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Targeting Toxics: A Characterization Report
A Tool for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers

Basinwide Toxics Reduction and Prevention Strategy Commitment Report: A Supporting Document for the 1999 Toxics Reevaluation and Revision

Chesapeake Bay Program

June 1999

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The Chesapeake Bay Program is a unique regional partnership that has been leading and directing restoration of the Chesapeake Bay since 1983. The Bay Program partners include the states of Maryland, Pennsylvania, and Virginia; the District of Columbia; the U.S. Environmental Protection Agency, representing the federal government; the Chesapeake Bay Commission, a tri-state legislative body; and participating citizen advisory groups.

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EXECUTIVE SUMMARY

There are many types and sources of chemicals - both natural and manmade - in our environment. For example, chemicals such as metals and pesticides are released into the environment from natural processes and/or human activities. Although many chemicals do not pose a threat, certain types and levels of chemicals found in waterbodies have the ability to affect the reproduction, development and, ultimately, the survival of living resources. By living resources we mean the fish, shellfish, crabs, worms, grasses and other creatures. These chemicals are called *toxics* or chemical contaminants.

Chemical contamination in water, sediment and/or in animal tissue is an important issue for people everywhere. In the Chesapeake Bay region, scientists and managers have been carrying out a multi-step effort to assess the Bay's tidal rivers and identify, or *characterize*, areas that are either free of chemical contamination or show early warning signs of chemical contamination. The result of that effort is this report: *Targeting Toxics: A Characterization Report - A Tool for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers*. At the same time, scientists have been working to identify the *sources* of chemical contamination in the Bay's tidal rivers. That study resulted in a related report: the *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory* (TLRI). The information in these reports will help Chesapeake Bay Program decision makers target specific tidal rivers for management and monitoring efforts.

Development of the Results

It is important to note that this report is the Bay Program's first comprehensive attempt to characterize the Bay's tidal rivers. It gives the most up-to-date picture possible based on available data. The panel of experts who characterized the rivers, the Regional Focus Workgroup of the Bay Program's Toxics Subcommittee, underwent an extensive three-year effort to weigh all available chemical contaminant data for each river segment and, based on their best professional judgement, developed consensus on the final characterization.

The Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) technically reviewed the technical workplan and the public report and provided a very favorable and constructive review, indicating that this initial assessment of the Bay's tidal rivers "provides a good model for other estuary programs to utilize" (See Appendix A for the STAC review and the Toxics Subcommittee's response).

Top Findings

Of the 38 river segments that the Bay program characterized for the report, there were no new *Regions of Concern*. The report supported previous conclusions about chemical contaminant-related problems, including where they were suspected. The effort also highlighted areas needing additional data. Overall, the Bay Program panel identified:

- **No New *Regions of Concern* (hot spots) -** Three areas were designated in 1993 and still remain. These are areas where available data indicate that there is a probable chemical contaminant-related problem.

- **Eight *Areas with Low Probability for Adverse Effects* (clean bill of health/no known problems with chemical contamination)** - These are areas where available data indicate that it is unlikely that there is a chemical contaminant-related problem.
- **10 *Areas of Emphasis* (early warning signs/areas where living resources may be affected by chemical contamination)** - These are areas where available data indicate that there is a significant potential for a chemical contaminant-related problem.
- **20 *Areas with Inconclusive or Insufficient Data*** - Available data are inconclusive or insufficient for characterizing the region into any of the three previous categories. Either the data are too limited temporally and/or spatially, do not provide a sufficient mix of concentration and effects data, are inconclusive or conflicting, or are not of good enough quality to characterize the region. These regions will be given high priority for future characterization.

Human Health

This report was designed to identify areas where chemical contaminant effects on the Bay's living resources occur or have the potential to occur. Human health impacts from contaminated air, soil and drinking water are not addressed. However, because potential human health impacts are an important issue, state agencies have already looked at human health issues in the tidal rivers of the Bay. Where human health concerns already have been identified, appropriate fish consumption advisories or other warnings have been issued. This report should not alter the current recreational or commercial uses of any of the rivers. If swimming, fishing and boating are allowed now, they should continue.

Context of the Characterization Effort

The Bay Program's Toxics Strategy calls for voluntary toxics reduction and prevention actions that are consistent with, and supplement, the requirements under the Clean Water Act. These Bay Program efforts build upon the ongoing state and federal regulatory programs to ensure the protection of the Bay's living resources and human health. This characterization report of the Bay's tidal rivers augments the state assessments of impaired waters required under the Clean Water Act by identifying areas with potential contaminant problems, areas with no known contaminant problems, and areas needing more data. This report is a first cut at characterizing the status of chemical contaminant effects on the living resources inhabiting the Bay's tidal rivers.

This report gives the most up-to-date picture possible based on available data; however, there are specific limitations to what the report is and is not.

What the Characterization Report IS:

- **IS the most comprehensive characterization to date of the chemical contaminant-related problems that could affect living resources in the tidal rivers of the Bay.** This characterization is more comprehensive than any other effort in the region. It goes beyond the state's *impaired waters* lists by identifying the areas with early warning signs where living resources may be affected by chemical contamination (*Areas of Emphasis)*, areas that do not have any known contamination problems (*Areas with Low Probability*

for Adverse Effects) and areas where the data are insufficient or inconclusive (*Areas with Insufficient or Inconclusive Data*). This report enhances the picture of the status of chemical contaminant-related problems in the Bay's tidal rivers.

- **IS a broad characterization of chemical contaminant conditions in the Chesapeake Bay's tidal rivers.** The panel of experts who characterized the rivers weighed all available chemical contaminant and effects data for each river segment and, based on their best professional judgement, developed consensus on the final characterization. All of the available data evaluated had to convey a reasonably consistent record throughout an entire segment, describing the status of chemical contaminant effects on living resources, to make a characterization. If available data were spatially or temporally insufficient to represent the entire segment, or if data were conflicting or inconclusive in describing the entire segment, a segment was characterized as an *Area with Insufficient or Inconclusive Data*. The characterization of a particular river segment does not mean that the entire area has a chemical contaminant-related problem because chemical contaminant conditions are not uniform throughout each segment. For example, even in the *Regions of Concern*, there are areas that have no known problems. When more data are available, future efforts will characterize specific areas within a river segment.

- **IS a supporting document to assist the Bay Program in reevaluating and revising the *1994 Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy*.** The characterization report will be used to help formulate future goals to direct chemical contaminant reduction and prevention and to direct management and monitoring in the appropriate areas beyond the year 2000.

What the Characterization Report IS NOT:

- **IS NOT a barometer for measuring the potential impacts on human health.** This report was designed to identify areas where chemical contaminant effects to the Bay's living resources occur or have the potential to occur. Human health impacts from contaminated air, soil and drinking water are not addressed. However, because potential human health impacts are an important issue, state agencies have already looked at human health issues in the tidal rivers of the Bay. Where human health concerns already have been identified, appropriate fish consumption advisories or other warnings have been issued. This report should not alter the current recreational or commercial uses of any of the rivers. If swimming, fishing and boating are allowed now, they should continue.

- **IS NOT a characterization of the mainstem Bay or non-tidal rivers.** The mainstem Bay was not characterized because levels of chemical contaminants tend to be very low and effects are unlikely. Techniques for detecting effects at these low levels are under development. Also, the report characterizes the tidal rivers of the Bay, as opposed to non-tidal waters, because tidal waters are the focus of the Bay Program's toxics efforts. The sites of many of the known toxics problems are in tidal waters, and most of the urban

areas and toxics-related land use activities are adjacent to tidal waters. However, it is important to note that non-tidal waters (above the fall line) are also a source of chemical contaminants to tidal waters.

- **IS NOT a ranking of the tidal rivers in the Bay based on chemical contamination.** This report is not intended to determine which river has the highest chemical contamination relative to all others. The report was designed to classify the Bay's tidal rivers into one of four categories based on the severity of chemical contaminant-related problems and the resulting need for chemical contaminant reduction, prevention, and/or assessment actions.

- **IS NOT an inventory of the sources of chemical contamination.** This report only identifies whether there is or is not chemical contamination in the Bay's tidal rivers. It does not indicate where the particular contaminants are originating. The 1999 TLRI addresses the sources and amounts of chemical contaminants into the Bay and rivers. It also is part of the Bay Program's toxics reevaluation and revision effort.

How The Chesapeake Bay Program Will Use This Information

Overall, the characterization report and the 1999 TLRI will serve as valuable planning and targeting tools to assist the Bay Program in assessing the success of its previous toxics reduction and prevention goals, and to formulate new goals. More specifically, the Bay Program is committed to take the following actions based on the results of this characterization effort:

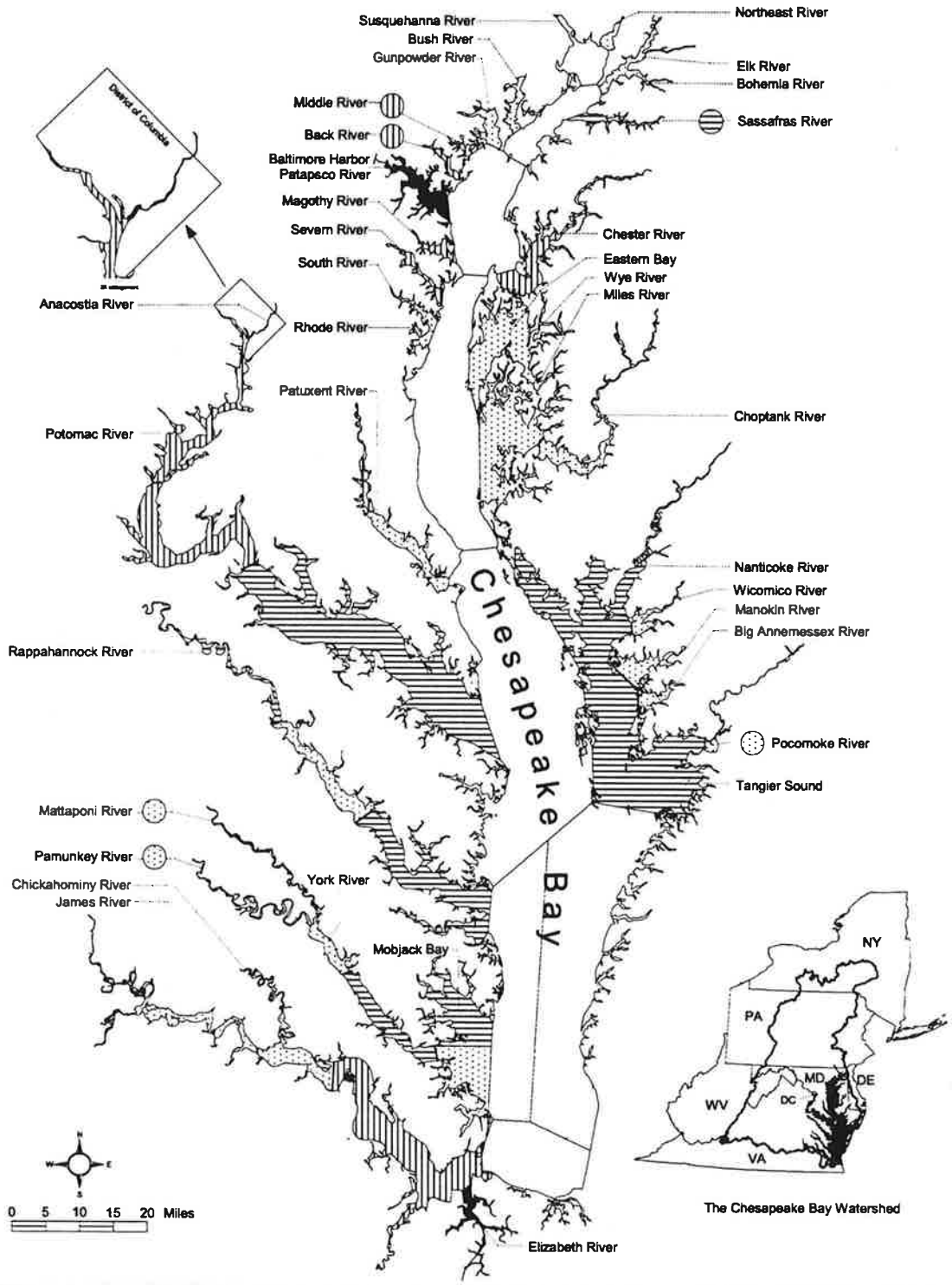
- Identify and implement necessary pollution prevention actions in the *Areas of Emphasis* to eventually eliminate the potential for chemical contaminant-related impacts.
- Take actions necessary to ensure future protection of the *Areas of Low Probability for Adverse Effects*.
- Initiate necessary assessments in *Areas with Insufficient or Inconclusive Data* to order to characterize these areas.

Segment-by-Segment Results for the Tidal Portions of the Bay's Rivers

The segments are being listed north to south and east to west. They are not ranked.

Status of Chemical Contaminant Effects on Living Resources in the Chesapeake Bay's Tidal Rivers

Chesapeake Bay Program



Region of Concern - area with probable adverse effects

Area of Emphasis - area with potential adverse effects

Area with Low Probability for Adverse Effects

Area with Insufficient or Inconclusive Data

Not characterized due to historically low levels of chemical contamination

In the Chesapeake Bay region, scientists and managers carried out a multi-step effort to characterize the status of chemical contaminant effects on living resources - fish, shellfish, crabs, worms, grasses, etc. - inhabiting the Bay's tidal rivers. The result of this characterization is a report, "Targeting Toxics: A Characterization Report - A Tool for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers", which includes this map. The information gathered for this report and map will be used by Chesapeake Bay Program decision makers to target specific tidal rivers for monitoring and management efforts. It is also part of the 1999 Toxics Reevaluation and Revision effort.

Produced in April 1999

For more information call 1-800-YOUR BAY.

I. *Why was this characterization conducted?*

A. Purpose of this report

This report, *Targeting Toxics: A Characterization Report - A Tool for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers*, is intended to provide the public with a summary of the purpose and methods used to characterize the status of chemical contaminant effects on the living resources inhabiting the Bay's tidal rivers, as well as to discuss the results of each river's characterization. A more detailed description of the steps the Chesapeake Bay Program took to develop the characterization is outlined in the *Targeting Toxics: A Characterization Report - A Tool for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers - A Technical Workplan* [1].

The Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) technically reviewed the technical workplan and this public report and provided a very favorable and constructive review, indicating that this initial assessment of the Bay's tidal rivers "provides a good model for other estuary programs to utilize" (See Appendix A for the STAC review and the Toxics Subcommittee's response).

B. Background information

Toxics and the Chesapeake Bay

Chemicals in the sediment, fish tissue and water that have the ability to affect the reproduction, development, and, ultimately, survival of living resources have been referred to as toxic chemicals, or chemical contaminants. Scientists have pointed out that any large body of water will never be completely free of chemical contaminants. In fact, many chemicals, including zinc, copper and other metals, occur naturally in the Bay and its sediments.

Chemical contaminants entering the Bay and its tidal rivers come from natural processes (such as weathering of rock) and human activities (such as manufacturing and driving). Many problem chemicals are currently being loaded into the Bay's rivers from a variety of sources, such as pesticide usage, urban activities, industrial activities, and shipping and boating activities. Chemicals travel through the watershed and are eventually deposited in the Bay or rivers. For example, oil and grease from a parking lot can be washed down a drain by stormwater and into a stream, eventually leading to the Bay. Some chemicals reach harmful levels when they accumulate in the sediment at the bottom of the Bay, in animal tissue, and/or in the water column.

Chesapeake Bay Program and Regional Focus Workgroup

The Bay Program is a unique regional partnership that has been leading and directing the restoration of the Bay since 1983. The Chesapeake Executive Council, consisting of the governors of Maryland, Pennsylvania, and Virginia; the mayor of Washington, D.C.; the EPA administrator; and the chair of the Chesapeake Bay Commission, is the Bay Program's governing

body and guides Bay restoration with directives and policies. The Bay Program is divided into subcommittees to address numerous Bay issues. One of the subcommittees, the Toxics Subcommittee, handles all chemical contaminant issues in the Bay watershed.

Since the 1980s, Bay scientists have agreed that the nature, extent and severity of toxic impacts vary widely throughout the Bay system. Based on further research, scientists determined that there was no evidence of severe, system-wide chemical contaminant problems in the Bay or its tidal rivers. However, three localized problem areas, or "hot spots," were discovered. In 1993, the Executive Council designated these hots spots as *Regions of Concern*: the Anacostia River (DC), the Baltimore Harbor/Patapsco River (MD), and the Elizabeth River (VA). These three specific areas were targeted for intense management efforts by Bay Program partners because notable chemical contaminant problems were well documented and living resources exhibited chemical contaminant-related effects. The Executive Council directed the jurisdictions to work with stakeholders to develop Regional Action Plans to remediate (clean up), reduce, and prevent chemical contamination in these chemical contaminant hot spots.

The Executive Council realized the importance of characterizing the chemical contaminant conditions in tidal tributaries outside these *Regions of Concern* to provide additional information about chemical contamination to the public, managers, and scientists. In the *1994 Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy*, the Executive Council committed the Bay Program signatories to:

> "...evaluate available data through the Chesapeake Bay *Regions of Concern* identification protocol, determine whether additional *Regions of Concern* should be designated, and publish a revised characterization of Bay and tidal tributary habitat status with regard to evidence for the presence of chemical contaminant-related impacts. Every three years this same evaluation of data will be conducted using data collected since the previous evaluation [2]."

In 1995, the Toxics Subcommittee formed the Regional Focus Workgroup to characterize the status of chemical contaminant effects on the living resources inhabiting the Bay's tidal rivers. The workgroup represents a good balance of technical experts from state agencies, federal agencies, interstate commissions, research institutions; and industries. Workgroup members weighed all available chemical contaminant data for each river segment and, based on their best professional judgement, developed consensus on the final characterization. The strength of this report is represented by the workgroup's technical knowledge of chemical contaminant data, its diversity of interests and membership, and its ability to reach a consensus on the final characterization.

What has the Bay Program been doing to reduce chemical contamination in the Chesapeake Bay and its rivers?

The Bay Program has been working to reduce chemical contamination in the Bay since 1983 with the Executive Council's signing of the historic *Chesapeake Bay Agreement.* In 1994, the Council adopted the *1994 Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy.* The goal of the strategy is "...a Chesapeake Bay free of toxics by reducing or eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on living resources that inhabit the Bay or on human health." The 1994 strategy called for a regional focus to address chemical contaminant problem areas, a focus in chemical contaminant assessments in direct support of management actions, and an increased emphasis on pollution prevention. As a result of this toxics strategy, Bay Program chemical contamination reduction efforts have focused on:

- **Controlling chemical contaminants in areas of known chemical contamination.** The three *Regions of Concern* (areas with known chemical contamination) have developed Regional Action Plans to reduce, remediate and prevent future chemical contamination.
- **Reducing chemical contamination entering the Bay.** These efforts have focused on determining contaminant sources as identified in the *Toxics Loading and Release Inventory*, reducing pesticide use through Integrated Pest Management practices, and preventing pollution from point and nonpoint sources.
- **Quantifying the chemical contamination in the Bay's tidal rivers.** This effort provides a characterization of the chemical contaminant-related problems that could affect living resources in the tidal rivers of the Bay. This comprehensive characterization identifies areas with chemical contaminant-related problem areas, areas with no known chemical contaminant problems and areas needing more data.

More information about any of these programs can be obtained by calling the Chesapeake Bay Program Office at 1-800-YOUR BAY.

C. Purpose of this characterization

This characterization represents the Bay Program's first comprehensive analysis of available data to assess the status of chemical contaminant effects on living resources in the Bay's tidal rivers. This characterization goes beyond identifying areas with known chemical contamination to identifying areas where significant potential exists for chemical contaminant-related impacts on living resources and their habitats. This effort also identifies areas that do not show evidence of adverse impacts due to chemical contamination and areas where data are lacking and additional study is required.

This report identifies areas where chemical contaminant effects to the Bay's living resources occur or have the potential to occur. Human health impacts from contaminated air, soils, and drinking water are not addressed. State agencies have already looked at human health issues in the tidal rivers and where human health concerns already have been identified, appropriate fish consumption advisories or other warnings have been issued by the respective state/district. This report should not alter the current recreational or commercial uses of any of the rivers segments. If swimming, fishing and boating are allowed now, they should continue.

Based on all available chemical contaminant data, the workgroup characterized all tidal river segments of the Bay into one of four categories:

Region of Concern - Available data indicate that there is a probable chemical contaminant-related problem. Concentrations of chemical contaminants are above thresholds associated with adverse effects, and these chemicals appear to be causing toxic effects on living resources.

Area of Emphasis - Available data indicate that there is significant potential for a chemical contaminant-related problem. Data reveal either elevated concentrations of chemical contaminants above thresholds associated with adverse effects and/or chemical contaminant-related adverse effects on living resources, but limited or no evidence for a relationship between the measured chemical levels and observed effects exists.

Area with Low Probability for Adverse Effects - Available data indicate that it is unlikely that there is a chemical contaminant-related problem in the region. Data reveal measured chemical contaminant concentrations below thresholds associated with adverse effects and no observed chemical contaminant-related adverse effects on living resources.

Area with Insufficient or Inconclusive Data - Available data are insufficient for characterizing the region into any of the three previous categories. Either the data are too limited temporally and/or spatially, do not provide a sufficient mix of concentration and effects data, are inconclusive or conflicting, or are of unknown quality and cannot support the level of confidence required to characterize the region. These regions will be given high priority for future characterization.

Characterizing the tidal rivers into these categories has management and political ramifications. In the 1994 toxics strategy, the Bay Program signatories committed to take the following actions based on the results of this characterization:

- Develop, adopt, and begin implementation of Regional Action Plans within two years of designation of additional *Regions of Concern*;
- Identify and implement necessary pollution prevention actions in the identified *Areas of Emphasis* to eventually eliminate the potential for chemical contaminant-related impacts;
- Take actions necessary to ensure future protection of resources in *Areas with Low Probability for Adverse Effects*; and
- Initiate necessary assessments in *Areas with Insufficient or Inconclusive Data* to characterize the habitat status through the protocol.

