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Species Assessments

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Cover photo by Chris Bennett

I. ARCTIC CHARR

Salvelinus alpinus oquassa

Introduction

Situated primarily across Maine's interior highlands are a handful of rare, sometimes brilliantly colored, native fish unknown to most people: Arctic Charr *Salvelinus alpinus oquassa* (hereafter charr). Also known as blueback and Sunapee trout, charr occur in just 14 waters in Maine. Maine is the only state in the contiguous U.S. that still contains native charr populations. Of Maine's 14 waters that currently support charr, 12 are thought to be native, and 2 are the result of historical stocking events from Floods Pond (Otis, Maine). Charr are masters of deep, cold, and extreme environments. They have become the object of intense study worldwide because of their flexibility in exploiting these habitats. Although most Maine anglers overlook them, charr are often sought by traveling anglers hoping to complete a lifetime checklist of fish caught around the globe. Altogether, this species remains a vital ecological, cultural, and genetic resource MDIFW is committed to preserving.

Life History

Charr display a wide diversity of life history strategies at the species, population, and individual levels, and have led some to postulate the species is the most variable vertebrate on Earth. With a circumpolar distribution, charr, or "trout of the mountains," are the northernmost freshwater fish species in the world, having adapted to cold and cool water habitats better than any other salmonid species. Charr exist in an extensive range of elevations (from sea level to 10,800 feet) and water depths (down to 1,500 feet in one Norwegian lake). Among salmonids, charr is the most cold-adapted species, capable of surviving temperatures as low as 1°C, sometimes even occurring in lakes where the ice remains year-round. Every possible niche dimension is utilized concerning habitat, feeding ecology, and spawning ecology.

Charr appearance in Maine is highly variable depending on the time of year, habitat, and feeding ecology. Coloration is most dependent on sexual maturity and time of year. During the summer months, most individuals are white and silvery with pale blue backs and lack the extensive markings of the better-known brook trout. Non-breeding charr are very non-descript, contrasting sharply with brook trout. Sexually mature fish during fall breeding exhibit a wide range of brilliant coloration. While males are typically more colored than females, both sexes can be brightly colored with yellow/orange ventral sides, brown/blue dorsal sides, white-yellow spots on the sides, and bright orange fins with leading white edges. Populations, and individuals within populations, exhibit these extreme coloration patterns and many variations between these extremes.

Charr body size is closely associated with feeding ecology and habitat. In most deep, cold lakes (e.g., Wassataquoik Lake and Rainbow Lake in Maine), individuals are usually 6–9 inches long, with diets consisting primarily of zooplankton.

At the other end of the spectrum, where fish make up a large proportion of their diet (e.g., at Floods Pond and Penobscot Lake in Maine), charr typically grow faster and have higher growth potential, often exceeding 12 inches. In most other waters, charr feed on a mix of zooplankton, insects, mollusks, and fish resulting in what most anglers in Maine would recognize as the typical 8–10-inch fish. Maine's current state record charr was caught at Pushineer Pond in 2008, tipping the scales at 5.24 pounds and 25.4 inches. Body shape has also been tied closely to feeding ecology. Charr exhibit the typical "troutlike" shape – elongated bodies, large terminal mouths, and moderately forked tails. However, research in Maine has revealed that the body form and relative size of many body parts (e.g., fins, eyes, head, and gill rakers) are highly influenced by diet and habitat.

Habitat use by charr outside of the fall spawning season has not been well studied in Maine. MDIFW biologists routinely capture charr during summer months in deep (40–100 feet.) water after lake stratification, indicating charr use deep, cold water during the summer. Additional studies conducted in Maine have found that charr occupy varying water depths and temperatures throughout the year, especially in late summer before spawning. Habitat use is strongly related to the location of the thermocline during the summer months; charr are often found immediately below the thermocline once the waterbody stratifies.

However, some fish make diel movements during the summer months from deeper, colder water into surface waters that are 6°F–8°F warmer, where they remain throughout the night, presumably to feed on zooplankton. These behaviors likely improve growth efficiency by enhancing digestion and food conversion, thereby maximizing growth rates.

Most of Maine's charr consume various insects, benthic macroinvertebrates, and fish (in order of importance, from least to most important). However, some populations are trophic specialists, including a piscivorous form at Floods Pond, a small benthivore at Gardner Pond, and a small pelagic insectivore/planktivore at Wadleigh Pond.

Across the species' range, charr display a wide range of spawn timing and location. Maine charr populations typically spawn from late October to early November, at water temperatures ranging from 44°F to 57°F. Across their range, shallow shoals with good wind fetch are the most common habitat used for reproduction. However, because charr are highly adaptable, their spawning locations aren't always found where expected and are notoriously difficult to locate. In fact, spawning areas have been discovered for just three of Maine's 14 populations. Spawning behavior is not well understood and is assumed to be similar to that of togue, where mature fish congregate on wind-swept shoals at night. Eggs and milt are broadcast together over cobble-sized stones with ample depth and space such that embryos are afforded protection from predators.

Management

Several charr populations have been extirpated in New England over the past 100+ years, perhaps most notably in Maine's Rangeley Lake Region. Maine's Arctic charr were first discovered in the Rangeley Lakes and were commonly referred to at the time as "blueback trout." The subspecies designation, oquassa, originated from the lake with the same name (Oquassoc Lake, later renamed Rangeley Lake). Mooselookmeguntic Lake, Cupsuptic Lake, Richardson Lake, and Rangeley Lake all had such heavy spawning runs that protection under the law was deemed unnecessary. The appeal of such an outstanding food source for settlers prompted an exemption in the general trout law that began in 1869, as bluebacks were not considered trout at the time. These once heavy spawning runs were overfished (bluebacks were rarely taken on a hook), and invasive species eventually took their toll on these populations. Introductions of landlocked Atlantic salmon in 1873 and rainbow smelt in 1891 hastened the demise of the overfished populations. By 1899, when the first law was passed banning any take, the charr populations had already collapsed and were considered extirpated from the Rangeley chain by 1914 (Kendall 1914). Multiple populations throughout New England had become extirpated by the mid-1900s.

Angling effort for charr significantly declined following the demise of many populations. Because charr are no longer frequently targeted by anglers, modern fishing regulations have limited influence in conserving Maine's charr populations. Often, anglers are not even aware that charr occur in the water they are fishing. Where sport fisheries do occur on charr waters, the primary species anglers target are brook trout. In fact, the current charr state record (25.4 in, 5.2 pounds, caught in Pushineer Pond) was caught by an angler targeting brook trout.

The most effective outcome of past sport fishing regulations has been the prevention of unintentional introduction of new fish species by disallowing the use of live fish as bait. A variety of more restrictive terminal gear regulations (e.g., fly fishing only or artificial lures only) are also employed on charr waters, though they are often associated with concurrent brook trout management. Regulations can address the unintentional introductions of new fish, but the intentional movement of fish through non-compliance with established rules remains a significant threat for charr conservation in Maine. For example, the high-profile and costly restoration projects at Big Reed Pond and Wadleigh Pond aimed to remove invasive rainbow smelt, a species that became established in both waters at times when their use was prohibited by rule.

There were two distinct periods when charr were translocated and propagated, with the goal of range expansion in Maine and beyond. The first occurred in the late 1800s and early 1900s when the U.S. government was interested in the culture and movement of charr and established a hatchery at Green Lake using a brood source from Floods Pond. At least 10 Maine lakes and seven states in the western U.S. were stocked with eggs or fingerlings, including Green Lake, where the hatchery was located. Of these stocked waters, Green Lake is the only one that still has a charr population today. However, reanalysis of previously published and new microsatellite datasets does not support a Floods Pond origin of Green Lake charr. This reanalysis included four Green Lake and 15 Floods Pond charr originally collected by Bernatchez et al. (2002) and two Green Lake and 90 Floods Pond charr amassed by Dr. Michael Kinnison's lab at the University of Maine. Despite the relatively small sample size, Green Lake charr possess a relatively high proportion of alleles (24-41%) not encountered in Floods Pond samples and cluster independently of Floods Pond in Bayesian structure analyses across a wide range of K values. By contrast, samples collected from other populations known to be established from Floods Pond (i.e., Long Pond, Enchanted Pond) only possess alleles found in Floods Pond and consistently cluster with Floods Pond in Bayesian structure analysis (Dr. Mike Kinnison personal communication). Cumulatively, this evidence suggests that the Green Lake charr population was not founded from Floods Pond progeny. Future monitoring and analysis will likely continue to enhance our knowledge of this population.

The second effort at range expansion occurred between 1968 and 1989 when charr from Floods Pond were stocked into 11 Maine waters with the goal of establishing at least five additional self-sustaining populations. At the time, the focus was to preserve the population thought to be the last representative of the Sunapee trout form that once existed at Sunapee Lake, New Hampshire (the original NH population was extirpated in the 1950s). More than 110,000 charr and 17,000 embryos were stocked into the 11 waters over the 21-year time period. Many of these waters showed early promise for success but ultimately failed to establish new populations. Two waters, Long Pond (Franklin County) and Enchanted Pond (Somerset County), did establish charr populations, both of which are self-sustaining to this day.

One unique aspect of the Floods Pond translocation effort was that Floods Pond is also the city of Bangor's water supply. Charr spawn on relatively shallow, rocky shoals when water levels are typically low. Concerns were beginning to be raised in the late 1960s that increased withdrawals for drinking water, coupled with drought conditions, could prevent charr from spawning during some years. In response, a cooperative effort was established in the 1980s (and is still in effect) between MDIFW and the Bangor Water District to ensure water levels are managed to provide adequate spawning habitat for charr.

Large, intensive chemical reclamation and restoration projects have been undertaken at Big Reed Pond (BRP) and Wadleigh Pond. Invasive rainbow smelt were first documented at BRP in 1991. The ecological havoc raised by a relatively small fish in a small water (90 acres; 21-foot mean depth) was so profound that the charr population was compromised within about two generations. Around the late 1990s–early 2000s, abnormally large fish were being caught in the sport fishery. Fish that were typically 10–14 inches long had increased to 16–20 inches long and weighed more than 2 pounds. As these larger fish exited the population through mortality, there was little to no recruitment of young fish, presumably due to competition and predation between smelt and young charr. By 2007, the population reached critically low numbers. Later that year, an intensive four-year effort began to remove as many live charr as possible from BRP and quarantine them to a private culture facility in Frenchville, Maine (Mountain Springs Trout Farm). The population declined so drastically, however, that only 14 charr were caught and moved. Over the next seven years, charr and brook trout from BRP were cultured at Mountain Springs and released in BRP (2011-2013) to restore the impacted populations.

Similarly, smelt were first reported at Wadleigh Pond (WP) in 2006, and there was an immediate increase in charr size and reduced population densities, indicating a similar situation as at BRP. Soon after, a decision was made to immediately implement BRP's restoration model at WP, before the population declined there as well. In 2012, two years after BRP was reclaimed with rotenone, WP was also reclaimed. Since the reclamation events, evidence of successful charr reproduction has been documented at both waters, and no smelt have been observed. Biologists continue to evaluate both restoration projects.

Current Status and Distribution

Considering the wide circumpolar distribution of Arctic charr, Maine has a very small number of extant populations, all of which are scattered across headwaters of major watersheds. Populations now exist exclusively in 14 lakes and ponds **(Table 1, Figure 1)**. Use of rivers and streams, if it occurs at all, is limited to short-term, seasonal movement between connected waters that support charr populations. Maine's charr waters are relatively small, deep lakes with low biological productivity. Lakes with the most suitable water quality (i.e., cold temperatures and high levels of dissolved oxygen in late summer) support the most abundant charr populations. Charr waters tend to be isolated from one another except for the Deboullie complex, where three ponds in close proximity are connected by relatively short stretches of flowing water; charr movement during the fall spawning season has been documented between two of these ponds (Deboullie and Pushineer Ponds).

Maine's charr populations are mostly restricted to the northern and western highlands, with the only two exceptions being the Union River watershed populations at Floods Pond and Green Lake. The 12 other populations, two of which are the result of transfers from Floods Pond, are scattered across the headwaters of the Penobscot and St. John watersheds. Maine charr are considered glacial relicts, presumably widespread as they colonized inland waters during the most recent deglaciation. Their current distribution is much more restricted due to subsequent invasions by other fish species, overfishing, and habitat change.

Maine's populations are entirely landlocked and represent the last endemic populations of the species in the lower 48 states. The surface area of these charr waters ranges from 55 to 2,989 acres, but most are roughly 150–1,200 acres. Maximum depths range from 60 to 180 feet. The three shallowest waters are Big Reed Pond, Pushineer Pond, and Big Wadleigh Pond, with maximum depths of 56, 53, and 46 feet respectively. Mean depths across all charr waters are generally 35–40 feet but as low as 18 feet at Bald Mountain Pond.

