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United States v. Wilson: Muddy Waters in the Search for Wetlands Protection

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A recent 4th Circuit case, *United States v. Wilson*, is attracting attention because of the fear it may threaten the power of the U.S. Army Corps of Engineers to regulate dredging and fill activity in isolated wetlands and because the 4th circuit includes much of the Chesapeake Bay watershed. *Wilson* does little to clarify the extent to which isolated wetlands receive federal protection, and the decision may result in future rulings adverse to conservation interests. However, a close reading of the case along with prior decisions on isolated wetlands reveals that *Wilson* is probably not the revolution in wetlands jurisprudence that some suggest.

James J. Wilson is CEO of a company called Interstate General and a general partner in St. Charles Associates, which is constructing an 80,000-resident planned community in Charles County, Maryland. In 1996, a federal district court convicted Wilson, Interstate General, and St. Charles Associates of four felony counts under the Clean Water Act. Wilson was sentenced to 21 months in jail and a \$1 million fine. The two other defendants were fined \$3 million and placed on probation. The district court found that the defendants had dug ditches on several parcels of the development that qualified as wetlands, then deposited dirt and additional fill next to the ditches, a practice known as sidecasting. Because the court found

they knowingly discharged fill material onto wetlands without a permit, the conviction carried criminal penalties.

Last December, the 4th Circuit Court reversed the conviction on appeal in *United States v. Wilson*.¹ While the *Wilson* opinion contains three significant rulings, the most important one turns on the current scope of federal power under the Commerce Clause, the constitutional provision that allows Congress to supersede state authority and regulate a host of activities related to "interstate commerce."²

Most federal environmental statutes, including the Clean Water Act, are enacted under the authority granted to Congress by the Commerce Clause. In 1995 the Supreme Court dealt the first significant blow to Congress's broadly defined Commerce Clause power in six decades when it struck down the Gun-Free School Zones Act of 1990 in *United States v. Lopez*.³ In *Lopez*, the Court reiterated the traditional three-part test for evaluating Commerce Clause cases. Federal legislation will be upheld under the Commerce Clause: 1) when the subject of the regulation is using the channels of interstate commerce; 2) when the subject of the regulation is itself in interstate commerce; and 3) when the subject of the regulation has a "substantial relation to" or "substantially affects" interstate commerce. The government argued that the Gun-Free School Zones Act was valid under the

third prong of this test because guns in schools harm the educational process by threatening the learning environment, and because educational quality significantly affects interstate commerce. The *Lopez* Court rejected that reasoning and held the Act to be unconstitutional because it did not regulate economic activity, it attempted to regulate guns that had not traveled interstate, and it infringed on the traditional authority of the States in the area of education.

The *Lopez* decision has been invoked by litigants in at least 40 recent cases in an attempt to invalidate federal legislation, including environmental measures such as the Eagle Protection Act and the Endangered Species Act⁴. The courts have consistently declined to apply *Lopez* and strike down the statutes, but the *Wilson* case signals a departure from that trend and indicates that the 4th Circuit is willing to use *Lopez* to limit regulations based on federal statutes.

Like the legislation in *Lopez*, the Clean Water Act (CWA) derives its constitutional validity from the third "substantially affects" prong of the Commerce Clause test. The statute gives the federal government authority to regulate waters of the United States. In turn, the CWA gives the Army Corps of Engineers permitting authority over the discharge of dredged or fill material into U.S. waters. A Corps regulation defines "waters of the

United States” to “include those waters whose degradation ‘could affect’ interstate commerce.”⁵ The defendants in *Wilson* argued that their parcels were not wetlands, and that the Corps’s

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regulation exceeded the authority of both the CWA and the Commerce Clause because it purported to cover wetlands that could affect, rather than those that substantially affect, interstate commerce. Two judges on the 3-judge panel agreed and held the regulation to be invalid.

