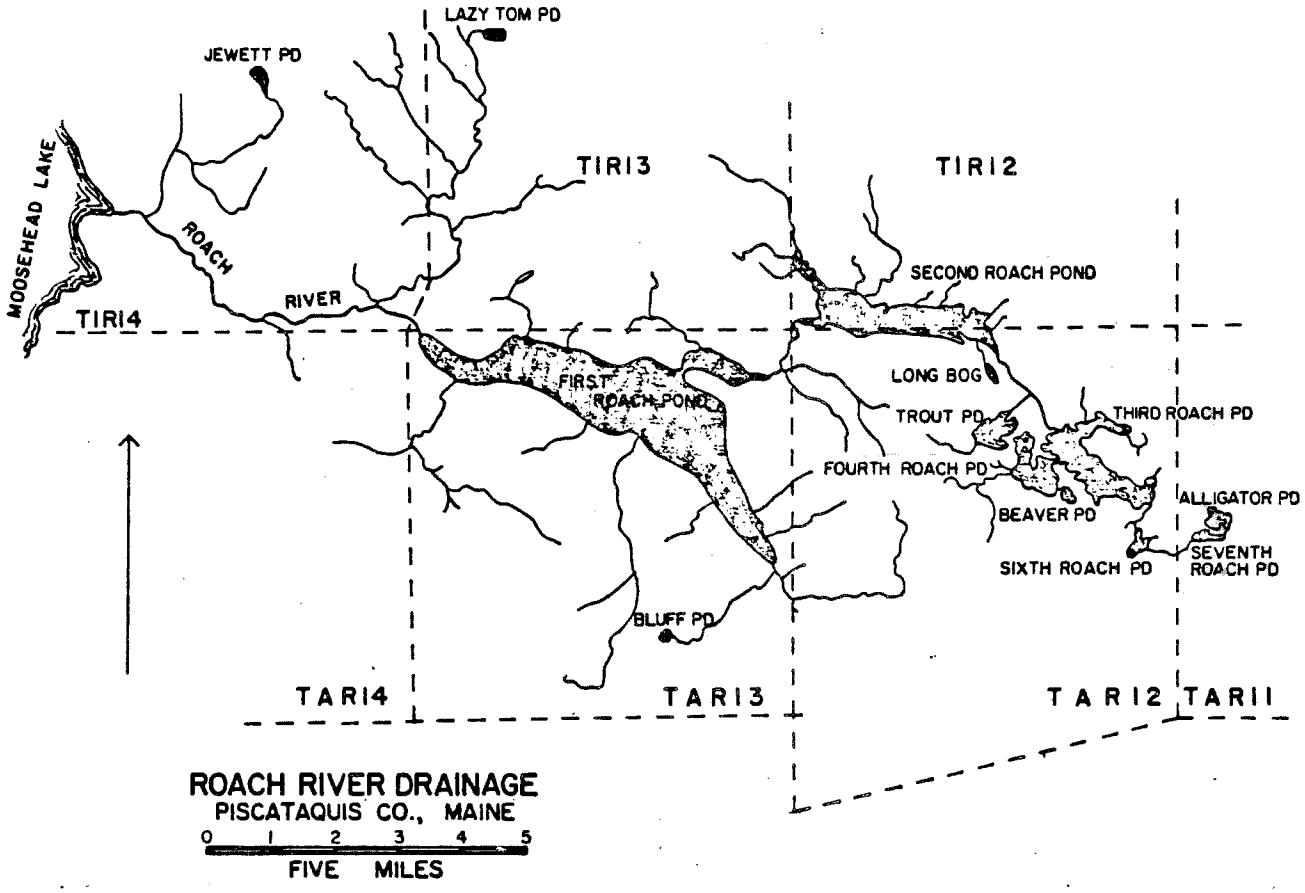
ROACH RIVER

STRATEGIC PLAN FOR FISHERIES MANAGEMENT

Prepared for:

The Cabinet Committee on
Hydropower Policy,
Land and Water Resources Council



Prepared by:

Scott Roy
Maine Department of
Inland Fisheries and Wildlife

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FOREWORD

This management plan has been developed by the Department of Inland Fisheries and Wildlife in response to Governor Brennan's Executive Order on Maine Rivers Policy, July 6, 1982; the "Maine Rivers Act" of June 17, 1983; and the Department's need to formalize and document specific objectives and procedures for managing important fisheries under its jurisdiction.

The Maine Rivers Study, completed in May of 1982 by the Department of Conservation, identified the Roach River as a "C" river; rating its recreational fishery for landlocked Atlantic salmon as highly significant. This plan will serve to document the extent and quality of this fishery, and to show how the Department intends to manage the fishery, and to serve as a guide and source of reference for the protection and enhancement of this valuable river resource in the future.

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INTRODUCTION

This document sets forth the management plan for the Roach River. Although brook trout contribute seasonally to the fishery in the Roach River, the landlocked Atlantic salmon is the species primarily fished for by the sporting public and the habitat is best suited for the management of salmon.

The plan is based on the potential of the existing habitat conditions within the river to support a landlocked salmon fishery and to provide natural reproduction for the wild landlocked salmon of Moosehead Lake. The rapidly increasing popularity of the sport fishery in the Roach River, particularly the fall fishery, may necessitate increased restrictions in the harvest if management goals are to be realized.

The first section of the plan describes the general physical characteristics of the Roach River. The sections that follow describe the historical use of the river, current species occurrence, fish habitat, and the current sport fishery. We have attempted to state in concise terms what we believe are the best management goals and objectives for the Roach River, identified existing and/or potential fishery management problems, and finally, presented management strategies appropriate to achieve the management goals and objectives. The management objectives for the Roach are not as specific as we would like to make them because of the lack of adequate data on the fishery. If we are able to accomplish detailed surveys of the fishery as planned, we will be able to develop more specific objectives in a future update of this document.

This plan is not intended to be so rigid as to preclude changes necessary to manage the resource better. The plan considers the attitudes and desires of both sporting and commercial resource users. With continued contact with the sporting public through angler interviews, correspondence, and discussions at hearings, and with an open relationship with the Kennebec Water Power Company, we expect to be able to assess changing conditions and needs to respond with appropriate management modifications.

DESCRIPTION OF THE DRAINAGE

General

Two major sub-drainages form the headwaters of the Kennebec River system. They are the Roach River and the Moose River. The Roach River drainage originates in Township A Range 11 in Central Piscataquis County and flows westerly to its junction with Moosehead Lake in Township 1 Range 14 in West-Central Piscataquis County. The Roach River drains 102 square miles of forested lands. The main river begins at the outlet of Third Roach Pond and flows through Second Roach Pond and First Roach Pond before discharging its water into Spencer Bay, Moosehead Lake. The drainage has an overall average gradient of just under 14 feet per mile. There are 94 miles of tributaries feeding the main river.

There are 13 ponds in the Roach River drainage with a total area of 5,426 acres. The largest is First Roach Pond with 3,270 acres, followed by Second Roach Pond (970 acres), Third Roach Pond (570 acres), Fourth Roach Pond (266 acres), and Trout Pond (145 acres). The remaining waters are less than 50 acres in size. First Roach Pond exceeds 120 feet in depth and is the deepest of the 13 waters. The other waters are less than 50 feet deep. All of the ponds in the Roach River drainage have been surveyed for habitat suitability. Sounding maps, physical characteristics, lists of fishes, and management recommendations for these waters have been published as individual lake survey reports and are available from the Department of Inland Fisheries and Wildlife in Augusta.

