R-WD-14-7

NHDES WATERSHED BUREAU

QUALITY ASSURANCE, QUALITY CONTROL, AND WORKLOAD REPORT 2013

New Hampshire Department of Environmental Services
P.O. Box 95
29 Hazen Dr
Concord NH 03302-3503

Thomas S. Burack
Commissioner

Vicki V. Quiram, P.E.
Assistant Commissioner

Eugene Forbes, P.E.
Director
Water Division

Prepared By: NHDES Watershed Management Bureau
Edited By: Scott Ashley & Sonya Carlson

EXECUTIVE SUMMARY

In 2013, the NHDES Watershed Management Bureau operated over a dozen individual programs to monitor, protect, and restore the state's surface waters including its lakes and ponds, rivers and streams, wetlands, and public bathing facilities. The diverse nature of these programs is exemplified by their activities that range from water quality monitoring, exotic species management, and regular sampling of beaches to funding vessel waste disposal facilities, support of nonpoint source pollution control activities, and inspection of pools and spas. In all cases, these programs are designed to promote the health one of New Hampshire's most valuable natural resources: water.

A key element to the success of each of these programs is the availability of a modern laboratory. The Jody Connor Limnology Center (JCLC) serves as the primary hub of activity in preparation for field surveys, water sampling processing and tracking. In 2013, the JCLC processed nearly 15,000 water quality samples and over 1,000 identifications of biological organisms. The laboratory's capabilities range from simple tests of pH in water to the determination of mercury content in fish tissue. In addition, Plymouth State University (PSU) and Colby Sawyer College maintain satellite laboratories that provide a water analyses in cases where samples cannot be transported to Concord. In all, these laboratories are critical to the support of two valuable volunteer surface water quality monitoring programs that successfully monitored over 170 lakes and ponds and 2,900 river miles in 2013.

In 2013, over 100,000 data records were collected from the state's surface waters by the Watershed Management Bureau. With such a high volume of data, maintaining and managing data quality is critical. Data quality is ensured through program specific Quality Assurance Project Plans (QAPP) or detailed standard operating procedure (SOPs). In both cases, these documents spell out specific procedures to confirm the acceptance of only high quality data.

Data meeting the quality assurance standards are stored in NHDES' environmental monitoring database (EMD). To date, the EMD houses millions of unique data points from nearly 25,000 monitoring stations and 638 individual projects. Data generated by the Watershed Management Bureau are entered through automated lab imports, batch uploads and manual entry. Applicable data are flowed directly to EPA's STORET/WQX using a node-to-node transfer. The EMD serves as a vital component in meeting the bureau's data management needs and responsibilities.

The following report describes the various program activities within the Watershed Management Bureau that collected data or utilized the facilities of the JCLC in 2013. The report is organized into two primary sections; the first section provides individual program summaries in a standardized template for quick reference; are the second section includes a more detailed account of the specific accomplishments of each program and, where applicable, data quality assessments.

TABLE OF CONTENTS

EXECUTIVE SUMMARY……2

I. WATERSHED AMBIENT MONITORING PROGRAM SUMMARIES 5

1.1 Jody Connor Limnology Center (JCLC) 6
1.2 Volunteer Lake Assessment Program (VLAP)..... 7
1.3 Volunteer River Assessment Program (VRAP)..... 8
1.4 River Monitoring Program (RMP)..... 9
1.5 Lake Assessment Program 10
1.6 Biomonitoring 11
1.7 Fish Mercury Program 12
1.8 Acid Rain Deposition Program 13
1.9 Surface Water Quality Complaints 14
1.10 Public Bathing Facility Program (PBF Program)..... 15
1.11 Beach Inspection Program 16
1.12 Boat Inspection Program..... 17
1.13 Clean Vessel Act Program..... 18
1.14 Exotic Species Program 19
1.15 I93 Chloride TMDL 20
1.16 Special Studies 21

II. NHDES JODY CONNOR LIMNOLOGY CENTER AND SATELLITE LABS.....22

2.1 Overall Workload..... 22
2.2 Data Quality Objectives..... 24
2.2.1 JCLC Laboratory..... 24
2.2.2 Satellite Laboratories..... 24

III. ANNUAL PROGRAM REPORTS 28

3.1 Assessment Based Programs 28
3.1.1 JCLC support summary..... 28
3.1.2 Volunteer Lake Assessment Program (VLAP)..... 28
3.1.3 Volunteer River Assessment Program (VRAP)..... 29
3.1.4 Lake Assessment Program 30
3.1.5 Biomonitoring Program..... 30
3.1.6 Wetlands Monitoring Program..... 32
3.1.7 I93 Chloride TMDL 33
3.1.8 Fish Tissue Program 34
3.2 Inspection Based Programs 34
3.2.1 JCLC Support Summary..... 34
3.2.2 Complaints 35
3.2.3 Public Bathing Facility Inspection Program..... 36
3.2.4 Freshwater Beach Program..... 37
3.2.5 Coastal Beach Program 38
3.2.6 Boat Inspection Program..... 38
3.2.7 Clean Vessel Act Program..... 39
3.2.8 Exotic Species Program 41

List of Figures

Figure 1: Chemical Analyses, Processed by NHDES JCLC, All Programs 22
Figure 2: Satellite vs JCLC Analysis 2004-2013 22
Figure 3: NHDES JCLC Total Annual Biological Analyses 23
Figure 4: NHDES JCLC Biological Analyses, by parameter and year 23
Figure 5: NHDES JCLC and Satellite Labs, Cumulative Replicate Percentage 24
Figure 6: NHDES JCLC Replicate Percentages for Individual Analyses 25
Figure 7: Sunapee Laboratory Replicate Percentages for Individual Analyses 26
Figure 8: PSU Laboratory Replicate Percentages for Individual Analyses 27
Figure 9: Total Annual Number of VLAP Lakes Monitored from 1985-2013 28
Figure 10: VRAP Group, Station, and Sample Count from 1998-2013 29
Figure 11: Biomonitoring data summaries for invertebrates (2012), fish (2013) and algae (2013) 30
Figure 12: Number of Fish Processed for Mercury Analyses 34
Figure 13: Inspections Conducted by NHDES JCLC for All Programs 34
Figure 14: NHDES Biology Section Complaint Summary, Complaint Percentage by Type 35
Figure 15: Number of Complaint Investigations Conducted by the NHDES Biology Section 35
Figure 16: Public Bathing Facility Inspections 36
Figure 17: New Hampshire Public Bathing Facility Violations 37
Figure 18: Water Quality Violations and Advisories at Freshwater Beaches 38
Figure 19: NHDES Biology Section Boat Inspection Summary 39
Figure 20: NHDES Clean Vessel Act Pumpout Boat Service 40
Figure 21: Exotics Species Program Lake Inspections 41
Figure 22: Exotics Species Program Control Practices 41

List of Tables

Table 1: 2013 Calendar Year JCLC Chemical Analyses Summary 25
Table 2: 2013 Calendar Year Sunapee Laboratory Chemical Analyses Summary 26
Table 3: 2013 Calendar Year Plymouth Laboratory Chemical Analyses Summary 27
Table 4: Three year sampling plan for Lake Survey Program 30
Table 5: Macroinvertebrate Quality Control Measures and Benchmarks 31
Table 6: Algal Abundance Quality Control Measures and Benchmarks 32
Table 7: 2013 Algal Abundance Duplicate Sample Summary 32
Table 8: Data completeness for in-situ specific conductance datasonde readings from 7/1/12-6/30/13 33
Table 9: Data completeness for grab samples and field meter measurements for 7/1/12-7/1/13 33

I. WATERSHED AMBIENT MONITORING PROGRAM SUMMARIES

1.1 Jody Connor Limnology Center (JCLC)

Purpose: Provide support to the Watershed Management Bureau's (WMB) statewide surface water monitoring activities through the completion of benchtop chemical and biological analysis. The lab serves as a preparatory space for field meter calibration, sample bottle organization and field sample login for all WMB field activities. The JCLC also is the primary hub for processing samples submitted by the Volunteer Lake Assessment Program (VLAP) and Volunteer River Assessment Program (VRAP).

Data usage: Data processed through the JCLC is used to complete surface water quality assessments, for issuance of public health advisories, completion of waterbody-specific reports, compliance with regulatory activities and general investigations of surface water quality.

Monitoring approach: The JCLC provides equipment, analytical services and sampling services to support probability based, targeted and trend monitoring activities.

Parameters measured: The JCLC and its satellite laboratories provide analysis for approximately 25 chemical and physical parameters as well as more than a half dozen biological parameters.

Method of data collection: Discrete samples are analyzed by the JCLC.

Number of records generated: In 2013 the JCLC and its satellite laboratories created 15,463 data records. The JCLC analyzed 634 biological samples and made over 400 species specific identifications.

Quality Assurance Measures: The JCLC and its satellite laboratories each maintain a laboratory manual detailing quality assurance measures and procedures for each specific analysis. In-lab quality assurance measures include blanks, duplicate analyses, continuing calibration verification (CCV) samples and spikes where appropriate. All quality assurance measures are documented by parameter in individual bench logs as well as the JCLC database; last year the JCLC and satellites performed 1,556 quality assurance measures.

1.2 Volunteer Lake Assessment Program (VLAP)

Purpose: VLAP was initiated in 1985 in response to an expressed desire of lake associations to be involved in lake protection and watershed management. Over 500 volunteers monitor water quality from May through September at lakes and ponds throughout the state. This data allows NHDES to analyze water quality trends, identify potential problems and fix them before they cause degradation in water quality. VLAP plays an essential role in monitoring water quality trends in New Hampshire's lakes.

Data usage: Data generated through VLAP are utilized annually to create seven regional water quality reports and approximately 180 individual lake reports. VLAP is a primary source of data utilized to complete surface water quality assessments for the federally required section 305(b) / 303(d) water quality report. VLAP data are also utilized by NHDES to complete Total Maximum Daily Loads (TMDLs), watershed management plans, and by lake associations and organizations to apply for grant funds.

Monitoring approach: Trend Monitoring - Repetitive visits to set of established sampling locations annually or on an established schedule for the purpose of tracking water quality parameters over time.

Parameters measured: VLAP measures a total of 12 chemical and biological parameters including: pH, conductivity, turbidity, chloride, total phosphorus, alkalinity, *E. coli*, dissolved oxygen, temperature, transparency, chlorophyll-*a* and phytoplankton (including cyanobacteria).

Method of data collection: VLAP collects discrete samples at multiple in-lake and tributary stations.

Number of records generated: In 2013, VLAP, and its associated satellite laboratories at Plymouth State University and Colby Sawyer College, accomplished the following:

- 423 individual sampling events conducted by volunteers and VLAP biologists.
- 185 lake deep spots and 500 river/stream stations monitored.
- 14,184 individual chemical and biological sample results generated.
- Approximately 3,700 hours collecting water quality samples.
- Approximately $82,000 value of volunteer time collecting water quality samples.

Quality Assurance Measures: VLAP operates under an EPA approved Quality Assurance Project Plan (QAPP), dated June 2, 2009. VLAP is required to update the plan once every five years and submit to EPA for approval. VLAP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and resolutions to those deviations.

1.3 Volunteer River Assessment Program (VRAP)

Purpose: The Volunteer River Assessment Program (VRAP) was initiated in 1998 to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP volunteers monitor water quality from May through October in rivers and streams throughout the state allowing NHDES to analyze water quality trends, identify potential problems and fix them before they cause degradation in water quality.

Data usage: VRAP is primarily a data procurement mechanism to determine whether rivers or streams are impaired or potentially impaired, based on legislative surface water quality standards and designated uses (e.g., swimming, fishing and aquatic life support). Data collected through VRAP are used to develop the federally required section 305(b) / 303(d) water quality report. Over 39 percent of the surface water quality assessments of riverine assessment units included in the 2010 303(b) report were provided by VRAP. Currently this data contributed to the assessment of 2,900 miles of rivers and streams.

Monitoring approach: VRAP conducts trend monitoring via repetitive visits to established sampling locations on an established schedule. Targeted monitoring is also conducted to investigate suspected sources of pollution or to measure the water quality impacts as they relate to changes in the landscape such as development.

Parameters measured: VRAP measures field parameters including dissolved oxygen, pH, turbidity, specific conductance, water temperature and flow. Laboratory parameters include *E.coli*, nutrients, chloride, chlorophyll-*a*, metals and cations.

Method of data collection: VRAP collects discrete samples at multiple river and riverine impoundment stations.

Number of records generated: In 2013, data generated by VRAP volunteers and its associated satellite laboratories at Plymouth State and the Rochester Wastewater Treatment Facility are summarized as follows:

- 31 VRAP groups supported.
- 290 river/stream stations monitored.
- 9,333 individual chemical and biological sample results generated.
- Approximately 1,600 hours spent by individuals collecting water quality samples.
- Approximately $34,000 value of volunteer time collecting water quality samples.

Quality Assurance Measures: VRAP operates under an EPA approved QAPP dated April 6, 2011. VRAP is required to update the plan once every five years and submit to EPA for approval. VRAP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and the resolutions to those deviations.

1.4 Ambient River Monitoring Program (ARMP)

Purpose: The Ambient River Monitoring Program (ARMP) was initiated in early 1970's. Data collected since 1990 is maintained in NHDES' Environmental Monitoring Database (EMD). ARMP is implemented directly by NHDES staff and measures water quality in rivers and streams throughout the state. In 2013, NHDES implemented a new series of stations to be monitored for trend analysis that provides a more comprehensive survey of stream types and varying levels of human impact.

Data usage: ARMP is primarily a data procurement mechanism to determine whether river or stream conditions are declining, improving or remaining stable over time. The data is also used to assess if individual river segments are impaired or potentially impaired, based on legislative surface water quality standards and designated uses (e.g., swimming, fishing and aquatic life support). Data collected through ARMP are used to develop the federally required section 305(b) / 303(d) water quality report.

Monitoring approach: ARMP conducts trend monitoring via repetitive visits to established sampling locations on an established schedule with the purpose of tracking water quality parameters over time. ARMP also conducts confirmation monitoring to determine if waterbodies can be removed from the 303(d). Targeted monitoring of previously unsampled waterbodies may also be completed to gain additional information about the condition of New Hampshire surface water resources.

Parameters measured: ARMP measures field parameters including dissolved oxygen, pH, turbidity, specific conductance, water temperature and flow. These parameters are collected via both instantaneous measurements and via deployable multi-parameter dataloggers. Laboratory parameters include *E.coli*, nutrients, chloride, chlorophyll-a, metals, cations and a number of other parameters as needed.

Method of data collection: ARMP collects discrete and continuous samples at multiple river and riverine impoundment stations. In 2013, over 2,500 individual chemical and biological sample results were generated.

