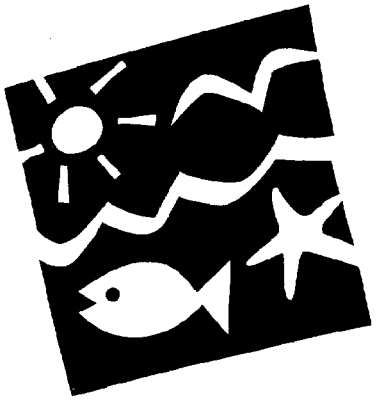
Project #94.4.3



Final Report

Educational Programs on
Coastal Resources for
Public and Municipal Audiences

Office of State Planning
Grant No. NA 47OZ0237

Seacoast Science Center and
Audubon Society of New Hampshire

Project Personnel
Richard Cook, Wildlife & Wetlands Dept. Director, ASNH
Diane DeLuca, Senior Biologist & Ornithologist, ASNH
Wendy Lull, Executive Director, SSC *(Project Manager)*
Steve J. Miller, Program Director, SSC
Beverly Shadley, Education Program Coordinator, SSC
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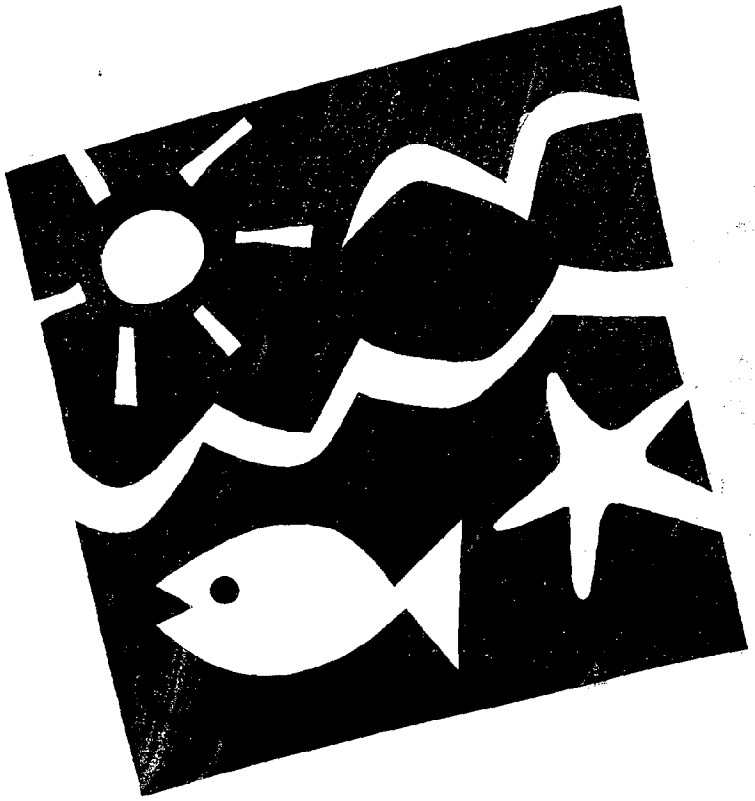

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Table of Contents

Final Report:
Development of Educational Programs on Coastal Resources for Public and Municipal Audiences by the Seacoast Science Center and the Audubon Society of New Hampshire

Project Objective

The objective of this proposed project was to develop and conduct three series of programs with current information about the status of coastal endangered wildlife species and coastal resources, and to provide technical advice to towns on resource management as needed. The program series were:

- Endangered Species (slide show and collateral materials)
- Natural and Cultural History of the Great Bay (for three audiences)
- Coastal Resources Programs (walking tours, slide show, lecture series).

The programs incorporated current wildlife research and resource management tools. The purpose of this program is to educate the general public and provide local municipal leaders with the information they need to make intelligent choices and decisions.

As these programs were developed another purpose was recognized: significant improvements have been made in the quality of some coastal resources and difficult steps have been taken to protect others. This "good news" needs to be told to the public to dispel the sense of overwhelming environmental damage people felt in the 1970s and maintain their enthusiasm for making environmentally sound choices by recognizing our improvements and successes. Keeping citizens aware of the current status of their coastal resources, including what they can do to support and maintain them, is even more critical as the federal government turns away from scientific-based environmental policy and toward politically-based environmental decisions.

The site for most of these programs was the Seacoast Science Center at Odiorne Point State Park. Since opening in June, 1992, the Seacoast Science Center has had over 145,000 visitors. Most of these visitors come from coastal states; over 800 come from other countries including Asia, Tonga, Ireland and Poland. Visitors come to the Center throughout the year to view the habitat and history exhibits and to participate in programs. These visitors are made aware of the diversity of coastal habitats and resources through exhibits (five of which were funded in part by the New Hampshire Coastal Program, Office of State Planning, Department of Commerce and National Oceanographic and Atmospheric Administration).

Wildlife Department at the Audubon Society of New Hampshire (ASNH). This proven staff approach combines the wetland resource and wildlife research strength of the ASNH staff with the educational expertise of the Center staff.

Endangered Species Programs

Although many citizens are concerned about endangered species, few are aware of them in their own communities. The endangered species slide program and collateral informational materials incorporated general natural history about local endangered birds as well as historical data and current research results.

Endangered species slide show

This presentation highlighted the natural history of each of the following species: the common tern (state endangered), the upland sandpiper (state endangered), the bald eagle (state and federally endangered) the osprey (state threatened) and the northern harrier (state threatened). It combined the most current information resulting from over five years of monitoring. It focused on giving the audience a good understanding of the habitat use and needs of these species, as well as ways the audience can get involved in preservation and conservation efforts.

The following individuals and organizations assisted in locating and/or providing slides: Bill Byrne, Massachusetts Fisheries and Wildlife Division; Dick Hughes, ASNH; Andrew Kendall, ASNH; Dr. Stephen Kress, National Audubon Society; Chris Martin, ASNH; Peter Wellenberger, Great Bay National Estuarine Research Reserve; and the National Wildlife Federation.

This program was presented to Seacoast Science Center staff and volunteers in March, 1995. Comments were incorporated into the script. The revised program was also presented to the public at the Center in June. It will be incorporated into regularly scheduled programs at both the Center and Audubon House in Concord, NH. A copy of the script and slides is in Appendix A.

Evaluation and recommendations

This program as been well received. A condensed version was presented at a series of four meetings with conservation commissions and other interested citizens from the coastal communities. It elicited positive feedback and responses. In addition to the incorporation of this program into regularly scheduled programs at both the Center and Audubon House, it should be presented to local municipalities to maximize its educational value.

Endangered species collateral materials
Public information brochures about the common tern and osprey were updated and reprinted (sample brochures are in Appendix B). The new brochures include information based on current research and the compilation of historical data. The brochures provide an up-to-date understanding of the life history, status in New Hampshire, and the efforts to monitor and protect threatened and endangered coastal bird species. They are included in the information packets described below.

Evaluation and recommendations
The inclusion of the brochures in the information packets maximizes the exposure of this information to coastal communities. The brochures will also be available to visitors at the Center and Audubon House. In addition, these brochures will be available to citizens throughout the state who call Natural History Services at ASNH. Further availability through the NHCP would also help ensure continued use and increased distribution.

Informational packets & technical support
Informational packets about New Hampshire's coastal endangered and threatened species were prepared for and distributed to coastal and Great Bay area towns where the birds are present. These packets included: a descriptive and explanatory cover letter, a map identifying the sites where endangered and threatened species are known to be present, information brochures about each species, and an offer to provide technical assistance. A sample packet is in Appendix B.

Combined, these materials identify areas of important habitat and will assist towns in setting priorities for habitat protection in the coastal zone. ASNH is committed to providing technical assistance on endangered and threatened species in the coastal region. Any requests for assistance that result from these packets after the grant period will be responded to as resources permit.

A condensed version of the endangered species slide show was developed and presented to four towns. Interest was generated to protect sites for threatened and endangered species.

Evaluation and Recommendations
The systematic identification of areas important to endangered and threatened species is a critical step in the habitat protection process. The towns of Newington and Durham came forward with questions concerning the protection of open grassland areas for nesting bird species. We are optimistic that we may be able to work with these towns to assist managing their grassland bird habitats.

In addition, we continue ongoing relationships with individual citizens and town officials in Durham, Newcastle, Newington and Stratham to protect known endangered and threatened species habitats. We are committed to responding to future requests for assistance as resources permit.

The Great Bay Resource Programs

The Great Bay Estuary presentation

The presentation, *The Great Bay Estuary, Its Cultural And Natural History,* was developed to encourage the protection of Great Bay natural resources and the maintenance of its rural quality. The program includes a slide show and two fact sheets which illustrate the natural and cultural history of the Great Bay Estuary, and the impacts that development has had on its ecological integrity. The script, slides and bibliography for this program are in Appendix C.

These products are the result of an extensive collection of information about the natural and cultural history of the Great Bay region. This effort benefited from the significant cooperation given ASNH staff by members of the following:

Durham Historical Society
University of New Hampshire (UNH) Sea Grant
Jackson Estuarine Laboratory
Great Bay National Estuarine Reserve and
Jack Adams, author of *Drowned Valley.*

While conducting the research for this program, extant oral histories recordings by people long associated with the Bay were discovered. After consultation with Steve Wallace of the New Hampshire Coastal Program (NHCP) it was decided not to proceed with this task, which would have duplicated the recordings.

Evaluation and Recommendations

Based on audience feedback, *The Great Bay Estuary, Its Cultural And Natural History,* does an excellent job of intertwining the cultural and natural histories of the Great Bay Estuary while explaining the environmental consequences of some of our past and present actions. This program should be shown throughout the region to maximize its educational value. It will be incorporated into the regular program offerings at ASNH's chapter meetings throughout the state, as well as at the Seacoast Science Center and Sandy Point Nature Center in the seacoast.

The fact sheets produced for the presentation should be made available by NHCP and ASNH to ensure their continued use and distribution to coastal zone residents and visitors.

Technical Assistance:

In the fall, Stephen Wallace coordinated a series of meetings with conservation commissions and other interested citizens from the 17 coastal communities. At each of the four meetings representatives of ASNH, the Society of the Protection of New Hampshire Forests (SPNHF), UNH Cooperative Extension, Natural Resource Conservation Service (NRCS), and the Great Bay Watch presented information about their work in the coastal zone.

The ASNH Great Bay Resource team presented information on wetlands protection using the New Hampshire Method and the Coastal Method. They also offered technical assistance to those communities that wanted to undertake a wetland inventory and evaluation. Information was also presented on restoration of coastal habitats in conjunction with NRCS. Following the series of meetings with the conservation commissions, two towns contacted ASNH about providing technical support for wetland protection or enhancement.

Durham was interested in evaluating freshwater wetlands in the Crommet Creek drainage. ASNH personnel recruited, trained and assisted five UNH Natural Resource seniors in the use of the New Hampshire Method. These students spent over 500 hours on the project and produced an excellent report that was presented to the Durham Conservation Commission on May 13, 1995. The report includes the results of the evaluation of 13 wetlands in the Crommet Creek drainage and future action recommendations for Durham's consideration.

North Hampton requested that Alan Ammann from NRCS and ASNH personnel attend a meeting to discuss restoration of the Little River marsh. At the January meeting of the Conservation Commission, options were discussed and a strategy was developed to work towards restoration. Other commitments prevented the Conservation Commission from following through with this project during the grant period. However, the community is still interested in working on this project and ASNH personnel will continue to provide assistance.

In addition to these two communities, Newmarket approached ASNH expressing interest in undertaking a Coastal Method project. However, there was not enough time to provide assistance in the grant period.

Evaluation and Recommendations

The technical assistance provided to Durham allowed the town to undertake a wetlands protection project in an area of town that has regional wildlife habitat significance. The NHCP grant program provides an opportunity for any coastal community to get the assistance it may require to undertake such projects. Many conservation commissions are interested in conducting wetland inventories and evaluations, but do not have the required time and/or manpower. NHCP should encourage communities to form partnerships with environmental organizations

and regional planning agencies to provide the resources they need. The NCHP grant program can provide the impetus needed to implement these partnerships.

Several of the conservation commissions from coastal communities did not attend any of the meetings held for their benefit or make use of the available technical assistance. Limited funds and time did not allow ASNH personnel to continue to try to develop program interest in these towns. In the future activities could be targeted toward these towns to identify individuals within the community who are interested in resource conservation and committed enough to act.

Coastal Resource Programs

Three programs were developed, and one revised as part of this grant module. The three new programs were two walking tours and a lecture series; the *Coastal Issues Curriculum* was revised. Copies of publicity materials for all of these programs is in Appendix D.

The two walking tours were developed for the general public. The first, the *Awcomin Marsh Tour,* taught about marsh ecology, values, restoration techniques, and included a guided walk through a marsh being restored and a marsh in an undisturbed state. The second, the Coastal Resources Walk, gave the public current information about the many coastal resources that can be appreciated from the shore. These programs are discussed below.

The Awcomin Marsh Tour

This program was designed to educate the general public about the status of marshes and their ecology, how coastal human development and use can damage the marsh, and current restoration techniques. Participants traveled by van to Awcomin Marsh where a significant restoration project is being done. Here they were given an overview of marsh ecology and values, sources of marsh damage, and marsh restoration techniques. They then returned to Odiorne Point State Park to view a relatively undisturbed marsh. Comparisons between the two marsh systems were made and discussed. Discussions included the physical state of the two marshes, as well as the flora and fauna found in each. The outline for the program is in Appendix E.

The Awcomin Marsh Tour was conducted 16 times for 109 participants in August and September, 1994. Based on participant and program leader feedback, revisions were made to the program. The program was been offered once in June for 2 participants. The program will continue to offered at SSC throughout the summer and fall of 1995.

Publicity for the program included articles in local newspapers, as well as listings in the Center newsletter, the *Seacoast Sun,* and the Center's in-house program flier.

The Sun is mailed to over 1,500 households (the list includes over 1,000 SSC members , as well as 15 media contacts). The fliers were distributed at the Center's visitor station. In August and September, 1994 13,910 people visited the Center; in June, 1995 approximately 21, 000 people visited (this breaks the previous monthly visitation record of 20,880 in June, 1992).

Evaluation and Recommendations

The *Awcomin Marsh Tours* were very successful. The informal tone of these public programs was an excellent way to reach an interested and concerned public. The walk format was an excellent way to be able to discuss the issues and answer questions. Although walks limit the number of people who can participant on each, the high participant to leader ratio makes it the best way to answer individuals' questions. The need to have specific questions answered is why many people went on the walks. This format is recommended to fill the information void between general public awareness and the specifics of each environmental issue.

In general the attendees were very interested in learning about marshes. Most of the participants seemed to have a high awareness of environmental issues and were concerned about coastal marshes, but lacked or wanted more detailed information to help them understand the specifics of the issues. Because many tours were offered, more people learned about marsh systems than originally planned. Many participants lived near coastal marshes and wanted to learn more about the marshes. They were aware that marshes were under pressure from human use and they wanted to learn more specific information and find out how they could help.

Coastal Resource Comparison Walking Tour

This program discusses the wildlife and ecology of three important coastal resource habitats: rocky shore, Gulf of Maine, and salt marsh. Designed for the general public, this walk included topics such as endangered species, use of these habitats by wildlife, ecosystem ecology, and coastal stewardship. Discussion of coastal issues such as fisheries, resource management, salt marsh assessment, and resource utilization were included, prompted by the waters off the Point which are always busy; lobster and fishing boats as well as commercial and pleasure craft are abundant during the summer months. Visitors are always curious about what the different boats are and how related activities affect the marine environment.

Perhaps more important, however, is Odiorne's history of coastal resource utilization. American Indians fished here in summers and it is the site of the first European settlement in New Hampshire in 1623, chosen because of the extensive salt marshes, coastal resources, the harbor, and river. Throughout the following 371 years, Odiorne Point has been the site of: fish flaking, salt marsh farms, tidal mills, hotels, estates, fortifications and now is a public education and recreation site. How all these resources have been and are developed can be seen within Odiorne Point,

making it a perfect outdoor coastal resource classroom. The program outline is in Appendix E.

The Coastal Resources Walking Tour was conducted 11 times for 122 participants in August and September, 1994. Based on participant and program leader feedback, revisions were made to the program. The revised program was offered three more times in June. The program will continue to offered at SSC throughout the summer and fall of 1995.

Publicity for the program included articles in local newspapers, as well as listings in the Center newsletter, the *Seacoast Sun*, and the Center's in-house program flier. The Sun is mailed to over 1,500 households (the list includes over 1,000 SSC members , as well as 15 media contacts). The fliers were distributed at the Center's visitor station. In August and September, 1994 13,910 people visited the Center; in June, 1995 over 21,000 people visited.

Evaluation and Recommendations

The *Coastal Resources Walking Tours* were very successful. In general the attendees were very interested in learning about coastal resources. Odiorne Point State Park is an excellent location to do these tours because so many of the resources are visible during the walks. Not only were participants able to receive current information, they could watch and see the resources being utilized. This experience was able to give them a deeper understanding of the connections between resource availability and utilization.

The environmental issue awareness and concern of these participants was very similar to those of the *Awcomin Marsh Tour.* This program format differed from that of the *Awcomin Marsh Tour* only in that no van transportation was required. This makes it easier to conduct, since no van scheduling is required, and transportation cost must be covered by program fees.

Revision of the Coastal Issues Lecture

As part of the 1993 OSP Shore Stewards Grant from the Office of State Planning, the original *Coastal Issues Lecture* script was revised. Recommendations for that program were to update and add new slides, add more current issues to the script, and to develop activities which would reinforce the information in that program. This was the time to implement those recommendations, creating an up-to-date slide program that will be educational for the general public and schools.

This task was originally defined to include the new slides and issues, however, after further analyses, it was determined that more than just new slides was needed. The entire approach, tone, and message of the slide show/lecture was changed. The new script for the Coastal Issues Lecture puts human utilization of

our coastal resources into an historic context. Beginning with American Indian use and continuing through European settlement to the present. The resources discussed are: waterways, salt marshes and estuaries, the Gulf of Maine, and the rocky shore. Describing how humans have utilized these resources over time provides an opportunity to celebrate recovery from misuse, as well as to discuss the cost/benefit/risk decisions we must make in the present. Because of the change in direction, developing new, quality activities and associated materials for use in schools as well as for Center visitors became outside the scope of this project period. The script and slides are in Appendix F.

Evaluation and Recommendations

Unlike previous versions of the script which emphasized negative impact humans have had, this version strives to be issue-neutral. It poses questions that participants need to consider when making political and policy decisions in their own communities. Experience with this approach has shown that it captures the intellect of participants, replacing a feeling of helplessness about the environment with cogitation and hope. This program is designed for the general public, adult organizations and civic groups. This program will be utilized at the Center through its programs offered to groups.

Coastal Issues Evening Lecture/Discussion Series

Seacoast 2000, a series of five evening lectures (one more than originally planned) on coastal issues was offered during Coast Weeks, from September 15 to October 13. Five experts in specific coastal issues gave a presentation and led a discussion. Prior to each program, reading materials were given to participants to facilitate the discussion. The list of speakers and reading materials are in Appendix E.

Evaluation and Recommendation

This evening lecture series on current coastal issues was designed to stimulate coastal residents to think of the future while examining current issues. The series was educationally excellent. Average attendance/lecture was 20. Evaluations from *Seacoast 2000* participants were very positive. Scheduling the talks during Coast Weeks added to the overall level of events offered in the seacoast region. *Seacoast 2000* reached an older group of citizens than those who usually participate in Coastal Clean-up.

Despite the positive response, a larger audience was expected. However, the Center has offered lecture series for three years which have always been met with enthusiastic audiences of this size. Promotion for programs has remained fairly constant, limited to fliers and other low-cost approaches. Unless different promotional approaches are tried (which would incur program costs and thus require program fees) and bring in more people, it may be that regional interest in evening lecture programs will always result in this level of attendance.

Project Analysis

The combination of ASNH's wildlife and wetlands biology and technical skills with the Center's educational talent and ready audience was ideal for this project. Citizens look to, and trust, both groups for this kind of information and education. The programs developed with this grant can now be offered throughout the state by both groups. Based on the success of the two walking tours, more programs using this format will be developed at the Center.

The technical assistance provided local towns will help those communities preserve their valuable resources. The meetings conducted at other communities has made them aware of the tools available to them once they have sufficient funds to implement them. Communities seem increasingly aware of the value of their wetlands resources. Now that awareness has been established, finding ways to fund protection strategies of these resources will become increasingly important.

During the development of these programs, two interesting points became clear. One is that progress has been made in cleaning, protecting, and preserving our coastal resources. People need to be made aware of the positive impact their actions have had, from reducing litter and the cessation of habitat altering practices to larger projects such as marsh restoration.

The second point is that there is an educational or information gap between awareness and action. For although the public is more environmentally aware, they are flooded with information that is too general for them to know how to interpret site-specific issues. This makes it difficult for them to differentiate between critical and irrelevant factors when they assess their local issues.

Filling this gap will not be easy. However, by providing more detailed information and programs, progress can be made. The products and results of this project are proof of the effectiveness of teaming environmental and educational organizations with appropriate agencies and citizens' groups. Perhaps the next step would be to offer a series of issue-specific discussion panels with representatives of very different resource user groups such as: state agencies, environmental groups, educational groups, businesses and utilities. Public participation in a series such as this would certainly illuminate the complexity of current resource utilization issues, and if not help fill the education gap, go a long way toward creating enough curiosity and furor to inspire the public to keep up with their environmental issues homework.

List of Appendices

Appendix A:
Script for the endangered species slide show

Appendix B:
Sample endangered and threatened species brochures and information packet

Appendix C:
Script for *The Great Bay Estuary, Its Cultural and Natural History*

Fact Sheets: *The Great Bay Estuary, Natural History*
The Great Bay Estuary, Cultural History

Copy of *Wetlands Evaluation and Policy Recommendation for the Town of Durham N.H.*

Appendix D:
Publicity materials for Coastal Resource Programs

Appendix E:
Outlines for *The Awcomin Marsh Tour* and *The Coastal Resource Walking Tour*

The list of Speakers and reading materials for the evening lecture series, *Seacoast 2000*

Appendix F:
Script fot the Coastal Issues Lecture

APPENDIX A

THREATENED AND ENDANGERED BIRDS IN NEW HAMPSHIRE'S COASTAL REGION

SLIDE PROGRAM NOTES

DEVELOPED BY THE AUDUBON SOCIETY OF NEW HAMPSHIRE, FUNDED BY A GRANT FROM THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION THROUGH THE N.H. COASTAL PROGRAM.

JUNE 1995

ACKNOWLEDGEMENTS

We would like to extend our appreciation to the various people who provided assistance in gathering information for this slide program, and who willingly loaned their slides for use in the program. In particular, we would like to thank:

John Kanter (NHF&G Nongame and Endangered Species Coordinator) for his support and supervision in monitoring endangered and threatened species in the coastal region.

Dick Hughes (ASNH) for his many hours of monitoring endangered and threatened species in the coastal region and for the use of several slides from his collection.

Peter Wellenberger (Great Bay Estuarine Research Reserve) for providing access to the GBERR slide collection and the loan of slides for this program.

Bill Byrne (Massachusetts Division of Fish and Wildlife) for the loan of Bald Eagle slides from his collection.

Dr. Stephen Kress (National Audubon Society) for his expertise in seabirds and tern restoration and the loan of slides from his collection.

THREATENED AND ENDANGERED BIRDS IN NEW HAMPSHIRE'S COASTAL REGION

SUMMARY OF SLIDE TITLES

#	Slide Title	Slide taken/loaned by
BALD EAGLE SECTION		
1.	Bald Eagle Head	National Wildlife Federation
2.	Eagle at nest	NWF
3.	Winter waterway	ASNH
4.	Eagle w/ fish	NWF
5.	Eagles perched	ASNH
6.	Eagle observers on Bay	ASNH
7.	Eagle plumages	ASNH
8.	Adult and Immature	Bill Byrne (Ma. Div. Of F&W)
9.	Adult bald eagle	NWF
10.	Patagial wing markers	NWF
11.	Adult w/fish	NWF
12.	Eagles at roost	ASNH
13.	Sunset on bay	Peter Wellenberger (GBERR)
14.	Numbers of Great Bay eagles	ASNH
15.	Woodman Point snag	ASNH
16.	Wilcox Point roost	ASNH
17.	Wilcox Point roost trees	ASNH
18.	Eagle pellet	ASNH
19.	Wilcox Point conservation easement	ASNH
20.	Bald Eagle adult	Cornell Lab of Ornithology
OSPREY SECTION		
21.	Osprey with fish	Cornell Lab of Ornithology
22.	Osprey soaring	Cornell Lab of Ornithology
23.	Durham beaver swamps	ASNH
24.	Durham nest site	ASNH
25.	Osprey tree-predator guards	ASNH
26.	Osprey tree after hurricane	ASNH
27.	Osprey nest with two adults	ASNH
28.	Squamscott nest	ASNH
29.	Powerlines	ASNH
30.	Stubbs pond	ASNH
31.	Stubbs pond platform	ASNH
32	Raising platform	ASNH
33.	Osprey head	ASNH

TITLE SLIDES CONTINUED

COMMON TERN SECTION

34.	Tern in flight	Dr. Stephen Kress (NAS)
35.	Lunging Island	ASNH
36.	Herring Gull	ASNH
37.	New Castle Islands	ASNH
38.	Fox Point - Hen Island	ASNH
39.	Hampton Saltmarsh	ASNH
40.	Canoe in saltmarsh	ASNH
41.	Monitoring terns	ASNH
42.	Nest in thatch	ASNH
43.	Nest closeup	ASNH
44.	Nest with No Trespassing sign	ASNH
45.	Nest with small chick	ASNH
46.	Chick hiding in grass	ASNH
47.	Results from aggressive terns	ASNH
48.	Great Horned Owl	Cornell Lab of Ornithology
49.	Rats	ASNH
50.	Flooding in salt marsh	ASNH
51.	Built up nest	ASNH
52.	Nest platform	ASNH
53.	Platform under nest	ASNH
54.	White and Seavey Islands	ASNH
55.	Tern decoys	ASNH
56.	Sound system	ASNH
57.	Seavey Island	ASNH
58.	Adult tern on nest	ASNH

UPLAND SANDPIPER SECTION

59.	Upland Sandpiper Closeup	Cornell Lab of Ornithology
60.	Open grasslands	ASNH
61.	South Concord Meadows	ASNH
62.	Pease International Tradeport	ASNH
63.	Stop sign at runway	ASNH
64.	Upland Sandpiper in grass	Cornell Lab of Ornithology
65.	Hard to find in grass	ASNH
66.	Dragging the islands	ASNH
67.	Stake at nest	ASNH
68.	Nest with eggs	ASNH
69.	Upland Sandpiper chick drawing	ASNH
70.	Upland Sandpiper in grass	ASNH

TITLE SLIDES CONTINUED

71.	Upland Sandpiper Phenology	ASNH
72.	Mowed edge	ASNH
73.	Upland Sandpiper on rock	ASNH
74.	Graph of Sandpiper numbers	ASNH
75.	Construction work at Pease	ASNH
76.	Other potential habitat	ASNH
77.	Acknowledgment slide	ASNH

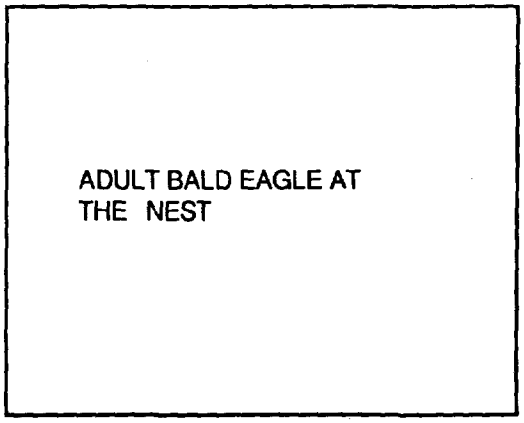
SLIDE 1 BALD EAGLE HEAD

CLOSEUP OF BALD EAGLE HEAD

In the last few years a pair of bald eagles have come back to nest in New Hampshire for the first time since 1949. Bald Eagles are not breeders in the coastal region at this time, but Great Bay is one of the most active wintering areas for bald eagles in New Hampshire.

ADDITIONAL INFORMATION:
*Bald Eagles nested on Lake Umbagog until 1949. Historical records point to a minimum of 6 Bald Eagle nests throughout the state.
*DDT problems coupled with continued persecution caused the numbers to plummet throughout the United States.
*Bald Eagles were placed on the Endangered Species list in 1967 after its passage in 1966.
*DDT was banned in 1972
*Protection through the Endangered Species Act , the banning of DDT use and the implementation of a recovery plan in the Northeast has allowed the eagle to recolonize many former nesting areas.

SLIDE 2 EAGLE AT NEST



ADULT BALD EAGLE AT
THE NEST

Amazingly enough, the first pair of eagles to breed in New Hampshire since 1949 came back to the same nest tree that a pair had nested in back in 1949. This tree is located at the junction of the Magalloway and Androscoggin Rivers on Lake Umbagog. Lake Umbagog straddles the Maine-New Hampshire state line in the Northeastern corner of New Hampshire. First showed interest in this tree in 1988. Made the first nesting attempt in 1989. Have successfully raised 9 chicks in this nest.

ADDITIONAL INFORMATION:
*Lake Umbagog is the true jewel of the North Country.
*Catches the water shed from the mountains in Maine's Rangeley Lakes region.
*Big lake with many ponds, large rivers, extensive marshes, bogs, swamps and uplands of northern conifers and hardwoods.

SLIDE 3 WINTER WATERWAY

AERIAL VIEW OF THE MERRIMACK RIVER IN WINTER

Although we only have one pair of Bald Eagles breeding in New Hampshire, this is an active wintering area. Winter is the best time to view eagles in N.H. Bald Eagles are migratory in parts of their range where the habitat is inhospitable in winter. They move south into areas where the waterways remain open and an adequate food supply is present. In conjunction with the NHF&G Department and the USFWS, ASNH has monitored wintering eagles since 1981

ADDITIONAL INFORMATION:

* The general pattern of migration from the various states and provinces is southward in the winter.
* The fall migration is timed to coincide with freezeup.
* Immatures usually go south first.

SLIDE 4 EAGLE WITH FISH

Bald Eagles move into New Hampshire and spend time hunting along open waterways. In the winter, this is often below power dams, wastewater treatment plants and other man-made conditions that help keep the water open. The preferred food source is fish, although they will take waterfowl and carrion as well.

ADDITIONAL INFORMATION:
*In New Hampshire wintering bald eagles congregate at a number of locations including: Great Bay, Merrimack River, Connecticut River, Androscoggin River and the Lakes Region.

SLIDE 5 EAGLES PERCHED

Bald Eagles will often congregate together in these feeding areas. They can often be found perching together in numbers near a good food supply.

ADDITIONAL INFORMATION:
*Unlike during the breeding season, wintering eagles will sometimes defend particular perches but they make no attempt to exclude other eagles from their winter ranges. Therefore, numerous birds may occupy small areas in winter.

SLIDE 6 EAGLE OBSERVERS ON BAY

ASNH WINTERING EAGLE OBSERVERS MONITORING EAGLE ACTIVITY ON GREAT BAY

We have been lucky to have a dedicated crew of very hardy volunteers who spend long hours observing and documenting winter eagle use along our waterways, including Great Bay. In the last few years, 15-20 individuals per year have observed on the Bay. Monitoring is divided into two components:

1. Participation in the National Wildlife Federation midwinter survey in January
2. Long term monitoring from December through March to document eagle numbers, habitat use, food resources and disturbance.

ADDITIONAL INFORMATION:

*Midwinter survey is a national survey coordinated through the National Wildlife Federation which documents the numbers of Bald Eagles found in the U.S. during the first two weeks in January.

*Long term monitoring is critical for habitat protection

SLIDE 7 EAGLE PLUMAGES

DRAWINGS OF IMMATURE AND ADULT PLUMAGES WHICH INCLUDE THE MOST CHARACTERISTIC FEATHERING FROM HATCH YEAR TO ADULT

Winter eagle observers are trying to gather important data which includes the number of individual Bald Eagles that are found in the state through the winter. Bald Eagles take about 5 years to reach adult plumage. During this time they exhibit unique plumages that will often allow you to distinguish individuals. By taking careful notes on plumages observed, it is often possible to estimate the number of eagles in a given area.

ADDITIONAL INFORMATION:
*This slide shows some very characteristic plumages for the Bald Eagle.
*Observers keep detailed notes on plumages as well as draw what they see. This enables biologists to make a minimum determination of the numbers seen at the end of a winter.

SLIDE 8 ADULT AND IMMATURE

PHOTOGRAPH OF AN ADULT
AND FIRST YEAR IMMATURE

Immatures are easy to pull apart from those eagles in full adult plumage.

ADDITIONAL INFORMATION:
*It will be five years before a Bald Eagle reaches full adult plumage.

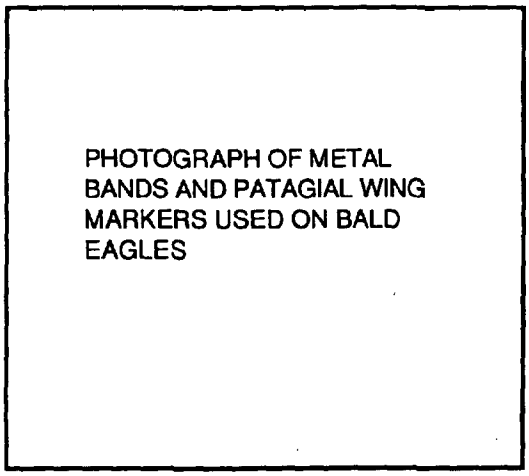
SLIDE 9 ADULT BALD EAGLE

ADULT WITH FEATHERS
ASKEW

Sometimes adults have distinctive characteristics that allow you to separate them from others in the region. An adult at this distance might allow you to use very subtle plumage variations to identify them as individuals.

ADDITIONAL INFORMATION:
*Adults will often have plumage and profile subtleties that will allow you to identify them, and to use these characteristics to identify them in following years.
*We rarely get views such as this on Great Bay as most observations are at considerable distances.

SLIDE 10 PATAGIAL WING MARKERS



The easiest way to identify eagles as individuals is through identification by either leg bands or patagial wing markers. This type of marking allows for a positive identification of an individual. Leg bands in birds of prey are fastened with rivets to prevent the loss through pulling with the bill. Patagial wing markers are placed over the shoulder and riveted through the skin of the underwing called the patagium.

ADDITIONAL INFORMATION:
*We have identified marked eagles in a number of regions through the state.
*Great Bay has an eagle with a blue patagial wing marker that was hacked from the Quabbin Reservoir in 1984 and has been present in Great Bay during the winter since that time.
*Markers also allow observers to make accurate determinations of the length of stay and the rate of return of an individual.

SLIDE 11 ADULT WITH FISH

ADULT BALD EAGLE
EATING FISH IN A PERCH
TREE

As well as documenting numbers of Bald Eagles, it is critical to document the areas that the birds are feeding and perching in. It is the documentation of habitat use that is the key to habitat protection.

ADDITIONAL INFORMATION:
*Bald eagles are attracted to a wintering location primarily because there is an adequate food source. It is important to document what areas they are using for feeding as well as any important perch trees being used during daylight hours.

SLIDE 12 EAGLES AT ROOST

BALD EAGLES CONGREGATED
IN A ROOST TREE

It is also critical to document where the eagles go to roost at night. A roost is an area where eagles rest and sleep during the night. Bald eagles may roost singly or communally in roosts located in close proximity to, or in some cases, a good distance from foraging areas. Identifying these roost sites is key to habitat protection, especially in areas with considerable development pressures.

ADDITIONAL INFORMATION:
*Night roosts are thought to provide protection from severe weather and possibly serve as "information centers" in regards to food location. These roosts may sometimes be used during the day, particularly during inclement weather.

