Chapter 1.1

Ecosystem health assessment:
Monitoring Maryland's Coastal Bays

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Introduction

The Maryland Coastal Bays estuary is one of 28 estuaries recognized through the U.S. Environmental Protection Agency's (EPA) National Estuary Program. The Coastal Bays are defined as shallow lagoons. Lagoons are bay systems that are characterized by being located behind barrier islands, having shallow depths, high salinities and limited flushing. These natural characteristics drive ecosystem processes, but these processes are affected by human (anthropogenic) influences.

This report uses environmental indicators to measure the health of the bays and provides an assessment of progress made toward implementing the priority actions of the Comprehensive Conservation and Management Plan (CCMP) created in conjunction with the EPA designation. **This report attempts to capture the major elements of the bays health that reflect the current perceptions of scientists and managers as to what constitutes the State of the Bays Health.** It contains many of the traditional measures for assessing aquatic ecosystem health.

The Aquatic Ecosystem Health Monitoring Plan was developed to help determine the effectiveness of management actions taken as part of the Maryland Coastal Bays National Estuary Programs' Comprehensive Conservation Management Plan (CCMP) (Maryland Coastal Bays Program 1999). Actions in the management plan address five priority problems: degraded water quality, loss of habitats, changes in living resources, unsustainable growth and development, and poorly planned recreational use of the bays. Degraded water quality, due to nutrient and sediment enrichment, was identified as the most pressing environmental problem facing Maryland's Coastal Bays. The Eutrophication Monitoring Plan was designed to specifically track the implementation of management actions and monitor changes in nutrient/sediment loading and subsequent responses to the ecosystem (e.g. impacts to general water quality, habitat and living resources).

One of the long-term goals of the Maryland Coastal Bays Program (MCBP) is to help identify and track a set of **regional environmental indicators and related threshold levels** and produce a "State of the Coastal Bays" report. The aquatic environmental indicators developed by the MCBP Scientific and Technical Advisory Committee (STAC) are used in this report to assess the health of the bays in addition to some new draft indicators (MCBP 2002) (Table 1.1.1). Environmental indicators are used to describe the status and trends of our natural resources, environmental health and

ecological condition. They help raise awareness about important issues, can inform environmental policy decisions and serve as a tool for evaluating the effectiveness of management actions. Environmental indicators are similar to many of the economic and social indicators that are ingrained into our culture, such as the Dow Jones Industrial Average. Just as the Dow gives investors a general picture of the state of the market, environmental indicators give scientists and managers a picture of the state of our ecosystems.

A variety of indicators and thresholds were used to assess estuarine health (summary table of indicators and thresholds used in Table 1.1.1). Thresholds were approved by STAC. Maryland Department of Natural Resources (DNR) scientists have worked with MCBP, University of Maryland and other researchers to evaluate the Coastal Bays monitoring data collected since 2001.

This report is intended to supplement other publications, such as the MCBP Progress Report and the University of Maryland Center for Environmental Science (UMCES), Integrated Analyses Network (IAN) Report Card. The MCBP Progress Report summarizes the management actions taken to date on each of the priority problems listed above. This report will serve to inform managers on the effectiveness of these actions. The IAN Report Card will be produced this year and will provide a "snapshot" of the Coastal Bays water quality based on intensive sampling over a few days or weeks. The "State of the Bays" report is intended to provide comprehensive coverage over a three-year period. This report will also inform and supplement current efforts by the Maryland Department of the Environment (MDE) and the Worcester County Department of Planning to develop and implement Total Maximum Daily Load (TMDL) regulations and Watershed Restoration Action Strategy (WRAS) plans, respectively.

For this report, the Coastal Bays, located in Worcester County behind Ocean City and Assateague Island, have been divided into six segments in which conditions are reported. The segments include Assawoman Bay, Isle of Wight Bay, St. Martin River, Sinepuxent Bay, Newport Bay and Chincoteague Bay (Figure 1.1.1).

Table 1.1.1 Summary of Indicator and thresholds

Aquatic Ecosystem Component	Indicator	Threshold	Monitoring Frequency
Stream Health	Stream nitrate	Less than 1 mg/L	Highly varied
	Stream bottom-dwelling animal index1	Less than or equal to 2.8	Annually
	Stream bottom-dwelling animal index2	Less than or equal to 4	Every 5 years
	Freshwater fish index	Greater than or equal to 4	Every 5 years
Water Quality	Total Nitrogen	No more than 0.65 mg/L for seagrass growth; No more than 1 mg/L as set by STAC*	Monthly
	Total Phosphorus	No more than 0.037 mg/L for seagrass growth; No more than 0.01 mg/L as set by STAC*	Monthly
	Chlorophyll *a*	No more than 15 micrograms/L to prevent low dissolved oxygen; No more than 50 micrograms/L as set by STAC*	Monthly, as well as continuous monitoring and water quality mapping (the latter two measure total chlorophyll)
	Dissolved Oxygen	No less than 5 mg/L to prevent effects on aquatic life; No less than 3 mg/L as set by STAC*	Monthly, as well as continuous monitoring and water quality mapping
	Water Quality Index	Greater than 0.6	Calculated by combining values from all water quality indicators
Harmful Algae	Harmful Algae Blooms	Species specific thresholds	As needed, when water quality indicates algae at high levels
Habitat	Seagrass	Goal acreage in development	Annual survey
	Macroalgae	None	Not routinely monitored
	Shoreline	Percent natural shoreline	Not routinely monitored
	Wetlands	No net loss	Not monitored directly
Living Resources	Phytoplankton	None	Monthly – weekly
	Fish	No decreasing trend in forage fish index	Monthly Trawl: April – Oct Seine: June and Sept.
	Fish kills	none	As needed
	Shellfish (clams, scallops, oysters)	None	Clams – annual survey
	Blue crabs	None	Monthly with fish survey
	Bottom dwelling animals	Federally-mandated index values	Annually 2000 - 2003

Monitoring
Many agencies participate in monitoring the Coastal Bays ecosystem (see Table 1.1.2).
Monitoring data is used to characterize water quality, habitat and living resource

conditions, providing an essential component to identifying and implementing management actions to address problem areas.

