natives para América Latina
USA - Alaska*	Pacific Ocean - Anchorage	**Halibut, 0.368 ± 0.484, 7**	Alaska Community Action on Toxics
USA - Hawaii	Lahaina - Pacific Ocean	**Wahoo, 0.131 ± 0.161, 2** **Mahimahi, 0.157 ± 0.046, 2** **YellowfinTuna, 0.173 ± 0.095, 6**	Biodiversity Research Institute

Evaluating the Results

Based on the U.S. EPA's reference dose of 0.0001 mg methylmercury per kg of body mass per day, we calculated fish consumption guidelines using an average body mass of 60 kg (132 pounds) and an average fish meal size of 170 grams (6 ounces). Fish containing mercury concentrations of 0.22 parts per million (ppm), red line in graphs, should be consumed no more than once per month. Fish with mercury concentrations less than 0.22 ppm can be consumed more frequently. Fish with mercury concentrations greater than 0.95 should be avoided entirely.

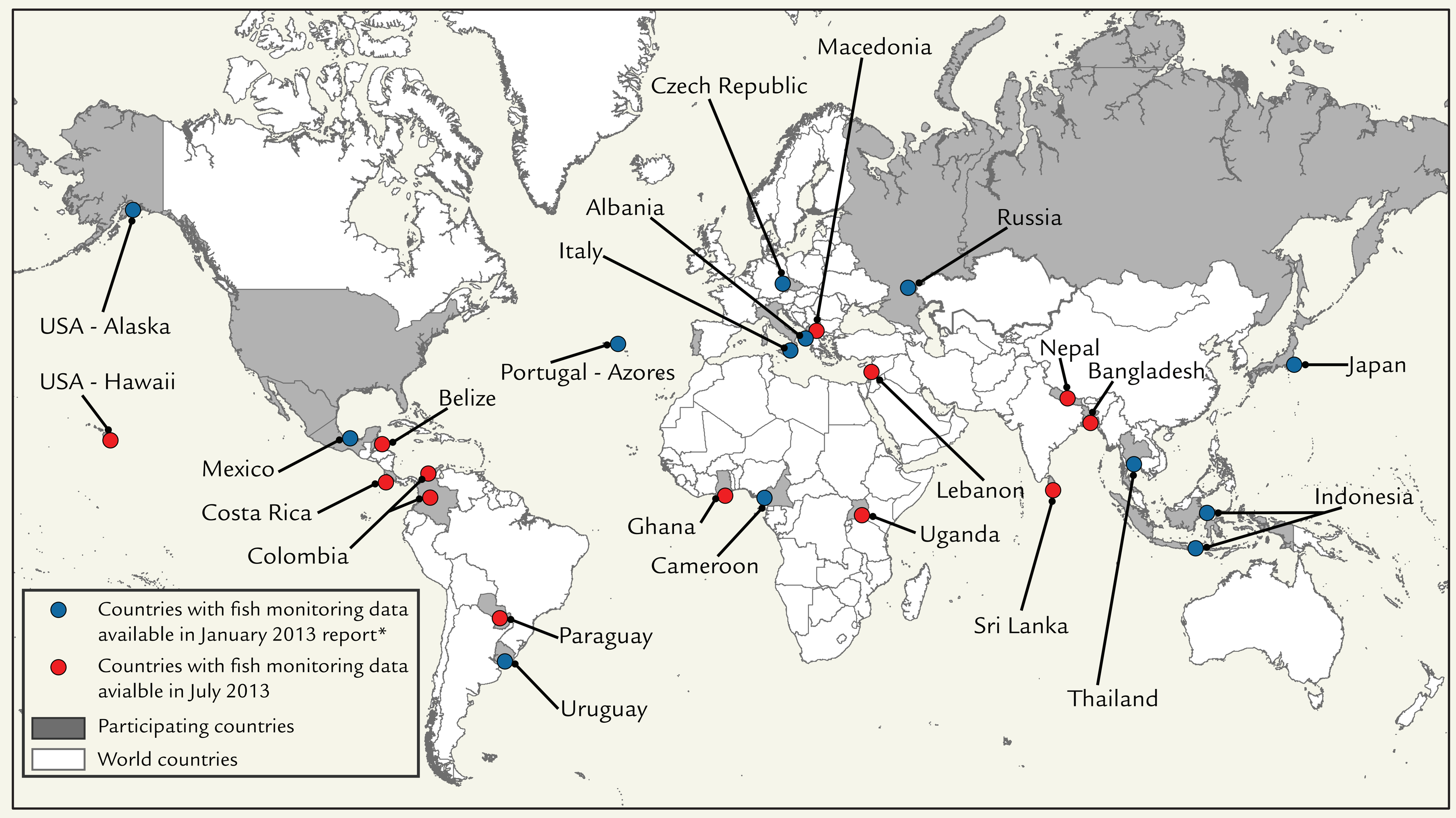


Figure 1. Geographic Scope of the IPEN-BRI Project. The Global Fish and Community Mercury Monitoring Project engaged IPEN Participating Organizations to collect samples of fish in targeted areas with known or suspected mercury contamination. *More specific information can be found on the countries evaluated in the IPEN-BRI report released in January 2013 (blue dots on map).

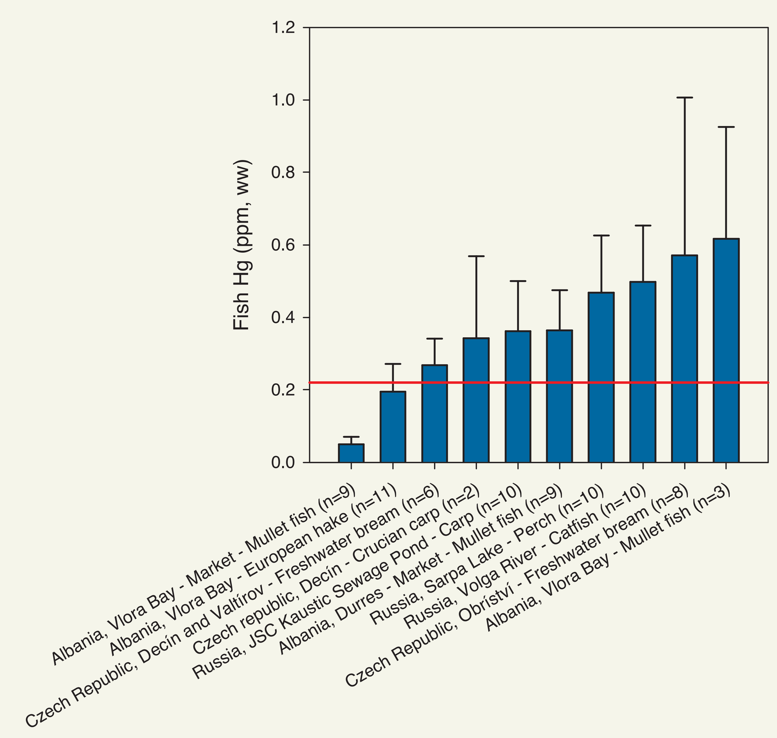


Figure 2. Mercury content from fish sampled from locations suspected to have mercury contamination from chlor-alkali facilities. Vlora bay in Albania is considered a contaminated site, but there was a presence of a former chlor-alkali and PVC plant.

