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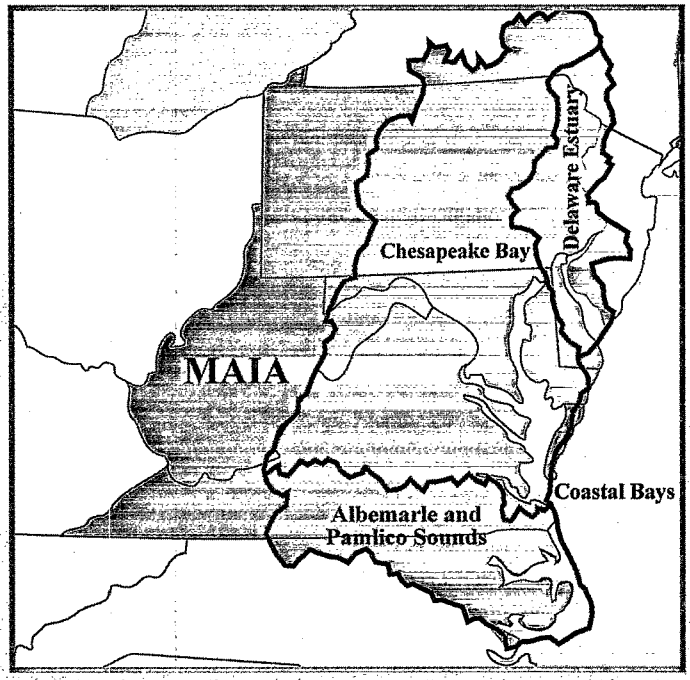
EPA

MAIA Project Summary
Condition of the Mid-Atlantic Estuaries

The *Condition of the Mid-Atlantic Estuaries* Report, publication no. EPA 600-R-98-147, was published in November 1998 and received wide distribution. This Project Summary is an overview of the important points presented in that report. To obtain the full report, call the MAIA Team at 410-305-2749. An electronic version of the report is available through the World Wide Web at http://www.epa.gov/emap/html/cond_mae.htm.

The Mid-Atlantic Integrated Assessment (MAIA) is an interagency, multi disciplinary research, monitoring and assessment program to develop high-quality scientific information on the region's natural resources: current condition, stressors, trends, and vulnerabilities. MAIA results and information must satisfy a broad group of stakeholders' needs, convey important information relevant to their assessment questions and issues, and be understandable and useful in making management decisions.



Overview

Estuaries are transitional zones where salt water from the sea mixes with fresh water flowing off the land (Figure 1). They provide habitat for many birds, mammals, fish and other aquatic life. Therefore, estuaries are important assets that humans use in a wide variety of ways. The report focuses on the current condition of the Mid-Atlantic estuaries from the early- to mid-1990s, and how and why the estuaries have changed over the years. The Mid-Atlantic estuaries included in the report are: the Delaware Estuary, Chesapeake Bay and Delmarva coastal bays.

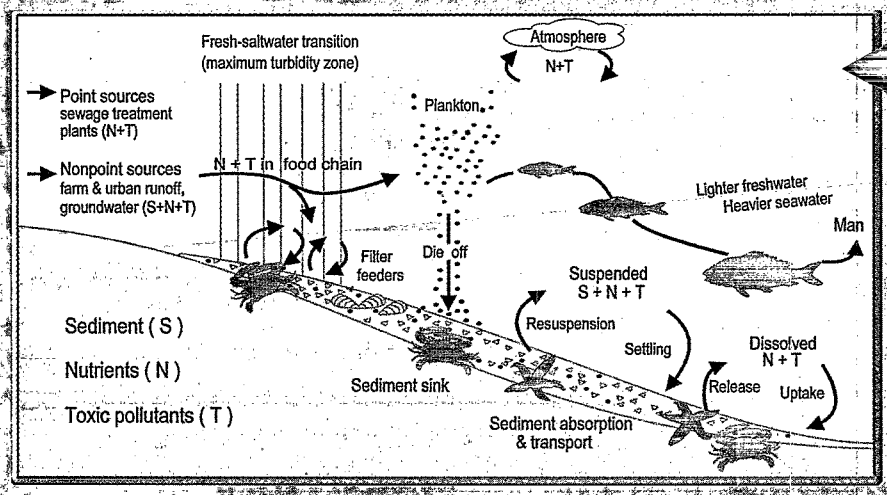


Figure 1. Schematic diagram of physical, chemical, and biological processes interacting in estuaries.

