May 2013

National Listing of Fish Advisories NEWSLETTER

Recent Advisory News

Health advisory and consumption guidelines for fish from Lake Oroville, California

A report released by the Office of Environmental Health Hazard Assessment and the California Environmental Protection Agency provides health advisory and consumption guidelines for consumers eating fish caught from Lake Oroville in California. Mercury and PCBs from historic mining activities and manufacturing are the primary contaminants of concern in Lake Oroville. The report utilized existing fish tissue data and compared mean tissue concentrations to established Advisory Tissue Levels (ATLs) to determine fish consumption frequency advice. Both the ATL determination and the advisory process incorporate the positive health effects of fish in the diet. When the consumption advice is followed, the exposure to mercury and PCBs from eating fish caught at Lake Oroville is at or below the average daily reference dose or cancer risk probability of one in ten thousand.
Link to original report: http://oehha.ca.gov/fish/special_reports/pdf/121812LakeOrovilleFinalReport.pdf

Source: California Environmental Protection Agency and Office of Environmental Health Hazard Assessment. December 2012.

Infected salmon declared fit for human consumption by Canadian Food Inspection Agency

For the first time, Canada's food safety regulator, the Canadian Food Inspection Agency (CFIA), is allowing Nova Scotia salmon infected with a flu-like virus to be processed for supermarkets and restaurants. The agency recently declared 240,000 Atlantic salmon infected with salmon anemia to be fit for human consumption. It is the first time that the CFIA has opted not to destroy fish that are infected with the virus since the agency began to regulate the fish farming industry in 2005. A 2010 report issued by the Center for Food Security and Public Health at Iowa State University concluded that the virus could be deactivated by the human body temperature and therefore posed no threat to humans. Because American law prohibits the importation of any diseased animal, salmon carrying the virus will not be sold in the United States. Link to original article: http://www.thestar.com/news/canada/2013/02/01/infected_salmon_declared_fit_for_human_consumption_by_canadian_food_inspection_agency.html

Source: Oved, Marco. Toronto Star. 2/1/2013.

Coastal and Marine Mercury Ecosystem Research Collaborative report: Mercury pollution in the marine environment

The Coastal and Marine Mercury Ecosystem Collaborative (C-MERC) is a group of 50 scientists and policy stakeholders that assembled in 2010 to review the current knowledge related to mercury contamination in the world's marine fish. After two workshops and publication of a series of peer-reviewed articles, the collaborative published a report synthesizing their findings. Four major findings came from the C-MERC synthesis: 1) mercury pollution is ubiquitous and contaminants seafood worldwide; 2) mercury pollution enters the waterways along distinct pathways

that are linked to different mercury sources; 3) most seafood consumers are "general consumers" whose methylmercury intake comes from fish typically harvested from the open oceans which receive atmospheric inputs from global mercury emission sources; and 4) methylmercury in marine fish will decline roughly in proportion to decreases in mercury inputs, although the response times will vary. Methylmercury intake by "local consumers" comes from seafood caught in nearby coastal waters that receive inputs from local, regional and global sources. This information can help guide mercury policies and management strategies under consideration at local, national, and international levels.
Link to original report: http://www.dartmouth.edu/~toxmetal/assets/pdf/sources_to_seafood_report.pdf

Source: The Coastal and Marine Mercury Ecosystem Research Collaborative. December 2012.

Muskegon and White Lakes in Michigan reach cleanup milestones

After 15 years of cleanup efforts, the U.S. EPA has lifted Beneficial Use Impairments on two Michigan lakes. Recent studies by Grand Valley State University suggest that fish in Muskegon and White Lakes do not contain higher concentrations of PCBs or mercury than fish in lakes that were not listed as Areas of Concern. Both lakes are still listed as Areas of Concern but are expected to be removed from the list in the next few years.
Link to original article: http://greatlakesecho.org/2013/03/12/muskegon-and-white-lakes-reach-cleanup-milestones/

Source: Dau, James. Muskegon and White lakes reached cleanup milestones. Great Lakes Echo. March 12, 2013.

Ohio fish consumption advisories updated for 2013

The Ohio Environmental Protection Agency has issued revised fish consumption advisories for 2013. The advisories identify types of fish or other aquatic animals that should be eaten in limited quantities or should not be eaten because of contamination. They also provide general advice to aid the public in making informed decisions about the benefits and the risks associated with eating locally caught fish from Ohio waters. More information on Ohio fish advisories can be found at: http://www.epa.state.oh.us/dsw/fishadvisory/index.aspx
Link to original article: http://epa.ohio.gov/news/onlinenewsroom/newsreleases/tabid/5967/vw/1/itemid/279/fish-consumption-advisories-updated-for-2013.aspx

Source: Ohio Environmental Protection Agency. February 28, 2013.

Mercury in the global environment: Patterns of global seafood mercury concentrations and their relationship with human health

The Biodiversity Research Institute (BRI) has compiled a database of biotic mercury concentrations in fish and wildlife from peer-reviewed publications and governmental sources. In a 2012 report, the BRI used the database to examine global seafood mercury concentrations and related ecological and human health impacts. The study is intended to raise awareness about marine species with the greatest concentrations of mercury and provide a resource for better integration of mercury science into policy decisions. The study found that global mercury contamination is widespread and varies based on associated contaminant sources and sensitivity of the ecosystem, and that marine organisms regularly harvested and consumed contain a wide range of mercury concentrations based largely on species. The study also identifies specific areas where further research is needed to better understand mercury distribution and effects in the environment. For more information on the study and BRI, go to http://www.briloon.org/
Link to original report: http://www.briloon.org/uploads/documents/hgcenter/seafood/PatternsofGlobalSeafood.pdf

Source: Evers, D.C., Turnquist, M.A., and Buck, D.G. 2012. Mercury in the global environment: Patterns of global seafood mercury concentrations and their relationship with human health. Biodiversity Research Institute. Gorham, Maine. BRI Science Communications Series 2012-48. 16 pages.

Fish consumption advisory for Lake Norman, North Carolina

The North Carolina Department of Health and Human Services has issued revised 2013 fish consumption advisories for Lake Norman. Recent studies have indicated elevated levels of polychlorinated biphenyls and mercury in striped bass and largemouth bass. The advisory recommends women of child bearing age and children avoid consumption and that the remaining population consume less than two meals per week of striped and largemouth bass. More information on North Carolina fish advisories can be found at: http://epi.publichealth.nc.gov/oee/programs/fish.html
Link to original article: http://www.ncdhhs.gov/pressrel/2013/2013-04-10_fish_advisory_lake_norman.htm

Source: North Carolina Department of Health and Human Services. April 9, 2013

Conferences

International Conference on Mercury as a Global Pollutant
July 28-August 2, 2013, Edinburgh, Scotland
http://www.mercury2013.com/

International Society of Exposure Science (ISES)-23rd Annual Meeting
August 20-23, 2013, Basel, Switzerland
http://www.isesweb.org/Meetings/mtgs_fut.htm

American Fisheries Society 143rd Annual Meeting
September 8-12, 2013, Little Rock, Arkansas
http://afs2013.com/

The Society of Environmental Toxicology and Chemistry (SETAC) North America 34th Annual Meeting
November 17-21, 2013, Nashville, Tennessee
http://www.setac.org/events/event_details.asp?id=244644

Illinois 2013 sport fish consumption advisory

The Illinois Department of Public Health has issued revised fish consumption advisories for 2013. The advisories identify the types of fish or other aquatic animals that should be eaten in limited quantities or, in some cases, avoided altogether because of contamination. They also provide general advice to the public on best fish preparation procedures to reduce contamination before consumption. More information on Illinois fish advisories can be found at: www.idph.state.il.us/envhealth/fishadvisory/illinois_fish_advisory.pdf
Link to original article: http://www.idph.state.il.us/public/press13/3.16.13_2013_Sport_Fish_Consumption_Advisory.htm

Source: Illinois Department of Public Health. 2013 Sport Fish Consumption Advisory. March 16, 2013.

