



RINHewS

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President's Corner by John F. Paul

This has been a busy year for the Rhode Island Natural History Survey. We are in the final planning phase of our conference to be held on 9 January 1998 at the University of Rhode Island. Nominations are coming in for the 1997 Distinguished Naturalist Award, to be announced at our conference in January. Our lecture series has continued to be most informative and well attended. The next lecture is scheduled for 12 November at the Coastal Institute at the URI Graduate School of Oceanography (for details of RINHS activities, see the articles on p. 9).

We have developed a program for providing RINHS institutional members a loan of storage cabinets for voucher specimen collections, using funding from a Champlin Foundations grant (see p.15).

The dissemination of information has continued with the newsletter, our expanded publications list, the second printing of the *Illustrated Key to the Seaweeds of New England*, and reprinting of Alonzo Quinn's *Rhode Island Geology for the Non-Geologist*. Don't forget to check out our publications list for interesting gift ideas for upcoming holiday giving--we have added a number of new publications in the past months. The first volume in the *Biota of Rhode Island* project is due out this winter.

One of the most important developments this year has been the work that the Board of Directors and Executive Director have been undertaking with an organizational consultant. We applied for and received a small grant from the Rhode Island Foundation (a charitable community trust serving the people of Rhode Island) to hire Joyaux Associates to work with us. We are grateful to the Rhode Island Foundation for this generous support. Simone Joyaux has experience with small nonprofit organizations such as the RINHS and is taking us through the process of improving our organizational structure and financial strategy. The Board of Directors has unanimously committed to undertake this consultancy and expend the necessary time and effort to see it through.

What we have done so far is to articulate our corporate understanding of what the RINHS is all

about, what it is that makes us unique, and what it will take from an organizational perspective to keep the Natural History Survey moving ahead. The Board will be contacting you, as members, to get your perspective of the RINHS and solicit feedback on how we're doing. The next step for us is to determine an appropriate funding strategy that will permit us to achieve all the things we believe that RINHS can be.

We remain committed to our original mission: to bring together Rhode Island's ecologists and naturalists to advance scientific knowledge, to facilitate and coordinate information, and to enhance communications. We need to work with you to ensure that we can effectively continue this.

I hope to see you at one of our RINHS sponsored lectures and at our upcoming conference. And thank you for your continued interest in the Natural History Survey.

John F. Paul is a researcher at the U. S. EPA Lab in Narragansett, and serves as president of the Rhode Island Natural History Survey.

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Mission Statement of the Rhode Island Natural History Survey

- To advance scientific knowledge of Rhode Island's biota, ecological communities, and environmental resources;
- To facilitate and coordinate the gathering and dissemination of information on Rhode Island's biota and natural communities;
- To enhance communication among Rhode Island's environmental and life scientists.

Research Reports

Diamondback Terrapin Research in Barrington: History & Future Direction

by Charlotte Sornborger, E. Douglas Rayner, and Steven E. Reinert

Barrington houses Rhode Island's only known breeding population of the state-endangered Diamondback Terrapin (*Malaclemmys terrapin*). The nesting site is Nockum Hill, a 28-ha (68-acre), raised, sandy-soiled peninsula (kame) extending into the Hundred Acre Cove estuary. Nesting activities at the site have been monitored since 1990, and at the present time a substantial volume of data on the demographics and nesting ecology of the population has been amassed. The objective of this report is to present principal findings from the first eight years of the study, and to seek additional help from the scientific community in outlining plans for future research efforts.

History of research effort. Preliminary field work conducted from 1985-1989 by local naturalist E. D. Rayner (1) established that the population size probably exceeded 100 sexually mature females, and (2) initiated a marking effort for captured nesting females. Findings from this preliminary study promoted interest in conservation issues surrounding the breeding site, and guidance was sought from a professional herpetologist. Early plans for the research effort started in 1990 were provided by Dr. Peter J. Auger (Harvard Museum of Comparative Anatomy). His assistant, Jennifer Bush, carried out the first year of systematic research (Bush and Auger 1990), assisted in the field by Mr. Rayner. In 1993, Caitlin Goodwin, advised by Dr. C. R. Shoop (URI), conducted field work on the population for her master's research. In all other years since 1990, Mr. Rayner and the first author have executed the bulk of the field work with help from various volunteers. Chris Raithel of RIDEM Fish and Wildlife has served as an advisor to the project throughout. Monetary support for the project has been provided by The Nature Conservancy, The Rhode Island Foundation, and the Barrington Land Conservation Trust.

During the nesting season (June, July) of each year, researchers watched daily for nesting females which leave the waters of the adjacent estuarine waters to lay their eggs in the sandy soil of Nockum Hill. After egg-deposition, females were captured, measured, photographed, examined for injuries, and marked (if not recaptures). Bush (1990) and Goodwin (1994) collected additional data on nest site vegetation/characteristics and nest success in their respec-

tive years of research. Data for each capture/recapture event has been stored in an electronic database since 1990.

Summary of results. Data on captured female terrapin are presented in Table 1. These numbers under-represent the total number of females nesting in the study area, as not all emerging females can be tracked: we feel that the total number of females in the population is substantially greater than the maximum one-year capture total of 106 (1993). In recent years, unmarked animals captured are primarily young females (8-10 years old). Many females nest twice during a single breeding season (at least 12 in 1990). Nest success in the population is extremely poor. The number of scavenged nests found from 1995-1997 were 198, 234, and 139, respectively, with no evidence of hatching events detected (outside of a few capped nests). In 1993, Goodwin marked and monitored 86 uncapped nests, of which 75 (87%) were depredated by mammals (we suspect raccoons, mink, weasels, and skunks). Although nest sites were not marked during 1995-1997, daily searches for hatchling terrapin were made with none found. Thus, recruitment of young into the population may be at a critically low rate presently due to the extent of mammalian predation.

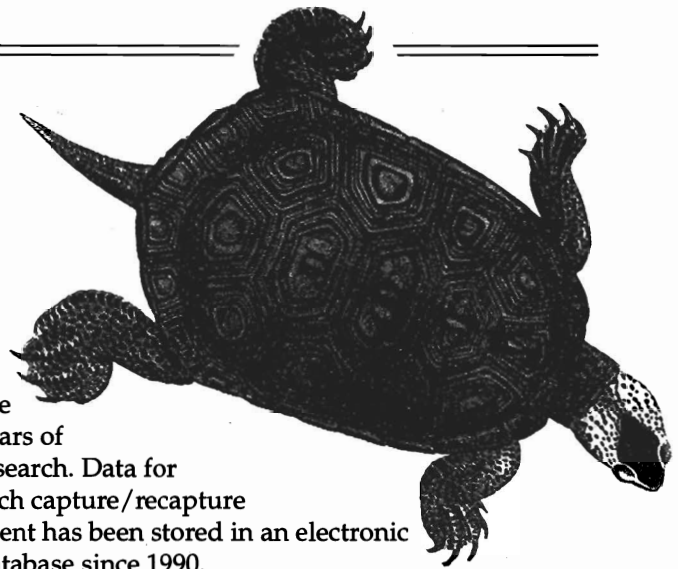


Table 1. Marked vs. recaptured terrapin by year.

Year	No. marked (% of total)	No. recaptured (% of total)	Total Captured
1990	78	---	78
1991	22 (31)	49 (69)	71
1992	24 (30)	56 (70)	80
1993	25 (24)	81 (76)	106
1994	6 (9)	62 (91)	68
1995	11 (21)	41 (79)	52
1996	19 (23)	63 (77)	82
1997	16 (15)	88 (85)	104

Terrapin preferred to nest in areas with less than 5% vegetative cover, but nest success was not related to percent vegetation, percent shrubs, and/or

percent slope at and surrounding the nest site (Bush 1990, Goodwin 1994).

Conservation milestones. Data from this study have resulted in three significant conservation initiatives by the Town of Barrington: (1) establishment of Nockum Hill as a Wildlife Sanctuary by the Barrington Comprehensive Community Plan in 1992; (2) formulation of the Nockum Hill Management Committee by the Barrington Town Council; and (3) establishment of a 5 MPH boat zone in the waters of the estuary surrounding Nockum Hill.

Direction of future research. The authors urge members of the southeastern New England scientific community to offer suggestions for future research efforts for this endangered, and potentially declining population. We openly offer our electronic database, experience and, enthusiasm for this project to parties interested in participating in research at the site, and especially for research aimed at estimating population size and formulating a management plan for the population (funding is available to support approved projects). Interested parties should call (401) 245-8467 or email the first author at martins@ids.net.

Literature Cited

- Bush, J. L. and P. J. Auger. 1990. Nesting of Diamondback Terrapins at Nockum Hill, Barrington, Rhode Island: A Report Submitted to the Barrington Land Conservation Trust. 13 pages.
- Goodwin, C. C. 1994. Aspects of Nesting Ecology of the Diamondback Terrapin (*Malaclemys terrapin*) in Rhode Island. M. S. Thesis, University of Rhode Island, Kingston, RI. 84 pages.

Charlotte Sornborger, Douglas Rayner, and Steven Reinert are with the Barrington Land Conservation Trust.

Protistan Responses to Oil Contamination by Gaytha A. Langlois

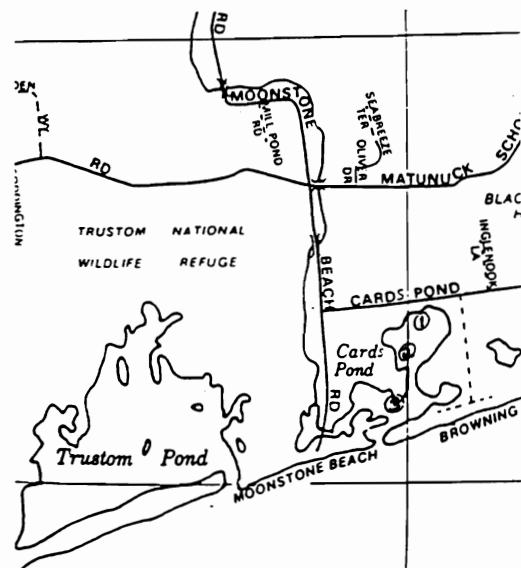
On January 19, 1996, in heavy rain and high winds, I left the Roger Williams University campus in Bristol, where I'd attended the 1996 RINHS Conference that day. I debated my route home, worried that the bridges might be closed because of the wind. I made it home safely, across the bridges, but little did I know at the time that earlier that afternoon a fire had erupted in the engine room of the tugboat, Scandia, which was towing the North Cape, a 340-foot barge loaded with four million gallons of home heating oil. On that cold and stormy day in Rhode Island Sound, the barge ran aground on Moonstone Beach.

