The Virginia Wetlands Report

Summer 1994
No. 94-6

Wetlands Program

Death on the Chesapeake Bay: The 1994 Avian Cholera Outbreak

Julie G. Bradshaw

Wildlife officials in Virginia may remember 1994 as "the year of the dead duck." Avian cholera killed 40,000-70,000 ducks and other birds on the state's portion of the Chesapeake Bay. The disease was discovered in February when some 500 dead oldsquaw washed ashore at the mouth of Eastern Bay in Maryland. By mid-April when the outbreak was over, 35,000 dead birds had been collected. (21,300 from Virginia, 13,000 from Maryland, and 1,300 from North Carolina.)

Avian cholera, caused by the bacterium *Pasteurella multocida*, is spread through body fluids. The course of the disease is most dramatic in ducks—often killing within 6-12 hours. In other birds, such as gulls, the disease course is 24-72 hours; unfortunately, this only increases the numbers of birds that are ultimately infected.

The bacterium has a wide range of hosts including shellfish and mammals and even occurs in domestic animals such as dogs and cats. Avian cholera, however, is *not* related to the cholera that infects humans; in humans, avian cholera generally results in only a mild infection.

The 1994 outbreak primarily affected sea ducks, including oldsquaw (74% of the total number of dead birds collected), the three species of scoters (9%), and bufflehead (4%) (see related article about oldsquaw and scoters in this issue). In winter, sea ducks tend to congregate over a food source (e.g., shellfish beds) in large groups, or "rafts," of 50,000 or more individuals, stretching a mile or two across the water. This rafting behavior puts the ducks in close proximity to each other, causing rapid transmission of the disease between individual ducks and consequently a high rate of mortality.

Of the 41 other bird species affected, gulls were the most numerous (2%). Gulls were most likely infected by scavenging the remains of infected ducks. The birds found in North Carolina were generally heavily scavenged and deteriorated; and most likely died in the Bay, were carried out by the tide and deposited on North Carolina beaches.

Finding and disposing of the birds soon after death is the most effective strategy for containing the spread of the disease. Cleanup in the Virginia portion of the Bay was a multi-agency cooperative effort headed by the Virginia Department of Game and Inland Fisheries. The cleanup required 8,119 hours and cost $182,588 (or $8.56 per duck). Surveillance for dead birds was accomplished by walking the Bay shorelines and observing from boats and helicopters. Dead birds were collected in plastic bags and sent to hospital incinerators in eastern Virginia and Maryland. One goal, and successful result, of the intensive cleanup effort was to prevent the spread of the disease up the tributaries and inland, where it would have the potential to affect a new suite of species, including dabbling ducks and songbirds.

Avian cholera is a relatively new disease to North American wildfowl. It began affecting domestic birds in the United States in the late 1800's. The first known outbreak in wildfowl was in the mid-1940's in Texas and California. It now occurs in all the major flyways on the continent. There are annual outbreaks in California, with losses of 10,000-25,000 birds/year, and nearly annual outbreaks in Texas and Minnesota. The disease has become a significant cause of mortality of wildfowl.

In Virginia, there have been three previously documented outbreaks. On the Chesapeake Bay, similar outbreaks occurred in 1970 and 1978, involving primarily sea ducks in the main portion of the Bay. The 1970 outbreak claimed approximately 70,000 birds. An estimated 100,000 waterfowl were lost in the 1978 outbreak. All three outbreaks have occurred between mid-February and late April. In 1975, avian cholera killed over 18,000 American coots in Back Bay. A somewhat radical strategy to contain this outbreak involved eliminating the remaining coot flock (approximately 6,000 birds) which prevented the spread of the disease to other areas.

Continued on page 2

Death on the Chesapeake Bay
continued from page 1

The Chesapeake Bay is a major migratory stopover and wintering area for waterfowl. Due to the unusually severe winter of 1994, there were probably more waterfowl than usual congregating on the Bay because their normal wintering grounds to the north and west, such as the Great Lakes, New York's Finger Lakes region, and Canadian lakes, were frozen. In addition, as ducks that wintered in the south began their spring migration northward, they stopped at the Chesapeake Bay because areas to the north were still frozen. With overcrowding and the stress of migration, they were vulnerable to the outbreak of disease.

