

The Virginia Wetlands Report

Summer 2001
Vol. 16, No. 2



Through The Years in Virginia's Wetlands: The 1970's

Gene M. Silberhorn, Ph.D.

As I sit down to write about my recollections of working in wetlands at VIMS, I can't help but reminisce about fellow workers and students. These fond memories are somewhat distracting to my progress in completing this report during my first summer of retirement. Now, the attendance and participation at meetings, conferences and workshops held both near and far, lose importance and meaning to me. Incidents in the field, however, are recalled as if they happened yesterday.

I arrived at VIMS from Canada in late June 1972, a day or two after tropical storm Agnes blew through. The campus was nearly deserted, not from storm damage or summer vacations, but because everyone was in the field gathering results from the storms impacts on the estuarine environment. I was hired into the fledgling Wetlands Research Department consisting of Ken Marcellus, George Dawes, and soon to follow, Tom Barnard. Our main goal was to inventory, classify and evaluate the tidal wetlands in the commonwealth.

The newly enacted Virginia Wetlands Act of 1972 went into effect July of that year. VIMS was given the task by the General Assembly of providing

the scientific and environmental support with regard to the Wetlands Act.

One of my very first assignments was to work with Marcellus and Dawes to make an ecological assessment of the tidal marshes of the proposed York River State Park in James City County. The fieldwork began soon after the flooded conditions caused by Agnes subsided. Preliminary plans were in place to develop a 15-acre marina near the mouth of Taskinas Creek, the main estuarine tributary of the park. The construction of the marina would have required dredging a defined acreage of tidal marsh and deepening the natural channel. While plotting the marsh vegetation communities in the field, we discovered the survey flags marking the area of the proposed marina.

Our study revealed that Taskinas Creek offered a unique wetland estuarine ecosystem experience with robust stands of saltmarsh cordgrass (*Spartina alterniflora*) and big cordgrass (*Spartina cynosuroides*) along the lower reaches of the waterway. The lower reaches of this creek are typical of saline estuarine marshes, however the waterway is pristine and grades to tidal freshwater marshes dominated by arrow arum (*Peltandra*

virginica), pickerelweed (*Pontideria cordata*) and northern wildrice (*Zizania aquatica*).

One of the primary recommendations in our study, submitted to the park service, was to reject the marina idea, and provide a small landing near the proposed visitors center as a canoe livery for public use and guided nature tours. We were very happy it worked out that way, because the park is a gem for the nature loving public and is now part of the Chesapeake Bay National Estuarine Research Reserve of Virginia (CBNERRVA). These plant community changes can be seen today traveling the narrow and sinuous natural channel of the creek. The experience is best enjoyed by canoe or kayak.

Foremost of the tasks that were before me at VIMS was to inventory the tidal wetlands in the Commonwealth as mandated in the Wetlands Act. This proved to be most difficult because funds were not provided. One must also remember that the technology (GIS, GPS, satellite imagery and fast computers) did not exist to facilitate the task. Aerial imagery was secured, almost always free, from different sources such as USDA, VDOT, and NASA Wallops. The Wetlands Act allowed each county and incorporated city or town

Editor's Note:

Professor Emeritus Gene M. Silberhorn is a nationally recognized botanist, educator, and author who came to VIMS in the early seventies to head up the newly created Tidal Wetlands Inventory Program. His arrival at Gloucester Point coincided with the passage of the Virginia Tidal Wetlands Act and Gene has been intimately involved with all aspects of wetlands science and policy as his career has direct parallels with the management of wetlands both in Virginia and nationally.

Having just retired from VIMS and the School of Marine Science of the College of William and Mary, Gene now busies himself with cycling, fishing, gardening, a consulting business and getting used to being called "Grandpa" for the first time. Gene is taking time out of this busy schedule to write of his recollections over an outstanding career at the Institute. The *Virginia Wetlands Report* is pleased to print the first of his reminiscences in this issue. Look for additional articles in the future.

to establish a wetlands board to act on wetland permits. It seemed logical, that each political unit that had or had the potential to set up a wetlands board should have it's own wetland inventory.