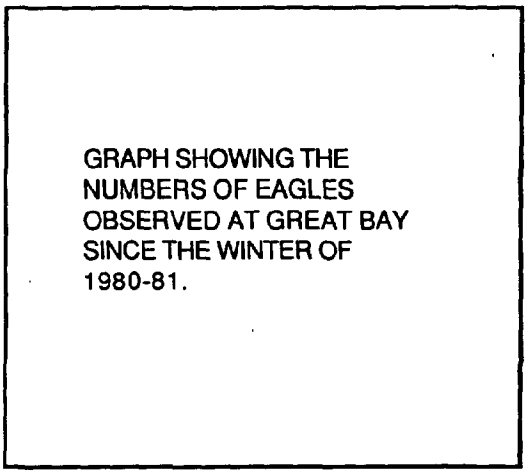
SLIDE 13 SUNSET ON BAY

PHOTOGRAPH OF A
SUNSET ON GREAT BAY
WINTER

Great Bay has been one of the most active wintering areas for Bald Eagles since monitoring began in 1981. Great Bay is an estuary, where freshwater rivers and ocean tides bring nutrients to nourish a wide variety of plants and animals. The Great Bay wintering area includes Great and Little Bays, seven tributaries (the Bellamy, Oyster, Lamprey, Squamscott, Cocheco, Salmon Falls and Winnicut Rivers), the Piscataqua River, and the adjacent Atlantic Ocean coastline.

ADDITIONAL INFORMATION:
*Approximately 4,500 acres of tidal waters and wetlands, together with about 800 acres of coastal land, comprise the Great Bay National Estuarine Research Reserve (GBNERR). Acquired through land purchases and conservation easements, the Great Bay Reserve was designated on October 3, 1989 to be preserved for the purposes of education, research, and resource protection.

SLIDE 14 NUMBERS OF GREAT BAY EAGLES



Results of the statewide winter eagle monitoring effort since 1980 reflect an increase in the number of bald eagles using New Hampshire's waterways during this period. Data generated from the winter eagle monitoring effort at Great Bay is consistent with statewide trends and shows a gradual increase in the number of eagles using this area since the winter of 1980-81. Sixteen individual eagles were present on Great Bay during the winter of 1993-94.

ADDITIONAL INFORMATION:
*Great Bay has been the most consistent wintering area since monitoring began in New Hampshire.
*The winter of 1994-95 continued the upward climb with a minimum of 17 individuals seen in the bay

SLIDE 15 WOODMAN POINT SNAG

SPINDLY SNAG IN THE CENTER OF PHOTOGRAPH IS THE WOODMAN POINT SNAG.

As noted in previous slides, it is important to document habitat use. On Great Bay, areas important to wintering eagles have been documented through the years. The snag seen in this photograph is the most important perch site in Great Bay. This snag is on Woodman Point situated to afford great views of the Bay from all directions. This point has now been protected through the designation of 1100 acres as the Great Bay National Wildlife Refuge. This area will be closed to all public visitation to protect the habitat for wintering eagles.

ADDITIONAL INFORMATION:
*Other important perch trees have been identified in the bay as well.
*The protection of this site through the refuge system is important to the future of wintering eagles in the bay.
*Data compiled since 1983 shows that this dead pine was used extensively during daylight hours - 52% of all documented perching.

SLIDE 16 WILCOX POINT ROOST

SLIDE OF THE WILCOX POINT ROOST AREA FROM THE WATER

Across the bay from the Woodman Point snag, the primary roost site was documented with 99% of all known roosting in the bay occurring at this location. This site is a peninsula that juts out into the bay. The attractiveness of this property as a perch and roost site can be attributed to its location on the lee shore of Great Bay. Its rolling topography and relative position to Adam's Point provide further protection.

ADDITIONAL INFORMATION:

*Documented night roost activity was limited almost exclusively to Wilcox Point on the Durham shore, which was preferred by both adults and immatures.

*This area has supported as many as seven eagles roosting communally.

SLIDE 17 WILCOX POINT ROOST TREES

CLOSER VIEW OF THE LARGE WHITE PINES USED FOR ROOSTING AT THIS SITE

The presence of very suitable large, open-branched trees and seclusion from human activity also help to make this area an ideal wintering site.

ADDITIONAL INFORMATION:
*Eagles tend to roost in the tallest trees on the wintering sites with average diameters ranging from 45 to 106 centimeters and average heights from 12.5 to 30 meters.
*As with perching, eagles prefer roost trees with stout, horizontal, and easily accessible branches. Roost trees are situated in an area protected from strong winds such as a bluff face, side valley or river basin.

SLIDE 18 EAGLE PELLET

EAGLE PELLETS FOUND UNDER
THE ROOST TREES AT
WILCOX POINT

A trip into the Wilcox Point roost area just after the winter eagle season revealed plenty of evidence of roosting eagles. Many pellets remained under the preferred roost trees and they revealed that waterfowl was an important component of the wintering eagle diet on Great Bay. Whitewash was also evident on the trees.

ADDITIONAL INFORMATION:
*The pellets were a real find as eagles that are eating fish would not leave pellets that would withstand weather conditions for any period.
*The pellets were also a good indication of the trees being used for roosting as well as the primary food source for the eagles.

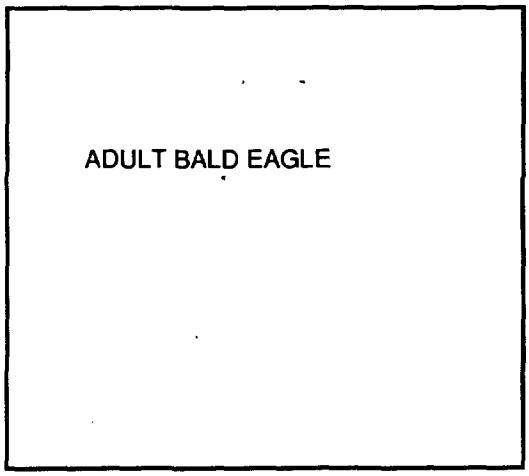
SLIDE 19 WILCOX POINT CONSERVATION EASEMENT

PHOTOGRAPH OF THE 9 ACRE CONSERVATION EASEMENT LAND WITH THE WINTER EAGLE MANAGEMENT AREA IN THE BACKGROUND

Wilcox Point was purchased as a winter eagle management area through the coordination of a number of conservation organizations which included ASNH, the NHF&G Department, the USFWS, the Nature Conservancy, the Land Conservation Investment Program, the Fish and Wildlife Foundation and the Great Bay National Estuarine Research Reserve. The peninsula of 27.5 acres was bought outright and is part of the GBNERR. This property is being managed through the NHF&G Dept. as a Winter Eagle Management Area. An additional 9 acres that abuts the point was protected through a conservation easement .

ADDITIONAL INFORMATION:
*Continued documentation of this property was the key to protecting it... the landowner was kept abreast of all that was documented at this site during the years of monitoring.
*This property is being managed through an advisory committee made up of individuals from many of the above organizations.
*A draft management plan has been completed.

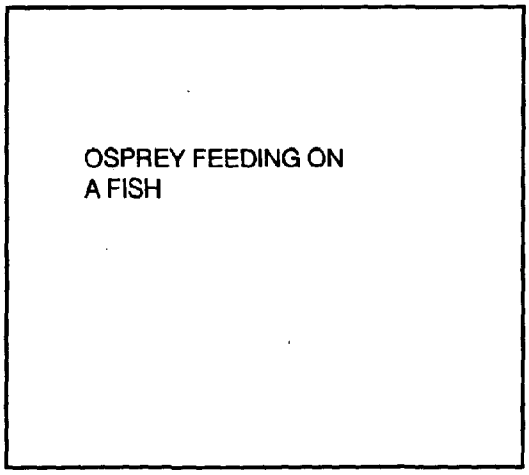
SLIDE 20 ADULT BALD EAGLE



These successes underscore the importance of our field research efforts on behalf of eagles and other species. It was long term documentation that built a compelling case for protecting Wilcox Point and serves as a catalyst to bring about long-term protection. We must continue to document important habitat for endangered and threatened species such as the Bald Eagle.

ADDITIONAL INFORMATION:
*These habitat protection projects have involved a diverse array of agencies, businesses, organizations, foundations, landowners and interested individuals working together in creative ways.

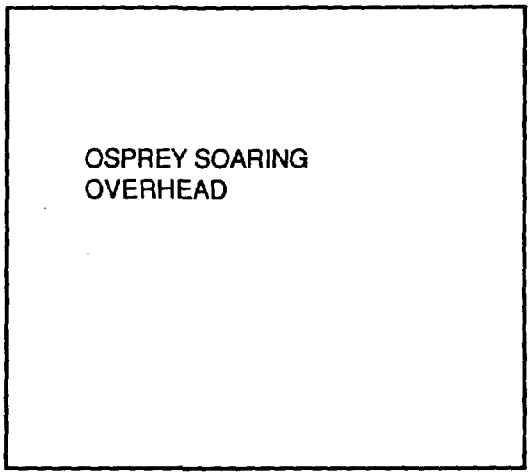
SLIDE 21 OSPREY WITH FISH



Osprey are a threatened species in New Hampshire. During most of this century, the only known osprey populations in N.H. occurred north of the White Mountains, primarily in the Androscoggin River Valley. Osprey are often called fish hawk as they prey almost exclusively on fish. They, as the Bald Eagle, went through a major decline with the problems of DDT poisoning.

ADDITIONAL INFORMATION:
*Osprey experienced very significant declines in the 1960's and early 70's. New Hampshire's seacoast population was extirpated during this time.
*Banning the use of DDT was coupled with intensive efforts up and down the Atlantic seaboard to rebuild osprey populations.
*New Hampshire's osprey population has seen a steady increase since the mid-80's.

SLIDE 22 OSPREY SOARING



In the spring of 1989, Osprey were observed engaged in breeding activity. They were first sighted in the air as they went through their courtship rituals.

ADDITIONAL INFORMATION:
*The male osprey may perform elaborate aerial courtship maneuvers as he works to attract and court a mate.
*These flight patterns helped to zero in on this pair as they attempted to nest.

SLIDE 23 DURHAM BEAVER SWAMPS

AERIAL PHOTOGRAPH OF
THE BEAVER SWAMP AREA
OF NESTING OSPREY

This pair of osprey were observed in an abandoned heron rookery located in a 7-8 acre beaver pond in Durham...approximately 1 mile from Great Bay.

ADDITIONAL INFORMATION:
*This is very dense terrain and it was with some real detective work by a local experienced birder that this pair was pinpointed.
*Aerial flights have been very helpful in locating sites such as these.

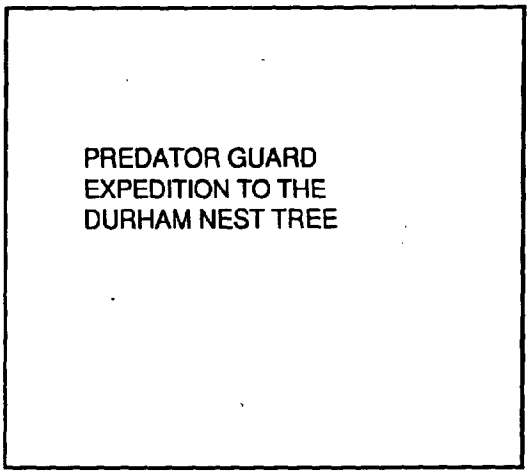
SLIDE 24 DURHAM NEST SITE

AERIAL OF THE DURHAM
WILLEY POND NEST SITE

This pair of osprey were observed in an abandoned heron rookery located in a 7-8 acre beaver pond in Durham...approximately 1 mile from Great Bay. This pair enlarged a great blue heron nest. As is often the case with first year pairs, the nest was unsuccessful. The pair remained in the vicinity during the breeding season.

ADDITIONAL INFORMATION:
*This is very dense terrain and it was with some real detective work by a local experienced birder that this pair was pinpointed.
*Aerial flights have been very helpful in locating sites such as these.

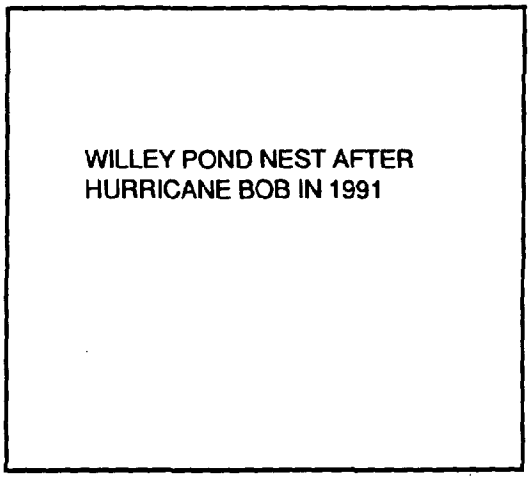
SLIDE 25 OSPREY TREE - PREDATOR GUARDS



Biologists installed a predator guard on the nest tree during the winter to prevent mammalian predation of future eggs and young. During the 1990 season the pair returned to this nest tree and fledged three young. This marked the first time in the present century that a successful breeding by osprey was documented in New Hampshire's coastal region. The following year they also fledged three young, and this continued success indicates an adequate food supply and good parenting abilities.

ADDITIONAL INFORMATION:
*Predator guards have been very successful in the North Country population in reducing the incidence of nest failure from predation.

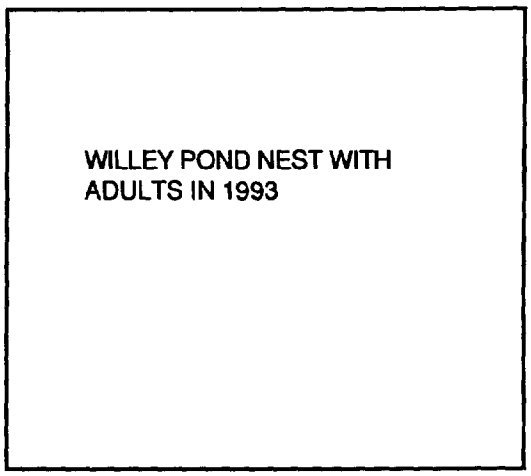
SLIDE 26 OSPREY TREE AFTER HURRICANE



Unfortunately, in August of 1991, 90% of the nest cup was blown out of the tree by Hurricane Bob. Although a good portion of the nest was gone, the adults and young continued to use the remaining nest for feeding and loafing. The pair returned in 1992, courtship ensued, but they never rebuilt the nest and soon abandoned the site. They built a new nest at an alternate site, but were unsuccessful in 1992.

ADDITIONAL INFORMATION:
*This was a chance to watch nest site tenacity. They explored an alternate site, but were back rebuilding the Willey Pond nest by the end of the 1992 season. We cannot be sure that we had the same two birds, of course.

SLIDE 27 OSPREY NEST WITH ADULTS



The pair returned to the Willey Pond site in 1993 and continued to fledge 3 young from this location in 1993 and 1994. The 1995 season holds promise for getting three young from the nest as well.

ADDITIONAL INFORMATION:
*Recruitment from this nest now stands at 12 (it will be 15 if three young fledge in 1995).
*Four young were present at the nest in both 1993 and 1994, but the fourth died at about 3.5 weeks in both years. The production of four young is very unusual and may speak to very good food resources in the area.

SLIDE 28 SQUAMSCOTT NEST

SQUAMSCOTT RIVER OSPREY
NEST ATOP PSNH POWERLINES

Foraging observations during the 1992 field season revealed activity at other locations in the Bay. Late in the summer, a pair of osprey were observed in courtship activity on a substantial nest placed on the crossbars of the PSNH powerlines that cross the Squamscott River.

ADDITIONAL INFORMATION:
*This pair of osprey were believed to have taken over at this site after a pair of red-tails had already started a nest.
*They were not successful in this first year.

SLIDE 29 POWERLINES

SQUAMSCOTT RIVER OSPREY NEST AND THE PROXIMITY TO THE POWERLINES

PSNH employees spent a considerable amount of time during the winter of 1992-93 making this nest site safer for the birds. The powerlines were lowered away from the nest cup, and perches were constructed at the level of the nest. Both of these measures are an attempt to keep the birds from electrocuting themselves on the wires, and have been used successfully in other states.

ADDITIONAL INFORMATION:
*PSNH donated all their time to this project...much appreciated.

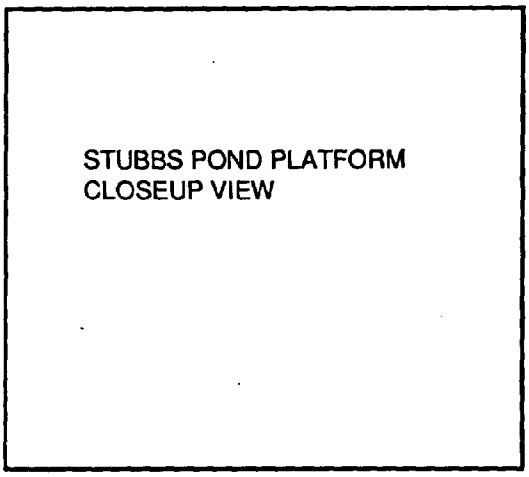
SLIDE 30 STUBBS POND

PHOTOGRAPH OF STUBBS POND:
A FRESHWATER IMPOUNDMENT
ON THE GREAT BAY NATIONAL
WILDLIFE REFUGE

Foraging observations also revealed considerable osprey activity in the freshwater ponds that border Great Bay at the National Wildlife Refuge. Frequent feeding was observed at this location. Osprey were also observed flying into the interior of the ponds and refuge.

ADDITIONAL INFORMATION:
*Investigations revealed that a partial nest was being constructed on the crossbars of a powerline that ran through the former weapons storage area.
*This pair may have been the same osprey that settled at Squamscott.

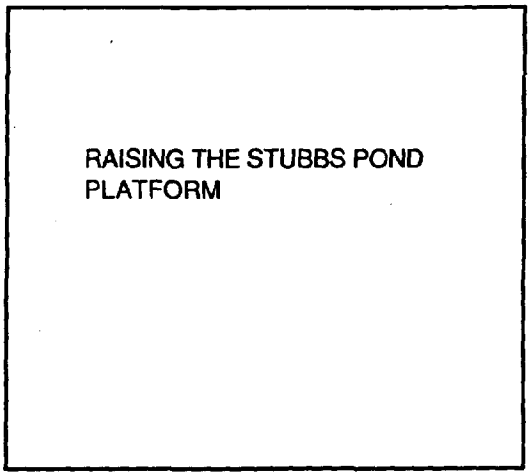
SLIDE 31 STUBBS POND PLATFORM



In the fall of 1994 a number of osprey platforms were placed around Great Bay. The hope is that they will attract osprey to suitable locations in which to nest. This closeup view of the osprey platform reveals the structure with crossbars and wire mesh.

ADDITIONAL INFORMATION:
*This platform was being built and erected at Stubbs Pond at the Great Bay National Wildlife Refuge.

SLIDE 32 RAISING PLATFORM



RAISING THE STUBBS POND PLATFORM

The platforms were erected through the cooperation of the New Hampshire Fish and Game Department, the USFWS personnel at the Great Bay National Wildlife Refuge and the generosity of PSNH. Platforms were placed atop donated PSNH poles and placed into position with PSNH equipment and personnel.
A partial nest has been constructed on the platform at the refuge in the 1995 breeding season.

ADDITIONAL INFORMATION:
*Platforms now exist at the Great Bay National Wildlife Refuge, along the Bellamy River and in the Lubberland Creek area of Great Bay.

SLIDE 33 OSPREY HEAD

OSPREY CLOSEUP VIEW

The interest in the platforms at both the Refuge and Lubberland Creek, along with the continued success at both Willey Pond and along the Squamscott River, make biologists hopeful that this small coastal population will continue to strengthen in the coming years.

ADDITIONAL INFORMATION:
*Coastal populations both to the north and south of New Hampshire have recovered very nicely. With the success of the recolonizing pairs in Great Bay we would expect to see good recruitment in the coming years.

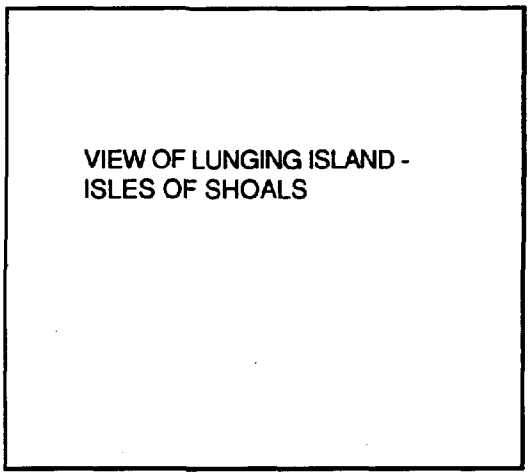
SLIDE 34 TERN IN FLIGHT

CLOSE VIEW OF A TERN IN FLIGHT. GOOD SILHOUETTE.

The Common Tern is an endangered species in New Hampshire. It is the only breeding tern that we have in New Hampshire at present. Terns are closely related to gulls, but are very agile in flight with long, pointed wings and forked tails.

ADDITIONAL INFORMATION:
*This slide is actually an arctic tern, but it is the best shot of the long wings and pointed tail found in the terns.

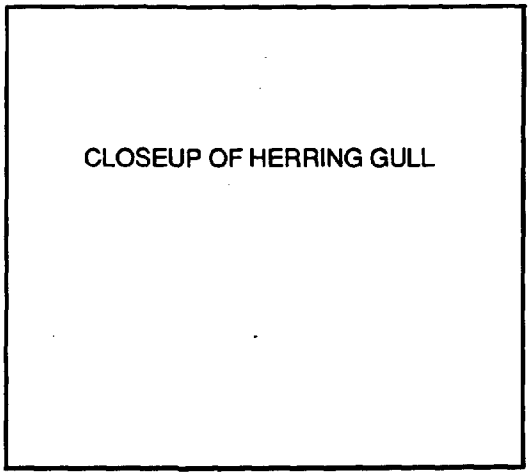
SLIDE 35 LUNGING ISLAND



Historically, terns bred out at the Isles of Shoals. There were 1500-2000 pairs of Arctic, Common and Roseate terns nesting out on these islands through the 1940's.

ADDITIONAL INFORMATION:
*The Isles of Shoals is a series of relatively small rocky islands approximately 5 miles offshore that straddle the Maine-New Hampshire border.
*Terns historically nested at Lunging Island in good numbers

SLIDE 36 HERRING GULL



With changes in the land use patterns of the outer islands and an increase in the number of gulls breeding on these same islands, terns were forced out. They were pushed in towards the mainland and more marginal nesting.

ADDITIONAL INFORMATION:
*Open landfills contributed to the explosion of gulls from 1930 on. Herring gulls increased steadily during those years. Great Black-backed Gulls increased rapidly in the 40's through 60's.
*Gulls are a major predator on both tern adults and chicks.
*Human presence in historical nesting areas also may have contributed to the movement of terns from the outer islands.

SLIDE 37 NEW CASTLE ISLANDS

The new sites for tern nesting included small, rocky islands just off the mainland - such as these islands off Newcastle.

ADDITIONAL INFORMATION:
*The Newcastle islands are just meters from the mainland shore...making them very vulnerable to disturbance.

SLIDE 38 FOX POINT - HEN ISLAND

HEN ISLAND FROM THE DOCK
AT FOX POINT

A small colony exists on islands just off the mainland in Little Bay. This is Hen Island, Fox Point in the town of Newington.

ADDITIONAL INFORMATION:

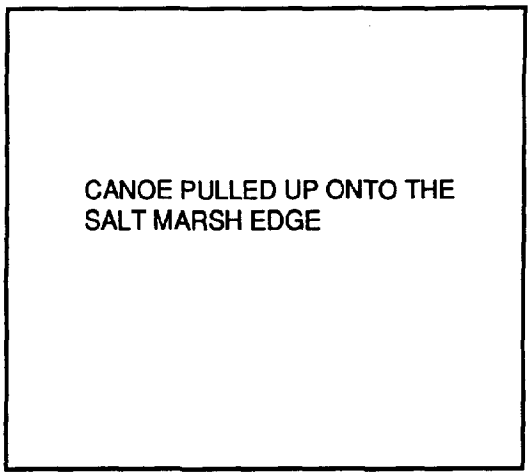
SLIDE 39 HAMPTON SALTMARSH

VIEW OF THE HAMPTON SALT MARSH, JUST NORTH OF RT. 51, BORDERED BY 1A ON THE EAST.

Terns also moved into the salt marshes along our coast. This is the Hampton salt marsh bordered by Rt. 51 to the south and Rt. 1A to the east. You can see the major development that rings this area, making the terns vulnerable to a variety of pressures.

ADDITIONAL INFORMATION:
*The terns have been most consistent at this salt marsh location, although they have been documented at other sites as well.

SLIDE 40 CANOE IN SALTMARSH



Field studies conducted annually since 1981 have documented a recent population decline on the mainland where colonies have suffered from marginal nesting habitat and heavy predation. In addition, field studies have been able to document changes in the colony sites through this time period. In order to monitor colonies, project staff will often canoe out. This allows for monitoring of nests - documenting breeding success and failures; determining the reasons for failure.

ADDITIONAL INFORMATION:
*Special care must be taken when visiting tern colonies. Visits are made only during good weather and do not last more than 30 minutes in one area.

SLIDE 41 WALKING ON SALT MARSH

BIOLOGIST WALKING THROUGH
TERN COLONY AT SALT MARSH
TO MONITOR NESTING STATUS

Careful maneuvering through the tern nests, both on the marsh and the islands, can help to facilitate nest checks. It is critical to get in and out of the colonies in brief time periods, be especially cognizant of the weather, take great care in how you move through the colonies and limit the number of times you move through in a season.

ADDITIONAL INFORMATION:
*Special care must be taken when visiting tern colonies. Visits are made only during good weather and do not last more than 30 minutes in one area.
*Island nesting terns can often be monitored from an offshore site to limit the disturbance.
*Salt marsh terns are difficult to observe and periodic visits to the colony are necessary to determine the status of nesting.

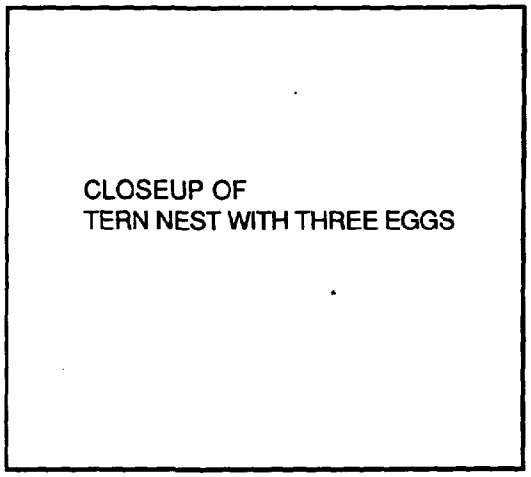
SLIDE 42 NEST ON MARSH

TERN NEST WITH THREE EGGS PLACED RIGHT ON THE SALT MARSH GRASS

Nests are placed directly on the substrate. In the salt marsh, terns place their nests directly on the thatch and areas of Juncus. In island nesting situations they may lay their eggs directly on the rocks, or build a small nest of grass or other vegetation.

ADDITIONAL INFORMATION:
*This type of nesting makes them particularly vulnerable to fluctuations in the water level.

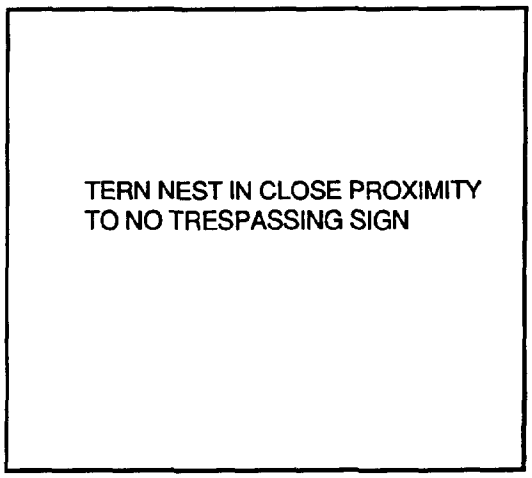
SLIDE 43 CLOSEUP OF NEST W/3 EGGS



A full clutch for Common Terns is 3 eggs. The eggs are cryptically colored with various patterns of brown on a buff or green background. They will incubate these eggs for approximately 21 days. Incubation is shared by both adults.

ADDITIONAL INFORMATION:
*Egg laying begins soon after terns arrive in late May. Repeated attempts may push continued egg laying into the later half of July.
*If one set of eggs is destroyed, terns may lay several times.

SLIDE 44 NEST WITH NO TRESPASSING SIGN



Terns will occasionally take advantage of the management techniques designed to protect them. This pair nested directly under the NO TRESPASSING sign placed to try to dissuade island visitors.

ADDITIONAL INFORMATION:
*Management techniques vary at each site. Some of the easily accessible areas are posted to try to dissuade visitors.

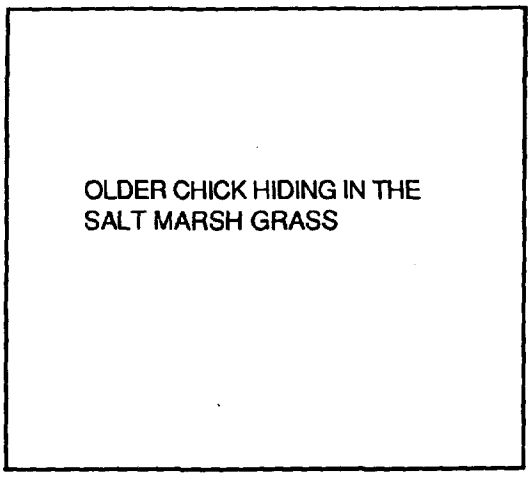
SLIDE 45 NEST WITH SMALL CHICK

NEST WITH JUST HATCHED CHICK
AND PIPPING EGGS

When the chicks hatch out they are covered with cryptically colored down. They are still very vulnerable to dangers in their colony as they will need to be fed by the adults for close to 4 weeks before they are ready to fly.

ADDITIONAL INFORMATION:
*Although the young are well developed when they hatch, they will stay near the nest, cared for by both adults and fed on small fish caught in the coastal shallows. Young terns are capable of short flights in three to four weeks after hatching and tend to gather in small groups by the water's edge, waiting to be fed.

SLIDE 46 CHICK HIDING IN GRASS



Young terns continue to rely on their camouflaged plumage as they grow. This chick is about 2.5 to 3 weeks of age, and hides in the grass from potential predators

ADDITIONAL INFORMATION:
*Although the young are well developed when they hatch, they will stay near the nest, cared for by both adults and fed on small fish caught in the coastal shallows. Young terns are capable of short flights in three to four weeks after hatching and tend to gather in small groups by the water's edge, waiting to be fed.

SLIDE 47 RESULTS FROM AGGRESSIVE TERNS

THE RESULTS OF TERN
AGGRESSION...THEY CAN
BE AMAZINGLY PERSISTENT
AND DRAW BLOOD

Terns can be aggressive when they are driving potential predators away from the nesting colony, especially during the height of their breeding season when they are defending their eggs and young. An individual who wanders too close to an active breeding colony is likely to be dive-bombed and "white-washed" by crying birds. Keep in mind that you have wandered into the birds' nursery and make a careful retreat.

ADDITIONAL INFORMATION:
*We have taken to wearing bicycle helmets into some of our tern colonies.

SLIDE 48 GREAT HORNED OWL

CLOSEUP VIEW OF AN
AN ADULT GREAT-HORNED
OWL

During the four weeks until they fledge, the tern chicks are especially vulnerable. Predators like the Great-horned Owl can decimate a colony, taking both adults and chicks.

ADDITIONAL INFORMATION:
*We have had problems with Great-horned Owl predation at a number of our colonies.
*This will often cause abandonment or zero productivity at these sites.

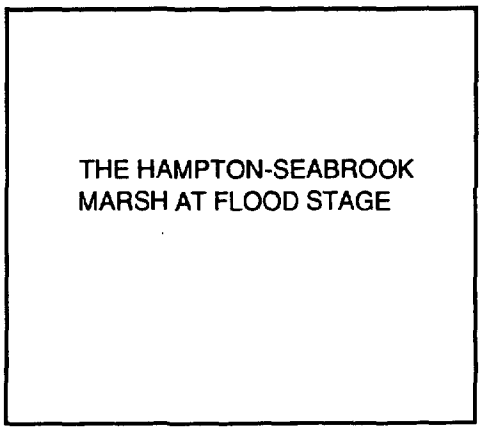
SLIDE 49 RATS

RATS TRAPPED FROM A TERN COLONY IN 1991

Especially in areas where terns nest in close proximity to humans, rats can wipe out these ground nesting birds as well. In 1991, a small colony in Little Bay was wiped out by rats as they ate all the eggs that were laid. Project staff were successful in eradicating the rats through an extensive trapping program in both the fall of 1991 and the spring of 1992.

ADDITIONAL INFORMATION:
*We continue to monitor for rats each spring, but have not had a reoccurrence of this problem.
*Rats are very good swimmers, and will come back and forth from island to mainland on a regular basis.

SLIDE 50 FLOODING IN SALT MARSH



THE HAMPTON-SEABROOK MARSH AT FLOOD STAGE

Natural flooding occurs in the marshes, as high spring tides may cover the entire marsh with water. When coupled with heavy rains, this can spell disaster for terns as their eggs may be washed out of the nests and young terns die from exposure.

ADDITIONAL INFORMATION:
*Damage to the natural flow of a salt marsh make the terns more vulnerable to flood conditions.
*Jet skiis have been observed moving through the tidal channels during the tern nesting season. These machines throw a significant wake, which washes up onto the marsh and can flood vulnerable nests.

SLIDE 51 BUILT UP NEST

RENEST ATTEMPT; THE NEST
HAS BEEN BUILT UP OFF
THE THATCH ABOUT 6 INCHES

Terns that have lost a nest to flooding will often build a nest that is more substantial and higher off the marsh grasses. This may also help them to persevere during flood periods. These higher nests are much more evident on a second round of nesting.

ADDITIONAL INFORMATION:
*Common Terns may renest 3 to 4 times during one breeding season.
*Damage to the natural flow of a salt marsh make the tern more vulnerable to flood conditions.
*Jet skiis have been observed moving through the tidal channels during the tern nesting season. These machines throw a significant wake, which washes up onto the marsh and can flood vulnerable nests.

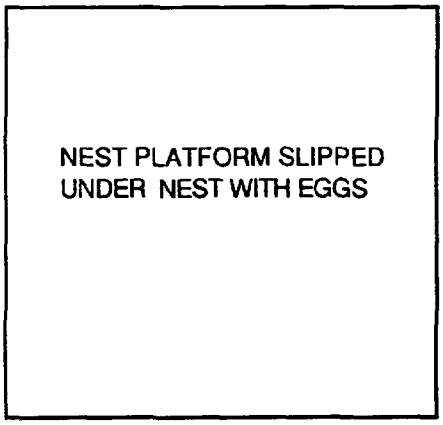
SLIDE 52 NEST PLATFORM

NEST PLATFORM WITH THATCH ON TOP OF THE SALT MARSH GRASSES

Another method that project personnel have utilized to try to deal with flooding are artificial platforms. These platforms are plywood squares that are placed atop a foam core and anchored in the marsh by a line and spike. The problem has been that the terns do not often choose to nest on the platforms themselves.

ADDITIONAL INFORMATION:
*The platforms ranged in size from 2ft.x2ft. to 8ft.x8ft.

SLIDE 53 PLATFORM UNDER NEST



In an attempt to use the platforms to the terns' advantage, we experimented with lifting the already established nests, slipping the float underneath and placing the nest back on the float. Once the nest is placed back on the float, the float is barely detectable. The terns showed no hesitancy to return to their nests and the success rate on these platforms was upwards of 80%.

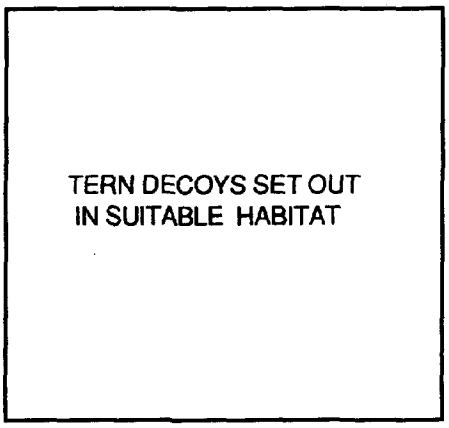
ADDITIONAL INFORMATION:
*The success rate of 80% is phenomenal in relation to those nests without the advantage of the platforms...more commonly 15-20%.

