

# National Listing of Fish Advisories

## NEWSLETTER

### Recent Advisory News

#### New Jersey DEP issues recreational fishing and boating advisory

Due to damage caused by Hurricane Sandy, the New Jersey Department of Environmental Protection issued a recreational and fish consumption advisory for several state waterways. Damage to wastewater treatment plants has caused temporary runoff of effluents, prompting advisories in the Hudson River, Passaic River, Hackensack River, Newark Bay, Kill Van Kull and Arthur Kill, Raritan Bay, Raritan River, and Sandy Hook Bay. Residents are advised not to eat any fish, crustaceans or shellfish from these waters due to contamination from pathogens. For updates on this advisory, all boaters, anglers and crabbers are encouraged to visit the Hurricane Sandy Webpage at <http://www.nj.gov/dep/special/hurricane-sandy/>  
Link to original article: [http://www.nj.gov/dep/newsrel/2012/12\\_0135.htm](http://www.nj.gov/dep/newsrel/2012/12_0135.htm)

Source: State of New Jersey Department of Environmental Protection. 11/2/2012.

#### Thousands eat Anacostia River fish despite health risks, warnings

A recent study found that in spite of established advisories in Maryland and Washington D.C., thousands of people are eating contaminated fish from the Anacostia River. Public misconceptions about seafood safety and gaps in risk communication are thought to contribute to the problem. The report noted that many anglers wrongly assume that contamination can be assessed visually and that it can be washed off or “cooked out” of the fish. In addition, posted warnings about health hazards may not be understood by anglers who are not native English-speakers. The study, managed by Anacostia Riverkeepers and authored by Opinionworks, highlights the need for improved risk communication.

Link to original article: <http://www.wtop.com/41/3123034/Thousands-eat-Anacostia-fish-despite-health-risks-warnings>

Source: Kate Ryan, WTOP, 11/16/2012



#### Arizona and Utah announce fish consumption advisory (striped bass) in southern Lake Powell

The Arizona Department of Environmental Quality has issued a fish consumption advisory for striped bass in Lake Powell due to mercury contamination. The advisory is limited to striped bass caught in the southern portion of Lake Powell, from Dangling Rope Marina in Utah to Glen Canyon Dam in Arizona. The current advisory recommends that the public limit consumption as follows: pregnant women and children under six should limit their consumption of striped bass to 4 ounces per month, women of child-bearing years and children between 6 and 16 should limit their intake to two 8-ounce meals per month, and all others are recommended to limit their intake to eight 8-ounce meals per month. The advisory does not limit consumption of any other fish or any recreational utilization of Lake Powell.

Link to original article: [http://www.azgfd.gov/h\\_f/fish\\_consumption.shtml](http://www.azgfd.gov/h_f/fish_consumption.shtml)

Source: Arizona Game and Fish Department. 10/25/2012



## Nebraska DHHS: Environmental risk assessment: Fish tissue advisories

A June 2012 update from the Nebraska Department of Health and Human Services reported active fish advisories for 12 streams and 66 lakes across the state. In addition, advisories were removed from 11 waterbodies in 2012. Advisory decisions were made based on data collected in 2010 for chemicals of concern including methylmercury, polychlorinated biphenyl (PCBs), dieldrin, and selenium. The advisories do not ban the consumption of fish from the waterways, but alert consumers on best methods to safely prepare and eat what they catch, and provide suggested guidelines for limiting consumption.

Link to original article: [http://dhhs.ne.gov/publichealth/Pages/puh\\_enh\\_environmentalriskassessment\\_fishtissue.aspx](http://dhhs.ne.gov/publichealth/Pages/puh_enh_environmentalriskassessment_fishtissue.aspx)

Source: Nebraska Department of Health and Human Services. 8/2/2012

## Alabama Department of Public Health issues 2012 fish consumption advisories

The Alabama Department of Public Health issued new and revised fish consumption advisories for 24 bodies of water in 2012. Updates include a recommended “no consumption” advisory for all species for perfluoralkyl sulfonate (PFOS) in the Baker’s Creek embayment of Wheeler Reservoir. PFOS is an emerging contaminant of concern, its human toxicity is not well understood. It is not currently classified as a carcinogen, but PFOS is known to be readily absorbed by the digestive system, is poorly metabolized and can stay in the body for a long time. Additional information about PFOS can be found at [www.epa.gov/fedfac/pdf/emerging\\_contaminants\\_pfos\\_pfoa.pdf](http://www.epa.gov/fedfac/pdf/emerging_contaminants_pfos_pfoa.pdf). Future testing will determine if the advisory needs to be extended beyond the current location. Specific information on all 2012 advisory updates can be found at: [http://www.adph.org/tox/assets/2012\\_Advisory\\_Table.pdf](http://www.adph.org/tox/assets/2012_Advisory_Table.pdf).