We decided that the marshes should be mapped on the scale of 1:24,000 so that inventory could be used in concert to USGS Topographic Maps. Topo maps also had wetlands, particularly, tidal marshes delineated. The newer the map, the more accurate the delineation could be. However,

The Virginia Wetlands Report is a quarterly publication of the Wetlands Program at the Virginia Institute of Marine Science of the College of William and Mary. Subscriptions are available without charge upon written request to: Wetlands Program, Virginia Institute of Marine Science, P.O. Box 1346, Gloucester Pt, VA 23062 USA. *Address corrections requested.*

Program Director:

Dr. Carl Hershner

Head, Wetlands Advisory Program:

Thomas A. Barnard, Jr.

Produced by:

VIMS Publication Center

In this Issue:

Through the Years in
Virginia's Wetlands: The 1970's 1
Atlantic White Cedar 3
A Summary of
The EPA Rapid Bioassessment
of Wetland Health Workshop 4
Northern Water Snake 5
Shoreline Situation Report Update ... 6
Book Review 7
Calendar of Upcoming Events 8

This report was funded, in part, by the Virginia Institute of Marine Science and by the Virginia Coastal Resources Management Program of the Department of Environmental Quality through Grant #NA97OZ0181-01 of the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resources Management, under the Coastal Zone Management Act, as amended.



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preliminary fieldwork revealed that a ground truthing was necessary because many marshes existed that were not found on the topos. Recent imagery helped this problem, but up to date imagery was not always available or was incomplete for a given political unit. When aerial photos were available the resolution was often less than desirable. With maps, aerial photos, binoculars, notebook, and a range finder, we would load a trailer boat with a makeshift wooden observation tower, towed by a well-worn Chevy CarryAll, and strike out to all areas of tidewater Virginia.

Our first inventory target was Mathews County. At this point in time, I don't recall why we chose Mathews, but it may be the wetlands board knew the law mandated an inventory and asked us to do it. If this was the case, the request either impressed us or shook us from our 'how are we going to do this' attitude to a "get to work" attitude. We were a sight at boat ramps and on the water, often answering questions on what we were doing and trying to ignore stares from watermen.

As technology improved, we were able to use a Zoom Transfer Scope (ZTS, borrowed from the VIMS Geology Division...remember we did not have funds to inventory wetlands) to transfer interpreted wetlands from aerial photos to topo maps. The ZTS was a huge, clunky apparatus that weighed a ton and displaced floor space of a small office. USGS 7.5 minute topographic maps were generally reliable, but some of them were somewhat dated and did not show all wetlands. Once the sites were traced on field maps, we could take them into the field in various weather conditions without the worry of ruining borrowed imagery. In addition to estimating location, area (acreage) and configuration of individual marshes, we estimated coverage of vegetation types and species. Indicator vegetation, a major component of tidal wetlands, is a defining entity in describing and delineating these estuarine ecosystems. The Wetlands Act lists species of wetland plants that occur in tidal wetlands of Virginia.

A VIMS report titled, *Coastal Wetlands of Virginia* by Marvin Wass and

Thomas Wright (1969 Interim Report), based much of their wetland descriptions on vegetation communities and individual plant species. Later, VIMS reports went further and described twelve tidal marsh communities, based primarily on vegetation changes in regard to differences in salinity and elevation in *Local Management of Wetlands, Environmental Considerations* (Marcellus, Dawes and Silberhorn, 1973) and *Coastal Wetlands of Virginia, Interim Report No.3* (Silberhorn, Dawes and Barnard, 1974). This report was the basis for the Wetlands Guidelines that were promulgated and printed by the Virginia Marine Resources Commission and have been revised and reprinted several times since.

The wetlands inventory project continued working in Lancaster County after Mathews County was finished. Mathews and Lancaster counties Tidal Marsh Inventory Reports were printed in 1973 and later reprinted in 1983.

Through the 1970's and continuing to the early 1990's, other VIMS wetland personnel authored or coauthored various tidal marsh reports including, George Dawes, Tom Barnard, Ken Moore, Walt Priest, Sharon Dewing, Art Harris, Joe Mizell, Andy Zacherle, Damon Doumlele, and Jim Mercer. All the inventory veterans, the adventures and miss-adventures that we had are fondly remembered.

The wetlands boards, planning commissions, and interested others utilized the reports over the years. Today the reports are archived on the VIMS Library Website, thanks mainly to Chuck Mc Fadden, Library Director.