SLIDE 54 WHITE AND SEAVEY ISLANDS

Terns historically bred out at the Isles of Shoals. The islands out there still have suitable habitat for terns. There has been a fair amount of preliminary work done to evaluate the suitability of White and Seavey Islands for recolonizing terns. Seavey Island still has some beautiful tern habitat. These islands were recently returned to the state of New Hampshire after the Coast Guard automated the lighthouse.

ADDITIONAL INFORMATION:
*The state has recently instituted an island caretaker program at this site..so the potential for doing a recolonization project is very real.

SLIDE 55 TERN DECOYS



In recent years, there has been a considerable amount of work done to recolonize terns to former colonies in both Maine and Massachusetts. The techniques used in these areas included placing tern decoys out in suitable habitat to visually attempt to attract terns.

ADDITIONAL INFORMATION:
*Decoys are carved or created from wood and painted in a stylized way to simulate an adult tern.

SLIDE 56 SOUND SYSTEM

SPEAKER FROM THE SOUND SYSTEM USED TO PIPE IN TERN VOCALIZATIONS

In addition to placing decoys out in this habitat, speakers are also placed out to simulate the sound of a real tern colony. These speakers can be hooked up to a battery and timer...allowing the sound to be turned on and off during the daylight hours.

ADDITIONAL INFORMATION:
*A photovoltaic cell hooked up to a car battery will run the system for the entire breeding season.
*Decoys and sound have been very successful in attracting terns.

SLIDE 57 SEAVEY ISLAND

VIEW OF THE SEAVEY ISLAND ROCKS: POTENTIAL HABITAT

Seavey Island still has some beautiful tern habitat. This is an island that is part of the White-Seavey complex that was recently returned to the state after the lighthouse was automated on White Island.

ADDITIONAL INFORMATION:
*Gull control would need to be undertaken as both Herring and Great Black-backed Gulls now occupy the tern space. Gulls are predators on both tern adults and young.
*A Double-crested Cormorant colony that numbers close to 500 also occupy a section of Seavey Island. Cormorants do not pose a problem for recolonization, however.

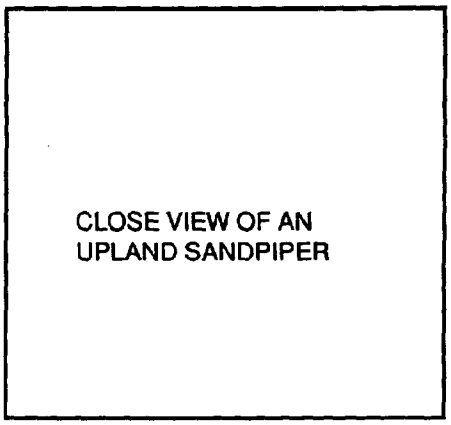
SLIDE 58 ADULT TERN ON NEST

ADULT COMMON TERN
INCUBATING A NEST

The hope is that we may soon be able to use these recolonization techniques. They have been very successful in many locations where they have been attempted. With all the pressures on the mainland colonies in N.H., this may be one way to help insure that terns will continue to nest along New Hampshire's coast.

ADDITIONAL INFORMATION:
*Successful recolonization would hopefully allow for continued tern productivity in New Hampshire.

SLIDE 59 UPLAND SANDPIPER CLOSEUP



Upland Sandpiper is a shorebird belonging to the sandpiper group. Closely related to the curlews and whimbrels. Characteristic bird of prairies and wide open grassy fields. Has a slender, graceful form, delicate head and neck. Endangered status in New Hampshire.

ADDITIONAL INFORMATION:
*A long-distance migrant that winters on the Argentinian pampas, this bird's stronghold is in the Midwest- prairie grasslands.
*Has many plover-like characteristics, hence the former name of upland plover still used by many.

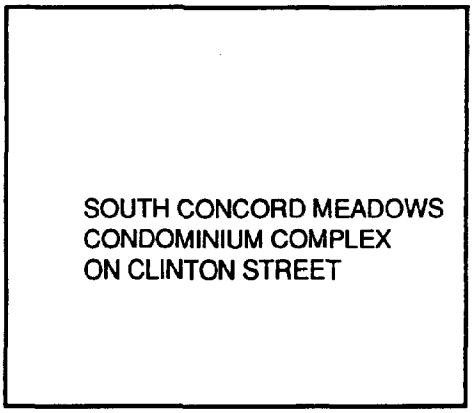
SLIDE 60 OPEN GRASSLANDS

VIEW OF GRASSLAND HABITAT SUITABLE FOR UPLAND SANDPIPERS

Upland Sandpipers expanded eastward into New England from the prairie states after European settlement converted unbroken eastern forests into extensive agricultural lands during the late 1700's and early 1800's. At their peak in the mid-1800's, these shorebirds were abundant migrants and locally common breeders in central and southern New Hampshire.

ADDITIONAL INFORMATION:
*Declined due to market hunting in the early 1900's. Some increase in the 1920's.

SLIDE 61 SOUTH CONCORD MEADOWS



But decline in agriculture and more recent conversion of farmlands to industrial, commercial and residential have slowed recovery of the Upland Sandpiper.

ADDITIONAL INFORMATION:
*Upland Sandpipers are on the threatened list in Massachusetts and Vermont; special concern in New York and Maine.
*Many other grassland species that nest in similar habitat are also in decline.

SLIDE 62 PEASE INTERNATIONAL TRADEPORT

PLANE TAKING OFF FROM
THE RUNWAY AT PEASE
INTERNATIONAL TRADEPORT

In recent years, the only known breeding population of Upland Sandpipers has been found at the Pease International Tradeport. Upland Sandpipers nest in the grassy islands located between the runway and the apron.

ADDITIONAL INFORMATION:
*Airfield conditions simulate the prairie grassland habitat that is favored by the Upland Sandpiper. They are found at a number of airports throughout the Northeast.

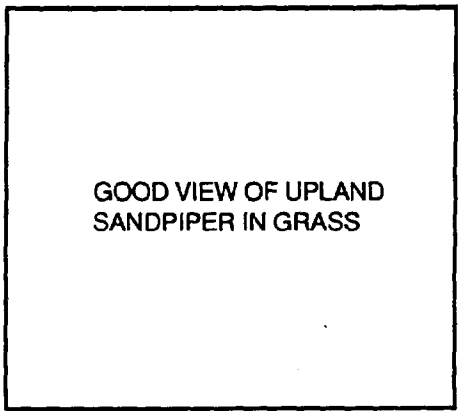
SLIDE 63 STOP SIGN AT RUNWAY

We have been monitoring the Upland Sandpiper population at Pease since 1989. In 1989 and 1990 the Air Force was still present at Pease and security was very tight. We would move through the area with an escort, observing from inside a vehicle. In 1991 and 1992, the Air National Guard was in charge of the airfield, and we were given greater access to the grassy infield. When the Pease Development Authority took over the airfield managment in the fall of 1992, we were allowed to walk through the Upland Sandpiper breeding areas.

ADDITIONAL INFORMATION:

*Surveys are conducted by moving through the grassy areas and stopping at designated points to observe for sandpipers. All upland sightings and observed behavior are recorded.

SLIDE 64 UPLAND SANDPIPER IN GRASS



When the birds arrive back in late April, the grass is short enough to get a good look. You can imagine that it gets increasingly difficult as the season progresses.

ADDITIONAL INFORMATION:
*Surveys for sandpipers begin during the second half of April as the birds arrive from their wintering grounds.

SLIDE 65 HARD TO FIND

DISTANT VIEW OF AN
UPLAND SANDPIPER
IN THE GRASS

As the season progresses the grass gets longer and it is increasingly hard to find the birds...especially as the grass starts to turn a golden color. Courtship, nest building and incubation follow soon after arrival.

ADDITIONAL INFORMATION:

SLIDE 66 DRAGGING THE ISLANDS

BIOLOGISTS DRAGGING THE GRASSY AREAS DURING A NEST CENSUS

As the season progresses the grass gets longer and it is increasingly hard to find the birds...especially as the grass starts to turn a golden color. Courtship, nest building and incubation follow soon after arrival.

ADDITIONAL INFORMATION:

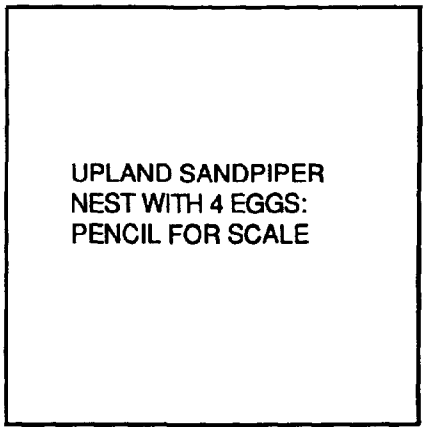
SLIDE 67 STAKE AT NEST

WOODEN STAKE PLACED AT AN UPLAND NEST SITE

By pinpointing the nest locations we were able to mark them to help avoid damage from mowing and other airfield operations. Finding the nests has become even more critical as construction proceeds out on the airfield as Pease is decommissioned.

ADDITIONAL INFORMATION:
*The mower operators are well versed in Upland Sandpipers and can be helpful in locating nests.

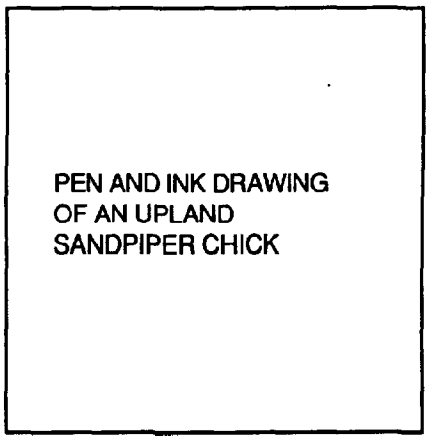
SLIDE 68 NEST WITH EGGS



The nest consists of a slight depression in tall grass, and is lined with leaves, small twigs or grasses. In late May or early June the female lays 4 creamy buff or white eggs spotted with reddish brown. Often grasses are arched over the top to hide the nest from above. The nest census allowed us to learn a great deal about the nesting of Upland Sandpipers at Pease. The timing of breeding , the synchrony of the birds, habitat usage.

ADDITIONAL INFORMATION:
*Upland Sandpipers build typical shorebird nests and lay 4 eggs.
*Both male and female will incubate the eggs for about 24 days.

SLIDE 69 UPLAND SANDPIPER CHICK



The chicks are well developed and downy when they hatch. They will follow the adults and feed within a day or so of hatching. They are very vulnerable to disturbance during the first weeks.

ADDITIONAL INFORMATION:
*We have observed chicks through our years of nest censuses as well as nests...as we work to refine the timing.
*Vehicles pose a threat to small chicks.

SLIDE 70 UPLAND SANDPIPER

Cared for by both parents, the chicks are full grown and ready to fly in about a month. Adult and young sandpipers feed on vast amounts of grasshoppers and other insects, as well as waste grain.

ADDITIONAL INFORMATION:
*Young chicks are particularly vulnerable to vehicles, as they will crouch down to hide from perceived dangers...making the possibility of running them over greater.
*The adults will often bring the chicks to a common location known as a brood area.

SLIDE 71 PHENOLOGY

GRAPH OF UPLAND SANDPIPER PHENOLOGY

Our observation time coupled with the nest census allowed us to get a good sense of breeding phenology.
May 10-15: egg laying
Incubation lasts approximately 24 days
June 5: first hatch
July 15: first young at fledging

ADDITIONAL INFORMATION:
*This information is important as we work to come up with mowing regimes, and to protect the Upland Sandpipers from construction activities.

SLIDE 72 MOWED EDGE

PHOTO OF THE MOWED EDGE OF A GRASSY ISLAND

The nest census also gave us a better indication of habitat usage. We had thought that the Upland Sandpipers were nesting around the wet areas in the grassy islands. The nest census showed that they were utilizing the edges of the islands on a more regular basis. We have also completed a vegetation analysis of the areas around the nest sites.

ADDITIONAL INFORMATION:
*This information is important as we work to come up with mowing regimes, and to protect the Upland Sandpipers from construction activities.
*The habitat usage information is also important as we work to evaluate other potential breeding areas for uplands.

SLIDE 73 UPLAND SANDPIPER

GOOD VIEW OF UPLAND SANDPIPER ON A ROCK

Another documented phenomenon that we were not aware of was the buildup in Upland Sandpiper numbers at Pease during the migration period. Uplands will move from their breeding grounds and spend a number of weeks feeding before heading to their wintering areas in Argentina. Observations show that Pease is used as a migration stopover.

ADDITIONAL INFORMATION:
*This information highlights the importance of Pease not only as a breeding but a migration area as well.
*The numbers of Uplands begins to build in the last few days of July and into the second week of August.

SLIDE 74 GRAPH OF NUMBERS

GRAPH OF UPLAND
SANDPIPER NUMBERS
THROUGH THE SEASON

The graph shows the very evident buildup of sandpiper numbers as you approach the end of July and the early part of August. The numbers have climbed to as high as 74 individuals.

ADDITIONAL INFORMATION:
*This information highlights the importance of Pease not only as a breeding but a migration area as well.

SLIDE 75 CONSTRUCTION SITE

CONSTRUCTION DISTURBANCE
IN GRASSY AREAS AT
PEASE

Construction from the decommissioning of the airfield as an Air Force installation coupled with the conversion to a commercial airport has caused a fair amount of disurbance to the grassy areas of the infield. This is, of course, a temporary disturbance but we have been working with airfield operations to coordinate construction activities and protect the nests. Reseeding operations should help to restore any disturbed habitat....and the upgrading of the runway may create additional habitat for uplands in the future.

ADDITIONAL INFORMATION:
*We have coordinated with the airfield operations in regards to construction since the Fall of 1993. We have a unique partnership with the NHF&G Dept. and the NHDES.

SLIDE 76 POTENTIAL HABITAT

PHOTO OF POTENTIAL HABITAT IN THE CONN. RIVER VALLEY

Upland Sandpipers have not been confirmed breeding in any other locations in New Hampshire since 1985. We continue to monitor potential habitat for upland sandpiper activity. In addition, we hope to use the habitat usage and vegetation analysis work to look more closely at other potential habitat.

ADDITIONAL INFORMATION:
*The vegetation and habitat analysis will allow us to make managment recommendations for areas with potential habitat for breeding Upland Sandpipers. This is critical for the future of this species in New Hampshire

APPENDIX B

Audubon Society of New Hampshire

3 Silk Farm Road, Concord, NH 03301-8200
phone: 603/224-9909 • fax: 603/226-0902

June 30, 1995

Kay Akerley
Conservation Commission Chair
325 Fox Point Rd.
Newington, N.H.

Dear Ms. Akerley:
Enclosed please find a packet of materials that identify areas of important habitat for endangered and threatened bird species in your community. In addition to the maps, we've included a summary sheet that details these mapped areas and a series of informational brochures on the bald eagle (federally and state endangered), the osprey (state threatened), the common tern (state endangered) and the upland sandpiper (state endangered). We hope that this information will be useful as you set priorities for habitat protection in your town.

The Audubon Society of New Hampshire has been working on the monitoring and management of coastal endangered and threatened species through the New Hampshire Fish and Game Department Nongame and Endangered Species Program since the early 1980's. The production of this packet of materials was made possible by funding from the National Oceanic and Atmospheric Administration through the New Hampshire Coastal Program, Office of State Planning. This funding allowed us to bring together information that has been gathered through the years and to distribute it to local communities.

In addition to the materials contained in this packet, a slide presentation entitled *Threatened and Endangered Coastal Bird Species in New Hampshire* was produced. This slide program highlights the natural history of each of the above species and shares the most current information gleaned from recent years of monitoring. This slide program will be given to public audiences through ASNH in Concord and at the Seacoast Science Center. If you are interested in a slide presentation in your local community, please let us know.

I would also be happy to provide any additional information that you might find helpful. Please feel free to contact me at Audubon House in Concord at (603) 224-9909. Any comments on the enclosed materials would be very welcome as well. Thank you very much.

Sincerely,

Diane De Luca
Senior Biologist

TOWN OF NEWINGTON
HABITAT USE SUMMARY OF ENDANGERED AND THREATENED SPECIES

BALD EAGLE

The number of wintering bald eagles using Great Bay has risen steadily since the early 1980's. In 1994-95, seventeen eagles wintered on the Bay, many of them staying for a good part of the period from December through March. Bald Eagles are attracted to Great Bay because it provides the open water, perch and roost trees necessary to support them.

The Newington shoreline provides many perch trees for the eagles to use during daytime foraging. The favored perch tree is located on Woodman Point, now protected through the Great Bay National Wildlife Refuge. This perch location has been documented to support more than 50% of observed perching in the Bay. In addition, they utilize other perch trees along the Refuge shoreline. Bald Eagles have also been documented to perch at Fox Point and Goat Island. See the enclosed map for locations.

UPLAND SANDPIPERS

The Upland Sandpiper is a shorebird that prefers dry, open grasslands, hayfields and pastures, especially those undisturbed by cultivation. Once found in good numbers, they have diminished with shrinking farms to only one known location in the state.

At present, the Pease Airfield in Newington supports the only known nesting population of Upland Sandpipers in New Hampshire. This population is estimated at 8-10 pairs. However, potential breeding habitat still exists, and the Town of Newington continues to have grasslands that could support Upland Sandpipers. If you know of locations where these birds may be nesting, please get in touch!

In addition, our work at Pease has given us a much clearer picture of the habitat needs of this species. We would be very excited to work with landowners with an interest in managing their grasslands to support upland sandpipers and other grassland bird species. If you know of this interest, please let us know!

COMMON TERNS

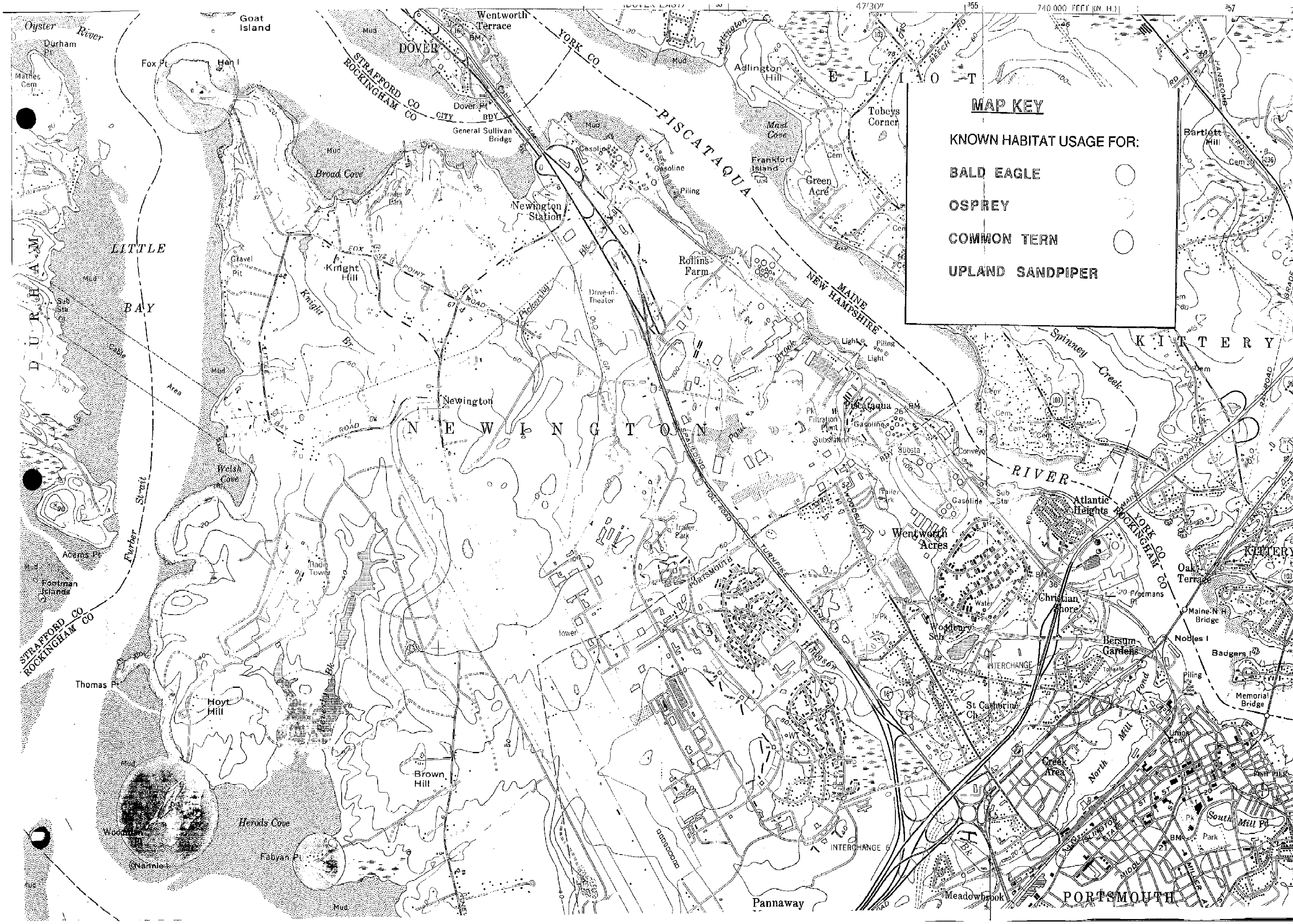
New Hampshire currently supports only small numbers of the Common Tern. This tern population includes scattered pairs nesting on rocky islands in the coastal bays and colonies in the Hampton Harbor Estuary. Field studies conducted annually since 1981 have documented serious instability in coastal colonies, where marginal nesting habitat and heavy predation have significantly hampered productivity.

The Town of Newington supports a small tern colony on Hen Island, an island approximately 70m. east of Fox Point on Little Bay. This colony has numbered between 9 and 12 pairs in recent years. The productivity at this location has been variable as the terns have been subject to some predation, including rats. Common Terns also forage all along the Newington shoreline. We have appreciated all the support the Town of Newington has given us in monitoring terns at this site as the potential for a very strong colony exists. The 1995 field season is looking very positive thus far!

OSPREY

During most of this century, the only known Osprey populations in New Hampshire occurred north of the White Mountains, primarily in the Androscoggin River drainage. In the spring of 1989, an Osprey pair took up residence in an abandoned heron rookery in a beaver pond in Durham. This pair has successfully fledged 12 young from this location, setting the stage for additional nesting pairs in the Bay. A second pair took up residence atop a power pole on the Squamscott River in 1992 and have also fledged young from this location. A third pair is showing interest in platforms erected at the Refuge in the fall of 1994. We expect to see a continued increase in the number of Osprey using the Bay.

Although Newington does not have any nesting osprey at present, the Newington shoreline supports significant Osprey foraging. Identification and protection of nest sites, preferred perch trees and foraging habitat is critical to the successful expansion of this fledgling Osprey population. Please let us know if there are Osprey observations from your town!

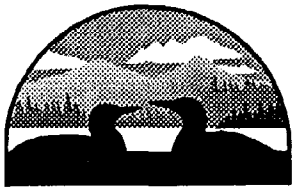

MAP KEY
KNOWN HABITAT USAGE FOR:
BALD EAGLE
OSPREY
COMMON TERN
UPLAND SANDPIPER
PISCATAQUA
RIVER
NEWINGTON
DURHAM
ELIOT
KITTERY
PORTSMOUTH
LITTLE BAY
Goat Island
Fox Pt
Hen I
Durham Pt
Oyster River
Broad Cove
Knight Hill
Newington Station
Newington
Wentworth Terrace
Dover Pt
General Sullivan Bridge
Adlington Hill
Tobeys Corner
Frankfort Island
Green Acre
Rollins Farm
Atlantic Heights
Wentworth Acres
Christian Shore
Bersum Gardens
St Catherine Ch
Woodbury Sub
Hoyt Hill
Brown Hill
Welsh Cove
Herods Cove
Fabyan Pt
Thomas Pt
Adams Pt
Footman Islands
Furber Strait
Pannaway
Meadowbrook
Oak Terrace
Badgers I
Memorial Bridge
Bartlett Hill
Spinney Creek
STRAFFORD CO
ROCKINGHAM CO
YORK CO
MAINE
NEW HAMPSHIRE
TURNPIKE
INTERCHANGE

What You Can Do To Help

- Contribute to our understanding of the Bald Eagle's distribution in New Hampshire by reporting any sightings to the Audubon Society of New Hampshire or the NH Nongame and Endangered Wildlife Program, N.H. Fish and Game Department.
- Shooting or harassing threatened or endangered wildlife species is against the law. Report any illegal activities to the N.H. Fish and Game Department.
- Learn more about the habits and needs of birds of prey, and share your knowledge and concern about them.
- Urge state and federal legislators and your local conservation commission to protect critical habitat for Bald Eagles and other wildlife.
- Support organizations working to protect threatened and endangered species and other non-game wildlife.
- Volunteer to help with our monitoring programs

The Audubon Society of New Hampshire

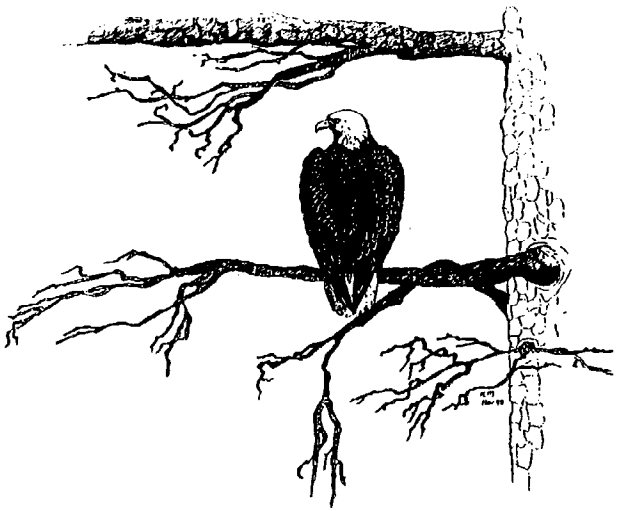
is an independent nonprofit organization with programs in wildlife conservation, environmental affairs, land protection, and environmental education.



Further information about ASNH can be requested from:
Audubon Society of New Hampshire
3 Silk Farm Road
Concord, NH 03301-8200
603-224-9909

This report was funded in part by a grant from the New Hampshire Coastal Program, as authorized by National Oceanic and Atmospheric Administration, (NOAA)

BALD EAGLE



How Can I Identify A Bald Eagle?

The Bald Eagle is one of the largest birds of prey in North America. This majestic bird stands more than 3 feet tall, and has extremely long, broad wings measuring 6 - 8 feet tip to tip when fully spread. The adult Bald Eagle has a white head and tail, a long and powerful yellow beak, and a brownish-black body. Immatures are variable in plumage, but primarily dark brown with varying degrees of white mottling depending on their age. Bald Eagles do not acquire the white head and tail until they are 4-5 years old. The Bald Eagle's flight is strong and steady, characterized by slow flapping, soaring for great distances with wings held horizontal, and occasional circling high in the sky.

The eagle is still classified as threatened and endangered in the 48 contiguous states. Through intensive efforts by federal, state and local agencies it is making a comeback.

Winter Eagle Ecology

Bald eagles leave their northern breeding grounds as lakes and rivers freeze and congregate in more southern wintering areas where open water allows access to food sources. Fish are the preferred food source, but they will take waterfowl and carrion as well. More Bald Eagles can be found throughout the United States during the winter months than at any other time of year.

Bald Eagles tend to perch near their foraging areas during the day. Although they will perch on rocks, logs, ice, powerlines and such, eagles prefer tree perches over other types. Eagles tend to favor tall trees with spreading, open branches and snags that give them easy accessibility and a wide panoramic view. These can be either conifers or deciduous trees.

A roost is an area where eagles rest and sleep during the night. Bald eagles may roost singly or communally in roosts located in close proximity to, or in some cases, a good distance from foraging areas. Night roosts are thought to provide protection from severe weather and possibly serve as "information" centers in regards to food location. These roosts may sometimes be used during the day, particularly during inclement weather.

New Hampshire Monitoring

Though eagles can be seen in New Hampshire at any time of year, December through March is the best period for eagle observations. A number of our waterways provide the open water , perch and roost trees necessary to support wintering Bald Eagles. Wintering eagles are often found on parts of the Connecticut and Androscoggin rivers, the Merrimack River, the Lakes Region, and on Great Bay.

Through a cooperative effort with the U.S. Fish and Wildlife Service, the New Hampshire Fish and Game Department and the Audubon Society of New Hampshire, biologists have monitored wintering eagles since 1980. Biologists monitor these areas to document the extent of eagle use, determine what food resources the eagles are using, evaluate the extent of human activity and potential disturbance, and learn how eagles are using specific habitats. This information provides a basis for evaluating potential effects of proposed land use changes within the wintering areas, and for setting priorities for efforts to protect this habitat.

In documenting eagle activity in New Hampshire, biologists rely heavily on dedicated volunteer observers and the cooperation of the public in reporting sightings of eagles throughout the state. Results of the statewide winter eagle monitoring effort reflect an increase in the number of Bald Eagles using New Hampshire's waterways. The estimated numbers of eagles went from a low of 16 in 1980-81 to a high of 83 in 1994-95.

Great Bay Wintering Area

Great Bay is an estuary, where freshwater rivers and ocean tides bring nutrients to nourish a wide variety of plants and animals. Great Bay provides a critical mix of habitats, including open water, which gives eagles access to fish and waterfowl, prominent spots for hunting and perching during the day, and stands of tall coniferous trees used as night roosts in severe weather. Winter eagle activity on the Bay has been the most consistent since monitoring began.

The number of winter eagles using the Bay has risen steadily since the early 1980's.

In 1994-95, seventeen eagles wintered in the Bay, many of them staying for a good part of the period December through March. Marked individuals help to establish return rates and length of stay information. One individual with a blue wing marker has been seen every winter in Great Bay since 1985.

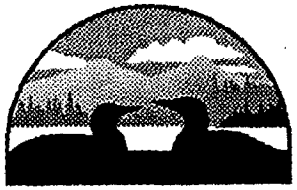
The many long hours of observation from 1980 through 1995 has allowed biologists to focus on the critical habitat needs for the Great Bay wintering population. The protection of perch and roost sites on the bay were made possible by the many hours of documentation and the hard work of numerous conservation organizations. Further efforts must continue to monitor habitat use so that wise management decisions can be made for this estuary.

What You Can Do To Help

- Contribute to our understanding of the Osprey's distribution within New Hampshire by reporting any sightings to the Audubon Society of New Hampshire or the NH Nongame and Endangered Wildlife Program, N.H. Fish and Game Department.
- Shooting or harassing threatened or endangered wildlife species is against the law. Report any illegal activities to the N.H. Fish and Game Department or your local conservation officer.
- Learn more about the habits and needs of native wildlife so that you can help to educate others.
- Share your knowledge and concern about birds of prey to help dispel myths that lead others to harm them.
- Urge state and federal legislators and your local conservation commission to protect critical habitat for Ospreys and other wildlife.
- Support organizations working to protect endangered species and other non-game wildlife.

The Audubon Society of New Hampshire

is an independent nonprofit organization with active programs in land preservation, environmental education, legislative action, and non-game research and management.



Further information about ASNH can be requested from:
Audubon Society of New Hampshire
3 Silk Farm Road
Concord, N.H. 03301-8200
603-224-9909

This brochure was funded in part by a grant from the New Hampshire Coastal Program, as authorized by National Oceanic and Atmospheric Administration (NOAA).

OSPREY

Pandion haliaetus

How Can I Identify an Osprey?

The Osprey is a large, long-legged, fish-eating raptor. Because of their large size, Osprey are sometimes mistaken for the more massive Bald Eagle, although at two feet tall with a six foot wingspan, they are considerably smaller than eagles, but larger than most hawks. Seen in flight, the Osprey's prominent features are its white or slightly mottled underparts, dark brown back, the pronounced crook in its long wings highlighted by distinctive black wrist patches. Seen from closer proximity, the Osprey's bright yellow eye and broad, dark eyestripe help to distinguish it from other birds of prey.

Life History

Ospreys arrive in New Hampshire during April, returning year after year to the same breeding grounds. An osprey nest is generally placed in the flattened top of a live or dead tree, but may also be placed atop man-made structures such as power transmission poles, waterfront pylons, channel markers and specially erected nesting platforms. The nest is up to five feet in diameter and is made with a large accumulation of various sized dead branches up to five feet long. Both sexes gather the nesting material, but the female does most of the nest arrangement. Softer materials such as sod, seaweed or marsh grass line the nest. Nests are often used in successive years and the addition of nesting materials in each season cause them to become very heavy and bulky, sometimes growing as high as eight feet.

Male and female Ospreys court each other with spectacular and vocal soaring, diving, and swooping. The male may hover high over his territory carrying a fish or a stick; a display that serves to favorably influence his mate and discourage potential rivals. The female lays from 2-4 blotched, oval eggs in two day intervals. Incubation by both the male and female continues for about five weeks. The chicks at hatch rely on the adults to feed them, but in 4-5 weeks they can eat, by themselves, the prey that both parents bring to the nest. At around 8 weeks, they are capable of flight and begin to follow the adults to their fishing grounds. After migrating south their first fall, young Ospreys spend the next year and a half on their winter grounds. They do not return to the breeding grounds until the spring of their second year.

The Osprey is a truly cosmopolitan bird. It is able to take advantage of water bodies suitable for its fishing way of life on every land mass on earth except New Zealand and Antarctica. Populations here in the northeast generally migrate to the warmer climates of Central and South America.

Historical Review

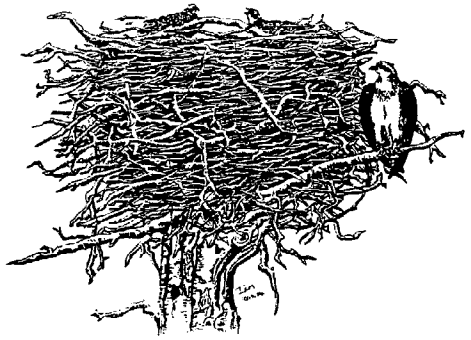
In the two-decade period from 1950-70, the Osprey population was severely diminished, especially in the eastern United States. Ospreys initially declined because of pesticides such as DDT and other persistent chemicals in their food chain, which caused infertility and thinned egg shells. Since the banning of DDT in the United States in1972, the Osprey has made a steady comeback. Osprey may still be threatened, however, by pesticide use near their wintering areas in the tropics.

Osprey face threats even before they hatch. Great -horned owls, gulls, raccoons, and fishers may prey on eggs left unattended in nests. Food availability directly affects chick survival. Declines in fish populations or water quality may reduce the size of local Osprey populations. although Osprey are protected under state and federal laws, illegal shooting still occurs.

Current Status of New Hampshire's Ospreys

Since the early 1980's, Ospreys have maintained active nests in the North Country region of New Hampshire. This population has experienced steady growth through the period, and now produces 20-30 young each year from an average of 25 nests.

In 1989, a pair of Osprey made Great Bay their home. After an early nesting failure that year, they have successfully raised young in subsequent years. Great Bay now has at least two successful breeding pairs with the addition of a nest on a utility tower along the Squamscott River. Each year brings more Osprey sightings and nesting attempts to the seacoast region. You can observe Osprey in southeastern New Hampshire from late March through mid-October. The Great Bay estuary system is a prime area. The marshes, harbors and beach areas along the seacoast can also be rewarding observation sites, especially during migration.

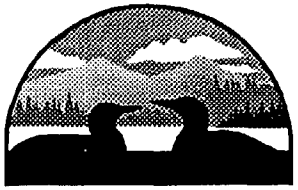


What You Can Do To Help

- Contribute to our understanding of the distribution of terns within New Hampshire by reporting any sightings of Common, Arctic or Roseate Terns to the Audubon Society of New Hampshire or the NH Nongame and Endangered Wildlife Program, N.H. Fish & Game Department.
- Shooting or harassing threatened or endangered wildlife species is against the law. Report any illegal activities to the N.H. Fish & Game Department or your local conservation officer.
- Urge state and federal legislators and your local conservation commission to protect sensitive coastal areas from development, pollution and exploitation.
- Stay away from areas where terns are known or thought to be nesting and keep pets away from these place, to avoid disturbing the birds or leaving scent trails for predators.
- Discourage gulls in beach areas by properly disposing of garbage and trash. Never dump wastes of any kind into the ocean.
- Learn more about the habits and needs of native wildlife so that you can help to educate others.
- Volunteer to assist with tern protection at a nesting area near your home.
- Support organizations working to protect endangered species and other nongame wildlife.