Recent Publications

Please note: The following abstracts are reprinted verbatim unless otherwise noted. Titles and citations (only) are listed for publications that are copyright protected.

Future trends in environmental mercury concentrations: Implications for prevention strategies

In their new paper, Bellanger and coauthors show substantial economic impacts to the EU from neurocognitive impairment associated with methylmercury (MeHg) exposures. The main source of MeHg exposure is seafood consumption, including many marine species harvested from the global oceans. Fish, birds and other wildlife are also susceptible to the impacts of MeHg and already exceed toxicological thresholds in vulnerable regions like the Arctic. Most future emissions scenarios project a growth or stabilization of anthropogenic mercury releases relative to present-day levels. At these emissions levels, inputs of mercury to ecosystems are expected to increase substantially in the future, in part due to growth in the legacy reservoirs of mercury in oceanic and terrestrial ecosystems. Seawater mercury concentration trajectories in areas such as the North Pacific Ocean that supply large quantities of marine fish to the global seafood market are projected to increase by more than 50% by 2050. Fish mercury levels and subsequent human and biological exposures are likely to also increase because production of MeHg in ocean ecosystems is driven by the supply of available inorganic mercury, among other factors. Analyses that only consider changes in primary anthropogenic emissions are likely to underestimate the severity of fu-

ture deposition and concentration increases associated with growth in mercury reservoirs in the land and ocean. We therefore recommend that future policy analyses consider the fully coupled interactions among short and long-lived reservoirs of mercury in the atmosphere, ocean, and terrestrial ecosystems. Aggressive anthropogenic emission reductions are needed to reduce MeHg exposures and associated health impacts on humans and wildlife and protect the integrity of one of the last wild-food sources globally. In the near-term, public health advice on safe fish consumption choices such as smaller species, younger fish, and harvests from relatively unpolluted ecosystems is needed to minimize exposure risks.

Source: Sunderland, E. M. and N. E. Selin (2013). "Future trends in environmental mercury concentrations: Implications for prevention strategies." Environ Health 12: 2.

Strong positive associations between seafood, vegetables, and alcohol with blood mercury and urinary arsenic levels in the Korean adult population

Blood mercury and urinary arsenic levels are more than fivefold greater in the Korean population compared with those of the United States. This may be related to the foods people consumed. Therefore, we examined the associations between food categories and mercury and arsenic exposure in the Korean adult population. Data regarding nutritional, biochemical, and health-related parameters were obtained from a cross-sectional study, the 2008-2009 Korean National Health and Nutrition Examination Survey (3,404 men and women age ≥ 20 years). The log-transformed blood mercury and urinary arsenic levels were regressed against the frequency tertiles of each food group after covariate adjustment for sex, age, residence area, education level, smoking status, and drinking status using food-frequency data. Blood mercury levels in the high consumption groups compared to the low consumption groups were elevated by about 20 percents with salted fish, shellfish, whitefish, bluefish, and alcohol, and by about 9-14 percents with seaweeds, green vegetables, fruits and tea, whereas rice did not affect blood mercury levels. Urinary arsenic levels were markedly increased with consumption of rice, bluefish, salted fish, shellfish, whitefish, and seaweed, whereas they were moderately increased with consumption of grains, green and white vegetables, fruits, coffee, and alcohol. The remaining food categories tended to lower these levels only minimally. In conclusion, the typical Asian diet, which is high in rice, salted fish, shellfish, vegetables, alcoholic beverages, and tea, may be associated with greater blood mercury and urinary arsenic levels. This study suggests that mercury and arsenic contents should be monitored and controlled in soil and water used for agriculture to decrease health risks from heavy-metal contamination.

Source: Park, S. and B. K. Lee (2013). "Strong positive associations between seafood, vegetables, and alcohol with blood mercury and urinary arsenic levels in the Korean adult population." Arch Environ Contam Toxicol 64(1): 160-170.

The influence of fish length on tissue mercury dynamics: Implications for natural resource management and human health risk

Consumption of fish has well-known human health benefits, though some fish may contain elevated levels of mercury (Hg) that are especially harmful to developing children. Fish length is most often the basis for establishing fishery harvest regulations that determine which fish will ultimately be consumed by humans. It is, therefore, essential to quantify the relationship between fish length and Hg accumulation in regard to harvest regulations for effective fishery and public health policy. We examined this relationship for three sportfish from six lakes across North Carolina, USA. Bluegill (*Lepomis macrochirus*) had the lowest Hg levels and only the very largest fish in the most contaminated site exceeded the US Environmental Protection Agency (USEPA) Hg screening level. Black crappie (*Pomoxis nigromaculatus*) had an intermediate level of Hg and larger individuals exceeded the USEPA screening level;

however, they tended not to exceed this level before reaching the harvest length limit. Largemouth bass (*Micropterus salmoides*) exceeded the USEPA screening level at sizes below the fishery length limit in two lakes, leaving only higher risk fish for anglers to harvest and consume. Removing the effects of fish age and trophic position, we found strong positive correlations between Hg and fish length for largemouth bass and black crappie. We suggest public health officials and wildlife managers collaborate to structure fishery regulations and length-based fish consumption advisories that protect consumers from Hg exposure and communicate the relative risk of fish consumption.

Source: Sackett, D. K., W. G. Cope, et al. (2013). "The influence of fish length on tissue mercury dynamics: Implications for natural resource management and human health risk." Int J Environ Res Public Health 10 (2): 638-659.

PFOS and PFC releases and associated pollution from a PFC production plant in Minnesota (USA)

Perfluorooctane sulfonate (PFOS) and PFOS-related substances have been listed as persistent organic pollutants in the Stockholm Convention. From August 2012, Parties to the Convention needed to address the use, storage, and disposal of PFOS-including production sites and sites where PFOS wastes have been deposited-in their national implementation plans. The paper describes the pollution in Minnesota (USA) caused by the 3M™ Company at one of the largest per/polyfluorinated chemical (PFC) production facilities. From early 1950s until the end of 2002, when 3M™ terminated PFOS and perfluorooctanoic acid (PFOA) production, PFOS, PFOA, and other PFC production wastes were disposed around the plant and in local disposal sites. Discharges from the site and releases from deposits caused widespread contamination of ground and surface waters including local drinking water wells. Fish in the river downstream were contaminated with PFOS to levels that led to fish consumption advisories. Human exposures resulted from ingesting contaminated drinking water, requiring installation of water treatment facilities and alternate water supplies. The critical evaluation of the assessments done revealed a range of gaps in particular of human exposure where relevant exposure pathways including the entire exposure via food have not been taken into consideration. Currently, the exposure assessment of vulnerable groups such as children or Hmong minorities is inadequate and needs to be improved/validated by epidemiological studies. The assessment methodology described for this site may serve-with highlighted improvements-as a model for assessment of other PFOS/PFC production sites in the Stockholm Convention implementation.

