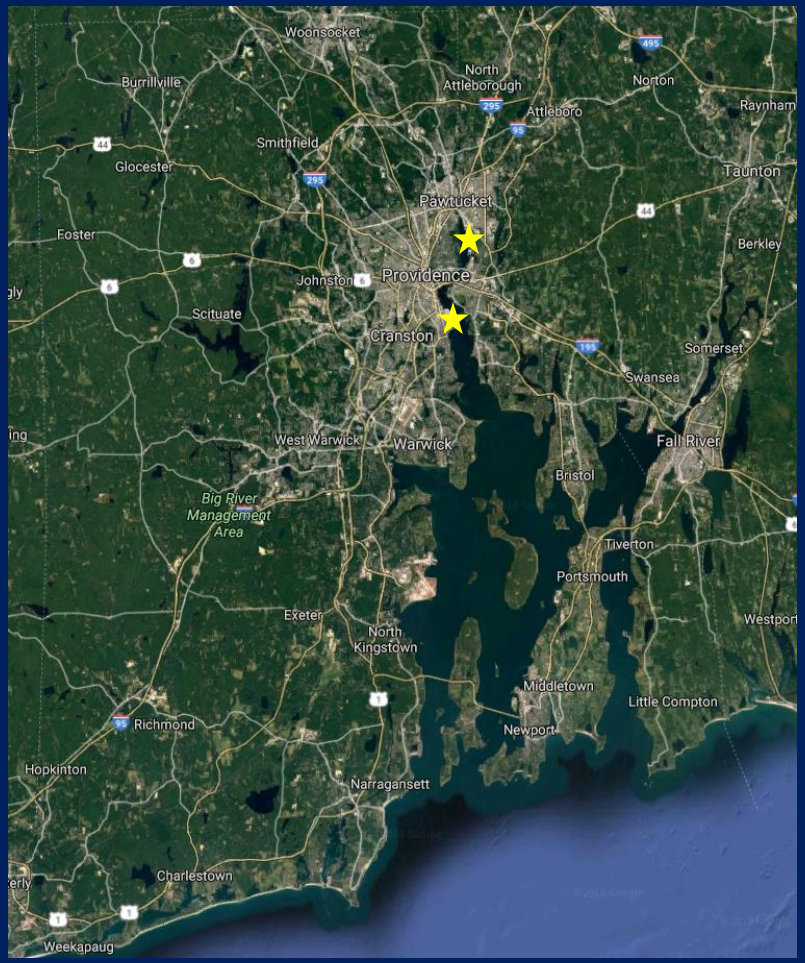
Benthic Video Surveys in the Providence River, Narragansett Bay, Rhode Island

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.