Quality Assurance Measures: ARMP operates under an EPA approved QAPP, dated July 25, 2008. ARMP is required to update the plan once every five years and submit to EPA for approval. The next update to the QAPP will be completed in 2014. ARMP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and resolutions to those deviations.

1.5 Lake Assessment Program

Purpose: The Lake Assessment Program was initiated in the mid-1970s. The program has recently been revamped and reinitiated by the WMB The purpose is to determine a trophic rating for the lake or pond as well as gather basic data.

Data usage: Beyond the previously mentioned trophic rating, the new monitoring approach attempts to gather enough data to determine if waterbodies meet use criteria as required by sections 305(b) and 303(d) of the Federal Clean Water Act.

Monitoring approach: Lakes are selected from a schedule of targeted watersheds on a rotational basis. The selection process is conducted by several biologists in the WMB and takes into consideration the age of available water quality data, public accessibility and recreational use.

Parameters measured: At the deep site a dissolved oxygen/temperature profile is collected and the degree of stratification is assessed. Secchi depth is measured. A water sample composite is collected and analyzed for Chlorophyll-*a* and a plankton haul is collected to mid-metalimnion depth. A discrete sample is collected and analyzed for alkalinity, pH, conductivity, apparent color, chloride, calcium, magnesium, NO_2 and NO_3 nitrogen, TKN nitrogen, total phosphorus, sodium, sulfate and total organic carbon.

Method of data collection: The Lake Assessment Program collects discrete samples.

Number of records generated: In 2013, 21 lakes were visited, a temperature/oxygen profile was collected on each one and a total of 177 chemical records were generated.

Quality Assurance Measures: The Lake Assessment program is in the process of drafting a QAPP for the revamped monitoring protocol. All analyses are performed in accordance with the JCLC laboratory manual or the Department of Health and Human Services (DHHS) water lab's NELAC certification.

1.6 Biomonitoring

Purpose: The Biomonitoring Program was established in 1995 to determine the ability of the state's surface waters to support a healthy community of aquatic organisms. Sampling is completed each in summer and fall and serves to satisfy federally water quality reporting requirements under sections 303(d) and 305(b) of the Clean Water Act. To date, sampling by the biomonitoring program has been primarily focused in rivers and streams.

Data usage: Data produced through the biomonitoring program is used to complete water quality assessments to determine whether rivers or streams are impaired or potentially impaired, based on legislative surface water quality standards and designated uses (e.g., swimming, fishing and aquatic life support). Biological data is used in the development of water quality standards and in making regulatory decisions.

Monitoring approach: Pre-2013, biological monitoring has been either part of a probability-based or targeted sampling design. Starting in 2013, biological monitoring was expanded to encompass approximately 27 long-term trend stations and 10-15 annual synoptic stations selected through a rotational watershed process as outlined in the WMB's surface water quality monitoring strategy.

Parameters measured: Fish, macroinvertebrates, dissolved oxygen, pH, specific conductance, water temperature, flow, physical habitat characters related to stream geomorphology, and various laboratory generated water chemistry parameters.

Method of data collection: Data is collected using discrete and continuous measures of water quality.

<u>Discrete sample points</u>

- Field chemistry measures.
- Laboratory samples.
- Invertebrate identifications.
- Fish identifications.
- Algal observations.
- Habitat measures.
- Stream gradient assessments.
- Pebble counts.

<u>Continuous points</u>

- Water temperature data.

Number of records generated: In 2012, 112 macroinvertebrate samples (11,980 discrete identifications) were processed. In 2013, 138 samples were delivered to the contract laboratory and taxa identifications are pending. In 2013, 20 fish samples (3663 discrete identifications) and 14 algal samples (336 discrete data points) were processed.

Quality Assurance Measures: The Biomonitoring Program operates under a federally approved QAPP that is currently under revision. The Biomonitoring Program and Ambient Rivers Program QAPPs will be merged in 2014 to cover physical, chemical, biological and habitat parameters used for assessing rivers and streams. All data is quality assured via specific measures as specified in the QAPP.

1.7 Fish Mercury Program

Purpose: To collect data on elemental mercury content in fish species within the State of New Hampshire.

Data usage: The data is used to conduct risk assessments for mercury exposure for the game fish consuming public. This risk assessment results in statewide and, if appropriate, waterbody-specific fish consumption advisories for various species of fish. The data is also used to track trends over time in the mercury content in fish tissue.

Monitoring approach: Trend and Targeted Monitoring – Most samples are supplied through volunteers who bring in fish from the lake where they live or often fish. Additional fish may be obtained through specific studies related to regulatory changes designed to reduce the deposition of atmospheric mercury. Additionally certain waterbodies have been targeted for long term collection to perform trend monitoring.

Parameters measured: Mercury content in fish tissue expressed as mg of Mercury/kg of fish, weight and length of the fish.

Method of data collection: Discrete.

Number of records generated: At least 100 fish are collected, processed and analyzed annually.

Quality Assurance Measures: Scale used for the weight is inspected and certified annually by a third party (contractor). Blanks, duplicates, continuing calibration verification (CCV) and spikes are performed in accordance with the JCLC laboratory manual protocols.

1.8 Acid Rain Deposition Program

Purpose: To collect data on acid rain deposition and determine its effects on sensitive lakes and ponds.

Data usage: Data is used to conduct trend analysis on the effects of acid rain deposition and the effectiveness of air pollution regulations. Data have been used by the NH Fish & Game Department to make stocking decisions on acid sensitive ponds and lakes. Rain is also collected in Concord, NH and analyzed to verify source inputs to lakes and ponds.

Monitoring approach: Trend Monitoring - Lakes and ponds included in this monitoring program have been monitored consistently over in excess of 30 years.

Parameters measured:

- Lakes/Ponds – pH, acid neutralizing capacity, conductivity, color, dissolved aluminum, dissolved calcium, sulfate, nitrate and chloride.

- Rain – pH, nitrate, sulfate and total phosphorus

Method of data collection: Discrete. Rain events are collected and analyzed at NHDES headquarters in concord.

Number of records generated: 20 lakes and ponds are sampled twice per year, helicopter stocked lakes are sampled once per year during stocking activities, and rain is sampled every time there is a rain event significant enough to yield the volume necessary for testing. In 2013, 59 rain events were sampled.

Quality Assurance Measures: All samples per requirements of the JCLC laboratory manual or Health and Human Services (H&HS) water lab protocols.

1.9 Surface Water Quality Complaints

Purpose: Investigate concerns impacting surface water quality reported to the WMB by staff and the public.

Data usage: To evaluate if an issue or water quality violation exists. If an issue exists there may be administrative action taken by NHDES or a referral to another agency for action to be taken.

Monitoring approach Targeted Monitoring – If investigator deems monitoring is warranted specific discrete samples are taken.

Parameters measured: Depends on the nature of the complaint.

Method of data collection: Continuous monitoring or discrete samples depending on the nature of the complaint.

Number of records generated: In 2013, 72 complaints were received, and 118 analytes were tested (not including macrophyte identification) during investigations.

Quality Assurance Measures: Parameter specific based on the JCLC Laboratory Manual or DHHS water lab protocols.

1.10 Public Bathing Facility Program (PBF Program)

Purpose: RSA 485A:26 requires NHDES to operate a year round statewide PBF program to ensure public health and safety when using bathing facilities such as pools and spas. Administrative rules Env-Wq 1100 specify the design, operation and maintenance requirements for public bathing facilities. The PBF program reviews applications for new public bathing facilities, inspects and tests the water in existing public bathing facilities to ensure that applicable requirements are being met.

Data usage: Data generated through the PBF program are used to evaluate facility compliance with state and federal public health and safety laws, determine enforcement actions, prioritize seasonal/regional inspections, shape educational outreach efforts and make historical comparison to evaluate program effectiveness. The U.S. Center for Disease Control makes periodic requests for data in studying chlorinated aquatic venues.

Monitoring approach: Targeted monitoring – The PBF program conducts periodic routine inspections to evaluate public health and safety and responds to illness complaints.

Parameters measured: The PBP program measures a total of 10 chemical and biological parameters. In-situ analysis includes temperature, pH, free chlorine, total chlorine, combined chlorine, bromine. Turbidity and total dissolved solids are measured in the JCLC laboratory. Field samples are submitted to the DHHS lab for *E. coli* and total coliform analysis.

Method of data collection: The PBP program collects discrete samples at public bathing facilities statewide.

Number of records generated: In 2013, the PBP achieved the following:

- 334 facility inspections.
- Collected 604 samples for chemical and microbial analysis.
- Identified 145 water quality violations.
- Found 99 safety/facility violations.
- Issued 18 Letters of Deficiencies.
- Issued 15 full design permits for new construction.

.

Quality Assurance Measures: Follows and updates the PBF Field Inspection QA & SOP manual (last updated 1/14/2013). PBF program staff follows the JCLC quality assurance measures for specific analysis. The PBF program is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QA manual and resolutions to those deviations.

1.11 Beach Inspection Program

Purpose: Public Beach Inspection Program personnel collect water from coastal and freshwater beaches to test for fecal bacteria to protect the public health of swimmers. During the summer swim season, NHDES personnel monitor about 170 freshwater public bathing beaches on a monthly basis and 16 coastal beaches on a weekly or bi-weekly basis. When bacteria counts at designated public beaches are higher than the state criteria, an advisory is issued to notify the public approximately 24 hours after sampling.

Data usage: The main goal of the program is to use the data collected to protect public health and inform the public of potential health risks at public beaches. Over time, data from beach sampling is used to determine impairment for the 303(d) list.

Monitoring approach: Targeted – samples are used to make daily beach posting decisions regarding public health and safety. Trend Monitoring – Repetitive visits to set of established sampling locations annually or on an established schedule with the purpose of tracking water quality parameters over time.

Parameters measured: The main parameters measured are chemical fecal bacteria. Additionally, six other physical parameters are collected during visits to beaches.

Method of data collection: Discrete data points are collected during each beach visit.

Number of records generated: In 2013, 2,451 bacteria samples were collected. For each sample collected, a suite of six other physical parameters were also recorded.

Quality Assurance Measures: Quality assurance measures for beach sampling are one trip blank and one field duplicate for every ten samples collected during each sampling trip. Quality assurance measures are completed daily for coastal beach inspections and twice a week for freshwater beach inspections. EPA approved Generic Beach Program QAPP was updated in April 2012.

1.12 Boat Inspection Program

Purpose: The program was initiated with the intention to promote proper boating practices and to enforce the No Discharge Area designation by conducting inspections for vessels with onboard wastewater containment facilities. Inspections are conducted during weekends of the boating season and are concentrated on waterbodies that accommodate larger vessels with onboard facilities including Lake Winnipesaukee, Lake Winnisquam and Lake Sunapee.

Data usage: The boat inspections fulfill a regulatory requirement under RSA 487 Control of Marine Pollution and Aquatic Growth. A database is maintained to track boaters and their onboard wastewater systems. Annual reports may query the database for approvals, violations and re-inspections with all related details as necessary.

Monitoring approach: Targeted – inspections of boats with onboard "heads" are conducted on weekends over the course of the boating season. Boats are boarded only when occupied or with prior permission. A boarding would be requested if an inspection decal was not visible on the port side forward window and/or the bow number did not return any information from the database. Re-inspections would be prompted by a change in ownership, modifications to the plumbing system, or a complaint. Inspection locations include areas accommodating vessels with onboard facilities.

Parameters measured: Information for the boat inspection database is collected from individual boat registrations and wastewater systems to include graywater and marine sanitation device (MSD) configurations. Details on location, dates of inspections or re-inspections, and compliance/non-compliance issues are documented.

Method of data collection: Vessel and owner information is entered into the database by the Boat Inspection Program coordinator.

Number of records generated: During the 2013 season, staff documented 60 boat plumbing inspections. Of these 60 inspections, 39 were initial inspections (including new boats) and 21 were re-inspections.

Quality Assurance Measures: Database entries are reviewed by either the program manager or Clean Vessel Act coordinator.

1.13 Clean Vessel Act Program

Purpose: The New Hampshire Clean Vessel Act (CVA) program is administered through NHDES and funded by the U.S. Fish and Wildlife Service Sport Fish Restoration Account. The Federal Clean Vessel Act of 1992 authorizes funds to states for the construction, renovation, operation and maintenance of stationary and mobile pumpout resources for the recreational boating public. Pumpout options are a key factor in maintaining a No Discharge Area (NDA) for NH inland and coastal waters.

Data usage: Locations and availability of pumpout resources are tracked to identify potential projects for CVA funding assistance in areas that would enhance compliance with No Discharge, safety of shellfish harvesting areas, maintenance of water classification status and protection of public health within recreational waters. Seasonal participants and sewage amounts are documented by grantees and contractors to track variations in boater usage from previous years and differing sites.

Monitoring approach: Targeted – information is collected annually from stationary and mobile pumpout resources through grantees, contractors and staff site visits.

Parameters measured: Information collected may include the location of the pumpout resource whether stationary or mobile, marina amenities, pumpout system mechanical information, system availability, usage fee collected if any, participant contact information, vessel name, vessel type, and sewage gallons pumped.

Method of data collection: Staff site visits employ the use of data sheets while grantees are required to document boat and sewage estimates in logbooks. The mobile pumpout services organize information by a manual receipt per service.

Number of records generated: Three stationary pumpout locations and one mobile pumpout boat are available to the recreational boating public along coastal waters. The 2013 mobile pumpout season operated from April to October documenting 996.5 captain hours, 597 serviced boats and approximately 14,250 gallons of sewage. Since 2002, the service has pumped off a total of approximately 133,000 gallons of boater wastewater.

New Hampshire also has approximately 19 pump/dump facilities with 17 (13 of which are public access) devoted to Lake Winnipesaukee and one to Lake Winnisquam. A dump station is located within Sunapee Harbor on Lake Sunapee. The mobile pumpout service for the inland waters was suspended following the 2012 season. This inland service will remain suspended pending a reevaluation of effectiveness and cost.

Quality Assurance Measures: Input from data sheets, logbooks and receipts are verified either by the seasonal intern or program coordinator.

1.14 Exotic Species Program

Purpose: The primary purpose of New Hampshire's Exotic Aquatic Plant Program is to "prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state" (RSA 487:17, II).

Data usage: Data generated through the Exotic Species Program are used to guide control activities on waterbodies across New Hampshire that are infested with exotic aquatic plants. Data are also used to track concentrations of aquatic herbicides that may be used in various waterbodies, and to determine the presence/absence of invasive aquatic plants in waterbodies.

Monitoring approach: Trend Monitoring – Repetitive visits to infested waterbodies to track infestations (size, density, distribution) over time. Water quality monitoring may also be performed along with invasive plant monitoring to determine impacts of the invasive species on the waterbody, or to determine impacts of the control practice on a waterbody.

