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Wildlife, Wetlands and Those "Other Plants"

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There are thousands of men and women whose job it is to venture into the wetlands and do work on behalf of the environment. Their job is to "manage" or "preserve" or "restore" swamps and woodlands, marshes and prairies, rivers and lakes, to promote biodiversity, and to encourage the growth of native plants and animals in an effort to preserve our ecosystems.

These "front-line" environmental field workers typically are the ones who take the soil and water samples, who count the plants and animals, and who use the herbicides and tractors. They are the ones who first notice when a single plant species is taking over, or when a duck species does not return the next year; they are the ones who report to the rest of us what's happening in the real world. Therefore, they need to know as much as possible about the wetlands they work in. These workers must know about the conspicuous invaders and the reclusive rarities, and also those "other plants" that are so important to the health and functioning of wetland ecosystems. They need to know about the grasses, sedges and rushes.

Grasses, sedges and rushes are often thought of, and frequently listed as "other plants" by workers in the "natural resource management" world. This is because grasses, sedges and rushes are difficult to identify, they don't get much press, and there are very many species.

Even professional managers of wetlands, mostly non-botanists, often cannot tell a rush from a sedge or a beneficial native grass from an unchecked invader. This is actually very understandable. Nature managers must focus on "invasions" by hundreds of new species and are unable to pay attention to the "other plants". Consider also the "common name problem": short things are "sedges" (whether they are or not); tall things are "big grasses."

We could have a problem here.

One reason why managers should pay close attention to the grasses, sedges and rushes that grow in their marshes, lakes and rivers is that these plants are very important to the diets of many waterfowl such as ducks and geese. If the necessary grasses, sedges and rushes disappear from a wetland or lake or river, so could many of the kinds of birds and other animals that depend on them for food and shelter. Natural resource management personnel, especially field workers, must be able to recognize native and non-native grasses, sedges and rushes in order to control only the non-native invasive plants and to promote the growth of these native plants that wild animals depend on.

This article lists some of the published research about several of the specific grasses, sedges and rushes that are preferred foods of ducks, geese and other waterfowl. The research cited here was identified in the **APIRS** database of the University of Florida. Though this database is about aquatic, wetland and invasive plants, it naturally includes much information about the animals that use them.

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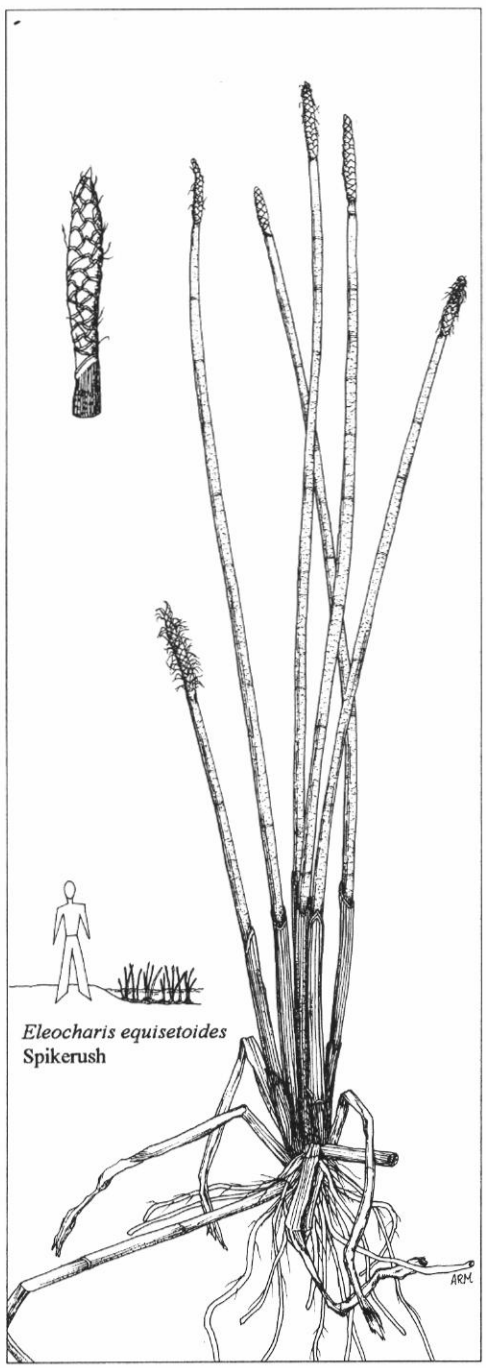

"Other Plants" - Continued from page 1

For the birds

Actually, it's *not* just for the birds. Research shows that the wild grasses, sedges and rushes of our wetlands are eaten and otherwise used by all kinds of animals including mammals as diverse as deer, rabbits, moose, cattle, alligators, beavers and boar. And, of course, birds.

Like other classes of animals, the birds include some species that are mostly vegetarian, some that are mostly carnivorous, and some that eat both plants and animals. Among the waterfowl, for example, wetland plant matter is very important to the diets of American widgeon, ring-necked ducks, redheads, gadwalls, mallards, pintails, wood ducks and canvasbacks; plant parts also are important to the diets of fulvous whistling ducks, green- and blue-winged teal, black ducks, spoonbill ducks, coots, moorhen, soras, Canada geese, snow geese, greylag geese, sandhill cranes, mourning doves, white-winged doves and other birds. Certain wetland grasses, sedges and rushes are also important as habitat and nesting materials. For example, American woodcocks have a special affinity for switch cane habitat (*Arundinaria gigantea*), and clapper rails prefer to nest in black needle rush (*Juncus roemerianus*) (46).

Management objectives

The literature shows that there are many issues that wetlands managers must deal with, such as development, pollution, recreational uses ("consumptive" uses such as hunting and "non-consumptive" uses such as tourism), and non-native species invasions. All of these challenges also affect the wetland's populations of grasses, sedges and rushes, and the animals that depend on them.

