

MAINE RIVERS STUDY

Final Report

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Department of Conservation

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Section I. Major Findings

1. The State of Maine is unique in the Northeastern United States in the number and diversity of significant natural and recreational river resources that it possesses.

The Maine Department of Inland Fisheries and Wildlife estimates that there are 31,806 miles of permanently flowing rivers and streams in the state, a figure equivalent to one linear miles of stream for every square mile of land surface. Rivers vary in size from the long and wide Penobscot River which drains 8570 square miles to the short and narrow Rapid River and Grand Lake Stream. Over sixty rivers enter the ocean along the Maine coast and three rivers form the U.S. / Canadian International Boundary. Among these water resources are select quantity of rivers which are widely recognized for their outstanding values.

Important river resources include:

- a. 17 river gorges, 61 waterfalls, and 38 white water rapids identified as being outstanding geological or hydrological features with state-wide significance.
- b. More miles of undeveloped free-flowing rivers than any other state in the Northeast United States
- c. River corridor segments which provide habitat for diverse populations of rare and endangered plant species of state and national importance.
- d. Coastal rivers which provide significant habitat for northern bald eagle and shortnosed sturgeon, on the Federal Threatened and Endangered Species List.
- e. 192 miles of high quality river habitat for an internationally known landlocked salmon fishery and 22,000 miles of primary brook trout habitat known for its excellence throughout New England
- f. The only rivers in the eastern United States containing significant self-sustaining Atlantic Salmon runs, and, due to federal and state restoration efforts, the East coast's most heavily fished Atlantic sea run salmon river.
- g. Three rivers which together account for over 60% of the state's commercial alewife catch and a number of other coastal rivers which have the potential to become profitable commercial fisheries
- h. The only two stretches of Class V white water and the longest single stretch of Class II-IV rapids in the entire New England region.
- i. The longest and most popular extended back country canoe trips in the Northeast and over 4000 miles of other rivers suitable to boaters of all ability levels.

2. The Maine River Study has identified 4264 miles of rivers and river segments which possess significant natural and recreational resource values.

Maine rivers have been inventoried and analyzed to identify important river areas and to rank these areas according to their overall significance as unique and/or multiple value natural and recreational resources. The final ranking represents a synthesis of objective resource analysis and a consensus of opinion among resource experts and state river conservation interests.

Rivers, river segments and related tributaries identified as possessing significant natural and recreation resource values were placed in one of four significance categories, identified as rating A, B, C, and D. These categories represent a hierarchy of cumulative resource values, and are defined in the following manner.

River Rating Hierarchy:

- A** Rivers and related corridors on the "A" list possess a composite natural and recreational resource value with greater than state significance.
- B** Rivers and related corridors on the "B" list possess a composite natural and recreational resource value with outstanding statewide significance.
- C** Rivers and river-related corridors or specific areas on the "C" list possess a composite natural and recreational resource value with state-wide significance.
- D** Rivers and river-related corridors or specific areas on the "D" list possess natural and recreational values with regional significance.

The total mileage of rivers and streams in each of the categories is summarized in the following table:

Significance Category Rating	Number of Rivers	Total Miles of Main Segments	% of the State's Total River/Stream Resource	Total Miles including Significant Tributaries	% of State's Total River/Stream Resource
A	20	867.0	2.7	1663.5	5.2
B	18	698.0	2.2	1176.0	3.7
C	41	843.5	2.6	1152.5	3.6
D	23	262.0	0.8	272.0	0.9
Total	102	2670.5	8.4	4264.0	13.4

A number of rivers included on the study's B list have been identified as possessing specific resource values of highest importance to Maine river constituents. These rivers are therefore deserving of special efforts to maintain the identified outstanding resource values. These rivers and their corresponding values are as follows;

Inland Fisheries Values:

- Crooked River
- Grand Lake Stream
- Kennebago River

Commercial Anadromous Fisheries Values:

- Damariscotta River
- St. George River

Whitewater Boating Values:

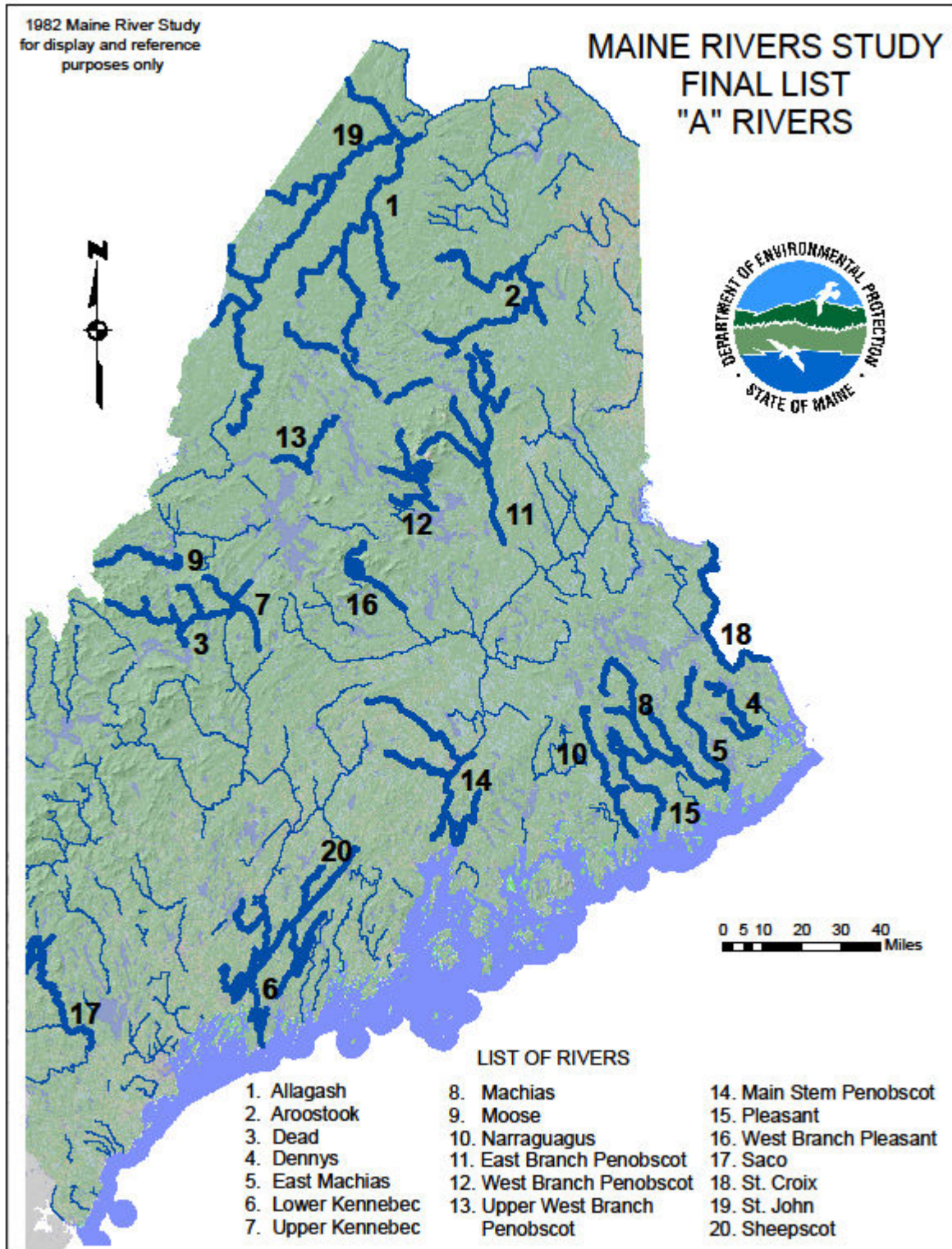
- Carrabassett River
- Rapid River

Critical Botanic Values

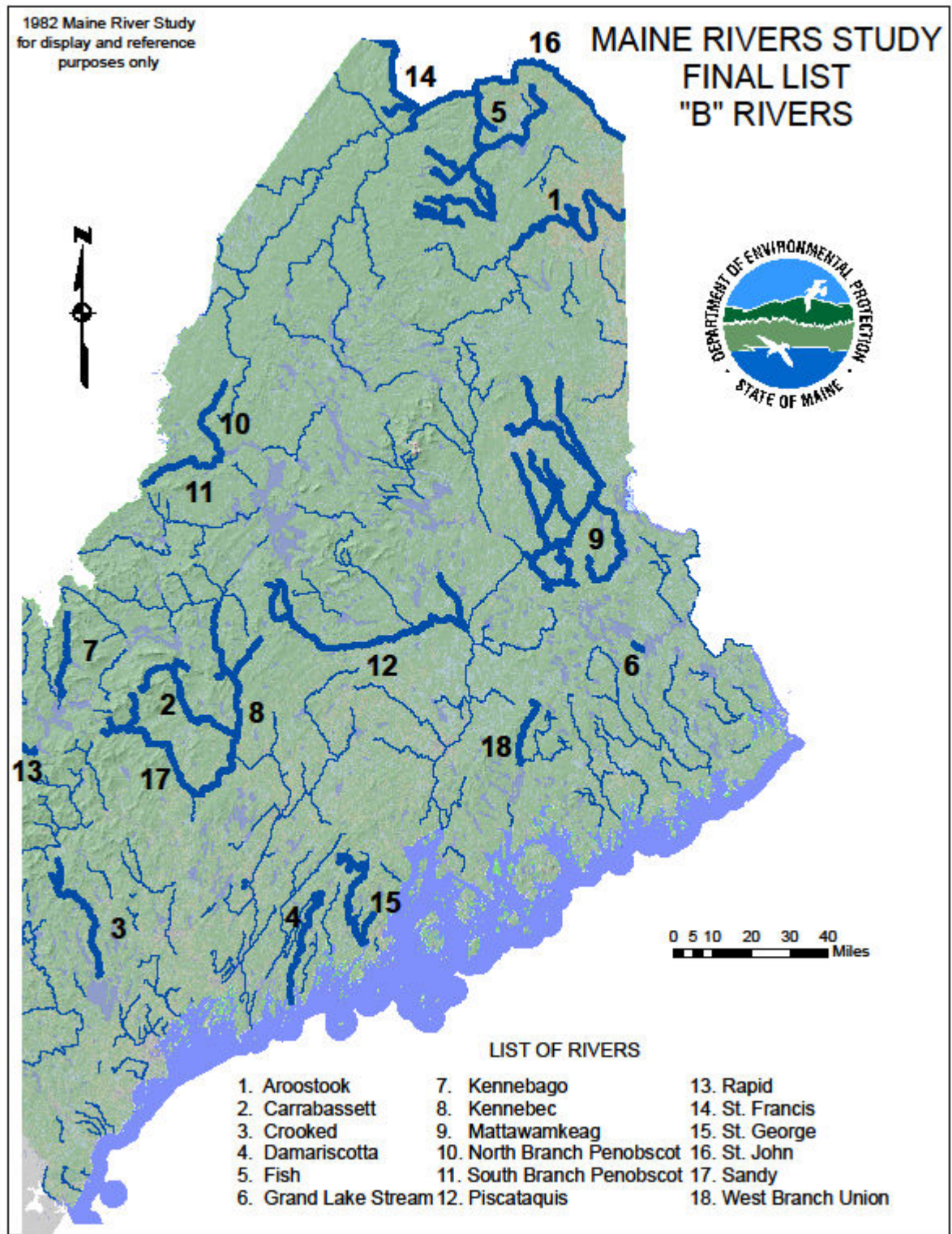
- St. John river
- Aroostook River

Maps identifying rivers and river segments included in the study's "A" and "B" significance categories follow.

“A” Rivers Map and River segments



“B” Rivers Map and River segments



3. The potential exists in Maine for the conservation of complete watersheds or river ecosystems, an opportunity unparalleled by few, if any, states in the Northeast.

