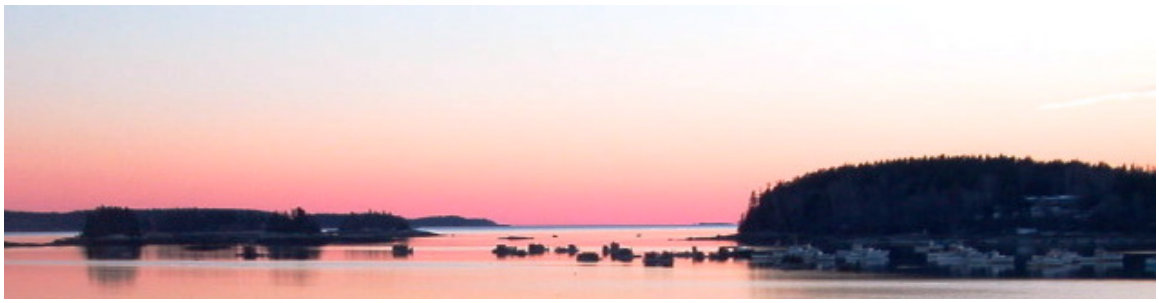
An Environmental Bibliography of Muscongus Bay, Maine



by Morgan King & Michele Walsh

Quebec-Labrador Foundation
Atlantic Center for the Environment

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Ipswich, MA (revised ed. 2008)

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Made Possible through Support From:
Americorps , Jessie B. Cox Charitable Trust, Surdna Foundation
University of Maine Cooperative Extension, Knox & Lincoln Counties, and Wallis Foundation

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Where is Muscongus Bay?

Muscongus Bay is located at the midpoint of Maine's coastline between Penobscot Bay to the east and the Damariscotta River to the west. Outlined by three peninsulas supporting ten small towns (Monhegan, St. George, South Thomaston, Thomaston, Warren, Cushing, Friendship, Waldoboro, Bremen, Bristol) straddling Knox and Lincoln counties, the bay has retained much of its traditional maritime culture and heritage.

For the purposes of this information research project Monhegan Island served as the bay's eastern (outer) limit. The bay's estuaries were included to the following extents:

- Medomak River estuary: From the bridge in Waldoboro center to the outer edge of Bremen Long Island with a line across to Martin Point in Friendship and Hockomock Point in Bremen.
- St. George River estuary: From the bridge on Route 1 in Warren to Pleasant Point in Cushing at the eastern edge of Pleasant Point Gut to Howard Point in St. George.

These boundaries were established based on recommendations from The University of Maine's National Spatial/Geographic Institute and from members of the Muscongus Bay Project Steering Committee[1]. They encompass 188.89 square miles of open water (21.55 square miles of which is within the estuaries) and 10.8 square miles of islands.

Why compile an environmental bibliography?

At the midpoint of the first decade of the 21st C, the Muscongus Bay region is undergoing a significant period of change driven in large part by coastal development. According to a 2003 report by Friends of Midcoast Maine, entitled "Patterns of Growth in the Midcoast Region", among the Muscongus Bay region's nine mainland towns all experienced population growth between 1990 and 2000 (on average 15.7%) ranging from an increase of 6.8% in Waldoboro to 33.8% in Cushing. (Notably during that same period towns in the four counties of the midcoast region experienced an average increase of 11.4%.) According to the same report – the number of housing units also increased in these towns, anywhere from 4% to 36% over that same time period for an average of 21%.

In order to understand the environmental impacts that development and other human uses are causing in Muscongus Bay it is important to conduct a characterization study to establish a working understanding of the area's existing natural and cultural heritage. The

[1] This is an ad hoc committee, formed in early spring 2003, with nine locally resident marine professionals. They serve voluntarily and their activities and meetings are coordinated by QLF staff. As of 2008 this advisory group included fourteen members.

first step of any such study is to determine what information about the site has already been documented. In a number of bays in Maine this kind of review has already been undertaken (*e.g.* Cobscook Bay[2], Penobscot Bay[3]). Although research on Muscongus Bay has been going on for many years, scientific literature relevant to this site is in fact relatively uneven with some aspects of this embayment and its estuaries studied extensively and others left unexamined.

The absence of a large scale research in this bay is likely why, until now, there has not been a thorough review of the scientific information about this marine area. Although Muscongus Bay bears multiple use burdens, it lacks the presence of major industrial sites, activities, cities, or ports all of which tend to give rise to more complete systematic scientific studies or establish an area as a standard sampling location for larger impact studies. This bay is also not thought to contain any especially rare or exceptional oceanographic, physiographic, or biological features or characteristics which could also catalyze significant scientific undertakings.

A compilation of existing studies is necessary to support the rational planning of future work and to attract interest in this bay as a relevant and suitable subject of investigation. Aware that a program of research could support local management of the bay and its resources, staff from the Quebec Labrador Foundation's Atlantic Center for the Environment (QLF) formed the Muscongus Bay Project Steering Committee to spearhead an effort to gather research reports on Muscongus Bay. The result of this work is this annotated bibliography. This group has since continued its collaboration to become part of the State of Maine's study of "bay management"[4].

How were the listings compiled?

The search for published and gray literature contained in this bibliography included investigations of library collections (The University of Maine, Orono; Maine Department of Marine Resources; Bigelow Laboratory for Ocean Sciences; The University of Maine Darling Marine Center; Maine State Library), internet compilations, published bibliographies, and materials stored in the private offices of other institutions and individuals. This publication represents all references found between June 2002 and October 2008 that either contain pertinent information about Muscongus Bay or include the bay as part of the research area documented in the article. Although a substantial effort was made to locate relevant materials, this bibliography is not intended to serve as a definitive listing of research papers on the bay.

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[2] Larsen, P.F. and R.V. Webb. 1996. An Environmental Bibliography of Cobscook Bay and the Quoddy Region. The Nature Conservancy, Brunswick, Maine; also Bigelow Laboratory Technical Report No. 100.

[3] "Bibliography of Penobscot Bay Scientific Research" In: Platt, D. 1996. Penobscot: The Forest, River and Bay. Island Institute. Rockland, ME.

[4] Go to http://www.maine.gov/dmr/baystudy/baystudy.htm for more information on this three-year project.

How are the listings organized?

This bibliography consists of articles, documents, maps, and reports considered peer reviewed or "gray" literature. These references are organized both alphabetically and by subject matter. Most of the alphabetical listings are annotated with either the author's original words and/or a descriptive notation provided by QLF staff. Articles known to contain information about Muscongus Bay but which QLF was not able to obtain during the preparation of this bibliography are not annotated. Not included in this document are the numerous other unpublished data and information sources uncovered during the literature search. Virtually all references listed are on filed and can be obtained by contacting the QLF field desk in Waldoboro, Maine (*see last page*).

Who made this publication possible?

The original research for this report was completed by two QLF interns. Kathleen Gustafson of Bristol, Maine began work on the project in the summer of 2003. Morgan King of Unity, Maine completed the research and finalized the listings in the summer of 2004. QLF's Marine Program Coordinator, Michele Walsh, and QLF's Marine Program Director, Jennifer Atkinson, edited the bibliography. In 2008, Muscongus Bay Project Coordinator, Amanda LaBelle reviewed and updated the listings with subsequent research.

Financial support for this first edition of this project was provided by the Surdna Foundation of New York and the Wallis Foundation of California. In-kind support was donated by the University of Maine Cooperative Extension Office for Knox & Lincoln Counties. The revised edition was supported by Americorps and the Jessie B. Cox Charitable Trust of Massachusetts.

Special thanks also are due to several members of QLF's 2004 Muscongus Bay Steering Committee who provided advice and review of the original materials. These members include: Diane Cowan and Sarah Ellis of The Lobster Conservancy, Chris Davis of Pemaquid Oyster Company, Slade Moore (then of the Maine Department of Marine Resources) and Richard Wahle of The Bigelow Laboratory for Ocean Sciences. The researchers for this report would also like to extend a special thanks to the many authors, municipal and state officials, and librarians who provided their time and expertise to this project.