"The first step to accomplishing the goal of marsh management for wildlife is to conduct a food habit study to determine if the best plants are growing in the marshes," according to H.F. Percival. To help answer this question for a South Carolina wetland, researchers investigated the conditions necessary for the growth of important wildlife plants such as soil nutrition, soluble salts concentrations and water level (40).

It is surprising how much wildlife food is produced in an acre of productive wetland. In a 1951 study by J.R. Singleton of the east Texas gulf coast, researchers found that in a single acre, *Scirpus robustus* produced an average of about 300 lbs. (dry weight) of seeds per acre per year; *Echinochloa walteri* produced about 800 lbs. of seeds per acre, *Cladium jamaicense* and *Polygonum hydropiperoides* each produced about 600 lbs. of seeds per acre, *Leersia oryzoides* produced about 150 lbs. of seeds per acre, *Rhynchospora corniculata* produced about 900 lbs. of seeds per acre, and each acre produced about 5 *tons* of plant corms (44).

Among their other responsibilities, wetland resource managers must control non-native invasive plants, lest they take over a wetland and replace native wildlife food plants. For example, F.A. Johnson noted that in central Florida, the very invasive torpedograss (*Panicum repens*) can become "dense enough to discourage waterfowl use". However, managers need to realize that when they are herbiciding, burning, chopping and otherwise controlling undesirable plants, they may also be killing very important grasses, sedges and rushes. According to Reid et al., "herbicide use has reduced grasses in the field" (46). When managers are controlling those familiar invaders such as cat-tail (*Typha*), silk reed (*Neyraudia reynaudiana*), elephant grass (*Pennisetum purpurea*) and para grass (*Brachiaria mutica*), they should take care that their herbicides and flames are not also killing those unfamiliar "other plants."

Rhynchospora inundata
Beak-rush

Food plants and birds

Birds are known to consume all parts of grasses, sedges and rushes, including tubers, rhizomes, stems, foliage, inflorescences and seeds. Therefore, work on the nutritional value and digestibility of wild plant parts has been conducted on *Scirpus americanus*, *Spartina* spp., *Juncus gerardi* and other grasses, sedges and rushes. (26).

In one unmatched study of mallard duck diets from 1918, W.L. McAtee reported collecting animals in 22 states and finding that mallards are mostly vegetarian, with more than 90% of their food being plant parts. Sedges (*Scirpus cubensis* and *Scirpus fluviatilis*), and *Fimbristylis*, *Cyperus* and *Cladium* comprised about a quarter of the mallard diet; with grasses (*Zizania aquatica*, *Echinochloa*, *Panicum* and *Spartina*) making up another 13%. The remainder of the mallard diet consisted of "smartweeds, 10%; pondweeds 8%; duckweeds 6%, coontail, 6%; wild celery 5%; sagittaria 5%; with the rest being acorns and berries" (30).

While some species of ducks eat more animals than plants, and some eat more plants than animals, for others the ratio depends on the habitat, food availability, and seasonality.

Seasonality in bird diets has been documented for several waterfowl species. Some kinds of ducks eat more animals during breeding/nesting season, and the same ones might prefer plant seeds during migration. For example, blue-winged teal change their diets seasonally, from eating aquatic invertebrates (such as gnats and small snails) in the breeding season, to eating mostly plant seeds during fall and winter (33). This may be due to the fact that animal foods provide more protein, possiby needed for egg development, etc., while plant seeds, rich in carbohydrates, provide more "quick energy" needed for flying.

In a study of gut contents of Wisconsin redhead ducks *(Aythya americana)*, researchers found 34 animal species and 30 plant species. Seeds predominated in pre-laying birds; *Scirpus* seeds and *Potamogeton* tubers were the primary components of laying redheads (22).

Duck diets change not just seasonally, but also according to location and food availability. For example, a study found that canvasbacks in Louisiana ate lots of grasses, sedges and rushes (17), but in another study in Maryland they ate mostly widgeongrass (*Ruppia* spp.) and *Potamogeton perfoliatus* (41).

Redhead ducks are so-called "diving ducks", so one might presume that redheads eat only underwater plants and animals. However, a study in North Dakota found that as much as 30% of the redhead duck diet was plant material, most of which was *Scirpus* seeds (11%), and seeds from a variety of other emergent plants including *Eleocharis* and *Echinochloa.* In fact, overall, redhead ducks ate more emersed plant food than submersed plant food (48).

Grasses sedges and rushes are important foods even to *very* aquatic birds, such as the bottom-sifting shoal-water spoonbill duck (*Spatula clypeata*). In one study, 16% of the spoonbill diet was *Scirpus*, *Carex* and *Cladium*, 11% was *Potamogeton* and 8% was *Panicum* spp. (31).

The most important "staging area" for migrating greater snow geese (*Chen caerulescens*) is a 3750-ha *Scirpus americanus* marsh, where rhizomes, shoots and stems make up about half their entire diet during the several weeks of both migration seasons (5).

Coots (*Fulica atra*) also are major wetland plant consumers. In one study on a Polish lake, two-thirds of the coot diet was plant parts and one-third was animals. Even though coots spend much of their time swimming and diving, the second-most important plant in the coot diet was *Phragmites australis* (after the bottom-growing *Chara* spp) (8).

Grow more grasses, sedges and rushes

In 1917, McAtee called for more dealers to grow and offer plants and seeds of various species of bur-reeds, pondweeds, cord grasses, bulrushes, saw grass, and sedges in order to supply wildlife managers who wanted to grow the right plants for birds (29).

In this booklet, McAtee tells managers how to propagate *Zizania aquatica* because wild rice, "in every stage of its growth is eaten by one or another of the North American ducks and geese, and practically all ducks feed on its ripened grain." It is "the staple fall food of many ducks in the numerous rice marshes of eastern U.S." This booklet also explains how to propagate chufas (*Cyperus esculentus*) and wild millet (*Echinochloa crus-galli*) (29).