The Executive Council committed the Bay Program signatories to reevaluate and revise, as necessary, the basinwide toxics strategy by 1999. This characterization report is part of the overall strategy reevaluation and revision effort and will serve as a valuable tool to help the Bay

Program formulate future goals for beyond the year 2000. In reevaluating and revising the 1994 toxics strategy, the Bay Program will use this information to identify the link between sources (as identified in the Bay Program's *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory*) and the Bay/river chemical contaminant conditions to target specific sources and chemicals to reduce.

Characterizing the tidal rivers of the Bay also has an educational and outreach focus. Information on impacts and chemicals causing impacts, coupled with the updated *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory* (TLRI) and available land use data, will enable managers, scientists, and the public to target their toxics reduction and prevention activities toward specific sources and chemicals in impacted areas of the Bay. Resource managers may find the characterization of their jurisdictional waters insightful for formulating site-specific or contaminant-specific action plans. Scientists may use this characterization to target specific areas for additional assessment to better characterize chemical contaminants conditions. The public, community groups, and watershed associations can augment the Bay Program's activities by helping to develop and implement a targeted response to contaminant problems on a local watershed scale. They can use this information about the tidal rivers with estimates of loadings to help clean up local waters and/or protect them from potential contamination. Stakeholder action has worked well in the Elizabeth River, a *Region of Concern*, with the creation of the Elizabeth River Project (see inset). This successful stakeholder organization could serve as a model for the development of additional community stakeholder groups. For additional information on activities to reduce chemical contamination, please refer to Section III.

Elizabeth River Project
The Elizabeth River Project was founded in 1992 to build broad community involvement in restoring the environmental health of the Elizabeth River, a *Region of Concern*. This partnership includes businesses, educators, military and government representatives. In order to improve the conditions in the Elizabeth River, the Elizabeth River Project's Watershed Action Team developed and implemented a detailed Watershed Action Plan which outlines specific guidelines to combat the river's degraded status.

D. Geographic focus of the characterization

The Chesapeake Bay has a direct connection with the Atlantic Ocean. Because of the ocean tides, saltwater from the Atlantic is mixed in the Bay with freshwater derived from land runoff. The part of the Bay and its rivers that are influenced by the tide are referred to as the "tidal Bay" and "tidal rivers." Moving upstream, there comes a point at which the rivers are no longer influenced by the ocean tide. The portions of the rivers that are not under the influence of the tide are referred to as "non-tidal." The boundary between the non-tidal and tidal portions of a river is called the "fall line." The fall line is the physiographic boundary representing the natural geographic break between the non-tidal and tidal regions of the Bay watershed. On the western shore, Interstate 95 generally follows the path of the fall line.

Chemical contaminants entering the tidal rivers tend to get trapped in the rivers with only a small amount making it to the mainstem of the Bay [3]. The mainstem Bay was not characterized because levels of chemical contaminants tend to be very low and effects are unlikely. Techniques for detecting effects at these low levels are under development. The workgroup characterized the Bay's tidal rivers, as opposed to non-tidal rivers, because tidal waters are the focus of the Bay Program's chemical contaminant efforts. In addition, non-tidal waters were not targeted because the sites of many of the known toxics problems are in tidal waters, and most of the urban areas and toxics-related land use activities are adjacent to tidal waters. However, it is important to note that non-tidal waters -- above the fall line -- are also sources of chemical contamination. All waters in Pennsylvania are non-tidal; therefore, the workgroup did not characterize these rivers.

The Bay Program divided the Bay and its tidal rivers into a number of geographical segments for the purpose of identifying areas in the Bay with similar attributes for collecting, analyzing, and reporting data. The workgroup used this segmentation scheme to characterize 38 tidal river segments. Most of the western shore tidal rivers are divided into 3 segments, while most of the eastern shore rivers and the smaller western shore rivers are represented by one segment. Some segments may comprise more than one river. The characterization worked well at this spatial scale given the amount of data available. Also, this scale is appropriate for stakeholder groups who are often organized around a river or watershed.

The three *Regions of Concern* designated by the Executive Council in 1993 were not re-characterized because current chemical contaminant data support the previous characterizations.

E. Other characterization efforts

There are several characterization efforts that identify chemical contaminant-related problems in the Bay watershed. National efforts such as the Environmental Protection Agency (EPA) Environmental Monitoring and Assessment Program and National Oceanic and Atmospheric Administration's ongoing sediment characterization effort in the Bay are designed to compare estuarine and coastal conditions on a nationwide scale. The national datasets used in these efforts also were used in the Bay Program's characterization.

There are also several regional programs that characterize chemical contamination in the Bay's rivers. Each state/district is required by section 303(d) of the *Clean Water Act* to develop a list of impaired waterbodies that do not meet their designated uses, such as aquatic life use (including fish/shellfish consumption), recreational use (swimming and boating), and use as a public water supply. The 303(d) list helps focus regulatory efforts to reduce chemical contaminant impacts on living resources by reducing chemical contaminant loads into the Bay's rivers. The Bay Program's characterization goes beyond the *Clean Water Act* requirements and not only identifies chemical contaminant-related problem areas, but also identifies areas with potential chemical contaminant problems, areas with no observable chemical contaminant problems, and areas needing more data to assess chemical contamination problems. Such a

comprehensive characterization is essential to better target management actions (e.g., voluntary pollution prevention activities) in those areas with known chemical contaminants problems and target more assessments in areas with limited chemical contaminant information. Together, these efforts give the most complete, up-to-date picture possible based on the best available data.

The Bay Program strived to be as consistent as possible with the state/district 303(d) assessments, recognizing differences that may occur with the use of additional data and interpretative tools. The state/district impaired waterbody designations are mainly based on exceedences of EPA-approved water quality criteria and fish consumption advisories, with supporting evidence from any available sediment and biological data (e.g., assessments of benthic community in the sediment). Due to the regulatory nature of the 303(d) lists, sediment and biological data oftentimes do not serve as the sole basis for these characterizations, since there are no EPA-approved criteria. In this characterization, all available chemical contaminant and biological data were evaluated, using the best interpretative tools available, to characterize the probability of adverse effects on living resources due to chemical contamination in the Bay's tidal rivers. Maryland and Virginia state agency representatives were members of the workgroup and ensured coordination with the state 303(d) efforts.

II. *How were the characterizations determined?*

Before a final characterization of the Bay's tidal rivers could be developed, all available chemical contaminant and biological data were acquired. Due to the generally high cost of chemical contaminant assessments, the Bay Program relies heavily on data collected by federal/state agencies and research institutions in addition to Bay Program-funded assessments to use in targeting its chemical contaminant management and monitoring activities.

Two types of data were used in this characterization: *chemical contaminant concentration* and *effects* data. Most of the available data were contaminant concentration data (particularly sediment data) with very limited effects data.

Concentration data

Concentrations of chemical contaminants can be measured in the water column, the sediment, and in finfish or shellfish tissue. Living resources are exposed to these contaminant levels in their habitat.

Contaminant concentration data were compared to thresholds specified by the workgroup in order to determine whether or not the chemical contaminant data presented a threat to exposed living resources. A threshold is a chemical concentration level above which harmful effects on living resources are suspected to occur if the exposure to that chemical concentration is sufficient. Comparing available measured concentrations to chemical concentration thresholds is necessary because it is difficult to know with certainty when concentration data are responsible for harmful effects on the Bay's living resources.

Effects data

Laboratory toxicity data and benthic community data were considered "effects" data because they indicate the measurable effect chemical contaminants have on living resources. For example, the toxicity of a river's sediment and water can be determined by exposing sensitive Bay species to water and sediment samples in a laboratory and observing the chemical contaminant impacts (e.g., mortality, reduction in growth and reproduction, etc.). Chemical contaminant effects also can be measured in the rivers by directly assessing the effect of chemical contaminants on living resources inhabiting the rivers, such as benthic communities living in the sediment.

Characterization process

Finally, workgroup members weighed all available chemical contaminant data for each river segment and, based on their best professional judgement, developed consensus on the final characterizations. Many different factors were considered when reviewing the available data and making the characterizations, such as the quality of the data, the spatial and temporal distribution of the data, the frequency of elevated levels of chemical contaminants, and the correlation between elevated levels and effects on living resources. To make a characterization, all of the available data evaluated by the workgroup had to be reasonably consistent throughout an entire segment, describing the status of chemical contaminant effects on living resources. If data were spatially or temporally insufficient to represent the entire segment, or if data were conflicting or inconclusive in describing the entire segment, the workgroup characterized the segment as an *Area with Insufficient or Inconclusive Data*. The strength of this characterization is represented by the workgroup's technical knowledge of chemical contaminant data, its diversity of interests and membership, and its ability to discuss the data and reach a consensus on all segment characterizations.

As called for in the 1994 toxics strategy, the Bay Program signatories have committed to update this characterization every three years based on data collected since the previous evaluation. Triennial updates to the characterization will allow the Bay Program to assess progress in reducing the number of *Regions of Concern* and *Areas of Emphasis*, increasing the number of *Areas with Low Probability for Adverse Effects*, and eliminating all *Areas with Insufficient or Inconclusive Data*.

Limitations of Data

It is important to note that, to date, there is no Baywide monitoring program designed to characterize toxics conditions in the Chesapeake Bay's tidal rivers on the scale necessary to perform comparable assessments of all rivers. Information used for this characterization was collected for a wide variety of studies that were conducted for different purposes. The result of this collection is a dataset with uncoordinated and incomplete spatial and temporal coverage. The workgroup was faced with the challenge of piecing together these different datasets and developing a consistent set of decision rules for how to interpret this information in making a characterization. As such, this characterization has limitations in the level of detail at which it can characterize toxic effects on the Bay's living resources. Through increased funding, intensified coordination with federal and state toxics monitoring and research efforts, and intentional collaboration between Bay Program signatory states at the governmental and academic level to address Bay-wide issues, the gaps in data coverage will be filled.

III. *What will be done with this characterization?*

The primary value and utility of the characterization is in identifying areas that need additional monitoring and assessment to better characterize the status of toxic effects on living resources inhabiting those areas. This characterization can also serve as a planning tool to help the Chesapeake Bay Program determine the areas in which to focus its voluntary pollution prevention and reduction efforts and the areas in which to focus its voluntary preservation/conservation efforts. The characterization gives the State/District partners base information to allow them to conduct the more detailed risk assessment analysis, site specific analysis, and source assessment studies which may be necessary before regulatory actions can be taken. The Bay Program will use this characterization to help focus management and monitoring activities and reduce chemical contamination in the Bay's tidal rivers, but the public can supplement governmental efforts and provide valuable assistance in the restoration and protection of the Bay. The public can use this characterization by:

- taking action to reduce or eliminate chemical contaminants that enter the Bay and its tidal rivers by informing private citizens, industries, municipalities, military facilities, and state/local governments about a local river's characterization and the loadings into local waterbodies;
- calling attention to the lack of data or chemical contaminant conditions in local rivers and informing the Bay Program about ongoing local research studies;
- developing local watershed groups to call for better management of chemical contaminant problems in the public's waters;
- attending technical assistance workshops and public forums to learn more about chemical contaminant-related problems; and
- implementing pollution prevention in their communities to protect areas with a clean bill of health.

This characterization provides unique information about chemical contamination in the Bay's tidal rivers.

In the future, the Bay Program will strive to expand its chemical contaminant data, improve its interpretive tools, and improve its understanding of chemical contamination in the Bay's rivers to enhance this characterization.

IV. *What are the results of the characterization?*

Segment Profiles

The following segment profiles represent a summary of each segment characterization, including a brief justification of the characterization, the available data considered, and any caveats or limitations of the characterization. Where necessary, a section has been included on "caveats/limitations" of the characterization which indicates the workgroup's level of confidence in the characterization. Also included for each segment are additional assessments of each river

conducted by Maryland and Virginia as directed by the *Clean Water Act*. These assessments list any "water quality limited segments" (areas that are "impaired" or "threatened" by chemical contaminants) and any waters with fish consumption advisories. Together, the Bay Program characterization and the state assessments provide the most complete picture to date on chemical contamination in the Bay's tidal rivers based on the best available data.

It is important to note that areas identified by the states' assessments do not necessarily correspond to the segment characterizations because the purposes of the characterization and the state assessments are different. The purpose of the Bay Program characterization is to provide a status of chemical contaminant effects on the living resources inhabiting the Bay's tidal rivers. This characterization will serve as a planning tool to help target future monitoring and voluntary chemical contaminant reduction and prevention activities. The states' assessments are mandated by the *Clean Water Act* and serve as a regulatory tool for reducing loads of contaminants to impaired waters. Because of the regulatory nature of the states' assessments, the states place more weight on data that indicate levels of chemical contaminants that exceed EPA-approved thresholds, such as the EPA water quality criteria or State Water Quality Standards.

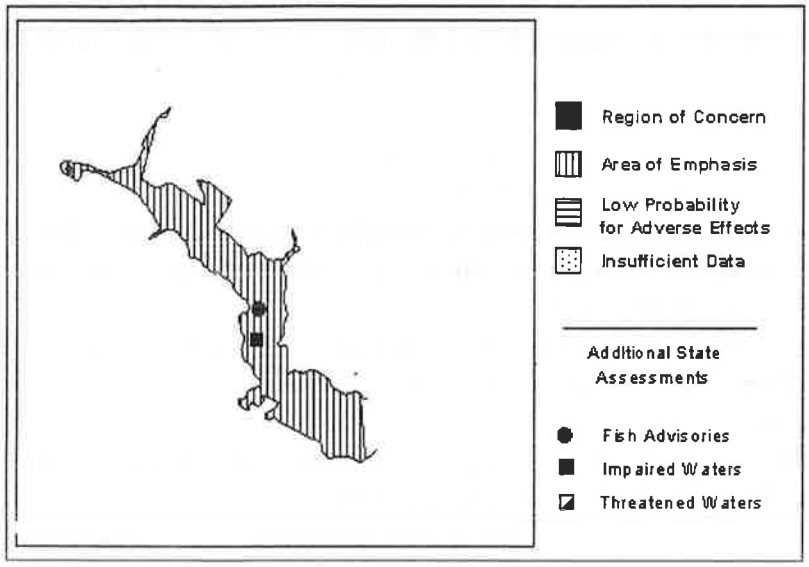
Overall, good spatial and temporal coverage of chemical contaminant concentration and effects data are lacking. If data were spatially or temporally insufficient to represent the entire segment, or if data were conflicting or inconclusive, the workgroup characterized the segment as an *Area with Insufficient or Inconclusive Data*. In most cases, more effects data (i.e., sediment and water toxicity tests and benthic community assessments) are needed to confirm initial characterizations or to make characterizations for those segments with insufficient or inconclusive data.

These profiles summarize evidence about adverse effects to living resources and the chemical contaminants that are likely causing the effects. Examples of contaminants that may cause effects are metals (such as copper, lead, mercury) and organic contaminants such as polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Metals come from both point and nonpoint sources from a variety of activities. PAHs come from the combustion of fossil fuels and from oil and grease used in cars. PCBs were used as fire retardants and can be found in older electric transformers and other machinery. Although PCBs and some pesticides are banned, they are still found in the environment. For information about the sources and loads of chemical contaminants entering the Bay and its tidal rivers, please refer to the *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory* (TLRI) [3]. As previously stated, this characterization provides the status of chemical contaminant effects on living resources. Coupled with the updated TLRI, this characterization will enable Bay Program managers to target their chemical contaminant reduction and prevention activities toward specific sources and chemicals in impacted areas. For information about how the Bay Program will use this information, see the Executive Summary of this report.

For More Information...

- For more information about the datasets used to support these characterizations, please refer to the technical workplan [1].
- For electronic copies of the data evaluated by the workgroup, please refer to the Bay Program Home Page at http://www.chesapeakebay.net or contact the Bay Program Office at 1-800 YOUR BAY. Note that where feasible, links are made to the actual datasets or summary reports/abstracts.
- For a copy of the *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory*, call the Bay Program Office at 1-800 YOUR BAY.
- For more information on Maryland's assessment of impaired waterbodies and fish consumption advisories, please refer to the Maryland Department of the Environment Home Page at http://www.mde.state.md.us.
- For more information on Virginia's assessment of impaired and threatened waterbodies, please refer to Virginia Department of Environmental Quality at http://www.deq.state.va.us.
- For more information on Virginia's fish consumption advisories, please refer to the Virginia Department of Health at http://www.vdh.state.va.us.

Tidal Back River, Maryland
Area of Emphasis

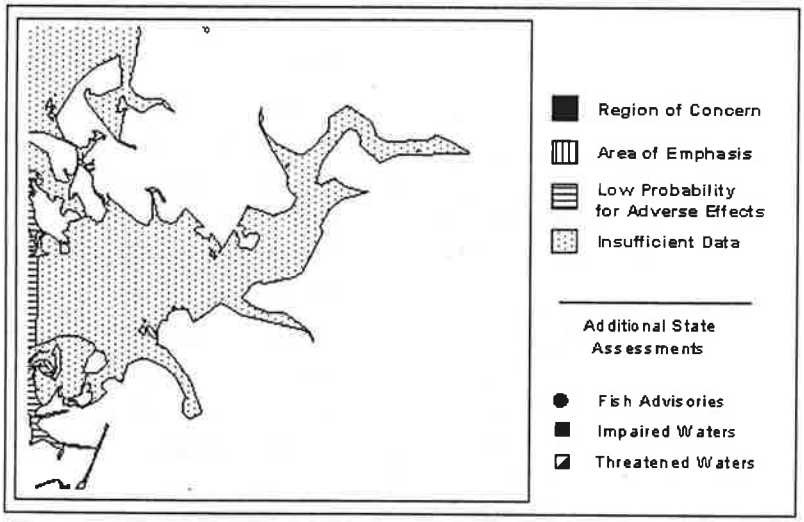


Summary: The tidal Back River was characterized as an *Area of Emphasis* because metals and polychlorinated biphenyls (PCBs) found throughout the river in sediment were at levels that indicate probable adverse effects on living resources. Additionally, there is an existing fish consumption advisory for eels and catfish due to chlordane contamination.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, effects data (sediment toxicity tests), and information on an existing fish consumption advisory in the river. The spatial coverage of the recent sediment contaminant concentration data was excellent and indicated a widespread distribution of metals, such as zinc and nickel (and in some areas, lead, mercury, and chromium), and PCBs at elevated levels that could cause adverse effects on the Bay's living resources. Only one out of four sediment samples taken from different areas of the Back River was found to be toxic to Bay organisms when exposed to the sediment in the laboratory. However, widespread, consistently elevated levels of metals and PCBs in the sediment, coupled with the existing fish consumption advisory in the Back River, was sufficient evidence of the potential for adverse effects in this river.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated this area as a chemical contaminant-impaired waterbody and placed it on a priority list of waters to manage. Currently, there is an advisory for the consumption of eels and catfish from Back river due to the presence of chlordane in the tissue of these fish.

Big Annemessex River, Maryland
Area with Insufficient or Inconclusive Data

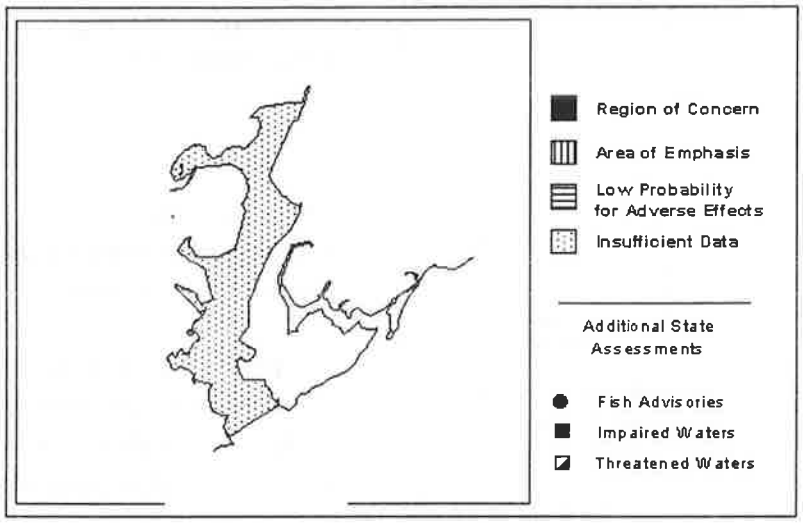


Summary: The Big Annemessex was characterized as an *Area with Insufficient or Inconclusive Data* because data were temporally and spatially, insufficient to describe the conditions in the river.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and effects data (benthic community assessments). The spatially limited sediment chemical contaminant concentration data did not indicated chemical contaminant levels that would cause probable adverse effects on living resources. However, benthic communities were degraded at two out of the four areas sampled, with the cause unknown. Additional assessments in this river are needed to describe the condition of the river.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination.

Tidal Bush River, Maryland
Area with Insufficient or Inconclusive Data

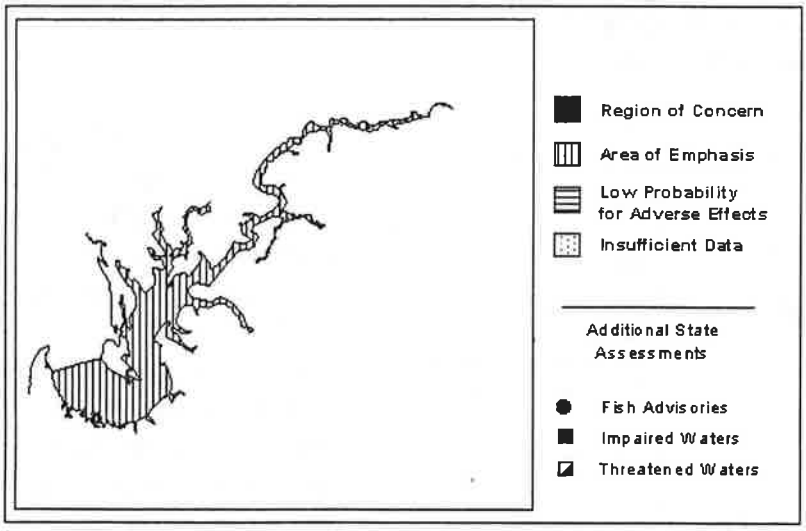


Summary: The tidal Bush River was characterized as an *Area with Insufficient or Inconclusive Data* because data were insufficient to describe conditions in the river. The spatial coverage of the sediment chemical contaminant concentration data was very poor and there was no available water or fish tissue chemical contaminant concentration data or effects data.

