SOME QUESTIONS AND ANSWERS ON THE Connecticut River Fish Tissue Contaminant Study 2000

ECOLOGICAL AND HUMAN HEALTH RISK SCREENING

Q A Are Connecticut River fish safe to eat?

This study has confirmed earlier findings that mercury levels in Connecticut River fish may pose a risk to people, particularly subsistence fishers, pregnant women, women of childbearing age who might become pregnant, nursing mothers and children. People should check with their state for specific advisories in their area. Advisory information for each state is provided towards the end of this fact sheet.

Q A What was the Connecticut River Fish Tissue Contaminant Study 2000?

The Connecticut River Fish Tissue Contaminant Study (2000) was a joint federal and state screening level survey designed to answer these questions:

- What were the levels of contaminants (i.e., mercury, dioxin-like PCBs, dioxins, and chlorinated pesticides), in the year 2000, in three common fish species (i.e., smallmouth bass, white sucker, and yellow perch)?
- Is there a potential risk to human health from eating Connecticut River fish?
- What threats does eating these fish pose to other mammals, birds, and fish?

The study has provided a starting point from which to determine future trends in contaminant levels and allow statistical comparisons in ecological and human health risk screenings to support state fish advisories. However, screening level surveys, such as this study, are often less detailed than those required by states for fish advisories.

The four New England states, which are part of the Connecticut River watershed (Connecticut, Massachusetts, New Hampshire and Vermont), in partnership with the Connecticut River Joint Commissions for VT and NH, requested the study. They wanted an analysis that would provide consistent data about fish contamination in the river using one set of methods for target species selection, fish collection, sample preparation and handling, and laboratory analysis.

The following sections contain specific information about how the study was designed, how data was analyzed, and discussion of specific findings.

EPA United States Environmental Protection Agency New England

EPA-901-F-06-005
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Q Where were fish collected?

The Connecticut River was divided into eight (8) sampling "reaches" (i.e., segments), at major dams (Map 1, Table 1). Tidal areas were not included in the study. Reach (segment) beginning and end points were at major dams and presumably separate fish populations. The exact location of fish collection within each reach was not recorded so data analyses were done by fish species and reach.

Q What fish species were studied and what contaminants were analyzed?

The study targeted commonly caught recreational fish, as well as other fish that are important in the river food chain. Smallmouth bass, white suckers and yellow perch (Table 2) were collected during 2000 from the mainstem of the Connecticut River (Table 1) and composite[2] samples were analyzed for total mercury, coplanar (dioxin-like) PCBs[3] and organochlorine pesticides, including DDT and its breakdown products.

Additionally, in Reach 3, brown bullheads, American shad and striped bass were sampled by the Commonwealth of Massachusetts.

One fillet composite each of smallmouth bass, white sucker and yellow perch from Reaches 1, 4, 5, and 7, for twelve total samples, were also analyzed for dioxins and furans, due to the cost and complexity of current dioxin analytical techniques.

Map 1. Connecticut River Fish Tissue Report Sampling Reaches (Segments)