Parameters measured: The exotic species program monitors for the location, density and percent cover related to exotic plants. Water depth, clarity, dissolved oxygen concentrations, herbicide concentrations, nutrient concentrations, temperature and turbidity may also be monitored as part of this program.

Method of data collection: Discrete samples at multiple stations in lakes and ponds, as needed based on the requirements of special studies that may be conducted.

Number of records generated: In 2013, the Exotic Species Program collected the following data:

- Plant identifications: >600
- Herbicide residue samples: >30
- Field inspections (GPS): >85
- Pet store Inspections (for invasive species sales): 47

Quality Assurance Measures: Activities performed by the Exotic Species Program are comprehensively described in the Quality Assurance Project Plan for the program, which was approved in 2014 by EPA.

1.15 I-93 Chloride TMDL

Purpose: Implementation monitoring for the Total Maximum Daily Loads (TMDL) for chloride for water bodies in the vicinity of the I-93 Corridor from Massachusetts to Manchester, NH.

Data usage: The data is used to determine compliance with the TMDL.

Monitoring approach:

- Continuous datasonde monitoring at four stations within the I-93 Corridor.
- Chloride grab samples every six weeks.

Parameters measured: Temperature, specific conductance and chloride.

Method of data collection: Continuous.

Number of records generated: 34,000-35,000 data points per station every state fiscal year**.**

Quality Assurance Measures: Datasonde deployments are checked for quality control with pre- and post-deployment field calibration checks with known standards. If these quality control checks failed to meet data quality objectives, the data from the whole deployment were invalidated unless there was sufficient evidence to support retaining the data.

1.16 Special Studies

Purpose: Short-term monitoring to collect data for the purposes of evaluating the environmental impact of a temporary event such as construction, answer a specific scientific question, evaluate a data collection method, or solve a specific problem within a waterbody or watershed.

Data usage: The primary use of data will fulfill the goal of the study. Any ambient monitoring data will be available via the EMD for other programs to use.

Monitoring approach: Targeted Monitoring approach

Parameters measured: Determined by study design.

Method of data collection: Determined by study design.

Number of records generated: In 2013, 264 analyses were conducted for the Pawtuckaway Lake instream flow pilot, 69 analyses were conducted for road salt TMDLs, and 296 analyses were conducted for the Low Impact Hydropower Certification program.

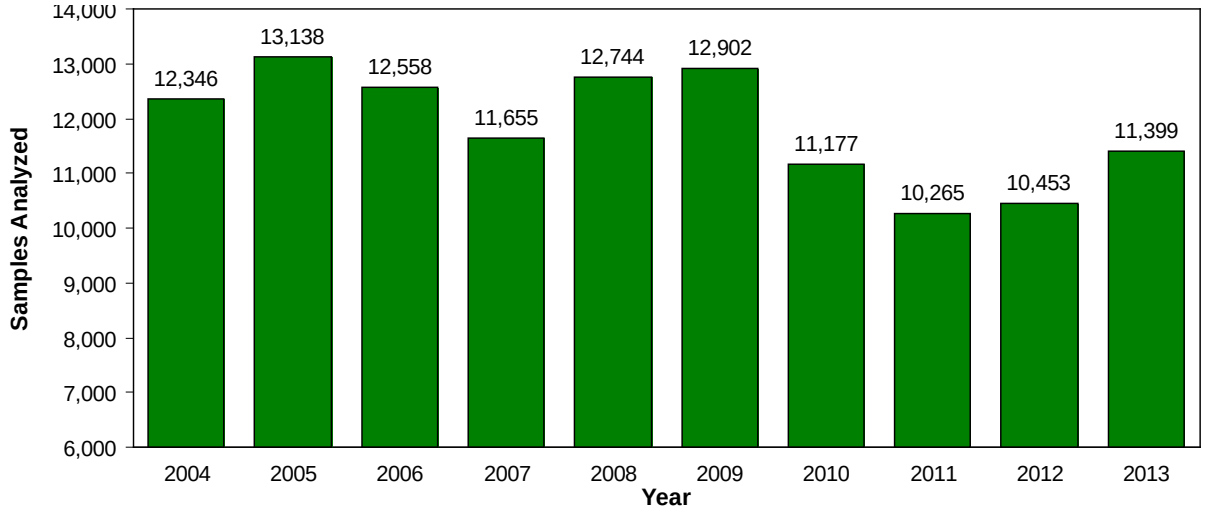
Quality Assurance Measures: Determined by study design.

II. NHDES JODY CONNOR LIMNOLOGY CENTER AND SATELLITE LABS

2.1 Overall Workload

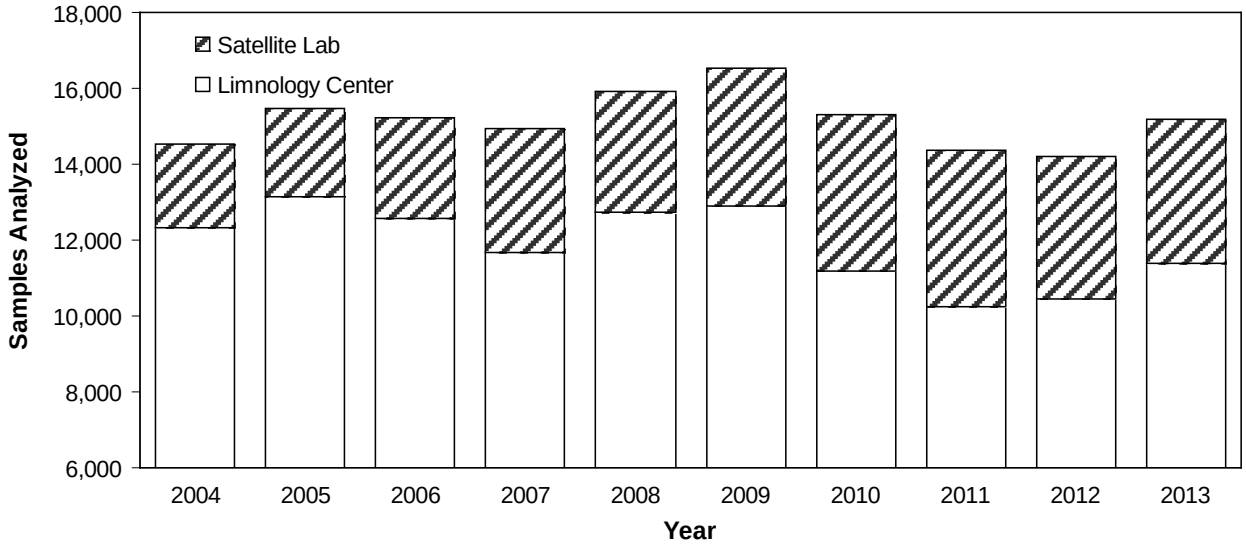
The NHDES Jody Connor Limnology Center (JCLC) staff processed 11,399 chemical analyses in 2013 (Figure 1), an increase of over 800 samples; the workload has increased for two consecutive years. This represents a rebound in sample load since a sharp decline in 2009-2011; the sample reduction observed in those three years reflects the impact of personnel reductions and program cut backs. Approximately 4,100 of the samples from 2013 were collected by JCLC programs but analyzed by the State of New Hampshire Public Health Water Laboratory operated through the Department of Health and Human Services.

Figure 1: Chemical Analyses, Processed by NHDES JCLC, All Programs



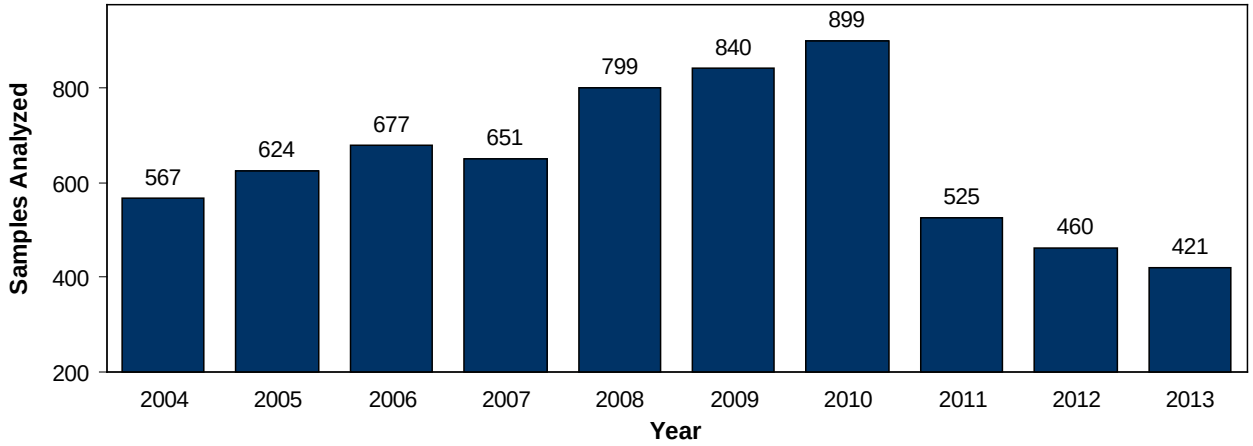
The JCLC has been striving to provide volunteer monitors better service by establishing satellite laboratories; there are currently two. The laboratory at Colby Sawyer College (CSC) has operated for about two decades, and the laboratory at Plymouth State University (PSU) Center for the Environment began processing samples during the 2007 season. The PSU lab serves volunteers in the northern region of the state from the lakes region to Pittsburg, NH. The JCLC's share of samples for VLAP and VRAP analyzed has steadily declined from 85 percent in 2005 to 75 percent in 2013 (Figure 2).

Figure 2: Satellite vs JCLC Analysis 2004-2013



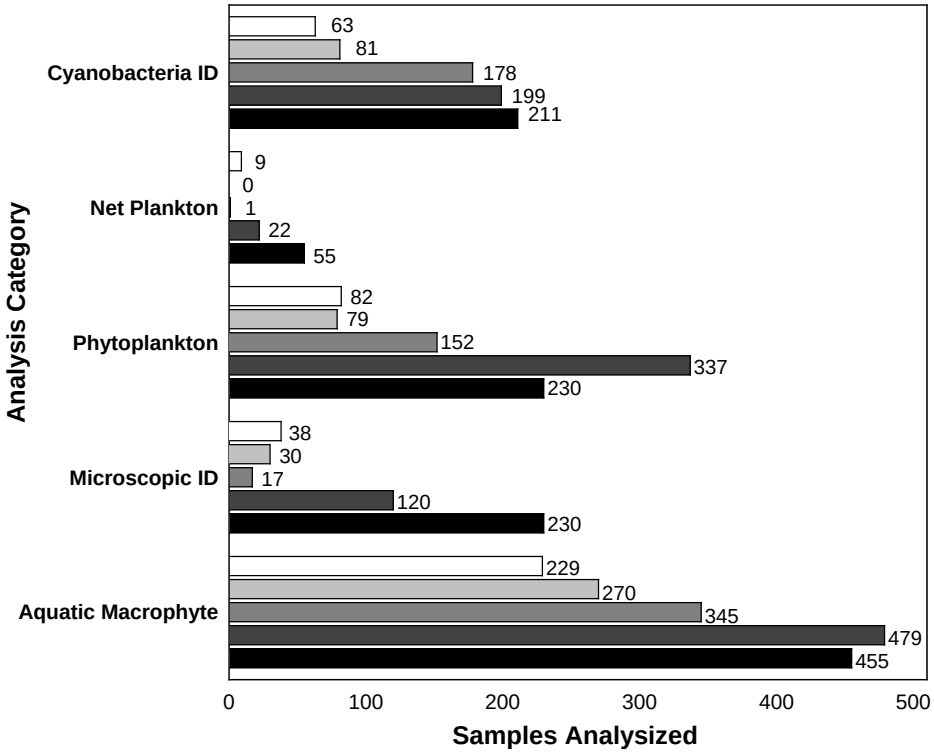
Quality control (QC) is an important component in assuring the production of high quality data. At both the JCLC and its satellite labs QC samples are processed regularly. In total, over 1,600 QC sample analyses were conducted by the three laboratories in 2013.

Figure 3: NHDES JCLC Total Annual Biological Analyses



The JCLC also analyses biological samples covering microscopic, phytoplankton, cyanobacteria and macrophyte identifications. The number of annual biological analyses performed rose steadily until 2010 (Figure 3), but has been steadily dropping since. A ten year low of 421 biological samples was analyzed in 2013. These analyses are time consuming and most often performed through microscopic examinations by trained staff. Reductions in biological analysis for 2013 were mostly from the Cyanobacteria identification and Macrophyte identification categories (Figure 4). Cyanobacteria identifications were reduced in 2013 because fewer blooms were reported by the public and NHDES staff members. Macrophyte ID samples come from either weed watchers or from the Lake Host program.

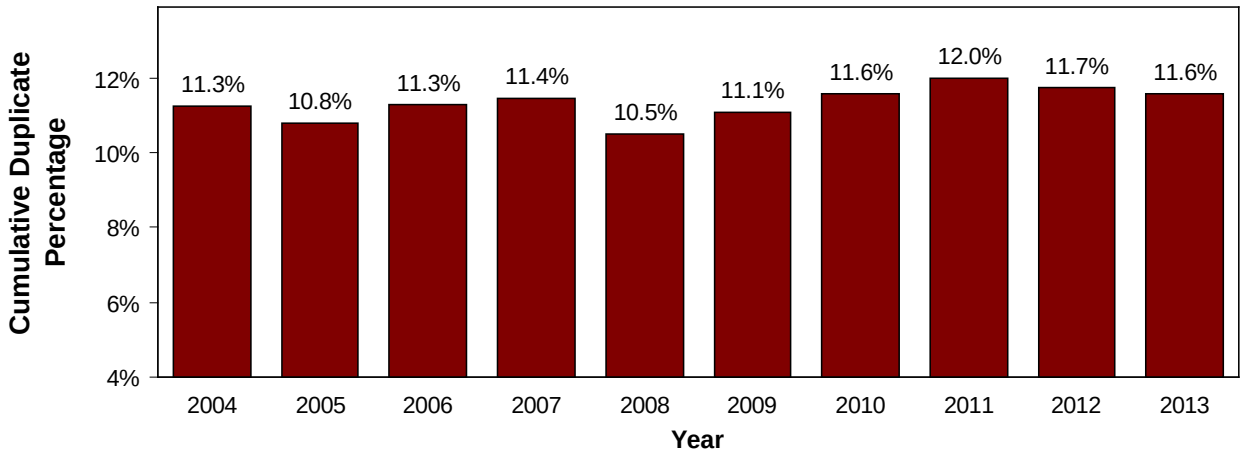
Figure 4: NHDES JCLC Biological Analyses, by parameter and year



2.2 Data Quality Objectives

The JCLC and its two satellite laboratories met their data quality objective (DQO) requirement of conducting replicate analyses on 10 percent of the processed samples (Figure 5). Since establishing the DQO objective in 1999, the cumulative laboratory replicate percentage has surpassed the 10 percent requirement each year. All three laboratories also continued to follow both Continuing Calibration Verification (CCV) and Critical Range (CR) criteria. The CCV and CR processes verify that the laboratory equipment, standard operating procedures and personnel are all meeting established standards and confirming that high quality, reliable data are being produced.