A specific river segment does not function independently but instead, both affects and is affected by adjacent land areas, connecting segments, lakes and tributaries. This physical and biological interdependence of rivers and tributaries within a watershed provides the basis for the principle that a systems approach to water resources planning and management is both prudent and necessary. This is particularly so in riverine systems which are in a natural state.

The Maine River Study has identified a number of relatively large watersheds within the state which are of high significance as undeveloped and interdependent hydrologic units. These sub-basins are characterized by a general lack of major artificial river impoundments, minimal river corridor development, a high degree of hydrologic and ecologic interdependence, and a consistency of resource quality among all segments. These include:

- a. The upper St. John watershed including the Northwest, Southwest, and Baker Branches, and the Little and Big Black Rivers.
- b. The East Branch of the Penobscot watershed, including the Seboeis River and Wassataquoik Stream.
- c. The Aroostook and Big Machias watershed above Sheridan.
- d. The Allagash watershed.
- e. The Mattawamkeag watershed.
- f. The Fish River watershed, including the Fish Lakes Chain.
- g. The Machias River watershed in Washington County

4. Potential conflicts between hydroelectric development projects and significant natural and recreation rivers exist in the State of Maine.

Estimates of the total hydropower potential in the state (including both undeveloped sites and existing dam sites capable of being retrofitted) vary between 600,000 kilowatts and 1,200,000 kilowatts. Preliminary assessments of feasible hydroelectric sites on the study's A, B, and C rivers by Maine's Office of Energy Resources have identified 72 sites capable of producing 400,000 kilowatts of power.

Of the river segments identified on the Maine River Study's A list, Federal Energy Regulatory Commission preliminary permits are pending for 5 sites with a total generation potential of over 125 megawatts. These projects are located on the West Branch of the Penobscot, the Kennebec, the Aroostook, and the East Machias. A 500 kilowatt project is currently being constructed on the Pleasant River in Washington County. Twenty additional potential sites are located on "A" list rivers. "B" list preliminary permit applications include projects on the St. George, Rapid, Kennebago, Mattawamkeag, Piscataquis, and Aroostook rivers with a total generation potential of over 60,000 kilowatts.

The extent of the conflict between significant river resource areas and hydropower development vary according to the specific resource characteristics associated with a particular site. In many instances, resource impact will be minimal or can be mitigated or avoided through proper facility sizing and placement, fishway design, and/or water release scheduling. However, while the impact on river related resources will be minor for many potential projects, a select number of developments could significantly alter a river's character and destroy irreplaceable resources, some with multi-state or national significance.

Corridor land development and resources use may also impact river resource values with adverse effects occurring on water quality, wildlife habitat, user access, and scenic values. Again, conflict can often be minimized through proper planning which recognizes the resource values associated with the particular river area.

5. There is a significant base of citizen and public agency support for the conservation and sound management of the river resources of Maine.

River conservation interests in the state vary widely. Such interests include recreational boating and fishing, commercial boating and fishing, education and scientific research, wildlife preservation, water quality maintenance, and miscellaneous recreational interests. While these interests vary and sometimes conflict, an underlying consensus exists that rivers in their natural condition constitute a valuable resource to the State of Maine. There also appears to be a consensus among river interests regarding which rivers are most important and warrant conservation action.

In addition, there appears to be a public recognition of the need to balance the goals of hydroelectric development and river conservation, and a desire for the use of hydropower where compatible with the resource values of a river and where impacts of development are avoided or minimized.

6. A variety of alternatives are available within the local, State and federal government and the private sector to conserve and manage Maine's significant natural and recreational rivers.

The natural and recreational resources of Maine's rivers are extremely significant, diverse and complex. These river areas contain a mix of public and private land ownership in the form of existing parks, recreation areas, agricultural lands, historic sites, natural areas, forests and villages. Natural resources in some areas are interwoven with the fabric of existing communities. These "living or working river areas" contribute to the uniqueness, quality, and resource value of the areas from a State and National perspective.

In addition to the importance of the river corridor resources, there appears to be a base of public agency and citizen support for improved management and enhancement of these resources. The State and local jurisdictions as well as private groups and citizens have committed themselves to conserve and enhance river areas throughout Maine. As strong as the support is for improved management of Maine's rivers, so are the feelings of a need for local control and private stewardship. Indications are that proposals for the conservation of Maine's rivers should be initiated and developed at the State and local level.

In this regard, no single level of government or existing system of parks, regulations, recreation areas, programs or preserves can be expected to conserve and manage Maine's rivers. Only through the shared responsibility of the several levels of governments and the private sector, can the significant natural and recreational values of the State's rivers be conserved or enhanced.

A coordinated application of existing government programs, consistent with varying river area goals, could result in significant economic benefits and will support federal, State and local conservation and enhancement efforts.

II. INTRODUCTION

On June 22, 1981, Governor Brennan released the Energy Policy for the State of Maine. The hydropower section of the policy directed that:

“The Department of Conservation, working with environmental, economic, energy and other appropriate interests, should identify river stretches in the State that provide unique recreational opportunities or natural values and develop a strategy for the protection of these areas for submission to the Governor.”

In response to this directive, and as a continuation of the State’s ongoing efforts to conserve Maine’s significant rivers, the Department of Conservation initiated the Maine Rivers Study. The U.S. Department of the Interior, National Park Service’s Mid-Atlantic Office, as part of their ongoing river conservation technical assistance to the State, has provided staff to conduct this study.

The purpose of the study is two-fold. The first is to define a list of unique natural and recreation rivers, identifying and documenting important river related resource values as well as ranking the State’s rivers into categories of significance based on composite river resource value. The second purpose of the study is to identify a variety of actions that the State can initiate to manage, conserve, and where necessary, enhance the State’s river resources in order to protect those qualities which have been identified as important.

III STUDY METHOD AND PROCESS

Introduction – Each of Maine’s rivers and major streams were assessed during the course of this study to identify the State’s unique natural and recreation rivers. The method used to identify and rank Maine’s rivers, prepared in cooperation with the River Basin Subcommittee of the State’s Land and Water Resource Council, was designed to:

- a. Rely on existing quantitative and qualitative research information.
- b. Rely on information from recognized river resource experts
- c. Use a “systems” or river-ecosystem approach of analysis which recognized the relationships and interrelationships of rivers, their tributaries and watersheds.
- d. Incorporate public and expert input into the evaluation process

The study process was intended to not only develop an objective and factual base of information on Maine’s rivers, but also a consensus among river experts regarding the most important rivers in the State.

The method used is based on the following five step process.

Step 1 – Identification and Definition of Unique River Values

The first step in the study identified unique recreation and natural river categories. These categories, selected by the study team and the River Basin Subcommittee, were used to serve as a framework for the collection and analysis of river information. The unique natural river categories selected for analysis included:

- 1) geologic and hydrologic features (gorges, waterfalls, etc)
- 2) critical and rare species of plants and wildlife (bald eagle wintering areas, etc)
- 3) undeveloped river corridors
- 4) scenic river corridors (river areas with outstanding views, visual diversity, etc)

The categories selected for unique recreational river areas included:

- 1) anadromous fisheries (salmon runs, etc)
- 2) inland fisheries (trout streams, etc)
- 3) whitewater boating (areas with rapids)
- 4) canoe touring (areas for canoe boat trips)
- 5) backcountry excursion boating (areas for extended wilderness trips)
- 6) river related historic sites with national significance

Once these categories or “types” of unique rivers and river segments were identified each category was described and defined in detail.

To help determine which rivers or river segments possessed resource values of regional or greater significance, a set of standards were established for each category. These standards serve as minimum “threshold” criteria to determine which rivers should be considered for further evaluation.

The specific criteria for each natural and recreational river category and the evaluation method used to identify qualifying river areas is described in Section IV of this report.

Step 2 – Identification of Significant River Resource Values

The second step of the study process involved the identification of those rivers and river segments which met the natural and recreation river category criteria. River areas were identified through a review of existing sources of information (canoe guidebooks, natural area studies, previous river inventories, etc) and through discussions with various government and private sector river experts. Rivers which met or exceeded the category criteria were identified on the Preliminary Draft List of Rivers Under Evaluation released in November 1981. This list of more than 120 rivers and river segments was distributed to public and private interests for review and comment.

Each of the rivers and river segments on the Preliminary Draft List was researched by natural and recreation river category, and river values were systematically identified. The Preliminary List and documentation of river values served as a basis for subsequent analysis.

Step 3 – River Category Evaluation

The next step of the study process focused on the evaluation and detailed documentation of river values by specific category. With assistance from resource experts all rivers and river segments identified as unique or significant in a given category were further inventoried and analyzed in detail to substantiate river values. The results of this analysis were recorded on lists by river category. These lists of rivers represent a culmination of the river evaluation, documentation and expert review process and are judged to possess resource values of regional, statewide, and greater than statewide significance.

Step 4 – River Category Synthesis

River information collected, evaluated and documented in earlier steps was combined in an effort to summarize all of the natural and recreation values associated with particular river segments and to connect adjoining river segments which possess similar values.

To help simplify the recording and display of river values a matrix was used. The matrix identified the total number of resource values associated with each river segment and highlighted those areas of statewide or greater than statewide significance. New river segment descriptions were defined using the following general guidelines.

1. Where a river possesses a combination of overlapping natural and recreation values, a composite river segment is identified with the outer boundaries of the overlapping segments determining the boundary of the entire river area.
2. A tributary stream which flows into, and is connected to a larger river area is included in the larger river segment description if the tributary stream: a) possesses natural or recreation values consistent with those of the main river area, and/or b) significantly enhances the overall value of the larger river segment's resources.
3. A tributary stream with natural or recreation values greater than those of a connecting main river area is listed separately from that area.
4. Larger connecting rivers have been listed as tributaries to a river system in certain unique situations (i.e. Big Machias River in the Aroostook River watershed), where: a) the rivers are free-flowing and within an undeveloped watershed; b) the rivers in the watershed exhibit a high degree of hydrological and ecological interdependence.

Following the combination of rivers and associated tributaries, river segment descriptions and resource values were revised and displayed on a matrix.

Rivers or river segments with related resource values which have been determined to be the state's most significant in a specific resource category were identified on a matrix with an asterisk. These resources possess greater than state or national significance, related to the distribution and rarity of the resource value.

Step 5 – Comparative River Evaluation

The combined unique and significant natural and recreational resource values of all river segments were evaluated on a comparative basis to determine their relative importance within the State of Maine. Each of the rivers from the Preliminary Draft List were ranked and placed into one of four categories of river resource significance ranking. These categories, identified as A, B, C, and D, represent a range of river values, from areas which are greater than that of State significance to those of regional importance.

Rivers and river segments were placed within particular categories based on the number and significance of various river values. The final river ranking scheme recognizes rivers which have a variety of significant values as well as importance due to specific unique resource qualities.

River Ranking Criteria – The criteria used to place rivers within the four categories are as follows:

“A” Rivers

1. River or river segments possessing six resource values with regional, statewide or greater than statewide significance in a specific resource category.
2. Rivers or river segments possessing two or more resource values which are recognized to be some of the State’s most significant in a given resource category. Included within this category are rivers providing important habitat (defined as self-sustaining viable runs or significant restoration efforts producing fishable populations) for the nationally significant Atlantic sea run salmon.

“B” Rivers

1. Rivers or river segments possessing four or five resource values with regional, statewide or greater than statewide significance in a specific resource category.
2. Rivers or river segments possessing one resource value which is recognized to be one of the State’s most significant in a given resource category.

“C” Rivers

1. Rivers or river segments possessing one to three resource values with regional, statewide or greater than statewide significance in a specific resource category.

“D” Rivers

1. Rivers or river segments possessing one or more resource values of regional significance

Using the aforementioned criteria, rivers and river segments were identified in the Draft Final List of Rivers Under Evaluation released in February 1982. This list of rivers was distributed to public and private interests for review and comment, and copies of the list were made available through a statewide news release.

