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# Drought-Induced Decline of Submerged Aquatic Vegetation in Escambia Bay, Florida

Emile M. Lores
*U.S. Environmental Protection Agency*

David T. Sprecht
*U.S. Environmental Protection Agency*

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MARÍA ISABEL GONZÁLEZ GONZÁLEZ, MAGALY VALDÉS AGUILA, AND ISAIDA DOMÍNGUEZ MARTÍNEZ, *National Institute of Hygiene, Epidemiology and Microbiology, Laboratory of Water Microbiology, Infanta 1158 e/ Clavel y Llinás, Centro Habana, CIP 10300 Cuba.*

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DROUGHT-INDUCED DECLINE OF SUBMERGED AQUATIC VEGETATION IN ESCAMBIA BAY, FLORIDA.—The submerged aquatic vegetation (SAV) in Upper Escambia Bay has been increasing in coverage over the past two decades, as was recently documented by Lores et al. (2000). *Vallisneria americana* Michaux was the dominant species of SAV in Upper Escambia Bay, and the area covered was >1.5 km$^2$. From 1950 to the 1970s, the SAV coverage in this area had declined. That decline was associated with increased nutrients and turbidity (Olinger et al., 1975). A recent dramatic decline apparently occurred over a period of a few months in early summer 2000.

*Observations.*—Locally, the recent decline of SAV was first noticed in Blackwater Bay, Florida, by N. Craft of the Northwest Florida Aquatic Preserves (pers. comm.). High salinity persisted throughout the summer and fall of 2000 because of a severe drought that has affected much of the southeast United States. Data from EPA's Gulf Ecology Division monthly monitoring of water quality parameters in profile at a station near the mouth of Escambia River (location indicated on Fig. 1) indicate that salinity was >12 at the surface from Oct. 1999 through Feb. 2000 and >15 at the surface during each of the monthly visits from June 2000 through Nov. 2000 (Table 1). This exceeds the *V. americana* salinity tolerance of 12 reported by Twilley and Barko (1990) and 15 reported by Kraemer et al. (1999). As a result, most of the area that was previously covered by SAV beds (Lores et al., 2000) is now bare sand/mud bottom.

Monitoring in July 2000 confirmed the decline in Escambia Bay. Observation suggested that *V. americana* was suffering adverse impacts of high salinity. Large rafts of *V. americana* blades were found in sheltered coves, and piles of fresh wrack were visible along the shore. Whole floating plants with no attached roots were also observed, one of the signs of salinity stress noted by Kraemer et al. (1999). Some remnant beds were observed but not mapped during that visit. In September 2000, we conducted a new mapping with a High-Precision Global Positioning System, A CMT (Corvallis MicroTechnology) model HP-GPS-L4, which uses a 12-channel Leica receiver, yielding a nominal postprocessed accuracy of 60 cm.

We documented the position of remaining beds and the absence of SAV along much of the northwestern corner of Escambia Bay, where the most dense beds had existed in 1998 (Fig. 1). The remaining *V. americana* grass beds were <0.3 m tall and frequently <0.1 m tall. This is in contrast to previous years, at this time when *V. americana* was generally taller than 0.5 m and flowering profusely. No evidence of reproduction was observed in any of the remaining beds. The remnant beds that were found were in very shallow water (<0.5 m). Also notable during this visit was the condition of emergent marsh vegetation, much of which had receded and appeared to be stunted, dormant, or dead. Subsequent to the Sep. mapping, and because of the continuation of