Information abounds

Natural resource managers, including those workers who maintain and protect wetlands, lakes and rivers, should remember the importance of the "other plants" in their charge. Managers should learn about the grasses, sedges and rushes, and promote these and other plants that are essential to so many species of birds and other animals.

GRASSES, SEDGES AND RUSHES USED BY WATERFOWL --CITED RESEARCH ARTICLES

The following is a list of some of the feeding studies of water birds taken from the **APIRS** database:

Arundinaria gigantea stands -- a preferred habitat of American woodcock (Straw et al, (46))

Brachiaria extensa seeds -- a major part of the diet of fulvous whistling ducks in Louisiana ricefields. (20)

***Carex* spp.** -- common snipe habitat (Arnold, (46))
Carex subspathacea -- a favorite food of geese (11)

Cladium jamaicense seeds -- very important to wintering gadwalls in Louisiana (39); a major food of ducks in SE Texas (44); a major food of mallards in the US (30)

***Cyperus* spp.** -- a major part of the diet of fulvous whistling ducks in Louisiana (20); tubers are a major part of canvasback diet in Mississippi River Delta (17)

***Distichlis* spp.** -- a food of sandhill cranes (46); among favorite food of gadwalls in Utah (13); eaten by mourning doves (46)

***Echinochloa* spp.** -- eaten by mourning doves (46)
Echinochloa crus-galli -- a preferred food of pintail ducks in California (9), (10); a preferred food of green-winged teal (10); a major food of mallard ducks in the US (30)
Echinochloa walteri -- a major food of ducks in SE Texas (44)

***Eleocharis* spp.** -- a favorite food of gadwalls in Utah (13), and of ruddy ducks (48)
Eleocharis cellulosa -- a major food plant of ducks in Texas (44)
Eleocharis equisetoides and ***E. quadrangulata*** -- important foods to overwintering waterfowl in South Carolina (40)
Eleocharis parvula -- leaves eaten by wintering gadwalls in Louisiana (39); a major food plant of ducks in Texas (44)
Eleocharis quadrangulata -- a major food of ducks in Texas (44)

***Fimbristylis* spp.** -- a major food of mallard ducks (30)

Juncus roemerianus -- favored clapper rail nesting habitat (Eddleman and Conway, (46))

Leersia **spp.** -- a major part of diet in 3-year study of redhead ducks in Wisconsin. (22)

Panicum **spp.** -- preferred food of mourning doves and white-winged doves (46); a major food of mallard ducks (30)

Paspalum distichum -- used by greylag and barheaded geese (36)

Phalaris arundinea -- a major food of ring-necked ducks in Minnesota (16)

Phragmites communis -- a major plant food of coots in Poland (8)

Rhynchospora **spp.** -- a major food of fulvous whistling ducks in Louisiana (20)

Scirpus **spp.** -- a major component of the diet of ruddy ducks (48) and common moorhen (Griej, (46)), soras (Melvin and Gibbs, (46)), seeds very important to overwintering gadwalls in Louisiana, to redheads in Wisconsin (22); a major food of spoonbill ducks (31)
Scirpus acutus -- among favorite foods of gadwalls in Utah (13)
Scirpus americanus -- rhizomes and seeds a major part of diet in canvasbacks in the Mississippi River Delta (17)
Scirpus cubensis -- a major food of mallard ducks in US (30)
Scirpus fluviatilis -- a major food of mallard ducks in US (30)
Scirpus littoralis and *Scirpus maritimus* -- tubers eaten by wintering greylag geese in Spain (1)
Scirpus robustus and *Scirpus validus* -- important foods to overwintering birds in South Carolina. (40)
Scirpus subterminalis and *Scirpus torreyi* -- constituted 30% of the fall food diet of black ducks in Maine (34)

Setaria **spp.** -- preferred food of mourning doves and white-winged doves in southwestern U.S. (46)

Zizania aquatica -- "eaten by practically all ducks" (29); a favorite food of soras in upper midwest U.S. (Melvin and Gibbs, (46)); a major food of mallard ducks in U.S. (30); a major food of black ducks and wood ducks (29)

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Although the **APIRS** database collects literature on aquatic, wetland and invasive plants, this necessarily includes peripheral subjects such as animals which use these plants for food, habitat, nesting, etc. For example, the database contains over 1,000 references with the following keywords: (*duck* or *ducks* or *birds* or *waterfowl* or *avian* or *geese* or *goose*). (NOTE: if you use *duck*$, you will retrieve a few hundred duckweed articles that don't necessarily pertain to ducks.) If you combine this search with *(food*$ or *feed*$ or *diet*$ or *consum*$ or *graz*$ or *herbiv*$*), you will retrieve over 300 references. With (*habitat* or *host plant*$ or *nest*$ or *breed*$*) - over 680 references. With *((primary production)* or *productivity)* - over 180 references that might report on the effects of herbivory on productivity, or the effects of productivity on bird habitat, foods, etc.

Juncus effusus
Soft rush

Books/Reports

IN SEARCH OF SWAMPLAND -- A WETLAND SOURCEBOOK AND FIELD GUIDE, by R.W. Tiner. 1998. 265 pp.

(Order from Rutgers University Press, 100 Joyce Kilmer Avenue, Piscataway, NJ 08854-8099. $26.00 paper; $55.00 cloth, plus S/H. 1-800-446-9323.)

This is another general introduction to wetlands that includes an overview of wetland ecology, and a "wetland identification guide" to plants, soils, animals and delineation. The book includes descriptions and drawings of more than 300 plants and 200 animals.

AQUATIC PLANTS IN BRITAIN AND IRELAND, by C.D. Preston and J.M. Croft. 1997. 365 pp.

(Order from Harley Books, Martins, Great Horkesley, Colchester, Essex CO6 4AH, ENGLAND. £25, net.)

The Chairman of the Environment Agency states in the forward, "...This volume presents, for the first time, a thorough review of all freshwater plants in Britain and Ireland. It is both an atlas of distribution and compendium of scientific information." The book summarizes the distribution, habitat and reproductive biology of 200 taxa in 72 genera, including distribution maps for Britain and Ireland. The book includes a single line drawing for each genus, and no photographs.