Topography and Geology

Topography varies widely within the Roach River drainage area. Bluff Pond lies near the summit of Bluff Mountain at an elevation of 2,130 feet above sea level. Water from Bluff Pond drops 1,100 feet in elevation before reaching Moosehead Lake (1,029 feet at normal pool elevation). The maximum elevation within the watershed is Number Four Mountain which stands 2,890 feet above sea level. There are six other peaks in excess of 2,000 feet elevation in the

drainage. The land south of First Roach Pond and Second Roach Pond has the most irregular features and nearly all of the highest peaks (Farrar Mountain lies north of Second Roach Pond). The land north of the river and the two largest ponds is better described as gently contoured hills, only 200 to 400 feet in height (generally less than 1,600 feet above sea level).

A brief and adequate description of the glacial history, climate, soils and forest of Northwestern Maine, which encompasses the Roach River drainage, is found in Maine Archaeological Society Inc. Bulletin; volume 24, Number 1 (Spring, 1984). It is generally accepted that the Laurentian ice sheet covered essentially all of New England approximately 18,000 years ago. It had retreated north of the St. Lawrence River by about 12,500 years ago. Local ice masses apparently remained in upland portions of New England until 11,000 years ago. A series of ponds, lakes, and other surfacial features, such as those in the Roach drainage, were left as the result of this most recent glacial advance and retreat.

The floral resources of the area fall largely within the Spruce-Fir-Northern Hardwoods zone. The zone is characterized by predominent red spruce and balsam fir, and some combination of beech, white birch, aspen, red maple, and sugar maple. The soils are generally classified as rough, rocky, and shallow.

Climate

The climate is more severe than that of the more densely inhabited coastal areas of the State. The January mean temperature ranges from 7 to 12°F and July mean temperatures from 61 to 68°F. The annual mean temperature is 39°F with a recorded low of -48°F and high of 104°F. The annual mean precipitation is 37 inches, with snowfall ranging from 90 to 130 inches. The frost-free period averages 111 days.

Hydrology

There are no flow records available for the Roach River. The river below Third Roach Pond and Second Roach Pond is no longer regulated by dams. The river below First Roach Pond is regulated by a dam constructed, maintained and operated by Kennebec Water Power Company. A minimum flow averaging at least 75 cfs is maintained through this dam. Maximum flows occur when excessive run-off must be spilled in the spring and when First Roach Pond is drawn down in late September and October.

HISTORY OF USE

Land and Water Development

Early road access to the Roach River watershed was by wagon road from Bangor to Katahdin Ironworks, then north and west to what was then called Upper Roach. Overnight lodging was available at approximately 10-mile intervals along this route, 10 miles being a typical day's travel. One of the overnight houses was located at Upper Roach, now known as Second Roach Pond. The development of this site dates back to 1875. The route bridged the outlet of Second Roach Pond and headed north for the final 10-mile leg of the trip to Grant Farm, the base of operations for the Great Northern Paper Company in its land holdings north of the Roach Drainage.

There was no continuous road network from Greenville to Kokadjo, at the outlet of First Roach Pond, until 1920. Loggers and logging supplies were boated from Greenville to Lily Bay on Moosehead Lake by steamer. Horse drawn wagons carried the freight from Lily Bay to Kokadjo in the earliest days. The building of Ripogenus Dam on the West Branch of the Penobscot River prompted the construction of a 30-mile gravel road from Lily Bay to Ripogenus Gorge. Upon completion in 1915, the new improved road permitted motor vehicles to speed materials to the Ripogenus Dam construction site. The 12-mile section from Greenville to Lily Bay was completed in 1920.

The forest within the Roach River drainage area was owned and managed by the Hollingsworth and Whitney Co. and is presently owned by Scott Paper Co., with the exception of that portion of the drainage in TA R11 which is owned by Prentiss-Carlisle. The waters of the Roach River drainage were used by the Hollingworth and Whitney Co. to store and transport softwood pulp logs to its pulp and paper mills located on the lower Kennebec River. First, Second and Third Roach Ponds have had water control structures built at their outlets since

1905. In later years, the dams served the dual purpose of providing water to drive wood downstream to Moosehead Lake and for storing any excess to be used for power generation at sites operated by Central Maine Power Co. on the Kennebec River. Remnants of the old dams remain at the outlets of Second and Third Roach Ponds. The rock-filled log-crib dam at the outlet of First Roach Pond was replaced with a modern concrete dam in 1978.

The early wood cutting operations bore little resemblance to the highly technical and more efficient methods employed today. Cutting was usually done in the winter by large crews using hand tools. The wood was moved over the ground to the various ponds in the drainage where it was stored over winter on the ice. Most operations were located within a short hauling distance of the waters that would eventually be used to carry the wood downstream. The operations were concentrated in the winter because it was easier to haul wood over roads made of ice and snow than it would have been to manually load wood onto wheeled carts to be transported to the receiving waters. With the arrival of ice-out and the spring run-off, the stored wood was driven to Moosehead Lake. There it was held in large booms, towed by steamer (later by diesel power) to the dam at the East Outlet, and sluiced into the Kennebec River. Winter cut and stored pulp tended to lose its bark easily during driving and further storage downstream. Bark from these past logging practices is still evident in some areas.

With the development of modern harvesting machinery, the woodsmen were able to efficiently cut and move wood over greater distances from the waterways. Crews were able to operate throughout the entire year. In the 1960's, major wood harvesting operations were concentrated near the section of the Roach River below First Roach Pond. Streamside landings were cleared and leveled to facilitate the piling of four-foot long pulp. The wood was later bulldozed into the stream channel to take advantage of the spring run-off or the metered flows through the First Roach Pond dam. The new method of driving pulp was

conducive to log jams. These jams caused pulp logs to be deposited over the river's banks and onto the flood plain where many still can be found. The gouging and digging caused by the pulp rushing downstream, the use of heavy machinery to rearrange or remove large boulders, and the actual bulldozing to straighten stream channels have all contributed to the permanent alteration of the natural river and stream beds within the Roach River drainage. The Fish and Wildlife Department's regional files contain correspondence and field notes from throughout the 1960's expressing concern over the physical changes in the river, the fluctuations in flow accompanying driving, the possible detrimental effects to fish migration, and the loss of fishing opportunity posed by logs remaining in the river.

With the end of log-driving on the Roach River in 1971, the system has stabilized and many of the physical damages have healed. Old streamside log landings are again vegetated. Much of the bark deposits have been flushed from the river channel. Scott Paper Co. supplied manpower and machinery in an attempt to remove sunken pulp and rechannel the river's mouth at Moosehead Lake. Lazy Tom Stream, once considered good habitat for young salmon, was dramatically altered during the log driving era. Only recently has the stream begun to show any improvement in the production of salmon parr. There is little doubt that some pools and adult holding areas have been lost due to the rearrangement of rocks, boulders, and siltation. Well planned stream improvement projects could help to reverse these losses.

Fisheries

Sporting camps were established in the late 1800's at the outlet of First Roach Pond. The Roach River post office was established April 5, 1890, with Elbridge H. Hunting as postmaster. The name of the office was changed to Kokadjo, February 1, 1911. The name Kokadjo is an abbreviated version of the Indian name for First Roach Pond. The Indian name, Kokadjeweemgwa'sebem, is

translated to mean Kettle Mountain Lake. There is little information available describing the early sport fishing in the Roach River area. All of the ponds in the drainage contained brook trout. First Roach Pond also supported populations of lake trout (togue) and lake whitefish. Much of the popular sporting literature of that period emphasized the native brook trout fisheries. It is logical to assume that the brook trout was the preferred species in the Roach system of ponds.