Part I

Alphabetical Listing by Lead Author

Ames, E. P. 1997. Cod and Haddock Spawning Grounds in the Gulf of Maine, From Grand Manan Channel to Ipswich Bay. Island Institute, Rockland, Maine. 31 p.

> *Author*: This report presents the result of oral histories among retired fishermen in the State of Maine and New Hampshire. Spawning areas and former spawning areas for cod haddock were identified in coastal waters extending from Grand Mahan Channel to Ipswich Bay. Characteristics of these areas and a review of factors related to the demise of these coastal stocks are included.

Atkinson, Jennifer F. and Stephen T. Engle. 2008. *Muscongus Bay Atlas*. Quebec-Labrador Foundation, Inc., Ipswich, Massahusetts. 50 p.

> *Authors:* The 23 annotated maps in this large format Atlas provide a visual explanation of how we share the area by showing the distribution and patterns of environmental features and human activities across both land and sea. And they evoke the possibility of regional thinking and action on a variety of issues, from public access to scientific research.

Barter, J. 2000. Sanitary Survey, Medomak River and Muscongus Bay Shellfish Growing Area S. Maine Dept. of Marine Resources, West Boothbay Harbor, Maine.

> *Author:* This sanitary survey presents the water quality data to date and the information obtained during shoreline surveys conducted by Jan Barter from the fall of 1997 to the fall of 1999. This shoreline survey utilized the new data base management program for itemization of dwellings and potential pollution sources. The raw data and specific inquires of the data are included in the appendix of this sanitary survey report.

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish and Wildlife Service, Washington, D.C. Vol. 53. 577 p.

> *Authors:* In the first two decades of the 1900's, the Bureau of Fisheries, with the cooperation of the Museum of Comparative Zoology of Harvard University, commenced an oceanographic and biological survey of the Gulf of Maine. This report focused on Gulf of Maine fishes, floating plants and animals (plankton), the physical and chemical state of its waters, and circulation patterns in the Gulf.

Born, J.W. 1977. Significant Breeding Sites of the Horseshoe Crab (*Limulus polyphemus)* in Maine and Their Relevance to the Critical Areas Program of the State Planning Office. Maine State Planning Office, Augusta, Maine. Report No. 28. 45 p.

QLF: The results of the report detail presence and absence according to locality of the horseshoe crab (*Limulus polyphemus*) in Maine. Breeding sites in the Salt Bay and Damariscotta River system are considered the most important in the state; Muscongus Bay harbors few significant breeding sites. Sam's Cove in Bremen is noted as the only consistent breeding site. Round Pond, Bristol, and the Medomak River are noted as sporadic breeding sites. This report also discusses future considerations for horseshoe crabs, the significance of the species in the regional ecosystem, and management recommendations.

Borrer, A.C. and B.B. Cadbury. 1966. Subtidal Animal Communities of Muscongus Bay, Maine: A brief summary of fifteen years' dredging results at the Audubon Camp of Maine. Maine Field Naturalist 22:107-112.

Authors: This paper presents a summary of the commoner species of invertebrates found, their relative abundance, and their ecological significance. These species are grouped according to the general type of bottom with which they were associated. Other factors, such as salinity, temperature, season, and depth also affect the distribution and abundance of animals in the bay, but data on these factors are incomplete, and their discussion is beyond the intended scope of this paper.

Brown, B. 1993. A Classification System of Marine and Estuarine Habitats in Maine: An Ecosystem Approach to Habitats. Part 1: Benthic Habitats. Maine Natural Areas Program, Department of Economic and Community Development. Augusta, Maine. 51 p. + 1 appendix.

QLF: A preliminary classification system for marine and estuarine benthic habitats in Maine which includes sites representative of habitat categories.

Card, D.J. and R.A. Aho. 1983. Coastal Marine Resources Inventory 1983, Pemaquid Point to Spruce Head. Maine Dept of Marine Resources, West Boothbay Harbor, Maine. 234 p.

Authors: This is one of two reports documenting the results of a comprehensive marine resources study of the coastal area between Pemaquid Point and Spruce Head, Maine, conducted for the Maine Department of Environmental Protection. The study was undertaken to provide information necessary for oil spill protection and damage assessment. This report details a part of the study including an inventory of selected marine resources of commercial, recreational, ecological and aesthetic value. The second report addresses the marine wildlife of the study area (Refer below to: **Hutchinson and Lovett**, Muscongus Bay, Marine Wildlife Inventory and Evaluation.)

Cowan, D.F. 1999. Method for assessing relative abundance, size, distribution and growth of recently settled and early juvenile lobsters (*Homarus americanus)* in the lower intertidal zone. J. Crust. Biol. 19(4):738-751.

Author: The purpose of this study was to establish a method for repeated, year-round sampling of young-of-the-year and juvenile lobsters, *Homarus americanus*, in the intertidal zone. The primary advantage of the intertidal lobster monitoring program is the ability to overcome limitations pursuant to subtidal sampling techniques through increased temporal and spatial resolution of data collected, using sampling methods possible at low tide.

QLF: Density samples were taken in shallow coastal regions, including Pemaquid Point.

Cowan, D.F. 2003. Mapping the Movements of Egg-Bearing Female Lobsters. In: Prototype Biophysical Maps of the Gulf of Maine. E. Richert and L. Incze, eds. Island Institute, Rockland, Maine. 26-28 p.

QLF: The Lobster Conservancy and a group of lobstermen in Friendship, Maine, tracked the movements of egg-bearing female lobsters. The purpose of the Lobster Sonar Tracking Project is to investigate where and at what temperature female lobsters spawn (egg out), carry (brood), and hatch (release larvae) and to test the inshore Broodstock Hypothesis. Seven lobsters from Muscongus Bay were tracked from September 2002 through July 2003. Results of this project are mentioned briefly and recommendations for more accurate and complete data were proposed.

Cowan, D.F., S.L. Ellis and J. Roundy. 2003. Field Handbook: Juvenile Lobster Monitoring Program. The Lobster Conservancy, Friendship, Maine. 51 p.

Authors: Since 1995, The Lobster Conservancy has conducted a volunteer-based project called the Juvenile Lobster Monitoring Program, designed to combine research and education by involving community volunteers in gathering and processing scientific data. The data collected by TLC's scientists and volunteers will help to: 1) identify significant nursery areas for habitat protection, 2) advance our knowledge of basic ecology and behavior of juveniles, 3) develop a prolonged time series that may be used to project future landings, and 4) provide quantitative data for better informed management decisions.

QLF: This handbook is a guide for volunteers on how to become involved with the Juvenile Lobster Monitoring Program. Included are volunteer expectations and instructions, data sheets with directions, and color photographs aiding in the surveying process.

Cowan, Diane F., Winsor H. Watson III, Andrew R. Solow, and Andrew M. Mountcastle. 2006. Thermal histories of brooding lobsters, *Homarus americanus,* in the Gulf of Maine. Mar. Biol. 150:463-470.

Authors: Although it is widely accepted that migration by ovigerous lobsters (*Homarus americanus* Milne Edwards) optimizes thermal conditions for embryonic development, temperatures experienced by freely moving lobsters

have never been measured. The precise thermal histories of 30 ovigerous lobsters at large in the Gulf of Maine were recorded to compare thermal conditions experienced during a brooding season…These data, which are the first to document the seasonal temperatures experienced by ovigerous lobsters, suggest that migrations do not necessarily increase the number of degree-days experienced by developing embryos, but do reduce the variation in their thermal regime.

Cowger, J. 1976. The Nesting Habitat of Leach's Storm Petrel in Maine and Its Relevance to the Critical Areas Program. Maine State Planning Office. Augusta, Maine. 13.

Author: Several Maine coastal islands constitute the southern limit of the breeding range of the Leach's storm petrel, *Oceanodroma leucorhoa*, with the exception of one small colony on a Massachusetts island. History and current status of Leach's storm petrels nesting in Maine is reviewed. The important nesting locations of Leach's storm petrels are proposed for inclusion on the Critical Areas Register, and management guidelines are proposed.

