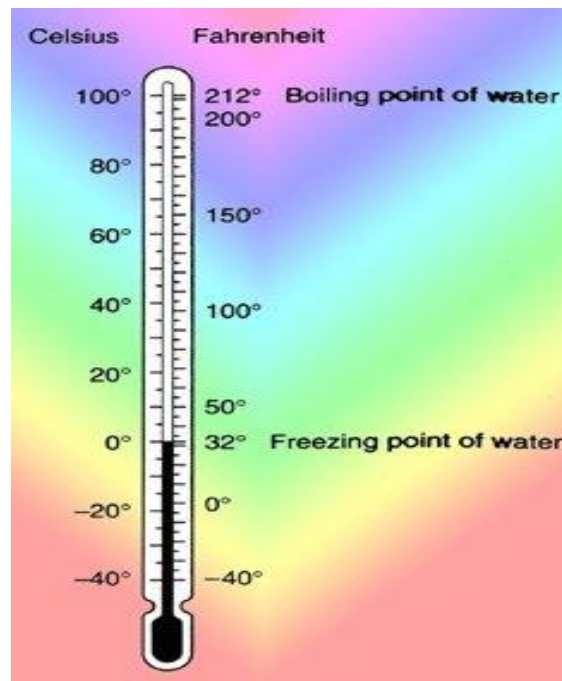


York River, VA water temperatures as surrogates for historical water temperatures elsewhere in Chesapeake Bay, Virginia

T.C. Mosca III and W.C. Coles



Abstract

- Temperature is one of the fundamental physical parameters of a body of water, and the rate and magnitude of marine chemical, physical and biological events are highly dependant upon water temperature. However there are few long-term water temperature data sets in the Chesapeake Bay to establish temporal trends. The water data maintained by the Virginia Institute of Marine Science (VIMS) are the only continuous long-term water temperature data available for the Virginia portion of the Chesapeake Bay. The purpose of this paper is to present regression equations to predict water temperatures in eight regions of the Chesapeake Bay (upper and lower Virginia portions of the Bay, upper and lower portions of the James, Rappahannock and York rivers), from the VIMS temperature data. These regressions may be used to correlate temperatures with other documented data, and to fill holes in other data sets. We compared the monthly mean temperatures at VIMS to temperatures gathered on a monthly schedule in eight strata of Chesapeake Bay and the three major tributaries. The relationship between the VIMS pier temperatures and temperatures measured in other parts of Chesapeake Bay is very strong ($R^2 \geq 95\%$), and therefore is a useful surrogate for long-term ecological studies of time series gathered in other parts of the lower Chesapeake Bay.

The Gloucester Point piers where the independent variable data were collected.



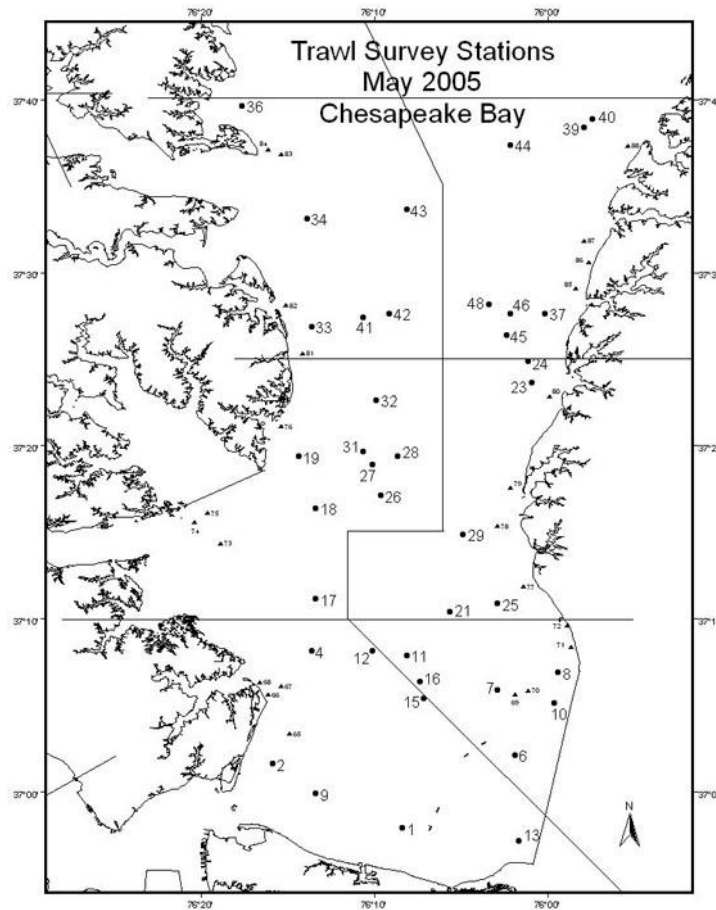
The data are now collected at a nearby buoy.