Source: Redrawn from USEPA, 1987

See the full report for all reference sources.

Condition of the Mid-Atlantic Estuaries was prepared by scientists from EPA's Office of Research and Development, Narragansett, Rhode Island, in collaboration with individuals from EPA Regions II and III and numerous other EPA offices; the states of Maryland, Virginia, and Delaware; the National Oceanic and Atmospheric Administration; the U.S. Geological Survey; and the U.S. Fish and Wildlife Service. It represents the synthesis of information published in a variety of independent scientific publications or contained in established scientific databases. Numerous research studies have been prepared by Federal and state programs and by academic researchers for individual states or estuaries; however, a comprehensive report including water quality, sediment contamination, habitat change, and the condition of living resources had never been done on a regional scale. Data from across Federal and state programs have been used and comparisons across systems within the Region have been made. The report not only identifies specific geographic problem areas, but estimates the percentage of estuarine area that is in good condition, is in moderate condition, or is degraded based on various estuarine indicators.

Environmental Challenge

The Mid-Atlantic Region has experienced some of the most rapid population growth, industrial growth, and intensive agriculture in the country. From 1950 to 1990, the population has grown from 13 to 21 million. By 2020 an estimated 25 million people will be living in the estuarine watershed of the Mid-Atlantic Region. (Figure 2). This growing population will require land for homes, transportation, shops, jobs, and recreation. Urban land currently comprises 5% of the region's watershed and generally is close to the estuarine shoreline. As watersheds become more developed, the amount of impervious surface area increases, the amount of pollutants carried in the storm-water increases, and the amount of wastewater and solid waste requiring disposal increases. Additionally, increased population puts increased pressure on the living resources.

Estuaries in the Mid-Atlantic Region are being adversely affected by human activities. Therefore, they need active management if environmental quality is to be sustained. The states, in conjunction with EPA through the Chesapeake Bay Program and the National Estuary Programs, have instituted successful environmental management programs to address these environmental challenges.

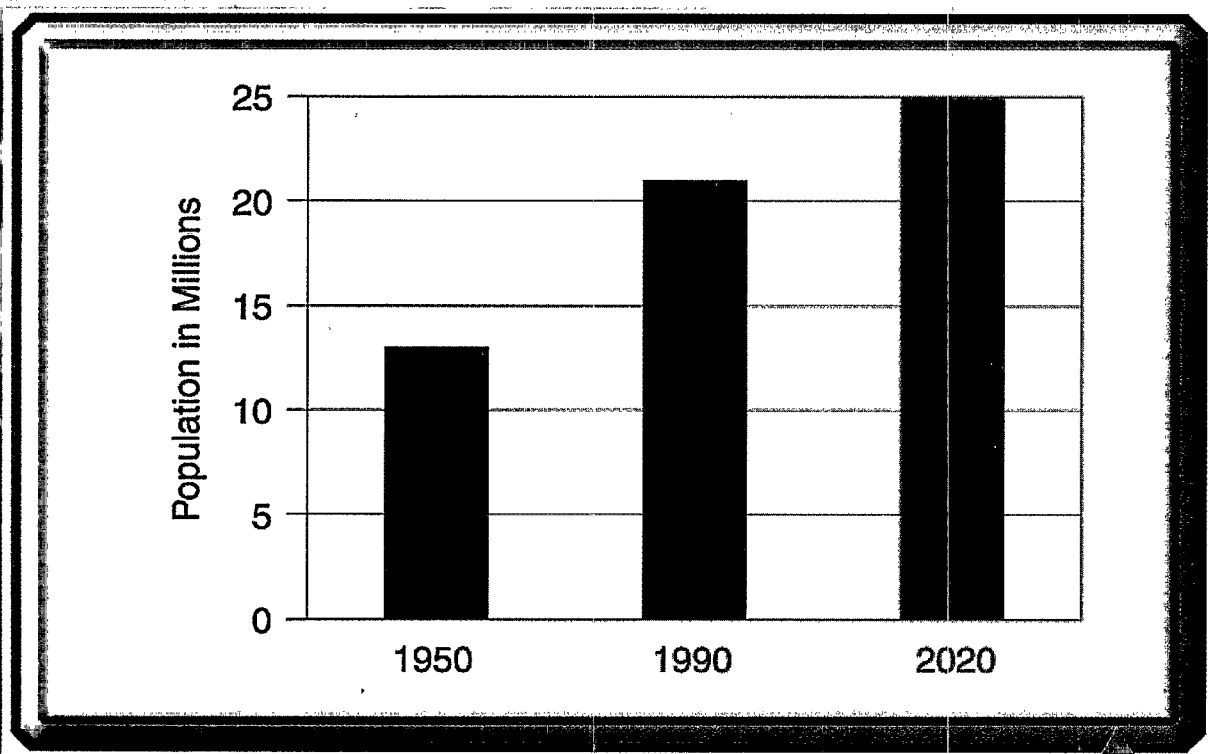
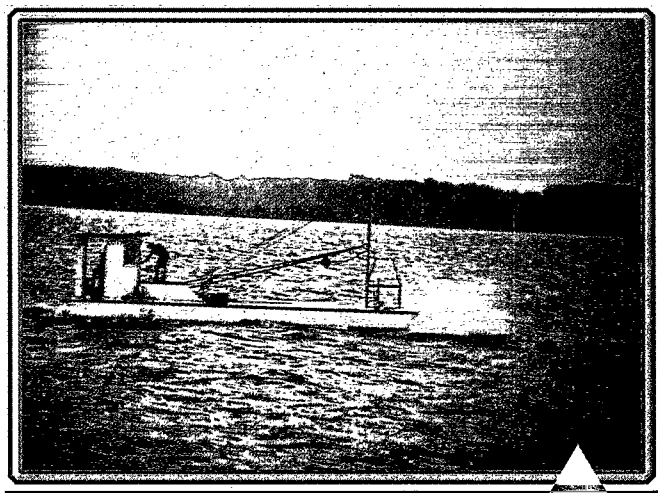