Cruickshank, Allan D. 1938. Observations at Muscongus Bay, Maine. The Auk 55(3):550-552.

Author: During the last two summers at the Audubon Nature Camp on Muscongus Bay, Maine, the writer has had the unusual opportunity of putting in six full months of intensive daily field observations. During this period, 175 species of birds have been recorded; some of these observations are of sufficient significance to be put on record. Of even greater interest, however, than unusual species and birds out of season is the noted increase in the numbers of nesting seabirds.

Davis, Matthew and John Rumpler. 2004. Off the Hook: Why Maine Needs Tough Penalties to Protect its Waters. Environment Maine Research and Policy Center, Portland, Maine. 39 p.

Authors: Based on extensive research, this report presents three major findings: (1) Illegal discharges remain a serious threat to Maine's waterways. (2) Illegal water pollution persists in Maine because violators rarely pay any penalty for their excessive discharges. (3) DEP can protect Maine's waterways from further illegal discharges by consistently seeking tough penalties for permit violations.

Doggett, L.F, P.F. Larsen, and S.C. Sykes. 1978. Intertidal Bedrock Areas of High Species Diversity in Maine, and Their Relevance to the Critical Areas Program. Maine State Planning Office, Augusta, Maine. Planning Report. No. 55.

QLF: Eighteen sites of high species diversity in intertidal bedrock areas along the coast of Maine were recommended to the Critical Areas Program for investigation.

Two sites with noteworthy species are within the boundaries of Muscongus Bay: Pemaquid Point and Port Clyde. The report details the species present in each intertidal zone.

Dow, R.L. 1975. Reduced Growth and survival of clams transplanted to an oil spill site. Mar. Pollut. Bull. 6:124-125.

Dudgeon, Steven R., Robert S. Steneck, Ian R. Davidson, and Robert L. Vadas. 1999. Coexistence of Similar Species in a Space-Limited Intertidal Zone. Ecological Monographs 69(3):331-352.

Authors: The lower intertidal zone (0.0 to +1.0 m mean low water [MLW]) of rocky shores in New England is a space-limited community occupied by two similar rhodophyte seaweeds, *Chondrus crispus* and *Mastocarpus stellatu*s, that overlap broadly in their use of three essential resources: space, light, and nutrients… Our objectives were to determine (1) whether these two species compete and (2) if so, what process(es) enable their coexistence.

Ellis, S.L. and D.F. Cowan. 2000. Gulf of Maine Intertidal Lobster Monitoring Program 2000. Lobster Conservancy. Friendship, Maine. Final Report, Project No. 00-072. 19 p.

QLF: This report summarizes the Intertidal Lobster Monitoring Program's achievements between November 1999 and November 2000.

Ellis, S.L and D.F. Cowan. 2001. Volunteer-based monitoring of juvenile American lobster, *Homarus americanus.* Mar. Freshwater Res. 52:1103-12.

Authors: The primary objective of the Juvenile Lobster Monitoring Program is to develop a time series of abundance and distribution of juvenile American lobsters. Between 1997 and 2000, trained volunteers quadrat sampled 1-m^2 quadrats along fixed 20-m transects monthly from May through October at 24 intertidal sites in the Gulf of Maine. A strong correlation between abundances at intertidal and subtidal sites ($r = 0.86$, $P < 0.001$, $n = 17$) indicates similar patterns of abundance in the two zones. A volunteer work-force allows cost-effective long-term research on juvenile lobsters over a wide geographical area.

Fefer, S.I. 1977. The American Eider (*Somateria mollissima dresseri)* in Maine and its Relevance to the Critical Areas Program. Maine Critical Areas Program, Maine State Planning Office, Augusta, Maine. Report No. 27. 72 p.

Author: Criteria for determining significant nesting areas for the eider duck in Maine are defined and a historical review of eider duck nesting on the Maine coast is presented. In 1976, the birds nested on at least 215 islands in Maine of which 49 were of significance for eiders. These significant areas provided breeding habitat for at least 60 percent of Maine's 1976 eider population. It is suggested that these nesting areas be maintained in their present condition and that human disturbance

on such islands be restricted during the nesting season (1 May – 15 July).
QLF: Of the 49 significant breeding islands in Maine, seven are within Muscongus Bay.

Forbes, William H. 1977. Significant Bedrock Fossil Localities in Maine and Their Relevance to the Critical Areas Program. Maine Critical Areas Program, Maine State Planning Office, Augusta, Maine. Report No 46.

Author: As a result of detailed and reconnaissance geologic mapping in Maine over the past few decades by geologists of the U.S. Geological Survey, the Maine Bureau of Geology, and a large number of academic institutions, the geologic framework of Maine has been considerably revised. The most significant of these fossil localities are detailed in this report.

Gilbert, James R., Gordon T. Waring, Kate M. Wynne, and Nikolina Guldager. 2005. Changes in abundance of harbor seals in Maine, 1981-2001. Marine Mammal Science 21(3):519-535.

Authors: Aerial counts of harbor seals *(Phora vitulzna concolor)* on ledges along the Maine coast were conducted during the pupping season in 1981, 1986, 1993, 1997, and 2001…Productivity in this population has increased since 1981 from 6.4% pups to 24.4% pups. The number of gray seals *(Halichoerus gypus)* counted during the harbor seal surveys increased from zero in both 1981 and 1986 to 1,731 animals in 2001.

Gladu, S. and Gustafson, K. 2003. Friends of the Medomak Watershed. Waldoboro, Maine. Vol. 2. 6 p.

QLF: The Friends of the Medomak Watershed newsletter gives a brief summary of volunteer and staff accomplishments in 2003. These include details of enterococci bacteria and estuary sampling, the Goose River oil spill, and results of estuary sampling conducted by the Maine Department of Marine Resources.

Griffith, F. 1976. Coastal Island Study, Maine Mid-Coast Region. Land Use Regulation Commission, Coastal Island File, Augusta, Maine.

QLF: Field Griffith was commissioned by LURC to characterize the islands within Muscongus Bay. For each island, a summary of location, access, description, geology, soils, vegetative cover, wildlife, shoreline characteristics, natural areas, land use, and marine resources is detailed. A map of marine and terrestrially significant areas follows the description.

Gross, Alfred O. 1944. The Present Status of the Double-crested Cormorant on the Coast of Maine. The Auk 61(4):513-537.

QLF: This article serves as an inventory of Double-crested Cormorant nesting sites on Maine islands.

Gross, Alfred O. 1945. The Present Status of the Great Black-Backed Gull on the Coast of Maine. The Auk 62(2):241-256.

Author: During the past four years I have had an opportunity, while serving with the U. S. Fish and Wildlife Service as a collaborator from 1941- 1943 and as Biologist in 1944, to observe and record the recent changes that are taking place in the sea-bird colonies along the Maine coast.' These trips were taken each year from about May 20 to June 20 at the height of the nesting season. All of the important Herring Gull colonies between the Isles of Shoals at the New Hampshire- Maine state boundary to the Bay of Fundy were visited for the purpose of gull control. This paper will deal primarily with the present status of the Great Black-backed Gull (Larus marinus).

Hall, C. Scott and Stephen W. Kress. 2004. Comparison of Common Tern Reproductive Performance at Four Restored Colonies along the Maine Coast, 1991-2002. Waterbirds 27(4):424-433.

Authors: We compared the reproductive performance of the Common Tern (*Sterna hirundo*) from 1991-2002 at four restored colonies in Maine that differ in location (inshore, nearshore and offshore sites), colony age and size and predation. Specifically, phenology, clutch size, survival, growth, provisioning rates and predation intensity and frequency were compared between sites.

Hall, S. 2003. Arctic and Roseate Tern Chick Diet in Maine [MS thesis]. College of Natural Resources and the Environment, University of Massachusetts Amherst, Amherst, Massachusetts.

Hurst, J.W., J.S. Kahl, E. Patry, and D. Nelson. 1976. Bioaccumulation of Trace Elements in Selected Marine Organisms; An examination of mined and unmined areas in mid-coastal Maine. Maine Dept of Marine Resources, West Boothbay Harbor, Maine. 86 p.

