

SOP 8 – Submerged Aquatic Vegetation (SAV) Mapping

Version 1.0 (August, 2007)

The following table lists all changes that have been made to this Standard Operating Procedure since the original publication date. Any recommended or required changes added to the log must be complete and concise and promptly brought to the attention of the Project Leader. The Project Leader will review and incorporate all changes, officially complete the revision history log, and change the date and version number on the title page. For complete instructions, please refer to Instructions for Recording Revisions in SOP 13.

Revision History Log:

New Version #	Previous Version #	Revision Date	Author (full name, title, affiliation)	Location in Document and Description of Change	Reason for Change

Introduction

The correlation between increased nutrient loading and declines in SAV distribution has been documented for estuaries worldwide (reviewed by Sand-Jensen and Borum 1991, Duarte 1995, Harlin 1995). Experimental studies have confirmed the causal relationships linking nutrient input, increased algal production, and decreased macrophyte growth and survival (Neckles et al. 1993, Short et al. 1995, Taylor et al. 1995, Sturgis and Murray 1997). The primary mechanism for loss of SAV in response to increased nutrient load is attenuation of light by fast-growing phytoplankton, epiphytic microalgae, and free-floating macroalgae, resulting in reduced availability of light at macrophyte leaf surfaces (Sand-Jensen 1977, Bulthuis and Woelkerling 1983, Twilley et al. 1985, Sand-Jensen and Borum 1991). SAV-dominated estuaries are considered more sensitive to nutrient input than are estuaries dominated by plankton (NRC 2000), and restoration and protection of SAV habitat is often a primary management goal. Thus, the trend in SAV distribution over time offers an indicator of changes in nutrient load, while providing information directly applicable to critical habitat protection efforts. Data must be interpreted with caution, however, because factors other than light availability at leaf surfaces also exert significant control on SAV distribution, including substrate type, wave energy, current velocity, and contaminant exposure (Koch 2001).

Guidance for mapping submerged aquatic vegetation (SAV) was developed for the NOAA Coastal Change Analysis Program (C-CAP). C-CAP is part of the Coastal Remote Sensing Program of the NOAA Coastal Services Center (CSC), located in Charleston, South Carolina. Benthic habitat mapping, which was originally part of the C-CAP function (Dobson et al. 1995), is now being developed separately within CSC and according to new data standards (see U.S. NOAA 2001). Several existing mapping programs already provide information on the

distribution of SAV in the majority of NPS Northeast Region coastal parks. These programs all follow the NOAA standards.

The basic mapping process involves the following steps, the details of which are documented in the metadata for each of the mapping programs as well as in U.S. NOAA 2001.

1. *Acquisition of aerial photography*
2. *Photointerpretation of SAV resources*
3. *Fieldwork to confirm photo-interpreted features*
4. *Compilation to a digital base map*
5. *Independent accuracy assessment procedure*

Several of the existing mapping programs that overlap with the NER are relatively new, and the frequency at which they will be remapped remains to be demonstrated. For those parks without SAV mapping, or where it is repeated in intervals of longer than five years, NPS will need to initiate additional mapping of its own. Where NPS mapping is to supplement less frequent state mapping, it is important that methods match with existing programs so data are comparable (particularly the photography scale and minimum mapping unit). Otherwise, it is acceptable to simply gather the GIS coverages from the individual mapping programs and examine the data for trends in SAV habitat loss or gain.

For cases where the NPS needs to initiate additional SAV mapping, the recommended approach is to partner with the NOAA CSC Benthic Habitat Mapping Project. This mapping project is an ongoing activity of CSC, which emphasizes the development of standards, collaborative partnerships, and technical guidance to the resource management community. In addition to their technical expertise, CSC maintains a list of qualified contractors and may soon have standardized “statements of work” available to NPS for use when contracting for mapping services (acquisition of aerial photography, photo interpretation, and field verification). Current points of contact at the NOAA Coastal Services Center for seagrass mapping are Bill Stevenson (bill.stevenson@noaa.gov, 843-740-1299) and Mark Finkbeiner (mark.finkbeiner@noaa.gov, 843-740-1264).

Acadia National Park

Maine's Department of Marine Resources (DMR) has mapped the SAV habitat for the entire state following C-CAP Protocols. This mapping was accomplished from aerial photography captured on conventional Kodak Aerochrome 2448 color positive film at a nominal scale of 1:12,000. The coast was flown in an incremental fashion from 1993 through 1997, and a composite coastal SAV dataset created from these multiple years of data. A polygon GIS coverage from this data (megrass) is available from the Maine Office of GIS at <http://musashi.ogis.state.me.us/catalog/> along with the applicable metadata. In addition to mapping SAV bed outlines, habitat is categorized into five separate cover classes (see metadata). A goal of the ME Department of Marine Resources is to periodically update this coverage, but the area surrounding ACAD has not been remapped since the original aerial photography of 1996. Additionally, only the Somes Sound spatial domain was mapped by the state. The shallower systems of Northeast Creek and Bass Harbor Marsh were outside the area of the DMR's mapping program (although some photography from 1996 is available). For an

inventory of DMR's coastal photography for Maine see <http://www.state.me.us/dmr/aerialphotos/preview/preview.html>.

NPS will need to either contract for its own SAV habitat maps, or investigate the feasibility of entering into a cooperative agreement with DMR to expand (in time and space) its mapping activities in this area. Since DMR's mapping effort addresses *Zostera marina*, it is important to note that *Ruppia maritima* is the SAV species found within the Northeast Creek spatial domain, and that both *R. maritima* and *Z. marina* are found in Bass Harbor Marsh. The current point of contact for SAV mapping at Maine DMR is Seth Barker (Seth.Barker@state.me.us, 207-633-9507).