Judge Niemeyer, writing for the majority, found the Corps’s definition flawed because there was no clear evidence that Congress intended the regulation to be interpreted so broadly. While the decision does not reach the issue of the constitutionality of either the regulation or the CWA itself, it contains dicta (non-binding commentary) indicating that “constitutional difficulties” might arise if the CWA was extended to cover “waters that are connected closely to neither interstate nor navigable waters, and which do not otherwise substantially affect interstate commerce.”⁶ Judge Niemeyer concedes that a 1985 Supreme Court ruling upheld Corps regulations that defined waters of the United States to include wetlands “adjacent to” waters of the United States,⁷ but he points out that the Supreme Court did so explicitly in the context of a wetland that actually abuts on a navigable waterway. Thus the *Wilson* decision restricts the application of the CWA to wetlands that are adjacent to other navigable water bodies or that have a substantial effect on interstate commerce. The decision invalidates the regulatory definition because it gives the Corps permitting authority over “intrastate waters that need have nothing to do with navigable or interstate waters.”

The question remaining for wetlands managers, developers, and conservationists in the 4th Circuit is to what extent isolated wetlands are covered by the CWA after *Wilson*. The 3-judge panel did not decide the constitutionality of the CWA, and the opinion does not illuminate the distinction between wetlands that “could affect” interstate commerce and wetlands which “substantially affect” it. The decision notes only that Congress can regulate discharges into waters that substantially affect interstate commerce; that Congress can presumably

regulate discharges “into non-navigable waters to the extent necessary to protect the use or potential use of navigable waters as channels or instrumentalities of interstate commerce;” and that Congress can arguably regulate non-navigable waters that flow into interstate waters.

While the decision may signal limits on the authority of the Corps over isolated wetlands in the 4th Circuit, the limits are far from clear and the issue of regulation of isolated wetland is far from settled. Some context for the *Wilson* decision is provided by a quick review of the section 404 caselaw across the country. Up to now, the courts have read “waters of the United States” to reach “a non[-]navigable stream, non[-]navigable, man-made mosquito canals, mangrove wetlands, sloughs, swamps, and similar wetlands, a pecan grove and pasture lands separated from the river by an earthen berm, [and] a disposal site for scallop shells separated from the river by a highway,” among other locations.⁸ Specifically, the current rule in at least three other circuits upholds the extension of regulatory jurisdiction to waters whose connection with interstate commerce was “potential rather than actual, minimal rather than substantial.”⁹ Since *Wilson*, at least one district court in Illinois has specifically rejected the *Wilson* approach of applying *Lopez* to the CWA.¹⁰

In conclusion, the concern over the *Wilson* case may be premature. While the court’s decision does question the Corps’s authority to regulate isolated wetlands, it does not depart from the traditional test for Congressional authority under the Commerce Clause. That test continues to be whether the regulations govern activity that substantially affects interstate commerce. Undoubtedly, regulators, developers, and conservationists would all benefit from much clearer guidelines on when isolated wetlands are considered to affect interstate commerce. As no such guidance was offered in the *Wilson* decision, the issue remains to be determined by clearer regulatory language or by future court decisions.

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Varied & Versatile Wetlands

Wetlands: A Critical Resource in the Revolutionary War?

Pamela Mason

The resource critical to the American Revolution, and indeed countless historic and current events, is iron. Thoughts about iron mining and production evoke images of black ore mined out of mountains and processed in huge city-sized factories. What, may you ask, do wetlands have to do with iron? Actually there are several types of iron ores which occur in different geologic settings. Due to some chemical properties of iron, one place it is commonly found is in wetlands and streams worldwide.

Iron is a common element in soils. In a reduced state, under anoxic conditions, it is soluble. As a result, water soaking through saturated soil leaches out the iron. When water laden with soluble iron is exposed to air (oxygen, specifically) the iron will come out of solution as a precipitate, or rust. This process may occur where groundwater discharges forming wetlands or streams. This iron ore is called bog iron. The scientific name for bog iron is limonite ($2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$). Limonite is brown in color. Pure limonite contains 59.8 percent iron (Britannica Online).

Current documentation dates the earliest known use of iron at around 1700 BC in eastern Europe. Given the relative ease of obtaining bog iron, it is likely that was a primary source for even the earliest use. Archeological research has provided insight into historical methods for smelting bog iron in ancient Rome, Africa and Norway. The ancient Norwegian method of using wood pyres to smelt and forge iron was used until relatively recent times by farmers to make farm tools (Heath 1998).