Link to original article: <http://media.alabama.gov/pr/pr.aspx?id=6986&t=1>

Source: Media.Alabama.gov. 8/31/2012.

## Tuna surprise: Mercury in school lunches

A recent study conducted by the Mercury Policy Project (MPP) revealed that mercury levels in albacore tuna (0.560 µg/g) were much higher than the FDA’s reported average of 0.350 µg/g and that light tuna mercury levels (0.118 µg/g) were slightly lower than the FDA’s reported average of 0.128 µg/g. As a result, MPP recommended that children not eat albacore tuna and that consumption of light tuna be limited. As tuna is a common ingredient in public school lunches, MPP further recommended that schools switch to seafood with lower mercury

concentrations and that subsidies for tuna in lunch programs be phased out.

Link to original article: <http://cspinet.org/new/pdf/tunasurprise.pdf>

Source: Groth, E. (2012). Tuna Surprise: Mercury in School Lunches. Montpelier Vermont, Mercury Policy Project.

## Recent Publications

Please note: The following abstracts are reprinted verbatim unless otherwise noted.

### Fish consumption and advisory awareness among the Philadelphia Asian community: a pilot study

Difficulties in the risk communication of fish consumption arise from the concept that this consumption can have both harmful and beneficial effects. This is particularly an issue among populations for which seafood is a major dietary and cultural component. Fish advisories are an important tool in preventing overconsumption of fish that have elevated concentrations of toxic contaminants. The exploratory pilot study described in this article examined fish consumption patterns and knowledge of the potential health risks associated with overconsumption of mercury-contaminated fish within a limited (N = 34) sample of the Philadelphia Asian-American population. Study data were used to evaluate the efficacy of state-issued advisories designed to encourage safe levels of fish consumption within the study population. Results indicate that while advisory awareness levels among study participants were greater than previously observed in Asian-American populations, consumption levels remained high. The limited findings of the authors' study, in combination with existing evidence, suggest the need for the development of more effective methods of disseminating advisory information.

Source: Perez, H., E. C. Sullivan, et al. (2012). "Fish consumption and advisory awareness among the Philadelphia Asian community: a pilot study." *Journal of Environmental Health* 74(8): 24-28.

### Fish advisories in the USA and Japan: risk communication and public awareness of a common idea with different backgrounds

Some countries have established fish advisories to manage fish consumption to minimize methylmercury exposure. Our objective was to compare the fish advisories and the resultant consumer behavior in the United States of America (USA) and Japan. Both countries have national consumption guidelines, but American states enjoy greater independence in issuing guidelines for local water bodies and

## Conferences

### **Society of Toxicology 52nd Annual Meeting and ToxExpo**

March 10-14, 2013, San Antonio, Texas

<http://www.toxicology.org/AI/MEET/AM2013/>

### **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](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](http://www.setac.org/events/event_details.asp?id=244644)

vary in the information that is provided for the public. The proportion of the American public that has heard of state fish advisories is thought to be close to 30%. There is a concern that this low level of awareness extends to pregnant women. In Japan, the current problem is the lack of comprehensive studies on the public awareness of fish advisories. Nonetheless, there is evidence that fish consumption has decreased in both countries. In USA, there is a possibility that the strong emphasis on mercury toxicity drives the general population towards a trend of lower fish consumption. In Japan, the fish advisory encourages seafood consumption for nutritional benefits. Consequently, the decrease may be due to the shift towards a "Western diet". Also, the Japanese fish advisory seems to be less active in advocating the issue of fish consumption and mercury exposure, which may be partly responsible for the possible lesser attention of the consumers. Cultural factors may explain for the baseline difference in consumption and account partly for the change in Japanese consumer behavior. However, the dissimilarities in fish advisories may also be responsible for the variations in consumer behavior.

Source: Ser, P. H. and C. Watanabe (2012). "Fish advisories in the USA and Japan: risk communication and public awareness of a common idea with different backgrounds." *Asia Pacific Journal of Clinical Nutrition* 21(4): 487-494.