Authors: This study purports to understand the relationship between toxic metals in the marine environment and metal levels in the biota of mid-coastal Maine. By examining mineralized and unmineralized, mined and unmined sites, we were able to gain some insight into the effect of these operations on the background metal levels in sediments and organisms in their respective areas. Given these varying metal background environments, we were also able to assess an organism's ability to regulate a given metal.

Hutchinson, A. E. and S. J. Lovett. 1984. Muscongus Bay, Marine Wildlife Inventory and Evaluation. Maine Dept of Inland Fisheries and Wildlife, Augusta, Maine. 122 p.

Authors: This report inventories and evaluates marine wildlife resources in Muscongus Bay and describes a method for assessing losses to the resource from oil pollution. (Refer above to: **Card and Aho**, Coastal Marine Resource Inventory.)

Hyland, J.L. 1977. A review of oil polluting incidents in and around New England. Ecol. Res. Ser. EPA-600/3-77-064.

Incze, L.S., R.A. Wahle, and J.S. Cobb. 1997. Quantitative relationships between postlarval supply and benthic recruitment in lobsters, *Homarus americanus*. Mar. Freshwater Res. 48:729-743.

Authors: Relationships between lobster postlarval supply and benthic recruitment were evaluated within and between oceanographically distinct segments of the range of the American lobster.

Kelley, J.T., W.A. Barnhardt, D.F. Belknap, S.M. Dickson, and A.R. Kelley. 1996. The Seafloor Revealed: The geology of the northwestern Gulf of Maine Inner Continental Shelf. Maine Geological Survey, Augusta, Maine. Open File 96-6. 55 p.

Authors: During the past ten years we have conducted many exploratory surveys of the seafloor of the western Gulf of Maine. Recently we compiled that information, along with previously published data, using a *geographic information system* (GIS) to produce a series of maps of the seafloor of the *inner continental shelf* of the western Gulf of Maine. This report is written to accompany the map series and to explain the field techniques used to collect data. The nature of the seafloor, as well as the late *Quaternary* geologic history of the area, is also described.

Kelley, J.T. and D.F. Belknap. 1991. Physiography, surficial sediments and quaternary stratigraphy of the inner continental shelf and nearshore region of the Gulf of Maine. Continental Shelf Res. 11:1265-1283.

Authors: The western edge of the Gulf of Maine is a bedrock-framed, glaciated continental shelf that has only recently been geologically mapped. The bathymetry is dividable into four physiographic areas: nearshore basins, shelf valleys, rocky zones, and outer basins.

QLF: Muscongus Bay was the focal point of this study.

Kellogg, D.C. 1991. Prehistoric Landslides, Paleoenvironments, and Archaeology of Western Muscongus Bay, Maine (Ph.D.). Orono, Maine. University of Maine, Orono.

Author: Archaeological study of marine adaptations during the late Pleistocene and Holocene requires reconstruction of the whole landscape because coastal settlement allows access to both marine and terrestrial environments. This study provides paleoenvironmental data and landscape reconstructions as background for the archaeological study of coastal adaptations to the Gulf of Maine region.

Kress, S.W. 1977. "Establishing Atlantic Puffins at a former breeding site." In: Endangered Birds: Management Techniques for Preserving Species. Ed. S.A. Temple. Univ. of Wisconsin Press. 373-377 p.

> *Author:* The primary objective of this program is to develop procedures for reestablishing puffins at former breeding sites. The project design is based on the assumption that puffins normally return to breed at their natal colony and often assume breeding activities in the same vicinity where they were reared. Eastern Egg Rock in Muscongus Bay, Maine, was selected as the site for experiments because of its history as a former puffin colony, the abundance of breeding places under large boulders, the absence of terrestrial mammals, and proximity to the National Audubon Society's Workshop on Hog Island, which serves as base for project operations.

Kress, S.W. 1979-1998. Egg Rock Update: Annual newsletter of National Audubon Society Fratercula Fund. Project Puffin, Ithaca, NY.

Kress, S.W. 1981. Restoring Maine seabirds. Maine Audubon Quarterly 5(2):8-14.

Kress, S.W. 1982. The Return of the Atlantic Puffin to Eastern Egg Rock, Maine. The Living Bird Quarterly. 1(1):11-14.

> *QLF:* Beginning with a brief history of seabird exploitation in the late 1800's, Kress describes the reestablishment program of Atlantic Puffins to Eastern Egg Rock from 1973 to 1982.

Kress, S.W. 1983. The Use of Decoys, Sound Recordings and Gull Control for Re-establishing a Tern Colony in Maine. Colonial Waterbirds. 6:185-196.

> *Author:* To re-establish breeding Arctic Terns, (*Sterna paradisaea*) on Eastern Egg Rock (Knox Co., Maine), breeding populations of Great Black-billed Gulls (*Larus marinus*) and Herring Gulls (*L. argentatus*) were eliminated and social attractants (Arctic Tern decoys and sound recordings of nonaggressive tern vocalizations) were used to attract terns to this former nesting site

Kress, S.W. 1991. A strategy for restoring Common, Arctic and Roseate Terns to historic nesting habitat in the Gulf of Maine. Transactions of the 1991 NE Fish and Wildlife Conference.

Kress, S.W. 1997. Using animal behavior for conservation: case studies in seabird restoration from the Maine Coast, USA. J. of the Yamashina Institute for Ornithology, 29(1):1-26.

> *Author*: This paper presents case studies of the first restored colonies of Arctic Terns, Common Terns, and Roseate Terns, Atlantic Puffins, and Leach's Storm-Petrels. These restoration projects are based on the use of two fundamental and

commonly occurring features of colonial waterbird behavior: social facilitation and philopatry.

Kress, S.W. 1998. Applying Research for Effective Management: Case Studies in Seabird Restoration. In: Avian Conservation. J.M. Marzluff and R. Sallabanks, eds. Island Press, Washington. 141-154 p.

Author: This chapter describes several long term case studies that show how existing knowledge of seabird behavior and life histories can be used to: (1) reestablish extirpated seabird colonies to islands; (2) expand species ranges to former distributions; and (3) increase diversity of nesting seabird communities.

Kress, S.W. and D.N. Nettleship. 1988. "Re-establishment of Atlantic Puffins (*Fratercula arctica*) at a Former Breeding Site in the Gulf of Maine" J. of Field Ornith. 59(2):161-170.

Authors: This study demonstrated that young puffins learn the location of their natal island sometime after they are 2 weeks old, and they will return and nest at a transplant site or nearby existing puffin colony. This study also demonstrated that young transplanted puffins develop a breeding schedule associated with conditions at their release site, rather than conditions where they were hatched, i.e., a genetically determined timetable for breeding.

Kury, Channing R. 1969. Pesticide Residues in a Marine Population of Double-crested Cormorants. The Journal of Wildlife Management 33(1):91-95.

Author: The double-crested cormorant *(Phalacrocorax auritus)* was successful in its reproduction in Muscongus Bay, Maine, colonies in 1966 despite the fact that gulls and exposure inflicted a high mortality (71 percent) on eggs and young. The cormorant obtained little or no pesticide from Maine fish. Pesticides present in the organs of the cormorant were obtained in some other area, possibly Florida where the bird winters. Pesticide residues seem not to have affected the reproductive success of the cormorant.

Langton, R.W., J.B. Pearce, and J.A. Gibson, eds. 1994. Selected Living Resources, Habitat Conditions, and Human Perturbations of the Gulf of Maine. NOAA, Woods Hole, Massachusetts. Technical memorandum NMFS-NE-106.

QLF: The eleven individually authored parts of this publication were compiled to give an overview of environmental and ecological factors effecting the fisheries in the Gulf of Maine. Muscongus Bay was one of the estuarine systems sampled in John E. O'Reilly's Nutrient Loading and Eutrophication section.

Larsen, P.F. 1985. Thermal satellite imagery applied to a littoral macrobenthos investigation in the Gulf of Maine. Int. J. Remote Sensing. 6(6):919-926.