In the Pine Barrens of New Jersey, iron rich groundwater perks aboveground forming the intricate stream and river network of the region. The soils in the Pine Barrens are very sandy, and where the iron oxidizes on the stream beds, it acts to cement the sandy soils together. The sand iron

composite is relatively easily dug from the creek beds. Besides the bog iron, two resources necessary for smelting iron are also readily available in the Barrens: limestone flux (from seashells) and charcoal from the pinewoods. Bog iron, seashells and an abundance of wood fueled the American Colonial iron industry in the Pinelands. Pineland foundries supplied cannon and shot for the American Revolution and the War of 1812. As many as 30 forges ran day and night to provide ordinances for the Wars. Bog iron smelting and forging continued in the Barrens until the mid-1800's, supplying nails, tools, kettles and cook stoves to markets from Philadelphia to New York (McPhee 1968). Other Colonial locales had the necessary raw materials to produce iron, and furnaces sprang up in places like eastern Massachusetts and on the Delmarva peninsula. The demise of the foundries came with the discovery of magnetite iron ore (with a higher percentage of iron) and anthracite coal in the mountains of Pennsylvania. Most of the early American forges, and the towns they created, have disappeared. However, two notable restoration efforts, Furnace Town in Worcester County on Maryland's Eastern Shore and Batsto in Burlington County in the New Jersey Pinelands, have been undertaken to preserve the history of early American iron production.

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Footnotes:

- ¹ *United States v. Wilson*, 133 F.3d 251 (4th Cir. 1997)
- ² U.S. Const. Art. I, §8, cl. 3 (giving Congress power "[t]o regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes").
- ³ *United States v. Lopez*, 514 U.S. 549, 115 S. Ct. 1624, 131 L.Ed.2d 626 (1995)
- ⁴ William Funk, *The Lopez Report*, 23-SUM Admin. & Reg. L. News 1.

- ⁵ Definition of Waters of the United States, 33 C.F.R. §328.3(a)(3) (1993).
- ⁶ *United States v. Wilson*, 133 F.3d 251, 257 (4th Cir. 1997)
- ⁷ See 33 CFR § 328.3(c), which reads: The term 'adjacent' means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are 'adjacent wetlands.'
- ⁸ treatise on CWA, page 336-337 (find cite)
- ⁹ *Hoffman Homes, Inc. v. EPA*, 999 F.2d 256, 260-261 (7th Cir.1993); *see also*, *Leslie Salt Co.*

- ¹⁰ *United States*, 896 F.2d 354, 360 (9th Cir. 1990) (holding that the commerce clause power and thus the CWA is broad enough to extend the Corps' jurisdiction to local waters which may provide habitat to migratory birds and endangered species); *see also*, *Utah v. Marsh*, 740 F.2d 799 (10th Cir. 1984) (lake subject to federal commerce clause jurisdiction because it was on the flyway of several species of migratory waterfowl).

Wondering about Wetlands

William Roberts

Q What kind of educational courses and publications does the Wetlands Program offer?

A As part of its mandate under the Tidal Wetlands Act of 1972 and other sections of the Code of Virginia, the Wetlands Program at VIMS is charged with developing and presenting educational programs about important topics in wetland resource management. These programs are designed for members of local wetland boards, state resource managers, county planning staff, coastal resource managers, waterfront property owners, marine contractors and interested citizens or citizen groups. The goal is to help insure balanced and consistent decisions regarding the management of the Commonwealth's aquatic resources.

The wetlands staff has devoted a great deal of time and resources to developing several different types of educational program offerings.

You are now reading one type of educational offering, *the Virginia Wetlands Report* (VWR), a thrice-yearly publication composed of continuing natural resource articles and featuring important topics facing resource managers. Through reading the VWR subscribers are able to keep abreast of the latest issues about impacts to the Chesapeake Bay ecosystem and learn more about specific topics of interest. In conjunction with the VWR, the wetlands program periodically publishes Technical Reports

which address, in some detail, current topics tied to the management of the Commonwealth's wetland and other natural resources. Recent reports about ecotourism, avian cholera and wetland mitigation protocols are a few of the topics discussed. For the botanist, the six per annum, Wetland Flora Techni-

each year the agenda for upcoming courses is listed in the Winter issue of the Virginia Wetlands Report and pre-registration is requested to help our staff in preparing for each course. The next offering, and the last for 1998, will be a two day course (December 16 and 17) in Winter Botany held at the VIMS campus in

Gloucester Point and designed to provide the basic skills needed to identify trees and shrubs in a leafless or winter condition.

Once each summer, the Wetlands Program offers another education event; a one day seminar which addresses tidal wetland related topics in the morning and provides a field learning experience that afternoon. This seminar is held on the VIMS campus and is designed for the general public as well as resource managers.

