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# New County Records Collected in Tidal Wetlands of Four Coastal Plain Counties Along the James River, Virginia

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ABSTRACT

The James River drains nearly a quarter of Virginia and traverses 483 km before entering the southern end of the Chesapeake Bay. It is the third largest tributary to the Bay. The river is tidal below the fall line and is bordered by wetlands. The present study examined tidal wetland floristics of four coastal plain counties along the lower James River. The study included nine sites: two estuarine emergent, three palustrine emergent, and four palustrine forested wetlands. Two hundred eighty-six species were found; 59 were previously unknown for one or more of these counties.

## INTRODUCTION

The area defined by a county has traditionally served as a geographic unit for research in floristic surveys. Some studies by county in the State of Virginia are: Survey of the vascular flora of Orange County, Virginia (Lantz 1972), Survey of the vascular flora of Caroline County, Virginia (Bolecek 1980), and Survey of the vascular flora of Rockingham County, Virginia (McMullen 1980). Tidal wetlands have a unique assemblage of plants (Silberhorn 1982), but few floristic studies have been based on the wetland habitat as a geographic unit (Anderson et al 1968). The present study contributes floristic knowledge and records new species for counties along the tidal section of the James River.

The James River drains 26,000 km$^2$ before entering the southern end of the Chesapeake Bay. The lower 156 km of the James River passes through Virginia's coastal plain and is bordered by botanically rich tidal wetlands (Harvill et al 1986). Many southern species have a northern limit of distribution in Virginia, and many northern species reach a southern limit. Southern wetland species that reach their northern limit in Virginia include *Ilex vomitoria, Tillandsia usneoides, Quercus virginiana,* and *Zanthoxylum clava-herculis* (Harvill et al 1977). The northern limit of canopy species which compose the southeastern palustrine forested wetland community may be reached along the tidal section of the James River (Doumlele et al 1985). Approximately 100 species of northern wetland plants reach a southern distribution limit in the state including *Carex hystericina* and *Polygonum cespitosum.* These circumboreal species may have retreated south during glaciation (Harvill et al 1977).

Though previously considered undesirable and useless land, wetlands are now widely recognized as valuable and significant systems (Sather and Smith

1984, Odum et al 1984). Every state along the Atlantic Ocean has enacted legislation protecting wetlands since the early 1970's. Prior to the passage of the Wetlands Act of 1972, Virginia lost approximately 160 ha of tidal wetlands per year, whereas most recent loss rates are about 8 ha per year (Silberhorn 1982).

The distribution of tidal wetland vegetation appears to be determined by horizontal salinity gradients (Anderson et al 1968, Silberhorn 1982). Day (1981) described soil texture as a major factor that stresses estuarine emergent wetland species and affects their distribution. However, Joshi (1982) found that soil texture has little to do with halophyte distribution and halophytes possess morphological and physiological adaptations necessary to survive high salt concentrations. Relatively few vascular plant species inhabit estuarine emergent wetlands compared to other tidal wetlands (Teal and Teal 1969).

A horizontal salinity gradient exists in the James River. Salinity averages 22 ppt (parts per thousand) at the mouth of the James River and decreases to an average of 0.5 ppt at Jamestown Island (Day 1981). Gunnison (1978) found that horizontal salinity gradients also exist in tidal tributaries of the James River. The distance salt water extends in the James River is determined by the rate of freshwater flow through Richmond, Virginia (Brehmer and Haltiwanger 1966). In addition to distance from the mouth, salinity also varies with depth, season, meteorological activity, and tides (Clark 1974). Salinity decreases rapidly upstream in the James River as compared with the York and Rappahannock Rivers. This is due to the James River's proximity to the mouth of the Chesapeake Bay and the high freshwater inflow resulting from the extensive watershed (Brehmer and Haltiwanger 1966). Lower Lawnes Creek and Ragged Island were the only two sites in the present study that average higher than 0.5 ppt salinity.

