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Dragonflies: Hawks of the Insect World!

Kirk Havens

Have you ever stood outside swatting and cursing at biting flies on a hot summer day? Or moved hastily indoors to avoid squadrons of mosquitoes as twilight closes around you? If you live near water then you probably have experienced your share of fly and mosquito bites. But did you know that your best friend in the fight against these pesky bugs lives part of its life in wetlands?

Dragonflies are highly beneficial and effective predators of mosquitoes, deerflies, blackflies, midges, horseflies and other insects. Their aerial prowess, which consists of the ability to hover, fly backwards and sideways and obtain speeds up to 50 kilometers/hour, has earned them the reputation as "hawks of the insect world". They have huge compound eyes which cover much of their head and have as many as 20,000 to 30,000 facets. The visual field of the adult is almost

360°: it can see in all directions except directly behind the head. Their legs are armed with stiff, spiny bristles which allow them to capture prey on the wing and hold them in a

cage formed by the legs. They then eat the prey while continuing on an aerial patrol of their territory.

Depending on the species, dragonflies lay hundreds of eggs either by inserting them singly into submerged

plant stems or simply by dropping them into water. Development into adult dragonflies can take 2 to 3 years. During this time, the young (nymphs) feed on tadpoles, small fish, mosquito larvae and small crustaceans. The nymph may shed its skin a dozen times before it finally emerges

on a summer morning by crawling up a wetland plant stem, splitting the nymph case and crawling out. It will spend a few moments pumping up its wings before taking flight. The recently emerged adult will be almost colorless and unhardened; a condition that will last less than a day. It will then live from 2 weeks to 2 months, never straying too far from water.

Dragonflies are one of the first winged insects found in the fossil record dating back about 250 million years and are considered relatively primitive in the insect world. They were around to see the dinosaurs evolve, dominate, and disappear. Some



of the early dragonflies had wingspans of over 60 cm (2 feet). Our present day dragonflies have wingspans of from 5 to 12 cm (2-5 inches) and there are about 5,000 species of dragonflies worldwide with 450 species in North America.

Dragonflies use a number of habitat types during their life cycle. Most important is the presence of water for larval development (except for the few species that have terrestrial larval development). They also require wetland vegetation for the deposition of eggs and for nymph emergence. In addition, forests are used for nocturnal roosting while meadows and fields are used for foraging.

There are generally two types of dragonflies; fliers and perchers. Fliers typically remain on the wing when active, patrolling along a continuous pattern looking for prey while perch-

Thanks for this fancy, insect king,
Of purple crest and filmy wing,
Who with indifference givest up
The water-lily's golden cup,
To come again and overlook
What I am writing in my book.
—Walter Savage Landor
(1775-1864)

ers stake out a particular spot from which they launch forays to capture prey. Most dragonflies feed in the early morning and at twilight. Dragonflies are ferocious predators and have been reported to attack prey larger than themselves such as hummingbirds, sparrows, swifts, badminton shuttles and even hawks (Corbet, 1999 pg. 353-354).

Dragonflies may be ferocious predators but a number of predators

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feed on dragonflies. These include frogs and fish (when the female dragonfly is laying eggs), orb-weaving spiders (when the dragonflies are patrolling the forests and wetlands), and hawks, purple martins and falcons (when the dragonflies are foraging in the fields and meadows). Curiously, bats seldom feed on dragonflies presumably because dragonflies generally cease flying as soon as bats become active.

Humans have utilized dragonflies in the past for a number of uses. In China, Japan and Mesopotamia dragonflies were used for magical and medicinal purposes including treatment of sore throats, eye diseases, tonsillitis, asthma, and even syphilis. In a number of countries dragonflies are considered delicacies. In Africa, Madagascar, Bali, Thailand, and Indonesia dragonflies are used in curry soup, fried in coconut oil and served with vegetables, boiled with ginger, garlic, shallots, and chili pepper in coconut milk, steamed or roasted whole in a banana leaf, fried in oil with onions, or eaten raw (Corbet, 1999 pg 360).

Dragonflies and damselflies are sometimes mistaken for each other but are actually quite easy to distinguish. Dragonflies are usually larger and their eyes are so large they often touch. Damselfly eyes are smaller and never touch. Also, when a dragonfly perches, their wings are spread open while most damselflies fold their wings together above the body when they perch.