One of the more recently developed and popular educational tools is the Self-Taught Educational Unit, designed for the convenience of those individuals who may not be able to

attend our formal seminars or courses due to work or travel conflicts or those who simply prefer to work at home at their own pace.

Presently there are 8 Self-Taught units, each of which contains a video presentation about one of the specific topics listed in the box above. Each unit contains explanatory text and a self-administered examination which can be returned to the Wetlands Program for correction. The corrected

Summary of VIMS Wetlands Program Courses and Materials

Educational Publications:

The Virginia Wetlands Report- 3x/year
Wetland Technical Report- quarterly
Wetland Flora Technical Report- 6x/year

Educational Courses:

Wetland Identification and Delineation- 4 days
Wetland Mitigation and Compensation- 3 days
Wetland Plant Identification- 3 days
Winter Botany- 2 days
Tidal Wetlands Seminar- 1 day

Self-Taught Educational Units

Coastal Resources: Definitions and Jurisdictions
Coastal Resource Management in Virginia
Wetland Compensation and Mitigation
The Role of the Wetlands Board and Operational Procedures
Wetlands Ecology
Wetland Functions and Values
Coastal Structures
Human Activities, Impacts and Alternatives

cal Reports provide detailed descriptions of the ecology and taxonomy of wetland trees, shrubs and herbs native to the coastal zone of Virginia.

Another type of educational program is the annual wetland education courses offered throughout the calendar year. These courses range in length from 2 to 4 days and are designed to provide basic information and develop basic skills in wetland plant identification, wetland delineation and coastal resource management. In February of

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— Feathers & Fins —

Tundra Swan

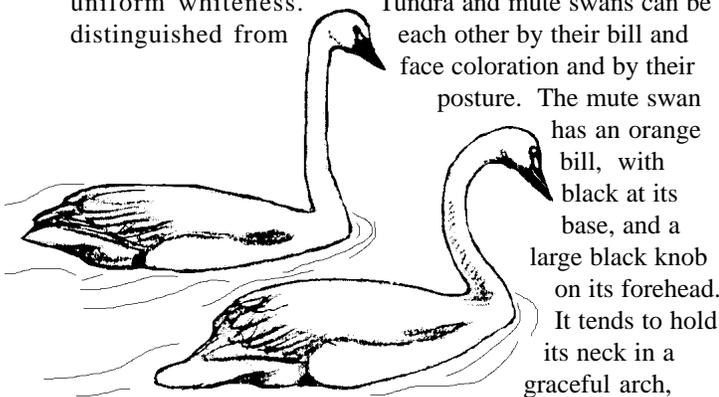
Cygnus columbianus

Julie Bradshaw

For some observers, the tundra swan, also known as the whistling swan, is symbolic of winter along marsh creeks in the Chesapeake Bay. The swans breed on the Arctic tundra, and winter in two distinct populations. The western population spends its winter along the Pacific coast from Vancouver to the San Francisco area, and along inland rivers and the Great Salt Lake. The eastern population winters along the Atlantic coast from New Jersey to South Carolina, with the Chesapeake Bay and North Carolina sounds being particularly important areas. The swans arrive in the Virginia portion of the bay in late October or November, and can be seen here until April.

Tundra swans, although large birds (47-58 inches in length, 6-7 foot wingspan), are the smallest of the North American swans. The other native swan, the trumpeter, found on the northwestern part of the continent, can reach a length of 72 inches, with an 8 foot wingspan. In addition to the tundra swan, waterfowl watchers in Virginia may also see the mute swan, which is a Eurasian species that was introduced to the U.S.. Although probably introduced as an ornamental “pond swan” in the mid-1800’s, the mute swan has naturalized, developing some wild populations, including a group which breeds in the Chincoteague area.

Swans are fairly distinctive due to their large size and uniform whiteness. Tundra and mute swans can be distinguished from each other by their bill and face coloration and by their posture.



