

US EPA ARCHIVE DOCUMENT

INTEGRATED MONITORING APPROACH FOR MID-ATLANTIC ESTUARIES 1997-98 Field Activities

Over the next several years, the U.S. Environmental Protection Agency in partnership with other Federal and state programs will be conducting research on an integrated monitoring approach for Mid-Atlantic estuaries. Estuaries are the aquatic environment where freshwater from rivers and streams meet the saltwater of the ocean. These areas represent unique and particularly important ecological resources. Estuaries provide habitat for many species of animals and plants. Over 90 percent of commercial marine finfish and shellfish depend on estuaries for some part of their existence. The Mid-Atlantic area contains many estuaries, including the Chesapeake Bay -- the largest estuary in the North America.

For the purposes of this research, the geographic area includes the watersheds of the Delaware Estuary, Chesapeake Bay, Delmarva coastal bays, and Albermarle-Pamlico System. These areas encompass the states along the Atlantic Ocean from New Jersey south to North Carolina. Most of the area falls within the jurisdiction of EPA Region III, but areas of Region II and IV are involved.

The objectives of this research program are to: (1) characterize the ecological condition of the Mid-Atlantic estuaries using a common set of measurements applied over the entire area, (2) focus research on small estuarine systems to determine better monitoring approaches for these critical systems, and (3) to demonstrate that effective partnerships can be established among Federal and state agencies with estuarine responsibilities in the pursuit of scientific data for resource management purposes.

This collaborative approach to monitoring permits direct comparisons to be made among and between the many estuaries in the Mid-Atlantic area. Comparative assessments can lead the way to more informed, scientific strategies for resource preservation and restoration. Additionally, several adjunct research projects being performed simultaneously with monitoring activities will foster better understanding of the ecological processes occurring in the estuaries of this region.

Background

A number of Federal and state agencies have been involved in monitoring a variety of parameters in the Mid-Atlantic estuaries. From 1990 to 1994, the EPA research initiative known as the Environmental Monitoring and Assessment Program (EMAP) was active in this geographic area. As data from this effort were assessed, it became apparent that small estuarine systems merited further investigation. In order to facilitate this additional research, partnerships were developed with other agencies actively interested in estuarine science.

Other monitoring programs sponsored by Federal and state agencies are more geographically specific. The Chesapeake Bay Program in conjunction with the states of Maryland and Virginia has been active in monitoring the Bay since program inception in 1984. The Delaware River Basin Commission in cooperation with the states of Delaware, New Jersey and Pennsylvania has conducted monitoring studies on the Delaware River and Bay for a number of years. Individual states have also designed and implemented complementary monitoring programs. In the case of other Federal agencies,

the National Park Service has an ongoing program to monitor in the Assateague National Seashore, a large preserve on the Delmarva peninsula. The National Ocean and Atmospheric Administration of the U.S. Department of Commerce has been active in monitoring both estuarine and marine environments through the National Status and Trends Program and other initiatives.

Partnerships

In order to accomplish the objectives of this research program, partnerships have been forged among the Federal and state agencies listed below. These partnerships recognize that each of the governmental entities play an important and vital role in estuarine monitoring. Shared experiences, data, and information contribute to the system-wide approach being implemented.

Federal and State Partners in the Monitoring of Mid-Atlantic Estuaries

U.S. Environmental Protection Agency - Offices of Research and Development, of Water, and of Policy, Planning, and Evaluation; Regions II, III and IV

Chesapeake Bay Program

Department of Commerce - National Ocean and Atmospheric Administration

Department of the Interior - National Park Service and U.S. Fish and Wildlife Service

States of Delaware, Maryland, North Carolina, Virginia, New Jersey, Pennsylvania

Delaware River Basin Commission

National Estuary Programs - Delaware Estuary Program, Delaware Inland Bays Program, Maryland Coastal Bays Estuary Program

Field Activities for 1997

Over 700 sampling sites were visited during the summer of 1997, with the emphasis at the majority of the sites on water and sediment quality. These included sites selected using statistical survey designs (random selection) and fixed station survey designs (targeted selection). The following table presents the geographic distribution of the sampling sites. Since one of the objectives of the research program was to further investigate small estuarine systems, more emphasis was placed on these systems by spatial intensification of sampling in selected areas. Certain systems were selected because of their interest from environmental resource managers.

Major Estuarine Areas Selected for Sampling in 1997

Delaware Estuary:	Delaware River and Bay (mainstem) Salem River Schuylkill River
Delmarva Coastal Bays:	Sinepuxent Bay Chincoteague Bay Virginia coastal bays
Chesapeake Bay:	Chesapeake Bay (mainstem) Susquehanna River Severn River South River Patuxent River Potomac River York River James River Annapostia River Chester River Choptank River Pocomoke River Mobjack Bay Cherrystone Inlet Rappahannock River Saint Jerome Creek Pamunkey River Elizabeth River
Albermarle - Pamlico System:	Corrituck Sound Albermarle Sound Chowan River Pamlico Sound Pamlico River

Field Activities for 1998

Over 500 sampling sites were selected for monitoring during the summer of 1998, with fish trawling conducted at over 120 sites. These include sites selected using statistical survey designs (random selection) and fixed station survey designs (targeted selection). The following table presents the geographic distribution of these sites.

