BROOK TROUT MANAGEMENT PLAN

Department of Inland Fisheries and Wildlife

Divisions of Fisheries and Planning

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BROOK TROUT LIFE HISTORY

The brook trout (*Salvelinus fontinalis*) has historically been the most abundant and ubiquitous coldwater game fish occurring in Maine and remains so today despite reductions in brook trout habitat that have occurred since settlement of the State by Europeans. The brook trout's basic requirements are cool, clean, well-oxygenated water and suitable spawning, nursery, and adult habitat. As long as water temperatures do not exceed 68° F for extended periods and oxygen levels remain at 5 ppm or greater, brook trout can usually survive and grow. Brook trout may spend part or all of their lives in habitats ranging from the smallest brook to the largest of lakes, provided that the habitat is suitable and competition from other fish is not excessive. In addition, they are capable of spending the adult portion of their lives in marine or brackish waters, and anadromous populations are found in some of Maine's estuaries.

The species is extremely vulnerable to the effects of interspecific competition, particularly in the first year or two of life. After attaining a length of about 10 inches, however, trout will feed heavily on other small fishes. There is evidence that larger brook trout may be very effective predators on their own young in certain circumstances. In waters where forage fish are not available to adult trout, they are still capable of good growth rates on a diet of invertebrates if the habitat is productive.

Brook trout are capable of extremely diverse growth rates, which are primarily dependent on such environmental factors as basic productivity, water temperature, and food abundance. A 5-year-old brook trout may weigh less than 2 ounces in waters with poor growth conditions. At the other extreme, a trout of the same age may weigh 4 or 5 pounds if growth conditions are ideal. Brook trout are generally short-lived, with relatively few survivors beyond 3 years of age. A few individuals may attain ages of 4 to 6 years, but rarely more. For stocked populations, the life span is typically even shorter, with few individuals surviving beyond 2 years. However, recent efforts to extend the life span of hatchery-reared brook trout through the rearing of eggs taken from wild fish have been successful, and progeny of these fish have lived to age IV to date.

Brook trout spawn in gravelly substrate over upwelling ground water in the fall, usually late September to November. In Maine, spawning occurs the earliest in high-elevation waters. Water moving through the gravel prevents the buried eggs from freezing and provides them with oxygen. Shore spawning is successful in some ponds where spring-water inflows occur in gravelly shallows. Survival of shore-spawned trout may be poor if protective cover for emerging fry is not available. Smelt are especially voracious predators of brook trout fry under these conditions. Brook trout eggs hatch in the

early spring after over-wintering in the gravel substrate. Young fish use cover for protection from predators and move to the deeper water that serves as adult habitat when they attain greater size.

Brook trout are highly catchable and their numbers are therefore easily reduced by over-fishing, especially in the smaller ponds and in streams that have easy angler access. They are, however, very resilient in good habitat, and their numbers can quickly rebound to former abundance under adequate regulatory protection. Furthermore, recent studies indicate that Maine's wild brook trout populations have not been genetically compromised due to excessive harvest of the older, mature fish.

BROOK TROUT MANAGEMENT HISTORY

This species has always been harvested as a food fish, but systematic exploitation of Maine's brook trout as a sports fish increased greatly in the latter 1800's. At that time, sporting camps flourished by catering to sportsmen in search of superior fishing for brook trout and other game fish common to the state. Records of the period mention trophy trout of 2 to 6 pounds fairly regularly, and a few fish ranged to 9 pounds. The state record is a 12.5-pound brook trout caught at Mooselookmeguntic Lake in 1886. It appears, however, that where large fish were caught they were not abundant. The converse was also true; high numerical catches were of smaller trout. One of the earliest recorded examples is from Arnold's expedition to Quebec in 1775. Soldiers' journals recorded catching dozens of brook trout weighing a half pound each at the Carry ponds. Angling pressure was relatively light, compared to current standards, well into the early 1900's. Early access to waters on Maine's vast private forest lands increased as they were harvested for timber, first using log drives and later private road systems to deliver their products to mills. As the number of anglers increased and more backcountry roads were constructed, angling pressure increased over the years to current levels.

Nearly all of the State's inland waters were originally suited for brook trout. This situation began to change as increases in human population growth, industrialization (including the construction of power-generating dams), agriculture, and timber harvesting became increasingly widespread in the 1800's. Forestry practices such as dam and road construction, river drives of raw wood (often involving channelization), and harvesting along shoreline riparian zones led to the degradation of trout habitat. Prior to the implementation of environmental laws, the indiscriminate use of large mechanized equipment to harvest timber resulted in the degradation of brook trout habitat through erosion, siltation, and the loss of cover and habitat. Similar losses occurred early in the state's history through widespread clearing for agricultural purposes, especially in the southern and central portions of the state. Loss of habitat as a result of industrial pollution increased in the nineteenth century and continued well into the twentieth century. In summary, the state's agricultural, silvicultural, and industrial history resulted in degradation

of much of the state's brook trout habitat. In most cases, however, these changes resulted in a decline in brook trout abundance, rather than outright extirpation.

The reduction in industrial and municipal pollution in the latter half of the twentieth century resulted in improved water quality and restoration of habitat in some of the major rivers. The imposition of environmental regulations designed to protect natural resources also provided additional protection to all brook trout habitat, including commercial woodlands. Some forestry companies have voluntarily exceeded regulatory standards in order to protect fisheries resources; indeed, in recent years some commercial landowners have showed a desire to partner with the Department to restore degraded fisheries habitat.

Scientific brook trout management began with the formation of the Fisheries Research and Management Division in 1951. Prior to this date, the Department's Commissioners authorized management activities, including stockings that were surprisingly widespread (thanks in large part to railroad transport) but poorly documented. William C. Kendall of the Bureau of Fisheries, U.S. Dept of Commerce, conducted the earliest scientific evaluation of Maine brook trout populations in 1918. His report - specific to the Rangeley Lakes area in western Maine - discussed the physical features, species composition, and abundance of these important brook trout waters. In addition, Dr. Kendall compiled records of brook trout harvests from previous documents dating back to the mid-1800's. Gerald P. Cooper, Assistant Professor of Zoology at the University of Maine, conducted the first systematic fishery survey of statewide significance. In a series of reports published from 1940-45, Dr. Cooper and his colleagues reported findings on the fisheries of the Rangeley chain of Lakes, the lower Androscoggin and Kennebec drainage systems, Moosehead Lake, and Haymock Lake. Of particular value for brook trout management were the age and growth data for lightly exploited populations.

Programs to survey brook trout habitat systematically and conduct research projects to provide guidance for the statewide management of this species were implemented soon after the Fisheries Division was established. These research projects included several investigations into the life history of lake and stream populations of both wild and stocked populations.

Efforts to manage the brook trout sports fishery intensively increased with angler use and with concern for the welfare of the species. Increasingly restrictive regulations - in the form of bag limits, minimum length limits, and gear restrictions - have been imposed over the years. The first fly-fishing-only restrictions were imposed on individual waters in the Rangeley and Moosehead areas near the turn of the twentieth century. However, there was no general-law bag limit on trout as late as 1910. At that time there was a 25-pound limit and a 5-inch minimum length limit. As of 1920, there was a 25-trout limit, a 15-pound limit, and a 6-inch minimum length limit. The bag limit for brook trout in lakes has been gradually reduced from 25 fish in 1950 to the current limits of five in northern Maine and two in southern

Maine. In addition, categories of standardized special regulations, including bag and length limits, were implemented in 1996 and refined effective 2007 to account for the variability in growth rates among trout waters and to standardize special brook trout regulations, thereby simplifying a confusing array of special regulations.

Hatchery-reared fish are used to provide fisheries where adult habitat is present but spawning and/or nursery habitat are lacking. Artificial propagation has played a significant role in the management of Maine's brook trout for many years. The first state fish hatchery was constructed in 1895 following a decade of private efforts to hatch and stock trout fry. With the development of additional public hatcheries and rearing stations and the improvement of transportation systems, brook trout stocking gradually increased throughout the state and reached an annual level of about 800,000 fish in the 1970's, where it has remained. Current numbers are somewhat lower, averaging 580,000 per year, due to the emphasis on stocking more waters with larger (but fewer) catchable-size brook trout, newly available due to the rebuilding of the Embden Rearing Station in 2004-05 for that express purpose. The average weight of brook trout stocked has also increased (from 1.1 oz. in the 1970's to 3.1 oz. in the 2000's) due to the trend toward stocking these older, catchable (legal-size) fish. Nonetheless, the majority of Maine's brook trout are stocked on a biological basis[1]. The quantity and quality of the habitat and the extent of competition from other fish species determine the size of the fish stocked. For those waters in which brook trout stocking is done on a non-biological (put-and-take) basis, catchable-size trout are typically stocked near population centers to provide immediate angling opportunity with little expectation of holdover due to habitat limitations. Brook trout stocked in marginal quality habitat during spring months will survive at least until water temperatures become prohibitively warm while those stocked in the fall provide both winter and spring fishing opportunity. This program is currently being expanded as a result of angler interest and the availability of larger numbers of catchable brook trout resulting from the upgrade of the Embden rearing station. Accordingly, requests for catchable brook trout increased 3% for spring yearlings and 276% for fall yearlings from 2003 to 2008 (Table 1). Special length and gear regulations are frequently imposed on biologically stocked brook trout waters (which are intended to attain larger size before harvest) to assure escapement to increase longevity. For put-and-take fisheries, low bag limits are more commonly imposed with the intent to distribute fish equitably among anglers. Stocking rates, determined from a policy developed by fishery managers, take into account water size, water quality, interspecific competition, and the amount of angler use.

[1] The stocking of legal-size fish intended for immediate harvest is referred to as put-and-take stocking. The stocking of sub-legal size fish that must grow to legal size before becoming vulnerable to harvest is referred to as biological stocking.

In the 1990's the Department undertook a program to improve its brook trout hatchery brood stock[2]. We developed new strains from wild fish originating from the Kennebago River and Sourdnahunk Lake with the goal of producing progeny that retain wild-fish characteristics, including greater longevity. Because these strains grow and behave differently from the more domesticated strains previously stocked, stocking rates have been evaluated and adjusted as necessary. Results of comparative performance studies of the new strains indicated that the longevity of both strains exceeded that of the older, domestic strains. However, the Kennebago strain fish performed better in the hatchery/rearing-station environment and provided better returns to the angler post-stocking. Consequently, the Kennebago strain has been retained for hatchery production, though these fish are frequently crossed with the older hatchery strain to provide faster-growing (though shorter-lived) fish for specific management situations. Comparative tests of the Kennebago strain vs. F_1[3] strain (progeny of Kennebago and Maine Hatchery Strain cross) stocked as fall fingerlings in study ponds indicated that the F_1 fish had a size advantage over the Kennebago strain and therefore attained legal size at an earlier age.

The removal of introduced competing warmwater fish species from trout waters by means of chemical reclamation began in 1939. Since that time, about 140 trout ponds have been reclaimed, usually with good – if sometimes temporary - results. Due to the expense of this management technique and changing public sentiment, the reclamation program is currently conducted at a modest level. Reclamation remains an especially valuable tool in eradicating illegally introduced fish species before they migrate throughout drainages. Removal of competing species by netting has been shown to be feasible in some cases but is labor intensive and temporary in nature in that it does not remove all of the competitors, which quickly repopulate to their former abundance.

The introduction and spread of competing fish species has had a substantial impact on the quantity and quality of Maine's brook trout resource. The chain pickerel was indigenous to only a few southern Maine waters but by 1850 had been introduced to other parts of the state and was well established in many trout waters. More recently, northern pike and muskellunge – which are related to pickerel but grow much larger - have been illegally introduced into several drainages where they continue to expand their range. The smallmouth bass had become established in many coastal drainages by the early 1900's, but continues to be illegally introduced into new drainages, including the upper Kennebec and Androscoggin River drainages (including the Rapid River) in the 1980's; and the St. John River drainage in the 2000's (they were documented in the Meduxnekeag River drainage, a subdrainage of the St. John River, in the 1990's). Because they are present above Grand Falls, they are expected to eventually invade the upper reaches of the St. John River drainage. The rate of illegal bass introductions

[2] 'Brood stock' are fish raised in a hatchery setting specifically for the production of progeny to be stocked in the state's public waters.

[3] F_1 (first filial generation) refers to the first offspring of the parental generation.

has recently increased, and is a great concern for brook trout fisheries. Efforts to reduce the abundance of invasive smallmouth bass in the Rapid River in western Maine by stressing fry through flow manipulation have been relatively unsuccessful to date but are ongoing.