Dragonflies can be captured for inspection by using a standard insect net though it must be swung from behind the dragonfly as it passes. Attempting to capture a dragonfly in flight by swinging a net in front of the insect will quickly become an exercise in futility. Their extreme agility in the air allows them to easily avoid a net swung at them head-on. Another method for capturing dragonflies is to

fill a large-volume squirt gun with soapy water. A direct hit with soapy water will temporarily disrupt the dragonfly's flying ability. Finally, if you are feeling especially skilled, you can try the traditional Japanese method of catching perched dragonflies by hand. This method involves rotating an index finger before the dragonfly's eyes in a circle of 2-5 cm diameter (1-2 inches) slowly approaching the insect until it can be grasped (Pemberton, 1995). Remember, however, that while dragonflies are not venomous and don't sting, they can inflict pain through their bite and by jabbing with the ovipositor at the end of their abdomen.

As with many other species, habitat destruction and degradation are a rising concern regarding dragonfly populations. In general, in upland streams

and headwaters, the most serious impacts are those affecting vegetation and soil

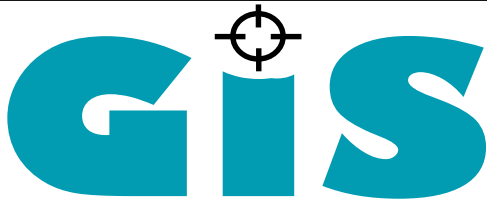
What would the world be, once bereft
 Of wet and of wildness? Let them be left,
 O let them be left, wildness and wet;
 Long live the weeds and the wilderness yet.
 -- Gerald Manley Hopkins (1881)

stability. In lower elevation areas, impacts affecting groundwater levels, aquatic plants, and terrestrial woodlands are the most serious. In addition, Industrialization and urbanization are considered the most serious since their effects are typically irreversible.

Next spring and summer, when you are once again swatting and cursing the swarms of biting flies, do a little experiment on your own. Watch for the first signs of dragonflies and see if the swarms of biting flies don't diminish as the population of dragonflies grows. From then on, I suspect that you, too, will join the ranks of the "friends of the dragonfly."

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Geographic Information System

Online Fauna and Flora Data in Virginia

Marcia Berman

Most of the GIS data discussed in this column has addressed the morphology and physical state of the shoreline. To keep in concert with the theme of the cover story, this GIS column highlights some sources for biological resource data available online through state agencies. Not all data is managed within a GIS, yet spatial reference is provided at each source, permitting integration within a GIS database if desired.

The Department of Game and Inland Fisheries (DGIF) maintains an online database of fauna and flora for Virginia. The site is accessed through the DGIF homepage at www.dgif.state.va.us. From there click on Wildlife and you'll enter their online database. The system is very

easy to navigate, and allows a user to query for a specific species or a specific geographic location. The database includes more than 2,000 species of mammals, amphibians, reptiles, terrestrial and aquatic invertebrate, fish, birds, and threatened and endangered plants and wildlife. For each species the following can be retrieved: the taxonomy, life history, geographic distribution, habitat, feeding trends, management practices, and any special status designation. These data can be written as text files or printed directly. A geographic search can also be performed to search for species present within a specific area. The coordinate boundaries are requested, and the occurrence of all species known or expected to inhabit that geographic

region is listed. Access to additional data is possible for qualified subscribers. These include state agency personnel, researchers, permit reviewers, and land managers.

The Department of Conservation and Recreation's Division of Natural Heritage (DNH) posts online information on rare plants and animals in Virginia. The site: www.state.va.us/~dcr/vaher.html is a collection of tables and reports which can be downloaded. Distribution maps are also available illustrating the extent of rare plant and animal communities in Virginia. These general distribution maps do not identify the location of specific communities. From the homepage site, however, a user can click the "County

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New Scholarship Housed At VIMS

The Wetlands Program of the Virginia Institute of Marine Science (VIMS) has been chosen by the Garden Club of America (GCA) to administer the latest addition to the collection of scholarships and fellowships awarded annually by the organization to exemplary graduate and undergraduate students. Titled the *GCA Award in Coastal Wetland Studies*, the scholarship seeks to promote wetland conservation through the support of young scientists in their field work and research. The scholarship funds one graduate student annually at \$5000 with the first award to occur in 2000.

