Narragansett Bay Commission 2020 Monitoring Season Update

Environmental Monitoring Collaborative Meeting, April 29, 2021

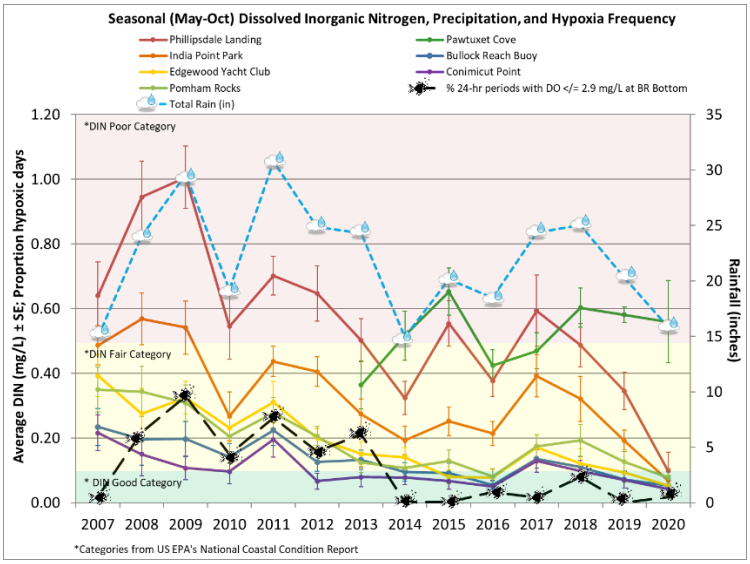
Seasonal Nitrogen Loading to Upper Narragansett Bay

- Field's Point and Bucklin Point remained in compliance with seasonal total nitrogen (TN) permit limits (5 mg/L) in 2020:
  - Avg. May – Oct 2020
    - Field's Point = 2.2 mg/L
    - Bucklin Point = 3.5 mg/L
- NBC seasonal 2020 N loadings were 87% below 2003 loadings.
- Table at right compares seasonal N loading from all major sources to upper Bay pre- (2006 - 2013) and post-nitrogen treatment upgrades (2014 - 2020) at NBC facilities. Overall, N loadings are down ~45% compared to the pre-upgrade period.

	2006 – 2013 Avg	% of Total Loading	2014 – 2020* Avg	% of Total Loading
	lbs/day	%	lbs/day	%
Bucklin Point	1,143	5.8%	531	4.9%
Field's Point	4,039	20.5%	1,026	9.5%
Blackstone River**	4,426	22.5%	2,173	20.1%
Moshassuck River**	174	0.9%	106	1.0%
Woonasquatucket River**	425	2.2%	141	1.3%
Pawtuxet River**	2,156	11.0%	1,124	10.4%
Ten Mile River***	812		202	
East Providence WWTP**	517	2.6%	232	2.1%
Taunton River**	2,692	13.7%	1,218	11.2%
Fall River WWTP	3,227	16.4%	3,537	32.7%
Other Sources TOTAL****	844	4.4%	742	6.9%
Total Contribution	19,668		10,830	

*2020 seasonal data incomplete due to COVID-19; June-October data are used
**River data is Total Dissolved Nitrogen only
***Ten Mile River loading data unavailable for 2018-2020. Historical numbers shown for reference, but excluded from annual totals at this time.
****"Other Sources" includes East Greenwich, Bristol, and Warren WWTP.

Dissolved Inorganic Nitrogen in the Providence and Seekonk River Estuaries



EPA National Coastal Conditions Report Dissolved Inorganic Nitrogen (DIN) Thresholds:

POOR	> 0.5 ppm
FAIR	0.1-0.5 ppm
GOOD	< 0.1 ppm

Seasonal (May – Oct) Average:

Bay Sampling Location	Average DIN (ppm) 2019	2020
Phillipsdale Landing	0.35	0.10
India Point Park	0.19	0.07
Pomham Rocks	0.13	0.08
Edgewood Yacht Club	0.09	0.05
Pawtuxet Cove	0.58	0.56
Bullock Reach Buoy	0.07	0.05
Conimicut Point	0.07	0.04

- Most stations in "good" EPA National Coastal Conditions DIN category.
- Pawtuxet Cove continues to exhibit the highest seasonal average DIN, averaging in the "poor" category.
- Low incidence of hypoxia at Bullock Reach in 2020 (more detail below).

Water Clarity

- In 2020, NBC collected 187 Secchi depth measurements in the Providence and Seekonk Rivers. Photosynthetic Active Radiation (PAR) was also collected with water column profiles.