SEAGRASS BIOLOGY -- PROCEEDINGS OF AN INTERNATIONAL WORKSHOP, Volumes 1 and 2, edited by J. Kuo, R.C. Phillips, D.I. Walker and H. Kirkman. 1996. Two hardcover volumes: 385 pp. and 276 pp.

(Order from John Kuo, CMM. University of Western Australia, Nedlands 6907, AUSTRALIA. E-mail: jjskuo@cyllene.uwa.edu.au US$80 plus US$30 postage.)

A 1996 statement from 65 of the world's leading seagrass scientists calls attention to the fact that seagrass habitat is declining world-wide, especially because of coastal development and watershed runoff, and that seagrass loss will reduce fisheries production, water quality, sediment stability and biodiversity. According to C. Peter McRoy, "unlike many other marine ecosystems, seagrasses may be amenable to management, if management practices are based on knowledge of plant biology and ecosystem interactions."

These are the proceedings and discussions of an international workshop held at Rottnest Island, Western Australia, 25-29 January 1996. Volume 1 contains 49 peer-reviewed papers on diversity and plant biology, molecular genetics, hydrodynamics, production and nutrient dynamics, animal interactions, decline and recovery, and monitoring and management. Volume 2 presents the transcripts of scientific discussions from each of the presented papers.

FRESHWATER ALGAE IN AUSTRALIA -- A Guide To Conspicuous Genera, by T.J. Entwisle, J.A. Sonneman, and S.H. Lewis. 1997. 242 pp.

(Order from Sainty and Associates Pty. Ltd., POB 1219, Potts Point, NSW 2011, Australia. E-mail: geoff@sainty.com.au OR WWW: http://www.sainty.com.au $A36.95 soft cover; $A49.95 hard cover, plus S/H.)

This is a beautifully organized and illustrated manual about 96 species of algae from Australia. The schematic keys are based on the most readily observable characters. The color micrographs and printing are exceptional for such a relatively inexpensive book. Each genus is described in terms of habitat and habit, color and microscopic features, species and distribution.

RIVER HABITAT QUALITY -- THE PHYSICAL CHARACTER OF RIVERS AND STREAMS IN THE UK AND ISLE OF MAN, by P.J. Raven, N.T.H. Holmes, F.H. Dawson, P.J.A. Fox, M. Everard, I.R. Fozzard, and K.J. Rouen. 1998. 90 pp.

(Order from Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS32 4UD, England. Or download it from http://www.environment-agency.gov.uk/info /riverhq.html)

This report "describes a method for evaluating the physical character of rivers." It also summarizes the results of the first ever baseline survey of river habitats in the United Kingdom. It is illustrated with photographs, drawings, graphs, charts and maps, and includes a pullout "summary fact-sheet".

WICKEN FEN -- THE MAKING OF A WETLAND NATURE RESERVE, edited by Laurie Friday. 1997. 306 pp.

(Order from Harley Books, Martins, Great Horkesley, Colchester, Essex CO6 4AH, England. £24.50 paper; £37.50 cloth, plus S/H.)

Wicken Fen, 305 hectares of mire, was established as a "reserve" in 1899 in order to help protect what was left of England's almost 4,000 sq. km. of Fenlands. There are four such reserves, however, "Only at Wicken Fen is there a feeling of continuity with the past...where the fenmen unwittingly conserved so many of the plants and animals of the untamed fen: at Wicken Fen the reeds and sedge are still cut."

This book is in four parts: an introduction to fenlands; habitats and communities remaining at the fenland reserves; flora and fauna of the fens; and "the human dimension": the history, management and future of the fens. Included with the several excellent essays about the plants, animals and human uses of the fens are many photos, drawings and lists.

THE PANTANAL OF POCONÉ -- Biota and Ecology in the Northern Section of the World's Largest Pristine Wetland, Monographiae Biologicae 77, by C.W. Heckman. 1998. 622 pp.

(Order from Kluwer Academic Publishers, Order Dept. POB 322, 3300 AH Dordrecht, The Netherlands. E-mail: services@wkap.nl $US285.00.)

The huge and isolated Pantanal of Poconé is believed to be the world's largest wetland "that is still in a nearly natural state". This impressive compendium is the most comprehensive source of information about all natural aspects of the Pantanal. Found in the "tropical wet-and-dry climatic zone" in the center of South America, the Pantanal covers about 200,000 sq. km., with a catchment area of nearly 1/2 million sq. km. Until the 1990s, little ecologic study of the Pantanal had been undertaken. This book includes observations of the author during the course of several years in the field as well as reviews of existing published research, and includes sections about geography, geology, climate, hydrology, water chemistry, flora, fauna, biotic communities, seasonal succession, ecosystem dynamics, human impact, and conservation of the Pantanal. The publisher states that this book "is meant to be a basic sourcebook of tropical ecology and wetland biology."

WHAT IS NATURAL? CORAL REEF CRISIS, by J. Sapp. 1999. 275 pp.

(Order from Oxford University Press, 198 Madison Avenue, New York, New York 10016-4314; WWW: http://www.oup-usa.org ISBN: 019-512364-6; $30.00)

For the past 30 years, huge (2 ft. diameter) crown-of-thorns starfish have been infesting coral reefs around the world, "leaving in their wake devastation comparable to a burnt-out rainforest." The continuing plagues have been blamed on everything from nuclear testing to pesticide use to El Niño. This story "offers a window from which to examine environmentalism and its relations with marine ecology and governments."

HYDROLOGY OF CENTRAL FLORIDA LAKES -- A PRIMER, by D.M. Schiffer. 1998. 38 pp.

(Order from U.S. Geological Survey, Branch of Information Services, Box 25286, Denver, CO 80225-0286. Circular 1 free on written request.)