Students pursuing advanced degrees in coastal wetlands science are invited to apply for this new award. Coastal wetlands is defined as those tidal and nontidal wetlands found in

the coastal states including those of the Great Lakes. The student may propose a wetlands program of his/her choice at a leading educational institution within the United States that specializes in wetlands studies.

All applications will be reviewed by a selection committee of practicing wetland scientists. Selection criteria include the degree to which the proposed scholarship work addresses the objectives of the Garden Club. Applicants must provide a resume', a letter of endorsement from their graduate faculty advisor, and a written plan (2 page maximum) for the work to be undertaken during the scholarship period. The project plan should include a brief explanation of how the proposal will promote wetlands conservation.

Scholarship recipients will be required to submit a written report on the

work completed with scholarship support. As practical, recipients may be asked to make an oral presentation of their project activities at a regional garden club meeting.

Application packages (with all required materials) are welcomed from students pursuing advanced degrees in coastal wetlands science at any college or university in the United States. Proposal submittals should be mailed to arrive by the January 31 closing date. Committee reviews will be completed by March 1 of each year and the recipient will be notified by the Garden Club shortly thereafter. Packages should be mailed to:

Garden Club of America Scholarship
c/o Wetlands Program
Virginia Institute of Marine Science
P.O. Box 1346
Gloucester Point, VA 23062-1346

Natural Lighting: Colonial Necessity is Today's Craft

Pamela Mason

Although used historically and today for medicinal and herbal purposes, Bayberry (*Myrica pensylvanica*) and Wax Myrtle (*Myrica cerifera*) have another notable use indicated by the common name they share, Candleberry. Also known variously as, Tallowberry, Tallow Shrub, Waxberry and Candlebush, both species produce waxy fruits, from which wax may be extracted and used in the production of soap and candles. While bayberry wax was used throughout colonial America for candlemaking, candles made exclusively from bayberry wax fell out of favor with the introduction of sperm whale oil in the late 18th century and paraffin wax (from distilled hydrocarbons) in the early 19th century.

Bayberry and Wax Myrtle are tall shrubs, with leathery dark green leaves and blue-gray berries. The berries grow in clusters beneath the leafy stem tips. With a slightly more northern range, *M. pensylvanica* is found from maritime Canada to the Gulf Coast while *M. cerifera* is found from southern New Jersey south to the Gulf Coast. Both species are commonly to the coastal plain of Virginia, occurring along the border between wetlands and uplands, in wet swales between dune ridges, and the edge and under story of maritime forests (Silberhorn 1982). Given the co-occurrence of the two species, their similar habit and habitat, they can be difficult to differentiate. However,

bayberry is deciduous and has broader leaves and larger berries (1/8 to 1/4 inch) than the evergreen wax myrtle.

Other species of bayberries, of the family Myricaceae, are common to coastal regions of Central and South

framing, it is typically mixed with paraffin wax to make candles.

Candles

Gather the berries in late summer or autumn and pick through them to remove debris. Place in a pot and cover with boiling water. Let cool a bit and then bruise the berries, stir and bring to a boil. The wax melts at 116 to 120 EF. Continue to boil over low heat for 3 to 4 hours. Turn off heat and allow to cool. The wax will float to the surface. If the berry wax has debris in it, it may be reheated and strained through a cheese cloth. Add the bayberry wax to the paraffin and combine over low heat. The wax can then be used to make candles by dipping or with candle molds. Cold drink cups work fine for molds; double the cups to protect against leaking. Tie the wicking to a pencil and suspend over the cups. Fill with wax, allow to cool, and refill as necessary (Stewart and Kronoff 1975).