The Audubon Society of New Hampshire

is an independent nonprofit organization with programs in wildlife conservation, environmental affairs, land protection, and environmental education.



Further information about ASNH can be requested from:
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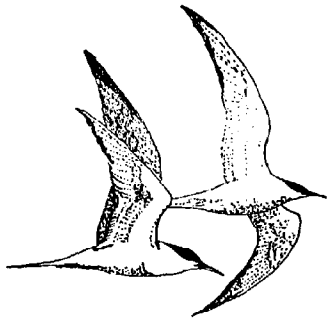
COMMON TERNS

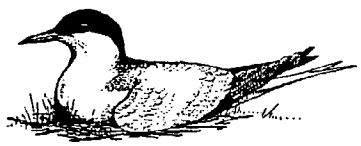
Sterna hirundo



What Are Terns?

Among the most elegant of seabirds, terns are smaller and more slender in build than the closely related gulls and are distinguished by long, narrow, pointed wings and deeply forked tails. They all have black caps during the breeding season, and long, tapering bills. The varying length of the tails and the colors of their bills can be used to tell the species apart.

Terns flit gracefully over the water, bills pointed downward, their long wings lifting them easily and swiftly 30-40 feet. When they spy food below, they plunge headfirst into the water, often disappearing completely under the surface. These birds sometimes gather in huge numbers over a school of fish, swirling in the air, screaming and diving again and again. Fisherman can often locate schools of fish by observing the tern's activities.



Life History

Terns arrive in New England during the first half of May, and usually breed in colonies on barrier beaches, offshore islands and in the salt marshes. After a brief courtship, which may include ritualized flight displays and intricate caressing and preening of each other's feathers, mating ensues. Common and Arctic Terns build vulnerable nests on open shores, scooping out shallow scrapes in the sand, placing a few weeds on bare rock or nestling atop the salt marsh grasses. Roseate terns conceal their simple nests among tall grasses or vegetation or in rock crevices.

Between late May and late July, terns lay 2-3 oval eggs with various patterns of brown on a buff background; if one set of eggs is destroyed, terns may lay several times. The chicks hatch after about 21 days of incubation and within a few days seek shelter in the grasses or other concealing vegetation. Although the young are well developed when they hatch, they will stay near the nest, cared for by both adults and fed on small fish caught in the coastal shallows. Young terns are capable of short flights three to four weeks after hatching and tend to gather in small groups by the water's edge, waiting to be fed.

Terns can be aggressive when they are driving potential predators away from the nesting colony, especially during the height of their breeding season when they are defending their eggs and young. An individual who wanders too close to an active breeding colony is likely to be dive bombed and "white-washed" by crying birds. Keep in mind that you have wandered into the birds' nursery, and make a careful retreat.

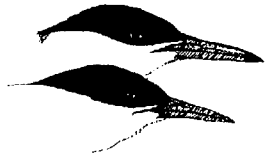
By late summer, large groups of terns begin to congregate on outer beaches and islands. Most depart for their southern wintering grounds in Central and South America in September. Some Arctic Terns make incredible oceanic journeys 25,000 miles, roundtrip between the Arctic and Antarctic via the coast of Africa and South America.

Historical Review

The numbers of terns breeding along the New Hampshire coast, as along the entire Atlantic coast, has fluctuated greatly in the last century. Once among the most abundant nesting birds on the Atlantic and Gulf coasts, they have since been plagued by a variety of threats. Tremendous numbers of terns were killed in the late 1800's for the millinery trade. Although protective laws were eventually passed and terns increased temporarily in the early 1900's, their populations have declined drastically since the 1950's.

Gull populations have increased dramatically in recent years due to the increase in the open dumping of garbage and an enormous growth in the fishing industry. These larger, more aggressive birds compete with terns for nesting sites and prey directly on tern eggs and chicks. Terns are subsequently forced into more marginal areas for nesting and become more vulnerable to predators and human disturbance.

Terns have been greatly affected by coastal development and pollution. Shorefront development has reduced available habitat and caused greater disturbance by house pets, off-road vehicles and humans. Human habitation has disturbed the balance of predators as well, often exposing tern colonies to increased numbers of raccoons, skunks and rats.



Current Status of New Hampshire Terns

New Hampshire currently supports only small numbers of the Common Tern. This tern population includes scattered pairs nesting on rocky islands in the coastal bays and colonies in the Hampton Harbor Estuary.

Field studies conducted annually since 1981 have documented serious instability in coastal colonies, where marginal nesting habitat and heavy predation have significantly hampered productivity.

What You Can Do To Help

- Contribute to our understanding of the Upland Sandpiper's distribution in New Hampshire by reporting any sightings to the Audubon Society of New Hampshire or the NH Nongame and Endangered Wildlife Program, N.H. Fish & Game Department.
- Shooting or harassing threatened or endangered wildlife species is against the law. Report any illegal activities to the N.H. Fish & Game Department or your local conservation officer.
- Stay away from areas where Upland Sandpipers are known or thought to be nesting and keep pets away from these places, to avoid disturbing the birds or leaving scent trails for predators.
- Urge state and federal legislators and your local conservation commission to protect critical habitat for wildlife.
- Learn more about the habitats and needs of native wildlife so that you can help to educate others.
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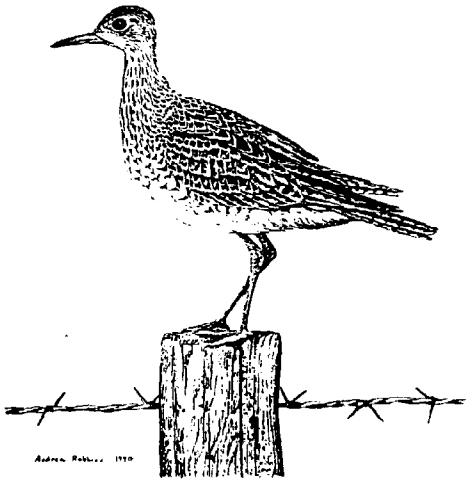
UPLAND SANDPIPERS

Bartramia longicauda



What are Upland Sandpipers?

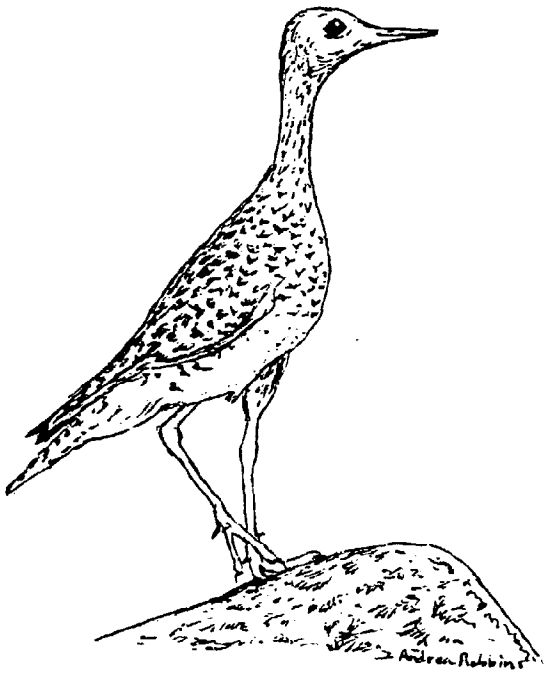
The Upland Sandpiper, formerly called the Upland Plover, is a large (11-12 inch), brownish shorebird with a short bill, slender neck and long legs and tail. Its wings are lined with black and white bars, which can be seen when the bird stretches its wings as it alights. You may see it fly close to the ground with its wings bent downward, flapping with short, stiff strokes, while uttering musical trills and notes. It may also perch on posts and poles. When it lands it stretches its neck up and points its wings high over its back before folding them down. On the ground the Upland Sandpiper moves like a plover, running swiftly and then stopping suddenly.

Life History

Upland Sandpipers are migratory birds which winter on the pampas of South America and return to New Hampshire in mid to late April. Unlike other shorebirds, they prefer dry, open grasslands, hayfields and pastures, especially those undisturbed by cultivation. These birds are quite conspicuous on arrival, uttering mellow, drawn-out whistles, soaring high, and flying low over the ground on vibrating wings. During courtship, the male struts with tail cocked, wings dragging and throat puffed out.

The nest consists of a slight depression in tall grass, and is lined with leaves, small twigs or grasses. In late May or early June the female lays 4 creamy buff or white eggs spotted with reddish brown. Often grasses are arched over the top to hide the nest from above. Both male and female incubate the eggs for about 24 days. Nesting birds circle and call overhead when disturbed, and will distract intruders by fluttering off with wings dragging. The young are well developed and downy when they hatch. Cared for by both parents, the chicks are full grown and ready to fly in about a month. Adult and young sandpipers feed on vast numbers of grasshoppers and other insects, as well as waste grain.

Upland Sandpipers begin to head to South America in early August through September, usually migrating in the evening or at night. Migrants from further north may begin to swell populations at breeding areas as early as late July, and peaking into early to mid-August.



Historical Review

Upland Sandpipers increased in New England during the late 18th century when fields replaced forests, but began to dwindle during the later 19th century. The return of forests in New Hampshire has eliminated much of the open habitat suitable for breeding Upland Sandpipers. Large-scale shooting for food and sport in the mid-west during the 1800's decimated populations in that region. Today Upland Sandpipers face lack of suitable nesting area in much of North America and the continued pressures of hunting, pesticides and land-use changes on their wintering grounds in Argentina.

Current Status of New Hampshire's Upland Sandpipers

Once found in the thousands, feeding on insect pests throughout New England's farms, they have diminished with the shrinking farms to only one known location in the state. Upland Sandpipers are now considered endangered in New Hampshire. At present, the Pease Airfield in Newington supports the only known nesting population of Upland Sandpipers in New Hampshire estimated at 8 - 10 pairs.

Upland Sandpiper habitat at Pease exists on the airfield, including three grassy "islands" surrounded by the runway and connecting taxiways. Vegetation on the islands is characterized by grasses widely interspersed with a variety of herbaceous plants and the occasional woody species. Coordination with airfield personnel and mowing operations has helped to improve the productivity at this site. Migration data from 1989-1994 point out the importance of the Pease airfield not only as breeding habitat for New Hampshire's only remaining population, but as a migration stopover for the regional population north and east.

Casual reports of possible sightings in other potential breeding habitat keep the search going. They are out there! (But where?) If you know of locations where these birds may be nesting, please let us know.

APPENDIX C

THE GREAT BAY ESTUARY:

ITS CULTURAL AND NATURAL HISTORY

SLIDE PROGRAM NOTES

DEVELOPED BY THE AUDUBON SOCIETY OF NEW HAMPSHIRE, FUNDED BY A GRANT FROM THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION THROUGH THE N.H. COASTAL PROGRAM .

DECEMBER 1994.

ACKNOWLEDGEMENTS

We would like to extend our appreciation to the various people who provided assistance in gathering information for this slide program, and who willingly loaned their slides for use in the program. In particular, we would like to thank:

Peter Wellenberger (NHF&G Region III) and Betsy Franz (NHF&G Sandy Point Nature Center) for providing access to their slide collection and 1991 videotaped interviews with longtime residents on the Great Bay Estuary.

Bill Penhale (Vice President, Great Bay Trust) for valuable discussions about the Great Bay Estuarine System Conservation Trust.

Jack Adams (author of *Drowned Valley: The Piscataqua River Basin*) and the New England Press for generously giving us permission to reproduce historic photographs from *Drowned Valley*.

Maryanna Hatch (Curator, Durham Historical Museum) for providing access to historic photographs and other historic information.

Sharon Meeker (UNH Cooperative Extension, Seagrant program) for assisting in the collection of background materials, providing access to books, existing slide programs and videos in the MERC library, and allowing us to use several slides in the program.

Steve Jones (UNH Jackson Estuarine Laboratory) for taking us out into the Estuary for photographs that were difficult to get from the land.

Fred Short (UNH Jackson Estuarine Laboratory) for the loan of several slides from his collection.

Gary Hulme (NH Division of Historic Resources) for the loan of several slides from his collection.

INTRODUCTORY NOTES TO PRESENTERS

PROGRAM FORMAT

The following notes describe the format of the notes accompanying the slide program, and provide direction on how the program should be used. In the notes that follow, each slide is described on a separate page. The format for each page provides:

* the slide number and title,
* a graphical representation of what the slide consists of,
* material that could be used as a script,
* "Additional Notes" provide the presenter with additional background information for some slides

It is important to note that there is no prescribed script as such for the program. The way in which the program has been set out is to encourage the presenter to personalize the program and tailor it to their level of knowledge. This makes the presenter more involved in the program than simply presenting a set program. While a script of sorts is provided, the presenter should feel free to add in information from the Additional Notes provided or their own background, or to cut back on the script if a shorter program is needed. The script provides guidelines rather than a prescribed format for presentation. The presenter can use the script to the degree that they feel comfortable. Some people may prefer adhering strictly to the script provided (which is fine), while others may wish to follow the script more loosely, adding some of their own knowledge of the seacoast. There is no right or wrong way to present the program!

Note that the term "Estuary" with a capital E refers to the entire Great Bay Estuarine system, and is used simply as an abbreviation. Estuarine with a capital E, is also used to refer specifically to the Great Bay Estuary.

PROGRAM TIMING

There are a total of 64 slides in the program. If the program were presented by following the script provided, the presentation would last approximately 30-35 minutes. However, there may sometimes be a time constraint and a need for a shorter program. To accommodate this need, certain slides (marked with a double asterisk on the Summary of Slide Titles) may be omitted, and the "script" for the remaining slides may be shortened (text marked in bold on the "script" for certain slides may also be omitted for a shorter program). If all the asterisked slides and the bold areas of the script were omitted, the shorter program would last approximately 20-25 minutes.

FACT SHEETS

Three fact sheets accompany this program, and should be made available to those attending the presentation. The fact sheets are: Natural History of the Great Bay Estuary (Fact Sheet 1) Cultural History of the Great Bay Estuary (Fact Sheet 2), and Thoughts for the Future and Recommended Further Reading (Fact Sheet 3). These fact sheets also provide some background information that complements the slide show. Presenters are encouraged to peruse some of the references recommended for further reading in Fact Sheet 3.

INFRARED AERIAL PHOTOGRAPHS

Several of the aerial photographs used in the program are infrared aerials. The light blue shows paved surfaces (as in the photo of Durham) and developed areas; vegetation shows up as various shades of red, and the water shows as black or a green-black-blue color. The Estuarine channels show up particularly well on these color infrared photos.

THE GREAT BAY ESTUARY - NATURAL AND CULTURAL HISTORY

SUMMARY OF SLIDE TITLES

#	Slide Title	Slide taken/loaned by:
1.	Title slide	UNH Seagrant Program
2.	New Hampshire's inland shoreline	Fred Short
3.	What is an estuary?	ASNH
4.	Great Bay Estuary is part of the Gulf of Maine**	ASNH
5.	What comprises the Great Bay Estuary?	ASNH
6.	Text slide: Tidal range of the Estuary**	ASNH
→ 7.	Formation of Great Bay Estuary	ASNH
8.	The role of ice in shaping the Estuarine shoreline	UNH Seagrant Program
9.	Relocation of marsh vegetation**	ASNH
10.	First Inhabitants - Native Americans	Gary Hulme
11.	The arrival of European settlers	ASNH
→ 12.	Plunder of the shorebirds	ASNH
13.	Eelgrass meadows	ASNH
14.	Eelgrass plants	Fred Short
15.	Inhabitants of eelgrass - 1**	Fred Short
16.	Inhabitants of eelgrass - 2**	Fred Short
17.	Navigation using the channels**	ASNH
18.	Eelgrass as a tool for navigation at night	Fred Short
19.	Mudflats	ASNH
→ 20.	Mudflat feeders**	ASNH
21.	Saltmarshes	ASNH
22.	Low marsh**	ASNH
23.	High Marsh**	ASNH
24.	Channel bottom habitat	ASNH
25.	Arrival of the gundalow	ASNH
26.	Evolution of the gundalow	ASNH
27.	Utility of the gundalow	ASNH (Jack Adams (*Drowned Valley*)
28.	Unloading gundalows**	ASNH (Jack Adams (*Drowned Valley*)
29.	Gundalow cargoes**	ASNH (Jack Adams (*Drowned Valley*)
30.	Gundalow transporting salthay	ASNH
31.	Salthay harvest	UNH Seagrant Program
32.	Ditching and diking on saltmarshes**	ASNH
33.	Fisheries	UNH Seagrant Program
34.	Lumber yards	ASNH (Jack Adams (*Drowned Valley*)
35.	The shipbuilding industry	ASNH (Jack Adams (*Drowned Valley*)
36.	The gundalow and the American Revolution	ASNH
37.	Brickyards	ASNH (Jack Adams (*Drowned Valley*)
38.	Gundalow transporting bricks	ASNH (Jack Adams (*Drowned Valley*)

39.	Bricks used to construct mills	ASNH
40.	Gundalow carrying cordwood	ASNH (Jack Adams (*Drowned Valley*)
41.	The cotton mills	ASNH (Jack Adams (*Drowned Valley*)
42.	Portsmouth's maritime economy	ASNH
43.	Demise of the gundalow	ASNH
44.	Railroad bridge at Dover Point	ASNH
45.	Subsistence to commerce and industry	ASNH
46.	Recreational activities - oystering	ASNH
47.	Closure of shellfish beds	ASNH
48.	Eelgrass wasting disease	Fred Short
49.	Recreational activities - boating	ASNH
50.	Commercial fishing	ASNH
51.	Commerce and industry	ASNH
52.	Shipping activities in Portsmouth**	ASNH
53.	Activity in Great and Little Bays	ASNH
54.	Great Bay Estuarine Research Reserve	ASNH
55.	Chapman's Landing**	ASNH
56.	Pease Air Force Base**	ASNH
57.	Sewage treatment works at Exeter	ASNH
58.	Sewage treatment discharge into Squamscott**	ASNH
59.	Industrial pollution	ASNH
60.	Other sources of pollution	ASNH
61.	Pollution in the watershed counts**	ASNH
62.	The Estuary is an altered system	ASNH
63.	What does the future hold?	ASNH
64.	Prepared by the Audubon Society of New Hampshire	ASNH

** *Slides that may be omitted for a shorter program*

SLIDE 1 TITLE SLIDE

Painting of gundalows moored outside the old Adams House, Adams Point

THE GREAT BAY ESTUARY: ITS CULTURAL AND NATURAL HISTORY

This program describes a region that was once the hub of New Hampshire, and provides some insights to the natural history of the Great Bay Estuarine system.

ADDITIONAL INFORMATION:

- The cultural history of the Great Bay Estuary from the start of European settlement through the end of the 19th century is depicted by examining the gundalow cargoes of the day, and the role of the gundalow in shaping the economy of the region we know today.

SLIDE 2 NEW HAMPSHIRE'S INLAND SHORELINE

Aerial Photograph of
the Great Bay Estuary

The Great Bay Estuary transforms New Hampshire's modest 18 mile coastal shoreline into a rich tapestry of biological diversity, with a total shoreline length of 150 miles. The Estuary is one of the largest on the Atlantic coast. This slide shows the Great Bay Estuarine system, with the mouth of the Piscataqua and Portsmouth in the foreground and Great Bay in the background (towards the upper left of the slide) (*point out landmarks on slide).*

ADDITIONAL INFORMATION:

- New Hampshire's Atlantic Coast shoreline is 18 miles; the Great Bay Estuarine system has a 132 mile long shoreline, making a total shoreline length of 150 miles. Not bad for a coastal state with one of the shortest ocean shorelines!
- The Estuary can be described as an "inland sea" of sorts, given the predominance of saltwater species. This is New Hampshire's hidden coastline.

SLIDE 3 WHAT IS AN ESTUARY?

Black and white illustration showing the formation of an estuary (drowned river valley)

An estuary is the place where the rivers meet the sea, where freshwater flowing downstream mixes with the salty ocean water. Many estuaries we know today are drowned river valleys. The old river channel still lies along the bottom of the estuary while the estuarine waters cover what had once been low coastline *(point out on slide)*.

ADDITIONAL INFORMATION:

- Estuaries are fragile ecosystems, and are amongst our most important, misunderstood and most abused resources.
- Many large estuaries we know today are drowned river valleys - places where the sea level has risen, the coastal plain has subsided, or both. The ancient river beds were originally cut by streams draining massive volumes of meltwater from the shrinking glaciers.

SLIDE 4 GREAT BAY ESTUARY IS PART OF THE GULF OF MAINE

Gulf of Maine watershed map

The Great Bay Estuary is one of the many estuaries found along the Gulf of Maine.

ADDITIONAL INFORMATION:

- The Gulf of Maine spans Massachusetts, New Hampshire, Maine, and the Provinces of NB & NS Canada, ~~and~~ includes 70% of the total area of New Hampshire.
- The entire Gulf of Maine can be considered an estuary since Gulf waters are somewhat isolated from the Atlantic Ocean by uplands and submerged offshore banks, and receive a tremendous volume of freshwater runoff from the land. The Northeast and the Great South Channels, created by ancient streams, form the major arteries for the exchange of waters between the Atlantic Ocean and the Gulf of Maine.
- The Gulf is comprised of channels (created by ancient streams), basins and banks (that were above water for hundreds of years)

SLIDE 5 WHAT COMPRISES THE GREAT BAY ESTUARY?

Black and white map of the
Great Bay Estuarine system

The Great Bay Estuary starts at the mouth of the Piscataqua River. Moving upstream, it angles into Broad Cove and Little Bay, squeezing through the bottleneck known as the Furber Strait at Adams Point into Great Bay itself (*point out on slide).* Freshwater inflow comes primarily from seven tidal rivers *(moving clockwise, starting in the bottom right hand corner of the slide, point out each of the rivers on the map.)* : the Winnicut, Squamscott, Lamprey, Oyster, Bellamy, Cocheco and Salmons Falls Rivers (the latter two join to become the Piscataqua River).

ADDITIONAL INFORMATION:

- The Estuary extends 15 miles from the mouth of the Piscataqua to the upper limit of Great Bay.

SLIDE 6 TEXT SLIDE: TIDAL RANGE OF THE ESTUARY

TIDES RELATIVE TO PORTLAND, MAINE

	Time Lag	Tidal Range
Piscataqua mouth	4 mins behind	8.1 ft
Dover Point	1.5 hrs behind	6.0 ft
Adams Point	2.0 hrs behind	
Lower Squamscott	2.5 hrs behind	6.2 ft

The Estuarine system is dominated by tidal flow which is pushed up the Piscataqua on an eight foot tide. Moving up the Estuary, the tidal range (the difference between low tide and high tide) generally decreases and tides lag increasingly behind those of the open ocean e.g. in the Lower Squamscott River at the far end of Great Bay, low tide is 2.5 hours later than low tide at Portland.

ADDITIONAL INFORMATION:

- Tidal flow dominates over freshwater inflows for much of the year, with freshwater averaging around 2% of the volume of water, although this does vary seasonally (increasing during wetter times such as snowmelt in spring).

SLIDE 7 FORMATION OF THE GREAT BAY ESTUARY

Photograph of a glacier showing meltwaters at the base of the slide (just visible).

The Estuary had its beginnings approximately 14,500 years ago following the melting of the last glaciers. The tremendous quantity of water released by the melting glaciers contributed to rising ocean waters which flooded the land, drowning the ~~ancient~~ river valleys that make up the Estuary that we see today.

ADDITIONAL INFORMATION:

- It is estimated that the Estuary has existed for the last 8,000 years, which is comparatively young in terms of geological time (which spans millions of years).
- As the huge weight of the glaciers was removed, the depressed land slowly rebounded to existing levels - a process that has taken many thousands of years.
- The shoreline of the Estuary probably arrived close to its present day position a few thousand years ago when the rise of sea level slowed down. Since that time, the Estuary has been continuously modified by a slow sea level rise (estimated at 1.5 mm/year).

SLIDE 8 THE ROLE OF ICE IN SHAPING THE ESTUARINE SHORELINE

Photograph of ice on the Estuary in winter

Ice has continued to play an important role in shaping the characteristics of the shoreline. During periods of ice movement, large amounts of shoreline sediments are dislodged and transported to other parts of the Estuary.

ADDITIONAL INFORMATION:

- During winter, much of the shoreline and the intertidal zone (areas that are alternately flooded and exposed by tides) are iced over.
- In winter and early spring, the effects of ice breakup causes erosion and resuspension of estuarine sediments. During summer, deposition of sediments is more common.

SLIDE 9 RELOCATION OF MARSH VEGETATION

Chunk of saltmarsh vegetation
that has been relocated by ice
(photo taken at Adams Pt)

Chunks of saltmarsh and eelgrass vegetation are torn loose by ice and rafted during periods of thaw. Many of these chunks can be seen stranded on the mudflats at low tide (*point out chunk of saltmarsh vegetation on the mudflat near the edge of the water - middle left of slide).*

ADDITIONAL INFORMATION:

- The movement of these rooted chunks of vegetation and marsh peat facilitate the spread of saltmarsh vegetation and eelgrass beds.

SLIDE 10 FIRST INHABITANTS - NATIVE AMERICANS

Photograph of Native American shell midden

The earliest known inhabitants to reap the bounty of the Great Bay Estuary were Native American tribes. Evidence of ancient harvests still exists today in the form of oyster and clam shell heaps (called middens) along the shore and in certain marshes (*point out the midden in the slide - it is the layer of decomposing shells visible between the two parallel rows of colored pins).* **In recent times, human activities along the shores of the Great Bay Estuary have left a more damaging legacy than decomposing shells.**

ADDITIONAL INFORMATION:

- These fishermen and hunter-gatherers lived on a bountiful harvest of the abundant shellfish, finfish and waterfowl that inhabited the Estuary.
- First impacts on Estuary with slash and burn land clearing practices.
- Despite thousands of years of occupation, these people left little lasting impact on the landscape, leaving the land more or less as they found it.
- While the Native Americans most likely inhabited the Estuarine shores for several thousand years, there is conclusive evidence (pottery, flintheads and harpoon heads found in the vicinity of Adam's Point) that Native Americans occupied sites around the Estuary 1200 years ago.

SLIDE 11 THE ARRIVAL OF EUROPEAN SETTLERS

In 1708, it was stated that the Great Bay abounded with fish such as

"cod and haddock.... bass, shad, mackerell, herring, blew-fish, alewives, pollock, ffrost fish, perch, fflounders, sturgeons, lumbs, eels, seales, salmon.... and all sorts of shellfish such as lobsters, crabs, cockles, clams, mussels, oysters etc." (Jackson, 1944)

The arrival of European settlers in the early 1600's began a history of increasing demand on the natural resources of the Estuary that continues today. They found a region rich in marine life - the waters teamed so many fish that they were used as fertilizer; oysters were abundant and clams so plentiful that they were fed to hogs; the skies were darkened with migrating wildfowl; and deer, bear and other wild game abounded in the adjacent forests.

ADDITIONAL INFORMATION:

- The text for the above slide, as quoted in Jackson, 1944, was originally documented in the British Calendar of State Papers, American and West Indies July 6, 1708. This information was communicated to the Council of Trade and Plantations during the early 18th century.
- Current figures show that the Estuary is home to 52 species of fish, and 110 bird species (excluding upland species), e.g. great blue heron, glossy ibis, yellowlegs and snowy egrets. Several endangered and threatened bird species, such as bald eagles, use the Estuary at various times of the year. Ospreys are known to forage here during migration, and several have been observed nesting in the area.
- Invertebrate populations include Eastern Oysters, lobsters, crabs and soft shell clams.

SLIDE 12 PLUNDER OF THE SHOREBIRDS

Photograph of Lesser Yellowlegs

The shorebirds, so numerous and in seemingly inexhaustible supply in the early days were hunted to near extinction by the end of the 19th century. The reason for this carnage was the increase in markets in coastal and inland cities for bird meat. At the peak of the demand, the birds were ruthlessly harvested like a crop, with little element of sportsmanship.

ADDITIONAL INFORMATION:

- In the early days, shorebirds were hunted annually, but only by local people for their own use. The carnage began when markets for bird meat developed in the cities up and down the coast.
- Examples of shorebirds are Black-bellied plover, golden plover, dunlin, common snipe yellowlegs.

SLIDE 13 EELGRASS MEADOWS

Eelgrass meadow at mid-tide

A number of different habitats supported the variety of animal species that the early settlers found in the Estuary. Eelgrass communities, occurring as "meadows" are the most abundant habitat found in the Estuary.

ADDITIONAL INFORMATION:

- Eelgrass beds occur as large meadows and smaller beds, and provide the largest spatial distribution within the Estuary, covering 2500 acres. The greatest concentration of eelgrass beds occur in Great Bay.

SLIDE 14 CLOSE UP VIEW OF EELGRASS PLANTS

Lobster in eelgrass meadow

Eelgrass is a submerged marine plant rooted in the Estuarine sediments. It provides valuable breeding and nursery grounds for the variety of finfish, shellfish, and crustaceans harvested by the early settlers. Eelgrass communities also filter estuarine waters, trapping sediments and dissolved nutrients, thereby enhancing Estuarine water clarity and quality.

ADDITIONAL INFORMATION:

- Eelgrass (*Zostera marina*) is an important base of the estuarine food chain. Decomposing leaves provide a food source for many invertebrates, which in turn provide food for larger life forms such as fish and crabs, which in turn are predated on. Sediments and larval organisms are suspended in the eelgrass meadows, and small animals use the blades as anchors. As such, eelgrass plays an important role in the life cycles of scallops, crabs, finfish, geese and ducks.
- Eelgrass communities are valuable sediment traps and help stabilize bottom sediments. They filter estuarine waters removing both sediments and dissolved nutrients (sediments settle out, and leaves use excess nutrient inflows for their growth). However, too many nutrients can produce algal blooms that shade and destroy eelgrass ecosystems. The health of eelgrass communities is both a factor in, and an indicator of, the overall health of the estuarine ecosystem.

SLIDE 15 INHABITANTS OF EELGRASS HABITAT - 1

Canada geese feeding
on eelgrass

Ducks and geese consume eelgrass leaves and seeds .....

SLIDE 16 INHABITANTS OF EELGRASS HABITAT - 2

Great blue heron feeding
on eelgrass

..... wading birds and diving ducks are attracted by the many fish and other food sources.

ADDITIONAL INFORMATION:

- Predatory fish such as striped bass are also attracted to eelgrass beds for feeding. Other fish include silversides and sticklebacks (permanent residents), and smelt and river herring (nursery grounds en route from river spawning grounds to open water).

SLIDE 17 NAVIGATION USING THE CHANNELS

Infrared aerial photo showing
Estuarine channels (Lamprey
River in the upper left and
the Squamscott in the lower left)

One of the hazards for boats in the Estuary was the shallow nature of estuarine waters. It was (and still is) important for boats to stay to the deeper channels to avoid possible grounding on shallow banks at low tide. The channels, so clearly visible in this photo, are not so visible from the water. Navigating these curving and twisting channels was no easy task (*point out the Lamprey and Squamscott River mouths).*

SLIDE 18 EELGRASS AS A TOOL FOR NAVIGATION AT NIGHT

Aerial view of Great Bay (Adam's Point in the upper right) showing eelgrass beds along the channel edges

Eelgrass was a boon to navigation at night because it would show slick or black against the light. The moon reflected off the the water, but there were virtually no reflections in the eelgrass. In this way, vessels traversing the Estuarine waters could sail safely in the dark (providing of course that there was moonlight!). (*Point out eelgrass beds (light green color) alongside the channels Bay channels).*

SLIDE 19 MUDFLATS

Photograph of mudflat in
Little Bay

First the Native Americans, and later the European settlers harvested clams from the productive mudflats. The second most extensive habitat in the Estuary, mudflats are extremely important areas for benthic invertebrates.

ADDITIONAL INFORMATION:

- Unvegetated mudflats are the second most extensive habitat. Mudflats are extremely important areas of benthic invertebrate production, and are a major contributor to primary productivity in the Bay. (Benthic invertebrates refer to invertebrates that occur on the bottom of a body of water). The mudsnail, numbering tens of thousands feeds on the highly productive benthic diatom layer. Birds, crabs and fish are the primary grazers on mudflat fauna.

SLIDE 20 MUDFLAT FEEDERS

Great blue heron on mudflat

Wading birds (e.g. great blue herons) feed on clams and worms at low tide, while fish and crabs move onto the flats at high tide to prey on invertebrates.

SLIDE 21 SALTMARSHES

Saltmarsh at high tide
showing tidal creek

Saltmarshes have long yielded rich harvests to humans. Both the Native Americans and the European settlers fished the creeks for alewives which came up the marshes in large numbers on their way to spawning grounds. The tidal creeks provide habitat for juvenile fish, feeding areas for birds, habitat for numerous insect species (including mosquitoes!), and transport large quantities of organic material into the Estuarine detrital cycle. **The third most abundant habitat, saltmarshes are found throughout the Estuary, being most abundant along the Squamscott River.**

ADDITIONAL INFORMATION:

- Estuaries are enormously productive because of the lush saltmarshes that are part of the shoreline. An acre of saltmarsh with a dense growth of cordgrass produces at least twice as much organic material as the best cultivated agricultural land.
- Mummichogs provide a major source of food for wading birds. Mummichogs have no commercial or recreational value, but are valuable in marsh food chains because of their high abundance.
- A number of terrestrial species, e.g. deer, raccoons, mink use saltmarshes for foraging.

SLIDE 22 LOW MARSH

Fringing low marsh along
the Estuarine shoreline edge

There are two types of marsh habitat - low marsh and high marsh. Low marsh, such as these fringing marshes found along the Estuarine shoreline, is flooded twice daily by the tides, and is dominated by saltwater cordgrass.

ADDITIONAL INFORMATION:

- Fringing marshes, which form a discontinuous band along the Estuarine shoreline, are an example of low marsh habitat.
- Fringing marshes provide habitat for a number of invertebrate species including amphipods and snails.

SLIDE 23 HIGH MARSH

Photograph of high marsh showing cowlicks

High marsh is the typical New England saltmarsh. Beyond the reach of daily tides, these marshes are flooded irregularly and are dominated by salt hay grass. It was the high marsh that the coastal farmers valued so highly for its crop of salt hay.

SLIDE 24 CHANNEL BOTTOM HABITAT

Aerial photograph of Moody Point area, location of large oyster bed

The rich and plentiful oyster harvests of the early days came from extensive beds found at the mouths of the tidal rivers (*point out river mouths*), in shallow creeks, at the edges of mudflats, and in the deeper channel areas (*point out channels*). Channel bottom habitat also provides refuge for fish and invertebrates retreating from the eelgrass meadows, mud flats and tidal marshes at low tide.

ADDITIONAL INFORMATION:

- Channel Bottom and subtidal (shallow but permanently inundated) habitat varies from soft mud, to hard sand, to gravelly cobble and rock.

SLIDE 25 ARRIVAL OF THE GUNDALOW

Photograph showing model of early open, barge-like gundalow

The early settlers not only derived their livelihood from the Estuary and its tidal rivers; they also depended on them for transportation. Around the early to mid 1600's, a simple square-ended flat bottomed vessel without a sail made its appearance. Known as "gundalows" these humble barge-like vessels had a major and lasting impact on the economic development of the region. **Without the Piscataqua gundalow, the development and growth of the towns on the shores of the Estuary would have been severely hampered.**

ADDITIONAL INFORMATION:

- This "commonplace" vessel affected the entire spectrum of economic, military and cultural history of the Great Bay Estuary.
- The gundalow survived and dominated the region for 200 years.

SLIDE 26 EVOLUTION OF THE GUNDALOW

Model of a "mature" gundalow
with a lateen

By the late 1800's, the gundalow had evolved to become more streamlined and had a triangular sail known as a lateen.

