An Overview of Monitoring Submerged Aquatic Vegetation in Coastal North Carolina

Dean E. Carpenter, D. Env.
Albemarle-Pamlico National Estuary Program

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SAV Questions

- What is APNEP’s role in natural resources conservation in general and SAV conservation in particular?
- How does SAV Partnership’s monitoring and assessment activities address SAV resources?
- What are the particular technologies being developed and applied for SAV monitoring in coastal North Carolina?
Albemarle-Pamlico Estuarine System: Nation’s Second Largest Estuary

Chesapeake Bay
Albemarle Sound
Pamlico Sound
Cape Hatteras
Cape Lookout
APNEP Mission

“To identify, restore, and protect the significant resources of the Albemarle-Pamlico estuarine system.”
2012-2022 Comprehensive Conservation Management Plan

CCMP Outcomes

- **Ecosystem Outcome 2b**: The extent and quality of upland, freshwater, estuarine, and near-shore marine habitats fully support biodiversity and ecosystem function.

CCMP Actions

- **Protection Action B2.2**: Develop and implement a submerged aquatic vegetation (SAV) protection strategy. APNEP will work with its partners in protecting SAV habitats through mapping efforts, examination of permitting requirements, water quality and habitat issues, and education for boaters.

- **Restoration Action C3.3**: Develop and implement a submerged aquatic vegetation restoration strategy. In conjunction with strategies to protect SAV (see B2.2), APNEP will work to restore areas capable of supporting SAV. This work will require study of effective restoration techniques, bathymetric mapping, water quality monitoring, and other efforts. APNEP will continue its contributions to the SAV Partnership to develop and promote a SAV restoration strategy.
2: Native Species

2B: The extent and quality of upland, freshwater, estuarine and near-shore marine habitats fully support biodiversity and ecosystem function.

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Habitat Management

| Invasive Aquatic Plant Species       | Eurasian Watermilfoil Population Status/Occurrences Hydrilla Population Status/Occurrences |
| Invasive Wetland Plant Species      | Phragmites australis Population Status/Occurrences, Alligator Weed (Invasive Comm) |
| Invasive Wetland Faunal Species     | Nutria Population Estimates; Notable Local Populations |
| Invasive Upland Faunal Species      | Feral Hog Population Estimates; Notable Local Populations Fire Ants Population Status/Occurrences |

2C: Non-native invasive species do not significantly impair native species’ viability or function, nor impair habitat quality, quantity, and the processes that form and maintain habitats.
SAV Partnership

- Federal: ACE, FWS, NOAA, NPS, NRCS
- Mixed: APNEP, NERR
- State: DCM, DMF, DWQ, DWR, EEP, WRC, DOT
- Academia: ECSU, ECU, NCSU, UNC-CSI, UNC-IMS, UNC-W, NC Sea Grant, DUML, CW&M-VIMS
- NGOs: NCCF, TNC
The First Complete* Mapping of North Carolina’s Submerged Aquatic Vegetation Resources

Don Field
NOAA – NOS – NCCOS Center for Coastal Fisheries and Habitat Research
Beaufort, NC
Monitoring and Mapping Objective

Monitor and map the distribution and abundance of Submerged Aquatic Vegetation (SAV) in North Carolina’s and southeastern Virginia’s estuarine and coastal waters. The network will cover the waters from Back Bay, VA, to the NC/SC boundary.
Environmental Parameters for Submerged Habitat Mapping

- Winds low – preferably 5 mph or less
- Sun Angle 20 – 45 degrees to reduce glint
- Low tide
- Turbidity low
- No clouds or haze
- Adequate biomass of target
2007 Monitoring Activities

- Resources: APNEP, FWS, DMF
  - NOAA IDIQ Contract Mechanism
- Flights: Aerometric, Dewberry
- Water Clarity Volunteer Network (Chappell-DMF)
  - 25 citizens: secchi depth
- Ground Truth Network
Aerial Monitoring Phases

• Image acquisition: Intergraph’s Z/I Digital Mapping Camera (DMC)
  – 24K feet above mean terrain
  – 1 m pixel resolution – 4 bands – Blue, Green, Red and Near IR

• Photogrammetric control coordination: airborne GPS + ground-based GPS receivers

• Softcopy aero-triangulation

• Digital imagery orthorectification using DEMs
Field Verification Parameters: Autumn 2007

- Position
- Water Clarity
- Temperature
- Salinity
- Depth
- Species Identification
- SAV Density
2007 Field Verification Points

- 1056 random points visited (82% by DMF)
- Points selected from areas where SAV was previously mapped or areas not previously mapped down to depth of 2m
- Points visited with small boats, SAV visualized from boats when possible, wading when possible and rakes when water too deep.
Intergraph’s Z/I Digital Mapping Camera (DMC)
Autumn 2007
Spring 2008
Acquisition

- 1,795.45 flight line miles
- 1,347 images
- Bogue, Back, and the mainland side of Core Sounds from 2006 – 0.3 m pixel size flown at 10,000 ft.
2007 1 m DMC imagery - Drum Inlet, NC
Manual On-Screen Digitization of SAV Polygons

- Initially by DMF Personnel
- NOAA – Bogue Inlet to Oregon Inlet
- APNEP funded contract to finish off all other areas
138,741 acres

Note: one less zero
Oregon Inlet to Cape Lookout

- 86,103 acres
- 71% of State Total
Area South of Oregon Inlet

- Length - 20 miles
- Width - 4 miles
- Total Area - 28,642 acres
- 7th most SAV “State”
2007 1.0m DMC - Core Sound, North of Atlantic
Where Do We Go From Here?

- Already at the five-year period from the initial acquisitions
- Monitoring – NOAA, ECU, NCSU, APNEP obtained a CRFL grant to try to develop a statewide monitoring program
- Challenges
  - Aerial surveys only in coastal regions
  - Inland regions must be surveyed on-the-ground (“invisible grass”)
  - SAV is highly seasonal
  - N. limit of *Halodule wrightii*
  - S. limit of *Zostera marina*
  - SAV is located in high and low salinity areas
Developing Protocols in high-turbidity submerged aquatic vegetation (SAV) beds in North Carolina’s estuaries using single-beam sonar and low-light video

Cecilia S. Krahforst¹, Joseph J. Luczkovich¹, Christine Buckel², Don Field², Richard W. Curran¹, Dean E. Carpenter³, Gayle R. Plaia⁴, W. Judson Kenworthy²

¹ East Carolina University
² National Oceanic and Atmospheric Administration
³ Albemarle-Pamlico National Estuary Program
⁴ North Carolina State University
SONAR Method

Target Strength (dB)

Ping Number

Depth (m)

DGPS(1)  DGPS(2)  DGPS(3)

report cycle #1  report cycle #2
Video Method

- High resolution low light camera
- Differential GPS
- Continuous stamped video – date, time & location
- Camera fixed 13cm above bottom
- Frame size ~0.25m²
- Individual frames classified for SAV presence/absence
Extent of Submerged Aquatic Vegetation

Why Is the Extent of the Submerged Aquatic Vegetation Important?

What Does This Indicator Report?

What Do the Data Show?

Why Can’t This Entire Indicator Be Reported at This Time?

Understanding the Data

Technical Notes
 Manage SAV Adaptively

- Most difficult step?
- Senior management engagement
- Trigger levels in plan
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