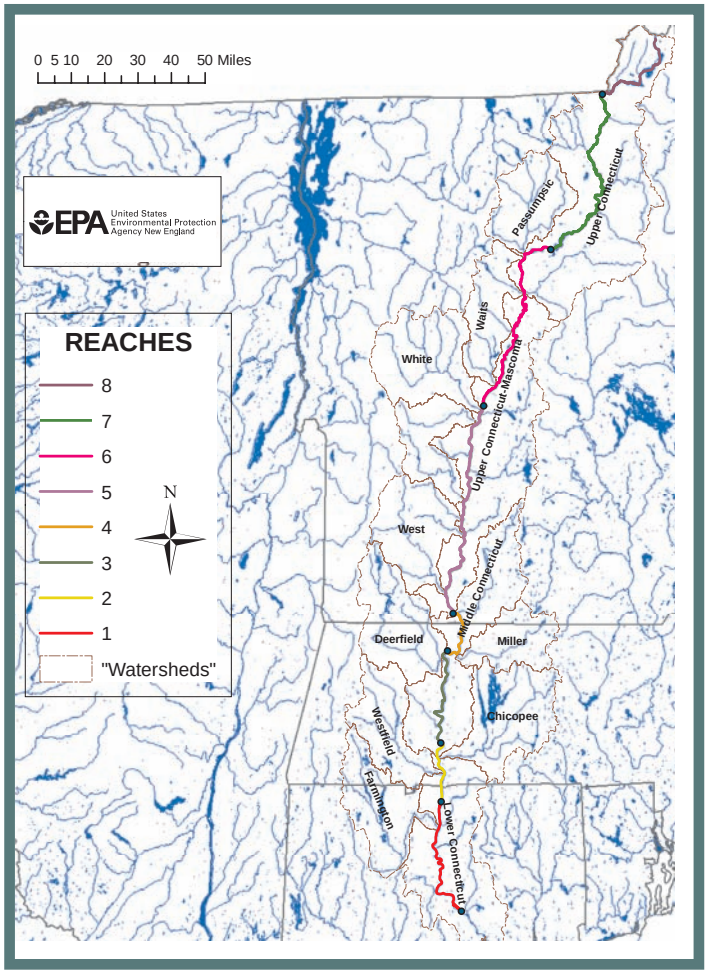


Table 1. Connecticut River Fish Tissue Sampling Reaches, starting at the southernmost point near Long Island Sound and moving upriver.

Reach (Segment)	~Latitude[1] - Top	~Longitude[1] - Top	~Length (Miles)	~% of Mainstem	Description
0	41.48 N	72.50 W	22	5	Clearly tidal area of CT River (not sampled)
1	41.95 N	72.61 W	49	12	Haddam, CT to Enfield, CT
2	42.21 N	72.60 W	20	5	Enfield, CT to Holyoke dam, MA
3	42.61 N	72.55 W	36	8	Holyoke Dam, MA to Turners Falls dam, MA
4	42.77 N	72.51 W	21	5	Above Turners Falls dam, MA to Vernon dam, VT
5	43.67 N	72.30 W	77	18	Above Vernon dam, VT to Wilder dam
6	44.34 N	71.87 W	74	18	Above Wilder dam in Lebanon/Hanover, NH to Moore dam
7	45.00 N	71.53 W	88	21	Above Moore dam Littleton, NH to Canaan, VT dam
8	45.23 N	71.20 W	36	9	Above Canaan, VT dam in West Stewartstown/Clarksville, NH
Total Mainstem Length			423	100	

[1] Latitude and longitude refer to the approximate top-most point in the reach (segment).

Table 2. Primary sampled species of Connecticut River fish.

Smallmouth Bass
Introduced species, frequents bottom habitats. Young feed on plankton (tiny animals and plants) and immature aquatic insects while adults eat crayfish, fishes, and aquatic and terrestrial insects. Preyed on by smallmouth bass, yellow perch, catfish, sunfish, suckers and turtles.

White Sucker
Native species, frequents bottom habitats. Usually occurs in small, clear, cool creeks and small to medium rivers. Young feed on plankton and other small invertebrates, becoming bottom feeders as they grow. Preyed upon by birds, fishes, lamprey, and mammals.

Yellow Perch
Native species, frequents bottom and mid-water habitats, most commonly found schooling in clear water near vegetation. Primarily zooplankton (tiny aquatic animal) feeders. Yellow perch are very cannibalistic when young are abundant. Preyed upon by fishes and birds.

photo credit: John F. Scarola and N.H. Fish and Game Department

[2] Individual fish were separated into fillet and offal (skin, bones, organs, etc.). Multiple fish from a segment were combined into composite fillet and offal samples for lab analysis. Analytical results from fillet and offal composites were added together to estimate whole fish concentrations. One consequence of this approach is that extreme (high or low) values in individual fish tend to be averaged with values that are more moderate.