This very good, easy-to-read, colorful, large-format booklet introduces citizens to the lakes of central Florida. Answering many of the basic questions people have, it explains lake classification, the hydrologic cycle, the geology of central Florida, the causes of lake water-level fluctuations, and water quality.

TECHNICAL EVALUATION OF MONITORING METHODS USING MACROPHYTES, PHYTOPLANKTON AND PERIPHYTON TO ASSESS THE IMPACTS OF MINE EFFLUENTS ON THE AQUATIC ENVIRONMENT, by L. St-Cyr, A. Cattaneo, R. Chasse and C.G.J. Fraikin. 1998. 200 pp.

(Order from CANMET, 555 Booth Street, Ottawa, Ontario, Canada K1A OG1.)

This technical report on biomonitoring methods was prepared for the Aquatic Effects Technology Evaluation Program and the Canadian Center for Mineral and Energy Technology. The report reviews published literature about "established and emerging monitoring methods using macrophytes, phytoplankton and periphyton, and makes recommendations as to the usefulness and cost-effectiveness of these methods."

BIOLOGICAL ASPECTS OF *SCENEDESMUS* (CHLOROPHYCEAE) - PHENOTYPIC PLASTICITY, by F.R. Trainor. 1998. 367 pp.

(Order from Gebruder Borntraeger, Verlagsbuchhandlung, Johannesstr. 3A, D-70176 Stuttgart, Germany; E-mail: order@schweizerbart.de Nova Hedwigia, Beiheft 117, US$72.00)

The question posed: Is *Scenedesmus*, a freshwater green colonial algae, a single extremely "plastic" (polymorphic) taxa, or is it hundreds of species and taxa? The problem is that *Scenedesmus* has so many growth forms that have been described during the past 175 years that it is necessary to write a book to support the idea that it is taxonomically-okay that the taxa has many, many "ecomorphs". Some growth forms may even be triggered by "infochemicals" released by algal predators in the local environment.

CONSTRUCTED WETLANDS FOR WASTEWATER TREATMENT IN EUROPE, edited by J. Vymazal, H. Brix, P.F. Cooper, M.B. Green and R. Haberl. 1998. 366 pp.

(Order from Backhuys Publishers, POB 321, 2300 AH Leiden, The Netherlands; E-mail: backhuys@euronet.nl WWW: http://www.euronet.nl/users/backhuys/ US$139.00, hardbound.)

This is a complete and readable history of wetland/wastewater technology in Europe, from the 1950s German experiments of Kathe Seidel to present work in Austria, Portugal, Norway and elsewhere. Experiences and case studies from 15 countries are described, including the types of constructed wetlands, main design parameters, treatment efficiency, construction, maintenance and operation, costs, operational problems and current research.

INVASIVE PLANTS--WEEDS OF THE GLOBAL GARDEN, edited by J.M. Randall and J. Marinelli. Brooklyn Botanic Garden, Handbook #149. 1996. 111 pp.

(Order from Brooklyn Botanic Garden, 1000 Washington Ave, Brooklyn, NY 11225-2097. (718)-622-4433, Ext. 274. $9.95 plus S/H.)

This very good little book includes two succinct and understandable introductions by the editors: Redefining the Weed, and How Non-Native Species Invade and Degrade Natural Areas. The book includes one section on "chemical-free weed controls" and another on choosing and applying herbicides when necessary. The remainder includes the "encyclopedia of invasive plants" with trees, shrubs, annuals, perennials, grasses, vines and aquatic plants, 76 species in all. Each plant treatment includes, in plain English, what does it look like? where did it come from? where has it spread? what problems does it cause? how can it be controlled? Color plant portraits, though small, are included.

FROM THE DATABASE

Here is a sampling of the research articles, books and reports which have been entered into the aquatic plant database since January 1998.

The database has more than 48,000 citations. To receive free bibliographies on specific plants and/or subjects, contact APIRS using the information on the back page or use the database online at http://aquat1.ifas.ufl.edu/

To obtain articles, contact your nearest state or university library.

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MEETINGS

INTERNATIONAL TRAINING COURSE ON AQUATIC PLANT BIOLOGY AND CONTROL.
June 28-July 14, 1999. Gainesville, Florida.

Produced by the University of Florida Center for Aquatic and Invasive Plants, this three-week course will include 1) a week of intensive classroom training on aquatic plant biology and control; 2) a week of field work collecting and rearing insects and applying herbicides; and 3) attendance at the Aquatic Plant Management Society annual meeting in Asheville, North Carolina. Attendees will be responsible for travel and living expenses.

Contact: Center for Aquatic and Invasive Plants, IFAS-University of Florida, 7922 NW 71 ST, Gainesville, FL 32653; (352) 392-9613; E-mail: aqplants@gnv.ifas.ufl.edu

INTERNATIONAL CONFERENCE ON PHRAGMITES-DOMINATED WETLANDS.
Their Functions and Sustainable Use.
April 18-23, 1999. Třeboň, Czech Republic.

This conference is convened by the Institute of Botany of the Academy of Sciences of the Czech Republic, an organization long respected for its work on *Phragmites australis*, the most common dominant plant of European temperate wetlands. Common reed is valued for maintaining stability of river and lake margins, and is considered a most important sanctuary for wildlife. In Europe, common reed is in the process of a general die-back, whereas in North America the plant seems to be expanding.

The purpose of this conference is to provide an international forum for the exchange of state-of-the-art information on *Phragmites*-dominated wetlands, especially on biogeochemical cycling, growth dynamics and ecophysiology.

Contact: Phragmites Conference Secretariat, Institute of Botany, AS Cr, Dukelská 145, CZ-379 82 Trebon, Czech Republic; E-mail: cizkova@butbn.cas.cz; WWW: http://www.butbn.cas.cz/phraconf

SIXTH SYMPOSIUM ON BIOGEOCHEMISTRY OF WETLANDS.
July 11-14, 1999. Ft. Lauderdale, Florida.