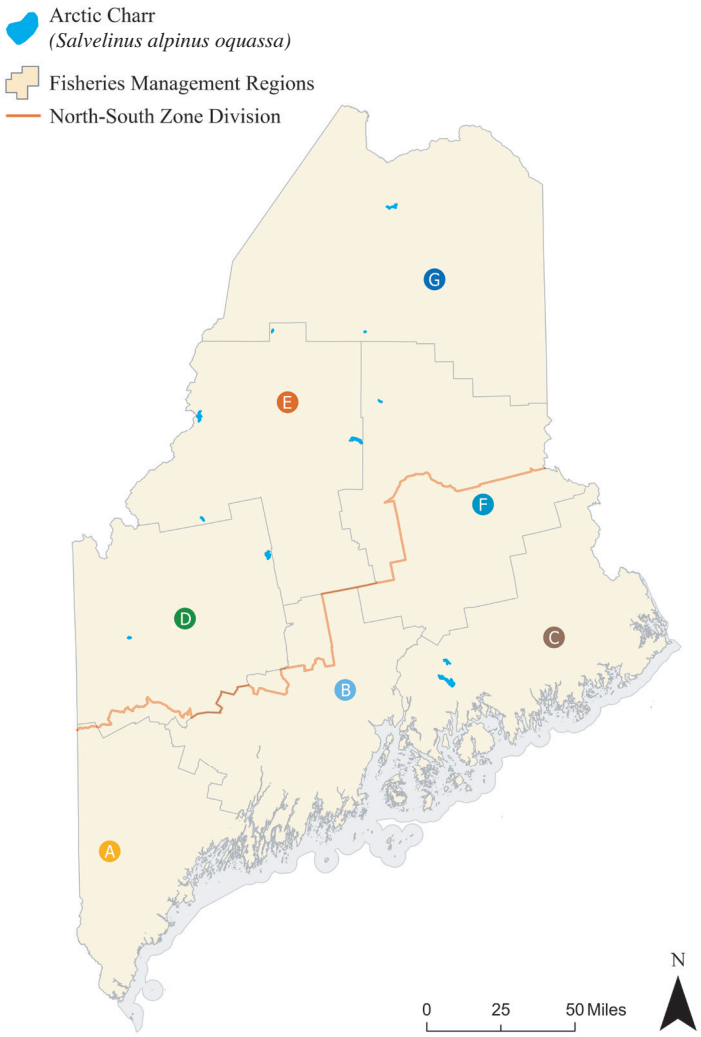


Figure 1. Lakes and ponds containing Arctic charr (14 waterbodies).

Arctic Charr Quick Facts

- Native to Maine: Yes
- Maine counties where these species occur: 5 of 14; Aroostook, Franklin, Hancock, Piscataquis, and Somerset
- State record: 25.4 inches and 5.2 pounds, caught at Pushineer Pond (T15 R09 WELS, Maine) in 2008
- Average length of a mature adult: 8–14 inches
- Propagated in Maine state hatcheries: No

Table 1. Statewide distribution of lakes and ponds containing Arctic charr, 2020.

LAKES/PONDS CONTAINING ARCTIC CHARR		
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING ARCTIC CHARR
A	0	0%
B	0	0%
C	2	3%
D	2	1%
E	4	1%
F	1	< 1%
G	5	1%
STATEWIDE TOTAL	**14**	**1.0**

II. BLACK BASS

Introduction

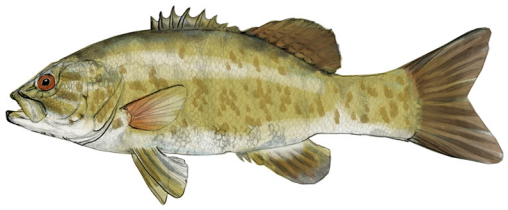
Smallmouth bass *Micropterus dolomieu* and largemouth bass *Micropterus salmoides* (hereafter collectively referred to as bass) are not native to Maine but have been introduced, both legally and illegally, throughout much of the southern and eastern portions of the state and have since become a high-valued sport fish. Smallmouth and largemouth bass now represent the second and third most popular freshwater sport fish in Maine (Responsive Management 2016). Irrespective of angler interest, illegal introductions of bass continue to compromise fisheries management objectives statewide, particularly for native species. Biologists strive to balance angler preferences for established bass fisheries while also managing agency responsibilities to protect and conserve native fisheries.

Life History

As their names imply, smallmouth and largemouth bass can be distinguished from each other by their mouth size. Additionally, the maxillary bone of the upper jaw in largemouth bass extends beyond the eye, whereas the maxillary of smallmouth bass stops short of the eye. Other less reliable morphological differences exist between the two species, including their coloration and the separation between the spiny and soft dorsal fin lobes (i.e., largemouth bass typically have a more pronounced area of separation between the two lobes). The two species also differ in behavioral and physiological characteristics which must be taken into consideration by fisheries managers.

SMALLMOUTH BASS

Micropterus dolomieu



Smallmouth bass thrive in many of Maine's lakes, ponds, large rivers, and streams. The northern limit of their range in Maine is dependent on whether recently hatched bass achieve adequate size to survive the approximately 200+ day starvation period encountered during their first winter when water temperatures fall below 50°F resulting in cessation of feeding and growth. MDIFW conducted a multi-year study on waters throughout southern, central, and eastern Maine, investigating the survival of young-of-year bass. The study revealed that bass less than about 2.2 inches long do not survive their first winter. The study also revealed that after a year of poor survival, subsequent year classes exhibited better growth and survival. The improved growth of subsequent year classes of bass, combined with relatively high overall recruitment, appears to compensate for any loss of an individual year class.

Male smallmouth bass mature at 3–4 years old, while females mature by age 4–5. Males usually mature at a smaller average length than females. Maine's relatively short growing season leads to slower growth for mature bass. A trophy-size smallmouth bass (18 inches or greater) may be 15–20+ years old.

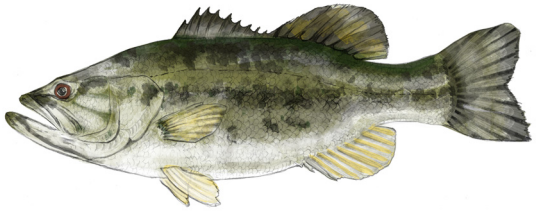
Stable water levels during the spawning period and suitable shoreline spawning gravel, usually interspersed with cover, are both important to the reproductive success of smallmouth bass. Female smallmouth bass can produce 7,000–8,000 eggs per pound of body weight. Individual females do not release all their eggs during a single spawning event, often spawning with multiple males during the spawning season. In Maine, most smallmouth bass spawn between mid-May and mid-June, depending on geographic location and water temperature. Male smallmouth bass are responsible for building the nest, which generally occurs in shallow water near large rocks, logs, stumps, or sharp drop-offs as water temperatures rise above 55°F. Spawning occurs when water temperatures reach 60°F –66°F.

Parental care is highly developed. Females leave the nest after egg deposition, while males remain to guard the eggs and fry for a few weeks. As males hover above the nest, the constant movement of their fins helps to prevent silt deposition on the eggs and keep the eggs well-oxygenated. The male's aggressiveness in protecting the nest makes him especially vulnerable to being hooked by anglers during the reproduction period. Removal of the male by angling can result in predation or other forms of mortality to the unprotected eggs or fry. In Maine, eggs hatch about 5–8 days after they are deposited.

Males are very sensitive to changes in water level and water temperature during the spawning period, and a relatively small change in either may cause males to abandon their nest. Renesting can occur once water levels and temperatures are restored, but the progeny of late-spawning bass may not have enough time to grow to a size that allows them to survive their first winter. In most Maine waters, smallmouth bass typically reach lengths of 2.2–2.9 inches by the end of their first growing season, although some fast-growing individuals may grow to be 4+ inches long. There is a direct relationship between size and overwinter survival in first-year smallmouth bass: The larger the fish is before the first winter, the more likely it is to survive.

LARGEMOUTH BASS

Micropterus salmoides



Although largemouth bass occur in various habitats in Maine, they thrive in shallow, weedy areas of eutrophic and mesotrophic lakes and slow-moving rivers and streams. This species grows best where the average summer water temperature is in the high 70s. Male largemouth bass mature at 3–4 years old, while females mature by age 4–5. Males usually mature at a smaller average length than females. Maine's relatively short growing season leads to slower growth for mature bass. Similar to Maine's Smallmouth Bass, a trophy-size largemouth bass (20 inches or greater) may be 15–20+ years old.

Largemouth bass spawning behavior is initiated in the late spring and early summer as water temperatures rise above 60°F. Shallow weedy areas and areas adjacent to stumps are commonly selected for nest sites, and nests are often less elaborate than smallmouth bass nests. Spawning occurs at water temperatures around 63°F. The fecundity of largemouth bass is high; mature females may produce 2,000–20,000 eggs per pound of body weight. After being released from the female, eggs sink to the bottom of the nest and adhere to the substrate. Females only deposit a portion of their eggs before departing the nest and may return to spawn again with the same male or may spawn in other nests with additional males.

Females leave their nest shortly after the eggs have been fertilized, while the male remains near the nest for several weeks, guarding the eggs and fry. Large fluctuations in water temperatures during incubation may result in nest desertion by the male and heavy egg mortality. Renesting can occur once water temperatures have returned to suitable levels. Hatching occurs within a few days to a week, depending on water temperatures.

Management

Early fishery managers were highly enthusiastic about providing bass fishing opportunities in Maine. Bass were viewed as an easy-to-catch, excellent-fighting fish that could provide additional table fare. Moreover, these early managers knew bass populations were relatively easy to maintain because they are often sustained via natural reproduction, and stocking is rarely necessary. Smallmouth bass were the first bass species introduced into Maine waters beginning in 1868 (largemouth bass were introduced sometime later in the 19th century). Bass were considered a species that could provide a high-value sport fishery in waters that did not provide suitable habitat for native coldwater fish but supported populations of warmwater fishes.

While bass survived to reproduce in many of the waters where they were introduced, growth rates continue to be on average less than what would be expected within their native range. Several factors combine to limit growth rates in Maine. High fecundity coupled with the male's protective behavior towards his progeny often results in successful recruitment. However, the low productivity of most Maine waters and the short growing season limit growth rates of the recruits, which, in combination with other factors, often leads to large populations of small-sized bass. The slow growth rate of bass in Maine must be considered by fishery managers when developing management plans. In addition, Maine's bass anglers should recognize that to have a chance of capturing a "trophy size" (20+ inch) bass often means the fish must live for at least 15 years. However, an overabundant population will limit growth rates, so a portion of the population must be harvested to allow for some individuals to grow to large sizes.

Maine's bass management began in 1877 when fisheries managers created the first open season for bass. This first open season had no restrictions on length, bag, or weight limits. Since that time, regulations have been modified to adapt to several factors, including increased and decreased harvest rates, the protection of spawning adults, and angler requests for quality size bass.

In recent years, Maine's fisheries managers have worked to simplify bass regulations while still providing diverse angling opportunities. For example, in the mid-2000s, MDIFW reduced the number of bass-specific special regulations and simplified the bass portion of the General Law. Maine traditionally managed bass by imposing a minimum length limit of 10 inches in southern and central counties and a 12-inch minimum length limit in eastern counties. Over time, biologists determined that a 10-inch minimum length limit would suffice throughout their range because fish that size were overabundant, and harvest of smaller fish encourages the growth of the remaining individuals in waters where spawning habitat and recruitment are not limiting factors. More recently, the General Law was updated to include no minimum length limit to further promote the harvest of smaller bass. In addition, numerous special bass regulations have been consolidated into a few slot regulations and catch and release waters. Catch and release regulations for bass are pretty rare in Maine and are only used where there are severe limitations on recruitment.

For many years, Maine had a "split" season on the daily bag limit of bass to protect spawning adults and help increase overwinter survival. A spring "catch and release, artificial lures only" season on bass existed for many years. This regulation was intended to protect bass during the spawning season when nest-guarding males are most vulnerable to angling. However, this regulation was difficult to enforce because anglers could fish for other species with live bait in the same water as spawning bass. There was no way for law enforcement to determine whether the angler was fishing for bass or some other species, so the regulation was eventually removed. Bass were also given additional protections during the ice fishing season when they are more vulnerable to anglers using live bait. These seasonal changes in bass regulations have recently been changed to a year-round, daily bag limit of two fish in the South Zone where bass are actively managed, and unlimited harvest in the North Zone where there's an abundance of native coldwater fisheries and bass are generally managed as an invasive species. Associated with the South Zone's daily bag limit is a size limit whereby only one of the two bass may exceed 14 inches. This combination of a daily bag and size limit is intended to encourage the harvest of smaller bass which are numerous in many of Maine's bass waters. Harvesting smaller bass, combined with

limiting the harvest of bass over 14 inches, will potentially benefit the number and size of larger bass by reducing competition for food and habitat. However, slot limits are only effective if there is a significant harvest from the target size range. Unfortunately for fishery managers, > 90% of all bass caught in Maine are released, even in waters with no size or bag limit.