[3] Non-coplanar (non-dioxin-like) PCBs are not considered further in this report as their toxicity is much less than for the dioxin-like (coplanar) PCBs. Historically total PCBs were summed in analyses, which provided no indication of the toxicity of the mixture. However, the complete validated data set for non-coplanar ("non-dioxin-like") PCBs is available in the full report at: **www.epa.gov/ne/lab/reportsdocuments.html.**

State of Connecticut hatchery-raised brook trout were used as a "control" fish species against which contaminant levels in wild fish species were compared.

Q/A What were the contaminant levels compared to?

Contaminant levels were compared in several ways:

- To EPA human health risk screening criteria, including those for recreational (sport) fishers and subsistence fishers (Table 3);
- To EPA and other ecological risk screening criteria for fish-eating mammals, birds, and fish;
- Contaminant levels were statistically compared between reaches;
- Contaminant levels of the different fish species were statistically compared with each other; and,
- Fish weight, length, 'condition' (a measure of health) and age (of selected smallmouth bass) were assessed and compared with contaminant levels.

Table 3. EPA Mercury Human Health Risk Screening Criteria

EPA Mercury Human Health Criteria [4] (parts per million in tissue)		
Recreational/ Sport Fishers (fillet only)	Subsistence Fishers (whole fish and fillet)	Water Quality Criterion
0.4	0.049	0.3

[4] States may use human health screening criteria that differ from EPA's values.

Human health screening levels did not consider vulnerable subpopulations, such as women of child-bearing age and children.

Recreational fishers are noncommercial fishers who do not rely on their catch as a major source of protein in their diet. EPA currently uses fish consumption rates of 17.5 grams/day (~0.6 oz/day) to calculate the health risk to recreational fishers.

Subsistence fishers rely on non-commercially caught fish and shellfish as a major source of protein in their diets. EPA currently uses fish consumption rates of 142.4 grams/day (~5 oz/day) to calculate health risk to subsistence fishers. Consumption rates used in state advisories may vary from these values.

What were the key findings?

1. Total mercury concentrations in all three species of wild fish (smallmouth bass, white sucker, and yellow perch) were significantly higher in upstream reaches of the Connecticut River than in downstream reaches and significantly higher than hatchery controls (Table 4). Mercury levels in all three wild species pose a potential risk to recreational and subsistence fishers and to fish-eating wildlife.

Table 4. Observed Range in Mercury (parts per million) in Connecticut River Fish Tissue Contaminant Study Fillet and Whole Fish Composites by Species

	Smallmouth Bass	White Suckers	Yellow Perch	Brook Trout (hatchery control)
Fillets	0.17-0.74	0.06-0.62	0.07-0.54	0.03-0.04
Whole Fish	0.13-0.56	0.04-0.41	0.06-0.37	0.03-0.07

2. Risk from dioxin-like (coplanar) PCBs was generally lower in upstream reaches than in downstream reaches, although this varied by fish species and was different for the humans/mammals, birds or fish that eat them. Levels of dioxin-like PCBs pose a potential risk to recreational and subsistence fishers and to fish-eating mammals and birds, but not to fish-eating fish.