The mute swan often swims with its secondary wing feathers arched over its back. The tundra swan has a black bill, with a small yellow patch near the eye. It holds its neck erect and its bill level and does not arch its wing feathers over its back. From a distance, the tundra swan might be confused with two other large white bird species which are present in Virginia: the white pelican and the

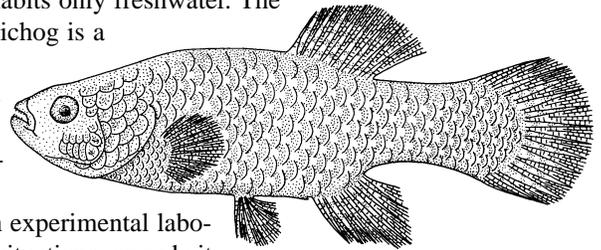
Mummichog

Fundulus heteroclitus

Lyle Varnell

The mummichog is an abundant and important member of the aquatic estuarine community. It is a member of the family Cyprinodontidae which includes various minnows (such as the sheepshead minnow, Virginia Wetlands Report, Volume 13, Number 1, Winter 1998), and other killifishes (such as the striped killifish, Virginia Wetlands Report, Volume 13, Number 2, Summer 1998). In low salinity areas, the mummichog is commonly confused with the banded killifish (*Fundulus diaphanus*), which is similar in appearance but inhabits only freshwater. The mummichog is a

hearty species which is commonly used in experimental laboratory situations, or as bait in the recreational fishery. However, its importance to the estuarine ecosystem transcends its direct importance to man. *F. heteroclitus* is a key detritivore and secondary producer. It is preyed upon by larger fishes, wading birds, and some fish-eating ducks such as mergansers.



The mummichog is identified by its blunt head and dark and silvery bars on its sides. The side bars are generally more numerous in females than in males. The anal fin contains 10-12 rays. *F. heteroclitus* may reach a total length of about five inches with the females being generally larger than the males. The geographic range of the mummichog extends along the Atlantic and Gulf coasts from the Gulf of St. Lawrence to Mexico. It is most common in estuarine environments, but occasionally enters freshwater areas.

Mummichogs generally move in schools. In fact, the term “mummichog” is derived from a Native American term meaning “moving in crowds.” Schools frequent areas with mucky bottoms such as intertidal marshes, migrating with the tides. Winter months can cause migration to deeper Bay waters, or they may burrow up to 20 centimeters deep into the intertidal substrate for protection from the elements.

Spawning occurs from about April to August in the Chesapeake Bay. The eggs of *F. heteroclitus* are laid in empty shells, on debris, or on marsh vegetation. Larvae are attracted to light and will visit the surface in nearshore areas. Juveniles prefer vegetated intertidal and shallow water areas. “Yearlings” may spawn during late August. Other-

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Geographic Information System

Using Remote Sensing and GIS To Perform Jurisdictional Wetlands Determinations— Are We There Yet?

Marcia R. Berman

No we are not. Unfortunately, this frequently asked and debated question still has no resolution. There have been a number of forums, agencies, and individuals which have explored the potential to perform wetland delineations using remote sensing and GIS techniques to a level of accuracy which will satisfy a jurisdictional determination. The demand and interest for this is clearly high. However, there are still a number of significant obstacles in this application.

To begin, we must acknowledge that any GIS or remote sensing application requires data input. These data inputs can be digitized maps, or digital imagery from a remote sensor such as satellite imagery, or airborne camera. Since jurisdictional determinations require very precise boundary delineators, any data used must have a very high degree of positional accuracy. Here we find that existing data can not meet such standards.

Let's explore this in some detail. First, to develop a GIS application to determine jurisdictional wetland boundaries, we would need to have digital wetland data. What is available? The National Wetlands Inventory Program (NWI) has a nationwide wetlands coverage, most of which is now available in digital format. This program maps wetlands from color infra-red photography, and drafts the wetland boundaries onto a 1:24,000 basemap, whose boundaries are equivalent to the USGS 7.5 minute quadrangles. These maps are then digitized. NWI's rigorous quality control programs insure a relatively accurate product for most wetland types. However, despite their confidence, even NWI cautions the use of their materials for performing jurisdictional determinations, and recommends consultation with local leaders where other wetland determinants may need consideration. In addition, NWI data may not include wetlands less than 1-3 acres in size. This could exclude a number of small site specific cases under deliberation. Finally, the digital NWI products can be outdated by as much as ten years for a given area.