Bass fishing tournaments occur across the U.S. and continue to grow in popularity in Maine. Tournaments provide anglers with an opportunity to showcase their fishing skills while also providing an opportunity for fishery managers to collect data. Anglers taking part in bass tournaments compete for prizes based on the weight of fish they catch during the tournament. Tournament participants are given special holding privileges that allow them to keep their bass alive (later released after weigh-in) and possess more fish than a typical daily bag limit. As such, any bass club sponsoring a tournament must purchase a tournament permit from MDIFW, and all participants must visibly display a marker that shows they are fishing as part of a tournament to help game wardens easily identify tournament participants from other boaters and anglers. Bass tournament organizers have other permit conditions such as hiring boat inspectors to check tournament boats for invasive plants, record keeping and data collection, and several other administrative-type responsibilities. Maine bass fishing tournaments are mostly managed through a lottery system. The number of bass tournaments permitted for each water is limited to reduce the impacts on bass populations, and the number of participants allowed in each tournament is based on the water's acreage. In addition, tournaments held during bass spawning season (May–June) must be catch/measure/release (i.e., fish are measured and immediately released at the catch location). For weigh-in tournaments, participants must use a flow-through live-well system to reduce mortality.

Illegal Introductions

Numerous unauthorized, illegal introductions have occurred over the past few decades throughout Maine as the popularity of bass has increased. These actions have altered fish populations and ecosystems and introduced parasites and pathogens into many of Maine's waters. It is well documented that bass introductions in Maine lead to changes in the structure of fish communities (particularly minnow species), and both bass species compete and prey upon native coldwater species. Two notable illegal smallmouth bass introductions occurred on the Rapid River (southwestern Maine) and the St. John River (northern Maine). Both introductions have jeopardized the status of native brook trout populations. An illegal largemouth bass introduction also recently occurred in Big Lake (Downeast Maine), which may impact the lake's popular smallmouth bass guiding industry.

Illegal bass introductions not only cause chronic negative impacts to sensitive fisheries, but they are also difficult, if not impossible, to mitigate. Several factors make smallmouth and largemouth bass highly successful at colonizing new waters. They are able to withstand poorer water quality than native trout and salmon, are prolific spawners, and their parental care for fry helps ensure a high level of reproductive success. MDIFW currently utilizes a "no size or bag limit" regulation on all waters where bass have recently been illegally introduced to discourage anglers from spreading invasive species and to reiterate the agency's commitment to stop the spread of invasive fish.

Once illegally introduced bass become established, they are difficult to nearly impossible to eliminate. Department efforts such as trapnetting and electrofishing are rarely effective at controlling invasive bass populations. The only method in Maine that has successfully eradicated bass from a lake or pond is a reclamation process whereby biologists use the piscicide rotenone to kill all fish in the pond. After the rotenone is no longer present (1–4 weeks after the initial application), the pond can be restocked. This process is expensive due to chemical and associated labor costs, and there is no guarantee the treatment will result in a complete kill of the invasive species; it only takes a few surviving fish to recolonize a reclaimed pond.

Bass are a popular and valuable sport fish but can cause irreparable harm when introduced into new waters. Therefore, all new bass introductions or transfers must be approved by MDIFW. Most recent introductions have been conducted in private ponds; MDIFW last stocked bass to establish a fishery in the mid-1990s.

Current Status and Distribution

SMALLMOUTH BASS

Smallmouth bass are not native to Maine. In 1868, fish from New York were transported into Maine and stocked into multiple waters, including Cochnewagon Pond, Phillips Lake, Sebasticook Lake, and Cobbosseecontee Lake. Smallmouth bass have since been introduced, either legally or illegally, throughout much of the state and now occur in 517 Maine lakes and ponds **(Table 2)**.

Smallmouth bass are located primarily in the lower 2/3 of Maine, as shown in **Figure 2**. In recent years, illegal introductions have expanded their range into northern Aroostook County, including populations in the St. John River and Limestone Stream. While they are still not found in the northern portions of Somerset and Piscataquis Counties, several illegal introductions have occurred in other parts of these counties since 2001.

In addition to the vast number of lake and pond fishing opportunities, many Maine rivers also support abundant smallmouth bass populations. Rivers such as the Androscoggin, Kennebec, Sebasticook, Penobscot, and St. Croix are renowned for their smallmouth bass fishing. In addition to these large rivers, many smaller drainages support populations of smallmouth bass. These rivers, brooks, and streams are typically associated with a lake or pond that supports smallmouth bass.

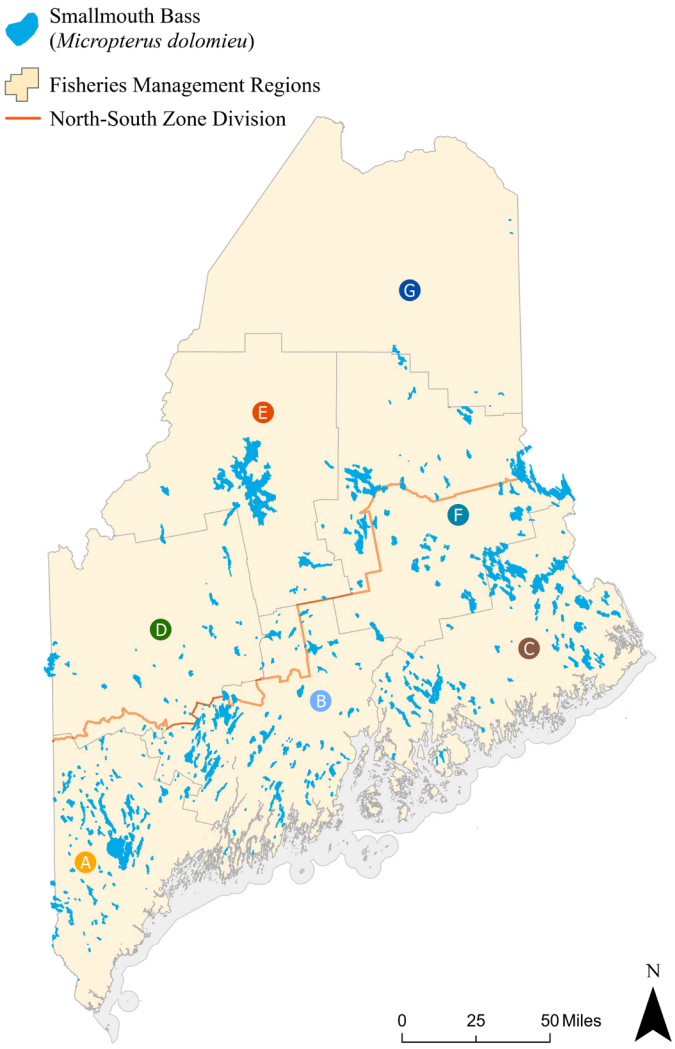


Figure 2. Lakes and ponds containing smallmouth bass (517 waterbodies).

Table 2. Statewide distribution of lakes and ponds containing smallmouth bass, 2020.

LAKES/PONDS CONTAINING SMALLMOUTH BASS		
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING SMALLMOUTH BASS
A	136	92%
B	146	91%
C	97	78%
D	32	22%
E	17	44%
F	84	76%
G	5	1%
STATEWIDE TOTAL	**517**	**59%**

LARGEMOUTH BASS

Largemouth bass are native to most states in the eastern half of the U.S., excluding the New England states. Widespread introductions have since created populations in all New England states and every other state in the U.S. except for Alaska.

The first largemouth bass introduction in Maine likely occurred when this species was mixed in with a group of intentionally stocked smallmouth bass during the late 1800s. The first recorded intentional largemouth bass introduction in Maine was in Forbes Pond (Gouldsboro, ME) in 1897. Other large lakes where largemouth bass were initially introduced include Great Pond and Messalonskee Lake, both in the Belgrade Lakes Region of central Maine.

Largemouth bass have since been introduced throughout much of the southern half of Maine, with unauthorized introductions accounting for most of the expanded distribution. Largemouth bass now occur in a total of 475 Maine lakes and ponds **(Figure 3, Table 3)**. Since 2001, numerous illegal introductions have expanded their range northward into a limited number of waters in Aroostook and Piscataquis counties and eastward into Penobscot and Washington counties.

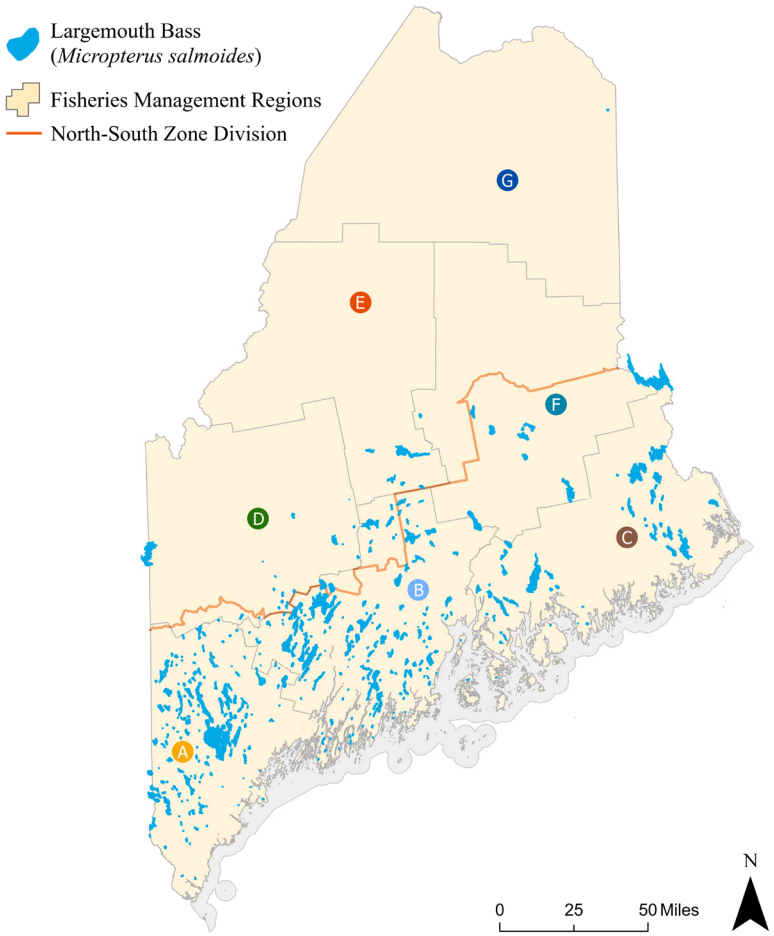


Figure 3. Lakes and ponds containing largemouth bass (475 waterbodies).

Table 3. Statewide distribution of lakes and ponds containing largemouth bass, 2020.

LAKES/PONDS CONTAINING LARGEMOUTH BASS		
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING LARGEMOUTH BASS
A	199	93%
B	187	91%
C	49	38%
D	19	10%
E	6	4%
F	14	18%
G	1	< 1%
STATEWIDE TOTAL	**475**	**30%**

Black Bass Quick Facts

- Native to Maine: No
- Maine counties where these species occur: All 16
- State record: largemouth bass: 11.63 pounds, caught at Moose Pond (Denmark) in 1968; smallmouth bass: 8.0 pounds, caught at Thompson Lake (Oxford) in 1970
- Average length of a mature adult: 8–23 inches
- Propagated in Maine state hatcheries: No

III. BROOK TROUT

Salvelinus fontinalis

Introduction

The eastern brook trout *Salvelinus fontinalis* is Maine's most sought-after fish species, both in the open water and ice fishing seasons (Responsive Management, 2016). While lake and pond populations of wild brook trout in other states have largely disappeared, Maine's several hundred lakes and ponds with healthy populations of native and wild brook trout represent a unique, valuable, and irreplaceable ecological and angling resource. MDIFW recognizes the unrivaled historical and economic importance of Maine's brook trout resource and focuses on the conservation and protection of this species.

