The Virginia Wetlands Report

Fall 2002
Vol. 17, No. 3

Marina Site Suitability Tool Available

By Marcia Berman, Tamia Rudnicki, Kirk Havens and Tom Barnard

The Center for Coastal Resources Management at VIMS, with a NOAA grant from the Virginia Coastal Program, has developed a planning tool to help with the siting of new marinas and the potential for expansion of existing ones. The tool is a series of maps of the Virginia coastline shown in segments which are rated according to their suitability for the siting of a marina or other place where boats are moored. The suitability is determined by how well the site meets the existing *Marina Siting Guidelines* of the Virginia Marine Resources Commission (VMRC).

Unfortunate as it may be, the siting of additional marinas, or the expansion of older ones, usually conflicts directly with laws and regulations enacted by the states and localities to protect marine resources. Presently marina developers, or those expanding or purchasing old marinas with the intention to expand, tend to acquire a parcel of land and only later investigate whether the area is suitable for a marina from a marine environmental perspective. If the area is environmentally sensitive, then a protracted and expensive permitting process can ensue. Very often significant public opposition may surface and significant investment dollars put at risk.

The Commonwealth of Virginia, through the Virginia Marine Resources Commission, has developed detailed criteria for siting of marina facilities (VMRC, 1993) (Table 1). This project uses these VMRC marina siting criteria to develop a map portfolio of marina siting suitability for the tidal shoreline of Virginia. The siting criteria were divided into three categories: criteria mostly related to marina design, criteria mostly related to water quality considerations, and criteria mostly related to habitat considerations. Geographic Information System (GIS) algorithms were developed to model the VMRC criteria (Table 1) and create indices of suitability related to marina siting. The indices were summed within each category (design, water quality, and habitat) to identify areas as desirable, desirable with limitations, and undesirable for the location of a marina. A final summary incorporating all three categories was also created.

With this planning aid marina developers will have the ability to better locate areas for potential marina construction while regulators will have information that will allow them to direct marina development to specific areas or away from sensitive natural resources. The potential economic and environmental benefits include 1) increased certainty that permit decisions will be positive through advanced identification of sensitive resource areas, compatible land use, etc.; 2) maintenance of the health of economically important natural resources; 3) reduced potential for loss of investment capital through improper sit-

Original Criteria	**Modeled Criteria**
Water Depth	2 meter contour
Salinity	Shellfish grounds
Water Quality	Shellfish Condemnation Zones
Designated shellfish grounds	Public or private oyster grounds
Maximum wave height	Fetch distance from shoreline
Dredging	Distance to the 2m contour
Proximity to Natural Channel	Distance to the 2m contour
Threatened or Endangered Species	Rare, threatened, or endangered species habitat
Adjacent Wetlands	Tidal marsh inventory
Navigation and Safety	Distance to 2m contour is > 50% creek width
Existing Use of Site	Considers aquaculture, oyster reefs, public beaches, mud flats
Submerged Aquatic Vegetation	Submerged aquatic vegetation
Finfish Habitat	Tidal Freshwater Wetlands

Not Modeled: Current velocity, flushing rate, shoreline stabilization, and erosion control
Added Criteria: Riparian land use to consider local planning and development needs.

Table 1. Original VMRC Criteria vs. that modeled for Marina Siting.

ing; and 4) increased ability of the states and localities to focus limited regulatory resources on the most environmentally sensitive areas.

The Center for Coastal Resources Management (CCRM) developed this tool using available GIS data, government specified criteria and existing scientific information to identify appropriate sites for future marinas. The protocol assigns the individual criteria to one or more of three major categories: **habitat, water quality,** and **design**. The criteria are numerically ranked based on their relative importance in contributing to the value of the category. For each category, these individual ratings are combined to produce a ranking for the category. A final ranking combines points for each category. The suitability levels are intended for general guidance related to marine environmental concerns. Additional issues involving local community planning (i.e. local zoning) are not reflected in this planning aid but can be easily inserted by local planners.

Because this is a GIS based aid, some of the VMRC criteria could not be used and some required a surrogate measure (for which data were available) for their inclusion. Table 1 displays the original criteria and the data actually used for each.