### **The influence of external subsidies on diet, growth and Hg concentrations of freshwater sport fish: implications for management and fish consumption advisories**

Mercury (Hg) contamination in sport fish is a global problem. In freshwater systems, food web structure, sport fish sex, size, diet and growth rates influence Hg bioaccumulation. Fish stocking is a common management practice worldwide that can introduce external energy and contaminants into freshwater systems. Thus, stocking can alter many of the factors that influence Hg concentrations in sport fish. Here we evaluated the influence of external subsidies, in the form of hatchery-raised rainbow trout *Oncorhynchus mykiss* on walleye Sander vitreus diet, growth and Hg concentrations in two freshwater systems. Stocking differentially influenced male and female walleye diets and growth, producing a counterintuitive size-contamination relationship. Modeling indicated that walleye growth rate and diet were important explanatory variables when predicting Hg concentrations. Thus, hatchery contributions to freshwater systems in the form of energy and contaminants can influence diet, growth and Hg concentrations in

sport fish. Given the extensive scale of fish stocking, and the known health risks associated with Hg contamination, this represents a significant issue for managers monitoring and manipulating freshwater food web structures, and policy makers attempting to develop fish consumption advisories to protect human health in stocked systems.

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Source: Lepak, J. M., M. B. Hooten, et al. (2012). "The influence of external subsidies on diet, growth and Hg concentrations of freshwater sport fish: implications for management and fish consumption advisories." *Ecotoxicology* 21(7): 1878-1888.

### Do national advisories serve local consumers: an assessment of mercury in economically important North Carolina fish

Consumption of marine fish provides both benefits (lean protein, omega-3 fatty acids and essential nutrients) and risks (main source of mercury (Hg) exposure for humans). Mercury is a potent neurotoxin and the source of more fish advisories nationwide than any other toxicant. Despite the widespread nature of Hg, it is unknown whether local Hg contamination reflects national and regional levels often used as bases to inform consumers of potential fish consumption risk. Thus, the objectives of our study were to examine Hg levels of six commonly consumed marine species harvested locally off the North Carolina coast and to compare our results to published regional (Monterey Bay Aquarium's Seafood Watch List) and national (Environmental Protection Agency, EPA, and Food and Drug Administration, FDA) Hg averages, action levels, and guidelines. We found significant differences in Hg concentrations among collected species, and we identified correlations between Hg concentration and fish length and trophic levels. Collected mahi mahi and triggerfish were below the EPA fish tissue action level (0.3ppm). Wahoo and grouper exceeded the EPA action level but were below the FDA action level (1.0ppm). King mackerel had the highest Hg concentration among targeted species, exceeding both EPA and FDA action levels. Further, our local results were not always consistent with calculated averages from EPA and FDA databases for the same species, and although many of our findings were consistent with Monterey Bay Aquarium's Seafood Watch List (southeast region), recommendations based on Hg levels would conflict with recommendations they provide based on sustainability. We find regional and national averages are not always reflective of local Hg contamination and suggest local data may be needed to accurately assess consumer risk.

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Source: Petre, S. J., D. K. Sackett, et al. (2012). "Do national advisories serve local consumers: an assessment of mercury in economically important North Carolina fish." *J Environ Monit* 14(5): 1410-1416.

### Social communication network analysis of the role of participatory research in the adoption of new fish consumption behaviors

The formulation and communication of fish advisories are highly complex because of the potential conflict between the nutritional and toxicological issues associated with fish consumption. Government and organization-sponsored fish advisories have had limited success in changing behaviors. Participatory approaches may enhance the understanding of complex issues and the adoption of new behaviors. Here we used social network analysis to investigate the adoption of dietary changes within the context of a community participatory research project. In the Brazilian Amazon, many communities are highly exposed to methylmercury from fish consumption. A participatory intervention based on dietary changes aimed at reducing methylmercury exposure while maintaining fish consumption was initiated in 1995. In 2001, we collected data on individual participation in the research, on the discussion network regarding mercury issues and on changes in fish consumption from 96 of the 110 village households. More than half of men and women had adopted new fish consumption behavior to reduce mercury exposure. Adoption was associated with participation in the research project for both women and men, and with a higher number of discussion partners about mercury issues for women. Adoption was likewise associated with the presence of a female communication partner in the personal networks of both men and women. At the household level, men and women who considered their spouse as a discussion partner were more likely to adopt than those who did not. Opinion leadership was associated with change in fish consumption only for women. We discuss the contribution of community participation and communication networks to overcome the difficulties in generating complex messages that take into account both health benefits and risks of fish consumption. We also discuss the relevance of building preventive health programs based on participatory research approaches and the roles and relations specific to men and women.