The stocking of landlocked salmon into Moosehead Lake in 1879 marked a permanent change in the fisheries at First Roach Pond and the section of river from First Roach Pond to Moosehead Lake. Salmon became well established in Moosehead Lake. The Roach River developed into a primary spawning tributary for the Moosehead Lake salmon population. Salmon were stocked into First Roach Pond as early as 1929. Depending on the condition of the dams and fishways at the outlet of First Roach Pond, salmon may have had access to the pond prior to the 1929 stocking.

The fishery in the Roach River below First Roach Pond has been dominated by salmon since at least the early 1960's. Mid- to late-summer runs of salmon and trout provide excellent fishing opportunity with a chance to catch a large fish of either species. The Roach River has become a popular fishery attracting anglers from all parts of the State and many areas outside of Maine. Total angler use appears to have increased dramatically in recent years.

During the 1940's and 1950's the Hatchery Division of the Department of Inland Fisheries and Game used salmon trapped in the Roach River as a major source of eggs. This operation continued about 15 years, ending in the mid-1950's. The "salmon stripping pool", located about one-half mile below First Roach Pond dam, was the site where salmon were trapped and netted, stripped of their eggs and milt, and released. Each fall, netting was continued until 300-400 (and sometimes 1,000) salmon had been captured. Some fish weighed 11 pounds, but

most were 2-3 pounds. Between 250,000 and 500,000 eggs were usually obtained from the operation. A large number of fry from the eggs were restocked the following spring, and additional fingerlings were sometimes stocked in the fall to retain a large salmon run. Although the men were seeking salmon, they often caught 8 to 10 washtubs of brook trout, many suckers and whitefish, and an occasional lake trout. They released the game fish above the netting fence, allowing the fish to continue upstream. Several male Pacific (chinook or king) salmon were also captured; these fish had been stocked in Second Roach Pond in 1937 and 1938, but they apparently were not able to reproduce successfully and the population disappeared.

Water Quality and Pollution

At present, development within the Roach River drainage is concentrated at Kokadjo and along the south shore of First Roach Pond. There is one privately owned cabin on the Roach River below Kokadjo. The cabin was originally used by the State as a Warden Service Camp but was later sold. A second building, known as the 'stripping camp' was located at the 'stripping pool' and was used by the State's hatchery personnel during egg-taking operations on the river. This building was burned by the Department of Inland Fisheries and Wildlife in the early 1970's when the building fell into disrepair. The general store and its associated sporting cabins at Kokadjo cater to fishermen and hunters. This commercial operation is licensed to discharge 1,500 gallons per day of treated domestic wastewater into the Roach River approximately 100 yards below the First Roach Pond dam. With proper secondary treatment, this volume of discharge should not degrade the water quality to less than the Department of Environmental Protection's current B-2 classification on the Roach River.

There are no fewer than 100 privately owned seasonal camps on First Roach Pond, most located on the south shore of the pond. These camps exhibit the full

range of use from occasional weekend visits to summer-long residency. At least two commercial operations can be found on the south shore of First Roach Pond. A restaurant with a campground is a relatively new operation near the outlet of the pond. A second commercial campground (once maintained by the Maine Forest Service) is situated near the mouth of South Inlet. This is a well-used site in part due to the availability of fine gravel beaches. Both operations meet State licensing requirements. Within the Department of Inland Fisheries and Wildlife's ability to measure water quality, no adverse effects to water quality have been detected to date. Using its more sophisticated equipment and methods, the Department of Environmental Protection may wish to sample First Roach Pond periodically to monitor any effects on water quality.

Second Roach Pond has no private development along its shores. However, there is a commercial sporting camp catering to fishermen and hunters located near the outlet of the pond. A campsite is maintained by the Maine Forest Service at the southeastern end of the pond. It can be assumed that the strict adherence to State plumbing codes and regulations regarding waste discharge will be sufficient to prevent water quality problems at Second Roach Pond. Similar precautions should be exercised by the owners of the two private camps on Third Roach Pond.

Obstructions and Fishways

When the remnants of the old dam at the outlet of Third Roach Pond were examined by the Regional Fisheries Biologist in 1963, he described the dam as "all fallen down but the sluiceways are a screen type of obstruction with all the water filtering through the cracks of the old sluiceways". At the time the site was also being used by beavers which created a further impass. The dam site was visited again in 1984. The dam has continued to deteriorate to the extent that passage through the dam is possible, although probably difficult

under certain water levels. The beaver dam at the outlet was gone; however, there are beaver dams in various states of repair downstream in the area of the deadwaters. Passage from Second Roach Pond into Third Roach Pond is presently hampered by these beaver dams. It had been recommended as early as 1956 that the river between Second Roach Pond and Third Roach Pond be cleared of the beaver dams to allow upstream passage of the salmon from Second Roach Pond. The Department of Inland Fisheries and Wildlife has taken no active measures to keep the river channel open nor has the owner of the dam removed its remains. The potential for maximum parr production in this section of the Roach River will not be realized until all obstructions to free passage are removed. The management of Third Roach Pond was expanded in 1970 to include landlocked salmon with the population being maintained through stocking. The program was terminated in 1980 and the pond is again being managed for its wild brook trout. A limited fishery for wild salmon should persist.

U.S.G.S. Water Resources Data for Maine records indicate that the fall of 1969 was the last time that water was stored behind the dam at Second Roach Pond. The gates were removed from the dam at about that time. The same source provides a continuous record of storage dating from 1928. The reservoir was described as having the usable capacity of 216 million cubic feet between gage heights 0.5 and 10.0 feet. The storage was usually reduced to the minimum by early October and the pond kept empty throughout the winter months until April. A fishway was built into the dam but had fallen into poor repair by the late 1950's. Attempts were being made to have the fishway rebuilt when yellow perch were discovered in Moosehead Lake. To prevent their migration into the Roach River drainage, the fishway in the First Roach Pond dam was closed. The fishway at Second Roach Pond was also closed as extra protection for the upper drainage. When the dam was finally put out of operation in 1969 and the gates removed, there was a potential for fish passage into the upper ponds if the yellow perch ever became

established in First Roach Pond. Scott Paper Co. was asked to maintain a head of approximately 4 feet above the natural pond level. This level would help provide boat passage around the lower end of the pond (a concern of the sporting camp operator) and provide a vertical head impassable to yellow perch. These adjustments were made in 1970. In 1974 the State gave permission to Scott Paper Co. to dredge the lower end of the pool below the dam to increase the drop from natural lake level to tail water level. Spring and fall flood conditions in the early 1980's weakened the remaining center crib and wings of the old dam. In the spring of 1983, extreme high run-off washed out all but the apron and bed logs of the dam. The Regional Fisheries Biologist decided to take advantage of the chance to improve fish passage over and through the remains of the dam because yellow perch had not been found in First Roach Pond. Apron planks were removed, bed logs were cut and notched, and rocks were rearranged in an attempt to allow salmon and trout to migrate up through what had been maintained as a barrier for over 20 years. An effort should be made to have the remains of the dam removed completely.