This symposium will emphasize various biogeochemical processes occurring in freshwater and estuarine wetlands. Topics include: the roles of wetlands in improving water quality, global climatic change and nutrient cycling; plant-soil interactions in wetlands; biogeochemical indicators; heavy-metal chemistry in wetlands; reactions of toxic organics in wetlands; and wetland eutrophication.

Contact: IFAS Office of Conferences, (352)392-5830; E-mail: mrp@gnv.ifas.ufl.edu; WWW: http://gnv.ifas.ufl.edu/~conferweb/#upcoming

FLORIDA LAKE MANAGEMENT SOCIETY, 10TH ANNUAL MEETING.
May 26-28, 1999. Safety Harbor, Florida.

Meeting subjects include all issues related to lake and watershed management in Florida. This year's meeting will include case histories of in-lake restorations, watershed management, fisheries management, aquatic plant management, and public outreach.

Contact: Nancy Page, Conference Coordinator, (727) 464-4425; E-mail: npage@co.pinellas.fl.us

SOCIETY OF WETLAND SCIENTISTS, 20TH ANNUAL MEETING.
June 6-12, 1999. Norfolk, Virginia.

The theme of the meeting is, "Wetlands Function, Assessment and Management", with sessions on wetland ecosystem types, dynamic processes and functions, wetland modification and manipulation, analytic techniques, wetland policy and management, and wetland education and outreach.

Contact: E-mail: sws@vimw.edu; WWW: http://www.sws.org

NALMS: 8th ANNUAL SOUTHEASTERN LAKES MANAGEMENT CONFERENCE.
Developing Watershed Solutions: Community Partnerships.
March 24-27, 1999. Clemson, South Carolina.

One objective of this meeting is "to explore ways to restore, enhance and preserve watersheds while supporting economic development". Session topics will include eutrophication, science programs for children, limnological studies, working with the media, aquatic weed control and more. Workshops on building effective lake associations also are planned.

Contact: Barbara Speziale, Dept. of Biological Sciences, 132 Long Hall, Clemson University, Clemson, SC 29634-1903; (864) 656-1550; E-mail: bjspz@clemson.edu; WWW: http://www.nalms.org/indexf.htm

AMERICAN FISHERIES SOCIETY, 129TH ANNUAL CONFERENCE.

August 29-September 2, 1999. Charlotte, North Carolina.

The meeting theme is "Integrating Fishery Principles from Mountain to Marine Habitats."

Contact: E-mail: fisheries@fisheries.org

NORTH AMERICAN BENTHOLOGICAL SOCIETY, 47TH ANNUAL MEETING.

May 25-28, 1999. Duluth, Minnesota.

NABS 99 Plenary Session is called, "Current Issues in Aquatic Sciences: Examples from the Great Lakes." In addition there will be Special Sessions on Great Lakes benthic science, the ecology and management of large rivers, aquatic ecosystem restoration,"interactive constraints", Native American environmental issues, and others on taxonomy, the role of fish in food webs, lentic food webs, and marsh and wetlands ecology. Pre-conference workshops on Geographical Information Systems (GIS) for aquatic professionals, midge taxonomy, and general taxonomy also will be held.

Contact: WWW: http://www.d.umn.edu/nabs99/

SHORT COURSE ON ENVIRONMENTAL MODELLING WITH GIS AND REMOTE SENSING.

April 12-16, 1999. Enschede, The Netherlands.

Contact: J. Looijen, ITC, POB 2, 7500 AA Enschede, The Netherlands; +31 (0) 53 4874265; E-mail: looijen@itc.nl

COMMUNITIES WORKING FOR WETLANDS, 3RD ANNUAL CONFERENCE.

February 18-20, 1999 New Orleans; March 18-20, 1999 San Francisco; April 8-10, 1999 Indianapolis; May 6-8, 1999 Andover, Massachusetts.

These meetings of roundtable discussions and workshops "are structured to encourage free, interactive discussion, led by participants selected for their experience in the subject", and are for everyone from landowners and gardeners to elected officials and government reps. The workshops include "wetlands primer", "landscaping wetlands" and"working with your corporate partner". Pre-conference registration fees run from $100 for students to $350 for corporate people, plus fees for workshops and field trips.

Contact: Conference, c/o Terrene Institute, 4 Herbert Street, Alexandria, VA 22305 (703)548-5473. E-mail: terrinst@aol.com

ECOSYSTEMS RESTORATION AND CREATION, 26TH ANNUAL CONFERENCE.

May 13-14, 1999. Tampa, Florida.

This annual forum provides for the exchange of results of scientific research in the restoration, creation, mitigation, permitting, and management of freshwater and marine wetlands and uplands. (The conference has expanded its scope to include mixed and upland ecosystem concerns.)

Contact: Frederick J. Webb, Dean of Environmental Programs, Hillsborough Community College, Plant City Campus, 1206 N. Park Road, Plant City, FL 33566, (813) 757-2104. E-mail: webb@mail.hcc.cc.fl.us

PREDICTING PLANT AND ANIMAL OCCURRENCES: ISSUES OF SCALE AND ACCURACY.

October 19-22, 1999. Snowbird, Utah.

This is an international conference to bring together scientists and land managers involved with habitat modeling, with "a focus on the future of modeling to support multi-scale landscape planning efforts for wildlife conservation and management." Manuscripts will be peer reviewed and published as a book.

Contact: Mr. Mike Scott (208) 885-6960; Dr. Patricia Heglund (208) 885-2665; or Ms. Kathy Merk (208) 885-2750, or see the web site: http://www.ets.uidaho.edu/coop/1999_symposium.htm

AQUATIC WEED CONTROL, AQUATIC PLANT CULTURE AND REVEGETATION SHORT COURSE.

May 17-20, 1999. Ft. Lauderdale, Florida.

A photo-review of what happened at the 1998 short course: New and used information about aquatic plant control, identification, culture and use, plus up to 20 Continuing Education Units (CEUs) awarded for Florida State Pesticide Applicator License recertification. These annual workshops are put on by Vernon Vandiver, David Sutton and David Buchanan of the University of Florida, Ft. Lauderdale Research and Education Center.