Inventory of coastal resources is still an ongoing process at VIMS as evidenced by the Comprehensive Coastal Inventory Program, headed by Marcia Berman. Wetlands inventory has expanded to watersheds and shorelines as well. This is all done more efficiently and more accurately through the utilization of advanced electronic technology. These tools were not available to us in the early 1970's. However, field work (groundtruthing), still remains an important component of these projects.

Look for recollections on various topics in the future issues of the Newsletter.

Atlantic White Cedar

Pam Mason

At lantic white cedar lumber is light weight, easily worked, rot resistant, resistant to shrinkage and warping, and has a pleasant fragrance. These characteristics promoted the early, and extensive harvest of the species and contribute to the continued importance as a timber crop today.

Commercial harvest of cedar currently centers around southern New Jersey, North Carolina and Florida. However, scientific understanding of the unique ecological functions of Atlantic white cedar, including water quality improvement and habitat for birds, small mammals and amphibians, has brought attention to the importance of the species beyond its use as a forest product.

Atlantic white cedar, *Chamacyparis thyoides*, is an evergreen conifer which grows to heights of 40 to 70 feet. Cedars grow in mostly monospecific stands and are found mainly in the coastal plain from southern Maine to Florida, with some distribution along the Gulf Coast. Cedar habitat is low, flat nontidal wetlands (Silberhorn, 1995). The cedar is classified as an obligate wetland plant.

The largest stands of Atlantic white cedar found in Virginia, both historically and today, occur in southeastern Virginia in the area of the Dismal Swamp. In colonial times, the Dismal Swamp Land Company was organized in the middle 1700's by prominent land speculators, including George Washington to make economic use of the Swamp. The Land Company built ca-

nals to transport lumber and promote drainage. Cedar was the most commonly harvested timber. While the primary use for the cedar lumber was shingles, studs for shipbuilding, housing and fencing were also a common use. Companies other than the Land Company, and individuals, notably

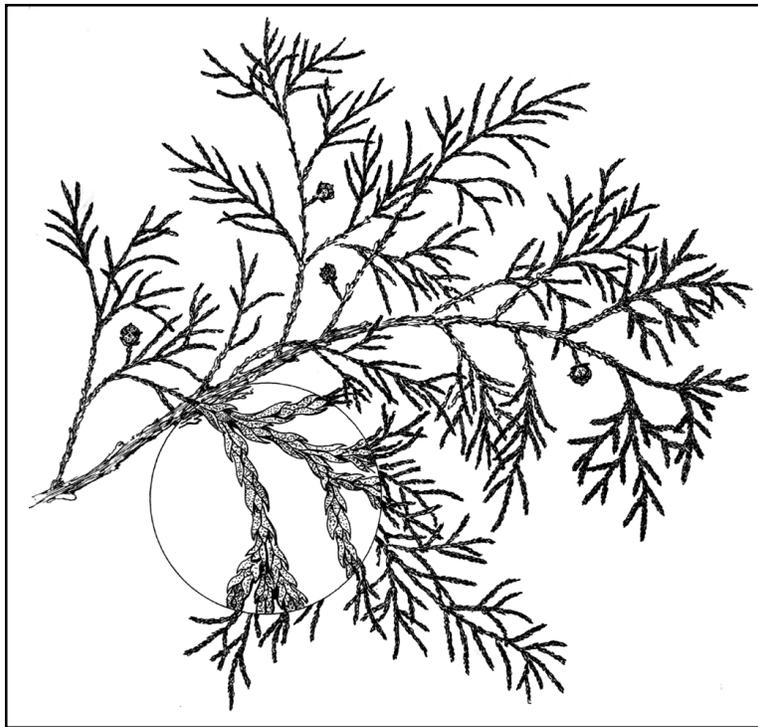
lina and New Jersey are focused on the restoration of Atlantic White Cedar. Some restoration efforts have met with moderate success. Investigations continue to look at natural regeneration, seed propagation, and seedling and steckling (rooted cuttings) planting in combination with deer fencing and

herbicide application in order to identify effective restoration approaches (Kuser and Zimmermann, 1995). Other studies are focused on gaining a better understanding of the ecology of Atlantic white cedar in order to aid restoration efforts (USEPA Atlantic white cedar restoration project, <http://www.cnu.edu/cedar/home.html>).