Figure 2. Human population estimates for the Mid-Atlantic estuarine watershed.
Source: Culliton *et al.*, 1990



Oyster harvest in the Chesapeake Bay

Photo by: Chesapeake Bay Program

polychlorinated biphenyl (PCB) concentrations. Chlordane levels that exceed the U.S. Food and Drug Administration action level have also been reported.

- The **Delmarva coastal bays** are the least degraded systems in the Mid-Atlantic Region, but are threatened by encroaching urbanization. These bays are moderately enriched by nutrients, particularly in Delaware, largely from agricultural sources. Eutrophication is increasingly noticeable in the dead-end canals along shorelines in the Delmarva coastal bays. SAV has historically been absent from the Delaware coastal bays due to high natural turbidity. The composition of shore zone fish species in the Delaware coastal bays indicates impacted environmental conditions. In contrast, the fish species in Maryland's coastal bays suggest a healthy habitat; researchers have, however, observed evidence of early stages of degradation in northern areas.
- **Oyster harvests** have declined from a high of 133 million pounds in 1880 to today's annual catch of about one million pounds. Disease, specifically Dermo and MSX, appears to be one of the major causes of the recent drastic decline in the oyster populations in the Chesapeake Bay and the Delaware Estuary, with over-harvesting and pollution also playing major roles in Chesapeake Bay. Although no immediate solution to the problem is known, researchers currently are working on the concept of introducing disease-resistant strains of oysters to the Mid-Atlantic.
- The most important shellfish industry in the Mid-Atlantic Region is now the **blue crab**. However, the significantly increased fishing pressure on this already heavily exploited resource is beginning to take its toll. To avoid a serious impact, both Maryland and Virginia have placed restrictions on crabbing in Chesapeake Bay waters.
- Each state monitors its estuarine waters for coliform bacteria and closes areas that reach critical levels to **shellfishing** (Figure 5). Coliform contamination may come from sewage treatment plants, leaking septic systems, marinas, industry, wildlife, boating, and runoff. Improvements in wastewater treatment have reduced the acreage closed to shellfishing from 18% in 1985 to 10% in 1995.