## MATERIALS AND METHODS

Nine collection sites were selected along the tidal section of the James River and its tidal tributaries. All study sites are characterized as wetlands: typically containing soil or substrate that is at least periodically covered or saturated with water. These areas are classified as estuarine when the average salinity of the water is greater than 0.5 ppt, and palustrine when the average is below 0.5 ppt. Physiognomy can further classify wetland types. Wetlands dominated by herbaceous vegetation (marshes) are termed emergent in this study, while wetlands dominated by woody species (swamps) are termed forested, following the classification set forth by Cowardin et al (1979). Therefore, the three types of study sites are estuarine emergent, palustrine emergent, and palustrine forested wetlands. These make up nearly 80% of all James River wetlands, while the remaining 20% is composed of non-vegetated wetlands (Wass and Wright 1969).

Access to study sites was most easily gained via small craft, since the land adjacent to sites was most often remote and densely vegetated. The shallow shoals, narrow channels, and scarcity of boat ramps made a canoe the most effective means of transportation. Study sites were visited and collections made twice monthly from April through November, 1985. Specimens

were collected during either the fruiting or flowering stage and identified using the following references: Manual of the Vascular Flora of the Carolinas (Radford et al 1968), New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada (Gleason 1952), Manual of the Grasses of the United States (Chase 1971), Gray's Manual of Botany (Fernald 1950), A Manual of Aquatic Plants (Fassett 1966), Aquatic and Wetland Plants of Southeastern United States, Monocots (Godfrey and Wooten 1979), and Flora of West Virginia (Strausbaugh and Core 1977). This study used the classification system and nomenclature presented by Kartesz and Kartesz (1980). Voucher specimens were placed in the James Madison University Herbarium in Harrisonburg, Virginia.

## SITE DESCRIPTION

The collection site closest to the mouth of the James River is located on Ragged Island in Isle of Wight County (Figure 1). The eastern boundary of the county is 15 km from the Chesapeake Bay. Erosion is moderate to severe in the 29% of the county's shoreline that borders the James River. Fastland erosion in the eastern end of Isle of Wight County is greatly reduced by large estuarine emergent wetlands, such as Ragged Island marsh (Owen et al 1975a). Tendency toward soil erosion at the marsh shore/river interface is often lower in estuarine emergent wetlands than in palustrine emergent wetlands, which have lower root and peat content (Odum et al 1984). However, in emergent wetlands close to the Chesapeake Bay, the impact of fetch and erosive waves causes erosion to be greater than in tidal wetlands farther upstream in the James River (Owen et al 1975a). The soil in the Ragged Island study site is a silty clay loam of the Bohicket Series (Isle of Wight County Soil Conservation Service, unpublished data).

Three study sites were located along Lawnes Creek in Surry County (Figure 1). The James River averages eight km in width at its confluence with Lawnes Creek, which is 40 km from the Chesapeake Bay. Topography of the fastland adjacent to Lawnes Creek is low to moderately low shore. Erosive forces are relatively low, since the creek averaged 61 m in width near its mouth, trends north-south, and is lined with estuarine emergent wetlands (Owens et al 1976a). Lower Lawnes Creek is bordered by extensive estuarine emergent wetlands underlain by silty clay loam soil of the Bohicket Series. Two study sites were located more than six km upstream and included a palustrine emergent wetland with silty clay loam soil of the Bohicket Series, and a palustrine forested wetland still farther upstream having a muck soil of the Mattan Series (Charles City County Soil Conservation Service, unpublished data).

Three sites were located along Morris Creek, which flows through Charles City County and is a tributary to the Chickahominy River (Figure 1). The Chickahominy River is one of the largest James River tributaries in the coastal plain and is 66 km from the Chesapeake Bay. Erosion of fastland is not critical near Morris Creek. The fastland slope is classified as low or moderately low shore, similar to Lawnes Creek fastland in Surry County (Owen et al 1976b). Meanders reduce fetch and the palustrine emergent and forested wetlands absorb wave energy. A forested wetland collection site at the mouth of