Contact: Vandiver at vvv@ufl.edu or Sutton at dlsutton@ufl.edu, or contact the FREC, 3205 College Avenue, Ft. Lauderdale, FL 33314 (954) 475-8990.

Continued - next page

NEW IDENTIFICATION TOOL!

Grasses, Sedges and Rushes of Wetlands Identification Deck -- With notes about wildlife use

A handy new identification tool, similar to the very popular ***Aquatic Plants Identification Deck***, is "at the printer" and is expected to be for sale in April, 1999. The ***Grasses, Sedges and Rushes of Wetlands Identification Deck*** is a stack of 3" X 4" laminated cards, bound with two rings to open as a book. The deck is sturdy enough to withstand extensive field use in a wetland environment. It has identification text and line drawings on one page facing color photographs of the plants on the other. Written by Victor Ramey, with the cooperation of botanist and noted wetland plant expert, David Hall, this ID deck treats 84 species of the most common and/or important grasses, sedges and rushes that occur in wetlands, including 22 non-native species. Each plant is well-described in terms that are readily understood by non-botanists. The ID deck is illustrated with 150 color photographs and 70 line drawings by Ann Murray, and is indexed according to scientific names, common names, and inflorescence shapes.

Incidental notes on each plant include its documented use by ducks, geese, swans and other waterfowl, since native grasses, sedges and rushes provide food, shelter and nesting habitat to many kinds of birds and other wildlife. The deck will teach managers, field personnel, students, and other wetlands enthusiasts to distinguish between the exotic elephant grass and native panic grasses, exotic para grass and native maidencane, and to identify and distinguish between 80 other grasses, sedges and rushes from *Amphicarpum muhlenbergianum* (blue maidencane) to *Zizaniopsis miliacea* (giant cut grass).

Each ***Grasses, Sedges and Rushes of Wetlands Identification Deck*** (Publication Number SP255) is $12 plus S/H. It will be available from the University of Florida, IFAS Publications, 1-800-226-1764. ***Please note that this item will not be available until April, 1999!***

MEETINGS - Continued

INTERNATIONAL SYMPOSIUM ON BASS SPP. CULTURE: BASIC AND APPLIED ASPECTS. September 13-16, 1999. Cestellón de la Plana, Spain.

The aim of the symposium is to collect all the current basic and applied studies conducted in the culture of American, European and Asiatic bass. Sessions include: reproduction, pathology, nutrition and metabolism, growth and development, genetics, and culture techniques and commercialization.

Contact: Liz Reed, E-mail: e.reed@elsevier.co.uk; WWW: http://www.elsevier.nl/locate/aqua99

MARKETING & SHIPPING LIVE AQUATIC PRODUCTS 99. November 14-17, 1999. Seattle, Washington.

"Technological refinements are revitalizing the centuries old practice of providing live aquatic products for display or consumption far from the point of harvest...This conference will assist fishermen, growers and marketers of aquatic products to supply the expanding market while complying with increased restrictions and regulations." Major topics include: resources, shipping, harvesting, physiology, exotics, holding, reconditioning, regulations, packaging, water quality, marketing, research, and environmental, sociological, political and humanitarian considerations.

Contact Conference Manager, John B. Peters, Nor'Westerly Food Technology Services, 20455 - 1st Ave. NE, Suite C 303, Poulsbo, WA 98370-9329. E-mail: johnbpeters@compuserve.com

Some responses to our last issue:

"The interesting article on the edibility of *Trapa bispinosa* reminded me of something I saw during a recent trip to the Landesmuseum in Zurich, Switzerland. A display of the foods used by the ancient Celtic tribes and Swiss lake-dwellers of the area included a *Trapa* nut, apparently *T. natans*." **Dr. Susan Sprecher, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.**

"It was funny reading about the fruits of *Trapa natans* from Burma made into rosaries and sold in Italy, because I remembered that *Trapa natans* is an invasive plant proliferating in one of the lakes in North Italy." **Dr. Francisco Comín, Universitat de Barcelona, Spain.**

Johnson's Seagrass Listed as Threatened

Agents of the National Marine Fisheries Service have issued a final rule (63 FR 49035) listing Johnson's seagrass, *Halophila johnsonii*, as a threatened species under the Endangered Species Act, with the conclusion that it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Johnson's seagrass has one of the smallest geographic distributions of any seagrass; it is found only in lagoons on the southeastern coast of Florida,.

Halophila johnsonii is dioecious (contains flowers of only a single sex on one plant). However, the male flower has never been recorded in the field or in laboratory culture. The absence of male flowers supports the hypothesis that sexual reproduction is absent in this species. Scientists have not observed new *Halophila* plants growing from root or stem fragments. Rather, the plant extends by branching and by growth of the rhizomes. This limited reproductive capacity further threatens the ability of the rare plant to survive human-induced or natural disturbances. Because it is most abundant amidst the heavy boating traffic of south Florida coastal area inlets and channels, potential threats to the diminuitive seagrass include dredging activities, boat propellor and anchor damage, and storm events.

Identifying characteristics of *H. johnsonii* include smooth linear leaves with entire margins. Leaves are 10-20 mm long on long petioles and occur in pairs at each node. The plant has a creeping rhizome and sessile female flowers. The plant tolerates broad ranges of salinity, temperatures, and water levels. It is found on sandy intertidal shoals where it is exposed to drying, intense sunlight and extreme temperature changes during low tide. It also is found in deeper channels with swift, eroding currents.

Johnson's seagrass is one of twelve species of the genus *Halophila*. Most *Halophila* species are less than four inches tall, shallow rooted, and have two to three orders of magnitude less biomass per unit area compared to all other seagrasses. In contrast to the restricted range of Johnson's seagrass, other members of the genus have a pantropical range. In addition, *Halophila* seagrasses cover the greatest range of water depths for seagrasses. They have been found growing in water depths of more than 100 feet deep, as well as in shallow estuaries and intertidal shoals. These seagrasses are known to provide a food source to green sea turtles, West Indian manatees, and dugongs.

