



Ecological Risk Assessment Fact Sheet

Housatonic River "Rest of River"

July 2003

United States
Environmental Protection Agency
New England Region
1 Congress Street
Boston, MA 02114

EPA Releases Ecological Risk Assessment for GE/Housatonic River Site, Rest of River, for Public Comment and Peer Review

Public Comment Period

EPA is holding a 30-day Public Comment Period on the Ecological Risk Assessment (ERA) from **July 14 to August 13, 2003**. After the Comment Period, the ERA will be reviewed by a panel of nationally recognized experts in the field. All input is welcomed, and EPA encourages everyone to participate. The public is encouraged to:

- Submit comments on the ERA to the MNG Center at SRA, a consultant hired by EPA to maintain third-party neutrality during the Peer Review process.
- Submit nominations for people to be considered to serve on the Peer Review Panel to the MNG Center at SRA.

Public comments and Peer Review Panel nominations must be sent via email by August 13 to the MNG Center at SRA at: GEPittsfield@sra.com (see back page for information on submitting comments and nominations).

EPA has released the Ecological Risk Assessment (ERA) report for the GE/Housatonic River, Rest of River, for public comment and Peer Review. The ERA is one of a series of reports being prepared by EPA under a Consent Decree negotiated with General Electric Company, EPA, and other government agencies.

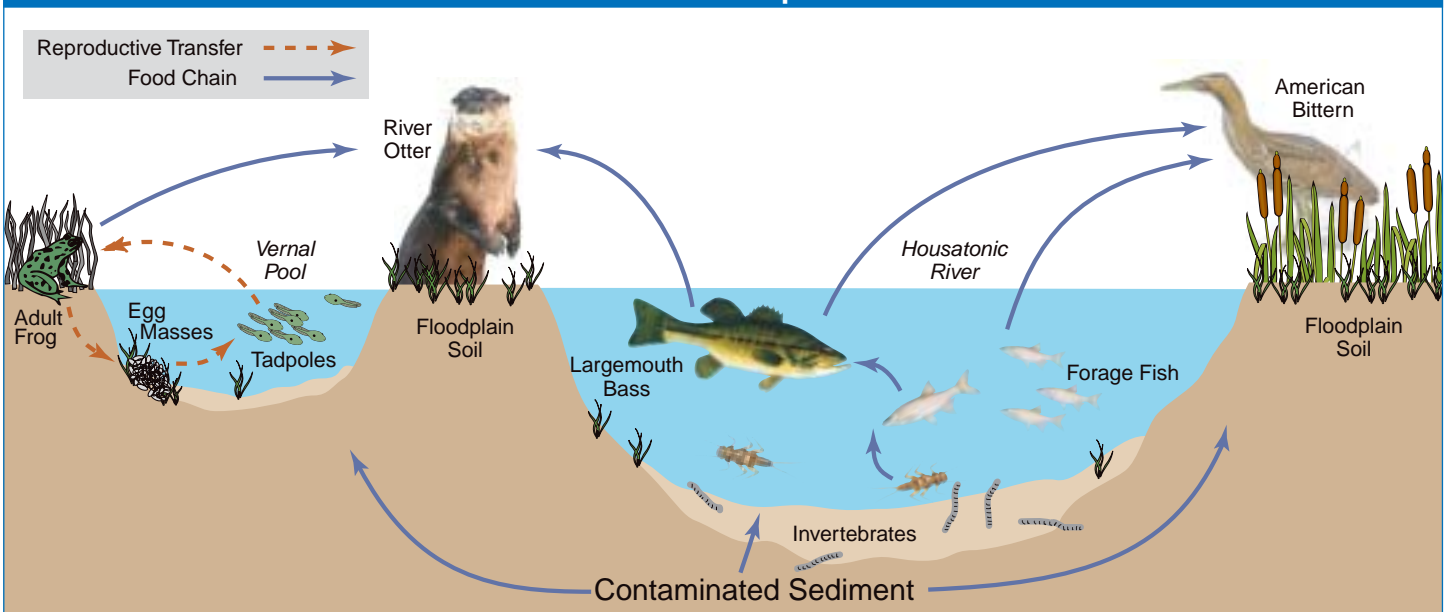
The Ecological Risk Assessment characterizes the risk posed to animals exposed to PCBs and other contaminants from the GE facility in Pittsfield, MA, while living and/or feeding in the river and floodplain.