Figure 5: NHDES JCLC and Satellite Labs, Cumulative Replicate Percentage



2.2.1 JCLC Laboratory

The JCLC continued to achieve its goal of producing quality data in 2013. Precision of JCLC replicate analyses was measured by comparing previously developed critical range (CR) acceptance limits for pH, acid neutralizing capacity (ANC), conductivity, turbidity, chlorophyll-*a*, chloride, color and total dissolved solids (TDS). Continuing calibration verification (CCV) was calculated for JCLC analyses for pH, conductivity, chloride and turbidity analyses. CCV requires checking an analytical instrument after a certain set of analyses to determine if the instrument performed within calibration tolerances during its use. These simple checks enabled the JCLC to verify and/or correct data that otherwise would have been reported inaccurately.
The JCLC met the duplicate DQO standard (10 percent) for all chemical parameters (Figure 6). As a result of requirements set forth in the NHDES Quality Management Plan (QMP), the JCLC began to track trained staff in 2003. Tracking staff training is a critical component to verify competency on equipment use, DQO procedures, CR and CCV procedures. At the start of each sampling season, in addition to routine training, interns and new permanent staff are required to complete a training checklist prior to conducting analyses. This checklist serves to standardize training for new analysts and to document the proficiency of laboratory staff.

The JCLC replicate split mean ranges (SMR) also show consistency in data quality (Table 1). The split mean range is the value difference between two aliquots (sub-samples) from the same sample. The JCLC generates split mean ranges as a non-statistical method to review that replicate ranges are consistent with historical SMRs. All parameters exhibited split mean ranges within their historic levels

2.2.2 Satellite Laboratories

The Sunapee Satellite Laboratory (SSL), located at Colby-Sawyer College in New London, continued to use the Microsoft Access™ based sample tracking system which allowed for standard and efficient data management and quality control routines.

Figure 6: NHDES JCLC Replicate Percentages for Individual Analyses

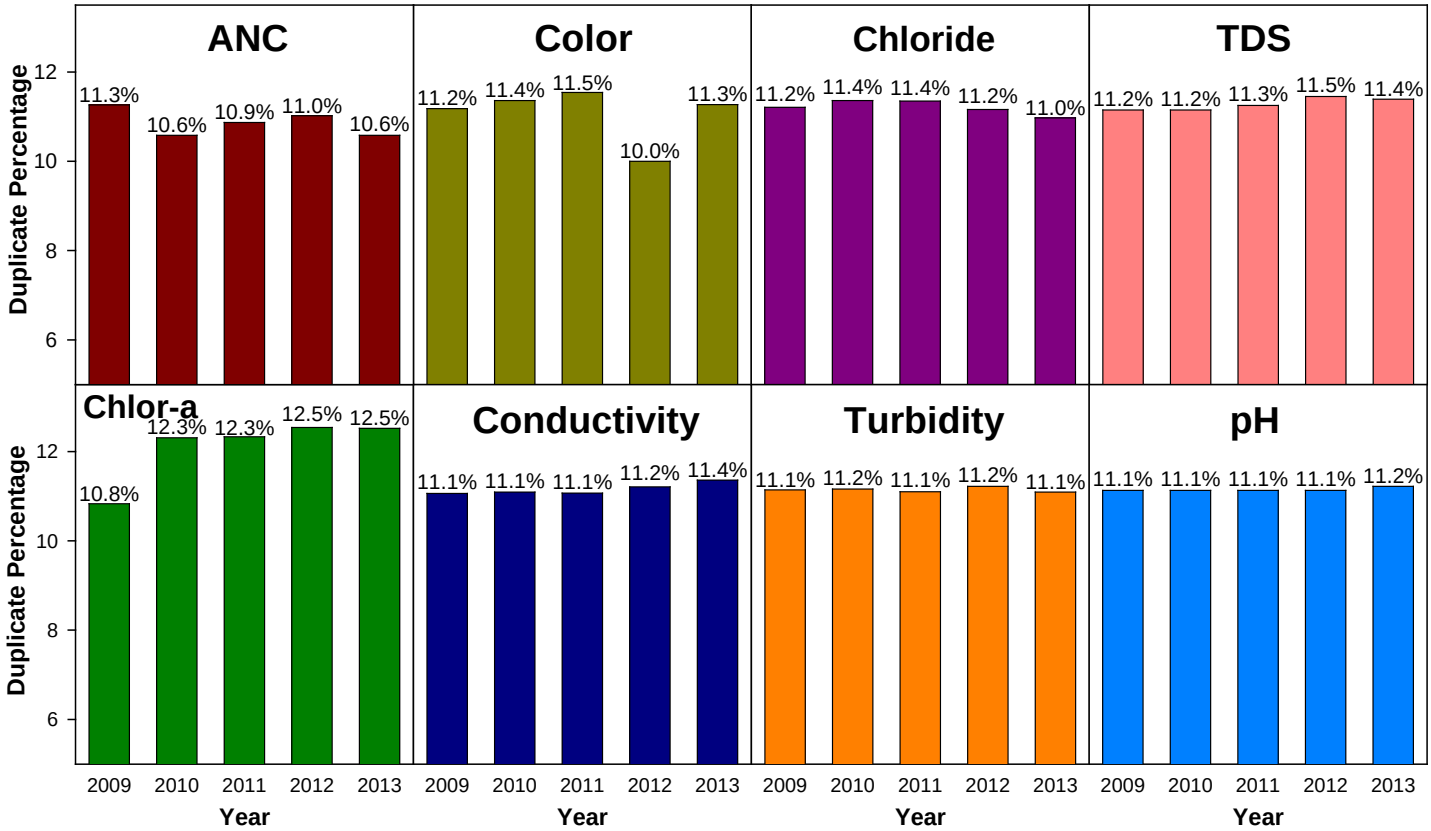


Table 1: 2013 Calendar Year JCLC Chemical Analyses Summary

Parameter	Replicate Analyses	Sample Analyses	Replicate Percent	Average Split Mean Range					
				2008	2009	2010	2011	2012	2013
Alkalinity (ANC) mg/L	42	397	10.58	0.38	0.22	0.30	0.18	0.26	0.47
Apparent Color (Visual) cpu	8	71	11.27	0.44	0.56	1.90	0.67	0.2	0.63
Chloride mg/L	142	1295	10.97	2.66	0.86	0.78	0.53	2.29	1.02
Chlorophyll-a mg/L	90	719	12.52	0.55	0.42	0.44	0.22	0.35	0.35
Conductivity µmhos/cm	244	2148	11.36	0.27	0.26	1.32	1.28	1.27	0.74
Microcystin mg/L (started analysis in 2010)	2	19	10.52			0.06	0.26	0.04	
Mercury mg/L	21	313	9.86	0.45	0.03	0.03	0.03	0.04	0.03
pH units	255	2272	11.22	0.11	0.07	0.08	0.06	0.05	0.06
TDS mg/L	60	527	11. 39	4.56	3.84	5.69	0.9	0.97	1.49
Turbidity NTU	292	2623	11.09	0.84	0.27	0.17	0.15	0.12	0.09

The SSL facility continues to be well operated and serves as a model satellite laboratory for producing high quality data in support of NHDES' volunteer water quality monitoring programs. SSL has consistently met or exceeded the replicate DQO for all VLAP parameters (Figure 7) since 2008. In addition, the 2013 split mean range remained consistent with previous years (Table 2). Lastly, SSL laboratory replicates met established critical range criteria for all parameters.

Figure 7: Sunapee Laboratory Replicate Percentages for Individual Analyses

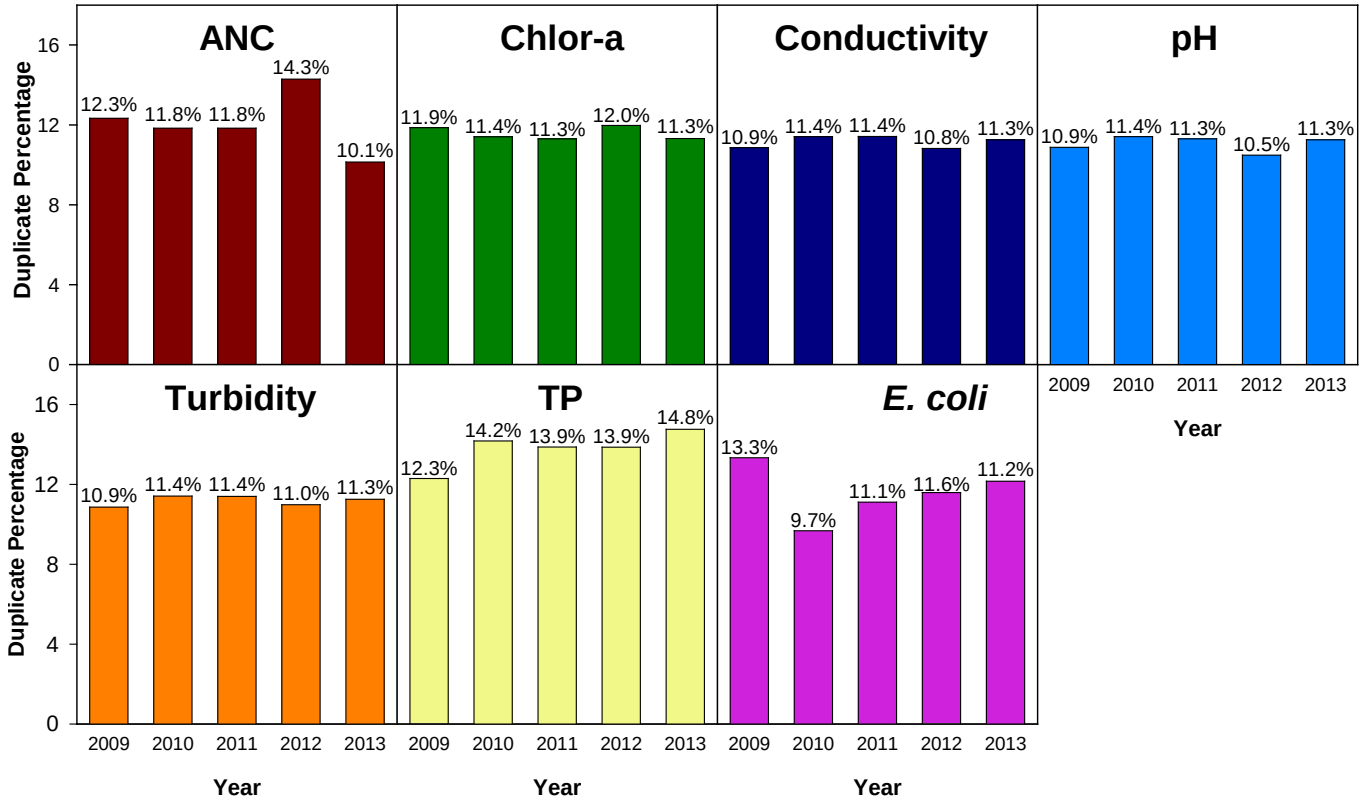


Table 2: 2013 Calendar Year Sunapee Laboratory Chemical Analyses Summary

Parameter	Replicate Analyses	Sample Analyses	Replicate Percent	Average Split Mean Range					
				2008	2009	2010	2011	2012	2013
Alkalinity (ANC) mg/L	7	69	10.14	0.40	0.36	0.27	0.47	0.52	0.29
Chlorophyll-a mg/L	12	106	11.32	0.28	0.20	0.28	0.27	0.17	0.27
Conductivity µmhos/cm	71	631	11.25	0.63	0.37	0.94	0.26	0.39	0.80
pH units	71	631	11.25	0.05	0.07	0.06	0.06	0.10	0.06
Turbidity NTU	71	631	11.25	0.19	0.16	0.24	0.23	0.21	0.18
E. coli counts/100ml	9	74	12.16	0.00	0.13	0.17	0.14	0.00	0.00
Total Phosphorus mg/L	84	606	13.86	0.001	0.001	0.001	0.001	0.001	0.0006

JCLC collaborated with PSU Center for the Environment in 2007 to create a satellite laboratory to serve northern New Hampshire. The PSU Laboratory is located in a modern facility equipped lab instruments that provide quality results. In 2013, the PSU lab produced quality data while also increasing its involvement in VLAP and VRAP in the North Country. The PSU Lab is a valuable asset that has considerably reduced the

workload on JCLC while acting as a convenient hub for volunteers from northern New Hampshire. The PSU lab has consistently met or exceeded the replicate DQO for all VLAP and VRAP parameters (Figure 8) since its inception in 2008. PSU's 2013 split mean range also remained consistent with previous years (Table 3).