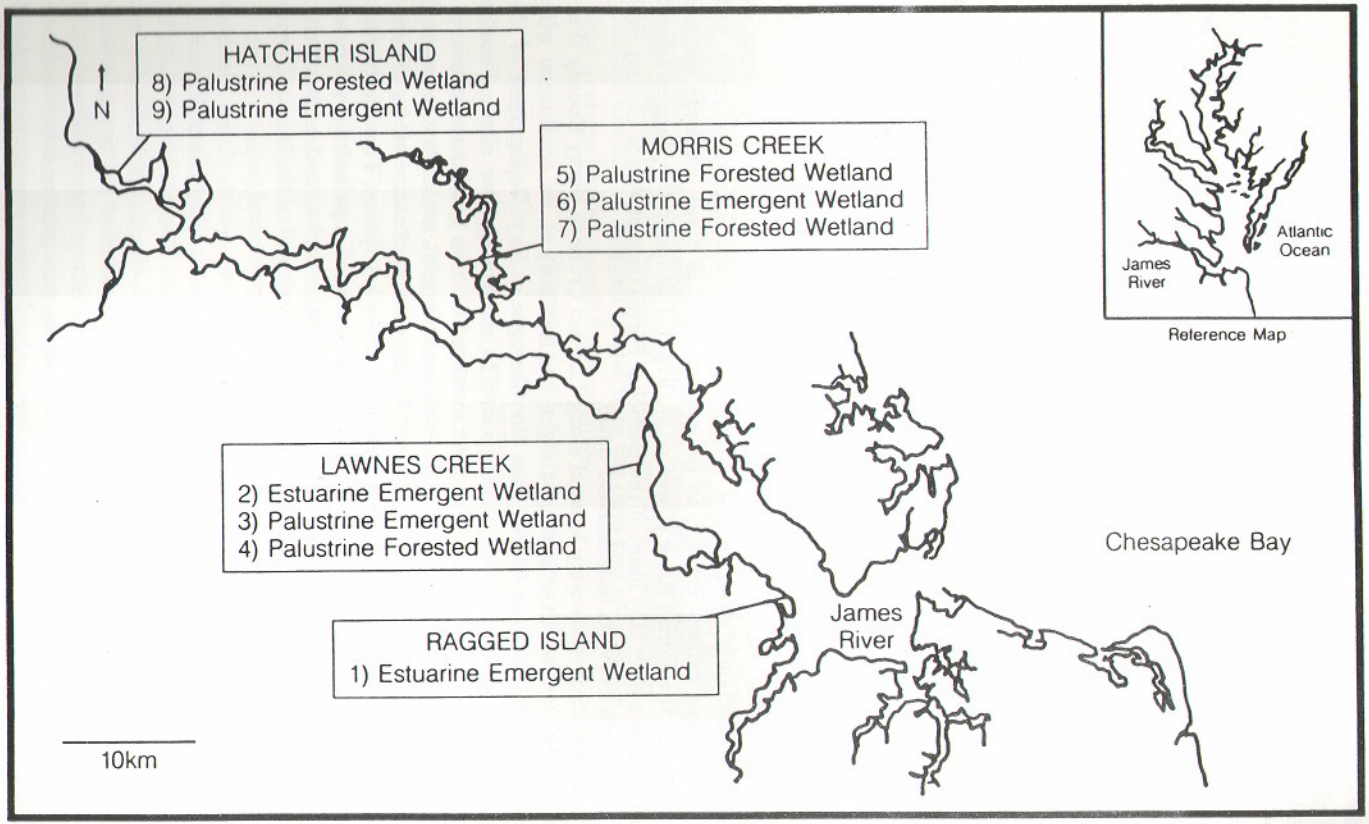


Figure 1. Locations of James River study sites.

Morris Creek is the closest Charles City County site to the Chesapeake Bay (68 km). The remaining study sites along Morris Creek include an emergent wetland near the middle of the creek and a forested wetland in the headwaters. Soil at the emergent wetland site was of the Lanexa Series, while both forested wetland site soils were of the Mattan Series (Charles City County Soil Conservation Service, unpublished data).