The report evaluates the fate and transport of PCBs and other contaminants in the river and floodplain and the potential routes of exposure and toxicological effects of PCBs and other contaminants; identifies both aquatic and terrestrial ecological endpoints to be assessed and representative species potentially at risk; and characterizes the risks for these animals. In addition, the ERA qualitatively discusses risks to all species (beyond the representative species selected for detailed evaluation) in the river and floodplain.

This fact sheet summarizes the conclusions presented in the ERA. Copies of the full report are available for public review at the repositories listed on the back page, or on EPA's web site at www.epa.gov/ne/ge.

The release of the ERA report starts the 30-day Public Comment Period, during which individuals, organizations, and other interested parties are encouraged to comment on the Risk Assessment to the Peer Review Panel and/or submit nominations for individuals to be considered to serve on the Peer Review Panel (see box to left and back page).

How Are Plants and Animals Exposed to Contaminants?



Housatonic River: Rest of River Background

Site History

GE used PCBs at its 254-acre facility in Pittsfield beginning in 1932 and ending in 1977. During this time, the Transformer Division manufactured and repaired transformers containing dielectric fluids, some of which included PCBs. PCBs were released to soil, groundwater, Silver Lake, and the river, and used and disposed of within and around the facility in landfills, former river oxbows, and other locations.

The Pittsfield facility is the only known source of PCBs to the Housatonic River in Massachusetts. Many of these PCBs are now located in the sediment and floodplain soil between the confluence of the East and West Branches of the Housatonic River and Woods Pond, but PCBs have also been found throughout the Rest of River, as far downstream as Long Island Sound.

In addition to the river, other areas in Pittsfield and surrounding communities have been discovered over the years to have received PCB-contaminated waste from the GE facility. These areas include 11 former oxbows on the East Branch, residential properties, the Pittsfield Landfill, Rose Disposal Site in Lanesboro, MA, and Dorothy Amos Park located on the West Branch of the Housatonic River.

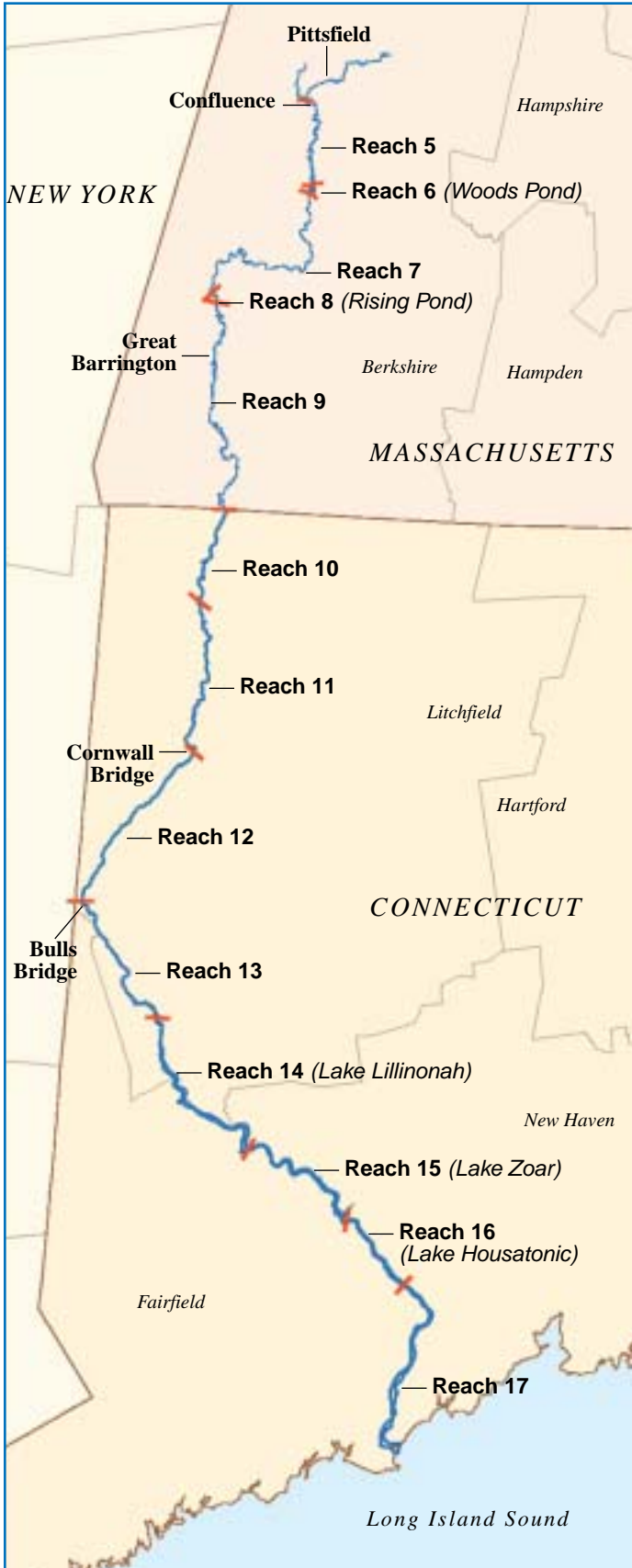
The Consent Decree for the General Electric/Housatonic River Site was approved by the federal court in October 2000. The Consent Decree (CD) calls for the river to be addressed in three phases: the cleanup of the Upper 1/2-Mile Reach (conducted by GE in 1999-2002); the cleanup of the 1 1/2-Mile Reach (currently being conducted by EPA, with funding shared by GE and EPA); and the investigation of the Rest of River, which includes the downstream portions of the river in Massachusetts and Connecticut. The CD requires that EPA conduct the Human Health and Ecological Risk Assessments and Modeling Study, and that these undergo public Peer Review before any potential cleanup alternatives are considered for the Rest of River.