Source: Oliaei, F., D. Kriens, et al. (2012). "PFOS and PFC releases and associated pollution from a PFC production plant in Minnesota (USA)." Environ Sci Pollut Res Int. epub.

Intakes of long-chain omega-3 (n-3) PUFAs and fish in relation to incidence of asthma among American young adults: The CARDIA study

BACKGROUND: Although long-chain omega-3 (n-3) PUFAs (LCω3PUFAs) have been linked to the prevention of some inflammatory disorders, little is known about the association between these fatty acids and incidence of asthma. OBJECTIVE: The objective was to prospectively investigate the association between LCω3PUFAs and fish intake and incidence of asthma among American young adults. DESIGN: A 20-y follow-up longitudinal analysis was conducted in a biracial cohort of 4162 Americans, aged 18-30 y, with a history of asthma at baseline in 1985. Diet was assessed by a validated interviewer-administered quantitative food-frequency questionnaire at the examinations in 1985, 1992, and 2005. Incident self-reported asthma was defined as having a physician diagnosis of asthma and/or the use of asthma medications between 1985 and 2005. RESULTS: During the 20-y follow-up, 446 incident cases of asthma were identified. LCω3PUFA intake was significantly inversely associated with incidence of asthma after adjustment for sociodemographic, major lifestyle, and dietary confounders. The multivariable-adjusted HR for the highest quintile of LCω3PUFA intake as compared with the lowest quintile was 0.46 (95% CI: 0.33, 0.64; P-trend < 0.01). However, a higher frequency of nonfried fish consumption was not significantly associated with the risk of asthma. DHA showed a greater inverse association than did EPA. The association between LCω3PUFAs and incident asthma was not appreciably modified by sex, race, BMI, smoking status, or atopic status. CONCLUSION: This study showed that intakes of LCω3PUFAs are inversely longitudinally associated with the incidence of asthma in American young adults.

Source: Li, J., P. Xun, et al. (2013). "Intakes of long-chain omega-3 (n-3) PUFAs and fish in relation to incidence of asthma among American young adults: The CARDIA study." Am J Clin Nutr 97(1): 173-178.

Relationship of methyl mercury accumulation with lipid and weight in two river cat fish species, *Wallagoo attu* and *Mystus aor*, from West Bengal, India

This study focuses on mercury (Hg) bioaccumulation in Indian cat fish, *Wallagoo attu* and *Mystus aor*, from different rivers. Methyl mercury (MeHg) concentrations were determined in muscle tissue of two different parts, ventral and dorsal part, of each species and the levels of organic mercury were co-related with lipid content of each part. The MeHg concentrations increased in a linear fashion with both weight and age for these river species. The average concentration of MeHg was found to be 0.93 ± 0.60 and 1.26 ± 0.62 μg Hg/g (expressed in wet weight basis) for ventral and dorsal parts, respectively in *W. attu* and this was above the 0.25 μg Hg/g of wet weight, the limit set by the Prevention of Food Adulteration Act for the maximum level for consumption of fish exposed to mercury pollution. In *M. Aor* the concentration of MeHg was not above the standard limit but threatening, it was 0.22 ± 0.07 and 0.23 ± 0.08 μg Hg/g (expressed in wet weight basis) in dorsal and ventral parts, respectively.

Source: Pal, M. and M. Ghosh (2013). "Relationship of methyl mercury accumulation with lipid and weight in two river cat fish species, *Wallagoo attu* and *Mystus aor*, from West Bengal, India." Environ Monit Assess 185(1): 31-37.

Types of fish consumed and fish preparation methods in relation to pancreatic cancer incidence: The VITAL cohort study

The associations of types of fish and fish preparation methods with pancreatic cancer risk remain unknown. The authors conducted a prospective cohort study in western Washington State among 66,616 adults, aged 50-76 years, who participated in the VITamins And Lifestyle (VITAL) cohort study. Diet was assessed by a food frequency questionnaire. Pancreatic cancer cases were identified by linkage to the Surveillance, Epidemiology, and End Results cancer registry. During an average follow-up of 6.8 years, 151 participants developed pancreatic cancer (adenocarcinoma). Long-chain (n-3) polyunsaturated fatty acids (LC-PUFAs) and nonfried fish intake were inversely associated with pancreatic cancer incidence. When the highest and lowest tertiles of exposure were compared, the multivariable-adjusted hazard ratio of pancreatic cancer was 0.62 (95% confidence interval: 0.40, 0.98) (P_{trend} = 0.08) for LC-PUFAs and 0.55 (95% confidence interval: 0.34, 0.88) (P_{trend} = 0.045) for nonfried fish. Docosahexaenoic acid showed a greater inverse association with pancreatic cancer than eicosapentaenoic acid. No statistically significant associations were observed with fried fish and shellfish consumption. The potential health impact of fish consumption may depend on the types of fish consumed and fish preparation methods. LC-PUFAs, particularly docosahexaenoic acid, and nonfried fish, but not shellfish or fried fish, may be beneficial in the primary prevention of pancreatic cancer.

Source: He, K., P. Xun, et al. (2013). "Types of fish consumed and fish preparation methods in relation to pancreatic cancer incidence: The VITAL Cohort study." Am J Epidemiol 177(2): 152-160.

Mercury in serum predicts low risk of death and myocardial infarction in Gothenburg women

PURPOSE: Markers of mercury (Hg) exposure have shown both positive and negative associations with cardiovascular disease (CVD). We assessed the association between serum Hg (S-Hg) and risk of cardiovascular disease in a prospective population-based cohort, with attention to the roles of dental health and fish consumption. METHODS: Total mortality, as well as morbidity and mortality from acute myocardial infarction (AMI) and stroke, was followed up for 32 years in 1,391 women (initially age 38-60), in relation to S-Hg at baseline, using Cox regression models. Potential confounders (age, socioeconomic status, serum lipids, alcohol consumption, dental health, smoking, hypertension, waist-hip ratio, and diabetes) and other covariates (e.g., fish consumption) were also considered. RESULTS: Hazard ratios (HR) adjusted only for age showed strong inverse associations between baseline S-Hg and total mortality [highest quartile: hazard ratio (HR) 0.76; 95% confidence interval (CI) 0.59-0.97], incident AMI (HR 0.56; CI 0.34-0.93), and fatal AMI (HR 0.31; CI 0.15-0.66). Adjustment for potential confounding factors, especially dental health, had a strong impact on the risk estimates, and after adjustment, only the reduced risk of fatal AMI remained statistically significant. CONCLUSIONS: There was a strong inverse association between Hg exposure and CVD. Likely, reasons are confounding with good dental health (also correlated with the number of amalgam fillings in these age groups) and/or fish consumption. The results suggest potential effects of dental health and/or fish consumption on CVD that deserve attention in preventive medicine.

