Pleasant Bay Citizen Water Quality Monitoring Program

Volunteer Handbook

Prepared By
Pleasant Bay Resource management Alliance
2001

Revised 05/22/2015

About the Handbook…

The purpose of this handbook is to provide you as a volunteer with the information you will need to participate in the Pleasant Bay Citizen Water Quality Monitoring Program. The handbook contains the following information:

Information about the program,
Information about monitoring equipment, and
Detailed instructions for water quality sampling.

For More Information

More detailed information on the parameters tested and analytical methods is found in the Quality Assurance Project Plan (QAPP). If you would like to view a copy of the QAPP, please contact Carole Ridley at 430-2563. If you have a question about sampling procedures or need to speak with someone about scheduling please call the station coordinator to whom you have been assigned:

a. Chatham Stations: Frank Messina (508-241-4357, fmessina@verizon.net)
Betsy Mosser (508-945-0529, betsymosser@aol.com)

b. Harwich Stations: Heinz Proft (508-430-7532; hproft@town.harwich.ma.us)

c. Orleans Stations: Carolyn Kennedy (508-255-7564; c2kenn2@verizon.net).

About the Pleasant Bay Resource Management Alliance

The Alliance was formed through an intermunicipal agreement involving the Towns of Orleans, Chatham and Harwich to implement the recommendations of the Pleasant Bay Resource Management Plan. The Alliance has a Steering Committee appointed by the Boards of Selectmen in the three towns. A Technical Resource Committee consisting of resource management professionals from the three towns as well as the Cape Cod Commission, Massachusetts Coastal Zone Management, and the Cape Cod National Seashore assists the Steering Committee. The Alliance has a Coordinator to manage implementation activities.

Part 1: About the Program…

Background

The Pleasant Bay Citizen Water Quality Monitoring Program is a cooperative effort of the Pleasant Bay Resource Management Alliance, the Orleans Marine Water Quality Task Force, the Harwich Shellfish and Marine Water Quality Committee, and the Chatham Water Watchers in conjunction with the Chatham Water Quality Laboratory.

The program relies heavily on the time and commitment of citizen volunteers who are trained in water quality monitoring and other support activities. Technical support for the program is provided by the Towns of Chatham, Harwich and Orleans, the Cape Cod Commission, the National Park Service, Waquoit Bay National Estuarine Research Reserve (WBNERR), and the School of Marine Science and Technology (SMAST) at the University of Massachusetts - Dartmouth.

The bay-wide water quality monitoring program is an out-growth of the Pleasant Bay Resource Management Plan. The RMP found that there is insufficient baseline data on the full range of water quality indicators, and no system is in place for monitoring long-term trends in water quality. Moreover, water quality may be threatened by intensifying land uses within the watershed, and increased boating in the bay.

Program Objectives

The program is designed to provide consistent, comprehensive and reliable water quality data necessary to implement several recommendations of the RMP. These recommendations include the development of watershed management strategies, monitoring impacts from shoreline structures and boating, monitoring the vitality and productivity of habitats, and planning for safe and reasonable accommodation of activities and facilities such as moorings and aquaculture.

Specific objectives of the program are to:

- Provide background data on general water quality conditions in the bay;
- Monitor nitrogen-loading trends by calculating the Buzzards Bay Health (eutrophication) Index and other interpretive analyses; and
- Provide periodic reports and publications on the health of bay waters for the public and local officials.