In addition, a series of public meetings in Bangor, Presque Isle, Machias, and Lewiston were held to solicit input. Public comments, and additional information where appropriate, were incorporated in final revision of the Draft Final List.

Thus, the Final List of Rivers released in April 1982 reflects the results of a comparative and cooperative river evaluation process which incorporates factual, objective information and the consensus opinion of numerous diverse river interests.

IV. RIVER RESOURCE CATEGORIES

Unique Natural Rivers – Overview

This section of the final report will outline the process of identification, documentation, and evaluation of Maine's "unique and natural rivers". The focus here is on these natural resources that make a river important:

- an absence of development within the land corridor adjacent to the river
- the presence of a variety of habitats for the fauna and flora
- uncommon and unique features like bedrock formations
- rare and threatened plant and animal species
- critical ecologic areas
- scenic waterfalls and vistas
- National Historic Sites and National Natural Landmarks

The combination of the wide scope of this study and the limited time allocated did not allow for the collection of new information or field work on a river by river basis. Rather, the emphasis was on the gathering and organizing of existing information from a variety of sources and experts. State and Federal resource management agencies were of help in this section of the study, and will be cited in discussion on the appropriate resources.

Much of the river-related resource information was taken from statewide assessments of natural resources by the Maine Critical Areas Program, a part of the State Planning Office. The groundwork for this program was laid in 1972 with the Maine Natural Areas Inventory, a report which attempted to identify the most significant natural areas around the state. After this study was issued, it became clear that additional work was needed for the systematic evaluation of the relative values of natural resources of the state, in order to identify which areas were the most unique or significant.

In 1974, the State Legislature passed an act establishing a state Register of Critical Areas, and charged the State Planning Office with initiating a Critical Areas Program designed to identify, document, and conserve statewide critical natural areas through management agreements and donation or acquisition of property. Primary emphasis in the program at this time is on identification and registration of critical areas.

The kinds of critical areas evaluated by the program primarily correspond to the definition of "historic and fragile lands," from U.S. Senate Act 268, 93rd Congress.

“ . . . lands where uncontrolled or incompatible development could result in irreversible damage to important historic, cultural, scientific, or esthetic values, or natural systems which are of more than local significance, such lands to include shorelands of rivers, lakes and streams, rare or valuable ecosystems and geological formations, significant wildlife habitats, and unique scenic or historic areas. . . .”

Other natural resource experts with important contributions to the study included wildlife resource experts from the University of Maine at Orono, Maine Department of Inland Fisheries and Wildlife, and U.S. Fish and Wildlife Service, who were helpful in the identification and documentation of significant river related wildlife resources. The prior assessment of the state's rivers by the National Park Service for the Nationwide Rivers Inventory was the primary source of information for the evaluation of corridor development and scenic resources of the rivers in Maine.

A. GEOLOGIC/HYDROLOGIC FEATURES

Introduction

The majority of bedrock formations of the State were originally deposited as sediments on the bottom of the ocean during the Lower Paleozoic era (hundreds of millions of years before the present), as well as being formed from molten rock material from deep within the earth. Later in the Paleozoic period during the building of the Appalachian Mountains, these sediments were subjected to intense pressures and temperatures causing them to become folded, faulted, and uplifted, accompanied by intense volcanic activity. Today these durable igneous and metamorphic rocks are exposed in the Mountains of New England upland section of the state, as well as along parts of Maine's rocky coast. The finest examples of bedrock features – such as waterfalls, gorges, and fossils – are distributed in these areas of Maine.

Many of the bedrock materials outcropping along the banks of streams and rivers in northern Maine contain traces of organisms and plants called fossils, which once lived in the early marine environments hundreds of millions of years ago. The majority of these river related fossil localities lie within a band of non-to-partially metamorphosed rocks which sweeps across the central part of the state, ending in the northeastern corner of Aroostook County. Most of these fossils are marine vascular plants and invertebrates from the Lower to Middle Paleozoic era.

During the Quaternary glaciation, the state was covered with a mile thick accumulation of snow and ice, a much larger version of the glaciers which survive today in the European Alps and Canadian Rockies.

As the glaciers from Laurentide Ice Sheet moved southward from eastern Canada they scoured the bedrock formed millions of years earlier, shearing off the tops of many hills, ridges, and mountains. Approximately 10,000 years ago this ice began to melt, leaving behind a watery landscape of lakes, ponds, streams, rivers, and wetlands.

A veneer of boulders, sand, gravel, and clay also remained to blanket the landscape, testimony to the tremendous erosive power of the slowly moving glaciers. These deposits of glacial sediments formed many of the state's lakes by damming valleys widened and deepened by the glaciers. The hydraulic action of glacial meltwater initiated the process of erosion on underlying bedrock material, occasionally encountering cliffs or abrupt jumps in the landscape, and forming waterfalls. Normally, these hydraulic features degenerated into whitewater rapids as the bedrock eroded. For a waterfall to remain in a landscape, one of two conditions must have been present. Either the flow of the stream was insufficient to significantly erode the bedrock, or the rock contained a particular feature (such as cracks or joints) which allowed the waterfall to maintain itself as erosion proceeded. In this situation, the falls would migrate upstream with time, excavating a downstream gorge. Waterfalls also resulted from streams selectively eroding areas of weakness in the bedrock.

Many interesting surficial geologic formations were formed at the margins of the melting glaciers in the central and southern areas of the State; many of these glacial deposits are the finest examples in the northeast region. Surficial formations related to rivers include linear ridges called eskers or horsebacks, intricately braided streams with complexes of river islands, rivers with sinuous meander complexes, glacial outwash plains, glaciofluvial marine deltas, and washboard moraines.

1. Definition

There are river-related physical features in the state whose location and distribution are controlled by the structure and composition of the bedrock, by the surficial geology and by natural geologic processes including weathering and erosion.

Towering waterfalls, steep-walled granite gorges, systems of lakes, ponds, and wetlands, and surficial glacial formations are among these unique physical features. The distribution of these resources is a function of the geologic events occurring hundreds of millions of years ago, as well as resulting from events occurring after the melting of more than one mile of ice which covered Maine until approximately 10,000 years ago.

2. Significance

a. Scientific – Many of the geologic features associated with rivers have unique importance for scientific research. These features (such as glacial eskers, fossils, or gorges) are useful in the research of past geologic processes which affected the distribution and composition of rocks and minerals on the earth, as well as understanding present-day geologic processes changing the world.

Gorges and waterfalls contain large areas of steam washed and exposed bedrock, important in a state where most bedrock areas are obscured by glacial drift making scientific study difficult if not impossible. Waterfalls are also important geologic sites for study because they are not accidental features in a landscape; their location is a function of the bedrock geology and / or glacial history of an area.

The scientific study of the fossils found in the rocks of the state has greatly affected the understanding of the State's paleogeographic history and the knowledge of the types of ancient forms of life which once lived in what is now Maine. Some of the state's fossil sites are widely known and well-documented localities and have yielded specimens of museum quality; many are the finest found in the world. Still other sites have been discovered only recently and deserve more detailed study.

One river-related geologic locality which is reportedly crucial to the understanding of central Maine geology is Ripogenus Gorge. The Gorge, which contains a wide variety of sedimentary, igneous, and metamorphic rock types; displays significant geologic structures in addition to being an important Silurian fossil locality; was recently recognized by the National Park Service as a potential National Natural Landmark.

b. Scenic / Recreational – Because of their scenic and esthetic qualities, waterfalls and gorges are often linked to local and regional tourist economies serving as camping or fishing sites or scenic roadside vistas. Some gorges have large rapids run by commercial whitewater rafting interests which bring dollars into local areas.

c. Historic – The rivers of Maine are intimately tied to the State's history because of their importance as traditional transportation routes. Many gorges and waterfalls presented obstructions to former log running and have legendary significance. Others have since been modified by channel improvements for log running, or obliterated by downstream dams for hydroelectric generation. Occasionally, waterfalls and gorges were the sites for mills or small towns and have associated historic buildings with state and national significance.

d. Ecologic – Gorges and waterfalls often contain a great diversity of hydrologic and ecologic environments, and a variety of habitat for flora and fauna. These environments may include flatwater above the hydrologic feature, ledges, rapids, and shooting flow through the gorge or waterfall, with gravel floodplains and rapid water downstream. Ravines, gorges, and streamside cliffs are often more shaded, with higher humidity than most environments, and many species of rare plants are known to grow in such areas. Sandy glacial outwash plains are another river-related geologic feature which have a unique association of plants. The droughty infertile soils are often maintained as blueberry barrens, supporting the cultivation of wild blueberries.

3. Standards for Inclusion

Unique and significant geologic and hydrologic features in Maine are studied on a continuing basis by the Critical Areas Program. The physical resources studied to date include bedrock fossil localities, eskers, waterfalls, and gorges. Significant white water rapids in the state have also been identified by this program, and their findings were incorporated into the assessment of recreational boating by the Maine Rivers Study.

Geologic and hydrologic features meeting the significance criteria defined by the Critical Areas Program are recommended for inclusion on the Register for Critical Areas; at this time, 61 waterfalls and 19 gorges have been recommended. Significant eskers and fossil locations have also been added to the Register.

River-related geologic features recognized by the National Park Service in the Nationwide Rivers Inventory as important because of their uniqueness, rarity, or scarcity (one-or-two-of-a-kind nature, or having significance for a particular region of the state) were also included in this study. These features included reversible falls, glacial outwash plains, river-linked lake systems, and river meander complexes.

4. Evaluation Method and Criteria

During the assessment of the State's geologic and hydrologic features, general criteria were used to identify significant river-related physical features. These criteria were developed in order to identify areas of geologic and hydrologic importance associated with rivers which deserved recognition by this study, but had not been comprehensively studied on a statewide basis. These criteria included the following:

a. Scarcity: a resource with extremely limited distribution in the State, New England region, or United States; distinctly unusual, rare, one-or two of a kind features.

b. Diversity of values: significant physical features occurring in association with other values (i.e., a gorge which is a classic geologic type locality with habitat for endangered bald eagles and high recreational value).

c. Susceptibility to human activities; features which could be degraded or destroyed by human presence or activities.

d. Ecologic significance: resource sites which contain a variety of habitats and ecological values.

e. Historic value: features that were involved in the settlement, transportation, or early industrial activities of the State. A site was considered significant historically if: a) it had interesting military history; b) it was an important industrial or economic site; c) it was important in 19th century log driving activities.

f. Scenic / Esthetic value: resource features which were important to the local and regional recreation and tourist economies. A feature was considered to have outstanding scenic attributes if: a) it was of large magnitude in some way (length, depth, overall size); b) had good potential or existing vistas, and c) it had a diversity of hydrologic elements including rapids, chutes, flumes or falls.

g. Scientific attributes: a site was considered geologically outstanding if any one of the following criteria existed: a) it was a type locality or best exposure of a geologic formation; b) it had an exceptional display of bedrock structures; c) it displayed exceptional hydrologic features.

The fossil sites were considered scientifically significant if meeting on or more of the following criteria:

1) Areas which are the type of locality of a particular fossil (i.e. The area where there first specimens known to science were collected).

2) Areas containing a unique fossil assemblage, index fossils, and/or fossils useful for scientific age determination and correlation work.

3) Areas with educational value and frequently visited by school groups.

The following rivers were recognized by experts as having outstanding river related geologic resources and highlighted on the Final List of Rivers with an asterisk:

Upper Kennebec River
West Branch Penobscot River
West Branch Pleasant River

5. Information Sources and Expert Review

The following references were used by the study team to identify and document resource values.

