

Community Metabolism Along Nutrient and Salinity Gradients of the Potomac River Estuary: An Application from Continuous Monitoring Sites



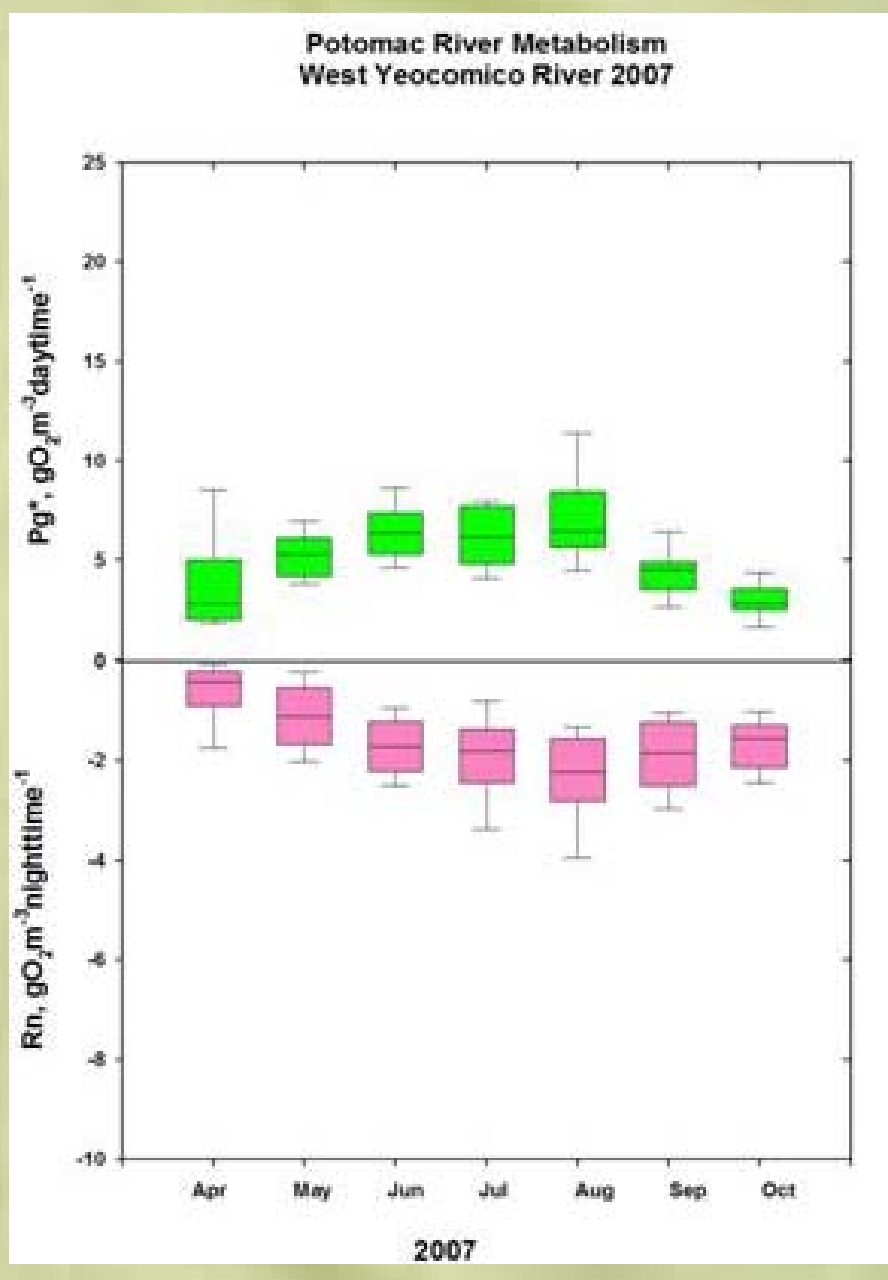
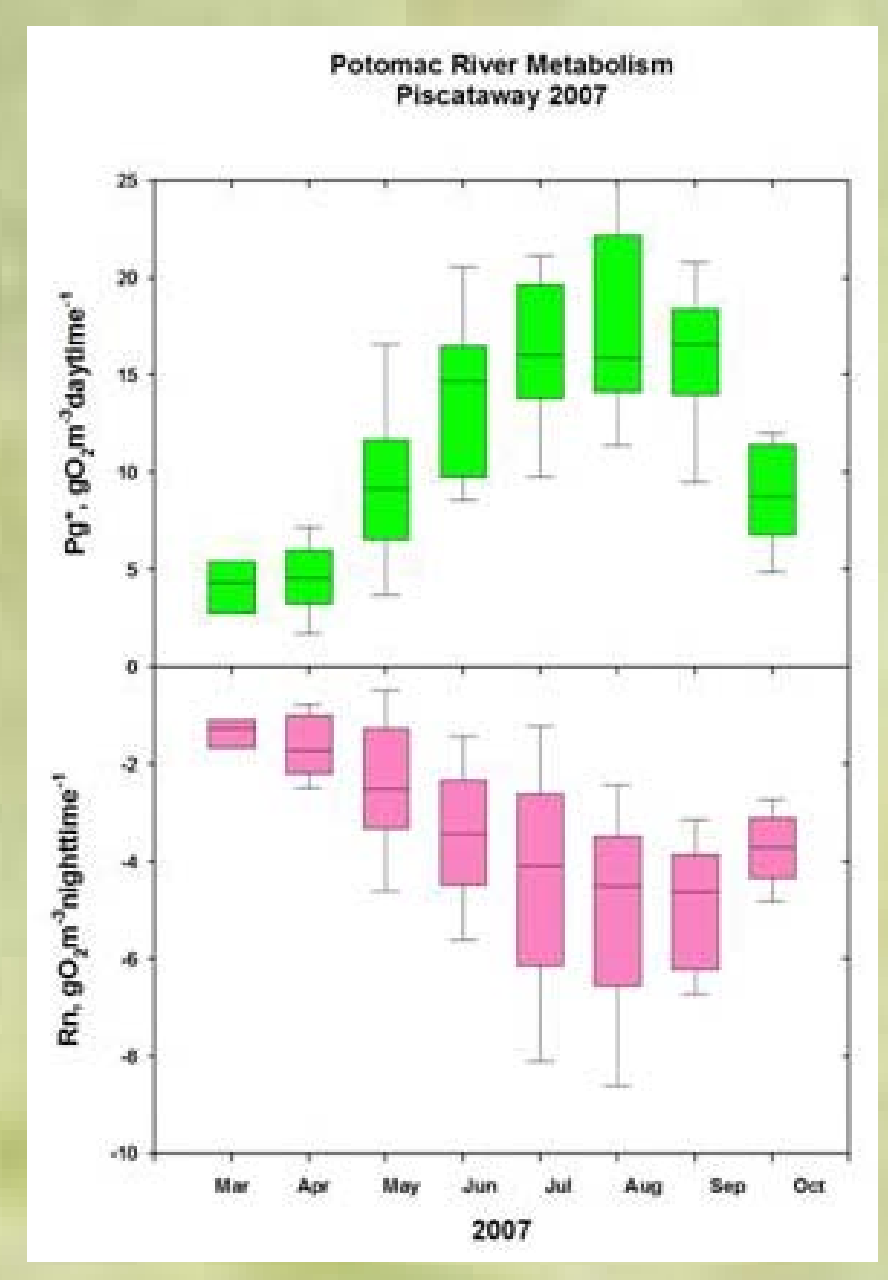