The slope of the land adjacent to tidal wetlands of the James River is greatest in the section near the fall line in Henrico County, where 75% of the 56 km of shoreline consists of narrow fringing marshes (Figure 1). Moderately low to high shore and some cliffs constitute 41% of the Henrico County shoreline. The James River averages 152 m in width and meanders are extensive in this end of the tidal section. River width and meanders reduce fetch and waves. Other erosional forces in this area include watershed runoff and flooding. Water levels exceeded 5 m above normal at this site during hurricane Camille in 1969 (Owen et al 1975b). The Hatcher Island wetlands were the closest study sites to Richmond, Virginia and the fall line. Sites included a palustrine emergent wetland and a palustrine forested wetland, which were adjacent to a wide secondary floodplain, 116 km from the Chesapeake Bay. Soil in the forested wetland study site was a fine sandy loam of the Toccoa Series (Clay 1975), but no data was available for the emergent wetland study site.

## RESULTS

A total of 286 species representing 75 families were collected and identified in the tidal wetland study sites. The study revealed the presence of 59 species that were new county records for the four counties in which study sites were located. Information on previously known species records for counties was obtained from the Atlas of the Virginia Flora (Harvill et al 1986). Henrico County had the largest number of records (29), and Isle of Wight County had the fewest (2). Estuarine emergent wetlands near the mouth of the James River were the site for three new county records, while 34 new records were found in palustrine emergent wetlands. Palustrine forested wetlands accounted for 22 new county records (Table 1).

New county records for Isle of Wight County included *Phragmites australis* (Cav.) Trin. ex Steud. and *Salicornia europaea* L. New county records for Surry County include *Atriplex patula* L., *Chamaecyparis thyoides* (L.) B.S.P., *Corylus americana* Walt., *Lycopus uniflorus* Michx., *Rhus aromatica* Ait., *Rorippa palustris* (L.) Bess., *Solidago elliottii* Torr. & Gray, and *Triglochin striata* Ruiz & Pavon. New county records for Charles City County include *Acorus americanus* (Raf.) Raf., *Cardamine bulbosa* (Schreb.) B.S.P., *Carex stipata* Muhl. ex Willd., *Eupatorium purpureum* L., *Hieracium venosum* L., *Ilex laevigata* (Pursh) Gray, *Juncus elliottii* Chapman, *J. roemerianus* Scheele, *Mentha arvensis* L., *Physostegia purpurea* (Walt.) Blake, *Plantago major* L., *Pluchea odorata* (L.) Cass., *Polygonum hydropiperoides* Michx., *Ptilimnium capillaceum* (Michx.) Raf., *Sagittaria falcata* Pursh, *Samolus valerandi* L., *Sium suave* Walt., *Solidago elliottii* Torr. & Gray, *Thelypteris simulata* (Davenport) Nieuwl., and *Typha angustifolia* L. New county records for Henrico County include *Agropyron repens* (L.) Beauv., *Alnus incana* (L.)

Moench, *Bidens laevis* (L.) B.S.P., *Celtis laevigata* Willd., *Chamaecyparis thyoides* (L.) B.S.P., *Echinochloa walterii* (Pursh) Heller, *Eragrostis frankii* C.A. Mey. ex. Steud., *Erysimum cheiranthoides* L., *Geum canadense* Jacq., *Heteranthera dubia* (Jacq.) MacM., *H. reniformis* Ruiz & Pavon, *Juncus brevicaudatus* (Engelm.) Fern., *J. roemerianus* Scheele, *Lycopus americanus* Muhl. ex Bart., *Paspalum fluitans* (Ell.) Kunth, *Peltandra virginica* (L.) Schott, *Phyla lanceolata* (Michx.) Greene, *Poa palustris* L., *Polygonum amphibium* L., *P. tenue* Michx., *Rorippa palustris* (L.) Bess., *Rumex altissimus* Wood, *R. conglomeratus* Murr., *Scirpus tabernaemontanii* K.C. Gmel., *Scutellaria lateriflora* L., *Typha angustifolia* L., *T. latifolia* L., *Urtica dioica* L., and *Veronica anagallis-aquatica* L.