ADDITIONAL INFORMATION:

- The gundalow evolved from a simple 20-30 foot long barge-like craft with no attached rudder, deck or transom and was rarely rigged for sail.
- Over time, it acquired a fixed rudder and tiller, platforms or decks at either end and a cabin ("cuddy") for living quarters. By the early 1800's, they were rigged with a single square sail.
- In her *Country By-ways* (1881), Sarah Orne Jewtt, a lifelong resident of the gundalow port of South Berwick, Maine, observed:

  "*When you catch sight of a tall lateen sail, and a strange clumsy craft that looks heavy and low in the water, you will like to know that its ancestor was copied from a Nile boat, from which a sensible old sea-captain took a lesson in shipbuilding many years ago.*"

SLIDE 27 UTILITY OF THE GUNDALOW

Pen and ink rendition by John Hatch showing gundalows off Adam's Point (the old Adams house is in the background)

These bulky flat bottomed craft could traverse almost any shallow tributary, and were surprisingly easy to maneuver in the swift currents of the Piscataqua. They provided an extremely cheap and effective means of transportation. Under favorable conditions of wind and tide, the gundalow could complete the 25 mile trip between Portsmouth and Exeter in a little over 2 hours - at around 11 mph, that was quite an achievement of speed!

ADDITIONAL INFORMATION:

- The key to the gundalow's success was its utility. It could go where ships could not, and could pass easily under low bridges (the sail could be quickly and easily lowered).
- Despite their bulky appearance, they were easy to maneuver in the swift currents of the Piscataqua, and provided an extremely cheap and effective means of transportation.
- When fully loaded, it drew no more than two feet of water.

SLIDE 28 UNLOADING GUNDALOWS

Historic photograph of overhanging storehouse (for unloading gundalows) on the Oyster River

That there were few riverside wharves did not matter, the gundalow was able come right up to the bank. Riverside storehouses were built with an overhanging upper storey (such as the one in this slide). The gundalow could pull up to the bank, and goods were hauled directly into the storehouse.

SLIDE 29 GUNDALOW CARGOES

Gundalow loaded with cordwood

The variety of cargoes carried by the gundalows during their 200 year history demonstrate the evolution of an increasingly sophisticated economy in the Great Bay Estuary.

ADDITIONAL INFORMATION:

- The gundalow was the dominant cargo bearer of the Piscataqua River, moving supplies throughout the river basin of NH and ME.

SLIDE 30 GUNDALOW TRANSPORTING SALTHAY

Slide of gundalow transporting salthay

Salt hay, used for horse and cattle fodder was a popular part of New England agriculture before the end of the 19th century. Each fall, farmers brought their horses on the gundalows to the high marshes to harvest the wild salt grass at neap tide. The gundalow then transported the hay downriver on the rising tide.

SLIDE 31 SALTHAY HARVEST

Photograph of salthay stacked on staddles

For local use, the cut hay was raked into beehive shaped stacks, and loaded onto staddles, a circle of wooden posts in the marsh that served to keep the hay high and dry. The farmers then returned with their horses in the winter when the marsh surface was frozen and easy to cross to move the hay to barn storage.

ADDITIONAL INFORMATION:

- Salt haying was one of the few successful farming practices. Farming the land around the Estuary on a large scale was difficult because the former ice sheet had left the land surface with only thin and rocky soils. Much of the fertile organic topsoil had been scraped off by glacial ice, leaving a rough land surface with many bare and exposed bedrock outcrops, scattered boulders, stones and sand. Dairy farming was amongst the more successful farming endeavors.

SLIDE 32 DITCHING AND DIKING ON SALTMARSHES

Marsh ditching

To make the marshes more firm and accessible for haying, drainage ditches were dug and dikes built. Later, ditching was used in an attempt to control saltmarsh mosquitoes.

ADDITIONAL INFORMATION:

- The objective of ditching for mosquito control was to drain the marshes of much of their water in belief that this would discourage the breeding of the saltmarsh mosquitoes. However, the ditches were never really successful in decimating the mosquito population. While the effects of ditching on marsh ecology are not well understood (more research is needed) we do know that they affect the physical character of the marsh through altering the hydrology.

SLIDE 33 FISHERIES

Salmon

A profitable fishing industry thrived in the Estuary through the first half of the 18th century. Salmon were particularly abundant in the Salmons Falls and Cocheco Rivers. In 1717, a Portsmouth merchant reported recovering 1,000 tons of salmon in a single season. The gundalows transported cured fish harvested from the Estuarine waters downstream for trade with other American cities and for export to Canada, Spain, Portugal and the West Indies.

ADDITIONAL INFORMATION:

- The salmon which once crowded the mouths of the Salmon Falls, Exeter and Lamprey Rivers are long gone, and only a vestige of the shad, herring and other fishes used by the early settlers remain.
- The construction of dams in the early 19th century was a factor leading to the disappearance of many fish. Salmon tend to return to the same river for spawning year after year, and apparently make little effort to find substitute spawning grounds. If the spawning grounds are cut off by dams, the entire population of that river ceases to exist (Jackson, 1944).

SLIDE 34 LUMBERYARDS

Historic photo of lumberyard
in Dover, NH, about 1885

Lumber (mainly white pine and oak) was another important natural resource harvested from the shores of the Estuary. A number of water powered sawmills sprang up along the tidal rivers. The tremendous quanties of sawdust produced by the sawmills presented an early Estuarine pollution problem. Historical reports cite a thick layer of sawdust coating the mudflats at low tide. Sawdust destroyed finfish spawning beds and young fry, and reportedly had a dramatic impact on the salmon population. Evidence of sawdust is still present in soil cores taken from the Great Bay Estuary.

ADDITIONAL INFORMATION:

- Sawmills were located on the waterways since they were run with water power, and the location facilitated easy export. Along with lumber, shipbuilding became a thriving business. The gundalows plied the tidal rivers with lumber for shipbuilding operations and cordwood for shipbuilding at the Portsmouth Naval shipyard.
- By the mid 1700's sawmills and shipyards covered the banks of the Piscataqua River and all of the tidal rivers flowing into the Estuary. Lumber and shipbuilding operations continued throughout the 200 years leading up to the Industrial Revolution.

SLIDE 35 THE SHIPBUILDING INDUSTRY

Shattuck shipyard in
Newington, 1919

Along with lumber, shipbuilding became a thriving business. A critical link in these operations, the gundalows plied the tidal rivers with lumber and cordwood for shipbuilding. **Lumber and shipbuilding continued throughout the 200 years leading up to the Industrial Revolution. With the advent of steam powered vessels built of steel, the shipbuilding business declined.**

ADDITIONAL INFORMATION:

- Shipbuilding was another major activity during the 1700s and early 1800s. Shipbuilding at the Dover boatyards produced as many as six vessels a year during the 1800s. The shipbuilding industry and the ship and packet lines needed the support of the gundalows to support their many activities.
- The shipbuilding industry spawned profitable businesses for carpenters, shipwrights and sailmakers, stimulating the coastal economy.
- By the late 1800s, steam powered vessels built of steel replaced wooden sailing vessels. Portsmouth shipyards were unable to compete with the cheaper materials, and the shipbuilding industry declined.

SLIDE 36 THE GUNDALOW AND THE AMERICAN REVOLUTION

Photograph of Fort Constitution

The gundalow played a little known but important role during the colonial wars and the Revolution. During the American Revolution, the gundalows carried raiders to Fort Constitution and then transported the powder back to the towns along the shoreline. **As part of his successful strategy to defend Portsmouth, General John Sullivan made a pontoon bridge between Pierce's island and the mainland consisting of gundalows moored head to stern.**

ADDITIONAL INFORMATION:

- The pontoon bridge was one of the first of its kind in American military history.

SLIDE 37 BRICKYARDS

Historic slide of brickyard

During the formation of the Great Bay Estuary, blue marine clay was deposited along the Estuarine shores immediately following ice retreat and inundation by the ocean. This clay was particularly suitable for brickmaking, spawning another major industry.

ADDITIONAL INFORMATION:

- At its peak in the late 1800's there were at least 43 brickyards, with greatest concentration at Dover Point .

SLIDE 38 GUNDALOW TRANSPORTING BRICKS

Historic photo of gundalow transporting bricks

With the advent of the Industrial Revolution, bricks and granite stone for building factories in the region were profitable gundalow cargoes.

SLIDE 39 BRICKS USED TO CONSTRUCT MILLS

Photograph of mills at Newmarket

These bricks were used locally in the construction of mills (*point out Newmarket mills on slide)*, factories and breweries, and also found a market throughout New England. **However, the supply of clay was limited, and eventually the waterside clay banks were exhausted, closing down the brickyards and forever altering the contours of the Estuarine shoreline.**

ADDITIONAL INFORMATION:

- During the Industrial Revolution, the red brick mill became a ubiquitous feature of the coastal landscape
- Many homes on Beacon Hill in Boston were built of the superior Dover Pt brick.

SLIDE 40 GUNDALOW CARRYING CORDWOOD

Slide of gundalow carrying cordwood

The gundalows transported cordwood throughout their 200 year history. Large quantities of cordwood were used for lumber and shipbuilding operations. The brickyard kilns burned huge amounts of cordwood each year, representing many gundalow loads.

SLIDE 41 THE COTTON MILLS

Photograph of workers at the
#6 cotton mill,
Newmarket Manufacturing Co.,
around 1905

The cotton industry took hold in the early 1800s. The major gundalow ports of Newmarket, Durham, Dover and Portsmouth contained some of the largest mills of their kind in the world. Gundalows brought up raw cotton, textile machinery, cordwood and coal for the factories, and transported the finished cloth downstream to the packets.

ADDITIONAL INFORMATION:

- The Cocheco Manufacturing Company, which dominated Dover's economy for over 100 years was one of the largest companies of its kind in the region.

SLIDE 42 PORTSMOUTH'S MARITIME ECONOMY

Aerial view of Portsmouth

Following the American Revolution, Portsmouth was involved in a lucrative export trade with the West Indies. Pine lumber, dried fish and beef, were exported while molasses, rum, sugar and cocoa were imported. The gundalow was an important part of this maritime economy, moving goods to and from the schooners and other ships in Portsmouth Harbor.

ADDITIONAL INFORMATION:

- Portsmouth's natural deep water, ice free, harbor is located four miles inland fromt he Atlantic ocean on the Piscataqua River, and is navigable to all types of boats and ships. This made the area a natural early shipping and business center in the region.

SLIDE 43 DEMISE OF THE GUNDALOW

Historic photo of Boston and Maine railroad cars

The gundalow's dying years were marked by the chartering of the Boston and Maine railroad in NH in 1835. The railroad not only took the gundalow's cargoes and routes, but also operated year-round (gundalows could not operate during the winter months when much of the Estuary and tidal rivers were icebound).

ADDITIONAL INFORMATION:

- By 1843, all five gundalow ports were served by railroad lines. During the last half of the 19th century, railroads, bridges, and steam-powered tugs increasingly pre-empted the gundalow. With the declining markets in salthay, cordwood and bricks, the gundalow soon found itself without a cargo.
- By the end of the 19th century, the gundalow had been replaced by railroads, bridges and steam powered tugs.

SLIDE 44 RAILROAD BRIDGE AT DOVER POINT

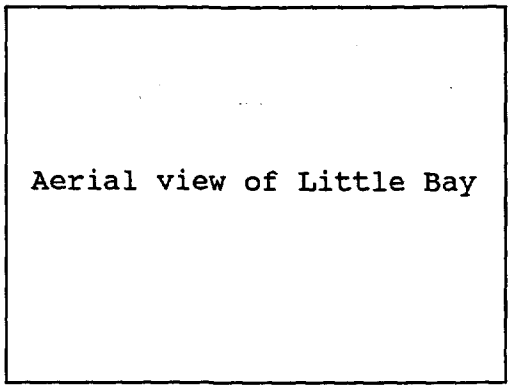
Old railroad bridge alongside
the Gen. John Sullivan Bridge
at Dover Point

The construction of the railroad bridge spanning the Piscataqua at Dover Point, linking Portsmouth with Dover in the 1870's sealed the fate of the gundalow. By the turn of the century, the gundalow had disappeared from the Piscataqua

ADDITIONAL INFORMATION:

- The completion of the bridge not only reduced gundalow business, but posed a navigational hazard. This bridge was replaced by the General John Sullivan bridge in 1934.

SLIDE 45 SUBSISTENCE TO COMMERCE AND INDUSTRY



With the Industrial Revolution came a change in lifestyle, and the economy of the region began to turn from dependence on the natural resources of the Estuary and the land to manufacturing and industry.

ADDITIONAL INFORMATION:

- By the 19th century, the rich self sufficient farming and fishing community of the early days could no longer feed itself and had to import large quantities of flour, butter, corn and cheese. The gundalows transported these products as well.

SLIDE 46 RECREATIONAL ACTIVITIES - OYSTERING

Photograph of oystering
off Adams Point

Today, the economy of the region is based on commerce and industry, and communities are no longer dependent on the Estuary for economic survival. The dominant use of Estuarine waters today is recreational. Shellfishing, in particular oystering are popular recreational activities

ADDITIONAL INFORMATION:

- Throughout its history, the Great Bay Estuary has experienced heavy use from recreational as well as commercial activity.

SLIDE 47 CLOSURE OF SHELLFISH BEDS

Shellfishing closed sign

As the lifestyle of the communities around the Estuary has changed, so too has the ecology of the Estuarine waters. Though not heavily contaminated, the Estuary exhibits warning signs of its fragility. The shellfish resources of the Estuary are no longer as abundant as they were in the early days of settlement when they were fed to hogs. While there are still large populations of shellfish, many of the beds in the Estuary have been closed mainly because of contamination from sewage treatment plants and septic systems that drain directly into the water.

ADDITIONAL INFORMATION:

- As of December, 1994, approximately 60% of the oyster beds and 80% of the clam flats are closed to shellfish harvesting. Most of the clam flats that are closed to harvesting are located in the tidal rivers flowing into the Estuary. A greater percentage of oyster beds are open since many of the oyster beds occur in the open areas of Great Bay.

SLIDE 48 EELGRASS WASTING DISEASE

Photograph of diseased eelgrass plant showing the progression of disease

The eelgrass communities, so important to the health of the Estuary, are threatened by disease and pollution. Pollutants in the Estuary, such as excess suspended sediments and nutrients shade or smother the plants, weakening their growth. In the early 1930s, a "wasting disease" killed over 90% of the North Atlantic eelgrass population. **The disease is caused by a marine slime mould - pinhead size dots appear on the leaves, spreading to form large black stripes and patches, and finally the whole leaf blackens and dies *(point out different stages on the slide)*.** Today the disease is again threatening eelgrass populations.

ADDITIONAL INFORMATION:

- The loss of eelgrass results in greater sedimentation, increased suspended sediments (and consequently decreased water clarity), and the loss of critical habitat for scallops, clams, crabs and many fish species. Although the eelgrass had recovered from the disease by the 1960s, in some locations it never grew back.
- Besides the wasting disease, pollution resulting in decreased water clarity reduces the amount of light reaching the eelgrass, reducing eelgrass growth. Suspended sediments shade or smother eelgrass plants, while nutrient loading shades the plants by promoting algal growth. These pollutants also result in the loss of benthic diatom production, both of which impact the Estuarine food chain.
- The dramatic reduction in the Brent Goose population in recent years was associated with the eelgrass wasting disease.

SLIDE 49 RECREATIONAL ACTIVITIES - BOATING

Boats moored at Great Bay Marine

Pleasure boating has become an increasingly popular pastime, spawning a number of marinas on the shores of the Estuary and the tidal rivers

ADDITIONAL INFORMATION:

- Pleasure boating, fishing, lobstering

SLIDE 50 COMMERCIAL FISHING

Photograph of Little Bay Lobster Company sign

There is still some limited commercial fishing in the Estuary, such as lobstering. Most traps are set in Little Bay and the Piscataqua, although there is some commercial lobstering in the main channel of Great Bay.

SLIDE 51 COMMERCE AND INDUSTRY

Photograph of tank farm
on the Piscataqua River

The New Hampshire side of the Piscataqua and Portsmouth Harbor are the focus of commercial and industrial activities on the Estuarine shore. "Tank farms" for the storage of oil products that are shipped all over New England are located along the Piscataqua River.

SLIDE 52 SHIPPING ACTIVITIES IN PORTSMOUTH

Portsmouth Harbor from the Piscataqua River

The port of Portsmouth, once an important export center, is now a center for shipping activities such as fuel oils, undersea cable, cement, scrap metal, salt, and fishing activities.

SLIDE 53 ACTIVITY IN GREAT AND LITTLE BAYS

Photograph of Great Bay residential development

Most commercial and industrial activities in the Estuary are concentrated in the Piscataqua River. Commercial uses of Great and Little Bays are relatively few. Activity is least in Great Bay although there is continuing residential development.

SLIDE 54 GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE

Map of GBNERR

The Great Bay National Estuarine Research Reserve (under the auspices of NH Fish and Game) has oversight responsibility for the management of Great Bay. Through the Reserve, 850 acres of upland and tidal marsh around Great Bay have been protected.

SLIDE 55 CHAPMAN'S LANDING

Marsh at Chapmans Landing

Two of the largest areas of land protected around Great Bay are the tidal marshes on the Squamscott River (*this slide shows a portion of the protected marsh at Chapmans Landing - point out the marsh behind the parking lot and the Squamscott River alongside*).

SLIDE 56 PEASE AIR FORCE BASE

Infrared aerial photo of
Pease showing weapons storage
area and wildlife refuge.
Adams Pt. is opposite Pease

..... and the wildlife refuge (which is over 1,000 acres) at the former Pease Air Force Base in Newington. *(In this slide, the wildlife refuge is the forested area shown along the Estuarine shoreline and extending back to the weapons storage area)*

SLIDE 57 SEWAGE TREATMENT WORKS AT EXETER

Infrared photo of Exeter sewage treatment works on the Squamscott River

There has been a long history of pollution of the Estuarine waterways by human activities. Except for the Bellamy River, all the major rivers flowing in the Estuary carry treated sewage effluent, contributing bacteria and excess nutrients to the Estuarine waters. This slide shows the Exeter sewage treatment works on the shore of the Squamscott River.....

SLIDE 58 SEWAGE TREATMENT DISCHARGE INTO SQUAMSCOTT

Exeter sewage outflow entering the Squamscott River

..... the treated sewage effluent later enters the Squamscott River near its mouth with Great Bay. **The dense stand of phragmites at the outflow is indicative of the heavy dilution of the tidal river water with freshwater.**

ADDITIONAL INFORMATION:

- Phragmites (common reed) is an invasive (i.e. non-native) plant that is commonly found in tidal areas (especially marshes) where the salt-freshwater balance has been disturbed. Phragmites can invade and eventually dominate disturbed tidal marshes, causing the loss of natural plant and animal diversity.

SLIDE 59 INDUSTRIAL POLLUTION

Portsmouth Naval Shipyard

Industry has long relied heavily on flowing water to carry away unwanted substances. Historically chemicals from the tanneries and mills located on all the major rivers were discharged into the Estuary. More recently industrial contaminants have been discharged from activities associated with the former Pease Air Force Base, the Portsmouth Naval Shipyard and other industrial activities in the region.

ADDITIONAL INFORMATION:

- Historically, the discharge of waste into the Estuary from industries was heavier than it is today, and the Estuary is actually cleaner (relatively speaking) now than it was then.
- However, since times of early settlement in the Estuary, there have been repeated inputs of contaminants, such as sawdust, fishwaste, untreated sewage and mill and tannery chemicals.

SLIDE 60 OTHER SOURCES OF POLLUTION

Golf course fronting onto Great Bay

Other sources of Estuarine pollution include fertilizers from lawns and golf courses and agricultural fertilizers and manure.

SLIDE 61 POLLUTION IN THE WATERSHED COUNTS

Infrared aerial showing development
near the Estuary shores
(slide shows Durham
and the Oyster River)

Because of the dynamic nature of the Estuary, pollution at any point in the watershed (which extends some distance inland) as well as throughout the Estuary itself will ultimately impact the entire system.

SLIDE 62 THE ESTUARY IS AN ALTERED SYSTEM

Historic slide of Little Bay

While some regard the Estuary as pristine, there have in fact been some significant impacts to this fragile ecosystem during the history of European settlement and in recent years (witness the loss of finfish and shellfish over the last 300 years)..

ADDITIONAL INFORMATION:

- Note that all other things considered, the Great Bay Estuary is one of the least altered estuaries on the Atlantic coast, and in this context may be considered relatively "pristine".

SLIDE 63 WHAT DOES THE FUTURE HOLD?

Scenic view of Great at Bay at Adams Point

We are short sighted in our use of our Estuarine land and water resources. Citizens need to understand the complexity and importance of the Estuarine system so they can make intelligent decisions about its future use and protection.

ADDITIONAL INFORMATION:

- At this point in the presentation, it is recommended that the presentation be opened up to dicussion, using Fact Sheet 3 as a guideline.

SLIDE 64 PREPARED BY THE AUDUBON SOCIETY OF NH

AUDUBON LOGO

Prepared by the Audubon Society
of New Hampshire,
December 1994

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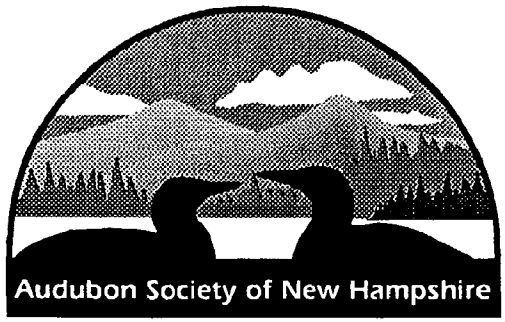

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The Great Bay Estuary
NATURAL HISTORY

FACT SHEET 1

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THE GREAT BAY ESTUARY

The Great Bay Estuary* transforms New Hampshire's modest 18 mile coastal shoreline into 150 miles of tidal shoreline, rich in salt and freshwater diversity. This is where freshwater from many of New Hampshire's inland lakes and rivers mingle with seawater pushed up the Piscataqua River on a eight foot tide. The Great Bay Estuary has its origin at the mouth of the Piscataqua River, the gateway to the ocean. Moving upstream, the Estuarine system angles sharply into Broad Cove and Little Bay, and then squeezes through the bottleneck known as the Furber Strait at Adams Point into Great Bay proper. Included in the Estuarine system are the tidal rivers. Likened to "spindling fingers" on an ancient hand, the Squamscott, Lamprey, Oyster, Bellamy Cocheco and Salmons Falls Rivers (the latter two join for become the Piscataqua River) empty their load of freshwater into the Estuary. A smaller contributor is the Winnicut River. The Great Bay Estuary is one of the largest estuaries on the Atlantic Coast.

Tidal flow dominates the Great Bay Estuarine system with freshwater inflows from the tidal rivers averaging only 2% of the volume of water, although this does vary seasonally, increasing during wetter periods such as spring snowmelt. The tide lags significantly as one moves further up the Estuary e.g. in the Lower Squamscott River at the far end of Great Bay, low tide is 2.5 hours later than low tide at Portland. Similarly, the tidal range (the difference between low tide and high tide) generally decreases as one moves up the Estuary.

** Estuary with a capital "E" refers to the entire Great Bay Estuarine system*

BIRTH OF AN ESTUARY

The Great Bay Estuary had its beginnings approximately 14,500 years ago following the melting of the last glaciers. The tremendous quantity of water released by the melting glaciers contributed to rising ocean waters which flooded the land, "drowning" the ancient river valleys that make up the Estuary that we see today. As the glaciers melted, the release of their tremendous weight from the land surface caused the depressed land to slowly rebound to existing levels - a process that has taken many thousands of years. The Great Bay Estuary has had a complicated sea level history since the melting of the glaciers, being flooded by the rising sea, then partially exposed, and later flooded by high sea levels once more. The shoreline of the Estuary probably arrived close to its present day position a few thousand years ago when the rate of sea level rise slowed down. Since then, slowly rising sea levels (estimated at 1/16 inch/year) have continued to modify the Estuarine shoreline. It is estimated that the Great Bay Estuary has existed as an estuary for the last 8,000 years, which is comparatively young in terms of geological time (which spans millions of years).

Ice has continued to play an important role in shaping the characteristics of the shoreline. During winter, much of the shoreline and the intertidal zone (areas that are alternately flooded and exposed by tides) are iced over. During periods of ice movement, large amounts of shoreline sediments are dislodged and transported to other parts of the Estuary. Chunks of saltmarsh vegetation and marsh peat and shallow eelgrass beds are torn loose by ice and "rafted" to other parts of the Estuary during periods of thaw. Many of these chunks can be seen stranded on the mudflats at low tide. The movement of these rooted chunks of vegetation can facilitate the spread of saltmarsh vegetation and eelgrass beds.

HABITATS AND INHABITANTS OF THE ESTUARY

The Great Bay Estuary includes five major water-dominated habitats: eelgrass, mudflats, saltmarsh, channel bottom, and rocky intertidal (in order of abundance). These rich and diverse Estuarine habitats are home to a variety of species, including 52 species of fish and 110 bird species. Several endangered and threatened bird species, such as bald eagles and ospreys also use the Estuary are various times of the year. Invertebrate populations include Eastern Oysters, lobsters, crabs and soft shell clams. Harbor seals may be observed in winter and spring especially near the mouth of the Oyster River and in the channel at Furber Strait.

Eelgrass

Eelgrass (*Zostera Marina)* is a submerged marine flowering plant growing in shallow waters and rooted in the estuarine sediments. Eelgrass communities occur as large "meadows" or in smaller beds, and are the most extensive habitat in the Estuarine system. This habitat forms an important base of the Estuarine food chain, with a number of invertebrates feeding on decomposing eelgrass leaves. These invertebrates in turn provide food for larger life forms such as fish and crabs, which in turn are predated on. Eelgrass habitat is a rich microcosm of estuarine life. Small animals are anchored to the blades; larval organisms are suspended in the water; many species of finfish and shellfish (e.g. silversides, sticklebacks, smelt, scallops and crabs) use eelgrass meadows as important breeding and nursery grounds; and predatory fish, such as striped bass, are attracted to eelgrass beds for feeding. Many waterfowl and wading birds feed in the eelgrass meadows. Ducks and geese consume eelgrass leaves and seeds while wading birds and diving ducks feed on the fish and other food sources.

In addition to providing valuable habitat for a variety of species, eelgrass communities play an important role in maintaining estuarine water quality and clarity. In this low energy environment the eelgrass plants filter the estuarine waters, allowing sediments to settle out, and using excess nutrients for their growth (although too many nutrients can be harmful to eelgrass communities). Eelgrass communities also play a role in stabilizing bottom sediments (rooted vegetation binds the sediments), which affects both water clarity and water quality.

The health of eelgrass is important to the overall health of the estuarine ecosystem. However, eelgrass communities are threatened by two factors: estuarine pollution and a wasting disease. Algal growth caused by nutrient loading (e.g. from sewage outflows) reduces the amount of light reaching the plants, and an excess of suspended sediments can shade or smother eelgrass plants. Both of these conditions adversely affect eelgrass growth. The second factor affecting the health of eelgrass communities is a wasting disease, caused by a marine slime mold. This disease devastated much of the North Atlantic eelgrass population in the 1930's, and is today again threatening eelgrass communities. Much still needs to be learned about the spread of this disease.

Mudflats

Large mud (tidal) flats dominate the shallower portions of Great and Little Bays. At low tide, approximately 50% of Great Bay is exposed as mudflat. These unvegetated mudflats are the second most extensive habitat in the Estuary. Estuarine mudflats are exposed at low tide and covered by shallow water at high tide. They are extremely important areas of benthic invertebrate (invertebrates that occur on the bottom of a body of water) production, and as such are a significant contributor to primary productivity in the Estuary. Mudsnails, numbering tens of thousands, feed on the highly productive benthic layer. Wading birds feed on clams and worms at low tide, while fish and crabs prey on mudflat invertebrates at high tide.

Horseshoe crabs, survivors of ancient history predating the dinosaurs to 200 million years ago, also feed extensively in mudflats at high tide. Despite its name, the horseshoe crab is not in fact a crab - its nearest relative is the spider!

Saltmarshes

Large areas of saltmarsh are found throughout the Estuary, being most abundant along the Squamscott River. These saltmarshes are enormously productive, producing large quantities of organic material (which enters the detrital cycle) and providing habitat for a variety of species. There are two types of marsh habitat: high marsh and low marsh. Low marsh is dominated by saltwater cordgrass (*Spartina alterniflora*) and is flooded twice daily by the tides. High marsh is the typical New England saltmarsh, and is flooded irregularly, being beyond the reach of daily tides. The high marsh is dominated by salt hay grass (*Spartina patens*) that lies flat and grows in characteristic "cow licked" mats.

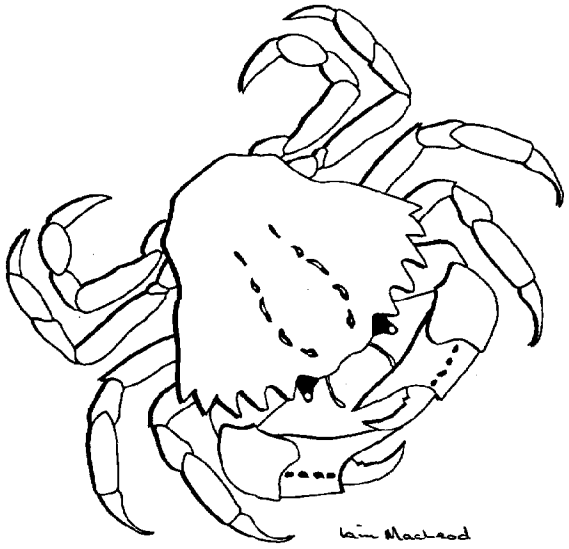
The extensive networks of tidal creeks that meander through the saltmarshes are an important link in estuarine ecology. These waterways transport large quantities of organic detritus (particles that result from the decomposition of organic material) into the Estuary. They also provide valuable habitat for juvenile fish and a number of insect species (including the ubiquitous saltmarsh mosquito!). Abundant populations of mummichogs found in the tidal creeks are an important link in the saltmarsh food chain. These small fish, which have no commercial or recreational value, provide a major food source for wading birds. A variety of birds such as glossy ibis, herons, snowy egrets, and yellowlegs, use saltmarshes during some portion of their life cycle. Terrestrial species, e.g. deer, raccoons, and mink are also attracted to the saltmarsh for foraging.

Channel Bottom habitat

The channels in the Estuary are relics of ancient river beds that were originally cut by streams draining massive quantities of water from the melting glaciers. These old river channels now lie along the bottom of the Great Bay Estuary. This habitat varies from soft mud to sand to gravelly cobble and rock areas. The deeper channel areas provide refuge for fish and invertebrates retreating from the eelgrass meadows, mudflats, and saltmarshes at low tide. Extensive oyster beds are found throughout this habitat. Oyster beds are also found at the mouths of tidal rivers, in shallow creeks and at the edges of mudflats. Oysters are among the few highly specialized creatures that only inhabit estuaries.

Rocky Intertidal habitat

This rocky habitat, so common along the Atlantic coast, only sporadically punctuates the estuarine shoreline. These rocky areas are dominated by seaweeds, which add fragmented tissue to the estuarine detrital cycle. These intertidal areas (i.e. exposed at low tide) are important areas for crustaceans, such as green crabs, and provide feeding grounds for some birds at low tide. Predatory fish feed here at high tide.



The publication *"The Ecology of the Great Bay Estuary, New Hampshire and Maine: An Estuarine profile and Bibliography"* by Fred Short (ed.), 1992 was a primary source of information for this fact sheet.

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The Great Bay Estuary
CULTURAL HISTORY

FACT SHEET 2

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THE FIRST HUMAN INHABITANTS

The earliest known human inhabitants to reap the benefits of Great Bay Estuary* and its shores were the Native American Tribes. These fishermen and hunter-gatherers lived on a rich harvest of the abundant shellfish, finfish and waterfowl that inhabited the Estuary. They were content to live with nature, and took only what was necessary for survival. Evidence of ancient shellfish harvests still exists today in the form of oyster and clam shell heaps (called middens) along the Estuarine shore and in some marshes.

Over several thousand years, these first settlers had little impact on the Estuarine environment. There were not many Indians, and the natural resources were many and varied. True, they did have some impact on the environment through clearing small areas of land for crops, such as corn, squash and beans, using slash and burn practices. However, careful use of crop rotation practices which allowed the fields to lie fallow in some years, and fertilization with fish and seaweed meant that it was possible to harvest the same fields for generations without exhausting the land. There was little erosion from these early cultivated lands. Primarily spring to fall residents, the Indians moved inland with the onset of winter.

** Estuary with a capital "E" refers to the entire Great Bay Estuarine system*

EUROPEAN SETTLEMENT

With the arrival of European settlers in the early 1600's, human activities became a major force shaping and altering the Estuarine environment. The early settlers found a region rich in natural resources: the waters teamed with fish (so many that they were used as fertilizer); oysters were abundant and clams so plentiful that they were fed to hogs; during the spring and fall migrations the skies were darkened with wildfowl; and deer, bear and other wild game abounded in the adjacent upland forests.

THE ARRIVAL OF THE GUNDALOW

The early settlers depended on the tidal rivers and estuarine waters for their livelihood and transportation. Around the early to mid 1600's, a simple square-ended flat bottomed vessel without a sail made its appearance. Known as "gundalows" these humble barge-like vessels had a major and lasting impact on the economic development of the region. This vessel, which was as commonplace then as trucks are today and seldom got a mention in history books, had a dramatic impact on the economic, military and cultural history of the Great Bay Estuary, and indeed New Hampshire itself. Without the gundalow, the development and growth of the towns around the Estuary would have been severely hampered.

The early gundalow was a simple 20-30 foot long, open barge-like craft, rarely rigged for sail, using poles for propulsion. In a video taped interview with NHF&G in 1991, Phil Johnson, a former Great Bay waterman and fisherman recalled that the early gundalow "...had a running board on the side so that they could pole and run along the boards. They would pole, run to the other end and pole, and so on. This was where the running boards of cars first got their names from". Over time, the gundalow acquired a fixed rudder and tiller, platforms or decks at either end, a cabin (known as a "cuddy") for living quarters and a simple square sail. By the late 1800's, the gundalow was more streamlined in shape and had a "lateen" or triangular sail. These later models were 60 feet or more in length.

The gundalow was a very utilitarian vessel, and this was the key to its success. Being flat bottomed, it could travel up almost any shallow river tributary as little as four feet deep, a depth impassable to ships. That there were few riverside wharves did not matter; the gundalow could come right up to the bank. Riverside storehouses were built with an overhanging upper storey for this purpose. The gundalow would

pull up to the bank beneath the upper storey, and goods were hauled directly into the storehouse. Despite their bulky and somewhat clumsy appearance, the gundalows were surprisingly easy to maneuver in the swift currents of the Piscataqua, and provided an extremely cheap and effective means of transportation. They were dependent on the tides, sailing upstream on the incoming tide and downstream on the outgoing tide. Under favorable conditions of wind and tide, the gundalow could pick up a fair speed, accomplishing the 25 mile trip from Portsmouth to Exeter in a little over two hours.

The variety of cargoes carried by the gundalows during their brief 200 year history demonstrate the evolution of an increasingly sophisticated economy in the towns bordering the Great Bay Estuary. The gundalows played an important role in shaping the region we know today. Much of the history of the Great Bay Estuary since the arrival of the European settlers up until the end of the 19th century is encapsulated in the typical gundalow cargoes of the day.

AGRICULTURAL & FISHING PRODUCTS

The earliest gundalow cargoes were agricultural and fishing products, such as salt hay, fish, lumber, salt and farm produce. Salt hay, used for horse and cattle fodder was a part of New England agriculture that had all but vanished by the turn of the end of the 19th century. Each fall, farmers brought their horses on the gundalows to the high marshes to harvest the salt grass at neap tide. The gundalow then transported the hay downriver on the rising tide. For local use, the cut hay was raked into beehive shaped stacks, and loaded onto staddles, a circle of wooden posts (still visible in some marshes today) that served to keep the hay high and dry. The farmers returned in winter when the marsh surface was frozen to transport the hay over land to barn storage. Much of the hay was transported via schooners to Boston where it provided fodder for the carthorses. It was also used as mulch for crops (especially strawberries) because the salt hay would not grow or sprout in the upland, and it was even shipped out for packing bananas being imported from other lands.