A set of GIS rules were required to model the requirements for each criteria. In some cases, presence or absence of a feature was the only criterion necessary. The last stage of the protocol development included the design of an evaluation scheme which assigned points to value the contribution that a particular criterion made in siting future marina construction. The higher the point value assigned, the more suitable a site is for marina development. Two criteria, threatened or endangered species and designated shellfish grounds, automatically ranked a segment as low if an endangered species or public oyster ground were identified within the sample area. This modification was incorporated into the ranking system to recognize the inherent regulatory difficulties associated with having either of these two items on site.

All evaluations were made on landscape units (segments) which were 600m alongshore, 30m inland, and 200 m seaward of the shoreline (Figure 1). This unit of measurement satisfied several issues of concern. The inland width was sufficiently wide to capture riparian land use, and the longshore length could analyze for even small, community level marina construction. The seaward limit could reasonably address water depth, and intertidal habitat communities which may persist and be impacted by pier construction or dredging activity.

After processing all the GIS data and ranking conditions for each criterion, the program generates four GIS coverages presented as color-coded maps of the shoreline. They represent the following: marina suitability evaluation based on water quality parameters, marina suitability evaluation based on habitat parameters, marina suitability evaluation based on design parameters, and a summary coverage which represents a combined assessment of all three parameters. All four coverages rank areas as 1) high, desirable; 2) moderate, desirable with limitations; 3) low, undesirable.

All of the information generated by this program is delivered in digital format only. The maps are available to the general public via the internet, and to selected agencies on CD. A website has been developed for access to maps, and GIS data. Maps illustrate the distribution of suitability within the tidal waters of Virginia. The region is divided into a series of plates. A user clicks on the category (habitat, water quality, design, or summary) they wish to view and then

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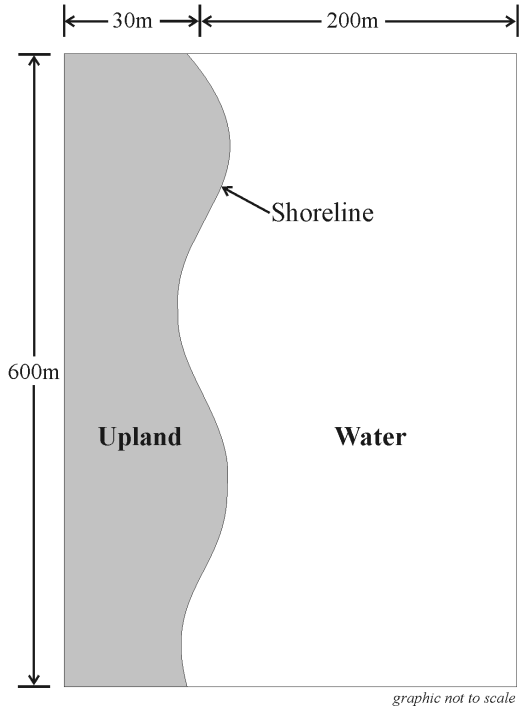

Figure 1. Shoreline analyzed in 600 meter by 230 meter blocks.

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.*

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VIMS Publication Center

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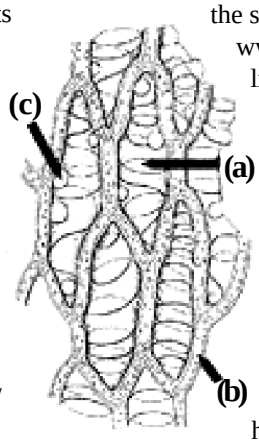
This report was funded, in part, by the Virginia Institute of Marine Science and by the Virginia Coastal Resources Management Program of the Department of Environmental Quality through Grant #NA97OZ0181-01 of the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resources Management,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

Sphagnum Moss: Natural Properties Promote Historic Uses

Pamela Mason

There are over 300 species of mosses in the genus *Sphagnum*, commonly referred to as Sphagnum moss. While most of the 14,500 species of mosses are found in moist, shaded habitats, Sphagnum is common to wetlands where water is abundant. *Sphagnum* is the only species of Bryophytes with economic importance. As discussed in a previous article, decaying sphagnum, which is peat, is burned for fuel and used as a horticultural product, and the living material is also used for horticulture and floral arranging. The morphology of *Sphagnum* differs from other mosses in several ways. These differences create the opportunity for the plant to function in a capacity which has been utilized by humans, namely the capacity for absorption.