Boston Harbor Islands National Park Area and Cape Cod National Seashore

The Massachusetts Department of Environmental Protection (DEP) Wetlands Conservancy Program (WCP) has an ongoing mapping program for SAV habitat in the state. The program was developed in collaboration with NOAA CSC using C-CAP protocols, and is accomplished from aerial photography captured on conventional Aerocolor 2448 color positive film at a nominal scale of 1:20,000. The coast was first flown in an incremental fashion from 1993 through 1996, and a composite coastal SAV dataset created from these multiple years of data. A polygon GIS coverage (eelgrass) and the applicable metadata are available from the Massachusetts Office of GIS at <http://www.mass.gov/mgis/eelgrass.htm>. In addition to mapping SAV bed outlines, habitat is categorized as either *R. maritima* or *Z. marina*. The goal of the MA DEP WCP is to update all maps on a recurring 5-year interval. Photography covering BOHA and CACO was originally captured in 1995, then again for CACO in 2000 and for BOHA in 2001. The more recent coverages are also available from Mass GIS, but not as part of the 1999 composite. This program should continue to meet the SAV mapping information needs for this protocol; however continued communication will be required. The current point of contact for SAV mapping by the Commonwealth of Massachusetts is Charles T. Costello, Section Chief, DEP WCP (charles.costello@state.ma.us, 617- 292-5907).

Fire Island National Seashore, Gateway National Recreation Area, Sagamore Hill National Historic Site

No ongoing benthic mapping programs are in existence that would be relevant to SAV resources at SAHI or GATE. Although SAHI enjoys only limited water frontage on Cold Spring Harbor, much of the harbor substratum (and the greater Oyster Bay system) falls within the boundary of the Oyster Bay National Wildlife Refuge, which is largely an estuarine subtidal refuge. Also in the vicinity is the Target Rock National Wildlife Refuge. The presence of additional DOI land interests in the area presents an opportunity to collaborate and cost share for benthic mapping.

Although eelgrass is not known to exist at the Jamaica Bay or Staten Island Units of GATE, there are literature reports of eelgrass in the Navesink River near the Sandy Hook Unit (Kuropat et al. 2002, Phelan et al. 2000), but these have not been systematically mapped, and there are no recent reports of eelgrass within or adjacent to park boundaries. Nevertheless, baseline maps using a consistent aerial photographic method are needed in order to document any future expansion of SAV resources in the park. Until such a time when eelgrass is seen to be recolonizing the system, however, it is reasonable to remap on much reduced (decadal) intervals.

In Great South Bay on Long Island, the NOAA CSC recently assisted the New York Department of State's Division of Coastal Resources office (NYDOS) and local government agencies to create a baseline SAV map for Long Island's South Shore Estuary Reserve (SSER). This baseline inventory is a key element of the Comprehensive Management Plan developed for the reserve and is intended to be used for change detection in the future. The frequency at which this system will be remapped remains to be demonstrated, so it may be necessary for NPS to supplement with additional mapping, or partner with NYDOS and the SSER in order to ensure a frequency of no more than every five years. NPS may also need to expand SSER mapping to include portions of Narrow Bay and Moriches Bay that fall outside the reserve.

The current SSER mapping effort used conventional-color metric aerial photography. Photographs with a map ratio of 1:20,000 were acquired in June of 2002 in order to avoid problems with poor water clarity associated with the late summer in this system. Habitat mapping and ortho mosaic development were accomplished by soft-copy photogrammetric methods. CSC staff conducted initial fieldwork to support the image interpretation and conducted a field validation of the final SAV map in the early fall of 2003. A vector GIS coverage from this data (final-poly) is available from the NY State Department of State at <http://www.nysgis.state.ny.us/inventories/state.htm> along with the applicable metadata. Current NYDOS point of contact for SAV mapping in this region is Fred Mushacke (fmmushac@gw.dec.state.ny.us, 631-444-0465).

Assateague Island National Seashore, Colonial National Historical Park, George Washington Birthplace National Monument

The Maryland and Virginia NCBN parks benefit from a longstanding SAV mapping program which, in recent years, has been updated annually. The program is supported with both state (VA and MD) and Federal (EPA and NOAA) funding, and conducted through the Virginia Institute of Marine Science (lead: Robert Orth, 804-684-7392, jjorth@vims.edu). Detailed information on mapping methods, years of coverage, and data are all available online at <http://www.vims.edu/bio/sav/>. Chesapeake Bay and Coastal Bays SAV have been mapped from aerial photography, primarily at a scale of 1:24,000, for the following regions: western shore, Va. only - 1971 & 1974; lower Bay, Va. only - 1980 & 1981; upper Bay, selected sections, 1979; Baywide, 1978, 1984 - 1987, and 1989 - 2002. Each area of SAV is classified into one of four density classes by the percentage of cover as determined from the aerial photography methodology described in each annual report - e.g. Orth et al. 2003. Current methods involve the use of aerial photography on black-and-white Agfa Pan 200 film at a scale of 1:24,000. Images are scanned, georectified and orthographically corrected to create orthophoto mosaics. Outlines of SAV beds are interpreted on-screen and edgematched. Ground surveys are then used to field check the photo-interpretation. The final product is a digital database for analysis of bed areas and locations.

To comply with the need for consistency, quality assurance, and quality control, guidelines are in place for the acquisition of aerial photography, and standard operating procedures used for orthorectification, mosaicking, photo-interpretation, edgematching, and field verification. This program should fulfill the information need for NPS SAV mapping for the foreseeable future. GIS polygon coverages for each year of the program are available at <http://www.vims.edu/bio/sav/savdata.html> along with the applicable metadata.

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