

Narragansett Bay Commission 2021 Monitoring Season Update

Environmental Monitoring Collaborative Meeting, December 9, 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 2021:
 - Avg. May – Oct 2021
 - Field's Point = 2.6 mg/L
 - Bucklin Point = 2.8 mg/L
- NBC seasonal 2021 N loadings were 84% 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 - 2021) at NBC facilities.

	2006 – 2013 Avg	% of Total Loading	2014 – 2021* Avg	% of Total Loading
	lbs/day	%	lbs/day	%
Bucklin Point	1,143	5.8%	520	4.2%
Field's Point	4,039	20.5%	1,006	8.2%
Blackstone River**	4,426	22.5%	2,532	20.6%
Moshassuck River**	174	0.9%	110	0.9%
Woonasquaket River**	425	2.2%	158	1.3%
Pawtuxet River**	2,156	11.0%	1,177	9.6%
Ten Mile River***	812		202	
East Providence WWTP	517	2.6%	228	1.9%
Taunton River**	2,692	13.7%	2,362	19.3%
Fall River WWTP	3,227	16.4%	3,474	28.3%
Other Sources TOTAL****	869	4.4%	697	5.7%
Total Contribution	19,668		12,263	

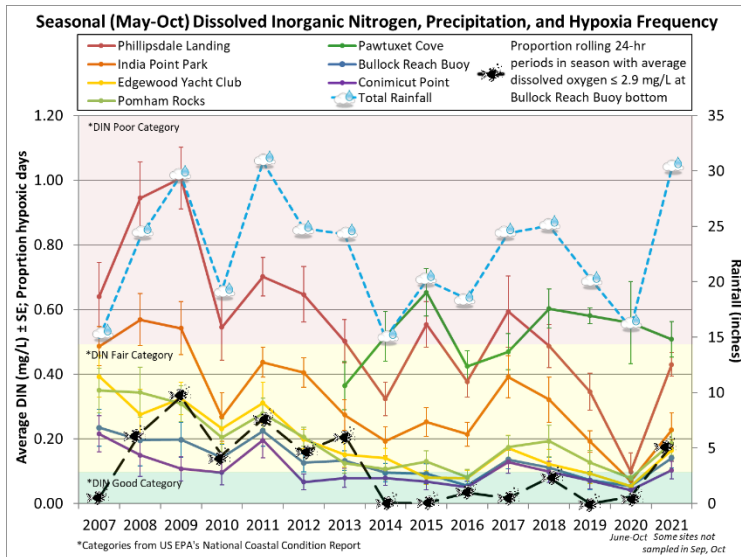
*2020 seasonal data incomplete due to COVID-19; June-October data only.

**River data is Total Dissolved Nitrogen only.

***Ten Mile River loading data unavailable for 2018-2021. 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)	
	2020	2021
Phillipsdale Landing	0.10	0.43
India Point Park	0.07	0.23
Pomham Rocks	0.08	0.19
Edgewood Yacht Club	0.05	0.16
Pawtuxet Cove	0.56	0.51
Bullock Reach Buoy	0.05	0.14
Conimicut Point	0.04	0.10

- Most stations in "fair" EPA National Coastal Conditions DIN category. Note India Point Park and Pawtuxet Cove not sampled in September, while Conimicut Point and Pomham Rocks not sampled in September or October due to the *R/V Monitor* being out of service.
- Pawtuxet Cove continues to exhibit the highest seasonal average DIN, in "poor" category.
- Conditions were hypoxic (average dissolved oxygen \leq 2.9 mg/L) for 18% of rolling 24-hour periods in the 2021 monitoring season in bottom waters at Bullock Reach Buoy, though note data coverage was limited in May and June, when oxygen conditions are typically better.

*Data are preliminary – full quality control review performed at year’s end

Water Clarity

- In 2021, NBC collected 169 Secchi depth measurements in the Providence and Seekonk River estuaries. Photosynthetic Active Radiation (PAR) was also collected with water column profiles.

Fixed-Site Seasonal Monitoring

- Bullock Reach Buoy:** deployed June 2 – November 18, 2021
 - May-October: Fair-to-poor water quality. Dissolved oxygen (DO) averaged 4.3 mg/L in bottom waters, hypoxic conditions (24-hour rolling average DO \leq 2.9 mg/L) for 18% of the season.
- Phillipsdale Landing:** deployed March 3 – present (mid-December), 2021
 - May-October: Fair-to-poor water quality. Bottom DO averaged 4.7 mg/L and hypoxic conditions occurred for 19% of the season.
- Temporary monitoring locations: east of Bullock Reach Buoy (May – Aug 2021); Pawtuxet Cove (Aug – Nov 2021) to support the Narragansett Bay Regional Ocean Modeling System (ROMS).
- Raw data can be downloaded from: <http://snapshot.narrabay.com/app/Buoys/Export>