Waterfalls in Maine and Their relevance to the Critical Areas Program of the State Planning Office;
Brewer, Thomas, 1978

Gorges in Maine and Their relevance to the Critical Areas Program of the State Planning Office; Brewer,
Thomas, 1978

A Preliminary Listing of Noteworthy Natural Features in Maine; Center for Natural Areas, June 1976.

Significant Bedrock Fossil Localities in Maine and Their Relevance to the Critical Areas Program;
Forbes, William H., 1977

Nationwide Rivers Inventory; U.S. Department of the Interior, National Park Service, Mid-Atlantic Regional Office, Philadelphia, PA, 1981

Dr. Thomas Brewer of Boston College, Boston Massachusetts, and Janet McMahon and Harry Tyler of the Critical Areas Program within the State Planning Office provided information and expert opinion to the study team.

B. RIVER RELATED CRITICAL/ECOLOGICAL RESOURCES

Introduction

The State of Maine possesses an unusual abundance of water and related land resources, having more miles of river and more lakes per square mile than any other state in New England, as well as the highest percentage of land covered by forest of any state in the United States. Of the 19.8 million acres of land in Maine, 17.4 million acres (approx 88% of the state) is in forest, and 1.5 million acres (7% of the state) is covered by inland fresh water. This figure does not reflect areas of bogs and wetlands which are perennially wet or flooded for certain seasons of the year.

The topographic relief in Maine has produced a complexity of terrestrial ecosystems, which for the purpose of this discussion can be grouped into basic vegetative types: Alpine tundra, Northern hardwood spruce-fir, Northeast spruce-fir, transition hardwood-conifer, and transition hardwood. With the exception of Alpine tundra, any of these major vegetative associations may be found along a river corridor, depending on the altitude of the area, as well as other influencing factors such as soil type, steepness and aspect of slopes, and amount of moisture present.

Just below the alpine areas and on the tops of many of the lesser peaks in the White Mountains is the Northeast spruce-fir association, usually consisting of pure fir forest just below timberline, with red spruce increasing at lower elevations. These conifer forests grade into Northern hardwood spruce-fir forests downward, the transition occurring at about 2500 feet in the White Mountains. These forests contain a variety of hardwood and conifer species. Some of the conifers such as red spruce and fir drop out at lower elevations and in the more southern portions of Maine. Transition hardwood-conifer forests, found in extreme southwest Maine and along lower valleys in other parts of the state, have a greater number of southern species like white ash, black birch, black cherry, and increasing concentrations of red oak, white oak and hickory.

Soils throughout the state are largely developed from glacial tills and stratified drift, tending to be podsoles (soils with upper horizons depleted of plant essential nutrients) at higher elevations under spruce-fir forests, and brown podsolics at lower elevations. Most of the soils are acidic, although limestone areas throughout the state often have unique calciphile (or calcium loving) vegetation, occasionally with associations of rare and endangered plant species.

These are other special types of river-related vegetation in Maine found with certain types and conditions of soils. Areas of coarse sandy glacial outwash along many rivers support pitch pine barrens. In some cases these areas are maintained in a lower successional stage as blueberry barrens by controlled burning and other management practices.

White pine is another species that grows well in glacial outwash areas, where it can reproduce without competition from other species of trees. This tree also grows well on steep-sided riparian areas (along rivers, streams, lakes, and ponds) in a variety of soil conditions. The vast majority of the immense pines which once grew along the rivers of Maine have been cut, although a few stands of old growth white pine exist in the state. The most notable example of these is The Hermitage stand along the West Branch of the Pleasant River.

Low, cool, poorly drained sites in Maine often support classic bog ecosystems, with typical acid peats resulting from the accumulation of sphagnum moss. These bogs are important natural areas, supporting many endemic, unique, or peripheral species of plants (especially orchids) which are found only in these unusual biotic systems. A special type of bog forest characterized by Eastern Atlantic or coastal white cedar is found in some parts of mid-coastal and southeastern Maine. Another unique type of bog sometimes within river corridor areas is the raised bog, formed in depressions on drier ridges surrounding bogs. A mound several feet high is formed by the accumulation of sphagnum moss, while water is retained by the sponge-like consistency of the moss.

Of all the various ecosystems associated with rivers, perhaps the most significant are the wetlands, the transition zones between the terrestrial and the aquatic environments. Wetlands have outstanding natural value (for the production of photosynthetic oxygen, as catchments for flood waters, pollution filters, and aquifer recharge areas and for species habitat) as well as significant economic value, supporting the important statewide hunting, fishing, and trapping recreational community. Inland wetlands have primary importance as feeding, nesting, and rearing areas for waterfowl.

Although generally associated with waterfowl, wetlands provide habitat for many furbearing animals as well. Otter, beaver, muskrat, mink, and others are directly dependent on these areas for their food and shelter. Other species such as deer, woodcock, and hare often inhabit areas bordering these wetlands. In addition to the previously mentioned furbearers and game animals, numerous non-game species depend on wetlands to supply some or all of their life requirements. Tidal rivers and salt marshes have plants which are adapted to changes in water level, salinity, temperatures, and nutrients. These coastal rivers and wetlands serve as resting areas for spring and fall migrations of waterfowl, as well as wintering areas for waterfowl and raptors, including the endangered bald eagle.

There are other areas associated with rivers that support unusual assemblages of plants, including certain relict and endemic species. These are highly specialized species, influenced by subtle changes in sunlight, humidity, temperature, and soil moisture, texture and composition. These areas include cliffs, where plants are subjected to fluctuations and extremes of light, temperature, climate, and erosion, as well as ravines and gorges which have shaded, humid conditions preferred by certain species.

BOTANIC CRITICAL / ECOLOGIC RESOURCES

1. Definition

There are over 2,100 species of vascular plants known to occur in the State of Maine. Of these, 318 species are considered scarce or rare. The Critical Areas Program has identified 97 species known to inhabit riverine areas. Significant habitats for vascular plants include cliffs, gorges, river and stream banks, pond and lake margins, bogs, and wetlands.

The causes of the rarity of these plants can be difficult to define at times, although the majority of the rare plants can be identified in one or more of the following categories, according to the Critical Areas Program:

- a. Species with scarce habitat within the State (although more common elsewhere)
- b. Species at the northern or southern limit of their range.
- c. Species with a very restricted natural range (endemics).
- d. Species with seriously declining populations.
- e. Species which, for a variety of reasons, are rare throughout their entire range.

The definition of rarity can be complex, since it is a function of the actual limited distribution of the plant in its habitat, as well as its perceived value to our society. The Critical Areas Program has defined rarity primarily by its biological distribution. A plant species is considered to be rare if it has been found in ten (or fewer) towns in the state; a species may be found in more than 10 towns and still be considered rare if it is at the limit of its range, is declining or vulnerable, or is restricted in distribution throughout its range.

2. Significance

The values of plants to our society and to other animals of the land and waters of this world are infinite. Plants regulate temperature near the earth, maintain the atmospheric balance of carbon dioxide to oxygen, convert solar energy into stored chemical energy needed by animals, have educational and aesthetic value, and supply an endless variety of medical and chemical products for humans. Communities of plants are important for soil development, prevention of erosion, storage of water, and providing food and shelter to many species of animals.

The many varieties of rare and unusual plant species are found in habitats which are unstable and changing, and subject to climatic extremes. The gene pool of these plants is a storehouse for traits necessary for breeding new species, as well as representing unknown potential as a source of new chemicals and drugs to serve mankind.

3. Standards for Inclusion

Using data on the distribution of rare plant species, as well as the previously mentioned rarity criteria, a group of botanists has assigned levels of importance to rare plants in the New England region. The Critical Areas Program has adopted this system for its own work in the state, assigning each listed plant species to one of three levels of importance; National, New England, or State.

National level rare species are of two types;

- 1) Presently listed as a Federal Endangered or Threatened Species, or proposed for review or under review for listing by the Office of Endangered Species of the U.S. Fish and Wildlife Service, or
- 2) found in few areas outside of New England, although not having official recognition as nationally threatened.

Species considered rare within New England are vascular plants listed through a joint effort by the U.S. Fish and Wildlife Service and New England Botanical Club. Some of these species may be rare throughout New England, but are common in Maine, and are obviously not included on this list.

Species rare at the state level are those species not considered rare through most of their range, but are rare within this state. The majority of species in this level are species reaching their northern limit in Maine.

In addition to identifying rare vascular plants, the Critical Areas Program has also assessed unusual stands of old growth white pine around the state. Significant river-related stands on the Presumpscot River, West Branch Pleasant River, and Vaughan Brook have been included in this study.

4. Evaluation Method and Criteria

The known or suspected locations of critical botanic species along the rivers in Maine were mapped, and segments containing the range of distribution of the plant species were defined using the following criteria;

- a. Plant species were considered to be river-related if found within the one-quarter mile land corridor adjacent to either bank of the river.
- b. A one-mile buffer zone in both directions of a species locality was included within the segment description, in order to account for possible disjunct populations of rare vascular plant species.

Once all localities of plant species were mapped, the river segments were analyzed to determine their overall significance for critical and rare plants, based on the diversity of species at the various levels of importance (National, New England, State).

A system of points was assigned to each of the particular levels of significance, as follows.

	Points
a. Species on the Federal Endangered and Threatened List. <i>Pedicularis furbishiae</i> (Furbish lousewort) is the only riverine plant species on the list at the present time.	5
b. Species under review for inclusion on the Federal Endangered and Threatened List. These species are: <i>Listeria auriculata</i> <i>Oxytropis campestris</i> var. <i>johannensis</i> <i>Viola novae-angliae</i> <i>Cardamine longii</i>	4
c. Other species with National level significance	3
d. Species with New England level significance	2
e. Species with state level significance	1

One half (0.5) points were deleted from the score for each species if a particular plant location of a species was based on historical records of botanists, and the location is only suspected and has not been verified in recent years by Critical Areas Program or other approved botanists. Thus, based on this scoring system, a river segment with a known location of *Oxytropis campestris* var. *johannensis* (National level significance), and suspected location of *Gentiana amarella* (New England level of significance) would be awarded a score of 5.5 points (4+ 1.5 points).

Based on this system of scoring, the following rivers were judged to be clearly outstanding on the basis of critical/rare vascular plant species, and identified with an asterisk on the Final List of Rivers;

St John River, between Hamlin and Hafford Brook

Arroostook River, between the Canadian Border and Pudding Rock

Information was also gathered on ecologic plant areas which have been recognized as having national significance by the Department of the Interior under the National Natural Landmarks Program. The following rivers with related National Natural Landmarks have been highlighted on the Final List of Rivers with an asterisk:

Dennys River – Meddybemps Heath, in the headwaters of Meddybemps Lake

Mattawamkeag River - Thousand Acre (Crystal) Bog, along Fish Stream & East Branch Molunkus Stream

Passadumkeag River – Passadumkeag Marsh, along Cold Stream

West Branch Pleasant River – The Hermitage Old Growth White Pine Stand

5. Information Sources and Expert Review

The following references were used by the study team to identify and document resource values.

Rare Vascular Plants in Maine, Critical Areas Program Report, June, 1981

A Preliminary Listing of Noteworthy Natural Features in Maine, Maine Critical Areas Program, June 1976

Mr. Harry Tyler and Ms. Susan Gawler of the Critical Areas Program within the State Planning Office provided information and review to the study team.

ZOOLOGIC CRITICAL / ECOLOGICAL RESOURCES

1. Definition

The reduction and deterioration in habitat of many species of river related wildlife is of major concern to the scientific community in the perpetuation and continued viability of these resources. When a type of habitat or significant ecologic area having certain necessary and indispensable qualities is destroyed or degraded, certain zoologic species suffer a reduction in abundance and may ultimately be threatened with extinction. For the purposes of this report, the following definition of critical or endangered zoologic species is offered.

a. Endangered – A species whose prospects of survival and reproduction are in immediate jeopardy. Its peril may be the result of a single cause or variety of causes, including the following:

1. Habitat: loss or change of habitat, high specialization of habitat, and restricted distribution.
2. Reproduction: small size of litters, long period of gestation, slow maturation of young
3. Behavior Patterns: poor adaptability to changing conditions.
4. Competition and predation
5. Over exploitation
6. Disease

b. Rare or Critical – A species, not presently threatened with extinction, but having such a small population or area of habitat throughout its range that it could face endangered conditions in the future if its environment worsens.