Several federal agencies have used satellite imagery to delineate the boundaries of wetlands in specific regions of the USA. Programs such as NOAA's Coastal Change Analysis (CCAP) program, or EPA's Multi Resolution Landcover Characterization (MRLC) program are using Landsat satellite imagery with a resolution of 30 m². This

means that features in the landscape smaller than 30 m² can not be resolved. These types of spatial restrictions are acceptable for regional trends in wetland status, but not acceptable for jurisdictional determinations.

If we search hard enough we will ultimately conclude that no other "comprehensive" digital coverage of wetlands exists at scales or resolutions which are better than that reported for NWI. Nevertheless, *basemap* products are available at resolutions which approach 1 ft² through private companies, and the USGS digital orthophotography archive. These can be used to *create* a wetlands coverage. When purchased, however, they are merely ortho-rectified photography available as a digital product. Essentially, a digital photograph with map coordinates.

In a number of forums, these products have been discussed as a base for developing regional wetlands coverages for the Chesapeake Bay Program to conduct their status and trend studies. Individual states too, have explored this option. The obstacle here is cost. At this resolution, the products are very expensive, and the file sizes generated extremely large. For a Bay-wide coverage, the cost is prohibitive, especially when long-term repeatability (5 year cycles) is considered.

Nevertheless, for site specific projects, individuals can purchase these products from a variety of private firms. The cost is still high (ranges between \$70.00-\$200.00 per square mile of coverage), but when smaller areas are considered, this cost may not be prohibitive. Local governments have contracted for these base products, which generally have restricted use under licensing agreements with the vendor, and the jurisdictions are prohibited from distributing the products. Still, these are merely base products, and the wetland delineations are not inclusive. Trained remote sensing technicians skilled in vegetation detection would be required to actually delineate the boundaries. These would require ground-truthing, especially if legal questions are raised.

This is where our assessment of the current "state of the technology" is. To revisit the original question, "Has GIS and remote sensing technology advanced to allow us to perform jurisdictional wetland determinations?" At this time, with costs associated with high resolution data, and the limitations inherent in these data sources, the answer is probably "no."

Responding to the Chesapeake Executive Council Directive for Wetlands Protection and Restoration Goals

Dr. Carl H. Hershner

“By this directive, we reaffirm our commitments ... to take steps to achieve a net resource gain as a long-term goal for wetland restoration in the Chesapeake Bay basin, recognizing the role wetlands play in the overall health of the Bay and its living resources.*”

With this statement, the Chesapeake Executive Council, committed partners in the Chesapeake Bay Program to an aggressive effort to halt the loss of wetlands in the watershed, and to reverse the trend by restoring and creating wetlands. Virginia, Maryland, and Pennsylvania each committed to development of a jurisdiction-specific strategy for achieving net gain goals. The first iteration of this strategy is due in December of this year, with updates in 2000 and every five years thereafter. The states also agreed to identify quantifiable goals for a net gain in wetlands acreage and function by the end of 1999.

To assist states in development of their strategies for achieving net gain goals, the Bay Program Wetlands Workgroup developed a template for strategy content. The template is not intended to be a rigid outline for the state plans, but rather is designed to suggest content which would be useful in making the plans consistent across the watershed. The template suggests six elements.

The first element is a Goal and Objectives Statement for the state. The 1997 Chesapeake Bay Program Directive identifies a no net loss, net resource gain in both acreage and function goal. It is assumed that this

will be the starting point for each of the states.

Inventory and Assessment of Wetlands Resources is the second element recommended for the strategy. This section would provide a brief overview of the historic and/or current wetlands resources of the state. It provides a context for the no net loss/net resource gain goal, and may provide some rationale for targeting of management and restoration efforts (e.g. regional concentrations of losses of a particular type of wetland, or regional opportunities for restoration of certain types of wetlands).

Evaluation of Existing and Needed Protection Mechanisms is potentially the most critical element in the initial state strategy document. This section would identify what is currently being done in wetlands management and what can/needs to be done to achieve the state goals. Given that effective achievement of a “no net loss, net resource gain” goal will generally require more than just regulatory program activity, it is important for the state to identify nonregulatory programs which impact wetland resource. In many areas, the most significant gains in wetland resources will be derived from nonregulatory programs.

Strategy Development and Implementation Plans is the actual identification of what will be undertaken. The Workgroup suggested that states particularly consider four things in their strategy: ways to address losses; ways to achieve gains; education/outreach programs; and information man-

agement (mechanisms for tracking and reporting strategy implementation).