Author: The application of satellite imagery to oceanographic problems has grown in recent years. Its use in biological oceanography, however, has been largely limited to studies of primary productivity. The ability of thermal satellite imagery to identify coastal oceanic fronts suggests that there may be an application to macrobenthos investigations. This communication describes how thermal satellite imagery was applied to the study of sand-beach community distribution in the Gulf of Maine.

QLF: Along with thermal satellite imagery a control of eight beaches, including Bristol beach, were sampled using standard littoral sediment techniques.

Larsen, P. F. and L. F. Doggett. 1976. The Salinity and Temperature Distributions of Selected Maine Estuaries. Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, Maine. 112 p.

Authors: Knowledge of the salinity and temperature structures of estuarine waters are central to management efforts. For this reason, the Bigelow Laboratory for Ocean Sciences, under a contract from the Maine State Planning Office, endeavored to do a cursory survey of the salinity and temperature distributions of selected Maine estuaries. This report presents data on the 21 estuaries sampled as a part of this program. The estuaries are the Chandler, East Machias, Fore, Harrington, Kennebec, Kennebunk, Machias, Medomak, Mousam, New Meadows, Nonesuch, Passagassawakeag, Piscataqua, Pleasant, Royal, Saco, St. Croix, St. George, Scarboro, Union, and York.

Larsen, P. F. and L. F. Doggett. 1991. The Macorinvertebrate Fauna Associated with the Mud Flats with the Flats of the Gulf of Maine. J. Coast. Res. 7(2):365-375.

Authors: Mud flats are a dominant habitat in the Gulf of Maine and are of significant economic and ecological importance to the region. This communication describes the macroinvertebrate fauna (> 1.0 mm) of five representative mud flats along 300 km of coastline in the central and northern Gulf of Maine.

QLF: A mudflat in East Friendship was a site sampled for this study.

Lazzari, M.A., S. Sherman, and J.K. Kanwit. 2003. Nursery use of shallow habitats by epibenthic fishes in Maine nearshore waters. Estuarine, Coastal and Shelf Sci. 56:73-84.

Authors: Species richness and abundance of epibenthic fishes were quantified with daytime beam trawl tows in shallow water habitats during April-November 2000 of three mid-coast Maine estuaries: Casco Bay, Muscongus Bay and the Weskeag River. This study documents the importance of shallow estuarine areas in Maine as nurseries for these species.

Lazzari, M.A. and B.Z. Stone. 2006. Use of submerged aquatic vegetation as habitat by young-of-the-year epibenthic fishes in shallow Maine nearshore waters. Estuarine, Coastal and Shelf Science 69:591-606.

> *Authors:* Epibenthic fishes were collected with daytime beam trawl tows (n ¼ 1713) in three shallow (<10 m) habitats of submerged aquatic vegetation (SAV), *Zostera marina* (eelgrass), *Laminaria longicruris* (kelp), *Phyllophora* sp. (algae), and unvegetated sandy/mud areas… This study provides direct evidence of shallow waters of the Gulf of Maine as critical facultative nursery habitat for juvenile *G. morhua, M. tomcod, P. virens, U. tenuis, U. chuss, T. adspersus, O. mordax* and *P. americanus,* and many ecologically important species.

Leach, T.T. 1998. The Bedrock Geology and Tectonic History of Hupper Island, Muscongus Bay, ME (Undergraduate Thesis). Dept of Geology, Bates College, Lewiston, Maine. 122 p, 2 maps.

> *Author:* The purpose of this study is to map the bedrock geology and interpret the tectonic history of Hupper Island, in Muscongus Bay, Maine, and relate this to the larger geologic environment of the St. Croix terrene in which the island is found. Specifically, the study of the rock units and structures found on Hupper Island will provide the link between previous studies of the Georges Islands further off shore by Eusden et al. (1996) and studies of the mainland by Guidotti (1979) and Berry (1987). New information from this study will help delineate the metamorphic, plutonic and structural sequences of the St. Croix terrene which will result in a better understanding of Appalachian tectonics in the Silurian.

Lincoln, Frederick C. 1921. American Tern Recovered in West Africa. The Auk 38(3):453-454.

> *QLF:* A report of one Common Tern, banded at Eastern Egg Rock, Muscongus Bay, which was discovered in South Nigeria, proving that "occasionally, at least, North American birds of this species do make the transoceanic flight to Africa."

Maine Department of Environmental Protection. 1974. Survey of waste discharges to Shellfishing Areas: Bremen. H.C. Winters, J. Underwood, S.R. Barter, S.P. Jellison, and C.A. Dolloff. Maine Dept of Marine Resources, West Boothbay Harbor, Maine.

> *Author:* The State of Maine conducts a sampling program designed to monitor shellfish and shellfish growing areas. Various criteria are used to determine the status of shellfish and shellfish habitats, one of the more important being the relative abundance of coliform bacteria (whose presence constitutes a potential public health hazard). This report details waste discharges in Bremen, Maine, one of the communities in Muscongus Bay. Discharges are noted and reported as to type, origin and significance to receiving waters and growing areas.

Maine Department of Environmental Protection. 1974. Survey of waste discharges to Shellfishing Areas: Bristol. H.C. Winters, J. Underwood, S.R. Barter, S.P. Jellison, and C.A. Dolloff. Maine Dept of Marine Resources, West Boothbay Harbor, Maine.

> *Author:* The State of Maine conducts a sampling program designed to monitor shellfish and shellfish growing areas. Various criteria are used to determine the status of shellfish and shellfish habitats, one of the more important being the relative abundance of coliform bacteria (whose presence constitutes a potential public health hazard). This report details waste discharges in Bristol, Maine, one of the communities in Muscongus Bay. Discharges are noted and reported as to type, origin and significance to receiving waters and growing areas.

Maine Department of Marine Resources. 1976. Sanitary Survey Report for Cushing, Maine. H.C. Winters and K.H. Hodgdon. West Boothbay Harbor, Maine.

> *QLF:* Survey of municipal/private areas with specific reference to shellfish area boundaries. Includes estimated shellfish productivity, disposal methods, water quality assessment and conclusions, and illegal waste discharge details. Maps accompany report.

Maine Department of Marine Resources. 1976. Sanitary Survey Report for Friendship, Maine. H.C. Winters and K.H. Hodgdon. West Boothbay Harbor, Maine.

> *QLF:* Survey of municipal/private areas with specific reference to shellfish area boundaries. Includes estimated shellfish productivity, disposal methods, water quality assessment and conclusions, and illegal waste discharge details. Maps accompany report.

Maine Department of Marine Resources. 1976. Sanitary Survey Report for St. George, Maine. H.C. Winters and K.H. Hodgdon. West Boothbay Harbor, Maine.

> *QLF:* Survey of municipal/private areas with specific reference to shellfish area boundaries. Includes estimated shellfish productivity, disposal methods, water quality assessment and conclusions, and illegal waste discharge details. Maps accompany report.

Maine Department of Marine Resources. 1976. Sanitary Survey Report for South Thomaston, Maine. H.C. Winters and K.H. Hodgdon. West Boothbay Harbor, Maine.

> *QLF:* Survey of municipal/private areas with specific reference to shellfish area boundaries. Includes estimated shellfish productivity, disposal methods, water quality assessment and conclusions, and illegal waste discharge details. Maps accompany report.

Maine Department of Marine Resources. 1976. Sanitary Survey Report for Waldoboro, Maine. H.C. Winters and K.H. Hodgdon. West Boothbay Harbor, Maine.

QLF: Survey of municipal/private areas with specific reference to shellfish area boundaries. Includes estimated shellfish productivity, disposal methods, water quality assessment and conclusions, and illegal waste discharge details. Maps accompany report.

Maine Department of Marine Resources. 1995. Eelgrass mapping project [aerial photographs]. Seth Barker. Muscongus Bay, Region 3. http://www.state.me.us/dmr/aerialphotos/preview/zone3/zone3.html.

Maine Department of Marine Resources. 2003. Aquaculture Lease Inventory. Muscongus Bay. 107.