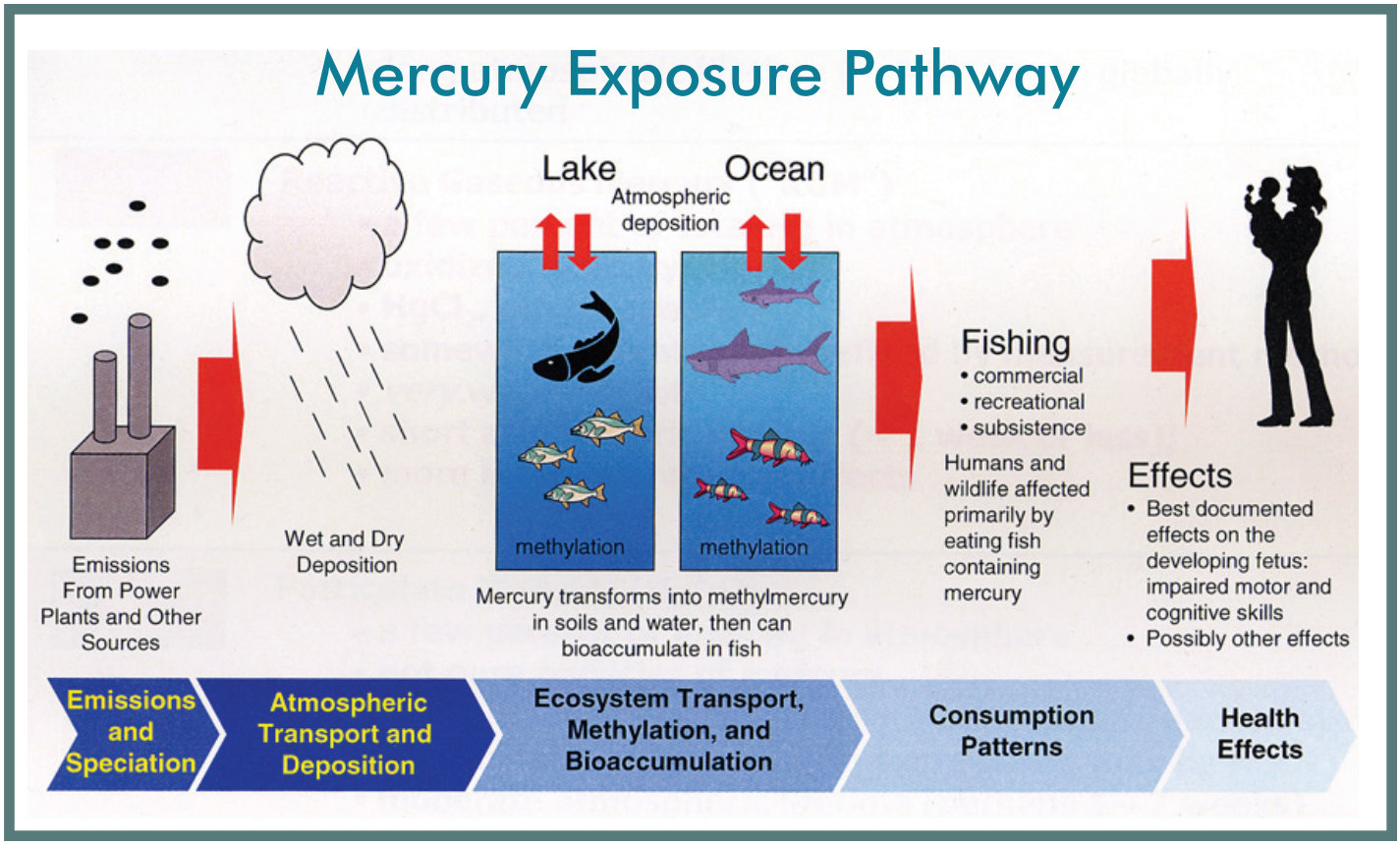
3. Dioxin toxicity in the twelve fillet composites analyzed posed a varying potential risk to both subsistence and recreational fishers, as well as to fish-eating wildlife. Since there were only 12 samples analyzed for dioxin, the study was not able to provide a complete estimate of human health and ecological risk from consumption of Connecticut River fish.

4. DDT and related breakdown products from chemical, physical and biological weathering, pose a potential risk to human subsistence fishers and to fish-eating birds, but not to recreational fishers or fish-eating mammals.

What are the sources of these contaminants in fish and what is being done about them?

Mercury occurring in the Connecticut River watershed continues to be deposited mostly from the atmosphere (Figure 1). Much of this mercury originates from emissions from coal-fired power plants and

Figure 1. How Mercury Enters the Environment (Source: USEPA 2006)



incinerators in the eastern United States. Federal and state rules adopted in the late 1990s have significantly reduced mercury emissions from municipal and medical waste incinerators. On March 15, 2005, EPA issued its Clean Air Mercury Rule, which with the Clean Air Interstate Rule, will reduce power plant emissions and ultimately the amount of mercury in fish. EPA New England has worked with all New England states to substantially reduce regional mercury emissions since the late 1990s, The Northeast region has reduced its mercury emissions by more than 50 percent since 1998.