The Great Bay Estuary was a significant hay producing area in the region. "They loaded an awful lot on the Oyster River. The hay was the same as our automobile fuel today. Everything depends on transportation which in turn depends on fuel. New Hampshire salt hay provided the "fuel" for the horses and oxen pulling wagons along the cobblestone streets of Boston , so hay was the fuel for transportation in Boston. This is something in transportation that people lose sight of today." (Phil Johnson, 1991 interview with NHF&G).

A profitable fishing industry thrived in the Estuary through the first half of the 18th century. Salmon were particularly abundant in the Salmons Falls and Cocheco Rivers. A report by C.F. Jackson in 1944 cites a Portsmouth merchant recovering 1,000 tons of salmon in a single season in 1717. Salted alewives were sent to Boston, and exported to the West Indies. The wealth of fish harvested from the Estuary also included "cod and haddock.... bass, shad, mackerell, herring, blew-fish, alewives, pollock, ffrost fish, perch, fflounders, sturgeons, lumbs, ells, seales, salmon.... and all sorts of shellfish such as lobsters, crabs, cockles, clams, mussels, oysters etc." (From *A Biological Survey of Great Bay*, NH by C.F. Jackson, 1944). The gundalows transported the cured fish from the Estuarine waters downstream to Portsmouth for trade with other American coastal cities and for export to Canada, Spain, Portugal and the West Indies.

LUMBER

Lumber (mainly white pine and oak) was another important natural resource harvested from the shores of the Estuary. The water powered sawmills were located on the waterways, which facilitated easy export. By 1700, there were an estimated 90 sawmills along the Piscataqua River. The gundalows transported lumber from the riverside sawmills to local shipyards and to the waiting schooners and coastal ports for export and use elsewhere in the US.

However, the profitable sawmills had a down side. Sawdust from the sawmills presented an early estuarine pollution problem. For each 1,000 feet of lumber cut, approximately 40 bushels of sawdust were produced and disposed of in the Estuarine waters. Historical reports recall a thick layer of sawdust coating the mudflats at low tide. Sawdust smothered and destroyed finfish spawning beds and young fry. In 1750, a visiting merchant remarked that salmon weren't returning to the Piscataqua as much as in the past because of sawdust choking the waterways (Jackson, 1944). Portable sawmills still existed along the Estuarine tributaries as late as the 1950's.

SHIPBUILDING

Along with lumber, shipbuilding became a thriving business. By the mid 1700's, numerous sawmills and

shipyards dotted the banks of the Piscataqua River and the other tidal rivers flowing into the Estuary. The gundalows plied the tidal rivers with lumber and cordwood for shipbuilding operations at the local shipyards, including the Portsmouth Naval shipyard.

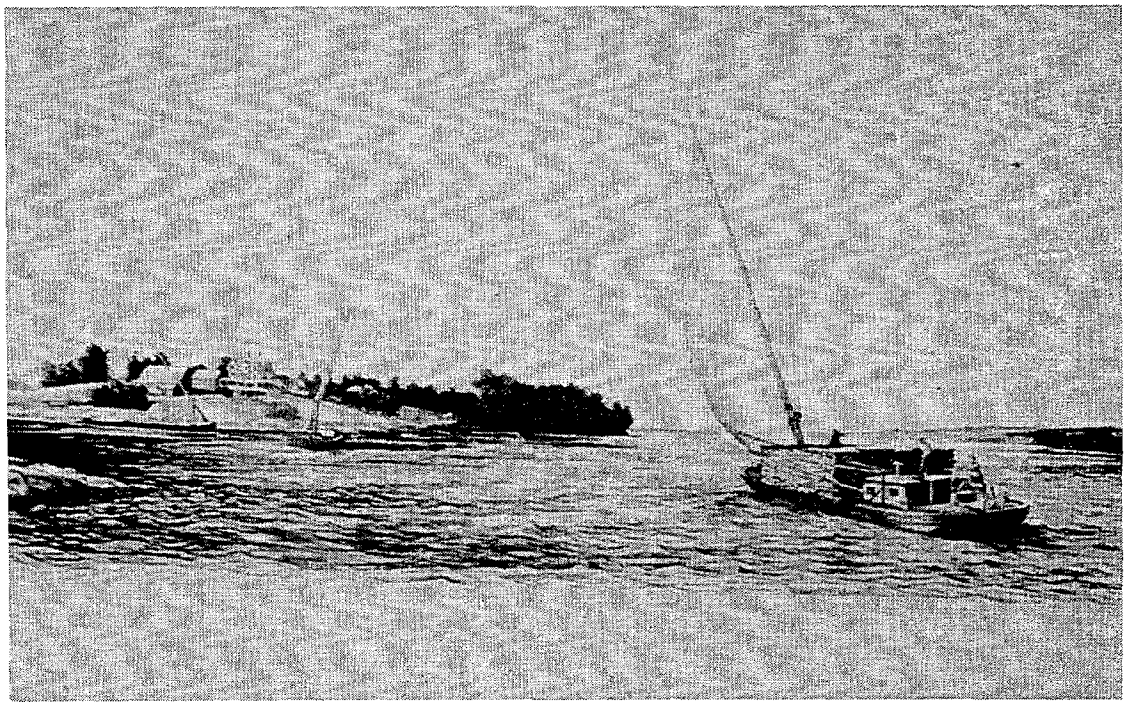
Shipbuilding at the Dover boatyards produced as many as six vessels a year during the 1800's. The shipbuilding industry and the ship and packet lines relied on the gundalows to support their many activities. Shipbuilding operations in turn spawned profitable businesses for carpenters, shipwrights and sailmakers, further stimulating the coastal economy.

Lumber and shipbuilding operations continued throughout the 200 years leading up to the Industrial Revolution. By the late 1800's, steam powered vessels built of steel replaced wooden sailing vessels. The shipyards were unable to compete with the cheaper building materials, and the shipbuilding industry declined.

Hill in Boston were built of the high quality Dover Point brick. The gundalows were instrumental in transporting bricks from the brickyards to the building sites and to the schooners for transport to Boston and other nearby centers. The brickyard kilns burned around 20-30,000 cords of wood a year, which represented many gundalow loads. However, since the clay was a limited resource, the Estuarine clay banks were eventually exhausted, closing down the brickyards. Extraction of the blue clay resulted in permanent modification to the Estuarine shoreline.

COTTON MILLS

During the Industrial Revolution, the red brick mill became a ubiquitous part of the Estuarine landscape. The major gundalow ports of Newmarket, Durham, Dover and Portsmouth contained some of the largest mills of their kind in the world. The cotton industry took hold in the early 1800's, with five mills built in Dover by 1827. Known as the Cocheco



BRICKYARDS

The blue marine clay found along the Estuary shores was found to be particularly suitable for brickmaking, spawning a major industry. At its peak in the late 1800's there were at least 43 brickyards, with the greatest number at Dover Point. These bricks were used locally in the construction of mills, factories and breweries, and also found a market throughout New England. Many homes on Beacon

Manufacturing Company, these cotton mills dominated Dover's economy for over 100 years. Dover was an extremely prosperous town during the cotton boom years. Gundalows brought up raw cotton, textile machinery, cordwood and coal to the factories, and transported the finished cloth downstream to the packets and ships.

A LUCRATIVE EXPORT BUSINESS

Sooner or later, the gundalows docked Portsmouth, at the mouth of the Piscataqua. In the early years Portsmouth's economy was based on fishing and pinemasting. Following the American Revolution, Portsmouth became a thriving export center in the region, being involved in lucrative export trade with the West Indies. Exported cargoes included pine lumber, dried fish and beef, while molasses, rum, sugar and cocoa were imported. The gundalow was a critical link in this maritime economy, transporting products from the riverside operations to the waiting ships, and bringing the imported products upstream to the Estuarine towns. Ironically, by the 19th century, the self sufficient farming and fishing community of the early days could no longer feed itself and had to import large quantities of flour, butter, corn and cheese. The gundalows transported these products as well.

THE GUNDALOW AND THE AMERICAN REVOLUTION

The gundalow played an important, but little known role during the colonial wars and the American Revolution. During the Revolution, gundalows were used to carry raiders to Fort Constitution and then transported gun powder back to the towns along the estuarine shoreline. In 1775, part of General Sullivan's plan to speed the defenses of Portsmouth was to use the gundalows to secure access between the Portsmouth side of the Piscataqua River and Pierce's Island. "... Sullivan explained "I immediately Collected a Number of Gondalows moored them head to stern and Laid pieces from one to the other & Plank across & Soon Compleated the Bridge". This pontoon bridge, connecting the island to the mainland, constituted the first link between the two points of land ..... The British never breached Sullivan's elaborate defenses during the war, thanks in part to the pontoon bridge, certainly one of the earliest in American Military History". (Excerpt from *The Piscataqua Gundalow* by R. Winslow).

THE END OF THE GUNDALOW ERA

The chartering of the Boston and Maine railroad in New Hampshire in 1835 signalled the beginning of the end of the gundalow era. The railroad not only took the gundalow's cargoes across a faster land based route, but also operated year-round. Gundalows could not operate during the winter months when much of the Estuary was iced over. By 1843, railroad lines served the five major gundalow ports. The construction of the railroad bridge across the Piscataqua at Dover Point (now the General John Sullivan Bridge), further undermined gundalow business, and posed a severe navigational hazard to the gundalows. During the last half of the 19th century, railroads, bridges, and steam-powered tugs increasingly displaced the gundalow. As the markets in salthay, cordwood, bricks, and cotton declined, the gundalow became a vessel without a cargo. By the turn of the century, the gundalow, so critical to the development of the economy of the region in the early days, had quietly disappeared from the Piscataqua region. After 1900, Capt. Edward H. Adams' (of Adams Point and the last of the gundalow captains) "Fanny M." was the only gundalow in operation,hauling coal to Exeter and supplies toNewmarket.

A CHANGING ECONOMY

With the advent of the Industrial Revolution, the economy of the towns around the Great Bay Estuary started moving from dependence on Estuarine resources to manufacturing and industry. The end of the gundalow era marked the final transition to a consumer based economy. Today, local communities are no longer dependent on the Estuary for economic survival and the dominant use of Estuarine waters today is recreational. In the 1930's, there was a move to dam Great Bay and make it into a recreational lake. This plan, which would have cut off tidal flow into Great Bay and devastated the ecology of the Estuary, fortunately never came to fruition. Popular recreational activities today include shellfishing, in particular oystering, waterfowl hunting and sailing. There is also still some limited commercial fishing in the Estuary, such as lobstering in Little Bay and the Piscataqua.

The publication "*The Piscataqua Gundalow: Workhorse for a Tidal Basin Empire*" By R. Winslow, 1983, was a source of information for this fact sheet, and is highly recommended (and interesting) reading.

This paper is funded by a grant from the National Oceanic and Atmospheric Administration through the N.H. Coastal Program. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its sub-agencies.

Copies of the Document Wetlands Evaluation and Policy Recommendations for the Town of Durham N.H. are available from The Office of State Planning Coastal Program, The Town of Durham Conservation Commission and the Wildlife and Wetlands Department of the Audubon Society of New Hampshire.

APPENDIX D

Seacoast
Science
Center

PRESS RELEASE

_X_ Release throughout the month of August.

Awcomin Marsh Tour

Weekend Dates: **Sun, 8/7 Sat, 8/20 Sun, 8/28**
Weekday Dates: **Wed, 8/3 Fri, 8/12 Wed, 8/17 Fri, 8/26 Wed, 8/31**
Time: **12 Noon OR 3:00 pm**
Place: **Meet at the SeaCoast Science Center**
Odiorne Point State Park in Rye
Phone: **(603) 436-8043**
Fee: **Free! Registration is required.**

Wetlands are wild and wonderful places. They perform a variety of ecological functions and are home to countless species. Come and explore the Awcomin Marsh with a naturalist Bernadette Heffernan, from the Seacoast Science Center. We'll compare an undisturbed marsh with a disturbed one and learn about the restoration work going on at Awcomin Marsh.

Join us for one of our weekend or weekend tours. Choose either a 12 Noon or 3:00 pm tour. Wear comfortable outdoor clothing and bring a pair of water-proof boots or old sneakers.This tour is free.Participants are to meet at SSC. From there we will shuttle over to Awcomin Marsh in Rye. Space is limited to 12. Be sure to register by calling us at (603) 436-8043.

The Awcomin Marsh Tour is supported by the NH Coastal Program of the NH Office of State Planning, and the Benjamin Allen Rowland Cultural and Environmental Fund of the Greater Piscataqua Community Foundation.

The Seacoast Science Center is a non-profit organization managed by the Audubon Society of New Hampshire under contract with the State of New Hampshire in affiliation with the Friends of Odiorne Point, Inc. and the University of New Hampshire Cooperative Extension/Sea Grant Program.

Seacoast
Science
Center

PRESS RELEASE

_X_ Release throughout the month of August.

Coastal Resources Tour

Weekend Date: **Saturday, 8/6**
Weekday Dates: **Friday, 8/5** **Wednesday, 8/10**
Friday, 8/19 **Wednesday, 8/24**
Time: **2:00 pm**
Place: **Seacoast Science Center**
Odiorne Point State Park in Rye
Phone: **(603) 436-8043**
Fee: **Free!**

Explore the coastal resources at Odiorne Point State Park with naturalist Bernadette Heffernan, from the Seacoast Science Center. We'll visit various habitats and discuss the coastal issues that effect their health and conservation. Learn about how these ecosystems are valuable resources to wildlife and humans alike.

Join us for our weekend tour on Saturday, August 6th. Tours will also be conducted on the following weekday dates: August 5th, August 10th, August 19th and August 24th. The tour will begin at 2:00 pm. Meet at the Seacoast Science Center and remember to wear comfortable outdoor clothing.

This tour is free. The Coastal Resource Walk is supported by the NH Coastal Program of the NH Office of State Planning, and the Benjamin Allen Rowland Cultural and Environmental Fund of the Greater Piscataqua Community Foundation.

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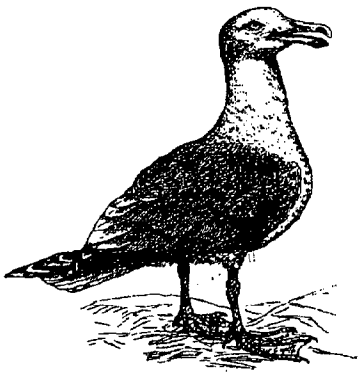


Seacoast Science Center

Seacoast Science Center
Odiorne Point State Park
PO Box 674
Rye, NH 03870
603-436-8043
603-433-2235 FAX

Seacoast Science Center Press Release

Release Dates: immediate through October 13, 1994

Phone: (603) 436-8043 **FAX:** (603) 433-2235

Center presents: ***Seacoast 2000***

The next millennium is only 6 years away. What will our seacoast resources be like then? *Seacoast 2000*, a series of five Thursday evening programs addresses challenging issues such as habitat destruction, marine pollution and fisheries decline. Join experts from the Seacoast region in lively discussion on the future of coastal issues.

More than just another lecture series, *Seacoast 2000* encourages participation. Background materials will be available to registrants prior to each program. This series and materials are free. Advance registration is required. For more information, or to register call (603) 436-8043.

Dates & Presenters:

September 15
Mr. Robert Burnett-Kurie
Educational Consultant
Fish Banks: Fisheries Resources & Management

September 22
Mr. Frank Richardson
New Hampshire Wetlands Bureau
Salt Marshes: Ecology & Restoration

September 29
Professor Janet Campbell
Ocean Process Analysis Laboratory, UNH
Gulf of Maine

October 6
Professor Rich Langan
Jackson Estuarine Lab,UNH
WaterQuality

October 13
Mr. Phil Colarusso
Water Management Div., EPA
Coastal Issues, Policy

Time: 7 pm - 9 pm

Place: Seacoast Science Center,Odiorne Point State Park,
Rye, New Hampshire

Seacoast 2000 is supported by the NH Coastal Program of the NH Office of State Planning, and the Benjamin Allen Rowland Cultural and Environmental Fund of the Greater Piscataqua Community Foundation.

Sail the World at SSC with BOC Oceanwatch

In September, off Charleston, South Carolina, thirty to forty sailboats will start a 27,000-mile race around the world. Although each boat will have only one person on board, the imaginations of thousands will accompany each skipper. Now in its fourth year, the BOC Challenge is an around-the-world, single-handed sailboat race held every four years. This year you can follow the race at the SSC.

Starting on Saturday, September 3 the Friends of Odiorne Point will be presenting the first of a ten part program called BOC Oceanwatch. Program participants will learn about every aspect of the race. Each will adopt a skipper and will follow that boat, as well as the other racers, as they proceed from Charleston to Cape Town, South Africa, on to Sydney, Australia, and Punta del Este, Uruguay, and return back to Charleston. Each program participant will keep a log, just as though they were racing too. The racers should complete their journey during April or May, 1995.

This year's race is especially exciting because Arnie Taylor, Marine Docent and FOOPs Board member Ann Taylor's son, will be sailing in this year's race! Arnie has been sailing since he was 7, and according to Ann, comes from a sailing family. Although she taught him how to sail, she never expected him to go this far—around the world! Arnie's boat, *Thursday's Child,* which looks "like no other boat you've ever seen" could be seen at Bow Street Dock at press time.

BOC Oceanwatch will be held every Saturday afternoon from September 3-November 5, 1-3 pm. Starting with the purpose of the race, participants will learn about the types of boats, supplies, emergency equipment, navigation, communications, expected and unexpected weather, even the skippers' special clothing. The program will also include information on the race's ports-of-call, the personal sacrifices of racers, as well as a bibliography.

After the first ten weeks, a monthly update will be held at the Center on the first Saturday of each month. Participants can track their skipper and race progress and watch videos taken throughout the race.

Participants will have the opportunity to build a model of an ocean racer under the guidance of an experienced model maker. At the end of the series, participants will have a good knowledge of the oceans and of the challenges that face a solo sailor.

BOC Oceanwatch and other Seasons of the Sea programs are designed for family participation. There is no cost for this program, but the number of participants will be limited. Please reserve your space; call the SSC at 436-8043.

Healthy Heart Day

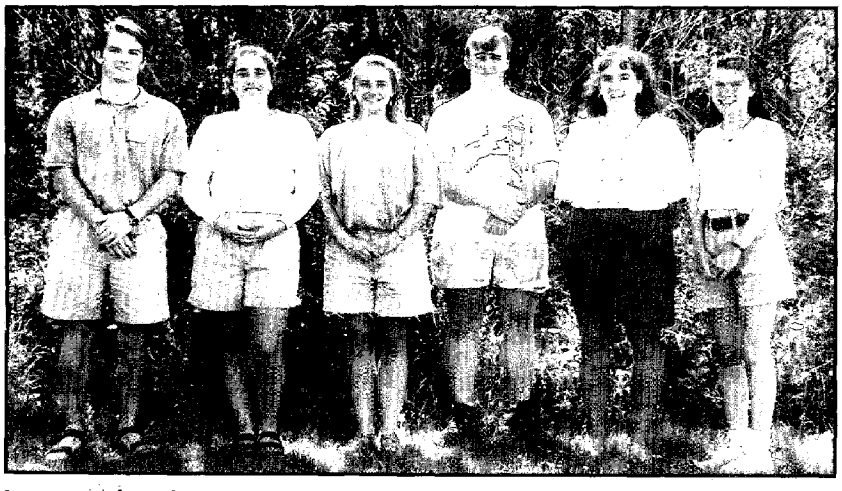
On Saturday, September 10, 1994, Cardiac Care Services at HCA Portsmouth Regional Hospital will be sponsoring a special program. "A Day in the Park for a Healthy Heart" will feature a presentation by walking expert and author, Robert Sweetgall, and designated walking trails for all levels of ability. Cardiac risk appraisals of cholesterol screening, literature, and healthy food samples will also be available. Watch your local papers for more information or you may call 433-4054.

Bird Programs and Seed Sale

The annual bird seed sale by the Seacoast Chapter of the Audubon Society of New Hampshire (ASNH) will be held at the Center 9 am-2 pm on Saturday, September 24. Having the sale in September means that you can stock up on seed in time to attract migrating birds.

Order forms will be available at the Center around September 1. In addition to the seed sale, there will be continuing programs on feeder use, and members of the Seacoast Chapter will be available to identify migrating hawks and other birds.

Bird feeders will be on sale, and a wide range of bird field guides, as well as other bird books, will be available at the Nature Store.



Interns on the Job

The Seacoast Science Center expanded its internship program this summer to include camp teaching, environmental education, and public programming interns in addition to its aquarist interns. Interns assist SSC with its programs and exhibits in exchange for the experience gained through their hard work. Pictured above are: Jason Drebitko, Camp Teaching; Perrin Cothran, Environmental Education; Jennifer Statile, Aquarist; Mike Dunnington, Aquarist; Traci Adams, Public Programming; and Tanya Ellsworth, Camp Teaching. Not pictured are Jon Leszcynski, Aquarist and Coastal Intern Bernie Heffernan. We are pleased to have such qualified interns on staff this summer. Welcome aboard!

Seasons of the Sea Weekend Programs

Come join in on weekend programs at the SSC. Designed for families, these programs range from slide shows to crafts to nature walks. The following gives you an overview of what to expect each month. Complete schedules are developed monthly and available at the Center front desk; be sure to pick one up the next time you visit.

August

Seacoast Garden Trail: August 6-7 (10am - 4pm)
Coastal Resource Walking Tour: August 6 (2pm)
Awcomin Marsh Tour: August 7, 13 and 28 (2pm)
Tidepool Tours: August 13-14 (noon), August 27 (11:30am) and August 28 (noon)
Binocular Clinic: August 13 (2-5pm)
Shorebird Decoy Carving Demo: August 20 (11am-5pm)
Fish Print T-shirts: August 21 (1-4pm) (registration required)
Book Signing: August 26 (7-8pm) Please RSVP.

September

BOC Oceanwatch: September 3-October 29, every Saturday (1-3pm)
Healthy Heart Day: September 10
Bird Seed Sale: September 24
Every Sunday there will be slide shows and walks on topics such as warblers, shells, and habitats.

Please call the Center at (603) 436-8043 for more information. Remember, there is something going on every weekend at SSC!

Volunteers

Volunteer Cards In

If you did not come to the party on the 22nd, your official SSC Volunteer card is waiting for you in the volunteer desk. We've put your name on the card, but you need to add the year you started volunteering. So far Charles Tallman leads the list as earliest volunteer; he started in 1968 with early plenary meetings with Parks Director Russell Tobey, about what the State should do with the Park.

For those of you who missed the party, join us next year for the fun, celebration, and calorie indulging only this event can provide! Special thanks go to Brandano's, Cafe Brioche, Ceres Bakery, Jeanie's Bakery, Shaw's, and Two Girls Catering for the superb food they provided.

The Seacoast Sun
Vol. 1 No. 2 August-September 1994
Editors: Wendy Lull, Dick McIntyre & Patricia Miller, with assistance from SSC Staff
Design and Production: PM Design

The *Seacoast Sun* is published regularly by the Seacoast Science Center at Odiorne Point State Park, which is solely responsible for its content.

The SSC is managed by the Audubon Society of New Hampshire under contract with the State of New Hampshire, in affiliation with the Friends of Odiorne Point, Inc. and the University of New Hampshire Cooperative Extension/Sea Grant Program.

The mission of the Seacoast Science Center (SSC) is to interpret coastal natural and cultural history through programs and exhibits. The SSC is open throughout the year; hours vary seasonally. Call (603) 463-8043 for program and daily schedules.

For SSC membership information, call (603) 436-8043.

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The Seacoast Sun

Notes and News from the Seacoast Science Center

August-September 1994

Artifacts Found in Park

Three artifacts from three of Odiorne's historic periods were brought to light by park visitors. A counterfeit coin from 1725, a ceramic sherd from the late 1800s, and a prehistoric pendant were brought to the Center staff this spring.

Justin Rossen, an elementary school student from Weare, NH, found the old coin during a tidepool trip with his class. According to Justin, "the coin was just sitting on a rock;" he uncovered it when he looked under some Knotted Wrack *(Ascophylum)*. Fortunately, Justin turned the coin over to his teacher, Marilyn Russell, who brought it to the staff.

Having these pieces discovered and turned in brings us glimpses of the different people who have utilized and occupied Odiorne Point through time.

Executive Director Wendy Lull turned to Strawbery Banke's Curatorial Assistant Rodney Rowland, for identification of this interesting artifact. Rodney sent her to Dolloff Coin Center in Portsmouth, for further verification. According to Dick Dolloff, the coin is a contemporary counterfeit French one écu. It is probably made of lead and was used between 1725-1775. At that time, counterfeit coins were in circulation for up to 50 years after the first real coins were issued. The coin is of significant historic interest, and will be studied further in late July by Professor David Switzer, who specializes in underwater archeology. As further information is available, it will be published in the *Sun*.

Mary Schilke of Merrimack, NH, turned in a piece of pottery, which was examined by Strawbery Banke Archeologists Mary Dupre and Martha Pinello. According to Pinello, the piece is of either European or American manufacture and is called whiteware. Whiteware was mass-produced after the 1870s; it is finer than earthenware, but not as delicate as porcelain. The patterns on the piece, especially the gilt edge, were most likely applied by hand.

The oldest of the three pieces, the pendant, was found 20 years ago by Alison Richard of Hampstead, NH. When her son came to Odiorne for a program, she brought the artifact to show to Lull.

According to Dupre, Pinello, and David Stewart-Smith of NH Division of Historic Resources, the piece is probably of the maritime archaic tradition, which makes it between 3,000 and 300 years old! Probably made of antler, the piece has incised markings on both sides and three small holes, one of which has a green stain on the rim, perhaps from copper or brass. This indicates that it could be less than 3,000 years old, or that it was recycled by later American Indians who used the piece with the metal that produced the stain. Further study is required to determine the pendant's age and material.

Having these pieces discovered and turned in brings us glimpses of the many different people who have utilized and occupied Odiorne Point through time. But all three archeologists stressed the importance of keeping artifacts you may discover "in context," meaning in their original location in the ground. A single artifact is only one tiny piece of a much bigger picture. Knowing exactly where a piece was found and the conditions of the location, such as whether it has been built on or washed away; and careful examination of whatever else may be seen in the nearby area, such as evidence of hearths, foundations, and possibly other artifacts, will add important clues to help fill in the picture.

According to Lull, if you find something that looks interesting in the park, the best approach is to carefully note its location and then contact a staff member. "This way we can keep the piece within its original context and consult with an archeologist. I hope that visitors would want to let us know about artifacts they have seen to help us better understand Odiorne's history. The things people might find here have little 'street value,' but considerable historic value. It is also important to know that because this is a State Park, whatever is found is the property of the State, and it is illegal to remove it from the park."

Together, these three new finds span Odiorne Point's cultural history, and will make an excellent contribution to our History exhibits. There is further work to be done to disclose all the stories they have to tell, but we thank Justin Rossen, Mary Schilke, and Alison Richard for their help in getting us started.

Cris Mera, SSC Program Naturalist, will be attending the Wetlands Resources course at the Shoals Marine Laboratory, from June 27-July 4. The Shoals Lab is on Appledore Island, Isles of Shoals.

Mera Receives Cottrell Scholarship

Cris Mera has been a Program Naturalist at the Seacoast Science Center since September of 1993. She recently received the Annette Cottrell Scholarship from the Friends of Odiorne Point to attend the Wetlands Resources course at the Shoals Marine Laboratory this spring. She received both her Bachelor of Science in Biology, with a concentration in animal physiology, and her Master's degree in science education from Cornell University.

This is the second year that support has been made available for an SSC naturalist to attend a course at the Shoals Marine Lab (SML). Last year a private donation allowed Senior Program Naturalist Beverly Shadley to attend the course Marine Biology for Teachers. The *Seacoast Sun* caught up with Cris recently to find out more about her exciting opportunity.

SS: Are you looking forward to going back to Appledore Island?

CM: Yes. I first visited the island when I took a course in 1991 called Adaptations of Marine

continued on page 2

Celebrate Odiorne Day a Booming Success

The kites started flying when families streamed into Odiorne Point State Park on June 18 to participate in "Celebrate Odiorne Day."

Offshore, sailboats drifted by, keeping a weather eye on the steamy fog lurking around Whaleback Lighthouse.

The annual celebration opened with a bang when the Eliot Independent Artillery, dressed in colonial militia uniforms, fired off a cannon marking the 50th anniversary of the test firing of the 16" guns that guarded Portsmouth Harbor during World War II. Malcolm Chase of Durham, safety officer of the local defense unit, recalled the test firing and how it shattered windows in the nearby Wentworth Hotel.

The weather at Odiorne was perfect, while inland, people sweltered in 95-degree sticky heat. Outside the Center, children crowded the UNH Marine Docent tables to assemble hand puppets and paint fish. Others sat in a circle with David Stewart-Smith, an American Indian scholar, to learn about the first occupants of New Hampshire's shores. Friends of Odiorne Point, sponsor of the celebration, staffed food tables and labored over hot coals to feed the crowds. Visitors came early and packed the tent to enjoy the rousing music of the 65-piece Seacoast Wind Ensemble.

It was a great day to spend at Odiorne, visiting exhibitor booths, relaxing before a video show inside the Center, viewing the new history exhibits, or riding around the park in a horse and buggy. The day concluded as 35 explorers rolled up their pant legs to follow SSC staff and docents to tidepool discoveries, while another group headed off to enjoy a two-hour history walk through the park.

Conrad Quinby

Noteworthy News

SSC Receives Two Grants

The Center has been awarded a grant from the Office of State Planning (OSP) New Hampshire Coastal Program, and the Greater Piscataqua Community Foundation (GPCF) for the development of new programs on coastal issues. This is the Center's fifth grant from OSP, and second from GPCF.

With this funding the program staff of the Science Center will develop four programs on coastal issues. These programs are: a guided tour of the restoration project at the Awcomin salt marsh, a resource comparison walking tour, a coastal issues school curriculum, and an evening lecture series.

According to Steve Miller, Program Director, "This project will give us the opportunity to update our information on recent coastal issues. The variety of program formats will enable us to reach adults, families and school children. By going on the marsh tour, adults will get a first-hand look at a leading marsh restoration project."

From just outside the Center, you can see how people put coastal resources to use. From fishing and yachting to commercial vessels and military use, you can see it all happening right off Odiorne Point. The Resource Walking Tour will discuss the implications of the activities they see as they walk along the coast.

We will also be revising the Coastal Issues Curriculum, first developed in the 1970s by Julia Steed-Mawson. The result will be a scripted slide program for school groups and teachers that will address the current "hot topics" along the coast. The original program was quite popular, but issues have changed a lot in twenty years. This slide program will also be appropriate for park visitors and the public.

In October, we will be offering an evening lecture series. Says Steve, "I'm very excited about the potential for this, because we have funding to bring in experts from all over coastal New England."

To help the staff get all these programs ready for summer, funding for an intern has also been obtained. In addition to support from OSP, funding has been received from the Greater Piscataqua Community Foundation for the intern's stipend.

For the second time the Center program staff will be working with members of the Wildlife Department, Audubon Society of New Hampshire, to develop other programs with support from OSP. Programs on local endangered species and the Great Bay will be developed for delivery at the Center starting late this summer. For more specific program schedules, call the Center at (603) 436-8043.

Center Receives Award of Merit

On Friday, June 10th, the International Lilac Society presented the Park and Center with its 1994 Award of Merit from Society Past President, and host of the Society's 1994 Annual Convention, Dr. Owen Rogers. Dr. Roger presented the plaque and a fine young purple lilac *CV Monge* to Center Executive Director Wendy Lull, who accepted on behalf of the Center. Members of the Society assisted in planting the lilac behind the Docent Bench on the North side of the building. The award was given to the Center for its educational programs and preservation of historic New Hampshire seacoast plants including the lilac. The International Lilac Society has over 500 members from around the world.

And if you wondered what happened to the Black Cherry by the Docent Bench, Park volunteers Charles and Louise Tallman have replaced the dying tree with a fine Red Maple. Thanks to their generosity and hard work, we will be able to enjoy the view from the bench in the shade of the tree in summer and the splendor of its color in the fall. Working with the Lilac Society, Louise and Charles timed the removal and planting of the trees with the planting of the new lilac. When Louise isn't planting trees, she is busy being a member of the Center Advisory Committee and the Board of the Friends of Odiorne Point.

Binocular Sale and Clinic

Whether you're birding, boating or just looking-out-to-see, a good set of binoculars makes all the difference. And the SSC Nature Store Binocular Sale makes a difference in how much binocular-power you can buy! Throughout August, you can save on binocs and spotting scopes by Bausch & Lomb and Nikon. See enclosed flyer for details. (Flyers for ASNH Seacoast Chapter members are being sent separately.)

To help you make a choice, Saturday, August 13 from 2-5 pm you can test binoculars and scopes outdoors—where you'll use them! Sales reps from Nikon and Bausch & Lomb will be on hand to answer questions and show off some of the best and newest optics available today.

Park Site for Not-So-Boring Study

Dr. Ruth D. Turner, malacologist at the Museum of Comparative Zoology at Harvard is conducting a field study to collect marine wood-boring organisms here. Along with several members of the Boston Malacological Club (BMC), Dr. Turner placed an experimental device in the water off Frost Point on June 25. The set-up consists of different types of wood suspended from an inner-tube. She hopes that the microscopic spawn of *Teredo* spp. molluscs and *Limnoria* spp. arthropods will settle out on the wood samples. Dr. Turner will be working with the staff during the summer, and will present the results during the October BMC shell show at the Center (see the next issue for details.)

Seacoast Garden Trail Benefits SSC

1994 marks the first year for the Seacoast Garden Trail, a fundraising project which will benefit the Seacoast Science Center. The Center was chosen to receive the proceeds because it fit all the requirements: it is regional in scope, is focused on nature, and is a non-profit organization.

The Trail will be comprised of flower and vegetable gardens planted by residents, children, businesses, and municipal properties. The gardens will be judged in July and open to the public on August 6-7, from 10am to 4pm. Trail maps and programs are free; there are discount coupons in the programs for those gardens which charge admission.

Gardens included in the tour include: the Fuller Gardens, Urban Forestry Center, Strawbery Banke, Prescott Park, the Rundlett-May House, the Langdon House, the Hamilton House, and the Moffatt-Ladd House. For more information call Rebecca Hushing at (603) 436-2732.

Book Signing

To celebrate the release of Odiorne's first illustrated walking guide, *Footprints in Time, A Walk Where New Hampshire Began,* a reception will be held at the Center on Friday, August 26 from 6-8 pm. At 6:00, authors Dick McIntyre and Howard Crosby will take you through portions of their book by leading two one-hour walks. Afterward they will be available to autograph books and answer questions during the reception. This is a great opportunity to experience Odiorne's history at its best, and pick up a copy of the book as well. Reservations are appreciated. Please sign up at the desk or call the Center at (603) 436-8043.

Mera Recieves Cottrell Scholarship *continued from page 1*

Organisms.The following summer I worked on the island as an engineer and as a lab assistant and the summer after that, I returned to work there once again. So I have been out there many times and think that the island is beautiful.

SS: What will you learn in this course?

CM: We will study coastal and freshwater wetlands including salt and freshwater marshes, ponds, and bogs. On the island there aren't many wetlands. There are a few depressions that are marsh-like but dry up when the weather gets warm. Therefore we will be doing most of our field work on the mainland. We will learn about the plants and animals that are unique to each type of wetland.

SS: Is it important to know about wetlands?

CM: I feel it is important to teach people about the value of wetlands. Most people think of a salt marsh as a place that smells and where mosquitoes live but what they may not know is that marshes are invaluable. For example, many types of fish use salt marshes as nurseries for their young. Marshes also act as a buffer between the ocean and the uplands. If a big storm hits the coast, the marsh will absorb most of the water and flooding of nearby residential areas can be avoided.

SS: Will there be new programs in the fall?

CM: It is important for people to understand the politics and issues that surround wetlands. I hope to learn more about this myself and to develop programs to educate visitors of the Science Center.

SS: Do you find that visitors are knowledgeable about wetlands?

CM: Many people don't know much about wetlands. They don't know what types of animals inhabit them or how important they are as an ecosystem. People need to understand that wetlands aren't a place that can be drained and built on: they need to exist.