Life History

Brook trout have historically been the most abundant and well-known coldwater sport fish species in Maine and remain so today despite reductions in their habitat that have occurred since Europeans settled the state in the early 17th century. The basic requirements of brook trout are cool (≤ 68°F), clean, well-oxygenated (≥ 5 ppm) water. Brook trout may spend part or all of their lives in habitats ranging from the smallest of brooks to the largest of lakes. In addition, they can spend the adult portion of their lives in marine or brackish waters. Anadromous populations are found in some of Maine's estuaries, though this assessment deals only with the landlocked form.

Brook trout are highly vulnerable to the effects of interspecific competition, particularly in the first two years of life. However, once they grow to be about 10 inches long, brook trout begin to feed heavily on other small fish (including other brook trout), and competition for food resources decreases. In some waters where forage fish populations are limited or non-existent, brook trout can still grow well on a diet of invertebrates.

Brook trout experience extremely diverse growth rates depending on environmental factors such as productivity, water temperature, and food abundance. For example, a 5-year-old brook trout can weigh as little as 2 ounces or as much as 5+ pounds depending on water-specific growth conditions.

Brook trout are generally short-lived, with relatively few surviving beyond age 3. Of those that live to be 4+ years old, most do not live beyond age 6. Among stocked populations, the life span is typically even shorter, with few individuals surviving beyond age 2. However, recent efforts to extend the lifespan of hatchery-reared brook trout through the rearing of eggs taken from captive wild strain fish (Kennebago) have been successful, and progeny of these fish have lived to age 4+.

In Maine's flowing waters, brook trout spawn in the fall, usually late September–November, starting in the highest elevation waters. Spawning generally occurs over groundwater upwellings or tailouts of pools, where there's small to medium sized gravel and adequate flow to keep the eggs well-oxygenated. Shore spawning can be successful in some lakes and ponds where spring water inflows occur in gravelly or sandy shallows. Survival of shore-spawned trout may be poor if protective cover for emerging fry is not available; rainbow smelt are especially voracious predators of brook trout fry under these conditions. Brook trout eggs hatch in the early spring after overwintering in the gravel substrate. Young fish use any available cover to hide from predators and move to deeper water that serves as adult habitat when they attain greater size.

Brook trout are highly catchable, making them susceptible to overfishing, especially in streams and small ponds with easy angler access. They are, however, very resilient when the habitat is not limiting, and their numbers can quickly rebound under adequate regulatory protection. A high level of genetic variation still exists within Maine's wild brook trout populations, indicating these populations have been well managed and not overfished.

Management

Historically, most of Maine's inland waters were naturally suited for brook trout. However, beginning in the early nineteenth century, increases in human population growth, timber harvesting, agriculture, and industrialization (including the construction of power-generating dams) led to a substantial decline in the amount of available brook trout habitat. Timber harvesting practices such as dam and road construction, river channelization, and cutting along shoreline riparian zones caused widespread erosion, siltation, and changes in water chemistry. Similar effects occurred through widespread land clearing for agricultural purposes, especially in the southern and central portions of the state. Loss of habitat due to industrial pollution increased in the nineteenth century and continued well into the twentieth century.

These habitat changes resulted in a decline in brook trout abundance rather than outright extirpation in most cases.

Before the Fisheries Research and Management Division was established in 1951, MDIFW's Commissioners authorized management activities without much scientific input, including stockings that were surprisingly widespread (thanks mainly to railroad transport) but poorly documented. Dr. William C. Kendall of the Bureau of Fisheries, U.S. Department 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 harvest from previous documents dating back to the mid-1800s. Dr. 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 to 1945, Dr. Cooper and his colleagues reported on the status of fisheries in the Rangeley chain of lakes, the lower Androscoggin and Kennebec drainage systems, Moosehead Lake, and Haymock Lake. Of particular value for current brook trout management were the age and growth data for lightly exploited populations which established a baseline for statewide age and growth datasets. The establishment of the Fisheries Division in 1951 led to the development of systematic programs to survey brook trout habitat and research projects intended to provide scientifically derived guidance for the statewide management of brook trout. 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 sport fishery increased with angler use and 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. 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 on trout. In 1920, the General Law was updated, including raising the minimum length limit to 6 inches and creating a 25-fish bag (not to exceed a combined weight of 15 pounds). The General Law bag limit for brook trout in lakes and ponds was eventually lowered (2021 limit of five in northern Maine and two in southern Maine) to reduce impacts of over-harvest. In addition, categories of standardized special regulations, including bag and length limits, were implemented in 1996 and refined in 2007 to account for the variability in growth rates among trout waters and standardize special brook trout regulations. The first fly-fishing-only restrictions were imposed on individual waters in the Rangeley and Moosehead Lake areas near the end of the 20th century.

Artificial propagation has played an important role in managing Maine's brook trout populations for many years. Hatchery-reared fish are typically used to provide fisheries where adult habitat is present but spawning and nursery habitat are lacking. The first Maine State fish hatchery was constructed in 1895 following a decade of private efforts to hatch and stock trout fry. With the development of additional state 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 1970s. While the number of brook trout stocked has decreased since the 1970s (average of 636,000 stocked annually 2011–2020, excluding fry), the stocked fish are on average larger and more likely to be immediately available to legal harvest than they were in the past. The average number of fish per pound stocked has decreased from 12.7 fish/pound in the 1970s to 2.6 fish/pound currently (10-year average, 2011–2020).

In the 1990s, MIDFW explored methods to diversify and improve the performance of its brook trout broodstock. New strains were developed from wild fish originating from the Kennebago River and Sourdnahunk Lake with the goal of producing progeny that more closely mimic characteristics of wild fish (e.g., greater longevity). A performance study of the new strains indicated that the longevity of both strains exceeded that of the original Maine hatchery strain. However, the Kennebago strain fish performed better than the Sourdnahunk strain in the hatchery environment and provided better returns to the angler post-stocking. Consequently, the Kennebago strain was retained for hatchery production. These fish are frequently crossed with the older Maine hatchery strain (result known as the F1 hybrid strain) to provide faster-growing, though shorter-lived, fish. In 2014, the Sourdnahunk strain returned to the Maine hatchery system as part of a project to stock fish that more closely resembled the native brook trout found within Baxter State Park. Adult fish from Sourdnahunk Lake were captured and stripped of their gametes. The gametes were then mixed, and the resulting offspring were raised in a special isolation area of the hatchery to manage biosecurity concerns associated with bringing wild fish into the hatchery environment. Wild gamete collection continued through 2020, though the future status of this program is under review due to ongoing biosecurity concerns.

The introduction and subsequent spread of competing fish species (native and non-native) have substantially impacted the quantity and quality of Maine's brook trout resource. White perch, yellow perch, and chain pickerel were introduced into brook trout waters throughout the state in the 1800s. More recently, invasive Northern Pike and Muskellunge have made their way into several brook trout drainages where they continue to expand their range. Smallmouth bass established populations in many coastal drainages by the early 1900s. This species continues to be illegally introduced into new drainages, including the upper Kennebec and Androscoggin River drainages (including the Rapid River) in the 1980s and the St. John River drainage in the 2000s (they were documented in the Meduxnekeag River drainage, a subdrainage of the St. John River, in the 1990s). Because smallmouth bass are present above Grand Falls (Grand Falls, NB, Canada), they are expected to eventually invade the upper reaches of the St. John River drainage where many native brook trout populations exist.

So far, Maine's chemical reclamation program has been the most successful method used to remove invasive species from brook trout waters. Since its inception in 1939, over 100 waters have been reclaimed at varying levels of success. The reclamation program is currently conducted at a modest level due to the expense of this management technique and changing public sentiment. Waters proposed for reclamation must undergo a thorough review process that is defined in Department policy. Removal of competing species by netting has been feasible in limited cases, but is labor-intensive and temporary in that it does not remove all competitors, which will eventually repopulate to their former abundance.

In the 1990s, MDIFW conducted a series of studies to determine the abundance, longevity, rates of harvest, and genetic variability of wild brook trout populations. Results from these studies are used as a baseline reference to monitor future population changes. More recently, detailed stream surveys have been conducted to better determine the relationship between stream habitat types and brook trout abundance. Once largely taken for granted, wild trout populations in streams are now recognized for their biological, economic, and aesthetic values.

Historically, road crossing structures were installed to move water without compromising infrastructure, with little to no consideration for the impacts these structures may have on fish movements. Today, that sentiment has changed, and MDIFW biologists work closely with state, local, and private entities to ensure that the needs of brook trout are considered in all road crossing projects. These considerations include maintaining upstream and downstream passage, protecting in-stream and riparian habitats, and, if possible, attempting to return the stream to a more natural state.

In 2005, the Maine Legislature enacted "An Act to Recognize and Protect the Native Eastern Brook Trout as one of Maine's Heritage Fish" (12 MRS §12461). This statute identified native brook trout lakes and ponds in Maine and established that the Commissioner may not stock or issue a permit to stock fish in a lake or pond listed as a state heritage fish water, and a person may not use live fish as bait or possess live fish to be used as bait on a lake or pond listed as a state heritage fish water. In 2013, the Legislature directed MDIFW to develop a management plan for lakes and ponds with wild (not stocked for at least 25 years) principal fisheries for brook trout. As a result, MDIFW developed a combined list (known as the Heritage List) of native and wild brook trout ponds that would be managed under the Heritage Fish rules.

As of January 1, 2021, the Heritage List included 583 lakes and ponds distributed throughout Maine.

A recently completed study conducted by the University of Maine, Orono, in cooperation with MDIFW, investigated the population structure of Maine's brook trout and the genetic effects of historical stocking practices (Erdman et al. 2018). This study identified distinct genetic profiles for native brook trout among Maine's major drainage basins. While there was some evidence of hatchery introgression, most historically stocked populations were genetically more similar to their native counterparts, suggesting a minimal genetic effect of stocking. A companion study to further investigate the genetic-level effects that hatchery fish may have on native populations is currently underway and is expected to be completed by late 2021. The results from these studies will inform future management decisions to ensure future and current stocking practices are not negatively affecting native populations of brook trout.

Over the past 50+ years, significant advances in knowledge and management expertise have been made relating to Maine's brook trout resource. However, increased angler 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. Regardless, the primary intent in managing Maine's wild brook trout fisheries shall be to maintain these self-sustaining fisheries so far as possible without resorting to stocking brook trout.

Current Status and Distribution

Brook trout exist in 1,681 lakes and ponds, accounting for 82% of Maine's total surveyed lake and pond area **(Table 4)**. The vast majority of these populations are wild or native. Stocked waters make up a higher percentage of the brook trout fisheries in the southern Management Regions (i.e., A and B), where competition, exploitation, and water quality limit the existence of wild brook trout populations.

Most brook trout waters are concentrated in the northwestern areas of the state where there has been less development and fewer introductions of competing fish species **(Figure 4)**. Large tracts of commercial forest land still prevail in this area of the state.

Of Maine's 30,000+ miles of flowing water, about 21,000 miles (66%) are considered to provide adequate brook trout habitat **(Table 5)**. As with the distribution of brook trout in lakes and ponds, most brook trout streams are concentrated in the interior highlands.

Brook Trout Quick Facts

- Native to Maine: Yes
- Maine counties where this species occurs: All 16 counties
- State record: 9 pounds, 0.3 ounces, caught in 2010 at Mousam Lake in Acton, Maine
- Average length of a mature adult: 6–12 inches
- Propagated in Maine state hatcheries: Yes - stocked out as fry, fall fingerling, spring yearling, fall yearling, and adult (retired brood)

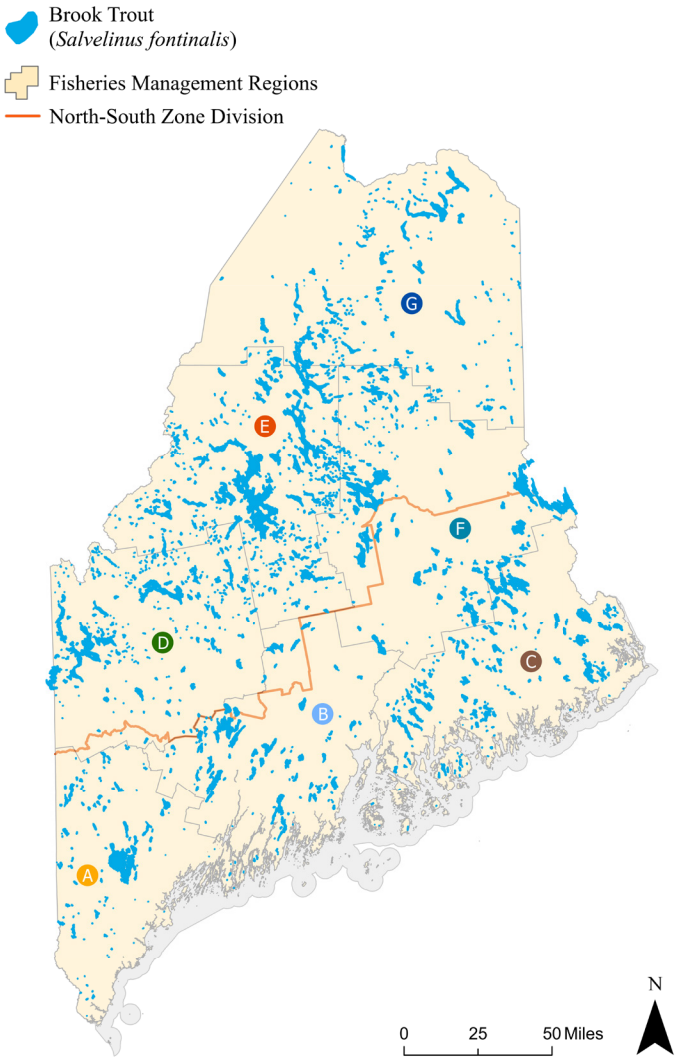


Figure 4. Lakes and ponds containing brook trout (1,681 waterbodies).