Swordfish sampled at the market in Montevideo, Uruguay

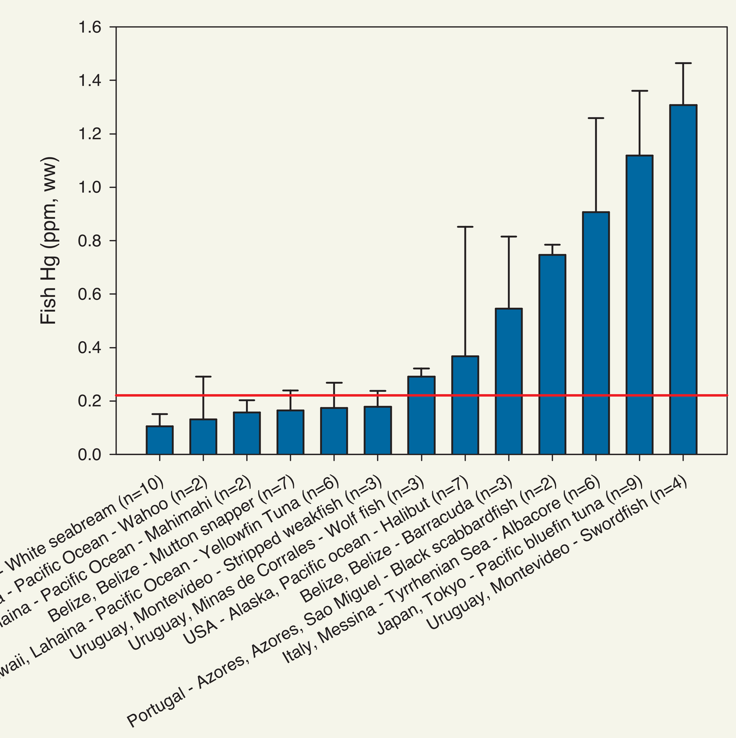


Figure 3. Mercury content from fish sampled at locations that represent fish and locations impacted by the global deposition of mercury. Many of these fish are large pelagic species.

The chlor-alkali plant Spolana in Neratovice, Czech Republic on the River Labe.

A woman on her way back from fishing in Takele, Douala Cameroon.

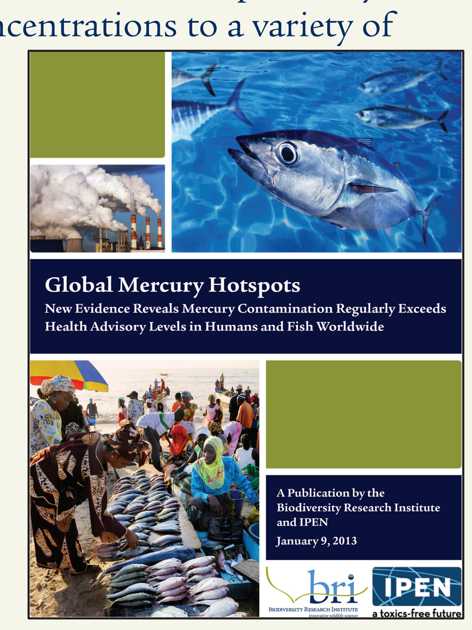
Volunteers from Center for Public Health and Environmental Development in Nepal with the fish samples.

Sampling Kits

BRI assembled the sample kits sent to the participating NGOs to sample fish. The kits included all the necessary bags for sample storage, scales to weigh the fish, gloves, and freezer packs for the return shipment. BRI also coordinated the shipping efforts with each country to ensure proper paper work and permits (USFWS form 3-177) were included in the overnight shipments, which were stored in Styrofoam cooler boxes.

IPEN-BRI January 2013 Report

In January 2013, IPEN and BRI released a report highlighting the results from 14 countries. The report provides an in-depth analysis of the data and relates fish mercury concentrations to a variety of human activities, such as chlor-alkali facilities, contaminated sites, coal-fired power plants, artisanal small-scale gold mining, mixed-use and chemical industrial sites.



For more information on the project and to download the full report, please visit BRI's website, **www.briloon.org/hgcenter** or scan the code to the right.

The full report as well as in-depth nationals reports and references can be found on IPEN's website, **http://www.ipen.org/hgmonitoring/** or scan the code to the right.