Monitoring Data Available: Snapshot of Upper Narragansett Bay, http://snapshot.narrabay.com/app/

Fixed-Site Seasonal Monitoring

Bullock Reach Buoy

- Bullock Reach Buoy: deployed mid-May – mid-November 2020
  - **May-October:** Good water quality – in bottom waters, dissolved oxygen (DO) averaged 5.4 mg/L and hypoxic conditions (DO ≤ 2.9 mg/L) occurred approximately 2% of the time.
- Phillipsdale Landing: deployed January – mid-December 2020
  - **May-October:** Fair water quality – bottom DO averaged 5.1 mg/L and hypoxic conditions observed approximately 20% of the time.
- Temporary monitoring location: Pawtuxet Cove (July – November 2020) to support the Narragansett Bay Regional Ocean Modeling System (ROMS) model development.
- Data can be downloaded from: http://snapshot.narrabay.com/app/Buoys/Export

Bacteria Monitoring in the Providence, Seekonk River Estuaries and Tributary Freshwater Rivers

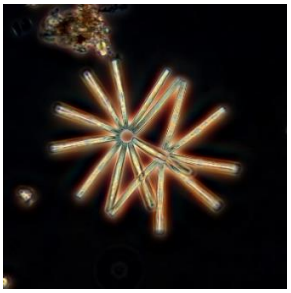
Annual Fecal Coliform Geometric Mean (MPN/100 mL)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Division St. Dock	339	395	188	453	228	140	211	304	170	92	270	221	79	96	221	136	263
Bishop Point	600	324	233	318	306	125	125	233	139	181	281	172	80	87	283	126	201
Off BP Outfall	819	294	329	499	415	117	166	330	120	217	261	175	79	131	242	156	160
Phillipsdale Landing	1386	322	226	197	420	144	109	170	138	163	144	143	53	154	277	93	120
Narragansett Boating Center	718	254	257	165	230	135	122	191	127	240	95	111	73	101	271	121	80
Crook Point	487	273	293	172	199	147	121	107	169	119	98	114	56	79	169	88	90
Point St. Bridge	3441	1946	3981	845	785	1022	402	530	562	367	600	504	511	282	699	567	678
India Point Park	425	318	255	171	182	112	86	214	102	167	74	52	55	77	198	92	82
Collier Point Park	493	313	296	277	188	201	164	187	188	161	149	106	55	124	197	132	168
Off FP Outfall	234	210	183	102	120	116	51	119	66	60	36	70	33	47	152	58	56
Save the Bay		46	61	59	46	38	50	46	35	34	21	36	16	33	57	26	30
South FP East	117	72	49	65	44	38	43	41	46	33	34	58	16	27	86	36	26
Edgewood Yacht Club	95	61	98	65	36	34	47	48	40	31	16	44	30	30	43	37	21
Pawtucket/Providence Junction	98	92	162	116	60	57	79	77	68	43	40	52	36	53	67	37	28
Gaspee Point	65	63	70	48	40	28	48	37	63	18	15	39	12	26	46	35	17
Bullock Neck	47	14	31	27	15	18	30	25	46	19	14	11	8	16	17	13	9
Bullock Reach Buoy	52	34	72	21	16	38	37	28	37	19	14	19	19	18	15	20	12
North of Nayatt Point		11	20	20	12	17	29	25	23	11	11	8	5	14	16	13	6
Conimicut Point	31	24	35	11	18	17	26	20	24	11	9	15	6	16	20	13	9
Shawomet		17	43	23	30	22	31	31	31	13	13	14	7	15	19	18	10
Annual Rainfall (inches)	45.05	57.37	54.31	42.69	57.09	54.86	53.5	55.49	40.99	45.02	47.19	40.74	38.99	47.74	62.79	51.75	44.48

- In 2020:
  - 365 fecal coliform samples, 117 enterococci samples were collected from the Providence and Seekonk Rivers across 17 sample days.
  - 1,727 fecal coliform samples across 108 days, 620 enterococci samples across 104 days from freshwater tributary rivers.
- Bacteria counts decrease with distance down-bay; average fecal coliform counts were lower in 2020 than in 2019.
- A comprehensive study of CSO Phase II impacts on bacteria counts is underway, estimated completion late 2021.

Phytoplankton Monitoring

- Monitor phytoplankton community and obtain phytoplankton counts at the Bullock Reach site.
- Five sets of phytoplankton samples collected in 2020 (reduced sampling due to COVID-19).
- Any observations of potentially-harmful plankton taxa are emailed immediately to RI DEM.