Results and Justification: The only data available for this river were sediment chemical contaminant concentration data which were spatially insufficient for describing the entire river. The Aberdeen Proving Ground is in the process of submitting electronic data to the Bay Program from a recently conducted ecological risk assessment of the Bush River. Therefore, this river has been initially characterized as an *Area with Insufficient or Inconclusive Data* until the new data are available and analyzed for future updates to the characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination.

Chester River, Maryland
Area of Emphasis, with the need for additional data to confirm characterization



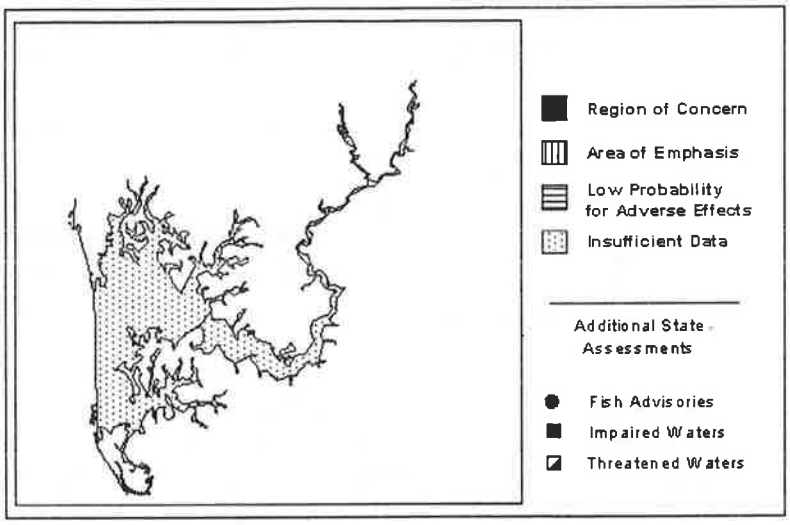
Summary: The Chester River was characterized as an *Area of Emphasis* because available water and sediment toxicity data and the elevated levels of a few pesticides and metals in some areas of the river indicated the potential for adverse effects on living resources.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water, sediment, and fish tissue and effects data (water/sediment toxicity tests and benthic community assessments). The sediment in the upper portions of the Chester River was found to cause adverse effects on Chesapeake Bay organisms exposed to it in the laboratory. Two banned pesticides, Dieldrin and DDT, were found in these sediments and may have contributed to some of the biological effects observed. Metal toxicity is unlikely. The ambient water was also found to cause adverse effects on Chesapeake Bay organisms exposed to it. In laboratory studies, sediment from the upper reach of the Chester River was more toxic to animals that live in the sediments than most other sediments tested in the Bay (ranking seventh out of 46 stations sampled in 16 rivers Baywide). Water from another station in the upper reach of the Chester River was more toxic to animals that live in the water than most other water samples tested in the Bay (also ranking seventh out of 46 stations sampled Baywide). DDT in the upper portion of the river and lindane, arsenic, and nickel in the lower portion of the river were at levels in the sediment that indicate adverse effects on living resources. Fish tissue data were too old to be representative of current conditions. Although elevated levels of contaminants in the sediment were not pervasive and effects data were lacking in the lower portion of the river, the elevated sediment contaminant levels and the observed water and sediment toxicity data provided sufficient evidence of the potential for adverse effects in this river.

Caveats/Limitations: Several workgroup members favored characterizing the Chester River as an *Area with Insufficient or Inconclusive Data* based on what they perceived as inconclusive chemical contaminant concentration and effects data. The characterization of this river was driven largely by the observance of water and sediment toxicity at sites in the upper and middle portions of the river. However, for the most part, measured contaminants at these sites were below probable effects levels. Data for the lower reaches were dated and toxicity information was lacking. The benthic community data, which was fairly extensive both spatially and temporally, suggested the presence of healthy indigenous populations in more than half of the sites sampled. The degraded benthic communities appeared to be related to low dissolved oxygen levels. Future assessments of both chemical contaminant concentration and effects data are recommended to confirm this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this segment as impaired by chemical contaminants. Based on the data evaluated by the state, there was no evidence of a water quality standards violation. Furthermore, the Bay Program characterization considered additional data that were not included in the state's analysis. Future state efforts will consider additional data, as it becomes available.

Upper and Lower Choptank River, Maryland
Area with Insufficient or Inconclusive Data

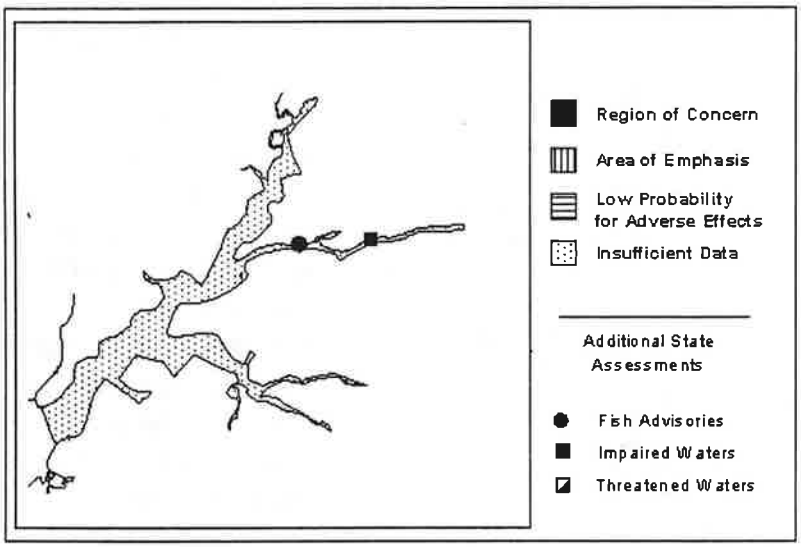


Summary: The Choptank River (both upper and lower segments) was characterized an *Area with Insufficient or Inconclusive Data* because the available sediment chemical contaminant concentration data were insufficient temporally and spatially, and the fish tissue chemical contaminant concentration data were too old to represent current conditions. No water chemical contaminant concentration or toxicity effects data were available.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and fish tissue and effects data (benthic community assessments). Although sediment data were insufficient to describe the entire river, the levels indicated a low probability of adverse effects on living resources. Benthic community data were inconclusive, since the main cause of degraded communities is likely low dissolved oxygen levels. Water and sediment chemical contaminant concentration, water and sediment toxicity tests, and benthic and fish community assessments were conducted on the Choptank in 1998 through a Bay Program funded study. Once these data are available, they will be used to update this characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination.

Elk and Bohemia Rivers, Maryland
Area with Insufficient or Inconclusive Data, with a potential metals contamination problem in the sediment.

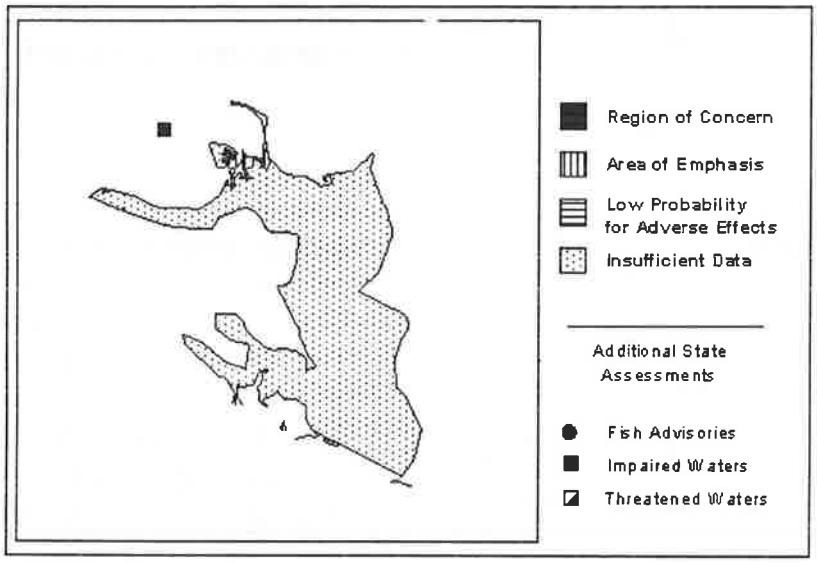


Summary: The Elk and Bohemia Rivers segment was characterized as an *Area with Insufficient or Inconclusive Data* because the data were insufficient to describe the conditions of the segment. The available sediment data were too limited spatially and temporally, water data were too old, and benthic data were too limited spatially to adequately describe the entire segment.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and water and effects data (benthic community assessments). Although the data were too limited for describing the entire segment, there was evidence for the potential for adverse effects on living resources. The available sediment data indicated metals such as lead, silver, copper, cadmium, arsenic, zinc, and nickel at levels well above those indicative of causing adverse effects on living resources. Older water data also showed elevated levels of copper and nickel. Furthermore, benthic communities were degraded in several areas of this segment where low dissolved oxygen levels do not appear to be the cause. Further assessments in this segment will help to confirm this suspected metals contamination problem.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated a section of the Elk River as a chemical contaminant-impaired waterbody and placed it on a priority list of waters to manage. In May 1999, a fish consumption advisory was issued in the C&D Canal for no consumption of all finfish species due to PCBs. This information will be considered in making a future characterization of this segment once all available data have been acquired.

Tidal Gunpowder River, Maryland
Area with Insufficient or Inconclusive Data



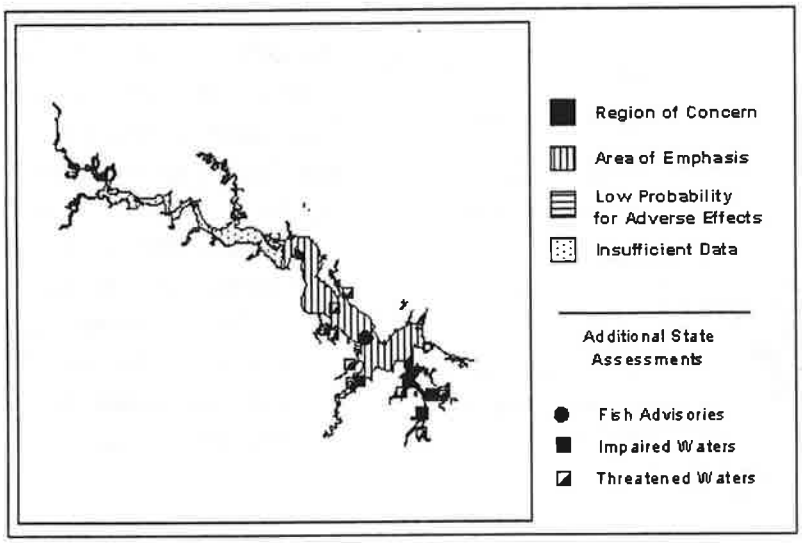
Summary: The tidal Gunpowder River was characterized as an *Area with Insufficient or Inconclusive Data* because the data were insufficient to describe the segment. The spatial coverage of the sediment chemical contaminant concentration data was very poor, and there were no available ambient water or fish tissue chemical contaminant concentration data or effects data.

Results and Justification: The only data available for this river were sediment chemical contaminant concentration data which were spatially insufficient for describing the entire river. The Aberdeen Proving Ground is in the process of submitting electronic data to the Bay Program from a recently conducted ecological risk assessment of the Gunpowder River. Therefore, this river has been initially characterized as an *Area with Insufficient or Inconclusive Data* until the new data are available and analyzed for future updates to the characterization.

Caveats/Limitations: Future assessments of effects in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated a section in the upper portion of the river as a chemical contaminant-impaired waterbody by heavy metals and placed it on a priority list of waters to manage. This information will be considered by the Bay Program in making a future characterization of this area once all available data have been acquired.

Upper Tidal James River, Virginia
Area with Insufficient or Inconclusive Data, with some evidence of a potential contaminant problem.

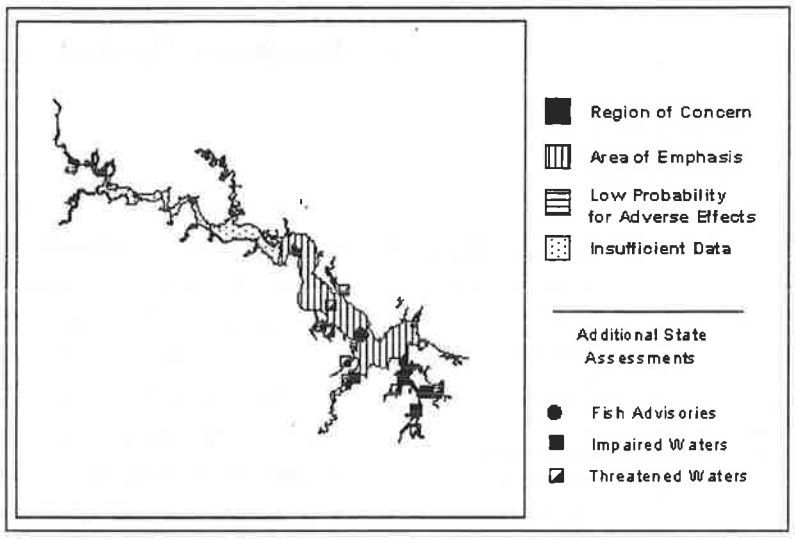


Summary: The upper tidal James River was characterized as an *Area with Insufficient or Inconclusive Data* because data were insufficient to describe the segment. Data were not available for those chemical contaminants that were thought to be problematic in this system due to historic or current use. Additionally, water and fish tissue chemical contaminant concentration data were insufficient, and effects data were lacking.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, water, and fish tissue. Effects data were lacking. Although sediment levels of the contaminants measured showed a low probability for adverse effects on living resources, many of the chemicals that were thought to be problematic, such as kepone, were not measured. Although the spatial coverage of water chemical contaminant concentration data was lacking, the available data indicated metals such as chromium, copper, iron, lead, and zinc were at levels in the water that indicate the potential for adverse effects on living resources. More relevant chemical contaminant concentration data need to be collected, along with effects data, to better describe this system.

Additional State Assessments: Currently, this area is included in a health advisory for the James River due to earlier fishing bans caused by kepone, a substance that has since been banned. The health advisory covers the mainstem James River and all tidal tributaries from the fall line at Richmond to the Hampton Roads-Norfolk Bridge Tunnel. In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate this area as an impaired or threatened waterbody.

Middle Tidal James River, Virginia
Area with Insufficient or Inconclusive Data

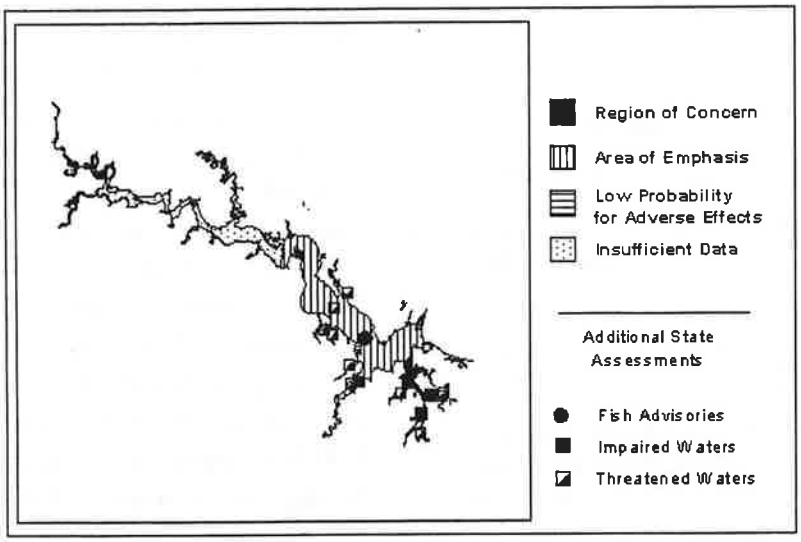


Summary: The middle portion of the tidal James River was characterized as an *Area with Insufficient or Inconclusive Data* because data were insufficient to describe the segment. The spatial coverage of sediment chemical contaminant concentration and effects data was poor and there was no recent water or fish tissue chemical contaminant concentration data.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and water and effects data (one sediment toxicity test). Spatial coverage of sediment chemical contaminant concentration data was poor, and water chemical contaminant concentration data were too old. Although sediment in the lower portion of the segment was found to cause adverse effects on Bay organisms exposed to it in the laboratory, spatial coverage of effects data were too limited to describe the entire system.

Additional State Assessments: Currently, this area is included in a health advisory for the James River due to earlier fishing bans caused by kepone, a substance that has since been banned. The health advisory covers the mainstem James River and all tidal tributaries from the fall line at Richmond to the Hampton Roads-Norfolk Bridge Tunnel. In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate this area as an impaired or threatened waterbody.

Lower Tidal James River, Virginia
Area of Emphasis, with special concern for Willoughby Bay



Summary: The lower tidal portion of the James River was characterized as an *Area of Emphasis* because available water and sediment toxicity data for Willoughby Bay indicated evidence of adverse effects on the Bay's living resources, most likely due to metals contamination. Since toxicity also was observed further upstream in the James River, the entire segment was characterized as an *Area of Emphasis*. The Elizabeth River was excluded from this characterization because it has been previously designated a *Region of Concern* in 1993.

Results and Justification: This segment was one of the most extensively sampled segments in all of the tidal tributaries of the Bay. The available data considered in making this characterization were chemical contaminant concentration data collected throughout the segment for water, sediment, as well as fish tissue and effects data (water and sediment toxicity tests) collected in the lower and middle portions of the segment. The data convey a consistent record for the potential for adverse effects on the Bay's living resources.

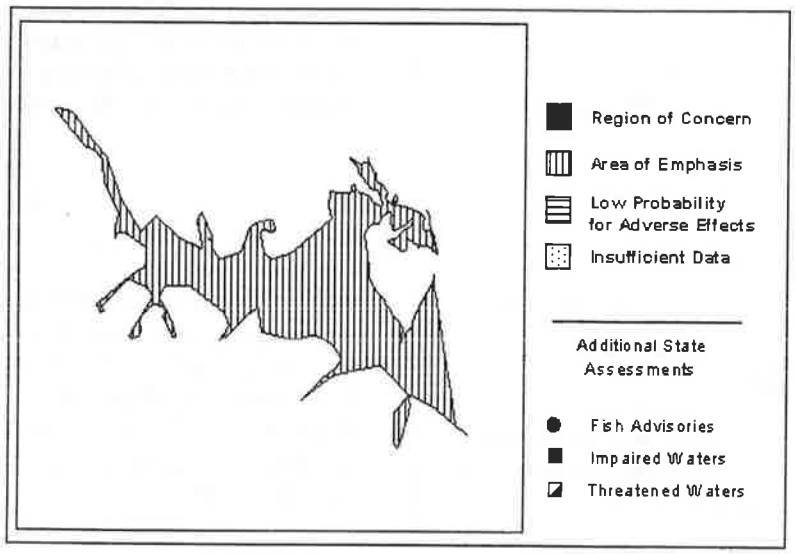
Both the water and sediment in Willoughby Bay were found to cause adverse effects to Bay organisms exposed to the water and sediment in the laboratory. In laboratory studies, water and sediment from the Willoughby Bay was more toxic to animals that live in the Bay than almost all other sites tested in the Bay (ranking third and fifth respectively out of 46 stations sampled in 16 rivers Baywide). These stations ranked slightly less toxic than stations sampled in the nearby Elizabeth River, a known "toxic hot spot," or *Region of Concern*. The combined toxicity of metals in the sediment such as arsenic, copper, lead, mercury, nickel, and zinc may account for a major portion of the toxicity observed in Willoughby Bay. Organic contaminants such as pesticides and polynuclear aromatic hydrocarbons (PAHs) were not detected.

Available data also provided evidence for chemical contamination problems in areas of this segment outside Willoughby Bay. Sediment and water at two locations above and below Newport News in the middle portion of the segment were found to cause adverse effects on Bay organisms, but to a lesser degree than in Willoughby Bay. Additionally, contaminant concentrations in ambient water in the upper portion of the segment in 1990 revealed levels of copper, zinc, and nickel high enough to raise concern about the potential for adverse effects in this area. Although these data are too old to represent current water conditions and analysis methods have improved since these data were collected, they provided supporting evidence for the potential for upstream problems.

Caveats/Limitations: Sediment contaminant concentration data for kepone and tributyltin, two substances of great concern in this region, were not available. Future assessments in the upper portion of this segment will be helpful in better characterizing the degree of toxicity upstream.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia designated sections of this segment as "threatened waters" due to chemical contamination. Currently, this river segment is included in a health advisory for the James River due to earlier fishing bans caused by kepone, a substance that has since been banned. The health advisory covers the mainstem James River and all tidal tributaries from the fall line at Richmond to the Hampton Roads Bridge Tunnel.