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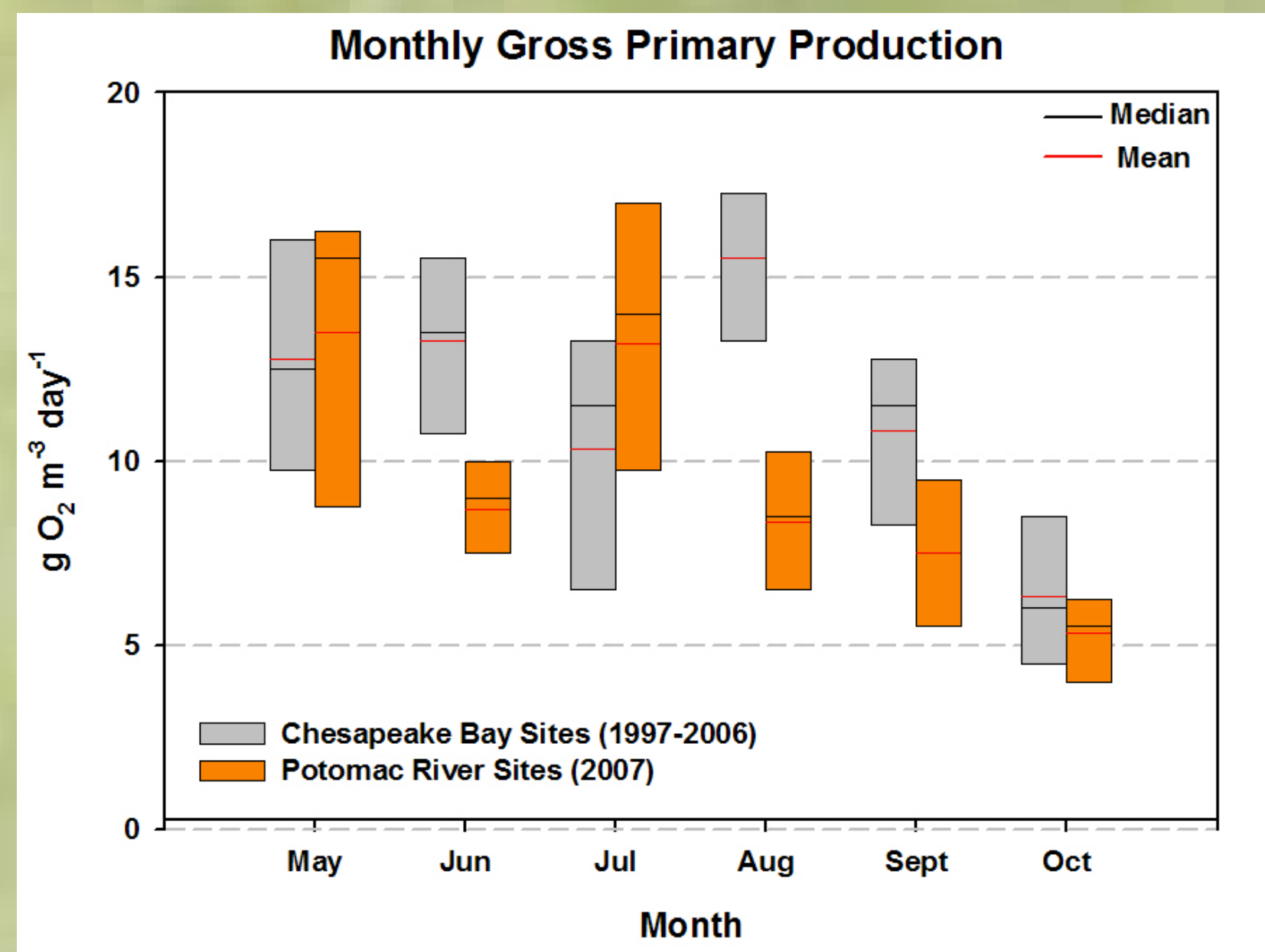
Basic Concept