Sphagnum has erect stems, 5-10 cm long terminating in a cluster of branches. The whorled branches of the plant are arranged horizontally, pendant (hanging downward) and twisted around the main stem. The leaves are made up of two kinds of cells: the larger, dead cells (**a**), (called hyaline cells with circular pores (**c**)) and the smaller living cells that contain chloroplasts (**b**). (See figure at right.) The ability of Sphagnum to retain fluid is derived from the hyaline cells, and in some species dead porous cells in the stem. Additionally, the overlapping leaves and twisted stems form a structure which acts like a wick providing more fluid retention capacity (http://www.bio.umass.edu/biology/conn.river/mosses.html).

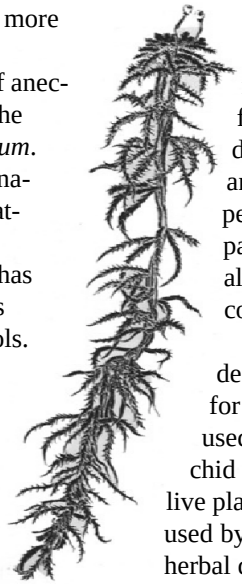


Estimates on the absorptive capacity of *Sphagnum* range up to 20 times its weight; two to three times more absorptive than cotton.

There is also a bit of anecdotal information regarding the antiseptic powers of *Sphagnum*. The antiseptic, or antibiotic, nature of *Sphagnum* has been attributed to the acidity of the growing habitat, although it has also been mentioned that it is due to the presence of phenols. Sphagnol, a distillate of Peat Tar (from decayed Sphagnum) is recognized as an effective treatment for skin diseases including eczema, psoriasis and acne.

The combination of absorptive properties and antiseptic qualities has been known for centuries. Native Americans and indigenous peoples of Northern Europe used Sphagnum for diapers, absorptive pads and dressings for wounds. Babies were placed in "moss bags" made from animal hides lined with rabbit skins and filled with moss or laid in cradles lined with skins and moss. Toddlers wore "diapers" made much the same way. http://www.borealforest.org/lichens/lichen14.htm .

Accounts from World War One and the Franco-Prussian and Russo-Japanese wars tell of the use of moss for surgical dressings. Much of the moss used for dressings was gathered from the British Isles (http://www.botanical.com/botanical/mgmh/m/mossph54.html), however, a history of the University of Washington tells of faculty and staff gathering sphagnum moss for surgical dressings during World War 1 (http://www.washington.edu/research/pathbreakers/foreword.html) . To make a dressing, the moss must be dried and picked over to remove stems, pebbles, etc. Then the moss is packed loosely into cloth bags allowing for the moss to swell on contact with moisture.



In addition to today's use of decayed moss in the form of peat for horticultural uses, Sphagnum is used extensively in bonsai and orchid culture and for the shipment of live plants. Sphagnum moss is also used by several companies to produce herbal disinfectants and other cleaning products.

While the use of *Sphagnum* for diapers and dressings may be no longer commonplace, the myriad and varied functions of wetland plants have provided, continue to provide and may yet provide, surprising uses.

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designates the area of interest from an index map. The maps are in color and can be downloaded. It is the "Summary" map which provides the final ranking based on a cumulative evaluation of the three main categories. Viewing the individual categories, however, allows a user to see which categories may have forced a particular segment or segment group to have an overall "desirable," "desirable with limitations," or "undesirable" ranking.

The project home page is located at this url: http://www.vims.edu/ccrm/marinasiting.htm

Wetland Denizens

Red Drum, *Sciaenops oscellatus*

Walter I. Priest, III

In September, Randy Owen from the Marine Resources Commission and I were beach seining in the Elizabeth River collecting data on a proposed construction site. I was holding the bunt of the net while Randy was hauling the free end ashore. Suddenly, I felt a very large fish thrashing in the net near my legs. I could not believe we had caught such a large fish so close to shore, the net was only 100' long. When we finally got the net ashore, we were both surprised to find a large red drum as well as a number of smaller puppy drum in the catch, coming, remarkably, from a river regarded as one of the most highly industrialized and polluted in the Chesapeake Bay.

Red drum (*Sciaenops oscellatus*) variously known as puppy drum, red fish and channel bass when larger, are members of the drum family (Sciaenidae). Other members of this family include spot, croaker, gray trout, speckled trout, black drum, kingfish and silver perch. Channel bass are one of the larger drums given that they can reach a maximum of five feet and over 90 pounds. Young puppy drum tend to be silvery above and whitish below. As they age, they take on the coppery red color dorsally that gives them their name. Their bodies are fairly robust in size with slightly elongated head and inferior mouths. They also sport one to several black spots or oscelli on their tails that resemble eyespots. Some evidence indicates these "eyes" divert predators, which are often attracted by the eyes of their prey, to less vital parts of the fish.