Tidal Magothy River, Maryland.
Area of Emphasis, with the need for additional data to confirm characterization



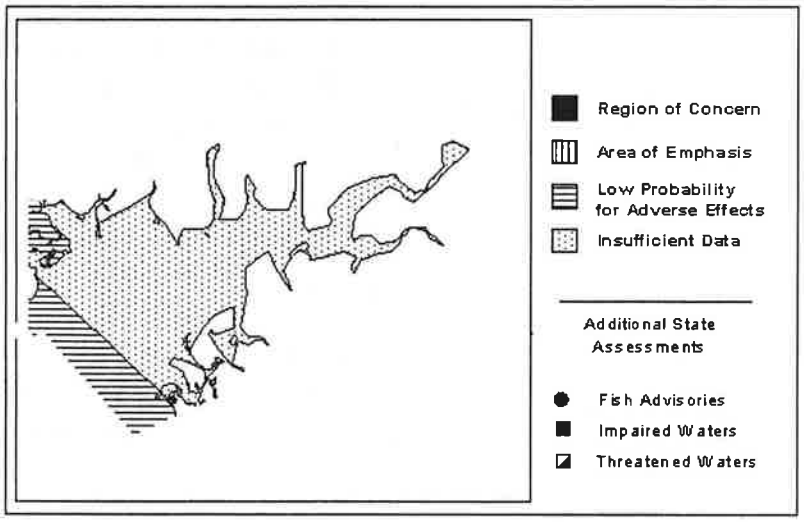
Summary: The tidal Magothy River was characterized as an *Area of Emphasis* because sediment contaminant levels and sediment and water toxicity tests provided evidence of adverse effects on the Bay's living resources. Contaminants in the sediment such as arsenic and polynuclear aromatic hydrocarbons (PAHs) were at levels where adverse effects on living resources are probable.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and water and effects data (sediment and water toxicity tests, benthic community assessments). The water and sediment in the Magothy River was found to cause adverse effects on Bay organisms exposed to the water and sediment in the laboratory. The sediment in the upstream area near South Ferry was found to more toxic than the sediment in lower portion of the river at Gibson Island. The sediment near South Ferry was more toxic to animals that live in the sediments than most other sediments tested in the Bay (ranking ninth out of 46 stations sampled in 16 rivers Baywide. Sediment contaminant concentrations of lead, arsenic, and PAHs were elevated to levels where adverse effects on living resources are probable. Downstream, where there was a lesser degree of toxicity, levels of PAHs were elevated. Degraded benthic communities appear to be caused by low dissolved oxygen levels. Although the spatial coverage of data was somewhat limited, the evidence of elevated levels of contaminants and associated toxicity, both upstream and downstream, was sufficient evidence of the potential of adverse impacts in this river.

Caveats/Limitations: The characterization of this river was driven largely by the observance of water and sediment toxicity at sites in the upper and middle portions of the river. However, with the exception of a few contaminants, many of the measured contaminants were below levels that may cause probable effects on living resources. Future assessments of both chemical contaminant concentration and effects data are recommended to confirm this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this segment as impaired by chemical contaminants. Based on the data evaluated by the state, there was no evidence of a water quality standards violation.

Manokin River, Maryland
Area with Insufficient or Inconclusive Data

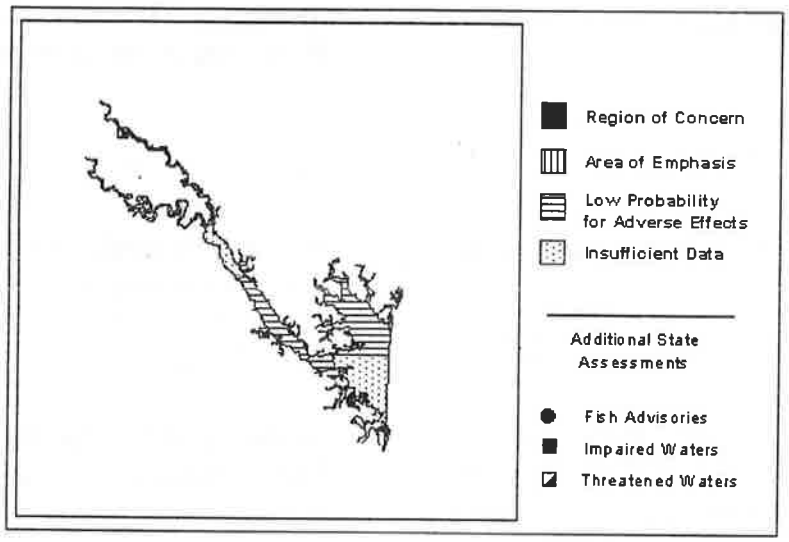


Summary: The Manokin River was characterized as an *Area with Insufficient or Inconclusive Data* because data were insufficient both spatially and temporally to describe the conditions in the river. Additionally, some of the available data were inconclusive.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and fish tissue and effects data (benthic community assessments). Sediment chemical contaminant concentration data were spatially and temporally limited and fish tissue data were too old to represent current conditions in the segment. Although the sediment chemical contaminant concentration data indicate levels of chemical contaminants that were unlikely to cause adverse effects on living resources, benthic communities in one out of the three areas sampled were degraded, and low dissolved oxygen does not appear to be a problem. Additional assessments are necessary to characterize this river.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination.

Tidal Mattaponi River, Virginia
Area with Insufficient or Inconclusive Data

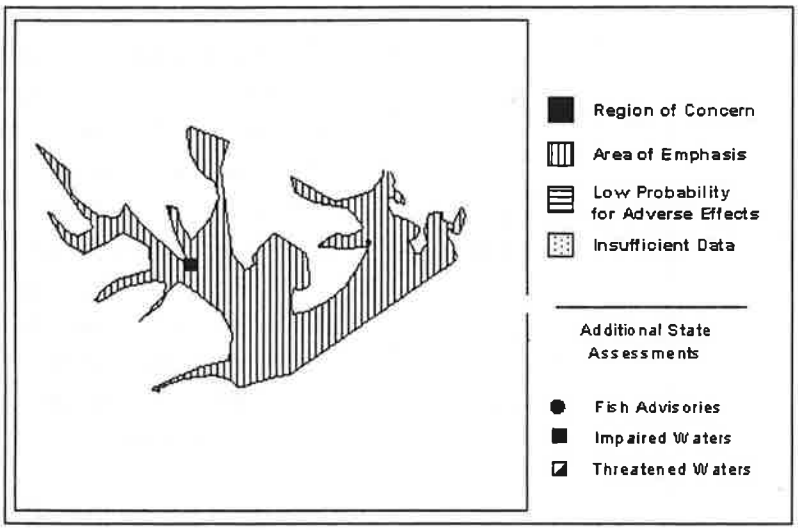


Summary: The tidal Mattaponi River draining into the York River was characterized as an *Area with Insufficient or Inconclusive Data* because data was insufficient to describe the segment. The spatial coverage of the sediment chemical contaminant concentration data was very poor, and there were no other data available.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment. The spatial coverage of sediment data was spatially insufficient to describe the river. Additional assessments are necessary in this river to characterize any chemical contaminant related problems.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia designated a small section in the upper portion of this river as threatened by chemical contamination. This information will be considered in making a future characterization of the entire river once all available data have been acquired.

Tidal Middle River, Maryland
Area of Emphasis, with limited data in eastern portion of river



Summary: The tidal Middle River was characterized as an *Area of Emphasis* because available water chemistry and toxicity data provided evidence of a chemical contaminant problem thought to be associated with metals contamination. Data for the eastern portion of the river were lacking.

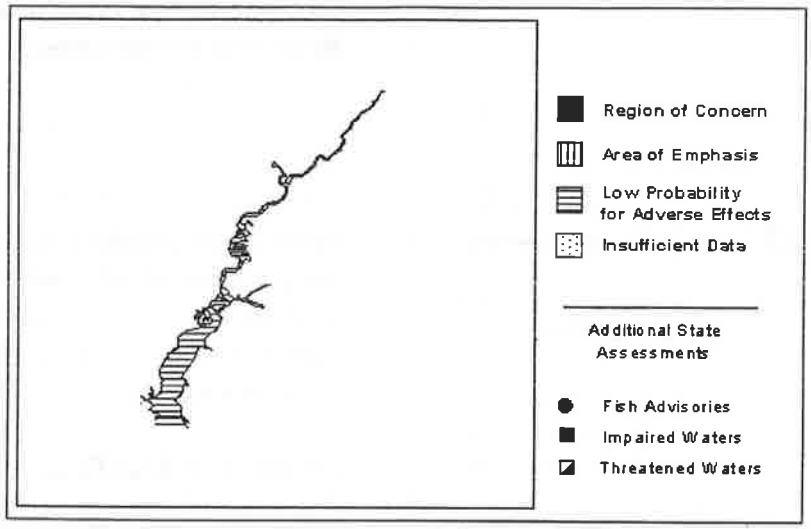
Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water and sediment and effects data (water and sediment toxicity tests). Although data are lacking for the eastern section of the river, the elevated levels of metals in the water column and the associated ambient water toxicity were sufficient data to indicate the potential for adverse effects in this river.

Water collected from the Middle River in both the fall and spring seasons was found to cause adverse effects to Bay organisms when exposed to it in the laboratory. This toxicity was thought to be caused by metals such as copper and nickel which were at levels that could cause adverse effects on living resources. When compared to a total of 46 stations sampled in 16 rivers Baywide, the two sites tested for ambient toxicity in the Middle River ranked fourth and eighth highest for ambient water toxicity. Although sediment toxicity was not observed, elevated levels of lead, nickel, zinc, and several polynuclear aromatic hydrocarbons (PAHs) were detected.

Caveats/Limitations: Future assessments in the eastern portion of this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated this area as a chemical contaminant-impaired waterbody and placed it on a priority list of waters to manage.

Nanticoke River, Maryland
Area with Low Probability for Adverse Effects, with the cause of benthic degradation unknown.



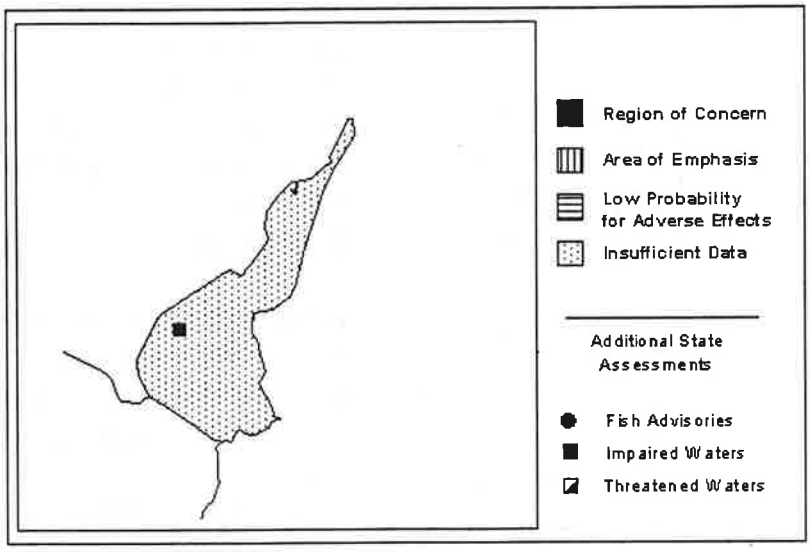
Summary: The Nanticoke River was characterized as an *Area with Low Probability for Adverse Effects* because levels of contaminants in the water and sediment were below those associated with adverse effects on living resources. Additionally, the sediment and water showed no toxicity, and benthic communities were healthy.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and effects data (water/sediment toxicity tests and benthic community assessments). The levels of contaminants in the sediment are below levels associated with adverse effects on living resources. The sediment and water showed no significant toxicity when Bay organisms were exposed to the water and sediment in the laboratory. Benthic communities were healthy at two out of the three sites sampled. The cause of benthic degradation at the third site does not appear to be due to sediment contamination. Although the spatial coverage of data was sparse, the high level of confidence in the ambient toxicity data indicating no effects and the supporting chemical contaminant concentration and benthic community data provided enough weight of evidence to assume a low probability for adverse effects in this river.

Caveats/Limitations: At one station, the cause of benthic community degradation is unknown. The degradation does not appear to be due to low dissolved oxygen nor due to chemical contamination. The workgroup did not have a reason to believe that contaminants in the sediment were higher than those thought likely to cause adverse effects on living resources. Future assessments should clarify the cause of this benthic degradation.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this area as impaired by chemical contamination.

Northeast River, Maryland
Area with Insufficient or Inconclusive Data

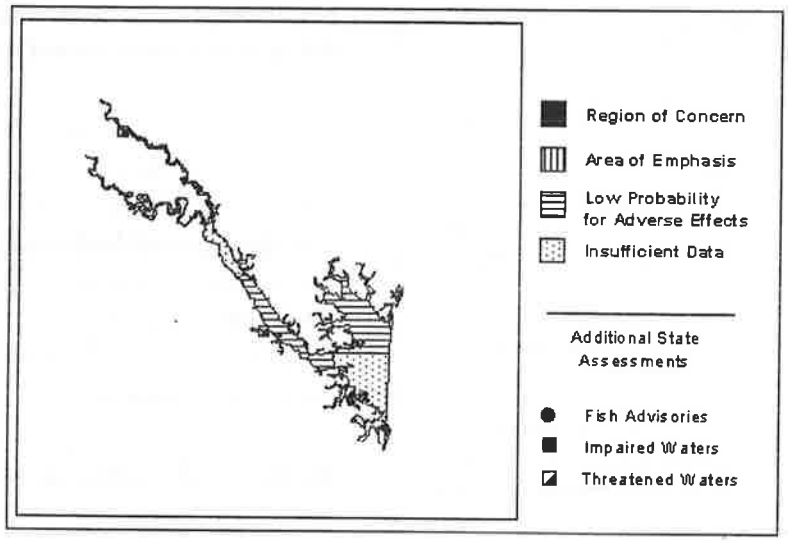


Summary: The Northeast River was characterized as an *Area with Insufficient or Inconclusive Data* because the temporal and spatial coverage of sediment data was insufficient to describe the system. No water or fish tissue chemical contaminant concentration data or effects data were available.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment. No effects data were available. The sediment chemical contaminant concentration data revealed metals such as arsenic, zinc, and nickel and a few polynuclear aromatic hyrdocarbons (PAHs) at levels that indicate probable adverse effects on living resources. Although these data provided evidence for the potential for adverse effects, data were too sparse to adequately characterize the entire river.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated a section in the lower portion of the river as a chemical contaminant-impaired waterbody and placed it on a priority list of waters to manage. This information will be considered in making a future characterization of this area once all available data have been acquired.

Tidal Pamunkey River, Virginia
Area with Insufficient or Inconclusive Data

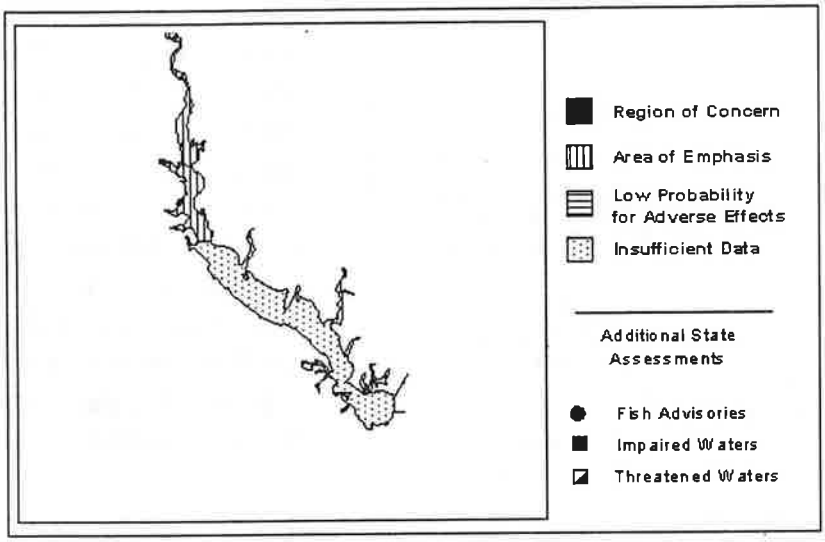


Summary: The tidal Pamunkey River was characterized as an *Area with Insufficient or Inconclusive Data* because data conflicted and were therefore inconclusive.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and water and effects data (sediment toxicity test). Overall, the fairly good spatial coverage of recent sediment data showed levels of chemical contaminants that are considered unlikely to cause adverse effects on living resources. However, at one site in the lower portion of the river, polynuclear aromatic hydrocarbons (PAHs) were found at levels in the sediment that are thought to cause probable adverse effects. Additionally, the sediment in the lower portion of the river showed evidence of adverse effects to Bay organisms exposed to it in the laboratory, although little weight was placed on these data due to poor survival of test organisms in the control (clean) sediments during the laboratory test. Because data were conflicting, this river has been initially characterized as an *Area with Insufficient or Inconclusive Data*. Additional assessments are needed to make a characterization in the future.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate the river as impaired by chemical contamination.

Upper Tidal Patuxent River, Maryland
Area of Emphasis



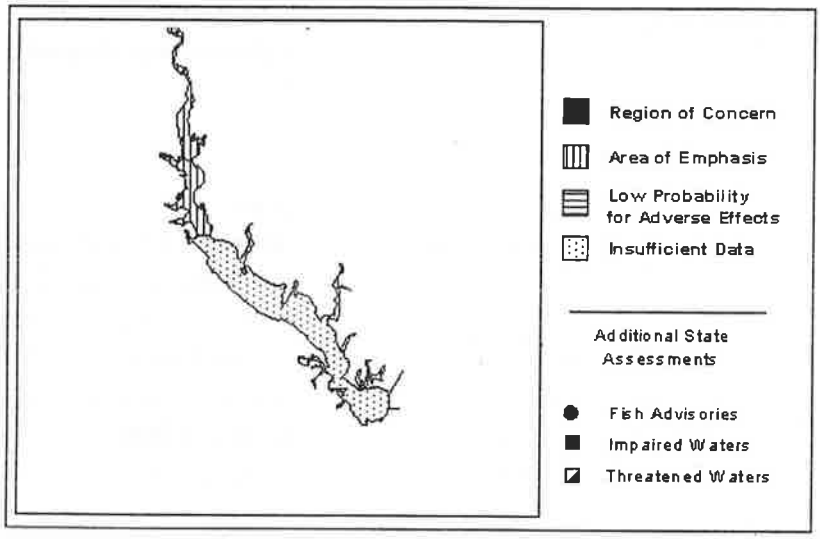
Summary: The upper tidal Patuxent was characterized as an *Area of Emphasis* because available data indicated that levels of pesticides in the water and sediment were at levels that indicate probable adverse effects on living resources, with supporting evidence of water toxicity and degraded benthic communities.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water and sediment and effects data (sediment toxicity tests). Pesticides in the water (chlorpyrifos and malathion) and sediment (DDT) were at levels indicative of probable adverse effects on living resources in both the upper and lower portions of the segment. The water in the lower portion of the segment was slightly toxic to Chesapeake Bay organisms exposed to the water in the laboratory. Benthic communities were degraded at several sites in the middle portion of the river and may be a result of chemical contamination, since dissolved oxygen levels do not appear to be problematic. Polynuclear aromatic hydrocarbons were at levels in the sediment that indicate probable adverse effects on living resources in the lower portion of the segment, although sediment toxicity was not observed. The weight of sediment and water chemical contaminant concentration data, water toxicity data, and the degraded benthic communities was enough to characterize this segment as an *Area of Emphasis*.

Caveats/Limitations: Future assessments of effects in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated portions of this segment as impaired and placed it on a priority list to manage. The Bay Program characterization considered additional data that were not available at the time of the state's analysis. Future state efforts will consider additional data, as it becomes available.

Middle Tidal Patuxent River, Maryland
Area of Emphasis



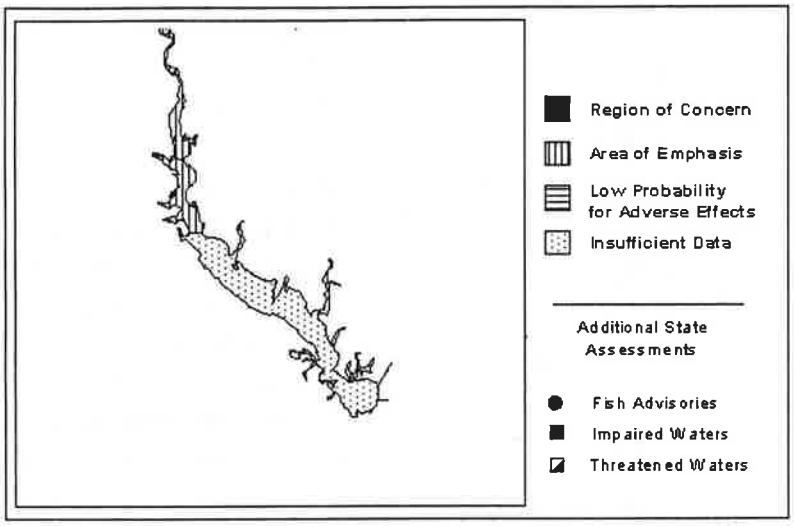
Summary: The middle section of the tidal Patuxent River was characterized as an *Area of Emphasis* because available data indicated that pesticides in the water and sediment were at levels that indicate probable adverse effects on the Bay's living resources. Additionally, the water and sediment were found to be toxic.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water, sediment, and fish and effects data (water and sediment toxicity tests). In the upper portion of the segment, recent pesticide (chlorpyrifos) levels in the water and sediment were at levels indicating probable adverse effects on living resources. In the lower portion of this segment, metals and the banned pesticide DDT were found at levels that could cause adverse effects on living resources. Additionally, the water and sediment were found to cause adverse effects on Bay organisms exposed to the water and sediment in the laboratory. The contaminant levels, coupled with water and sediment toxicity, provided evidence of a chemical contaminant problem in the lower portion of this segment. Even though the fish tissue data were too old to be representative of current conditions and the spatial coverage of the sediment and water contaminant concentration data was not adequate, the water and sediment chemical contaminant concentration and effects data provide sufficient evidence for the potential for adverse effects on living resources in this section of the Patuxent River.

Caveats/Limitations: Future assessments of effects in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this area as impaired by chemical contaminants. Based on the data evaluated by the state, there was no evidence of a water quality standards violation. Furthermore, the Bay Program characterization considered additional data that were not available at the time of the state's analysis. Future state efforts will consider additional data as it becomes available.

Lower Tidal Patuxent River, Maryland
Area with Insufficient or Inconclusive Data, with potential for toxicity near Broomes Island.



Summary: The lower tidal Patuxent River was characterized as an *Area with Insufficient or Inconclusive Data*, with the potential for toxicity in the middle of the segment, near Broomes Island. Although there was fairly good spatial coverage of recent water and sediment chemical contaminant concentration data and effects data were available, the data were inconclusive and did not provide consistent, conclusive evidence to make a segment-wide characterization.