Source: Bergdahl, I. A., M. Ahlqwist, et al. (2013). "Mercury in serum predicts low risk of death and myocardial infarction in Gothenburg women." Int Arch Occup Environ Health 86(1): 71-77.

Effects of mercury deposition and coniferous forests on the mercury contamination of fish in the South Central United States

Mercury (Hg) is a toxic metal that is found in aquatic food webs and is hazardous to human and wildlife health. We examined the relationship between Hg deposition, land coverage by coniferous and deciduous forests, and average Hg concentrations in largemouth bass (*Micropterus salmoides*) -equivalent fish (LMBE) in 14 ecoregions located within all or part of six states in the South Central U.S. In 11 ecoregions, the average Hg concentrations in 35.6-cm total length LMBE were above 300 ng/g, the threshold concentration of Hg recommended by the U.S. Environmental Protection Agency for the issuance of fish consumption advisories. Percent land coverage by coniferous forests within ecoregions had a significant linear relationship with average Hg concentrations in LMBE while percent land coverage by deciduous forests did not. Eighty percent of the variance in average Hg concentrations in LMBE between ecoregions could be accounted for by estimated Hg deposition after adjusting for the effects of coniferous forests. Here we show for the first time that fish from ecoregions with high atmospheric Hg pollution and coniferous forest coverage pose a significant hazard to human health. Our study suggests that models that use Hg deposition to predict Hg concentrations in fish could be improved by including the effects of coniferous forests on Hg deposition.

Source: Drenner, R. W., M. M. Chumchal, et al. (2013). "Effects of mercury deposition and coniferous forests on the mercury contamination of fish in the South Central United States." Environ Sci Technol 47 (3): 1274-1279.

Mercury concentration in breast milk and infant exposure assessment during the first 90 days of lactation in a midwestern region of Brazil

Breast milk samples collected from 18 nursing mothers between the 15th and 90th day of lactation were digested in nitric acid in a microwave, and total mercury (THg) levels were quantified by atomic fluorescence spectrometry. Participants responded to a 24-h dietary recall questionnaire on the 74th and 76th day of lactation and to a Food Frequency Questionnaire querying the frequency of fish intake over the last 90 days. Usual intake was estimated using the PC-SIDE software package. A meal of fish was offered on the 75th day of lactation. Mothers' individual mean THg levels ranged from <0.76 to 22.7 ng/mL during the period, and the mean level for all samples (n = 142) was 6.47 ±6.04 ng/mL. The multilevel mixed linear model used showed high heterogeneity of the mercury levels among the mothers, and THg levels did not change significantly over the period under study. However, a significant increase in THg levels was observed after the intervention with the fish meal. Exposure increased for most infants on the 90th day of lactation, with intakes exceeding the THg provisional tolerable weekly intake (PTWI) at least once during the period for 77.8 % of samples. Mothers consumed mostly food from the fat and grain groups, and a significant correlation was detected between consumption of food of these groups and breast milk THg levels ($p = 0.006$ and 0.007). A significant correlation was also found between vegetable consumption and carbohydrate intake and THg levels in the samples ($p = 0.015$ and 0.045, respectively). No correlation was found between mothers' daily fish consumption frequency and THg levels. Although this study showed that mercury intake by infants during lactation may exceed the toxicologically safe exposure level (PTWI), we nevertheless believe that the benefits of lactation for both the mother and the infant outweigh the eventual risks that this exposure may represent.

Source: Cunha, L. R., T. H. Costa, et al. (2013). "Mercury concentration in breast milk and infant exposure assessment during the first 90 days of lactation in a midwestern region of Brazil." Biol Trace Elem Res 151(1): 30-37.

Mercury exposure in young adulthood and incidence of diabetes later in life: The CARDIA trace element study

OBJECTIVE: Laboratory studies suggest that exposure to methylmercury at a level similar to those found in fish may induce pancreatic islet β-cell dysfunction. Few, if any, human studies have examined the association between mercury exposure and diabetes incidence. We examined

whether toenail mercury levels are associated with incidence of diabetes in a large prospective cohort. RESEACH DESIGN AND METHODS: A prospective cohort of 3,875 American young adults, aged 20-32 years, free of diabetes in 1987 (baseline), were enrolled and followed six times until 2005. Baseline toenail mercury levels were measured with instrumental neutron-activation analysis. Incident diabetes was identified by plasma glucose levels, oral glucose tolerance tests, hemoglobin A1C levels, and/or antidiabetic medications. RESULTS: A total of 288 incident cases of diabetes occurred over 18 years of follow-up. In multivariate analyses adjusted for age, sex, ethnicity, study center, education, smoking status, alcohol consumption, physical activity, family history of diabetes, intakes of long-chain n-3 fatty acids and magnesium, and toenail selenium, toenail mercury levels were positively associated with the incidence of diabetes. The hazard ratio (95% CI) of incident diabetes compared the highest to the lowest quintiles of mercury exposure was 1.65 (1.07-2.56; P for trend = 0.02). Higher mercury exposure at baseline was also significantly associated with decreased homeostatic model assessment β-cell function index (P for trend < 0.01). CONCLUSIONS: Our results are consistent with findings from laboratory studies and provide longitudinal human data, suggesting that people with high mercury exposure in young adulthood may have elevated risk of diabetes later in life.

Source: He, K., P. Xun, et al. (2013). "Mercury exposure in young adulthood and incidence of diabetes later in life: The CARDIA trace element study." Diabetes Care. Epub ahead of print.

Neurodevelopmental effects of low-level prenatal mercury exposure from maternal fish consumption in a Mediterranean cohort: Study rationale and design

Background: Mercury is a neurotoxic environmental pollutant. However, the literature on the neurodevelopmental effect of low-level prenatal mercury exposure from maternal fish intake is inconsistent. We assessed the association between prenatal mercury exposure and infant neurodevelopment in coastal areas of 4 Mediterranean countries. Methods: This was a prospective cohort study that planned to enroll approximately 1700 mother-infant pairs. Pregnant women and their newborn children were recruited in selected hospitals of the study areas. Biological samples, including maternal hair and cord blood, were collected from mothers and children, and the concentrations of mercury and other elements were measured. Exposures to lifestyle, environmental, and social factors were assessed through questionnaires. The main outcome was child neurodevelopment at 18 months, as measured by the Bayley Scales of Infant and Toddler Development, Third Edition. Conclusions: This cohort has a number of strengths. First, mercury concentration was measured in several biological samples, which allows for a better understanding of mercury kinetics and is useful for sensitivity analyses. Therefore, we expect to be able to adjust for the potential confounding effects of lifestyle and social factors and for the effects of other elements that were measured in the biological samples. Finally, this is a multinational study and thus permits assessment of the relation between mercury and child neurodevelopment in different populations.