Figure 8: PSU Laboratory Replicate Percentages for Individual Analyses
(*Duplicate results were lost for TP & *E. coli* in 2009)

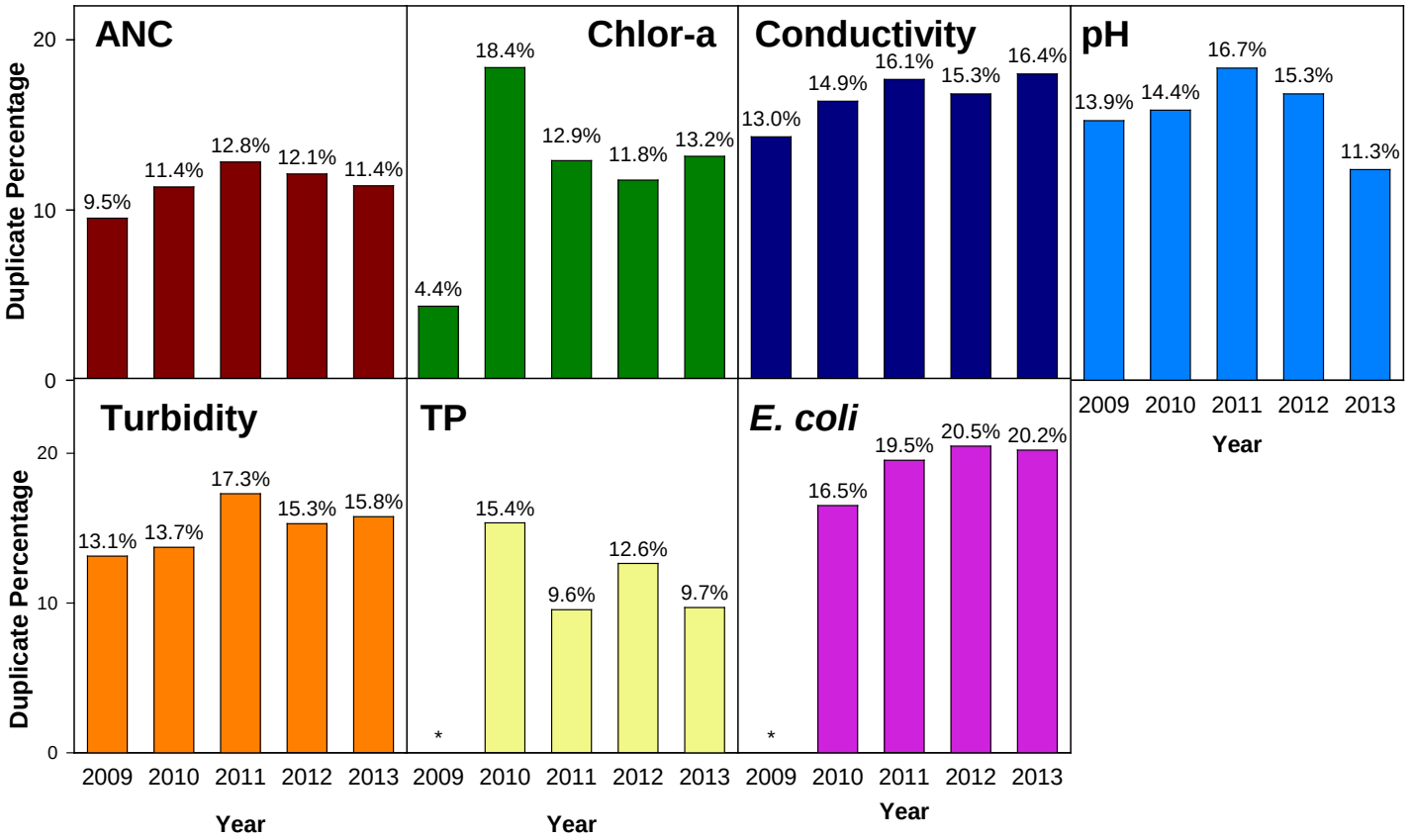


Table 3: 2013 Calendar Year Plymouth Laboratory Chemical Analyses Summary

Parameter	Replicate Analyses	Sample Analyses	Replicate Percent	Average Split Mean Range					
				2008	2009	2010	2011	2012	2013
Alkalinity (ANC) mg/L	4	35	11.43	0.03	0.60	0.08	0.14	0.25	0.05
Chlorophyll-a mg/L	5	38	13.16	0.16	0.89	0.32	0.29	0.4	0.43
Conductivity µmhos/cm	27	165	16.36	0.63	0.37	0.39	0.35	0.98	1.28
pH units	27	165	16.36	0.05	0.07	0.06	0.03	0.03	0.04
Turbidity NTU	26	165	15.76	0.06	0.16	0.06	0.10	0.07	0.12
E. coli counts/100ml	19	94	20.21	1.25	--	4.67	1.97	2.42	3.26
Total Phosphorus mg/L	16	165	9.70	0.001	--	0.0002	0.0002	0.0005	0.0005

III. ANNUAL PROGRAM REPORTS

3.1 Assessment Based Programs

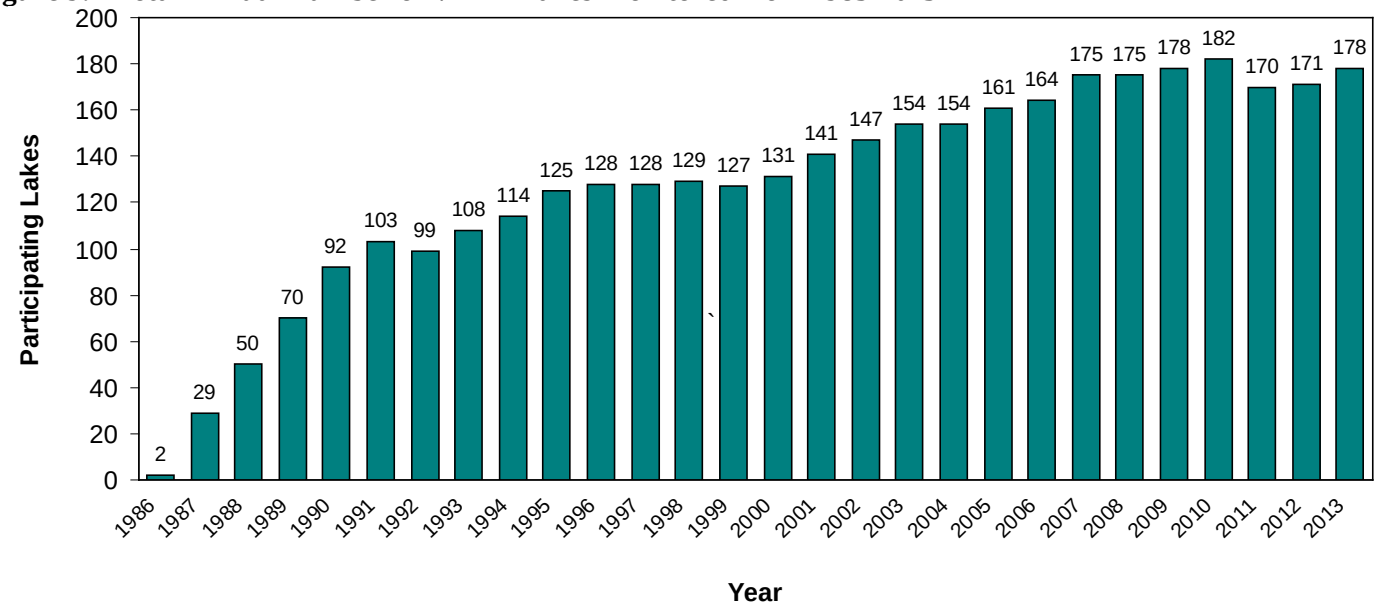
3.1.1 JCLC support summary

JCLC provided analytical services for over a dozen programs in the Watershed Management Bureau in 2013. In addition, JCLC provides bench space where field equipment can be maintained, calibrated and prepared for field use. Equipment from JCLC is also loaned to volunteers and other state agencies for the purpose of surface water quality monitoring. The following sections summarize the activities of the programs supported by JCLC.

3.1.2 Volunteer Lake Assessment Program (VLAP)

VLAP was established in 1985 and volunteers collect monthly in-lake and tributary water quality samples during the summer. In 2013, 178 lakes were sampled through the program (Figure 9). Since its inception, VLAP has consistently enrolled additional lakes into the program on an annual basis. However, due to budget cuts in 2011, VLAP did not accept any new lakes into the program despite the request of multiple groups. The continued dedication of volunteers from nearly 200 lakes statewide clearly demonstrates the program's popularity and reflects the public's devotion to watershed management, water quality improvement and lake protection for future generations.

Figure 9: Total Annual Number of VLAP Lakes Monitored from 1985-2013



The VLAP coordinator continued to provide the necessary level of service to volunteers in order to produce quality data under the auspices of an EPA approved QAPP. Sample collection and data quality control is extremely important as this data are used to prepare the state's Section 305(b) water quality report and list of impaired waters the 303(d) list. In addition, VLAP data are utilized to complete Total Maximum Daily Load (TMDL) studies, water quality criteria development and watershed planning efforts.

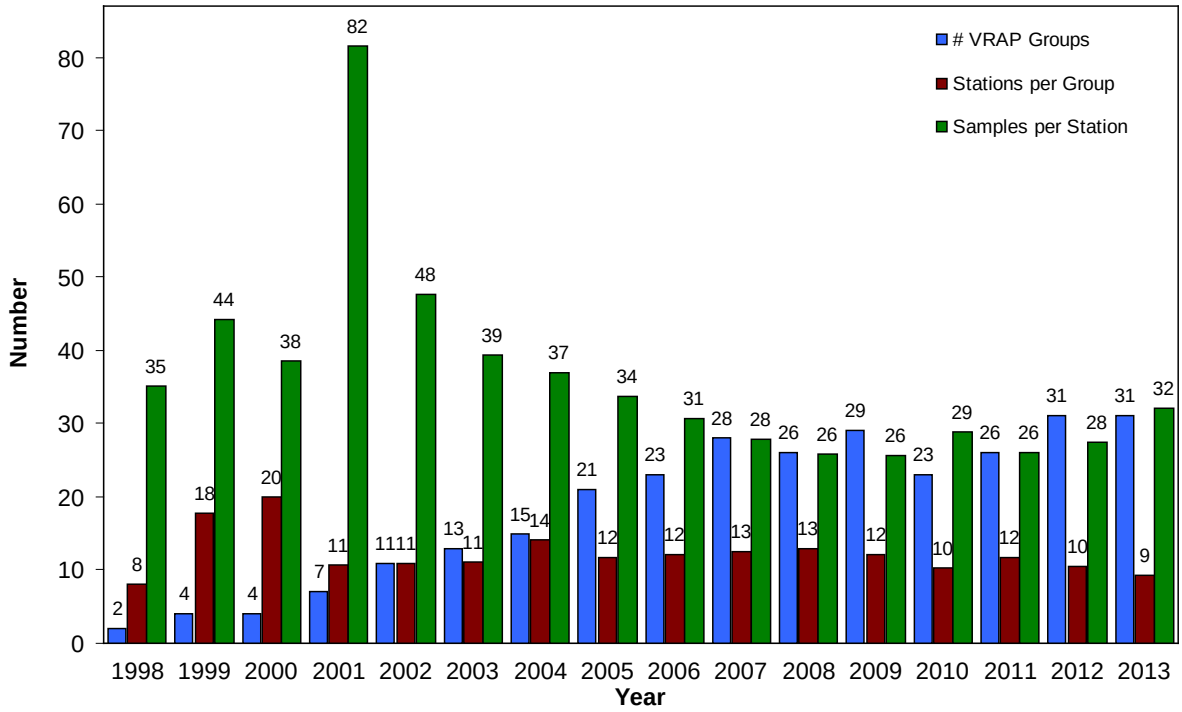
Lake associations are educated on the importance of practicing quality control during sampling events and sample preservation during the delivery of samples to the JCLC. In addition, volunteer monitor sample techniques are audited by collecting field duplicate samples during biennial NHDES staff visits to each participating lake and pond. If data are suspect, the VLAP coordinator assesses sample collection techniques and if necessary, provides quality control recommendations to the on-site volunteer monitors.

3.1.3 Volunteer River Assessment Program (VRAP)

In 1998, NHDES established VRAP to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology, and to improve water quality monitoring coverage for the protection of water resources. Today, VRAP loans water quality monitoring equipment, provides technical support and facilitates educational programs. In 2013, VRAP supported 32 volunteer groups (Figure 10) on numerous rivers and watersheds throughout the state.

VRAP is a cooperative program between NHDES, river groups, local river advisory committees, watershed associations and individuals working to protect New Hampshire's rivers and streams. VRAP volunteers are trained by NHDES staff in the use of water quality monitoring equipment at an annual training workshop. NHDES staff work with VRAP groups to establish monitoring stations and develop a sampling plan. During each sampling season, NHDES receives water quality data from trained volunteers. The data are reviewed for quality assurance, and are entered into the EMD. During the off-season, NHDES staff interpret the data and compile the results into an annual report for each river. VRAP volunteers can use the data as a means of understanding the details of water quality, as well as to guide future sampling efforts.

Figure 10: VRAP Group, Station, and Sample Count from 1998-2013



Data collected through VRAP is used to develop the Section 303(d) impaired waterbodies list and the Section 305(b) water quality report, from which impaired or potentially impaired waters are targeted for additional, detailed study. Over 39 percent of the surface water quality assessments of riverine assessment units included in the 2012 Section 305(b) report were provided by VRAP. In 2013, this data contributed to the assessment of 2,900 miles of rivers and streams.

3.1.4 Lake Assessment Program

This year the WMB reinitiated the Lake Assessment Program as part of the bureau's comprehensive monitoring strategy. Each year ten lakes will be selected from a rotating set of watersheds that will be common for other monitoring efforts. Of the ten lakes selected 9 were surveyed and one was found to be inaccessible due to a blocked access road. The selected waterbodies will be resampled over three consecutive years. Another ten waterbodies in the next rotation of watersheds will be selected for sampling in 2014 (see Table 4 for sampling progression).

Table 4: Three year sampling plan for Lake Survey Program

Sampling Month		June	July	August	Maximum Lakes Sampled
Sampling Year	2013	x	x	2013 selections	10
	2014	x	2013 selections	2014 selections	20
	2015	2013 selections	2014 selections	2015 selections	30
	2016	2014 selections	2015 selections	2016 selections	30
	2017	2015 selections	2016 selections	2017 selections	30
Each year of selection represents up to 10 lakes					

3.1.5 Biomonitoring Program

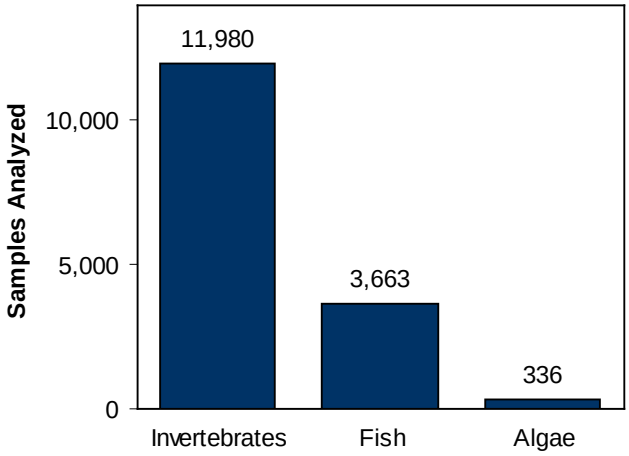
The NHDES biomonitoring program was established in the mid-1990's in response to an EPA directive for states to develop the capacity to characterize the condition of its aquatic communities. Since that time, the program has focused on the development and implementation of biological condition indices for rivers and streams. The program also collects chemical and habitat data using these data in conjunction with biological data to complete comprehensive water quality assessments of river and stream segments.

In 2013, the Biomonitoring Program worked cooperatively with other WMB staff to collect physical and chemical water quality parameters at 53 (40 Trend, 13 Synoptic) monitoring stations one to two times per month from June through September and biological samples from 40 (27 trend, 13 synoptic) monitoring stations.

As part of the 2013/2014 National Rivers and Streams Assessment project, a probabilistic assessment of the nation's rivers and streams, data for various water quality, habitat and biological parameters were collected at 14 sites in New Hampshire. Most samples were processed through EPA contract laboratories.