Table 4. Statewide distribution of lakes and ponds containing brook trout, 2020.

LAKES/PONDS CONTAINING BROOK TROUT			
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	# OF DIRECTLY STOCKED LAKES/PONDS (INCLUDING AS % OF TOTAL)	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING BROOK TROUT
A	127	97 (76%)	57%
B	128	101 (79%)	69%
C	204	83 (41%)	64%
D	316	113 (36%)	98%
E	433	88 (20%)	99%
F	225	70 (31%)	81%
G	248	52 (21%)	96%
STATEWIDE TOTAL	**1681**	**604 (36%)**	**82%**

Table 5. Statewide distribution of suitable brook trout habitat within flowing waters.

SUITABLE BROOK TROUT HABITAT WITHIN FLOWING WATERS			
FISHERIES MANAGEMENT REGION	MILES OF SUITABLE BROOK TROUT HABITAT IN STREAMS	TOTAL MILES OF STREAM	SUITABLE/AVAILABLE
A	2,634	3,729	71%
B	2,568	3,598	71%
C	2,688	3,793	71%
D	2,959	4,837	61%
E	2,365	4,134	57%
F	3,382	4,770	71%
G	4,531	6,945	65%
STATEWIDE TOTAL	**21,127**	**31,806**	**66%**

IV. BROWN TROUT

Salmo trutta

Introduction

Brown trout *Salmo trutta* are not native to Maine but have been stocked in the state since 1885 to provide recreational angling opportunities. Due to low catch rates, brown trout are often described as elusive, but what they lack in catch, they make up for in growth and survival. Brown trout are more tolerant of higher water temperatures and competition with other fish species than any other trout species in Maine and are therefore most commonly managed in marginal waters with more complex fish assemblages. In 2020, brown trout occurred in 173 lakes and ponds, with 86% of those waters located in Management Regions A, B, and C. Recent survey results cited brown trout as the fifth most targeted fish species by Maine anglers during the open water season (Responsive Management 2016).

Life History

Brown trout date back approximately 70 million years to the Eocene Epoch, where it is believed they originated in the Arctic regions and were entirely ocean-dwelling. As the glacial sheet advanced, brown trout were pushed southward and eventually became established in the fjords of the Scandinavian Peninsula. When the glacier receded, some Scandinavian populations entered streams and lakes, and gradually established populations in freshwater environments. Brown trout then migrated farther inland and southward and later became established throughout most of Europe. Today, due to human intervention, brown trout exist on every continent except Antarctica.

Brown trout exhibit a greater range of color variation than Maine's native salmonids. They are typically yellowish-brown with large brown or black spots on their sides, back, and dorsal fin. These spots are usually surrounded by faint halos, and a few red or orange spots. The adipose fin may have orange or red spots on it as well.

Brown trout typically mature at three or four years of age, and maturity is somewhat dependent on body size. Spawning occurs in the fall, usually after brook trout spawn, and typically occurs in flowing water habitats. Spawning behavior is triggered by a combination of decreased daylight, increased streamflow, and decreased water temperature (usually when water temperatures drop below 50°F). Males defend territories against rival males before spawning. Females sculpt multiple dune-shaped redds in a gravelly substrate and pair with individual males throughout the spawning season. Egg incubation time varies depending on water temperature, but hatching occurs in 50 days at 50°F. The young generally spend the first two to three years in the stream where they hatched, feeding on insects, plankton, and other small organisms.

Adult brown trout that reside in lakes or ponds rely heavily on fish and other aquatic organisms for forage, whereas those that remain in stream environments rely on aquatic insects and small fish.

In Maine, age-1 brown trout are approximately four to six inches long, reaching six to eight inches by age two. Brown trout can grow to large sizes (the current Maine state record is 23 pounds), and four-pound fish are common in many lakes and ponds in Maine. Brown trout can survive to a decade or more, but survival beyond six to eight years of age is uncommon in Maine waters.

Management

Brown trout were first stocked in Maine into Branch Lake (Ellsworth) in 1885. By 1900, there were nearly 20 waters scattered throughout central and southern Maine being stocked with brown trout. During this time, many native landlocked Atlantic salmon fisheries were in decline, and brown trout stockings were initiated to provide an additional recreational opportunity for Maine anglers.

Many of the early introductions of brown trout in Maine were not successful, and fisheries managers were consequently skeptical of their long-term success. The general feeling toward brown trout during the early 1900s is best summarized in the following excerpt from the 1906 Fish and Game Commissioner's Report:

"We continue to raise a few brown trout but are very careful where we plant them. They have not as yet developed in sufficient numbers where planted so as to enable us to give an opinion as to the desirability of propagating them. A few have been taken, however, some weighing fourteen pounds."

Early fish culturists, lacking technical knowledge and experience in brown trout management, had problems with early introductions and gave up stocking the species altogether in 1920. However, a continuing decline in native salmon and trout fisheries prompted another trial with brown trout in 1932. Through the 1940s, more than 100 waters were stocked with a combined total of 1.5–2 million brown trout annually. Advanced fry (two to four inches) and small fall fingerlings (four to six inches) were stocked in most of these waters. A lack of awareness regarding the potential adverse impacts from non-native fish led to more than 240,000 brown trout being stocked into Sebago Lake, a world-renowned landlocked Atlantic salmon fishery. Fortunately, brown trout never became established in Sebago Lake. Unsuccessful introductions also occurred in the Rangeley Lakes area and at Grand Lake Stream.

As management focus shifted from the hatchery to the habitat, biologists studied the behavior and habits of brown trout in the wild. Fish biologists learned first-hand that the life history of brown trout was similar to native landlocked Atlantic salmon and brook trout; brown trout require clean, cool waters but are more tolerant of warmer water and competitor fishes. Brown trout target the same forage as salmon, but they are also more opportunistic, feeding on organisms that salmon and brook trout do not readily consume. Brown trout and salmon spawn during fall and require the same gravelly substrate and habitat conditions.

Brown trout stockings became controversial once biologists recognized that brown trout compete directly with native salmonids. As a result, many brown trout stocking programs were terminated in waters that supported other high-quality coldwater fisheries, and a new management philosophy emerged. Fisheries managers refocused stocking efforts to a more marginal habitat that was less suitable for native salmonids but still capable of supporting brown trout growth and survival. In addition, in the waters that supported other higher quality coldwater fisheries, brown trout were stocked less to minimize their impact on other fisheries. The vast majority of waters stocked with brown trout lack sufficient spawning and nursery habitat to support natural reproduction and recruitment. Despite decades of stocking, only a small number of waters in Maine currently support self-sustaining populations of brown trout.

Currently, fisheries biologists stock brown trout under a few management scenarios. In a few instances, brown trout are stocked into waters with excellent water quality and abundant forage. Brown trout are also stocked into waters that are managed in conjunction with other salmonids as the principal fishery. However, in most cases, brown trout are utilized in waters where management for other salmonids such as brook trout or salmon has proven unsuccessful. These waters often have depressed dissolved oxygen levels in the hypolimnion and a compressed thermocline. Additionally, many of these waters have an abundant population of competing species and no self-sustaining salmonid populations. Unlike other hatchery salmonids, brown trout can provide quality coldwater fisheries in marginal waters, where management would otherwise be limited to existing warmwater species or put-and-take brook trout fisheries.

Current Status and Distribution

Between 2001 and 2020, the number of brown trout lakes and ponds decreased from 213 to 173, respectively **(Table 6, Figure 5)**. The decrease in distribution that occurred is representative of a statewide decline in waters managed for brown trout. Brown trout are notoriously elusive, and older-age fish are primarily only susceptible to experienced anglers. As a result, catch rates on brown trout are low, and in many situations, fisheries biologists are either ending programs altogether or exploring other options that provide better angler returns (e.g., rainbow trout).

Approximately 86% of the brown trout lakes and ponds in Maine are in Management Regions A, B, and C. These three regions encompass the southern portion of the state where habitat conditions are more commonly conducive to the brown trout management strategy (i.e., marginal habitat with compromised water quality and greater species assemblages). Brown trout are also stocked into higher quality waters either as the only salmonid species or as a complement to another salmonid program. Most waters managed for brown trout are mesotrophic but still support water quality suitable for brown trout growth and survival. In 2020, waters that supported principal fisheries for brown trout ranged in size from 14 to 8,239 acres.

In addition to lake stockings, about 40 flowing waters in Maine have been stocked annually with brown trout since 2000. Brown trout are typically stocked as spring yearlings into medium–large rivers and streams where brook trout habitat is severely compromised by abundant competitor fishes and marginal water quality. Fall yearlings are stocked less frequently in rivers, but they are an attractive option in locations with good angler access and waters with larger predator fishes. Brown trout fry are currently stocked in rivers, but only as unscheduled stockings when there is a surplus of fry.

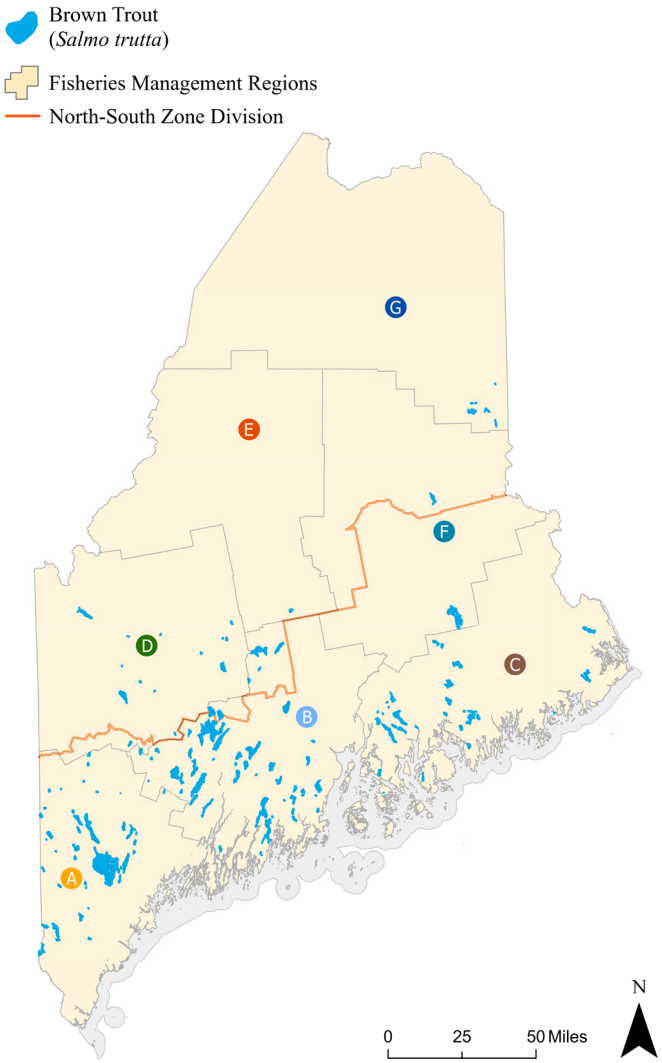


Figure 5. Lakes and ponds containing brown trout (173 waterbodies).

Table 6. Statewide distribution of lakes and ponds containing brown trout, 2020.

