APNEP's Estuarine Water Quality & Surficial Sediment Monitoring Strategy (Draft): Project Update

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Water Resources Monitoring & Assessment
14 September 2023

Project Timeline for Post-June 2023

- Jul 28: Distributed incomplete draft to MAT
- Aug 3: MAT orientation meeting
- Aug 22: Strategy feedback due from MAT
- Sep 14: MAT remote sensing capabilities
- Sep-Oct: Indicator-specific MAT discussions
- Oct: Distribute complete draft to MAT
- Nov: Distribute draft to STAC, CAC
- Dec: Distribute final draft to LC

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Table 3. Module/Sub-Module/Indicator/Metric hierarchy addressed in this plan. (*) = metrics that were recommended for continuous long-term monitoring in APNEP's first (1989) baseline water quality monitoring plan. (^) = metrics also supporting the "Phytoplankton" indicator. (#) = metric also supporting water column clarity.

Module/Sub-Module	Indicator	Metrics
Aquatic/Estuarine	Water Column Pathogens	Enterococci concentration
		Shellfish closure areas
	Phytoplankton	Chlorophyll *a* concentration#
		Extent & frequency of algal blooms
		Cyanobacteria density
		Algal toxins
	Sediment Quality	Chemical contaminant index
		Sediment toxicity index
		Sediment moisture and organic contents
	Water Column Clarity	PAR attenuation
		Secchi depth/ transparency
		Turbidity
		CDOM
	Water Column Physical-Chemical	Water temperature*
		Salinity*
		Dissolved oxygen concentration*^
		Hydrogen ion concentration (pH)^
		Nutrients: Nitrogen (Nitrate/Nitrite+ Ammonium + DON + Particulate N), Phosphorus (Orthophosphate + OP + TP), Carbon (DIC + DOC + Particulate C) concentrations
		Relative sea level
		Underwater Soundscape
	Water Column Contaminant Chemistry	SVOCs concentration
		Plastic waste concentration
		Dissolved metals concentration
		PFAS concentration
		Pharmaceutical & personal care products (PPCPs)concentration

2.2.8. Abiotic-Stressor Metric: Salinity

Rationale: Estuaries by definition are areas of maximum spatial and temporal variation in salinity regime. Given that salinity tolerances vary widely among SAV species, it should be of little surprise that the salinity regime is an important predictor variable in determining SAV community composition at waterscape scales[61], as well as productivity and growth. Estuarine salinity is often classified into three zones: low (oligohaline), medium (mesohaline), and high (polyhaline). SAV communities within the three salinity zones can have different interannual dynamics and responses to stressors[62], with oligohaline communities being especially sensitive to salinity changes on the order of a few parts per thousand (ppt).

There is a very good understanding of the spatial/quantitative characteristics of the salinity gradient in APES (Section 1.1). The knowledge gap is how temporal fluctuations in salinity alter this structure with respect to its influence on SAV. Stressors that influence the salinity regime include extreme freshwater inputs from droughts, tropical storms, flood control[63], and impervious land surfaces. Also, the introduction of salt from water treatment facilities with reverse osmosis technologies can affect local salinity. Relative sea-level rise affects the tidal prism and increases saltwater flow into the estuarine interior.

Status: While many APNEP partners monitor salinity (mesohaline and polyhaline) or conductivity (oligohaline) of estuarine waters, it remains to be determined whether the spatial and temporal resolution of their collective network is adequate to reflect shallow-water salinity in all sub-regions. Few partners monitor salinity continuously (Table 4).

Citizen Volunteering: Volunteers if provided with refractometers (approximately $300 each) can monitor surface-water salinity, or with calibrated water quality meters or multi-parameter sondes.

3.2.8. Abiotic-Stressor Metric: Salinity

Assessment Points: Currently with limited information on SAV-salinity dynamics, it is challenging to identify assessment points for directions on monitoring sensitivity. The prospects should improve however, as we build a better understanding of species composition, distribution and relative abundance of SAV in low-salinity waters.

Needs and Recommendation: The need is to Intensify (spatially and temporally) salinity monitoring in low-salinity waters. Beginning in 2021, we recommend compiling and analyzing salinity databases to identify priority gaps, plus measurements taken during Tier-2 sampling events.

Table 5. Summary of APNEP SAV monitoring elements. MAT = Monitoring and Assessment Team

Component	Metric	Spatial Scale (Grain & Extent)	Temporal Scale (Grain & Extent)	Method	MAT Lead
Mesohaline to Polyhaline Waters: Bogue, Back, Core, Eastern Pamlico Sounds	SAV Areal Extent by Cover Class	0.3 m-resolution census of targeted sub-region in annual rotation	Bi-seasonal (May and mid-Sept. to mid-Oct.) every 3-5 years	Aerial survey via digital mapping camera, four-band color Cover class interpretation, manual	SAV
	SAV Maximum Depth Distribution	0.3 m-resolution census of targeted sub-region in annual rotation	Bi-seasonal (May and mid-Sept. to mid-Oct.) every 3-5 years	Aerial survey via digital mapping camera, four-band color Edge interpretation, manual	SAV
	SAV Species Presence	75-150 sites randomly assigned and spatially balanced, majority at targeted sub-region in annual rotation	Bi-seasonal (May and September), majority every 3-5 years, minority annually	Species identification during Braun-Blanquet survey	SAV
	SAV Relative Abundance	75-150 sites randomly assigned and spatially balanced, majority at targeted sub-region in annual rotation	Bi-seasonal (May and September), majority every 3-5 years, minority annually	Braun-Blanquet, 4 replicate quadrats per site	SAV
Oligohaline Waters: Neuse Estuary, Pamlico Estuary, Western Pamlico Sound, Albemarle Sound, Currituck Sound, Back Bay	SAV Areal Extent by Cover Class	Five roughly equal segments of total shoreline for each sub-region, majority at targeted segment per sub-region in annual rotation	Seasonal (Months TBD), majority every 5 years, minority annually	Sonar at two shore-parallel isobaths (0.75 m and 1 m) plus shore-normal sonar transect(s) past SAV maximum depth	SAV
	SAV Maximum Depth Distribution	Five roughly equal segments of total shoreline for each sub-region, majority at targeted segment per sub-region in annual rotation	Seasonal (Months TBD), majority every 5 years, minority annually	Determined from shore-normal sonar transect data	SAV
	SAV Species Presence	75-150 sites randomly selected and spatially balanced, majority at targeted segments in annual rotation	Seasonal (Months TBD), majority every 5 years, minority annually	Species identification during Braun-Blanquet survey	SAV
	SAV Relative Abundance	75-150 sites randomly selected and spatially balanced, majority at targeted segments in annual rotation	Seasonal (Months TBD), majority every 5 years, minority annually	Braun-Blanquet, 4 replicate quadrats per site, possible near-shore (< 0.5 m depth) UAV survey	SAV