Biomonitoring data summaries included in this report are from 2012 macroinvertebrate samples and from 2013 fish samples as part of the NRSA project. In total, 112 macroinvertebrate samples from 38 stations were collected. These data included 11,980 discrete identifications of 217 unique taxa (Figure 11). Biological monitoring for fish at 20 stations included 3,663 identifications of 37 unique taxa. Algal assessments resulted in 336 discrete data points (56 transects, 6 data points/transect) from 14 stations, including quality control samples.

Figure 11: Biomonitoring data summaries for invertebrates (2012), fish (2013) and algae (2013)



Macroinvertebrate data quality control measures require a random selection of samples to be sent to a second independent macroinvertebrate laboratory for reprocessing. A total of 13 samples were re-evaluated for data quality (11.6 percent), meeting NHDES' requirement of 10 percent. Quality control measures include sorting efficiency, taxonomic completeness and identification accuracy (Table 5). For 2012, sorting efficiency was >99 percent, taxonomic completeness was 100 percent and identification accuracy was >95 percent for all 13 quality control samples. Based on these results, all of the macroinvertebrate data was considered valid.

Table 5: Macroinvertebrate Quality Control Measures and Benchmarks

QC Measure	Description	Formula	Benchmark
Sorting efficiency	Percentage of individuals missed in the original sort	=100 - [|(OI - RI)| /(OI + RI)] OI = total number individuals in original sort RI = total number individuals in re-sort	≥ 95%
Taxonomic completeness	Percentage of taxa included in the original sort	=((RT - |(OT - RT)|)/RT) *100 OT = total number taxa in original sort RT = total number taxa in re-sort	≥ 95%
Identification accuracy	Percentage of individuals differing in their final taxonomic disposition	=1 -[(∑ (OTSI -RTSI)/2) /OI] OTSI = number of taxa specific individuals in original sort RTSI = number of taxa specific individuals in re-sort OI = total number individuals in original sort	≥ 95%

Fish identification data quality control measures relied on having an expert fish taxonomist on site during sampling. Any unknown species were retained for laboratory analysis and further consultation with other state agencies and partners.

For 2013, the abundance of benthic algae was estimated at 13 sites and resulted in 803 observations. Algal observation quality control measures included duplicate and replicate observations (Table 6). For 2013, a total of 8 quality control transects were obtained. Only one transect repeat measures failed the 30 percent RPD benchmark (Table 7). This measure was flagged and not considered valid. The remaining data quantifying benthic algae was considered valid.

Table 6: Algal Abundance Quality Control Measures and Benchmarks

QC Measure	Explanation	Sample Evaluation Method	Benchmark
Duplicate observation sample	Repeat transect sample by same individual	Contingency table testing; initial versus repeat sample transects; 6 categorical frequency distribution observations / transect	RPD between original and repeat transect score <30%
Replicate observation sample	Repeat transect sample by different individual		

Table 7: 2013 Algal Abundance Duplicate Sample Summary

QC Measure	Total Transects	Quality control Transects	Benchmark Failures*	Overall Benchmark Failure Rate
Duplicate observation sample	56	5 (9%)	1	20%
Replicate observation sample		3 (5%)	0	0%
* instances where RPD of transect scores were >20% between the original and repeat observations				

3.1.6 Wetlands Monitoring Program

In 2012, EPA awarded a Wetlands Program Development Grant (WDPG) as a cooperative project to the WMB and Wetlands Bureau, the NH DRED-Natural Heritage Bureau (NHB), and University of New Hampshire Cooperative Extension (UNHCE) in order to compare several wetland assessment methodologies. Together, the partnership collected data from 27 bogs and fens using four field protocols at each site.

The purposes of the methods comparison were to:

- Improve understanding of the methods and their potential applicability to various permitting and water quality monitoring and assessment programs.
- Improve protection for New Hampshire's wetland resources.
- Increase knowledge to support development of water quality standards for wetlands.

The wetland assessment methods chosen for the 27 study sites were: 1) EPA's USA RAM; 2) NHB Level 2.5 Ecological Integrity Assessment; 3) Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire (NH Method); and 4) Floristic Quality Assessment.

Each of the methods characterizes wetlands using a combination of existing data (*e.g.*, soil maps and remote sensing data) and brief field surveys that collect relatively basic data. Important distinctions between methods inherent in their design include the purpose of the assessment method, use of existing data types, field measurements, expertise required and final condition outcomes. The paired methods will allow for comparisons made of inter-observer variability, time investment (office and field), and extent of agreement between indices measuring the same features.

Wetland systems studied were characterized as representing a range of size and quality. Field surveyors applied the different methods working independently at the same sample locations. Three sample locations were sampled by multiple surveyors each using all four methodologies.

Presently, the NHB is drafting a report to summarize the strengths and weaknesses of the different methodologies. Ultimately, summary tables of the data collected and comparisons between methods will be stored in digital format (MS Access and MS Excel) and distributed to partners. In addition, raw data for the project will be entered by the NHB in its Biotics database and used to track new and updated exemplary wetland records documented during field surveys. NHDES will maintain the information in its EMD. The final report will be posted on the NHB (www.nhnaturalheritage.org) and NHDES websites.

This project represents an initial step by NHDES in the development of a wetland monitoring and assessment program. Future efforts that build on this experience will be necessary to establish the assessment tools necessary that ensure wetlands are subject to the full protections afforded in the water quality standards.

3.1.7 I-93 Chloride TMDL

In 2013 data collection continued for the I-93 TMDL development and implementation. The data quality objective for data completeness is to obtain continuous data for 80 percent of the year at each station. The 80 percent data completeness criterion was met for the datasonde records for Policy Brook, Beaver Brook and the North Tributary (Table 8). At station I93-DIN-01 in Dinsmore Brook, valid specific conductance readings were made for 72 percent of the year. The datasonde was removed from this station between March 11, 2013 and June 14, 2013 because there was construction and logging in the area that might have damaged the equipment.

Table 8: Data completeness for in-situ specific conductance datasonde readings from 7/1/12-6/30/13

Station ID	Valid Specific Conductance Data Points	15 Minute Intervals in Reporting Period	Portion of Reporting Period with Valid Conductance Data
I93-POL-01V	34,355	35,040	98%
10A-BVR	34,357	35,040	98%
I93-DIN-01	25,235	35,040	72%
I93-NTC-01	28,127	35,040	80%

The actual number of handheld meter samples for temperature and specific conductance (34) was slightly less than the expected number (36) (Table 9). However, this result met the data completeness quality objective of 80 percent of the planned measurements. There were 9 pairs of routine and field duplicate samples for temperature and specific conductance, which equaled the expected number. The RPD between the routine and duplicate samples was less than 15 percent (the data quality objective) for all the temperature and specific conductance data pairs.

Table 9: Data completeness for grab samples and field meter measurements for 7/1/12-7/1/13

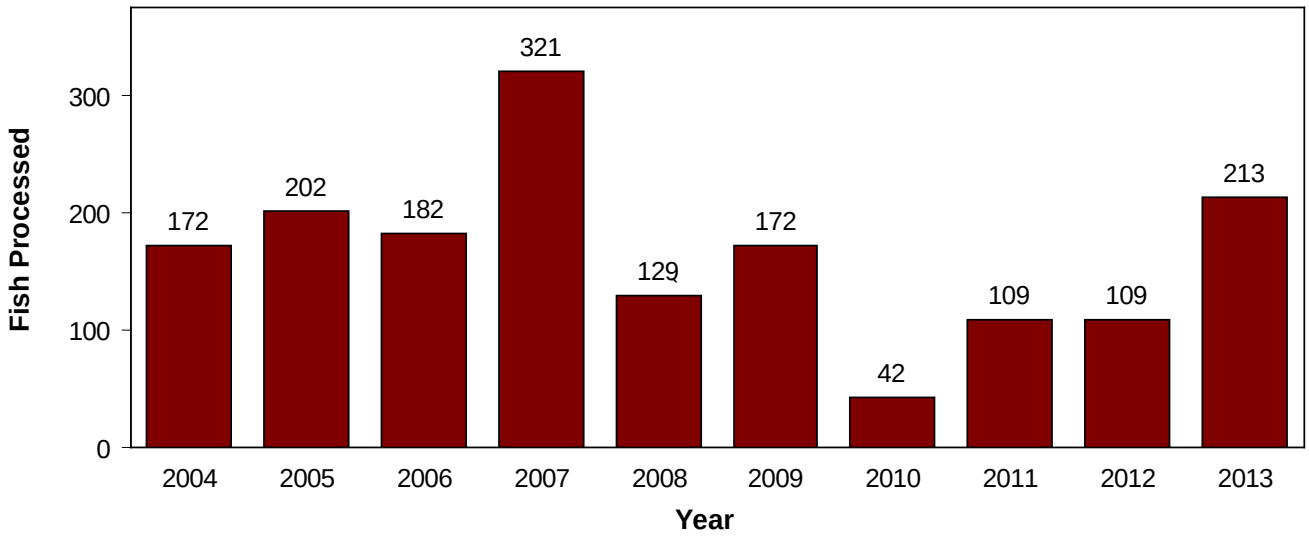
Parameter	Actual Samples or Measurements	Expected Samples or Measurements	Completion Rate
Temperature	34	36	94%
Specific Conductance	34	36	94%
Chloride	34	36	94%
Temperature Duplicates	9	9	100%
Specific Conductance Duplicates	9	9	100%
Chloride Duplicates	9	9	100%

The actual number of chloride grab samples (34) was slightly less than the expected number (36) (Table 9). However, this result met the data completeness quality objective of 80 percent of the planned measurements. There were 9 pairs of routine and field duplicate samples for chloride (Table 6), which equaled the expected number. The RPD between the routine and duplicate sampled was less than 15 percent (the data quality objective) for all but one of the data pairs. The one exception had a RPD of 17 percent, which was a small deviation. Therefore, the quality control samples do not indicate any systematic problems with the chloride samples collected for this study.

3.1.8 Fish Tissue Program

JCLC plays a critical role in the state's fish tissue study program. NHDES is responsible for organizing the collection of fish specimens for state and national fish tissue studies. Fish are collected by VLAP volunteers using traditional fishing methods, by NHDES and NH Fish and Game staff using fish electroshock boats during the summer months, and at ice fishing tournaments during the winter. In addition, NHDES obtains fish from a US Fish & Wildlife study evaluating the outfall area around the PSNH Bow power plant. The number of fish collected and processed by JCLC over the past several years has ranged from a high of 321 to a low of 42 (Figure 12). The number of fish processed in 2013 was 213, well above the average number of fish processed each year (158).

Figure 12: Number of Fish Processed for Mercury Analyses

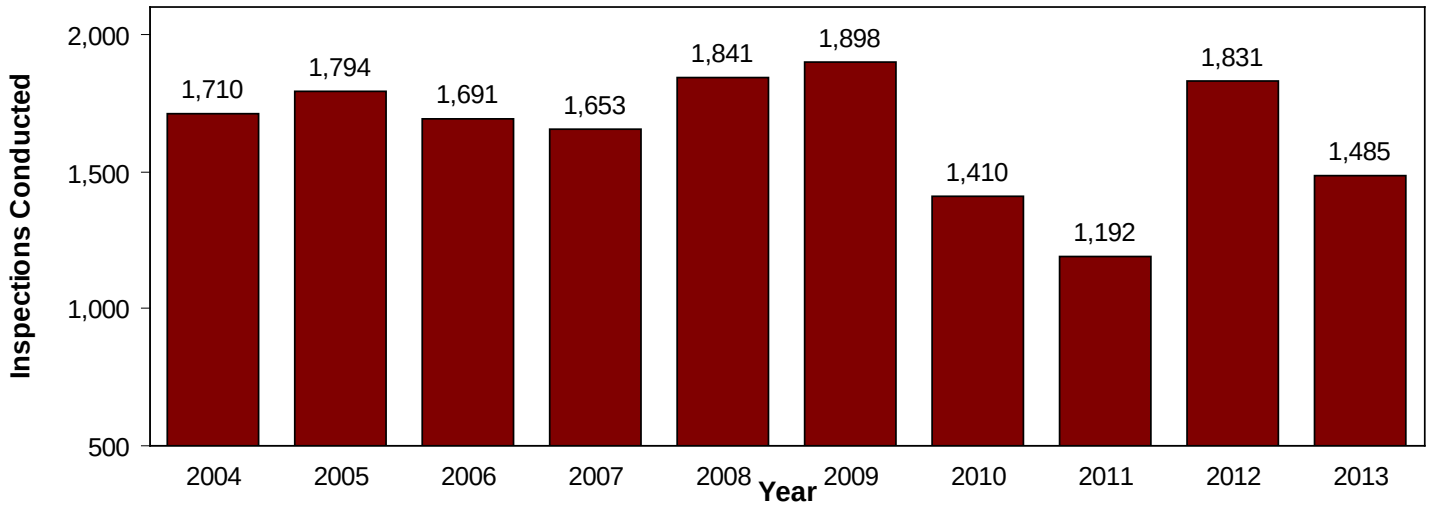


3.2 Inspection Based Programs

3.2.1 JCLC Support Summary

Several programs are responsible for conducting field inspections. These programs include public bathing facility, coastal and freshwater public beach, boat discharge, and exotic plant inspections conducted at pet supply stores and plant supply stores (Figure 13). Program inspections may be either routine, a result of complaints or inquiries. In addition, suspect exotic aquatic plant samples are regularly submitted by the public to JCLC for identification. These programs protect public health and welfare and require a significant investment of JCLC staff time and resources.

Figure 13: Inspections Conducted by NHDES JCLC for All Programs



3.2.2 Complaints

Seventy two new complaints were added to the EMD during the 2013 calendar year. Biology section staff conducted site visits for 15 (Figure 14), or 21 percent, of the complaints, 9 were handled over the phone and 13 were resolved via email.

The JCLC continues to track all complaints in the EMD. The complaints module of the EMD has been valuable for communicating complaint information and details within the WMB and NHDES. The main complaints reported to WMB were general water quality concerns (36 percent), cyanobacteria/algae blooms (15 percent), turbidity and erosion (13 percent), and bacteria (6 percent) (Figure 15).