Bullock Reach Buoy

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	2021*
Division St. Dock	339	395	188	453	228	140	211	304	170	92	270	221	79	96	221	136	263	236
Bishop Point	600	324	233	318	306	125	125	233	139	181	281	172	80	87	283	126	201	189
Off BP Outfall	819	294	329	499	415	117	166	330	120	217	261	175	79	131	242	156	160	136
Phillipsdale Landing	1386	322	226	197	420	144	109	170	138	163	144	143	53	154	277	93	120	176
Narragansett Boating Center	718	254	257	165	230	135	122	191	127	240	95	111	73	101	271	121	80	127
Crook Point	487	273	293	172	199	147	121	107	169	119	98	114	56	79	169	88	90	75
Point St. Bridge	3441	1946	3991	845	785	1022	402	530	562	367	600	504	511	282	699	567	678	985
India Point Park	425	318	255	171	182	112	86	214	102	167	74	52	55	77	198	92	82	103
Collier Point Park	493	313	296	277	188	201	164	187	188	161	149	106	55	124	197	132	168	133
Off FP Outfall	234	210	183	102	120	116	51	119	66	60	36	70	33	47	152	58	56	61
Save the Bay		46	61	59	46	38	50	46	35	34	21	36	16	33	57	26	30	11
South FP East	117	72	49	65	44	38	43	41	46	33	34	58	16	27	86	36	26	24
Edgewood Yacht Club	95	61	98	65	36	34	47	48	40	31	16	44	30	30	43	37	21	23
Pawtucket/Providence Junction	98	92	162	116	60	57	79	77	68	43	40	52	36	53	67	37	28	53
Gaspee Point	65	63	70	48	40	28	48	37	63	18	15	39	12	26	46	35	17	25
Bullock Neck	47	14	31	27	15	18	30	25	46	19	14	11	8	16	17	13	9	13
Bullock Reach Buoy	52	34	72	21	16	38	37	28	37	19	14	19	19	18	15	20	12	13
North of Nayatt Point		11	20	20	12	17	29	25	23	11	11	8	5	14	16	13	6	10
Conimicut Point	31	24	35	11	18	17	26	20	24	11	9	15	6	16	20	13	9	11
Shawomet		17	43	23	30	22	31	31	31	13	13	14	7	15	19	18	10	18
Annual Rainfall (inches)	45.05	57.37	54.31	42.69	57.09	54.86	53.5	55.48	40.99	45.02	47.19	40.74	38.99	47.74	62.79	51.75	44.71	45.3

*Rainfall total for 2021 includes rain data from 1/1/2021 to 12/07/2021.

- 2021 – note no Bay data from September – early December due to *R/V Monitor* out of service.
 - 308 fecal coliform samples, 98 enterococci samples were collected from the Providence and Seekonk Rivers across 14 sample days thus far this year.
 - 1,655 fecal coliform samples across 103 days, 580 enterococci samples across 96 days (as of 11/30/21) from freshwater tributary rivers.
- Bacteria counts decrease with distance down-bay; average fecal coliform counts were higher in 2021 than 2020 (same limited time periods Jan-Aug compared).
- Comprehensive study of CSO Phase II impacts on bacteria counts is underway, estimated completion early 2022.

Water Column Profiles

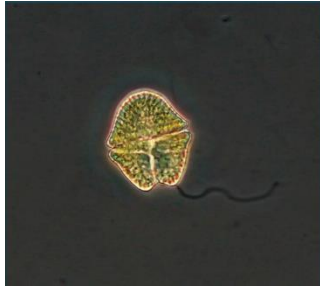
- A Seabird instrument is used to collect water quality profiles every two weeks to monthly; 142 profiles were collected from January through August in 2021. Note the NBC vessel the *R/V Monitor* was out of service from September to early December.
- Hypoxic conditions were most prevalent during July and August.

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

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Phytoplankton Monitoring

- Monitor phytoplankton community and obtain phytoplankton counts at the Bullock Reach Buoy site.
- 13 sets of phytoplankton samples collected thus far in 2021 (no samples from September – early December due to *R/V Monitor* out of service).
- Any observations of potentially-harmful plankton taxa are emailed immediately to RIDEM.



200x phase contrast micrograph of a *Akashiwo sanguineum*



200x phase contrast of *Chaetoceros socialis*

Benthic Video Monitoring

- 6 successful surveys in 2021; analysis of videos incomplete at this time.
- 2021 – RI SeaGrant-Funded collaborative benthic video study with the Nature Conservancy (and others) will continue into 2022 due to COVID-related delays.

2021 Successful Benthic Video Surveys

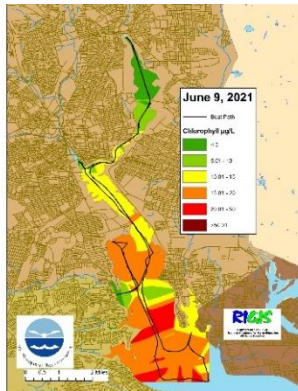
	Edgewood	Sabin	Bullock Reach
March	X	X	X
April			
May			
June			
July			
August	X	X	X



Mud-tube anemones, Sabin Transect, 3/23/21. 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 2021 an equipment change was made from a YSI 6-Series sonde to YSI EXO2 sonde.
- In 2021, surface water quality has been mapped on 21 days thus far; highest surface chlorophyll was observed during June (no surveys in July, September, October, and November due to the *R/V Monitor* out of service).



High surface chlorophyll (RED) in the Seekonk River (June)



Low (GREEN) surface chlorophyll (May)

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