Source: Valent, F., M. Horvat, et al. (2013). "Neurodevelopmental effects of low-level prenatal mercury exposure from maternal fish consumption in a Mediterranean cohort: Study rationale and design." Journal of Epidemiology Journal of Epidemiology. Epub ahead of print.

An analysis of mercury exposures among the adult population in New York state

The extent of methylmercury exposures among adults in New York State (NYS) has not been well characterized. Over the past few years, the NYS Heavy Metals Registry (HMR) has seen an increase in both blood mercury tests being reported, and nonoccupational exposures to mercury, which appear primarily due to fish consumption. This study will, (1) Characterize the adults who are tested for blood mercury in NYS; (2) Examine the circumstances for blood mercury testing; and (3) Characterize this population in terms of exposure history, specifically those individuals who are non-occupationally exposed through a diet of seafood consumption in reference to blood mercury levels. Data available from HMR laboratory results, including basic demographics and test results, were combined with data from telephone interviews. The interview contains information on the reasons for testing, possible sources of exposure, and the individual's work and home environment. Approximately 99 % of adults reported to the HMR, with identifiable exposures to mercury, had non-occupational exposures resulting from seafood consumption. Common types of fish consumed include salmon, tuna, and swordfish, with 90 % of adults eating seafood a few times or more per week. Information will be provided on the reasons for being tested and the range of blood mercury levels in relation to their seafood consumption. NYS residents who frequently eat fish should be aware of what types of fish contain mercury and avoid or reduce consumption of fish with high mercury levels.

Source: Fletcher, A. M. and K. H. Gelberg (2012). "An analysis of mercury exposures among the adult population in New York state." Journal of Community Health. Epub ahead of print.

Fish consumption patterns and mercury exposure levels among women of childbearing age in Duval County, Florida

Consumption of fish containing methylmercury can pose serious health concerns including neurotoxic effects in adults and toxicity to the fetuses of mothers exposed during pregnancy. In the study described in this article, the authors examined fish consumption patterns and measured hair mercury levels of women of childbearing age in a coastal county in Florida. Women from the community participated in a risk factor assessment survey (N = 703). Hair samples (n = 698) were collected and analyzed for mercury. The authors identified 74.8% below detection limit; 25.2% had detectable limits of mercury, while 7% exceeded 1 μg/g. Hair mercury levels increased with fish consumption and age. Race, income, and education levels were also associated with increased hair mercury levels. Women of Asian/Pacific Islander origin had the highest levels. Although reported fish consumption exceeded the recommendations for women of childbearing age, the study population had lower mercury levels than other comparative studies in Florida and at national levels.

Source: Traynor, S., G. Kearney, et al. (2013). "Fish consumption patterns and mercury exposure levels among women of childbearing age in Duval County, Florida." Journal of Environmental Health 75(6).

Evaluation of seafood toxicity in the Australes archipelago (French Polynesia) using the neuroblastoma cell-based assay

Ciguatera fish poisoning (CFP), a disease caused by consuming fish that have accumulated ciguatoxins (CTXs) in their tissue, is regarded as the most prevalent form of intoxication in French Polynesia. Recently, the Australes, one of the least affected archipelago until the early 1980s, has shown a dramatic increase in its incidence rates in 2009 with unusual CFP cases. In the present work, potential health hazards associated with the proliferation of various marine phytoplankton species and the consumption of fish and marine invertebrates highly popular among local population were assessed in three Australes islands: Raivavae, Rurutu and Rapa. Extracts from the marine dinoflagellates Gambierdiscus, Ostreospis and mat-forming cyanobacteria as well as fish, giant clams and sea urchin samples were examined for the presence of CTXs and palytoxin (PLTX) by using the neuroblastoma cell-based assay (CBA-N2a). Cytotoxic responses observed with both standards (Pacific CTX-3C and PLTX) and targeted marine products indicate that CBA-N2a is a robust screening tool, with high sensitivity and good repeatability and reproducibility. In Rurutu and Raivavae islands, our main findings concern the presence of CTX-like compounds in giant clams and sea urchins, suggesting a second bio-accumulation route for CFP toxins in the ciguatera food chain. In Rapa, the potential CFP risk from Gambierdiscus bloom and fish was confirmed for the first time, with levels of CTXs found above the consumer advisory level of 0.01 ng Pacific CTX-1B g(-1) of flesh in three fish samples. However, despite the presence of trace level of PLTX in Ostreopsis natural assemblages of Rapa, no sign of PLTX accumulation is yet observed in tested fish samples. Because this multi-toxinic context is likely to emerge in most French Polynesian islands, CBA-N2a shows great potential for future applications in the algal- and toxin-based field monitoring programs currently on hand locally.

Source: Pawlowiez, R., H. T. Darius, et al. (2013). "Evaluation of seafood toxicity in the Australes archipelago (French Polynesia) using the neuroblastoma cell-based assay." Food Addit Contam Part A Chem Anal Control Expo Risk Assess 30(3): 567-586.

Seafood consumption and blood mercury concentrations in Jamaican children with and without autism spectrum disorders

Mercury is a toxic metal shown to have harmful effects on human health. Several studies have reported high blood mercury concentrations as a risk factor for autism spectrum disorders (ASDs), while other studies have reported no such association. The goal of this study was to investigate the as-

sociation between blood mercury concentrations in children and ASDs. Moreover, we investigated the role of seafood consumption in relation to blood mercury concentrations in Jamaican children. Based on data for 65 sex- and age-matched pairs (2-8 years), we used a General Linear Model to test whether there is an association between blood mercury concentrations and ASDs. After controlling for the child's frequency of seafood consumption, maternal age, and parental education, we did not find a significant difference ($P = 0.61$) between blood mercury concentrations and ASDs. However, in both cases and control groups, children who ate certain types of seafood (i.e., salt water fish, sardine, or mackerel fish) had significantly higher (all $P < 0.05$) geometric means blood mercury concentration which were about 3.5 times that of children living in the US or Canada. Our findings also indicate that Jamaican children with parents who both had education up to high school are at a higher risk of exposure to mercury compared to children with at least one parent who had education beyond high school. Based on our findings, we recommend additional education to Jamaican parents regarding potential hazards of elevated blood mercury concentrations, and its association with seafood consumption and type of seafood.

Source: Rahbar, M. H., M. Samms-Vaughan, et al. (2013). "Seafood consumption and blood mercury concentrations in Jamaican children with and without autism spectrum disorders." Neurotox Res 23(1): 22-38.

Dietary habits, nutrients and bone mass in Spanish premenopausal women: The contribution of fish to better bone health

The moderate consumption of fish is recommended for a healthy diet and is also a feature of the Mediterranean diet. Fish is a major food group in diets throughout the world, and studies show that fish consumption is associated with a lower risk of a number of conditions. Spain has one of the highest annual per capita consumptions of fish worldwide. As fish is a source of high quality protein; n-3 polyunsaturated fatty acids; vitamins, such as A and D; and minerals, such as selenium, calcium, iodine, magnesium, copper and zinc, nutrients that have positive effects on bone characteristics, it has been proposed that its consumption could improve bone health. In this cross-sectional study, we have investigated the relationship between dietary habits and nutrient intake of 151 Spanish premenopausal women and analyzed the association of fish consumption on bone mass measured by quantitative ultrasound of the phalanges. A higher ($P < 0.05$) bone mass and vitamin D intake ($P < 0.05$) was observed in the group with a fish intake of 5-7 servings/week. We conclude that increased fish consumption is helpful in maintaining an adequate bone mass in Spanish premenopausal women.