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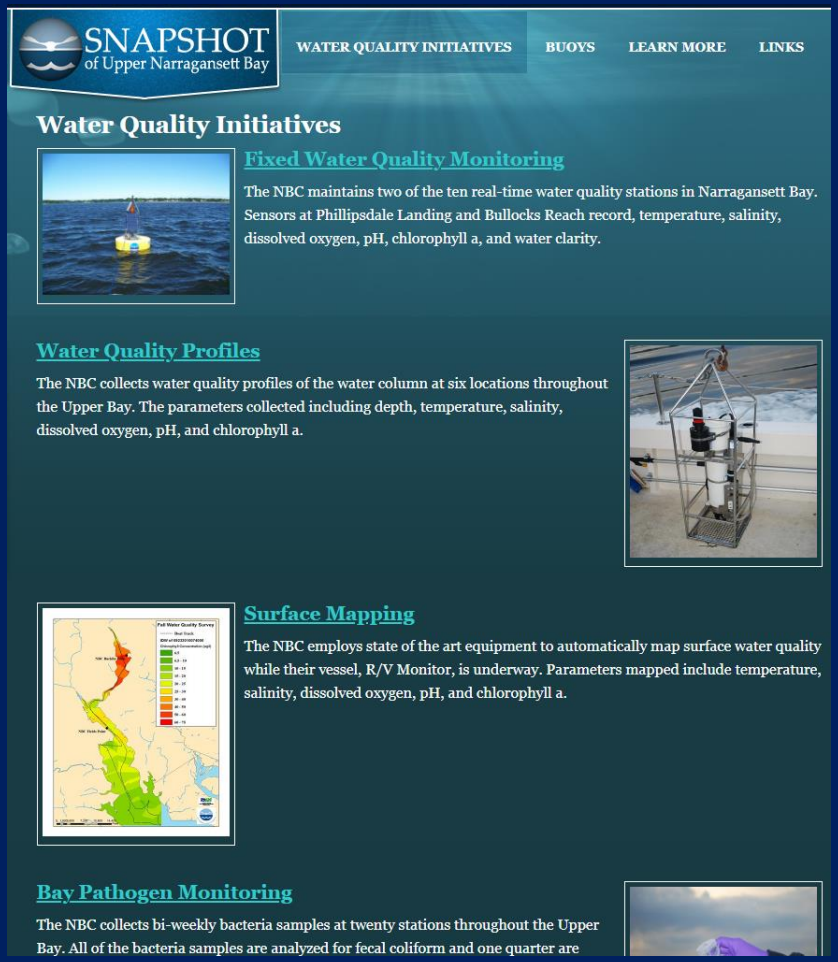
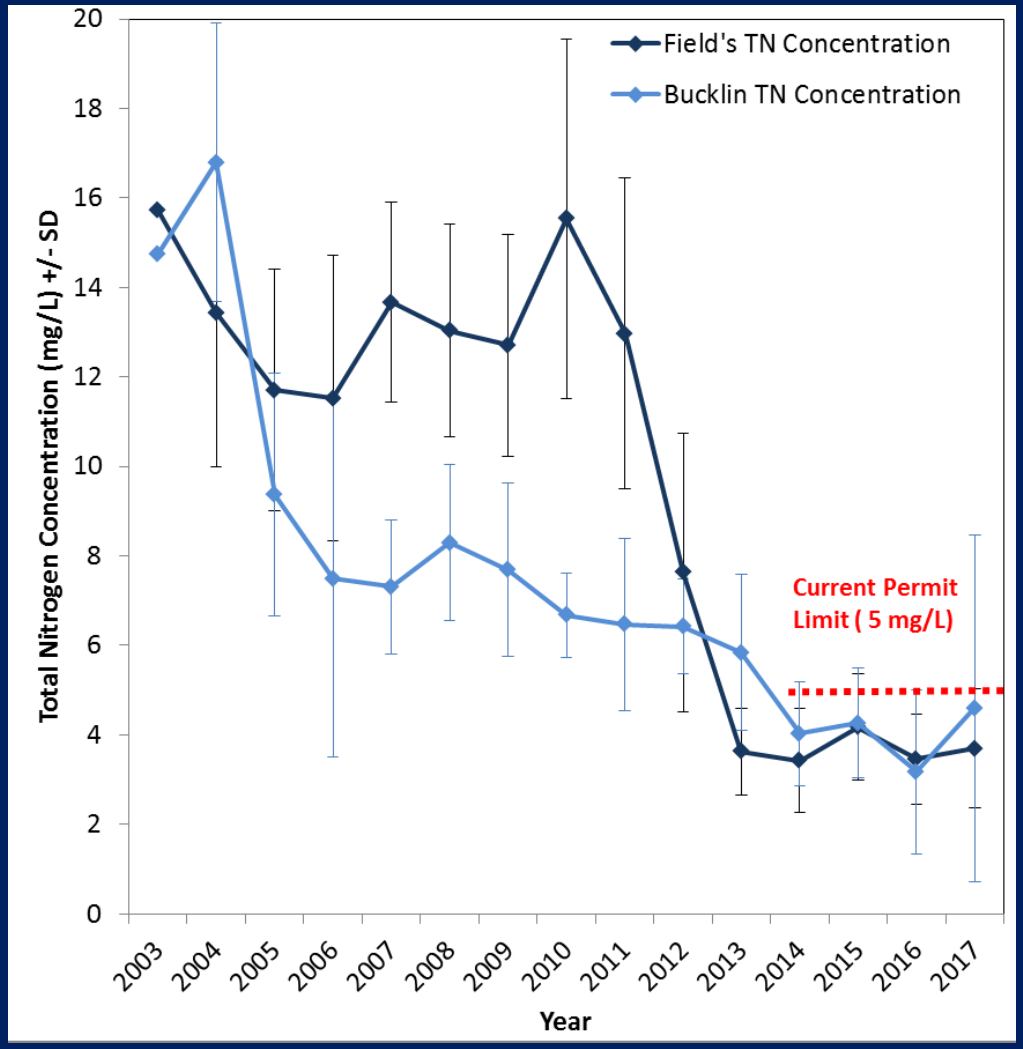


- Extensive receiving waters monitoring program to track effects of infrastructure investment.
  - snapshot.narrabay.com for all data