Once in the river, mercury concentrates to high levels in the food chain. Saltwater and freshwater fish are the primary source of mercury exposure for humans and fish-eating wildlife. Older fish tend to have higher levels of mercury and other contaminants. Higher levels of mercury in the upper reaches may partly be a result of water level manipulations in reservoirs. EPA and state scientists are conducting cutting-edge research to study the movement of mercury throughout the environment and its effects on humans and wildlife.

EPA banned the use and manufacture of PCBs in the U.S. in 1977 after production of over 1.5 billion pounds. DDT use was severely restricted by EPA in 1972 after application of over 1.3 billion pounds during the previous thirty years. Dioxins and PCBs break down very slowly in the environment and concentrate in food chains. Similarly, DDT is very long-lived in the environment in either its original or breakdown forms. There are no known current sources of PCBs or DDT to the Connecticut River so current levels in fish result from historical contamination in the watershed. However, dioxins are produced in nature and inadvertently by humans, often through combustion processes such as at waste incinerators. Levels of dioxins in Connecticut River fish reflect historic and possibly current sources.

Q How do I find out if the fish I catch in the Connecticut River are safe to eat? What are the current state fish advisories for the Connecticut River?

A

Your state public health or environmental agency issues fish consumption advisories based on estimates of potential risks to "at risk" and other populations using data on contaminant levels in fish sampled in the state. Some advisories limit the number of fish meals per month while others recommend avoiding certain species. The entire Connecticut River is covered by statewide advisories for mercury; however, current Connecticut River state fish advisories for PCBs are variable and site-specific, and there are no advisories for dioxins or organochloride pesticides, such as DDT. Based on the information from this study, the state health agencies may evaluate existing advisories and consider whether others are needed to adequately protect human health. Additional studies to assess the risks from dioxins and other pollutants may also be considered.

Current state consumption advisories summarized by contaminant are:

Mercury

All four states have statewide advisories for mercury in fish for sensitive "at risk" subpopulations (i.e., women of child-bearing age and children younger than 12 years, depending on the state). Connecticut has a statewide mercury advisory for all populations, for all waterbodies and all fish species, except stocked brook trout.

PCBs

Massachusetts and Connecticut have PCB advisories for some fish species for all Connecticut River waters in their states. However, Massachusetts and Connecticut provide differing fish consumption advice for sensitive "at risk" and general consumers. New Hampshire and Vermont currently have no PCB advisories for Connecticut River waters.

Dioxin

There are currently no advisories for dioxin for the Connecticut River.

Organochlorine pesticides

There are currently no advisories for organochloride pesticides, such as DDT, in the Connecticut River.

Current state-specific advisories are:

Connecticut

The Connecticut Department of Public Health (CTDPH) currently has fish advisories for common carp and catfish on the entire length of the Connecticut River based on PCBs. A statewide advisory is in effect for mercury in fish for all populations. Information on Connecticut fish advisories is available by calling the Connecticut Department of Health at (860) 509-7742 or at: www.dph.state.ct.us/BRS/EOHA/webfsh.htm.

Massachusetts

The current statewide fish advisory by the Massachusetts Department of Public Health (MADPH) cautions pregnant women, women of childbearing age who might become pregnant, nursing mothers and children less than 12 years to avoid eating fish from all freshwater bodies due to concerns about mercury contamination. It also cautions these groups to refrain from eating certain marine fish and includes advice on healthy eating habits to maximize nutritional benefits while minimizing risks. MADPH also issues water body specific advisories. In the early 1990s, MADPH issued updated fish consumption advice for the Connecticut River, based on total PCB levels, advising sensitive populations not to consume any fish from the river. In addition, it advises the general public not to eat channel catfish, white catfish, American eel or yellow perch. This advisory covers all towns from Northfield to Longmeadow, including Agawam, Chicopee, Deerfield, Easthampton, Gill, Greenfield, Hadley, Hatfield, Holyoke, Longmeadow, Northampton, Northfield, Montague, Springfield, South Hadley, Sunderland, Whatley, and West Springfield. Information on Massachusetts fish consumption advisories may be obtained from the Massachusetts Department of Public Health Center for Environmental Health, Environmental Toxicology Program at (617) 624 5757 or at: db.state.ma.us/dph/fishadvisory/.