During the following week 828,000 gallons of oil spilled into the water, washed ashore onto the beach and into Trustom and Cards Ponds. The rate of the

leakage and the type of oil were initially undetermined, but it was feared that crude oil might cause a more extensive physical impact, while refined oils could be expected to be more volatile but also more toxic. In fact, about 20% of the oil evaporated, while about 80% was mixed into the water column. Recently it was confirmed that two kinds of oil were released by the spill—diesel oil and a lighter home heating oil. Initial ecological damage estimates were based on the lower toxicity of the diesel fuel (3 percent polycyclic aromatic hydrocarbons or PAHs), and had to be adjusted accordingly to reflect the 7 percent PAH composition of the heating fuel which represented about one-half of the spilled oil.

The North Cape spill was more than twice the size of the World Prodigy spill which occurred off Brenton Reef in the summer of 1989, dumping 290,000 gallons of #2 fuel oil into Narragansett Bay. Most of the #2 fuel oil remained on the surface and later evaporated. About 800 dead crabs and lobsters were reported.

Oil leaking from the North Cape was driven deep into the water and beaches where it killed marine life over an extensive area. At the height of the spill as much as 1ppm of oil was found in seawater samples. Biologists counted about one million dead lobsters and nearly 400 dead birds, but everyone concerned understood that many marine creatures had simply died and disappeared into the sediments. An area of 105 mi² in Block Island Sound was closed to fishing for several months and \$8 million dollars was spent on initial cleanup. A year and a half later the effects could be seen within a ten mi² area. Severe weather continued for several days after the accident, mixing the oil thoroughly into the water column and sediments. Dead lobsters, qua-



Area immediately affected by the North Cape spill

hogs, amphipods and other marine invertebrates littered the beaches. Many biologists stressed their concern about interrupted food chains.

Of special concern at the time of the spill was the fact that the oil had been forced up into Cards and Trustom Ponds, which were covered with ice. These fears were confirmed a few weeks later when the ice melted and Cards Pond was breached by U.S. Fish and Wildlife Refuge workers, who found that the benthic flora and fauna were almost total destroyed, with layers of dead amphipods littering the bottom of the pond. Not only do these ponds serve as breeding grounds for fish and migratory waterfowl, but in addition, Trustom Pond is a National Wildlife Refuge set aside especially for protection of the Piping Plover, an endangered species in the U.S. There was concern that the plovers would lack food or ingest contaminated crustaceans. Although it is not known if the oil spill was a definite contributing factor, Lee Schisler, Executive Director of the Audubon Society of Rhode Island, recently noted that the "Piping Plovers which nest on the beach by Trustom Pond did not have good success breeding in 1996" (*Audubon Report*, 1997).

Food chain effects of petroleum hydrocarbons (PHCs) are often subtle and non-linear. Selective uptake and biomagnification can result in differential effects on microbial and invertebrate populations; localized concentrations of particular pollutants can enhance the impact and act synergistically. For example, in Narragansett Bay, high concentrations of PHCs and PAHs are concentrated in Allen Harbor, near an old U.S. Navy landfill site associated with the Davisville and Quonset Point bases. According to NOAA statistics, Narragansett Bay shows higher levels of PAHs when compared to other U.S. embayments (CCMP, 1992). In short, pollutants may affect some organisms more than others and may bioaccumulate in the tissues of organisms important to food chains.

The extent to which PHCs cause disturbances in marine and estuarine ecosystems is a serious concern, whether the contaminant is from a massive tanker spill, or from chronic, low-level releases associated with stormwater runoff, leaking underground storage tanks, industrial effluents or marine pollutants. Some marine bacteria, fungi and protozoa are able to degrade PHCs of low molecular weight, but this activity is limited. PHCs of high molecular weight, particularly PAH compounds, may persist in coastal sediments for long periods of time (years), and may cause toxic effects on benthic organisms. Synergistic effects of combined pollutants can further enhance toxicity. Petroleum spills into salt marshes have been shown to affect net community primary productivity, species composition and biomass of benthic algae. Soluble fractions

of PHCs can produce lethal effects on adult macrofauna at levels from 1-100 ppm and on larval and juvenile forms from 0.1 to 1 ppm. Sublethal responses may be stimulated by levels of PHCs as low as 1-10 ppb. PAHs can induce delayed cellular division in phytoplankton, abnormal fish spawning, cause reduced chemostatic response in snails and crabs, decrease filter feeding of mussels and disrupt the ultrastructure of cells.

Soft-bottom coastal and estuarine benthic communities are particularly vulnerable to the influx of PHCs and show unusually slow recovery from oil spills. In the Penzance marshes on Cape Cod in Massachusetts, oil residues persisted for decades. Even chronic releases can produce significant alteration because bottom substrata accumulate the PHCs, and many benthic species are sessile or show only limited mobility within narrow territories.

Benthic marine and estuarine ciliates frequently show unique adaptations to their highly specific niches, and are often characterized by a limited ability to adjust to changes in the physical environment, food availability, predator dynamics, and general community stability. Since these ciliate species play important trophic roles in benthic microbial communities, as well as contributing to nutrient fluxes (links and sinks), their presence or absence may be indicators of the ecological health of a given ecosystem. Furthermore, changes in microbial populations may provide some indication of the relative damage caused by PHC pollutants.

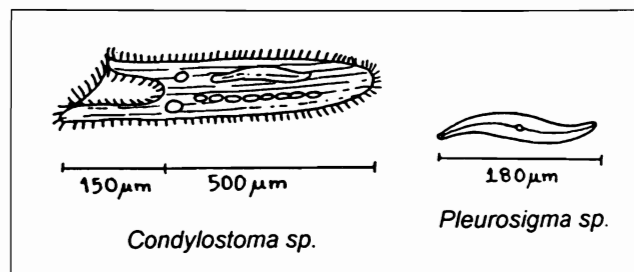
In the months since the North Cape spill, teams of scientists have attempted to assess the impacts of the oil on Narragansett Bay and Block Island Sound, as well as on the adjoining coastal ponds. Beatty *et al* (1997) completed a study of Trustom and Cards Pond, comparing impacts on invertebrate and fish populations with a similar location in Narrow River at a site unaffected by the North Cape spill. Zooplankton, benthic invertebrates and fish populations were examined biweekly at several locations, water quality was analyzed and sediment samples were tested for HCNs. Benthic cores were examined for macrofauna and microfauna. Analysis of study results was hampered by the fact that no comparable macro- or microfaunal studies existed for the ponds, nor was there data recorded on background levels of PHCs associated with boating or non-point source pollution.

However, information is available from oil contamination experiments conducted at the Marine Ecosystems Research Laboratory (MERL) at the Graduate School of Oceanography at the University of Rhode Island. Although the MERL studies were designed to mimic the soft bottom sediments of Narragansett Bay and emphasized primarily the effects of longer term chronic exposure to PHCs, the

residual effects of the North Cape oil remaining in the pond sediments may resemble the dynamics of chronic exposure to PHCs in shipping channels or near sewage treatment plant outfalls.

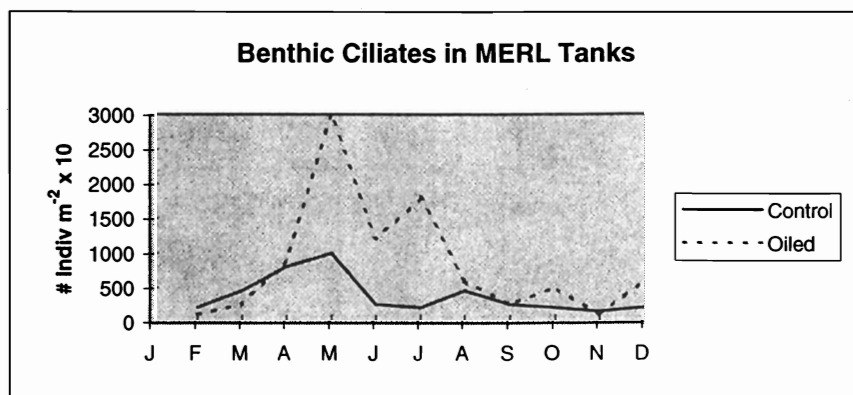
The following trends among microbiota have been previously reported from mesocosm studies in which the water-accommodated fraction of #2 fuel oil was added to experimental tanks at the MERL facility in dilute concentration (90 ppb):

- (1) Numbers of diatoms and ciliates increased during chronic exposure to #2 fuel oil, and decreased following cessation of oil addition.



Opportunistic Diatom-eating Ciliates in Oil-stressed MERL Tanks

- (2) The number of diatom and ciliate species increased during oil exposure and dropped sharply during recovery.
- (3) Some invertebrate species were greatly reduced in oil-stressed tanks (harpacticoids and ostracods); recovery was slow for these species.
- (4) Species composition for the benthic microbial community changed in the oil-stressed tanks; these changes were distinguishable from the normal seasonal shifts.



- (5) Large diatoms increased; diatom-eating ciliates increased, and predatory ciliates occurred in larger numbers.
- (6) Shifts in species composition were also found in the meiofauna and plankton communities. These findings clearly demonstrated subtle links within marine communities that are

adversely affected by exposure to very dilute concentrations of PHCs--impacts that can alter predation dynamics and species composition. Furthermore, the results of the MERL studies show that there is wide variability in tolerance to dilute concentrations of PHCs.

In trying to decipher the degree to which the salt ponds were damaged by the North Cape spill, the Beatty study, along with observations made at the time of the spill, during the cleanup efforts and in subsequent monitoring studies, depict the following trends:

- (1) At the time of the North Cape spill, extremely high numbers of amphipods were killed along the beaches and in the ponds.
- (2) When Cards Pond was breached in early 1996, massive faunal kills were evident.
- (3) Late summer (1996) samples taken from Cards Pond indicated a productive benthic community and abundant zooplankton; however, there was no pre-spill baseline data with which to compare the numbers.
- (4) Amphipods and cnidarians in Cards Pond samples had declined by the end of the summer.
- (5) Ciliate numbers were high in the 1996 Cards Pond sediment cores, and included species which would be expected in a typical salt pond microbenthos. However, high numbers of large diatoms were present in 1997 samples, along with moderate numbers of diatom-eating ciliates, indicating a possible residual effect of the PHCs that remain in the Pond's sediments.
- (6) Visual evidence of PHCs can still be seen at Moonstone Beach, with cores that show layers of oiled sand lying just below the surface; additional studies should address the sediments just offshore.

Studies of the recovery process shown by the microbial community in Cards Pond are still underway, with the following questions to be answered: How long do the PHCs remain in estuarine sediments following an acute perturbation? Are there selective impacts whereby one species might be more greatly

affected than another? In other salt ponds with similar ecological dynamics, what is the profile of the microbial community? Under experimental condi-

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tions, how do oil-resistant ciliates handle the recovery phase? Is there comparability in the response of shallow salt ponds to oil spills and the dynamics studied in the MERL experiments?

It is abundantly clear that definitive studies of Rhode Island's salt ponds should be pursued, so that scientists and resource managers will be in a better position to protect these valuable natural ecosystems, and at the very least to be able to assess damage associated with chronic and acute pollution events.