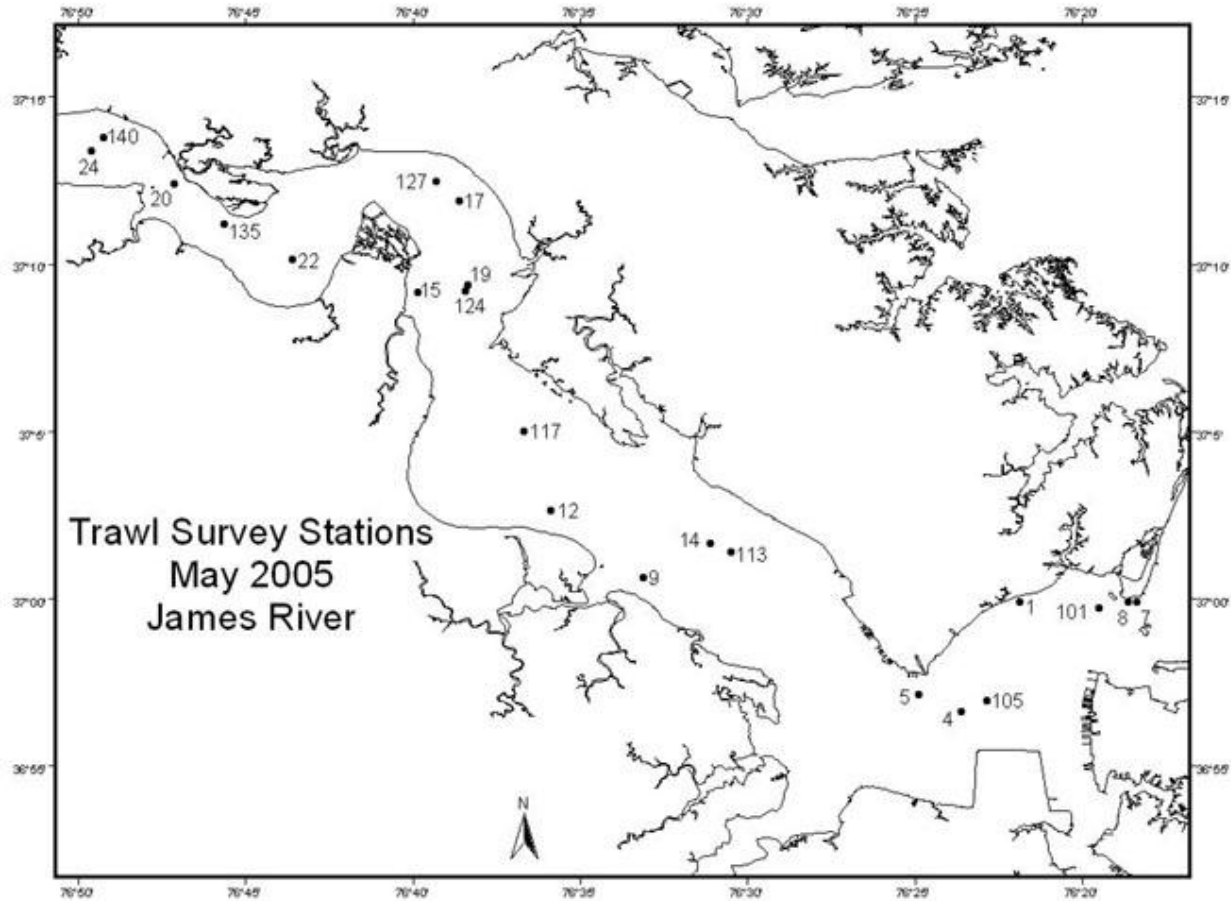
The dependant data were collected
on research vessels



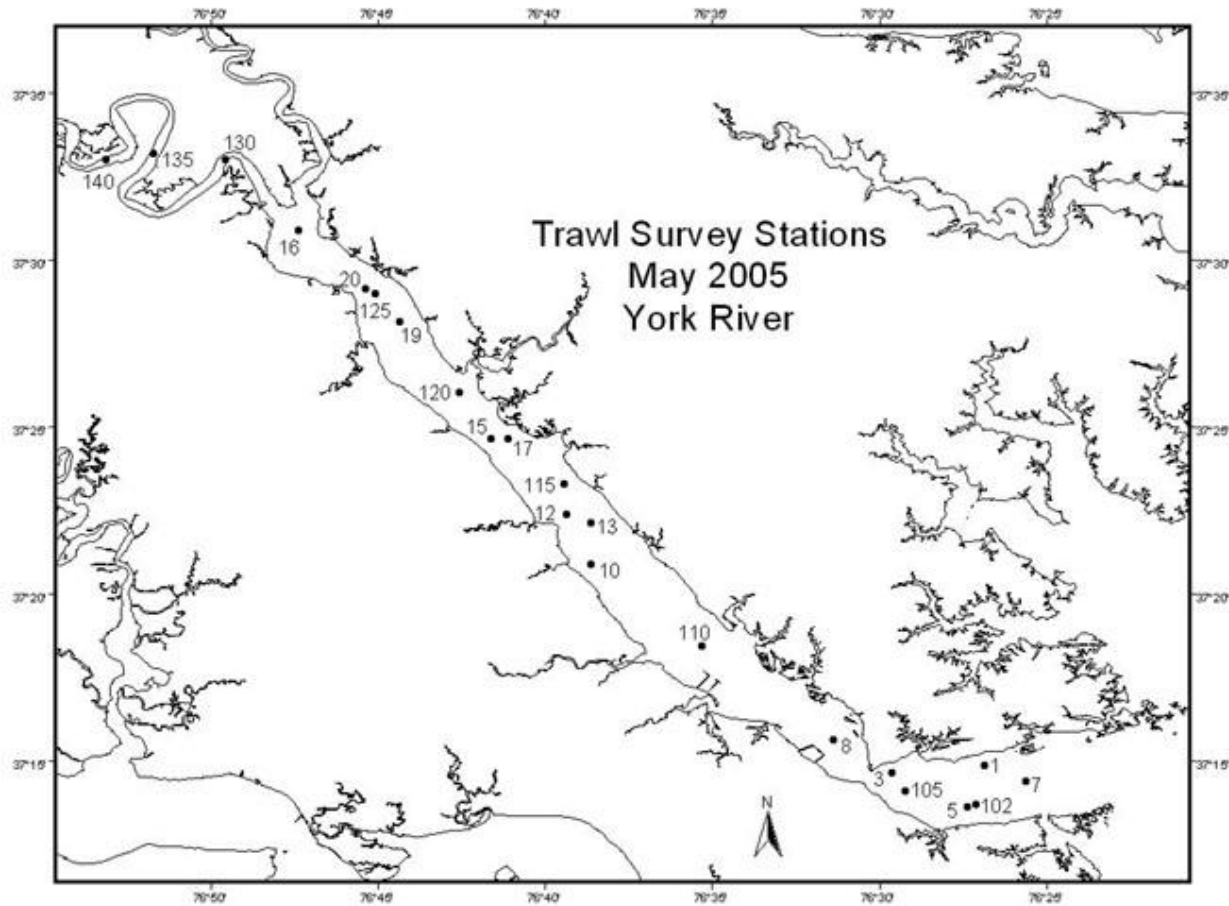
The dependent data locations: Chesapeake Bay mainstem