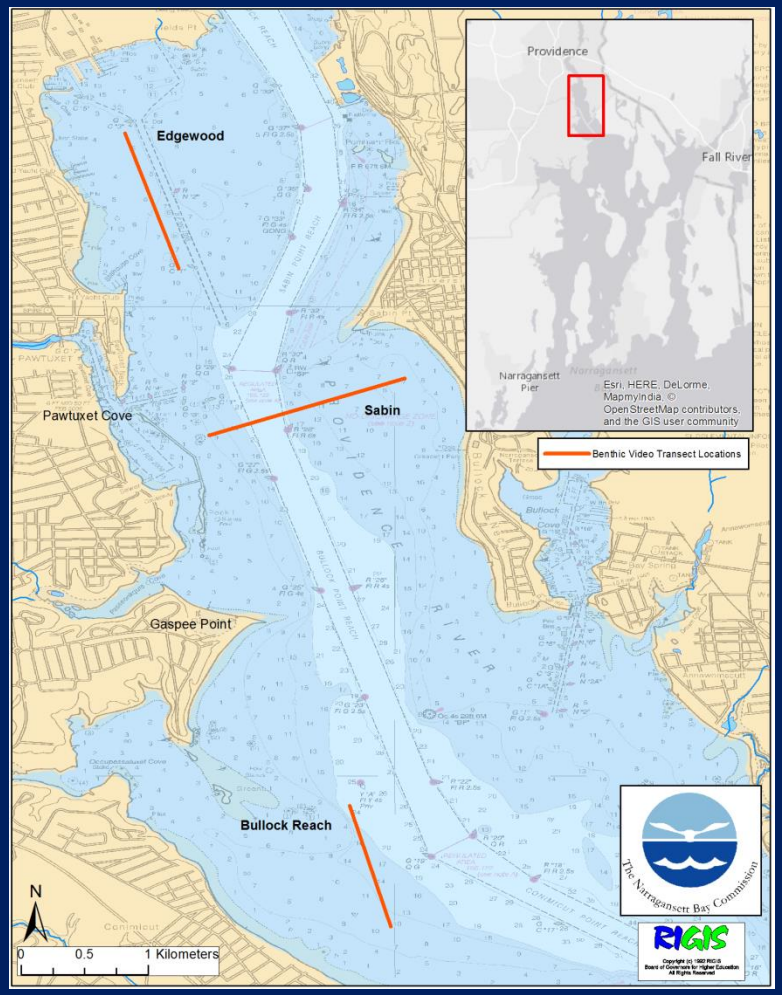
Narragansett Bay Commission



- 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!