Monitoring Locations

See Table below for monitoring stations. See also Figure 1 (note, not all stations shown on Figure 1 are being actively sampled). The locations have been identified by GPS (Global Positioning Satellite) coordinates. The monitoring locations are:

Pleasant Bay Monitoring Stations

Count	Station Number	Name	Volunteer Coordinator (See contact information above)
1.	PBA-1	Chatham Harbor	Messina/Mosser
2.	PBA–3	Ryder's Cove – inner	Messina/Mosser
3.	CM-13	Ryder's Cove – outer	Messina/Mosser
4.	PBA-4	Crows Pond	Messina/Mosser
5.	PBA-5	Muddy Creek	Messina/Mosser
6.	PBA-5A	Muddy Creek - Upper	Messina/Mosser
7.	PBA-6	Big Bay - SW	Proft
8.	PBA-8	Big Bay – NE	Proft
9.	PBA–9	Round Cove	Proft
10.	PBA-10	Quanset Pond	Kennedy
11.	PBA-11	Paw Wah Pond	Kennedy
12.	PBA-12	Namequoit Point – south	Kennedy
13.	PBA-13	Namequoit Point – north	Kennedy
14.	PBA-14	Arey's Pond	Kennedy
15.	PBA-15	Lonnie's Pond	Kennedy
16.	PBA-16	Meetinghouse Pond	Kennedy
17.	PBA-19	Strong Island – NE	Messina/Mosser
18.	PBA-20	Nickerson Neck	Messina/Mosser
19.	PBA-21	Little PB	Kennedy
20.	WMO-03	Pochet-mouth	Kennedy
21.	WMO-05	Pochet-upper	Kennedy
22.	WMO-06	Namequoit River – upper	Kennedy
23.	WMO-8	The River	Kennedy
24.	WMO-10	Meetinghouse Pond – outer (@Rattles dock)	Kennedy
25.	WMO-12	Little Quanset Pond	Kennedy

Monitoring Schedule

Monitoring will occur at stations throughout the Bay twice monthly July through August and once in September. The monitoring dates are distributed in early spring each year through the volunteer coordinators. In the event of extreme weather conditions sampling may be cancelled for that day. Volunteers will be notified in the event of a postponement.

Sampling normally occurs between 6-9 AM. However, depending on tidal conditions this window may change, any change(s) will be noted on the yearly sampling schedule.

It is the responsibility of the volunteers and boat operators to exercise good judgment in determining whether local conditions are acceptable to undertake the sampling on any given sampling day. No sample is worth the risk of injury or damage to private boats.

Types of Monitoring to Be Conducted

The program will test bay waters for the following water quality indicators. These indicators were selected because they are needed to calculate the Buzzards Bay Health (eutrophication)

Index. The index has been used by the Buzzards Bay Baywatchers since 1992 a means of assessing the impact of excessive nutrients in the water.

Excessive nutrient inputs, especially nitrogen, pose a major threat to water quality. The natural response of coastal aquatic systems to nutrient loading is termed "eutrophication". On-site septic systems account for 70-80% of nitrogen inputs to coastal waters, with much smaller amounts generated from lawn fertilizers, road run-off, waterfowl, and rainfall. It is not the nutrients themselves that cause problems, but the increased production of algae they cause. Once nitrogen compounds reach the water column, they can stimulate the growth of macroalgae and microscopic plants. This increased production can reduce the amount of oxygen in the water column and can ultimately lead to anoxic (no oxygen) or hypoxic (little oxygen) conditions. Even short periods of low oxygen can cause serious damage to bottom dwelling organisms and eventually lead to "fish kills".

1. **Salinity, Temperature and Dissolved Oxygen (DO)**

Salinity, temperature and dissolved oxygen are essential water quality parameters and are relatively easy and inexpensive to collect. Oxygen concentrations will be measured with Dissolved Oxygen (DO) meters. Oxygen is produced by plants, algae and other photosynthetic organisms (e.g. cyanobacteria) and is consumed through the respiration of animals, plants and microbes at night. Oxygen is measured at its lowest level in the early morning. Temperature is important because it affects the rates of chemical and biochemical reactions in the water.

2. **Water Transparency or Secchi Depth**

Secchi depth is a measurement of water transparency. A black and white disc known as a secchi disk is lowered into the water. The depth at which the disk disappears from view is the secchi depth. A secchi depth measurement is an indirect measure of light availability for photosynthesis by aquatic plants such as algae. If too many algae are growing in the water column due to excessive nutrients, the secchi depth will be reduced.