The basic concept and method for computing community production and respiration was developed by H.T. Odum and C.M. Hoskin (1959) and, with numerous modifications, has been used since for measuring these rate processes in streams, rivers, lakes, estuaries and the open ocean. The technique is based on following the oxygen concentration in a body of water for at least a 24 hour period. During hours of daylight, oxygen increases in the water due to the release of O₂ as a by-product of photosynthesis. During hours of darkness, O₂ declines due to O₂ consumption by both primary producers and all other heterotrophs. The rate processes (gross photosynthesis, Pg; nighttime respiration, Rn) are estimated by computing the rate of change in O₂ concentrations during day and night periods. This rate of change is then corrected for O₂ diffusion across the air-water interface and the result is an estimate of Pg and Rn. Continuous Monitoring (ConMon) data are exactly the type of data needed for these computations in that all the needed variables are measured (dissolved oxygen, temperature and salinity), the measurement frequency is high (15 minute intervals) and the measurement period is for 9 or more months. It is very rare when a rate process can be measured with such temporal intensity.

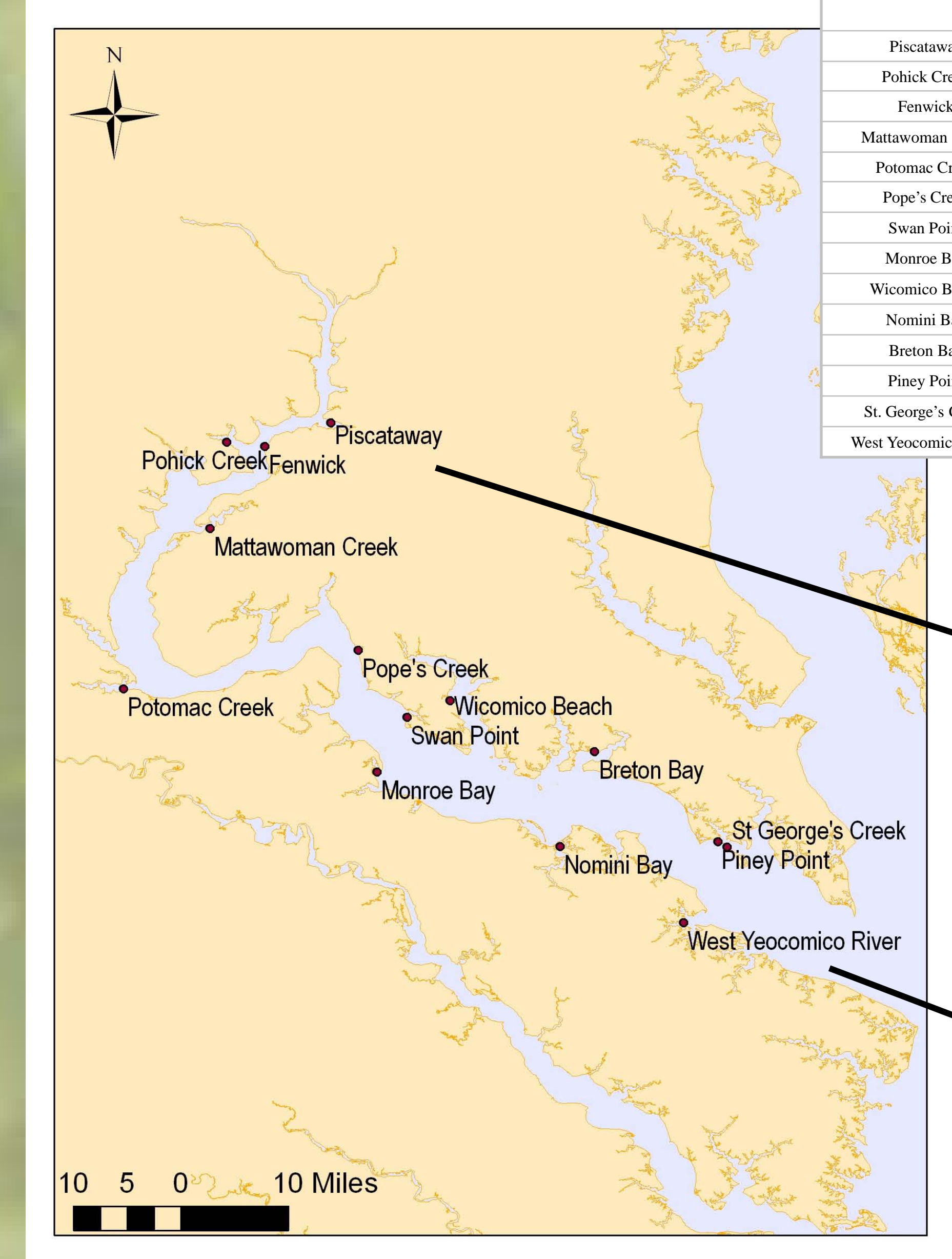


Monthly box and whisker plots of Pg* and Rn for two Potomac River ConMon stations.

Locations	Gross Primary Production (g O ₂ m ⁻³ day ⁻¹)						
	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.
Other Maryland Sites							
Back River Site 1			12	17	13	9	
Back River Site 2			13	16	14	10	
Corsica River Sycamore	13	10	14	13	7	5	
Coastal Bays Bishopville	15	14	21	16	18	11	
Coastal Bays Turville	9	12	15	12	11	5	
Patuxent River Littoral	5	8	10	7	5	3	
Patuxent River Channel	4	5	9	9	6	3	
Coastal Bays Public Landing	3	6	8	8	5	2	
Potomac River Sites							
Piscataway Creek	5	9	15	16	16	17	8
Pohick Creek	5	9	10	10	9	8	6
Fenwick	3	6	12	17	17	16	11
Mattawoman Creek	3	5	10	11	9	8	7
Potomac Creek	5	7	8	9	11	6	4
Pope's Creek	3	4	6	7	6	5	4
Swan Point	2	5	6	6	7	5	3
Monroe Bay	6	7	10	5	4	3	3
Wicomico Beach	4	5	9	8	7	6	5
Breton Bay	3	7	8	7	7	7	5
Nomini Bay	4	7	7	8	7	5	4
Piney Point	2	6	6	5	5	4	4
St. George's Creek	2	5	6	6	7	5	3
West Yeocomico River	3	5	6	6	6	5	3



Summary of average monthly rates of gross primary production at a variety of Chesapeake Bay locations and for all 14 Potomac River Con Mon sites.