The establishment of Atlantic white cedar is only one of many wetland restoration efforts underway in the United States and worldwide. It is the primary goal of these programs to restore ecological functions, including habitat, flood buffering, nutrient cycling, etc.

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Atlantic White Cedar. Artist: Kent Forrest. From Silberhorn, *Common Plants of the Mid-Atlantic Coast*. Johns Hopkins

farmers working off season, also participated in the cedar harvesting. As early as the 1830's cedar shortages became apparent forcing the need to continually locate new stands. The invention of shingle producing machines further contributed to the demise of the cedar population. (Peter, 1979).

The estimated result of centuries of harvest, hydrologic modification and fire suppression is a reduction in the Virginia population by as much as 98% and a 90% loss in North Carolina. Research efforts in Virginia, North Caro-

A Summary of The EPA Rapid Bioassessment of Wetland Health Workshop

Rebecca Jo Thomas

The national meeting of the U. S. Environmental Protection Agency's Biological Assessment of Wetlands Workgroup (BAWWG) in partnership with the Izaak Walton League of America, Inc. was held in Orlando, Florida, May 14-16, 2001. The three day conference entitled "Assessing the Health of Wetland Life: Policy, Science and Practice" provided a full day of focus on each aspect.

Policy speakers ranged from county, tribe and state officials to the head of EPA's Wetland Monitoring Strategy, Doreen Vetter. Ms. Vetter explained that the objective of BAWWG was to improve methods and programs to assess the biological integrity of wetlands. Ms. Vetter further explained EPA's support of this effort in that the development of a wetland monitoring program is one of the five core elements of EPA's comprehensive wetland program. To this end, EPA plans to fund monitoring pilot projects at a rate of one state/region/year and one tribe/region/year, with all states having a wetland monitoring strategy by FY02 and a program under development by FY06. Additionally, EPA plans to establish two regional monitoring workgroups per year to provide the states and tribes with technical guidance in defining the elements of a wetland monitoring program with the focus on biological, physical, and landscape measures. EPA's Wetland Program Development Grants will also provide support to develop training in these assessment techniques.

The science discussion focused on the value of bioassessment, the scheme for developing metrics and indices of biotic integrity (IBIs), and the importance of incorporating the human disturbance gradient into the reference sites. Specific methods for different biological assemblages including amphibians, algae, vascular plants, birds, macroinvertebrates, and fish were dis-

cussed in concurrent sessions. These methods were also distributed to attendees in a draft version of EPA's publication 843-B-00-002 entitled "Methods for Evaluating Wetland Condition."

Dr. Jim Karr of the University of Washington defined bioassessment as the process of sampling the organisms of a site and using the character of the sample to evaluate the health of the system. The biota of a site can be used to define 1) a benchmark – a minimally disturbed site, 2) a guide – evaluation over time to determine the extent of improvement, or 3) a goal – to protect pristine biota. As the goal of the Clean Water Act is to protect public interest in water resources, bioassessment provides a method to reach this goal.

Dr. Karr along with Naomi Detenbeck (EPA) and Dr. Denise Wardrop (Penn State University) detailed the basic steps in developing IBIs. Step 1 is to decide which of the biological assemblages will be used in the assessment. Table 2 in the draft module "Introduction to Wetland Biological Assessments" provides a list of strengths and weaknesses for each of the biological groups to facilitate choosing ones that are appropriate for your focus and abilities.

Step 2 is to identify wetlands to be used as reference sites and to classify them as well as the wetlands of interest. Ms. Detenbeck discussed a variety of classification schemes including geographically based systems with fixed boundaries such as watersheds, environmentally based systems such as habitat zones, and hydrologic based systems such as hydrogeomorphic regions. She emphasized that both the reference and test sites should be classified under the same system and that an IBI should be developed for each class within the system. Dr. Wardrop also recommended that the reference sites included in the IBI development should portray a range along a human

disturbance gradient. The method used to determine this gradient includes observation of activities or stressors in proximity of the wetland, applying a weighting factor to these stressors, and combining this factor with buffer type and width in calculating a value of disturbance.