Source: Calderon-Garcia, J. F., J. M. Moran, et al. (2013). "Dietary habits, nutrients and bone mass in Spanish premenopausal women: The contribution of fish to better bone health." Nutrients 5(1): 10-22.

OCPs and PCBs in marine edible fish and human health risk assessment in the eastern Guangdong, China

Marine edible fish samples were collected from two important nearshore fishing sites in the eastern Guangdong Province, China: Shantou Harbor and Haimen Bay. In the mixed edible muscle tissues of marine fish samples, the concentrations of polychlorinated biphenyls, dichlorodiphenyltrichloroethanes (DDTs), hexachlorocyclohexanes (HCHs), chlordanes, and hexachlorobenzene ranged from 1.12 to 53.87, ND (not detected) to 84.01, 0.22 to 7.09, ND to 4.74, and ND to 1.49 ng/g wet weight (ww) in Haimen Bay, respectively, and from ND to 70.35, ND to 164.83, ND to 8.68, ND to 25.61, and ND to 1.76 ng/g ww in Shantou Harbor, respectively. The concentrations of PCBs, DDTs, and HCHs in all samples did not exceed maximum residue limits (China and United States Food and Drug Administration). However, a few fish samples exceed the maximum levels established by the European Union. Daily fish consumption from this region can be of serious concern, and lifetime cancer risk remains a possibility in the studied area.

Source: Shi, J., Y. Li, et al. (2013). "OCPs and PCBs in marine edible fish and human health risk assessment in the eastern Guangdong, China." Archives of Environmental Contamination and Toxicology 64(4): 632-642.

Higher fish intake is associated with a lower risk of hip fractures in Chinese men and women: A matched case-control study

Objectives: Fish is rich in nutrients that are favorable to bone health, but limited data are available regarding the relationship between fish intake and hip fractures. Our study examined the association between habitual fish intake and risk of hip fractures.

Methods: A case-control study was performed between June 2009 and June 2012 in Guangdong Province, China. Five hundred and eighty-one hip fracture incident cases, aged 55 to 80 years (mean: 71 years), were enrolled from four hospitals. 1:1 matched controls by gender and age (±3 years) were also recruited from communities and hospitals.

Face-to-face interviews were used to obtain habitual dietary intake and information on various covariates.
Results: Univariate conditional logistic regression analyses showed significantly dose-dependent inverse correlations between the risk of hip fractures and the intake of fresh-water fish, sea fish, mollusca, shellfish, and total fish in all of the subjects (p-trend: <0.001–0.016). After adjusting for covariates, the associations were slightly attenuated but remained significant for all (p-trend: <0.001–0.017) except for fresh-water fish (p = 0.553). The ORs (95%CI) of hip fractures for the highest (vs. lowest) quartile were 0.80 (0.48–1.31) for fresh-water fish, 0.31 (0.18–0.52) for sea fish, 0.55 (0.34–0.88) for mollusca and shellfish, and 0.47 0.28–0.79) for total fish, respectively. Stratified and interaction analyses showed that the association was more significant in males than in females (*p*-interaction = 0.052). Conclusion: Higher intake of seafood is independently associated with lower risk of hip fractures in elderly Chinese. Increasing consumption of sea fish may benefit the prevention of hip fractures in this population.

Source: Fan, F., W. Q. Xue, et al. (2013). "Higher fish intake is associated with a lower risk of hip fractures in Chinese men and women: A matched case-control study." PLoS One 8(2): e56849.

Issues of fish consumption for cardiovascular disease risk reduction

Increasing fish consumption is recommended for intake of omega-3 (n-3) fatty acids and to confer benefits for the risk reduction of cardiovascular disease (CVD). Most Americans are not achieving intake levels that comply with current recommendations. It is the goal of this review to provide an overview of the issues affecting this shortfall of intake. Herein we describe the relationship between fish intake and CVD risk reduction as well as the other nutritional contributions of fish to the diet. Currently recommended intake levels are described and estimates of fish consumption at a food disappearance and individual level are reported. Risk and benefit factors influencing the choice to consume fish are outlined. The multiple factors influencing fish availability from global capture and aquaculture are described as are other pertinent issues of fish nutrition, production, sustainability, and consumption patterns. This review highlights some of the work that needs to be carried out to meet the demand for fish and to positively affect intake levels to meet fish intake recommendations for CVD risk reduction.

Source: Raatz, S. K., J. T. Silverstein, et al. (2013). "Issues of fish consumption for cardiovascular disease risk reduction." Nutrients 5(4): 1081-1097.

Human dietary exposure to uranium in Catalonia, Spain

The purpose of this study was to determine the daily dietary intake of uranium (U) by the general population of Catalonia, Spain. Uranium concentrations were measured in foods widely consumed by the population living in that autonomous community. Food samples were randomly acquired in 12 representative cities of Catalonia. The dietary intake of U was estimated for various age-gender groups: children, adolescents, adults, and seniors. Fish and seafood was the food group showing the highest U concentrations (0.090 μg/g of fresh weight (fw), followed by dairy products (0.044 μg/g fw). In contrast, the lowest U levels were found in oils and fats (0.003 μg/g fw), while in tubers and milk, U was not detected in any sample. The estimated dietary intake of U for a standard male adult of 70 kg body weight living in Catalonia was 15.48 μg/day. According to the age/gender of the population, the highest dietary intake of U corresponded to children (20.32 μg/day), while senior females was the subgroup with the lowest U intake (10.04 μg/day). Based on the tolerable daily intake established for U, the current dietary intake of this metal by the general population of Catalonia should not mean health risks for any of the different age/gender groups of consumers.

Source: Bellés, M., V. Linares, et al. (2013). "Human dietary exposure to uranium in Catalonia, Spain." Biol Trace Elem Res 152(1): 1-8.

Establishment of a seafood index to assess the seafood consumption in pregnant women

BACKGROUND: Seafood (fish and shellfish) is an excellent source of several essential nutrients for pregnant and lactating women. A short food frequency questionnaire (FFQ) that can be used to quantitatively estimate seafood consumption would be a valuable tool to assess seafood consumption in this group. Currently there is no such validated FFQ in Norway. OBJECTIVE: The objective of this study was to establish and validate a seafood index from a seafood FFQ against blood biomarkers (the omega-3 index, the omega-3 HUFA score, and serum 25OH vitamin D). DESIGN: We assessed maternal seafood consumption during the 28th gestation week in healthy Norwegian women (n=54) with a seafood FFQ. A seafood index was developed to convert ordinal frequency data from the FFQ into numerical scale data. The following blood biomarkers were used as a validation method: omega

-3 index, omega-3 HUFA score, and the serum 25OH vitamin D. RESULTS: The reported frequency of seafood as dinner and as spread was strongly correlated with the estimated frequencies of seafood as dinner and as spread. This indicated that the seafood index is a valuable tool to aggregate reported frequencies from the seafood FFQ. The seafood index composed of the frequency of seafood consumption and intake of omega-3 supplements, termed the total seafood index, correlated positively with the omega-3 index, omega-3 HUFA score, and 25OH vitamin D. CONCLUSION: We established and validated a seafood index from a seafood FFQ. The developed seafood index can be used when studying health effects of seafood consumption in large populations. This seafood FFQ captures seafood consumption and omega-3 supplement intake considerably well in a group of pregnant women.

