

Chapter 1.1

Ecosystem health assessment: Monitoring Maryland's Coastal Bays

Catherine Wazniak¹

¹Maryland Department of Natural Resources, Tidewater Ecosystem Assessment, Annapolis, MD 21401

Introduction

The Maryland Coastal Bays estuary is one of 28 estuaries recognized through the US 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, sandy sediments and limited freshwater flow. 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 Coastal Bays and provide 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 (Maryland Coastal Bays Program 1999a). **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 Coastal Bays' health.** It contains many of the traditional measures for assessing aquatic ecosystem health.

The Maryland Coastal Bays Eutrophication Monitoring Plan, also known as the Aquatic Ecosystem Health Monitoring Plan, was developed to help determine the effectiveness of management actions taken as part of the CCMP (Maryland Coastal Bays Program 1999b). Actions in the Coastal Bays 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 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**. 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 (Maryland Coastal Bays Program 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, inform environmental policy decisions, and evaluate 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 stock 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 (Table 1.1.1). Thresholds were approved by the STAC. DNR scientists have worked with the MCBP, the University of Maryland, and other researchers to evaluate the Coastal Bays monitoring data collected since 2001.

The Maryland Coastal Bays Ecosystem Health Assessment is intended to provide comprehensive monitoring coverage over a three-year period. This ecosystem health assessment is intended to support other publications, such as the MCBP Progress Report. 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. 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. This assessment will also provide a reference for the University of Maryland Center for Environmental Science Integration and Application Network (IAN) report card. The IAN report card will be produced later this year, providing a snapshot of Coastal Bays water quality based on intensive sampling over a few days.

For this report, the Coastal Bays 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 indicators and thresholds

Aquatic Ecosystem Component	Indicator	Threshold	Monitoring Frequency
Stream Health	Stream nitrate	Less than 1 mg/L	Highly varied
	Stream benthic index1	Less than or equal to 2.8	Annually
	Stream benthic 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 <i>a</i>	No more than 15 µg/L to prevent low dissolved oxygen; No more than 50 µg/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
Sediment Quality	Excess Organic Carbon	Less than or equal to 1%	Periodically
	Mean Apparent Effects Threshold	None	Calculated from sediment contaminant data (2000-2003)
	Ambient Toxicity	Significant difference from uncontaminated sediment	Annually 2000 - 2003
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	Direct wetland losses from permitted activities tracked.
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
	Benthic organisms	Federally-mandated index values	Annually 2000 - 2003
	Exotic species	Presence	Survey 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 in the Coastal Bays, 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	Indicator	Monitoring group*
<i>Stream Health</i>	Stream nitrate	DNR- WRS; USGS; DNR- MANTA
	Stream benthic index1	DNR- MANTA
	Stream benthic index2	DNR- MBSS
	Freshwater fish index	DNR- MBSS
<i>Water Quality</i>	Total nitrogen	ASIS DNR – TEA
	Total phosphorus	ASIS DNR – TEA
	Chlorophyll <i>a</i>	ASIS DNR – TEA MCBP UMCES
	Dissolved oxygen	ASIS DNR – TEA UMCES
	Water quality index	UMCES
<i>Sediment Quality</i>	Excess organic carbon	DNR-MGS
	Mean apparent effects threshold	DNR- MGS
	Ambient toxicity	DNR - TEA
<i>Harmful Algae</i>	Harmful algae blooms	DNR - TEA
<i>Habitat</i>	Seagrass	VIMS
	Macroalgae	DNR - TEA
	Shoreline	DNR-MGS
	Wetlands	DNR-WRS MDE USACE
<i>Living Resources</i>	Phytoplankton	DNR-MANTA
	Fish	DNR – FISH
	Fishkills	MDE
	Shellfish (clams, scallops, oysters)	DNR –FISH
	Blue crabs and horseshoe crabs	DNR – FISH
	Benthic index	DNR - TEA
	Exotic species	UDCMS

* 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.