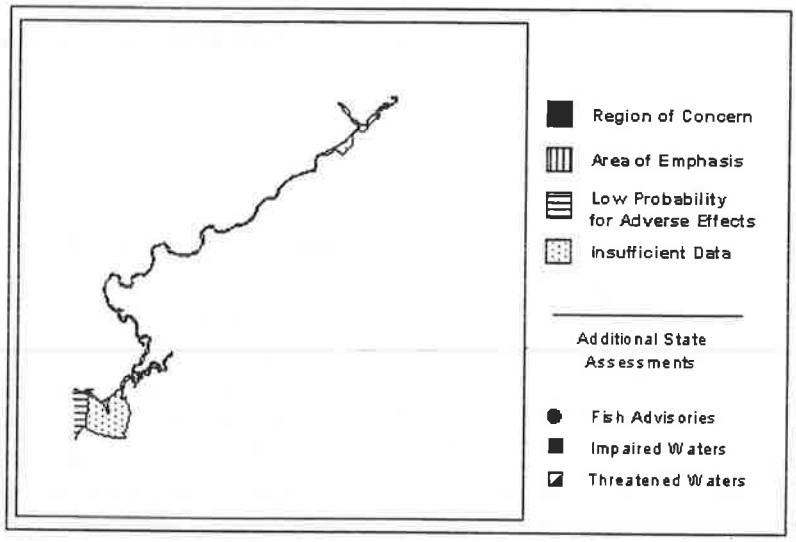
Results and Justification: The available data considered in making this characterization were sediment, water, and fish tissue chemical contaminant concentration data and effects data (sediment/water toxicity tests and benthic community assessments). Near Broomes Island, water taken from the river was found to cause adverse effects to Bay organisms exposed to it in the laboratory. In the laboratory studies, water from near Broomes Island was more toxic to animals that live in the water than almost all other waters tested in the Bay (ranking third out of 46 stations sampled in 16 rivers Baywide). Benthic communities in this area were degraded, although sediment toxicity was not reported. Additionally, a pesticide (endosulfan II) was at levels indicative of probable adverse effects on living resources.

Although the spatial coverage of recent water and sediment chemical contaminant concentration data was good and biological effects data were available, the data did not provide sufficient evidence of a segment-wide chemical contaminant problem to characterize the entire segment as an *Area of Emphasis*. Likewise, the majority of the segment could not be considered an *Area with Low Probability for Adverse Effect* because some metals such as arsenic and nickel upstream of Broomes Island were at levels in the sediment that are associated with probable adverse effects on living resources. Additionally, benthic communities were degraded in several areas throughout the segment. Since the data were inconclusive, this area was characterized as an *Area with Insufficient or Inconclusive Data*. Additional assessments are needed to better characterize the nature of chemical contaminant-related problems in this segment.

Caveats/Limitations: Future assessments of effects in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination. Based on data evaluated by the state, there was no evidence of a water quality standard violation. Furthermore, the Bay Program characterization considered additional data that were not included in the state's analysis. Future state efforts will consider additional data as it becomes available.

Pocomoke River, Maryland/Virginia
Area with Insufficient or Inconclusive Data

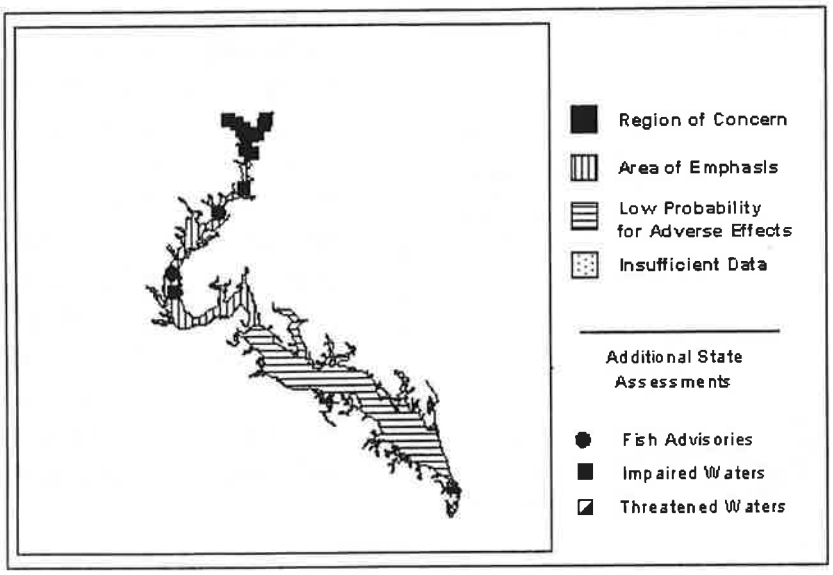


Summary: The Pocomoke River was characterized as an *Area with Insufficient or Inconclusive Data* because the available data were insufficient to describe the segment. The sediment chemical contaminant concentration data were too limited temporally and spatially to adequately describe the system, and no water chemical contaminant concentration data or effects data were available.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and fish tissue. No effects data were available. Although the sediment chemical contaminant concentration data were too limited to describe the river, the available data indicated the unlikelihood of adverse effects on living resources. At the time this characterization was made, a preliminary study found elevated levels of metals (arsenic, selenium, and lithium) and steroids in the water. Follow-up studies are under way and will be used to update this characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland and Virginia did not designate the river as impaired by chemical contamination.

Upper Tidal Potomac River, Maryland
Area of Emphasis



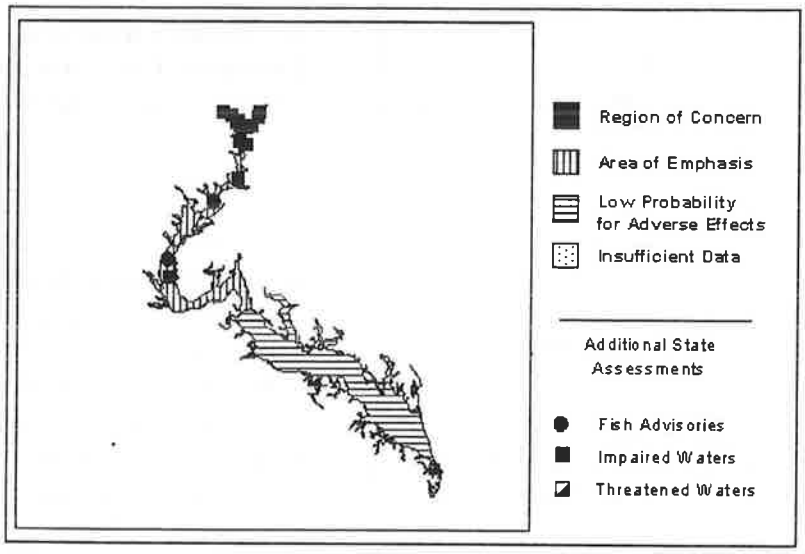
Summary: The portion of the tidal Potomac River was characterized as an *Area of Emphasis* because metals were found in sediment throughout the river at levels that suggest probable adverse effects on living resources. Available sediment toxicity data in the lower portion of this segment indicated adverse effects on living resources, most likely due to the presence of metals contamination. The Anacostia River was excluded from this characterization because it has been previously designated a *Region of Concern* in 1993.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water, sediment, and fish tissue and effects data (water and sediment toxicity tests). There was good spatial coverage of sediment chemical contaminant concentration data. Metals such as copper, zinc, and nickel were found in sediment throughout the river at levels that indicate probable adverse effects on living resources. At various locations in the segment, polychlorinated biphenyls (PCBs) were at levels that indicate possible adverse effects on living resources. Elevated levels of polynuclear aromatic hydrocarbons (PAHs) were detected in the sediment downstream of the Anacostia River. The sediment collected from the lower portion of this segment was found to cause adverse effects to Bay organisms when exposed to it in the laboratory. When compared to a total of 46 stations sampled in 16 rivers Baywide, one station ranked tenth highest for sediment toxicity, most likely due to metals. Even though no effects data were available for the upper portion of this segment, the pervasive elevated levels of metals, the persistent elevated levels of PAHs in the upper portion of the segment, and the sediment toxicity observed in the lower portion of the segment provided sufficient evidence of the potential for adverse effects in this section of the Potomac River.

Caveats/Limitations: Future assessments of effects in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated a portion of this segment as impaired. This area has been placed on a priority list of waters to manage. In April 1999, a PCB fish consumption advisory was placed on the tidal Potomac River (from the Woodrow Wilson Bridge to Smith Point, MD/Brent Point) for channel catfish larger than 18 inches (limit consumption to no more than 1 8 oz meal/month). In addition, caution was recommended when eating carp and eel.

Middle Tidal Potomac River, Maryland
Area of Emphasis



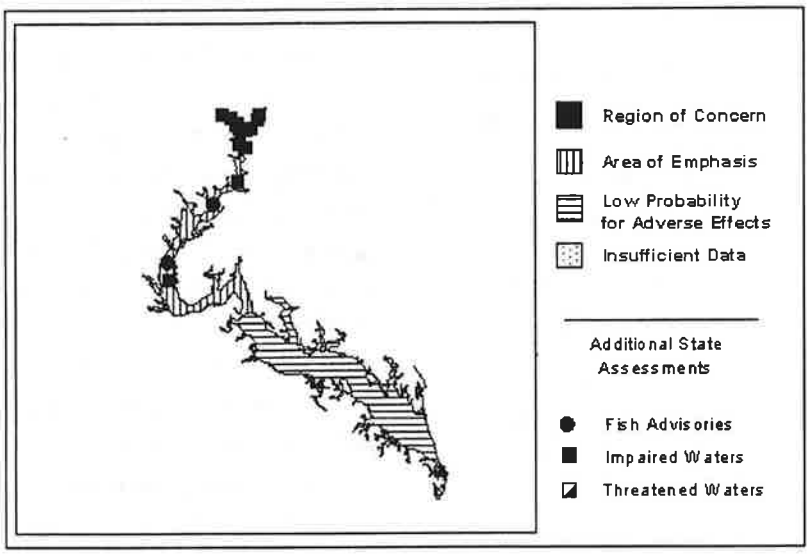
Summary: The middle portion of the tidal Potomac River was characterized as an *Area of Emphasis* because metals found in the sediment throughout the river and pesticides found in the upper and lower portions of the segment were at levels that indicate probable effects on living resources. Also, the sediment showed some degree of toxicity.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water and sediment and effects data (water and sediment toxicity tests). Throughout the segment, nickel was at levels in the sediment that indicate adverse effects on living resources. In the upper and lower reaches of this segment, pesticides were found in sediment at levels that indicate adverse effects on living resources. At various locations in the segment, polychlorinated biphenyls (PCBs) were at levels in the sediment that indicate possible adverse effects on living resources. In the lower portion of the segment, sediment showed some degree of toxicity. Water chemical contaminant concentration data collected in the upper and lower portions of this segment in the late 1980s and early 1990s revealed levels of metals such as copper, zinc, cadmium, lead, and nickel high enough to raise concern about potential contamination problems in this area. Although these data are too old to represent current water quality conditions, they provided supporting evidence for the potential for adverse effects. There was sufficient sediment data, toxicity data, and supporting (yet older) water data to indicate the potential for adverse effects.

Caveats/Limitations: Future assessments of effects in this river, particular in the upper and middle portions of the segment, will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland designated portions of this segment as a chemical contaminant-impaired waterbody and placed it on a priority list of waters to manage. In April 1999, a PCB fish consumption advisory was placed on the tidal Potomac River (from the Woodrow Wilson Bridge to Smith Point, MD/Brent Point) for channel catfish larger than 18 inches (limit consumption to no more than 1 8 oz meal/month). In addition, caution was recommended when eating carp and eel.

Lower Tidal Potomac River, Maryland
Area with Low Probability for Adverse Effects, with the need for additional data to confirm characterization



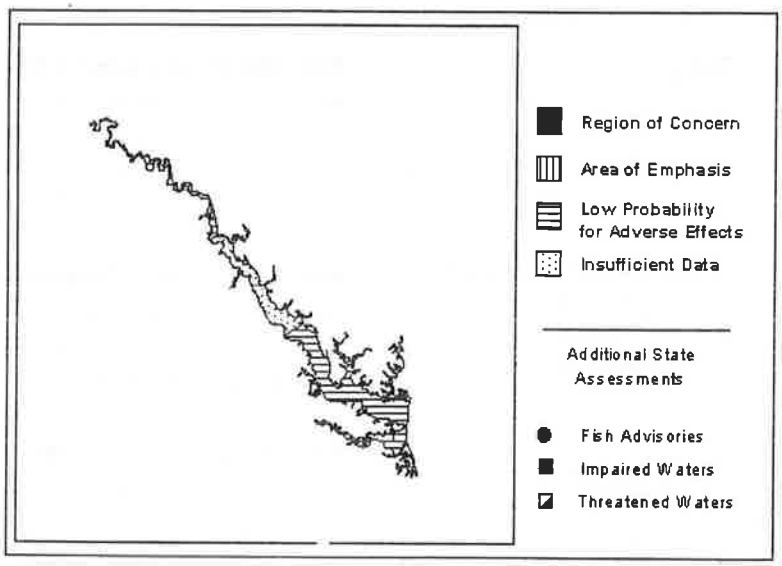
Summary: The lower tidal Potomac River was characterized as an *Area with Low Probability for Adverse Effects* because the excellent spatial coverage of recent sediment contaminant levels throughout the river are below levels associated with the potential for causing adverse effects on living resources.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, water, and fish tissue. No effects data were available. The spatial and temporal coverage of recent sediment chemical contaminant concentration data was excellent and, for the most part, indicated levels of chemical contaminants that were below levels associated with adverse effects on living resources. The fish tissue data were too old to be representative of current conditions, the spatial coverage of water chemical contaminant concentration data was poor, and effects data were lacking. However, the sediment chemical contaminant concentration data were plentiful and recent, and the preponderance of evidence indicated that adverse effects are unlikely.

Caveats/Limitations: Although the preponderance of evidence suggested a low likelihood of adverse effects on living resources, there was conflicting evidence that needs further evaluation. Some levels of contaminants in three Virginia shore creeks indicated the potential for adverse effects, these data stored in the STORET database were ambiguous and the precision and sensitivity of the analytical methods were unknown. Benthic communities were degraded in several areas on the southern shore of this segment, where dissolved oxygen did not appear to be the problem. A more thorough quality check of the STORET data and additional assessments in this area of the lower Potomac are necessary to confirm this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination. Based on data evaluated by the state, there was no evidence of a water quality standard violation. Virginia designated a few small creeks on the southern side of this segment as "threatened waters" due to chemical contamination in the sediment. These creeks will be targeted by Virginia for future assessments. The Bay Program characterized the entire segment of this river and not individual creeks. Even though there was evidence for a site specific problem in a small creek, the overwhelming weight of evidence indicated that, overall, this segment had a low probability for adverse effects.

Upper Tidal Rappahannock River, Virginia
Area with Low Probability for Adverse Effects, with a site-specific contaminant problem



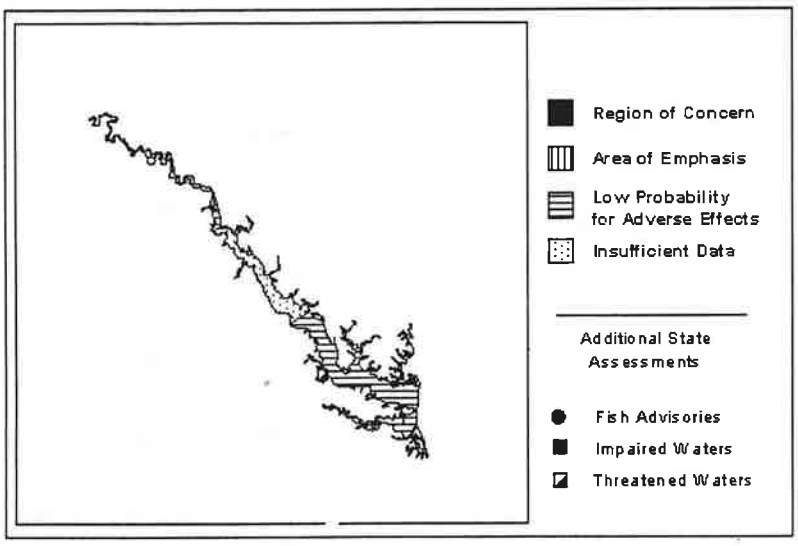
Summary: The upper tidal Rappahannock River was characterized as an *Area with Low Probability for Adverse Effects* because the good spatial coverage of recent sediment chemical contaminant concentration data indicated that levels of contaminants were well below levels associated with adverse effects. Data provide sufficient evidence that polynuclear aromatic hydrocarbons (PAHs) in the sediment from a superfund site in the upper portion of this segment are localized in a tributary and are not transported downstream.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, water, and fish tissue and effects data (sediment toxicity tests). The excellent spatial coverage of recent sediment contaminant data indicated that levels were well below those associated with adverse effects on living resources. Sediment taken from the lower portion of the river segment was found to be not toxic to Bay organisms when exposed to the sediment the laboratory. Although recent water and fish tissue chemical contaminant concentration data and good spatial coverage of effects data were lacking, the sediment chemical contaminant concentration data conveyed a consistent story that adverse effects were unlikely in this area.

In the far upstream portion of the tidal Rappahannock River, remarkably high levels of PAHs were observed in close proximity to a former wood preserving facility that used creosote (a wood preservative). The area of the Rappahannock near this facility has been designated as a superfund site. The available data indicate that the PAH sediment contamination is localized and is not transported downstream. Therefore, overall, this section of the Rappahannock has a very low probability for adverse impacts on living resources, with a site specific contamination problem that is being addressed.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate this area as an impaired or threatened waterbody. In 1986, the EPA placed a portion of the river which is in close proximity to a former wood preserving facility on its National Priority List. Clean up actions were taken to address the contamination problem caused by creosote.

Middle Tidal Rappahannock River, Virginia
Area with Insufficient or Inconclusive Data, with potential contamination at one site.

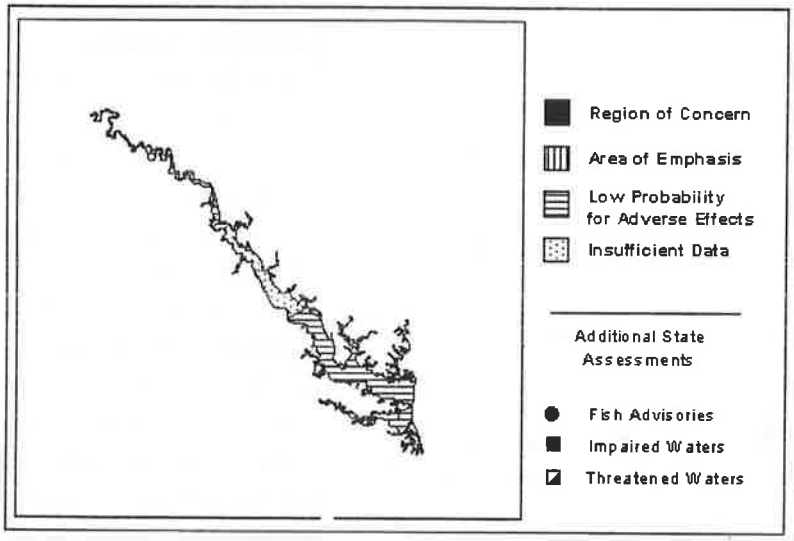


Summary: The middle portion of the tidal Rappahannock River was characterized as an *Area with Insufficient or Inconclusive Data*, with the potential for contamination at one site. Although the available data indicated that the rest of the segment had a lower likelihood of a chemical contaminant problem, the spatial coverage of the data was insufficient to make a definite characterization.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, water, and fish tissue and effects data (sediment toxicity test). One station near the mouth of the Farnham Creek in the lower portion of this segment showed levels of polynuclear aromatic hydrocarbons (PAHs) at levels that indicate probable adverse effects on living resources. The sediment chemical contaminant concentration data indicate levels of chemical contaminants that are unlikely to cause adverse effects on living resources. Sediment taken from one location in the upper portion of the segment was not toxic to Bay organisms exposed to the sediment in the laboratory. Even though these data showed evidence that a chemical contaminant problem is unlikely outside of the one problem site, the fish and ambient water chemical contaminant concentration data and the effects data were too spatially limited to confirm this.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate this area as an impaired or threatened waterbody.

Lower Tidal Rappahannock River, Virginia
Area with Low Probability for Adverse Effects, with limited effects data



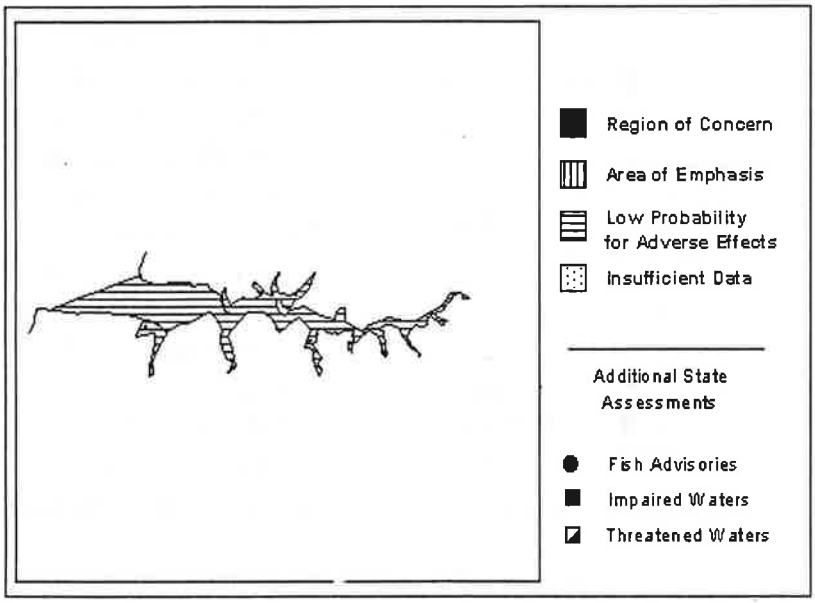
Summary: The lower tidal Rappahannock River was characterized as an *Area with Low Probability for Adverse Effects* because the recent sediment chemical contaminant concentration data with good spatial coverage indicated that levels of contaminants were well below levels associated with adverse effects.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, water, and fish tissue and effects data (sediment toxicity test). Overall, levels of contaminants in the sediment were well below those associated with adverse effects on living resources and the sediment sampled at one location was not toxic to Bay organisms exposed to it in the laboratory. Although the recent water and fish tissue chemical contaminant concentration data and sediment toxicity data did not have good spatial coverage, they provided supporting evidence for this characterization.