The last remaining active dam on the Roach River drainage is at the outlet of First Roach Pond. Historically, the water was controlled to maximize its value for both transportation of pulp wood and generation of electricity at downriver facilities. Prior to the days of formal fisheries management, little was known about the complete life history requirements of many species of cold-water sport fish. The expertise and the legal support were not available to back demands and negotiations for binding drawdown and water level agreements. A review of lake drawdown records for First Roach Pond reveals a major operational change which appears to coincide with the increased demand for power generation in the late 1950's. The records were examined with particular attention directed to the critical spawning-to-hatching period of October to April. In the 1930's and 1940's the lake was usually empty, or nearly so, during October. This

permitted the lake trout (togue) to spawn along the shores of First Roach Pond under conditions that tended to allow for good survival. Water use was altered dramatically so that in the years since the early 1960's the pond has suffered winter drawdowns in excess of 2 feet in 20 of 23 years for which records are available. Drawdowns of this magnitude have the potential of exposing fall spawned eggs to freezing, causing the loss of entire year classes of lake trout. The correspondence on file at the regional fishery office indicates increasing dissatisfaction with the First Roach Pond lake trout fishery during this time period.

The Department of Inland Fisheries and Wildlife has consistently recommended and requested a minimum flow of no less than 75 cfs through the First Roach Pond dam at all times. As the old wooden dam fell into disrepair, that minimum flow was maintained almost entirely through leakage. Since the passage of the pulp driving era, it appears that stream flows have experienced less dramatic fluctuations. With the lake's total storage capacity (938 million cubic feet between gage heights 1.5 and 8.0 feet) used solely for power generation, it may have become possible to meter out that storage at a more constant and predictable rate. Better flow regulation has probably contributed to the consistently good parr production in the Roach River in recent years. Recommendations have also been made concerning the fall lake level in First Roach Pond. From as early as 1965 the Regional Fisheries Biologist has requested that First Roach Pond be lowered by the 15th of October to ensure successful lake trout spawning.

The road from Greenville to Kokadjo previously crossed the river over the bridge deck on the old Scott Paper Co. dam. The slow deterioration of the dam made it necessary to abandon the increasingly unsafe deck. In 1972 the State Highway Commission built the bridge that presently spans the river about 100 feet downriver of the dam. This move probably helped extend the life of the dam by a few years. The dam had reached a state where constant minor repairs

and bracing were necessary. In 1978 the Kennebec Water Power Co. engineered the removal of the old structure and replaced it with a modern concrete dam of the same size. Extreme caution was taken during the construction process to prevent the accidental passage of yellow perch. The new dam was designed to provide space for the future construction of a fishway. Additional illegal introductions of smallmouth bass and white perch into Moosehead Lake, and at least one of its other tributaries, makes it very doubtful that free and unrestricted passage will ever be permitted through the First Roach Pond dam. This does not preclude the construction and operation of a "blind" fishway that will trap fish moving upstream, allowing them to be sorted manually. This is a costly and time consuming proposition, however.

The present dam was designed to be the same height and have the same storage capacity as the old dam. A minimum flow of 75 cfs has been requested and approved. The Kennebec Water Power Co. has been asked to have First Roach Pond drawn down by October 15, whenever possible, and to have normal river flows restored by November 1. The Kennebec Water Power Co. has been cooperative by adjusting water management to help maximize the potential benefits to the fisheries.

Access

Present day access into and within the Roach River drainage area is provided by a system of gravel logging roads. A paved road from Greenville follows the east shore of Moosehead Lake to Lily Bay. From Lily Bay, sections of gravel as well as paved road lead to Kokadjo, at the outlet of First Roach Pond. A gravel road provides access to the many private camps on the largest and most popular pond within the drainage. Traditional access to Second Roach Pond was over the old Hollingsworth and Whitney road that originated at Kokadjo and followed the town line between T1 R13 and TA R13. The relatively new Rowell Brook Road

constructed by Scott Paper Co. is the more improved of the two access roads. These two roads meet about 1 mile from the bridge crossing the outlet of Second Roach Pond. At this point, one road (so-called Farrar Mountain Road) passes to the north of Second Roach Pond and provides access to Third Roach Pond. The other road crosses the outlet of Second Roach Pond and divides again into an older and a newer section. The older section closely follows the south shore of Second Roach Pond. At one time this road crossed the Roach River where it enters Second Roach Pond and joined the Farrar Mountain Road, forming a complete loop around Second Roach Pond. The newer road travels in a southeasterly direction between Long Ridge and Trout Mountain. A connecting road joining the old and new roads provides access to Long Bog and Trout Pond. Fourth Roach Pond is accessible by a short walk from the newer road. The Roach River below First Roach Pond is paralleled by old gravel roads on both sides. Skidder trails and foot paths provide access to several points along the river.

All of these roads have been built in conjunction with wood harvesting operations. The condition of these roads varies depending upon the location of active cutting operations. Much of the forest along the lower river was clear-cut in the 1960's and early 1970's. Recent cutting has involved small softwood stands left during the original harvesting. Major road upgrading was not necessary. The so-called Roach River North and South Roads are in poor repair at present. Frost-heaved culverts, washed out stream crossings, and road bed erosion have rendered these roads impassable in some areas. It is unlikely that these roads will be upgraded before the forest has grown back to a condition where large scale commercial harvesting is again feasible. The roads leading to the ponds in the drainage above Kokadjo are maintained to be at least passable by the private campowners on First, Second and Third Roach Ponds. An active cutting operation by Scott Paper Co. has recently connected the roads that follow both shores of First Roach Pond. It is reasonable to expect this road

system will be well maintained for the near future. Old roads also provide access to Lazy Tom Pond and Jewett Pond, the outlets of which empty into the Roach River below Kokadjo. Except for the section of county-maintained road along First Roach Pond, all road access is over private roads owned, built, and maintained by Scott Paper Co.

SPECIES OCCURRENCE AND ABUNDANCE

Until recently, the distribution of the fishes in the Roach River drainage remained much as it developed when the last glacier retreated, approximately 11,000 years ago. Brook trout and lake trout were the predominant salmonids until man intervened by stocking landlocked salmon into Moosehead Lake in the late 1870's. Smelts were also introduced as a forage source for the developing salmon population. There is no record of the distribution of the minnow species within the drainage, but whitefish, suckers, cusk and "chubs" are known to have been present. Impassable falls on the main stem of the Kennebec River prevented the migration of most fish species into the upper reaches of the drainage. It was fortunate that man did not introduce any of the warmwater species into Moosehead Lake or the Moose River and Roach River drainages during the period around the turn of the century when fish rearing and stocking became popular. Those "sports" who have had the opportunity to fish the waters of Moosehead Lake and the Roach River drainage from the time of its earliest development to the present, have enjoyed some of the best salmonid fishing that the State of Maine has to offer.

Recent events involving the illegal introduction of three species of fish not native to the drainage may have devastating effects on the future of this long famous brook trout fishery. In the past 25 years, we have witnessed the introduction of yellow perch (presumably accidentally through irresponsible use of the species as live bait in the late 1950's), the illegal and deliberate introduction of smallmouth bass in 1974, and white perch in 1984. The combined competition from these three species will probably overwhelm the brook trout in a relatively short period of time. The loss of the quality brook trout fishery presently provided by Moosehead Lake and the lower Roach River would be tragic. It is imperative that a barrier be maintained at the outlet of First Roach Pond to prevent the migration of yellow perch, smallmouth bass, and white perch into the upper drainage.