In addition to these river cleanup activities, the Consent Decree calls for the investigation and cleanup of contamination outside the river. Several major soil investigations have been completed or are in progress on the GE property, including the 50-acre parcel to be transferred to the Pittsfield Economic Development Authority (PEDA) for redevelopment.

What Is the "Rest of River"?

The area known as the "Rest of River" includes the main stem of the Housatonic River and floodplain from the confluence of the East and West Branches in Pittsfield downstream to Long Island Sound (see map to left).

For the purposes of the ERA and other EPA studies, the Rest of River has been divided into 17 reaches. EPA and GE studies show that the greatest mass of PCBs is within the 10 1/2 miles of river and floodplain between the confluence and Woods Pond Dam. This area (Reaches 5 and 6) is called the Primary Study Area.



Rest of River

What Is an Ecological Risk Assessment?

EPA performs the Ecological Risk Assessment to find out what the possibility is that contaminants in the environment will cause harm, now or in the future, to animals that come into contact with them. The risk assessment provides the community and decision makers with an understanding of the potential ecological risks posed by contamination at a hazardous waste site in the absence of any cleanup.

To find out what the current and future ecological risks are, the risk assessment answers the following questions:

- **Are toxic compounds present? (Conceptual Model)**

The Ecological Characterization identified the plants and animals that live in the Rest of River area. Samples of soil, sediment, water, plants, and animals were collected to find out what contaminants are present in the Housatonic River, floodplain, and biota. The Conceptual Model shows how the animals may be exposed to contaminants in soil, sediment, water, plants, and other animals.

- **What animals are exposed? How often? To what degree? (Exposure Assessment)**

Animals are exposed to contaminants through breathing (inhalation); eating, drinking, or preening (ingestion); or by skin contact (dermal). The Exposure Assessment is an estimate of how specific animals may come into contact with chemicals and how often (for example, the number of fish a mink eats from the river). The most important exposure for many animals in the Rest of River is through their diet. A range of likely exposures was developed for representative species based on where they live and what they eat, to estimate the amount and types of contaminants they ingest over time.

Weight-of-Evidence Approach

EPA used a weight-of-evidence (WOE) approach for the ERA, which lays out the way that EPA took different types of information, and using all this information, arrived at a conclusion about risk. The WOE approach included:

1. **Evaluating the Information (Lines of Evidence)** – There are three general types of information used to describe and interpret ecological risk:

- Field surveys
- Toxicity studies using soil, sediment, water, and sometimes using animals from the site
- An estimate of site-specific exposure compared to adverse effects reported in other studies.