Literature Cited

- Beatty, L.L., A.A. Keller and M.P. O'Connor. 1997. *Effects of the North Cape Oil Spill on Zooplankton, Benthic Invertebrate and Fish Communities in Cards Pond*. Report prepared for the Audubon Society of Rhode Island.
- Comprehensive Conservation and Management Plan for Narragansett Bay. Final Report. 1992. U.S. EPA, Region I, Boston, MA. Rhode Island State Guide Plan Element 715: Report #71.
- Elmgren, R., G.A. Vargo, J.F. Grassle, J.P. Grassle, D.R. Heinle, G. Langlois and S.L. Vargo. 1980. "Trophic Interactions in Experimental Marine Ecosystems Perturbed by Oil." In Giesy, J.P., Jr. (ed.). *Microcosms in Ecological Research*. U.S. Technical Information Center, U.S. Department of Energy, Symposium Series 52 (CONF-781101).
- Lord, P.B. 1997. "North Cape Oil Shows High Toxicity." *Providence Journal-Bulletin* (September 18):A1, A17.
- Mooney, T. 1996. "Wildlife Deaths Horrify U.S. Scientists." *Providence Journal-Bulletin* (February 1):A1, A6.
- "Pond Recovering from Oil Spill." 1997. *Audubon Report* (July-August) 31(6):1, 3.

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The Submerged Flora in Trustom Pond is Changing by Marilyn M. Harlin and Veronica J. Masson

Background on Trustom Pond. Trustom Pond is a beautiful 164-acre brackish pond located on the southern coast of Rhode Island. This water body is sometimes considered a lagoon because it is bordered on the south by a barrier beach that protects it from Rhode Island Sound. Natural and manmade breaches break the barrier beach adding seawater to the pond. This mix of seawater with freshwater provides the submerged aquatic vegetation (SAV) including algae with the challenge of adapting to various levels of salinity.

The SAV in Trustom Pond was first examined in 1948 (Wright *et al.* 1949) in connection with its importance for migrating waterfowl. Five species were noted as infrequent or moderate members of the submerged flora. Three follow-up assessments have been conducted in the intervening 50 years. In August 1978, a detailed vegetative survey

(Thorne-Miller *et al.* 1983) mapped the SAV and macroalgae for the purpose of serving as a basis to detect changes in flora over a temporal scale, especially in the event of an environmental assault. This analysis was repeated 17 years later (Harlin *et al.* 1995) and was fortuitously timed, because it preceded the North Cape oil spill on January 19, 1996. During a storm a barge ran aground on Moonstone Beach on the sea-side of the unopened breachway on the southeast side of Trustom Pond, and heavy winds with high seas caused a small breach permitting gallons of #2 home heating oil to spill into the pond. In August 1996, a fourth survey (Masson & Harlin 1997) used a subset of the stations assayed the previous year to make an immediate comparison in flora. With information from these four surveys, long term changes in submerged flora can be separated from those that result from the oil spill.

In recent springs, the U.S. Fish & Wildlife Service has breached the opening to the sea to lower nutrient loads from agriculture and fowl feces. This mechanical alteration also changed salinity. In 1996, for example, salinity increased from 2.5 to 17‰ before the breach; after which salinity decreased to a steady 10‰ as a result of rainwater during the spring and summer. In contrast, salinity in 1995 was 6‰ before the breach, and after the breach remained high: from 33‰ gradually reducing to 16‰ by mid August. Water temperatures in 1995 ranged from 2.2°C in mid January to 27.3°C in mid August. All surveys but the one in 1948 worked on a grid system measuring SAV and macroalgae at 60 stations over intervals of 100 m on a grid where north-south lines intersected east-west lines (Fig. 1). In 1995 and 1996 chlorophyll *a* concentrations were also measured

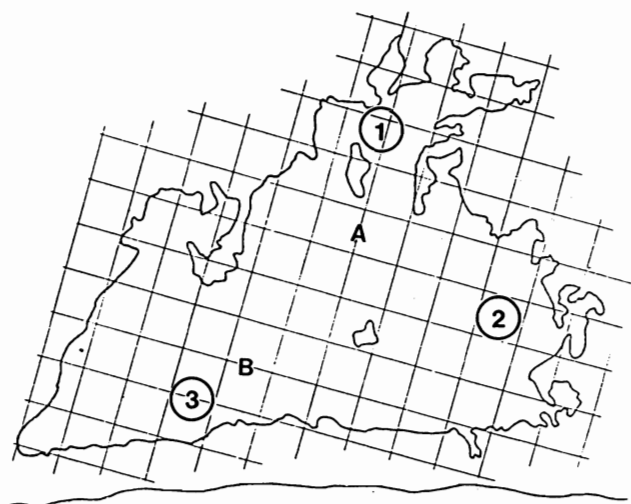


Fig. 1. Trustom Pond. Intercepts on a north-south, east-west gradient determined SAV collection stations; chlorophyll *a* concentrations were taken from numbered locations in 1996 and from lettered locations in 1995.

(techniques of Oviatt & Hindle 1994) to follow the changes in phytoplankton density in the pond. In 1995, chlorophyll *a* concentrations were assessed at two stations (Fig. 1) on one day in August, and in 1996 at three stations (Fig. 1) from immediately after the breach in March through the spring, summer and fall seasons.

How do the four surveys (1948 to 1996) compare?

The five most prominent species from the original study are compared to the last three studies (Table 1). The presence of *Ruppia maritima* and *Potamogeton pectinatus* (Fig. 2, adapted from Hellquist & Crow 1980) has not changed since the original study by Wright *et al.* (1949). *Potamogeton perfoliatus* (Fig. 2) and *Chara* spp. were not found in 1995 but reappeared the following year. Only one of the original five species, *Zanichellia palustris* was missing in both 1995 and 1996. A common local seagrass, *Zostera marina*, was not found in any of the studies.

Table 1. Changes in SAV over 50 years.

Species (Common name)	Survey summer			
	1948	1978	1995	1996
<i>Ruppia maritima</i> (Wigeongrass)	++	++	++	++
<i>Potamogeton pectinatus</i> (Sago Pondweed)	++	++	++	++
<i>Potamogeton perfoliatus</i> (Clasping-leaf Pondweed)	+	+	-	+
<i>Zanichellia palustris</i> (Horned Pondweed)	+	+	-	-
<i>Chara</i> spp. (Muskgrass)	+	+	-	+

Green macroalgae (Chlorophyta) were surveyed during the latter three studies and included *Cladophora* sp., *Monostroma* sp., and *Enteromorpha* spp. Together, these algae constituted only a minor component of the flora (<1 percent lagoon cover). Reportedly, the abundance of these organisms changed from 1978, when there were masses of *Cladophora* to 1995 when an appearance was rare. Red and brown algae (Rhodophyta and Phaeophyta, respectively) are found in the other coastal lagoons in Rhode Island but are absent from Trustom Pond.

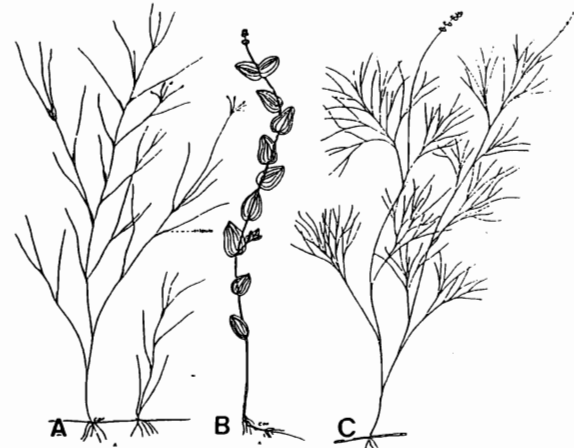


Fig. 2. Habit of three species of SAV (from Hellquist & Crow 1980). A = *Potamogeton pectinatus*, B = *Potamogeton perfoliatus*, C = *Ruppia maritima*.

The summer bloom (rapid multiplication) of phytoplankton in 1996 was characterized by two peaks in chlorophyll *a* concentration (Fig. 3). These peaks mimic those observed in Narragansett Bay (Durbin and Durbin 1988) that are attributed to rise in temperature and reduction of zooplankton grazing rates. The highest concentrations of chlorophyll *a* (5-6 ug/l) surpassed those in Narragansett Bay five fold. The most abundant phytoplankton were dinoflagellates and diatoms. Concentrations of phytoplankton decreased (Fig. 3) following the

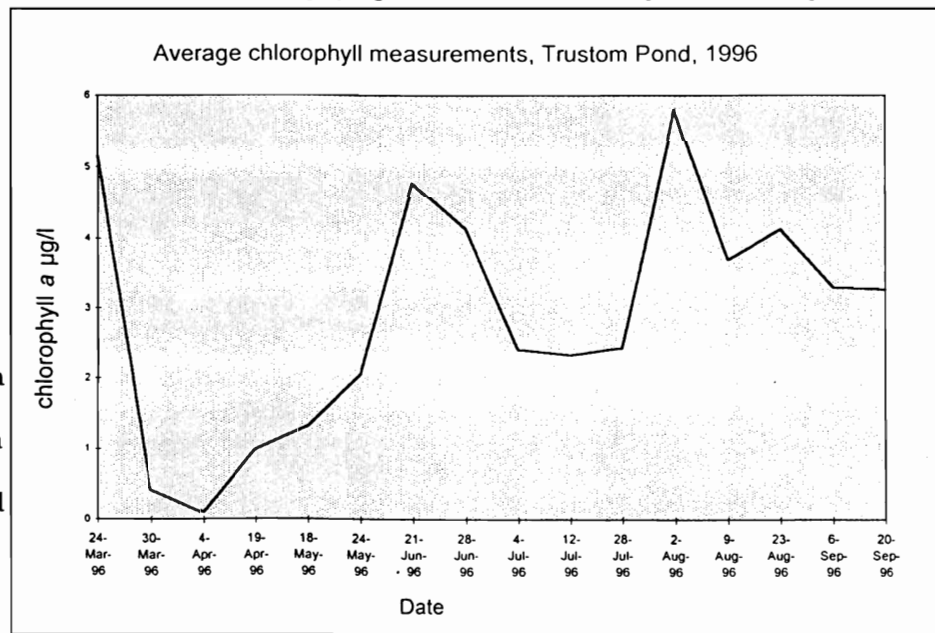


Fig. 3. Chlorophyll *a* concentration. Averaged from 3 stations in Fig. 1 from after the breach in early March through mid-August 1996. Note two peaks.

breach of the barrier suggesting that either bloom organisms entered the pond or that once in the pond, these organisms bloomed. In 1995, chlorophyll *a* (19-24 ug/l) had been four times higher. Reduction in phytoplankton concentration from August 1995 to August 1996 is likely to be attributed to dilution of samples by rainwater and not likely to have been caused by the oil spill. In addition to phytoplankton blooms, mud churned from the bottom of the pond can increase turbidity.