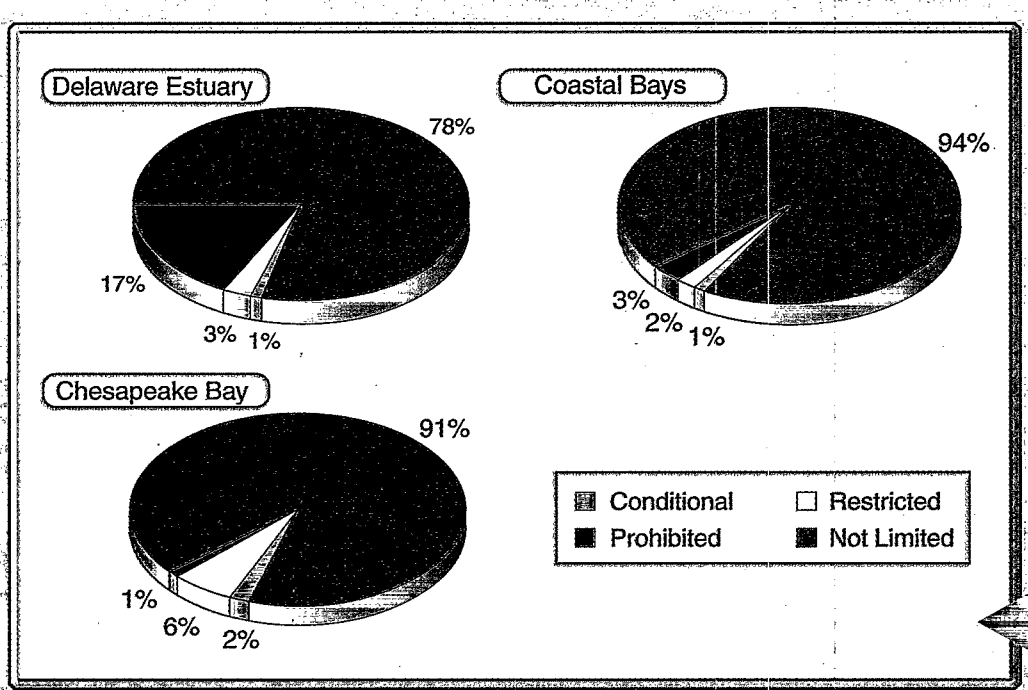
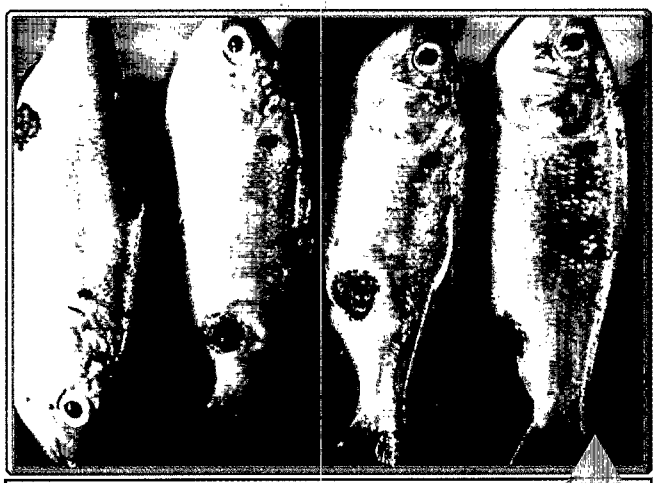


Figure 5.
Shellfish closures in Mid-Atlantic estuaries expressed as a percent of acreage classified as *productive* grounds.

Source: NOAA, 1997

Summary of Fish Trends Data

- The striped bass fishery in Chesapeake Bay and the Delaware Estuary is considered to be recovering.
- American shad populations are improving region-wide.
- The white perch population is stable but low in Chesapeake Bay.
- Summer flounder populations are stable or perhaps declining in the Delaware Estuary.
- Summer flounder populations are improving in the Maryland coastal bays.
- Drum species populations are variable in the Delaware Estuary.
- Shore-zone species composition suggest degraded conditions in the Delaware coastal bays.
- Shore-zone species compositions suggest generally healthy conditions with slight indications of degradation in the northern coastal bays of Maryland.