The initial cause of avian cholera outbreaks is not clear. One theory is that the environment acts as a reservoir for the bacteria that cause the disease, and the birds pick up the bacteria when they are in that environment. The reservoir may be the marsh substrate, soil or water at wintering grounds. In the Chesapeake Bay, this theory suggests that the outbreaks could have been caused by ingestion of shellfish infected with the bacteria. Another theory is that there is a carrier state for the bacteria. The bacteria are apparently less virulent at the end of an outbreak than at the beginning, resulting in birds that get sick, but do not die. It is thought that these recovered birds still carry the bacteria, and that an outbreak is initiated when the weakened birds undergo some stress at a later time, such as with migration, exposure to especially cold weather or exposure to other diseases. Some have suggested that the Chesapeake Bay outbreaks have occurred when waterfowl from other flyways were forced to the Chesapeake Bay by harsh weather. However, this idea is apparently not supported by the bacteriology of the outbreaks. None of these general theories has been conclusively proven or disproven.

There was concern over whether infected Chesapeake Bay ducks would spread the disease as they migrated out of the region. Because the disease acts so quickly, it was considered unlikely that terminally ill birds would make it out of the Bay region before dying. However, if the theory of a carrier state is correct, the disease could be transmitted out of the area through carriers. It is thought that there is some mortality due to avian cholera on the breeding grounds, but since many of these ducks breed on the relatively inaccessible Arctic tundra, this cause has not been well studied. It is also likely that some ducks die from avian cholera every year on wintering grounds, but that the disease only "explodes" and decimates a population when the

Continued on page 3

Wetlands Program **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 Point, VA 23062 U.S.A.
Address corrections requested.

Program Director:
Dr. Carl Hershner
Head, Wetlands Advisory Program:
Thomas A. Barnard, Jr.
Produced by:
VIMS Publication Center

In this issue:

Death on the Chesapeake Bay: The 1994 Avian Cholera Outbreak . 1
Wetlands Education Program Survey 2
Dismal Swamp National Wildlife Refuge 3
Sea Ducks: Scoters & Oldsquaw . 4
Red Drum 4
Wetlands Management Symposium A Success 5
Gabions 7
Calendar of Upcoming Events . . . 8

This report was funded by the Wetlands Program of the Virginia Institute of Marine Science.
Printed on recycled paper

Wetlands Education Program Survey

Maryann Wohlgemuth

In early April a tidal education survey form was mailed to everyone on the Wetlands mailing list. The information request on the form asked that each addressee list the courses of interest and any locations suitable for a regional wetlands workshop. We greatly appreciate the comments and suggestions many of you sent to us.

The information from the survey will help us set up education workshops to best suit your needs. The original due date for returning the form was April 29, however, we have extended that date indefinitely in hopes of getting additional surveys returned. Some respondents have mentioned a need for evening, weekend, or holiday workshops. If you prefer a workshop other than regular work hours please let us know. We sincerely appreciate your efforts in helping us meet your wetlands education needs.

Based on the responses we have received to date, we are considering offering regional workshops through the summer, and then having a one or two day workshop at VIMS in the fall. The tentative dates for the fall two-day workshop are October 11 & 12, 1994. If you are interested in attending the October workshop or if you have a group interested in a regional workshop, contact the Wetlands Program at 804-642-7380.

Natural Places to Visit

Dismal Swamp National Wildlife Refuge

(Part 2 of 2)

Pam Mason

Location: The Virginia portion of the refuge is in the cities of Suffolk and Chesapeake. There are many access points to the refuge. To reach the refuge office use U.S. 460. Take U.S. 13 and Route 32 south. To reach the boardwalk from Suffolk take Rt. 13 to Rt. 32 south for 4.5 miles to White Marsh Rd. Take White Marsh Rd. (Route 642) to Washington Ditch. Parking is about one mile down Washington Ditch Rd. Lake Drummond is a 4.5 mile hike along Washington Ditch Rd.

Details: The refuge is owned by the U.S. Fish and Wildlife Service and is open sunrise to sunset year round. Feeder ditch, approximately 14 miles south of Deep Creek on Route 17, provides canoe access to Lake Drummond. A private canoe company at the ditch rents canoes and offers tours of the lake. A small campground at the ditch provides free campsites on a first come—first served basis.