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Source: Mertens, F., J. Saint-Charles, et al. (2012). "Social communication network analysis of the role of participatory research in the adoption of new fish consumption behaviors." *Soc Sci Med* 75(4): 643-650.

### Interspecific and intraspecific variation in selenium:mercury molar ratios in saltwater fish from the Aleutians: potential protection on mercury toxicity by selenium

A number of factors affect the consumption risk from mercury in fish, including mercury levels, seasonal patterns

of mercury concentrations, human consumption patterns, and sensitive populations (e.g. pregnant women, fetuses, young children, and yet unknown genetic factors). Recently the protective effects of selenium on methylmercury toxicity have been publicized, particularly for saltwater fish. We examine levels of mercury and selenium in several species of fish and seabirds from the Aleutians (Alaska), determine selenium:mercury molar ratios, and examine species-specific and individual variation in the ratios as a means of exploring the use of the ratio in risk assessment and risk management. Variation among species was similar for mercury and selenium. There was significant interspecific and intraspecific variation in selenium:mercury molar ratios for fish, and for birds. The mean selenium:mercury molar ratios for all fish and bird species were above 1, meaning there was an excess of selenium relative to mercury. It has been suggested that an excess of selenium confers some protective advantage for salt water fish, although the degree of excess necessary is unclear. The selenium:mercury molar ratio was significantly correlated negatively with total length for most fish species, but not for dolly varden. Some individuals of Pacific cod, yellow irish lord, rock greenling, Pacific halibut, dolly varden, and to a lesser extent, flathead sole, had selenium:mercury ratios below 1. No bird muscle had an excess of mercury (ratio below 1), and only glaucous-winged gull and pigeon guillemot had ratios between 1 and 5. There was a great deal of variation in selenium:mercury molar ratios within fish species, and within bird species, making it difficult and impractical to use these ratios in risk assessment or management, for fish advisories, or for consumers, particularly given the difficulty of interpreting the ratios.

Source: Burger, J., M. Gochfeld, et al. (2012). "Interspecific and intraspecific variation in selenium:mercury molar ratios in saltwater fish from the Aleutians: potential protection on mercury toxicity by selenium." *Sci Total Environ* 431: 46-56.

### Stakeholder participation in the management of North East Atlantic pelagic fish stocks: The future role of the Pelagic Regional Advisory Council in a reformed CFP

When the Regional Advisory Councils (RACs) were created during the last reform of the Common Fisheries Policy (CFP) in 2002, it was recognised that in addition to the five geographically orientated stakeholder lead advisory bodies, a separate RAC dedicated exclusively to pelagic fisheries was needed because of it being so distinctly different from other fisheries. Pelagic fishing is different mostly due to the

fact that the targeted fish species behave in a unique manner by grouping in schools in mid-water unlike other commercially targeted fishes, which typically reside on or near the ocean floor. For this reason, as well as the fact that they are usually widely distributed, researching and managing this dynamic group of fishes across the borders of many countries requires a unique approach. Fortunately, despite these complexities, policy makers have succeeded to establish a reasonably well functioning management framework, which has lead to the situation that most pelagic fish stocks are harvested biologically sustainable. While a majority of Europe's fish stocks still need rebuilding, and the main aim accordingly is to reduce fishing mortality, the current focus for pelagic fish stocks is to improve the performance of already implemented Long Term Management plans in terms of their biological as well as social and economical objectives. This paper reflects upon experiences of the Pelagic Regional Advisory Council (PRAC) in its role as advisor to the EU institutions. Subsequently, in the context of ideas presented in the European Commission's Green paper, the authors discuss the future of the PRAC and conclude that its main development potential lies not with the current EU's CFP reform, but rather should be sought in a wider international context.

Source: Coers, A., J. Raakjær, et al. (2012). "Stakeholder participation in the management of North East Atlantic pelagic fish stocks: The future role of the Pelagic Regional Advisory Council in a reformed CFP." *Marine Policy* 36(3): 689-695.