2. Significance

Critical zoological resources are of importance to the environment in the State of Maine by insuring the preservation of natural diversity in an ecosystem. The maintenance of a heterogeneous species pool allows a particular species to more readily adapt to changing environmental conditions. The preservation of critical and endangered species has a cultural significance as well, which comes from a deep-seated psychological and philosophic evaluation of the environment, including a refined reverence for life. This view holds that all plants and animals have value as intrinsic components of the living part of our planet and should not be destroyed through man's intentional or inadvertent activities upon the environment. In this view, species extinction brought about by man's activities is considered a cultural disaster.

3. Evaluation Method and Criteria

Due to the absence of a well developed data base a comprehensive assessment of river related wildlife and ecologic areas was not possible in the time allocated for this study. Where information was available on the statewide distribution and significance of certain species (such as bald eagles), then this data was incorporated into the study. Some wildlife resource experts did contribute information on regionally significant river related ecologic areas, which was noted in the documentation section of this report for the study's "A" and "B" rivers.

a. Federal Endangered Wildlife Species

The State of Maine has the only significant population of bald eagles in the northeast United States. The northern subspecies of bald eagles was officially listed as endangered in the state in February 1978. Coastal areas and river estuaries provide important habitat for the majority of Maine's wintering and breeding populations of eagles; Inland rivers, ponds, and lakes also have seasonal importance to nesting and summering eagles, although the use of these areas undergoes a marked decline during the winter months when ice cover limits their opportunities for foraging.

Wildlife biologists from the University of Maine at Orono have assessed river-related areas in the state for the presence of important habitat for bald eagles.

Important rivers are those with a significant concentration of birds for a particular region of the state, including:

- a. Areas with active nesting sites
- b. Areas with historic nesting sites
- c. Areas which are used by significant concentrations of wintering eagles

Based on these criteria, the following rivers have been rated as outstanding for the presence of very significant concentrations of nesting and/or wintering populations of bald eagles and have been identified with an asterisk on the matrix with the Final List of Rivers:

Lower Kennebec River: including Merrymeeting Bay

Main Stem Penobscot River: Bucksport to Old Town

Dennys River: Hinkley Point to headwaters of Meddybemps Lake

b. Critical Zoologic Species with Statewide Significance

The Critical Areas Program is involved in an ongoing process of assessment of critical zoological species in the state. At the present time heron rookeries, horseshoe crabs, and American oysters are the only river-related critical species that it has evaluated on a statewide basis. Significant habitat areas for these species (such as nesting areas and breeding grounds), have been listed on the Maine Register of Critical Areas.

When assessing the significance of a particular zoologic species, the Critical Areas Program uses the following criteria:

- 1) **Peripherality:** the degree to which a species is at the edge of its typical geographic breeding range.
- 2) **Endemicity:** the range of distribution to which species is restricted (i.e. Found only in Maine out of the entire Northeast, out of the entire U.S., out of North America, out of the entire world).
- 3) **Relative Scarcity:** the number of sites where a particular species is known to be found
- 4) **Probable Status Change:** a measure of a species trend in population and sites of location over a specified period of time.
- 5) **Relative Specialization of Habitat:** the environmental requirements of a particular species and its degree of specialization to certain habitats; including its vulnerability to loss of habitat.
- 6) **Scarcity of Habitat:** the relative scarcity of potential or actual suitable habitat of a species.
- 7) **Susceptibility to Disturbances:** the relative degree of tolerance of a species to immoderate human presence.
- 8) **Relative Knowledge:** the amount of information available on the distribution and scarcity of a particular species.
- 9) **Relative Use:** the general level of public interest in a species.
- 10) **Spatial Distribution:** a measure of the pattern of distribution of a species over its geographic range.
- 11) **Probable Site Persistence:** the relative probability of species presence at a certain location for a majority of years over a given span of time (usually 20-25 years).
- 12) **Seasonal Mobility:** the conditions of seasonal movements of a species
- 13) **Area Size Needs:** the area required by a species for all life needs (breeding sites, feeding grounds, territory) during its breeding season.

c. Critical Ecological Areas

The Maine Department of Inland Fisheries and Wildlife has identified and inventoried eight inland and six coastal types of wetlands located around the state. The Land Use Regulation Commission has also zoned fish and wildlife protection sub-districts for deer wintering yards and wetlands in the unorganized territories. Regional biologists associated with the Department of Inland Fisheries and Wildlife were able to document the more important ecologic areas for many of Maine's rivers. These areas included critical coastal salt marshes important for shorebirds and migratory and wintering waterfowl, significant acreages of inland wetlands and their associated fauna, and large deer wintering areas.

4. Information and Expert Review

The following references were used as sources of information for this study:

A Preliminary Listing of Noteworthy Natural Areas in Maine:

Center for Natural Areas; South Gardiner, Maine 1976

Register of Critical Areas,

Maine Critical Areas Program, Maine State Planning Office

An Ecological Characterization of Coastal Maine,

U.S. Department of the Interior, Fish & Wildlife Service; Newton Corner, Mass., 1980

Bald Eagle Management Plan, Ray Owen and Charlie Todd,

University of Maine at Orono, School of Forest Resources

Expert opinion and review was provided by Ray Owen and Charlie Todd from the University of Maine at Orono, resource biologists from the Maine Department of Inland Fisheries and Wildlife, and the U.S. Fish and Wildlife Service.

C. UNDEVELOPED RIVER AREAS

1. Definition

Any physical alteration of the land surface will influence the natural processes along the river corridor. Construction activities can cause increased soil erosion and runoff to enter a stream; septic tank effluent from seasonal homes along river banks can cause changes in water quality. Development in the river corridor may have a negative or positive impact on the resources of a river depending upon how it alters the essential elements which compromise it.

2. Significance

Undeveloped lands contiguous to the rivers of Maine represent some of the more significant natural resource areas in the State. The interface between the adjacent land and the flowing water of a river is an important area, providing food, cover, and habitat for a variety of fauna and flora. Wetlands associated with rivers have special importance in the hydrologic and biological systems, serving as areas for aquifer recharge, acting as catch basins for flood waters, filtering out pollution, producing oxygen by photosynthesis, and providing species habitat. Forests and ground cover lining the river banks cool the waters by providing shade, and prevent soil erosion. River corridors in the natural state often have high quality scenery for recreational users of the river. It is clear for all these reasons that undeveloped corridor lands warrant the conservation and protection of their special qualities.

3. Standards for Inclusion

Rivers and river segments in Maine which were evaluated for the amount of existing corridor development must have met the following qualifying criteria.

- a. The main stem of a segment must be greater than 10 miles in length (tributaries to the main segment could be less than 10 miles in length) .
- b. The river or river segment must be free from significant hydrologic impoundments, modifications, and diversions.

Once the river evaluations were conducted, a cutoff value of 30 development points per mile was used to define the more significant undeveloped rivers in Maine. An explanation of the development point system of evaluation follows in the next section.

4. Evaluation Method and Criteria

The National Park Service of the Department of the Interior developed a process for evaluating the undeveloped character of a river corridor in its work on the Nationwide Rivers Inventory. The method used for the Inventory was adapted for use in this study. The assessment of land use development in river corridor areas was made using the most recent USGS 7.5' or 15' quadrangle maps available. This information was supplemented in some cases with aerial photos and local road maps and atlases.

Each river and river segment was measured on the map and divided into one mile intervals beginning with the downstream segment boundary. The study river corridor (defined as contiguous lands within one quarter mile of each river bank) was also defined on the map.

Using data sheets, all land use development was recorded for each mile interval, and numerical values were assigned to the various land uses. Development having a greater impact on natural values, (i.e. bridge crossings, parallel railroads and power lines, and small towns) were given more points than lower impact development (i.e. footpaths and unpaved roads).

The following is a list of land use features typically found within river corridors and their corresponding development points.

<u>Land Use Development Features</u>	<u>Points</u>	<u>Land Use Development Features</u>	<u>Points</u>
Primitive road ending	1	Railroad parallel	20
Footbridge	2	Paved road parallel (red)	
Gaging station		Pipeline parallel	25
Primitive road parallel (trail)	3	Powerline parallel	
Small dock	4	Water storage tank	
Unpaved road ending (plain)		Bulkhead	
Orchards, farms, dwellings, cemetery	5	Rip rap	
Abandoned rail line ROW	6	Small Tributary reservoir	
Outfalls		Gravel pits	
Railroad ending	8	Developed recreation area	30
Powerline ending		Marina (site check)	
Fire tower		Country club	
Outbuildings, schools		Swimming pool	
Unpaved road		Radio tower	35
Light duty bridge (plain)		Power substation	
Paved road ending (red)	10	Pumping station	
Paved boat ramp		Paved road bridge (4 lanes)	40
Campground		Sewage plant	
Picnic area		Apartment building	
Unpaved road parallel (plain)		Hospital (site check)	
Pipeline and powerline crossing	15	Village (up to 499 pop / site check)	
Railroad bridge	18	Dam (small)	
Paved road bridge (red)			

After the land use development features for the river segment were identified, the numerical scores for each one mile interval were tabulated. By totaling all interval scores, and dividing through by the number of intervals (river miles), an average mile by mile index of the river's corridor development was calculated.

Outstanding River Segments

Examination of previous National Park Service work for the Nationwide Rivers Inventory has shown that rivers with an average of less than 15 point per mile are equivalent to the least developed rivers in the northeast United States. Outstanding undeveloped rivers in the State with a corridor development index of 15 points or less and a length greater than 25 miles were identified with an asterisk on the matrix accompanying the Final List of Rivers; and are as follows:

- Allagash River Aroostook - Machias System
- East Machias River
- Machias River (Washington County)
- East Branch Penobscot – Seboeis River System
- Upper West Branch Penobscot River
- Pleasant River (Washington County)
- St Croix River
- St Francis River
- St John River (including the Big Black, Little Black, and Baker Branch)

5. Information Sources and Expert Review

The following references were used as sources of information for this study:

Wild and Scenic Rivers System Study – Northeast Region, US Department of the Interior, Heritage Conservation and Recreation Service, Northeast Region, Philadelphia, Pennsylvania.

Wild and Scenic Rivers System Study – Northeast Region, Guidelines for Evaluating Wild, Scenic and Recreational Rivers.

Nationwide Rivers Inventory, Criteria for River Evaluation; US Department of the Interior, Heritage Conservation and Recreation Service, Northeast Regional Office, J. Glenn Eugster, October, 1979

Nationwide Rivers Inventory – Final List of Rivers, State of Maine, US Department of the Interior, Heritage Conservation and Recreation Service, Northeast Regional Office, January 1981

Nationwide Rivers Inventory, Criteria for Establishing River Priorities; US Department of the Interior, Heritage Conservation and Recreation Service, Northeast Regional Office, J. Glenn Eugster, April, 1980

J. Glenn Eugster from the National Park Service in Philadelphia provided information and expert review for this portion of the study.

D. SCENIC RIVER RESOURCES

1. Definition

Different river areas in Maine possess different types of scenery. Traditionally, scenic river resources have been identified by user preference studies and professional evaluations. To determine user preferences, groups of people are usually shown a series of river area photos, and asked to rate them according to preference or quality. Results are then analyzed to determine which river and landscape corridor elements or mix of elements correlate highly with preferred areas.