2. **Assessing each Piece of Information (Measurement Endpoint)**

- How well does it measure the possible toxic effects to the animal? (low, moderate, or high values were assigned to each measurement endpoint)
- Was there an adverse effect, and if so, how great? (the magnitude of response observed)
- The amount of agreement or disagreement between the different measures of risk (measurement endpoints).

- **How toxic are the compounds? (Effects Assessment)**

EPA used information from studies conducted in the Housatonic River and floodplain, and from studies conducted elsewhere, to assess the potential for contaminants to cause harm to different species.

- **Are there potential ecological risks? (Risk Characterization)**

The Risk Characterization describes the types and magnitude of risk from contaminants for different animals. However, because of the many different interactions in a complex ecosystem like the Housatonic River, there is some uncertainty (things that cannot be well-defined as a single number, but that can be bounded) that is considered when determining ecological risk. This uncertainty is evaluated using statistical methods, and the risk for each assessment endpoint is expressed in terms about how certain that risk is.

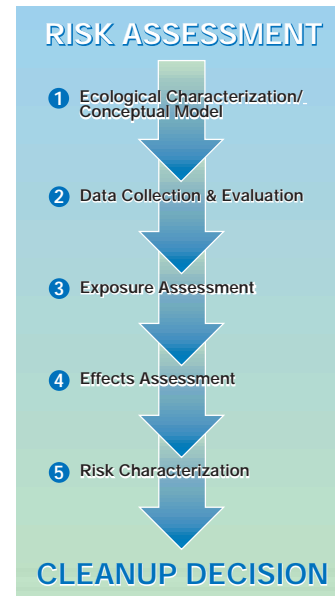


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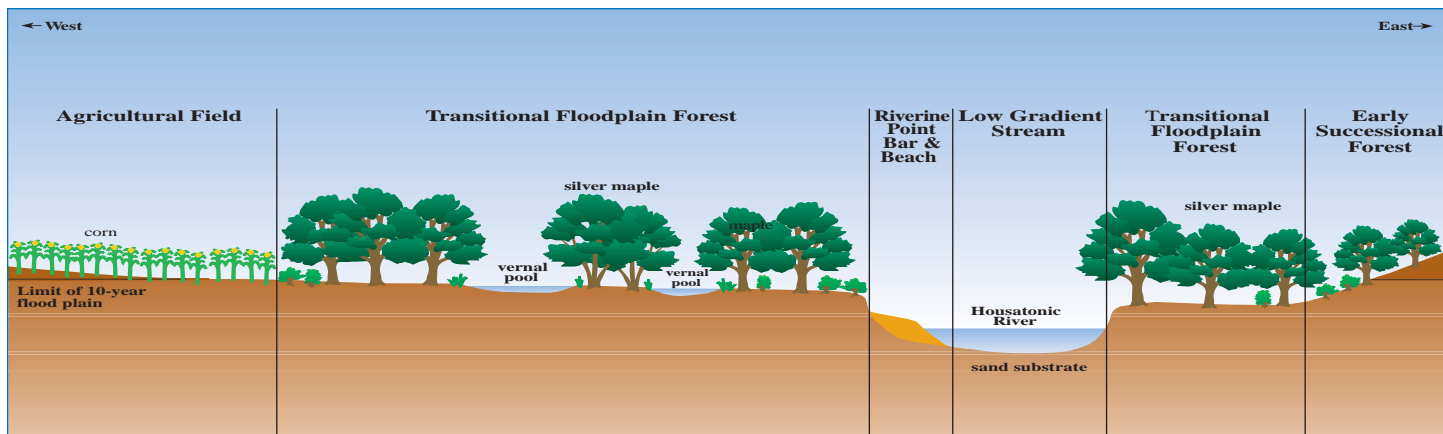
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Ecological Setting



Considered one of the most biologically diverse regions in New England, the Housatonic River-Rest of River area includes a complex mix of aquatic and terrestrial habitats. While urban, suburban, and agricultural landscapes are found along the river, the land use adjacent to the river is dominated by a wide variety of natural wetland systems, including the meandering river, streams, large floodplains, backwater ponds, vernal pools, shrub swamps, and forested wetlands, as well as large tracts of unfragmented forest.

The regional presence of acidic bedrock material (schist) and more neutral carbonate-rich bedrock (marble) has created a diverse composition of soil that contributes to the richness of the natural communities, and may explain the number of rare plant species found in the area.