Source: Markhus, M. W., I. E. Graff, et al. (2013). "Establishment of a seafood index to assess the seafood consumption in pregnant women." Food Nutr Res 57: 1-11.

Maternal fish consumption during pregnancy and risks of wheezing and eczema in childhood: The Generation R Study

Background/Objectives: Maternal fish consumption during pregnancy might influence the fetal immune system through anti-inflammatory effects of omega-3 fatty acids, and might affect the risks of childhood asthma and atopy. In Generation R, a prospective cohort study in the Netherlands, we examined the associations of first trimester fish consumption with childhood wheezing and eczema in the first 4 years of life. Methods: In total, 2976 mothers completed a 293-item semiquantitative food frequency questionnaire covering dietary intake in the first trimester. The occurrence of wheezing and eczema was yearly assessed by questionnaires. Results: Median weekly fish consumption was 83 (95% range 0-316) grams per week. We observed no consistent associations of maternal total-, lean- or fatty-fish consumption during pregnancy with the risks of childhood wheezing. Maternal shellfish consumption of 1-13g per week was associated with overall increased risks of childhood wheezing and eczema (OR 1.20 (1.04, 1.40) and OR 1.18 (1.01, 1.37), respectively). Maternal fatty fish consumption of 35-69g per week was associated with increased overall risks of childhood eczema (OR 1.17 (1.00, 1.38)), but maternal total- or lean-fish consumption was not. Conclusions: During pregnancy, shellfish consumption was associated with increased risks of wheezing and eczema, while fatty fish consumption was associated with a higher risk of eczema only. Maternal total fish or lean fish consumption were not associated with wheezing or eczema. Further studies are needed to replicate these findings and to explore underlying mechanisms.

Source: Leermakers, E. T., A. M. Sonnenschein-van der Voort, et al. (2013). "Maternal fish consumption during pregnancy and risks of wheezing and eczema in childhood: The Generation R Study." European Journal of Clinical Nutrition 67(4): 353-359.

Mercury levels in feed and muscle of farmed tilapia

Source: Botaro, D., J. P. Torres, et al. (2012). "Mercury levels in feed and muscle of farmed tilapia." American Journal of Industrial Medicine 55(12): 1159-1165.

Heavy metals distribution in muscle, liver, kidney and gill of European catfish (*Silurus glanis*) from Italian Rivers

Source: Squadrone, S., M. Prearo, et al. (2013). "Heavy metals distribution in muscle, liver, kidney and gill of European catfish (*Silurus glanis*) from Italian Rivers." Chemosphere 90(2): 358-365.

Toxic metals (Hg, Pb, and Cd) in commercially important demersal fish from Mediterranean Sea: Contamination levels and dietary exposure assessment

Source: Storelli, M. M. and G. Barone (2013). "Toxic metals (Hg, Pb, and Cd) in commercially important demersal fish from Mediterranean Sea: Contamination levels and dietary exposure assessment." J Food Sci 78(2): T362-366.

Regional variation in mercury and stable isotopes of red snapper (*Lutjanus campechanus*) in the northern Gulf of Mexico, USA

Source: Zapp Sluis, M., K. M. Boswell, et al. (2013). "Regional variation in mercury and stable isotopes of red snapper (*Lutjanus campechanus*) in the northern Gulf of Mexico, USA." Environ Toxicol Chem 32(2): 434-441.

Mercury, arsenic and selenium concentrations in water and fish from sub-Saharan semi-arid freshwater reservoirs (Burkina Faso)

Source: Ouedraogo, O. and M. Amyot (2013). "Mercury, arsenic and selenium concentrations in water and fish from sub-Saharan semi-arid freshwater reservoirs (Burkina Faso)." Sci Total Environ 444: 243-254.

Biomagnification of mercury and its antagonistic interaction with selenium in yellowfin tuna *Thunnus albacares* in the trophic web of Baja California Sur, Mexico

Source: Ordiano-Flores, A., R. Rosiles-Martinez, et al. (2012). "Biomagnification of mercury and its antagonistic interaction with selenium in yellowfin tuna *Thunnus albacares* in the trophic web of Baja California Sur, Mexico." Ecotoxicol Environ Saf 86: 182-187.

Organochlorine and organobromine compounds in a benthic fish (*Solea solea*) from Bizerte Lagoon (northern Tunisia): Implications for human exposure

Source: Ben Ameur, W., Y. El Megdiche, et al. (2013). "Organochlorine and organobromine compounds in a benthic fish (*Solea solea*) from Bizerte Lagoon (northern Tunisia): implications for human exposure." Ecotoxicol Environ Saf 88: 55-64.

Exposure to organochlorines and mercury through fish and marine mammal consumption: Associations with growth and duration of gestation among Inuit newborns

Source: Dallaire, R., E. Dewailly, et al. (2013). "Exposure to organochlorines and mercury through fish and marine mammal consumption: Associations with growth and duration of gestation among Inuit newborns." Environ Int 54C: 85-91.

Risks and benefits' consumption of birdbeak dogfish *Deania calcea*

Source: Paiva, R. B., A. Neves, et al. (2012). "Risks and benefits' consumption of birdbeak dogfish *Deania calcea*." British Food Journal 114 (6): 826-839.

The effect of maternal omega-3 (n-3) LCPUFA supplementation during pregnancy on early childhood cognitive and visual development: A systematic review and meta-analysis of randomized controlled trials

Source: Gould, J. F., L. G. Smithers, et al. (2013). "The effect of maternal omega-3 (n-3) LCPUFA supplementation during pregnancy on early childhood cognitive and visual development: A systematic review and meta-analysis of randomized controlled trials." Am J Clin Nutr 97(3): 531-544.

Differential accumulation of trace elements in ventral and dorsal muscle tissues in tilapia and milkfish with different feeding habits from the same cultured fishery pond

Source: Ling, M. P., C. C. Wu, et al. (2013). "Differential accumulation of trace elements in ventral and dorsal muscle tissues in tilapia and milkfish with different feeding habits from the same cultured fishery pond." Ecotoxicol Environ Saf 89: 222-230.

Concentrations of lead, cadmium, and mercury in halfbeaks (*Hyporhampus affinis*) from the east Java coast, Indonesia and human health hazard

Source: Asmysari, A. S., B. Irawan, et al. (2013). "Concentrations of lead, cadmium, and mercury in halfbeaks (*Hyporhampus affinis*) from the east Java coast, Indonesia and human health hazard." Hum. Ecol. Risk Assess. Human and Ecological Risk Assessment 19(1): 151-157.