Major Findings

- The extent of significant Hg contamination is ubiquitous in marine and freshwater ecosystems around the world.
- Biological Hg hotspots are globally common and can be related to human activities that release Hg to air, land, and water from multiple point and nonpoint source types.
- Fish samples regularly exceed health advisory guidelines based on the U.S. EPA reference dose of 0.22 ppm.
- From the 24 sampled countries, 401 fish were analyzed, and 36% of these fish were not safe for consumption for more than one meal per month (Fig. 4). The fish analyzed varied in trophic position, size, and age which influences mercury content.
- Apex marine predators such as tuna, swordfish, and other large pelagic fishes are the most susceptible to Hg exposure based on their position at the top of the marine food web. These species are also an important part in the global marine fisheries.
- The results highlight the ongoing problem of Hg pollution.

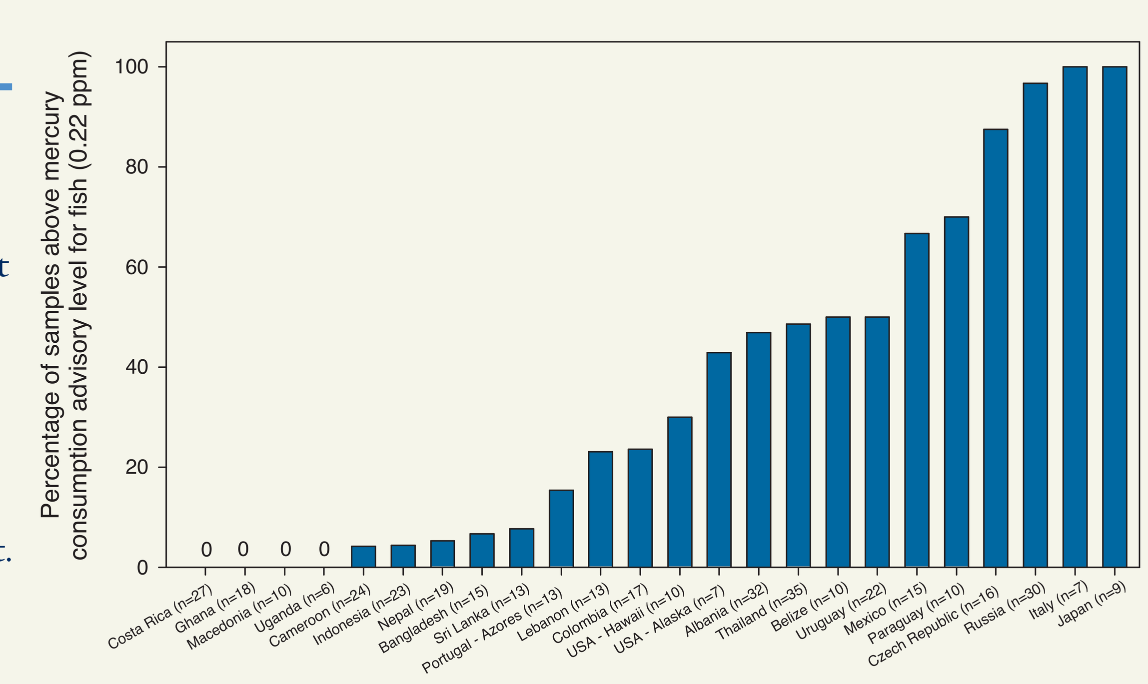


Figure 4. The percentage of fish samples for each country above the fish consumption advisory guideline of 0.22 ppm. This also includes fish species with a low sample sizes that were not included in the graphs (Figs. 2 - 3) or table with average fish Hg concentrations.

IPEN is a leading global organization working to establish and implement safe chemical policies and practices that protect human health and the environment around the world.

BRI's missing is to assess emerging threats to wildlife and ecosystems through collaborative research, and to use scientific findings to advance environmental awareness and inform decision makers.

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