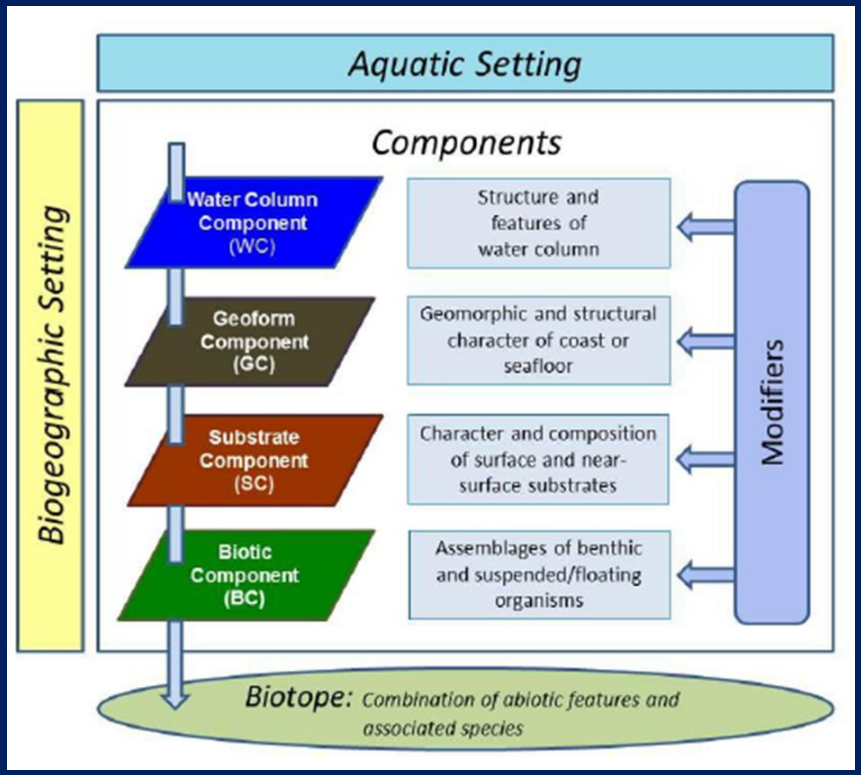
NBC Benthic Video Monitoring

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

NBC CMECS Analysis

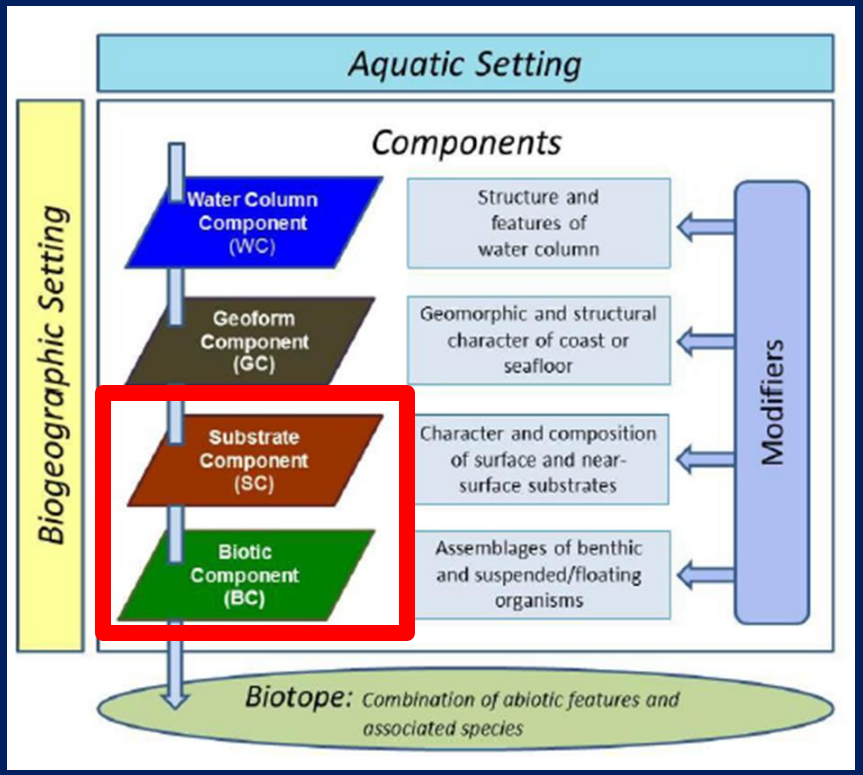
- Acknowledgement:
  G. Cicchetti

- Approach
- Adjustments
- Remaining Challenges



NBC CMECS Analysis

- Approach
  - Substrate and Biotic components only

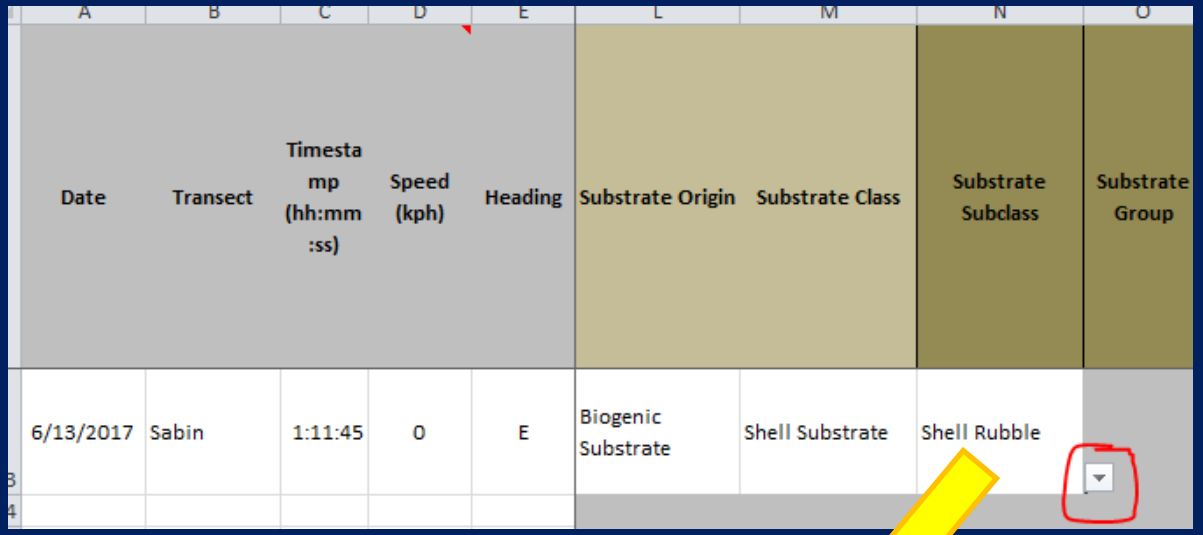


NBC CMECS Analysis

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

NBC CMECS Analysis

- Approach
  - Data entry – Excel with data validation

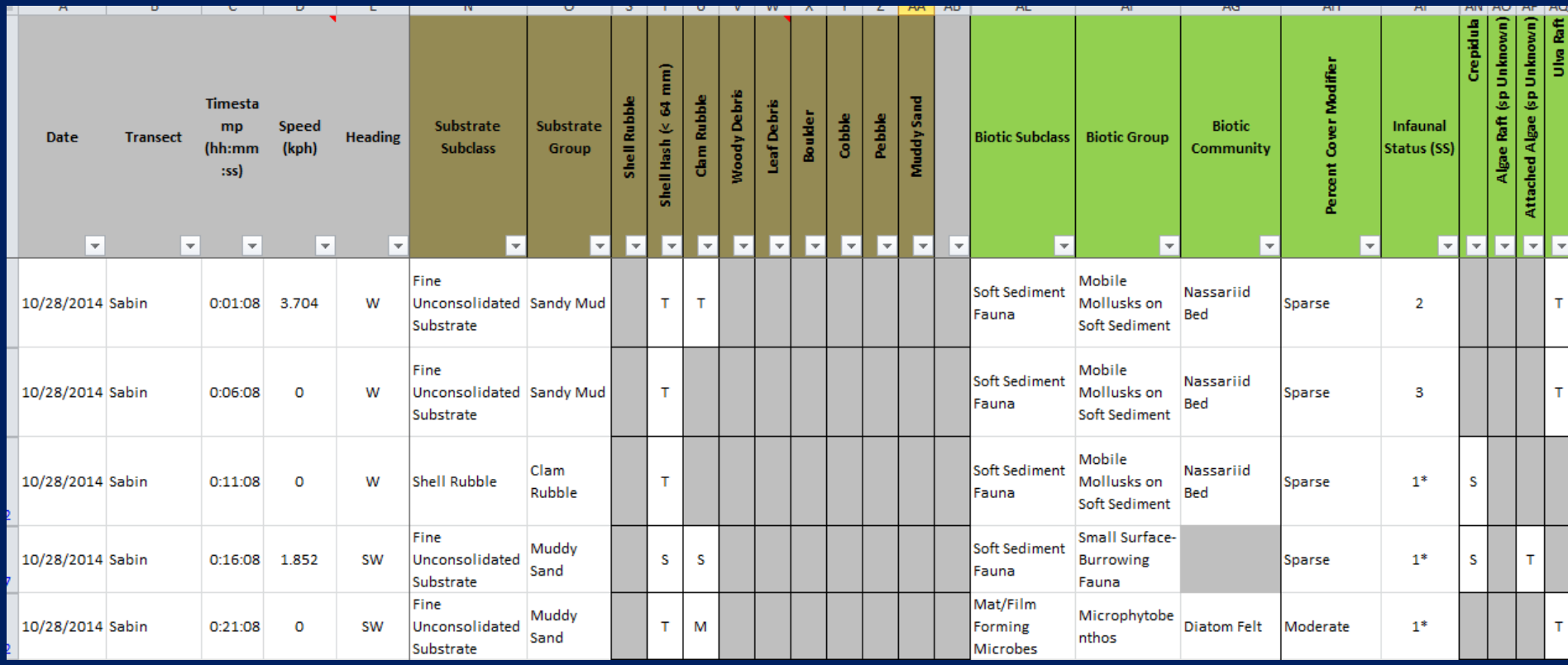


	A	B	C	D	E	L	M	N	O
	Date	Transect	Timestamp (hh:mm:ss)	Speed (kph)	Heading	Substrate Origin	Substrate Class	Substrate Subclass	Substrate Group
3	6/13/2017	Sabin	1:11:45	0	E	Biogenic Substrate	Shell Substrate	Shell Rubble	
4									

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"