Step 3 is to select appropriate metrics or attributes that will be readily assessed at each site as well as provide the most pertinent information. Candidate metrics for each biological assemblage are included in the method modules. Several metrics should be evaluated to determine those that provide the most difference between sites with varying levels of disturbance. This analysis will enable the metric results to better predict the level of disturbance in the test wetland. An example of a potential macroinvertebrate metric used to predict wetland health includes population density. This metric, however, is not a good indicator of disturbance in that there could be a lot of midge larva indicating high density but these organisms are pollution tolerant. Conversely, percent species that are clingers is a good metric to use because their population would decrease in response to an increase in sedimentation caused by human disturbance.

Step 4 is to develop and standardize the rapid sampling protocols. Examples of such protocols are included in the method module for each biological assemblage. These protocols should then be compared to full-scale reference site evaluations to analyze the predictability of the rapid assessments. The standard protocols would then be used to assess the health of wetlands of interest.

The BAWWG conference concluded with a practice session at the Orlando Easterly Wetlands, which is a

Continued on page 8



Wetland Denizens

Northern Water Snake

Nerodia sipedon sipedon

William Roberts

Our wonderful State of Virginia in the summer time; hot sunny days, cool evenings and plenty of places to swim and cool off! Until someone yells: “WATER MOCCASIN!” The once tranquil scene is immediately transformed into pandemonium, driven by the knowledge that “the last man out of the water might get bitten!”

Sometimes its good to look like something else. Various organisms in nature have successfully used mimicry as a protection strategy for eons. Mimicry is a normally successful strategy, unless you happen to be our subject this month, the Northern Water Snake, *Nerodia sipedon*. In what might be termed an environmentally bad deal *Nerodia*, to the untrained professional, looks just like the water moccasin and consequently ends up in first place on a very short list of snakes to be exterminated!

The northern water snake, *Nerodia sipedon sipedon* is an interesting species of nonvenomous snake found in the coastal plain of Virginia. A moderate to large size, thick-bodied snake, it may approach 50-55 inches in length. There are several other species of *Nerodia* found in the coastal plain, but the species *sipedon sipedon* is the most common of the watersnakes. While not venomous, it is an aggressive snake which

when cornered or threatened will coil in the familiar rattlesnake fashion and strike repeatedly at its tormentor. The bite, while not deadly is quite painful and will bleed profusely due to the anticoagulant found in the snake’s saliva.

From a coloration perspective, *Nerodia* is an extremely variable species and may be brown, tan, gray or reddish in color. The neck and anterior body section typically have dark crossbands while the remainder of the body has dark blotches on the top

(dorsal area) and alternating bands along the sides. The ventral surface is white, yellowish or light gray in color with 2 irregular rows of brown or reddish half-moon-shaped spots frequently outlined with dark or black borders. The variable dorsal colorations and patterns are especially prominent in juveniles and young adults.

Unfortunately for *Nerodia*, it resembles the venomous water moccasin or cottonmouth, *Agkistrodon piscivorus* at many stages throughout its life cycle. When young, the variable dorsal patterns of blotches and bars resemble

those of the water moccasin. As it grows older, and consequently gets longer and thicker, these colorations and patterns so distinctive when younger are often obscured as the snake turns dark gray or often black in color. *Nerodia* often appears too similar for comfort to the venomous cottonmouth water moccasin, which also can be very dark in color as it ages.

Nocturnal in nature, *Nerodia* spends most of the day either warming itself in the sun while lying on rocks bordering a body of water or beneath rocks in the shade during the hottest part of the day. *Nerodia* is a predator of fish and small amphibians. Research has shown that trout, sunfish, pike, bass and sculpins as well as



Continued on page 8



Geographic Information System

Shoreline Situation Report Update

Marcia R. Berman

Shoreline Situation Reports are being published by the Comprehensive Coastal Inventory Program (CCI) at VIMS. This series reports shoreline conditions for Tidewater localities in Virginia. Maps, imagery, and tables illustrate and quantify conditions in the immediate riparian zone, the bank interface, and along the shoreline. Land use, shore stability, bank height, and the location of erosion control structures are among a few of the many attributes surveyed. Global Positioning Systems (GPS) are used in the field to compute the geographic position of conditions observed from a shoal draft

boat. Geographic Information Systems (GIS) and image processing systems are used to process, display, and archive the data.