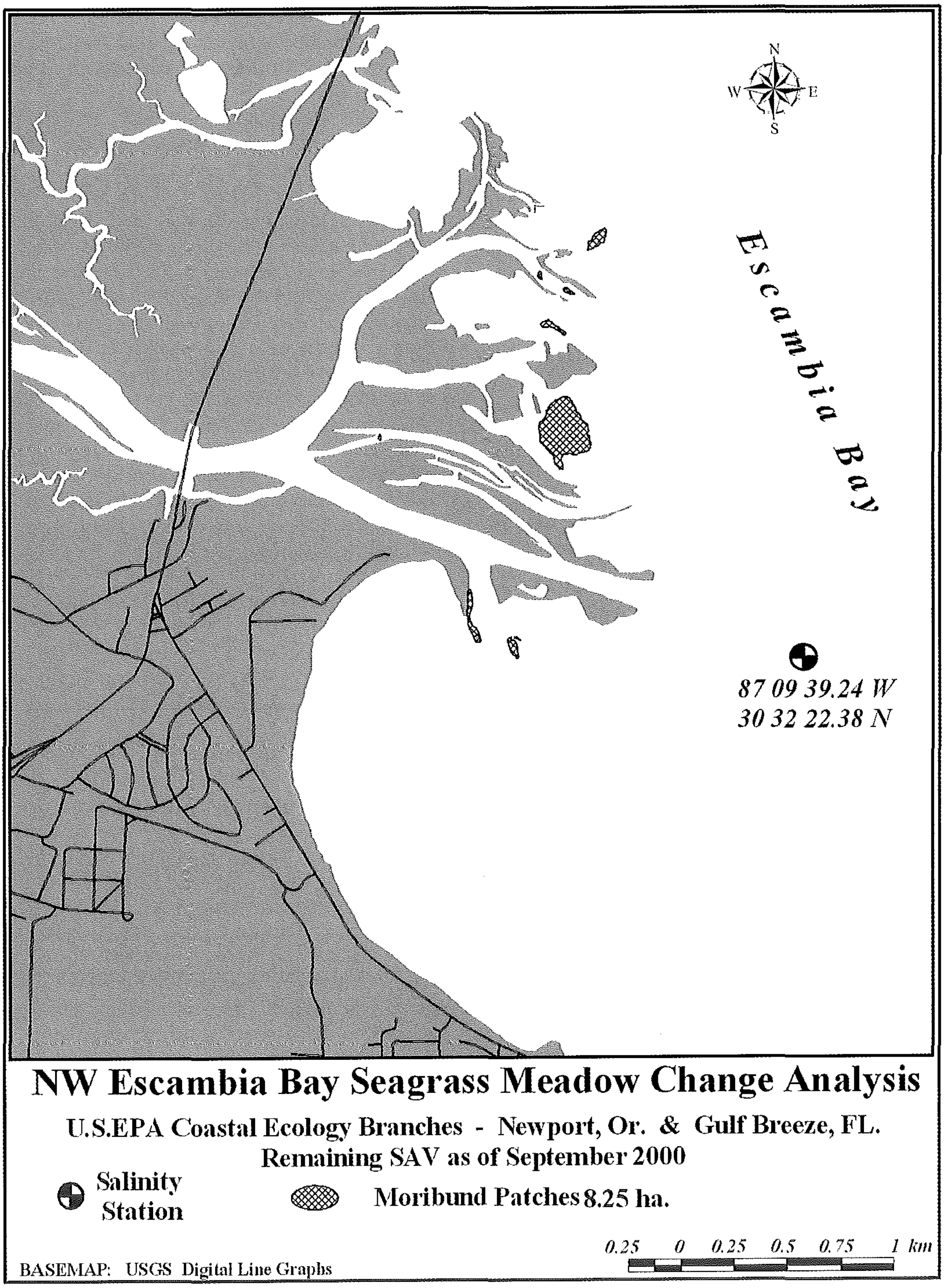


Fig. 1. Remaining SAV beds in Escambia Bay as of Sep. 2000 after summer of drought. Salinity values in Table 1 were measured at the site indicated. Total area of remaining beds was 8.25 hectares.