QLF: Details of aquaculture lessee including: company name, contact information, lease location, acreage/rent, species cultivated, cultivation techniques, conditions, date of lease, terms, and maps.

Maine State Planning Office. 1981. The Ecology of Maine's Intertidal Habitats. Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, Maine. 183 p.

Author: The purpose of this handbook is to present a synthesis of information on certain ecological aspects of the land-sea interaction as they pertain to the Maine coast. In particular, the kinds of animals living in the intertidal zone are documented, and the relationship between these animals and their environment, both natural and perturbed, is discussed.

Maine State Planning Office. 1994. Exploring limits, Making Decisions About the Use & Development of Maine Islands. Maine State Planning Office, Augusta, Maine. 84 p.

QLF: Six limiting factors for island use are examined in this handbook: groundwater, solid waste, social experience, vegetation and soil resiliency, nesting habitat, and scenic quality. This guide uses Monhegan and Loud's Island as examples for the six issues.

Mayo, D.W., D.J. Donovan, and L. Giany. 1974. Long term weathering characteristics of Iranian crude oil: the wreck of the *Northern Gulf*. In: Proc. Mar. Poll. Mon. Symp. May 1974. Gaithersburg, MD. 10C-UNESCOWMONBS. 201-208 p.

McMahon, J. 1994. The Medomak River Watershed, A Natural Resource Inventory. Medomak Valley Land Trust. 104 p. Availability: Waldoboro Town Office.

Author: The purpose of the natural resource inventory was to identify lands that are most important from the point of view of the watershed as a whole, such as prime farmlands, shore access for clammers and others, recreational and scenic lands, lands that protect water supplies, and lands that support wildlife.

Miller, David S., William B. Kinter, David B. Peakall, and Robert W. Risebrough. 1976. DDE feeding and plasma osmoregulation in ducks, guillemots, and puffins. Am. J.Physiol. 231(2):370-376.

> *Authors:* To assess the possibility that organochlorine pesticide disruption of osmoregulation is responsible for recent large kills of young seabirds, we have studied the effects of DDE feeding (lo-250 ppm) on plasma osmoregulation and nasal gland function in the following species: mallared and white Pekin ducks (both *Anas platyrhynchos*), black guillemot (*Cepphus grylle*), and common (*Fratercula arctica*).

Morse, Douglass H. 1971. The Foraging of Warblers Isolated on Small Islands. Ecology 52(2):216-228.

> *Author:* In this paper I attempt to answer the question, "What (if any) differences occur in the foraging of isolated wood warblers (Parulidae) and ones in large multispecies populations?" Parula (*Parula Americana*), Myrtle (*Dendroica coronata*), and Black-throated Green (*D. virens*) Warblers were studied on seven small spruce-clad islands off the coast of Maine, each island supporting one pair of one to three of these species.

Morse, Douglass H. 1971. Great Horned Owls and Nesting Seabirds. The Auk 88(2):426-427.

> *QLF:* Observations suggesting that Great Horned Owls inhabiting the mainland or large forested islands of Muscongus Bay may be preying on the nesting seabirds that populate the bay's many spruce-clad islands.

Morse, Douglass H. 1973. Habitat Utilization by Meadow Voles on Small Islands. Journal of Mammalogy 54(3):792-794.

> *Author:* Considerable interest has developed recently over how animals utilize habitats in the presence and absence of potential competitors…Here I present data on the distribution of meadow voles (*Microtus pennsylvanicus*) and red-backed voles (*Clethrionomys gapperi*) along the coast of Maine.

Morse, Douglass H. 1977. The Occupation of Small Islands by Passerine Birds. The Condor 79(4):399-412.

> *Author:* In this paper I report upon the patterns by which passerine birds occupy extremely small forested islands and adjacent large mainland habitats in and around Muscongus Bay, Maine, thus expanding upon earlier observations (Morse 1971a). I attempt to answer the following questions: From which mainland habitats do the inhabitants of these islands come? Which characteristics of the islands best predict the number of species that will occupy them? What factors best account for the presence or absence of any given species on the islands? How

stable are the island assemblages in time? How does the total density of birds and the densities of individual species compare with the densities on the mainland? Then, where appropriate, I relate my findings to island biogeographic theory (MacArthur and Wilson 1963, 1967, Diamond 1975).

Muscongus Pond Association. *Pond Reflections*, description of alewife restoration by Muscongus Pond Association, Inc. in Webber Pond in Bremen,

QLF: Available from Muscongus Pond Association, Inc Maine P.O. Box 259, Bremen, ME.

National Oceanic and Atmospheric Administration. 1944. North Atlantic Estuaries, Muscongus Bay (NO60). 2004. http://www.spo.nos.noaa.gov/bathy/northatlantic.html.

Author: Bathymetry for Muscongus Bay was derived from nine surveys conducted in 1943 and 1944 containing 109,649 soundings.

Neal, B.P. 2003. Eastern Gulf of Maine Atlantic Herring Spawning Area Survey Project Year 6 Summary. Island Institute, Rockland, Maine. 10 p.

Author: The Island Institute's herring spawning project sought to use a network of fishermen to collect information on herring spawning activity in nearshore waters. The project aimed to locate and record the sites, times, and size of specific Atlantic Herring spawning events on the mid and eastern Maine coast.

QLF: Monhegan Island was added as a survey site in 2000 but subsequently removed because no spawning grounds were detected.

Neil, C., D.B. Locke, M.E. Foley, R.G. Marvinney, R.D. Tucker, and B.J. Wilson, Jr. 1999. Significant Sand and Gravel Aquifers: Bristol Quadrangle, Maine. Dept of Conservation, Maine Geological Survey, Augusta, Maine. Open file No. 99-13.

QLF: Along with sand and gravel aquifer zones, this map shows locations of wells associated with depths of bedrock, and information gathered by seismic refraction studies. Sand and gravel aquifer maps aid in decision-making about groundwater supply and protection.

Neil, C., D.B. Locke, M.E. Foley, R.G. Marvinney, R.D. Tucker, and B.J. Wilson, Jr. 1999. Significant Sand and Gravel Aquifers: Pemaquid Point Quadrangle, Maine. Dept of Conservation, Maine Geological Survey, Augusta, Maine. Open file No. 99-14.

QLF: Along with sand and gravel aquifer zones, this map shows locations of wells associated with depths of bedrock, and information gathered by seismic refraction studies. Sand and gravel aquifer maps aid in decision-making about groundwater supply and protection.

New England River Basins Commission. 1981. Maine's Central Coastal River Basins Overview, Public Review Draft. Augusta, ME. 108.

Author: The Commission has prepared summary reports on each of the region's major river basins. The series establishes a uniform information base with respect to demands on water resources, problems associated with the use of resources, and programs and projects relevant to the management of water in each of the region's major river basins. These reports concentrate on identifying problems in the existing network, of planning and resource management programs and advance recommendations for state and federal planning through its investigation of and reporting on interstate resource issues and will also provide information for setting agency priorities.

Parnell, J.F., D.G. Ainley, H. Blokpoel, B. Cain, T.W. Custer, J.L. Dust, S. Kress, J.A. Kushlan, W.E. Southern, L.E. Stenzel, and B.C. Thompson. 1988. Colonial Waterbird Management in North America. J. of the Colonial Waterbird Society. 11(2):129-345.

Author: Colonial waterbirds are an important natural resource highly valued by many people in Canada and the United States. The habit of nesting in large groups makes these birds especially susceptible to problems, such as human disturbance, predation, severe weather events, and competition for nesting habitat. They, like all birds, also face threats from habitat degradation, loss and contamination of their environments, and changes in food webs. Strategies for adequate monitoring and management of these species are discussed in this report.

Perkins, L.F. and P.F. Larsen. 1975. A Preliminary Checklist of the Marine and Estuarine Invertebrates of Maine. Maine Dept of Marine Resources, West Boothbay Harbor, Maine. TRIGOM Publication No. 10.

Authors: This annotated checklist summarizes information on the distribution and abundance of the marine and estuarine macroinvertebrates of Maine, and is intended for use by planners, educators and the general public as well as the scientific community. The present document is a first cull of the recent data (since 1940) and is offered as a preliminary report for use while the longer, complete form is in preparation.