Table 1.1.2   Summary of monitoring efforts in the Coastal Bays.

Aquatic Ecosystem Component	Criteria	Monitoring group*
Stream Health	Stream nitrate	MD DNR- watershed restoration service (WRS); U.S. Geologic Survey (USGS), MD DNR- Monitoring and non-tidal assessment (MANTA)
	Stream benthic index1 Stream benthic index2	MD DNR- MANTA MD DNR- Maryland Biological Stream Survey (MBSS)
	Freshwater fish index	DNR- MBSS
Water Quality	Total Nitrogen	ASIS MD DNR – Tidewater Ecosystem Assessment (TEA)
	Total Phosphorus	ASIS MD DNR – TEA
	Chlorophyll *a*	ASIS MD DNR – TEA MCBP
	Dissolved Oxygen	Assateague Island (ASIS) National Park Service MD DNR – TEA
	Benthic Chlorophyll	MD DNR-TEA
	Water Quality Index	DNR
Harmful Algae	Brown Tide	MD DNR – TEA ASIS
	Harmful Algae Blooms	MD DNR - TEA
Habitat	Seagrass	Virginia Institute of Marine Science (VIMS)
	Submerged aquatic vegetation (SAV) Index	MD DNR- TEA
	SAV water clarity	MD DNR- TEA
	Macroalgae	MD DNR - TEA
	Wetlands	MD DNR-WRS Maryland Department of the Environment (MDE) U.S. Army Corps of Engineers
	Fish	MD DNR – coastal fisheries
	Fishkills	MDE
	Shellfish (clams, scallops, oysters)	MD DNR – coastal fisheries
	Benthic Index	MD DNR - TEA
	Bluecrabs	MD DNR – coastal fisheries
	Horseshoe crab	MD DNR – coastal fisheries MCBP
	Piping Plove	ASIS
	Waterbirds	MD DNR – Wildlife and Heritage

* DNR-Maryland Department of Natural Resources (the following are DNR divisions and programs): WRS-Watershed Restoration Service; MANTA-Monitoring and Non-Tidal Assessment; MBSS-Maryland Biological Stream Survey; TEA-Tidewater Ecosystem Assessment; MGS-Maryland Geological Survey; FISH-Fisheries Service. (The following are non-DNR monitoring partners): USGS-United States Geological Survey; ASIS-National Park Service, Assateague Island National Seashore; MCBP-Maryland Coastal Bays Program; UMCES-University of Maryland Center for Environmental Science; VIMS-Virginia Institute of Marine Science; MDE-Maryland Department of the Environment; USACE-United States Army Corps of Engineers; UDCMS-University of Delaware College of Marine Studies.

DNR, the National Park Service and MCBP volunteers all routinely monitor water quality. The United States Geological Survey (USGS) analyzes ground water inputs to the estuary. DNR also monitors stream health, sediment quality and harmful algae blooms. Habitat monitoring is conducted by the Virginia Institute of Marine Science through an annual aerial survey of seagrass bed distribution, while macroalgae abundance and distribution and shoreline change is tracked by DNR. The Maryland Department of the Environment (MDE) teams with DNR to collect data on wetlands. Fish, blue crabs, shellfish and benthic communities are surveyed by DNR and VERSAR while fish kills are monitored by MDE and exotic species abundances were surveyed by the University of Delaware.

References

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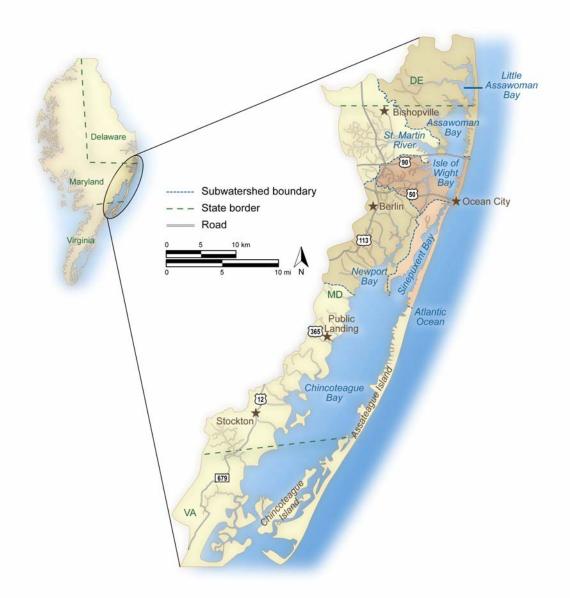
Figure 1.1.1 General location of Maryland's Coastal Bays along the east coast of the United States. The watershed area of each of the Coastal Bays is also shown.