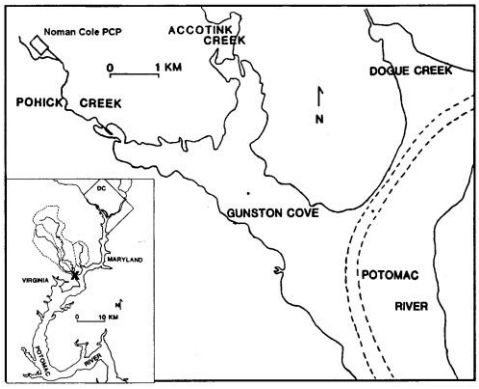
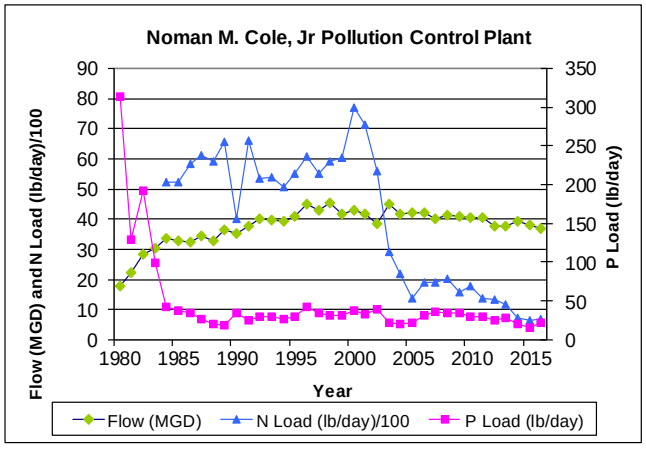
An Ecological Study of Gunston Cove
2016 Synopsis

Gunston Cove is an embayment of the tidal freshwater Potomac River located in Fairfax County, Virginia about 12 miles (20 km) downstream of the I-95/I-495 Woodrow Wilson bridge. The Cove receives treated wastewater from the Noman M. Cole, Jr. Pollution Control Plant (NCPCP) and inflow from Pohick and Accotink Creeks which drain much of central and southern Fairfax County. The Cove is bordered on the north by Fort Belvoir and on the south by Mason Neck. Due to its tidal nature and shallowness, the Cove does not undergo seasonal thermal stratification, and its water mixes gradually with the adjacent tidal Potomac River mainstem. Thermal stratification can make nutrient management more difficult, since it can lead to seasonal since it can lead to seasonal oxygen-diminished bottom waters that may result in fish mortality. . Since 1984 George Mason University, with funding and assistance from the Wastewater Management Program of Fairfax County, has been monitoring water quality and biological communities in the Gunston Cove area including stations in the Cove itself and the adjacent river mainstem.



The Chesapeake Bay, of which the tidal Potomac River is a major sub-estuary, is the largest and most productive coastal system in the United States. The use of the Bay as a fisheries and recreational resource has been threatened by over-enrichment with nutrients (phosphorus, nitrogen). As a major discharger of treated wastewater into the tidal Potomac River, particularly Gunston Cove, Fairfax County has been proactive in decreasing nutrient loading since the late 1970's. As the graph to the right shows, nitrogen and phosphorus loadings have dramatically reduced over the study period. Treatment plant effluent chlorine and solids concentrations have also been reduced or eliminated. The reduction in loadings has been achieved even as flow through the plant has remained high.