A list of species presently found in the Roach River drainage is shown in Table 1. Table 2 lists all the fishes and the ponds and river sections in which they occur. More specific comments concerning the relative abundance and management of the various fishes in the 13 ponds can be found in the individual lake survey reports which are available through the Department of Inland Fisheries and Wildlife, 284 State St., Augusta, Maine 04333.

Table 1. Fishes of the Roach River Drainage

Common Name	Scientific Name
Landlocked salmon	*Salmo salar*
Brook trout	*Salvelinus fontinalis*
Lake trout (togue)	*Salvelinus namaycush*
Rainbow smelt	*Osmerus mordax*
Lake whitefish	*Coregonus clupeaformis*
Round whitefish	*Prosopium cylindraceum*
Brown bullhead (hornpout)	*Ictalurus nebulosus*
White sucker	*Catostomus commersoni*
Longnose sucker	*Catostomus catostomus*
Burbot (Cusk)	*Lota lota*
Pumpkinseed sunfish	*Lepomis gobbosus*
Freshwater sculpin	*Cottus cognatus*
Threespine stickleback	*Gasterosteus aculeatus*
Fallfish	*Semotilus corporalis*
Lake chub	*Couesius plumbeus*
Creek chub	*Semotilus atromaculatus*
Fathead minnow	*Pimephales promelas*
Pearl dace	*Semotilus margarita*
Blacknose dace	*Rhinichthys atratulus*
Finescale dace	*Phoxinus neogaeus*
Northern redbelly dace	*Phoxinus eos*
Common shiner	*Notropis cornutus*
Golden shiner	*Notemigonus crysoleucas*
Yellow perch *	*Perca flavescens*
White perch **	*Morone americana*
Smallmouth bass**	*Micropterus dolomieui*

* Yellow perch established in the drainage below First Roach Pond.

**White perch and smallmouth bass illegally introduced into Moosehead Lake and may become established in the drainage below First Roach Pond.

Table 2. Species occurrence in individual waters of the Roach River drainage.*

Water	Salmon	Brook trout	Lake trout	Yellow perch	Hornpout	Smelt	Lake whitefish	Round whitefish	White sucker	Longnose sucker	Fallfish	Lake chub	Creek chub	Fathead minnow	Pearl dace	Blacknose dace	Finescale dace	Redbelly dace	Golden shiner	Common shiner	Cusk	3-sp. stickleback **	Pumpkinseed sunfish	Sculpin
River below 1st	X	X	X	X					X			X				X					X	X		X
First Roach Pd.	X	X	X		X	X	X	X	X		X	X	X							X	X			X
Second Roach Pd.	X	X			X	X	X	X	X	X	X	X	X				X	X	X	X	X		X	X
Third Roach Pd.	X	X			X	X	X		X		X	X									X			
Fourth Roach Pd.	X	X			X	X	X		X		X	X	X					X		X	X		X	
Sixth Roach Pd.		X			X				X			X	X			X				X	X			X
Seventh Roach Pd.		X							X			X	X											
Alligator Pd.		X							X				X		X									
Beaver Pd.		X			X				X			X	X					X		X	X			
Long Bog		X										X	X					X						
Trout Pd.		X			X		X		X			X	X					X		X	X		X	X
Bluff Pd.		X																	X					
Jewett Pd.		X										X	X	X				X						
Lazy Tom Pd.		X															X							
River 2nd to 3rd.	X	X							X		X	X				X					X			X
River 1st to 2nd.	X	X									X	X	X											

* Some of these waters were sampled only a few times, therefore it is possible that this distribution chart reflects incomplete data for some of the ponds and river sections.

** The threespine stickleback is present in Moosehead Lake.

HABITAT AND PRODUCTION POTENTIAL

First Roach Pond to Moosehead Lake

From its origin at the outlet of Third Roach Pond, the Roach River flows 19 miles (9 miles through Second Roach Pond and First Roach Pond) to Moosehead Lake. There are three geographically distinct sections to the Roach River. They will be described individually as follows: from the outlet of First Roach Pond to Moosehead Lake; from the outlet of Second Roach Pond to First Roach Pond, and from the outlet of Third Roach Pond to Second Roach Pond.

The section best known for its fishery and most important for its contribution to the natural reproduction of landlocked salmon and brook trout for Moosehead Lake is the 6.3-mile section below First Roach Pond. From the base of the dam at First Roach Pond to Moosehead Lake at its normal pool elevation (1,029 feet), the Roach River drops approximately 190 feet, an average gradient of about 32 feet per mile. The river width varies from approximately 50 feet to 132 feet during normal flows, averaging 75 feet. However, when water covers the entire river bed, the average width is approximately 100 feet. The depth varies from about 1 to 6 feet during normal flows. The river flows through well-defined banks, once heavily forested. Except for narrow green-belts on either side of the river, the forest was clear-cut in the 1960's and early 1970's.

Approximately 90% of the river bottom consists of rock and boulder riffles providing excellent nursery areas for salmon and brook trout. The remaining 10% is small rocks, gravel, and sand; the rubble's coarseness is best suited for salmon spawning. The most extensive gravel area is located in the river's lowest 200 to 300 yards (shown as section 10 in Figure 1). Another major salmon spawning site is within the upper one-half-mile below the pool at the First Roach Pond dam (shown as section 1 in Figure 1). There are scattered salmon and brook trout spawning sites among the larger rocks or at the edges of bars in the river's wider sections. There are few resting pools available for adult salmon and trout.

