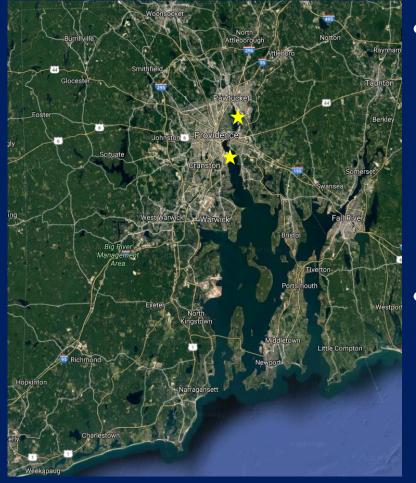
# Benthic Video Surveys in the Providence River, Narragansett Bay, Rhode Island

## Eliza Moore Narragansett Bay Commission



## Narragansett Bay Commission





- Own and operate two largest WWTFs in Rhode Island
  - Field's Point 42.14 MGD (2017)
  - Bucklin Point 17.96 MGD (2017)
- Serve 360,000+ residents and 8,000+ businesses in ten RI communities.

## Narragansett Bay Commission





WATER QUALITY INITIATIVES BUOYS

OYS LEARN MORE LINKS

#### Water Quality Initiatives



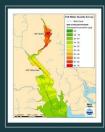
Fixed Water Quality Monitoring

The NBC maintains two of the ten real-time water quality stations in Narragansett Bay. Sensors at Phillipsdale Landing and Bullocks Reach record, temperature, salinity, dissolved oxygen, pH, chlorophyll a, and water clarity.

#### Water Quality Profiles

The NBC collects water quality profiles of the water column at six locations throughout the Upper Bay. The parameters collected including depth, temperature, salinity, dissolved oxygen, pH, and chlorophyll a.





#### Surface Mapping

The NBC employs state of the art equipment to automatically map surface water quality while their vessel, R/V Monitor, is underway. Parameters mapped include temperature, salinity, dissolved oxygen, pH, and chlorophyll a.

#### **Bay Pathogen Monitoring**

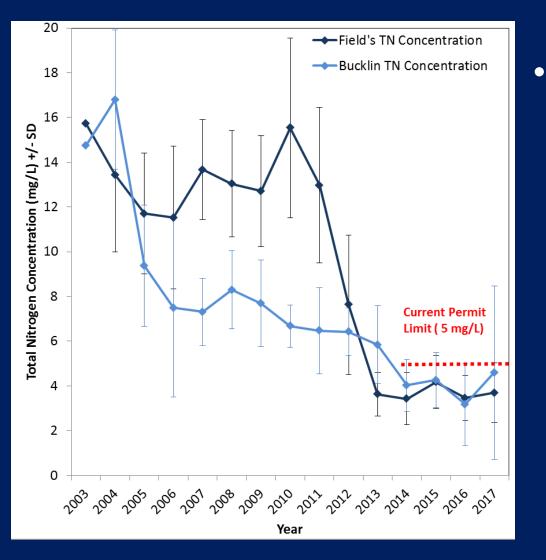
The NBC collects bi-weekly bacteria samples at twenty stations throughout the Upper Bay. All of the bacteria samples are analyzed for fecal coliform and one quarter are



- Extensive receiving waters monitoring program to track effects of infrastructure investment.
  - snapshot.narrabay.com
     for all data

## Narragansett Bay Commission



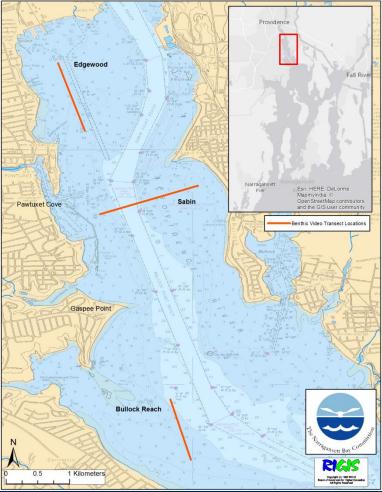


Extensive receiving waters monitoring program to track effects of infrastructure investment.

- snapshot.narrabay.com for all data
- e.g., recent nitrogen reduction upgrades

## NBC Benthic Video Monitoring

- Began in 2014
- Focus on three transect areas
   1-5 m depth
- Surveys attempted monthly
  - Averaging 3 6 good videos per transect per year
- SeaView camera
  - Scale lasers added 2017.
- Acknowledgement: NBC field staff conduct monitoring and maintain equipment!