LAKES/PONDS CONTAINING BROWN TROUT			
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	# OF DIRECTLY STOCKED LAKES/PONDS (INCLUDING AS % OF TOTAL)	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING BROWN TROUT
A	50	36 (72%)	55%
B	64	43 (67%)	62%
C	35	21 (60%)	16%
D	13	10 (77%)	6%
E	1	1 (100%)	< 1%
F	3	0	4%
G	7	4 (57%)	2%
STATEWIDE TOTAL	**173**	**115 (66%)**	**16%**

Brown Trout Quick Facts

- Native to Maine: No
- Maine counties where these species occur: 15 of 16; no populations in Penobscot County
- State record: 23.5 pounds, caught at Square Pond (Sanford, Maine) in 1996
- Average length of a mature adult: 14 – 22 inches
- Propagated in Maine state hatcheries: Yes - stocked out as spring yearling, fall yearling, and adult (retired brood)

V. CUSK

Lota lota

Introduction

Cusk *Lota lota* are native to Maine and are known for their strange look and lack of fight compared to other coldwater species. Other common names for cusk include burbot, ling, eelpout, loche, and lawyer. Despite their lack of angling qualities, cusk are known to be among the best tasting of Maine's freshwater fishes. Regardless of their great taste, relatively few anglers (3%) target cusk in Maine (Responsive Management 2016). Of the anglers that target cusk, an overwhelming majority do so only during the ice fishing season when cusk are most active. In Maine, there are no length, weight, or bag limits for the species.

Life History

Cusk are a unique member of the family of cod-like fishes (Lotidae), distinguished as the only species in this family that spends its entire life in freshwater. Cusk are like their marine relatives in that their distribution is circumpolar; cusk can be found in cool, fresh waters throughout northern Europe, Asia, and North America. In North America, their range extends from the northernmost contiguous U.S. to northern Alaska and across Canada.

Unlike Maine's other coldwater species, cusk are not known for their grace and beauty. Their bodies are elongated, almost eel-shaped, with long soft-rayed dorsal and anal fins that meet a rounded tail. Although smooth and slimy to the touch, their skin is embedded with tiny cycloid scales. The head of a cusk is broad and somewhat flattened, with a large mouth containing several rows of small teeth on the jaws. A single, whisker-like barbell protrudes from the tip of the chin. There are no obvious external differences to distinguish males from females.

In general, adults are olive brown to dark brown on the back and sides. This background color is overlaid with distinctive patterns of dark brown or black markings and spots. The belly is creamish in color. Habitat conditions are thought to influence overall coloration as body color often varies among, and sometimes even within, individual waters.

Cusk typically inhabit large deep lakes but can also be found in many other habitats, including small shallow lakes and ponds, as well as large rivers and small streams. Cusk prefer deep, well-oxygenated (> 4 ppm), cool-water areas during the summer. The optimum water temperature range for cusk is 60–65°F, and 74°F is often regarded as their upper thermal tolerance. In the spring and fall, cusk move into shallow littoral habitats. During the winter, when cusk are most active, they can be found at all depths under the ice. Young-of-the-year are most often found along rocky shores and sometimes in weedy areas of tributary streams.

Mature females are longer than males of the same age. Cusk over 20 inches long, weighing 2+ pounds, are commonly caught in Maine waters, and a few fish over 10 pounds are harvested each year. Maine's largest angler caught cusk on record weighed 18.5 pounds and was caught in 1986 from Eagle Lake in Aroostook County.

Throughout their range, cusk spawn from November to May. In Maine, cusk spawn early to mid-February, making it Maine's only freshwater fish species known to spawn principally under the ice. Spawning occurs at night, most often over shoals, at depths from 3 to 15 feet. Spawning substrate consists of sand, gravel, and small stones. A current or upwelling of water is usually present at the site, keeping the area free of sediment and the eggs well-oxygenated. Cusk have also been known to move into rivers to spawn using similar substrates.

Males arrive first at the spawning site. Once the females arrive, the actual spawning period lasts about one week. Cusk have tremendous reproductive potential; a single female can produce hundreds of thousands of eggs, and large females (> 25 inches long) can produce over 1 million eggs. Females broadcast their non-adhesive eggs into the water column to be fertilized by nearby males. Eventually, the eggs settle into interstitial spaces in the substrate. After spawning, the adults leave and provide no parental care for the young which hatch in the early spring.

In Maine, cusk feed heavily on smelt and crayfish. Interestingly, crayfish are often a vital component of the cusk diet in early summer when cusk feed in relatively shallow water. Additional food items include other fish species (sculpins, sticklebacks, yellow perch, and suckers), insects, opossum shrimp, discarded bait, and the remains of fish cleaned by other anglers. Due to their varied diet, cusk must be considered an important competitor with other coldwater sport fish species and as a predator for newly stocked brook trout, togue, and landlocked Atlantic salmon.

Feeding occurs primarily at night, generally near the substrate. During the summer months, when cusk inhabit deeper waters, they do not appear to be active feeders. Feeding activity increases with the advent of cooling surface water temperatures in the fall and peaks in the late winter and early spring. Some cusk may also move into rivers to feed soon after they spawn.

Management

In general, the status of the cusk fishery has not changed much since the first fisheries commissioners were hired in the late 19th century. As such, MDIFW does not actively manage this species with special regulations, and any cusk data that are collected are typically incidental to data collections targeting other species.

Most anglers who target cusk fish with bait, on or near the bottom, at night (this is when cusk actively feed). Several Maine lakes (e.g., Moosehead, Chamberlain, Eagle, Sebago, and West Grand) provide locally popular night fisheries for cusk. Historically, anglers often discarded all but the largest cusk in favor of the other species they were after. Recently, however, more anglers have recognized the value of cusk as food; and while still relatively low, harvest rates have been increasing. MDIFW will continue to collect supplementary data on cusk to ensure these populations continue to be sustained.

Current Status and Distribution

Cusk occupy a total of 167 lakes and ponds **(Figure 6, Table 7)**, comprising 51% of the state's total surveyed lake/pond area. Cusk fisheries exist in waters of all sizes, from the relatively small 99-acre Minnehonk Lake (Mount Vernon, Kennebec County) up to the 74,890-acre Moosehead Lake. Most waters with cusk fisheries are managed exclusively for other coldwater species.

Naturally reproducing cusk populations typically exist in deep, cold lakes and ponds throughout Maine, often located towards the headwaters of large river systems (e.g., Kennebec, Penobscot, and St. John Rivers). There are no historical records that indicate cusk were intentionally moved around the state, so it is assumed that Maine's current distribution of cusk approximates their natural distribution. Unfortunately, new populations have recently become established via unauthorized introductions, particularly in southern Maine. MDIFW is monitoring the spread of this species, but like many illegal introductions, opportunities for complete eradication are limited.

Cusk also inhabit many of Maine's large rivers, often in the tributaries to lakes containing cusk, though few offer significant fishing opportunities. However, there is very little information on the distribution of this species in the state's 32,000+ miles of stream habitat.

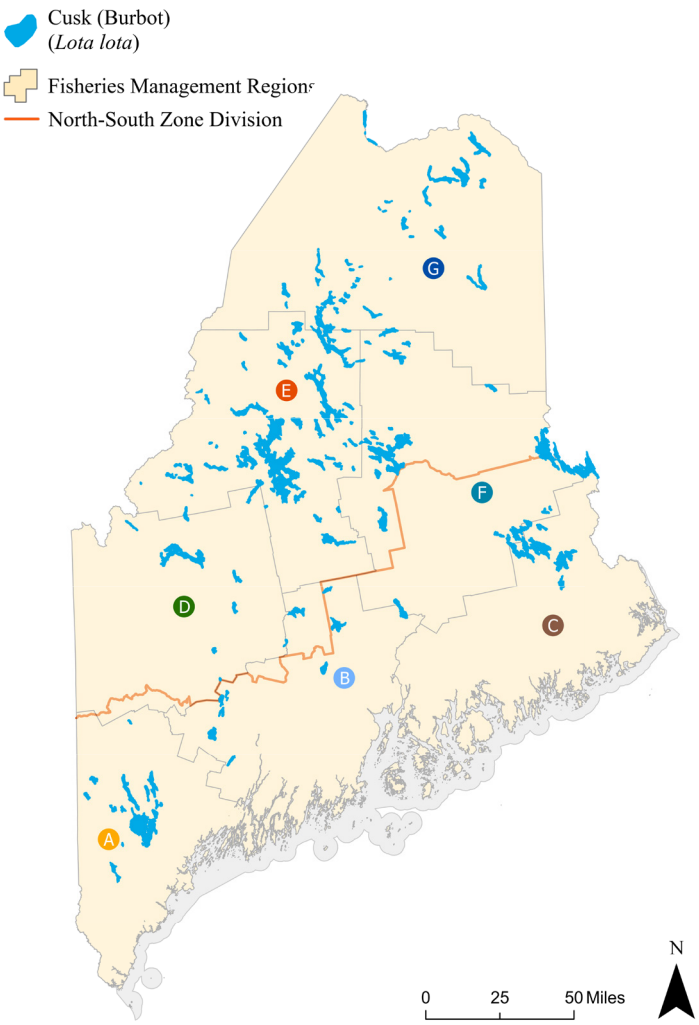


Figure 6. Lakes and ponds containing cusk (167 waterbodies).

Table 7. Statewide distribution of lakes and ponds containing cusk, 2020.

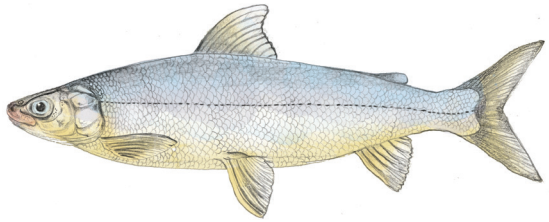
LAKES/PONDS CONTAINING CUSK		
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING CUSK
A	18	53%
B	14	22%
C	8	21%
D	7	24%
E	54	83%
F	27	53%
G	39	74%
STATEWIDE TOTAL	167	51%

Cusk Quick Facts

- Native to Maine: Yes
- Maine counties where this species occurs: 12 of 16; Androscoggin, Aroostook, Cumberland, Franklin, Kennebec, Oxford, Penobscot, Piscataquis, Somerset, Waldo, Washington, and York
- State record: 18 pounds, 8 ounces, 1986, Eagle Lake (T16 R6 WELS)
- Average length of a mature adult: 18 inches
- Propagated in Maine state hatcheries: No

VI. LAKE WHITEFISH

Coregonus clupeaformis



Introduction

Lake Whitefish *Coregonus clupeaformis* are native to Maine and provide a small but important sport fishery for Maine anglers. The increase in recreational fishing for lake whitefish in the 1970s coincided with the species' decline in Maine; today, whitefish are found in just a fraction of the waters they historically occupied. Because of their limited distribution and low abundance, whitefish currently support only a minor sport fishery in Maine but remain an important resource for a cohort of anglers and are an irreplaceable component of the ecosystems within which they exist. Lake whitefish are considered a species of Special Concern in Maine. The primary reason for their decline is believed to be the establishment of introduced rainbow smelt. More detailed information can be found in Wood's (2016) "Current Status of Lake Whitefish in Maine; an Update to MDIFW's 2001 Whitefish Assessment" and Whitaker and Wood (2021) "An Investigation of Lake Whitefish Recruitment, Spawning, and Early Life History in Northern Maine: Final Report."

Life History

Lake whitefish are a species of whitefish found in large, cool-water lakes. Lake whitefish are part of the salmon family Salmonidae, bearing the distinctive adipose fin located on the back between the dorsal and caudal fins. Body coloration is silvery on the sides with a dark-colored back and fins, and a white belly. Lake whitefish have large scales, a deeply forked tail, and a distinctly shaped snout that overhangs the lower jaw. A proportionately small head and small toothless mouth are also distinct characteristics of the species.

Lake whitefish are widely distributed across the Canadian provinces from New Brunswick and Labrador through British Columbia and the Northwest Territories. In the U.S., they are found from the Great Lakes region north and east along the U.S./Canada border into Maine. Maine populations are now concentrated in headwater lakes of the Allagash and Penobscot River drainages in the north-central part of the state. Lakes in the St. Croix drainage in Washington County are also noted for whitefish populations. Distribution in southern and western Maine is limited to only a few lakes. Throughout the historical range of lake whitefish, particularly in Maine, many lakes have seen populations disappear or dwindle to relic numbers.

True to their name, lake whitefish are primarily a lake-dwelling fish. They thrive in deep, oligotrophic lakes with large volumes of cold, well-oxygenated water, rarely entering streams except to spawn.

Known to be a schooling fish, lake whitefish are often found in groups of similar-sized fish. Where food and adequate water quality are present, they spend much of their time near the lake bottom. Segments of some populations may undergo feeding excursions into nearby streams.