Caveats/Limitations: Sediment was tested for toxicity at only one site in the upper portion of this river segment. Future effects assessments are needed on a broader spatial scale to confirm this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate any waterbodies in this segment as impaired by chemical contamination. However, they did identify a small creek (Urbana Creek) as threatened. The Bay Program characterized the entire segment of this river and not individual creeks. Even though there was evidence for a site specific problem in a small creek, the overwhelming weight of evidence indicated that, overall, this segment had a low probability for adverse effects.

Sassafras River, Maryland
Area with Low Probability for Adverse Effects

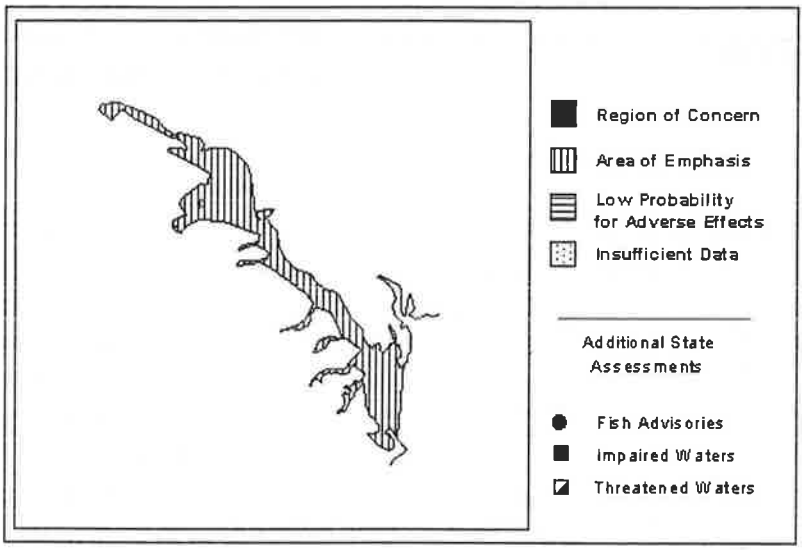


Summary: The Sassafras River was characterized as an *Area with Low Probability for Adverse Effects* because the fairly good spatial coverage of recent sediment chemical contaminant concentration data indicated that levels of contaminants were, for the most part, below those associated with adverse effects on living resources. The sediment showed no toxicity and water showed very low toxicity, and benthic communities were healthy.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and effects data (water and sediment toxicity tests and benthic community assessments). The water showed a low degree of toxicity to Bay organisms exposed to the water in the laboratory. The spatial coverage of recent sediment chemical contaminant concentration data was fairly good and, for the most part, indicated levels of multiple chemical contaminants below levels associated with adverse effects on living resources. Even though some contaminants in the sediment were at levels that indicate probable adverse effects on living resources, the sediment was not found to be toxic to Bay organisms exposed to it in the laboratory. Furthermore, the benthic communities living in the sediment were found to be healthy.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this area as impaired by chemical contamination.

Tidal Severn River, Maryland
Area of Emphasis



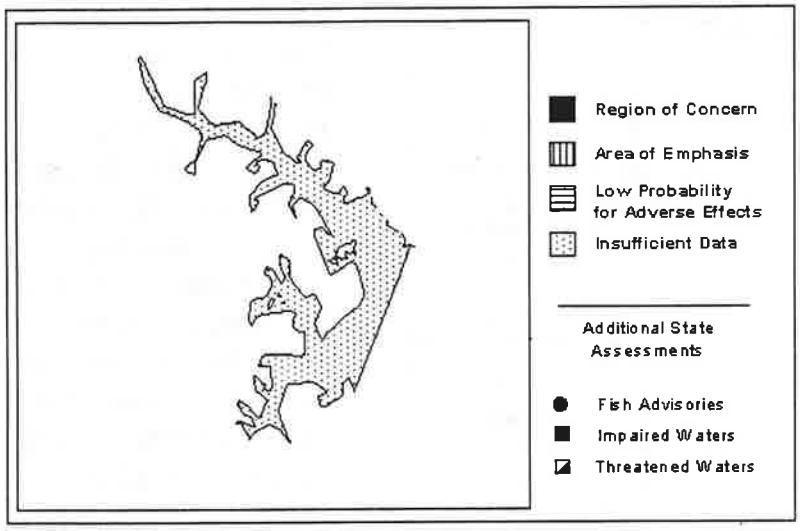
Summary: The tidal Severn River was characterized as an *Area of Emphasis* because recent data indicated widespread metals, polynuclear aromatic hydrocarbons (PAHs), and some pesticides for multiple years at levels that indicate probable adverse effects on living resources. Additionally, there was supporting evidence of sediment and water toxicity.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water and sediment and effects data (water and sediment toxicity tests and benthic community assessments). Metals (such as copper, zinc, and nickel) throughout the tidal river, pesticides (lindane, DDT) in the upper and middle river, and PAHs in the middle and lower river were at levels in the sediment that indicate probable adverse effects on living resources. The water and sediment were found to cause adverse effects to Bay organisms when exposed to the water and sediment in the laboratory. Even though benthic communities appeared to be healthy in the Severn River, the widespread elevated levels of multiple chemicals over multiple years and the toxicity data provided sufficient evidence for the potential for adverse effects in this river.

Caveats/Limitations: Future assessments of effects data in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this area as impaired by chemical contaminants. Based on the data evaluated by the state, there was no evidence of a water quality standards violation. Furthermore, the Bay Program characterization considered additional data that were not included in the state's analysis. Future state efforts will consider additional data as it becomes available.

Tidal South/Rhode Rivers, Maryland
Area with Insufficient or Inconclusive Data



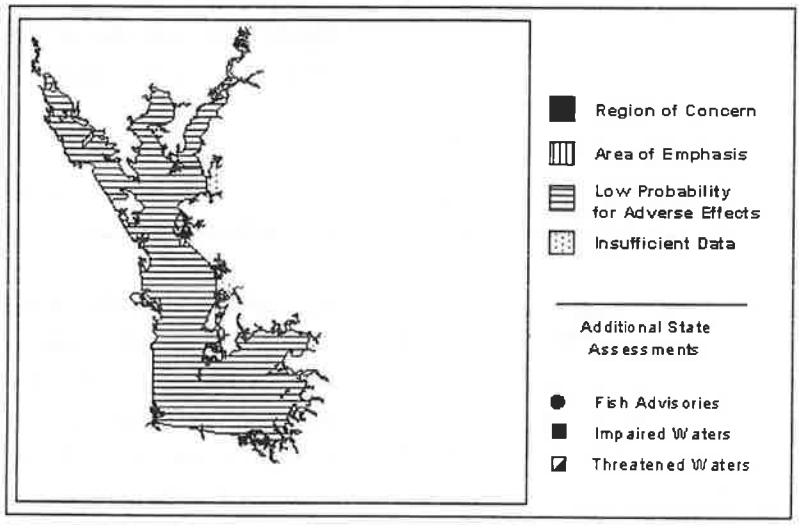
Summary: The South/Rhode River area was characterized as an *Area with Insufficient or Inconclusive Data* because available data were spatially and temporally insufficient to describe this system.

Results and Justification: The only available data for this area were sediment chemical contaminant concentration data which had poor spatial coverage and fish tissue chemical contaminant concentration data which were too old to be representative of current conditions. No current ambient water or fish tissue chemical contaminant concentration or effects data were available. Since sediment and ambient water toxicity data and concurrent sediment and water chemical contaminant concentration data will be available later in 1999 from a Bay Program funded study (as well as some previously collected sediment toxicity data from Maryland Department of Natural Resources), this area initially has been characterized as an *Area with Insufficient or Inconclusive Data* until the data are available and analyzed for future updates to the characterization.

Caveats/Limitations: Future assessments of effects in this river will be helpful in confirming this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination. Based on data evaluated by the state, there was no evidence of a water quality standard violation. Furthermore, the Bay Program characterization considered additional data that were not included in the state's analysis. Future state efforts will consider additional data as it becomes available.

Tangier Sound, Maryland/Virginia
Area with Low Probability for Adverse Effects, but effects data are needed.



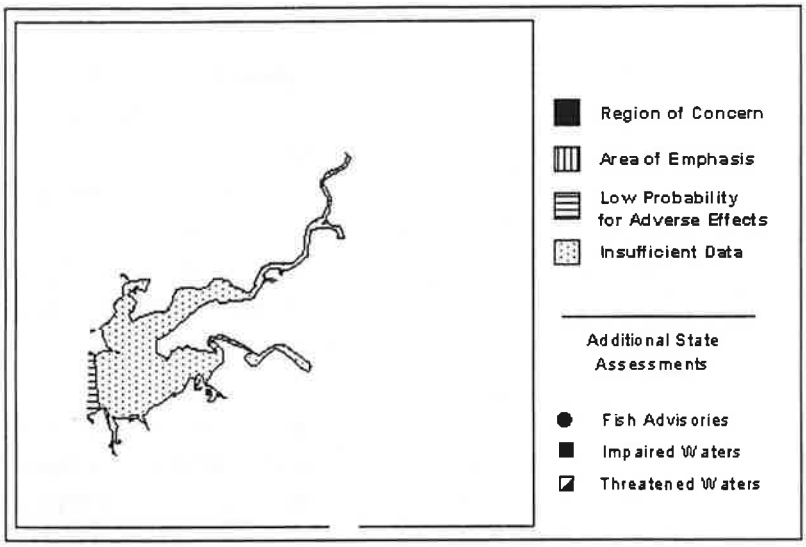
Summary: The Tangier Sound was characterized as an *Area with Low Probability for Adverse Effects* because the excellent spatial coverage of recent sediment chemical contaminant concentration data indicated levels of contaminants that were well below those associated with adverse effects on living resources. Benthic communities appeared fairly healthy.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and effects data (benthic community assessments). Even though there was no sediment/water toxicity test effects data, the excellent spatial coverage of sediment contaminant data and the fairly healthy benthic communities provided sufficient evidence that contaminant problems in the Tangier Sound are unlikely.

Caveats/Limitations: Future effects assessments involving collection of concurrent water and sediment toxicity testing and chemical contaminant concentration data are needed to confirm this initial characterization.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate this area as impaired by chemical contamination. Virginia designated a small creek in the southern portion of the sound as threatened by chemical contamination. The Bay Program characterized the entire segment of this river and not individual creeks.

Wicomico River, Maryland
Area with Insufficient or Inconclusive Data

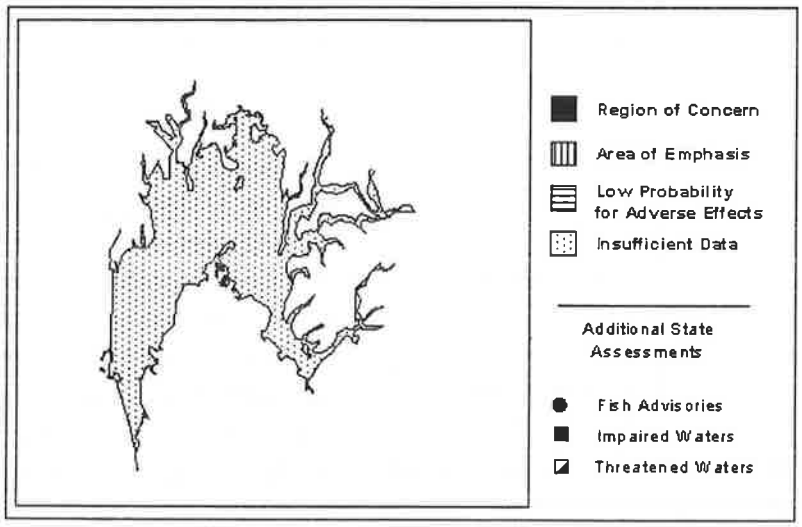


Summary: The Wicomico River was characterized as an *Area with Insufficient or Inconclusive Data* because available sediment chemical contaminant concentration data were insufficient both spatially and temporally to describe the conditions in the river. Fish tissue chemical contaminant concentration data were too old to be representative of current conditions, and no effects data were available. Additionally, the available data did not include any pesticide data which is necessary to characterize a river in an agriculturally dominated region.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and fish tissue. No effects data were available. Available evidence indicated a low likelihood of adverse effects on living resources; however, limitations in the data preclude a definitive conclusion.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination.

Wye River, Maryland
Area with Insufficient or Inconclusive Data, with evidence of a low probability for adverse effects on living resources.



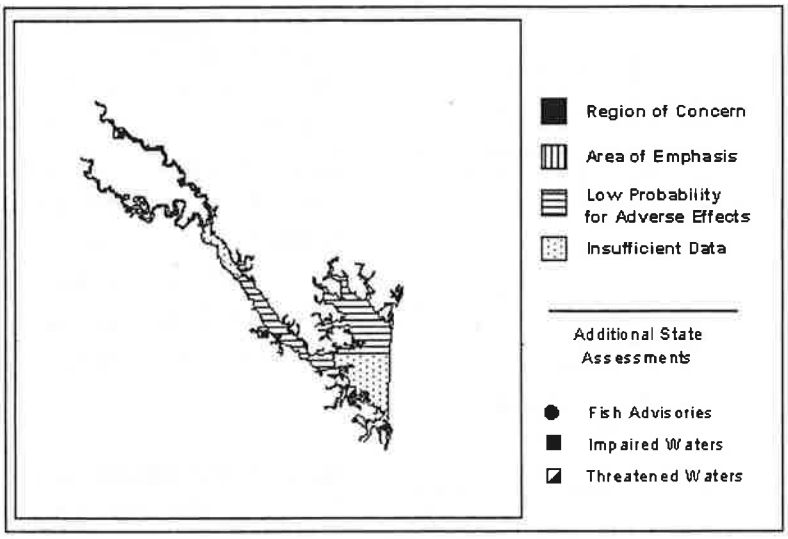
Summary: The Wye River was characterized as an *Area with Insufficient or Inconclusive Data* because the available data were insufficient temporally and spatially to describe the entire river.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment, water, and fish tissue and effects data (sediment and water toxicity tests). The sediment and water toxicity tests data were conducted over several consecutive years and indicated a decline in toxicity in the later years. Although the workgroup members had a high level of confidence in the concurrently collected sediment and water toxicity and chemical contaminant concentration data, the majority did not think these data were spatially sufficient to describe the entire river. Data were particularly lacking for the mainstem of the Wye River. Additionally, fish tissue data were too old to be representative of current conditions.

Caveats/Limitations: The Wye River was classified as an Area of Insufficient Data by a majority of the workgroup members. At least one workgroup member disagreed with this classification and felt that there were sufficient data to classify the Wye River as an *Area with Low Probability for Adverse Effects*. Even though ambient toxicity data were limited to two sites in one of the river's creeks, these data were collected at these sites for several consecutive years. The water and sediment toxicity and elevated levels of nickel in the water observed in the earlier years were not observed in later years, suggesting that toxicity in this area is not persistent.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Maryland did not designate the river as impaired by chemical contamination.

Upper Tidal York River, Virginia
Area with Insufficient or Inconclusive Data, with concern for a contaminant problem near the confluence of the Pamunkey and Mattaponi Rivers.

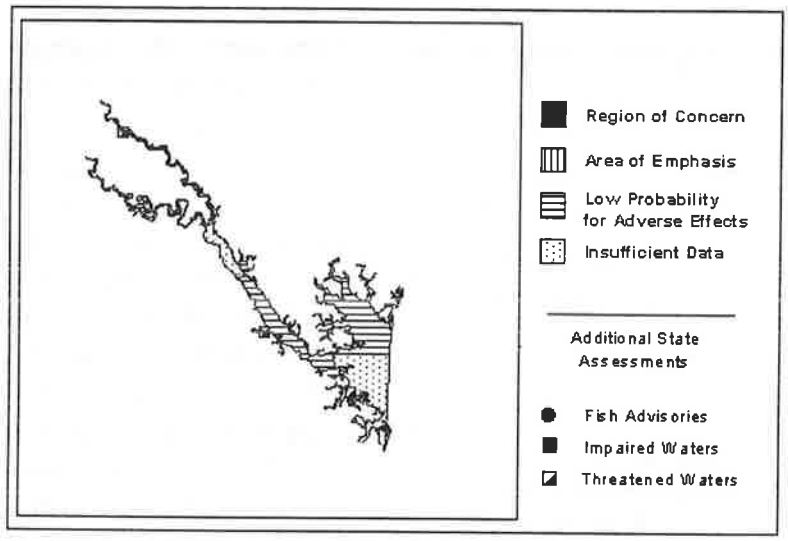


Summary: The upper portion of the York River below the Mattaponi and Pamunkey rivers was characterized as an *Area with Insufficient or Inconclusive Data*, (with a contaminant problem in the upper portion of the segment). Although the available data indicated that the rest of the segment had a low likelihood of a chemical contaminant problem, data were spatially insufficient to make a definite characterization.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water and sediment and effects data (water and sediment toxicity and benthic community assessments). Water collected in the Pamunkey River below West Point was found to be cause adverse effects to Bay organisms exposed to the water in the laboratory. When compared to a total of 46 stations sampled in the 16 rivers Baywide, this site ranked sixth for water toxicity. No water or sediment toxicity was observed upstream of this site, although a metal (lead) was found at levels that indicate probable adverse effects on living resources. Even though chemical contaminants measured in the sediment in the rest of the segment were at levels that are unlikely to cause adverse effects on living resources and benthic communities appeared to be healthy, the spatial coverage of these data was not sufficient to describe the entire segment. Therefore, it was characterized as an *Area with Insufficient or Inconclusive Data*.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate this area as an impaired or threatened waterbody.

Lower Tidal York River, Virginia
Area with Low Probability for Adverse Effects

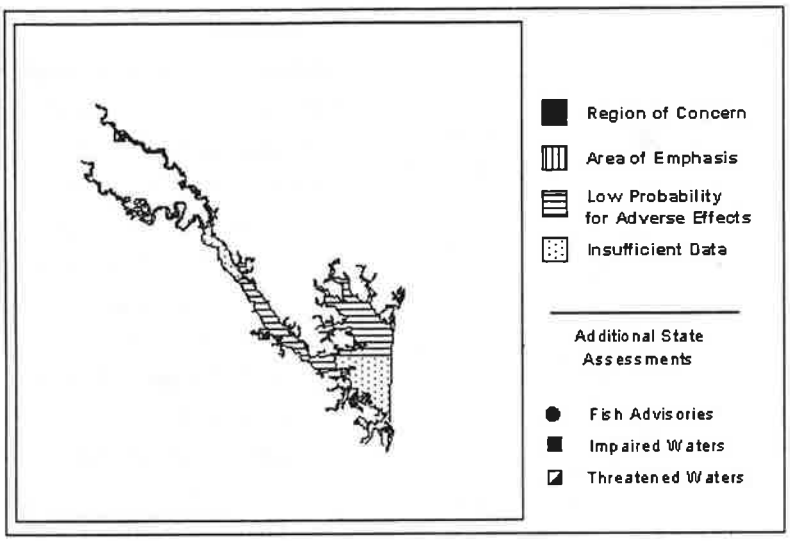


Summary: The lower portion of the tidal York River (north of Mobjack Bay) was characterized as an *Area with Low Probability for Adverse Effects* because sediment levels of contaminants were below levels that are associated with adverse effects, and the water and sediment was not toxic to Bay organisms.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for water, sediment, and fish tissue and effects data (water/sediment toxicity tests). The excellent spatial coverage of recent sediment chemical contaminant concentration data indicated levels of contaminants below those associated with adverse effects on living resources. Water and sediment showed no significant toxicity when exposed to Bay organisms in the laboratory. The water and fish tissue chemical contaminant concentration data were too old to use in this characterization. The sediment chemical contaminant concentration data and supporting water and sediment toxicity data demonstrated a consistent record that adverse effects are unlikely throughout the segment.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate any waterbodies in this segment as impaired by chemical contamination. However, they did identify a small creek (Queen Creek) as threatened. The Bay Program characterized the entire segment of this river and not individual creeks. Even though there was evidence for a site specific problem in a small creek, the overwhelming weight of evidence indicated that, overall, this segment had a low probability for adverse effects.

Upper Mobjack Bay, York River, Virginia
Area with Low Probability for Adverse Effects

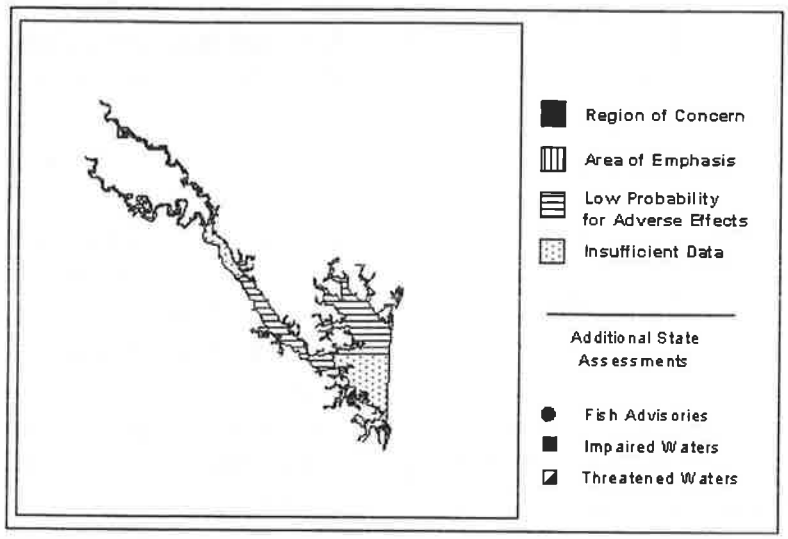


Summary: The portion of Mobjack Bay, north of the York River mainstem, was characterized as an *Area with Low Probability for Adverse Effects* because good spatial coverage of recent sediment chemical contaminant concentration data indicate that levels of multiple chemical contaminants were well below those associated with adverse effects on living resources.