Date	Transect	Timestamp (hh:mm:ss)	Speed (kph)	Heading	Substrate Subclass	Substrate Group	Shell Rubble	Shell Hash (< 64 mm)	Clam Rubble	Woody Debris	Leaf Debris	Boulder	Cobble	Pebble	Muddy Sand		Biotic Subclass	Biotic Group	Biotic Community	Percent Cover Modifier	Infaunal Status (SS)	Crepidula	Algae Raft (sp Unknown)	Attached Algae (sp Unknown)	Ulva Raft
10/28/2014	Sabin	0:01:08	3.704	W	Fine Unconsolidated Substrate	Sandy Mud		T	T								Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	2				T
10/28/2014	Sabin	0:06:08	0	W	Fine Unconsolidated Substrate	Sandy Mud		T									Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	3				T
10/28/2014	Sabin	0:11:08	0	W	Shell Rubble	Clam Rubble		T									Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	1*	S			
10/28/2014	Sabin	0:16:08	1.852	SW	Fine Unconsolidated Substrate	Muddy Sand		S	S								Soft Sediment Fauna	Small Surface-Burrowing Fauna		Sparse	1*	S		T	
10/28/2014	Sabin	0:21:08	0	SW	Fine Unconsolidated Substrate	Muddy Sand		T	M								Mat/Film Forming Microbes	Microphytobenthos	Diatom Felt	Moderate	1*				T

Data Entry

Substrate Component (data validation drop down lists)