In the floodplain, the area is primarily vegetated by riparian forests that receive over-bank flow during flood events. These floodplain forests provide habitat for hundreds of plant and animal species, including reptiles, amphibians, and birds, and are also used as a travel corridor by mammals such as mink, raccoon, and white-tailed deer.

Within the aquatic environment, there are a wide variety of natural communities and species. The river, stream, and pond habitats support diverse populations of invertebrates, 45 different species of fish and amphibians, as well as the predators that feed upon them like river otter, kingfisher, and osprey. Wetlands such as emergent marshes and wet meadows provide habitat for amphibians, foraging wading birds like American bittern, and other species of birds and mammals. Seasonally-flooded depressions known as vernal pools occur along the river and are used by breeding amphibians and predatory species like snapping turtles, painted turtles, and garter snakes.

Terrestrial environments in the Rest of River area include five different types of forest communities. These forests support a broad range of animal species, such as wood turtles, wood thrush, rose-breasted grosbeak, blue-headed vireo, Eastern chipmunks, gray squirrels, fisher, and bobcat, to name just a few examples.

Because of its unique ecological setting and the diverse natural communities, the Housatonic River is also host to more rare, threatened, and endangered species than most other bioregions in Massachusetts or Connecticut.

Assessment Endpoints

Eight Assessment Endpoints and representative species were selected for evaluation in the Ecological Risk Assessment.

The ERA evaluated the survival, growth, and reproductive success of the following species:

- **Fish**
- **Insectivorous birds (tree swallows and American robins)**
- **Piscivorous (fish-eating) birds (belted kingfisher and osprey)**
- **Piscivorous mammals (mink and river otter)**
- **Omnivorous and carnivorous mammals (northern short-tailed shrews and red fox)**
- **Endangered species (American bittern, bald eagle, and small-footed myotis bat)**

In addition, the assessment evaluated the community condition, survival, reproduction, and development of:

- **Benthic invertebrates**
- **Amphibians (leopard frogs and wood frogs)**

Definitions

Assessment Endpoint: An explicit environmental value to be evaluated and protected. Assessment endpoints are described by a type of animal (for example, the fish community in the Housatonic River) and a function (such as reproduction success). The assessment endpoints are selected because they represent important elements of the ecosystem, they are exposed to the contaminants and may be affected by the exposure, and in addition, any adverse responses can be measured.

Hazard Quotient(HQ): The hazard quotient represents the dose below which adverse effects are not expected to occur, similar to a Hazard Index used to describe noncancer effects to people. A HQ of 1 represents an exposure above which effects have occurred or would be expected to occur; this is called a toxic effects threshold level.

Levels of Risk: The characterization of risk to wildlife is generally expressed in quantitative terms (such as a 10% probability that more than 25% of the wood frog larvae will die). High, intermediate, and low risk categories were defined in this ERA using models of site-specific exposure compared to data from other studies on the effects from exposure to contaminants.

Assessment Endpoints – Aquatic Species

Risks to the eight Assessment Endpoints evaluated in the Housatonic-Rest of River Ecological Risk Assessment are summarized below.

Benthic Invertebrates

Benthic invertebrates, including insects (such as dragonflies, shown at right) that live on and in river sediment for part of their lives, were evaluated in this ERA because they form the base for the food chain in the river. Three different aspects of the benthic invertebrates in the river were evaluated: the community structure; site-specific toxicity studies (conducted both in the river and with river sediment in the laboratory); and a comparison of measured benthic tissue concentrations to sediment quality benchmarks from the literature. *The risk characterization indicates that there is significant risk to aquatic invertebrates in the PSA, and that risk may also occur in limited areas downstream of Woods Pond to Rising Pond.*



Amphibians

Amphibians were included in the ERA because they are known to be sensitive to PCBs and other contaminants, and there are 14 different species of frogs, salamanders and newts that live in contaminated water, sediment and soil in the Housatonic River and floodplain. Exposure and effects were evaluated using two site-specific studies that measured reproduction and development, and two field surveys that measured species richness, abundance and egg mass density. *The risk characterization indicates that there is a high probability of ecologically significant risk to amphibians such as leopard frogs (photo at right) above Woods Pond Dam. In addition, several large areas of the floodplain may pose risk to amphibians between Woods Pond and Rising Pond, with only small isolated areas of potential risk downstream of Rising Pond.*