White perch and yellow perch, both severe competitors with brook trout, became widespread during the late 1800's. These species remain an active threat, as exemplified by the introduction of yellow perch into the Moosehead Lake drainage, the Rangeley Lakes, and the Fish River Chain of Lakes in the 1950's and 1960's. The often inadvertent spread of white suckers and a number of minnow species used as bait caused still further interspecific competition with brook trout, but is less of a problem today because their use as live bait is prohibited from most waters with native or wild brook trout populations. It has long been the policy of fisheries biologists to recommend the imposition of regulations restricting the use of live fish as bait on newly-surveyed waters that have brook trout populations but few if any competing species. Nonetheless, unscrupulous individuals continue to illegally introduce bait species into brook trout waters in order to harvest them for profit. Introductions of other coldwater species of fish, including smelts, landlocked salmon and lake trout, were made into many waters that originally harbored only brook trout, but their effect on trout is fortunately less severe than that of warmwater fish.

Maine's wild brook trout populations are recognized for their genetic and aesthetic values and efforts to protect these traits through the imposition of special regulations have been expanded. Department policy now formalizes past Fishery Division guidelines by preventing the stocking of hatchery-reared fish in waters with thriving wild populations unless these waters have previously been stocked. In 2006, Legislative protection[4] was extended to native brook trout populations[5]. Henceforth, any proposal to stock waters with native brook trout will require review and consent from the Maine Legislature's Fish and Wildlife Committee.

In the 1990's the Department conducted studies to determine the abundance, longevity, rates of harvest, and genetic variability of wild trout populations. This information is being used as a reference to monitor future population changes. More recently, detailed stream surveys have been conducted in an effort to determine more accurately the relationship between stream habitat types and brook trout abundance. Thanks to funding received from the Natural Resources Conservation Service's Fish and Wildlife Conservation Grant Program, we surveyed more than 1,000 streams in 2007 and a comparable number in 2008 to document the presence and abundance of brook trout in lotic waters throughout the state. As part of this effort, stream habitat is also being systematically evaluated for symptoms of

[4] LD 1131, An Act to Recognize and Protect the Native Eastern Brook Trout as one of Maine's Heritage Fish.
[5] Native brook trout waters are those that have never been stocked. Wild brook trout waters are defined as those that have not been stocked within the last 25 years. Their populations, though self-sustaining, originated from stocking or have been influenced by stocking.

degradation and fragmentation. Wild trout populations in streams, once largely taken for granted, are now recognized for their biological, economic, and aesthetic value.

Over the past 50 years, significant advances in knowledge and management expertise have been made relating to Maine's brook trout resource, enabling sound and rational management programs for this species. However, increased demand for brook trout, coupled with habitat threats and stagnant or decreasing funding levels for management and research, are necessitating innovative approaches to brook trout management. For example, the recently developed standardized regulations imposed on waters according to biological principles are not only resulting in a simplified law book, but – more importantly – are preventing overharvest, protecting genetically important older-age fish, and increasing carry-over to meet angler demands for larger fish.

Recognizing the economic importance of Maine's brook trout, we have increased promotional advertising of the sport fishery to both in state and out of state anglers. This advertising includes the following initiatives that are promoted through the media and at sportsman's shows that the Department attends annually throughout the northeast:

- Brook trout fishing is promoted at seminars
- Brook trout photos are featured prominently at sportsman show displays
- Promotional literature, posters, and stickers are handed out at these events
- Maine brook trout are promoted in national fishing magazines and web sites
- Brook trout are featured prominently in the Department's merchandise line
- The species author completed two books (technical and non-technical versions) on brook trout biology and management
- A brook trout initiative is currently being developed to inform the public of Maine's wild brook trout resources and to facilitate angling through the development of a dedicated website.

These initiatives are put forth under the premise that promotion and protection of Maine's brook trout resource need not be mutually exclusive if they are adequately protected by appropriate regulations.

In the absence of pure research, brook trout data have been consolidated onto computerized statewide databases, which are being used to monitor trends in the fishery. Grants are increasingly being used as funding sources to accomplish specific fisheries projects, notably resource inventory and stream restoration projects. Finally, the Department recognizes and supports the evolving angler ethic regarding the voluntary release of legal-size fish. These changing attitudes, together with the preservation of habitat through reasonable environmental regulations and intensive management efforts, demonstrate the Department's and the public's commitment to protecting and preserving our brook trout fishery. Despite this commitment, however, habitat degradation from past land use practices and the illegal introduction of predatory and competing fish species remain dire threats to brook trout populations.

PAST MANAGEMENT GOALS

Lakes and Ponds

The management goal for the planning period commencing 1986 called for the maintenance of existing availability and quality of brook trout in all Regions except A and B, where these parameters were to be expanded through increased stocking to accommodate the greater population of anglers. In 1991, the management goal again called for the maintenance of existing availability and quality of brook trout statewide but was modified to improve fishing quality on waters capable of above-average growth rates. Specific objectives for **abundance** in 1991 were to increase the distribution of brook trout from 7,000 to 9,000 acres in Region A and from 3,600 to 4,500 acres in Region B. It was also recommended that the contribution of wild stocks be maximized statewide. Since these objectives were first stated, the distribution of brook trout in Regions A and B has increased substantially, exceeding the distribution objectives for these two Regions. The increase in distribution resulted primarily from the stocking of legal-size brook trout in marginal (limited by unsuitable water quality, temperature, and/or by interspecific competition) habitat with the intent that they be angled or outmigrate before they succumb to these limitations.

On a statewide basis, the distribution of principal-fishery brook trout waters has increased from 391,400 acres in 1991 to 435,846 in 2009 (an 11% increase) primarily due to increased stocking but also as additional existing brook trout lakes have been surveyed and added to the inventory.

To meet the abundance objective of maximizing the contribution of wild stocks to the fishery statewide, the Fishery Division formulated and implemented the aforementioned regulations to reduce harvest and afford protection to genetically important, sexually mature individuals of wild trout populations. These special regulation categories initially became effective in 1996 and were expanded to include trophy regulations in 2007. Evaluations of the effectiveness of these regulations indicate that populations with moderately restrictive regulations had higher proportions of older-age trout, but additional benefits have not been demonstrated to date with severe regulations (Table 2).

The **harvest** objective developed in 1986 was to permit removal of 40-50% of the estimated spring legal wild population and, for hatchery-supported populations, 60-80%[6] of the total number stocked over a two-year period following stocking. The objectives were redefined in the 1991 update because these parameters could not be determined for more than a few waters annually with existing management capabilities. Instead, future comparisons were to rely on the relative number of pounds per acre harvested, as determined from statewide angler surveys and confirmed by field data as resources allowed. The harvest objective in the 1991 update was therefore set at 0.5 pounds per acre based on the estimated

[6] This figure is less than 100% due to the natural mortality that occurs prior to harvest.

annual (winter plus summer) statewide harvest rate of 0.45 pounds per acre reported. However, the annual harvest rate for lakes reported during the 1996 planning period increased to 1.11 pounds per acre and to 0.96 pounds per acre in 1999, approximately twice the 1991 harvest objective. The fact that size quality and a stable proportion of sexually mature fish are being maintained or improved with these harvest rates suggests that the harvest objective can safely be maintained at 1 pound per acre if sexually mature wild fish are afforded adequate regulatory protection. No statewide angler surveys have been conducted since 1999, however, necessitating reliance on size quality and age structure of sampled fish as indicators of population health.

The 1986 **fishing quality** objectives were to improve fishing quality in Regions A and B to levels typical of other Regions (0.5 trout caught per angler trip and an average size of 11 inches for open water fishing in lakes) and to optimize public access statewide. The fishing quality goal was met for Regions A and B as of 1996, when the number of trout caught per angler trip averaged 0.49 and 0.57 respectively. Angler surveys used to estimate fishing quality for the 2001 species plan update indicated that fishing quality in Regions A and B was similar to that of 1996, with brook trout catch rates per angler trip of 0.43 and 0.44, respectively. Statewide, the catch rate per angler trip declined slightly from 0.98 in 1996 to 0.85 in 2001. Current figures are not available because a recent angler questionnaire has not been conducted.

The fishing quality objective of increasing the average brook trout length in Regions A and B to 11 inches has been exceeded (current average lengths are 12.9 and 12.4 inches, respectively). The statewide average for lakes, derived from clerk surveys and sampled from 1996-2000, was 13.3 inches; for 2001-2006, it was 10.6 inches (9.3 inches for stocked waters and 13.4 inches for wild waters).

Brooks and Streams

No management goals were specified for brooks and streams in previous strategic plans. De facto goals included the maintenance of populations at existing levels except for waters with exceptional growth potential. Representative streams have been monitored annually since the 1960's to determine changes in brook trout abundance and age structure and as a guide for promulgating appropriate general law regulations. Appropriately restrictive special regulations have been imposed on individual streams with exceptional growth rates.

OPPORTUNITY

Maine has the most extensive distribution and abundance of brook trout in the eastern United States. A 2005 range-wide assessment by the Eastern Brook Trout Joint Venture concluded that:

> Maine is the only state with extensive intact populations of wild, self-reproducing brook trout in lakes and ponds, including some lakes over 5,000 acres in size[7]. Maine's lake and pond brook trout resources are the jewel of the eastern range: lake populations are intact in 185 subwatersheds (18% of the historical range), in comparison to only six intact subwatersheds among the 16 other states[8].

Brook trout occur in 1,503 Maine lakes (762,123 acres) and provide principal fisheries in 1,148 lakes (431,036 acres) (Table 3). Because it is a more accurate indicator of fishing quality, the amount of lake

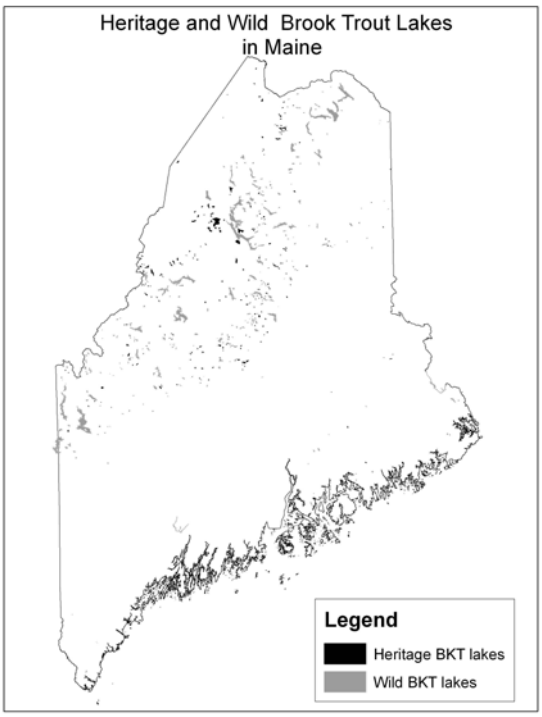

Figure 1. Location of native (Heritage) and wild brook trout lakes in Maine.

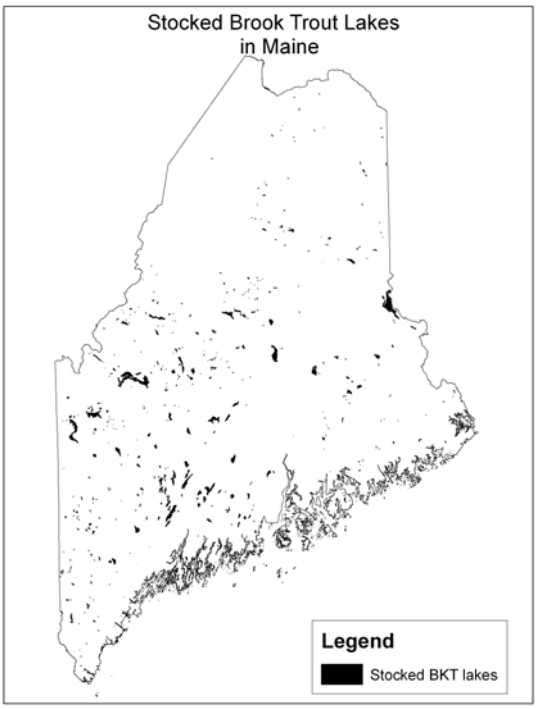

Figure 2. Location of stocked brook trout lakes in Maine.

habitat providing *principal fisheries,*[9] rather than the total occurrence, *are used in this document*. Maine's wild brook trout waters are not evenly distributed throughout the state but are concentrated in the

[7] 16 lakes totaling 192,413 acres in size.
[8] Page 34, Eastern Brook Trout: Status and Threats.
[9] A principal fishery is one for which the species is regularly sought by anglers and which makes up a significant portion of the catch.

interior highlands – particularly in Region E - which have a cooler climate and fewer introduced competing fish species than the southern part of the state (Figure 1). Those brook trout lakes located in the southern, coastal, and interior lowlands are more likely to be dependent on stocking to provide a fishery (Figure 2). Regions D, E, F, and G, which include most of the interior highlands, contain 73% of the lakes and acreage in which brook trout occur. These Regions contain an even greater proportion of the lake (lacustrine) habitat categorized as principal fisheries: 81% of the lakes and 92% of the acreage.