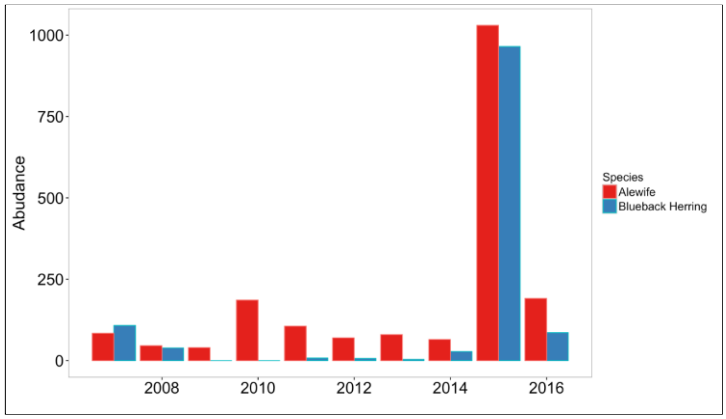


Study results from 2016 generally reinforced the major trends reported in recent years which provide documentation of major improvements in the Cove's water quality and biological resources. Dissolved oxygen values were well above saturation for most of the year in Gunston Cove indicating strong growth of phytoplankton diatoms (i.e., freely suspended aquatic flora that produce oxygen) in the spring and submersed aquatic vegetation (SAV) in the summer. Water clarity (as indicated by Secchi Disk readings to the right) was good for

most of the year and was outstanding in the late summer-early fall attaining a new record of almost 2 meters in the Cove. Nitrogen (N) and phosphorus (P) levels continued to show a general decline and values of N in particular were generally lower in the Cove than in the river. Un-ionized ammonia nitrogen values continue to be low and represent no threat to aquatic life. Phytoplankton algae populations (which can cause nuisance algal blooms, hypoxia, and a decline of fisheries) in Gunston Cove have shown a clear pattern of decline since 1989 as indicated by chlorophyll-a values. Accompanying this decline have been more normal levels of pH and higher dissolved oxygen, and increased water clarity. The zooplankton assemblage in Gunston Cove is dynamic and shows a diversity of organisms that are important to ecosystem recovery. The introduced bivalve *Corbicula* constituted the majority of bivalve catch, but several specimens of native Unionid river mussels were also found. The benthos (i.e., fauna found in bottom sediments) of the study area is exhibiting a clear improvement over the early years of the study. Study results indicate that with increased water clarity, the coverage of SAV in the Cove has been extensive over the last decade and remained strong in 2016. The rebound of SAV contributes to enhanced water quality, and provides increased habitat value for a more diverse fish community and aquatic organisms.

The SAV also filters nutrients and sediments and itself will inhibit the overgrowth of phytoplankton algae. A lag period of 10-15 years between phosphorus control and phytoplankton decline as observed in Gunston Cove has been found in many freshwater systems resulting at least partially from sediment nutrient loading to the water column which can continue for a number of years.

The anadromous fish study (of fish migrating from salt water to spawn in fresh water) found significant spawning of river herring in 2016, although less than in 2015 (see graph at right which shows spawning adult populations sampled in Pohick and Accotink Creeks. In a notable sign of recovery Pohick Creek (stream that receives the NCPCP effluent), which was totally devoid of spawning fish in the early years of the study, now harbors more spawners than Accotink Creek. In January 2012, a moratorium on River Herring was put in effect in all states bordering the Chesapeake Bay to alleviate fishing pressure and help stocks rebound. The 2015 data indicate a very strong rebound in River Herring populations which was less convincing in 2016 data. Continued monitoring in years after this large spawning population was observed, will determine if this spawning season results in a successful year class, and if this is the first year of continued high river herring abundances. Another trend of significance is changes in the relative abundance of fish species. While it is still the dominant species in trawls (and also indicative of limited or little SAV), White Perch has gradually been



displaced in seines by Banded Killifish. This trend toward increased abundance of the SAV-associated fish species and generally higher diversity is continuing.

In short, the strong wastewater management efforts of the County and the robust monitoring program, demonstrates how effective water quality improvements can promote natural aquatic ecosystem restoration. The Gunston Cove has proven an extremely valuable case study in eutrophication recovery for the Bay region and internationally. The onset of larger areas of SAV coverage in Gunston Cove are expected to further enhance the biological resources and water quality of this part of the tidal Potomac River.