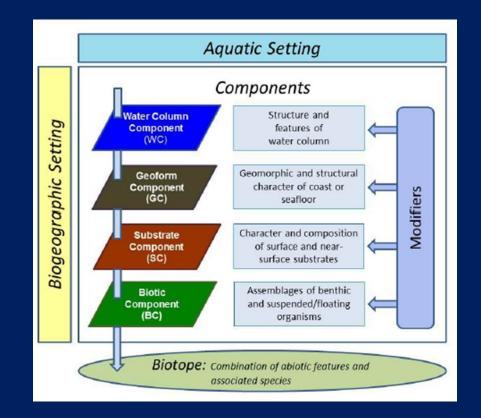


## NBC Benthic Video Monitoring

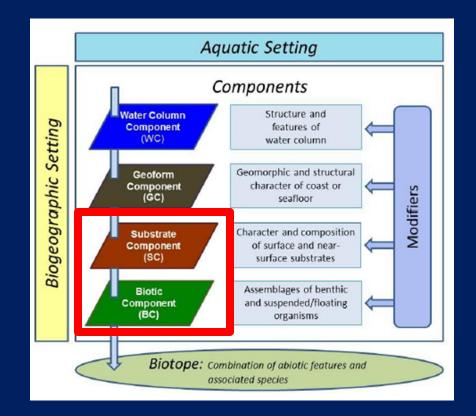
- Video subsampled
- CMECS
  - Every 1-5 minutes
  - Determining best subsampling interval using rarefaction curves (in progress)
     Freeze frame



- Acknowledgement: G. Cicchetti
- Approach
- Adjustments
- Remaining Challenges



- Approach
  - Substrate and Biotic components only



- Approach
  - Archiving frames used in analysis (keyword tagging?)



- Approach
  - Data entry –
     Excel with data validation

l.	A	В	С	D	Ł	L	M	N	0
	Date	Transect	Timesta mp (hh:mm :ss)	Speed (kph)	Heading	Substrate Origin	Substrate Class	Substrate Subclass	Substrate Group
в	6/13/2017	Sabin	1:11:45	0	E	Biogenic Substrate	Shell Substrate	Shell Rubble	
4									

Substrate Subclass	Substrate Group
Coarse Unconsolidated Substrate	Sandy Mud
Fine Unconsolidated Substrate	Muddy Sand
Organic Detritus	Gravel (Boulder)
Shell Hash	Gravel (Cobble)
Shell Rubble	Clam Rubble
Trash Bits	Clam Hash
Trash Rubble	

## Data Entry

### "Front Matter"

					<mark> </mark>																					
	Date	Transect	Timesta mp (hh:mm :ss)	Speed (kph)	Heading	Substrate Subclass	Substrate Group	Shell Rubble	<ul> <li>Shell Hash (&lt; 64 mm)</li> </ul>	Clam Rubble	▲ Woody Debris	<ul> <li>Leaf Debris</li> </ul>	< Boulder >	<ul> <li>Cobble</li> </ul>	A Pebble r	▲ Muddy Sand	AD	AL Biotic Subclass		Biotic Community	Percent Cover Modifier	Ai Infaunal Status (SS)		Algae Raft (sp Unknown)	Attached Algae (sp Unknown) <sup>2</sup>	
:	10/28/2014		0:01:08	3.704	w	Fine Unconsolidated Substrate			т	т								Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	2				т
:	10/28/2014	Sabin	0:06:08	0	w	Fine Unconsolidated Substrate	Sandy Mud		т									Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	3				т
2	10/28/2014	Sabin	0:11:08	0	w	Shell Rubble	Clam Rubble		т									Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	1*	s			
, :	10/28/2014	Sabin	0:16:08	1.852	SW	Unconsolidated	Muddy Sand		s	s								Soft Sediment Fauna	Small Surface- Burrowing Fauna		Sparse	1*	s		т	
2	10/28/2014	Sabin	0:21:08	0	SW	Unconsolidated	Muddy Sand		т	м								Mat/Film Forming Microbes	Microphytobe nthos	Diatom Felt	Moderate	1*				т

## Data Entry

### Substrate Component (data validation drop down lists)

Co-occurring elements (T, S, M, D, C percent cover modifiers)

a (2) (2)