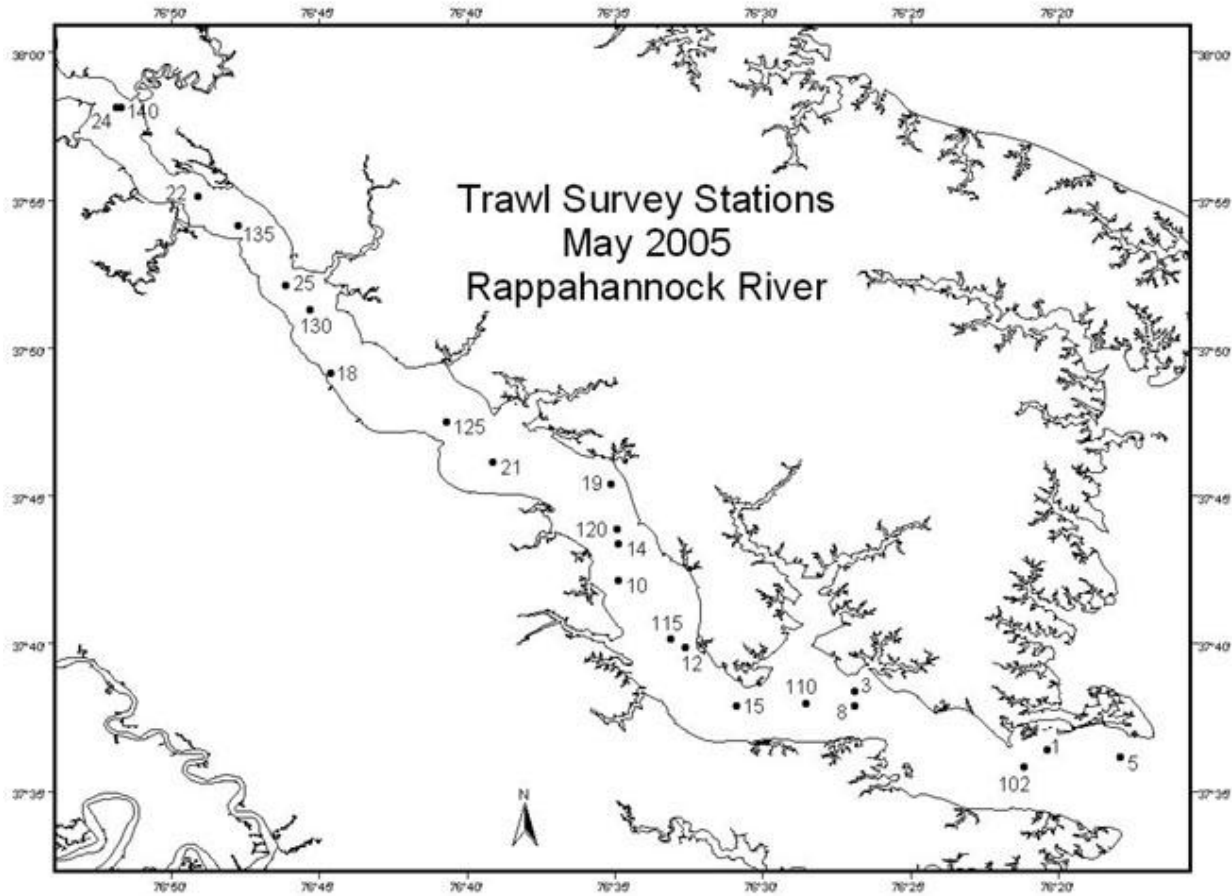
James River



York River

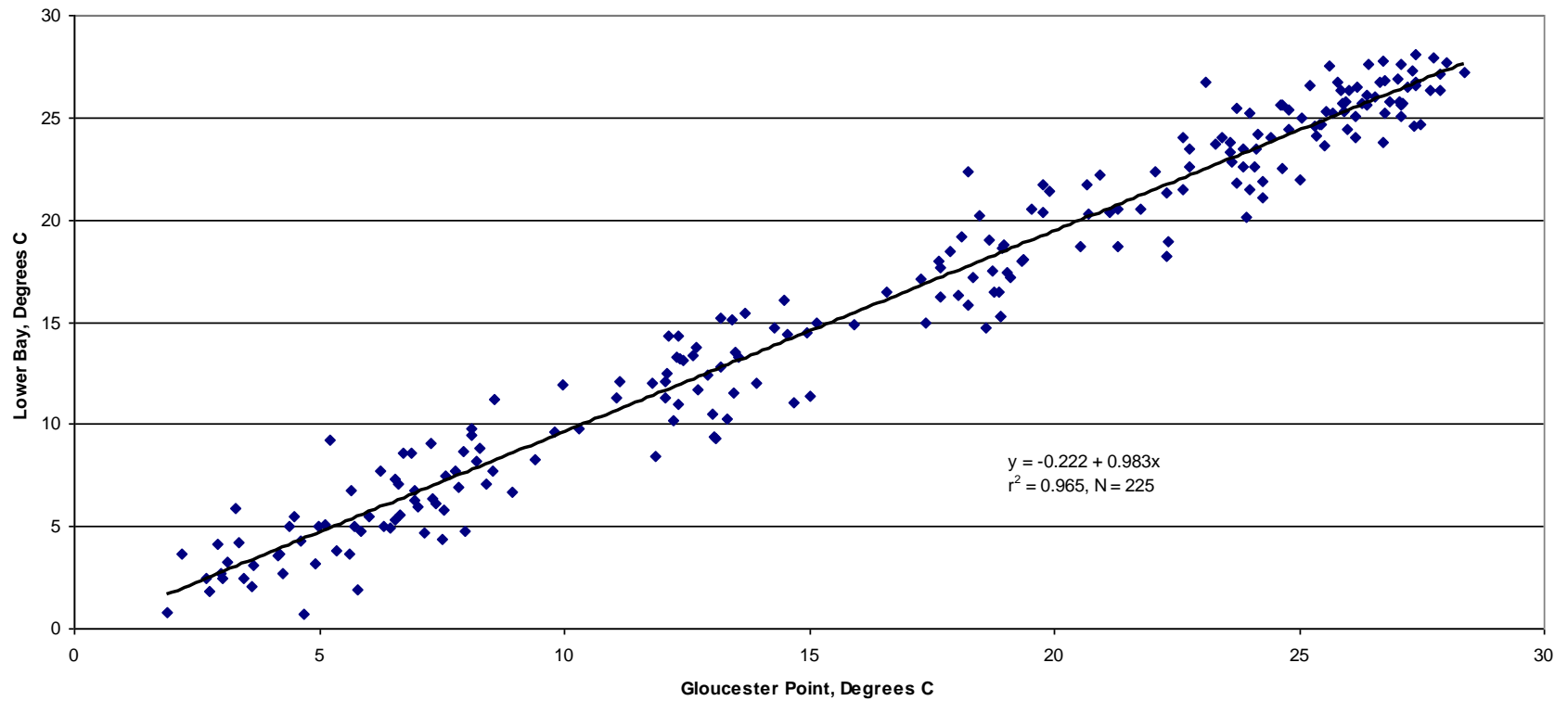


Rappahannock River



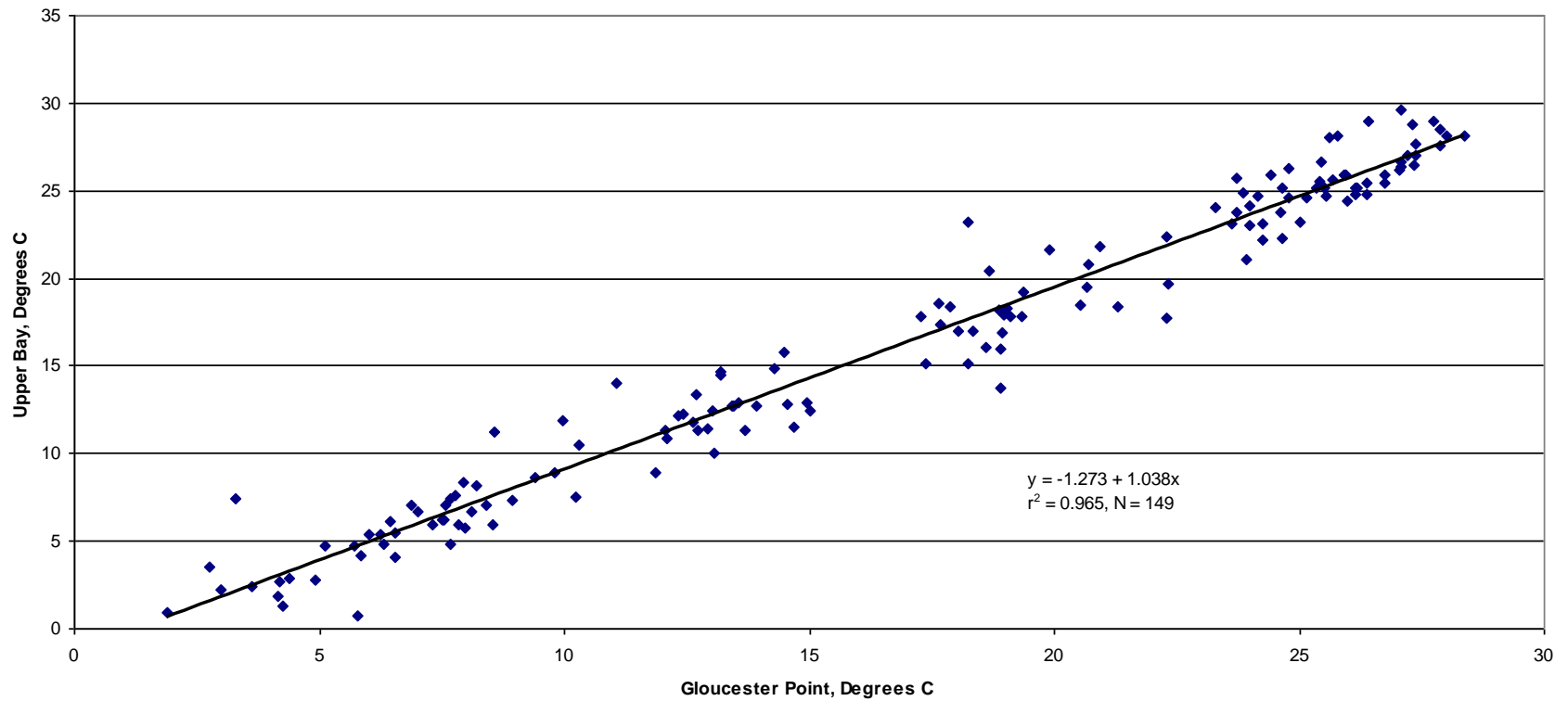
The VIMS/Chesapeake Bay Regressions

York River at Gloucester Point and Lower Chesapeake Bay Temperatures



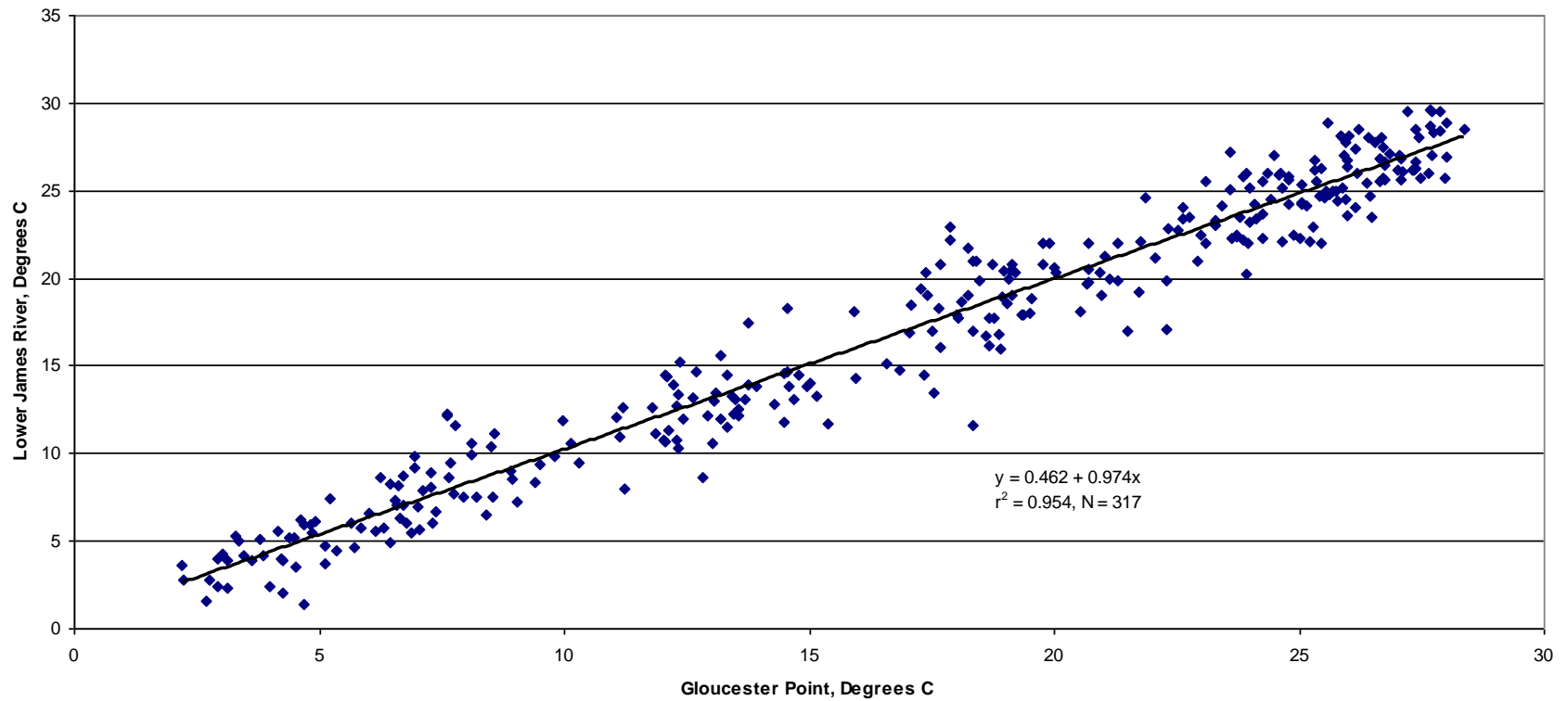
The VIMS/Chesapeake Bay Regressions

York River at Gloucester Point and Upper Chesapeake Bay Temperatures



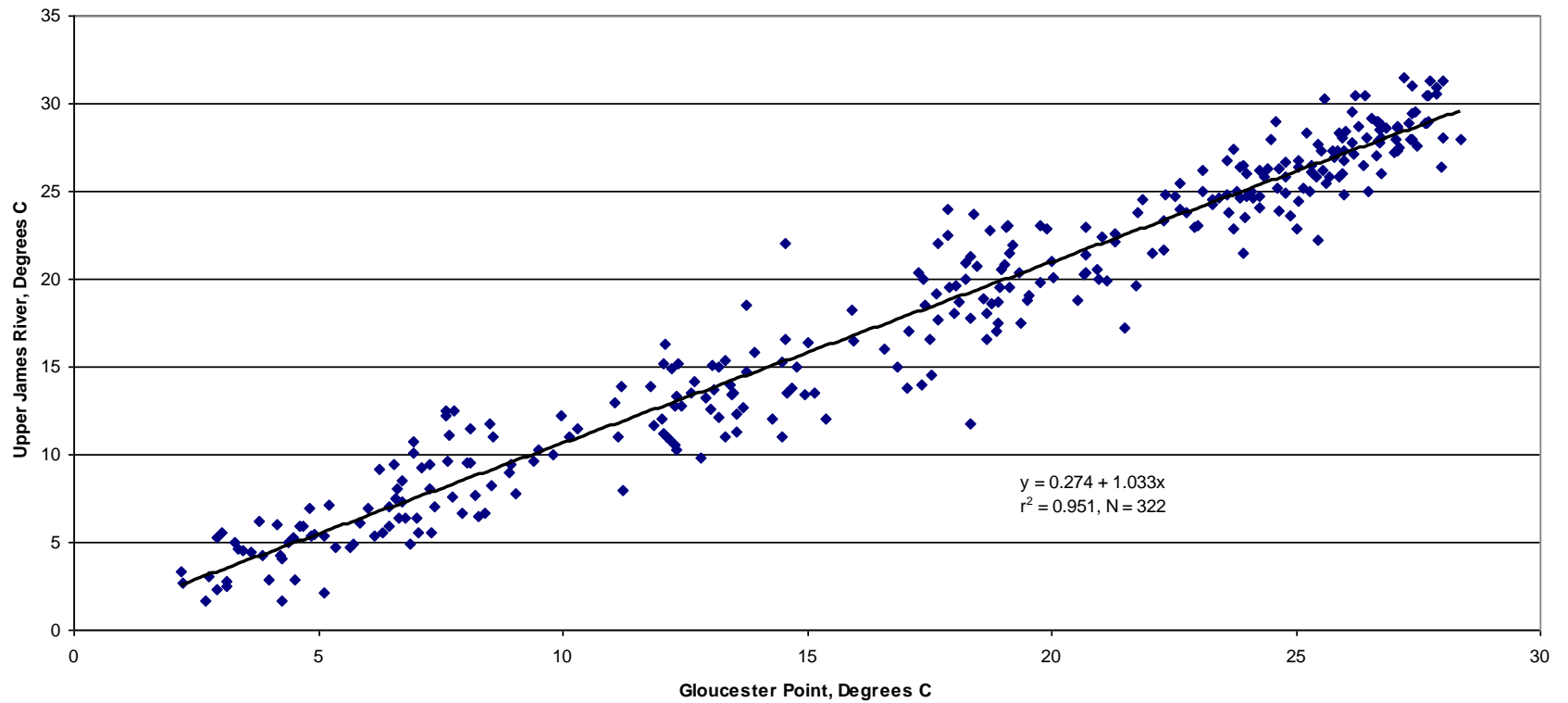
The VIMS/James River Regressions

York River at Gloucester Point and Lower James River Temperatures