Because brook trout tend to favor the shallow (littoral) areas of lakes, the size of the body of water is an important indicator of brook trout abundance. Smaller ponds and lakes generally produce more trout per acre than larger, deeper lakes that have proportionally less productive trout habitat for their size. For that reason, an arbitrary-but-realistic size of 200 acres or less is used to designate typical brook trout ponds. More than three quarters (78%) of the state's brook trout waters are 200 acres or less in size (Table 4). Of the 1,148 brook trout lakes of all sizes that provide principal fisheries, 491 (43%) are currently being stocked with brook trout ranging in age from fry (less than 6 months old) to fall yearlings (1.5 years old) (Table 5); these waters account for 31% of the principal-fishery acreage of all lakes and ponds. Conversely, 657 principal brook trout fisheries are sustained by natural reproduction. Of these, 311[10] lakes and ponds, comprising 23,747 acres, have never been stocked, and therefore contain potentially unique genotypes. These waters – referred to as the 'A List' or Heritage waters - received special Legislative protection in 2006. In addition, some of the infrequently stocked lakes may still contain relatively pure genotypes because early stockings were often unsuccessful. These 246 brook trout lakes and ponds, comprising 164,609 acres and referred to as the 'B List' waters, are defined as having not been stocked directly or indirectly within the last 25 years. (The number of both A List and B List waters will change as A List waters are surveyed and as additional B List waters meet the 25-year criterion.) In its 2006 report to the Joint Standing Committee on Inland Fisheries and Wildlife (*Managing Maine's Wild Brook Trout Fisheries in Lakes and Ponds*), the Department stated that "The primary intent for managing wild brook trout in lakes and ponds shall be the protection and conservation of these self-sustaining fisheries, in so far as possible, without resorting to stocking brook trout" and stipulates management policies, including Permissible Management Strategies and Procedures, that must be implemented prior to stocking. These strategies include the following management techniques:

- Manipulation of regulations
- Habitat restoration/enhancement
- Removal/control of predator/competitor populations
- Restoration/enhancement of forage
- Control/elimination of diseases/parasites.

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[10] The current number of never-stocked brook trout waters is substantially less than the 424 reported in the previous Plan because historic Federal stocking records were located indicating that 118 of these waters have in fact been stocked in the past.

It is recognized, however, that these decisions must involve a realistic assessment of habitat conditions and must have a reasonable chance of success. It is the responsibility of the Regional Fisheries Biologist to make this determination before preparing a formal proposal to stock any of these waters.

Abundance estimates were determined for a number of brook trout waters 200 acres in size and less in the 1990's as part of the fishing regulation evaluations for wild fish and genetic strain evaluations for stocked fish. These data permit more detailed categorization of brook trout lakes by size, stocking status, and degree of interspecific competition. Separation into categories is presumed to result in more accurate abundance estimates. Sample sizes remain small, however, and may not be truly representative of statewide averages. Few estimates of brook trout abundance exist for waters greater than 200 acres in size, and the abundance figures for these waters are therefore also subject to error. Nonetheless, this method of categorizing habitat has the potential to yield increasingly accurate abundance estimates as additional data are collected. For the current estimates of post-fishing season (late fall) abundance, only principal fisheries are included. The average number of brook trout per acre for lakes less than 200 acres in size varies widely from the average of 33/acre. Not surprisingly, waters that were stocked and had little interspecific competition had the greatest number of brook trout (115/acre); those with wild populations and with high interspecific competition had the least (15/acre). Brook trout were 14 times more abundant on a per acre basis in waters less than 200 acres in size than in those over 200 acres in size (Table 6). Multiplying the average number per acre by the statewide number of principal fishery lakes (separated by category) yields an estimate of about 3.5 million brook trout 6 inches in length and longer in lakes statewide.

No significant changes are anticipated in the amount of physical habitat presently available in lakes and ponds during this planning period, though some continued loss from development and even greater losses from the introduction of competing species to trout waters is anticipated. The loss of habitat through the introduction of interspecific competitors can be slowed somewhat by reclamation[11], which has proven successful in eradicating some illegal introductions before they spread throughout the drainage. The Department's *Administrative Policy Concerning Eradication of Exotic Fish Species from Private Ponds* and *Rapid Response Plan for Invasive Plants, Fish, and Other Fauna* (in coordination with the Maine Dept. of Environmental Protection) provides guidance for the best practicable, timely, and efficient implementation of invasive control methods.

In the early 1990's a statewide reduction in the abundance of older-age (age IV and greater) brook trout was documented by comparing the age structure of recent samples to those of relatively unexploited brook trout populations sampled in the 1930's and 1940's. The decline in the proportion of older fish was

[11] The application of a piscicide (fish toxicant) to remove all fish from selected waters.

attributed to increased angler use and harvest, and was an incentive for developing restrictive regulation categories to reverse this trend. These regulation classes, which are combinations of low bag limits and high length limits, were imposed to restore age and size quality of these populations to their former levels. They became effective in 1996 on 453 (40%) of Maine's lakes with principal brook trout fisheries and a demonstrated ability to grow large fish. A smaller number of lakes considered to provide exceptional brook trout fisheries were chosen as 'Fisheries Initiatives' waters, and had highly restrictive special regulations applied, also effective 1996, to protect and enhance trophy-class brook trout fisheries.

In 2006, an array of restrictive regulations was consolidated into a smaller number of standardized regulations (1 trout, minimum length 14 in.; 1 trout, minimum length 18 in.; and catch and release) intended to foster quality fisheries while simplifying regulations to the maximum extent possible. These regulations were imposed on only those waters with exceptional brook trout growth potential. An experimental slot limit, which is still being evaluated, was also imposed on a number of waters at that time. Regulation categories, which were applied to most brook trout waters prior to 2007, are presented in Table 7. The number of special gear regulations currently in effect on lakes and ponds are presented in Table 8.

Statewide data (grouped into 5-year increments except 2006-08) indicate that the proportion of older age wild brook trout sampled increased after imposition of the restrictive regulations in 1996 (Table 9). The proportion of older-age Kennebago strain stocked brook trout sampled also continued to increase over time; there was no corresponding trend for the older Maine Hatchery Strain fish. An evaluation of the efficacy of these regulations indicated that – as intended - wild brook trout lakes with restrictive regulations have accrued a significantly higher proportion of older fish than those with regulations of low to moderate severity (Tables 2 and 10).

Management objectives have been assigned to Maine’s brook trout lakes based on growth potential. Using this method, 365 (31%) of Maine’s principal brook trout lakes are managed as ‘Size Quality’ waters (Tables 11 and 12). These waters meet angler expectations of the presence of brook trout that have a minimum length of at least 12 inches. Waters with 10 inch length limits are included in this category because clerk angler surveys indicate that the average length of brook trout caught from wild and stocked lakes with a 10-inch limit exceeds 12 inches (Table 13, Appendix 2). There are also 25 lakes with 18 inch length limits managed as Trophy fisheries. The relatively small number of Trophy waters reflects the fact that only a small proportion of Maine’s lakes are capable of growing very large brook trout.

The majority of brook trout waters that retain more liberal harvest regulations, including the 6 and 8-inch general law restrictions, do so for a variety of reasons:

- For most stocked waters, brook trout are in fact much longer than 6 inches in length when stocked and are intended to be available for immediate harvest. In this case the 6-inch regulation

is retained for law book standardization because a longer length limit would serve no practical purpose. (For stocked waters designated as Quality of Trophy waters, the length limit is increased to the extent allowed by the growth potential.)

- For wild brook trout waters with poor growth rates (resulting from sterile, unproductive habitat, interspecific competition, and/or a high reproductive rate) low length limits are imposed to allow harvest of fish that have low biological growth capacity. The imposition of high length limits on waters with high reproductive rates has been found to be counterproductive in that it results in large numbers of stunted brook trout, at greater risk of disease and parasite epidemics.

For wild populations, the minimum length limit is based on growth potential, which is water specific. The length limit may be set at a length to ensure that the particular population is protected from harvest until the brook trout become sexually mature. However, other factors, such as the population size and the harvest rate are also considered. There are many wild brook trout lakes in Maine where, despite a low length limit of 6 inches, populations remain high and slow growing. Increasing the length limit on these waters would clearly further compound the slow-growth/high abundance problem. Conversely, these waters must be periodically monitored for changes in brook trout abundance and growth rates to assure that more restrictive regulations are imposed if the population abundance declines due to increased harvest or other factors.

Analysis of statewide brook trout samples indicates that overall brook trout size declined since the restrictive regulations were imposed in 1996, even as the proportion of older-age fish increased. The average length of age III+ (the most abundant year class) wild brook trout sampled statewide declined from an average of 13.0 inches in 1991-95 (before the restrictive regulations were imposed) to 11.4 inches in 2006-08 (Table 14). Average weights declined correspondingly. The decline is attributed to increased brook trout density resulting from reduced harvest, which causes greater intraspecific competition for food and space (commonly referred to as “stockpiling”). Growth rates declined more dramatically in waters where highly restrictive regulations were imposed than on those where they were not. These trends did not hold for stocked brook trout because potential growth-rate reductions resulting from reduced harvest were attenuated by reducing stocking rates. In fact, the average size of stocked brook trout increased after the imposition of restrictive regulations, as intended. For wild brook trout waters, these data reinforce the notion that restrictive regulations must be imposed cautiously on a water-by-water basis, and must carefully consider the potential impacts on recruitment.

Brooks and Streams

Of Maine's 31,806 miles of flowing water, about 21,127 (66%) are considered to be brook trout habitat (Table 15). As with the distribution of brook trout in lakes, the majority of brook trout streams are concentrated in the interior highlands; Regions D, E, F, and G contain 76% of the miles designated as

brook trout stream habitat. Again, the Eastern Brook Trout Joint Venture analysis singles out Maine as being "the last true stronghold for brook trout in the eastern United States" and states that "Maine boasts more than twice the number of intact subwatersheds for brook trout populations as the other 16 states in the eastern range combined" but points out that "almost 65% of the state has no quantitative data on [stream] brook trout status." Recognition by the Joint Venture of Maine's unique stream brook trout resource, multiple threats to that resource, and acknowledged understaffing of fisheries management personnel all contributed to a range-wide sense of urgency to conduct an extensive resource inventory as a first step to protecting the resource. Accordingly, the Department was awarded funding through the Natural Resources Conservation Service's Fish and Wildlife Conservation Grants Program to conduct an inventory in 2007-2008; 1,061sites were electrofished in 2007 and 929 in 2008, for a total of 1,990.

Prior to the initiation of the comprehensive statewide survey, estimates of brook trout abundance in streams were determined from multi-year samplings of representative waters that have been conducted since the 1960's. Because electrofishing is labor-intensive, population estimates were determined for relatively few waters and for relatively short reaches of stream. Nonetheless, accurate sampling of representative streams is thought to have yielded realistic estimates. Beginning in 1998, this procedure was refined by separating population estimates for some waters by stream type, defined by differences in stream characteristics. Many of the streams were historically selected for population estimates because they contained what was believed to be the best brook trout habitat; they were typically low gradient, winding reaches with riffle-pool habitat. These streams contained an average of 110 legal-size brook trout per mile. Streams that were steeper, straighter, and had fewer pools averaged only 63 legal-size brook trout per mile – the average for all streams was 75 brook trout per mile. The statewide surveys currently underway will provide information to determine brook trout abundance for other stream types and to expand these samples to obtain an accurate statewide estimate of brook trout abundance in streams.