The Maryland Department of Natural Resources (DNR), National Park Service at Assateague Island (ASIS), and the MCBP volunteers all routinely monitor water quality (Maryland Coastal Bays Program 1999a). The University of Maryland Center for Environmental Science (UMCES) provides expertise in water quality mapping. The United States Geological Survey (USGS) analyzes ground water inputs to the estuary (Dillow et al. 2002). Maryland DNR also monitors stream health, sediment quality, and harmful algae blooms. Habitat monitoring is conducted by the Virginia Institute of Marine Science through annual aerial surveys of seagrass bed distribution (Virginia Institute of Marine Science 2003), while macroalgae abundance and distribution (McGinty et al. 2002) and shoreline change (Maryland Geological Survey 2004) is tracked by DNR. The Maryland Department of the Environment (MDE) teams with DNR to collect data on wetlands (Maryland Department of the Environment 2004a). Fish, blue crabs, shellfish, and benthic communities are surveyed by DNR (Maryland Coastal Bays Program 1999a) while fish kills are monitored by MDE (Maryland Department of the Environment 2004b). The University of Delaware has surveyed exotic species abundances and their presence is recorded during MD DNR fish surveys.

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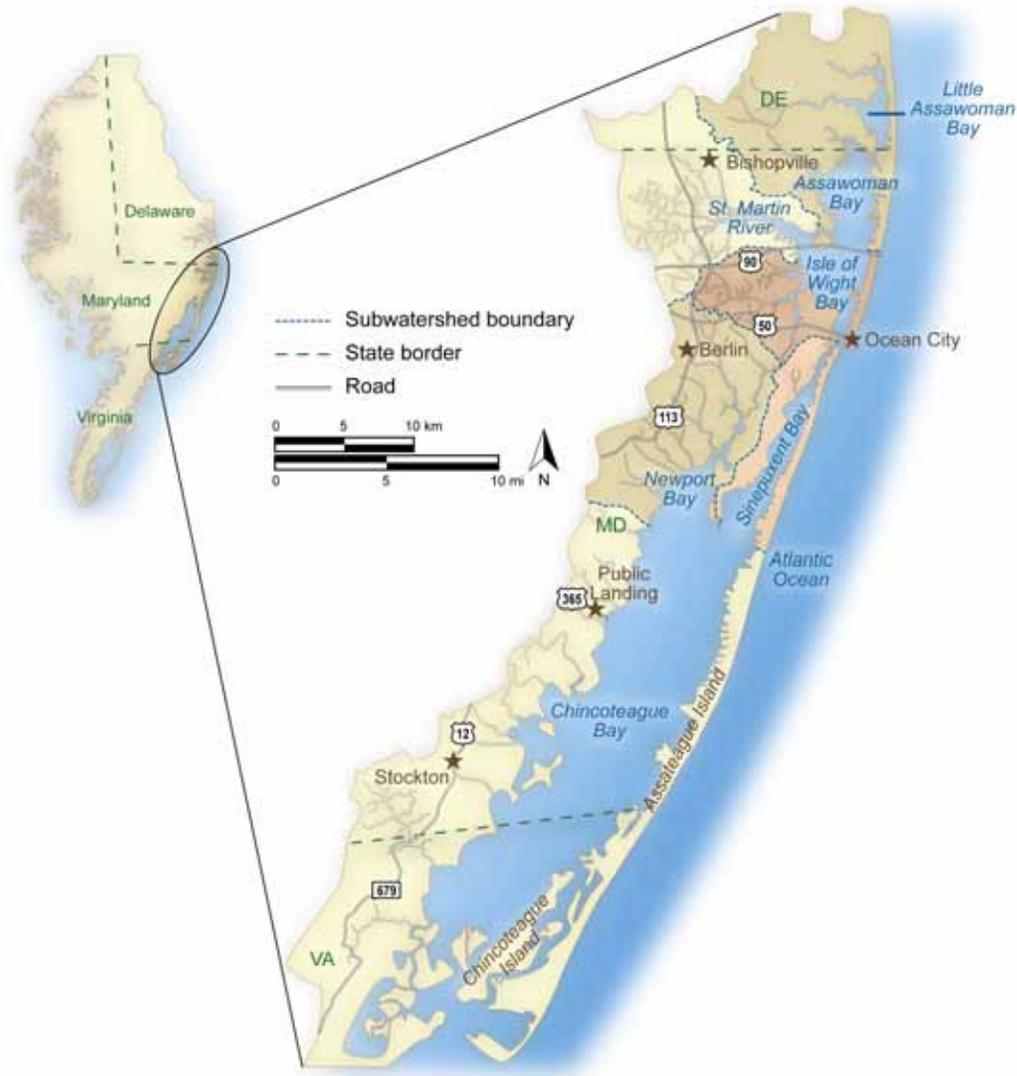


Figure 1.1.1: General location of Maryland's Coastal Bays along the east coast of the Del-Mar-Va peninsula, United States. The watershed area of each of the Coastal Bays segments is also shown.