## Which fish should I eat? Perspectives influencing fish consumption choices

**BACKGROUND:** Diverse perspectives have influenced fish consumption choices. **OBJECTIVES:** We summarized the issue of fish consumption choice from toxicological, nutritional, ecological, and economic points of view; identified areas of overlap and disagreement among these viewpoints; and reviewed effects of previous fish consumption advisories. **METHODS:** We reviewed published scientific literature, public health guidelines, and advisories related to fish consumption, focusing on advisories targeted at U.S. populations. However, our conclusions apply to groups having similar fish consumption patterns. **DISCUSSION:** There are many possible combinations of matters related to fish consumption, but few, if any, fish consumption patterns optimize all domains. Fish provides a rich source of protein and other nutrients, but because of contamination by methylmercury and other toxicants, higher fish intake often leads to greater toxicant exposure. Furthermore, stocks of wild fish are not adequate to meet the nutrient demands of the growing world population, and fish consumption choices also have a broad economic impact on the fishing industry. Most guidance does not account for ecological and economic impacts of different fish consumption choices. **CONCLUSION:** Despite the relative lack of information integrating the health, ecological, and economic impacts of different fish choices, clear and simple guidance is necessary to effect desired changes. Thus, more comprehensive advice can be developed to describe the multiple impacts of fish consumption. In addition, policy and fishery management interventions will be necessary to ensure long-term availability of fish as an important source of human nutrition.

Source: Oken, E., A. L. Choi, et al. (2012). "Which fish should I eat? Perspectives influencing fish consumption choices." *Environ Health Perspect* 120(6): 790-798.

## Relative influence of prey mercury concentration, prey energy density and predator sex on sport fish mercury concentrations

Mercury (Hg) bioaccumulation in aquatic food webs has created a human health concern for anglers who consume fish. Variability in sport fish Hg concentration adds to the uncertainty of the amount of fish an angler can safely consume, so predicting where variability arises is useful. We evaluated the relative influence of diet (prey Hg concentration and energy density) and sex on sport fish Hg concentrations using a bioenergetics approach. Our results indicated that sport fish diets (prey Hg concentration followed by

energy density) were the most important factors for determining sport fish Hg concentration followed by sex. Although physiological and behavioral differences based on sex may lead to differences in gross growth efficiency, resulting in different Hg concentrations in male and female sport fish, evaluating the relative importance of these differences will require sex-specific parameterization of bioenergetics models. Our results support previous findings that knowledge of sport fish diets (prey Hg concentration followed by energy density) and sex could aid in the prediction of sport fish Hg concentrations. Thus, basic knowledge of system-specific food web structure could provide valuable information for developing sport fish consumption advisories to better protect anglers and their families from Hg contamination.

Source: Stacy, W. L. and J. M. Lepak (2012). "Relative influence of prey mercury concentration, prey energy density and predator sex on sport fish mercury concentrations." *Sci Total Environ* 437: 104-109.

## Selenium and mercury molar ratios in saltwater fish from New Jersey: Individual and species variability complicate use in human health fish consumption advisories

Balancing risk versus benefits to humans and other organisms from consuming fish is a national concern in the USA, as well as in many other parts of the world. Protecting public health is both a federal and state responsibility, and states respond by issuing fish consumption advisories, particularly for mercury. Recently it has been emphasized that the protective role of selenium against mercury toxicity depends on their molar ratios, which should be evaluated as an indication of selenium's protective capacity, and incorporated in risk assessments for fish consumption. However, there is no single "protective" ratio agreed upon. In this paper we examine the selenium:mercury (Se:Hg) molar ratios in a wide range of saltwater fish caught and eaten by recreational fishers along the New Jersey coast. We were particularly interested in interspecific and intraspecific variability, and whether the molar ratios were consistent within a species, allowing for its use in managing risk. The selenium-mercury molar ratio showed significant variation among and within fish species. The molar ratio decreased with the size of the fish species, decreased with the mercury levels, and within a fish species, the selenium:mercury ratio decreased with fish size. As an essential element, selenium undergoes some homeostatic regulation, but it is also highly toxic. Within species, mercury level tends to increase with size, accounting for the negative relationship between size and ratio. This variability may make it difficult to use the selenium:mercury molar ratio in risk assessment, risk

management, and risk communication at this time, and more information is needed on how mercury and selenium actually interact and on the relationship between the molar ratios and health outcomes.

Source: Burger, J. and M. Gochfeld (2012). "Selenium and mercury molar ratios in saltwater fish from New Jersey: individual and species variability complicate use in human health fish consumption advisories." *Environ Res* **114**: 12-23.