Wild brook trout populations in streams are supplemented by stocking if wild genomes will not be compromised (a possibility that must be evaluated with care given their ability to migrate) and if angler demand exceeds the ability of streams to produce brook trout. This situation frequently occurs in the most populous areas of the state. Accordingly, stream stocking is practiced most intensively in Region A, which accounted for 41% of the brook trout stocked statewide from 2005-2008 (Table 16). Statewide, fry account for the largest number of brook trout stocked in streams[12] (at the least cost), but provide the poorest returns given their high mortality rates. Fall fingerling stocking can be successful if over wintering habitat, in the form of pools, is available. Frequently, however, it is not, and spring yearlings are stocked with the expectation that immediate returns to anglers will be high but carryover rates to older

[12] An average of 135,450 fry were stocked per year statewide from 2005 to 2008.

ages will be low. As with lake stocking, stream stocking is initiated only after efforts to provide a wild fishery have been exhausted.

Some loss of stream habitat is anticipated despite the protection afforded by environmental laws. Although these losses are expected to be relatively small, they will likely occur in those areas of the State that are being the most aggressively developed and where the current resource is poorly distributed and the most heavily utilized. Habitat losses accelerate with increased rates of development, and are frequently permanent and thus cumulative. Much of the brook trout habitat fragmentation and loss in states south of Maine has resulted from cultural development. Detailed stream surveys conducted within recent years suggest that many of Maine's interior rivers and streams that provide brook trout habitat are degraded as a result of activities associated with log driving, timber harvesting, and associated road construction. Although log driving was terminated many decades ago, surveyed streams that were driven tend to remain overwidened, entrenched (incised), and have fewer pools than would be expected. Loss of habitat connectivity resulting from improperly placed/sized culverts at road crossings limits fish passage and isolates populations. Data collected as part of the Eastern Brook Trout Joint Venture surveys indicate that approximately 80% of the culverts examined act as barriers to fish passage.

It is assumed that restoration of these streams to their natural state would improve fisheries habitat and therefore brook trout abundance. Several stream restoration projects intended to enhance brook trout habitat are currently underway and are being evaluated for efficacy, but early indications are that they are indeed successful in improving measurable habitat parameters.

Brook trout abundance and size quality has increased on larger streams and small rivers with above-average growth potential that were selected for special regulations similar to those imposed on lakes. (Indeed, many of these riverine fisheries have associated lake habitat, providing trout with seasonal access to more productive habitat.) These regulations include high length limits and low bag limits intended to preserve and enhance wild brook trout fisheries. Though the number of streams is not large, those included are some of the state's most valuable brook trout resources.

DEMAND

Lakes and Ponds

Brook trout populations supported by natural reproduction account for 59% of the lakes with principal fisheries. Minimum length restrictions categories ranging from 6 to 18 inches, depending on growth potential, have been promulgated on brook trout lakes with both wild and stocked populations since 1996. Prior to 1996, the statewide minimum length limit on brook trout in both lakes and streams

was 6 inches, except in three southern counties where it was 8 inches in lakes[13]. The allowable statewide harvest has been determined by multiplying the estimated supply of brook trout by the maximum allowable harvest, expressed as a percent. For wild brook trout populations, an annual harvest of 50 % of the available population of fish 6 inches and longer was set as a maximum allowable harvest for 1996 planning periods. For stocked waters, where natural reproduction is not a consideration, an annual harvest of up to 70% of the legal size trout was determined to be allowable during the first year at large, providing for some escapement to larger sizes. Using the estimated springtime standing crop plus an estimated 25% rate of recruitment, a figure of 2,150,000 brook trout of legal-size (6 inches and greater in length) was determined for the planning period commencing in 1986. Using the same method, the current standing crop of brook trout 6 inches and greater in length was estimated to be 4,139,000 in 1991 and 3,507,965[14] in 2006 (from Table 6).

Although the 6-inch minimum length limit remains in effect statewide, efforts to estimate the allowable brook trout harvest are complicated by the imposition of special (if necessary) length limits on nearly 500 lakes. Furthermore, the concept of maximum allowable harvest has been replaced by optimum sustained yield, which implies consideration of size, age, and genetic qualities of wild brook trout populations in addition to their standing stocks when determining appropriate harvest rates. The imposition of special regulations reversed the decline in the numbers of older, genetically important brook trout as indicated by an increase in the proportion of age IV+ and older brook trout in the population from a low of 10% as recently as the 1980's to the current 18%, which approaches the historic 20% proportion. The loss of older-age fish from brook trout populations through the 1980's appears to have been a function of selective harvest of large fish rather than excessive overall harvest resulting from the set maximum allowable harvest of 50% of trout 6 inches or greater in length.

The angler demand on brook trout in lakes has been determined from angler questionnaires. Estimates from the 1999 angler questionnaire indicated an annual demand of 1,882,368 angler days, of which 1,633,496 (87%) occurred in the summer. Of these, 1,488,211 (91%) were on lakes. No angler questionnaires have been conducted since 1999, prompting efforts to calculate these parameters from sampled data. Estimation of current angler demand through the use of clerk survey data (Table 17) is less reliable because of disproportionate sampling on large lakes during the winter season, yielding results that are not representative of the statewide brook trout fishery[15]. The estimated number of angler days derived from this exercise was 34% less than the figure determined from the 1999 angler questionnaire (Table 18), and therefore suspect. Furthermore, accrual of additional open water fishery data from

[13] The 8-inch minimum length limit imposed on the lakes of the ten southern counties was rescinded effective 2007. It became unnecessary because the fish that comprised these fisheries are in fact at least 8 inches long when stocked.
[14] The numeric decline in abundance may reflect refinement in estimation rather than an actual reduction in the number of fish.
[15] Twenty four estimates were from lakes less than 200 acres in size; 56 were from lakes greater than 200 acres in size, a disproportionate 38 of which were ice fishing estimates.

surveys of individual waters declined during the last 5-year period in the absence of a motivating brook trout research project. With limited personnel and traveling budgets it will be difficult to sustain an on-going program to collect current information on angler use and harvest estimates from brook trout lakes with differing sizes, regulatory restrictions, water-quality limitations, and degrees of interspecific competition. The inability to estimate accurately angler demand emphasizes the need for updated information provided by a statewide angler survey.

The voluntary release rate of legal-size brook trout, which was considered to be negligible during the first planning period, has increased substantially, and therefore both the number of fish caught and the number kept are now used as indicators of success. Overall angler success is lower in the winter because most of the more productive trout waters are closed to ice fishing. Anglers and managers alike recognize that brook trout in small ponds are extremely vulnerable to ice fishing, and that fisheries would be destroyed if this type of fishing were allowed. Likewise, the historical closure to fishing during the fall spawning period should be continued where brook trout are known to reproduce.

Regional estimates of **winter** angler-use and catch (Table 19) indicate that Regions E and G, located in the northwest section of the state, account for 45% of the statewide angler-days and 45% of the brook trout harvest. These two regions have the greatest number of large lakes with principal brook trout fisheries open to ice fishing. The 1999 Angler Questionnaire indicated that, on a statewide basis, winter anglers kept 37% of the legal-size trout they caught, a substantial decline from the 48% reported in the 1993-94 angler questionnaire. They caught brook trout at an average rate of 0.47 per day and kept them at a rate of 0.18 per day. No data are available to update these parameters beyond the results of the 1999 angler questionnaire.

For lakes during the **summer** season, the highest rates of angler-use and catch occurred in Regions D, and E, which together accounted for 53% of the angler days and 47% of the harvest (Table 20). Statewide, the proportion of legal-size trout kept also declined from 32% in 1994 to 25% in 1999. Brook trout were caught at a rate of 0.84 per day and kept at a rate of 0.25 per day.

There were no clear trends in catch-rate changes from 1994-1999; the number of trout caught per angler day in lakes increased from 0.40 to 0.47 during the ice fishing season but declined from 0.99 to 0.84 during the summer season.

The mean length of brook trout harvested from lakes (as determined from clerk surveys) is 13.2 inches in the winter and 14.0 inches in the summer (Table 21). Their mean weights are 0.92 and 1.05 pounds respectively, yielding an estimated annual harvest of 362,420 pounds, 40,593 pounds (11%) of which are harvested during the winter and 321,827 pounds (89%) are harvested during the summer. The estimated yield represents a 10% decline from that of 1994. This decline was anticipated given the imposition of restrictive regulations and the increased tendency toward catch and release, and is expected

to contribute toward improved brook trout size quality. However, on a per-acre basis, the annual harvest was 0.96 pounds[16] (0.16 pounds were harvested in the winter and 0.80 pounds were harvested in the summer), indicating that the harvest objective of 1.0 pounds per acre is being met. This rate approximates the annual harvest of 1.11 pounds per acre reported in the 1996 update.

Angler demand increased in the 1980's as a result of increasing license sales and improved access to once-remote trout ponds. License sales have remained relatively consistent the last decade, and angler demand is expected to remain stable during the next planning period as well. However, harvest is expected to decline as a result of the imposition of restrictive regulations designed to restore quality brook trout fisheries and as more anglers practice catch and release. Conversely, catch rates are expected to rise.

Brooks and Streams

There are a total of 21,126 stream miles of habitat, with an estimated 75 wild brook trout 6 inches and longer per mile of streams sampled. However, because the number of brook trout per miles varies considerably with stream type and size, it is not possible to estimate accurately the number of brook trout in streams statewide. Angler use on streams was estimated to be 399,696 angler-days in 1999, a decline of 24% since 1994. These anglers caught an estimated 978,505 legal-size brook trout, or 2.45 per angler; the harvest rate was 0.82 fish per angler-day. The proportion of trout kept declined from 37% in 1994 to 34% in 1999 while the catch rate increased from 2.00 to 2.41 for the same period. Region G, which has the greatest mileage of streams suitable as brook trout habitat, accounted for 20% of the angler-use and 34% of the catch.

Despite the fact that three times as many angler days are spent fishing on lakes as on streams, the number of trout caught is similar because the catch-rate on streams is three times that of lakes. The total number of trout kept is slightly higher on streams because these anglers keep a higher proportion of their catch.

A harvest of 50% of available supply was set as a safe maximum for streams in earlier species plans. However, this standard is difficult to measure given present monitoring capabilities. Instead, brook trout abundance is currently monitored statewide annually on representative waters, and results – as defined by the estimated number of mature fish per unit of area - indicate that brook trout in streams are not being over harvested at current use levels, although fishing quality has declined in specific streams that receive high levels of angler-use. While this problem has been addressed with the imposition of special regulations on selected streams and rivers that are capable of exceptional brook trout fisheries, there remain many fisheries in smaller streams that have become locally over-fished. Under current

[16] Calculated from the acreage of principal fishery waters open to fishing.

levels of staffing, it is not possible to document systematically the locations or extent of these local areas of depletion. Overall, future demand during the current planning period, like that of lakes, is expected to remain stable or increase slightly as a result of increased stream stocking. Therefore, demand should not exceed available supply.

CONSTRAINTS ON OPPORTUNITY

Overall opportunity to use the existing brook trout resource is not severely limited. Unavoidable limitations on the use of this species include regulations designed to sustain their numbers and distribute the catch among anglers, as well as the physical distribution of brook trout populations throughout the state, which – for wild populations - is concentrated away from population centers. Use opportunity is also limited by restricted access to some public waters, particularly in the western part of the state. Traditional access to brook trout waters within commercial forests is expected to become more tenuous with accelerated changes in land use patterns. Regulations imposed to protect brook trout populations from over-exploitation include bag, length, gear, and season restrictions. Among the latter, the closure of many brook trout waters to ice fishing is the most use-restrictive; only 278 (24%) of the lakes are open to ice fishing (Tables 22 and 23); however, these lakes represent 62% of the total acreage because only the larger brook trout lakes (including many of the state's largest lakes) are open to ice fishing.

Brook trout waters have historically been closed to fishing after Sept. 30 to protect spawning populations. As a result of angler initiatives, the fishing season was extended throughout October on many stocked lakes and ponds effective 2002 to provide additional opportunity. Waters open to October fishing have restrictive gear restrictions and are limited to catch-and-release fishing only.

Due to angler mobility, the distance of the majority of Maine's brook trout lakes from population centers does not significantly reduce opportunity. Furthermore, the advent of all-terrain vehicles (ATVs) in the 1980's resulted in increased use of waters once accessible only by foot. These vehicles are sometimes used to access Remote Ponds in violation of LURC zoning standards, although the 2005 passage of a law prohibiting the operation of ATVs on the land of another without permission has reduced this practice. Landowner restrictions on legal and physical angling access are significant in some unorganized townships of the state. Private roads remain the only means of vehicular approach to many of the trout waters located in northern and western Maine. Public use of many of these roads is often controlled and sometimes restricted by the landowner resulting in reduced use-opportunity. Accelerated rates of real estate transfers and development within Maine's wild lands may reduce angler access as parcels are fragmented and posted. The total acreage of brook trout lakes where public access is currently restricted is 6,615, or 1.6% of the statewide total (Table 24). Region D has 39 lakes (71%) of the 55

brook trout lakes where access is restricted to club members or paying guests. Accessibility to many trout waters throughout the state is in a constant state of change as new logging roads are constructed and old ones degrade to impassability. Overall, however, additional permanent road development has resulted in net gain in road access and use since the 1970's.