Lake whitefish are among Maine's more long-lived sport fish, normally living 10 or more years, with the capability to live for as long as 30 years. As is typical of most long-lived fish, growth is relatively rapid until the onset of sexual maturity, at which point growth slows depending on population abundance, food source, and competition with other species. Slow growth later in life results in crowding of circuli at the margin of the scale, making it very difficult to accurately determine the age of slow-growing whitefish using scales. Recent studies have shown that sagittal otoliths can be used to age these slow-growing fish more accurately and have demonstrated that lake whitefish in many lakes are longer-lived than previously thought. While the bulk of mature adult lake whitefish may weigh one to three pounds, some can grow considerably larger. The largest lake whitefish on record for Maine waters is a specimen weighing 7.5 pounds, taken by an angler from Sebago Lake in 1958.

Lake whitefish typically reach sexual maturity between ages three and six, and spawn between mid-October and December, when water temperatures drop below 43°F. Spawning occurs on shallow, windswept lake shoals or tributaries where suitable water depth, water velocity, and spawning substrate exist. Spawning may occur during the day or at night, over a period of several days to a week or more. Whitefish gather in spawning pairs, with the female broadcasting eggs mid-water where they are fertilized by the male and settle into cracks and crevices in the substrate below. Females are highly fecund, with the ability to lay more than 10,000 eggs each. Fertilized eggs develop in the substrate over winter and hatch the following spring.

Larval and post-larval whitefish feed primarily on zooplankton and can tolerate somewhat warmer water than adults. As they grow, the diet of juvenile whitefish transitions to bottom-dwelling species such as snails, insect larvae, and clams, and their habitat use changes to reflect this diet shift (i.e., they move from open water to bottom habitats). Where lake whitefish co-occur with rainbow smelt in Maine lakes, larger (generally 16+ inches) whitefish often feed on smelt, which contributes to a higher rate of growth in these fish. The ability to feed on smelt is controlled by several factors, including the relatively small toothless mouth of whitefish and the size and abundance of smelt. While they may consume smelt, whitefish are best suited to feed on the bottom with their specialized mouth shape and a stomach that allows them to digest hard-shelled prey items such as snails.

An unusual trait that is rarely found in other species but frequently seen among whitefish is the tendency to form dwarfed populations. Though still considered the same species (despite some debate), the dwarf form of lake whitefish grows to a much smaller size, matures earlier (at age one or two), and has a much shorter life span. Initially discovered in the early 1900s and further studied in the 1950s, dwarf lake whitefish populations have been found in 29 Maine waters, some of which have since been extirpated.

Decades of research by the Louis Bernatchez laboratory from Laval University in Quebec suggests that the existence of the dwarf form of lake whitefish in Maine lakes represents several unique snapshots in the long-term formation of a new species. Where dwarf and normal lake whitefish are found in the same lake—exclusively in the St. John River drainage—they represent a continuum of morphological and genetic differentiation. By utilizing different life history tactics, dwarf lake whitefish have developed reproductive isolation from the normal form despite retaining a very similar genetic makeup, probably due to the recent nature of this speciation process. A fast-growing, early-maturing, and relatively short-lived life history strategy appears to present some advantages in lakes where dwarf populations occur and allows whitefish to more fully utilize available habitat in a particular water. Additionally, several waters with marginal habitat for lake whitefish contain populations of only the dwarf form.

Management

Though some anglers sought lake whitefish for sport as early as the late 1800s, it took decades for the species to become a popular sport fish on a larger scale. The modern lake whitefish sport fishery began developing sometime around the early 1970s. The growing popularity and availability of snowmobiles made many waters more accessible to ice anglers, and since jigging through the ice is a very effective way to catch whitefish, the species became a significant part of the winter catch. Some open water angling for whitefish has developed over time as well.

Though overfishing was once thought to have caused whitefish declines, recent research and monitoring have determined that interactions with non-native fish species have been the driving force impacting whitefish populations in Maine. Today, the few waters that maintain adequate lake whitefish populations to support recreational fisheries are highly prized by anglers. The largest concentration of these waters exists in the major lakes of the Allagash River drainage in northern Maine and the network of large lakes surrounding and including West Grand Lake in Downeast Maine.

As the popularity of lake whitefish grew and the species declined in range and abundance, MDIFW undertook efforts to conserve and enhance these populations. Although angling is not currently believed to be related to their decline, restrictive fishing regulations have been implemented and adjusted to minimize the potential impacts of angler harvest on whitefish populations. Whitefish are now managed under a General Law bag limit of three fish, with no minimum length. Whitefish in several waters are further protected with more restrictive regulations, including 16-inch and 18-inch minimum length limits and bag limits as low as one fish.

In addition to restrictive fishing regulations, MDIFW initiated an experimental lake whitefish stocking program in 2002 to restore declining populations and create a new fishery in St. Froid Lake. Within a relatively short amount of time (2002–2010), this program resulted in the stocking of more than 80,000 fish into seven waters in the Allagash and Fish River drainages. Stocking concluded in 2010 to allow for a follow-up evaluation of its effectiveness. As of 2021, the experimental stocking program does not appear to have accomplished its objectives. However, it did provide the Division with a better understanding of how a future stocking program could be modified for better results (e.g., stocking larger fish to improve post-stocking survival and measuring success based on decades-long time frames to better understand long-term success).

Lake whitefish populations have continued to decline despite regulatory protection and attempts to supplement populations with hatchery-reared fish. Recent research and analysis of past data indicate that the establishment of rainbow smelt is likely linked to whitefish declines and extirpation in many waters. In places where smelt are impacting whitefish, future management efforts may be directed toward reducing smelt numbers. Potential strategies may include increasing smelt harvest, managing for high numbers of smelt predators, or through other means determined by future research and available resources.

Current Status and Distribution

Lake whitefish are believed to currently occur in at least 53 lakes in five of the seven MDIFW Fisheries Management Regions **(Figure 7, Table 8)**. Of these, 46 lakes are believed to support self-sustaining populations, while another seven contain migrant lake whitefish from nearby populations or contain remnant members of past populations that no longer successfully reproduce. Because lake whitefish are in decline statewide, of the 53 populations, only 14 are classified as principal fisheries, most of which are in the northernmost management regions.

Lake Whitefish Quick Facts

- Native to Maine: Yes
- Maine counties where these species occur: 7 of 14; Aroostook, Cumberland, Oxford, Penobscot, Piscataquis, Somerset, and Washington
- State record: 7.5 pounds, caught at Sebago Lake (Cumberland County) in 1958
- Average length of a mature adult: 14–18 inches; dwarf form 7–10 inches
- Propagated in Maine state hatcheries: No

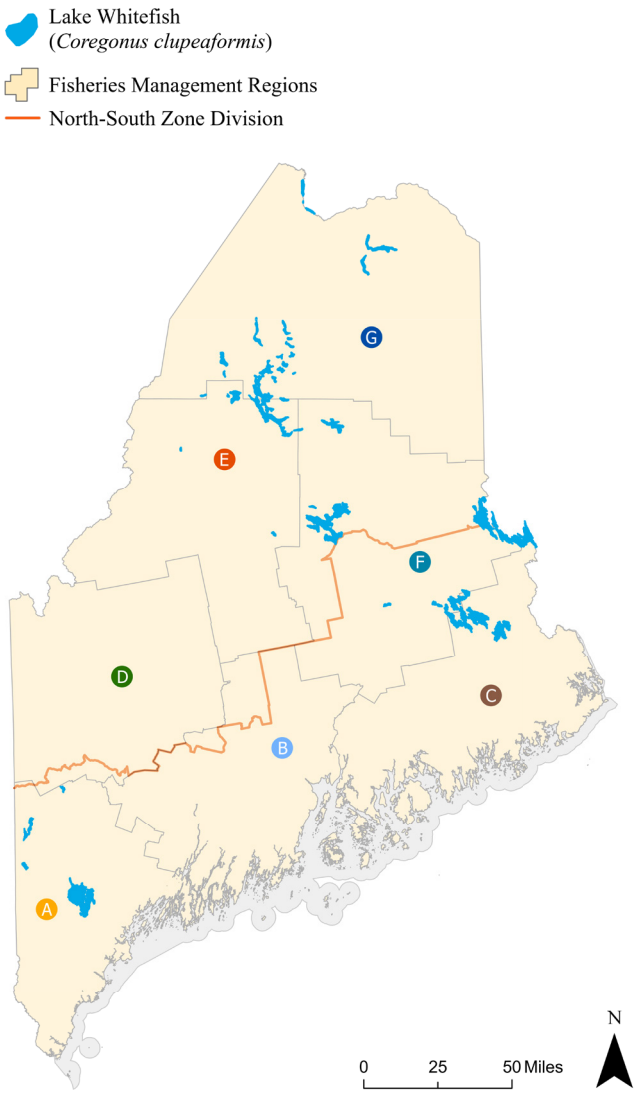


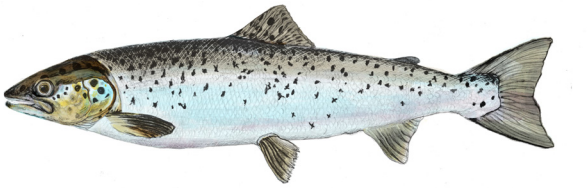
Figure 7. Lakes and ponds containing lake whitefish (53 waterbodies).

Table 8. Statewide distribution of lakes and ponds containing lake whitefish, 2020.

LAKES/PONDS CONTAINING LAKE WHITEFISH		
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING LAKE WHITEFISH
A	4	36%
B	0	0%
C	3	19%
D	0	0%
E	7	8%
F	15	43%
G	24	41%
STATEWIDE TOTAL	**53**	**21%**

VII. LANDLOCKED ATLANTIC SALMON

Salmo salar sebago



Introduction

The landlocked Atlantic salmon *Salmo salar sebago* (hereafter landlocked salmon) is one of Maine's most highly prized native coldwater sport fish, second only to brook trout (Responsive Management 2016). These fish are known for their outstanding sporting qualities, relatively long lifespan, good growth potential, and the ease with which they can be cultured in hatcheries. These factors, along with their tolerance of a moderately wide range of habitat conditions, make landlocked salmon highly responsive to intensive management.

Life History

Maine's landlocked salmon evolved from the sea-run Atlantic salmon *Salmo salar* through a gradual physiological adaptation to the lake environment. Because they are the same species, landlocked salmon are morphologically identical and similar in appearance to sea-run Atlantic salmon. Distinguishing characteristics of adult landlocked salmon are their deeply forked tail, silver body color, and the presence of small X-shaped marks on their dorsal and lateral surfaces. Males in spawning condition develop a kype (hooked jaw), and their bodies darken. Spawning females develop swollen egg-filled abdomens, and their silver body color intensifies. The bodies of post-spawn landlocked salmon are often thin and dark, and these fish are often referred to as "racers" or "black salmon."

In North America, landlocked salmon are native to lakes in Maine and the eastern Canadian provinces and were historically present in Lakes Ontario and Champlain. They are also native to several waters in Scandinavia and western Russia. Early fish culturists attempted to introduce landlocked salmon to virtually every state in the U.S. and throughout the world, though most introductions failed. Relict introduced populations still exist in New Hampshire, Vermont, Massachusetts, and New York.

Before 1868, landlocked salmon populations occurred in only four river basins in Maine: the St. Croix, including West Grand Lake in Washington County; the Union, including Green Lake in Hancock County; the Penobscot, including Sebec Lake in Piscataquis County; and the Presumpscot, including Sebago Lake in Cumberland County. By 1900, their range was expanded considerably through numerous introductions by state and federal fish culturists. In waters with adequate conditions for reproduction, stocked fish survived and reproduced naturally. Introductions in less suitable habitats often failed or were only temporarily successful. Over time, the number of hatchery facilities increased, and more fish were available for stocking. The increase in hatchery production provided an opportunity to maintain populations, through periodic stocking, in waters that lacked suitable spawning habitat. Landlocked salmon are now present in at least one lake in every Maine county. In addition, Maine supports one of the largest sport fisheries for this species in the world.

The model landlocked salmon habitat is a large, clear lake with rocky shores and cool (<50°F throughout the year), deep, well-oxygenated water which is fed by a swiftly flowing gravel bottom stream. Ideally, these waters would also contain an abundance of smelt and a limited number of competing fishes. Maine's best wild landlocked salmon fisheries exist in lakes with large inlet or outlet streams with abundant spawning and rearing habitat. Research conducted by MDIFW on stocked waters has shown that landlocked salmon can tolerate less than ideal conditions when smelt are abundant, including summer water temperatures that approach the mid 70°F range and oxygen levels near 5 ppm. However, optimum development of landlocked salmon fisheries is best achieved in lakes with excellent habitat and where competition for food and space with other species is negligible.