Figure 14: NHDES Biology Section Complaint Summary, Complaint Percentage by Type

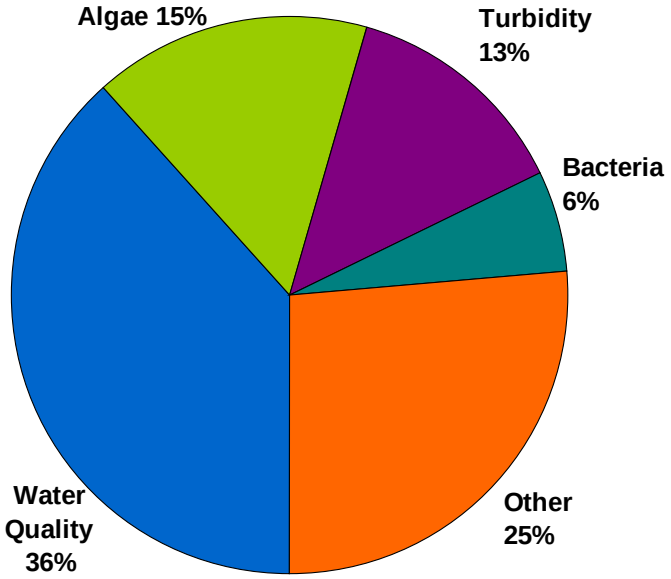
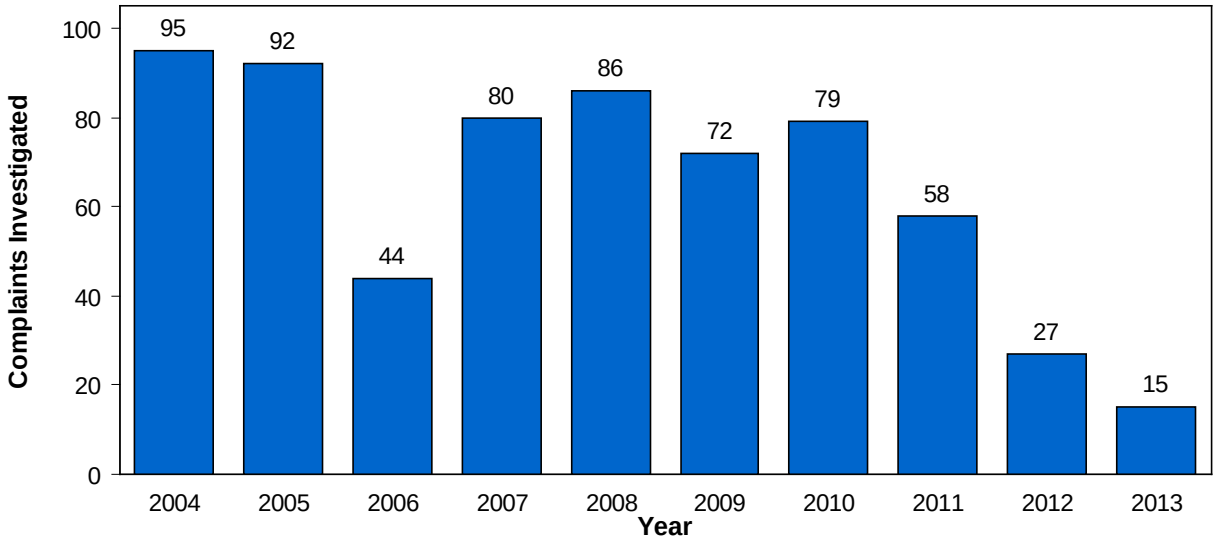


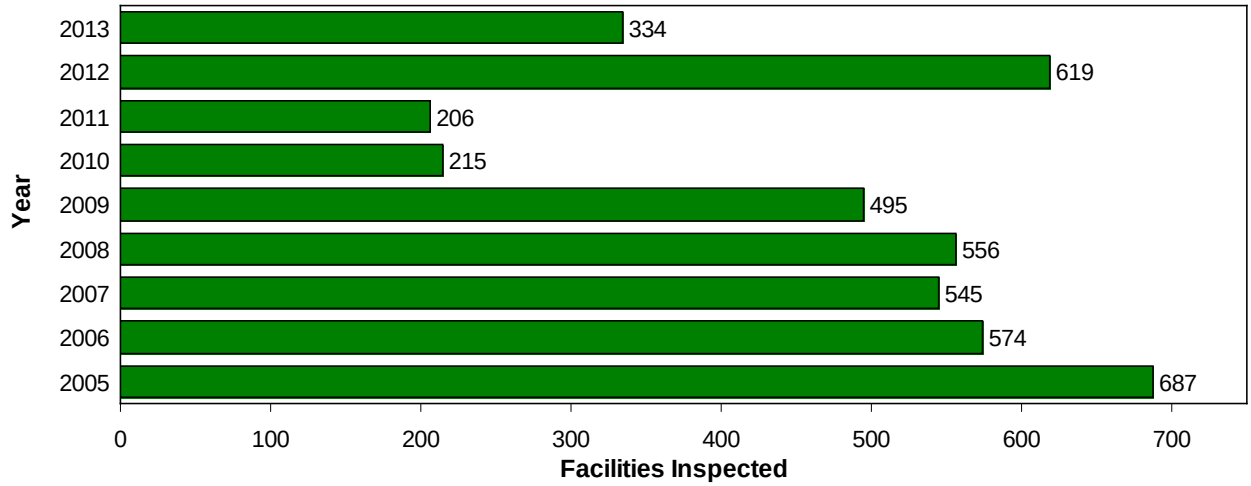
Figure 15: Number of Complaint Investigations Conducted by the NHDES Biology Section



3.2.3 Public Bathing Facility Inspection Program

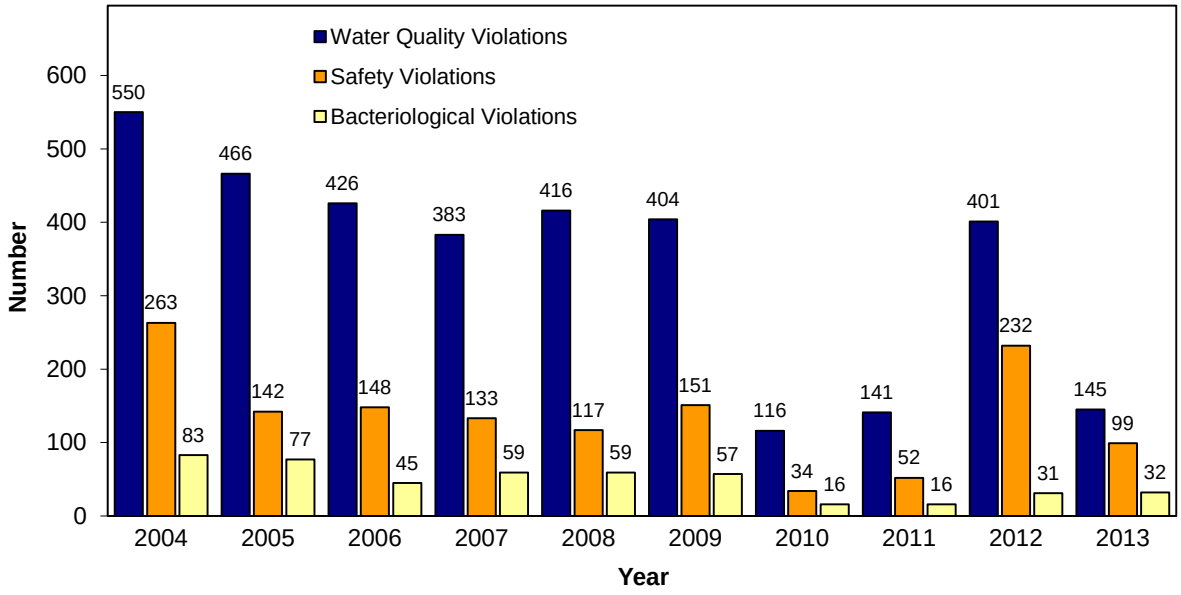
In 2013, 334 facility inspections were conducted including 295 routine inspections, 13 complaint inspections, 12 retest inspections and 14 pre-opening inspections (Figure 16). Since the inception of the program in 1997, water quality violations, as a percentage of inspections conducted (334 inspections in 2013), have averaged 70 percent. There has been a downward trend over the last several years in this category but the lowest level of water quality violations came in 2013 (Figure 17). Despite this overall improvement, an increase in the number of bacterial violations was identified in 2013, as well as higher-than-normal occurrences of low disinfection. Thirty-two facilities, or 9 percent of all inspections conducted (334), were found to have bacteria in the water, along with 71 occurrences of low disinfectant. It is believed that the summer's very high temperatures and frequent rain storms had a direct effect on these two metrics. Safety violations often involved potentially direct hazards to bathers such as missing break float safety lines or broken, lose or missing drain covers. Of the 99 safety/facility violations identified in 2013, the majority were issues with record keeping/testing and depth markers. In comparison to prior years, the number of safety violations increased slightly as a percentage of the total inspections conducted. Eight facilities were found with unapproved main drain covers. Fifteen permit applications were submitted and issued in 2013. This is a 50 percent increase over 2012. Historically, the number of permits issued by NHDES has seemed to trend with the health of the economy. 2006 saw the second highest number of permits issued in one year at 44. There was a steady but rapid decrease to the fewest the program has witnessed in 2010, numbering only 10. This drop off in pool construction continued through 2012

Figure 16: Public Bathing Facility Inspections



with most construction coming from the hospitality industry. Pool construction this year came from a broader spectrum of categories; including hotels, condos, campgrounds, health clubs, assisted living facilities and even a municipal pool.

Figure 17: New Hampshire Public Bathing Facility Violations



3.2.4 Freshwater Beach Program

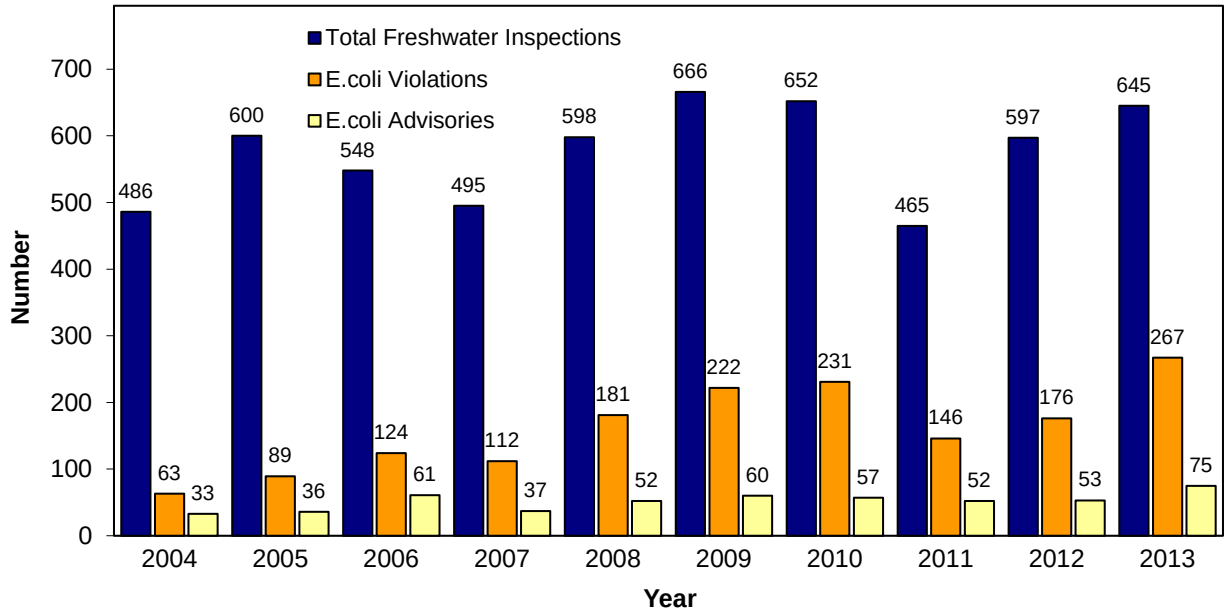
In 2013, freshwater beaches were inspected by the Public Bathing Beach Inspection Program from June 17 to August 29. The goal of the freshwater beach program is to inspect each beach in the program three times between Memorial Day and Labor Day. In 2013, NHDES personnel performed 645 beach inspections at 166 freshwater beaches in 11 weeks (Figure 18). Of these inspections, 488 were routine scheduled inspections while the remaining 157 inspections were related to elevated bacteria levels and advisories. Drinking Water and Groundwater Bureau personnel conducted 97 routine inspections at juvenile camp beaches. The 742 inspections conducted yielded a total of 1,622 *E. coli* samples analyzed by the state laboratory, including field duplicates. In 2013, 267 *E. coli* samples exceeded the state standards, resulting in the issuance of 76 freshwater beach advisories, the most ever issued in a single summer. The percentage of *E. coli* samples exceeding the state standard was 14 percent. Of the 59 beaches with elevated bacteria levels leading to advisories, 20 also had advisories in 2012. Eight additional beach advisories were issued for cyanobacteria, one less than issued in 2012.

Since 2008, NHDES has also issued cyanobacteria lake warnings if an algae bloom occurs far away from a beach or on a lake without a public beach. One cyanobacteria warning was issued for a week on Province Lake, Effingham and another was issued for 16 days on Horseshoe Pond, Merrimack.

Fifteen pre-emptive fecal bacteria advisories were issued at Ahern State Park, Laconia, 6 more than in 2012. Pre-emptive advisories are issued when >0.25 inches of rain falls in a 6 hour period at the state park. The increase was due to the increased rainfall in the beginning of the summer. Additional sampling was conducted in the summer of 2013 to determine if the efforts to reduce the goose population by letting the grass grow tall have been successful. However, sampling conducted after heavy rainfall at Ahern State Park was not conclusive. The testing regime at Ahern State Park will be continued in 2014. Not all freshwater beaches sampled by the NHDES program are accessible to the general public. Of the 145 town and private beaches that are sampled by the NHDES inspection staff, 102 limit entry to residents and guests only. Seven of the beaches

charge entry fees to everyone. Only 36 of 145 private and town beaches allow unrestricted access to the swimming areas.

Figure 18: Water Quality Violations and Advisories at Freshwater Beaches



3.2.5 Coastal Beach Program

The Beach Program is a federally funded program that provides resources for coastal beach research and monitoring. NHDES inspected 16 coastal public swimming beaches in 2013. During the swim season, Memorial Day through Labor Day, ten beaches were inspected twice weekly and four were inspected weekly according to their tiered monitoring assessment. Sampling at two beaches, Hampton Harbor and Northside Park (a.k.a. Plaice Cove), occurred every other week in 2013. Sampling frequency was reduced because Hampton Harbor Beach has very few visitors and Northside Park has never had any samples over the state standard out of 391 samples collected since 2002.