Publications are being distributed to the county planning offices, the local planning district commissions, the Virginia Marine Resources Commission, the Chesapeake Bay Local Assistance Department, the Department of Conservation and Recreation, Division of Soil and Water Conservation, and the Department of Environmental Quality, Coastal Resources Management Program. Plans are being made to distribute these documents to local libraries

as well. The GIS data generated for each locality completed is available on the VIMS website at www.vims.edu. The following counties are now available:

Essex County
King and Queen County
King William County
Lancaster County
Mathews County
Middlesex County
City of Poquoson

Piankatank River Watershed

VIMS Tidal Wetlands Workshop

July 18, 2001



Workshop attendees plant a tidal marsh on VIMS' beach, during the recent workshop. Eighty-four participants attended the annual event.

— Book Review —

Discovering the Unknown Landscape: A History of America's Wetlands

By Ann Vileisis

Published by Island Press, Washington, D.C. 1997. 433 pp.

US\$19.95 (softcover), ISBN: 1-55963-315-8

Review by Tom Barnard

Since I was reading this book not only for my own general consumption but also as a reviewer for this newsletter, I had promised myself that I was going to treat this book differently, that I was going to do more than just begin reading at Chapter 1, page 1. So I found myself studying the cover which bears the Martin Johnson Heade painting of a Florida landscape at sunset and thinking about why the author might have chosen the title she did. Who was Ann Vileisis anyway? I had never heard of her. O K, according to the back cover she was a Yale graduate in Environmental History. A historian.....writing about wetlands? I moved gingerly past the title page, the dedication, the contents page and stopped at the preface. And there it was, confirming all my fears; a definition of wetlands.....but from The American Heritage Dictionary! Surely only a non-wetlander would use such a definition! I made a mental note of my disappointment, read the Preface and moved on to Chapter One.

My initial disappointment however turned out to be very short-lived, for Chapter One opened not with a history lesson but with the author's recollection of her early childhood impressions of the marshes of Long Island Sound and then a college ecology class field trip where a manipulated New Jersey marsh dispelled many of her preconceived ideas about wetlands. I began to sense that this might not be a pure historian writing this book after all. I soon found myself enjoying this well-written book very much, as Ms Vileisis has eloquently combined the geography, history, ecology and sociology involved with the emergence of this new nation, the exploitation of its bountiful resources and the role played by wetlands in this "New World" landscape.

In a very readable writing style she weaves together a tapestry displaying the paradoxical attitudes Americans have had and maintain today toward wetland systems. Attitudes that range from the moral virtues of wetlands as seen by Henry David Thoreau and Gene Stratton Porter, to the evil characterization of swamps by southern politicians of the mid-nineteenth century who termed them pestilential or claimed they were prolific of disease and inflicted a curse. Others could only see the wetlands as standing in the way of progress. Agrarianism endured and all landscapes, not just the wetlands, were evaluated only in terms of their cultivability. It is very much to the author's credit that she is able to combine the role of wetlands in the economic development of this struggling young nation with a clear understanding of the impacts to wetland ecology and how these impacts then affected all aspects of American life over time. This is what makes the book truly rewarding to anyone with an interest in understanding the motives, attitudes, perceptions, politics, economics, etc. that have resulted in the loss of over half the original wetland acreage in the continental United States.

Perhaps one of the most disturbing chapters in this very well documented book is number nine which deals with the conflicting roles, policies and attitudes in the government agencies. By the 1930's people had begun to see the effects on the landscape of wetland destruction and realized that long-standing attitudes had to change. Franklin Roosevelt's Civilian Conservation Corps (CCC) was famous for planting a million trees on cutover and erodible areas but was also responsible for retraining more than a million and a

half acres of wetlands in the south and ditching 248,000 acres of tidal wetlands in Delaware. The Corps of engineers and the Soil Conservation Service continued to dam, levee and drain wetlands that the Fish and wildlife Service was spending duck stamp money to restore. Even when science eventually demonstrated the natural services and values of wetlands, leading to changes in official policies promoting their protection, the bureaucracy was very slow to change the ingrained attitudes which in the past had encouraged wetland drainage and destruction.