Fishing quality and the opportunity for solitude frequently declines as accessibility increases. The Fish & Wildlife Department therefore does not advocate unlimited vehicular access to all brook trout waters, but rather equal access for all anglers. To provide a variety of angling opportunity, we recommend that the access to remote ponds remain undeveloped. To that end, some remote waters have been designated "wilderness" ponds under Land Use Regulation Commission statutes at the advice of the Department of Inland Fisheries and Wildlife. A total of 170 waters in the unorganized townships of eight counties are protected from permanent road construction within a half mile of their shorelines (Table 25); this number represents a decline of 7 waters (4%) since the 1996 update was written.

Opportunity to fish for brook trout in flowing waters increased with the extension of the open-water fishing season from August 15 in brooks and streams and from September 15 in rivers to September 30, effective 1988. To protect pre-spawning populations, this season extension requires the use of artificial-lures-only and restricts the bag limit to one trout. Angler access to some streams or portions of streams is barred by private landowners who do not allow trespassing, and access to many streams located in the unorganized townships of the state is affected by landowners who control public use on private roads (e.g., lands within the headwaters of the Androscoggin River drainage in western Maine). The extent of these restrictions on public use has not been quantified, but, thanks to landowner tolerance, is not yet a severe problem statewide. The promotion of responsible public use of private lands – as well as the resolution of conflicts between landowners and anglers - is addressed through Project Landshare, the Department's landowner relations program, which received new direction and emphasis in 2000.

The opportunity for anglers to use existing brook trout fisheries is expected to remain at current levels or decrease slightly during the next planning period, but could change unpredictably with any ownership or policy changes of the major woodland owners. The imposition of fees for private road use, while justifiable if reasonable and equitably applied, may discourage some angler use.

The effect of recently enacted special regulations intended to improve the quality of brook trout fisheries has not discouraged angler use as evidenced by fishing license sales, which have remained steady or increased modestly since 1996[17]. It also seems unlikely that restrictive regulations will discourage angling given the increasing voluntary release rate of legal-size fish. It is anticipated that the proportion of anglers who fish non-consumptively and who value quality fisheries will continue to increase. These contentions are supported by angler preferences expressed in the summer, 1999 open

[17] 267,158 fishing licenses were sold in 1996 vs. 279,262 in 2006, a 4.5% increase.

water fishing survey; a majority of anglers rated fishing in remote waters and fishing for wild fish as 'very important'. Only a minority felt that 'catching many fish' was very important. Furthermore, the rating of fishing quality by anglers, as reported in open water fishing surveys, increased from 2.1 ("fair") in 1994 to 2.9 ("good") in 1999, implying angler approval of recent management initiatives.

Publicity generated by the Eastern Brook Trout Joint Venture and advertisement of the development of quality brook trout fisheries will likely attract additional angler use. Because of the brook trout's vulnerability to harvest by ice fishing, it is not recommended that use opportunity be increased by opening additional waters during the winter season. In terms of brook trout 6 inches and longer, supply still exceeds angler demand. The loss of older-age fish in the population has been reversed through the imposition of regulations intended to restore brook trout fishing quality in lakes.

Table 1. Spring yearling and fall yearling brook trout brood year request by Region and age, 2003-2008.

		Brood Year[18]					
Region	Age	2003	2004	2005	2006	2007	2008
A	SY	65,200	63,800	56,075	55,975	57,515	53,390
	FY	3,400	5,300	6,650	8,900	10,635	10,610
	Both	68,600	69,100	62,725	64,875	68,150	64,000
B	SY	63,250	60,850	40,175	56,900	62,400	57,600
	FY	11,575	11,375	11,375	11,375	22,025	18,950
	Both	74,825	72,225	51,550	68,275	84,425	76,550
C	SY	3,475	3,475	5,300	5,925	6,800	8,450
	FY	0	0	1,525	1,965	2,125	3,000
	Both	3,475	3,475	6,825	7,890	8,925	11,450
D	SY	37,400	33,450	77,650	49,900	55,500	53,650
	FY	2,600	2,200	16,150	22,250	18,600	16,650
	Both	40,000	35,650	93,800	72,150	74,100	70,300
E	SY	55,825	60,575	59,075	59,325	60,925	59,825
	FY	0	11,600	10,725	10,725	8,875	10,650
	Both	55,825	72,175	69,800	70,050	69,800	70,475
F	SY	26,600	27,000	28,600	28,100	27,300	30,275
	FY	1,100	3,100	3,500	10,150	8,900	11,800
	Both	27,700	30,100	32,100	38,250	36,200	42,075
G	SY	15,175	15,525	12,225	12,150	12,100	11,875
	FY	1,425	3,525	3,575	4,125	4,150	3,850
	Both	16,600	19,050	15,800	16,275	16,250	15,725

[18] The year in which the eggs were taken.

[19] 91% of which are sexually mature.

All	SY	266,925	264,675	279,100	268,275	282,540	275,065
	FY	20,100	37,100	53,500	69,490	75,310	75,510
	Both	287,025	301,775	332,600	337,765	357,850	350,575

Table 2. Percent of older-age wild brook trout sampled from lakes by regulation class.

	Ages						
Regulation class	III+	IV+	V+	VI+	VII+	All	Sample size
5 trout, 6″ min.	24.5	4.9	1.1	0.3		30.8	3,945
2 trout, 6″ min.	30.6	5.4	1.5			37.5	754
2 trout, 8″ min.	37.8	7.6	1.6			47.0	755
2 trout, 6-12″ slot	25.5	5.4	1.0			31.9	388
2 trout, 10″; 1>12″	27.4	11.2	2.6	0.4		41.6	4,628
2 trout, 12″; 1>14″	30.6	11.2	2.3	0.5	0.1	44.7	2,180
1 trout, 14″ min.	50.0					50.0	28
1 trout, 18″ min.	26.0	10.7	2.6	0.3		39.6	1,333
Catch & Release	18.0	2.9	2.4			23.3	206
All	**27.5**	**8.6**	**2.0**	**0.3**	**0.01**	**38.4**	**14,217**

Table 3. Number and acreage by Region of Maine brook trout lakes as of 2009.

	Total Occurrence		**Principal Fisheries**		Unknown Status	
Region	Number of Lakes	Acres of Lakes	**Number of Lakes**	**Acres of Lakes**	Number of Lakes	Acres of Lakes
A	116	46,467	**101**	**13,511**	6	1,638
B	103	68,023	**76**	**49,205**	23	4,050
C	185	89,760	**74**	**6,039**	19	13,570
D	249	103,065	**200**	**75,889**	9	1,153
E	420	228,125	**365**	**165,707**	1	14
F	202	140,808	**132**	**37,946**	2	33
G	228	85,875	**200**	**82,739**	35	2,873
STATE	**1,503**	**762,123**	**1,148**	**431,036**	**95**	**23,331**

Table 4. Number and acreage of principal fishery brook trout lakes as of 2009 by size category and by origin (wild vs. stocked).

Size category (acres)	Origin	Number (%) of lakes	Acreage of lakes
Less than 200	Wild	526 (46)	23,521
	Stocked	380 (33)	18,088
	Both	906 (79)	41,609
Greater than 200	Wild	119 (10)	258,831
	Stocked	123 (11)	130,578
	Both	242 (21)	389,409
All	Wild	645 (56)	282,352
	Stocked	503 (44)	148,666
	Both	1,148	431,018

Table 5. Average number of brook trout (exclusive of fry) stocked per year in **lakes**, 2005-2008 (FF=fall fingerlings; SY=spring yearlings; FY=fall yearlings; AD= adults).

Region	Age	Average stocked per year: Number	Per principal acre[19]	Percent of total number stocked:
A	FF	14,938	1.1	
	SY	20,563	1.5	
	FY	8,400	0.6	
	AD	215	0.02	
	All	44,116	3.2	8
B	FF	13,825	0.3	
	SY	52,598	1.1	
	FF	17,593	0.4	
	AD	125	0.003	
	All	84,141	1.7	14
C	FF	68,010	8.5	
	SY	8,694	1.1	
	FY	2,129	0.3	
	AD	63	0.01	
	All	78,896	9.9	14
D	FF	94,300	1.2	
	SY	39,463	0.5	
	FY	15,688	0.2	
	AD	80	0.001	
	All	149,531	2.0	26
E	FF	61,276	0.4	
	SY	40,225	0.2	

[19] From Table 3.

	FY	7,863	0.05	
	AD	188	0.001	
	All	109,552	0.7	19
F	FF	20,050	0.5	
	SY	27,516	0.7	
	FY	9,470	0.2	
	AD	187	0.005	
	All	57,223	1.5	10
G	FF	37,825	0.5	
	SY	12,200	0.1	
	FY	4,300	0.1	
	AD	63	0.001	
	All	54,388	0.6	9
All	FF	310,224	0.7	
	SY	201,259	0.5	
	FY	65,443	0.2	
	AD	921	0.002	
	All	577,847	1.3	100

Table 6. Estimated numbers of brook trout 6 inches in length and greater in Maine lakes with principal brook trout fisheries, by category.

Lake size category (acres)	Stocked	Substantial interspecific competition	Estimated number of BKT/acre[20]	Statewide number of: Lakes	Acres	Estimated number of brook trout
<200	No	No	45	348	1,178	53,010
	No	Yes	15	192	13,077	196,155
	Yes	No	115	176	4,620	531,300
	Yes	Yes	40	192	13,006	520,240
Subtotal			**41**	**908**	**31,881**	**1,300,705**
>200	No	No	10	14	10,305	103,050
	No	Yes	3	123	270,102	810,306
	Yes	No	25	4	1,304	32,600
	Yes	Yes	11	112	114,664	1,261,304
Subtotal			**3**	**253**	**396,375**	**2,207,260**
Total			**8**	**1,161**	**428,256**	**3,507,965**

[20]The number of brook trout per acre is estimated from fall population estimates plus harvest estimates, and therefore does not account for recruitment or natural mortality.

Table 7. General law and standardized special regulation classes for brook trout lakes, effective 2006.

Class	Bag limit	Length limit	Lake category	No. (%) lakes[21]
C&R	0	N/A	Trophy	7 (0.6)
I	1 trout	18 inch minimum	Trophy	27 (2.1)
II	1 trout	14 inch minimum		12 (0.9)
III	2 trout	12 inch minimum; only 1 fish may be greater than 14"	High growth potential	135 (10.6)
IV	2 trout	10 inch minimum; only 1 fish may be greater than 12"	High growth potential	242 (19.1)
V[22]	2 trout	8 inch minimum	Moderate growth potential and stocked waters where distribution of the catch among anglers is a goal	173 (13.6)
VI[23]	5 trout	6 inch minimum	"Put and take" stocked waters, slow-growth waters, and remote waters with low angler use	632 (49.8)

[21] Principal fisheries only.
[22]Class V regulations are general law regulations on lakes in Androscoggin, Cumberland, Franklin (effective 2007), Kennebec, Knox, Lincoln, Oxford, Sagadahoc, Waldo, and York counties.
[23]Class VI regulations are general law regulations on lakes in Aroostook, Hancock, Penobscot, Piscataquis, Somerset, and Washington counties.

VII	2 trout	6 inch minimum; all greater than 12 inches must be released	Experimental slot limit	12 (0.9)
None	Noncom-forming			28 (2.2)
Total				**1,268**

Table 8. Number of principal brook trout lakes and ponds with special gear restrictions by lake type.

Regulation[24]	Statistic	Category				
		A waters	B waters	Other wild	Stocked	All lakes
FFO	Number	67	72	17	38	217
	% of category	31	33	8	18	
ALO	Number	68	45	14	69	210
	% of category	22	18	10	14	
NLFAB	Number	43	53	21	120	278
	% of category	14	22	15	25	
All lakes	Number	311	245	142	489	1,187

Table 9. Percent of older-age wild (>II+) and stocked (>I+) brook trout sampled from lakes by origin and year group (before and after regulation changes).