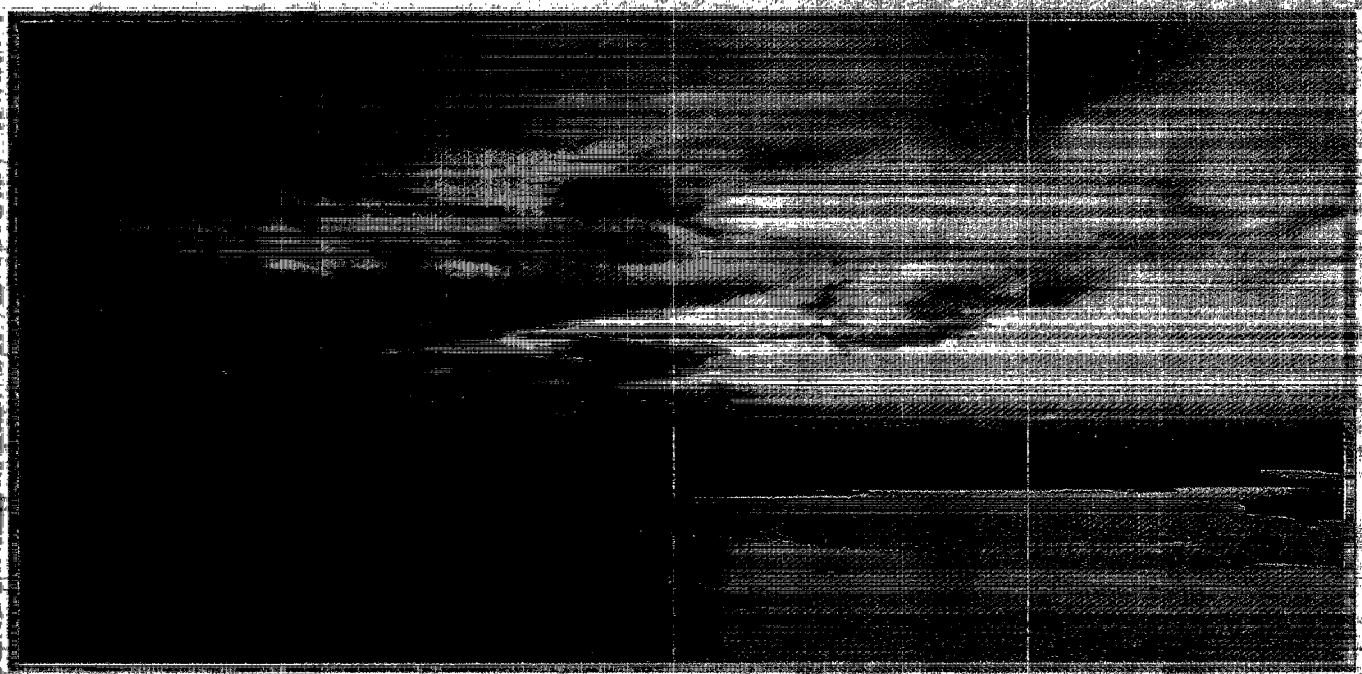


Fish exhibiting sores caused by *Pfiesteria.*

Photo by: Maryland Department of Natural Resources

- During the summer of 1997, a number of fish kills occurred in several small tributaries of Chesapeake Bay and the coastal bays. It was determined that these kills were caused by the toxic dinoflagellate *Pfiesteria*. ***Pfiesteria*** is not a disease, but an organism that is part plant and part animal, and occurs naturally from the Gulf of Mexico to the Delaware Estuary. A large number of research projects are currently underway to better understand this organism.

- In the states surrounding the estuaries of the Mid-Atlantic, numerous species of plants and animals are listed as **threatened** or **endangered** and virtually every county has at least one listed species. It is encouraging that the threatened and endangered species directly associated with the estuaries are improving.



Major Findings

- The **Chesapeake Bay** is the estuary most deficient in oxygen in the region. (Figure 3). Impacts to the Bay are associated with nutrient over-enrichment and the lack of dissolved oxygen. Excessive nutrients during the 1970s and 1980s contributed to prolonged algae blooms, which decreased dissolved oxygen and clarity of the water. This resulted in massive losses of submerged aquatic vegetation (SAV), which is critical habitat for animal life in the Bay – spawning fish, crabs, etc. Nutrient levels are now declining in response to improved wastewater management practices, implementation of best management practices on agricultural lands (nitrogen), and bans on certain types of detergents (phosphorus). The reduction in nutrients has resulted in partial recovery of the SAV beds. There has been more success in controlling point sources than controlling non-point sources of nutrients.
- The **Delaware Estuary** is impacted by the lack of water clarity (Figure 4) and toxic contaminants associated with urbanization and industrialization. It has some of the largest concentrations of nutrients measured anywhere in the world, although harmful phytoplankton blooms and other effects traditionally associated with nutrients are held in check by other factors, including low water clarity. The Delaware Estuary also has some of the highest levels of chemical contaminants in fish and shellfish in the nation. Portions of the estuary have bans or advisories on consumption of fin-fish due to elevated