Extensive logging of the swamp has allowed the invasion of many tree and plant species. Red maple and sweet gum are common throughout the swamp in wet and dry areas. The once dominant tupelo, bald cypress and Atlantic white-cedar are still found in the wetter areas of the swamp, as well as water oak, willow oak and green ash.

Common in the understory are American holly, redbay, sweetbay, swamp azalea and sweet pepperbush. A plant which looks very much like bamboo, commonly known a switch cane, is also prevalent in the understory. Many species of trees, shrubs and herbaceous plants can be observed from the boardwalk at Washington Ditch.

Numerous varieties of birds are found in abundance in the swamp. Migratory songbirds are prevalent in the spring. Some woodland species that nest in the swamp include pileated woodpecker, barred owl, red-eyed vireo and ovenbird. Winter woods provide cover and food for large flocks of redwinged blackbirds, American robins, brown thrashers and other birds. Along the ditches of the swamp, look for great blue herons, green herons, and black-crowned night herons.

The Dismal Swamp supports large communities of common animals such as the white-tailed deer and cottontail rabbit, in addition to a population of black bears and bobcats, uncommon east of the mountains. The yellow-bellied pond slider, the southern cricket frog and the squirrel treefrog are at their northern limit in the swamp. The endangered Dismal Swamp short-tailed shrew is found only in the swamp.

Notably however, the swamp also provides habitat for a number of rare plant and animal species. The silky camellia, which reaches its northern limit, and the dwarf trillium, a piedmont species, both grow on the swamp hummocks.

The unusual history, geology, plants and animals, as well as the unique Lake Drummond, lead to the designation of this special area as a National Wildlife Refuge. Educational and recreational opportunities available in the Swamp should be experienced firsthand. As a nation, we are only just beginning to appreciate our wetland resources. A visit to the Great Dismal will help dispel old myths and perceptions of swamps as valueless wastelands. Plan a visit to the Dismal Swamp and enjoy.

Death on the Chesapeake Bay
continued from page 2

birds are particularly stressed or crowded together.

Habitat changes in the Pacific, Central and Mississippi flyways over time are considered to be contributing factors to the prevalence of the disease in these areas. General loss of wetlands throughout the U.S. has significantly altered waterfowl habitats. Previously, the birds were able to make use of numerous separate wetlands for migration, wintering and breeding. Today waterfowl are concentrated on remaining wetlands and tend to spend more time per single wetland with greater numbers of other waterfowl. They are stressed by having less space and less food, and by being in close proximity to many other birds.

Waterfowl management efforts tend to concentrate birds for longer periods of time, with impoundments constructed and agricultural fields planted for the primary purpose of providing waterfowl habitat.

Due to the decline of submerged aquatic vegetation, many waterfowl species have been forced to find new food sources. Many have switched from submerged aquatic vegetation to

Continued on page 6

Feathers & Fins

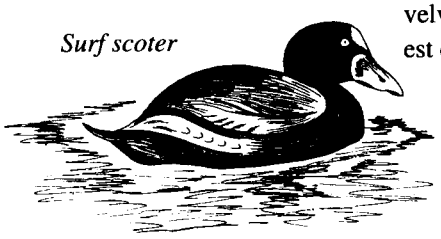
Sea Ducks: Scoters and Oldsquaw

Julie G. Bradshaw

The ducks commonly referred to as "sea ducks" may be found in the ocean, as their name suggests, but also are found in estuaries, bays, lakes and rivers. These ducks are generally stocky and powerfully built for the rigors of diving for their food. Some sea ducks commonly found in the Chesapeake Bay during winter and in fall and spring migration are scoters and oldsquaw. Individuals of these species were hardest hit by the recent outbreak of avian cholera on the Bay, as they were during outbreaks of the disease in 1970 and 1978 (see related article in this issue).