Origin[25]	Year group	Ages							
		II+	III+	IV+	V+	VI+	VII+	All	Sample size
Wild	1986-90		35.7	10.1	1.1	0.2		47.1	1,777
	1991-95		31.7	6.6	0.5			38.7	2,807
	All before		**33.7**	**8.4**	**0.3**	**0.1**	**0**	**42.9**	**4,584**
	1996-00		24.8	8.3	2.1	0.3		35.4	5,881
	2000-05		33.0	13.1	3.6	0.6	0.03	50.3	3,413
	2006-08		32.0	10.4	1.5	0.2		44.1	1,308
	All after		**29.9**	**10.6**	**2.4**	**0.4**	**0.01**	**43.3**	**10,602**
MHS	1986-90	27.4						27.4	102
	1991-95	4.9	7.1					12.0	124

[24] FFO = fly fishing only; ALO = artificial lures only; NLFAB = no live fish as bait.

[25] MHS = Maine Hatchery Strain; Kenn. = Kennebago Strain. All stocked as fall fingerlings.

	All before	**16.2**	**7.1**			**19.7**	**226**
	1996-00	43.0	0.6			43.6	293
	2000-05	3.4	0.3	0.1		3.8	226
	2006-08	23.3	1.9	16.5		41.7	103
	All after	**23.2**	**0.9**	**8.3**		**29.7**	**622**
Kenne-	1996-00	29.7	4.5	0.7		34.9	671
bago	2000-05	24.7	6.3	0.7		31.7	1,033
	2006-08	29.6	18.4	1.0		49.0	98
	All after	**28.1**	**6.3**	**0.7**		**35.1**	**1,802**

Table 10. Percent of older-age stocked brook trout sampled from lakes by age and regulation class.

Strain	Regulation class	Ages II+	III+	IV+	All	Sample size
MHS	5 trout, 6″ min.	9.6	4.5	0.2	14.3	490
	2 trout, 6″ min.	23.3			23.3	86
	2 trout, 8″	20.9	0	0.4	21.3	268
	2 trout, 6-12″ slot	100	0	0	100	7
	2 trout, 10″; 1>12″	20.2	0.6	1.2	22.0	173
	2 trout, 12″; 1>14″	8.9	0.6	0.6	10.1	180
	1 trout, 14″ min.	0	16.7	0	16.7	6
	1 trout, 18″ min.	23.7	9.9	8.3	41.9	253
	Catch & Release	0	0	0	0	0
	All	**16.5**	**3.4**	**1.8**	**21.7**	**1,463**
Kenn.	5 trout, 6″ min.	16.0	2.2	0.5	18.7	626
	2 trout, 6″ min.	15.4	7.7		23.1	13
	2 trout, 8″ min.	25.4	7.2	0	32.6	445
	2 trout, 6-12″ slot	0	0	0	0	0
	2 trout, 10″; 1>12″	51.8	20.2	1.6	73.6	193
	2 trout, 12″; 1>14″	29.5	5.8	1.2	36.5	844
	1 trout, 14″ min.	0	100	0	0	3
	1 trout, 18″ min.	100	0	0	0	17
	Catch & Release	51.4	0	0	51.4	35
	All	**24.8**	**5.9**	**0.7**	**31.5**	**2,176**

Table 11. Lakes with special brook trout regulations, by Region.

Regulation	No. of:	Region A	B	C	D	E	F	G	**All**
2, 6-12″ slot	Lakes				7	5	1		**13**
	Acres				126	458	38		**622**
2, 10″; 1>12″	Lakes	6	2	10	65	111	30	12	**236**
	Acres	122	766	216	46,486	15,160	9,733	950	**73,433**

Other 10″ min.	Lakes					8	2		**10**
	Acres					447	106		**553**
2, 12″, 1>14″	Lakes	5	5	14	8	36	2	35	**105**
	Acres	324	237	1,845	3,880	29,541	97	63,077	**99,001**
1 trout, 14″	Lakes			4	2	7			**13**
	Acres			2,589	108	88,891			**91,588**
Other 14″ min.	Lakes					1			**1**
	Acres					64			**64**
1 trout, 18″	Lakes		1	1	6	8	1	8	**25**
	Acres		78	126	9,110	345	8	287	**9,954**
All	**Lakes**	**11**	**8**	**29**	**88**	**176**	**36**	**55**	**403**
	Acres	**446**	**1,081**	**4,776**	**59,710**	**134,906**	**9,982**	**64,314**	**275,215**

Table 12. Number and acres of principal fishery brook trout lakes by management objectives.[26]

	General		Size Quality		Trophy	
Region	No. lakes	Acres	No. lakes	Acres	No. lakes	Acres
A	91	13,311	12	484	0	0
B	70	48,521	7	1,003	1	126
C	51	3,195	28	4,650	1	126
D	118	16,022	83	50,397	7	9,622
E	193	30,178	172	136,104	11	403
F	97	27,970	34	9,968	1	8
G	151	19,081	47	63,651	12	1,070
State	**771**	**158,278**	**383**	**266,257**	**33**	**11,355**

Table 13. Average length in inches of brook trout caught by anglers in the summer, by origin (wild vs. stocked) and minimum length limit in effect.

Origin	Minimum length limit[27]	Average length of brook trout caught	Number of brook trout in sample
Wild	6	11.8	195
	8	12.9	162
	10	13.9	850
	12	15.1	352
Stocked	6	9.6	489
	8	10.2	180
	10	13.1	10
	12	13.5	40

Table 14. Mean sizes (inches and pounds) of wild and stocked brook trout sampled during summer and fall months by year group. Solid vertical line denotes imposition of restrictive regulations in 1996.

[26] General: lakes and ponds managed for 'average' fisheries; Size Quality: lakes and ponds managed to enhance abundance of trout greater than 12 inches in length; Trophy: managed to enhance abundance of trout greater than 16 inches in length.

[27] Includes Class III and IV regulations (See Table 7).

		Year group					
		1981-85	1986-90	1991-95	1996-00	2001-05	2006-08
Wild (Age III+)	Length	12.8	12.4	13.0	12.3	11.9	11.4
	Weight	1.00	0.80	0.89	0.74	0.66	0.55
	Number	87	646	891	1,457	1,189	453
Stocked (Age II+)	Length	11.6	12.8	12.7	12.2	12.6	13.3
	Weight	0.74	0.97	0.91	0.74	0.83	0.89
	Number	24	92	155	724	795	53

Table 15. Estimated miles of stream habitat by management Region.

Region	Estimated total stream mileage	Miles brook trout habitat	Percent brook trout habitat
A	3,729	2,634	71
B	3,598	2,568	71
C	3,793	2,688	71
D	4,837	2,959	61
E	4,134	2,365	57
F	4,770	3,382	71
G	6,945	4,531	65
State	**31,806**	**21,127**	**66**

Table 16. Average number of brook trout (exclusive of fry) stocked per year in **streams**, 2005-2008

Region	Age	Number	Percent of total number stocked:
A	FF	2,023	
	SY	42,461	
	FY	1,060	
	AD	261	
	All	**45,805**	**41**
B	SY	14,653	
	All	**14,653**	**13**
C	SY	2,275	
	FY	206	
	Ad	185	
	All	**2,666**	**2**
D	FF	1,492	
	SY	17,386	
	FY	2,338	
	All	**21,216**	**19**
E	SY	18,620	
	FY	1,881	
	Ad	125	
	All	**20,626**	**18**

F	SY	5,310	
	FY	533	
	Ad	4	
	All	**5,847**	**5**
G	SY	1,400	
	All	**1,400**	**1**
State	FF	2,984	
	SY	102,105	
	FY	6,018	
	AD	575	
	All	**111,682**	**100**

Table 17. Estimated brook trout catch, effort, and harvest, by lake size class and origin (hatchery vs. wild). Data from clerk surveys conducted from 1994-2006.

Lake size class (acres)	Origin	No. anglers /a	No. harvest-ed/a	Lb. harvest-ed/a	No. acres state-wide	No. anglers state-wide	No. harvest-ed state-wide	Lbs. Harvest-ed state-wide
LE 200	Hatch-ery	26.5	15.1	7.3	17,626	467,089	266,153	128,670
	Wild	5.8	3.6	0.8	14,225	82,505	51,210	11,380
	Both				31,851	549,594	317,363	140,050
G 200	Hatch-ery	2.1	0.1	0.1	115,968	243,533	11,597	11,597
	Wild	0.7	0.2	0.1	280,407	196,285	56,081	28,041
	Both			0.1	396,375	439,818	67,678	39,638
Both	Hatch-ery				133,594	710,622	277,750	140,267
	Wild				294,632	278,790	107,291	39,421
	Both				428,226	**989,412**	**385,041**	**179,688**

Table 18. Estimated Brook Trout Catch and Effort by Season and Water Type. From 1998-99, and 1999 Angler Questionnaires. (Numbers in Parentheses are 95% Confidence Intervals).

Season	Water Type	Anglers	Angler Days	Legal fish Caught	Legal fish Kept	% Kept	Fish per Angler-day Caught	Fish per Angler-day Kept
Winter	Lakes	38,441 (1,468)	248,872 (17,648)	119,644 (21,988)	44,122 (6,293)	37	.48	0.18
Summer	Lakes	124,534 (2,208)	1,239,339 (48,516)	1,055,274 (67,823)	308,062 (6,473)	29	0.85	0.25
Summer	Streams	51,580 (1,897)	399,696 (21,512)	978,505 (66,758)	326,449 (30,275)	33	2.45	0.82
Both	Both	142,392 (2,123)	1,633,496 (56,310)	2,049,028 (105,316)	635,985 (42,672)	31	1.25	0.39

Table 19. Estimated Brook Trout Catch and Effort, Ice Fishing Season, by Region. From 1998-99 Angler Questionnaire. (Numbers in Parentheses are 95% Confidence Intervals).

Region	Anglers	Angler Days	Legal Fish		Percent Kept	Fish Per Angler Day	
			Caught	Kept		Caught	Kept
A	8,016	40,362	18,610	7,598	41	0.46	0.19
	(972)	(5,596)	(7,920)	(2,831)			
B	7,772	43,847	11,118	5,193	47	0.25	0.12
	(959)	(7,616)	(2,968)	(1,542)			
C	2,997	16,537	10,281	4,078	40	0.62	0.25
	(620)	(3,751)	(4,679)	(1,475)			
D	2,579	8,302	4,809	2,091	43	0.58	0.25
	(577)	(1,961)	(2,104)	(952)			
E	13,940	60,905	33,004	10,874	33	0.54	0.18
	(1,215)	(7,934)	(7,769)	(2,505)			
F	5,785	28,609	17,565	5,193	30	0.61	0.18
	(842)	(5,278)	(13,170)	(1,854)			
G	6,643	51,135	24,256	9,096	38	0.47	0.18
	(877)	(9,602)	(15,228)	(3,108)			
ALL	47,732	249,697	119,643	44,123	37	0.48	0.18

Table 20. Estimated brook trout catch and effort, open water fishing season, by water type and region. From 1999 Angler Questionnaire. Sums are not additive because estimates were made independently.

Region	Water Type	Anglers	Angler Days	Legal Fish		Percent Kept	Fish Per Angler Day	
				Caught	Kept		Caught	Kept
	Lakes	22,133	217,362	93,699	27,301	29	0.43	0.13
A	Streams	9,689	82,667	108,290	30,872	29	1.31	0.37
	All	28,972	299,485	203,582	58,623	29	0.68	0.20
	Lakes	14,344	123,187	53,715	18,202	34	0.44	0.15
B	Streams	3,420	24,600	29,067	13,581	47	1.18	0.55
	All	17,003	147,824	83,445	31,931	38	0.56	0.22
	Lakes	6,649	42,461	37,332	14,439	39	0.88	0.34
C	Streams	3,800	17,561	58,230	24,128	41	3.32	1.37
	All	9,309	60,558	95,561	38,566	40	1.58	0.64
	Lakes	42,651	372,947	339,836	69,185	20	0.91	0.19
D	Streams	15,009	98,077	255,147	47,170	18	2.60	0.48
	All	49,015	471,559	600,684	116,694	19	1.27	0.25
	Lakes	42,651	287,308	278,925	73,644	26	0.97	0.26

E	Streams	8,739	39,768	133,178	43,793	33	3.35	1.10
	All	46,261	327,550	413,932	117,498	28	1.26	0.36
	Lakes	13,204	72,719	100,691	46,787	46	1.38	0.64
F	Streams	6,934	44,504	109,525	46,001	42	2.46	1.03
	All	18,048	116,467	210,216	92,655	44	1.80	0.80
	Lakes	18,618	133,620	147,378	56,944	39	1.10	0.43
G	Streams	10,069	83,770	250,017	112,422	45	2.98	1.34
	All	23,558	216,650	402,625	170,030	42	1.86	0.78
State	Lakes	160,250	1,249,604	1,051,576	306,502	29	0.84	0.25
	Streams	57,660	390,947	943,454	317,967	34	2.41	0.81
	All	217,910	1,640,551	1,995,030	624,469	31	1.22	0.38

Table 21. Mean brook trout length (inches) and weight (pounds) from lakes by Region and season for the years 1996-2000. Data from clerk surveys. Means are means of weighted means. N is the number of surveys.

