MONITORING INVENTORY AND NEEDS ASSESSMENT FOR THE DELAWARE ESTUARY

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Introduction

The revised Comprehensive Conservation & Management Plan (CCMP) for the Delaware Estuary is a 10-year plan created to guide the work of partners across the region for watershed improvements. The Monitoring Approach section of the revised CCMP outlines activities that facilitate coordination of monitoring of diverse natural resources (e.g., water quality, living resources). These activities include:

- Annual joint meetings of the Science & Technical Advisory Committee (STAC) and the Monitoring Advisory & Coordination Committee (MACC) to share results of activities monitored and coordinate monitoring plans for the upcoming year
- Collaboration on State of the Estuary (SOE) reporting every 4-5 years to identify and collect indicator datasets from diverse monitoring and research programs
- Monitoring workshop every 4-5 years to create and update an inventory of critical monitoring in the region

In September 2018, 300 regional scientists and monitoring experts were invited to provide information on past and present monitoring efforts to be incorporated into a baseline draft of a new monitoring inventory. The geographic focus was the Delaware River Basin, especially the lower half that comprises the Delaware Estuary Focus Area outlined in the revised CCMP (Fig 1). Special attention was given to monitoring programs that were geospatially broad and conducted for longer time periods. These 300 regional experts were later invited to provide additional input during a monitoring workshop and post-workshop survey.

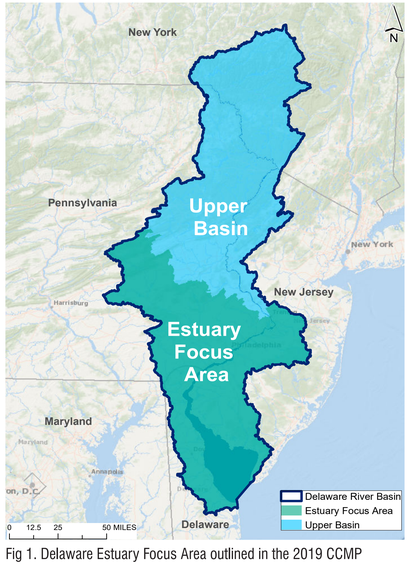

Fig 1. Delaware Estuary Focus Area outlined in the 2019 CCMP

WHAT'S IN THE DELAWARE ESTUARY MONITORING INVENTORY?

The monitoring inventory includes 6 overarching categories of information for each entry: general project information, temporal data, spatial coverage, project notes and sampling method, data availability and access, and additional information (Fig. 2). There are 620 monitoring entries in the current inventory database. Monitoring projects and activities were submitted by 36 different organizations and partnerships (Fig 3). About 20 different characteristic groups for associated entries were collected in the inventory (Fig 4).

General Project Information	• **Characteristic Group** (e.g., biological, chemical) • **Parameter** (e.g., relative abundance, DO) • **Unit** (e.g., mg/L) • **Project/Contact Name and Info/Collected by**
Temporal Data	• **Status** (e.g., ongoing) • **Frequency** (e.g., annually, biennually) • **Period** (e.g., May-Sep, all year) • **Start and end year**
Spatial Data	• **State(s)** (DE, PA, NJ) • **HUC** *(if applicable)* • **Waterbody** *(if applicable)* • **River Mile From and To** *(if applicable)*
Project & Sampling Notes	• **Sample Matrix** (e.g., water, air) • **Gear/Method** • **Changes in sampling** *(if applicable)*
Data Availability & Access	• **Data Access** (e.g., National Water Quality Data Portal) • **Data Availability** • **Time Frame** (e.g, 1991-present)
Additional Information	• **Project/Program objective** • **QAPP** *(if applicable)* • **Other project comments**

Fig 2. Project entry categories in the Delaware Estuary Monitoring Inventory

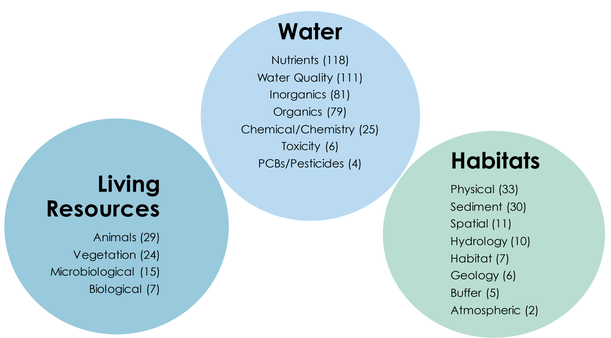

Fig 4. Characteristic groups identified in the Delaware Estuary Monitoring Inventory entries