Results and Justification: The available data considered in making this characterization were sediment chemical contaminant concentration data. Good spatial coverage of recent sediment chemical contaminant concentration data indicated that levels of contaminants were well below those associated with adverse effects on living resources. Although no effects data were available, the sediment chemical contaminant concentration data conveyed a consistent record that adverse effects are unlikely in this area.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia did not designate this area as an impaired or threatened waterbody.

Lower Mobjack Bay, York River, Virginia
Area with Insufficient or Inconclusive Data, with potential contaminant problem in Back River



Summary: The portion of Mobjack Bay, north of the York River mainstem, was characterized as an *Area with Insufficient or Inconclusive Data* because data were insufficient to describe the segment. Throughout the segment the spatial and temporal coverage of chemical contaminant chemical contaminant concentration data was poor, and effects data were lacking.

Results and Justification: The available data considered in making this characterization were chemical contaminant concentration data for sediment and water. No effects data were available. The Back River is the site of two federal facility superfund sites. Contamination is suspected from metals (such as copper), polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Copper was found in the water of Back and Poquoson rivers at levels that indicate a high likelihood of adverse effects on living resources. Measurements for the other chemical contaminants that are suspected to be problematic were unavailable. This segment will be characterized once data from the federal facility superfund sites and data from ongoing studies become available.

Additional State Assessments: In 1998, in assessing the conditions of its waters as directed by the *Clean Water Act*, Virginia designated the Poquoson River of this segment as a threatened waterbody. This information will be considered in making a future characterization of this area once all available data have been acquired.

V. *References*

[1] Chesapeake Bay Program. 1999. *Targeting Toxics: A Characterization Report - A Tool for Directing Management and Monitoring in the Chesapeake Bay's Tidal Rivers - A Technical Workplan.* U.S. EPA CBPO, Annapolis, Maryland.

[2] Chesapeake Executive Council. 1994. *Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy.* Annapolis, Maryland.

[3] Chesapeake Bay Program. 1999. *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory.* U.S. EPA CBPO, Annapolis, Maryland.

VI. *Appendix A:* Scientific and Technical Advisory Committee Review of Characterization

June 1, 1999

Mr. Robert Summers
Chair, Toxics Subcommittee
Maryland Department of the Environment
2500 Broening Highway
Baltimore, MD 21224

Dear Mr. Summers:

In response to the request from the Implementation Committee, the Scientific and Technical Advisory Committee (STAC) conducted an expedited, independent technical review of the Toxics Subcommittee's publication *Targeting Toxics: A Characterization Report - A Tool for Directing Management and Monitoring Actions in the Chesapeake Bay's Tidal Rivers*, and its *Technical Workplan*. The results of this review process are described in the attached report.

The review panel for this effort, chaired by Dr. Jonathan Phinney from the Center for Marine Conservation, was charged with three tasks: (1) evaluate the protocol used for the characterization, and its utility as a management tool, (2) determine of the protocol was properly implemented, and (3) recommend how this information can be more effectively communicated in the future. Each of these charges are addressed in detail in the attached report. A presentation and discussion with the subcommittee of the findings of the review panel can be arranged, if requested.

In general, the review panel found the protocol used for this toxics characterization, and its implementation given the available data sets, to be appropriate. They commended the Toxics Subcommittee for pulling together so many disparate datasets to be effectively used for a single purpose. However, despite the large number of data sets used in the characterization, significant information gaps exist for the Bay's tidal rivers. As such, the reviewers recommend that the results of this characterization be used primarily to direct future toxics research and monitoring efforts.

The attached report recommends some specific changes to the characterization report and its technical workplan. STAC requests that the Toxics Subcommittee respond to those recommendations, identifying how they were implemented or clarifying why such changes were not feasible and/or appropriate, by June 18, 1999. After the responses are received, STAC will submit the technical review report to the Implementation Committee.

STAC appreciates the opportunity to participate in the review of the toxics characterization report. If you have any questions or need further information, please feel free to contact myself or Caryn Boscoe, STAC Coordinator.

Sincerely,

Richard L. Jachowski
Chair, Scientific & Technical Advisory Committee

CC: Kelly Eisenman, TSC Coordinator
Carrie McDaniel, TSC Fellow
Joe Winfield, Regional Focus Workgroup Chair

Technical Review

of

Targeting Toxics: A Tool for Directing Management and Monitoring Actions in the Chesapeake Bay's Tidal Rivers

Public Report & Technical Workplan

June 1, 1999

Conducted by the Scientific and Technical Advisory Committee to the Chesapeake Bay Program

Review Panel Members

Jonathan Phinney (chair); Center for Marine Conservation
Richard Coffin; Naval Research Laboratory
Dan Dauer; Old Dominion University
Dennis Suszkowski; Hudson River Foundation
Caryn Boscoe (coordinator); Chesapeake Research Consortium

Introduction

In April 1999, the Chesapeake Bay Program's Implementation Committee requested that the Scientific and Technical Advisory Committee establish a review panel to conduct an expedited, independent, technical review of two publications produced by the Toxics Subcommittee: *Targeting Toxics: A Characterization Report - A Tool for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers* and the characterization's *Technical Workplan*. The ad hoc review panel was charged with the following three tasks:

1. Evaluate the scientific merit of the protocol and criteria used in the characterization of any designated region of the tidal Chesapeake, as detailed in the 1999 Technical Workplan. Address the suitability of this protocol as a management tool.

2. Provide an assessment of whether the protocol was properly used to categorize tributary segments described in the workplan and the report.

3. Recommend how future reports on characterization of contaminant-related impacts can most effectively and accurately communicate information about habitat status.

Foremost, the Toxics Subcommittee and its Regional Focus Workgroup is to be commended for weaving together the many databases used in the characterization into a centralized, useable system. Formatting so many disparate sources such that they can be used to address a single problem is a significant challenge. In addition, the successful coordination of the many agencies and individuals involved in the Workgroup's development of the protocol and the characterizations is a major accomplishment in itself.

The data available for use in the development of this characterization posed a considerable challenge to the Regional Focus Workgroup. Information was collected from a wide variety of research and monitoring efforts which tested for different compounds at different time scales, using a range of sampling protocols. The result of this collection is a dataset with *uncoordinated and* incomplete spatial and temporal (historic and seasonal) coverage. As such, this toxics characterization has limitations in the level of detail at which it can classify toxicity, as well as identify sources and primary contaminants in a system. This paucity of data should be emphasized in the report, both for an accurate understanding of the limitations and to encourage further, coordinated monitoring efforts. The review panel makes some specific recommendations about future research and monitoring later in this report.

Review Process

Reviewers were chosen to represent expertise in a range of toxicological disciplines. Following the review of the two documents and the datasets used by the Regional Focus Workgroup to characterize the Chester River segment, the review panel submitted written comments to Caryn Boscoe, who drafted the initial report. Based on three group discussions of the pertinent issues, reviewers made revisions to two subsequent redrafts before completion of the final report.

1. Scientific Merit of the Protocol and Criteria

In general, the review panel found the protocol used in the Technical Workplan to be suitable for the limited dataset presently available, and should be considered a first attempt to characterize the toxicity in the Bay's tidal rivers and to direct future monitoring efforts. The characterization protocol presented a logical series of steps that involved identifying and compiling relevant data, interpreting the data in light of established endpoints, and then characterizing river segments into qualitative categories.

Categories: Given the present level of data and information, the four categories used in the characterization are appropriate: (1) Region of Concern, (2) Area of Emphasis, (3) Area with Low Probability for Adverse Effects, and (4) Area with Insufficient or Inconclusive Data. The review panel recommends that descriptions and figures (particularly Figure 3) for each of the segments in Category 4 specify whether the data available were insufficient or inconclusive. Insufficient data requires more general monitoring, while inconclusive data calls for focused research and/or monitoring.

Endpoints: The endpoints, or thresholds, used to characterize the level of contamination in each segment were generally appropriate. Those used to evaluate water quality were found to be conservative and appropriate guidelines. The thresholds for sediment analyses are currently a subject of scientific debate, but appropriately based on current information.

Management Tool: As a management tool, the protocol is useful as an initial assessment of the Bay's tidal tributaries and provides a good model for other estuary programs to utilize. It summarizes existing data and sets up priority segments for future analysis. The greatest strength of the characterization may be its role as a scientifically sound means to identify future sites and issues for study and monitoring, and should be used to direct upcoming efforts.

The current characterization presents two potential problems related to management actions and public interpretation of the results: (a) it may overstate problems because the relationships between cause and effect in the segments are not well established, or (b) they may understate problems because data are limited or lacking altogether. These information gaps limit the ability of the characterization to identify specific locations and/or contaminants which require regulation or management. This qualification should be considered when using the characterization as a management tool.

2. Protocol Implementation

The reviewers examined the datasets available from the Chester River as a case study for the implementation of the characterization protocol. Based on this information, the reviewers felt that the consensus process utilized by the Workgroup successfully implemented the criteria and decision rules described in the technical workplan. The panel would like to reemphasize a point made in the workplan, that making a characterization is not a standardized or reproducible process. Rather, the Workgroup members had to apply their best professional judgement and group consensus in the characterization of each of the segments.

The review panel recommends the following revisions to the Technical Workplan and Public Report:

- The segment profiles in the public report make statements about the toxicity levels in the tributaries which are inappropriate and/or misleading, particularly when based on a limited number of presumably uncoordinated toxicity tests. For example, the Chester River profiles states "The sediment in the upper portions of the Chester River was found to be **highly** toxic...to Chesapeake Bay organisms..." The panel recommends that descriptors such as "highly toxic" be changed to more neutral language (e.g. "adverse effects") unless detailed definitions are included for such classifications.
- Areas with Low Probability for Adverse Effects: the report should emphasize that just because there is not a chemical contaminant-related problem does not mean that the tributary is healthy, requiring no further management or restoration efforts. Other environmental factors, such as low dissolved oxygen, may impact chemical fates and transport times, having future implications for the segment. A notation of this caveat could also be included in the figures (especially Figure 3).
- Include more information about the datasets used in the characterization. For example: (1) Discuss the temporal coverage of the water column data. Were samples collected seasonally? Monthly? Coordinated with precipitation events? (2) What does the toxicity data consist of? What species are used? What are the degrees of toxicity?
- The public report mentions the "Workgroup's confidence" or "level of confidence." From a scientific perspective, the report should clarify the level of uncertainty, where possible, in making a decision about the potential toxic effects in a segment, thus illustrating the possibility of an incorrect (either positive or negative) classification.
- The major purpose of the characterization is to prompt action when problems are found - or yet to be found. There is very little detail about the types of actions that might be taken. Though it may be premature to describe detailed remedies, it is likely that ongoing inputs will be problematic in areas of concern. What will be done to investigate the sources of the pollutants? If multiple sources are discovered, then some relative significance will have to attached to the various sources. If this is the case, loadings will have to quantified and models may be necessary to link the loads with observed conditions in water, sediment and biota. Is modeling planned? Will sources be quantified? Will the existing data support model development?
- Pollution Prevention is stated as an option, however, this form of contaminant reduction may not be appropriate to deal with problematic compounds like PCBs and DDT -- chemicals that were banned years ago. What about TMDLs or other regulatory tools?

3. Future Research and Monitoring

As stated earlier, the greatest utility of the toxics characterization is to direct and influence future chemical contaminant research and monitoring programs. It is clear from the inconsistencies in the present dataset that a focused, coordinated monitoring program would allow a much more detailed, comprehensive analysis of the toxicity problems in the Chesapeake Bay ecosystem. The following are a few specific recommendations for consideration in future monitoring and research programs, in anticipation of an updated characterization project.

- Identifying those contaminants which have significant adverse effects on living resources would allow the prioritization of monitoring and restoration efforts. Genetic and tissue toxicity assays can demonstrate the contaminant effects at multiple levels of the food web and be beneficial in setting priorities. (See References)
- Continuing studies on the impact of low level, long-term exposure to ambient toxicity should be encouraged.
- Future work for assessing habitats in the segments would benefit from a more thorough analysis of spatial and seasonal variations in contaminant concentrations and the contaminant turnover time. For example, sampling should be coordinated with pesticide applications in the spring.
- Repeated measurement of chemicals which are no longer in use (e.g. DDT) may be of limited utility for regulation and prevention, particularly in areas where new introductions are unlikely. If initial surveys demonstrate that these chemicals are not present or in harmless amounts, monitoring should be shifted to incorporate chemicals and pesticides currently used in the watershed.
- As data availability improves, the guidelines and criteria used for the characterizations should also be updated. For example, EPA's Acute and Chronic Water Quality Guidelines are outdated and do not take into account advances in toxicity assessment such as AVS measurement of sediment toxicity, speciation measurements, and synergism between toxicants. The Guidelines should be used as a first assessment of a potential problem that could require follow-up speciation and toxicity tests.

- Public health implications of chemical contaminants would seem to be of paramount importance, and should have greater emphasis in future characterizations. Specifically, (1) highlight fish tissue data and associated health advisories in future reports, (2) in conjunction with state organizations, conduct a Bay-wide assessment of contaminants in edible species, with an emphasis on organics, (3) considering the movement of contaminants in fish, reassess the characterization of the mainstem Bay as free of toxics impacts.

Textual Comments

Reviewers identified specific questions and comments about the text of the documents, detailed below.

Overview comments / questions

- Throughout the report, the distinction between "exposure" and "effects" is unclear. Recommend changing to "concentration" and "toxicity" (or other appropriate terms).
- How will PCBs be quantified? The Workplan states that arochlors and congeners will be summed. Will the 18 or so congeners be combined to obtain a measure of total PCBs? If so, this total will likely be a factor of 2 too low. Why was the Workgroup's confidence in using a total PCB threshold...fairly low?
- Are there other endpoints that have management implications that could be used in the characterizations? For instance, is dredged material analyzed in relationship to any toxics endpoints? If so, these endpoints would be useful to include. The more endpoints that have specific management implications, the better.

Page-specific comments / questions

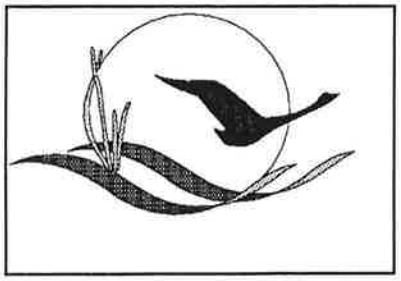
- Pg 2 para 2 bullet 1. Change sentence to read *Better* identify and *conduct risk assessment analysis* in the Areas of Emphasis. As written, "implement necessary pollution prevention action" is premature given that there is little data available in some areas of emphasis. More direct field studies would be the logical next step.
- Pg 4: the mainstem of the Bay is not characterized because contaminant levels are low. The sentence about technique development implies that there are possible effects in the mainstem (or also in the tributaries) which can not be detected. Is this statement based upon caution or suspected cases in the data set where toxicity effects were found but no measured levels of contamination?
- Pg 4, bottom: "... spatially or temporally insufficient.... inconclusive... data.." A bit vague and never resolved. Possibly this is an outcome of the shear size and complexity of the task at hand.
- Pg 5: "... limited or no evidence for a relationship..." "... Strong evidence for a linkage..." Vague.
- Pg 5 para 4: drop "pollution prevention actions" replace with better characterization of toxicity using speciation, risk assessment, other tools. See explanation first bullet.
- Pg 6 para 1: "Chemical contaminants entering the tidal rivers tend to get trapped...." This indicates that a mass balance of input relative to dilution from river and tidal energy has been accomplished. If this has not been done this needs to be restated.
- Pg 7 para 1: Table 1 need to have sources embedded in a legend, so the reader doesn't have to interpret Appendix B. For instanced, water column contaminant data concentrations could include EPA's Acute and Chronic Toxicity Guidelines.
- Pg 8 para 4, line 2: What was the QA/QC on data going back to 1976? For trace metals, "clean techniques" were developed during that period and not implemented for another10 years or so. There should be added emphasis on screening of data sets.
- Pg 9 para 2, line 2: "water exposure" should be changed to "water concentration." Exposure is a nebulous term and the data are generally reported in concentration units.
- Pg 9 para 2 line 4: Define "adequate spatial coverage": 50 % of tributary? other?
- Pg 10 para 2 line 5: "no random benthic sampling data were available for Virginia waters.." A benthic monitoring program has been in place in Virginia since 1996. Statement in the report needs to clarify that the data from this program were just not used in the characterization.
- Pg 11, bottom: Last sentence about "absence of data" and inference from expectations is troublesome.
- Pgs 12-13: List the actual data sets used in the guidelines. It is done in some sections such as water Column Concentration-(e.g. EPA aquatic life criteria) ,but not Bottom Sediment or Finfish/Shellfish. Just listing the Chesapeake Bay Program Toxic Databases is not enough; list NOAA's ER-L/ER-M threshold document and others.
- Pg 13: benthic B-IBI criteria conflict with those in Appendix B, page 10.
- Figure 6 shows locations of benthic community samples used in the report. There were hundreds of EMAP locations that are not indicated here. Were EMAP data used? In 1996 the Virginia Benthic Monitoring Program began random sampling at 100 locations each year. There are 200 random Virginian locations that were available for the period 1996-1997. Were these data used?

References

Ray, S., Dunn, B.P., Payne, J.F., Fancey, L. and Belands, P. 1991. Aromatic DNA-carcinogen adducts in Beluga whales from the Canadian Arctic and Gulf of Lawrence. Mar. Pollut. Bull. 22: 392-396.

Stein, J., Collier, T.K., Reichert, E., Casillas, T., Hom, T. and Varanasi, U. 1992. Bioindicators of contaminant exposure and sublethal effects: studies with benthic fish in Puget Sound, Washington. Environ. Toxicol. Chem. 11: 701-714.

Reichert, W.L. and French, B. 1994. 32P-Postlabeling protocols for assaying levels of hydrophobic DNA adducts in fish. NOAA-NWFCS Tech Memo-14.



Chesapeake Bay Program

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June 15, 1999

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On behalf of the Toxic Subcommittee, I would like to thank you for coordinating such a comprehensive STAC technical review of the toxics characterization effort. The review panel's in depth review of the scientific merit of the protocol and criteria used in the characterization, the application of the protocol, and communication of the results has helped us to strengthen this initial characterization and will provide insight on how to improve the characterization in future updates.

Attached is our response to the STAC review which details how we have responded to the recommendations and issues that were raised. We would be happy to meet with the STAC review panel and the entire Committee to discuss the review in more detail if desired. You will note throughout our response, that we highlight several areas where follow up discussions and further coordination with STAC would be beneficial, particularly in acting on the review panel's recommendations for future research and monitoring. We would like to continue this dialogue with the broader scientific community as we undergo reevaluating and revising the 1994 toxics strategy this year, particularly at the upcoming "science forum" in September.

The reviews that the STAC has conducted over the years on key Toxics Subcommittee products and budget proposals have been invaluable. We look forward to continuing these discussions and interactions with the STAC and the broader scientific community as we plot our course for the year 2000 and beyond.

Sincerely,

Bob Summers
Chair, Toxics Subcommittee
Maryland Department of the Environment

Attachment
cc: Jonathan Phinney, Chair of Review Panel/Caryn Boscoe, STAC

Toxics Subcommittee Response to the STAC Technical Review of Targeting Toxics: *A Tool for Directing Management and Monitoring Actions in the Chesapeake Bay's Tidal Rivers* Public Report & Technical Workplan

This report represents the formal response from the Toxics Subcommittee to the Scientific and Technical Advisory Committee (STAC) review report of the characterization (Attachment A). The STAC recommendations are listed under heading topics used in the STAC review report in the order they appear in the review report. The Toxics Subcommittee's response follows each recommendation and includes a combination of actions (in bold text) and further explanations. The "workgroup" refers to the Toxics Subcommittee's Regional Focus Workgroup which was charged with conducting the toxics characterization.

Introduction

RE: Data Limitations: "This paucity of data should be emphasized in the report, both for an accurate understanding of the limitations and to encourage further, coordinated monitoring efforts."

Agreed. We appreciate that the review panel recognized one of the more important limitations to our efforts. It is important to emphasize that the database used in this characterization is from a wide range of research and monitoring programs [sic: uncoordinated efforts] that provide inadequate descriptions of the presence of contaminants and their potential or actual impacts for much of the Bay [sic: incomplete spatial and temporal (historic and seasonal) coverage]. This characterization is limited in the level of detail at which it can classify problems related to contamination [sic: toxicity]. It should be apparent that a better understanding and more clear picture of the problems can only be provided by enhanced and coordinated monitoring efforts at all levels within the Chesapeake Bay Program. This limitation is clearly stated in the technical workplan (Section III.A.5. Data Limitations and Section VI. Recommendations for Future Updates). **We have added the following section in the public report "Limitations of Data" (Section II) to ensure that this limitation is clearly stated:** *"Limitations of Data*: It is important to note that, to date, there is no Baywide monitoring program designed to characterize toxics conditions in the Chesapeake Bay's tidal rivers on the scale necessary to perform comparable assessments of all rivers. Information used for this characterization was collected for a wide variety of studies that were conducted for different purposes. The result of this collection is a dataset with uncoordinated and incomplete spatial and temporal coverage. The workgroup was faced with the challenge of piecing together these different datasets and developing a consistent set of decision rules for how to interpret this information in making a characterization. As such, this characterization has limitations in the level of detail at which it can characterize toxic effects on the Bay's living resources. Through increased funding, intensified coordination with federal and state toxics monitoring and research efforts, and intentional collaboration between Bay Program signatory states at the governmental and academic level to address Bay-wide issues, the gaps in data coverage will be filled." **We have also added the following sentence in Section VI Recommendations:** "Only through increased funding, intensified coordination with all Federal and State toxics monitoring and research efforts, and intentional collaboration between the Signatory states at the

governmental and academic level to address Bay-wide issues, will the gaps in data coverage and gaps in our knowledge of the distribution and extent of toxic effects be filled."

1. Scientific Merit of the Protocol and Criteria

RE: "... should be considered a first attempt to characterize toxicity in the Bay's tidal rivers and to direct future monitoring efforts."

Agreed. Prior to future updates to the characterization, an accounting of the "lessons learned" would be useful for future refinements and the next characterization to be performed in 3 years (see *1994 Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy*) or for periodic updates as new data become available (an alternative strategy to triennial updates).