## Awareness of methylmercury in fish and fish consumption among pregnant and postpartum women and women of childbearing age in the United States

In 2004, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) reissued joint advice recommending that pregnant women, nursing mothers, young children, and women who may become pregnant not consume fish high in mercury such as shark, swordfish, king mackerel, and tilefish, and not consume more than 12 ounces (340.2 g) of other lower mercury fish per week. These groups were encouraged to eat up to 12 ounces (340.2 g) of low mercury fish per week to get the health benefits of fish. Using a survey of 1286 pregnant women, 522 postpartum women, and a control group of 1349 non-pregnant/non-postpartum women of childbearing age, this study evaluated awareness of mercury as a problem in food and examined fish consumption levels across groups using regression analysis. We also compared awareness of mercury as a problem in food to awareness of *Listeria*, dioxins and PCBs. We found that the majority of all 3 groups of women were aware of mercury and that nearly all women in all 3 groups limited consumption consistent with the advice; they ate less than 340.2 g (12 oz) of fish per week and no high mercury fish. Compared with the control group, pregnant and postpartum women were more likely to be aware of mercury as a problem in food, and pregnant women ate less total fish and were less likely to eat fish, to eat more than 340.2 g (12 oz) of fish, and to eat high mercury fish. However, all groups ate much less than the recommended 340.2 g (12 oz) of low mercury fish per week for optimum health benefits. Among women who ate fish, the median intake of total fish was 51.6 g/wk (1.8 oz/wk), 71.4 g/wk (2.5 oz/wk), and 85.3 g/wk (3.0 oz/wk) for the pregnant, postpartum, and control groups, respectively. Thus, it appears that the targeted groups of women were more aware of mercury and were eating fish within the FDA/EPA guidelines, but these women may be missing the health benefits to themselves and their children of eating a sufficient amount of fish.

Source: Lando, A. M., S. B. Fein, et al. (2012). "Awareness of methylmercury in fish and fish consumption among pregnant and postpartum women and women of childbearing age in the United States." *Environ Res* **116**: 85-92.

## Risks and benefits of consumption of Great Lakes fish

**BACKGROUND:** Beneficial effects of fish consumption on early cognitive development and cardiovascular health have been attributed to the omega-3 fatty acids in fish and fish oils, but toxic chemicals in fish may adversely affect these health outcomes. Risk-benefit assessments of fish consumption have frequently focused on methylmercury and omega-3 fatty acids, not persistent pollutants such as polychlorinated biphenyls, and none have evaluated Great Lakes fish consumption.

**OBJECTIVES:** The risks and benefits of fish consumption have been established primarily for marine fish. Here, we examine whether sufficient data are available to evaluate the risks and benefits of eating freshwater fish from the Great Lakes.

**METHODS:** We used a scoping review to integrate information from multiple state, provincial, and federal agency sources regarding the contaminants and omega-3 fatty acids in Great Lakes fish and fish consumers, consumption rates and fish consumption advisories, and health effects of contaminants and omega-3 fatty acids.

**DATA SYNTHESIS:** Great Lakes fish contain persistent contaminants--many of which have documented adverse health effects--that accumulate in humans consuming them. In contrast, data are sparse on omega-3 fatty acids in the fish and their consumers. Moreover, few studies have documented the social and cultural benefits of Great Lakes fish consumption, particularly for subsistence fishers and native communities. At this time, federal and state/provincial governments provide fish consumption advisories based solely on risk.

**CONCLUSIONS:** Our knowledge of Great Lakes fish has critical gaps, particularly regarding the benefits of consumption. A risk-benefit analysis requires more information than is currently available on the concentration of omega-3 fatty acids in Great Lakes fish and their absorption by fish eaters in addition to more information on the social, cultural, and health consequences of changes in the amount of fish consumed.

Source: Turyk, M. E., S. P. Bhavsar, et al. (2012). "Risks and benefits of consumption of Great Lakes fish." *Environ Health Perspect* **120**(1): 11-18.