	Winter					Summer					Annual				
		Length		Weight			Length		Weight			Length		Weight	
Region	N	Mean	SE	Mean	SE	N	Mean	SE	Mean	SE	N	Mean	SE	Mean	SE
A	9	13.1	0.4	0.74	0.13	1	15.9		1.59		10	12.9	0.40	0.64	0.14
B	7	13.5	0.7	0.97	0.18	4	11.2	1.0	0.46	0.13	9	12.4	0.87	0.83	0.21
C	6	15.0	1.0	1.42	0.29										
D	3	8.9	0.9	0.32	0.10	5	13.5	0.4	1.06	0.17	6	13.7	0.34	1.11	0.11
E	10	14.5	0.6	1.11	0.21	4	14.1	0.4	0.95	0.07	12	14.3	0.18	0.99	0.05
F	3	13.5	2.3	0.91	0.31	2	15.6	0.4	1.37	0.25	4	12.1	1.86	0.74	0.26
G	40	13.9	0.2	0.99	0.06	2	13.6	0.1	0.89	0.06	31	14.3	0.17	1.03	0.04
State	78	13.2		0.92		18	14.0		1.05		71	13.3		0.94	

Table 22. Number and acres of brook trout lakes open to fishing, 2006.

	All Lakes				Principal Fisheries			
	Open summer		Open winter		Open summer		Open winter	
Region	Number	Acres	Number	Acres	Number	Acres	Number	Acres
A	117	46,378	83	45,336	101	14,340	71	13,122
B	105	69,618	83	69,961	48	16,973	61	49,751
C	182	88,886	136	85,868	81	8,057	43	6,042
D	239	103,731	23	33,508	205	76,904	10	9,329
E	431	223,899	40	150,390	385	167,045	23	108,946
F	193	138,719	93	110,898	127	35,801	38	26,586
G	234	91,511	40	44,056	214	89,464	32	42,363
State	1,501	762,742	498	539,747	1,161	408,584	278	256,139

Table 23. Mean brook trout length (inches) and weight (pounds) from lakes by Region and season for the years 2003-2008. Data from clerk surveys. N is the number of fish in the sample. Means are weighted.

		Winter			Summer			Annual		
Region	Origin	N	Length	Weight	N	Length	Weight	N	Length	Weight
A	Wild	.	.	.	.	.	.	.	.	.
	Stocked	.	.	.	.	.	.	.	.	.
	Both	9	13.1	0.74	1	15.9	1.59	10	12.9	0.64
B	Wild	.	.	.	.	.	.	.	.	.
	Stocked	.	.	.	.	.	.	.	.	.
	Both	7	13.5	0.97	4	11.2	0.46	9	12.4	0.83
C	Wild	11	14.1	0.94	.	.	.	.	.	.
	Stocked	.	.	.	.	.	.	.	.	.
	Both	.	.	.	.	.	.	.	.	.
D	Wild	23	11.0	0.56	161	13.5	1.04	184	13.2	0.98
	Stocked	37	14.0	1.34	71	8.9	0.25	108	10.6	0.63
	Both	60	12.4	1.00	232			292		
E	Wild	78	14.8	1.11	.	.	.	.	.	.
	Stocked	.	.	.				.	.	.
	Both	.	.	.	4	14.1	0.95	.	.	.
F	Wild	.	.	.	.	.	.	.	.	.
	Stocked	.	.	.	.	.	.	.	.	.
	Both	3	13.5	0.91	2	15.6	1.37	4	12.1	0.74
G	Wild	14	13.6	0.78	4	17.9	2.89	18	14.6	1.25
	Stocked	6	12.1	0.68	332	9.1	0.26	338	9.1	0.27
	Both	20			336					
State	Wild	126	13.9	0.96	165	13.6	1.09	291	13.8	1.03
	Stocked	43	13.7	1.24	403	9.0	0.26	446	9.5	0.36
	Both	169			568					

Table 24. Principal fishery brook trout lakes closed to general public access or closed to all fishing.

		Closed to general public access	
		Number of:	
Region	Number of lakes with fee access	lakes	acres
D	3	37	6,058
F	3	1	544

G	3	1	13
State	9	39	6,615

Table 25. Number and acres of brook trout lakes zoned as Remote Ponds by the Land Use Regulation Commission (LURC); by management Region.

	Lakes		Acres	
Region	Number	Percent	Number	Percent
A	1	<1	17	<1
B	0	0	0	0
C	3	2	108	2
D	15	9	192	4
E	114	69	3,686	71
F	20	12	586	11
G	13	8	607	12
State	166		5,196	

Appendix 1. Brook trout waters with no or limited public access.

Region	Water	Town	Acres
D	Abbie Pond	Bowmantown Twp.	12
	Baker Pond	T5 R6 BKP WKR	270
	Barker Pond	Bowmantown Twp.	35
	Beaver Pond	Seven Ponds Twp.	20
	Billings P # 1	Parmachenee Twp.	20
	Billings P # 2	Parmachenee Twp.	10
	Black Pond, Lower	Oxbow Twp.	30
	Black Pond, Upper	Bowmantown Twp.	30
	Blakeslee Lake	T5 R6 BKP WKR	55
	Boundary Pond, South	Massachusetts Gore	10
	Butler Pond	King and Bartlett Twp.	45
	Carry Pond, East	Carrying Place Town Twp.	267
	Carry Pond, Middle	Carrying Place Town Twp.	126
	Carry Pond, West	Carrying Place Town Twp.	675
	Deer Pond	King and Bartlett Twp.	30
	Everett Pond	King and Bartlett Twp.	20
	Felker Pond	King and Bartlett Twp.	50
	Flatiron Pond	Davis Twp.	30
	Grants Pond	Massachusetts Gore	20
	Island Pond, Little	Seven Ponds Twp.	50
	Island Pond, Big	Seven Ponds Twp.	350
	Johns Pond	Davis Twp.	267
	Kamankeag Pond	Davis Twp.	40
	Kennebago L, Big	Davis Twp.	1700
	King & Bartlett Lake	King and Bartlett Twp.	538
	King Lake, Little	King and Bartlett Twp.	90
	L Pond	Seven Ponds Twp.	95
	Long Pond	King and Bartlett Twp.	60
	Long Pond	Seven Ponds Twp.	35
	Northwest Pond	Massachusetts Gore	45
	Northwest Pond, Little	Massachusetts Gore	10
	Otter Pond	Parmachenee Twp.	14
	Parmachenee Lake	Lynchtown Twp.	912
	Rock Pond	Chain of Ponds Twp.	26
	Ross Pond	Rangeley	26
	Rump Pond	Parmachenee Twp.	35
	Secret Pond	Seven Ponds Twp.	10
F	Shin Pond, Upper	Mount Chase	544
G	Butterfield Lake	Caswell Plt.	13

Appendix 2. Average length (inches) of wild brook trout caught by anglers, by water and minimum length limit in effect.

	Survey	Minimum length	Average length of brook trout caught and	Average exceedance of

7/29/09

Water and County	season	limit	(sample size)	length limit
Allagash Lake, Piscataquis	Winter	12	15.0 (52)	3.0
Aziscohos Lake, Oxford	Summer	8	13.0 (106)	5.0
		10	14.3 (418)	2.3
Moosehead Lake, Piscataquis	Winter	12	14.3 (418)	2.3
Mooselookmeguntic Lake, Oxford	Summer	10	13.2 (437)	3.2
Pierce Pond, Somerset	Summer	10	16.0 (127)	6.0
Rangeley Lake, Franklin	Summer	10	13.7 (46)	3.7
Richardson Lakes, Oxford	Summer	8	12.6 (46)	4.6
All	All	8	12.9 (152)	4.9
		10	13.9 (791)	3.9
		12	14.4 (470)	2.4

BROOK TROUT IN LAKES

GOALS AND OBJECTIVES

2009-2016

GOAL: Maximize the contribution of wild stocks to the fishery. Provide principal fishing opportunities for brook trout in 1,205 lakes and ponds (440,993 acres).

OBJECTIVES:

Abundance: Increase the current distribution of brook trout from 1,187 to 1,205 lakes and ponds (1.5%) and from 435,846 to 436,281 principal-fishery acres (0.1%).

Harvest: For brook trout lakes less than or equal to 200 acres in size, establish harvest rates of 1.0 pound per acre for wild populations and 5.0 pounds per acre for stocked populations. For brook trout lakes greater than 200 acres in size, establish harvest rates of 0.1 pound per acre for wild populations and 0.2 pound per acre for stocked populations.

Fishing quality:

Statewide: Increase the catch rate to 1.0 brook trout/angler day but reduce the number of fish kept/day to 0.25. Increase the average lengths and weights of brook trout kept from 12.6 to 13 inches and from 0.9 to 1.0 pound.

General Management Waters: 731 lakes and ponds (104,960 acres). Waters chosen for this management class should provide an average catch rate of 0.9 fish/angler-day with an average size of 10.75 inches and 0.6 pound.

Size Quality Management Waters: 365 lakes and ponds (264,639 acres). Waters chosen for this management class should provide brook trout with an average size of 14.25 inches and 1.25 pound.

Trophy Management Waters: 25 lakes and ponds (9,954 acres). Waters chosen for this management class should provide brook trout with an average length of 16 inches.

Regional management criteria for brook trout:

Regional management objectives for brook trout in lakes vary considerably but on a statewide basis stipulate an average catch rate of 0.85 brook trout per angler for General Management waters. For Size Quality and Trophy waters, the management objectives are defined by average fish length, which are 14 inches and 17 inches respectively (Table 26).

Capability of Habitat: Given the anticipated unauthorized introduction and migration of competing fish species, it will be a challenge to increase brook trout abundance and distribution even modestly throughout the next planning period. To do so, it will be necessary to add lakes and ponds to the inventory through new surveys of existing populations and to create new fisheries through stockings. In areas that remain free from invasive fish species, the contribution of wild stocks is being maximized by protecting trout to spawning size through regulatory fiat. Despite success in restoring older age classes though the imposition of restrictive regulations, it will be necessary to continue to monitor individual waters to assure that regulations remain appropriate, effective, and do not negatively impact growth rates.

The harvest objective of 1.0 pound per acre is reasonable given the regulatory protection afforded larger, sexually mature wild fish and, for stocked populations, the increased stockings of catchable fish. There is adequate habitat to meet the objective of increasing brook trout fishing quality in large salmonid lakes by stocking catchable trout (spring yearlings and fall yearlings). Many oligotrophic lakes currently supporting lake trout and/or salmon fisheries have few wild brook trout, possibly as a result of predation by these larger species and/or interspecific competition from warmwater species occupying the littoral zone. Numbers of stocked spring and fall yearlings have been increased in recent years, thanks in large part to the expansion of the Embden Rearing Station and provide additional angler opportunity, especially for those who wish to harvest fish.

Feasibility: As evidenced by the increase in the number of legal-size brook trout voluntarily returned to the water alive and the willingness to accept stricter regulations, anglers are supportive of improved fishing quality at the expense of harvest. Restrictive regulations recently imposed on waters capable of

producing brook trout of above-average size are maximizing the contribution of wild stocks and improving size quality. These regulations are also increasing escapement of hatchery-reared trout on selected waters, resulting in increased holdover to the second year post-stocking and beyond. The expansion of fish rearing capability resulted in increased availability of spring yearling and older brook trout beginning in 2006. Evaluation of new hatchery-reared strains of brook trout indicated that the Kennebago Strain fish survive to older age than do the older Maine Hatchery Strain fish, but that a cross of the two strains yields a hybrid that grows quickly and provides superior returns for fish stocked biologically as fall fingerlings. This variety of genetic traits assists managers by providing a range of management options.

Desirability: A modest increase in the current distribution of brook trout is desirable because of the species' aesthetic and economic value. Maximizing the contribution of wild stocks will ensure perpetuation of the species and maintenance of its genetic traits while improving size quality. Permitting a harvest of up to 1.0 lb/acre of hatchery-reared populations will maintain current fishing quality for stocked fish in most waters and improve size-quality on selected waters through recently imposed restrictive regulations. The stocking of spring and fall yearling brook trout in larger lakes with suitable water quality will improve fishing quality for this species in waters where past stocking efforts, including those of fall fingerling stockings, have performed poorly.