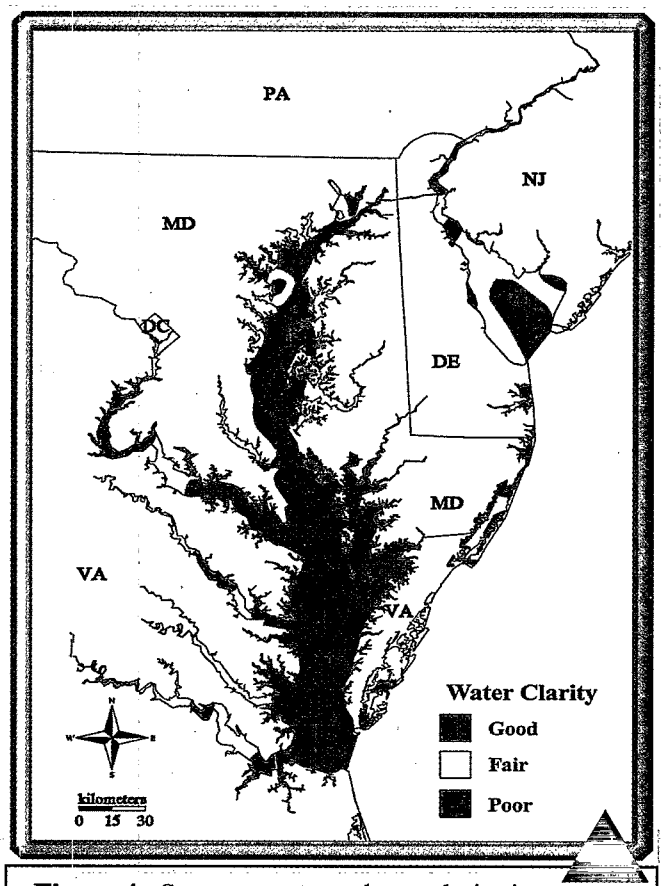


Figure 4. Summer water column clarity in Mid-Atlantic estuarine waters as observed in 1990-93. Water clarity categories are poor (red), fair (yellow), and good (green), which are defined in the Technical Appendix of the full report.