Worldwide, there are three species of scoters; all three are found on the Chesapeake Bay from about mid-October to mid-April. Adult males of all three species are primarily black. The surf scoter, sometimes called "skunkhead," is notable for its peculiarly colored bill: the tip is orange, and the bottom of the base is white with a large black spot. It has white patches on the forehead and at the nape of the neck. The surf scoter is the most abundant wintering scoter on the Chesapeake Bay. Formerly known as the common scoter, the black scoter is also called "butterbill" for the orange-yellow knob at the base of its bill. Otherwise, it is completely black and its head is more rounded than that of the other two scoter species. The white-winged scoter, also called the velvet scoter, is the largest of the scoter species. As its name suggests, the feathers on the trailing edge of its wings are white. Other distinguishing marks are a white crescent under the eye and orange at the tip of the bill.

Surf scoter



Scoters are generally relatively quiet. They can be found "rafting" together with oldsquaw in large flocks, but are also seen in small single-species groups. They are often seen flying single file within one or two feet of the water surface. From the water surface, they dive to the bottom for their food, sometimes in water 30 or 40 feet deep. Their diet consists primarily of mollusks, but also includes some crustaceans and other organisms. The ducks consume the entire mollusk; their strong gizzards grind the shell. Scoters

Continued on page 6

Red Drum

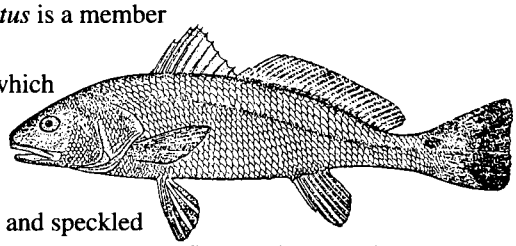
Sciaenops ocellatus

Other common names: puppy drum, channel bass, redfish

Lyle Varnell

Red drum can be found in Virginia's coastal waters and the lower Chesapeake Bay during late spring and summer. In the Chesapeake Bay region this species is a popular recreational target, but of minor commercial importance. South of Cape Hatteras along the Atlantic Coast and in the Gulf of Mexico region more red drum are landed recreationally than any other single species in many years.

S. ocellatus is a member of the family *Sciaenidae*, which also includes the black drum, spot, croaker, gray and speckled trout, silver perch and the kingfishes. They are characterized by a bronze colored elongated body which is generally darker on the dorsal side. Distinguishing features include the absence of barbels on the lower jaw and a conspicuous dark spot or spots on the caudal peduncle (the area just anterior to the tail fin). Red drum may reach a size of approximately five feet and 92 pounds.



Red drum range from Massachusetts to northern Mexico, including the coastal waters of the Gulf of Mexico. They are infrequently found in coastal waters north of New Jersey.

Immature and adult red drum overwinter in deeper coastal waters just south of Cape Hatteras. A northwestern migration occurs in the spring. During this time, and continuing throughout the summer period, red drum can be observed to travel in large schools. Spawning occurs in outer coastal waters primarily from Virginia south to Florida. Spawning begins in July and continues through December, with peak spawning activity during September and October. Individual females can release up to three million eggs. Generally, young-of-the-year appear in the Chesapeake Bay during mid-September. Red drum mature during their third to fifth years, with all fish mature at the end of their fifth year (approximately 27-32 inches total

Continued on page 8

Wetlands Management Symposium A Success

The thirteenth annual Virginia Wetlands Management Symposium was held April ninth at Turner Hall on the campus of Hampton University. Approximately 70 people enjoyed the informative presentations and excellent lunch provided by the University.

Mr. Bart Theberge, from Ocean and Coastal Law at the Virginia Institute of Marine Science, opened the symposium reporting on several years of research identifying and inventorying previously unknown state-owned lands on the Eastern Shore of Virginia. This research resulted in identifying and mapping approximately 30,000 acres of land. Legislation protecting and managing these lands was introduced in the last session of the General Assembly. Local governments, state agencies, federal agencies and private interest groups are working with Professor Theberge and others to develop a management plan for the lands.

Laura McKay, Coastal Programs Coordinator at the Department of Environmental Quality, described the success of Northampton County's Special Area Management Planning Grant over the past two years. Since thousands of migratory song birds move through a narrow corridor within the economically depressed county each year, efforts have been directed toward attracting bird watching enthusiasts and other tourists, along with their dollars, to the area. An annual bird festival with numerous activities has been developed and promoted. Simultaneously, studies on protecting the birds and their habitat are being conducted so that the increased tax base does not result in environmental damage. The concept of nature tourism is alive and well in Northampton County! [See related VWR article, Spring 93]

One major consideration will be the adequacy of Virginia's existing coastal zone boundary with regard to protecting coastal waters from nonpoint source pollution.