The VIMS/James River Regressions

York River at Gloucester Point and Upper James River Temperatures



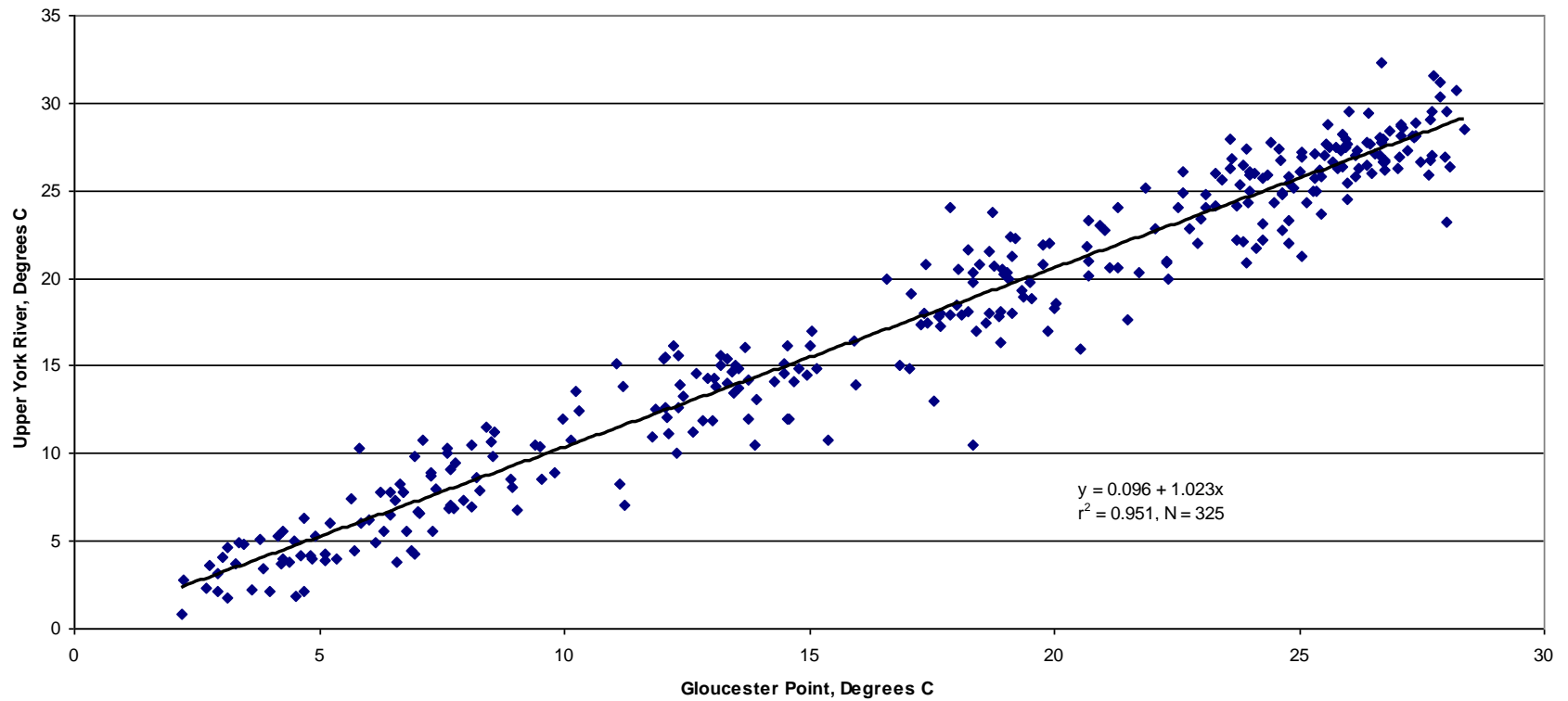
The VIMS/York River Regressions

York River at Gloucester Point and Lower York River Temperatures



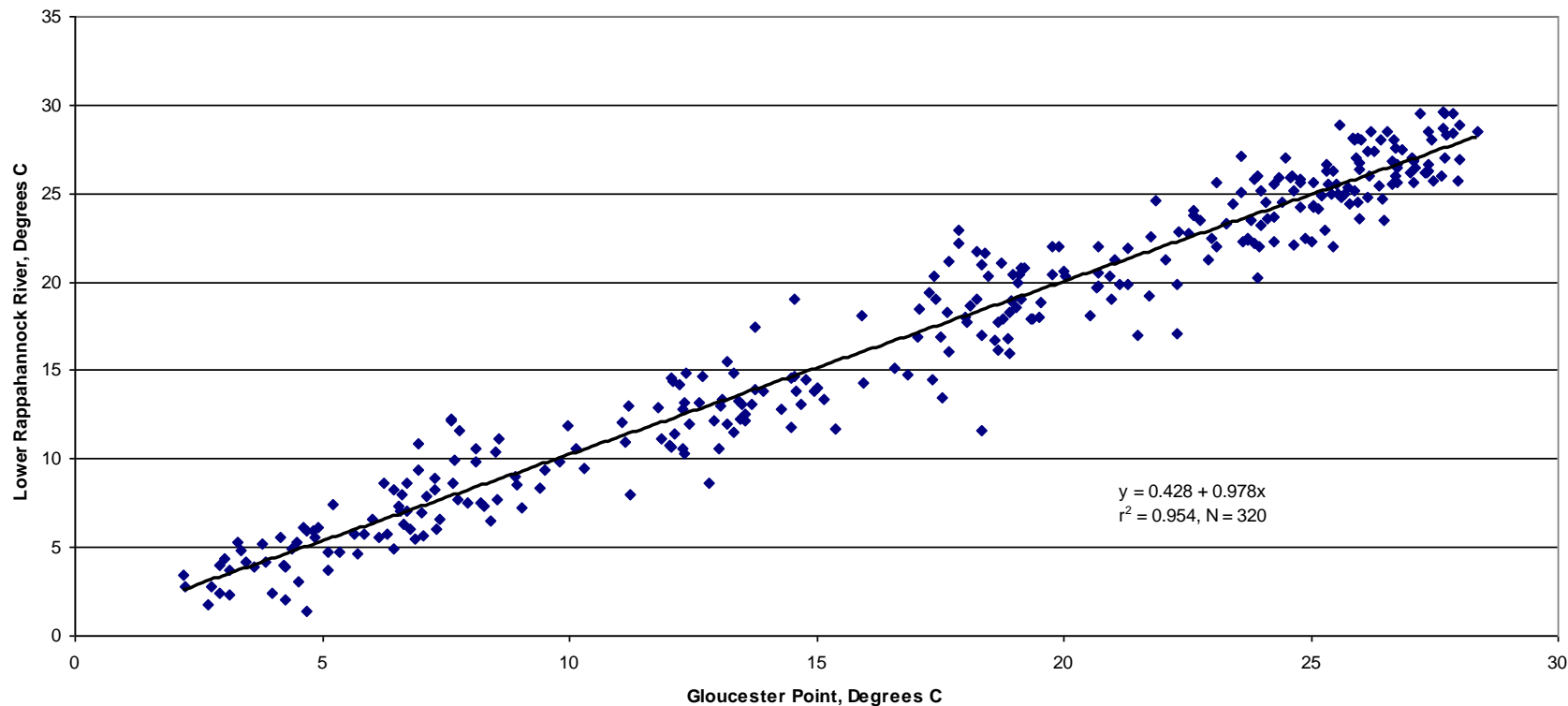
The VIMS/York River Regressions

York River at Gloucester Point and Upper York River Temperatures



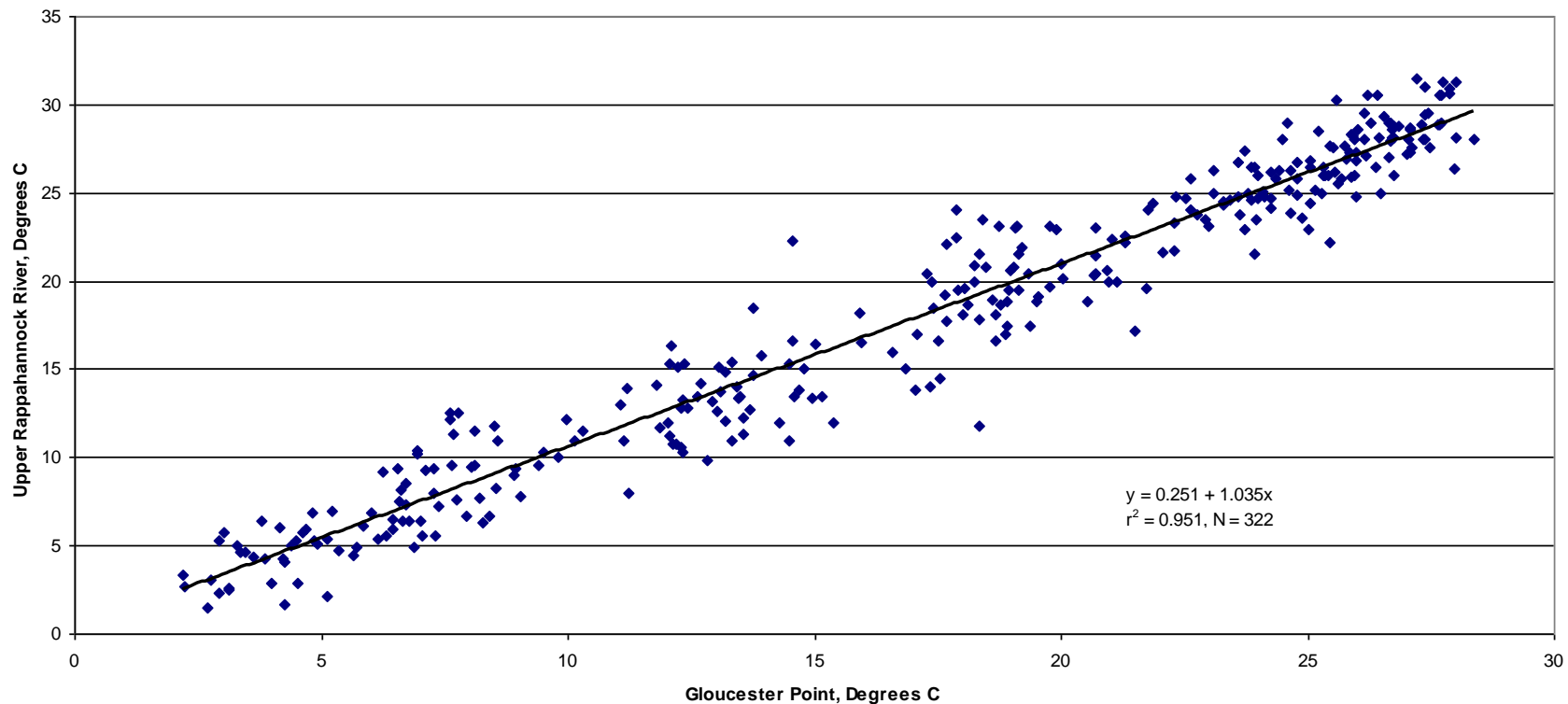
The VIMS/Rappahannock River Regressions

York River at Gloucester Point and Lower Rappahannock River Temperatures



The VIMS/Rappahannock River Regressions