Trace elements in two marine fish species during estuarine residency: Non-essential versus essential

Source: Mieiro, C. L., J. P. Coelho, et al. (2012). "Trace elements in two marine fish species during estuarine residency: Non-essential versus essential." Mar Pollut Bull 64(12): 2844-2848.

Long term neurocognitive impact of low dose prenatal methylmercury exposure in Hong Kong

Source: Lam, H. S., K. M. Kwok, et al. (2013). "Long term neurocognitive impact of low dose prenatal methylmercury exposure in Hong Kong." Environ Int 54C: 59-64.

Mercury in the seafood and human exposure in coastal area of Guangdong province, South China

Source: Li, P., X. Feng, et al. (2013). "Mercury in the seafood and human exposure in coastal area of Guangdong province, South China." Environ Toxicol Chem 32(3): 541-547.

Global transcriptome analysis of Atlantic cod (*Gadus morhua*) liver after in vivo methylmercury exposure suggests effects on energy metabolism pathways

Source: Yadetie, F., O. A. Karlsen, et al. (2013). "Global transcriptome analysis of Atlantic cod (*Gadus morhua*) liver after in vivo methylmercury exposure suggests effects on energy metabolism pathways." Aquat Toxicol 126: 314-325.

Mercury, arsenic and selenium exposure levels in relation to fish consumption in the Mediterranean area

Source: Miklavcic, A., A. Casetta, et al. (2013). "Mercury, arsenic and selenium exposure levels in relation to fish consumption in the Mediterranean area." Environ Res 120: 7-17.

Relationship of estimated dietary intake of n-3 polyunsaturated fatty acids from fish with peripheral nerve function after adjusting for mercury exposure

Source: Wang, Y., J. M. Goodrich, et al. (2013). "Relationship of estimated dietary intake of n-3 polyunsaturated fatty acids from fish with peripheral nerve function after adjusting for mercury exposure." Science of the Total Environment 454-455: 73-78.

Estimated intake levels for Finnish children of methylmercury from fish

Source: Karjalainen, A. K., A. Hallikainen, et al. (2013). "Estimated intake levels for Finnish children of methylmercury from fish." Food and Chemical Toxicology 54: 70-77.

Effects of skin removal on contaminant levels in salmon and trout filets

Source: Zhang, X., N. Gandhi, et al. (2013). "Effects of skin removal on contaminant levels in salmon and trout filets." Science of the Total Environment 443: 218-225.

Mercury in fishes from Augusta Bay (southern Italy): Risk assessment and health implication

Source: Bonsignore, M., D. Salvagio Manta, et al. (2013). "Mercury in fishes from Augusta Bay (southern Italy): Risk assessment and health implication." Food and Chemical Toxicology 56(1): 184-194.

Fish, contaminants and human health: Quantifying and weighing benefits and risks

Source: Hoekstra, J., A. Hart, et al. (2013). "Fish, contaminants and human health: Quantifying and weighing benefits and risks." Food and Chemical Toxicology 54: 18-29.

Neuropsychological assessment at school-age and prenatal low-level exposure to mercury through fish consumption in an Italian birth cohort living near a contaminated site

Source: Deroma, L., M. Parpinel, et al. (2013). "Neuropsychological assessment at school-age and prenatal low-level exposure to mercury through fish consumption in an Italian birth cohort living near a contaminated site." International Journal of Hygiene and Environmental Health. Epub ahead of print.

Dietary exposure and risk assessment of mercury via total diet study in Cambodia

Source: Cheng, Z., H.-S. Wang, et al. (2013). "Dietary exposure and risk assessment of mercury via total diet study in Cambodia." Chemosphere. Epub ahead of print.

Concentrations of organochlorine pesticides (OCPs) in human blood plasma from Hong Kong: Markers of exposure and sources from fish

Source: Wang, H.-S., Z.-J. Chen, et al. (2013). "Concentrations of organochlorine pesticides (OCPs) in human blood plasma from Hong Kong: Markers of exposure and sources from fish." Environment International 54: 18-25.

Role of dietary n-3 polyunsaturated fatty acids in type 2 diabetes: A review of epidemiological and clinical studies

Source: Jafari, T., A. A. Fallah, et al. (2013). "Role of dietary n-3 polyunsaturated fatty acids in type 2 diabetes: A review of epidemiological and clinical studies." Maturitas 74(4): 303-308.

Effects of docosahexaenoic acid and methylmercury on childs brain development due to consumption of fish by Finnish mother during pregnancy: A probabilistic modeling approach

Source: Leino, O., A. K. Karjalainen, et al. (2013). "Effects of docosahexaenoic acid and methylmercury on childs brain development due to consumption of fish by Finnish mother during pregnancy: A probabilistic modeling approach." Food and Chemical Toxicology 54: 50-58.

From fish chemical characterization to the benefit-risk assessment - Part A

Source: Afonso, C., H. M. Lourenco, et al. (2013). "From fish chemical characterization to the benefit-risk assessment - Part A." Food Chemistry 137(1-4): 99-107.

Fish consumption during child bearing age: A quantitative risk-benefit analysis on neurodevelopment

Source: Zeilmaker, M. J., J. Hoekstra, et al. (2013). "Fish consumption during child bearing age: A quantitative risk-benefit analysis on neurodevelopment." Food and Chemical Toxicology 54: 30-34.

Heavy metal concentrations in some commercially important fishes and their contribution to heavy metals exposure in Palestinian people of Gaza Strip (Palestine)

Source: Elnabris, K. J., S. K. Muzyed, et al. (2013). "Heavy metal concentrations in some commercially important fishes and their contribution to heavy metals exposure in Palestinian people of Gaza Strip (Palestine)." Journal of the Association of Arab Universities for Basic and Applied Sciences 13(1): 44-51.

Mercury and selenium levels, and selenium:mercury molar ratios of brain, muscle and other tissues in bluefish (*Pomatomus saltatrix*) from New Jersey, USA

Source: Burger, J., C. Jeitner, et al. (2013). "Mercury and selenium levels, and selenium:mercury molar ratios of brain, muscle and other tissues in bluefish (*Pomatomus saltatrix*) from New Jersey, USA." Science of the Total Environment 443: 278-286.

Fish consumption, omega-3 fatty acids, and environmental contaminants in relation to low-grade inflammation and early atherosclerosis

Source: Turunen, A. W., A. Jula, et al. (2013). "Fish consumption, omega-3 fatty acids, and environmental contaminants in relation to low-grade inflammation and early atherosclerosis." Environ Res 120: 43-54.

Additional Information

For more information about specific advisories within a state, contact the appropriate state agency listed on EPA's NLFA website at http://fishadvisoryonline.epa.gov/Contacts.aspx

For more information about the NLFA or EPA's Fish Advisory Program, contact:

The NLFA Newsletter at Fish_Advisory@epa.gov or
Jeff Bigler, National Program Manager, Fish Advisory Program

Telephone: 202.566.0389
E-mail: bigler.jeff@epa.gov

U.S. Environmental Protection Agency
Office of Science and Technology (4305T)
1200 Pennsylvania Avenue, NW, Washington, DC 20460