America and South Africa. Today, the bulk of commercially produced bayberry wax comes from Columbia (DeWolf Chemical 1999). The extraction process is fairly easy, but labor intensive. It takes a large amount of berries to produce enough wax for candle making; one estimate claims it takes four pounds of berries to yield one pound of wax (Grieve 1995). As the green wax is quite hard and brittle, time-consuming to produce, and quite

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Corps of Engineers Maneuvering to Adjust James River Dredging Restrictions

The Norfolk District Corps of Engineers, specifically the Rivers and Harbors Branch, is charged with maintaining most of the Federal Project Channels in Virginia including the 25 foot deep James River channel which runs from Hampton Roads to the Port of Richmond. The Corps faces numerous problems on many fronts in trying to carry out its charge. First the agency has to obtain the funding, which most of the time involves the Congress and a required local contribution. The locality is also required to furnish the disposal area for the dredged material as part of the articles of local cooperation. The Corps monitors channel depths and designs the dredging once the siltation fills the channel to the point where it interferes with navigation. The federal agency also has to deal with various federal and state environmental resource and regulatory agencies, generally charged with issuing permits and minimizing the adverse effects of these dredging activities on living marine resources and habitats. States have in the past denied Corps requests for dredging but more usually restrict the dredging in a number of ways in order to protect shellfish, submerged aquatic vegetation, wetlands and anadromous fishes.

The latter is a problem for the Corps' dredging program but only in the spring of the year (mid-February through June) when the fish swim up the rivers from the ocean in order to spawn in fresh water. Dredging during this period is usually restricted in rivers where the fish spawn, especially if the dredged material is pumped back into the river a short distance away from the channel, as is the case in the middle James. Previous studies have shown increased levels of turbidity to affect respiration, delay hatching, and impact blood chemistry in fishes. The Corps would like to be able to dredge all year round and is not convinced by previous studies that the silt clouds, generated by the dredging and overboard disposal, have an adverse impact on migrating anadromous fish.

Consequently, the Corps has initiated a three year study utilizing sophisticated electronic sensors to monitor both the movement of the resuspended sediments and the behavior of the fish when both are in the river at the same time. This past October, during a normal maintenance dredging exercise, the Corps and their study consultants hosted, on a working dredge, state agency personnel, the press, and others in hopes of convincing the permitting agencies that they

should be allowed to test their dredging effects while the fish are on their spawning migration up the river; usually the period when no dredging is permitted.

Studies of this type have not been attempted until recently because the sophisticated instrumentation was not available. The ideal outcome for the Corps and the dredging interests would be for the tests to show that the fish pay no attention to the suspended sediment and go on about their business. In order for this to happen, it will have to be demonstrated that the instrumentation can identify the several anadromous species (including American shad, striped bass, blueback herring and alewife), track the fish for long distances in the river, both inside and outside the sediment plumes and observe their behavior as influenced by the dredge and turbidity, irrespective of other factors which could be affecting their movements. Given the newness of the technology and the inherent difficulty in setting up the experimental design, cause and effect will be difficult to demonstrate. The Corps however, is motivated by its charge maintain the federal channels and is planning to spend \$150,000 to \$200,000 over the life of this 3-year study.

Online Fauna and Flora Data in Virginia

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List of Species" and easily navigate to a table of natural heritage resources for a locality. Plants, mammals, reptiles, amphibians, insects, non-insects, fish and birds data are compiled in tables which are easily downloaded as Adobe Acrobat .pdf files through the "Rare Plant and Animal Lists and Maps." This is also the source of valuable information pertaining to the state and federal legal rankings of species of status. DNH maintains a robust GIS database which offers more site specific data than the website. Due to the sensitive nature of the data maintained

there, access is restricted to certain individuals. The homepage has an Information Requests button with instructions for acquiring data.

The Virginia GAP Analysis Program is developing biodiversity indices for species in Virginia using remote sensing tools. Data is not yet available, but information on the project can be viewed at <http://fwie.fw.vt.edu/WWW/vagap/index.htm>. The Gap Analysis Program is a National Program at the United States Geological Survey. More information about the goals and objectives of this program can be viewed at <http://www.gap.uidaho.edu/gap/>.

Finally at our own VIMS homepage, you can link to maps illustrating the distribution of Submerged Aquatic Vegetation (SAV). Click on "Research Departments." You will find the SAV data within the "Biological Sciences" list. The direct address is <http://www.vims.edu/bio/sav/index.html>. The VIMS Tidal Marsh Inventory Series is available as Adobe Acrobat .pdf files. These are text files reproducing the hardcopy series developed by VIMS. To access these online reports, click on "VIMS Library," and then "Online Books." Scroll to the Tidal Marsh Inventories. They are arranged by locality. The digital GIS data will soon be available through the CCI website.