In professional evaluations, river areas are analyzed by trained planners according to a set of fixed criteria using either design principles, ecological and cultural criteria, or a quantitative scale.

In both instances the objective is to focus on specific variable river and river corridor characteristics which have been determined to be major influences on perceived scenic or landscape quality.

2. Significance

For many years there has been a growing recognition of the concept that certain landscape elements such as scenery are unique resources worth identifying and protecting. In fact, there are many federal and state laws and regulations which address the growing need for management of visual resources. Until the 1960's the area of public environmental management and policy related to scenic resources developed mostly in the context of outdoor recreation. The focus was predominantly on the management and preservation of specific areas with unique or outstanding scenic attributes. Concern with scenic values in the context of a larger landscape area or the relationship of scenic values to a wider range of resource issues are a side effect of environmental legislation within the last 15 years. For example, at the federal level, scenic and aesthetic considerations were addressed in the National Environmental Policy Act of 1969, the Coastal Zone Management Act of 1972, and the Wild and Scenic Rivers Act of 1968. The State of Maine followed the approach of these laws when it formulated the Mandatory Shoreland Zoning Act and Site Location of Development Act.

Scenic values and qualities have been recognized for years in the real estate field, which has assigned higher market values based on public demand to certain scenic features, such as properties with mountain views, or locations on river or lake waterfront areas. The Maine tourism industry also recognizes the scenic qualities of the State's river environment in many of its programs.

3. Minimum Standards for Inclusion

Initially rivers, river segments and other landscape areas were identified using recognized sources of scenic or visual information such as the Nationwide Rivers Inventory, various Critical Areas Program reports, canoe guides, travel information and other documents. To be placed on the Preliminary Draft List of Rivers Under Evaluation, rivers had to be recognized or documented as being scenic or possessing a high degree of visual quality due to a specific feature, characteristic or element. All sources of information, whether subjective or objective, were treated equally.

4. Evaluation Method and Criteria

The two basic components of the scenic river resource assessment are land form and pattern. The quality of any scenic river experience is dependent on the synthesis of land pattern into the overall land topography.

Land forms are the natural forms of the surface of the earth, the mountains, rolling hills and valleys which form the overall context of a natural landscape. The study of land forms constitutes an important part of a scenic river resource assessment, through the visual impact of dominant landscape forms, as well as affecting the patterns and distribution of other components of scenic river areas.

Land use pattern is the interlocking texture of fabric of the landscape including man and the by-products of his technology and culture. Patterns of land uses are a function of combinations of the parts of the natural and built environment and their overall composition. The composition of these parts is an important determinant of the visual quality of a landscape. For example, a small New England river hamlet against a steeply forested mountain range, or a sandy floodplain area next to a large rock outcrop are examples of contrasting combinations of texture which create patterns that are visually interesting. The nature of our perceptions depends upon the combination of natural and built pattern within the existing landform. The scenic quality of the river environment will depend on the quality of both the natural pattern and built pattern, and on the extent to which the two patterns are meshed or harmonized with one another.

The perceived scenic quality of a river and its corridor will also be a function of the frequency and diversity of the various natural and man-made components which combine to form a landscape (such as geomorphic and hydrologic features, vegetation, and cultural values), as well as the interrelationships among these components. Scenic resource values can be defined based on general relationships among components of a landscape. These relationships, which become the basic principles upon which assessment of river-related scenic resources is based, include the following:

- As the relief increases, the scenic quality of the river corridor increases
- As the landscape becomes more rugged, the scenic quality of the river corridor increases
- As the amount of enclosure by vegetation increases, the scenic quality of the river corridor increases
- As the diversity of land uses increases, the scenic quality of the river corridor increases
- As the naturalness of a landscape increases, the scenic quality of the river corridor increases.

- As the amount of tree cover increases, the scenic quality of the river corridor increases.
- As the density of land use edges increases, the scenic quality of the river corridor increases.
- As the diversity of land use edges increases, the scenic quality of the river corridor increases.
- As the compatibility of land use increases, the scenic quality of the river corridor increases.
- As the water surface and water edge increases, the scenic quality of the river corridor increases.
- As the size and length of the view increases, the scenic quality of the river corridor increases.

In general, spatial variety and three-dimensional contrast are positive values within a given river corridor's landscape composition. The greater the contrast and variety in spatial landforms and patterns, the higher the perceived scenic value. Spatial variety is judged on the shape of spaces, the degree of enclosure by landform or vegetation, and the diversity of shape, pattern, and enclosure which exist in a landscape.

Once relationships among compatible parts of a landscape have been defined, it is possible to proceed with the analysis by identifying the presence of specific landscape components or combinations of components which have scenic value. The following are river and landscape features and components which were identified in this analysis:

1) Landscape Physiography

This qualitative evaluation of physiographic relief will give an index of three dimensional contrast in a river-related landscape. The topography surrounding a river corridor is classified into one of the seven categories of form, representing a continuum of physiography from flatland to mountains. The underlying assumption is the greater the amount of relief in a river corridor, the greater the scenic quality.

2) Landscape Diversity

The amount of spatial variety is another measure of scenic value in a landscape. The scenic value of a river corridor will be enhanced when there is a diversity of hydrologic, geomorphic, and vegetative elements present. A general rule is the greater the diversity of landscape elements (land, water, vegetation) the higher the scenic quality.

a) Hydrologic features inventoried included channel shape, the presence of waterfalls, cascades, and whitewater rapids, tributary confluences, ponds and lakes, river islands, and complexity of water edges. The presence of hydrologic features (such as waterfalls and rapids) that have universal public appeal will enhance the scenic qualities of a river corridor. Scenic quality will also increase as the complexity of hydrologic elements increases. The greater the sinuosity of a river channel, the greater the visual carrying capacity of recreational users at the river's surface. In a similar manner, the more irregular or complex a river's shoreline or corridor (from the presence of river island complexes or tributary confluences for example), the higher its visual quality.

b) Vegetative features inventoried on the rivers included the percentage of tree cover, diversity of vegetative types, presence of forest edges, and forest wetland contacts. The underlying assumption was that scenic quality increases with the increased amount of tree cover, density of forest edges, and diversity of vegetation.

c) Outstanding geomorphic landforms and landscape features were identified for each of the three physiographic sections in Maine (Seaboard Lowland, New England Upland, and White Mountains) and then inventoried for each of the evaluated rivers. These representative and unique scenic features, by physiographic section, included:

- Seaboard Lowland

Landforms: undulating topography, worm clam flats, tidal marshes, beaches, and dunes

- New England Upland

Landforms: rolling topography, bold dome-like hills, soft round hilltops, steep side slopes and V-shaped gullies.

Drainage: curved dendritic, right-angle tributaries, glacial ponds and swamps, oxbow lakes

Landscape Features: eskers, kames, moraines, monadnocks, glacial erratics fields

- White Mountains

Landforms: V-shaped valleys, conical peaks in rows, eroded cliff and bench topography.

Drainage: radial, dendritic, deranged,

Landscape Features: ravines, escarpments, monadnocks, eskers, drumlins, kames, lake deltas, other glacial features.

In addition to inventorying these specific features which are thought to increase a river corridor's scenic quality, other geomorphic elements were identified which by their complexity of form or shape, add to river scenery. These elements of form are defined as relief enclosure.

- **Relative Relief:** the scenic quality of the river corridor will increase with greater relative relief. To calculate, elevation points were selected at quarter-mile intervals on a topographic map for a river area, and the lowest elevation point was subtracted from the average high elevation.

- **Enclosure:** as the amount of enclosure increases, scenic quality increases. Enclosures were measured by calculating the percentage of area enclosed by (lying below) the median of relative relief.

3) Land Use Diversity and Compatibility

Land use diversity relates to the number of different land use types, their areas, and the length of their edges. Compatibility of land use is a measure of the visual congruence (the visual fit) of adjacent land uses. Land use includes visually distinctive types of surface cover such as agricultural fields or forest, which may support more than one use.

b. Evaluation Methodology

The National Park Service of the Department of the Interior developed this process of scenic assessment outlined in the previous section for its work on the Nationwide Rivers Inventory. Evaluation of scenic river landscapes was conducted for the Inventory using the most recent USGS 7.5' of 15' quadrangle maps available, supplemented by field work, videotapes and slides from low-altitude helicopter flights over many of these rivers. Substantial use was made of this existing data base which was modified and expanded where appropriate for the Maine Rivers Study.

For this study's scenic river assessment, each river or river segment was measured on a topographic map and divided into one mile intervals beginning with the downstream segment boundary.

Using data sheets, all significant scenic landscape components were recorded for each mile interval. Greater value was assigned to segments with an outstanding diversity of components, or those riverscapes with a highly compatible combination of vegetative, hydrologic, geomorphic, and cultural values.

5. Information Sources and Experts

The following references were used as sources of information for this study;

Nationwide Rivers Inventory – Criteria for River Evaluations: US Department of the Interior, Heritage Conservation and Recreation Service, Northeast Regional Office, Philadelphia, Pa. 1979

Study of Visual and Cultural Environment for North Atlantic Region: Research Planning and Design Associates, Amherst, MA, published as Appendix N, North Atlantic Water Resources Study, November 1970

Guidelines for Identifying and Evaluating Scenic Resources; Hudson River Basin; Water and Related Land Resources Study, Technical Paper 4, October 1978

A Preliminary Listing of Noteworthy Natural Features in Maine: Center for Natural Areas, South Gardiner, Maine, June 1976

J. Glenn Eugster from the Mid-Atlantic Regional Office of the National Park Service provided information and review for this section of the study.

E. HISTORICAL RIVER RESOURCES

1. Definition

The rivers of Maine have long served a vital role in the colonization, development, and industrial growth of the state. This part of the Maine Rivers Study focused on the identification of river related historic places and sites which have achieved recognition as national Historic Landmarks or are listed on the National Register of Historic Places. It is realized that many of the rivers of Maine have historical and cultural value other than these recognized on the national level, such as the historic use for logging runs, the presence of archaeological sites, building with state or local importance, or settlements which represent unique cultural values. However, a lack of expertise and state agency assistance did not permit a more comprehensive survey by the study team. Thus, this discussion will focus on National Historic Landmark and National Register sites associated with rivers in the state.

2. Significance

River-related national historic landmarks and places in Maine are visible reminders of the events, places, and objects which have affected broad patterns of American history and reflect the evolution of industry and culture in this state and the US. They contain prehistoric and historic villages of the American Indian and early colonists, fortifications for the protection of access to waterways, sites of industry and resource extraction activities, and bridges with unique architectural styles. All historic areas designated as National Historic Landmarks are of national significance; other properties which are nominated by the State of Maine and placed on the National Register of Historic Landmarks after approval by the Secretary of the Interior are of national, state, or local significance. In recent years, building districts which possess a composite quality and evoke a special feeling and association have been added to the National Register. Such districts may contain individual buildings which of themselves may not be outstandingly significant but which, as an assemblage representing a special character of an urban or rural waterfront or port, possess national, state, or local significance.

3. Standards for Inclusion

There are many National Historic Sites which are found along rivers in Maine. However, only those sites which have a direct connection to the river, in terms of industrial, economic, or cultural importance (such as former significant winter ports or fortifications at the mouths of rivers for the defense of upstream settlements) were noted as significant by this study.

4. Evaluation Methods and Criteria

To attain the designation of National Historic Landmark, a property must be studied by National Park Service historians, architects, or archaeologists, usually as a part of a major theme in American history such as Social and Humanitarian Movements or Agriculture. The property should meet three general criteria:

- 1) significance in a given field
- 2) association with individuals and events
- 3) integrity, the latter meaning that original and intangible elements which contribute to national significance must remain intact

Potential landmarks are brought semi-annually before two advisory boards of scholars and national leaders – the Consulting Committee for the National Survey of Historic Sites and Buildings, and the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments. These boards review the presentations of National Park Service professionals. Those properties which meet the approval of the Secretary's Advisory Board are recommended for landmark status. The actual designation is effected when the Secretary of the Interior, acting upon the counsel of his Advisory Board, approves landmark designation. The National Historic Landmarks Program is the only honorary historic preservation program of its kind in the Nation.