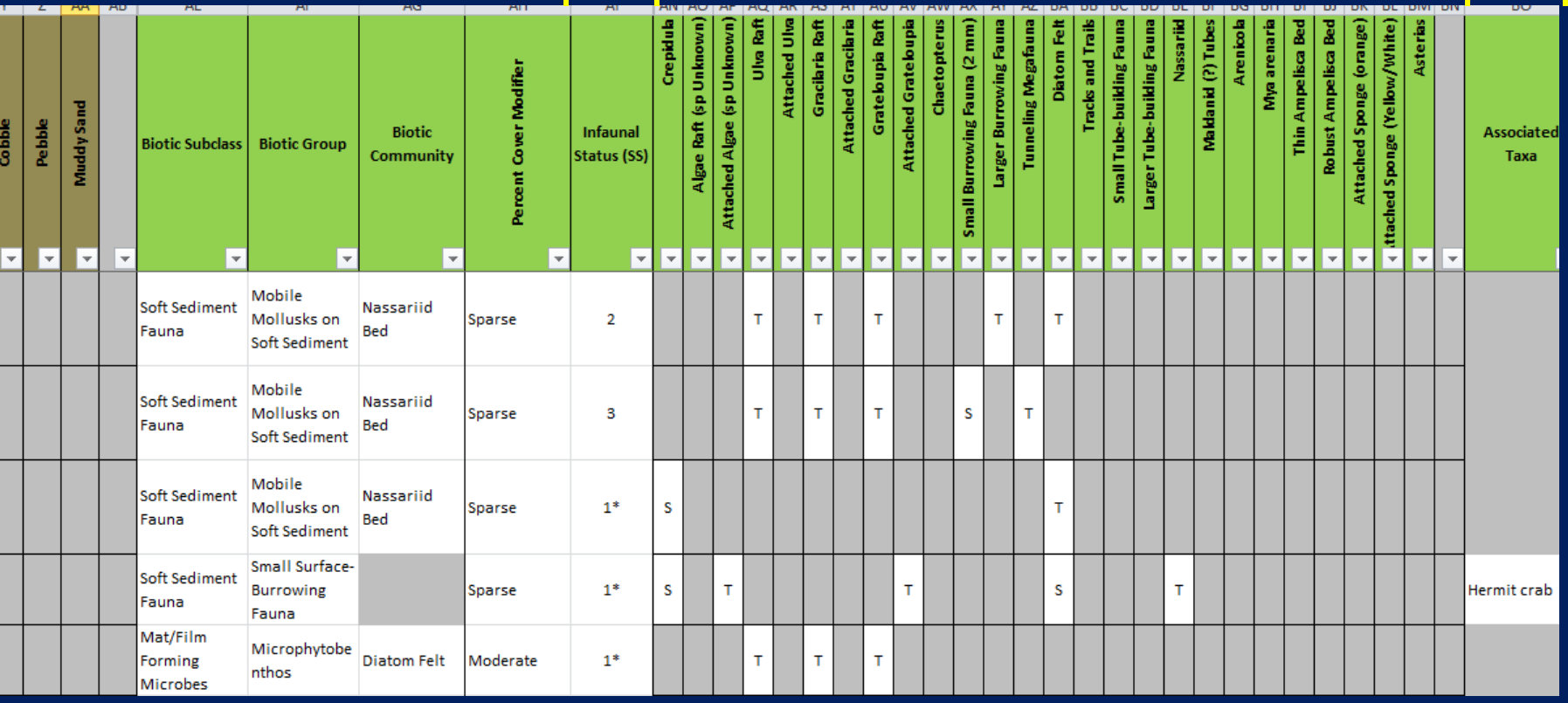
Co-occurring elements (T, S, M, D, C percent cover modifiers)

Date	Transect	Timestamp (hh:mm:ss)	Speed (kph)	Heading	Substrate Subclass	Substrate Group	Shell Rubble	Shell Hash (< 64 mm)	Clam Rubble	Woody Debris	Leaf Debris	Boulder	Cobble	Pebble	Muddy Sand	Biotic Subclass	Biotic Group	Biotic Community	Percent Cover Modifier	Infaunal Status (SS)	Crepidula	Algae Raft (sp Unknown)	Attached Algae (sp Unknown)	Ulva Raft
10/28/2014	Sabin	0:01:08	3.704	W	Fine Unconsolidated Substrate	Sandy Mud		T	T							Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	2				T
10/28/2014	Sabin	0:06:08	0	W	Fine Unconsolidated Substrate	Sandy Mud		T								Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	3				T
10/28/2014	Sabin	0:11:08	0	W	Shell Rubble	Clam Rubble		T								Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	1*	S			
10/28/2014	Sabin	0:16:08	1.852	SW	Fine Unconsolidated Substrate	Muddy Sand		S	S							Soft Sediment Fauna	Small Surface-Burrowing Fauna		Sparse	1*	S		T	
10/28/2014	Sabin	0:21:08	0	SW	Fine Unconsolidated Substrate	Muddy Sand		T	M							Mat/Film Forming Microbes	Microphytobenthos	Diatom Felt	Moderate	1*				T