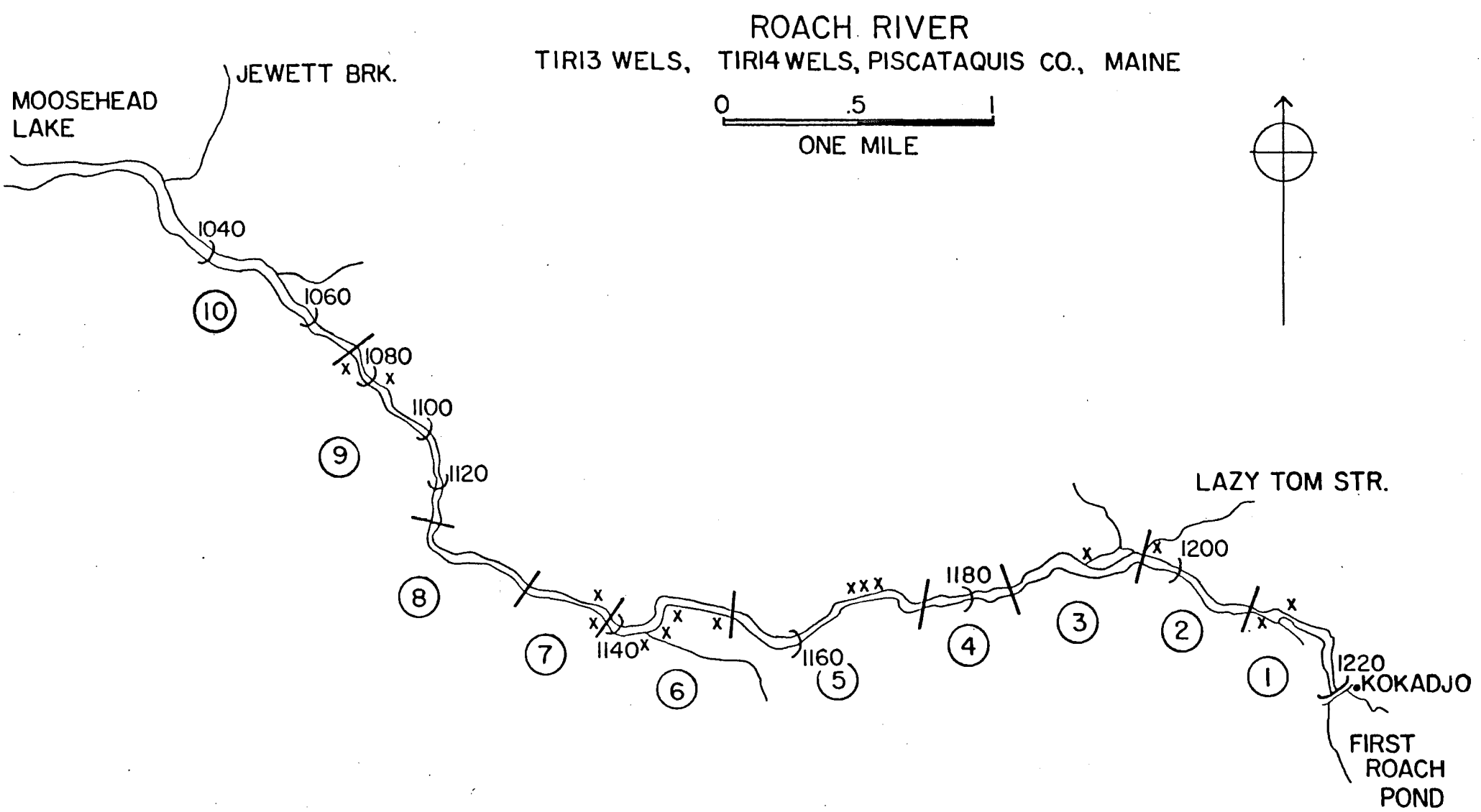

Figure 1. Habitat survey sections on the Roach River, First Roach Pond to Moosehead Lake.

Two major tributaries enter this section of the Roach River. Jewett Brook enters less than 1 mile from Moosehead Lake. This small stream has some brook trout in the springy areas, but salmon spawning areas are not available and trout spawning areas are limited.

Lazy Tom Stream, entering approximately 1 mile below First Roach Pond, has spawning and nursery facilities available in the 2-mile section between the river and an old dam at the outlet of Lazy Tom Deadwater. The flowage was used to store pulpwood that was driven through the dam on high water and into the river. Bulldozed streamside landings and the pulpwood drives widened the stream and removed much of the bank and stream cover during the wood driving years. Recovery has been slow but the stream banks are again vegetated. Electrofishing has provided evidence that a limited number of salmon parr are again using Lazy Tom Stream as a nursery area.

A minimum flow of 75 cfs has been established for the Roach River from First Roach Pond to Moosehead Lake. Lesser flows are injurious to aquatic insects and plant life so necessary for fish populations, destroy eggs of fish and insects, reduce the size of salmon and trout nursery areas, and make fish more vulnerable to preying birds and mammals.

In July, 1971, the entire reach from First Roach Pond to Moosehead Lake was surveyed to evaluate its spawning and nursery suitability. Determination of spawning suitability was made based on visual comparisons of the river bottom to areas within the river where salmon spawning was known to occur annually. Since 1971, the two major areas deemed suitable for salmon spawning have been repeatedly visited during the subsequent spawning seasons and both spawning adults and redds have been observed. No attempt was made to calculate actual acreage of suitable spawning gravel. Nursery areas were rated based on visual comparison with areas where salmon parr had historically been electrofished in significant numbers.

Areas suitable for brook trout reproduction were noted when observed. At the time of the survey, the flow through the First Roach Pond dam was estimated at 50 cfs. Lazy Tom Stream contributed an additional estimated 10 cfs. A summary of field observations is given in Table 3. The widths shown in the table are of the wetted area of the river channel.

The total area of this section of the Roach River was calculated to estimate the amount of salmon nursery area available. Measurements were made from aerial photographs (scale 1:15,840 or 4 inches to the mile) obtained from Scott Paper Company. The length was measured, using a map measurer, three times and the results averaged. Also from the aerial photos, twenty measurements of width were made and the mean calculated. The potential nursery area on the Roach River from the dam at First Roach Pond to Moosehead Lake is 2,502 units (one habitat unit equals 100 square yards). Estimates of parr abundance have been made using standard electrofishing techniques. The area sampled is, on appearance, typical of most of the river that was rated as "very good" nursery habitat. The two most recent estimates were made in August 1978 and 1979 (4.68 parr and 5.12 parr per habitat unit) and average 4.9 parr per habitat unit. Based on these estimates the total potential parr production for the Roach River might average 12,250 per year. Using observations made by biologists equipped with SCUBA gear who floated sections of the river counting salmon parr, and estimates based on electrofishing done prior to 1978, the actual number of parr per habitat unit may be as high as 7.0. AuClair (1982) chose to use 7.0 parr per unit to determine potential production for the Roach River. The resulting estimate was approximately 17,500 salmon parr, approximately one-half of the total estimated parr production from all of the Moosehead Lake tributaries.

Second Roach Pond to First Roach Pond

The Roach River between Second Roach Pond and North Inlet on First Roach Pond is 1.75 miles long. The vertical drop is approximately 35 feet from the

Table 3. Summary of field observations on the Roach River, July, 1971.

SECTION	LENGTH	WIDTH*	GRADIENT	SPAWNING	NURSERY	GENERAL DESCRIPTION
1	0.5 mi.	60'- 80'	moderate	very good	very good	alternating boulders and gravel; pools and riffles; 3 small tribs.
2	0.5 mi.	75'-85'	moderate	poor	very good	boulder riffle with patchy gravel; no pools; 1 small trib. and Lazy Tom Str.
3	0.5 mi.	75'-85'	moderate-steep	fair to good	very good	boulder riffle; gravel fair to good; pools and riffles; 1 small trib.
4	0.5 mi.	75'-85'	moderate	fair	very good	mixed riffle and pool; boulders and patchy gravel; 1 good pool and gravel area.
5	0.75 mi.	50'-60'	moderate-steep	poor	very good	boulder riffle; 2 good pools at base of steep banked area; good gravel at head of first pool; 3 small tribs.
6	0.5 mi.	80'-100'	low-moderate	good	very good	boulder riffle; 1 pool near steep banks; good gravel; 4 small tribs.
7.	0.5 mi.	70'-85'	low-moderate	good	good	large area of big gravel; most only fair; 2 small tribs.
8	0.5 mi.	60'-80'	moderate	good brook trout & salmon	very good	boulder riffles; small pools and riffles; 2 large bars of salmon gravel.
9	0.75 mi.	60'-70'	moderate-steep	poor	good	boulder riffle; ledges; small pools; patchy gravel and shale; 2 small tribs.
10.	1.50 mi.	80'-100'	moderate	good-very good at mouth	very good	boulder riffle; few pools; abundance of gravel at mouth; Jewett Brook

* Wetted area

outlet of Second Roach Pond to First Roach Pond. This section of the Roach River is comprised of a variety of runs, riffles and small shallow pools. The upper half of this section was surveyed in 1971 and the remainder was completed in 1983.

The river bottom is generally covered with small rock and cobble, unlike the river below First Roach Pond. The most suitable gravel areas for spawning are found near the mouth of the river above North Inlet. Future visits to this and other areas along the river are needed to confirm actual use by adult salmon.