So, which factors affect the SAV? In the summer of 1996, the number of species and density of macrophytes had increased over those in the summer of 1995. *Ruppia maritima* was still the most abundant SAV member; *Potamogeton pectinatus*; the second most abundant; and *Potamogeton perfoliatus* appeared where it was not been seen the year before. Did the oil that flushed over the barrier beach favor growth of macrophytes, and if so how? Petroleum kills animals that graze on plants from small algae that grow on SAV to the vascular plants themselves. This increase in macroflora is consistent with reports from other oil spills such as those on the shores of France and off southern California.

Salinity and turbidity are critical factors in regulating flora. *R. maritima* can tolerate higher salinity than *P. pectinatus* (Verhoeven & Van Vierssen 1978), and both species tolerate high levels of turbidity (Stuckey 1971). By 1995, *P. pectinatus* decreased in plant numbers compared to 1978, and *P. perfoliatus* was not found at all, perhaps the result of higher salinity or turbidity. In 1996, however, *P. pectinatus* populations increased and *P. perfoliatus* reappeared in the lagoon. Another difference between these two years was that the breachway was manually opened at different times. Because oil had spilled into Trustom Pond in 1996, the pond was breached earlier in the season (early March) than in the previous year (April 27). This effort gave sufficient time during the rainy season to decrease the salinity of the pond before the new spring plant growth. Rain, on the other hand, can also bring nutrients from adjacent farmlands. In addition, 1995 had been especially dry and salinities stayed high. *Zanichellia* is sensitive to mid-range salinities like those in recent years at Trustom Pond, whereas *Zostera* is excluded because it requires higher salinities.

Practical application from these studies: The U.S. Fish & Wildlife Service is using these findings to help make management decisions for Trustom Pond in order to increase diversity of SAV as food for migrating waterfowl. In Trustom Pond, a critical factor appears to be the timing of the breach. By flushing the winter nutrients before the phytoplankton bloom, light is able penetrate to the base of attached plants (ca 1 m). The earlier in the year that the breach

occurs, the more time there is for rainwater to accumulate, lowering salinity and nutrients. We, therefore, suggest that breaching in late winter or early spring (March) is the single most important management strategy for the continued health of the SAV. Trustom Pond is a lovely wildlife refuge, and we hope that visitors take advantage of the opportunity to experience its wonderful flora and fauna.

Literature cited

- Durbin, E. G. & A. G. Durbin. 1988. Secondary production by zooplankton in Narragansett Bay. *Maritimes* 33:8-11.
- Hellquist, C. B. & G. E. Crow. 1980. *Aquatic Vascular Plants of New England. Part 1. Zosteraceae, Potamogetonaceae, Zannichelliaceae, Najadaceae.* Station Bulletin 515. N. H. Agri. Exper.Sta., Univ. N. H., Durham, NH. Pp. 14, 55, 58.
- Harlin, M. M., V. J. Masson, & R. E. Flores. 1995. *Distribution and Abundance of Submerged Aquatic Vegetation in Trustom Pond, Rhode Island: Survey and Analyses August 1995.* Report to U.S. Fish and Wildlife. 28 pp.
- Masson, V. J. & M. M. Harlin, 1997. *An Update on Trustom Pond for the 1996 Season.* Report to U.S. Fish & Wildlife. 13 pp.
- Thorne-Miller, B. M. M. Harlin, G. B. Thursby, M. M. Brady-Campbell & B. A. Dworetzky. 1983. Variations in the distribution and biomass of submerged macrophytes in five coastal lagoons in Rhode Island, USA. *Bot. Mar.* 26:231-242.
- Oviatt, C. A. & K. M. Hindle 1994. *Manual of Biological and Geochemical Techniques in Coastal Areas.* MERL Series, Report No. 1, Third Ed. The Univ. of RI, Kingston, RI.
- Stuckey, R. L. 1971. Changes of vascular aquatic flowering plants during 70 years in Put-In-Bay Harbor, Lake Erie, Ohio. *The Ohio Journal of Science* 71: 321-342.
- Verhoeven, J.T. A. & W. Van Vierssen. 1978. Structure of macrophyte dominated communities in two brackish lagoons in the island of Corsica, France. *Aquat. Bot.* 5:77-86.
- Wright, T. J., V.I. Cheadle, E. A. Palmatier. 1949. *A Survey of Rhode Island's Salt Ponds and Brackish Water Ponds and Marshes.* Pittman Robertson Pamphlet No. 2. RI Dept. Agric. & Conserv, Division Fish & Game. Federal Aid in Wildlife Restoration Project 5-R.

Marilyn Harlin and Veronica Masson are with the Department of Biological Sciences, Ranger Hall, University of Rhode Island.

It's time to Renew!

All RINHS memberships
are due October 1.

Please remember to
send in your renewal soon.

And if you've already renewed,
thanks for the prompt response!

Biota of Rhode Island Project Continues to Receive Support

The Rhode Island Natural History Survey's *Biota of Rhode Island* project continues to gain recognition from foundations. This year we were happy to receive \$6500 to support final preparation of the *Vascular Flora of Rhode Island*, from Furthermore, the Publication Program of the J. M. Kaplan Fund, and \$20,000 from The Prince Charitable Trusts to support oversight of the entire project. In 1996 the Virginia B. Butler Fund of the Rhode Island Foundation provided \$23,800 of support for publication of the biota volumes on Rhode Island's vertebrates, invertebrates, and viruses, bacteria, protists, mycota, and non-vascular plants.

The *Biota of Rhode Island* project is an ambitious undertaking, aiming to catalog every organism in the state. The databases will be a repository for information on each species' nomenclature, life history, status in Rhode Island, and much more. At the same time the databases are being developed, RINHS members are preparing four volumes on the state's biota. *The Vascular Flora of Rhode Island* will be published this winter, followed soon by *Vertebrates of Rhode Island*.

The published volumes will be invaluable tools for researchers, educators, consultants, and naturalists. We hope they will also serve as springboards for further research into the state's biota, by exposing gaps in our knowledge and increasing understanding of ecological relationships.

RINHS 1997-1998 Lecture Series Off to a Good Start

Christopher Raithel, from the RIDEM Division of Fish and Wildlife, led off the 1997-1998 Lecture Series on Rhode Island Fauna, Flora, Geology and Ecosystems with a rousing lecture in September on *Habitat Fragmentation and Amphibian Populations in Rhode Island*.

Upcoming lectures will feature Michael Zavada, of Providence College, speaking on *Sexy Plants: The Natural History of Pollen*, on November 12 at the URI Coastal Institute in Narragansett; Mark Bertness, of Brown University, speaking on *The Ecology of New England Salt Marshes*, at the Barrington Public Library in Barrington on February 10 (the Barrington Land Conservation Trust is co-sponsoring this lecture); and P. A. Buckley, of the University of Rhode Island and the USGS Biological Resources Division, speaking on *Going South for the Winter: Perils Facing Neotropical Migratory Birds*, on April 2 at Moses Brown School. Moses Brown School is co-sponsoring this lecture, which will also showcase the "Bird Room" at Moses Brown, an antiquarian bird collection (featured on p. 8 of the April 1997 *RINHewS*).

Lectures begin at 7:30 p.m.; the public is welcome.

RINHS Conference: January 9, 1998 Ecological Research in Rhode Island: A Continuing Assessment

The Rhode Island Natural History Survey will hold its fourth annual conference on January 9, 1998 at Chafee Hall at the University of Rhode Island in Kingston, RI, around the theme of *Ecological Research in Rhode Island: A Continuing Assessment*.

The keynote speaker for the conference will be Dr. Tundi Agardy of Conservation International. Dr. Agardy, who received her doctorate from the University of Rhode Island, is currently working on global strategies for the protection of marine habitats.

In addition to the keynote lecture, there will be morning and afternoon breakout sessions by topic areas. The 1997 *Distinguished Naturalist Award* will be presented, and the day will end with a wine and cheese reception at the University Club.

A special component of the 1998 conference will be the participation of up to 150 secondary school students. RINHS and the Education Department of the Roger Williams Park Zoo are working together to plan this part of the conference, which will include special breakout sessions for the students.

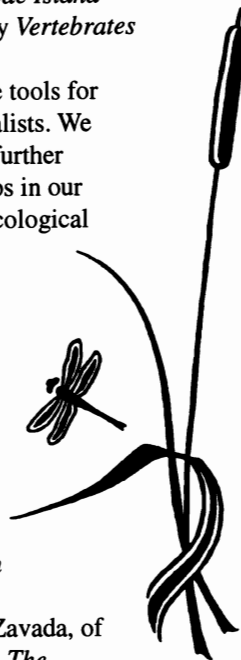
RINHS is seeking donations from foundation, corporate, and institutional sponsors to defray the cost of the secondary students' participation, as well as donations for the RINHS Student Sponsor Fund, which subsidizes the attendance of undergraduate and graduate students at RINHS conferences. Your contributions are welcomed!

We welcome contributed papers, posters and organizational displays on any topic related to natural history in Rhode Island. Topics may include geology, hydrology and soil; ecosystems and habitats; analyses of impacts to ecological systems; natural history collections; life history, distribution, or status of particular taxonomic groups; environmental education; or other pertinent work.

Participation by academic researchers, state and federal scientists, environmental educators and organizations, consultants and trade associations, naturalists, students, and other interested people is encouraged. Abstracts are due by November 15. For more information, contact the RINHS office at (401) 874-5800.

Northeastern Naturalist: New Member Benefit

RINHS members may now subscribe to the regional journal, *Northeastern Naturalist*, at a 20% discount (\$24/year regular subscribers; \$16/year students). Check out your renewal notice for detailed information.



Rhode Island Collections

The Philip R. Pearson Collection

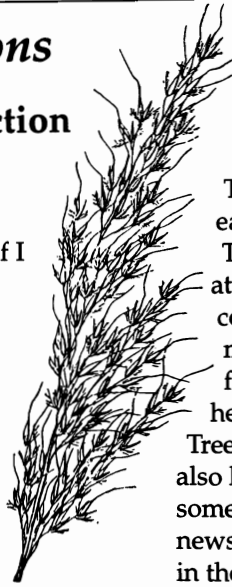
by Peter T. Lockwood

When Professor Keith Killingbeck, curator of the URI herbarium, asked me if I would be interested in seeing a recently received collection of pressed plants, I little imagined I would spend the next two years and over two hundred hours with my nose in dusty old folders and botanical journals. The collection of herbarium specimens had been presented to URI by Rhode Island College and represented the life collection and acquisitions of Dr. Philip R. Pearson, Jr. (1927-1996), Professor Emeritus of Biology at Rhode Island College. In an unassuming manner, Dr. Killingbeck suggested there may be "some interesting specimens."

Before coming to Rhode Island in 1967 to teach biology, botany and ecology at Rhode Island College, Dr. Pearson taught at Rutgers and Temple University in New Jersey. He was known for his interest in forest ecology and published several articles on the arborescent composition of woodlands (e.g., Pearson, 1963, 1975), much of which is documented by specimens in this collection. Prior to that, while fulfilling the requirements of his Ph.D. work in plant ecology at Rutgers University, he collected numerous plants from various soil types in Warren and Sussex Co., New Jersey.