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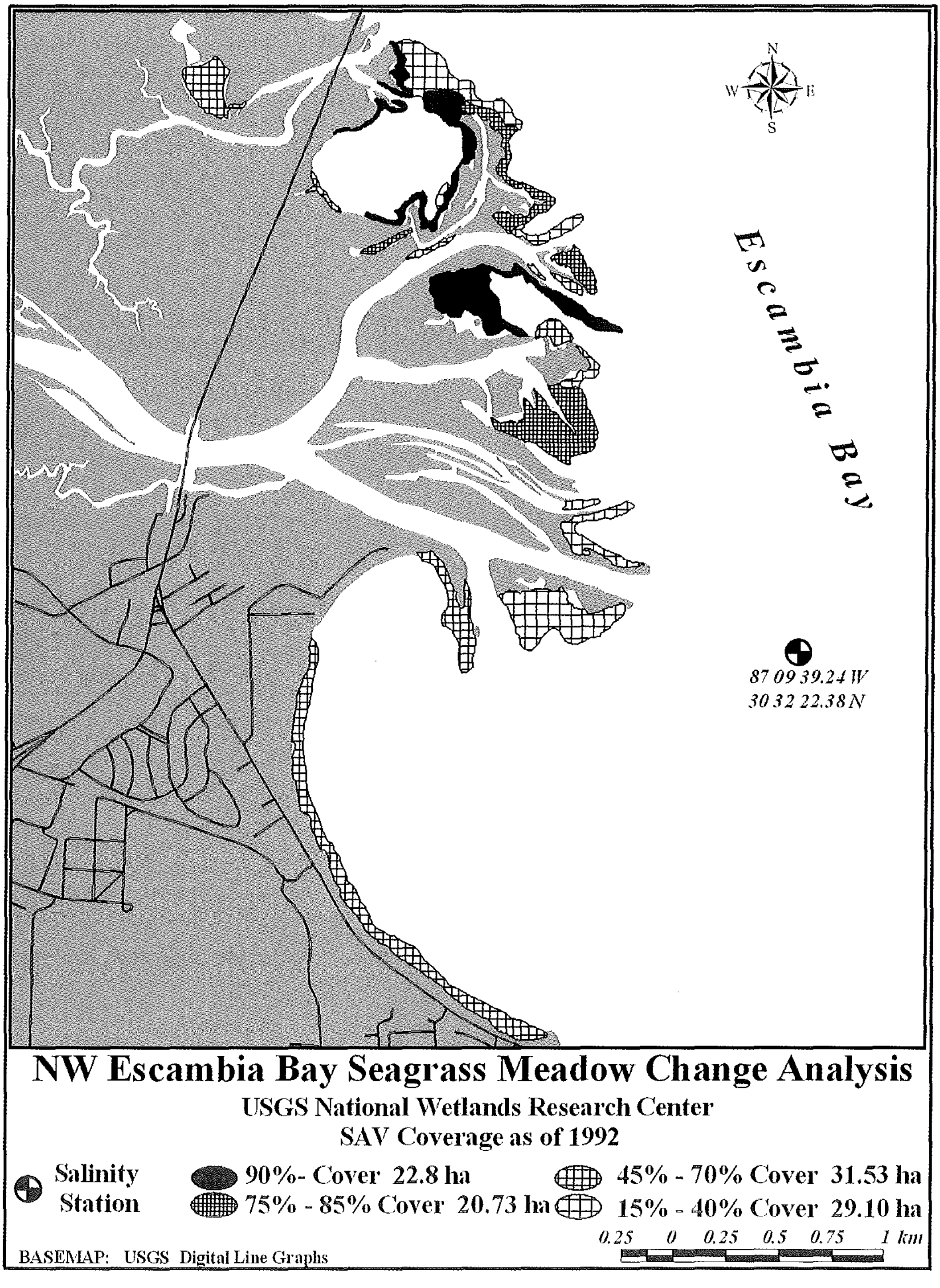


Fig. 2. Map of SAV beds from 1992 in the same area as Figure 1. Density of coverage and area is shown in the legend.

TABLE 1. Salinity (PSU) at the mouth of Escambia River in summer of 2000.

| | Date | | | | | | |
|---|---|---|---|---|---|---|---|
| Depth (m) | May 9 | Jun 13 | Jul 11 | Aug 15 | Sep 12 | Oct 18 | Nov 15 |
| Surface | 10.0 | 18.5 | 15.2 | 15.9 | 15.9 | 21.6 | 16.1 |
| 1 | 12.5 | 18.6 | 17.6 | 17.5 | 15.8 | 25 | 22.8 |
| 2 | 14.5 | 18.6 | 19.1 | 23.2 | 18.7 | 26.5 | 27.6 |
| Bottom | 16.5 | 18.9 | 20.1 | 24.9 | 22.7 | 26.5 | 29.7 |
| (depth, m) | (3) | (2.4) | (3.5) | (3) | (2.6) | (2) | (3) |

drought conditions, surface salinity at the mouth of Escambia River increased to >21 (Table 1), and, in mid-Nov., the largest remnant bed found earlier in Sep. had virtually disappeared.

*Discussion.*—In the 1992 USGS map of Escambia Bay (Lores et al., 2000), the total area covered by SAV was 1.5 $km^2$. The SAV perimeter survey in 1998 (Lores et al., 2000) suggests that coverage was even greater, but the area was not measured. Midsummer biomass measurements of 320 $g/m^2$ above ground and 330 $g/m^2$ below ground were reported by Quarles and Macauley (1999). Under the assumption that the average density of the SAV in Escambia Bay was half that value, the biomass of grass introduced to the surrounding waters was ~490 metric tons (dry wt.). It is likely that this high salinity in the upper regions of Escambia Bay had direct adverse effects on many other benthic organisms. Even more significant are the longer-term effects that this loss of SAV will likely have on nutrient processing, turbidity, and ecological effects based on the loss of habitat and changes in the form of primary productivity in the system for many years. Given the magnitude of this decline, it is likely that the area will be recruitment limited, as was Perdido Bay after water quality was improved (Davis et al., 1999). Therefore, even small restoration projects in the next few years would enhance recruitment and may significantly reduce the time it will take for this ecosystem to recover from these adverse effects.

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EMILE M. LORES AND DAVID T. SPRECHT, *US Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Lab, (EML) Gulf Ecology Division, 1 Sabine Island Drive, Gulf Breeze, Florida 32561; (DTS) Western Ecology Division, 2111 SE Marine Science Drive, Newport, Oregon 97365-5260.*



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