There is an area of larger rocks and boulders in the section below the Scott Paper Company bridge that crosses the river. This appears to have the maximum potential for salmon parr habitat of any area between Second Roach Pond and First Roach Pond. The site was electrofished in 1982 and 1983 and produced estimates of 1.5 and 2.5 (average 2.0) parr per habitat unit. Young-of-the-year salmon were reported as very abundant. With a normal low flow of approximately 10 cfs, the river width averages 30 feet. The calculated potential nursery is 308 habitat units. At 2.0 parr per unit, the potential production is 616 salmon parr.

With the loss of the barrier dam at the outlet of Second Roach Pond and the subsequent cleaning of the bottom within the long access channel to the pond, some additional suitable spawning area has been created. The remnants of the old dam (bed logs and apron) should be removed to guarantee access to the site. When the dam and its fishway were operational, adult salmon were observed using this site in the fall. Unfortunately, no additional nursery has been created.

Third Roach Pond to Second Roach Pond

The Roach River from Third Roach Pond to Second Roach Pond drops about 40 feet in 1.7 miles. Historically, beaver dams have created barriers to upstream migration on this section of the river. When surveyed in 1984, four old and two new beaver dams were observed.

The river immediately above Second Roach Pond is rocky riffle with an occasional boulder. The river below the outlet of Third Roach Pond is similar except for the absence of any large boulders. Both areas have some suitable nursery habitat for salmon. The combined length of these two areas is about 0.8 miles (4,375 feet) with an average width of 35 feet. Only 3,000 feet of the combined areas is suitable nursery for salmon, providing 118 habitat units.

In the middle section of the river between Third Roach Pond and Second Roach Pond are two deadwaters (4.3 acres and 9.5 acres) joined by an area of wide (average 52 feet) slow moving water. The outlet from Trout Pond enters the lower end of the upper deadwater. Suitable trout spawning habitat can be found within the mouth of the stream. At the upstream end of the same deadwater there is a limited amount of spawning gravel typical of what salmon are known to use elsewhere in the drainage. The deadwaters provide little measurable benefit to the young salmon that might be produced in the river. A previous owner of the sporting camp at the outlet of Second Roach Pond kept a boat or canoe hidden near the deadwaters for his guests to use during the early-season brook trout fishery. When surveyed in 1984, the river above Second Roach Pond showed little evidence of angler use. Adult salmon have been observed in the late fall upstream as far as the beaver dams at the lower end of the deadwaters.

Recent electrofishing (1983) at the site of the old bridge crossing above Second Roach Pond confirms the continued presence of young salmon within this section. Young-of-the-year and parr were taken but in relatively low numbers. A few young brook trout were also taken. Electrofishing records from 1959 and 1963 indicate that young salmon were more abundant within the section or river than they are at present. An estimate of 3.3 parr per habitat unit in 1959 may reflect the potential for this section of river. At that rate, the Roach River between Third Roach Pond and Second Roach Pond might produce 389 salmon parr.

The combined calculated potential production of salmon parr from the two

sections of the Roach River above First Roach Pond is approximately 1,000 fish. It is not known to what degree salmon dropping out of the river as young-of-the-year might contribute to the salmon populations in the waters within the Roach River drainage. A limited salmon fishery for wild salmon in Second Roach Pond may be sustained through the natural reproduction occurring in the two upper river sections.

RECREATIONAL FISHERIES

The upper one-half to three-quarters of a mile of the Roach River below First Roach Pond is the most heavily fished section. The main access road from Greenville bridges the river approximately 100 feet below the dam on the outlet of the pond. There is no fishway in the dam, therefore fishing is permitted from the dam and along both shores of the large pool below the dam. It is rare to drive past the area without seeing at least one angler trying his luck from the dam, the bridge, or at pool-side. The increase in fishing pressure at this site has reflected the overall increase in fishing pressure observed throughout the general area.

The upper section provides a summer-long fishery. The dam pool and the so-called "dump pool" and "stripping pool" are some of the deepest water in the river and provide excellent holding areas for adult salmon and trout. The more accomplished fly fisherman can, with some patience, bring a salmon to his net even under the harshest conditions of late July and August. We have observed very little fishing pressure in the remainder of the river until late in the season.

Cooling water temperatures and increases in flow associated with fall rains and lake drawdowns cause a dramatic change in the Roach River fishery. Mature brook trout and salmon begin their annual spawning migration into the river from Moosehead Lake. We believe that some salmon and trout within First Roach Pond are also attracted by the increased flow through the dam and pass down stream into the river. The timing of these movements is quite variable, beginning from as early as mid-August to mid-September. The September fishery has become increasingly popular in recent years. Fishermen have located several down-river sites where suitable adult holding areas provide fishing opportunity. Access to these sites is by foot trails maintained by the anglers using old skidder roads and game (moose) trails.

Because of the pattern of fishing (early morning-late afternoon) and the hardships involved with access, it has been impossible to design an efficient ground survey of the Roach River anglers given current manpower and financial limitations. For some of the same reasons, it has not been possible to conduct an aerial survey to determine total angler use on the Roach River. In the summer of 1984, creel survey boxes were placed at various sites along the river in an attempt to collect angler-catch and fish-size statistics. In June, two boxes were placed (one on each side of the river) at the access trails to the upper river pools at Kokadjo. A supply of survey cards requesting specific information was maintained at each site. The boxes were tended at least weekly and completed cards were removed. We observed much more angler use then the card returns would indicate. We feel that the early season card returns from these two sites may be highly biased by the more successful anglers. In September, two additional boxes were placed at downstream access points, one at each of two sites. Based on our observations of use at these sites, we believe that we may have received completed cards from a greater proportion of the downriver fishermen. These data may also be biased by the more successful fishermen. A summary of the survey results is given in Table 4.

Based on the card survey, the percent of successful anglers is very high for the entire season (about 40%). Survey data collected from voluntary record books for 1981, 1982, and 1983 indicates a success rate somewhere between 20 and 30%. Very limited clerk survey data from 1979 and 1981 indicate an even lower, more realistic success rate in the 15 to 20% range.

The proportion of sub-legal salmon in the catch is quite constant at about 30 to 35%. The majority of the sub-legal salmon are reported as parr-size fish. The proportion of sub-legal brook trout in the 1984 card survey is unusually high. The legal length limit for brook trout is 6 inches. Lengths were not reported

Table 4. Summary of angler catch and effort statistics from voluntary angler reports, summer of 1984.

	June, July and August sample	September Sample	Total Season sample
No. anglers surveyed	70	259	329
Angler hours	171	1,179	1,350
Number (and percent successful) in catching a legal:			
Brook trout	19 (27%)	107 (41%)	126 (38%)
Salmon	26 (37%)	112 (43%)	138 (42%)
Lake trout	0	3 (1%)	3 (1%)
Number of legals kept:			
Brook trout	7	49	56
Salmon	11	47	58
Lake trout	0	0	0
Number of legals released:			
Brook trout	21	94	115
Salmon	25	115	140
Lake trout	0	3	3
Number (and percent) of sublegal fish:			
Brook trout	24 (46%)	35 (20%)	59 (26%)
Salmon	26 (42%)	75 (32%)	101 (34%)
Lake trout	-	-	-
Legals kept per angler:			
Brook trout	.100	.189	.170
Salmon	.157	.181	.176
Mean length (mm) of legals kept (and number reported):			
Brook trout	300 (3)	423 (43)	415 (46)
Salmon	476 (10)	476 (46)	476 (56)

for all "short" brook trout, and it is likely that many small legal trout were released and reported as "shorts".