During more than 30 years of teaching and research, Dr. Pearson amassed approximately 809 mounted specimens representing collections from Pennsylvania, New Jersey, Rhode Island, Massachusetts, Vermont, and New Hampshire. Within this set, it is interesting to observe some 127 specimens from Pine Hill Road in North Scituate—nothing is so well scoured as a botanist's backyard! Additionally, 137 specimens represent what I can only envision as enjoyable excursions to the summit of Mt. Cardigan (NH), Church Pond and Sabbaday Falls Trails (Passaconaway, NH), Victory Bog (Essex County, VT), Stannard Mountain (Caledonia County, VT) and Hardwick, Vermont. In combination with his working collection from the RIC campus in Providence, we have a representation of a good portion of the New England flora that is carefully annotated, mounted, and preserved.

Intermixed with these recent specimens are found 398 mounts labeled as "The School of Horticulture" and collected between 1939 and 1944. The locality data for the majority of these specimens, to the north of Philadelphia in Ambler, PA, led me to



discover their origin from "The Pennsylvania School of Horticulture for Women." These specimens represent the careful and thorough collecting activity of several young women during their botanical studies at TSH (now Temple University, Ambler Campus) during the early years of World War II.

Thanks to the assistance of Dr. George Manaker at Temple University, I have actually been able to contact one of these student collectors. Imagine my delight in finally speaking with one of the former students, now an octogenarian, and hearing stories of young ladies collecting Tulip Tree flowers from the third floor of a dormitory. I also learned this particular student recalled seeing some older specimens, a few pressed in Civil War-era newspapers, in the bottom of a large wooden cabinet in the dormitory at The School of Horticulture. She recalls reading news stories about Sherman's March on Atlanta!

This brings us to the foundation of Dr. Pearson's acquisitions. As I began the inventory of the collection, I encountered numerous specimens simply labeled "Germantown Botanical Club" accompanied by pasted, cut-out notations in the old Spencerian cursive. These specimens had been remounted and most labels were unsigned, but a little research and analysis soon indicated a collection of substantial botanical interest.

Presently, the label data from the entire 2,964 specimen collection have been entered into a computerized database (the first complete printout is over 90 pages in length!). This will allow the information to be sorted electronically, revealing patterns of collection locality and date, as well as establishing correlations of handwriting styles for the 1,654 19th Century specimens. Preliminary handwriting analysis suggests between five and nine styles of unidentified handwriting may be found on the tickets.

Although the majority of specimens are unidentified as to collector, circumstantial evidence suggests whoever mounted and preserved these plants had "connections" in the Philadelphia and American botanical circles of the 1880s. Most of the specimens were gathered in the vicinity of Germantown, Pennsylvania, however, at least 37 states and 6 countries are represented. Included are such materials as:

- Approximately 70 specimens labeled "Colorado Territory" or "Rocky Mountains" from the period 1862 to 1883. A few of these plants were collected by such renowned botanists as C.C. Parry and E. Hall as part of the famous Hayden and King Surveys. Additionally, some specimens are labeled only "Dr. Hayden" (i.e. F.V. Hayden) and either reflect his expeditionary collections for the federal government or his involvement in the extensive Pacific Railroad Surveys. Additional specimens labeled "Yosemite

Valley" and "Washington Territory" are attributable to Thomas Meehan (see below).

- 33 specimens with labels from the Herbarium of the U. S. Department of Agriculture which appear to be annotated by George Vasey, the Curator of the USDA Herbarium at that time. The majority of these specimens are ferns collected during the 1870s in the Southwest by such famed botanists/collectors as M. S. Bebb, J. G. Lemmon, J. T. Rothrock, and E. Palmer.

- 44 specimens labeled "Northern Texas" from the years 1883 and 1884. It is not difficult to imagine that botanical collectors valued a six-shooter as much as a vasculum in those days! Some of the western specimens are labeled merely "Indian Territory," "Dakotah," "American Plain," or "From the West."

- 58 specimens from Mt. Desert Island, ME (1882-1885). These

specimens predate the first published flora of the Island (Rand and Redfield, 1894) by almost 15 years. Several of the Mt. Desert specimens in the Pearson Collection were not included in, or were explicitly excluded from, that flora but additional evaluation of the plant material is needed to validate their identification. One of the authors of the flora, John H. Redfield (1815-1895), was from the Philadelphia area and visited Mt. Desert nearly every summer. However, careful handwriting analysis seems to discount Redfield as the annotator of these labels.

- Other New England specimens of interest include 35 Rhode Island plants from Conanicut (i.e., Jamestown), Newport, and Warwick.

- An estimated 200 specimens from the southeastern United States, one (#1823; *Azalea calendulacea*, Mx.) collected during a celebrated "Trip to North Carolina" by the party of Asa Gray, C.S. Sargent, J.H. Redfield, and Wm. Canby. An account of this excursion was subsequently published (Redfield, 1879).

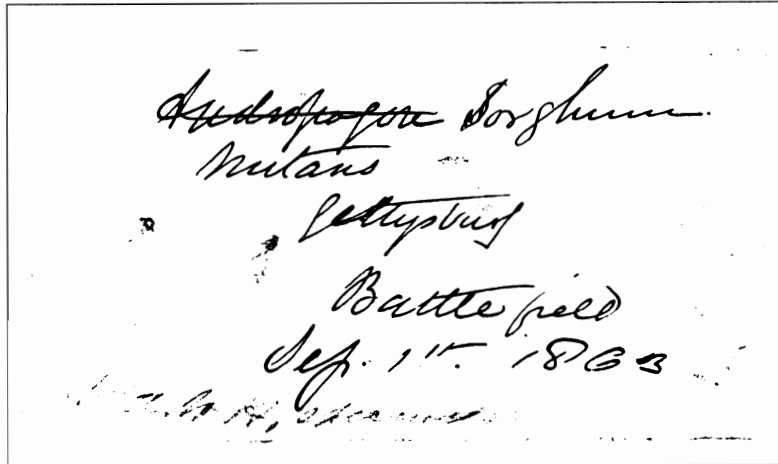
- 170 specimens attributable to Thomas Meehan (1826-1901), a Germantown horticulturist, nurseryman, and botanist. Professor Meehan was vice-president and longstanding member of the Academy of Natural Sciences of Philadelphia, as well as the first State Botanist of Pennsylvania. Forty of these specimens are labeled "From Prof. Meehan's Botanical Garden" with various interesting notations.

But perhaps the most striking of all the specimens is a single stem of Indiangrass (*Sorghastrum nutans*) labeled "#794, Gettysburg Battlefield, Sep. 1, 1863" [see box]. Exactly 58 days before this plant was

collected, some 160,000 soldiers were involved in a three-day battle that would result in more American casualties than the entire Vietnam War. Who was this collector and why were they there? Was this gathered from a reported location where a loved one fell amongst the rutted fields? Did this plant endure Pickett's Charge toward Cemetery Ridge, or survive the cannonade at Round Top; that "dirty, nasty little hill" where "death held such high carnival"?

Abraham Lincoln stated in The Gettysburg

Address two months later: *The world will little note nor long remember what we say here, but it can never forget what they did here.* Although we may never know by whom, for whom, or why specimen #794 came to be, we do know that one dried culm of



grass also lies in silent testimony for what came to pass under the July sun in 1863.

At least it is clear that further analysis and research of this collection may indeed reveal material of some worth to taxonomic research or the history of United States botanical exploration. In the interest of preserving such noteworthy collections, the Rhode Island Natural History Survey has recently funded the purchase of a new herbarium cabinet to house the collection. As such, we can be assured it will be protected for now and generations to come.

Literature Cited

- Cope, M.S. 1882. Further notes on the occurrence of *Hieracium aurantiacum* in the Catskill Mountains. *Bull. Torr. Bot. Club* 9:12.
- Pearson, P.R., Jr. 1963. Vegetation of a woodland near Philadelphia. *Bull. Torr. Bot. Club* 90:171-177.
- Pearson, P.R., Jr. 1975. Arborescent composition of woodlands on diabase in Bucks and Montgomery Counties, Pennsylvania. *Bartonia* 44:1-7.
- Rand, E.L., and J.H. Redfield. 1894. A Preliminary Catalogue of the Plants Growing on Mount Desert and the adjacent islands. Cambridge, MA. 286 pp.
- Redfield, J.H. 1879. Notes of a botanical excursion into North Carolina. *Bull. Torr. Bot. Club* 6:331-339.
- Redfield, J.H. 1881. Occurrence of *Hieracium aurantiacum*, in the Catskill Mountains. *Bull. Torr. Bot. Club* 8:112; *Proc. Acad. Nat. Sci. Phil.* 1881: 429.
- Redfield, J.H. 1884. *Corema conradii* and its localities. *Bull. Torr. Bot. Club* 11: 97-101.

Peter Lockwood is on the Board of the Rhode Island Association of Wetland Scientists and the Advisory Board of the Rhode Island Natural History Survey.

In Memoriam: Donald J. Zinn

1911 - 1996

Dr. Donald Joseph Zinn, Professor Emeritus of Zoology at the University of Rhode Island, died of cancer September 18, 1996 in Falmouth, Massachusetts at the age of 85. He was an extraordinary person, an educator, marine biologist, environmentalist, and civic leader.

Don Zinn made many contributions to various fields, but his passion was always natural history and the environment. This led him early in life to discoveries about the invertebrates of sandy beaches and about marine fouling communities. Later he became a leader in the fight to conserve the natural resources of Rhode Island and the nation. He also was a pioneer in aviation physiology during World War II.

He was the husband of Margery (Poole) Zinn. His first wife, Eleanor L. (Blevins) Zinn, died in 1986. In addition to his wife he leaves a brother, two sisters, two sons, four grandchildren, two step-children, two step-grandchildren, and several nieces and nephews.

Zinn earned a bachelor's degree in Zoology from Harvard College in 1933, then became director of the Bass Biology Laboratory in Englewood, Florida. Following this he moved to Rhode Island, enrolling in what was then Rhode Island State College, and received his Master of Science in Zoology in 1937 for his work on the starfish of Narragansett Bay. From there he went to Yale University for the Ph.D., and studied under one of the greatest ecologists, G. Evelyn Hutchinson. It was at Yale that he began his life-long interest in the animals of sandy beaches—the meiofauna. His doctoral dissertation was a study of a newly-discovered marine interstitial fauna migrating between grains of sand, landward and seaward, with the flow and ebb of the tides.