Data Entry

Infaunal Status modifier

Associated Taxa



Cobble	Pebble	Muddy Sand	Biotic Subclass	Biotic Group	Biotic Community	Percent Cover Modifier	Infaunal Status (SS)	Crepidula	Algae Raft (sp Unknown)	Attached Algae (sp Unknown)	Ulva Raft	Attached Ulva	Gracilaria Raft	Attached Gracilaria	Grateloupia Raft	Attached Gratelopia	Chaetopterus	Small Burrowing Fauna (2 mm)	Larger Burrowing Fauna	Tunneling Megafauna	Diatom Felt	Tracks and Trails	Small Tube-building Fauna	Larger Tube-building Fauna	Nassariid	Maldanid (?) Tubes	Arenicola	Mya arenaria	Thin Ampelisca Bed	Robust Ampelisca Bed	Attached Sponge (orange)	Attached Sponge (Yellow/White)	Asterias	Associated Taxa
			Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	2				T		T		T				T		T													
			Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	3				T		T		T			S		T														
			Soft Sediment Fauna	Mobile Mollusks on Soft Sediment	Nassariid Bed	Sparse	1*	S													T													
			Soft Sediment Fauna	Small Surface-Burrowing Fauna		Sparse	1*	S		T						T						S			T								Hermit crab
			Mat/Film Forming Microbes	Microphytobenthos	Diatom Felt	Moderate	1*				T		T		T																		

NBC CMECS Analysis

- Adjustments
  - Percent cover – "Trace" = <10%

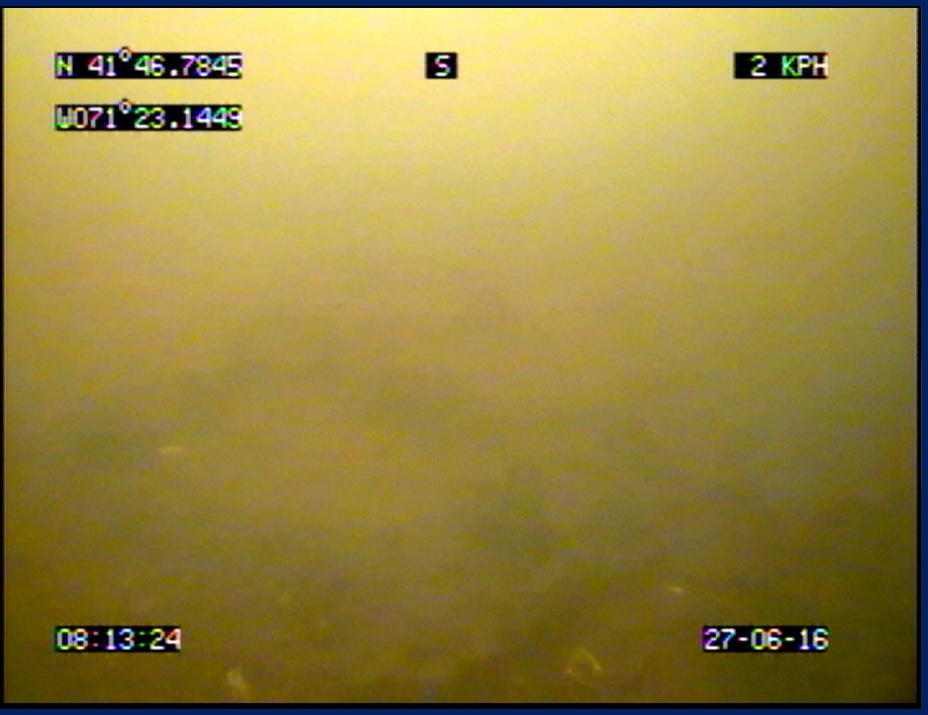
Table 10.29. Percent Cover Modifiers.