3. **Phytoplankton Pigments** (Chl-a, Pheophytin)

Living and dead phytoplankton (microalgae) contain pigments that turn eutrophic waters green or brown.

4. **Dissolved Inorganic Nitrogen** (DIN)

The three forms of inorganic nitrogen are ammonia, nitrite and nitrate. Algae quickly take up these forms. DIN is usually found at low concentrations in coastal waters; a high level of DIN is an indication of potential eutrophication.

5. **Particulate Organic Nitrogen** (PON)

PON is nitrogen that has been incorporated into microscopic floating plants, known as phytoplankton, and microscopic floating animals, or zooplankton. DIN is usually efficiently converted into PON in coastal waters

6. **Dissolved Organic Nitrogen** (DON)

DON is a mixture of organic nitrogen compounds (e.g., amino acids, urea) released by decaying organic matter. DON is organic forms of nitrogen that will pass through a filter.

7. **Total Organic Nitrogen** (TON)

TON is the sum of PON and DON.

8. **Total Nitrogen** (TN)

Total Nitrogen is a widely used as an indicator of eutrophication. TN is the combination of organic (TON) and inorganic (DIN) nitrogen, and will be high in an estuary that is eutrophic.

Part 2: About Equipment…

Equipment

All of the equipment you will need as a volunteer will be provided through the Alliance. Field monitoring kits with the below-listed elements will be prepared for each station team.

Before leaving home volunteers are asked to:

1. Check to make sure you have all the contents of the equipment checklist (exhibit A);
2. Place a filter in a clear plastic filter holder; align steps in top and bottom of holder and screw on clamp to hold together;
3. Properly label all sample bottles in your cooler;
4. Pack cooler with frozen ice packs.

Part 3: How to Collect Samples in the Field…

Anchoring at the Station Buoy

Sampling buoys should not be tied off to or used as anchors; they are not designed for that purpose. The boat should stop upwind of the station buoy, deploy an anchor, and drift to the buoy so that the boat is alongside the buoy. Most stations will be marked with a buoy. However, volunteers are encouraged to also identify landmarks that enable them to locate the station in the event that a buoy is missing.

The Order of Sampling

Once at the station, sampling should be conducted in the following order:

1. Turn on Dissolved Oxygen (DO) Meter.
2. Record observations and physical conditions on field data sheet (exhibit B);
3. Measure Secchi depth and total depth and record on field data sheet.
4. Measure salinity using refractometer.
5. Measure Dissolved Oxygen and Temperature (using DO meter) at ½ meter below the surface, and then repeat at ½ meter above the bottom and record on field data sheet.
6. Conduct nutrient sampling and filtration (using Niskin sampler and filter system) at ½ meter below the surface, and then repeat at ½ meter above the bottom.

Each type of measurement is described below. **Specific, step-by-step instructions are on the Field Sampling Protocol.**

1. Recording Physical Characteristics

Record your observations on conditions and any unusual characteristics such as odor, presence of algae, or other relevant factor, should be recorded on the Field Data Sheet.

a. Measuring Secchi Depth

Lower Secchi disk into water slowly from shady side of the boat or pier until it just disappears from view. (It is a good idea to remove your sunglasses while taking this measurement!) Record depth of disappearance as the first Secchi depth from where the tape meets the water (sometimes it's helpful to use clothespins to mark where the tape intersects the water, and then pull up the tape to read.) Lower below view, then raise until the disk comes into view and record second Secchi depth (these numbers should be very close). Average the two numbers and report the final value.

b. Measuring Total Depth

Total depth should be measured on the downstream side of the boat to avoid any impact on samples from the disruption of bottom sediments. Slowly lower the secchi disk until it touches bottom, and record the total depth.

c. Measuring Salinity

Salinity is measured using a refractometer. Detailed instructions for taking measurements with a refractometer are found in exhibit C. Two measurements should be taken. The first measurement is taken using de-ionized ("distilled") water, and recorded on the Field Data Sheet. This measurement should be "0". The second measurement should be taken using water taken by a dropper from over the side of the boat. The second measurement should be recorded on the Field Data sheet.