200x phase contrast micrograph of a pennate diatom



200x phase contrast of Thalassionema *spp*

Monitoring Data Available: Snapshot of Upper Narragansett Bay, http://snapshot.narrabay.com/app/

Benthic Video Monitoring

- 8 successful surveys in 2020, plus special exploration of areas following shellfish transplant activities.
- Amphipod tube mats observed more frequently than in recent years, suggesting elevated organic matter.
- 2020 – RI SeaGrant-Funded collaborative benthic video study with the Nature Conservancy (and others) delayed due to COVID.

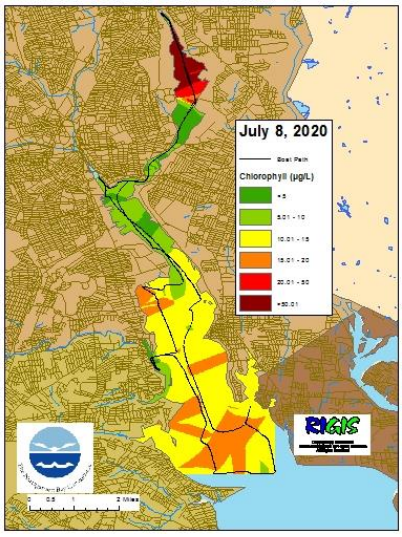
2020 Successful Benthic Video Surveys

	Edgewood	Sabin	Bullock Reach
February			X
March	X		
April			
May			
June			
July			
August	X	X	X
September			X
October	X		X

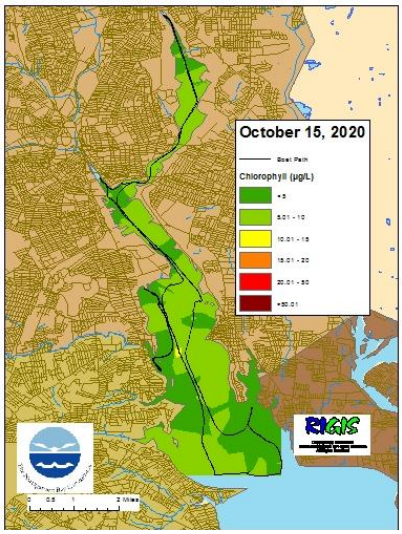
Amphipod tube mats at Edgewood 10/22/2020. Scale lasers ~28 cm apart.

Estuarine Surface Water Quality Mapping

- Surface water quality is mapped throughout the Seekonk and Providence Rivers as the NBC vessel is underway via pumping water to a sonde, which collects data every four seconds.
- Chlorophyll data is analyzed as a proxy for phytoplankton abundance.
- In 2020, surface water quality was mapped on 31 days; highest surface chlorophyll was observed during July.



High surface chlorophll (RED) in the Seekonk River (July)