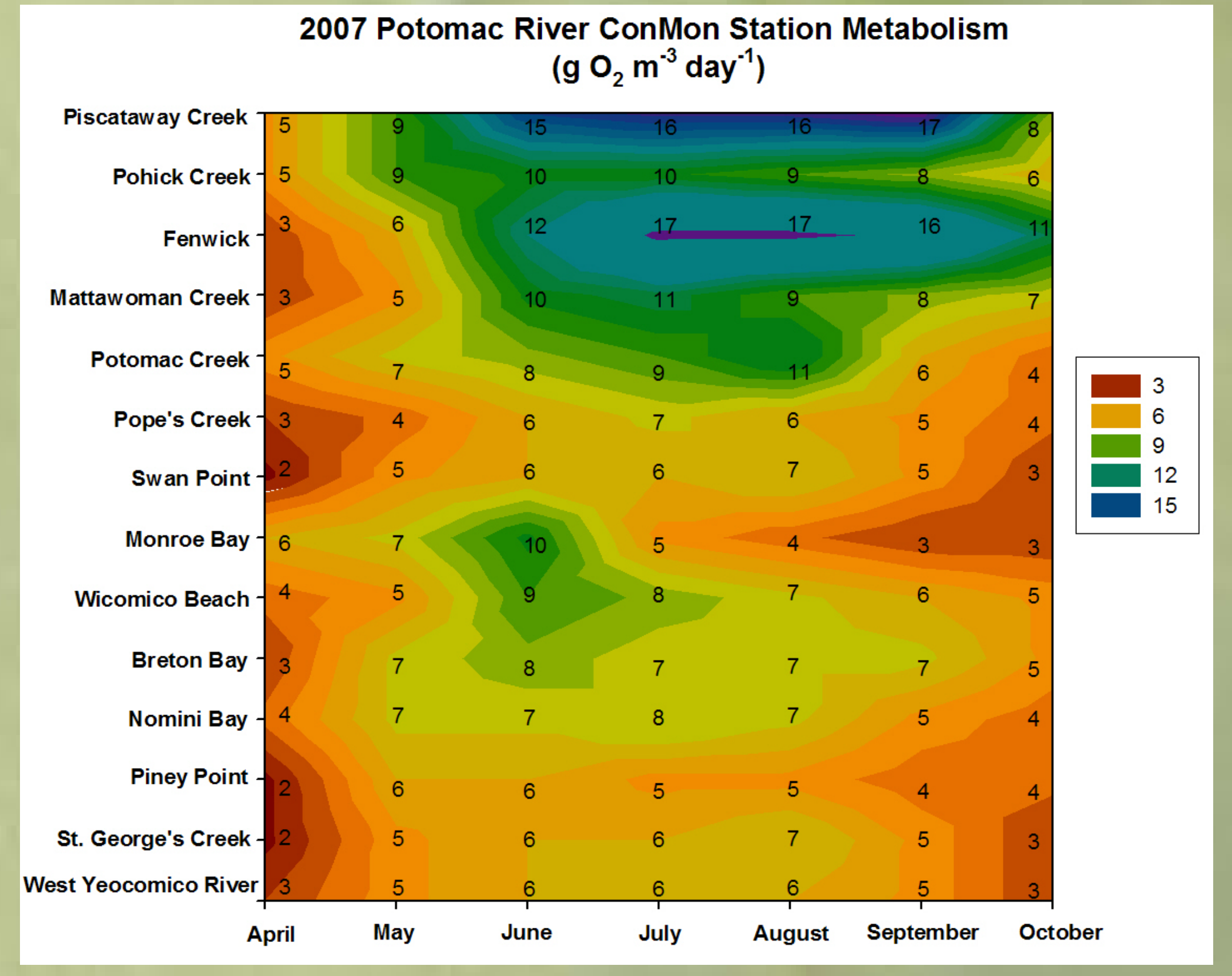


General locations and place names of continuous monitoring (ConMon) sites in Maryland and Virginia portions of the Potomac River estuary. Photos of select sites above right. Station information in table at top right.



Conclusions

Rates of production (Pg*) ranged from modest to very large. In the Potomac River Estuary there was a clear indication that rates at both mainstem and tributary sites were much higher in the upper than lower estuary. Rates at all locations were low in the spring and late fall. Two distinct seasonal patterns were evident wherein at the most enriched sites Pg* was well correlated with water temperature and at less enriched sites Pg* reached maximum rates in late spring or early summer. When compared to other sites in the Chesapeake Bay, the enriched Potomac River sites were similar to the very high rates seen areas like the Back River and dead-end canals of the Maryland Coastal Bays.



Contour plot of average monthly rates of gross primary production (Pg*) at all 14 ConMon sites in the Potomac River estuary and tributary rivers.