

Interannual variation in submerged aquatic vegetation and its relationship to water quality in subestuaries of Chesapeake Bay

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Supplement 1.

Results of trend evaluation for water quality predictor variables and SAV response variables (EOFs). Trends were evaluated using a Mann-Kendall test (Hirsch & Slack 1984).

Abbreviations indicate salinity zone (OH = oligohaline, MH = mesohaline, PH = polyhaline).

Significant trends ($P < 0.05$) were subtracted from the raw time series to produce detrended variables that were used in the further analyses.

Series	Salinity Zone	p-value	Slope
<i>EOF1</i> (unitless)	MH	0.216	0.005
	OH	< 0.001	0.018
	PH	< 0.001	-0.018
<i>EOF2</i> (unitless)	OH	< 0.001	-0.015
<i>March chl a</i> ($\mu\text{g/L}$)	MH	0.024	0.292
	OH	0.05	0.405
	PH	0.206	-0.129
<i>April chl a</i> ($\mu\text{g/L}$)	MH	0.442	0.145
	OH	0.71	0.048
	PH	0.503	-0.099
<i>May chl a</i> ($\mu\text{g/L}$)	MH	0.078	0.25
	OH	0.264	-0.239
	PH	0.035	0.109
<i>June chl a</i> ($\mu\text{g/L}$)	MH	0.03	0.243
	OH	0.13	0.151
	PH	0.118	0.106
<i>Growing season chl a</i> ($\mu\text{g/L}$)	MH	0.168	0.177
	OH	0.503	0.058
	PH	0.834	-0.013

<i>DOC max (µg/L)</i>	MH	< 0.001	-0.441
	OH	< 0.001	-0.289
	PH	< 0.001	-0.282
<i>DOC mean (µg/L)</i>	MH	0.002	-0.082
	OH	< 0.001	-0.082
	PH	0.002	-0.123
<i>DOC min (µg/L)</i>	MH	0.003	-0.063
	OH	0.014	-0.048
	PH	0.027	-0.06
<i>Secchi max (m)</i>	MH	0.016	-0.021
	OH	< 0.001	-0.037
	PH	0.001	-0.037
<i>Secchi mean (m)</i>	MH	< 0.001	-0.019
	OH	0.016	-0.006
	PH	< 0.001	-0.022
<i>Secchi min (m)</i>	MH	< 0.001	-0.008
	OH	0.016	-0.003
	PH	< 0.001	-0.018
<i>TSS max (mg/L)</i>	MH	0.005	1.3
	OH	0.834	-0.108
	PH	0.08	0.698
<i>TSS mean (mg/L)</i>	MH	0.944	-0.007
	OH	0.272	-0.098
	PH	0.469	-0.051
<i>TSS min (mg/L)</i>	MH	0.624	-0.01
	OH	0.657	-0.048
	PH	0.107	-0.061
<i>Susquehanna & Potomac Rivers average daily N load (Mg/day)</i>		0.168	-3.576
<i>Susquehanna average daily N load (Mg/day)</i>		0.293	-1.54
<i>All Rivers average daily N load (Mg/day)</i>		0.168	-3.553

Supplement 2.

The methods for analyzing total suspended solids (TSS) samples within Chesapeake Bay changed. From 1984 to 1998, the Maryland Department of Health and Mental Hygiene processed the samples. After that the samples were processed by the Chesapeake Biological Lab (USEPA 2012). The earlier samples were weighed on un-ashed GF/F filters whereas the later samples were weighed on pre-ashed GF/F filters. The change in methodology increased the

accuracy of the measurements and decreased the variability among samples. Some analysts consider the earlier data incompatible with the later data, but our cross-correlation analyses are robust to this change. In a correlation analysis, the exact values of the data are less important than the relative magnitudes. The additional variability in the pre-1998 data could potentially obscure a correlation, but it would not produce a false pattern. Nevertheless, to be conservative and complete, we evaluated the correlations of the modes of SAV abundance with TSS for each sub-series of TSS data (1984-1998, 1999-2009) separately as well as the complete series.

Supplement 3.

In a literature review using the search engine Web of Science and the keywords “sea grass” or “seagrass” or “*Zostera marina*” and “Chesapeake Bay,” we found 441 peer reviewed journal articles. A similar search using the terms: “Chesapeake Bay” and “SAV” or “submerged aquatic vegetation” or the common and scientific names of the other macrophyte species found in the estuary found 190 papers. The Chesapeake hosts only one species (*Zostera marina*) that is universally accepted as a true seagrass (Green & Short 2003), and *Zostera* occurs only in the bay’s polyhaline zone. The polyhaline zone contains about 16% of the potential SAV habitat of the bay (Patrick et al. 2014) yet 70% of the peer reviewed literature on Chesapeake Bay SAV is about polyhaline SAV. Across the global literature, broader keyword searches using more terms and more species found 2,284 articles on some type of submerged plant in estuaries. Of these 1,561 (68%) considered seagrass, 441 (19%) considered SAV that were not seagrasses, and 282 considered both.

Literature Cited

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