Because of their recognized national significance, National Historic Landmarks associated with particular rivers in Maine have been noted on the matrix accompanying the Final List of Rivers with an asterisk, to highlight their outstanding historic value.

A variety of criteria have been defined to guide the State, Federal agencies, and the Secretary of the Interior in evaluating potential entries in Maine for addition to the National Register of Historic Places, and include the following:

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- a. That are associated with events that have made a significant contribution to the broad patterns of the state's history; or
- b. That are associated with the lives of persons significant in the state's past; or
- c. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- d. That have yielded, or may be likely to yield, information important in prehistory or history.

Before submission to the National Register, all nominations must be approved by a State review board whose membership includes professionals in the fields of architecture (or architectural history), history, and archeology. If the property meets the National Register criteria, the board recommends it for nomination. The nomination form is then signed by the State Historic Preservation Officer and forwarded to the National Register, which reviews the potential entry and decides whether to accept or reject it.

5. Information Sources and Expert Review

The following references were used by the study team to identify and document resource values:

National Register of Historic Places, US Department of the Interior, Heritage Conservation and Recreation Service, Washington, DC, 1976

Annual Listing of Historic Properties, National Register of Historic Places; US Department of the Interior, Heritage Conservation and Recreation Service, Federal Register; Tuesday, February 6, 1979

_____ ; Federal Register, Tuesday, March 18, 1980

_____ ; Federal Register, Tuesday, February 3, 1981

The State Historic Preservation Office was requested to participate in the identification, documentation, and review of significant historic and cultural rivers but declined.

Unique Recreational Rivers – Overview

Both the economically important tourist industry and the life style of Maine residents rely heavily on the recreation use of the state's natural resources. Rivers are important components of this recreational use, providing diverse recreational experiences to a variety of interests. Recreational activities associated with rivers include camping, picnicking, fishing, boating, hiking, sightseeing, swimming, hunting, skating, and sailing.

While each of these activities is important to varying degrees, the Maine River Study has restricted its recreational analysis to activities which are:

- 1) directly dependent on free-flowing river resources
- 2) highly popular throughout the state, and
- 3) engaged in by large and readily identifiable user groups.

The recreational categories chosen for analysis include recreational boating (canoe touring, white water boating, and extended back country boating), inland fishing, and anadromous fishing.

For each recreational category, rivers were evaluated according to resource significance, economic importance, and user priority. This evaluation process recognized that user preference ultimately plays a dominate role in the determination of a river's value as a recreational resource. Input from concerned user groups was therefore sought throughout the process, with a strong attempt made to arrive at a consensus of opinion among users regarding the recreational significance of specific rivers.

This user input, coupled with objective analysis by resource experts, resulted in the category findings detailed in this report. The specific method used for each recreational category follows.

A. ANADROMOUS FISHERIES

a. Definition

Fresh water and tidal rivers which empty into the ocean or salt water estuaries provide vital habitat for anadromous fish. An anadromous fish species is characterized by its migratory nature, spending much of the life cycle in salt water but returning to fresh water to spawn. Catadromous fish species (e.g. the American eel) reverse this pattern by migrating to the ocean to spawn. For the purpose of this study, catadromous fish are considered to be included in the anadromous category.

The Maine River Study has identified important anadromous fishery rivers and isolated those that are of highest value to the state and its residents.

b. Significance

Historically, anadromous fish were of high importance to Maine's commercial fishing industry and were a dependable food source for coastal river inhabitants. While extensive commercial fishing depleted this resource, it was the increase in industrial pollution and the construction of impassable dams which most seriously depleted anadromous fish populations. The creation of the Atlantic Sea Run Salmon Commission in 1947, as well as the state Department of Marine Resources' strong commitment to anadromous fish restoration beginning in the mid-1960's, provide evidence that Maine recognizes the tremendous ecological and recreational significance as well as the commercial value of the state's anadromous fish.

a. Ecological Importance – Many of Maine's coastal rivers are characterized by their exceptional potential to support anadromous fish, both in numbers and species diversity. Of special note are the rivers which provide habitat for the more sensitive species. The shortnosed sturgeon found in a limited number of rivers is listed as an endangered species by the federal government. The American shad and Atlantic sea run salmon have also had their numbers severely reduced and depend on Maine rivers for their survival.

Maine's six rivers with fishable self-sustaining Atlantic salmon runs are unique, as no other state can claim even one. At least three additional rivers in the state are recognized as having high potential for restoration of historic Atlantic salmon fisheries.

b. Recreational Importance – The Atlantic sea run salmon fishery is recognized as a statewide high priority resource of value to Maine's recreational fishing interests as well as to the state's tourist industry. The Penobscot River is the most heavily fished Atlantic salmon river in the country; the value of this one river to the tourist industry is estimated to be a half million dollars per year. The American shad and rainbow smelt also are potentially of high recreational importance. Smelt are currently popular as a winter fishing resource. Overall, more user-days are expended fishing smelt than any other of the state's anadromous fish species.

c. Commercial Importance – Salmon, smelt, shad, and alewife were historically of high value to the commercial fishing industry. While the depletion of salmon, shad, and smelt have lessened their commercial importance, the alewife, which is an essential lobster and trawling bait, continues to be an important commercial fishery. According to the Maine Department of Marine Resources, landing of alewife doubled between 1970 and 1977, with total catch tripling during this time. With successful restoration, shad and smelt could also contribute significantly to Maine's commercial fishery industry.

Restoration efforts by the State Department of Marine Resources and the Salmon commission, assisted by federal funding, are beginning to produce results. Restoration, coupled with improvements in water quality and proper planning for future impoundments, will ensure that the ecologic, recreation, and commercial potential of Maine's rivers as anadromous fish resources will be realized.

3. Standards for Inclusion

Rivers were included in the Preliminary Draft List of Rivers Under Evaluation if they met the following standards:

- a. The river must be a viable anadromous fishery resource. It therefore must either currently support a substantial anadromous fish population or have realistic potential for restoration as evidenced by:
 - a) current restoration efforts, or
 - b) management plans which call for timely restoration.

b. The river must drain a minimum of 25 square miles before discharging into tidal waters. (Thirty of Maine's sixty coastal rivers meet both of these standards).

4. Evaluation Method and Criteria

The criteria used to evaluate anadromous fishery river significance include:

- a. Habitat quality and quantity
- b. Presence of threatened, endangered, or sensitive species
- c. Species diversity
- d. Recreational importance
- e. Commercial importance
- f. Evidenced restoration efforts
- g. Unique characteristics (i.e. self-sustaining Atlantic sea run salmon runs)

Note: The migratory nature of the resource makes specific anadromous fish segment identification difficult. Both the major thoroughfares and the spawning areas are essential to species survival. Therefore, when labeling segments for rivers in the anadromous category, the entire length of the river migration cycle was identified.

Rivers meeting the minimum standards were evaluated with the assistance of the Maine Department of Marine Resources' anadromous fish experts. The Preliminary Draft List was reviewed by private fishing interests and Atlantic Sea Run Salmon Commission staff. Because of the unique value of the Atlantic salmon, all rivers which support self-sustaining salmon runs were given high priority. All of these salmon rivers are, however, of importance to other species and to the state's overall anadromous fish program.

The rivers in Maine which were judged to be of highest significance include the following. Each river is identified by an asterisk in the Final List of Rivers section of this report.

Damariscotta River: high commercial alewife importance

Dennys River: self-sustaining Atlantic salmon run

East Machias River: self-sustaining Atlantic salmon run

Kennebec River: high habitat quality and quantity, species diversity and abundance, presence of endangered species, high recreational importance.

Machias River: (Washington County): the state's largest self-sustaining Atlantic salmon run, recreational importance

Narraguagus River: self-sustaining Atlantic salmon run

Penobscot River: high recreational importance, high restoration expenditure, habitat quality and quantity

Pleasant River (Washington County): self-sustaining Atlantic salmon run

Sheepscot River: self-sustaining Atlantic salmon run, endangered species

St George River: high commercial alewife importance

5. Information Sources and Expert Review

Information and expert opinion was provided to the study team by the following agencies and organizations.

Maine Department of Marine Resources

(fisheries biologists' input and review, species management plans)

Maine Department of Inland Fisheries and Wildlife

(Atlantic Sea Run Salmon Commission staff biologist review, miscellaneous publications)

Trout Unlimited

Maine Sportsman Magazine

B. RIVER-RELATED INLAND FISHERIES

1. Definition

Inland fish include all fish species which inhabit a fresh waters environment throughout their life cycle, in contrast to the migratory anadromous fish which require both fresh and salt water habitats. Included in the general category of inland fisheries are both cold water and warm water species. This analysis is restricted to river fisheries and does not consider lake fisheries. However, rivers which derive their major importance from their support of lake fisheries are given recognition.

While factors such as ecological importance (i.e., critical habitat) are given strong consideration, the focus of the study is the identification of inland fishery rivers and streams which are judged to be of high recreational importance.

2. Significance

The State of Maine has approximately 32,000 miles of flowing water, all of which support sport fisheries. Major cold water species include the native brook trout (the most abundant and certainly one of the most important cold water species), and native landlocked salmon (a highly prized fish found in a limited number of rivers), and the introduced brown trout (an adaptable species capable of providing a sport fishing resource where other cold water species will not thrive). Rivers which provide principal habitat for cold water species total 23,000 linear miles with an average of 153 legal sized fish per mile. Landlocked salmon are found in 64 rivers covering 635 miles. Nearly 200 miles of Maine's rivers provide exceptionally high quality habitat for this species.

Major stream-related warm water species include the native white perch and the introduced smallmouth and largemouth bass. All have self-sustaining populations. Warm water species predominate in 6400 miles of Maine's rivers and streams.

Sport fishing for inland species has witnessed a large increase in popularity over the past few years among Maine's residents, and approximately 190,000 resident fishing licenses are sold annually. When non-resident licenses and youth (who are not required to obtain a license) are taken into account, the Department of Inland Fisheries and Wildlife projects that 385,000 people fish Maine waters. Studies using creel census expansion techniques estimate 460,000 angler-days are spent annually on Maine's rivers and streams, accounting for one-third of the total inland fishing use. Cold water fish harvest in rivers and streams totals 532,000 fish annually, and the Department of Inland Fisheries and Wildlife estimates that there is potential for doubling both the use and take figures. The Department currently stocks 316,000 cold water fish annually in 105 streams totaling 826 linear miles.

Inland fisheries have economic as well as recreational value. Seventy to eighty thousand out-of-staters annually purchase fishing licenses and a number of in-state fishing guides and outfitter businesses depend on Maine inland fisheries. The overall dollar value of inland river and stream fishing has not been established, but it is definitely an important component of Maine's natural resource-related tourist industry.

3. Standards for Inclusion

Preliminary inland fish resource data was obtained with the assistance of the Maine Department of Inland Fisheries and Wildlife. Using a questionnaire accompanied by guidelines for evaluation, fisheries biologists in each of Maine's seven wildlife management regions were asked to identify approximately ten river and/or stream segments which they determined to be of high importance to that region's recreational fisheries program. A total of 81 river segments totaling 1487 miles was identified through this process. These results were reviewed by state level fisheries biologists from the Department of Inland Fisheries and Wildlife, and four additional segments were added due to their statewide significance. These 85 rivers and river segments comprise the Preliminary Draft List of Rivers Under Evaluation.