**Table 1. Wetland Type, Location, and Number of County Records for Each James River Collection Site**

| Site | Wetland Type | County | Distance from Mouth (km) | County Records |
|---|---|---|---|---|
| 1 | Estuarine emergent | Isle of Wight | 16.0 | 2 |
| 2 | Estuarine emergent | Surry | 40.0 | 1 |
| 3 | Palustrine emergent | Surry | 46.4 | 1 |
| 4 | Palustrine forested | Surry | 47.2 | 6 |
| 5 | Palustrine forested | Charles City | 68.0 | 9 |
| 6 | Palustrine emergent | Charles City | 72.8 | 7 |
| 7 | Palustrine forested | Charles City | 75.2 | 4 |
| 8 | Palustrine forested | Henrico | 116.0 | 3 |
| 9 | Palustrine emergent | Henrico | 116.0 | 26 |

It appears that *Heteranthera dubia, Juncus brevicaudatus, Poa palustris,* and *Polygonum amphibium* are new coastal plain records, and all four were found exclusively in Henrico County. There were no state records collected in the study.

## DISCUSSION

The results of the present study add significantly to the species lists for some of the counties along the tidal section of the James River. Two new species were added to the list for Isle of Wight County, eight for Surry, 20 for Charles City, and 29 new county records were found in Henrico County. As expected, palustrine wetlands had more species and more county records (56) than estuarine wetlands (3). Isle of Wight County with highest salinity had 27 species and two county records. Surry County was the next closest county to the Bay and had 98 species and seven county records. Charles City County is upriver from Surry County and had 146 species and 20 new county records. Henrico County was the farthest site from the Bay and had 141 species and 29 new county records.

Several species found in this study that are not widely distributed in Virginia's coastal plain, include *Chamaecyparis thyoides, Eragrostis frankii,*

*Erysimum cheiranthoides, Heteranthera dubia, Lycopus uniflorus, Juncus brevicaudatus, J. elliottii, Paspalum fluitans, Plantago major, Poa palustris, Polygonum amphibium, Rhus aromatica, Rumex altissimus, Solidago elliottii, Thelypteris simulata, Triglochin striata,* and *Urtica dioica.* Of these, *Heteranthera dubia, Juncus brevicaudatus, Poa palustris,* and *Polygonum amphibium* are new coastal plain records. Several species had been found in most other coastal plain counties, but had not been recorded for one of the counties until the present study. These include *Corylus americana, Peltandra virginica, Typha latifolia, Bidens laevis, Echinochloa walteri, Geum canadense, Lycopus americanus, Rumex conglomeratus, Scutellaria lateriflora,* and *Phragmites australis.*

One reason for the large number of new county records collected may be the seasonality exhibited by many wetland plants. Species that flower only briefly would not be found unless flowering coincided with the study schedule. This is particularly true of palustrine emergent wetlands, which is where most county records (35) were collected. Initial spring growth in these marshes is often broadleaf species such as *Sagittaria latifolia, Peltandra virginica,* and *Pontederia cordata.* By late summer, graminoids outgrow the broadleaf species, and the appearance of the marsh changes. Late summer species include *Leersia oryzoides, Zizania aquatica,* and *Bidens laevis.*

Several other factors can cause wetland plants to be overlooked, including plant size and growth form. Species such as *Triglochin striata, Samolus valerandi,* and *Salicornia europaea* are examples of small plants that were new county records in the present study. Species could also be missed if different elevations are not covered within each study site. The period of inundation or exposure time a species can tolerate plays a major role in determination of its location, or zone, in the wetland (Wass and Wright 1969). County records that were found in higher elevations of emergent wetlands include *Phragmites australis, Typha angustifolia,* and *T. latifolia.* Lower elevation species that were county records in the present study include *Sagittaria falcata, Heteranthera reniformis,* and *H. dubia.* The remote location, high humidity, and quantity of pests may also limit research time in some wetlands. The high marsh is often bordered by an ecotone of dense shrub growth and vines, while an approach via the water is made difficult by the occurrence of mud flats.


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