York River at Gloucester Point and Upper Rappahannock River Temperatures



Discussion

- The temperature time series collected at Gloucester Point on the York River by the Virginia Institute of Marine Science (VIMS), Va. is sometimes used for surrogate temperatures in long-term ecological studies of other portions of the Chesapeake Bay and tributaries (*e.g.* Austin *et al* 1996, Coles 1999, Mosca 1997). We decided to test the validity of the VIMS pier temperature time series as surrogate for other parts of Chesapeake Bay.
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- Several localized factors significantly affect water temperature. Two of the most influential are direct precipitation and fresh water discharge from the drainage area. Direct precipitation is sometimes geographically widespread, and sometimes not.
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- The York River drains the smallest geographical area of any of the major tributaries to the Chesapeake Bay. Among the Virginia tributaries, the James River drains the largest area, including a large portion of Virginia and West Virginia. The Rappahannock River drainage area is intermediate between the other two. The Chesapeake Bay watershed includes Virginia, West Virginia, Maryland, Pennsylvania, New Jersey and New York.
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- It is therefore not automatic that the water temperature of the York River would predict the rest of the Virginia portion of the Chesapeake Bay river system.
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- We compared the monthly mean temperatures at VIMS to temperatures gathered on a monthly schedule in each of eight strata of Chesapeake Bay and the three major tributaries. The strata correspond to those used in the VIMS trawl survey, from which the data originated, except that we subdivided the Virginia portion of the Bay into two strata.
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- The relationship between the VIMS pier temperatures and temperatures measured in other parts of Chesapeake Bay is very strong ($R^2 \geq 95\%$), and therefore is a useful surrogate for temperature in ecological studies of other parts of the lower Chesapeake Bay.
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