d. Oxygen and Temperature

Oxygen content and temperature will be measured using a dissolved oxygen meter. **Surface measurements are taken ½ meter below the surface, bottom measurements are taken ½ meter above the bottom.** Mid-depth measurements are taken mid-way between the surface and bottom based on the total depth of the station. Instructions for using a DO meter are found in exhibit D.

e. Taking Water Samples

All water samples for the program will be collected using Niskin samplers (or sampling pole for shallow stations) due to their track record for accuracy, ease of use, and durability. **Two water samples need to be collected (shallow stations only collect one mid depth sample): one taken ½ meter below the surface and one taken ½ meter above the bottom**. Instructions for using a Niskin sampler are found in exhibit E.

f. Nutrient Sample Filtering

Nutrient sample analysis is conducted on samples taken at both surface and bottom depths. The six plastic bottles placed in the coolers are to prepare two "sets" (e.g. one bottom set, one surface set) of three bottles that need to be prepared for laboratory processing. If your station only does mid depth sampling you will only need one set of bottles.

Before you begin processing, be sure bottles are labeled as follows:

SET #1: 1L (light bottle), 1L (dark bottle), 60 ml bottle each labeled with station number, date, "surface" and "Chatham".

SET #2: 1L (light bottle), 1L (dark bottle), 60 ml bottle each labeled with station number, date, "bottom" and "Chatham".

(Note: "Chatham" is indicated on the bottles only so the SMAST laboratory knows who to contact with a question)

Nutrient Sample Processing

Note: The following procedure should be completed for sample water taken at each depth, beginning with the "surface" sample.

1. Rinse the two (one light/one dark) 1L bottles with a small amount of sample water, and then fill with sample water. Note: you will need to deploy the Niskin sampler twice to obtain enough sample. Cap the dark bottle and place in cooler.
2. Shake the light 1L bottle, rinse and fill 60 cc syringe with water from the light bottle by removing plunger and pouring sample into the barrel of the syringe (use your finger to cover the hole on the end of the syringe so that water does not empty out) and replace plunger.
3. Attach the filter holder with a twisting motion (with the bell shaped end pointed away from the syringe.)

4. Slowly filter 20-30 cc of water and discard, then filter the next 20-30 cc into the 60 ml sample bottle provided, replace cap, shake and discard water.
5. Now refill the syringe with sample water and **filter enough water to fill the 60 ml bottle to the shoulder**. Leave a small air space in the bottle so it will be water-tight. Cap the 60 ml bottle tightly and place in the cooler
6. Cap the light 1L bottle and place in cooler.
7. Repeat steps 1-6 at the next depth.

Part 4: Once You Have Finished Sampling

Delivery of Samples

Samples should be taken as soon as possible to your designated drop-off location. **Samples need to be delivered to the drop-off no later than 11:00 a.m. on the day of sampling (see note below regarding Orleans stations).** This is to allow enough time to transport samples to the laboratory for processing. Time is important to the quality of the samples, and samples arriving after 11 a.m. will not be included in laboratory analysis.

1. Chatham and Harwich stations should deliver samples to the Chatham Department of Health & Environment, Town Office Annex, 261 George Ryder Road, lower level, back entrance.

2. Orleans stations should be delivered by **9:30 am** to Orleans Water Quality Lab., lower level of the American Legion Building on School Rd. across from Orleans Town Hall.

When you drop-off samples you will be asked to sign your field sheet and hand it in along with your sample bottles. You will also pick up fresh collection bottles for next month's sampling date.

Exhibits:

Exhibit A: Field Kit Contents
Exhibit B: Field Data Sheet example
Exhibit C: Instructions for Refractometer
Exhibit D: Instructions for YSI Dissolved Oxygen Meter
Exhibit E: Instructions for Filtration Set-up
Exhibit F: Instructions for Niskin Sampler
Exhibit G: Field Sampling Protocol