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

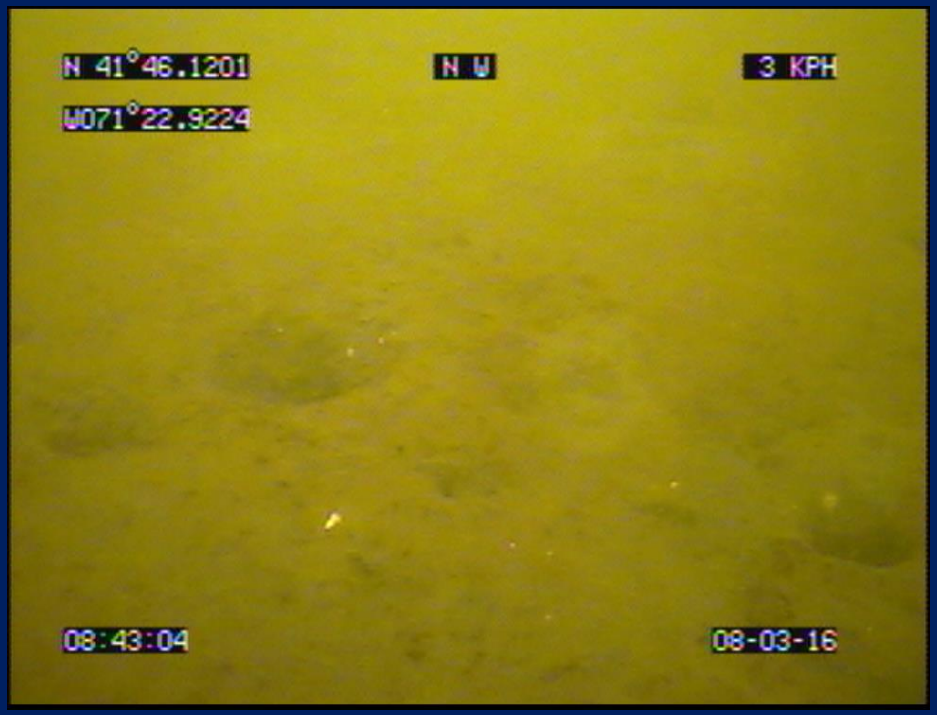
NBC CMECS Analysis

- Adjustments
  - Percent cover – “Trace” = <10%
  - “Active” Tunneling Megafauna
  - Visibility Score –
    - 0 → 5
    - Ranks the quality of video, for use in data interpretation.

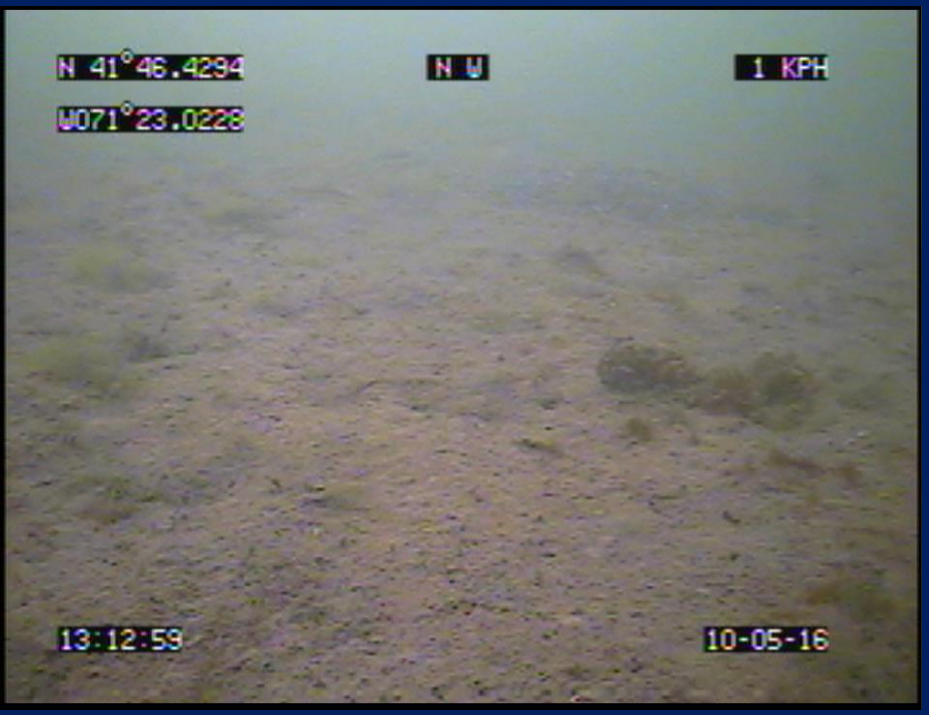
1 - Mostly obscured, large burrows visible but not much else



3 - Visibility poor, small details may not be visible



5 - Bright, high contrast, all detail generally visible



Remaining Challenges

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

Biotic Subclass	Biotic Group	Biotic Community	Percent Cover Modifier	Infaunal Status (SS)	Crepidula	Algae Raft (sp Unknown)	Attached Algae (sp Unknown)	Ulva Raft	Attached Ulva	Gracilaria Raft	Attached Gracilaria	Grateloupia Raft	Attached Grateloupia	Chaetopterus	Small Burrowing Fauna (2 mm)	Larger Burrowing Fauna	Tunneling Megafauna	Diatom Felt	Tracks and Trails	Small Tube-building Fauna	Larger Tube-building Fauna	Nassariid	Maldanid (?) Tubes	Arenicola	Mya arenaria	Thin Ampelisca Bed	Robust Ampelisca Bed	Attached Sponge (orange)	ttached Sponge (Yellow/White)	Asterias
				2											T	T		T							T					

Remaining Challenges

- "Bed" and "Reef" terminology
  - Nassariid "Bed"? Probably not.
  - Crepidula "Reef"? Probably not.
  - Created "Nassariid" and "Crepidula" co-occurring elements.

Remaining Challenges

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

Remaining Challenges

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