Under the development plan, also, are efforts to promote a sustainable seafood industry through protecting finfish and shellfish habitats in the area. The Sustainable Development Task Force is responsible for developing new enforceable policies to help meet this goal.

Rick Hill, Coastal Nonpoint Source Coordinator with the Department of Conservation and Recreation, presented an overview of the nonpoint source pollution control efforts which may be required of states with approved CZM Programs under the Coastal Zone Act Reauthorization Amendments passed in 1990, Section 6217. Although no decision has been made to develop a nonpoint source program in Virginia (this will require action by the General Assembly), present efforts are: defining existing programs which address nonpoint sources; identifying the programmatic changes necessary to implement a coastal nonpoint source program; and providing the basis upon which to make decisions regarding authorization of a nonpoint source control program in Virginia. One major consideration will be the adequacy of Virginia's existing coastal zone boundary with regard to protecting coastal waters from nonpoint source pollution. Virginia's present coastal zone planning area covers 8,700 square miles. The NOAA recommended Section 6217 management area encompasses 17,600 square miles. This is one of many controversial issues involved as Virginia examines its existing nonpoint source control programs and explores ways in which they can be networked into a comprehensive program.

Russ Baxter, staff to the Chesapeake Bay Commission, addressed the activities of his Commission's efforts toward Chesapeake Bay restoration. The Chesapeake Bay Commission is a multi-state legislative advisory body, created by the Maryland, Virginia and Pennsylvania General Assemblies. The Commission is a signatory to the 1987 Chesapeake Bay Agreement and is thus the legislative arm of the Bay Program. Commission members work to maintain continuity in legislative initiatives among Bay Program participants. Representing Virginia on the Commission are Senator Elmo G. Cross, Jr., Chairman; Delegate Robert S. Bloxom, Delegate Howard E. Copeland, Secretary of Natural Resources Becky Norton Dunlop, Senator Joseph V. Gartlan, Jr., and Delegate W. Tayloe Murphy, Jr.

The final speaker of the day was Craig Seltzer, an ecologist with the Planning Division of the Norfolk District, Corps of Engineers. Craig briefly outlined the Corps' program of fish and wildlife restoration within the James River Basin of Virginia. The report of the reconnaissance phase of the program has recently been issued and identifies stream and other habitat restoration activities; removal of migratory fish barriers; oyster reef establishment; habitat evaluation; and food source supplementation as possible actions to be recommended for funding. A limited number of copies of the report are available by contacting Craig at the Norfolk District of the Corps.

A variety of topics of concern were discussed by attendees in an open forum. Tony Watkinson advised the boards that VMRC is required by Executive Memorandum 599 to look at the unfunded state mandates under the purview of the agency and that an upcoming survey would ask boards to outline their various costs incurred in implement-

Continued on page 6

Death on the Chesapeake Bay
continued from page 3

human-grown grains. Grains tend to be lower in vitamin A than the natural food sources, possibly leading to vitamin deficiencies which would make the birds more vulnerable to disease.

There are many possible contributing factors to the prevalence of avian cholera in other flyways. However, of these factors, only a few apply to the outbreaks in the Chesapeake Bay. This may account for the fact that the disease has not become an annual event in the Bay as it has in other areas. Sea ducks involved in the Chesapeake Bay outbreaks are probably not seriously affected by the wetland loss or food shift factors as they don't use wetlands, and submerged aquatic vegetation is not a major food source. It may be possible that environmental contaminants, in addition to the stress of harsh winters, are making Chesapeake Bay sea ducks and/or their food sources more susceptible to the avian cholera bacteria, however, no studies have investigated these possibilities.

Unraveling the mystery of the Chesapeake Bay avian cholera outbreaks remains a daunting task for the future.

Many thanks to:

Glen Askins, Gary Costanzo with Virginia Dept. of Game and Inland Fisheries; Kathy Converse, Lou Locke, USFWS Wildlife Health Lab, Madison, WI; Doug Forsell, USFWS Chesapeake Bay Program Office, Annapolis, MD; Mike Haramis, USFWS Patuxent Wildlife Research Lab, Laurel, MD.