Transect mp (hh:mm :ss)	mp (hh:mm :ss)		Speed (kph) T	Heading	Substrate Subclass Tine	Substrate Group	Shell Rubble	♦ Shell Hash (< 64 mm)	<ul> <li>Clam Rubble</li> </ul>	Woody Debris	<ul> <li>▲ Leaf Debris</li> </ul>	<ul> <li>■ Boulder</li> </ul>	<ul> <li>Cobble</li> </ul>	. ▲ Pebble	A Muddy Sand	Biotic Subclass		Biotic Community Vassariid	Percent Cover Modifier	Infaunal Status (SS)		▲ Algae Raft (sp Unknowr	Attached Algae	
:	Sabin	0:01:08	3.704		Unconsolidated Substrate	Sandy Mud		т	т							Fauna	Mollusks on Soft Sediment	Bed	Sparse	2				т
14 9	Sabin	0:06:08	0	w	Fine Unconsolidated Substrate	Sandy Mud		т								Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	3				т
014 :	Sabin	0:11:08	0	w	Shell Rubble	Clam Rubble		т								Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	1*	s			
/2014 !	Sabin	0:16:08	1.852	sw	Unconsolidated	Muddy Sand		s	s							Soft Sediment Fauna	Small Surface- Burrowing Fauna		Sparse	1*	s		т	
8/2014	Sabin	0:21:08	0	sw	Unconsolidated	Muddy Sand		т	м							Mat/Film Forming Microbes	Microphytobe nthos	Diatom Felt	Moderate	1*				т

## Data Entry

#### Infaunal Status modifier

#### Associated Taxa

	Pebble	Muddy Sand		AL Biotic Subclass	Ai Biotic Group	Biotic Community	Percent Cover Modifier	Infaunal Status (SS)	Crepidula 2	Algae Raft (sp Unknown)	Attached Algae (sp Unknown)	Ulva Raft D	Attached Ulva	Graciaria Raft &	Attached Graciaria		Attached Grateloupta	Small Burrowing Fauna (2 mm)	Larger Burrowing Fauna	Tunneling Megafauna	Diatom Felt	Tracks and Traik	Small Tube-building Fauna	Larger Tube-building Fauna	Nassariid	Maldanid (?) Tubes	Arenicola	Mya arenaria	Thin Ampelisca Bed	Robust Ampelisca Bed 9	Attached Sponge (orange)	<ul> <li>A Attached Sponge (Yellow/White)</li> </ul>	Asterias		Associated Taxa
-	•	•	-	<b>*</b>	¥	<b>*</b>	<b>*</b>	<b>*</b>	Ŧ	-	-	•	¥	•	<b>•</b>	-	• •	•	Y	-	•	-	•	-	-	-	-	-	-	-	-	Ŧ	-	-	
				Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	2				т		т	٦	r			т		т														
				Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	3				т		т	٦	r		s		т															
				Soft Sediment	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	1*	s												т														
				Soft Sediment Fauna	Small Surface- Burrowing Fauna		Sparse	1*	s		т						т				s				т									ŀ	Hermit crab
				Forming	Microphytobe nthos	Diatom Felt	Moderate	1*				т		т	٦	г																			

### • Adjustments

Percent cover – "Trace"
 = <10%</li>

Table 10.29. Percent Cover Modifiers.

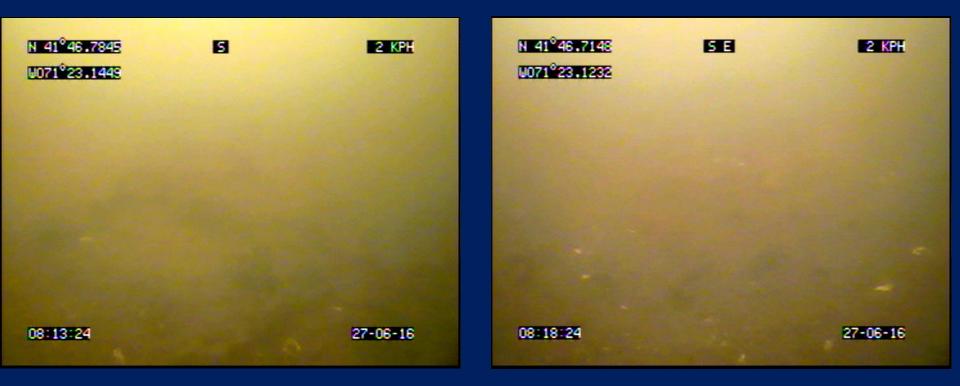
Coarse Percent Cover Values	Fine Percent Cover Values
Trace	< 1%
Sparse	1 to < 10%
(1 to < 30%)	10 to < 20%
	20 to < 30 %
Moderate	30 to < 40 %
(30 to < 70%)	40 to < 50 %
	50 to < 60 %
	60 to < 70 %
Dense	70 to < 80 %
(70 to < 90%)	80 to < 90%
Complete	90 to 100%