The support from the Annette Cottrell Scholarship is a great opportunity for Cris and the SSC. The new programs Cris will be designing and implementing will supplement the coastal resource programs the staff is developing with a grant from the Office of State Planning (see above). Watch for these new programs in the upcoming monthly program fliers, available at the front desk.

Odiorne Point: A Natural Area Park

The area of Fort Dearborn east of Route 1A was deeded to the State of New Hampshire in 1961 to be used for "recreational purposes." For almost ten years it was held without a clear management focus. Prof. Albion Hodgdon, UNH Botanist, began to explore the plant communities of the park acreage. At a meeting of the N.H. Natural Areas Forum, he gave a description of the area as having an exceptional variety of plant habitats, from edge of the shore to upland forests. It was suggested that, as a State Park, it should therefore be preserved as a natural area, and that the designation of "recreation" could be compatible with environmental education.

Attending that same meeting was Annette Cottrell, representing the New England Wildflower Society. To urge the "Natural Area" status for Fort Dearborn, she met with Park Director Russell B. Tobey. He listened with interest to Annette's description of the range of natural features, and his response was, "Prove it." Annette met that challenge by compiling essays on Odiorne's natural and cultural history that are still a useful reference today. An important part of this initial park habitat compilation was the park plant list. In an extensive study, Dr. Clotilde Strauss explored and described each of the seven basic plant habitats. Specimens were gathered and mounted professionally for a herbarium collection.

Social history had not been contemplated originally, but discovery that Odiorne was the first settlement in New Hampshire in 1623 made the story of the people who lived here and how they used the land another unique feature of the park.

Land and Plants Change

In the years since the plant study was initiated, the upland areas of Odiorne have changed. At that time much of the area was at the half-way point between field and forest. Today, many plants that require sun have been lost to shade and crowding. Some of the invading woody species are sumac, poplar, alder buckthorn. Poison ivy is all too common. The Army is largely responsible for the bittersweet, planted as camouflage on the "bunkers."

A positive contribution to the current diversity are the cultivated plants persisting on the old estates. Samples of varieties have been propagated and used in the perennial bed at the SSC. Wildflowers also add their attractive color and form. Through the summer we can enjoy the sparkle of Deptford Pink along the trails. A related perennial, Maiden Pink, has been put into the bed, as well as Canadian Burnet. This plant was was introduced to the park in the gravel used for the parking area, and has beautiful foliage and five foot high candle-like stalks of white fuzz. A favorite miniature is the Red Sand Spurrey that borders sandy trails. Other plants underfoot may have beautiful form, such as Carpetweed.

A recent new discovery is the Pig Sty Daisy that grows in the center of the driveway circle and blooms between mowings. Surprise guests to the flower bed are the Thin Leaf Sunflower, providing welcome summer color, and wild Mint.

It is important to identify and protect the special plants of the park. The Heritage Garden has had rescue and maintenance since 1975; you can view the bulbs that bloom in Spring and the old-fashioned roses late in June. Throughout the park, the fine old apple trees are being adopted for care, and look for the rare Mountain Mint with its blue-gray bloom next to the bike trail, south of the entrance.

The concept of Odiorne as a "Natural Area" did not start with just tidepools—it started with the variety of plant habitats. As a couple from Manchester who walk the park weekly expressed, "Where else do you have so much natural variety to see?"

Louise Tallman

WALLIS SANDS LIFE SAVING CREW IN 1891

Front row, left to right—Capt. Selden F. Wells, Walter Rand, John Berry, Orville Varrell. Second row, left to right, George O. Remick, No. 1 surfman, William Odiorne and William Randall. Only two of the group are now living. Walter Rand resides in Massachusetts and William Randall at Rye Harbor. Captain Wells was well known in the old Life Saving Service. He was stationed at the Jerry's Point station at New Castle and in September, 1890, went to the Wallis Sands station when that was placed in commission.

Odiorne Point Plays Part in the Lifesaving Service

The Lifesaving Service began in 1848, when an amendment to the Lighthouse bill secured an appropriation of $10,000 from the Congress. This was to provide surf boats, rockets, carronades, and other necessary apparatus for the better preservation of life and property from shipwrecks on the coast of New Jersey.

The service grew, and in 1888, the government attempted to buy land for a lifesaving station at Wallis Sands, just south of Odiorne Point. Not being able to buy land that year, the Lifesaving Service made an arrangement with Mr. Cyrus Eastman of Odiorne Point to use his stable to store their lifesaving apparatus and gun. This would keep the equipment readily available should a wreck occur between Odiorne Point and Rye Harbor.

The shores were constantly patrolled, no matter what the weather... the patrol from Wallis Sands was sometimes prevented from reaching Odiorne Point because of seas breaking over the path.

Eventually land for the lifesaving station was acquired and at midnight on August 31, 1890, the Wallis Sands Lifesaving Station was opened. The man in charge of the station was called a keeper and under him were six surfmen making up the lifeboat crew. The Wallis Sands Lifesaving Station was a 1½ story building with space inside for the crew to eat, work and sleep. The equipment housed at the station was the surf-boat, beach cart, Lyle gun, breeches-buoy, hawsers, hauling lines, sand anchors, and many other items.

The men at the station were on duty ten months of the year. With the exception of the keeper they were off (without pay) during June and July. When on duty, their days were spent drilling in the various methods of lifesaving and in maintaining their building and apparatus. At night the shores were constantly patrolled, no matter what the weather. It is reported by Mr. Ralph Brown that the patrol from Wallis Sands was sometimes prevented from reaching Odiorne Point because of seas breaking over the path in the vicinity of the Drowned Forest. The night hours were divided into three watches. At the beginning of each watch two men set out from the station on patrol duty going in opposite directions along the shore until they met men from the adjacent stations. Upon meeting, tokens were exchanged as proof that the patrols had been faithfully executed. In 1894, the government bought a piece of land at Odiorne Point from Mr. Eastman for the purpose of erecting a small lifesaving substation to store a gun, lifeline and other necessary equipment should a ship be in distress off of the Point. This building became the northern end of the beach patrol from the Wallis Sands station.

According to Mr. Brown, the patrol from Wallis Sands carried a time clock into which they inserted a key located at the Odiorne Point substation. The key caused a mark to be made on the paper inside the clock which noting the time.

There were four Lifesaving Stations along the short New Hampshire coast. They were located at Jerry's Point on New Castle Island, Wallis Sands, Straws Point, and Hampton Beach. In 1915, the Lifesaving Service became a part of the U.S. Coast Guard. The Wallis Sands station was discontinued on April 15, 1939.

This article is an overview of the Seacoast Survivors flip book exhibit which features photographs and illustrations of the men, equipment, and locations listed here. Plan some extra time for this exhibit the next time you visit the Center.

The History Corner is prepared by the Friends of Odiorne Point History Committee, and highlights aspects of Odiorne Point history. Should you discover inaccuracies, have additional information, or possess photographs that you would like to share, please call Howard Crosby at 431-5936.

A Reminder

If you want to keep up with the Seacoast Science Center by getting the *Sun*, remember to send in your SSC membership form. If you did not receive a membership application in the mail, you can pick one up at the front desk the next time you come in, or call us at (603) 436-8043.

article from *Foster's Daily Democrat*, August 10, 1994

Naturalist to lead tours in August at Seacoast Science Center in Rye

RYE – Special programs are running throughout the month of August at Seacoast Science Center, Odiorne Point State Park.

Visitors are invited to join naturalist Bernadette Heffernan who will lead the Awcomin Marsh and Coatal Resources Tours.

On the Awcomin Marsh Tour, an undisturbed marsh will be compared with a disturbed one. Participants will learn about the restoration work going on at this site. Wetlands perform a variety of ecological functions and are home to countless species.

This tour is free. Participants meet at SSC and from there are shuttled over to Awcomin Marsh in Rye. Space is limited to 12. Register by calling 436-8043.

The Awcomin Marsh Tour will be conducted at noon or 3 p.m. on the following dates: Aug. 12, 17, 20, 26, 28 and 31.

The Coastal Resources Tour will explore the coastal resources at Odiorne Point State Park. Participants will visit various habitats and discuss the coastal issues that affect their health and conservation and learn about how these ecosystems are valuable resources to wildlife and humans alike. This free tour will be conducted on Aug. 10, 19 and 24. The tour will begin at 2 p.m. and last approximately an hour. Participants meet at SSC.

The tours are supported by the New Hampshire Coastal Program of the New Hampshire Office of State Planning and Benjamin Allen Rowland Cultural and Environmental Fund of the Greater Piscataqua Community Foundation.

Naturalist Bernadette Heffernan will lead the Awcomin Marsh and Coastal Resources Tours at Seacoast Science Center, Odiorne State Park in Rye, throughout the month of August.

Programs & Education

Weekend Program Highlights June-July

SATURDAY	SUNDAY
6/3 **BOC Wrap Up** 1-3pm Join us as we conclude the series on the BOC Challenge: the around-the-world solo sailing race. **National Trail Day** 9am-2pm Make a difference in the park. Join us for trail maintenance and clean-up. Additional saws and tree-trimming tools would be helpful. Wear your boots and bring work gloves. Lunch and T-shirts will be provided for those participating in the effort. Please call to sign up for work teams. **Sponsored by Eastern Mountain Sports.**	**6/4** **Adopt a Tree** 2pm Part of understanding nature is learning how to make critical observations of the environment. Children will take a guided walk to learn about nature and choose a tree they will observe throughout the summer. **Art Show** The Seacoast Art Association opens their monthly Art Exhibition. **Don't forget the Seacoast Garden Trail!** To enter your garden, pick up entry blanks at SSC.
6/10 **Tidepool** 1, 2, &3pm Explore Odiorne's dynamic tidepools with an SSC naturalist. Take advantage of the low tide to see what is happening on our shore. Families welcome. **This is a Stick-Up!** 10am Dave Dupee, a seasoned birder and craftsman, leads this program on shorebird decoys or "stick-ups." Dave will demonstrate the art of painting shorebird decoys along with the history of their use.	**6/11** **Coastal Resources Tour** noon Explore Odiorne's natural habitats and learn about their value to wildlife and human beings. **Awcomin Marsh Tour** 2pm Learn about Salt Marsh restoration. Call to sign up or for more information. **The Awcomin Marsh and Coastal Resources Tours are sponsored by the Office of State Planning.**
6/17 **Wildflowers and Watercolors** 10am Learn to paint wildflowers with Sylvia Jones. Bring paints, brushes, hat and a bag lunch. Class size is limited. $3 charge for paper. Call to reserve a place. **A Walk Where New Hampshire Began** 2pm From the first NH settlement to farms, estates and forts, Odiorne is rich in history. Dick MacIntyre and Stephen Miller bring the past to life again in this walk around Odiorne Point! **Concert and Clam Bake-by-the-Sea** 5:30-10pm A wonderful evening is planned for this fund raising event. Ad[illegible] only. Call to receive an invitation.	**6/18** **Fish Print T-shirts** 1, 2, & 3pm Design and make your own colorful T-shirt. $5 for children/$7 for adults. Call the sign up for this popular program. **Coastal Resources Tour** noon Explore Odiorne's natural habitats and learn about their value to wildlife and human beings. **The Coastal Resources Tour is sponsored by the Office of State Planning.**
6/24 **Tidepooling** 2pm Explore Odiorne's dynamic tidepools with an SSC naturalis[illegible]e advantage of the low tide to see what is happening on our shore. Families welcome.	**6/25** **Toobers and Zats** 2pm Bring your imagination to life using soft sculpture materials. Kids will love t[illegible]ands on activity. Please call to reserve a place.
7/1 **Art in Nature** 1-4pm Explore the impact of spirals on our everyday lives. Join us for an afternoon of discovery and instruction in sculpture, drawing, watercolors, geology, and marine life. The program is supported in part by a grant from the NH State Council on the Arts and the National Endowment for the Arts.	**7/2** **Folklore and Medicinal Uses of Wildflowers** 2pm Learn where the names of wildflowers originated and why, and how they continue to be important in society.
7/8 **This is a Stick-Up!** 10am Dave Dupee, a seasoned birder and craftsman, leads this program on shorebird decoys or "stick-ups." Dave will demonstrate the art of painting shorebird decoys along with the history of their use.	**7/9** **Rhythm and Strings** 2pm The Dulcimer and rhythm instruments are part of our musical history. Join "Patches" as she goes back in time and tells their story. Be part of the music as you sing and play along. $2 charge. Please call to reserve a space.
7/15 **Seacoast Garden Trail** Take part in this Seacoast-wide event. Odiorne's Heritage Gardens will be featured as one of the many gardens along the coast. Follow the trail to tour many splendid private gardens throughout the Seacoast. **Wildflowers and Watercolors** 10am Learn to paint wildflowers with Sylvia Jones. Bring paints, brushes, hat and a bag lunch. Class size is limited. $3 charge for paper. Call to reserve a place.	**7/16** **Seacoast Garden Trail** Take part in this Seacoast-wide event. Odiorne's Heritage Gardens will be featured as one of the many gardens along the coast. Follow the trail to tour many splendid private gardens throughout the Seacoast.
7/22 **Nature Walk** 2pm Explore the uplands and the life that calls this area home. Plan for a long walk and beautiful views.	**7/23** **Natural Writing and Art** 2pm Lindsay Barret George, author and artist of children's books about nature, tells her story and provides inspiration and a wonderful outlook into animals and their lives. Please call to reserve your place.
7/29 **A Walk Where New Hampshire Began** 2pm From the first NH settlement to farms, estates, and forts, Odiorne is rich in history. Dick MacIntyre and Stephen Miller bring the past to life in this walk around Odiorne Point!	**7/30** **This is a Stick-Up!** 10am Dave Dupee, a seasoned birder and craftsman, leads this program on shorebird decoys or "stick-ups." Dave will demonstrate the art of painting shorebird decoys along with the history of their use.

This is only a taste of SSC programming! Call 603-436-8043 or pick up a flyer at the SSC front desk for more details. Programs are scheduled from noon-3pm each weekend and will run daily starting in July. Unless noted otherwise, the programs are free to SSC members. Please support the SSC by your donation or membership. Thank you!

EDALHAB Is Coming!

EDALHAB (Engineering Design and Analysis Laboratory HABitat) is an underwater habitat that was designed and built by seven undergraduate engineering students at the University of New Hampshire in 1968. This habitat allowed divers to live at sites from 30 to 50 feet under water for extended periods of time. In a project spearheaded by the Friends of Odiorne Point, with enthusiastic cooperation from the Portsmouth Naval Shipyard, EDALHAB is now being renovated. It will soon be on its way to Odiorne Point State Park and will be sited outside the Center.

EDALHAB will become the centerpiece of the ongoing marine exploration programs at the Center. Program Director Steve Miller was part of a UNH research team last summer which spent ten days living in the NOAA Aquarius Habitat off Key Largo, Florida. Steve has been using that experience to develop new and exciting programs. The Center hopes the EDALHAB will "strike a spark" for young and old visitors alike, and interest them in further study of the undersea world.

Rye Middle School's Invention Convention

On April 11, Ms. Ellwood's eighth grade science class at Rye Middle School held its first Invention Convention. Eighteen student teams put the laws of physics to work designing Rube Goldbergesque machines that put toothpaste on a tooth brush. The teams competed for three prizes (points towards their final grade). The entire school assembled for the final demonstration and judging of the 18 machines.

Each machine was rated according to how well it met prescribed criteria including size, number of working elements used (e.g. lever, inclined plane, screw) as well as creativity and whether the machines worked or not. Center Executive Director Wendy Lull and Visitor Services Director Peter Lareau were among the 10 judges for this competition. According to Lull, "A lot of thought and work went into each machine. The students used a remarkable range of materials, from the chemical reaction of baking soda and vinegar (creates quite an exuberant foam) to a golf ball return; from a fan to move a sail boat that pushed a lever, to a weight falling on scissor handles to cut a string. The ingenuity was refreshing and fun. What a great way to really find out how the laws of physics can really be used."

The Seacoast Sun

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Seacoast Science Center

The mission of the Seacoast Science Center (SSC) is to interpret coastal natural and cultural history through programs and exhibits. The SSC is open throughout the year; hours vary seasonally. Call (603) 463-8043 for program and daily schedules.

For SSC membership information, call (603) 436-8043.

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The Seacoast Sun

Notes and News from the Seacoast Science Center

June-July 1995

SSC Legislation Pending

Of the two bills to support the Center, one met a predictable fate, and the other became surprisingly dramatic. The bill requesting $400,000 for the Center building (SB 72-FN-A) was not approved by Senate Public Affairs Committee. According to Center Executive Director Wendy Lull, given the State's current fiscal condition, SB-72's failure was no surprise and the Center is likely to try again.

Passing this bill will ensure a healthy Seacoast Science Center.
—Rep. Howard Dickinson

However, what happened to SB 91-FN (to increase the park entrance fee to support SSC) was unexpected. On April 4, supportive testimony for the bill was given to the House Resource, Recreation and Development Committee (RRDC) by Bill Bartlett, Commissioner of the Dept. of Resources and Economic Development; Richard McLeod, Acting Director of the Division of Parks; Senator Burt Cohen (D–New Castle); Representative Jane Langley (R–Rye); Representative Martha Fuller Clark (D–Portsmouth); and Richard Moore, Development Director, Audubon Society of New Hampshire (ASNH). Testimony against the bill was given by Representative Warren Goddard (R–Portsmouth).

After the bill was reviewed in subcommittee, the RRDC passed the bill, with a minor amendment. The amended bill made a quick trip back to the Senate for approval, and was voted on the House floor May 2. No one expected a floor fight.

But they were wrong. A vigorous 45 minute debate about how to fund the Center followed. Some saw the fee as a tax, others felt the Center should be funded through a General Fund appropriation. Although supported by both the Republican and Democratic leadership, SB-91 lost a roll call vote by three votes. Rep. Neal Kurk (R-Weare) moved the bill inexpedient to legislate which would have killed it for two years. However, an eleventh hour motion to table the bill by Minority Leader, Rick Trombly (D-Boscawen) saved SB-91.

The next day the RRDC amended the bill authorizing ASNH to collect up to $1, as long as they had the Center management contract. During the May 9 House session, Dickinson moved to take the bill off the table, and it passed with a resounding voice vote. It then went to the House Finance Committee to approve the amendment.

It was expected to receive Finance's approval at press time. It then goes back to the House. Before it can get to the Governor, it needs to return to the Chair of the originating Senate Fish, Game and Recreation Committee. If approved, it then goes to the Governor who can have 5 days to sign or veto it in five days. If he does not sign it in five days, it becomes law. All indications look positive...but we've heard that before!

Indian Artifact Mystery Part II

In the last issue, UNH student Jason Drebitko reported on his research of a collection of projectile points which had been donated to the Center by Betsy Baybut of New Castle. His research has taken some interesting turns. Fortunately Jason will be at the Center teaching Safari this summer, and will be continuing his investigation on the collection. Updates will be published as new information is unearthed.

When I left off in the last issue of the *Sun*, I had made arrangements to meet with Strawbery Banke Archeologist Martha Pinello to see if she could offer any information as to the artifact collection's context. This remained the most significant factor in my research of the projectile points. If I wanted to investigate the collection's relevance to the Seacoast region, I still needed to verify who collected the points, and exactly where the points were found.

On a Thursday afternoon, I met with Strawbery Banke Archeologists Martha Pinello and Mary Dupré, and Carl Crossman, Senior Research Fellow, to discuss the collection. First, I wanted to know about the excavations that Strawbery Banke had done at the Wentworth Coolidge Mansion. Pinello stated that the purpose of the excavations was to look for the Wentworth's formal gardens. She mentioned that a variety of prehistoric artifacts were unearthed, including one projectile point. Since only one point was found, I began to question the idea that all 62 of the points came from the Wentworth Coolidge Mansion area.

Next, I needed to know why I couldn't get in touch with Betsy Baybut. Crossman mentioned that Betsy often spent the winters elsewhere. This explained my unanswered calls and letters. I would have to wait until Spring to get in touch with her.

I decided to check back with Dr. Robert Goodby at the University of New Hampshire. Goodby was working on verifying the typology of the points by taking quantitative measurements and examining the materials that were used to fashion the points. He will be attempting to draw some conclusions about the collection's context from this examination.

continued on page 2

Beverly Shadley was recently promoted to Educational Program Coordinator. Photo by Tim Kerwin.

Keeping up with Beverly Shadley

Beverly Shadley was the third person hired to work at the Center in 1992. As the Center evolved and grew, so did her responsibilities. The *Sun* caught up with Bev between phone calls to camp parents, summer staff, teaching volunteers and the Gulf of Maine Secretariat.

Sun: When did you first come to Odiorne Point?

BS: In 1990, when I was a student in UNH's environmental education course, LMT 743. We were responsible for opening the Russell B. Tobey Visitor Center (RBTVC) for the upcoming season, so we did everything from building exhibits, getting the tanks up and seawater running, and cleaning, to finding grant money as well as teaching.

Sun: Was this your first exposure to marine science?

BS: No, I had spent two summers working on a whale watch boat out of Provincetown, MA. As a sophomore, I worked for Dr. Fred Short as a research assistant at UNH's Jackson Estuarine Lab. In the summer of my senior year, I accepted the seasonal naturalist position at Odiorne, funded by the Audubon Society of New Hampshire (ASNH). Although my work was essentially a continuation of LMT 743, I dealt with visitors more and helped with the Seasons of the Sea lecture series. When the visitor center closed for the fall, I took a position as a graduate teaching intern at the New Jersey School of Conservation (NJSOC). There I learned more about upland environments, and how to teach field programs without an intertidal zone. I also learned how much I missed marine habitats.

Sun: Was there much difference between the RBTVC and NJSOC?

BS: Yes! The NJSOC was a much older, larger, year-round facility. At RBTVC we taught only two school day-programs, compared to NJSOC with about 50 over-night school programs. It was fun; NJSOC had an established programming foundation with well-honed lesson plans, so I learned a lot about how environmental courses should be done.

Sun: What did you do after the internship?

BS: I went to work at the Chewonki Foundation in

continued on page 2

Noteworthy News

On April 22, 1995, members of the Odiorne family dedicated two park benches in the park in honor of John and Mary Odiorne, who settled here in 1660. The benches were constructed by Parks employees, using oak from Nancy Condon's woods. Nancy hopes that others will be inspired to contribute benches to the park so that visitors can enjoy the coastal views so loved by her late mother and 12 generations of Odiornes. Here the Odiornes "give" the benches to the park. Left to right: Wendy Lull, SSC Executive Director; Tom Mattson, Superintendent of Parks, Seacoast Region; Rich McLeod, Acting Director, NH Div. of Parks; Gail MacGregor; Barbara Kerr; Cynthia Carone; Nancy Odiorne Condon; and Barbara MacGregor. Photo by Neil Gallagher.

Spring Clambake-By-The-Sea

Clambake-by-the-Sea

Remember the first Annual Clambake-By-The-Sea is June 17th. This Friends of Odiorne Point fundraising event supports children's programming at the Center. The Seacoast Wind Ensemble will be playing from 5:30-7pm, followed by the clambake. A raffle for movies, related items and trips will be on-going. Tickets are $37.50/person. For ticket and raffle information, call the Center at (603) 436-8043.

Our New Address

No, we haven't moved, but we have outgrown our post office box! Thanks to the patient efforts of volunteers Dick MacIntyre and Stephen Miller, our new mailbox is installed and we have a new mailing address. Although we will continue to keep the post office box through the summer, mail is being delivered to the new mailbox, so please note our new address!

Seacoast Science Center
570 Ocean Boulevard
Rye, NH 03870

SSC Wins First Art Grant

Art and science will come together during the week of June 26, thanks to a grant awarded to the Center by the New Hampshire State Council on the Arts and the National Endowment for Arts. Artist and Center staff member Joyce Zarins will lead a multi-media art project with a fellow artist, sculptor Mark Ragonese. The project links the artistic and scientific investigation and interpretation of the spiral. Using natural materials, the artists will create a spontaneous work—a giant horizontal spiral using the rocks from the shore. The opportunity to participate in building and then walking through the sculpture makes this art form accessible and engaging for everyone.

To compliment the main project, sea kayakers from Adventure Learning and other local kayaking groups will create a spiral in the sea. Students in SSC's June Safari session (K-5) will further explore the concept of the spiral through art, science, and performance projects.

This is the first artistic grant the Center has applied for and received. Zarins wrote it during her winter hiatus from working at the Center. Members, volunteers, and Nature Store mavins know her work: she led the art workshop during last November's Volunteer Conference, and painted the marine still-life pieces reproduced in the Center's natural notecard series. You can meet Joyce on Tuesday when she works in the Nature Store. It is a tribute to the Center that she put so much personal effort into developing the spiral project concept as well as researching and writing the grant. The next time you see her, be sure to give her a special thank you!

Keeping Up With Beverly *continued from page 1*

Maine. Their program focused on outdoor experiential environmental education, like rope courses, hiking and canoeing. I also co-led their nature camp program. After that, I came back to Odiorne.

Sun: How did you manage that?

BS: I knew I would be moving back to the area to get married, so I kept tabs on the development of the new SSC. Fortunately, while I worked as ASNH's Seasonal Naturalist my boss was Jeff Schwartz, who was overseeing opening the Center—including hiring. I was in the right place at the right time.

Sun: What were the early days of the Center like?

BS: Crazy! We were starting from scratch. We had a strong volunteer base plus school and summer programs, as well as ASNH's camp format to build upon. But other than the volunteers and me, the entire staff was brand new. We had four weeks to prepare lesson plans and materials for our first winter camp. All this without furniture, a photocopier, program supplies, or a registration system in place. But we did it! And that summarizes my first year here; shooting from the hip and trial-and-error. After that I was promoted to Senior Program Naturalist.

Sun: What changed with the promotion?

BS: The biggest change was being assigned the camp programs. That meant making sure that these programs continued to grow and improve while teaching, overseeing budgets, hiring and supervising a summer staff which now numbers 13. I'm pleased that the camps have become so successful; last year Safari booked 100% with a waiting list.

Sun: You have made some significant additions to the Safari program this year.

BS: One change is the addition of a 5th session for the K-5 program. We found that most summer programs ended too soon for working parents. But the change I am very excited about is our brand new Steward Session for children in grades 6-9. It gets students out into the field working with environmental professionals. This accomplishes three things: it allows the students to actually experience the work itself; it exposes them to environmental careers; and most importantly, it shows them that they have the power to make positive environmental changes.

Sun: But you do much more than camp. Tell us about your other projects.

BS: Although I still teach, I spend a lot of time driving a desk. Especially since I received the grant from the Gulf of Maine Council on the Marine Environment (see *Sun* Vol. 2, No. 2).

Sun: You certainly have a lot on your plate.

BS: All of us do; fortunately, I have had some work relief. John Skafidas has taken on the volunteer responsibilities (see *Sun* Vol. 2, No. 2). Additionally, our bumper crop of teaching volunteers and non-staff naturalists who Steve Miller has recruited will carry a tremendous part of the teaching load.

Sun: What's on deck for the upcoming year?

BS: As part of the grant, I am helping to organize an international Gulf conference for marine educators. For me this is another learning experience and opportunity to grow professionally. Opportunities like this, and tackling new projects, are what keeps the Center so exciting for me.

Artifact Mystery Part II *continued from page 1*

On April 7th, I received word from SSC Executive Director Wendy Lull that she had received a letter from Mr. Ralph Brown indicating that he may be able to help with my research of the collection, and she suggested that I talk to him. Mr. Brown had worked for the Coolidges for many years and knew the family and mansion grounds very well. I contacted him, and soon after had the pleasure of spending an afternoon listening to his wonderful stories and historical recollections. "If there were 9,000 year old artifacts down by the boat launch, I would have found them," stated Mr. Brown. He continued by telling of his days at the Mansion with near perfect recollection. "Each year, rough storms would wash the gravel that lined the Coolidge's boat ramp out to the harbor, and each year the Coolidges would have gravel brought in from the pits next to the South Street Cemetery in Portsmouth. We would fill the boat ramp up about three inches with gravel and rake it all through," stated Mr. Brown. "If there was anything near the boat ramp, we would have found it."

Mr. Brown shared great stories with me that afternoon, and was able to help me in researching the context of the collection. As I was getting ready to walk out of the door of his farmhouse, he exclaimed, "One thing I can say for sure is that there is no way all 62 of those points could have been found at the boat slip. There is no way!"

I will be continuing my research on the artifact collection through the summer. Be sure to look for future developments in upcoming issues of the *Sun*.

— Jason Drebitko

The History Corner

A Colony in Transition: Neale Departs

Odiorne's history during the settlement years must be pieced together from several sources, which sometimes differ widely. When preparing the Seacoast Science Center history exhibits, the line most often repeated from source to source, or the interpretation which seemed most reasonable, was chosen by the exhibit committee and now by the writer of these articles.

— Dick MacIntyre

By 1632, Captain Walter Neale felt confident in leaving the Piscataqua settlements in the hands of his aides and heading inland with Henry Jocelyn and Darby Field. However, the search for the riches of the "Crystal Hills" proved fruitless and Neale returned to Rendezvous.

Late in November of 1632, according to one historian, a pirate bolder than most raided the Piscataqua fishery, destroying several small vessels. "Four pinnaces and shallops, with forty men aboard" sailed in search of this pirate, Dixy Bull. They "gave chase to eastward, but were forced to lay windbound in Pemaquid for nearly three weeks" and failed to capture the attackers.

As a reaction to this raid or simply because of the growing importance of the colony, "foure grete guns were given by a merchant of London for the defence of the river...." Captains Neale and Wiggin made "a choise of the most convenient place in the said river to make a fortefecatyon for the defence thereof,... and they gave it the name of Fortpoynt, and allotted it so far backe into the island (New Castle) about a bow-shoat [shot] to a grete high rocke where [illegible] was intended in time to set the principalle fort." Later to be known as Fort William and Mary and Fort Constitution, this fortified elevation was always to "command a place in New Hampshire's budget and in the defense of the harbor."

In a letter in June of 1634, John Winter, an agent on Richmond's Island in Maine, wrote: "Heare hath not bin to this Iland one Indian all these yeare, nor to the maine to our house, that brought any skins to trade.... I sent out a boate twyse this last winter and got not one ounce of bever from the Indians."

As in the fur trade, the adventurers of the Laconia Company soon discovered that the valuable minerals they sought were not to he found. However, they were forced to agree with John Smith's assessment that fish and lumber were "as good gold as the mines of Potosi (in Bolivia) and Guiana." Perhaps frustrated by the failure to find sources of immediate wealth, Walter Neale returned to England in 1633.

Ferdinando Gorges and Captain John Mason divided their holdings in 1633 (?) drawing the line "down the middle" of the Piscataqua. Thus, the settlement at Pannaway became Mason's sole responsibility to promote and support.

Mason wrote Ambrose Gibbons in 1634 that he had "disbursed a great deal of money in the Plantation and never received one penny...." When he died in 1635 Mason's holdings in the settlements were valued at 10,000 pounds. He left the house at Pannaway to grandson Robert Tufton and the balance of his Piscataqua estate to grandson John Tufton on the condition that each adopt the name Mason. While John died young, Robert fulfilled the condition and became heir to all these holdings. He failed to claim them for some time, unfortunately, and in the meantime the stewards and servants of the Piscataqua settlements appropriated the land and other assets for themselves.

Mason had indeed supported the colony fully as evidenced by a 1635 inventory: 24 cows, 34 other neat cattle, 92 sheep, 27 goats, 64 hogs, plus 21 horses and colts. By way of food-stocks were: 220 bushels of corn and meal, 20 bushels of oatmeal, 15 barrels of malt and 29 of peas, 610 pounds of sugar, 512 pounds of tobacco, 6 pipes (a cask equal to 4 barrels) of wine and 2 of brandy. The inventory also numbered among other items: 26 arguebuses (muskets), 4 murtherers (cannons), 46 fowling pieces, 12 pistols, and 61 swords: all these matched with 13 barrels of gunpowder and a thousand pounds of bullets and shot. Finally, to cheer the settlers, 2 drums and no less than 15 hautboys (oboes) and "soft recorders."

As we noted previously, some of the stewards and servants purloined quantities of these supplies after the departure of Neale and the death of Captain Mason. One Captain Francis Morton is said to have driven cattle to Boston and there sold them for 20 pounds per head. The Great House at Strawbery Banke was seized and occupied until 1644 by Thomas Warnerton, who in that year appropriated some of the arms, ammunition, and other goods from the Mason estate and accompanied them to Port Royal (Nova Scotia), disposing of them there. The Great House with its thousand acres then was taken by Sampson Lane until 1647, when Richard Cutt with his descendants came into possession of the property until the house fell into ruins (c. 1685).

Next in the Sun: *Life as Part of Massachusetts.*

Natural History

Book Review

Written in Stone, A Geological History of the Northeastern United States
By Chet Raymo and Maureen E. Raymo

Written in all the rocks and stones in the northeast is the history of our landscape. Chet and Maureen Raymo's book *Written in Stone* explains the geologic history of the northeast. They make geology exciting, beginning their story when the only life on earth was microscopic and living in the sea. They tell how plants and animals invaded the land and dinosaurs dominated the globe until their perplexing disappearance.

The Raymos have a true affection for the landscape which makes geology come alive. *Written in Stone* will captivate the interested layperson.

Summer Hours

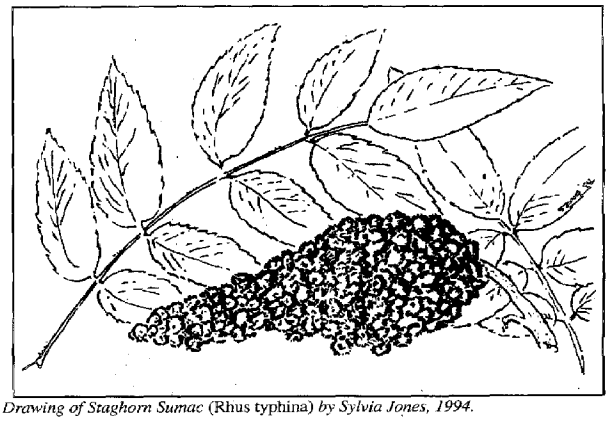
Beginning June 1 the Center will be open 10am-6pm. Visitor Services Director Peter Lareau explains that although the Center has always had extended summer hours, this is the first time the Center has been open after 5pm. "The evening hours are for people who enjoy the park after work in the summer. Traditionally there has been a little peak of visitors about 4:30, and those people were never able to enjoy all our exhibits in the half hour before we closed. Early evening is a beautiful time to come to the shore and now it's a good time to visit the Center as well."

Staghorn Sumac: Friend or Foe?

Wherever you walk at Odiorne you will soon come across the all-intrusive, ever-invasive *Rhus typhina,* or Staghorn Sumac (not to be confused with Poison Sumac). This large shrub has pinnately compound leaves, and furry looking branches. Its fuzzy plumes of red fruit ripen in in mid-summer. Despite her best efforts to keep it in check, *R. typhina* always seems to be one step ahead of park horticul-turalist Louise Tallman's trimming blade (see related story in the April-May issue of the *Sun* (Vol. 2, No. 2)

It is difficult to believe that this troublesome shrub was once a very important source of medicine to American Indians and early European settlers. The Indians made a tea from the bark to treat digestive disorders and the settlers made a tea from the sumac's leaves for sore throats and lung ailments. The red fruit was crushed and simmered to make a cough syrup, and the leaves were smoked to control asthma attacks.

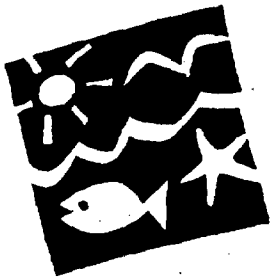
The most popular use of the sumac, however, was the lemonade that its fruit produced. From mid-June to mid-August, the fruit is just dripping with a tart juice that is delicious and thirst quenching.



Drawing of Staghorn Sumac (Rhus typhina) *by Sylvia Jones, 1994.*

The Gilmour household has been making "Indian Lemonade" for many years. The recipe? Come to the Science Center in July and we'll make some! It will be a treat you will not soon forget, and may want to try at home.

—Marilyn Gilmour



Seacoast 2000

An Interactive Lecture Series

Where: **Seacoast Science Center**
Odiorne Point State Park
Rye, NH

When: **September 15, 22, 29;**
October 6 and 13

Time: **7 pm - 9 pm**

Price: **Free!**

Join experts from the Seacoast region in lively discussions on the future of coastal resource issues such as habitat destruction, marine pollution, and fisheries decline. Lectures will precede each discussion; background materials will be available. Explore the issues relevant to your coastal future.