References:

Botzler, Richard G. 1991. Epizootiology of avian cholera in wildfowl. Journal of Wildlife Diseases 27(3):367-395.

Davidson, William R. & Victor F. Nettles. 1988. Field manual of wildlife diseases in the southeastern United States. Southeastern Cooperative Wildlife Disease Study. Dept. of Parasitology. College of Veterinary Medicine. Univ. of Georgia. Athens.

Friend, Milton. 1981. Waterfowl management and waterfowl disease: independent or cause and effect relationships? Transactions of the North American Wildlife and Natural Resources Conference 46:94-103.

Friend, Milton (ed.). 1987. Field guide to wildlife diseases. U.S. Fish & Wildlife Svc. Resource Publ. 167. 225 pp.

Gordus, Andrew G. 1993. Notes on the first known avian cholera epizootic in wildfowl in North America. Letter to the editor. Journal of Wildlife Diseases 29(2):367.

Locke, Louis N., Vernon Stotts, & George Wolfhard. 1970. An outbreak of fowl cholera in waterfowl on the Chesapeake Bay. J. of Wildlife Diseases 6:404-407.

Montgomery, R.D., G. Stein, Jr., V. Stotts, & F. Settle. 1978. The 1978 epornitic of avian cholera on the Chesapeake Bay. Avian Diseases 24:966-978.

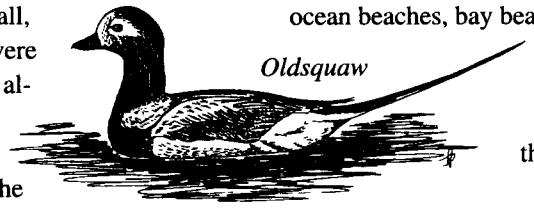
Pursglove, Samuel R., Jr., Dennis F. Holland, Fairfax H. Settle, & Donald C. Gnegy. 1976. Control of a fowl cholera outbreak among coots in Virginia. Proc. Ann. Conf. Southeast. Assoc. Fish Wildl. Agencies 30:602-609.

Wobeser, G. 1992. Avian cholera and waterfowl biology. Letter to the editor. Journal of Wildlife Diseases 28(4):674-682.

Sea Ducks: Scoters and Oldsquaw
continued from page 4

also eat some plant material while on their breeding grounds in the far north along the tundra and inland lakes and rivers.

Oldsquaw are similar to scoters in their food habits, but have been known to dive to depths of 200 feet. Many individuals of these species have been caught in fishermen's drift nets in the past. In contrast to the scoters, oldsquaw are noisy and lively, with a strange careening flight. They have an odd musical yodeling call, thought by some to sound as if they were saying "south southerly," which is an alternative name by which they are known. The oldsquaw is also sometimes called the long-tailed duck for the adult male's distinctive long tail, the only sea duck so adorned. It is the only duck with two distinctive bright plumages. In winter, the adult male is mostly white, with a dark brown breast and dark brown patch behind the eye. It has a stubby bill with a pink band. In late spring, it becomes mostly dark brown on the back, neck, and head, with white cheek patches remaining. This species breeds on the Arctic tundra, and is seen on the Chesapeake Bay from late October through mid-April.



Oldsquaw

The scoters and oldsquaw in the Chesapeake Bay may be seen by boaters. By land, the species may be seen from ocean beaches, bay beaches such as Grandview in Hampton, and from the Chesapeake Bay Bridge Tunnel islands. These ducks are hunted, but because of their diet are not too palatable.

Wetlands Management Symposium A Success
continued from page 5

ing the wetlands and dunes acts. Tony also reminded board attendees that Section 28.2-1304 of the Wetlands Act requires annual reports and that VMRC is to receive copies of the reports each year. The audience was reminded that legislation passed this year allows permits to be signed by a Wetlands Board designee and no longer just the chairman. Another subject discussed was the updating of the Virginia Wetlands Management Handbook, which if funded by the Coastal Resources Management Program, will be completed in late 1995.

Structurally Speaking. . .