## Risk trade-offs in fish consumption: a public health perspective

Fish consumption advisories instruct vulnerable consumers to avoid high mercury fish and to limit total fish intake to reduce neurotoxic risk. Consumption data from the U.S. suggest that nontarget consumers also respond to such advice. These consumers reduce exposure to mercury and other toxicants at the cost of reduction in cardioprotective fatty acids. We present a probabilistic model to assess these risk trade-offs. We use NHANES consumption data to simulate exposure to contaminants and nutrients in fish, employ dose-response relationships to convert exposure to health end points, and monetize them using benefit transfer. Our results suggest that newborns gained on average 0.033 IQ points from their mothers' compliance with the prominent FDA/EPA advisory. The welfare gain for a birth cohort is estimated at \$386 million. This gain could be fully offset by increments in cardiovascular risk if 0.6% of consumers aged 40 and older reduced fish intake by one monthly meal until they reached the age of 60 or if 0.1% of them permanently reduced fish intake.

Source: Rheinberger, C. M. and J. K. Hammitt (2012). "Risk trade-offs in fish consumption: a public health perspective." *Environ Sci Technol* 46(22): 12337-12346.

## Mercury in the Gulf of Mexico: Sources to receptors

Gulf of Mexico (Gulf) fisheries account for 41% of the U.S. marine recreational fish catch and 16% of the nation's marine commercial fish landings. Mercury (Hg) concentrations are elevated in some fish species in the Gulf, including king mackerel, sharks, and tilefish. All five Gulf states have fish consumption advisories based on Hg. Per-capita fish consumption in the Gulf region is elevated compared to the U.S. national average, and recreational fishers in the region have a potential for greater MeHg exposure due to higher levels of fish consumption. Atmospheric wet Hg deposition is estimated to be higher in the Gulf region compared to most other areas in the U.S., but the largest source of Hg to the Gulf as a whole is the Atlantic Ocean (>90%) via large flows associated with the Loop Current. Redistribution of atmospheric, Atlantic and terrestrial Hg inputs to the Gulf occurs via large scale water circulation patterns, and further work is needed to refine estimates of

the relative importance of these Hg sources in terms of contributing to fish Hg levels in different regions of the Gulf. Measurements are needed to better quantify external loads, in-situ concentrations, and fluxes of total Hg and methylmercury in the water column, sediments, and food web.

Source: Harris, R., C. Pollman, et al. (2012). "Mercury in the Gulf of Mexico: Sources to receptors." *Environ Res.* [Epub ahead of print].

## Analysis of potential mercury policies: The impact of stream basin characteristics on susceptible populations

Human exposure to mercury through fish consumption from local waterways is an ongoing concern to regulatory decision makers. Previously described population exposure and bioaccumulation models were combined in order to analyze the impact of potential policies on susceptible populations. The combined model simulated the problem of mercury exposure by examining the system from the point of mercury in the water column to its concentration in population biomarkers. Evaluated policy scenarios included the protectiveness of fish consumption advisories, Total Maximum Daily Load (TMDL) changes, and watershed management strategies. Simulations indicated the characteristics of a basin combined with the unique pattern of intake rates of susceptible populations determine the risk associated with fish consumption from a given waterway. Each population had a unique pattern of biomarker response to changes in fish tissue mercury. Management strategies that lowered bioaccumulation rates also reduced ecosystem services. Reducing fish tissue contamination through reductions in mercury loading to watersheds is a long term solution. For the short term, fish consumption advisories should be used to protect populations from adverse exposures. The combination of characteristics of the basin and the populations that fish from the waterway should be the determinant for setting advisories.

Source: Chan, C. and R. R. Jacobs (2012). "Analysis of potential mercury policies: The impact of stream basin characteristics on susceptible populations." *Integr Environ Assess Manag Integrated Environmental Assessment and Management.* [Epub ahead of print].

## Temporal trends of polychlorinated biphenyls and organochlorine pesticides in Great Lakes fish, 1999-2009

Temporal trend analysis of the latest Great Lake Fish Monitoring and Surveillance Program (GLFMSP) data showed statistically significant decreases in persistent bioaccumulative and toxic (PBT) contaminant (polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichlorethane and its metabolites (DDTs), dieldrin, cis-chlordane, oxychlordane, cis-nonachlor) concentrations in Lakes Huron, Ontario, and Michigan lake trout over the period of 1999 to 2009. In contrast, for most contaminants, no statistically significant concentration trends were found in top predator fish in Lakes Superior and Erie during the same period. For Lakes Huron, Ontario, and Michigan  $5.0 \pm 2.6\%$  average annual concentration decreases were found for PCBs, DDTs, dieldrin, and other organochlorine pesticides (OCs) decreased at a faster rate, ranging from  $10 \pm 4.3\%$  to  $20 \pm 7.1\%$  per year. For these three lakes, with the exception of PCBs, these current decreases are greater than were shown by an earlier trend analysis that estimated an annual contaminant decrease of about 2-5% for the period of 1980 to 2003. For Lakes Superior and Erie, the finding of no statistically significant trend is in agreement with previously reported results for these lakes.