QLF: Muscongus Bay is split into two regions: Region 2 – Knox Region and Region 5 – Lincoln Region.

Podolsky, R.H. and S.W. Kress. 1989. Factors Affecting Colony Formation in Leach's Storm-Petrel. Auk 106(2):332-336.

QLF: From 1980 to 1983, the social facilitation hypothesis was tested on Leach's Storm-Petrels (*Oceanodroma leucorhoa*) on five islands in Muscongus Bay; Eastern Egg Rock, Ross Island, Wreck Island, Franklin Island, and Old Hump

Ledge. The hypothesis states that first-time breeding seabirds are more likely to nest in a location with a group of conspecifics. The experiment used amplified vocalizations and hand-dug nests to induce petrels to nest on uncolonized islands.

Podolsky, R.H. and S.W. Kress. 1989. Plastic Debris Incorporated into Double-Crested Cormorant Nests in the Gulf of Maine. J. Field Ornithol. 60(2):248-250.

Authors: We report the incorporation of plastic debris into Double-crested Cormorant (*Phalacrocorax auritus*) nests on three islands in the Gulf of Maine. Of the 497 nests examine during 1967 and 1988, 188 nests (37%) contained plastic debris. Sections of lobster trap line, plastic bags and pieces of fishing net dominated the debris. We discuss the importance of such debris in nests and recommend future monitoring of plastics in seabird nests.

Quebec Labrador Foundation/Atlantic Center for the Environment. 1989. Resource Inventory of the St. George River, Maine. T. Coffin, R. Shea, and B. Sauerhaft. Ispwich, Massachusetts. 94 p.

Author: The Resource Inventory documents the natural, cultural, and recreational resources of the St. George River for the Georges River Land Trust. Resources are described by their degree of significance and degree of protection. Key unprotected areas that possess multiple values or outstanding singular values are identified for the Land Trust as "action areas." The report also summarizes protected areas and describes resource protection programs available to towns and landowners.

Rich, Walter. 1929. Fishing Grounds of the Gulf of Maine. Reprinted 1983. Maine Dept. of Marine Resources, West Boothbay Harbor, Maine.

QLF: An early description with charts and tables of the "fishing spots" off Maine's coast compiled from previous studies and interviews with boat captains. Includes location, bottom type, and fishery for each location. Several Muscongus bay sites listed.

Rounsefell, George A. and Louis D. Stringer. 1945. Restoration and Management of the New England Alewife Fisheries with Special Reference to Maine. Transactions of the American Fisheries Society 73(1):394-424.

Authors: To augment the fish supply in New England increased attention is being accorded to the alewife. Through neglect, obstructions to migration, overfishing, and other causes, the alewife populations have been reduced greatly. A survey of the coastal streams of Maine disclosed many streams that can be returned to production by building fishways or modifying present fishways, in conjunction with a program of restocking and proper management methods. During the 1943 season, barren spawning areas (lakes) on 13 streams were stocked with alewives and observations indicated successful production and survival of young.

Recommendations are made for the removal of obstructions or the construction of fishways on 17 streams.

Shelley, P. 1998. Muscongus Bay – St. George River. In: Rim of the Gulf, Restoring Estuaries in the Gulf of Maine. Ed. D.D. Platt. Island Institute, Rockland, Maine. 59 p.

QLF: One section of this report briefly summarizes Muscongus Bay estuaries (Georges River and Medomak River.) It includes segments on location, area, habitats, tidal ranges, people, and threats.

Shenton, E.H. 1973. An historical review of oil spills along the Maine coast 1953-1973. Maine State Planning Office, Augusta, Maine. TRIGOM Pub No. 3.

Author: A one month study was conducted to assemble and document oil spill data along the coast of Maine beginning in 1953. A total of 451 oil spills were found reported over a 20 year period; 336 of these occurred in the Portland vicinity. Recent data reported by the Maine Department of Marine Resources show long term oil persistence and biological impact in two cases, the Northern Gulf and Long Cove.

QLF: In 1963, the "Northern Gulf" crude oil spill in Casco Bay had major implications on Muscongus Bay.

Sidle, W.C. 1991. Reconnaissance Bedrock Geology of the Waldoboro Pluton Complex and Other Intrusive Rocks in Coastal Lincoln and Knox Counties, Maine. Maine Geological Survey, Augusta, Maine. Open File No. 91-3. 11 p, 2 maps.

Author: This preliminary report outlines granitoid macroscopic petrography, structural features in the granitoids, and mafic dikes on the herein named Waldoboro Pluton Complex. A tabled summary of the Waldoboro Pluton Complex structural development is also included. Detailed geologic mapping over a ten month period in 1987-1989 covered parts of the Union, Jefferson, Waldoboro East, Waldoboro West, Damariscotta, Friendship, Loud's Island, and New Harbor quadrangles (Plates 1,2).

Sindermann, C.J. 1957. Diseases of Fishes of the Western North Atlantic VI. Geographic Discontinuity of Myxosporidiosis in Immature Herring From the Gulf of Maine. Dept of Sea and Shore Fisheries, Augusta, Maine. Research Bulletin No 29.

Author: The gross symptoms of myxosporidiosis in immature sea herring from the Gulf of Maine - opaque white fusiform intramuscular cysts - may serve as indicators of movement or lack of movement of host fish. This infection was found to be common in age-group-0 herring along the western Maine coast, particularly in Casco Bay, but was absent from fish of this age-group from Penobscot Bay and the eastern Maine coast.

QLF: Sampling sites include Bremen, Friendship, Friendship Harbor, and Loud's Island.

Smith, G.W. 1974. Reconnaissance Surficial Geology of the Friendship Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open-file No. 74-15.

QLF: This map details the sequence of glacial recession and deposition of surficial materials.

Smith, G.W. 1976. Reconnaissance Surficial Geology of the Loud's Island Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open-file No. 76-36.

QLF: This map details the sequence of glacial recession and deposition of surficial materials.

Smith, G.W. 1976. Reconnaissance Surficial Geology of the Waldoboro West Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open-file No. 76-39.

QLF: This map details the sequence of glacial recession and deposition of surficial materials.

Smith, G.W. and B. Anderson. 1975. Reconnaissance Surficial Geology of the Waldoboro East Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open-file No. 75-25.

QLF: This map details the sequence of glacial recession and deposition of surficial materials.

Sowles, J., S.A. Sherman, H. Smith, D.E. Grout, D.W. Perkins, Jr., R. Tetrault, and C. Rice. Fall 2000 and Spring 2001 Maine-New Hampshire Inshore Trawl Survey. Maine Department of Marine Resources, West Boothbay Harbor, Maine. Tech Research Doc 02-2.

Authors: This report summarizes the first year of a comprehensive bottom trawl survey of groundfish and other species for Maine-New Hampshire's inshore waters. The survey was a "proof of concept" pilot project that followed many less successful attempts at gathering fishery independent information or resource management in these inner waters. This is a multispecies survey that provides broad information on finfish and invertebrate populations and communities that can contribute to how we address climate change, select marine protected areas, designate Essential Fish Habitats, and study ecological patterns, processes and trophic relationships.

Steneck, R.S. and C.J. Wilson. 2001. Large-scale and long-term, spatial and temporal patterns in demography and landings of the American Lobster, *Homarus americanus,* in Maine. Mar. Freshwater Res. 52:1303-1319.

Authors: The American lobster, *Homarus americanus*, is abundant (>1/m^2) in spatially complex coastal habitats of the Gulf of Maine. Quadrat surveys (stratified by exposure, depth, and substrate) conducted at fixed locations since 1989 revealed consistently higher lobster population densities west and south of Penobscot Bay in central Maine. Catch rates per trap haul of prerecruits (<83 mm CL) and catch rates per area for lobsters fully recruited to the fishery (greater than or equal to 83 mm CL) correspond with local lobster densities. Consistent spatial and temporal patterns suggest that population densities can be reliably determined from calibrated fishery-dependent data.