Please call the Seacoast Science Center for more details and to register at (603) 436 - 8043.

Seacoast 2000 is supported by the NH Coastal Program of the NH Office of State Planning, and the Benjamin Allen Rowland Cultural & Environmental Fund of the Greater Piscataqua Community Foundation.

Foster's Daily Democrat, Dover, N.H.
Friday Evening, September 16, 1994

Fish game goes swimmingly

UNH students learn first-hand about industry

By DIANE SCARPONI
Democrat Staff Writer

RYE – Fifteen people learned how to bankrupt the fishing industry and wipe out the fish population in about an hour Thursday night.

By playing a game called "Fish Banks," participants, including University of New Hampshire students, learned first-hand how the fishing industry has recently reached crisis proportions.

Robert Burnett-Kurie, an education consultant who tours the country exhibiting the interactive games to everyone from high school students to federal regulators, told the participants not to feel badly about the loss.

"You can attain the interests of your company, and have your economics and environment too," he said. "By planned growth, you can have a sustainable natural resource."

The game, developed by UNH professor Dennis Meadows, divides participants into teams to represent fishing companies.

The companies are told to "maximize your assets," and are given money to buy boats and put them out to sea.

Money is extracted for operating costs, interest on loans and purchase of boats, but teams can earn money by selling fish or boats.

Teams must decide how many boats to buy and where to deploy them. In the deep sea, boats catch more fish, but the long trip costs more to operate each boat.

In the coastal waters, boats catch less fish, but the trips cost less.

Transactions were handled on a computer, and also accounted for the fish taken, their reproduction rate, and weather variables.

In order to "maximize assets," most teams bought between 10 and 13 boats and deployed them in deep water.

The companies caught fish and made money, which the teams used to buy more boats and deploy into deep water.

Team Two believed they were in competition with other teams, and members decided to leave their 15 boats in deep water to catch as many fish as they could.

The team members reasoned that they would make a lot of money in the first few

☆ Fish game
Please turn to Page 15

Fish game

Continued from Portsmouth Page

rounds, and then would sell their boats when the fish stocks started decreasing.

Team Three, on the other hand, realized after the second round that stocks were decreasing in the deep sea, so they moved all 13 of their boats to coastal waters, where stocks were still strong.

In the end, Kurie said all teams would have gone bankrupt, except for Team Three, if they were able to sell their boats to more competitive teams.

Even Team Three's scenario was dangerous, he said, and is similar to local fishermen's fear of the closing of Georges Bank, which will drive deep-sea fishing boats into local waters.

Kurie told the teams, after bankruptcy and environmental destruction was imminent, that the teams should not have assumed they were in competition with each other.

He also said the teams should have included the value of the fish at sea as an asset, instead of only seeking to maximize profits.

The game's scenario has actually happened in many places, he said, including in the Peruvian anchovy trade and the Pacific sardine trade.

After the game was over, participants seemed troubled by the results, but noted that there are few simple answers to such complex problems.

"I need to learn more about it," said UNH student Cicely Buckley. "Our real assets are the environment and the food chain, while the economic resource needs to be sustained."

The teams played the game at the Seacoast Science Center in Rye as part of the Seacoast 2000 lecture series on the future of the Seacoast. The event was sponsored by the Office of State Planning and the Greater Piscataqua Community Foundation.

APPENDIX E

Seacoast
Science
Center

Outline of Awcomin Marsh Tour

I. Before Starting Out

Introduction/Welcome

~ hand out binoculars

II. Shuttle Over

III. Marsh Tour

A. Wetlands Discussion:
What are they & why are they important?
(See sheets "All About Salt Marshes".)

B. Common plants & animals of a salt marsh
(See field guide component of Teacher Guide#2 "The Salt Marsh")

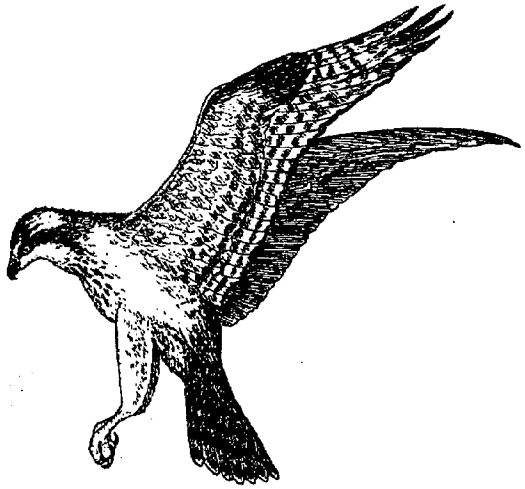
C. Salt Marsh Disturbances
(See "All About Salt Marshes")

D. Awcomin Marsh Restoration Project
(See sheet with this title.)

IV. Wrap-Up

Answer questions

V. Shuttle back to SSC



Seacoast
Science
Center

Outline of Coastal Resources Tour

I. Before Starting Out

Introduction/Welcome

~ hand out binoculars

II. Exploring the Coastal Habitats

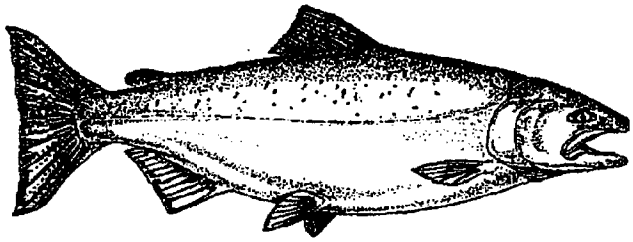
A. Fresh Water Marsh
B. Salt Marsh
C. Rocky Shore
D. Gulf of Maine

(See sheets with these titles.)

III. Wrap-Up

Answer questions

IV. Back to SSC



The list of speakers and reading materials for the evening lecture series, Seacoast 2000

September 15
Robert Burnett-Kurie, Certified Trainer, Fish Banks, Inc.
The Tragedy of the Commons

September 22
Frank Richardson, Senior Inspector, NH Dept. Environmental Services
Life and Death of the Salt Marsh, John & Mildred Teal, © 1969

September 29
Dr. Janet Campbell, Research Assoc. Professor, Institute for the Study of Earth, Oceans and Space, University of New Hampshire (UNH)
Mission to Planet Earth, by Isabell Abrams, in *Current Health*, April 1991.

October 6:
Dr. Richard Langdon, Mgr. Jackson Estuarine Laboratory, UNH
Pollutants in Long Island Sound (copy on file at SSC)

October 13:
Phil Colarusso, Marine Biologist, U.S. Environmental Protection Agency
Creating and Restoring Wetlands in *Wetlands Issues*, Environmental Issues Forum, North American Association for Environmental Education

Restoring Seagrass in Systems in the United States by Mark Fonseca, in *Restoring the Nation's Marine Environment*, Symposium

Coastal Issues Slide Show

SLIDE	TEXT
Coastal views (1 & 2)	New Hampshire's 18 mile coastline is rich in resources. Our waterways and harbors, salt marshes and estuaries, and rocky shores in the Gulf of Maine provided early coastal settlers with most of the resources they needed for survival. Today we still count on these resources to provide food, transportation, recreation and a place to live. In this presentation we will examine how humans have utilized each of these resources in the past and what the future holds for our ability to utilize them conscientiously.
River shot (3)	Waterways have always played vital roles as territorial boundaries, food and water sources, avenues for transportation and recreation. In the 15th century, Indians of the Merrimack Valley area gathered at seasonal fishing sites in large numbers. The fish they dried and smoked during the harvest sustained them through the winter. In addition to using this river resource for food, the harvest was a time for communicating with large gatherings of families who lived apart the rest of the year. It was also a festive time, with group sports, gaming and making marriage contracts.
Piscataqua River (4)	European explorers were always on the lookout for waterways that would provide access to the interior and its rich timber and fur resources. The Piscataqua River was first explored in 1603 by Capt. Martin Pring, who ran his ship, the *Discoverer*, 12 miles up river. Like the explorers who preceeded him along the coast, he looked for deep rivers that went far inland. The Piscataqua fit the bill. The first European settlement in New Hampshire was established by David Thomson in 1623, on the coast near Odiorne Point, and the mouth of the Piscataqua River. Thomson's objectives were to establish trade relations with the Indians, provide fishermen and lumbermen a year-round base, and to establish a community.

Old Ports. Harb. (5)

Portsmouth Harbor and its waterways served as an access port to the riches of the interior from the sea. Pring noted evidence of Indian use of the river, but did not elaborate. They launched ocean-going canoes from here, fished along the coast and at the Isles of Shoals, 9 miles off-shore. Although the Shoals were already an established fishing ground when Captain John Smith surveyed the area in 1614, he named them after himself: Smyths Isles. His description of them reflects their rich fishing resource: "...barren rocks...in the heart of the strangest fish-pond I ever saw..." Although the islands were given to Smith a few years later, his name never stuck; the islands were too well known as the Isles of Shoals (shoals referred to schools of fish).

Falkland frigate (6)

Until the steam engine and reliable overland transportation were developed, ships were the primary method of transporting goods and people throughout human history. American Indians built ocean going canoes, as well as canoes for in-shore and in-land use.

It is not surprising that shipbuilding was among the first industries Europeans established here, especially since shipwrights were needed to support the area's first industry: fishing. Shipbuilders set up shop along the shores of the harbor and the Piscataqua River. This is the frigate *Falkland*. She and her sister British warship, the *Bedford Galley* were built in 1690 marking the birth of naval shipbuilding in America and the beginning of a shipbuilding industry that thrived in the Portsmouth Harbor area until 1829.

Portsmouth Harbor not only provided a deep water port for the ships and yards, the coastal lands provided much needed timber. In the 1600s white pines, 200 feet tall and 24 inches in diameter were marked as the Kings Mast Trees, to be used only for building His Majesty's ships. The mast trees were an extremely valuable resource for England because most of its forests were depleted. The importance of trees becomes clearer when you realize that it took 2,500 trees to make a 200 foot long warship in the 1770s.

Fort Constitution (7)	Portsmouth Harbor's strategic importance was quickly recognized. Near here the first cannons were placed to protect early settlers from pirates and the French (at that time the Indians were still friendly). On this site the British built Fort William and Mary in 1635, renamed Fort Constitution during the Revolutionary War. This fort was active in all subsequent American wars from the War of 1812, the Civil War, and World Wars I and II. Today, it is an active Coast Guard Station. During President Bush's term (1988-92) over 60 men were on active duty here to protect the coast around his home in Kennebunkport, Maine. Usually the station has 20 crew on active duty.
Shipyard river front (8)	The Harbor's strategic value was greatly increased when the Portsmouth Naval Shipyard was built in Kittery, Maine in 1800. This photo shows the shipyard-built *USS Portsmouth* which was taken in the 1880s. Yard built ships served in every American conflict, from the War of 1812 to Vietnam. The yard's motto is "from sails to atoms" because their construction record stretched from sailing ships to nuclear submarines.
Yard today (9)	The first fast attack nuclear submarine, the *Sand Lance*, was launched here in 1969. Today the shipyard no longer builds submarines, but overhauls and repairs them. Its economic value to the community is significant and Portsmouth is fortunate that the Yard was not recommended for closure in 1995.
LPG tanker (10)	Portsmouth Harbor is an active commercial port for transoceanic ships; some of which, like this Liquefied Petroleum Gas tanker, carry hazardous or potentially environmentally damaging cargo. Coal, fuel oil, salt, scrap metal and cable are among the other regular cargoes carried by ships here today. That these cargoes are carried upriver to Newington while we still have such a clean coastal environment is a testament to how humans can utilize a resource without damaging it--so far.
Gundalow (11)	How many of you think that carrying explosive cargoes, like LPG, or potentially damaging cargoes like oil is more hazardous to the coastal environment than the way this resource was used in 100 years ago? The cargoes of the 1780s to 1830s included molasses, rum, sugar, salt, coral, coffee and brandy, so it would seem that we are taking greater risks today.

However, increased industrial activity and population expansion in the 19th century brought on many problems to these waters that we do not have today. Sewage, fisheries and slaughterhouse wastes were some of the biological pollutants entering the waterways. Outbreaks of yellow fever, tuberculosis, cholera and smallpox occurred because of these unsanitary practices. Sawmills disposed of large amounts of sawdust into the estuaries, smothering them. Dyes from cotton mills and tanneries were also dumped into the tributaries, contributing chemical pollutants to the waterways.

Hampton Beach (12)	We still have problems related to pollution and over-development. While sewage and control has improved, non-point source pollution, such as fertilizer run-off from lawns, and trash from boats, continues to be a problem. As our understanding and awareness of the interrelationships between our actions, our environment's health and human health increases, we make better choices and even find more responsible ways to have fun.
Little Harbor (13)	The recreational value of Little Harbor and near-shore waters is significant. Day sailors, cigarette boats, wind surfers and private ocean-going yachts all ply these waters. The marinas and launching areas built for them impact on the second coastal resource group we are going to discuss today: estuaries and salt marshes.
Estuary (14)	The ecological importance of estuarine and marsh systems is just now being appreciated. Estuaries are where fresh and salt water mix. This is part of Great Bay estuary, formed where the fresh waters of the Piscataqua and other rivers meet saltwater at high tide. These brackish waters sustain many kinds of life. Rivers also provided sources of power and transportation, so that towns were often sited near them. Since estuarine systems are so ecologically important, it is critical that we utilize this resource carefully. Among the Great Bay's resources was the blue marine clay found along its shoreline. It could be used to make very high quality bricks. Two dozen brickyards eventually were built along the Bay's shores. By 1900 over 20,000 bricks were manufactured here per year and shipped throughout the east coast. The industry died when the clay source was exhausted.

Estuary (15)	The waters of an estuary are always moving. Tidal action causes the fluctuation of temperature, salinity, water clarity and current speeds. This state of constant flux brings in nutrients and takes away wastes and sediments. You might think that the plants and animals that thrive in estuarine systems would be able to tolerate wide ranges of temperature, salinity, and suspended sediments, and thus be less sensitive to pollution and disturbances caused by boat traffic and propeller blades. Not necessarily.
Eelgrass bed (16)	Eelgrass beds are important sub-habitats of the open water and tidal creek habitats in an estuary. Unlike marine algae, Eelgrass is a flowering rooted plant that has adapted to live partially submerged. Since it needs sunlight for photosynthesis it is only found in the shallow soft bottoms throughout the Bay. Eelgrass beds are extremely productive. Many creatures find refuge in these thick stands; others eat the living plants or consume them after they have died.
Eelgrass & lobster (17)	Eelgrass needs sunlight to photosynthesize. When the water becomes too turbid for light to penetrate, the plants die. Running small boats through Eelgrass beds not only stirs up sediment, blocking sunlight, but propeller blades cut the plant, often uprooting it. This type of disturbance not only affects the Eelgrass, but has negative impact on the entire Eelgrass bed community.
Osprey (18)	Estuarine systems sustain over 60 plant and animal species that are listed as rare, threatened or endangered or are candidates for such listing. Here in New Hampshire osprey (shown here), the piping plover, the common tern and short-nose sturgeon are just some of the species on the infamous list. These animals have experienced significant population decline primarily from habitat loss and the effects of pollution.
Marsh creek (19)	Although many people still think of salt marshes as bug-ridden wastelands, we now know that marshes serve many important ecological functions. By definition, they are subject to daily tidal flow. Tidewater brings in marine organisms and nutrients and exports other nutrients and organisms to the ocean.

Marsh zone shot (20)	Marshes can be divided into High and Low marsh zones, defined by the vegetation found in each. High marsh plants (those closer to the freshwater source) have a low tolerance for saltwater; low marsh plants have a low tolerance for fresh. The run-off from our streets and lawns not only carries fertilizers and toxic pollutants, it is fresh water. Even too much clean water run-off can offset the chemical balance of the marshes if it floods the low marsh with fresh water.
Marsh creek bank (21)	Like estuaries, they are nurseries for many fish and the habitat for many shellfish. Two-thirds of the commercially harvested fish and shellfish utilize marsh-estuarine systems at some point in their life cycle. Salt marshes provide flood, storm and erosion control. They buffer and absorb water and energy, minimizing coastal erosion and damage. Marshes serve as water filtration systems, trapping sediments; marsh vegetation can take up some organic pollutants, converting them to useful nutrients.
Mud flat (22)	Mud flats are sub-habitats in the Low Marsh. Although mud flats don't look like much at first, they are very productive biological systems, alive with different species of microscopic algae. Snails and zooplankton are attracted to this rich food source. Certain species of bacteria are also well adapted to this environment. Anaerobic bacteria metabolize sulfur instead of oxygen. The strong odor associated with mud flats is caused by this bacteria's release of hydrogen sulfide.
Phragmites (23)	Other species are indicators of a marsh's condition. *Phragmites* and purple loose strife are two problematic plants which indicate that the system is going through ecological change. These plants cannot tolerate salt water, therefore their presence indicates a reduction in salinity, which may reflect changes or damage to water circulation within the marsh.

Loose strife (24)	Some people find the presence of these plants aesthetically pleasing but these plants provide little food value for wildlife and are not part of a healthy salt marsh flora. Historically, people have utilized salt marshes and estuaries primarily as a food resource. They were fished and harvested by American Indians. When the European settlers arrived, the Indians showed them how to harvest the marshes. The marshes made quick pastures for cattle in a land that was heavily forested.
Marsh grass (25)	During the 1800s the marshes were extensively harvested for their "hay." *Spartina alterniflora* and *S. patens* are the two primary marsh plants. *S. patens* thrives in the high marsh and along marsh creeks, and was preferred by cattle. Farmers dug trenches through the marshes to encourage the spread of *S. patens*.
Staddle (26)	Harvested hay was stored on concentrically arranged wooden staddles, shown here. Two factors were instrumental in the decline of commercial salt marsh haying. Tractors could not be used in the soft marshes, and tractors rapidly replaced the horse or ox teams. American tastes were changing as well, and milk was becoming a popular beverage. Milk from cows that grazed in salt marshes tasted salty. As soon as dairies began to refuse milk from salt marsh pastured cows, the practice ceased.
Dumping in marsh (27)	Human population growth and development had greatly affected wetland habitats. In fact, in the mid-19th century the Swamps Land Acts was established to encourage agricultural development on these habitats. In a 1990 Report to Congress, the Department of the Interior gave an estimate of 53 percent loss of original wetlands since the 1780s. Remaining wetlands have suffered from other human activities. This picture was taken in 1986. Fortunately, it's a scene we should not see often anymore—at least not legally!

Power plant & marsh (28)Although marsh systems are able to absorb some pollution, their filtering capability is limited. It is unlikely that the marsh system could absorb radioactive waste, although some deep ocean sediments have been shown to absorb it. Using the marsh as a site for the Seabrook nuclear power plant was very controversial when construction began in 1976. (Construction was completed in 1986; full power production began on August 19, 1990.)Power plant (29)

The plant uses ocean water for cooling and as a repository for the heated water. A 17,140 foot intake tunnel brings seawater in from 7,000 feet offshore. The 16,500 foot long discharge tunnel discharges the heated water 5,500 feet from shore. The surface water temperature increase over the discharge area is about 3° F. The long term effect of this "heat pollution" is unknown.

Today the plant's safety record ranks it in the top 25% of the safest in the country. Whether or not building the power plant here is a good use of the marsh and coastal resource is as problematic as shipping liquefied petroleum gas up the Piscataqua River. An accident in either case would be disastrous.

If an LPG tanker exploded, the damage would impact a large, densely populated area. What would be the effect of a melt-down at the power plant melts down? And yet hazardous cargos have been transported by ship up and down Piscataqua River for hundreds of years. The Seabrook Plant has been on-line for 5 years, generating power for 1 million homes (40-50% of the area's electrical power). Are these uses worth the risk?

Marsh and harbor (30) The State of New Hampshire estimates that half of its coastal wetlands have been destroyed since colonial times. Much of that destruction was caused by development, rather than storm damage. As we have described, waterfront property has been a prized resource, and as solid ground was developed, people found ways to build on marshes. Today New Hampshire's seacoast is one of the fastest growing areas of the state. Seacoast population has grown 31% over the last 18 years. Meeting the demands for this growth without negatively impacting coastal resources is a challenge we must meet.

Fisherman statue (31) When we discussed human use of the harbors and waterways you probably noticed that fishing played a large role. Fish have been the primary commercial resource of the last coastal resource we will discuss today: the Gulf of Maine.

Gulf of Maine map (32)

The Gulf of Maine extends from Georges Banks of the shore of Cape Cod, (USA) north to include the Bay of Fundy in Canada. It is often called a "sea within a sea" because its waters are separated from the Atlantic Ocean by the submerged plateaus of Georges Bank and Browns Bank. As a result, the Gulf's temperatures and salinities differ from that of the Atlantic. Where temperature variation, tides, currents and bottom topography combine and bottom and surface waters combine, biological productivity is at its highest.

These physical characteristics make the Gulf a prime feeding ground for fish, and thus a prime fishing ground for humans. By 1616, 200 European fishing boats were working in the Gulf. Two years later, 138,000 pounds of fish were landed from Gulf waters. One of the compelling reasons David Thomson gave for funding his settlement in 1620 was that fishermen could take advantage of the second (fall) cod run if they could survive winter on the coast.

In modern times, lobsters, shrimp, herring, bluefish, whiting and bluefin tuna are some of the commercial species that are harvested from these waters.

Fishing boats (33)

Better and more efficient ways of catching more and more fish were constantly being developed. Eventually people became too efficient. A decline in the fisheries was felt as early as the mid-18th century. In the 1970s Russian fishing trawlers crossed into American waters at night to fish Jeffreys Ledge, 20 miles east of the Isles of Shoals.

In 1977 the United States and Canada pushed back their territorial waters boundaries to 200 miles off shore. This reduced factory ship access to fish populations, which should have allowed those populations to rebound. However, this was not enough and fish landings continued to decrease. Cod catches dropped from 200,000 tons in 1977 to 22,000 tons. Drastic measures were needed. In 199X Canada closed its fishing grounds in the Gulf; the United States closed its grounds in 1994. It is hoped that this drastic measure will give the fish stock a chance to recover.

Live & kicking (34)

As the fishing industry collapses, the survival of many coastal towns is threatened. Towns with no other industry and few other commercial resources to utilize, face very hard times and even harder decisions.

Shore & Shoals (35)	The Gulf of Maine provides more than food. Like all coastal waters it is used for transportation and recreation. Its beauty captivated early explorers like Pring and Smith, and captivates tourists and residents today. Nearly half the US. population lives within 50 miles of the coast. There is another population that lives along the coast--the plants and animals that live in the intertidal zone--the land exposed at low tide.
Zonation (36)	Plants and animals dominate each area because of their tolerance to exposure at low tide and submersion at high tide. At low tide, these zones look like colored stripes, as you see here. The highest part of the rocky shore is called the splash zone, its only contact with sea water is the occasional splashing of waves. This zone is also called the black zone, because of the black cynobacteria (once called blue-green algae) that dominate here. Below the splash zone is the barnacle zone, named for the dense populations of barnacles that live here. Seaweeds dominate the middle or brown zone. This area is submerged with every tide. The lower or red zone is only exposed during very low tides and marks the end of the intertidal.
Tide pooling (37)	Throughout the inter tidal zone, there are areas where the outgoing tidewater is trapped in tide pools. In these sub-habitats plants and animals that cannot withstand prolonged exposure to air thrive. These include amphipods, nudibranchs, flat and coiled worms, sponges, anemones, sea stars and sea urchins.
Beach trash (38)	As the human population increased along the coast its impact on the intertidal and near-shore plant and animal communities was increasingly detrimental. Dumping from ships, on-shore litter and trash were not only ruining the esthetic value of the coast, they created health hazards. Negative human impact on coastal areas was significant enough in 1972 for Congress to pass the Coastal Zone Management Act (CZMA). The CZMA addresses coastal resource issues by having states develop comprehensive coastal management programs with federal guidance from the National Oceanic and Atmospheric Association (NOAA).

Trash display (39)

Coastal clean-ups, which are now international. On specific dates around the world people volunteer to clean up the trash on their communities' coast. The trash is classified and quantified; the results tallied and published annually in the Center's report, *Coastal Cleanup Results.*

New Hampshire communities have participated in the clean-up since it began in 1988. Current trash trends show that beach goers contribute more trash than ocean goers. Cigarette butts and food containers on sandy beaches account for more trash than found on rocky shores. Rocky shore trash is mostly from that which washes ashore from boaters—including fishing boats, ocean liners and recreational boats.

Fishing boat (40)

The future of our ability to live near and utilize coastal resources is mixed. We are much more aware of the impact our actions have, and no longer use waterways as waste disposal sites. However, the human population continues to grow, putting more and more demands on finite resources.

There are no easy or simple answers; no known quick fixes. However, there are positive signs. The eagle has returned to Great Bay and is no longer endangered. We are beginning to take drastic steps to prevent further degradation, such as closing economically valuable fishing grounds we have fished for over 300 years. Let's put the same amount of energy, zeal and resources into conserving our resources as we do utilizing them!

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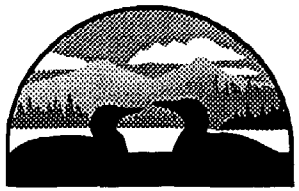
What You Can Do To Help

- Contribute to our understanding of the Osprey's distribution within New Hampshire by reporting any sightings to the Audubon Society of New Hampshire or the NH Nongame and Endangered Wildlife Program, N.H. Fish and Game Department.
- Shooting or harassing threatened or endangered wildlife species is against the law. Report any illegal activities to the N.H. Fish and Game Department or your local conservation officer.
- Learn more about the habits and needs of native wildlife so that you can help to educate others.
- Share your knowledge and concern about birds of prey to help dispel myths that lead others to harm them.
- Urge state and federal legislators and your local conservation commission to protect critical habitat for Ospreys and other wildlife.
- Support organizations working to protect endangered species and other non-game wildlife.

The Audubon Society of New Hampshire

is an independent nonprofit organization with active programs in land preservation, environmental education, legislative action, and non-game research and management.



Further information about ASNH can be requested from:
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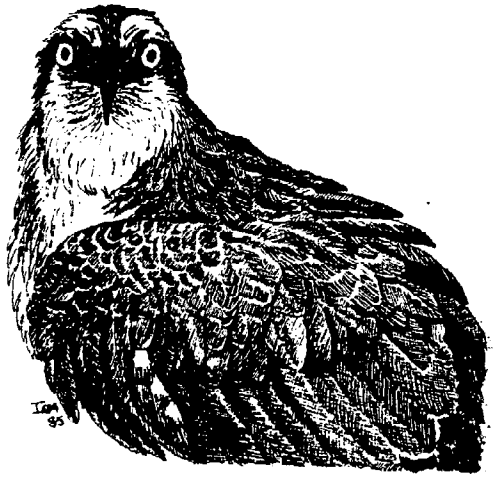
OSPREY

Pandion haliaetus



How Can I Identify an Osprey?

The Osprey is a large, long-legged, fish-eating raptor. Because of their large size, Osprey are sometimes mistaken for the more massive Bald Eagle, although at two feet tall with a six foot wingspan, they are considerably smaller than eagles, but larger than most hawks. Seen in flight, the Osprey's prominent features are its white or slightly mottled underparts, dark brown back, the pronounced crook in its long wings highlighted by distinctive black wrist patches. Seen from closer proximity, the Osprey's bright yellow eye and broad, dark eyestripe help to distinguish it from other birds of prey.

Life History

Ospreys arrive in New Hampshire during April, returning year after year to the same breeding grounds. An osprey nest is generally placed in the flattened top of a live or dead tree, but may also be placed atop man-made structures such as power transmission poles, waterfront pylons, channel markers and specially erected nesting platforms. The nest is up to five feet in diameter and is made with a large accumulation of various sized dead branches up to five feet long. Both sexes gather the nesting material, but the female does most of the nest arrangement. Softer materials such as sod, seaweed or marsh grass line the nest. Nests are often used in successive years and the addition of nesting materials in each season cause them to become very heavy and bulky, sometimes growing as high as eight feet.

Male and female Ospreys court each other with spectacular and vocal soaring, diving, and swooping. The male may hover high over his territory carrying a fish or a stick; a display that serves to favorably influence his mate and discourage potential rivals. The female lays from 2-4 blotched, oval eggs in two day intervals. Incubation by both the male and female continues for about five weeks. The chicks at hatch rely on the adults to feed them, but in 4-5 weeks they can eat, by themselves, the prey that both parents bring to the nest. At around 8 weeks, they are capable of flight and begin to follow the adults to their fishing grounds. After migrating south their first fall, young Ospreys spend the next year and a half on their winter grounds. They do not return to the breeding grounds until the spring of their second year.

The Osprey is a truly cosmopolitan bird. It is able to take advantage of water bodies suitable for its fishing way of life on every land mass on earth except New Zealand and Antarctica. Populations here in the northeast generally migrate to the warmer climates of Central and South America.

Historical Review

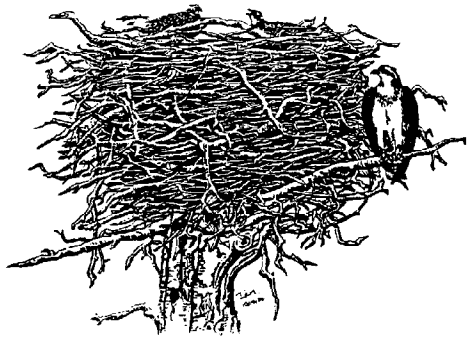
In the two-decade period from 1950-70, the Osprey population was severely diminished, especially in the eastern United States. Ospreys initially declined because of pesticides such as DDT and other persistent chemicals in their food chain, which caused infertility and thinned egg shells. Since the banning of DDT in the United States in1972, the Osprey has made a steady comeback. Osprey may still be threatened, however, by pesticide use near their wintering areas in the tropics.

Osprey face threats even before they hatch. Great -horned owls, gulls, raccoons, and fishers may prey on eggs left unattended in nests. Food availability directly affects chick survival. Declines in fish populations or water quality may reduce the size of local Osprey populations. although Osprey are protected under state and federal laws, illegal shooting still occurs.

Current Status of New Hampshire's Ospreys

Since the early 1980's, Ospreys have maintained active nests in the North Country region of New Hampshire. This population has experienced steady growth through the period, and now produces 20-30 young each year from an average of 25 nests.

In 1989, a pair of Osprey made Great Bay their home. After an early nesting failure that year, they have successfully raised young in subsequent years. Great Bay now has at least two successful breeding pairs with the addition of a nest on a utility tower along the Squamscott River. Each year brings more Osprey sightings and nesting attempts to the seacoast region. You can observe Osprey in southeastern New Hampshire from late March through mid-October. The Great Bay estuary system is a prime area. The marshes, harbors and beach areas along the seacoast can also be rewarding observation sites, especially during migration.



What You Can Do To Help

- Contribute to our understanding of the distribution of terns within New Hampshire by reporting any sightings of Common, Arctic or Roseate Terns to the Audubon Society of New Hampshire or the NH Nongame and Endangered Wildlife Program, N.H. Fish & Game Department.
- Shooting or harassing threatened or endangered wildlife species is against the law. Report any illegal activities to the N.H. Fish & Game Department or your local conservation officer.
- Urge state and federal legislators and your local conservation commission to protect sensitive coastal areas from development, pollution and exploitation.
- Stay away from areas where terns are known or thought to be nesting and keep pets away from these place, to avoid disturbing the birds or leaving scent trails for predators.
- Discourage gulls in beach areas by properly disposing of garbage and trash. Never dump wastes of any kind into the ocean.
- Learn more about the habits and needs of native wildlife so that you can help to educate others.
- Volunteer to assist with tern protection at a nesting area near your home.
- Support organizations working to protect endangered species and other nongame wildlife.

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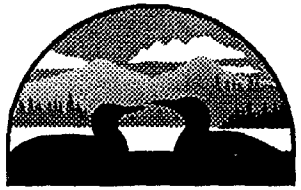

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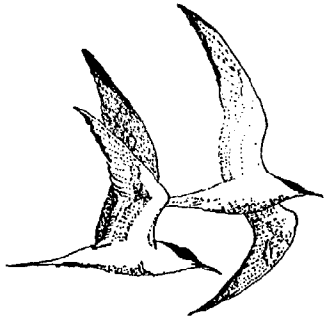
COMMON TERNS

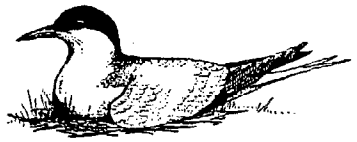
Sterna hirundo



What Are Terns?

Among the most elegant of seabirds, terns are smaller and more slender in build than the closely related gulls and are distinguished by long, narrow, pointed wings and deeply forked tails. They all have black caps during the breeding season, and long, tapering bills. The varying length of the tails and the colors of their bills can be used to tell the species apart.

Terns flit gracefully over the water, bills pointed downward, their long wings lifting them easily and swiftly 30-40 feet. When they spy food below, they plunge headfirst into the water, often disappearing completely under the surface. These birds sometimes gather in huge numbers over a school of fish, swirling in the air, screaming and diving again and again. Fisherman can often locate schools of fish by observing the tern's activities.



Life History

Terns arrive in New England during the first half of May, and usually breed in colonies on barrier beaches, offshore islands and in the salt marshes. After a brief courtship, which may include ritualized flight displays and intricate caressing and preening of each other's feathers, mating ensues. Common and Arctic Terns build vulnerable nests on open shores, scooping out shallow scrapes in the sand, placing a few weeds on bare rock or nestling atop the salt marsh grasses. Roseate terns conceal their simple nests among tall grasses or vegetation or in rock crevices.

Between late May and late July, terns lay 2-3 oval eggs with various patterns of brown on a buff background; if one set of eggs is destroyed, terns may lay several times. The chicks hatch after about 21 days of incubation and within a few days seek shelter in the grasses or other concealing vegetation. Although the young are well developed when they hatch, they will stay near the nest, cared for by both adults and fed on small fish caught in the coastal shallows. Young terns are capable of short flights three to four weeks after hatching and tend to gather in small groups by the water's edge, waiting to be fed.

Terns can be aggressive when they are driving potential predators away from the nesting colony, especially during the height of their breeding season when they are defending their eggs and young. An individual who wanders too close to an active breeding colony is likely to be dive bombed and "white-washed" by crying birds. Keep in mind that you have wandered into the birds' nursery, and make a careful retreat.

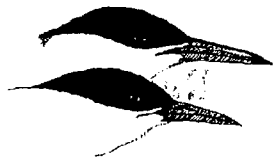
By late summer, large groups of terns begin to congregate on outer beaches and islands. Most depart for their southern wintering grounds in Central and South America in September. Some Arctic Terns make incredible oceanic journeys 25,000 miles, roundtrip between the Arctic and Antarctic via the coast of Africa and South America.

Historical Review

The numbers of terns breeding along the New Hampshire coast, as along the entire Atlantic coast, has fluctuated greatly in the last century. Once among the most abundant nesting birds on the Atlantic and Gulf coasts, they have since been plagued by a variety of threats. Tremendous numbers of terns were killed in the late 1800's for the millinery trade. Although protective laws were eventually passed and terns increased temporarily in the early 1900's, their populations have declined drastically since the 1950's.

Gull populations have increased dramatically in recent years due to the increase in the open dumping of garbage and an enormous growth in the fishing industry. These larger, more aggressive birds compete with terns for nesting sites and prey directly on tern eggs and chicks. Terns are subsequently forced into more marginal areas for nesting and become more vulnerable to predators and human disturbance.

Terns have been greatly affected by coastal development and pollution. Shorefront development has reduced available habitat and caused greater disturbance by house pets, off-road vehicles and humans. Human habitation has disturbed the balance of predators as well, often exposing tern colonies to increased numbers of raccoons, skunks and rats.



Current Status of New Hampshire Terns

New Hampshire currently supports only small numbers of the Common Tern. This tern population includes scattered pairs nesting on rocky islands in the coastal bays and colonies in the Hampton Harbor Estuary.

Field studies conducted annually since 1981 have documented serious instability in coastal colonies, where marginal nesting habitat and heavy predation have significantly hampered productivity.