New Hampshire

A statewide advisory is in effect for mercury in fish. "At risk" and other populations are advised to limit consumption of NH freshwater fish. In addition to the state wide advisory, Comerford (Segment 6) and Moore Reservoirs (Segment 7) currently have specific advisories recommending "at risk" populations avoid consuming any fish and all others to limit consumption. Further information on New Hampshire fish advisories may be obtained by contacting Ms. Pamela Schnepper at Pschnepper@des.state.nh.us (603) 271 3994, a toxicologist at the

New Hampshire Department of Environmental Services (NHDES). Information on current NH fish advisories is available on the web at: www.wildlife.state.nh.us/Fishing/fish_consumption.htm.

Vermont

The Vermont Department of Health (VTDOH) currently has fish advisories for mercury in all fish in all state waters. "At risk" populations are cautioned to not consume any fish from Comerford Reservoir (Segment 6) and Moore Reservoir (Segment 7). Other fishers are advised to limit meals. In McIndoes Reservoir (Segment 6), Vermont advises limiting consumption of all fish. Ms. Razelle Hoffman-Contois Rhoffma@vdh.state.vt.us (802-863-7558) may be contacted for additional information on Vermont's fish advisories. The public may also call 1-800-439-8550. Specific fish advisories in effect for Vermont waters may be found at: www.healthvermont.gov/enviro/fish_alert/fish_alert.aspx.

Q A Who conducted the Connecticut River Fish Tissue Contaminant Study?

U.S. Environmental Protection Agency Region 1 (EPA New England);
Connecticut Department of Environmental Protection (CTDEP);
Connecticut Fish and Game (CTF&G);
Massachusetts Department of Environmental Protection (MADEP);
New Hampshire Department of Environmental Services (NHDES);
New Hampshire Fish and Game (NHF&G);
Vermont Department of Environmental Conservation (VTDEC);
Vermont Fish and Game (VTF&G);
U.S. Fish and Wildlife Service (USFWS);
U.S. Geological Survey (USGS), and
New England Interstate Water Pollution Control Commission (NEIWPCC).

Q A Why did it take until 2006 to release the findings?

Given the implications of this study for human health and state fish advisories, data quality was considered one of the highest priorities. Questions about data from a contract laboratory required an unusually protracted data validation by EPA and its contractors. Final data validation for dioxins/furans was ultimately completed in the fall of 2004.

Q A What next steps does this study suggest?

- Continued outreach by the states, non-profits and EPA New England, particularly to sensitive populations, including subsistence fishers, women of child-bearing age and young children;
- Continued monitoring of contaminant levels in Connecticut River fish tissue by the states, possibly including assessment of coplanar (dioxin-like) PCBs, dioxins/furans and 'emerging' fish tissue contaminants, such as PBDEs (polybrominated diphenyl ethers)[5];
- Review of and revision of state fish advisories as warranted by monitoring data and emerging scientific knowledge; and,
- Continued efforts by EPA New England and the New England states to substantially reduce mercury emissions and contributions from all regional sources.

[5] PBDEs are widely used as fire retardants in furniture, carpeting, automobiles and computers, among other uses. PBDE industrial use has increased dramatically since the 1970s, as have the observed levels in biological "compartments", including fish tissue and mother's milk.

How would I obtain the full report?

The complete report:

Hellyer, G. 2006. Connecticut River Fish Tissue Contaminant Study - Ecological and Human Health Risk Screening, Ecosystem Assessment Unit, USEPA - New England Regional Laboratory, North Chelmsford, MA., May 31, 2006. 411 pp. + data appendices

is available to download at: **www.epa.gov/ne/lab/reportsdocuments.html.**

Whom do I contact if I have questions about this study?

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