As I read through the final chapters of this history dealing with the post war boom years, the rise of the environmental movement, the Reagan years, "no net loss," the development of wetlands protection in state and federal law, etc., I was amazed at how the author presented the material in a non-judgmental yet highly engrossing fashion. Not since the first time I began reading Stewart Udall's *The Quiet Crisis* have I enjoyed a book of the environmental history genre as I did this one. I have already given you many of the reasons why you should read this book. No matter your attitude toward how our wetlands have been managed since colonial times, this book will help you understand why history has played out as it has with this segment of the natural landscape and may well adjust your perspective toward wetlands conservation. Above all, this book will make you think about the lessons of history it describes and how the nation should approach the use of our remaining wetland resources. I recommend it highly for history buffs but particularly for all "wetlanders."

Calendar of Upcoming Events

- Oct. 29-Nov. 2, 2001** **Wetlands Regulatory Workshop**, A closer look at contemporary wetland regulatory issues. Atlantic City, NJ. Contact Ralph Spagnolo (3ES30), USEPA Region III, 1650 Arch Street, Philadelphia, PA 19103-2029. Email: spagnolo.ralph@epa.gov
- January 6-9, 2002** ***Phragmites australis*: A Sheep in Wolf's Clothing?** Vineland, NJ
Contact Dr. Michael P. Weinstein, New Jersey Marine Sciences Consortium, Bldg #22, Fort Hancock, NJ 07732. Ph. 732-872-1300, Ext. 21. Email: mweinstein@njmsc.org
- VIMS Short Courses:**
- Sept. 12-14, 2001** **Wetland Mitigation/Compensation.**
Contact Bill Roberts at (804) 684-7395 or email: wlr@vims.edu
- Dec. 13&14, 2001** **Winter Botany.** Contact Bill Roberts - see above.

A Summary of The EPA Rapid Bioassessment of Wetland Health Workshop *continued from page 4*

water reclamation facility, constructed on a cattle pasture in the 1980s. Three stations were set up for demonstrating the rapid methods of evaluating vascular plants, benthic macroinvertebrates and algae assemblages. These demonstrations showed the ease and quickness of these types of evaluations while affirming their viability in the assessment of wetland health. Although these IBI bioassessment methods are still in the comment stage they will be available to the public in the near future. Please visit webpage <http://www.epa.gov/owow/wetlands/bawwg> for more information.



Northern Water Snake *continued from page 5*

minnows are part of its diet. Almost every species of aquatic frog and salamander found in *Nerodia*'s range can end up as a meal. All prey are swallowed whole and digested by the snake's strong digestive secretions. In turn, *Nerodia* is preyed upon by the eastern kingsnake, raccoons, largemouth bass and snapping turtles. Blue herons have also been known to utilize *Nerodia* for food.

Biologically speaking, a snake, or serpent, is a limbless reptile with expandable jaws and slender recurved teeth. Snakes have no ear or ear opening, but are able to "hear" by means of vibrations that are picked up, not through the air, but through the ground. A snake constantly flicks its tongue to capture small airborne particles that give it a sense of taste and smell. Its sense of smell is excellent. Snakes don't have a moveable eyelid and their eyesight is generally very good. Larger in length and weight, the female gives birth to approximately 15-30 live young in August to October. The northern water snake is found in a wide variety of aquatic habitats in Virginia. In the nontidal western part of the state *Nerodia* is found in lakes, ponds, rivers and ditches. Here in the eastern coastal plain it is found in tidal creeks, brackish

and salt water marshes and any low, wet area.

There are several important clues that can be used to correctly identify whether or not the snake you are confronting is indeed the harmless northern water snake of the venomous cottonmouth water moccasin:

First and foremost, *Nerodia* is NOT a pit viper (venomous snake) and therefore does not have a pit or opening located between the eye and the nostril.

Second, the eye or pupil of *Nerodia* is round; the water moccasin has a slit-like pupil.

Third, the head of *Nerodia* is shaped like that of a worm, it is rounded, somewhat like your thumb; the head of the water moccasin is flared, or triangular-shaped and is flattened.

Fourth, when *Nerodia* is swimming, only its head is out of the water; a water moccasin swims with its body floating on the surface.

Finally, if you see the snake living in brackish or salt water or in a saltmarsh it is probably *Nerodia*; the water moccasin does not tolerate brackish or salt water very well. The cottonmouth water moccasin is generally not found north of the James River watershed.