Red drum are found from Northern Mexico to the Gulf of Maine but are not common north of New Jersey. They are most abundant in the Gulf of Mexico where they support major commercial and recreational fisheries. In Virginia, they are found from late spring to late fall primarily along the coast and in the lower bay where salinities are above 15 parts per thousand. They have been recorded as far north in the Bay as the Patuxent River. Adults frequent the ocean shorelines and deeper areas of the lower bay while younger juveniles prefer shallower nearshore waters. Young puppy drum are especially fond of marshy shorelines where they are frequently sought by sport fishermen in the late summer and early fall. Adult channel bass are sought-after by surf fishermen along the Eastern Shore and Outer Banks of North Carolina and bait fishermen in the lower bay. The Virginia record for channel bass is an 85.3 pound fish taken at Wreck Island on the Eastern Shore in 1981.

Note the prominent tail spots on these puppy drum taken from the Elizabeth River.

Spawning occurs during the late summer and fall in coastal water near the mouth of the bay. Juveniles begin entering the bay from August through September. In fact, we took young-of-the-year fish, 20-30mm, at a nearby seining site on the September field trip. Together with the fish shown in the pictures, the sampling effort that day yielded three different year classes with the smallest fishes at the shallowest site and the larger fish in deeper water (4-5 feet). Their food varies with size and age and consists primarily of small to medium sized crustaceans and other fishes.

The life history of the red drum mimics that of many of the estuarine dependent fish that rely on the wetlands and shallow water habitat of estuaries to complete their life cycles. The adults spawn offshore or in deeper water and the juveniles migrate into the food rich protection of the estuary where they can grow in relative safety until they are ready to migrate to deeper offshore waters to spawn. Here the cycle begins again and includes one of the more "polluted" rivers of the Bay; one whose resource or habitat value has been largely written off by laymen and scientists alike.

This 26-inch red drum was a big surprise, taken near Craney Island in a 100-ft beach seine.

Private Piers and Tidal Marsh Cumulative Impacts

by Tom Barnard

A recent study, conducted by the South Carolina Marine Resources Research Institute reports the effects on salt marshes resulting from the installation of private piers and docks; activities that are totally exempted from the Virginia Wetlands Act of 1972 due to the belief that they have no significant direct or cumulative adverse effects on tidal marshes. This first of its kind comprehensive study presents some interesting results and raises several management questions for regulators of tidal wetlands and water quality alike on the east coast and is therefor presented here in capsulized form.

Evaluation of the Impacts of Dock Structures on South Carolina Estuarine Environments.
By Denise M. Sanger and A. Frederick Holland

In 1982 the South Carolina Department of Health and Environmental Control issued only 80 permits for private piers in tidal waters compared to the annual average between 1991 and 2000 of approximately 700. This is an order of magnitude increase in annual pier construction in a little over twenty years. Residential development has been and continues to increase in estuarine watersheds in Virginia and virtually all coastal states, and South Carolina is no different. The urbanized portion of Charleston, for example, has increased 400 times between 1973 and 1994 and is expected to grow by a similar amount in the next several decades. This study was aimed at examining the cumulative harm dock structures may be causing to South Carolina estuaries and the implications of future development increases.

For their study, Sanger and Holland utilized the data from two previous water quality monitoring studies and attempted to correlate the data with the density, size, configuration, number, etc. of docks and piers present where the monitoring data had been gathered. These two earlier studies were called the Small Tidal Creek Study and the Large Tidal Creek Study. Both were originally intended to look at the connections between land use development and tidal creek environmental quality using a comparative watershed approach. Because the two monitoring studies were conducted in creeks according to their respective watershed sizes, the authors were able to look at the effects of similar impact scenarios on small vs large creek systems.

The study demonstrates a significant shading effect by individual piers but minimal cumulative impact overall.

Orientation of piers with respect to the sun had no significant effect on shading impacts to marsh grasses.