DELAWARE ESTUARY MONITORING SURVEY

Overview

A monitoring survey was sent to a list of 300 regional scientists and monitoring experts in December 2018. The purpose of the survey was to examine results from the October 2018 monitoring workshop, aid in prioritizing and ranking results from the workshop, and gather additional information for the Delaware Estuary Monitoring Inventory. The survey broke the monitoring inventory into four sets of parameters: non-plant living resources, plants and habitat, water quality in the Delaware River and Bay, and water quality in the tributaries. For each of the four sets of parameters, respondents were asked to rank the importance of various parameters in a list that were identified at the workshop as not yet being robustly monitored in their respected study area.

Results

Fifty-five people from 34 organizations, companies, and universities representing a diverse spread of expertise participated in the monitoring survey (Fig 5). Of the parameters identified as not yet being robustly monitored, survey respondents indicated that the following parameters were high priority in their respected study area: invasive species, freshwater bivalves, population-level monitoring, cumulative impacts, submerged habitat, transition zone monitoring, endocrine disruptors, fish tissue analysis, pharmaceuticals, wet weather, and flow measurements (Figs. 6-9).

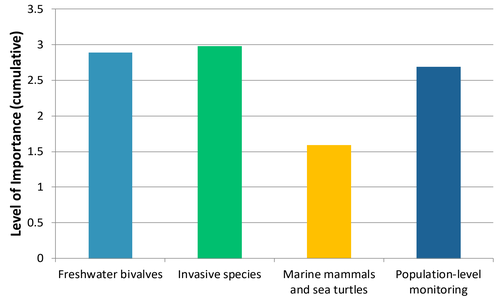

Fig 6. Ranking of non-plant living resource parameters identified as not yet being robustly monitored

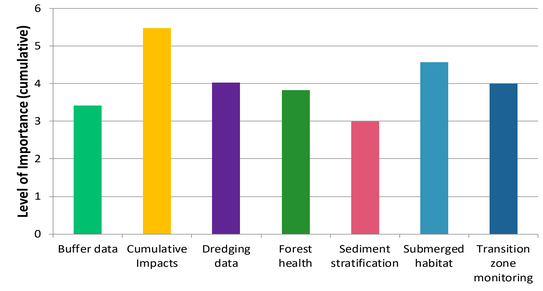

Fig 7. Ranking of plant and habitat parameters identified as not yet being robustly monitored

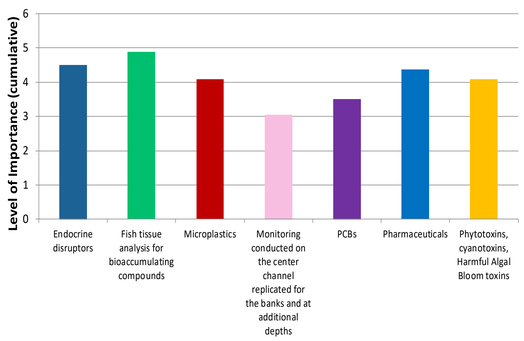

Fig 8. Ranking of water quality (Delaware River and Bay) parameters identified as not yet being robustly monitored

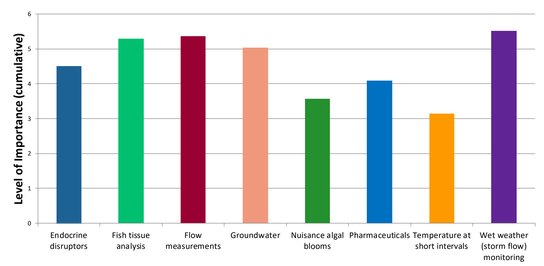

Fig 9. Ranking of water quality (tributary) parameters identified as not yet being robustly monitored

DELAWARE ESTUARY MONITORING WORKSHOP

Overview

The goal of the October 2018 monitoring workshop was to review the draft inventory of monitoring parameters, identify gaps in data collection, and gather input to help prioritize future monitoring efforts. A total of 36 individuals participated in the monitoring workshop. Discussion topics during this workshop included the following:

- Important resources and/or parameters to monitor over the next ten years
- Missing programs/parameters from the draft inventory
- Geographic data gaps
- New programs and efforts to be prioritized for the future

Results

Participants suggested evaluating the level of effort that would be required to create a geospatial representation of the monitoring inventory entries. Participants also recommended to ensure that there are sufficient habitat and wildlife representatives involved in or contributing to the process (e.g., collect additional monitoring data from regional forestry experts). According to workshop participants, the following resources should be monitored over the next 10 years:

- Water quality (e.g., DO, PCBs)
- Habitat (e.g., land use, land cover change)
- Species (e.g., richness, populations)
- Human-related parameters (e.g., behavioral change)

American Rivers
Berks Nature and volunteers
Bucks County Conservation District
Delaware Nature Society
Delaware State University
Delaware StreamWatch
DNHP & DNREC
DNREC
DNREC & DNERR
DNREC & PDE
DRBC
DRBC & DNREC
DRBC & NJDEP
DRBC & NPS
DVRPC
Independence Seaport Museum
Lower Merion Conservancy
NJDEP
PADEP & CRM
Pennypack Ecological Restoration Trust
PWD
PWD & USGS
Rutgers Haskin Shellfish Research Laboratory
Temple University
TNC DE Volunteers
TNC NJ & Rutgers University
Tookany Tacony-Frankford Partnership
USGS
Villanova University
White Clay Wild and Scenic River Program
Wissahickon Valley Watershed Association

Fig 3. Characteristic groups identified in the Delaware Estuary Monitoring Inventory entries

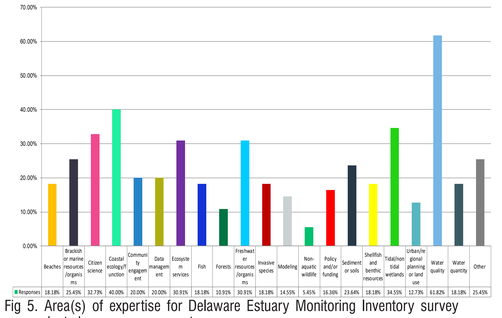

Fig 5. Area(s) of expertise for Delaware Estuary Monitoring Inventory survey respondents by response percentage

Delaware Estuary Monitoring Inventory and the Environmental Response Management Application (ERMA)

ERMA is a web-based Geographic Information System (GIS) tool that assists both emergency responders and environmental resource managers in dealing with incidents that may adversely impact the environment. Coordinating with the Partnership for the Delaware Estuary (PDE), the National Oceanic and Atmospheric Administration (NOAA) added parameters from the monitoring inventory as an area of interest layer on ERMA (Fig. 10). Layers include the primary Delaware Focus Area (as outlined in the revised CCMP) and the secondary upper portion of the Delaware River Basin as well as monitoring inventory layers separated by characteristic group (e.g., chemical, physical, vegetation). There are three methods to review the studies represented by the points on the Monitoring Inventory layers in ERMA:

1. Map click query
2. Area of interest (AOI) polygon
3. Full data table view

As PDE works with regional partners to provide inventory updates, NOAA can update ERMA to be consistent with the current version of the inventory.

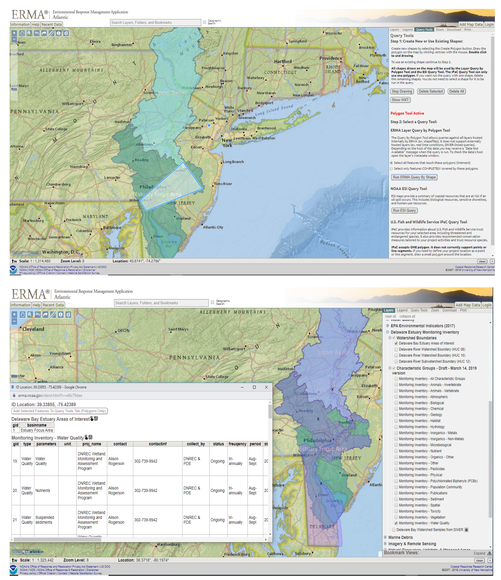

Fig 10. Delaware Estuary Monitoring Inventory characteristic group layers in ERMA via polygon AOI query (top) and map click query (bottom)