The Roach River between First Roach Pond and Moosehead Lake is being managed to maximize its parr production to Moosehead Lake. In order to minimize losses due to hooking mortality, the fishing method has been restricted to fly fishing only. The successful release of legal-size fish is also aided by the restriction. The daily bag limit on the Roach River has varied over the past, but in 1984 was reduced to one fish per day. This new limit applies to the entire season. Prior to 1984, the daily bag limit from May 1 to September 15 allowed an angler to possess 2 brook trout, 2 lake trout (very few are caught) and 1 salmon, for a total of 5 in the aggregate. Recent improvements in the growth and numbers of salmon and trout at Moosehead Lake have produced corresponding improvements in the quality and quantity of those species in the Roach River spawning runs. When conditions (temperature, flow, etc.) attracted salmon and trout into the river before the 15th of September, there was a potential for too great a harvest of the large, mature fish. With the dramatic increase in the number of anglers fishing the river, we felt it was necessary to restrict the catch over the entire season. These regulations allow for the catching of salmon and trout and the harvest of a limited number of each helps to assure sufficient escapement for spawning under the present conditions.

There is only a little information available concerning the fishery in the section of river between Second Roach Pond and First Roach Pond, and the section above Second Roach Pond. Neither section has been surveyed to determine the quality of its fishery. Various comments within the correspondence on file concerning the old dam at the outlet of Second Roach Pond indicate that a limited seasonal fishery for brook trout and salmon existed in the large outlet pool, at least through the early 1960's. There is no evidence that a significant summer fishery ever developed in the river between Second Roach Pond and First Roach Pond. One of the previous owners of the sporting camp at the outlet of Second

Roach Pond stated that he was able to locate and catch a few adult salmon within this section in early September during some years. In recent years these fish were probably mature salmon moving upstream from First Roach Pond. Both sections of the Roach River above First Roach Pond are closed to fishing after the 15th of September, therefore, late season spawning run fisheries were never permitted. These upper sections are relatively small and offer little suitable adult salmon holding areas. Likewise, the number of suitable fishing sites (for salmon) would accomodate only a few anglers. Both upper sections of the Roach River do offer an early season fishery for brook trout.

The lower reaches of all three river sections provide an abundance of excellent smelt spawning habitat. Smelts provide an essential forage in waters where salmon occur. The smelt is also actively pursued by legions of spring "dippers" who are permitted to dipnet (2 quart limit) spawning adults in streams. The section of the Roach River that enters into Moosehead Lake has a tremendous potential to produce smelts to the lake. Since salmon are being intensively managed at Moosehead Lake, all smelt spawning runs have been closed to fishing in order to protect this important source of forage. We have not yet been able to document a smelt spawning run in the river between Second Roach Pond and First Roach Pond; however, the early season concentration of salmonids at the mouth of North Inlet (Roach River) is consistent with our observations of known smelt spawning runs. Because of its relative inaccessibility, this run has not been closed to the taking of smelts. The Roach River, tributary to Second Roach Pond, supports a large smelt run which is open to the dipping. Our management of Second Roach Pond is aimed toward providing a brook trout fishery. Because brook trout are not dependent upon smelts for growth, we feel that allowing the taking of smelts from this section of river will have no adverse effects on the pond management.

MANAGEMENT GOALS

The management goals for the Roach River between First Roach Pond and Moosehead Lake are to maintain or improve the quality of habitat, maximize the number of young landlocked salmon and brook trout produced naturally, and maintain the quality of the fishery for salmon and brook trout, especially late season runs of adults. The management goals for the river sections above both First Roach Pond and Second Roach Pond are to maintain or improve the quality of the habitat, the number of young salmon and brook trout produced there, and the present quality of the fisheries for salmon and brook trout.

MANAGEMENT OBJECTIVES

The management objectives for the Roach River between First Roach Pond and Moosehead Lake are:

1. to maintain the integrity of the river bottom, its banks, and its water quality
2. to maintain production of young landlocked salmon and brook trout at or above present levels
3. to maintain or improve fishing opportunity, and
4. to provide for angler success which allows both catch and harvest commensurate with the ability of the runs of salmon and trout to support this use with adequate escapement for spawning.

The management objectives for the two river sections above First Roach Pond are the same as stated above.

MANAGEMENT PROBLEMS

1. Limitations on funds and personnel have prevented detailed study of the fishery for the determination of:
    a. size of adult spawning runs,
    b. annual production of young,
    c. maximum sustainable yield,
    d. current total angler use and harvest, and
    e. optimum allowable harvest.
2. Lack of adequate funds and personnel has also precluded needed stream improvement.
3. The apparent rapid increase in angler exploitation of the salmon and trout population may in the future exceed the capacity of the river to sustain the current high quality fishery and allow adequate spawning escapement to Moosehead Lake.
4. The presence of yellow perch, and the potential establishment of smallmouth bass and white perch threatens the brook trout fishery of Moosehead, and thus of the Roach River, and precludes the use of a fishway in the First Roach Pond dam.
5. Because of the limited number of pools, angler use is concentrated in a few areas of the river, causing congestion and undesirable interaction among anglers.
6. The remnants of old dams above First Roach Pond are partial barriers to migration.

MANAGEMENT STRATEGIES

1. Maintain a minimum flow agreement of 75 cfs in the river between First Roach Pond and Moosehead Lake.
2. Obtain free, unobstructed fish passage in the two river sections above First Roach Pond by requesting complete removal of the remnants of the two old dams.

3. Assure the continued integrity of the river's bottom, its banks and its water quality through strict adherence to LURC and DEP standards, and support the re-zoning of all sections of the river by LURC to P-RR.
4. Maintain a barrier at the First Roach Pond dam to prevent the upstream migration of yellow perch, smallmouth bass, and white perch.
5. Maintain as first priority the management of all sections of the river for salmon and brook trout spawning and nursery.
6. Initiate a periodic sampling schedule (trap-netting) to determine the number, fish size and timing of the salmon and brook trout spawning runs.
7. Continue population estimates (electrofishing) of salmon parr and expand the number of sampling sites to represent a greater proportion of the river.
8. Discontinue the special extended fall season (September 16-30) if excessive removal of adult salmon and brook trout has an adverse effect on natural reproduction.
9. Investigate the possibilities of managing the extended season fishery by manipulating the timing and composition of fall runs of adults through water level management.
10. Maintain the integrity of the wild salmon and brook trout populations of the river by continuing the policy of not stocking in or near the river.
11. Investigate the feasibility of constructing and operating a "blind" fishway at the First Roach Pond dam.
12. Negotiate and maintain an agreement (currently informal) with Kennebec Water Power Company regarding drawdown dates for First Roach Pond (October 15) and a date (November 1) when normal flow (75 cfs or inflow) would be resumed.
13. Maintain a low bag limit (1 fish per angler per day).
14. Maintain terminal gear and fishing method restrictions of fly fishing only.
15. Adjust length limits to conform to any length limit changes on Moosehead Lake.

16. Improve fishing opportunity through stream improvement to provide adult salmon and brook trout holding pools where physical alternations would not adversely affect nursery habitat.
17. Initiate a survey to determine total angler use and harvest with particular emphasis on the September fishery.

The order in which the above strategies are listed is in no way intended to imply priority of one strategy over another.

LITERATURE CITED

AuClair, Roger P. 1982. Moosehead Lake fishery management. ME. Dept. Inland Fish. and Wildl. Fish. Res. Bull. No. 11: 175 pp.