Monitoring Progress will generally involve two activities: field inventories of wetland resources to track natural changes; and record keeping of regulatory and nonregulatory program activities to track anthropogenic changes. The Bay Program is currently considering a proposal to initiate a status and trends monitoring program based on remote sensing of the entire watershed. This is expected to capture the general trends in the resource. Individual states are expected to desire more accurate tracking of the regulatory and nonregulatory program impacts than will be available through remote sensing, and so will probably emphasize record keeping protocols.

The final element in the recommended strategy template is a glossary of terms. This is important primarily to facilitate interjurisdictional data sharing. Since there will be a desire to view the status of the resource at a watershed scale, it will be important that there be some consistency in the protocols for identification of wetland losses and gains.

**Editors note: The text of the Chesapeake Executive Council Directive was included in the Fall 1997 issue of The Virginia Wetlands Report, volume 12, number 3. You may also find the Directive on-line, along with all other Bay Program Directives at <http://www.chesapeakebay.net/bayprogram/pubs/pubs3/htm>*

*Wondering About Wetlands
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self-examination will be returned to the individual and can be kept along with the written text in a personal notebook for future reference and re-

view. The Self-Taught Units are available upon request from the Wetlands Program.

Please contact William Roberts, Wetlands Educational Coordinator, Department of Resource Management

and Policy, Wetlands Program for further information or if you have any questions.

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Calendar of Upcoming Events

- Dec. 16-17, 1998** **VIMS Winter Botany Course**
Contact: Bill Roberts at (804) 684-7395, or Judy Hudgins at (804) 684-7380
- Mar. 11-13, 1999** **Ecology and Management of Bottomland Hardwood Systems: The State of Our Understanding. Memphis, TN**
Contact: Leigh Frederickson or Annette Wiseman at gaylord@sheltonbbs.com, or (573) 222-3531.
- June 6-12, 1999** **Society of Wetland Scientists Annual Meeting, Norfolk, Virginia**
Contact: Harold Jones at (757) 441-7777 or email: harold.r.jones@usace.army.mil.
Also see the SWS South Atlantic Chapter homepage: <http://www.sws.org/regional/southatlantic/>
- July 24-30, 1999** **Coastal Zone 99, San Diego, CA.**
Contact Martin C. Miller, USACE Waterways Experiment Station at (601) 634-3999 or email: m.miller@cerc.wes.army.mil

Tundra Swan

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snow goose. Both of these species, however, have wings edged in black. Young tundra swans are pale brown-gray with mottled pinkish bills.

Tundra swans feed primarily on the seeds, stems, roots, and tubers of submerged aquatic vegetation (SAV) and emergent marsh vegetation. Benthic organisms are also eaten. With the decline of SAV's earlier this century, grain fields became an important food source for swans, prompting farmers to be concerned about crop damage, leading to a resumption of a hunting season on the eastern tundra swan population in 1984.

Tundra swans form monogamous pairs and share in the care of their offspring. Young stay with the parents during fall migration and throughout their first winter, until arriving back on the Arctic breeding grounds the following spring.

Prior to the 1918 Migratory Bird Treaty Act, swan populations declined significantly due to hunting for skin, meat, and feathers for the millinery trade. Swans are once again being hunted, although hunting is regulated. Additional current threats to tundra swan populations include lead poisoning from ingesting lead shot and fishing sinkers, and habitat loss. The Arctic tundra wetlands on which the tundra swans nest are potentially impacted by oil and gas drilling activities. Loss of prairie pothole wetlands along the migratory pathway has adversely impacted the swans. And in their wintering areas, loss of SAV's and wetlands will continue to create problems for the birds.

With careful management and preservation of the various wetland habitats on which this species depends, we can hopefully continue to enjoy the sight of the majestic tundra swan far into the future.

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Mummichog

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wise, maturity is reached during the second year. At maturity, males average 32 millimeters total length and females average 28 millimeters standard length. The mummichog's life span is approximately 3 years.

Mummichogs prey upon polychaetes (marine worms), small crustaceans and mollusks, insects and insect larvae, plant matter, algae, detritus, and other fishes. Due to their position in the food chain and their abundance (VIMS scientists have collected approximately 50,000 individuals from a 1.5 acre cove marsh), the mummichog is considered one of the most important species in the Chesapeake Bay ecosystem. They are highly dependent upon tidal wetlands and other shallow water areas for feeding and reproduction.