Source: Chang, F., J. J. Pagano, et al. (2012). "Temporal trends of polychlorinated biphenyls and organochlorine pesticides in Great Lakes fish, 1999-2009." *Sci Total Environ* **439**: 284-290.

## Fish consumption advisories and the surprising relationship to prevalence rate of developmental disability as reported by public schools

According to the Environmental Protection Agency (EPA), fish consumption is the most significant route of mercury exposure, and the concern is greatest for women of childbearing age due to the potential for neurodevelopmental effects on a developing fetus. Rates of developmental disorders vary. But in 2008 it was demonstrated that the rate of autism is higher near industries that emit heavy metals. Furthermore past research findings can be taken to show that where a pregnancy occurred may predict later autism likelihood in the offspring more than where diagnosis occurs. If mercury plays any role in developmental disabilities, the rate of disability should relate to any reliable direct measure of contamination. The current research focuses on one index of environmental mercury contamination. Specifically, mercury-related fish advisories are found to be a surprisingly strong predictor of a state's autism rate,  $r = 0.48$ ,  $p < 0.001$ . The relationship remains strong after

controlling for student to teacher ratio and per pupil spending. It is argued that a secular increase in autism has been occurring and that prenatal exposure to heavy metal toxins may play a significant role. Because we suspect this finding may be of some interest, the full data set is provided in the appendix so that researchers can independently analyze the key findings which rely on CDC, EPA and IDEA data sets.

Source: DeSoto, M. C. (2012). "Fish consumption advisories and the surprising relationship to prevalence rate of developmental disability as reported by public schools." *Journal of Environmental Protection* **03** (11): 1579-1589.

## Association between omega-3 fatty acid supplementation and risk of major cardiovascular disease events: A systematic review and meta-analysis

Context: Considerable controversy exists regarding the association of omega-3 polyunsaturated fatty acids (PUFAs) and major cardiovascular end points.

Objective: To assess the role of omega-3 supplementation on major cardiovascular outcomes.

Data Sources: MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials through August 2012. Study Selection: Randomized clinical trials evaluating the effect of omega-3 on all cause mortality, cardiac death, sudden death, myocardial infarction, and stroke.

Data Extraction: Descriptive and quantitative information was extracted; absolute and relative risk (RR) estimates were synthesized under a random-effects model. Heterogeneity was assessed using the Q statistic and I<sup>2</sup>. Subgroup analyses were performed for the presence of blinding, the prevention settings, and patients with implantable cardioverter-defibrillators, and meta-regression analyses were performed for the omega-3 dose. A statistical significance threshold of .0063 was assumed after adjustment for multiple comparisons.

Data Synthesis: Of the 3635 citations retrieved, 20 studies of 68 680 patients were included, reporting 7044 deaths, 3993 cardiac deaths, 1150 sudden deaths, 1837 myocardial infarctions, and 1490 strokes. No statistically significant association was observed with all-cause mortality (RR, 0.96; 95% CI, 0.91 to 1.02; risk reduction [RD] -0.004, 95% CI, -0.01 to 0.02), cardiac death (RR, 0.91; 95% CI, 0.85 to 0.98; RD, -0.01; 95% CI, -0.02 to 0.00), sudden death (RR, 0.87; 95% CI, 0.75 to 1.01; RD, -0.003; 95% CI,

-0.012 to 0.006), myocardial infarction (RR, 0.89; 95% CI, 0.76 to 1.04; RD, -0.002; 95% CI, -0.007 to 0.002), and stroke (RR, 1.05; 95% CI, 0.93 to 1.18; RD, 0.001; 95% CI, -0.002 to 0.004) when all supplement studies were considered.

Conclusion: Overall, omega-3 PUFA supplementation was not associated with a lower risk of all-cause mortality, cardiac death, sudden death, myocardial infarction, or stroke based on relative and absolute measures of association.

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Source: Rizos, E. C., E. Bika, et al. (2012). "Association between omega-3 fatty acid supplementation and risk of major cardiovascular disease events: A systematic review and meta-analysis." Journal of the American Medical Association **308**(10): 1024-1033.



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

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## Additional Information

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