RE: "The review panel recommends that descriptions and figures ... for each of the segments in Category 4 specify whether the data available were insufficient or inconclusive."

We agree that distinguishing between areas with insufficient data versus areas with inconclusive data is important. Initially, the Regional Focus Workgroup (hereafter, workgroup) was working with only the category of "insufficient" and found that in some cases it was difficult to classify a segment because the data, although of adequate spatial/temporal coverage, were considered "inconclusive" or conflicting for one or more reasons. "Insufficient" was considered just too little data to interpret for the spatial scale of the segment. In developing a consensus, the workgroup "lumped" these two categories together because the best professional judgement was that any additional monitoring or research in these areas would have to be directed at answering one question: what is the level of impairment due to toxics, if any? The workgroup has not developed specific definitions or decision rules to distinguish segments with insufficient data from segments with inconclusive data and therefore cannot provide extra detail on the map. **We have clearly indicated when data were spatially or temporally insufficient versus inconclusive in the summary section of each segment profile in the public report.**

It is obvious that the two strategies suggested by STAC ("more general monitoring" vs. "focused research and/or monitoring") are good approaches for resolving the classification uncertainties. **The Toxics Subcommittee will continue to use the more detailed information in the segment profiles and the data used to make the characterizations to set its characterization priorities in the *Areas with Insufficient or Inconclusive Data*.** It may be appropriate for STAC and the Toxics Subcommittee to work together in the process of setting specific objectives for the research and monitoring programs. That is, the Toxics Subcommittee should recognize the differences among the *Areas with Insufficient or Inconclusive Data* and decide the appropriate monitoring strategy with STAC review so that the uncertainties can be resolved at a management and scientific level, respectively.

RE: *Endpoints*

Concur.

RE: *Management Tool*

1st ¶ RE: "model for other estuary programs" and "greatest strength of the characterization may be its role as a scientifically sound means to identify future sites and issues for study and monitoring."

Concur.

2nd ¶ (a) "two potential problems related to management actions"
We agree that the "greatest strength of the characterization may be its role as a scientifically sound means to identify future sites and issues for study and monitoring, ...". We also agree that there are limitations in how this characterization can be used for targeting management activities. We believe that this initial characterization can serve as a valuable planning tool to help the Bay Program to better target its voluntary management actions in the watershed. We have always pursued two goals: to improve our understanding of toxic impacts in the Bay, while concurrently acting with the knowledge we have now to ensure that we are reducing and preventing chemical contamination in the Bay. As our understanding increases, we will be able to better target our management actions. This characterization will allow the Chesapeake Bay Program to determine the areas in which to focus its voluntary pollution prevention and reduction efforts and the areas in which to focus its preservation/conservation efforts. For example, in the *Areas of Emphasis* where point source loadings of chemicals of concern are substantial (based on the recently published *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory*) we could target businesses in those watersheds for further voluntary chemical reductions through the voluntary pollution prevention program, Businesses for the Bay. The characterization gives the State/District partners base information to allow them to conduct the more site specific analysis and source assessment studies necessary for implementing regulatory programs called for in the *Clean Water Act.*

We agree that we need to clearly state the utility of this characterization, highlighting its primary value as a tool for targeting monitoring and carefully describing how it can be used for targeting voluntary management activities. **To clarify the utility of the characterization, we have added the following paragraph into the public report (Section III: What will be done with this characterization effort) and in Technical Workplan (Section V. Implications of the Characterization):** "The primary value and utility of the characterization is in identifying areas that need additional monitoring and assessment to better characterize the status of toxic effects on living resources inhabiting those areas. This characterization can also serve as a planning tool to help the Chesapeake Bay Program determine the areas in which to focus its voluntary pollution prevention and reduction efforts and the areas in which to focus its voluntary preservation/conservation efforts. The characterization gives the State/District partners base information to allow them to conduct site specific analysis and source assessment studies which may be necessary before regulatory actions can be taken."

2nd ¶ (b) RE: "overstate problems"
The workgroup made every effort to be conservative in characterizing an area as an *Area of Emphasis*. However, due to the limitations of the data, it is possible that some problems may be overstated either in degree or extent of contamination. Uncertainty in the characterizations has been detailed in the caveats in the segment profiles in the public report. It is important to note that the burden of proof for an *Area of Emphasis* does not require a demonstrated cause and effect relationship. It may be argued that, with few exceptions, direct cause and effect relationships are impossible to define when working with ambient exposure and effects data. Only where there are site-, contaminant- or effects-specific studies with the objective to identify causative agents and to confirm their actions against target species, populations or communities is there a chance for some level of confidence in defining causality. We intentionally restricted our efforts to looking at ambient data and not data from known "hot spots" for contaminants or effects to ensure that we were characterizing an entire segment rather than letting a known problem (hopefully under responsible management attention such as the implementation of TMDLs or remediation efforts) drive the classification for a segment. Also, we "raised the bar" for our use of the "disputed" thresholds or benchmarks to reduce the likelihood of overstating problems because of the concern for unwarranted alarm or management action.

2nd¶ (c) RE: "understate the problem"
Agree. This is an issue that the workgroup struggled to address. We are highly concerned about overlooking a problem where current data "suggest" that there is no problem and giving the managers and public a false sense that the entire segment is clean or safe from either a natural resources, habitat, or human health perspective. **We have addressed any limitations or caveats in the characterizations in the segment profiles in Section IV of the public report.**

2. Protocol Implementation

RE: CASE STUDY: Chester River "...the reviewers felt that the consensus process utilized by the Workgroup successfully implemented the criteria and decision rules described in the technical workplan."

Concur.

Bullet 1: "The panel recommends that descriptors such as 'highly toxic' be changed to more neutral language (e.g. 'adverse effects') unless detailed definitions are included for such classifications."

Agree that a more globally understood term or terms be used throughout the report to describe results of toxicity tests. The author of the source document for these data used words such as "highly toxic" and "low to moderately toxic" to indicate the severity of toxicity observed based on the number of toxicity tests and endpoints showing toxic effects. **Since these words are not in and of themselves descriptive, we have replaced them with text which describes that an adverse effect occurred and gives an indication of the severity of toxicity.** An example of the change in wording is: "the

[sediment/water] was found to cause adverse effects on Chesapeake Bay organisms exposed to the [sediment/water] in the laboratory. In laboratory studies, sediment from [location] was more toxic to animals that live in the sediments than almost all other sediments tested in the Bay (ranking third [for example] out of 46 stations sampled in 16 rivers Baywide)." Where the author provided inferences regarding what chemical contaminants may be contributing to the toxicity, we have provided that information as well. **For those people wanting more detail on the toxicity test results, the number of endpoints significantly different from the controls, the toxicity index, etc. we have included the following reference in Section IV. For More Information of the public report:** "For electronic copies of the data evaluated by the workgroup, please refer to the Bay Program Home Page at http://www.chesapeakebay.net or contact the Bay Program Office at 1-800 YOUR BAY. Note that where feasible, links are made to the actual datasets or summary reports/abstracts."

Bullet 2: "... the report should emphasize that just because there is not a chemical contaminant-related problem does not meant that the tributary is healthy..."

Agreed, but assessing impacts due to non-anthropogenic substances was beyond our charge-of-duties and beyond our capacity to evaluate with the available data. We did take into consideration *in situ* effects measures where low dissolved oxygen levels may have been a causative factor for reduced benthic indices because the data were available. It is, however, very important to describe other factors that can influence the survival of living resources by affecting the toxicity of substances in the environment. **We have mentioned this in the Section III.A.5 of the Technical Workplan.**

Bullet 3: "Include more information about the datasets used in the characterization..."

Agree that the more detailed information regarding the purpose of the study, the sample design, the species used in toxicity tests, etc. is necessary to fully evaluate the characterization. It was beyond the Regional Focus Workgroup's charge to develop a narrative summary of the numerous datasets it evaluated in conducting the characterization. However, we understand that many users of the characterization are not as familiar with the data as the workgroup is and need background information. The characterization reports, supporting data, and references for all data evaluated will be published on the Chesapeake Bay Program homepage. **Where feasible, we will provide links from the reference table to the actual studies to ensure that the more detailed information about the study can be accessed. We have indicated this in Section IV. For More Information of the public report.** We are hopeful that we will have the cooperation of the scientific community in making their datasets, reports, and abstracts available via the web.

Bullet 4: "The report should clarify the level of uncertainty, where possible, in making a decision about the potential toxic effects in a segment,..."

Agree that the level of uncertainty in making a characterization is important to stress in the report. The level of confidence by the workgroup is an expression of the magnitude,

frequency and extent (or distribution) of the contaminants or effects measured. The level of confidence cannot be numerically quantified in the sense of a quantitative risk assessment process for ambient concentration gradients about a source, but it can be expressed in terms of how convincing or compelling the data were when carefully weighed and subjected to the best professional judgement by the individuals and confirmed through a consensus process. The Regional Focus Workgroup has clearly indicated the overall uncertainty in the characterization effort in the technical workplan (Section A.5. Limitations of Data, B.6. Limitations in Data Interpretation, VI. Recommendations for Future Updates to Characterization) and in the way the decision rules were set up to account for uncertainty in the data and thresholds used (see Section B.2. Decision Rules for Interpreting Data and Appendix B.). The workgroup's level of uncertainty in individual characterizations is stated in the limitations and caveats section of each of the segment profiles. **To ensure that uncertainty is more directly addressed in the public report, we added a statement in the first paragraph of Section IV to point the reader to the caveat/limitations section of each of the segment profiles for more description on the level of uncertainty for each characterization.**

Bullet 5: "What will be done to investigate the sources of pollutants?"

Agree in concept, however, identifying sources and recommending actions to take in certain areas is beyond the workgroup's charge-of-duties and greatly exceeds the level of effort available for this report. Actions can be taken on two fronts; 1) regulatory and 2) voluntary. To recommend regulatory actions may overstep our relationships with the States. Voluntary programs underway can benefit from some of the information in the characterization and more detailed segment profiles. For example, for voluntary programs in an area classified as an *Area with Low Probability for Adverse Effects*, the participants can encourage preservation and good stewardship of an impacted resource. Point and nonpoint source chemical contaminant loads to the Bay and its major tidal rivers have been quantified in the *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory*. The characterization, coupled with the loadings inventory, will provide initial information to enable managers, scientists, and stakeholders to target their toxics reduction and prevention activities towards specific source categories and chemicals. Further assessments may be necessary to elucidate the problems and sources, before regulatory actions can be taken. With respect to the data supporting model development, only the modelers will know if the data meet their assumptions and needs (See related responses in Section 1. Scientific Merit re: management tool, Bullet 6 of this section, Section IV. Page Specific Textual Comments, Bullet 1).

Bullet 6: "What about TMDLs or other regulatory tools?"

It was beyond the scope of the Regional Focus Workgroup to determine the specific activities and remedies that should be taken in each of the characterized segments. The report outlines general actions that the Chesapeake Bay Program can take in each of the four categories which originated from the *1994 Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy*. We agree that pollution prevention activities will not address contamination problems that are due to historically used chemicals that are

banned, yet persistent. Regulatory programs at both the federal and state level are necessary to address the intractable problems of sediment contaminated with historically used persistent bioaccumulative chemicals. The Chesapeake Bay Program's role in toxics management is to supplement the regulatory programs with voluntary actions where necessary. We believe it will take a combination of both regulatory and voluntary actions to effectively address chemical contaminant impacts in the Bay. It is up to the Chesapeake Bay Program and its partners to determine the next steps that need to be taken to prevent and reduce chemical contaminant impacts in the Bay and to protect and conserve areas in the Bay from future harm.

3. Future Research and Monitoring

Many of the recommendations for future research and monitoring were incorporated into the FY2000 Request for Proposal for Toxics Subcommittee funding for chemical contaminant characterization efforts. As part of the Toxics Strategy Reevaluation and Revision, the Bay Program will hold a forum in September with the scientific community to discuss many of these issues and recommendations. We are working with STAC to ensure that this dialogue with the scientific community continues so that we can develop actions to deal with these information gaps in order to better target our management actions.

Bullet 1: "Genetic and tissue toxicity assays can demonstrate the contaminant effects..."

The endpoints suggested must be shown to be important and relevant to the stakeholders. That is, resource managers and the public should fully understand the meaning of the endpoints for genetic and tissue toxicity assays. For resource managers, these endpoints must relate to some decision point in their regulatory programs.

Bullet 2: "Continuing studies on the impact of the low level, long term exposure to ambient toxicity should be encouraged."

Concur. The Toxics Subcommittee is working closely with the NOAA Chesapeake Bay Environmental Effects Committee's Toxics Research Program to ensure that the funded research addresses management questions. Although the focus of the research program for the next 5 years is on contaminated sediment in the three Regions of Concern, impacts from low levels will also be addressed. It may be necessary for STAC and the Toxics Subcommittee to partner with other such research programs to leverage additional funds to more thoroughly address this issue.

Bullet 3: "...more thorough analysis of spatial and seasonal variations..."

Concur. Although resource limited, a subset of this problem is addressed in the FY2000 Request for Proposals for Toxics Subcommittee funding which solicit projects to assess the effects of pesticides in the Eastern Shore rivers by coordinating sampling with pesticide applications in the spring.

Bullet 4: "Repeated measurements of chemicals which are no longer in use...may be of limited utility..."

Concur. However, it is important to note that some of these banned chemicals (i.e., PCBs and chlordane) are continuing to have an impact and accumulate in aquatic life, resulting in fish consumption advisories and potentially other problems.

Bullet 5: "As data availability improves, the guidelines and criteria used for characterizations should also be updated."

Concur. However, if we do not use the US EPA Acute and Chronic Water Quality Criteria for surface waters (or the States' standards) what does STAC recommend? Updating existing criteria and developing criteria for additional chemicals and media (i.e., sediment) is a long standing issue. We cannot expect to improve our characterization unless our interpretative tools improve. We will address this issue as part of the Toxics Reevaluation and Revision with STAC and the broader scientific community and other stakeholders in our Toxics Revaluation and Revision "science forum" that will be held in September.

Bullet 6: "...(1) highlight fish tissue data and associated health advisories in future reports, (2) in conjunction with state organizations, conduct a Bay-wide assessment of contaminants in edible species... and (3) reassess characterization of the mainstem of Bay..."

Concur with all 3 items listed. However, each and every endpoint must be matched to a regulatory decision framework or decision endpoint to ensure that something will be done if a problem is discovered. We will need to rely on the States and EPA to declare human health advisories from fish consumption to use in future characterizations. It is important to note that this characterization is not a human health assessment. Where human health concerns already have been identified by the states, appropriate fish consumption advisories or other warnings have been issued. Please note: <u>The Toxics Characterization did not assess the mainstem as free of toxic impacts.</u> The mainstem was not characterized due to historically low levels of chemical contaminants. We are considering formally characterizing the mainstem of the Bay in subsequent updates.

4. Textual Comments
Overview Comments/Questions

Bullet 1: "...the distinction between 'exposure' and 'effects' is unclear."

We will clarify the distinction between "exposure" and "effects" in the report. We will replace "exposure" with "concentration" when describing the data that was used in the characterization and will provide the definition stated below. We will continue to use the word "effects" for the reason stated below. "Concentration" data refer to a method-defined value derived from a measurement by an instrument or other direct observations. It does not necessarily express the bioavailable form of the

contaminant measured and the pathway by which the contaminant has an effect on an individual organism, population, or community. "Effects" covers all potential and actual impacts to living resources as opposed to "toxicity" which suggests that we can attribute the impairment to a substance, eliminating all other potential and real causes.

Bullet 2: "How will PCBs be quantified? ... Why was the Workgroup's confidence in using a total PCB threshold fairly low?"

The Workgroup's confidence in using a total PCB benchmark was fairly low because the confidence of the authors who developed the total PCB benchmark was low (Long et al., 1995). The process for how PCB levels in sediment and fish tissue were evaluated is described in the Decision Rules (Technical Workplan, Appendix B, pages B-6 and B-9). Because the confidence of this approach was fairly low, PCB data were used to support a characterization and did not drive a characterization unless they were the cause of an existing fish consumption advisory. The reviewers mention that the sum of the congenors "will likely be a factor of 2 too low" but did not provide a reference for us to review so we cannot respond directly to that statement.

Bullet 3: "...is dredged material analyzed in relationship to any toxics endpoints?"

Data for or from site-specific problems or biased study areas (e.g., dredge material assessments, investigations at "hot spots") were not evaluated since we were attempting to characterize large areas (segments). Information or data concerning dredge material was not used since the material was probably targeted for removal and the problems, if any, may be resolved or will be resolved in the near future at the test site (don't know what will happen at the location where contaminated sediments will be placed). Also, we choose to use the most relevant and important management and characterization endpoints that we could find and that had some level of quality control and had passed some form of quality assurance. The workgroup felt that relevant endpoints were important since neither management or the public will listen to any description of a problem unless it is relevant and important to their respective interests.

Page-Specific Comments/Questions

Bullet 1:

It is important to note that the verbiage used in the technical workplan and the public report regarding actions that the Bay Program will take in the four different areas comes directly from the *1994 Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy*. By classifying a segment as an *Area of Emphasis* we have determined by weighing the evidence and applying best professional judgement that there is sufficient data to say there is a problem and that actions are necessary now. The Bay Program can use this characterization to act now to target voluntary actions in these areas. Further studies may be necessary to better elucidate the problem and its sources before regulatory actions such as developing TMDLs are implemented by the States/District.

As mentioned in section 1 of this response, we have added the following paragraph

to both the public report and technical workplan to explain the limited utility of the characterization for guiding management actions: "The primary value and utility of the characterization is in identifying areas that need additional monitoring and assessment to better characterize the status of toxic effects on living resources inhabiting those areas. This characterization can also serve as a planning tool to help the Chesapeake Bay Program determine the areas in which to focus its voluntary pollution prevention and reduction efforts and the areas in which to focus its voluntary preservation/conservation efforts. The characterization gives the State/District partners base information to allow them to conduct the more detailed risk assessment analysis, site specific analysis, and source assessment studies which may be necessary before regulatory actions can be taken."

Bullet 2:

The statement is based upon our lack of knowledge of the potential for low levels of contaminants in the mainstem to have subtle yet important impacts on living resources throughout the Bay and tributaries. Our current arsenal of toxicity assessment tests do not allow us to adequately assess the impacts of the low levels of contaminants on living resources. Endocrine disruptors alone at extremely low concentrations have the potential for affecting population dynamics and community assemblages in the plankton found in the mainstem.

Bullet 3:

The Regional Focus Workgroup did not develop set rules for defining how much data is enough to make a characterization because the size and attributes of each segment and the available data for each segment varied a great deal. Adequate spatial coverage was an issue that was resolved by visually integrating the distribution of stations within a segment, the complexity of the watershed, and amount of data for each media type (water, sediment, and tissue) and contaminant class (metals, organic compounds). The determination of adequate coverage was treated in a weight of evidence fashion by each member of the workgroup and decided by best professional judgement. Reading through the segment profiles and the supporting data is a good way to get a feel for how much data was enough to make a characterization, when data were insufficient, and when data were inconclusive.

Bullet 4:

It is unclear why the review panel thinks these terms are vague. A good way to illustrate the difference between "strong evidence for a linkage" and "limited or no evidence for a relationship" is to compare data from a *Region of Concern* with an *Area of Emphasis*.

Bullet 5:

See explanation in Bullet 1.

Bullet 6:

The reference provided for this statement in the public report is the *1999 Chesapeake Bay Basinwide Toxics Loading and Release Inventory* which summarizes a preliminary mass balance conducted by Dr. David Velinsky, ANS, and Dr. Joel Baker, UMD-CBL.

Bullet 7:

We are describing the data we used and not the thresholds. Thresholds are referenced in Appendix B of the Technical Workplan.

Bullet 8:

Table 2 refers to the dates for which the Chesapeake Bay Program has data stored in its toxics database. Only a subset of these data were evaluated for the toxics characterization as described in Table 3. **We clarified this in the Technical Workplan (Sections III.A.3 and III.B.3.1) with the following text:** "Of particular concern is the issue of methods for the measurement of metals in water. Older data did not use the "clean techniques" for measuring metals. It is believed that historical studies report metals that are bound and freely dissociated in the water column, while it is known that the more toxic form of a metal is the freely dissociated ion. The historical data were used with caution by the workgroup and were customarily used to confirm suggestions of concentrations in other media (sediments or tissue) that metals were a problem in a segment."

Bullet 9:

Agree. We replaced the term "exposure" with "chemical contaminant concentration".

Bullet 10:

We will include the following definition of "adequate spatial coverage": "Adequate spatial coverage was an issue that was resolved by visually integrating the distribution of stations within a segment, the complexity of the watershed, and amount of data for each media type (water, sediment, and tissue) and contaminant class (metals, organic compounds). The determination of adequate coverage was treated in a weight of evidence fashion by each member of the workgroup and decided by best professional judgement."

Bullet 11:

You are correct that additional data are available for the Virginia waters that, unfortunately, were not considered in the characterization. The 1996 and 1997 benthic data from random sites in Virginia waters were not provided to the workgroup for use in the initial characterization. **We will ensure that we acquire these data and evaluate them in future updates to the characterization.**

Bullet 12:

To clarify this sentence we added the following text: "(e.g., lack of pesticide data in highly agricultural areas would tend to drive a classification towards an *Area with Insufficient or Inconclusive Data*.)"

Bullet 13:

Appendix B provides the complete set of decision rules and outlines the thresholds used and how they were interpreted. By listing the thresholds in a summary paragraph in the workplan as suggested, we run the risk of the reader assuming that we took these thresholds at face value. **Therefore, we continued to list them only in the decision rules in Appendix B.** It is important to note that although our characterization approach will stay more or less the same, it is likely that we will update the list of thresholds in future characterizations as our interpretative tools improve.

Bullet 14:

We edited the text in section B.1. to be consistent with the correct text in the decision rules in Appendix B.

Bullet 15:

See Bullet 11 for response.

Additional Actions:

We have included a copy of the STAC review and the Toxics Subcommittee response as an Appendix to the characterization report.