He returned to Rhode Island after his service in the Army Air Corps, joining the faculty of the Department of Zoology at Rhode Island State College in 1946. Here he continued his studies of beach meiofauna, and added studies of marine fouling communities. During the course of his career he published over 90 articles in scientific and lay journals. He also taught invertebrate zoology, histology, ecology, and taxonomy to generations of U.R.I. students before retiring in 1974. His students were impressed by his demanding courses, attention to detail, quick wit, and passion for puns. He also was a good cook, and often ended laboratory sessions by

cooking up the edible subjects that had just been studied

Don Zinn was the author of two books: *A Handbook for Beach Strollers*, and *Marine Mollusks of Cape Cod*. The *Handbook* was a collection of articles about the natural history of common marine invertebrates written for *Maritimes*, a magazine published by the Graduate School of Oceanography. The last chapter of the *Handbook*, entitled "Out of the Sea and onto the Table" gives the scientific and common names of 29 edible invertebrate animals that can be collected in Rhode Island, where to find them, how to eat them, and recipes for some.

Zinn was quick to recognize opportunities to do works of civic improvement and to promote conservation education. The White Pine trees in Kingston's Potter Woods Park are from seedlings planted one Saturday by the Cub Scouts in Dr. Zinn's den. The

community services he rendered both in Rhode Island and in Falmouth, Massachusetts were many, throughout his lifetime.

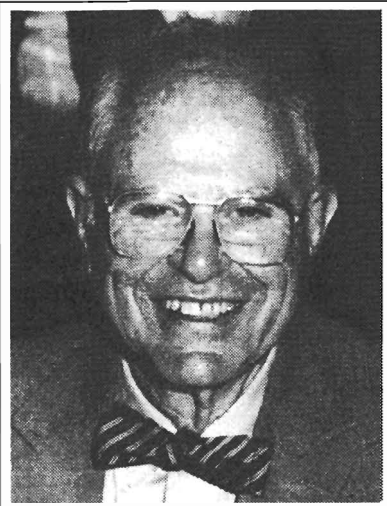
It was Zinn's initiative that started a URI summer workshop in Natural History and Conservation for school teachers in 1952 with funds from the Rhode Island Director of Conservation. The class was in the field four afternoons each week, led by Zinn, Bob Harrison, Elmer Palmatier and Saul Salla, among other Rhode Island natural historians.

His desire to educate the public was not limited to books and articles for laymen. During the 1960s he hosted weekly, early Saturday mornings, a television program about wild animals and conserving natural resources, from a studio on the top floor of the Outlet Department Store in Providence.

In the 1950s Don Zinn began a long association with the National Wildlife Federation. He served as President of the Rhode Island chapter, and in 1961 he was elected Northeast regional director. He served as national president from 1967 to 1970. After 1970 he was a member of the Federation's Board of Directors. Zinn was a member of far too many other scientific, conservation and civic organizations to list here.

Don Zinn made significant contributions to Rhode Island natural history and to our understanding of marine animals. His passion for conservation and for educating the public about threats to the environment made him a leader nationwide. His wit, wisdom, and dedication will be sorely missed.

R. W. Harrison and J. Stanley Cobb, Department of Biological Sciences, University of Rhode Island.



SAVE THE BAY

by Wenley Ferguson

Save The Bay, a nonprofit organization that works to protect and restore Narragansett Bay, was started in 1970 by a small group of citizen volunteers. Through their hard work, they successfully blocked the building of an oil refinery along Tiverton's coast. Today Save The Bay has grown into southeastern New England's largest environmental organization, with over 15,000 members.

Save The Bay's mission is to ensure that the environmental quality of Narragansett Bay is restored and protected from the harmful effects of human activity. Save The Bay seeks carefully planned use of the Bay and its watershed to allow the natural system to function normally and healthfully both now and in the future. Through advocacy, education and stewardship, Save The Bay works to improve water quality and the health of Narragansett Bay habitat.

Save The Bay's Habitat Restoration Initiative

In 1995, Save The Bay embarked on The Habitat Restoration Program, a key example of Save The Bay's proactive approach to Bay protection. Designed to address issues that have caused historic habitat decline, this initiative galvanizes the efforts of community groups, public agencies and private organizations to develop a blueprint to protect and restore salt marshes, eelgrass beds, and fish runs throughout Narragansett Bay.

The goals of Save The Bay's Habitat Restoration Program are to ensure no further loss of current Narragansett Bay habitat, and restore critical habitat throughout Narragansett Bay and its rivers including revitalization of existing habitat and an increase in habitat area where possible. To ensure success, Save The Bay is working with groups like the U.S. Fish and Wildlife Service, Narragansett Bay Estuary Program, Natural Resource Conservation Service, and local town officials to facilitate habitat restoration throughout Narragansett Bay. Save The Bay's collaboration with the technical expertise of R. I. Natural History Survey members will continue to assist with these habitat restoration efforts.

Historic and Current Conditions of Bay Habitats

Salt marshes have been severely impacted by historic filling of the coastline. An estimated 50 percent of Rhode Island's salt marshes, from downtown Providence to Wickford Harbor, have been lost or degraded. The majority of the remaining 3,100 acres of salt marshes have been degraded to some

degree by inadequate buffer zones, ditching in the marsh, and road and bridge crossings which restrict the tide from entering the marsh.

To assess the health of Narragansett Bay's remaining salt marshes, Save The Bay has trained volunteers representing local conservation groups, local government and neighborhood associations to evaluate historic and current impacts to salt marshes. The results of those assessments were sobering—all marshes evaluated were degraded to some degree.

Impacts included polluted stormwater runoff from surrounding land uses, fill activities in the marsh, and roads or bridges that restrict tidal flow. These human impacts create conditions (increased elevation, lower salinity, disturbed soils, increased nutrient levels) that allow *Phragmites australis* to aggressively invade the marsh outcompeting other salt marsh plants. Out of the 1885 acres of salt marshes evaluated thus far, 62% of these salt marshes contain *Phragmites*, 70% are affected by tidal restrictions, and 63% are impacted by filling.

Eelgrass beds once extended from the Providence River and Greenwich Bay to the Kickemuit and Palmer Rivers. Eelgrass has been lost in most of the Bay due to poor water clarity caused by nutrient-rich polluted runoff and sewage treatment plant discharges, hurricane damage, and wasting disease. After aerial surveys of eelgrass were conducted in the summer of 1996*, it was found that only 100 acres of eelgrass remain in the 96,000 acre Narragansett Bay. In the upcoming months, Save The Bay will work with technical experts to determine the feasibility of restoring eelgrass to the Palmer River.

Most of the rivers and streams that flow into Narragansett Bay have been restricted by dams that were built as early as colonial times. The once-teeming population of spawning fish has substantially declined. Over 50% of historic fish runs have been lost and only two fish runs in Rhode Island remain undammed.

Advocacy Work

Save The Bay introduced habitat restoration legislation into the 1997 Rhode Island General Assembly. The legislation's goals are to protect and restore salt marshes, eelgrass beds, establish funding dedicated to coastal habitat restoration initiatives, develop a statewide habitat protection and restoration policy, and facilitate community-based restoration projects by providing financial and technical assistance. Although the bill did not pass during this legislation session, a new bill will be introduced in 1998.

*Funding for this project was provided by: RI Aqua Fund, U.S. EPA/RIDEM Narragansett Bay Estuary Program, Save The Bay and Project Data Generation/Analysis: U. Mass. Natural Resources Assessment Group, Digital Mapping Data: RIDEM GIS Program, Municipal Sponsor: Town of Warwick, RI.

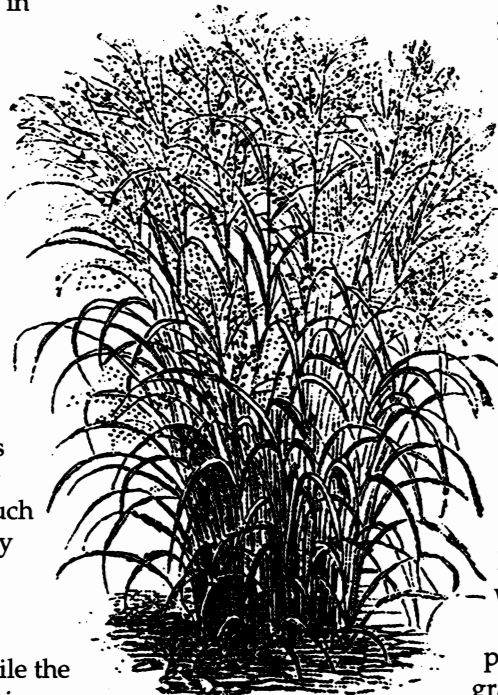
Prairie in New England?

While most people don't think of prairies when they think of the New England landscape, at one time extensive grasslands existed across western Long Island, Martha's Vineyard, and coastal Connecticut and Rhode Island until the early 20th century. In fact, grasslands were once so abundant in this region that the Heath Hen, now extinct, thrived here. Several species of native grasses common to the tall grass prairie can be found in Rhode Island. At Trustom Pond National Wildlife Refuge, we find Big Bluestem, Little Bluestem, Indiangrass and Switchgrass outside of the old hay fields. Of the original 50,000 acres of New England's native grasslands dominated by Little Bluestem, few acres remain today.

Grasslands in this region, as in the Midwest, require periodic disturbance to maintain grassland communities of plants and wildlife. Frequent wildfires, either natural or set by Native Americans, or grazing by bison and other large herbivores, kept woody vegetation from encroaching upon grasslands and helped maintain grassland plant communities. When disturbance is halted by suppressing wildfires, woody plants will overtake the grasslands and the habitat will eventually grow into a shrubland or forest. In fact, the Heath Hen Preserve on Martha's Vineyard is now the State Forest! Many thousands of acres of New England's grasslands have been lost to fire suppression, as well as agriculture and development.

Why Are Grasslands Important?

Since few grasslands remain in coastal New England, many of the species that depend on grasslands have become threatened and endangered. Currently 32% of Rhode Island's state-listed plants are dependent on grasslands or similar early succession habitats, and 25% of the state-listed birds are dependent on grasslands. Birds like the Upland Sandpiper and the Grasshopper Sparrow no longer nest on the mainland; currently Grasshopper Sparrows and Northern Harriers nest only on Block Island. Plant species, such as Sandplain Gerardia and Bushy Rockrose, exist only in a few locations. Invertebrates like the Regal Fritillary butterfly have disappeared from the region while the existence of other grassland species,



such as American Burying Beetle, is imperiled.

Declines in grassland species have occurred throughout New England. Between 1966-1995 there has been an 84% decline in Upland Sandpiper in New York, a 97% decline in Eastern Meadowlark in Connecticut, a 97% decline in Grasshopper Sparrow in New York, and a 92% decline in Grasshopper Sparrow in Vermont.

Many species of grasses that occur in both naturally-occurring grassland remnants and in planted grasslands for pasture or hay are alien and not native to this region. While these plants may provide some habitat, native plants provide better cover for wildlife and are more resistant to flattening from winter storms, resulting in better winter cover for wildlife and better nesting cover in the spring. Big Bluestem, Little Bluestem, Indiangrass, and Switchgrass are four of the dominant native grasses that make up native grasslands in this region. All four species are very resistant to flattening by winter storms, unlike alien or non-native species of grasses, and provide excellent winter and nesting cover for grassland birds.