QLF: Lobster sampling sites within Muscongus Bay are Monhegan Island, Allen Island, and Pemaquid Point.

Timson, B.S. 1974. Coastal Marine Geologic Environments of the Friendship Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open File No 74-22.

QLF: For ease of reading, this map is divided into three categories: supratidal, intertidal and subtidal. Each category is further subdivided into the coastal environments found in each area.

Timson, B.S. 1976. Coastal Marine Geologic Environments of the Loud's Island Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open File No 76-103.

QLF: For ease of reading, this map is divided into three categories: supratidal, intertidal and subtidal. Each category is further subdivided into the coastal environments found in each area.

Timson, B.S. 1976. Coastal Marine Geologic Environments of the Waldoboro East Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open File No 76-136.

QLF: For ease of reading, this map is divided into three categories: supratidal, intertidal and subtidal. Each category is further subdivided into the coastal environments found in each area.

Timson, B.S. 1976c. Coastal Marine Geologic Environments of the Waldoboro West Quadrangle, Maine. Maine Geological Survey, Augusta, Maine. Open File No 76-137.

QLF: For ease of reading, this map is divided into three categories: supratidal, intertidal and subtidal. Each category is further subdivided into the coastal environments found in each area.

U. S. Fish and Wildlife Service, Dept of Interior. 1980. An Ecological Characterization of Coastal Maine (North and East of Cape Elizabeth). S.E. Fefer and P.A. Schettig. Newton Corner, Massachusetts. Vols. 1-6.

QLF: A six volume description of Maine's coastal ecology and ecosystems. The most comprehensive of its kind and still the most recent material related to many aspects of Maine's marine environment. The coast is characterized within regions. Muscongus Bay is described as part of the materials covering region 3.

U.S. Geological Survey. 2004. U.S. Geological Survey Open-File Report 01-154 Bottom Photos: Field ID 1919 Muscongus Bay, Maine http://pubs.usgs.gov/of/of01-154/htmldocs/bphotos/bp1919.htm

U.S. Geological Survey. 2004. Woods Hole Field Center, Summary for Field Activity Number 84018 Ship Asterias , Seismic Profiling, Muscongus Bay, Maine http://quashnet.er.usgs.gov/data/1984/84018/index.html

Wahle, R.A. 1999. An *In Situ* Study of the Impact of Sea Urchin Dragging on the Benthos. Maine Dept of Marine Resources, West Boothbay Harbor, Maine. 22 p.

Author: In response to a Maine DMR request for research, the present study evaluates the short-term impact of different types of sea urchin drag gear on sea urchin populations and benthic communities of cobble and ledge habitats on the coast of Maine. By video and suction sampling techniques, the study provides evidence that the impact of urchin dragging depends on gear and habitat type. Based on these results, recommendations are made that may assist harvesters and managers in determining how sea urchin dragging will be conducted in the future to both minimize environmental impacts and improve catch efficiency.

QLF: Muscongus Bay (Sea Urchin Harvesting Zone 1) was the site used to compare impacts of "pipe" dragging on cobble-boulder and ledge environments. Bar Island and Long Ledge were the respective sites of study.

Wahle, R.A., R. Glenn, P. Lawton, D. Robichaud, R. Steneck, and C. Wilson. 2002. New England Lobster Settlement Index: Update 2002. Bigelow Laboratory for Ocean Sciences. 2004. http://www.bigelow.org/pi/lobsterset.html

Authors: This sampling program aims to evaluate the strength of lobster year classes when they first arrive as post-larvae in shallow near-shore nurseries where they spend their first few years of life. The data are being used to gain a better understanding of the role of environmental factors in determining the regional population trends, a potentially valuable tool in lobster fishery stock assessment and forecasting.

Wahle, R.A., L. Incze, R. Steneck, and R. Glenn. 2001. New England Lobster Settlement Index: Update 2001. Bigelow Laboratory for Ocean Sciences. 2004. http://www.bigelow.org/pi/lobsterset.html

Authors: The New England lobster settlement index is a sampling program supported by Maine, Rhode Island, and Massachusetts to evaluate the strength of

lobster year classes as they first arrive by larval settlement in shallow nearshore nurseries. The aim is to use this information in stock assessment and forecasting trends in the fishery. Surveys are conducted by diver-based suction sampling in nearshore cobble-boulder nurseries at the end of the settlement season to late August in southern New England to early October to the north. Because earlier experiments demonstrated that densities of young-of-year lobsters at this time correlate strongly with postlarval supply, they are taken as an index of settlement.

Wahle, R.A., R. Glenn, P. Lawton, R. Steneck, C. Wilson, and A. Pershing. 2003. New England Lobster Settlement Index: Update 2003. Bigelow Laboratory for Ocean Sciences. 2004. http://www.bigelow.org/pi/lobsterset.html

Authors: The aim of the New England lobster settlement index - a monitoring program that is independently supported by Rhode Island, Massachusetts, Maine, and New Brunswick, Canada - is to evaluate the strength of lobster year classes when they first arrive by post-larvae settlement from the plankton in shallow near-shore nurseries where they spend their first few years of life. The data are being used to gain a better understanding of the role of environmental factors in determining regional population trends, a potentially valuable tool in lobster fishery stock assessment and forecasting. Each update will feature an aspect of the data analyses being conducted with the time series. In this update we examine the degree to which annual fluctuations in settlement are synchronous from region to region.

Welch, Linda J. 1994. Contaminant Burdens and Reproductive Rates of Bald Eagles Breeding in Maine [MS Thesis]. University of Maine, Orono, Maine. 86 p.

Yentsch, C.M. and H.E. Glover. 1978. Iron in Maine coastal waters; seasonal variation and its apparent correlation with a dinoflagellate bloom. Limnol. Oceanogr. 23(3):534-537.

Authors: During 1975, 12 km south of Boothbay Harbor, soluble iron concentrations in the first 20 m of water were three times great in October and November than in August and September, while particulate iron concentrations only increased transiently before the fall bloom. Nutrient enrichment experiments and chlorophyll *a*:cytochrome f^1 ratios indicated that low iron concentrations limited phytoplankton populations. In August 1976, 1-4 km from Monhegan Island, increased iron concentrations from land runoff preceded a dinoflagellate bloom.

Yentsch, C.M. and J.W. Hurst. 1979. Toward an Environmental Predictive Index for Rise in Shellfish Toxin Associated with Dinoflagellates. Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, Maine.

Authors: The overall objective of this study was to develop an environmental predictive index that would be useful in pinpointing the timing of rise in shellfish

toxin; the duration of the levels of shellfish toxin over and above quarantine levels; and the extent of geographic distribution of the causative organisms.

Part II

Topical Listing by Principle Subject of Document

A. BIOLOGY (taxa specific: such as phytoplankton, macrophytes, invertebrates, fishes, birds, mammals)

B. CHEMISTRY (nutrients, dissolved oxygen, toxins, metals, water quality)

C. ECOLOGY (communities, primary productivity, habitat associations)

D. ENVIRONMENTAL HISTORY (oil spills, waste water, etc.)

E. HUMAN USES (clamming, boating, aquaculture)

F. HYDROGRAPHY (aquifers, watersheds, groundwater)

G. MAPS, PHOTOS, ILLUSTRATIONS

H. OCEANOGRAPHY (light, temp, currents, tides, salinity)

I. PHYSIOGRAPHY (substrate, bathymetry, sediments)

A. BIOLOGY (taxa specific: such as phytoplankton, macrophytes, invertebrates, fishes, birds, mammals)

Ames, E. P. 1997. Cod and Haddock Spawning Grounds in the Gulf of Maine, From Grand Manan Channel to Ipswich Bay. Island Institute, Rockland, Maine. 31 p.

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish and Wildlife Service, Washington, D.C. Vol. 53. 577 p.

Born, J.W. 1977. Significant Breeding Sites of the Horseshoe Crab (*Limulus polyphemus)* in Maine and Their Relevance to the Critical Areas Program of the State Planning Office. Maine State Planning Office, Augusta, Maine. Report No. 28. 45 p.