Major Estuarine Areas Selected for Sampling in 1998

Delaware Estuary:	Delaware River and Bay (mainstem)
Delmarva Coastal Bays:	Sinepuxent Bay Chincoteague Bay
Chesapeake Bay:	Chesapeake Bay (mainstem) Susquehanna River Patuxent River Potomac River York River James River Choptank River Rappahannock River Magothy River Mattaponi River Occohannock Creek Lynnhaven Bay Chickahominy River Eastern Bay
Albermarle - Pamlico System:	Neuse River

Common Set of Measurements

A unique aspect of this collaborative research program is the sampling for a set of consistent measurements across the Mid-Atlantic estuaries. The list of the parameters collected was developed in conjunction with Federal, state, and county authorities to address critical scientific issues affecting these estuaries. These parameters focus on many aspects of the estuarine biotic community, both plants and animals, as well as provide important information about the exposure to stresses in the estuarine environment. In general, the measurements include data on fish and shellfish, benthic (bottom-dwelling) community structure, water quality, toxic contaminants in bottom sediment, and sediment toxicity. The complete list of measurements is found in the Appendix.

Future Activities

The ultimate goal of this cooperative research program is to design an integrated monitoring approach for the Mid-Atlantic estuaries which will be embedded in ongoing monitoring programs. The data collected in 1997 and 1998 will be analyzed and synthesized, and reports will be prepared starting in 1999.

For More Information

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Appendix

CORE MEASUREMENTS FOR MID-ATLANTIC ESTUARIES (EMAP Protocol Unless Otherwise Specified)

Location (latitude and longitude)

Time and Date of Sampling

Depth of Water Column

Water Column Measurements (Water Quality)

Physical measurements (surface and bottom; water column profiles at some stations)

- Temperature
- Salinity
- Dissolved oxygen
- pH
- Conductivity

Water Clarity (Secchi disk or turbidity) (measured once per station)

Water Column Chemistry (Chesapeake Bay Program Protocol) (surface and bottom)

- Dissolved silica
- Dissolved ammonia
- Dissolved nitrite and nitrate
- Dissolved nitrite
- Particulate organic nitrogen
- Total dissolved nitrogen
- Total dissolved phosphorous
- Dissolved orthophosphate
- Total particulate phosphorous
- Particulate organic carbon
- Total suspended solids
- Chlorophyll *a*
- Pheophytin

Sediment Measurements (Sediment Quality)

Benthic macroinvertebrates (1997 emphasis)

- Species composition and enumeration
- Biomass
- Silt-clay content (% silt/clay)

Observational SAV (in conjunction with benthic grab)

Sediment Chemistry (1997 emphasis)

- NOAA NS&T contaminants (see table below)
- Acid volatile sulfides (AVS) and simultaneously extractable metals (SEM)
- Silt-clay content (% silt/clay)
- Total organic carbon

Sediment Bioassay (1997 emphasis)

- Pore water concentrations of ammonia and hydrogen sulfide
- Microtox[®] sediment toxicity
- Ampelisca abdita* sediment toxicity

Fish/Shellfish Measurements (1998 emphasis)

Fish tissue contaminants
Fish community
External pathology
Macrophage aggregates
Crab hemolymph

Organic contaminants and major trace elements
as used in the NOAA NS&T Program.

Polycyclic aromatic hydrocarbons

Low molecular weight PAHs
(2- and 3-ring structures)

1-Methyl naphthalene
1-Methyl phenanthrene
2-Methyl naphthalene
2,6-Dimethyl naphthalene
1,6,7-Trimethylnaphthelene
Acenaphthene
Acenaphthylene
Anthracene
Biphenyl
Fluorene
Naphthalene
Phenanthrene

High molecular weight PAHs
(4-, 5-, and 6-rings)

Benzo[a]anthracene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[e]pyrene
Benzo[ghi]perylene
Benzo[k]fluoranthene
Chrysene
Dibenz[a,h]anthracene
Fluoranthene
Indeno[1,2,3-cd]pyrene
Perylene
Pyrene

Chlorinated Pesticides

2,4'-DDD
2,4'-DDE
2,4'-DDT
4,4'-DDD
4,4'-DDE
4,4'-DDT
Aldrin
beta-Hexachlorohexane
Chlorpyrifos
cis-Chlordane
cis-Nonachlor
delta-Hexachlorohexane
Dieldrin

Endosulfan I
Endosulfan II
Endrin
alpha-Hexachlorohexane
gamma-Hexachlorohexane (lindane)
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Mirex
Oxychlordane
trans-Chlordane
trans-Nonachlor

Polychlorinated Biphenyl congeners (UPAC numbering system)

PCB 8, PCB 18, PCB 28, PCB 44, PCB 52, PCB 66, PCB 101, PCB 105, PCB 118/108/149, PCB 128, PCB 138, PCB 153, PCB 170, PCB 180, PCB 187/182/159, PCB 195, PCB 206, PCB 209

Major and trace elements

Al, Si, Cr, Mn, Fe, Ni, Cu, Zn, As, Se, Sb, Ag, Cd, Hg, Tl, Pb

Organotins

Monobutyltin³⁺, Dibutyltin²⁺, Tributyltin, Tetrabutyltin