References:

1) Durako, M. and F. Wettstein. 1994. Johnson's seagrass. The Palmetto, Winter 1994, pp. 3-5.

2) Eiseman, N.J. and C. McMillan. 1980. A new species of seagrass, *Halophila johnsonii*, from the Atlantic coast of Florida. Aquatic Botany 9:15-19.

3) U.S. Federal Register 63(177):49035. 1998.

NOTE: The **APIRS** database contains 27 references on *Halophila johnsonii*.

The Literature on Seagrasses

A seemingly little known nugget of information within the Aquatic and Wetland (and now Invasive) Plant Information Retrieval System (**APIRS**) is the literature collection on seagrasses. Probably due to our increasingly complex yet still not completely accurate name, few people seem to realize that we also collect the literature on our saltier friends, the seagrasses. This little-used body of literature on seagrasses constitutes approximately 10% of our collection, or approximately 5,000 references. We plan to increase the visibility of the seagrass collection to broader circles of researchers with hopes of increasing the use of the collection and possibly finding financial support to continue it. Please feel free to share this newsletter with any colleagues working on any aspect of seagrasses.

For those who work in the marine environment, here is a list of the number of references in the **APIRS** database on some of the various species of seagrass. The first number given indicates the number of citations where the species name is found *in the text but not the title* of the reference; the second number indicates the number of citations where the species name is found *in the title* of the reference (e.g., more specific or relevant references). Of course, many references refer to more than one species of seagrass.

Zostera - 670 (text), 510 (title)	(total=1,180)
Ruppia - 627, 130	(total=757)
Thalassia - 479, 131	(total=610)
Halodule - 429, 67	(total=496)
Syringodium - 307, 33	(total=340)
Halophila - 294, 77	(total=372)
Cymodocea - 195, 62	(total=257)
Posidonia - 176, 238	(total=414)
Enhalus - 92, 5	(total=97)
Phyllospadix - 58, 17	(total=75)
Amphibolis - 55, 18	(total=73)
Thalassodendron - 48, 17	(total=65)
Total records in this list:	4,736

Sample keywords that can be used in combination with these plant species include '*host plants*' (over 700 references), '*physiology/ photosynthesis*' (over 650 references), '*reproduction*' (over 300 references), '*fish$*' (over 300 references), and '*epiphytes*' (over 250 references). Any keyword may be used when searching the **APIRS** database.

The **APIRS** collection contains hard copies of over ninety percent of the references listed in the database, and is available for the free use of researchers. In exchange, we expect those researchers to contribute reprints of their published work to **APIRS**. To access the database, go to our website at http://aquat1.ifas.ufl.edu/ and click on the **Online APIRS Database** link. You must have a telnet application specified in your Internet browser. To request free searches of the database, contact Karen Brown at *kpb@gnv.ifas.ufl.edu* or use the address on the back page of this issue. Bibliographies can be printed and mailed, or sent via e-mail.

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AQUAPHYTE

This is the newsletter of the Center for Aquatic and Invasive Plants and the Aquatic, Wetland and Invasive Plant Information Retrieval System (**APIRS**) of the University of Florida Institute of Food and Agricultural Sciences (IFAS). Support for the information system is provided by the Florida Department of Environmental Protection, the U.S. Army Corps of Engineers Waterways Experiment Station Aquatic Plant Control Research Program (APCRP), the St. Johns River Water Management District and UF/IFAS.

EDITORS: Victor Ramey
Karen Brown

AQUAPHYTE is sent to managers, researchers and agencies in 71 countries around the world. Comments, announcements, news items and other information relevant to aquatic, wetland and invasive plant research are solicited.

Salvinia molesta found in U.S.

The famously disruptive floating plant, giant salvinia (*Salvinia molesta*), has finally been discovered established in the United States, covering significant areas of rivers in the states of Texas and Louisiana. Efforts are underway to eliminate these infestations.

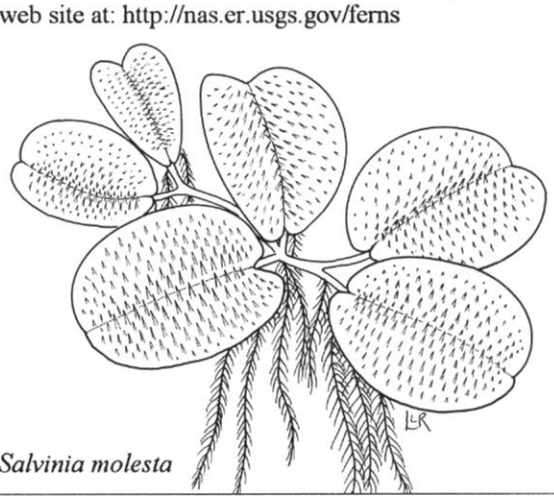
In an effort to identify new infestations of this very aggressive **aquatic weed**, and to help speed the deployment of chemical control actions against the plant, the U.S. Geological Survey has issued a special alert to aquatics managers:

REPORT SUSPECTED SIGHTINGS.

Giant salvinia has oblong floating leaves, ½ to 1-½ inches, often folded and compressed into upright chains. Leaf surfaces have white bristles or hairs joined at the tips to form a "cage", visable with a hand lens. Bristles give a velvety appearance and repel wetting.

Please report suspected giant salvinia occurrences to your state department of wildlife or environmental protection, *and also* please report to the U.S. Geological Survey. Ms. Colette Jacono, a biologist with the USGS, is mapping new occurrences and also acting as a clearing house of identification and control information. In addition, informative flyers are available from her for distribution to water and wetland management agencies, fish camps, sports organizations, homeowners associations and others likely to encounter giant salvinia.

For more information, contact Ms. Jacono (toll free) at 1-877- 786-7267, or view their web site at: http://nas.er.usgs.gov/ferns



Salvinia molesta

surface hairs or bristles