Calendar of Upcoming Events

- December 10, 1999** **Urban Wetlands:** A one day seminar presented by Virginia Association of Wetland Professionals. Huntley Meadows Park, Alexandria, Virginia.
Contact Magi Shapiro at (804) 883-6337. \$20 for members, \$25 for non-members.
- December 15-16, 1999** **Winter Botany:** A two day course, on the campus at VIMS, teaching the participants how to identify trees and shrubs during winter when there are no fruits, leaves or flowers. Cost is \$200.
Contact Dawn Fleming at (804) 684-7380 or Bill Roberts at (804) 684-7395.
- February 18, 2000** **A House Built on Sand:** An Exploration of the Legal Foundations of Wetland Regulation— A one day seminar presented by the Virginia Association of Wetland Professionals. Randolph Macon College.
Contact Magi Shapiro at (804)883-6337. \$20 for members and \$25 for non-members.
- March 13-17, 2000** **Fifth Marine and Estuarine Shallow Water Science and Management Conference.**
Atlantic City, NJ.
Contact Ralph Spagnolo at (215)814-2718 or email him at spagnolo.ralph@epa.gov

Book Review

Salt Tide: Cycles and Currents of Life Along the Coast by Curtis J. Badger. The Countryman Press, Woodstock, Vermont. 1993. 134pp., \$12.95 (soft-cover). Cover Illustration by Harry Jaecks.

Review by Anne Newsom

Clamming. Fishing. Boating. Birdwatching. Beachcombing. Curtis Badger, in his book, *Salt Tide: Cycles and Currents of Life Along the Coast*, uses descriptions of these activities and glimpses into his families' history to convey to the reader his love for Virginia's barrier islands and salt marshes. In the introduction, the author describes some of the changes that have occurred along Virginia's coast since the Civil War, but stresses that there are still areas along the coast that are much the same today as they were three centuries ago. From the start, Badger wants the reader to value the wilderness that remains, because it is his belief that "something will have gone out of us as a people if we ever let the remaining wilderness be destroyed."

The first eleven chapters of Badger's book are devoted to a different part of the natural environment

found within the salt marshes and barrier islands of Virginia. Included are the many types of plovers that inhabit the islands, the different species of fish to be caught off the coast and the secrets to finding clams buried deep within the mud flats surrounding the marshes. Just as each chapter describes different aspects of the natural environment, Badger approaches each topic from two points of view: scientific and personal. For example, in his chapter on *Spartina*, he discusses the plant's habitat, its value to the natural ecosystem and the chemistry of the plant that allows it to flourish in the harsh, intertidal salt marsh environment. From a more personal note, he talks of the small treasures that can be found within a *Spartina* marsh: marsh periwinkles that feed off of the surface of the grass, the carapace of a horseshoe crab washed up into the intertidal zone or fiddler crab burrows that the crabs scurry to when humans or large predators approach.

In the last two chapters of *Salt Tide*, Badger tells us the stories of his family, which help to complete the vision of the salt marshes and islands to which we have been introduced. He places the environment into an historical perspective that allows the reader not only to see the beauty of nature, but

also the changes that have occurred since the first settlers arrived. Fields were cleared for farming, trees were harvested for money and, sea level rising - a natural process - has slowly claimed land where trees once stood. This historical perspective brings the reader back full circle to Badger's ultimate point set forth in the introduction. Virginia's barrier islands and salt marshes are among the few surviving areas of wilderness along the East Coast and "the important thing about wilderness...is the effect it has on the human spirit."

Salt Tide will appeal to a variety of readers. All should be entertained by the personal stories woven amongst the scientific details and for those interested in more technical scientific descriptions, the bibliography provides an array of resources to be explored. The personal glimpses into Badger's life help to bring the marshes and islands alive, especially to those who may have never seen nature as it was intended - alone, along a quiet stretch of creek, with the silence broken occasionally by the wind rustling through the marsh grasses or by birds in the distance. Allow Badger to introduce you to the natural treasures that can be found, even today, along Virginia's barrier coast.