In addition to correlating the water quality data with pier structures, the authors also looked at the effects of marsh shading by structures and compared their results with previous similar marsh shading studies. The researchers found in their shading study that *Spartina alterniflora* stem densities under docks were 71% lower than that for the same grasses five meters away from the structure. This result compares to a 65% reduction in stem densities found in Virginia by McGuire (1990). South Carolina has approximately 370,000 acres of salt marsh and at the present degree of development, the authors estimated a reduction in stem production of 0.03% to 0.72% for individual creeks based on 1999 dock numbers and a projected range of 0.18% to 5.45% for the maximum build out, no regulation scenario. The study indicated no reason for concern with regard to shading by piers except for the 5+% under the maximum development alternative; one that is extremely unlikely to occur. The investigators also observed, but did not quantify during their study, that damage to marshes due to normal construction practices was generally healed during the one to two growing seasons following construction.

The authors compared the various environmental parameters using a reference marsh (no development), a suburban area marsh with no docks and a suburban marsh with docks. This design gave them the ability to compare the cumulative impacts by level of watershed development and number of docks, for both small and large tidal basins.

Some of the findings of the study for both small and large tidal creeks were:

1. The presence of dock structures had little effect on heavy metal concentrations; including copper, chromium and arsenic.

Continued on next page

Calendar *of Upcoming Events*

December 11-13, 2002	**Winter Botany Short Course at VIMS.** Contact Bill Roberts wlr@vims.edu, (804)684-7395.
April 13-16, 2003	**Inaugural National Conference on Coastal and Estuarine Habitat Restoration.** Hyatt Regency Inner Harbor. Baltimore, MD. Contact Heather Bradley at (703)524-0248 or email hbradley@estuaries.org
June 8-13, 2003	**Society of Wetland Scientists 24th Annual Meeting**, New Orleans. Changing Landscapes and Interdisciplinary Challenges. Contact Lisa Gandy at (501) 225-1552 or gandylc@swbell.net
July 13-17, 2003	**Coastal Zone 03. Coastal Zone Management Through Time.** Baltimore, MD. Contact Jan Kucklick at (843) 740-1279 or email Jan.Kucklick@noaa.gov

Private Piers
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2. The presence of dock structures had small effects on polynuclear aromatic hydrocarbons (PAH) levels.
3. There is no evidence that structures are a source of polychlorinated byphenyls (PCB's).
4. Dock structures had only small effects on the kinds and abundance of benthic (bottom dwelling) organisms in the creeks studied.
5. No consistent relationship was found among juvenile fish and crustaceans comparing creeks with none or a few dock structures.

One of the major problems encountered by the researchers was that piers and docks were strongly associated with the amount of impervious surface area in the watershed. The cumulative environmental impacts due to pier and dock structures in any given creek therefor cannot easily be dissociated from that of suburban development in coastal watersheds. It is very likely that some of the impacts due to dock structures were masked by upland development. The authors were also unable to find an impact differential between small and large watersheds using the same pier development scenarios.

Currently, the state of South Carolina requires, among other things, that piers over marshes be constructed at least 3 feet above mean high water, no wider than 4 feet, no longer than 1000 feet and the property owner must have at least 75 feet of waterfront (50 feet if constructing a joint pier with adjacent property owner). As a result of this study, the South Carolina Office of Coastal Resources Management is proposing legislation which would further limit pier length to 500 feet and 750 feet for private piers and community piers, respectively. Also proposed is legislation which would not allow structures in creeks less than 20 feet wide.

Virginia Wetlands Report (VWR) Reader Survey Result

Our reader survey published in the last issue of the *Virginia Wetlands Report* generated a good response from our readership and provided much in the way of very helpful input regarding future format changes to the newsletter. Listed below is a summary of the responses we received expressed as percent of the total responses. Some of the responses will not total 100% due to multiple choice answers.

- Almost 90 per cent of our respondees found an article of interest in every or most VWR issues.
- Most of our responses came from interested citizens (20), state agency persons (14), wetland board members and staff (20), and educators (10).
- 46 % voted for publishing the newsletter 3-times/year, and 31% preferred quarterly issues.
- 85% thought the technical level of the newsletter was "about right."
- 71% thought the VWR was about the right length.
- 66% found the feature articles of greatest interest, with 25% favoring the continuing columns such as "Wetland Denizens" and "Varied and Versatile Wetlands."
- Readers expressed the highest interest in articles dealing with environmental issues (62), wetland research (54), coastal erosion (51), and wetland flora and fauna (49).
- 88% of those responding rated the newsletter as excellent or very good.

We received many helpful written comments, too numerous and lengthy to mention here but all very important to us and we thank all who have responded. If you still wish to comment on the newsletter content etc., you can do so online at <wetlands@vims.edu>. We would still like to hear from any of you who have not yet responded.