Fish

Fish were included in the ERA because they are known to be sensitive to PCBs and other contaminants, and historical information showed that fish in the Housatonic River contained very high concentrations of PCBs. Exposure and effects were evaluated using several methods, including the following: two site-specific toxicity tests (one using fish taken from the river, the other exposing hatchery fish to Housatonic River contaminants) that evaluated biological responses to contaminants; field surveys of habitat used by fish in the river and by nesting largemouth bass; and comparisons of site-specific fish tissue concentrations to effects levels gleaned from the literature. *The risk characterization indicates that there is a high probability of moderate impacts to fish, such as largemouth bass. These impacts do not appear to be affecting the sustainability of the local fish populations in the PSA under current conditions (existence of fish advisory). No risks were indicated in any of the reaches below the PSA. However, coldwater species, such as trout, are potentially at risk in Reaches 7 and 9, but not farther downstream.*



Measurement Endpoint: Methods that are used to estimate the effects of exposure on an assessment endpoint. More than one measurement endpoint is often used for an assessment endpoint. For example, in assessing risks to amphibians in the Housatonic River area, several measurement endpoints were used, including analyses of water, sediment, and tissue; laboratory studies of frog reproduction success and growth rates; and field surveys.

Parts per million (ppm): Contaminant concentrations in soil and tissue are often given in ppm (or, as shown in the report, as milligrams per kilogram [mg/kg]). One ppm is approximately one drop in 13 gallons of water.

PCBs (polychlorinated biphenyls): A class of chemicals consisting of 209 individual compounds, known as congeners. PCBs are classified by EPA as probable human carcinogens. EPA recognizes neurological and developmental effects as additional toxic effects of PCBs, and considers all PCB mixtures to be toxic.

Probabilistic Modeling (referred to as modeling): A mathematical method used to describe the statistical distribution of certain biological, chemical, or physical parameters. Probabilistic modeling provides a full characterization of the certainty of the risk.

Riparian: The land adjacent to a river or stream.

Toxic Equivalence (TEQ): A method of comparing the toxicity of mixtures of congeners based upon the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The toxicity of some PCB congeners and dioxin/furans (referred to as "dioxin-like") that exhibit toxic behavior similar to 2,3,7,8-TCDD are added together using this method to derive a TEQ.

Vernal Pool: Isolated, temporary bodies of water (typically in floodplains) that provide essential breeding habitat for certain amphibians, such as wood frogs and spotted salamanders. These pools do not support fish.



Assessment Endpoints – Terrestrial Species

Insectivorous Birds

The ERA included these species because they are exposed to contaminants by eating contaminated insects, and because the floodplain provides nesting and feeding habitat for a number of insectivorous birds. Two methods were used to assess the risk to these birds: two field-based reproduction studies, and probabilistic modeling of exposure using prey tissue concentrations and effects concentrations described in scientific literature. *The risk characterization indicates that some insectivorous bird species are likely not at risk (tree swallows, shown at right), while for other species, the risks are also likely low, but more uncertain (American robin).*



Piscivorous Birds

Fish-eating (piscivorous) birds were chosen for inclusion in the ERA because they live near and migrate through the Housatonic River, and they have the potential to accumulate high levels of contaminants because of the high concentrations found in fish. Exposure to PCBs and other contaminants was estimated by using a model of the amount and size of fish they eat and concentrations of PCBs in fish from the Housatonic River, and by comparing these exposures to effects in the literature. In addition, a field survey of nesting belted kingfishers was conducted. *The risk characterization indicates that belted kingfishers (shown at right) are likely at low risk, while osprey may be at high risk.*



Piscivorous Mammals

Fish-eating (piscivorous) mammals were included in the ERA because some species such as mink are known to be very sensitive to PCBs, and mink and river otter habitat exists in the Housatonic River and floodplain. Three approaches were used to evaluate risk for these species: a mink feeding study was conducted with a diet containing contaminated fish from the Housatonic River; field surveys were performed; and modeling of exposure using site-specific prey tissue concentrations compared with effects concentrations from other scientific studies. *The risk characterization indicates that local populations of fish-eating mammals like mink (pictured at right) are at high risk as a result of exposure to PCBs and other contaminants in the PSA. In addition, mink may be at risk in Reaches 7 through 10, and river otter in Reaches 7 through 12.*