If You Build ItThey Will Come!

The U.S. Fish & Wildlife Service is working to restore declining grassland species in Rhode Island. The Service as an agency has been involved in restoration of native grasslands for a number of years in the midwest and prairie states. We have recently been applying some of the techniques used elsewhere to fields at Trustom Pond National Wildlife Refuge in South Kingstown with encouraging results.

So far we have successfully planted close to 40 acres at Trustom, with another 40 planned over the next year or two.

If there are no remnant native grasses in the stand then you really have to start from scratch. Usually the first step is to mow everything down. Then we use an offset harrow to break up the sod layer on the surface. This process makes it much easier to turn over with the plow. We then use a deep bottomed plow to turn the fields under. This step helps to bury weed seeds as deep under as possible, assisting weed control. In the spring we use a disk or harrow to kill any sprouting weeds; this step is repeated twice.

After harrowing, the field is packed with a roller because native grasses require a firm seedbed to

germinate properly. We then use a grass drill specially built to handle native grass seeds. The seeds of native grasses like Little Bluestem, Big Bluestem, and Indiangrass are very chaffy, requiring specialized agitators in the seed box to keep the seed tubes from clogging. Depending on the location of the field, we use a Little Bluestem-dominated mixture on drier fields and a mixture dominated with Big Bluestem in wetter fields. This tends to mimic natural mixes of native grasses that we have seen in the wild. Native grasses take two seasons to become mature, and competition by annual weeds can be fierce in native grass fields; weed control is the key to establishing native grasses.

We have begun restoration efforts to expand native grasslands at Ninigret National Wildlife Refuge in Charlestown from 20 to 200 acres. We will use a variety of habitat management techniques, including brush removal, mowing, and controlled burns (using fire in a carefully controlled way), to establish and maintain grasslands. In areas where native grasses have been overtaken by non-native species, we will replant native grasses. As we remove the deteriorating runways and taxiways from Ninigret, we will plant native grasses in their place. Our hope is that once the appropriate habitat is restored, many of the native species that once made the coastal plain their home will come back.

Marcianna Caplis and Ron Flores of the U.S. Fish and Wildlife Service in Charlestown, RI prepared this article.

RINHS Publication Listing Continues to Expand

We've added several new items to the list this year. They include a new printing of Alonzo Quinn's *Rhode Island Geology for the Non-Geologist, Minerals of Rhode Island*, and several publications from the Connecticut Department of Environmental Protection. Just arrived are:

Massachusetts Audubon Society's *Habitat Guides*, full-color, laminated fold-out eight-sided field guides chock full of identification and natural history information. Five guides are now available from RINHS: *Backyard Birds*, *Beachcombers*, *Whale Watchers*, *Pond Watchers*, and *Cloud Forest*. Great holiday presents for young and old! The guides are \$3.95 each plus \$0.75 shipping/handling.

The Rhode Island Resource Protection Project, a 16-page, 11" x 17" full-color summary of the project, full of maps and information about the protection of Rhode Island's natural resources. A joint project of the U. S. EPA, New England Interstate Water Pollution Control Commission, and the Rhode Island Department of Environmental Management. Free plus \$1.25 shipping/handling.

RINHS Institutional Members: Special News & Events

Portsmouth Abbey School is developing a two-year course program in oceanography, limnology, and estuarine science, the Marine and Environmental Studies Program. The program will give students field and laboratory experience both on and off campus. Students in the advanced segment of the program will conduct original research projects at Portsmouth Abbey School, or off-campus in conjunction with institutions such as Water Works, Inc., **Norman Bird Sanctuary, the Narragansett Bay National Estuarine Research Reserve, and Roger Williams University**. The program will also encourage area scientists and graduate students to use the research facilities at the school. Institutions that might like to work with this program should contact Bruce Moravchik at (401) 683-6862.

The Museum of Natural History at Roger Williams Park will celebrate the opening of *Joint Ventures: A Bare Bones Exhibit*, on Sunday, November 1, from 10 a.m. to 5 p.m. This exhibit features 35 spectacular skeletons from around the world.

The Rhode Island Wild Plant Society has a new home in Peace Dale, and a new Executive Director, Deborah Poor. For information about the Society's programs and events, contact the office at P. O. Box 114, Peace Dale, RI 02883; (401) 783-5895. **Happy 10th Anniversary, RIWPS!**

Roger Williams University dedicated on September 24 the Center for Economic and Environmental Development (CEED) facility. This 41,000 sq.ft. building will enhance the undergraduate mission of the university, enrich community service including career retraining, and enable more research to be conducted at the Bristol campus. The building includes traditional teaching laboratories for Biology, Chemistry, Physics, and Computer Science; it also has student and faculty research space including a wet-lab, collection and instrumentation rooms, greenhouse, and an aquaculture pond. Mark Gould, who also serves on the RINHS Board of Directors, is the first Director of CEED.

Collection Protection!

Part of the mission of the RINHS is to help conserve Rhode Island natural history collections. Thanks to the generosity of the Champlin Foundations, RINHS is able to purchase cabinets to loan to member institutions for housing valuable voucher specimen collections. To date, **The Nature Conservancy, the Rhode Island Natural Heritage Program, the RWU Center for Economic and Environmental Development, the URI Department of Biological Sciences and the URI Department of Geology** have taken advantage of this unique member benefit.

Upcoming Conferences & Seminars

November 12. *Sexy Plants: The Natural History of Pollen*, an RINHS lecture by Michael Zavada (Department of Biology, Providence College), 7:30 p.m., Coastal Institute, URI Graduate School of Oceanography, Narragansett, RI. Free. (401) 874-5800.

November 13. *South Kingstown Greenways Planning Meeting*, 7:30 p.m., Neighborhood Guild, 325 Columbia Street, Peace Dale, RI. Sponsored by the Saugatucket River Heritage Corridor Coalition. (401) 789-7033.

November 17. *Dragonflies of Rhode Island*, a lecture by Virginia Carpenter (RI Office of The Nature Conservancy), 12:00 noon, 113 White Hall, University of Rhode Island, Kingston, RI. URI Dept. of Natural Resources Science Fall Seminar Series. (401) 874-2495.

November 17. *Diversification at the Insect/Plant Interface*. A lecture by Brian Farrell (Harvard University), 12:00 noon, Eddy Auditorium-BMC291, Brown University, Providence, RI. Sponsored by the Brown U. Department of Ecology & Evolutionary Biology.

December 1. *Piping Plovers on Cape Cod*, a lecture by Eric Strauss (Boston College), 12:00 noon, 113 White Hall, URI, Kingston, RI. URI Dept. of Natural Resources Science Fall Seminar Series. (401) 874-2495.

December 1. *The Hunt for Red October: Following the Trail of Senescing Leaves to Potential Resorption*. A lecture by Keith Killingbeck (U. of Rhode Island), 12:00 noon, Eddy Auditorium-BMC291, Brown University, Providence, RI. Sponsored by the Brown U. Department of Ecology & Evolutionary Biology.

December 7. *Winter Walk & Tea*, Nettie Jones Nature Preserve, W. Greenwich, RI, 2-5 p.m., a winter ecology walk led by Lisa Gould (R.I. Natural History Survey), followed by an English tea at Whispering Pines Lodge. For fees & registration, and information about other programs, contact New England Wild Flower Society at (508) 877-7630 x 3303.

December 8. *Soil-Landscape Relationships*, a lecture by Mark Stolt (University of Rhode Island), 12:00 noon, 113 White Hall, URI, Kingston, RI. URI Dept. of Natural Resources Science Fall Seminar Series. (401) 874-2495.

December 12. *History of Narragansett Bay: Pollution and Reclamation*, a lecture by Scott W. Nixon (URI Professor of Oceanography and Director of R. I. Sea Grant College Program), 7:00 p.m., Dom Luke Childs Lecture Series, Portsmouth Abbey School, Portsmouth RI. (401) 683-6862.

January 3-7, 1998. *Annual Meeting, Society for Integrative and Comparative Biology*, Boston, MA. (312) 527-6697; sicb@sba.com

January 9. RINHS Conference: *Ecological Research in Rhode Island: A Continuing Assessment*, Chafee Hall, URI Campus, Kingston, RI. (401) 874-5800 to register.

January 9. *Marine Mammal Rescue and Rehabilitation*, a lecture by James Rice (New England Aquarium), 7:00 p.m., Dom Luke Childs Lecture Series, Portsmouth Abbey School, Portsmouth RI. (401) 683-6862.

January 10. *Biological Control of Invasives*, a lecture by Richard Casagrande (URI Department of Plant Sciences), 1 p.m., Jamestown Library, Jamestown, RI. Sponsored by the R.I. Wild Plant Society. (401) 783-5895.

February 10. *The Ecology of New England Salt Marshes*, an RINHS lecture by Mark Bertness (Department of Ecology and Evolutionary Biology, Brown University) 7:30 p.m., Barrington Public Library, Barrington, RI. Co-sponsored by the Barrington Land Conservation Trust. Free. (401) 874-5800.

February 28. *Ell Pond*, a walk with Chris Nerone (URI Department of Biological Sciences), 1 p.m., Hopkinton, RI. Sponsored by the R.I. Wild Plant Society, (401) 783-5895 (call for fees & registration).

March 17-21. *Applications of Landscape Ecology in Natural Resource Management*, 13th Annual Meeting of the International Association for Landscape Ecology, E. Lansing, MI. (817) 755-2911; iale98@Baylor.edu

April 2. *Going South for the Winter: Perils Facing Neotropical Migratory Birds*, an RINHS lecture by P. A. Buckley (University of Rhode Island and USGS-Biological Resources Division) 7:30 p.m., Sinclair Room, Moses Brown School, Providence, RI. Co-sponsored by Moses Brown School. Free. (401) 874-5800.

April 3. *Ocean Law/Development and Enforcement of Policy*, a lecture by Danielle J. Luttenberg (Coastal Ocean Program, NOAA), 7:00 p.m., Dom Luke Childs Lecture Series, Portsmouth Abbey School, Portsmouth RI. (401) 683-6862.

April 6-12. *1998 North American Ornithological Conference*, St. Louis, MO. Contact (314) 516-6224; email bird_stl@umsl.edu; <http://www.nmnh.si.edu/BIRDNET>

June 7-12. *The Land-Water Interface: Science for a Sustainable Biosphere*, St. Louis, MO. American Society for Limnology & Oceanography and the Ecological Society of America. (800) 929-2756; business@aslo.org

August 2-6. *Ecological Exchanges Between Major Ecosystems*, 83rd Ecological Society of America Annual Meeting, Baltimore, MD. (801) 797-2555; fwagner@cc.usu.edu

August 2-6. *Modelling Solutions for a Finite Earth*, International Society for Ecological Modelling, Baltimore MD. (423) 576-3436; awk@ornl.gov

Opportunities for Volunteers & Students

Audubon Society of Rhode Island, 12 Sanderson Road, Smithfield RI 02917, welcomes volunteers to help with property surveys and inventories, checking property bounds, doing trail maintenance, and serving as trail wardens. Contact Properties Manager Dave Rodrigues at (401) 949-5454.