Sources: Strobel *et al.*, 1995; Paul *et al.*, 1997

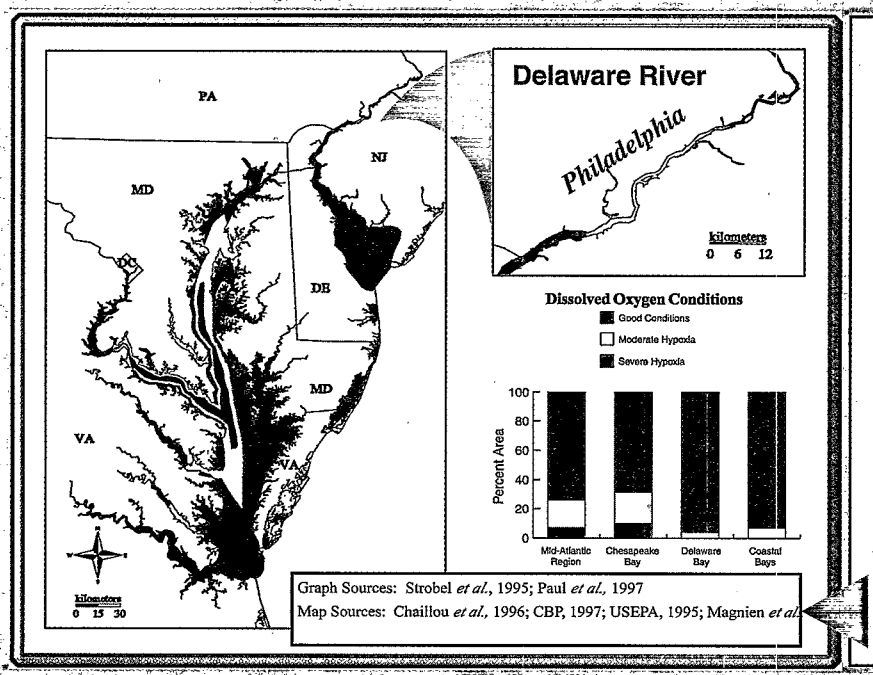
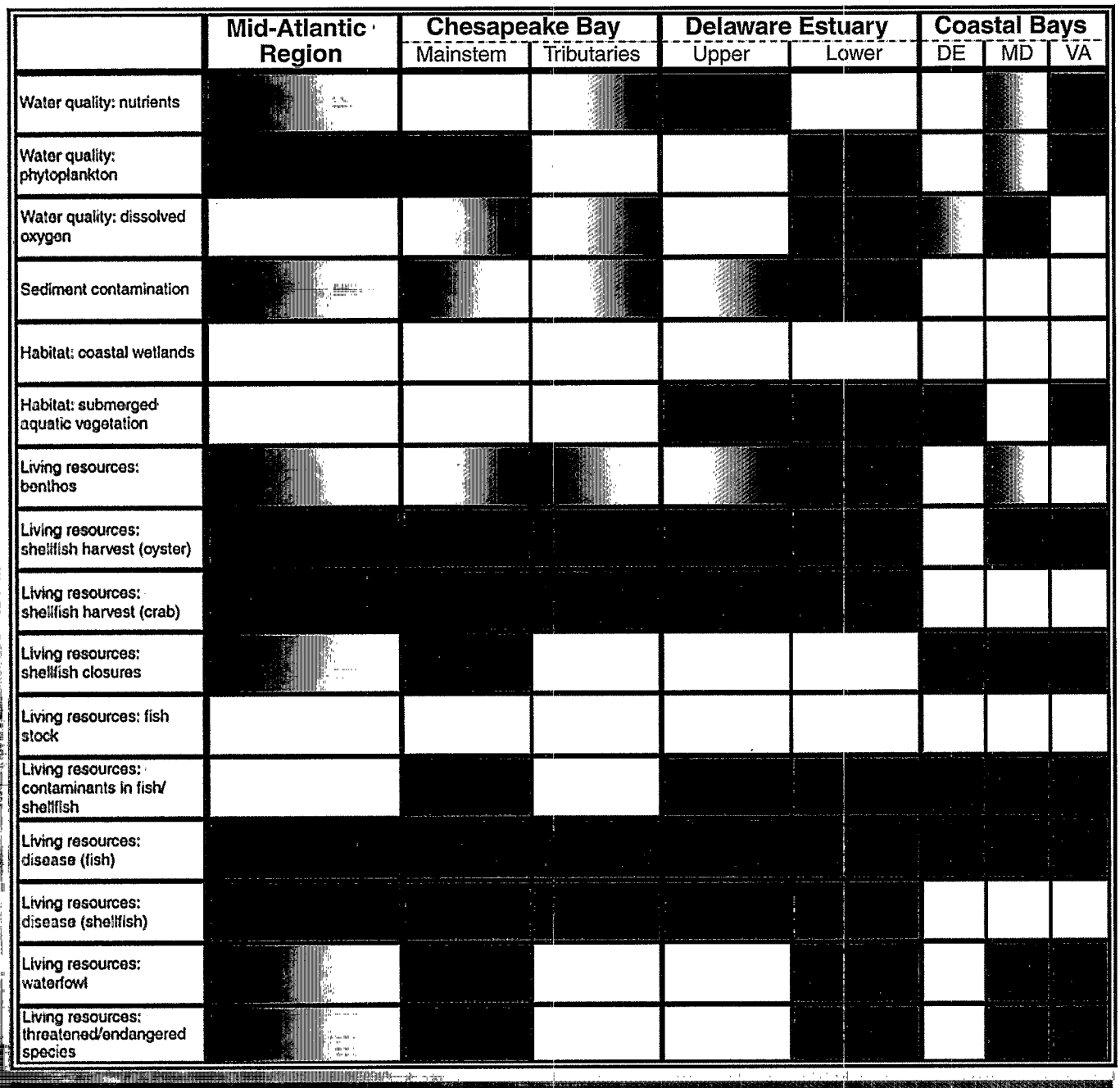


Figure 3. Distribution of summertime dissolved oxygen within one meter of bottom sediments across estuarine waters in the Mid-Atlantic Region. Categories are defined in the Technical Appendix of the full report. Data were derived from daylight observations and do not necessarily reflect night time depressions that may occur in some areas. Map depicts spatial distribution derived from multiple sources of information. Bar graph shows percent areas derived from EPA EMAP 1990-93 data.

Summary of ecological conditions across the Mid-Atlantic estuaries. Colors represent the best estimate of condition based upon information presented in the report—green for good condition, yellow for a moderate problem, and red for a problem. A lack of color indicates that inadequate information was available. Where multiple colors are shown, our best estimate is that condition ranges between the two categories. Problem areas are determined by individual indicator values. The table does not imply that problem areas are always man-induced.



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