Possible Consequences: Increasing the numbers and distribution of catchable brook trout within the confines dictated by policy will create additional fisheries and improve fishing success on some currently stocked waters, particularly those near human population centers. Increasing brook trout abundance in larger salmonid lakes by stocking spring yearlings may require changing priorities at rearing facilities, which may impact the ability to rear adequate numbers of other fish species. Existing policy permits the expansion of stocked brook trout distribution on a case-by-case basis after a review intended to prevent or minimize the impact on native and wild populations. Efforts to maximize the contribution of wild stocks by imposing higher minimum length limits and lower bag limits will result in a reduction in allowable harvest rates, which will be unpopular with some anglers. There are biological limits on the number of waters where greater fish size can be achieved by simply increasing the length limits – those with high reproductive rates being a prime example. The higher length limits imposed on selected waters with both wild and stocked populations may also result in increased rates of hooking injury and mortality despite efforts to minimize these effects through gear restrictions. Although the benefits of restrictive regulations outweigh the detrimental effects of hooking mortality, anglers often react negatively to the loss of individual fish to hooking mortality.

BROOK TROUT IN LAKES
MANAGEMENT PROBLEMS AND STRATEGIES IN ORDER OF PRIORITY

PROBLEM 1. Statewide brook trout abundance and harvest estimates are not statistically robust because an inadequate number of lakes have been sampled to date. The number of estimates of population abundance, standing crop, and harvest remains low in proportion to the total number of brook trout lakes, and is biased toward winter fisheries in large lakes.

Strategy 1. Continue to evaluate brook trout populations in lakes at the current level, yielding post-season abundance estimates for two to six waters per year and angler use and harvest estimates as economically feasible.

Strategy 2. Expand the above program to include waters with both wild and stocked brook trout populations, both acreage categories (LE 200 acres and >200 acres), a variety of regulations, intra-specific competition, and varying levels of angler-use.

Strategy 3. Re-establish the statewide angler questionnaire on a 5-year basis.

PROBLEM 2. Age and growth data indicate that restrictive regulations imposed on Quality and Trophy waters have been successful in maximizing the contribution of wild stocks but have resulted in overall decreased rather than increased average fish size at age. Conversely, there may be waters with low reproductive potential that could benefit from the imposition of more restrictive regulations. For stocked waters, abundance is currently appropriate for the regulations in effect in terms of maximizing growth and allowing escapement to older ages; however, these waters will need to be monitored closely in the future to maintain this balance.

Strategy 3. For wild brook trout lakes, evaluate the success of these regulations by comparing the relative population abundance (determined from routine netting catches), relative growth rates, and the proportion of older-age (age III and greater) fish sampled to that from pre-regulation change data. For stocked populations, compare the proportion of age II and older fish sampled and growth rates to that from pre-regulation change data.

Strategy 4. Initiate a systematic statewide sampling regime designed to gather clerk survey information on waters with different classes of regulations. Contract with outside labor to perform this work.

PROBLEM 3. Restrictive regulations imposed on Maine brook trout waters have resulted in increased brook trout catch rates, thereby creating a more desirable fishery, especially for anglers inclined to release a portion or all of their catch. Increased angler use is desirable economically and is sustainable biologically because restrictive regulations protect the resource from overhavest. In fact, there is evidence that limited increased harvest might benefit wild populations by reducing intraspecific competition. However, this resource has been under-advertised to date, particularly to out-of-state anglers.

Strategy 5. Develop print and web-based promotion of Maine's brook trout resource through the Department's Public Information & Education Division and the Maine State Office of Tourism, emphasizing Maine's unique wild brook trout resource, a catch-and-release ethic, and the physical beauty of the setting of many of Maine's brook trout waters.

PROBLEM 4. The expanded catchable (spring and fall yearling) stocking program has not been fully evaluated.

Strategy 6. Using information from routine lake sampling, correlate statewide catch and harvest information to stocking rates, accounting for age at stocking, strain, interspecific competition, regulations, and other factors that influence brook trout growth and survival.

PROBLEM 5. A number of Maine's public brook trout lakes are inaccessible to anglers because access is denied over privately owned roads.

Strategy 7. Gain appropriate public access rights over private ways by purchase, negotiation and agreement, easement, gift, cooperation with other State Agencies, legislation, and by encouragement of private groups and enterprises.

PROBLEM 6. Angler demand, use-rates, and harvest rates of remote brook trout lakes are unknown. Such knowledge would be useful to determine the effectiveness of current zoning and the need to zone additional waters as LURC Remote Ponds.

Strategy 8. Obtain angler counts on a sample of remote ponds as an indicator of use.

Strategy 9. Determine angler demand through use of the statewide angler questionnaire.

BROOK TROUT IN STREAMS

GOAL: Maintain current abundance and fishing opportunity for existing fisheries on 22,250 miles of flowing water and provide additional fishing opportunity in selected river sections.

OBJECTIVES:

Abundance: Maintain an average population of about 1,350 brook trout of all size classes for each stream mile classified as permanent brook trout habitat. Maintain a late-summer average of 5 to 7% of the total population at lengths exceeding 6 inches.

Harvest: Maintain harvest levels at or below 50% of legal fish available pre-season.

Fishing quality:

Statewide: Maintain angling quality at 2.5 legal trout caught and 0.75 harvested per angler day, and an average length of 10 inches.

General Management Waters: Maintain an average catch rate of 2.0 fish/angler with a minimum average length of 9.5 inches.

Size Quality Management Waters: Maintain an average length of 12 inches.

Trophy Management Waters: Maintain an average length of 14 inches.

Regional management criteria for brook trout:
Regional management objectives for brook trout in streams specify a catch rate of 2.47 fish per angler with an average length of 9.4 inches for General Management waters and an average length of 12.0 inches for Size Quality waters (Table 27).

Capability of Habitat: Brook trout stream habitat is abundant on a statewide basis and does not limit overall goals and objectives. However, there is less suitable stream habitat in Regions A and B. The

majority of streams supporting native brook trout populations do not normally produce trout of exceptional size; thus, there is limited potential statewide for creating quality brook trout fisheries through the imposition of restrictive regulations.

Feasibility: Harvest rates have not, to date, reduced brook trout abundance or opportunity statewide. Some continued loss or degradation of stream habitat is expected to occur as a result of development, including road construction, and agricultural practices. Restrictive regulations intended to improve fishing quality on many of the State's larger quality brook trout streams were imposed in 1996. The success of these regulations in increasing the average fish size will continue to be evaluated over the period.

Desirability: The stated goals and objective, if met, will maintain the existing brook trout stream fishery overall and improve quality where growth potential occurs.

Possible Consequences: Success of special regulations imposed to improve fishing quality in streams capable of growing larger-than-average brook trout may increase angler demand. These fisheries are expected to attract non-consumptive and trophy anglers and, in doing so, may displace some of the more traditional anglers. Increased demand may also result in crowding and associated degradation of the aesthetic angling experience on some waters.

BROOK TROUT IN STREAMS

MANAGEMENT PROBLEMS AND STRATEGIES IN ORDER OF PRIORITY

PROBLEM 1. A 2005 assessment by Maine's fisheries biologists for the Eastern Brook Trout Joint Venture indicated that 64% of the subwatersheds (12 digit HUC[28]) have no quantitative data on brook trout status. Although recent efforts toward collecting information regarding stream brook trout status has increased substantially, there remains a lack of detailed information on the quantity and quality of brook trout habitat for some areas of Maine. In addition, estimates of angler demand, harvest, and angling quality of both wild and stocked brook trout stream fisheries remain unknown.

Strategy 1. Complete the inventory of Maine's lotic brook trout habitat at a rate of 100 HUC – 6 watersheds per year using the methodology outlined in "A Large-Scale Assessment of Brook Trout (*Salvelinus fontinalis*) Populations and Habitat in Maine"[29] by collaborating with partner agencies and seeking additional funding mechanisms for continued efforts.

Strategy 2. Compile statewide summaries of voluntary data for brook trout streams to estimate harvest and angling quality and expand efforts as necessary.

Strategy 3. Initiate a systematic statewide sampling regime for estimating angler use, harvest, and fishing quality on brook trout streams.

PROBLEM 2. Maine has the largest remaining number of anadromous brook trout populations but the exact number of waters and the status of their populations remain unknown.

Strategy 4. Complete the systematic sampling regime currently underway to determine the distribution and abundance of coastal brook trout populations.

Strategy 5. Investigate methods for identifying brook trout populations with an anadromous component, giving preference to non-lethal sampling.

Strategy 6. Address fish passage concerns in coastal brook trout habitats.

PROBLEM 3. Because the degree of genetic diversity and heterozygosity within Maine's wild lotic brook trout populations has not been determined, it is not possible to determine their uniqueness and therefore the degree to which they should receive regulatory protection.

Strategy 7. Determine the genetic diversity of Maine's wild riverine brook trout populations by analyzing archived genotype samples collected from the statewide stream status assessment project.

[28] HUC is an acronym for Hydrologic Unit Code. The HUC system classifies nested watersheds from large river basins (2 digit code) to small subwatersheds (12 digit code).

PROBLEM 4. Restricted public access to some streams may limit use opportunity in some areas.

Strategy 8. Improve access to trout streams by purchase, negotiation, easement, or gift. Encourage other state agencies, private groups or enterprises to work toward acquisition of new access and protection of existing access.

PROBLEM 5. Illegally introduced fish species that compete with brook trout migrate throughout drainages to new waters. There is currently an incomplete knowledge of existing and potential manmade and natural barriers to fish migration that would allow managers to predict and limit fish movement.

Strategy 9. Continue statewide survey efforts to document barriers to fish movement in conjunction with the statewide stream inventory as outlined in Strategy 1 above and other efforts underway by partner agencies..

PROBLEM 6. Recent stream surveys indicate that stream degradation may be impacting brook trout habitat and abundance. However, the extent of this problem is unknown.

Strategy 10. Continue efforts to determine stream habitat condition in conjunction with stream surveys and population determination to correlate stream condition to brook trout indices.

Strategy 11. Continue to implement and evaluate stream restoration treatments to determine their efficacy in restoring brook trout habitat in degraded streams.

PROBLEM 7. Environmental degradation from habitat fragmentation, streamside tree harvesting, development, and pesticide/herbicide application threatens some stream fisheries.

Strategy 12. Continue cooperation with other state and federal agencies charged with evaluating and enforcing these areas of degradation, including replacement of culverts that restrict migration. Support legislation intended to minimize or eliminate specific environmental risks. Inform the public and encourage interest and participation in addressing these issues.

[29] Prepared by Project Leader Merry Gallagher, Research Fishery Biologist.

Table 26. Regional management criteria for brook trout in lakes.

	Management objective									
	General				Size Quality			Trophy		
Region	No.	Acres	Catch rate	Average length	No.	Acres	Average length	No.	Acres	Average length
A	84	13,930	0.43	12.0	9	594	14.0	0	0	17.0
B	28	7,379	0.44	9.0	6	969	13.0	3	161	17.0
C	46	2,883	0.88	11.0	33	5,018	14.0	1	126	16.5
D	121	12,203	0.91	11.5	70	60,964	14.0	2	542	17.5
E	186	19,788	0.97	11.0	170	145,896	14.0	13	5,590	17.5
F	94	24,539	1.38	11.0	34	10,925	13.0	1	8	16.0
G	172	24,238	1.10	10.0	58	67,528	14.0	4	115	17.0
State	**731**	**105,604**	**0.85**	**11.0**	**430**	**291,894**	**14.0**	**24**	**6,542**	**17.0**

Table 27. Regional management criteria for brook trout in streams.

		Management criteria			
		General		Size Quality	
Region	Miles	Catch rate[30]	Average length	Catch rate	Average length
A	1,678	1.31	9.4±0.3	.	12.0
B	720	1.18	9.4±0.3	.	12.0
C	2,845	3.32	9.4±0.3	.	12.0
D	3,870	2.60	7.1±0.3	.	12.0
E	3,307	3.35	7.5±0.2	.	13.0
F	3,578	2.46	9.4±0.3	.	12.0
G	6,250	2.98	11.0±0.3	.	12.0
State	**22,248**	**2.47**	**9.4±0.3**	**.**	**12.0**

[30] Number of legal-size brook trout caught per angler.