Happy 100th Birthday, ASRI!

Garden Club of America, 14 East 60th Street, New York NY 10022 lists many opportunities for college & graduate students, doctoral candidates, PhDs, and landscape architects. They include:

- a grant to study medicinal botany
- a fellowship in landscape architecture at the American Academy in Rome
- awards in tropical botany for PhD candidates to pursue independent field study
- a grant for graduate students in horticulture to conduct field research on the biology and management of rare flora
- a scholarship to study areas in the US that provide habitat for threatened or endangered native birds
- scholarships for college students who would like to take summer courses in environmental studies
- regional scholarships for college or graduate students who wish to pursue the study of horticulture and related subjects.

The RINHS office has a list of the various programs and how to contact them directly.

Johnson & Wales University, 8 Abbott Park Place, Providence, RI 02903 is seeking sites and site supervisors for students during winter 1996-1997. Thanks to an endowment from Alan Shawn Feinstein, 1000 students (mostly sophomore business majors) per year will be placed in positions to work 1-4 hours per week for 8-10 weeks, where they will help with activities such as organizing walks, public events, or educational fairs. For more information contact Matthew McConeghy at (401) 598-1766.

Mystic Marinelife Aquarium, 55 Coogan Blvd., Mystic, CT 06355 has volunteer opportunities in administration, visitor and member services, marketing and public relations, special events, exhibits, interpretation, development, education and programs, maintenance and grounds-keeping, husbandry, and research

and veterinary services. Both adults and young people ages 15-17 are welcome to participate.

The MMA also offers an Intern Program for college students to gain practical experience in a museum setting. Working from 21-35 hours per week, students may gain experience working with marine mammals and birds, fish and invertebrates, or work in research, education, marketing, public relations, graphics, merchandising, development, human resources, and engineering and maintenance. College credit is available for these internships.

For more information contact the MMA at the above address or call (860) 572-5955.

New England Wild Flower Society, 180 Hemenway Road, Framingham, MA 01701 is now accepting applications for its Horticulture and Conservation Internship Program at Garden in the Woods, the Society's 45-acre botanical garden. Intern assignments are Propagation and Nursery Management, Botanic Garden Maintenance and Development, and Plant Conservation. Interns live and work at the Society's headquarters. Four internships are available in 1998:

Two 6-month internships (April 1-Sept. 30) in Propagation/Nursery Management and Garden Maintenance/Development.

Two summer internships (mid-May-Aug. 30) in Propagation/Nursery Management and Plant Conservation.

Housing on site, \$150/week stipend for summer interns, \$210/week for 6-month positions, and free admission to numerous classes. Application deadline February 15, 1998. For information contact Cheryl Lowe at NEWFS, or call (508) 877-7630 x 3401. Email: lowe@newfs.org

Rhode Island's National Wildlife Refuges: Ninigret, Trustom Pond, Pettaquamscutt Cove, Sachuest Point, and Block Island Refuges need your help counting wildlife, banding birds, constructing nesting boxes, maintaining trails, leading nature walks, and assisting refuge visitors. The program offers you several areas of opportunity; these include biological, visitor interpretation, education and orientation, maintenance, and miscellaneous skills. For more information contact Pamela Hess at (401) 364-9124.

Rhode Island Natural History Survey, C.E. Education Center, 3 E. Alumni Avenue, URI, Kingston, RI 02881, seeks a volunteer to help with the newsletter and other Survey projects. Computer skills (especially PageMaker and database experience) are particularly welcome. Contact Lisa Gould at (401) 874-5800.

Opportunities, continued from page 17

Roger Williams Park Museum of Natural History, Elmwood Avenue, Providence, RI 02905 has a number of collection-related projects for (unpaid) student internships; projects include curatorial upgrading, nomenclatural updating, inventory, and conservation of the museum's 10,000 specimen herbarium.

Opportunities to work with other natural and physical science collections exist as well. Independent research that earns college or graduate credit toward degree completion is encouraged and welcomed. For information contact: Marilyn Massaro, Curator, (401) 785-9457 ext. 248.

Roger Williams Park Zoo in Providence, RI has an intern program designed for people considering a career in the zoo world. It provides initial zoo experience and exposure to different zoo careers. Interns spend a minimum of 4 days/week for 10 weeks in the program. Admission to the program is based on an application and interview. For information contact: Curator of Education, Roger Williams Park Zoo, Elmwood Ave., Providence, RI 02905; (401) 785-3510 x 353.

The Sierra Club, RI Chapter has many interesting opportunities for volunteers. The chapter is always looking for people interested in leading outings to natural areas. The RI Chapter is also active in issues related to the protection and restoration of natural resources. Anyone interested in calling or writing public officials or writing letters to the editor is encouraged to join our activist network.

The RI Chapter also has a large slate of natural history based outings throughout the year. Call the RI Chapter at (401) 521-4734, or write: Sierra Club, RI Chapter, 10 Abbott Park Place, 4th Floor, Providence, RI 02903.

Instituto de Ciencias Sociales Y Ambientales--Improving the Scientific Basis for Environmental Decisions--announces opportunities for volunteers to spend from 15 days to 3 months working in Calblanque Park, La Manga del Mar Menor, Spain during the summer. For information phone 34 902 113793 - 34 68 220 596 or email murban@ctv.es Website: <http://www.ctv.es/USERS/murban/volunt.htm>



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Cooperative Extension Education Center
3 East Alumni Ave., URI, Kingston, RI 02881
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Email: RINHS@URIACC.URI.EDU
Website: www.edc.uri.edu/rreapage/nathist

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Anthony Vecchio, Roger Williams Park Zoo

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Annual Membership Fees:

\$25 Individual
\$40 Family
\$10 Student/Ltd Income
\$100 Institution



**Weaving the Web:
Electronic Resources**

"Buffer Zones: Their Processes and Potential in Water Protection" conference proceedings website is: <http://www.qest.demon.co.uk/bzchp.htm>

Bioregional Information Systems project has a daily News server called Tidepool. Websites: www.inforain.org and www.tidepool.org

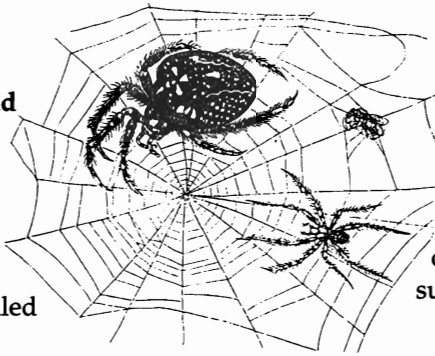
Committee for the National Institute for the Environment offers great information resources on environmental topics such as biodiversity, climate change, energy, agriculture, forestry, marine issues, international laws and treaties, and much more. Website: <http://www.cnie.org>
For the on-line library: www.cnie.org/nle

Consortium for International Earth Science Information Network announces the availability of the United Nations Environment Programme's Environmental Effects of Ozone Depletion 1997 Interim Report: <http://sedac.ciesin.org/ozone>

Cooperative State Research, Education, and Extension Service (CSREES) web page: <http://www.reeusda.go>

Environmental Protection Agency (EPA) announces:
--data on drinking water is available at: <http://www.epa.gov/enviro>.
--For information on watersheds, use: <http://www.epa.gov/surf/iwi>
--for information about EPA's Environmental Education Grants Program: <http://eelink.umich.edu>

Frogs of New England website: <http://library.advanced.org/11034>



Institute for Agriculture and Trade Policy (IATP) *Ag-Impact*, an automated, email discussion group on methods, tools, and programs for assessing the environmental impacts of agriculture. To subscribe send a message to listproc@mtn.org. Leave subject line blank. In the body of the message write: subscribe Ag-Impact your name. The IATP web site is: <http://www.iatp.org/iatp>

National Pesticide Telecommunications Network, co-sponsored by EPA & Oregon State University, announces its website at: <http://ace.orst.edu/info/nptn/>. This site provides objective, science-based information about pesticide products, pesticide poisonings and emergencies, toxicology and environmental chemistry.

National Water Summary on Wetland Resources, compiled by the U. S. Geological Survey, is available from the Government Printing Office at (703) 648-4888; ask for an order form and select document #5100. Highlights are available at: <http://water.usgs.gov/lookup/get?WSP2425>

The Nature Conservancy 1997 Species Report Card: the State of U.S. Plants and Animals, is available at website <http://www.springer-ny.com/journals/ecosystems>.

Ocean98 promotes the Year of the Ocean, to create awareness for all aspects of oceans, seas, and coastal waters. Website: www.ocean98.org

World Conservation Monitoring Centre Biodiversity Source Book: <ftp://ftp.wcmc.org.uk/products/wcmc.publications/1.sourcebook>. For the WCMC Threatened & Endangered Species Lists of the World: http://www.wcmc.org.uk/species/animals/animal_redlist.html

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- Individual (\$25) Family (\$40) Student/Limited Income (\$10)
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in the
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Thanks!

The Rhode Island Natural History Survey is grateful for the continued support of many people and institutions. We thank the Rhode Island Office of the State Geologist for a copy of *Minerals of Rhode Island* (now a new addition to the RINHS Publications Listing); Peter Lockwood for *Among Rhode Island Wildflowers* and *Conserving Grassland Birds* series; and Paul Fofonoff for a copy of "Reproductive Biology of Marine Cladocerans, in *Advances in Marine Biology, Vol 31*. Continued thanks are due to Christopher Little for his legal advice. We are also grateful for the daily support of the staff at the Cooperative Extension Education Center, for office help provided by Aun Sang and Salinda Daley, and to Mark, Hannah, and Meg Gould for their help with RINHS bulk mailings.

Thanks to a grant from the Rhode Island Higher Education Assistance Authority, this summer we were able to hire Mt. Holyoke student Kerry Manire, a North

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Kingstown resident, to begin entries in the RINHS natural history literature database. The database now has over 800 citations.

And a special thanks to the dedicated proofreaders of RINewHS--Ginger Carpenter, Mark Gould, and Douglass Morse--for their sharp eyes and high standards.

**RINHS Participates in Rhode Island College
Internship Program**

Under the auspices of RIC's Department of Accounting and Computer Information Systems, RINHS is fortunate to have intern Diane Pesaturo working in the office this semester. Diane, a student in Professor Jules Cohen's Software Development course [Jules is also president of the Rhode Island Wild Plant Society], is helping RINHS streamline its accounting and bookkeeping procedures by entering past data into *QuickBooks* and training RINHS office staff how to use this program. We are delighted to have Diane working with us and look forward to a fully-automated bookkeeping system.

*Each man's necessary path, though as
obscure and apparently uneventful as
that of a beetle in the grass, is the way to
the deepest joys he is susceptible of.
Though he converses only with moles and
fungi, and disgraces his relatives, it is no
matter, if he knows what is steel to his
flint.*

--Henry David Thoreau

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