The list of rivers developed should not be construed to represent all rivers of significance for inland fisheries in each region. A limitation was placed on the number to be listed per region, and the emphasis was on importance for recreational fisheries. It should be clearly stated that all other rivers, brooks, and streams not on the list have at least some significance to the overall inland fisheries resources of Maine. Also, recreational demands upon these resources can be expected to change over time, with consequent shifts in significance for recreational fisheries uses and relative importance.

4. Evaluation Method and Criteria

The Department of Inland Fisheries and Wildlife's regional biologists evaluated the rivers which they selected according to the following criteria:

- a. **Species Composition** – The existence of fish species of major importance by virtue of being:
 - 1) rare in the region
 - 2) highly preferred by anglers
 - 3) of major ecological importance
- b. **Water Quality** – The extent to which overall water quality is capable of sustaining preferred fish resources.
- c. **Aquatic Habitat Quality** – The existence of natural features favorable to fish production and sustenance of preferred fish species (adequate flow, cover, etc)
- d. **Fishing Quality** – An evaluation of recreational fishing results (success rate, size of take, desirability of species taken, etc.)
- e. **Quality of Recreational Use** – The ability of a river segment to provide a satisfying recreational fishing experience (scenery, solitude, challenge, variety, etc)
- f. **Existing Recreation Use** – The popularity of a river segment as a recreational fishery resource.
- g. **Economic Importance** – The importance of recreational fishing on the river segment to the regional economy (use of local guides, retail sales, etc)

Using comparative analysis, rivers which were preliminary judged to be of highest statewide significance were identified. The regional lists were then distributed to Maine fishing interests for review and comment. Each of Maine's local Trout Unlimited chapters evaluated rivers on the [Preliminary Draft List](#) according to the criteria of fishing quality, recreational quality, and current use. Again using comparative analysis, rivers were ranked by region and the highest priority rivers were noted. Trout Unlimited's Maine Council combined local chapter findings and produced a comprehensive list of that organization's statewide fishery priorities.

The study's final determination of the state's outstanding inland fishing rivers incorporated the Department of Inland Fisheries and Wildlife's preliminary findings, Trout Unlimited's review and evaluation, and comments from other recognized resource experts and interested individuals who reviewed the study's [Preliminary Draft List](#).

Rivers which were identified as being the States' most significant recreational inland fishery rivers follow. Each is identified with an asterisk in the [Final List of Rivers](#) section of this report.

Crooked River
Fish River Lake Thoroughfares
Grand Lake Stream
Kennebago River
Penobscot River, Upper West Branch
Penobscot River, West Branch (Ripogenus Gorge Section)
Penobscot River, East Branch

Other highly significant recreational fisheries include the:

Moose River
Narraguagus River
Rapid River
Roach River
Saco River
St John River
Sheepscot River
Nahmakanta Stream
Presque Isle Stream
Wassataquoik Stream

Trout Unlimited efforts and expenditures on the Little Ossipee River and the Pleasant River (Cumberland County), and the Maine Department of Inland Fisheries and Wildlife's stocking and management efforts on a number of additional rivers throughout the state attest to these rivers' significance. Those rivers identified by this study as being of high importance are, however, the result of a consensus of expert and public opinion and are representative of high quality resources of a type not found in this abundance in other states in the eastern United States.

5. Information Sources and Expert Review

Information and expert opinion were provided to the study team by the following agencies and organizations:

Maine Department of Inland Fisheries and Wildlife (state fisheries biologists, regional fisheries biologists, species management plans)

Trout Unlimited (local chapters and Maine Council)

Maine Sportsmen Magazine

Sportsman's Alliance of Maine

Regional and state biologists from the Maine Department of Inland Fisheries and Wildlife performed the preliminary identification and assessment of inland fisheries, and provided comment and review throughout the study. Species management plans were the source of information on habitat and significance of particular species. The Maine Council and local chapters of Trout Unlimited, as well as Maine Sportsmen Magazine and Sportsman's Alliance of Maine provided review and comment on the study.

C. RIVER-RELATED RECREATIONAL BOATING

1. Definition

The present study focuses on river-related recreational boating which is dependant on flowing waters and the use of a "waterway trail". Consequently, river resources were identified which were of importance mainly to recreational activities using open and closed canoes, kayaks, and inflatable rafts. In order to represent a broad range of recreational boating interests, the general recreational boating category has been subdivided into three more specific categories, which identify distinct recreational boating activities and river users. These three categories are as follows:

- a. **Canoe Touring** – Rivers and river segments which are navigable in an open canoe by novice to intermediate paddlers and which contain predominantly flat water, quickwater, and Class I rapids.
- b. **Whitewater Boating** – Rivers and river segments which are navigable in canoes, kayaks, or rafts by intermediate to expert boaters and which contain a significant number of Class II to Class V rapids.
- c. **Backcountry Excursion Rivers** – Rivers located in natural environments which are of adequate length to provide an extended river camping experience. These rivers may contain any combination of white water and/or canoe tour boating.

2. Significance

Maine's natural amenities have long been the source of recreational opportunities for the people of the state as well as the principal generator of tourist industry revenue. While historically the coast has been the focus of tourist recreation attention, the 1970's saw a strong diversification in recreation use patterns, with river use in particular increasing at an unparalleled rate. Though comprehensive user statistics do not exist for most state rivers, those that do exist verify this marked increase in river recreation popularity. The Allagash Wilderness Waterway witnessed a 60% increase in use between 1966 and 1980, while use on the St John has more than doubled since 1975. Use on the Saco River increased 300% between 1971 and 1976, and recent analysis suggests that recreational boater use on the Saco has since increased by 25% annually. The most significant change in boating use has occurred in commercial rafting. In 1976 approximately 600 commercial passengers rafted the Kennebec Gorge and the West Branch's Ripogenus Gorge. In 1981 this figure approached 14,000, a 200-fold increase.

Even without future growth, commercial rafting will annually add approximately \$2,000,000 to Maine's tourist industry revenues. River recreation popularity has also made canoe outfitting a viable component of the tourist industry with significant use on the Allagash, St John, Penobscot, and coastal rivers in eastern Maine.

Maine's recreational river resources are extensive. For example, the Appalachian Mountain Club's canoe guide identifies 4,474 miles of boatable rivers and streams within the state. The Maine Rivers Study has determined that 1,750 of these miles represent significant boating areas of high resource quality and high use priority. 650 of these miles are predominantly associated with white water boating, 500 with flat water canoe touring, and 600 with back country excursion boating.

Included in these 1,750 miles of river are a number of river segments which possess unique features. Maine can boast New England's only two stretches of Class V white water as well as the region's longest stretch of continuous canoeable white water. It can also boast the Northeast's premier back country canoe trips and one of three federally designated wild and scenic rivers.

These river resources, combined with a number of lesser known rivers with significant recreation potential, provide the State of Maine with a recreational resource of extremely high value. Though 98% of the state's river corridors are privately owned, the prevalent multiple use concept at work in the state ensures that these resources will remain accessible to boating enthusiasts.

3. Standards for Inclusion

To be included in the Preliminary Draft List of Rivers Under Evaluation, a river had to:

- a. Be listed as a prominent river trip in one or more of the recognized river guide books
- b. Be recommended by one of the state's recognized statewide recreational boating interests or organizations, or
- c. Show evidence of use by commercial outfitters

4. Evaluation Method and Criteria

A list of rivers meeting the minimum standards for inclusion in the recreational boating category was distributed to representatives of recreational boating interest groups, commercial outfitters, and other knowledgeable sources. Experts were asked to review the list and to evaluate each river segment's statewide significance in relation to others on the list. They were then asked to group rivers in priority categories from high to low. The following criteria were offered as guidelines in making these determinations.

General criteria with relevance to all the boating categories included:

1. Existing use
2. Access
3. Navigability
4. Length of season and flow regularity
5. Scenery and aesthetic experience
6. Economic importance

Specific criteria for each of the recreational boating categories included:

- Canoe Touring – safety, use by organizations
- Whitewater Boating – presence of significant rapids
- Backcountry Excursion – length of trip, lack of corridor development, availability of camp sites

Concurrent with this expert review process, study team members assembled available river use statistics, identified commercially significant rivers, and researched each river segment in an attempt to identify unique recreational features. Individual expert evaluations were then combined, and a list which represented a consensus of opinion was developed. This list was cross checked with the study team's independent evaluation, and the final list of outstanding recreational rivers was produced.

The following rivers were identified as outstanding (the state's most significant) in each category, and identified with an asterisk on the Final List of Rivers.

Backcountry Excursion:

Allagash River
Machias River (Washington County)
East Branch Penobscot River
Upper West Branch Penobscot River
St Croix River
St John River

Whitewater Boating

Carrabassett River
Dead River
East Branch Penobscot River
Upper Kennebec River
Machias River (Washington County)
West Branch Penobscot River
Rapid River
Seboeis River
Wassataquoik River

Canoe Touring

Moose River
Saco River

Many other canoe touring rivers have importance to regional recreational boaters, including the following rivers:

Royal River
St George River
Kennebec River
Aroostook River
Upper Androscoggin River

5. Information Sources and Expert Review

Information and expert opinion was provided to the study team by the following agencies and organizations.

Appalachian Mountain Club, Maine Chapter
High Adventure BSA
Maine Audubon Society
Maine Professional Guide's Association
Maine State Planning Office
Natural Resource Council of Maine River Committee
Penobscot Paddle and Chowder Society
White Water Outfitters Association of Maine

The following references were used by the study team to identify and document resource values.

AMC River Guide, Appalachian Mountain Club, Volumes 1 and 2, Boston: AMC, 1980

New England White Water River Guide, Gabler, Ray, New Canaan, Conn: Tobey Publishing Co., Inc., 1975

Canoe Trails Directory, Makens, James C., New York: Doubleday and Company, Inc., 1979

Maine Rivers, Thorndike, Maine: The Thorndike Press.

Maine's Whitewater Rapids, McMahon, Janet, Augusta, Maine: Maine State Planning Office, 1981

Pole, Paddle, and Portage, Riviere, William A., Boston: Little, Brown, and Company, 1969

Canoeing Maine (#1 and #2), Thomas, Eben, Thorndike, Maine: The Thorndike Press, 1979

Canoeing Racing: Hot Blood and Wet Paddles, Thomas, Eben, Hallowell, Maine: Hallowell Printing Company, 1974.

The Maine Atlas and Gazetteer, Yarmouth, Maine: Delorme Publishing Company, 1981.

V. Final List of Rivers

The following is the list of all rivers and streams in the state of Maine which have been determined through the study process to have significant and/or unique natural and recreational resource values. This list represents the product of the river evaluation, documentation, and expert and public review process and are judged to possess resource values of regional, statewide, and greater than statewide significance.

The list defines for each river the segment of the river with one or more resource values. The matrix accompanying the list identifies the total number of resource values associated with each river segment. Resource values which are the state's most outstanding in a particular resource category or greater than statewide significance are highlighted on the matrix with an asterisk.

The following guidelines were used to define the limits to the segment of river containing a significant resource value. The river segment for each specific resource value for a particular river is defined in the appendices following this report. River segments were defined by the following criteria:

1. Segments were described using readily identifiable physical locations.
2. Distinct river segments were identified for each natural and recreation value by determining the length of river required to preserve a given natural value or to support a given recreational activity.
3. Segments were identified such that each exhibits a relatively consistent level of resource quality throughout the segment.
4. A river segment could extend through a natural or man-made lake if the upstream and downstream portions of the river segment were of consistent resource quality and type, and if the lake did not significantly disrupt the river's natural values or recreational use. Rivers which flow through urban or other developed areas were handled in a similar manner.
5. In recognition of the importance of upstream tributaries to the resource value of a river segment, the designation "to headwaters" was used to describe segment boundaries whenever the segment location and resource values justify such a description.
6. Segment boundaries were determined by associated resource values alone and did not take into account jurisdictional boundaries or the location of potential development.