Omnivorous and Carnivorous Mammals

Omnivorous and carnivorous mammals were evaluated in the ERA because 42 different species of mammals live in the Housatonic River and floodplain, and there is a high likelihood of exposure through their ingestion of contaminated food. Two methods were used to evaluate risks for these species: field surveys and modeling of exposure using site-specific prey tissue concentrations compared to effects concentrations from the literature. *The risk characterization indicates that red fox (at right) may be at high risk, although the estimate is highly uncertain, and that local populations of northern short-tailed shrews may be at intermediate risk in the Housatonic River area.*



Threatened and Endangered Species

Threatened and endangered species were evaluated because these species are already at risk for population declines, and some threatened and endangered species either are known to or would be expected to live in the Housatonic River and floodplain. Three representative species were chosen: bald eagle (a raptor), American bittern (a wading bird), and the small-footed myotis (an insectivorous bat). One method was used to evaluate risks to threatened and endangered species: modeling of exposure using site-specific prey tissue concentrations compared to effects concentrations from the literature. Field surveys were also conducted that provide qualitative information. *The risk characterization indicates that American bitterns (shown at right) and bald eagles are likely at high risk, and small-footed myotis are at intermediate risk as a result of exposure to PCBs and other contaminants in the PSA. Downstream of Woods Pond Dam, eagles may be at low risk in the vicinity of Rising Pond, while the other species are expected to have no risk in the downstream areas.*



Summary of Ecological Risk

A weight-of-evidence approach was used in the Risk Characterization to determine the risks for each Assessment Endpoint. The findings of the Risk Characterization for each of the eight endpoints are summarized below.

High Risk

Benthic Invertebrates, Amphibians, and Fish-Eating Mammals

Risk is high for benthic invertebrates, amphibians, and fish-eating mammals. Confidence in this conclusion is high because:

- (1) Multiple lines of evidence with similar results were available,
- (2) The models used to estimate risk were not conservative, and
- (3) After evaluation of the uncertainties, a high degree of confidence exists that significant effects are occurring.

Intermediate to High Risk

Fish-Eating Birds (some), Omnivorous and Carnivorous Mammals (some), Threatened and Endangered Species (some)

Risk is estimated to be intermediate to high for some fish-eating birds, omnivorous and carnivorous mammals, and some threatened and endangered bird and mammal species. However, multiple lines of evidence were not available, leading to some uncertainty regarding these conclusions.

Low to Intermediate Risk

Fish

Risk is considered to be low to intermediate for fish, and confidence in this conclusion is high due to the results observed in toxicity studies and the observations made during the field studies that severe impacts at the local population level are not occurring.

Low Risk

Insectivorous Birds

Risk is considered to be low for insectivorous birds. Confidence in this conclusion is moderate as there are some conflicting conclusions in the different lines of evidence.