Gabions

Walter I. Priest, III

Bulkheads and riprap are not always the most desirable, or even practical, solution to a shoreline erosion problem. In some instances, the engineering aspects, site characteristics, soils, topography, construction access or cost may dictate an alternative method. On occasion, the answer might be gabions.

Gabions are wire mesh baskets that are either galvanized or coated with polyvinyl chloride (PVC) for corrosion protection. The baskets are compartmented and come in a range of sizes. In Virginia, the most commonly used sizes are 12'x3'x3', 12'x3'x1.6' and 6'x3'x1.6'. Gabions are usually filled in place with rock and wired shut to produce a single construction unit. This allows smaller stone to be used to make a larger structure that is capable of coping with conditions at an exposed site.

Gabions used to construct a gapped breakwater system.

Experience with gabions has indicated a number of practices that can improve or extend their effectiveness as shoreline defense structures around the bay. First, and most important, is to fill the baskets as full as possible. The most frequent cause of failure is the abrasion of the wire coating which causes the wire to corrode and break. This is often the result of the stone setting within the basket causing voids that allow movement of the small stones by wave action. This can be accentuated if the stone or rubble used to fill the gabions has sharp edges or very angular surfaces. In fact, the life of the gabions can be extended if fill within the baskets is supplemented periodically to offset consolidation of the original material and prevent the development of voids.

When placing a gabion structure, it is helpful to underlay it with filter cloth. This helps prevent differential settling where one section of the gabion settles faster than another, creating voids and allowing movement of the fill material. Also, the structural integrity of the gabions can be improved by wiring together multiple units to form a single unit.

Corrosion of the gabion wire occurs more rapidly in saltwater than in freshwater. This can shorten the life of the gabion, especially in areas where the galvanizing or PVC has been worn off and the wire is directly exposed. Placing gabions at sites where substantial amounts of sand can be trapped effectively burying and protecting the gabion can minimize these problems.

Gabions placed perpendicular and immediately adjacent to another structure such as a bulkhead or a groin often experience a phenomenon known as "juncture puncture." For reasons not completely understood, the wire closest to the vertical structure breaks, allowing the dispersal of its rock contents and reducing the effectiveness of the structure. This failure could be the result of abrasion from debris outside of the gabion that becomes lodged between the structures, increased stress on the wire by reflected wave energy or some other unknown reason.

Gabions are not the answer to every erosion problem, but they do have a place in a comprehensive framework of erosion control strategies. This is particularly true when there are access problems that preclude the use of conventional machinery or when cost is an issue and the landowner is willing to supply his own labor to fill the structures.

Red Drum
continued from page 4

length). Five year old red drum constitute the bulk of the spawning population in the mid-Atlantic area.

Juvenile red drum prefer seagrass beds or oyster shell clumps over slightly muddy bottoms in quiet, protected waters of less than six feet depth. Juveniles have also been observed inhabiting intertidal salt marshes. Subadults spend the first three to four years within estuarine waters. However, in the Chesapeake Bay region, subadults tend to overwinter in nearby coastal waters. Red drum favor coastal environs as maturity progresses. Adults are almost exclusively coastal water inhabitants.

Like other members of the *Sciaenidae*, red drum are primarily bottom feeders. Adults may also feed in the nekton on smaller fishes in coastal waters. Their preferred prey items include clams and crabs.

Estuarine wetlands and beds of submerged aquatic vegetation (SAV) play an important role in the life cycle of the red drum.

Immature red drum use these areas as nursery and feeding grounds. Additionally, many prey species of the red drum are dependent upon wetland areas in their life histories.

Calendar of Upcoming Events

October 8	Invasive Exotic Plant Seminar Piedmont Community College For more information, contact Ted Scott, 12493 Spicewood Road, Orange, VA 22960 Phone: 703-672-3814
November 13 - 16	Dredging '94 - "The Second International Conference on Dredging and Dredged Material Placement" Lake Buena Vista, FL For more information, contact Russell K. Tillman, Dredging '94 Management Chair, c/o CEWES-EP-L, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199 Phone: 601-634-4201, FAX: 601-634-3528

Wetlands Program

The Virginia Wetlands Report
Wetlands Program
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, VA 23062

NON PROFIT ORGANIZATION
U.S. POSTAGE PAID
GLOU. PT. VA 23062
PERMIT #6