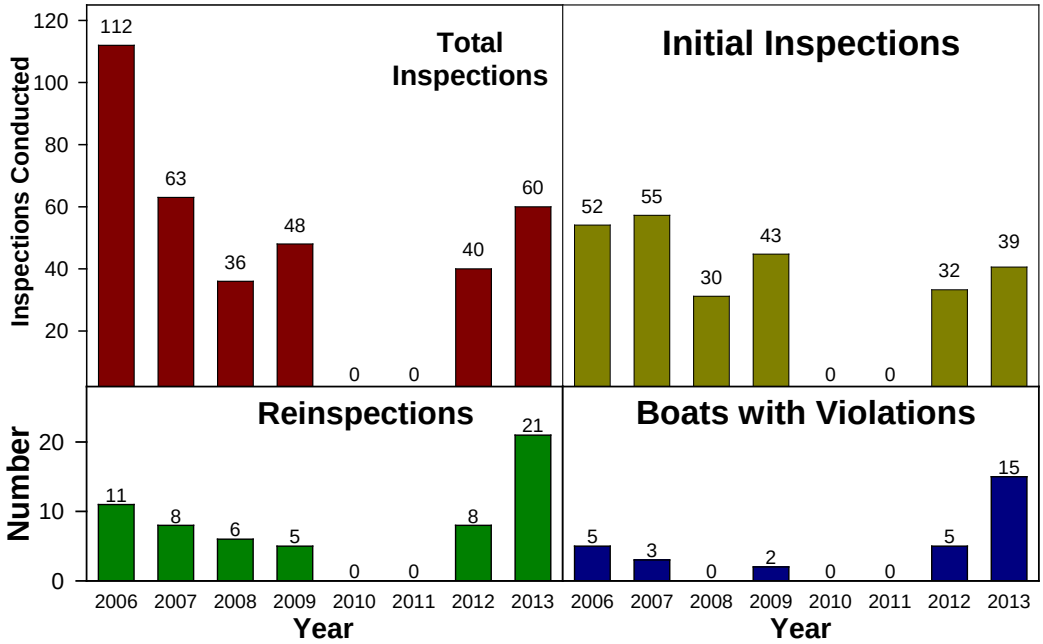
Staff members conducted 297 inspections and collected 1027 samples for *Enterococci* analysis during the swim season. No off-season sampling was conducted in 2013. During the swim season, 16 *Enterococci* samples exceeded the state standard, resulting in five coastal beach advisories. Four of the five advisories were at North Hampton State Beach and in effect for a total of 7 days. The other advisory was issued for two days at Bass Beach in North Hampton. The swim season in New Hampshire was 98 days long in 2013 which translates into 1,568 beach days for all 16 beaches. With only 9 advisory days during the entire summer at coastal beaches, the chance of a beach not being under a swimming advisory was 99.4 percent in 2013.

3.2.6 Boat Inspection Program

Promotion of proper boating practices and enforcement of the No Discharge Area designation was continued in 2013 by conducting inspections of vessels with onboard marine sanitation devices (MSD) that operate on inland waters. No marine toilet, sink or shower on any boat operated upon fresh waters of the state shall be so constructed or operated as to discharge graywater or sewage (whether it’s treated or not) per RSA 487:2-3.

The 2013 season documented 60 boat plumbing inspections. Of these 60 inspections, there were 39 approvals on the initial inspection, 15 violations and 21 re-inspections (Figure 19). Out of the fifteen violations, six were corrected within the same season and nine are still pending re-inspection/approval.

Figure 19: NHDES Biology Section Boat Inspection Summary



3.2.7 Clean Vessel Act Program

The New Hampshire Clean Vessel Act (CVA) program is a result of a cooperative effort between the NHDES and the U.S. Fish and Wildlife Service. The Federal Clean Vessel Act of 1992 was established to support adequate facilities for recreational boaters to dispose of waste from marine sanitation devices. Through grants from the U.S. Fish and Wildlife Service Sport Fish Restoration account, the NHDES CVA program has funding available to construct, operate, maintain, and repair stationary pumpout facilities and mobile pumpout boat services. These federal funds can be used to account for 75 percent of all approved projects with a minimum of 25 percent supplemented by the applicant including state and local government, private businesses or associations.

New Hampshire funding has been applied to the operation of a mobile pumpout service along the coast since 2002 and within inland waters 2010-2012. Beginning in 2006, these grants were also used to implement an Operation and Maintenance Funding program that continues to assist marinas in seasonal upkeep costs to ensure existing pumpout resources remain in proper working condition. Eligible state activities include general program administration and educational outreach to marina owners, boat dealers and their consumers.

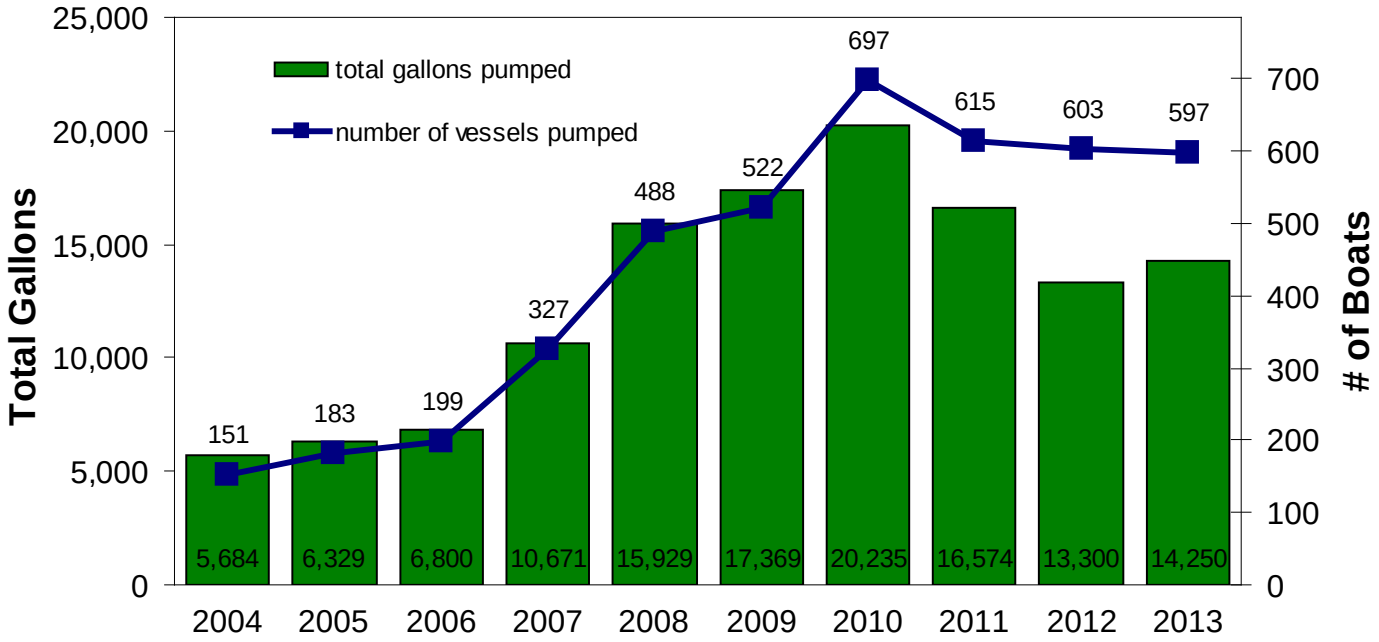
Pumpout options are a key factor in maintaining No Discharge Areas (NDA) throughout New Hampshire waters. All waters within three miles of the New Hampshire shoreline and the Isles of Shoals are part of the coastal NDA where treated or untreated boat sewage is prohibited. Tidal and estuarine waters, including all bays and rivers to the tidal dams, are also incorporated into the NDA. Important goals of the CVA program continue to include educating the boating fraternity of their environmental responsibilities and encouraging public awareness of sources of pollution and pumpout resources.

Coastal Waters – Three stationary pumpout locations and one mobile pumpout boat are available to the recreational boating public along New Hampshire's coast. All three stationary facilities have taken part in NH CVA funds at one point or another either for initial installation or seasonal repairs. An additional stationary facility is currently under repair and in the process of obtaining funds to assuage this cost. Two of the four marina locations were awarded 2013 CVA operation and maintenance funding for their stationary pumpout

units. Under this grant, Wentworth Marina in New Castle, and Great Bay Marine in Newington continued routine operation and maintenance. Wentworth Marina also continued to support the mobile pumpout boat service by serving as the pumpout facility where all the collected sewage was discharged.

The mobile pumpout service receives CVA funding annually through a multi-year contract. Since 2002, approximately 133,000 gallons of sewage have been removed from recreational boats through the use of the mobile pumpout service. During 2013, the mobile pumpout season operated from April to October and the program documented 996.5 captain hours, 597 serviced boats, and the disposal of approximately 14,250 gallons of sewage. The popularity and effectiveness of the mobile resource has been evident in the consistency in boater user numbers and sewage pumped since program implementation (Figure 20). Seasonal activity within the recreational boating community varies from year to year depending on economic and weather conditions.

Figure 20: NHDES Clean Vessel Act Pumpout Boat Service



Inland Waters – New Hampshire has approximately nineteen pump/dump facilities with seventeen (13 of which are public access) devoted to Lake Winnipesaukee and one to Lake Winnisquam. A dump station is also located within Sunapee Harbor on Lake Sunapee. Approximately 50 percent of the available pump/dump facilities have taken part in NH CVA funding at one point or another either for initial installation or seasonal repairs. Three marinas on Lake Winnipesaukee were awarded 2013 CVA operation and maintenance funding for their stationary pumpout units.

The mobile pumpout service for the inland waters was suspended for the 2013 season. The program will remain suspended pending a reevaluation of public need.

The NH CVA program anticipates funding construction, renovation, and maintenance of systems as necessary in 2014. Specifically, project review for a new pumpout location has been requested for a facility site within Paugus Bay on Lake Winnipesaukee and repairs to a coastal facility in Hampton. Education and outreach to marinas, pumpout/dump stations, and the boater fraternity in general will continue both for inland waterbodies and coastal waters.

3.2.8 Exotic Species Program

The primary purpose of the exotic aquatic species program is to "prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state" (RSA 487:17, II). The program has five focus areas: 1) Prevention of new infestations; 2) Early detection of new infestations; 3) Control of established infestations; 4) Research towards new control methods with the goal of reducing or eliminating infested areas; and 5) Regional and national cooperation.

There were no new infestations of exotic aquatic plants in New Hampshire in 2013, so the total number of infested waterbodies remains at 79. The exotic species program inspected 87 waterbodies in 2013 for exotic species infestations (Figure 21). The exotics species program anticipates conducting at least 50 lake inspections in 2014 that have a high potential for exotic species infestations. The total number of management actions for exotic plant control in 2013 is shown in Figure 22.

Figure 21: Exotics Species Program Lake Inspections

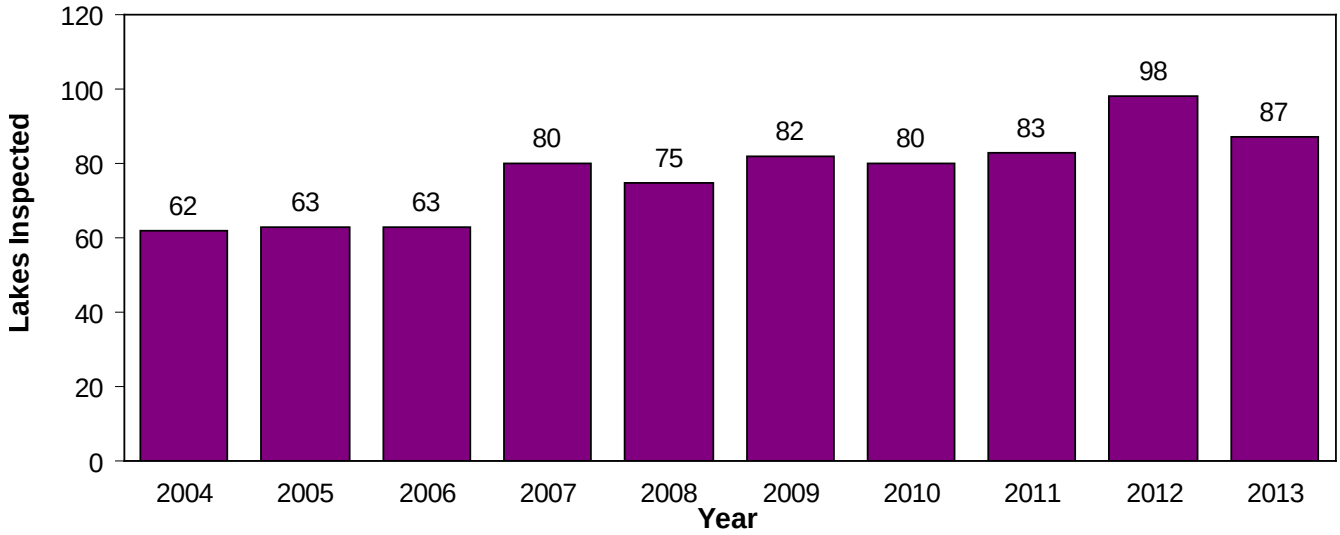
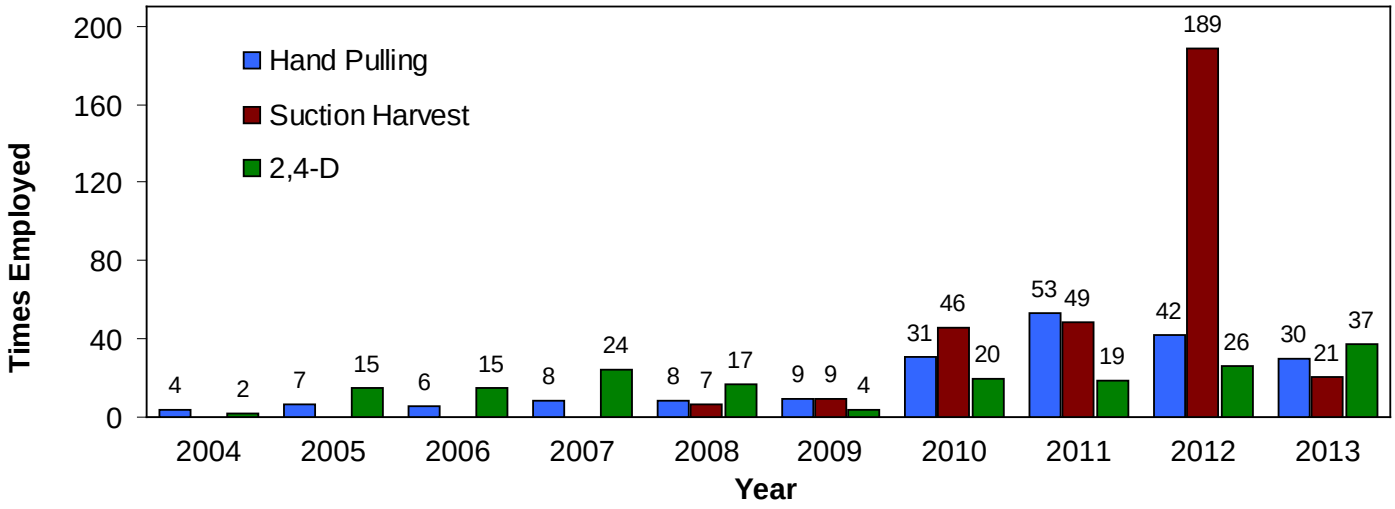



Figure 22: Exotics Species Program Control Practices