Comparing Risk Between Species

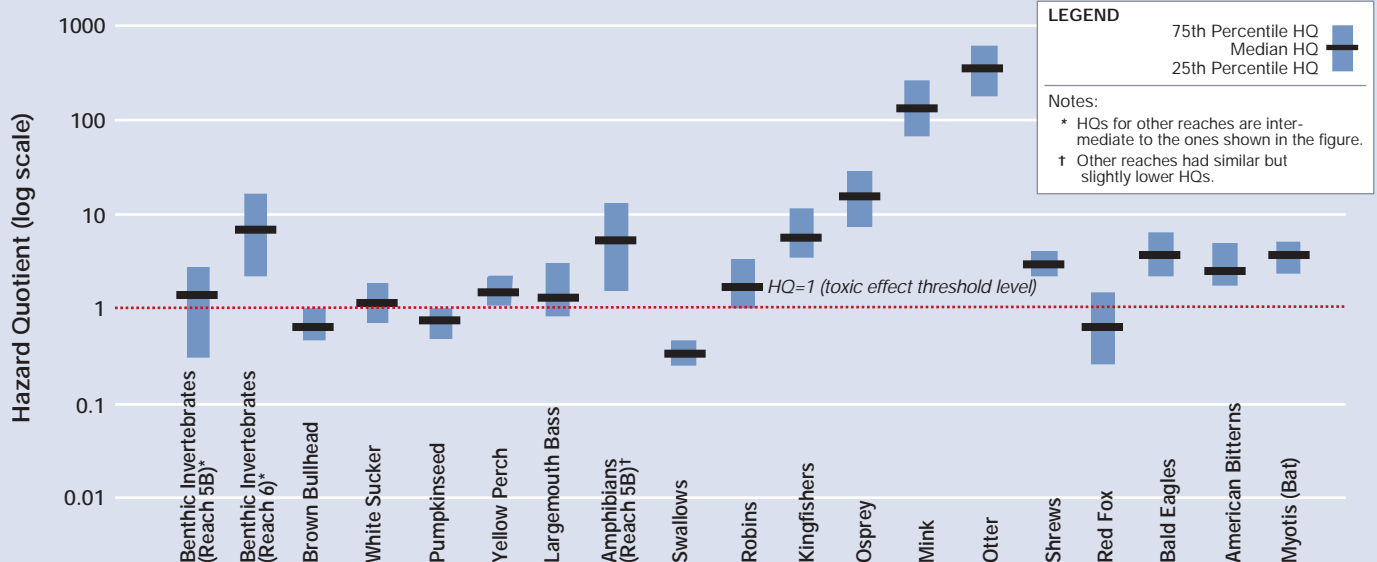
The ERA for the Housatonic River was conducted using lines of evidence for different species, including many different measurement endpoints. Although it is clear in the previous discussion that risks vary between species, it is difficult to picture these differences based upon the text. Therefore, a relative comparison of risks among aquatic life and wildlife is presented using Hazard Quotients (HQs).

A HQ is a comparison of the expected contaminant exposure at a site divided by the estimated low or no toxic effect threshold exposure:

$$HQ = \frac{\text{site exposure}}{\text{toxic effect threshold exposure}}$$

A HQ greater than 1 indicates that the site exposure exceeds the toxic effect exposure level, and may be cause for concern. HQs for selected species for each assessment endpoint are shown below. The boxes in the figure reflect the amount of certainty around the risk (from the 25th percentile to the 75th percentile), with the median shown as a solid line.

Summary of the Range of Hazard Quotients from Total PCBs for Selected Species



Peer Review Process

Consistent with EPA's goal to involve interested parties, and as part of the agreement between EPA and GE, the ERA will be reviewed by a panel of independent experts in a formal Peer Review. The Consent Decree established the objectives for the Peer Review. The Peer Review Charge translates these objectives into a series of technical questions that the Panel members must consider in conducting their review.

The Public Comment Period provides an important opportunity for the public to both nominate experts for the Peer Review Panel and to submit comments on the ERA relevant to the technical questions in the Charge for consideration by the Panel. Both the nominations and comments must be submitted to the MNG Center at SRA by the close of the Public Comment Period, which is August 13, 2003 (see box to the right).

At the close of the Public Comment Period, the Panel will be selected by a neutral expert in the field, and will have approximately 13 weeks to review the ERA and comments submitted by the public.

Early in 2004, the Panel will meet in Berkshire County. The public can present verbal comments to the Panel at the meeting (speakers must pre-register). The Panel will publicly discuss the ERA in the context of the Charge, and will also consider the input received during the public comment period and the verbal comments.

After the meeting, final comments will be submitted by the Panel for consideration by EPA. EPA will then issue a Responsiveness Summary and revise the ERA as necessary.

For More Information...

For more information on the ERA and the Peer Review Charge, go to: www.epa.gov/ne/ge or visit an information repository at:

Berkshire Athenaeum Public Library Reference Department
Pittsfield, MA 01201 (413) 499-9480

Simon's Rock College of Bard Library
Great Barrington, MA 01230 (413) 528-7274

Cornwall Public Library
Cornwall, CT 06796 (860) 672-6874

Kent Memorial Library (Kent Library Association)
Kent, CT 06757 (860) 927-3761

Housatonic Valley Association
Cornwall Bridge, CT 06754 (860) 672-6678

EPA Records Center
Boston, MA 02114 (617) 918-1440

Massachusetts Department of Environmental Protection
Springfield, MA 01103 (413) 784-1100

Connecticut Department of Environmental Protection
Hartford, CT 06106 (860) 424-3854

To submit comments or to nominate Peer Reviewers, email: GEPittsfield@sra.com or contact:

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