## Adjustments

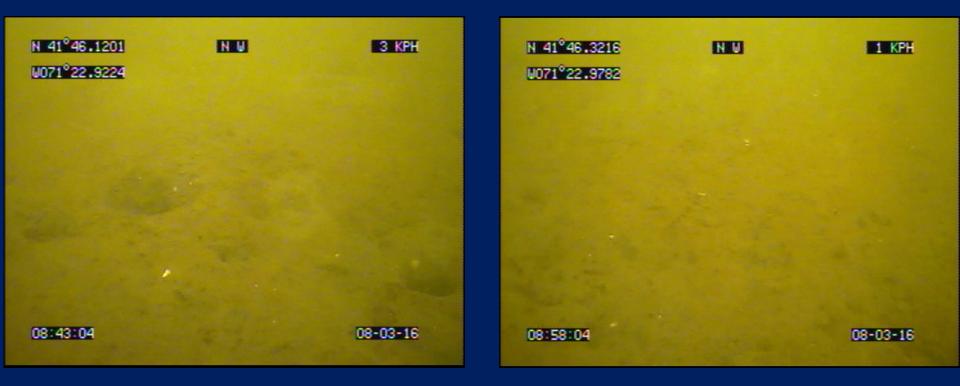
- Percent cover "Trace"
   = <10%</li>
- "Active" Tunneling Megafauna
- Visibility Score -
  - $0 \rightarrow 5$
  - Ranks the quality of video, for use in data interpretation.



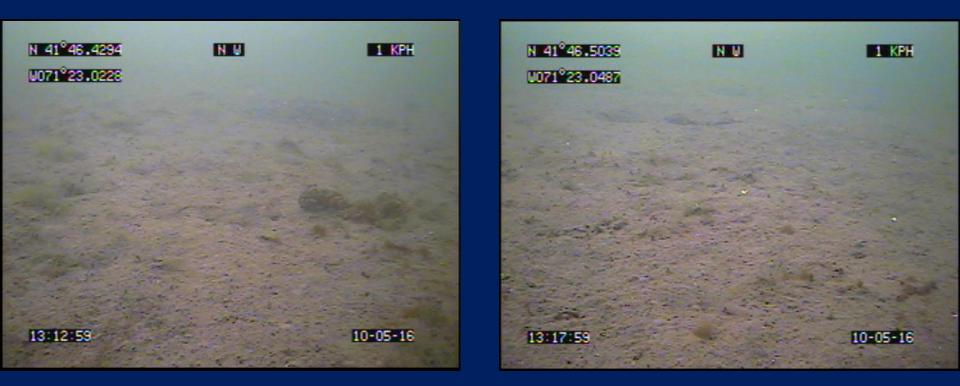
# 1 - Mostly obscured, large burrowsvisible but not much else



# 3 - Visibility poor, small details may not be visible



# 5 - Bright, high contrast, all detail generally visible



- "Dominant" component
  - Should not depend on project focus.
  - What if no spatial dominant?
    - Leaving it blank, cooccurring elements only.



	Biotic Subclass	Biotic Group	Biotic Community	Percent Cover Modifier	Infaunal Status (SS)	<ul> <li>Algae Raft (sp Unknown)</li> </ul>	<ul> <li>Attached Algae (sp Unknown)</li> </ul>	✓ Ulva Raft	<ul> <li>Attached Ulva</li> </ul>	4 Gracilaria Raft	<ul> <li>Attached Gracilaria</li> </ul>	4 Grateloupia Raft	<ul> <li>Attached Grateloupia</li> </ul>	<ul> <li>Chaetopterus</li> </ul>	Small Burrowing Fauna (2 mm)	Larger Burrowing Fauna	Tunneling Megafauna	▲ Diatom Felt	Tracks and Trails	Small Tube-building Fauna	<ul> <li>Larger Tube-building Fauna</li> </ul>	<ul> <li>Nassariid</li> </ul>	<ul> <li>Maklanid (?) Tubes</li> </ul>	Arenicola	▲ Mya arenaria	Thin Ampelisca Bed	Robust Ampelisca Bed	<ul> <li>Attached Sponge (orange)</li> </ul>	<ul> <li>A Attached Sponge (Yellow/White)</li> </ul>
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- "Bed" and "Reef" terminology
  - Nassariid "Bed"?Probably not.
  - Crepidula "Reef"?
     Probably not.
  - Created "Nassariid" and "Crepidula" co-occurring elements.



- Subjectivity
  - Currently I'm the only analyst.
  - Careful training of new analysts underway.
  - Archiving of screen shots helps.



- Biotope development
  - Lumping raw classifications for a reasonable number of meaningful biotopes.
- What to do with the data?
  - Mapping
  - Trend analysis?
  - What is appropriate?