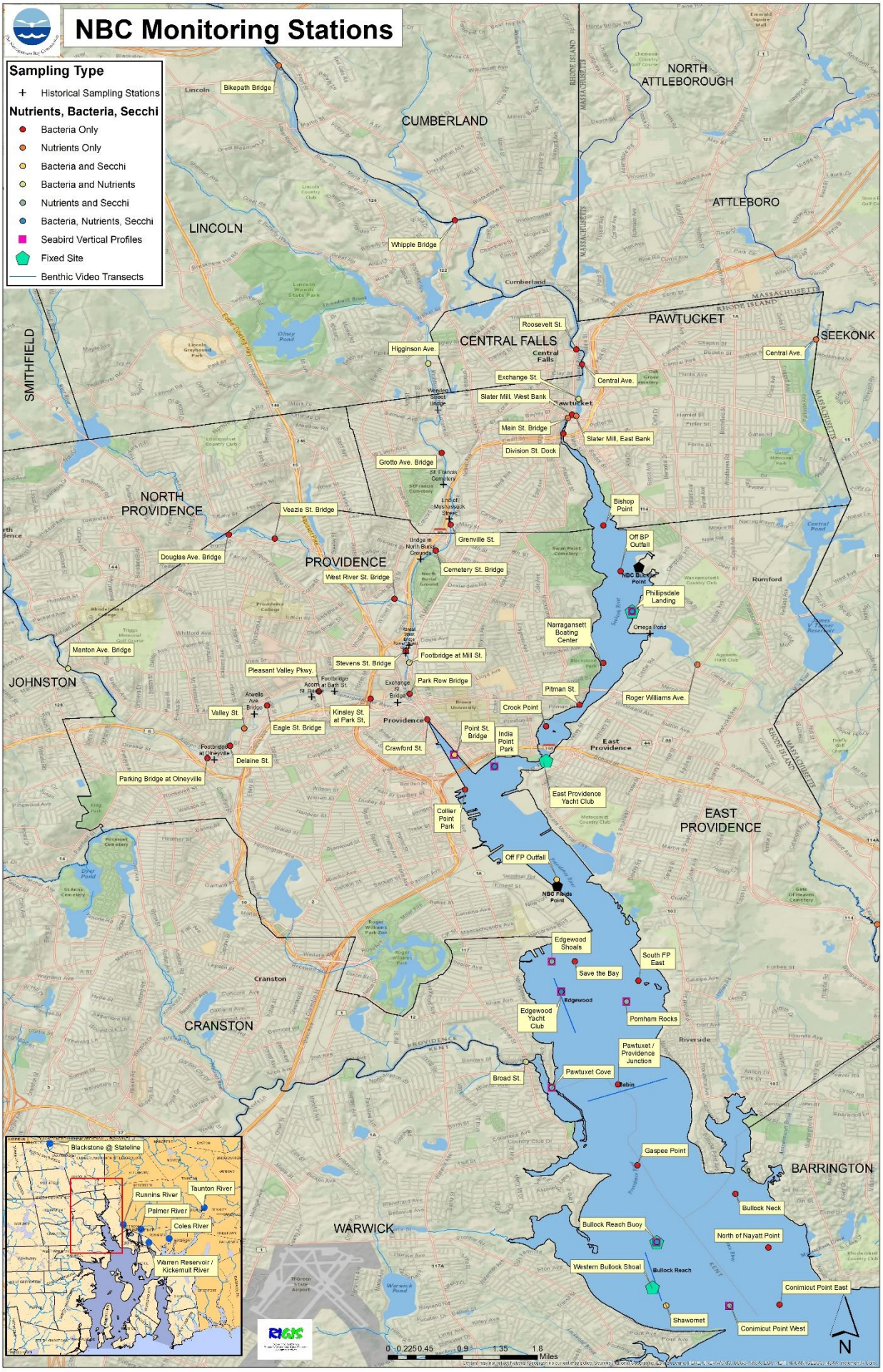


Low (GREEN) surface chlorophyll (October)

- In 2021 an equipment change is being made from YSI 6-Series sonde to YSI EXO2 sonde.

Water Column Profiles

- A Seabird instrument is used to collect water quality profiles every two weeks to monthly; 112 profiles were collected in 2020.
- Profiles from July 15th through September 2nd 2020 were performed with a YSI EXO1 sonde while the Seabird instrument was out for calibration. These data are not posted to Snapshot but are available upon request.
- Hypoxic conditions were most prevalent during July and August.


NBC Monitoring Stations
Sampling Type
Historical Sampling Stations
Nutrients, Bacteria, Secchi
Bacteria Only
Nutrients Only
Bacteria and Secchi
Bacteria and Nutrients
Nutrients and Secchi
Bacteria, Nutrients, Secchi
Seabird Vertical Profiles
Fixed Site
Benthic Video Transects
Bikepath Bridge
Whipple Bridge
Roosevelt St.
Higginson Ave.
Exchange St.
Slater Mill, West Bank
Main St. Bridge
Slater Mill, East Bank
Division St. Dock
Central Ave.
Grotto Ave. Bridge
Veazie St. Bridge
Douglas Ave. Bridge
Grenville St.
Cemetery St. Bridge
West River St. Bridge
Bishop Point
Off BP Outfall
Phillipsdale Landing
Omega Pond
Narragansett Boating Center
Manton Ave. Bridge
Stevens St. Bridge
Footbridge at Mill St.
Pleasant Valley Pkwy.
Park Row Bridge
Pitman St.
Roger Williams Ave.
Crook Point
Valley St.
Eagle St. Bridge
Kinsley St. at Park St.
Point St. Bridge
India Point Park
Crawford St.
Footbridge at Olneyville
Delaine St.
Parking Bridge at Olneyville
East Providence Yacht Club
Collier Point Park
Off FP Outfall
Edgewood Shoals
South FP East
Save the Bay
Edgewood Yacht Club
Pomham Rocks
Pawtuxet / Providence Junction
Pawtuxet Cove
Broad St.
Gaspee Point
Bullock Neck
Bullock Reach Buoy
North of Nayatt Point
Western Bullock Shoal
Bullock Reach
Conimicut Point East
Conimicut Point West
Shawomet
NORTH ATTLEBOROUGH
CUMBERLAND
ATTLEBORO
LINCOLN
SMITHFIELD
CENTRAL FALLS
PAWTUCKET
SEEKONK
NORTH PROVIDENCE
PROVIDENCE
JOHNSTON
CRANSTON
EAST PROVIDENCE
WARWICK
BARRINGTON
Rumford
Blackstone @ Stateline
Runnins River
Taunton River
Palmer River
Coles River
Warren Reservoir / Kickemuit River
0 0.225 0.45 0.9 1.35 1.8
Miles
N