The age at which landlocked salmon reach sexual maturity varies considerably. In self-sustaining populations, most males spawn first at age 3 or 4 (although some precocious males spawn at age 1 or 2), and females usually spawn first at age 4 or 5. Spawning runs of wild landlocked salmon may be composed of fish ranging in age from 1 to 10, but 3–5-year old individuals make up the bulk of most runs. Landlocked salmon may be iteroparous (repeat spawners), but most fish observed on spawning runs are maiden fish spawning for the first time. Those that are iteroparous may spawn in consecutive or alternate years, in consecutive years then skip a year, and some may even skip 2 or 3 years between spawning events.

Landlocked salmon spawn between mid-October and late November. They prefer to spawn in lake outlets or large inlets. They can also spawn on lake shoals or in small inlets, though production from these areas is generally poor. Females select swift water sites with the appropriate gravel size for nest building. Eggs are buried 4–12 inches into the nest, where they remain until hatching early the following spring. Freshly hatched landlocked salmon (known as "alevins") are born within the substrate with a nutritious yolk sac attached to their body. They remain in the gravel for about six weeks, slowly growing by absorbing their yolk sacs. Once the yolk sacs are fully absorbed, the alevins emerge from the gravel as fry, and then spend 1–4 years (2 years for most in Maine) growing in the stream. As the fry grow, they begin to develop parr marks along their sides. The parr marks fade just before the fish are ready to migrate into the lake. This color-changing process, known as smoltification, turns the fish a bright silver color, during which time they are known as "smolts." Smolts immigrate from streams to lakes during spring and fall, but most of the movement is in the spring. Changes in body color help camouflage these small fish from predators in their respective environments.

The diet of young landlocked salmon consists of a variety of invertebrates and gradually shifts to mostly fish once they grow to be about 12 inches long. Rainbow smelt are the principal forage species for landlocked salmon in Maine lakes. Without adequate numbers of smelt, landlocked salmon growth and condition can decline, drastically reducing their value as a sport fish. Therefore, maintaining smelt populations is the most essential element of landlocked salmon management in Maine.

Landlocked salmon are among Maine's longest-lived sport fish. While most harvested by anglers are 2–5 years old, fish older than 5 are not uncommon. Populations sustained by natural reproduction often grow slower and have a greater number of older-age fish than those supported by stocking. The oldest landlocked salmon on record in Maine was a 13-year-old fish caught by an angler on Long Lake in Aroostook County in 1960.

There are often large variations in landlocked salmon growth rates from year to year that are mostly correlated to smelt abundance. MDIFW biologists have found that growth rates are highest in lakes with excellent water quality and a limited number of other smelt predators, particularly togue. The origin (hatchery vs. wild) of landlocked salmon in a waterbody often determines that population's growth and size potential. Hatchery sustained fisheries generally provide higher size quality than wild fisheries because the number of smelt predators (i.e., landlocked salmon) being stocked can be strictly controlled. Therefore, precise management for particular types of fisheries (e.g., trophy fishery) is best achieved in stocked waters with limited to no natural reproduction.

Management

The challenge of managing landlocked salmon as a sport fish has been recognized since the mid 1800s. Reports from early commissioners praised the sporting qualities of landlocked salmon and urged their propagation and distribution in Maine waters. However, only a small number of enthusiastic anglers benefited from the early sport fishery. Poachers reportedly accounted for many of the landlocked salmon harvested during this early period, especially during the spawning season when these fish were confined to small tributaries. Many of the early sport fisheries were exceptionally high quality with either fast action or large size quality. Even then, not all fish were trophy-sized. Some lakes (e.g., Sebago Lake) had a reputation for producing large fish in the 3–10-pound class, but other lakes seldomly produced landlocked salmon over 1–3 pounds. For example, a report in 1868 cited catch records from West Grand Lake from 1856 to 1858, where 1,641 landlocked salmon were caught in 2,367 hours, equating to an average of 0.69 fish per hour. However, the average weight of these fish was only 1.4 pounds.

Access to landlocked salmon waters gradually improved near the beginning of the 20th century, first through improved railroad transportation and later because of improved automotive transportation and better road networks. Logging operations gradually became more efficient and increased accessibility to more landlocked salmon waters, especially after World War II. An increasing number of anglers began to take advantage of opportunities to catch landlocked salmon, which soon became one of Maine's most sought-after sport fish species. Coincident with improved access and increased fishing effort, the Division's lake inventories revealed additional waters had the potential to provide fisheries via hatchery stockings. Successful stocking programs were established in many of these waters resulting in increased fishing opportunity and use.

The first documented landlocked salmon stocking in Maine occurred in 1868 when 800 eggs were planted in a tributary to Cathance Lake in Washington County. Interestingly, those eggs were collected from fish at Grand Lake Stream, the same source population where roughly 75% of Maine's stocked landlocked salmon still originate today. Gradual improvements in hatchery propagation, coupled with investigations into the success of various ages of stocked fish, have led to an overall reduction in stocking rates and improved angler success. For example, the state transitioned from primarily stocking fall fingerling (age 0+) landlocked salmon in the 1960s and 1970s to predominantly stocking spring yearlings (age 1+) today. Fall yearlings (age 1+) are utilized to a lesser extent (14% of all landlocked salmon stocked in 2020) throughout the state. Fish of this age class are larger (~ 12–14 inches long) at the time of stocking than spring yearlings (~ 8–10 inches) and are often stocked to provide immediate winter fishing and harvest opportunities on heavily fished lakes. Fall yearlings are also stocked in some flowing waters to create short-term stream fishing opportunities where demand for salmon fishing is high but suitable habitat is limited. Currently, about 100,000 landlocked salmon are stocked annually throughout Maine.

Maine's General Law for landlocked salmon includes a 14-inch minimum length limit on all waters and a 25-inch maximum length limit in rivers and streams. The 14-inch minimum allows most adults to spawn before reaching a harvestable size, and the 25-inch maximum protects adult sea-run Atlantic salmon (which are typically > 25 inches) from accidental harvest. In addition to length limits, the General Law includes a two-fish bag limit to protect populations from overharvest. Furthermore, the S-22 Special Law Code, which limits harvest to one fish, is imposed on high-use waters (51 waters in 2021) to protect against overharvest and spread the catch more evenly among anglers. While many of the state's salmon populations are limited in abundance, several are currently overpopulated and are experiencing reduced growth rates due to increased competition. The Division has been exploring several liberalized regulations to encourage harvest within these overpopulated populations and help improve the overall condition of the population. For example, at Aziscohos Lake (Oxford County), there is currently no size or bag limit on landlocked salmon less than 16 inches. The idea behind this management strategy is to decrease the population size so there are more smelt available per salmon, thus increasing the overall condition of the salmon population. However, liberalized regulations like this are only successful if anglers actively participate and harvest the fish they catch.

MDIFW has undertaken several habitat-related projects to increase wild salmon production by enhancing connectivity to spawning habitat. In addition, when smelt abundance isn't adequate to support salmon growth, biologists can enhance those populations via smelt egg, fry, and adult transfers. These transfers are only used as a temporary resolve and are never meant to be sustained. Stocking rates and harvest restrictions are reviewed if smelt abundance is routinely insufficient to support salmon fisheries.

MDIFW strives to maintain the distribution and abundance of landlocked salmon, provide diverse fishing opportunities, and improve the overall fishing quality for landlocked salmon. Changes in distribution, abundance, fishing pressure, and use opportunities, combined with a broader knowledge of habitat requirements and life history, have contributed to making landlocked salmon one of Maine's most intensively managed freshwater sport fishes.

Current Status and Distribution

Landlocked salmon occupy a total of 319 lakes and ponds, comprising 65% of the state's surveyed lake/pond area **(Figure 8, Table 9)**. The only major Maine waters that have a high potential to produce landlocked salmon fisheries, yet presently do not, are in the Allagash and upper Penobscot River drainages. Since these waters are managed for native populations of togue, brook trout, and lake whitefish, the introduction of landlocked salmon has not been considered, as they would likely have detrimental impacts on the native fisheries.

The landlocked salmon lakes of Maine are distributed such that most anglers live within a short driving distance of at least one of the waters. However, some of the better-known lakes are more widely dispersed. For example, the Rangeley Lakes in Franklin and Oxford Counties, the Grand Lakes in Washington County, and the Fish River Lakes in Aroostook County are all separated by hundreds of miles.

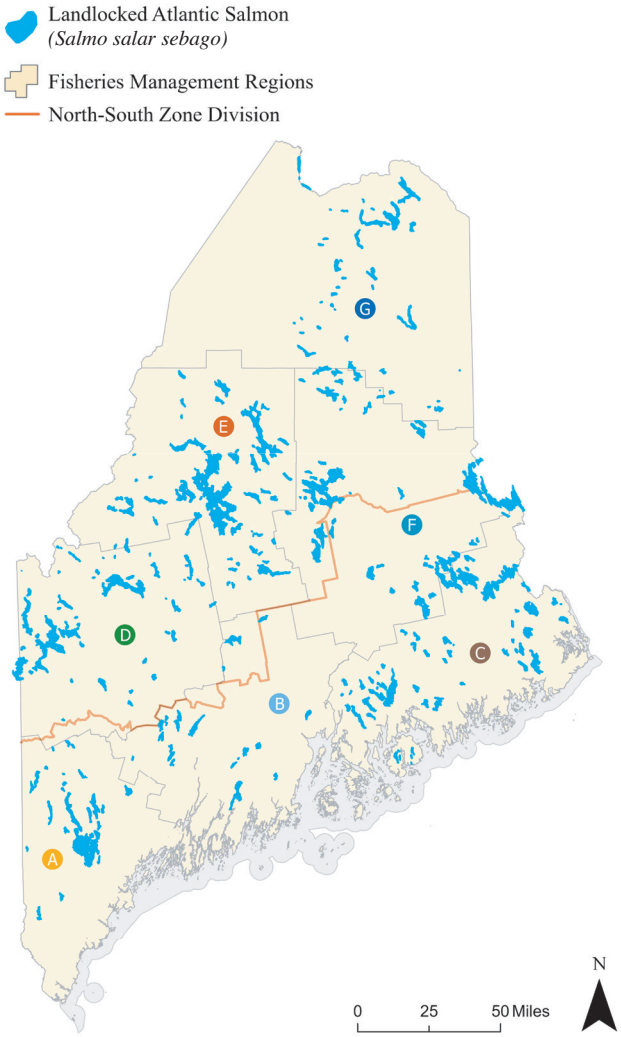


Figure 8. Lakes and ponds containing landlocked Atlantic salmon (319 waterbodies).

Table 9. Statewide distribution of lakes and ponds containing landlocked Atlantic salmon, 2020.

LAKES/PONDS CONTAINING LANDLOCKED ATLANTIC SALMON			
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	# OF DIRECTLY STOCKED LAKES/PONDS (INCLUDING AS % OF TOTAL)	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING LANDLOCKED ATLANTIC SALMON
A	29	24 (83%)	61%
B	22	13 (59%)	28%
C	63	35 (56%)	69%
D	56	19 (34%)	82%
E	51	15 (29%)	75%
F	55	29 (53%)	68%
G	43	5 (12%)	56%
STATEWIDE TOTAL	**319**	**140 (44%)**	**65%**

Most of Maine's principal fisheries for landlocked salmon occur in the cooler, deeper, oligotrophic (low productivity) lakes. However, nearly half of the principal fisheries are in mesotrophic lakes (moderately productive), and a small number even occur in eutrophic (highly productive) lakes. Aside from the fisheries in far southern Maine, most of these non-oligotrophic fisheries are in northern and western Maine, where summer surface temperatures regularly exceed 70°F. The fact that nearly half of the state's principal landlocked salmon fisheries occur in habitats formerly thought to be poorly suited for the species indicates how well these fish can perform across a diversity of habitats.

Of the 319 waters supporting landlocked salmon, 140 (44%) are sustained by direct stocking. All Fisheries Management Regions stock landlocked salmon in some of their waters. Regions A, B, C, and F are the most dependent on stocking to sustain their landlocked salmon fisheries.

The bulk of wild landlocked salmon fisheries are in western and northern Maine (Management Regions D, E, and G) where spawning and nursery habitat is most abundant. Drainages in these Management Regions that provide the highest quality spawning and nursery areas include the Kennebago and Magalloway Rivers in Region D, the West Branch Penobscot, Roach, and Moose Rivers in Region E, and the upper Aroostook River and thoroughfares connecting the Fish River Lakes in Region G.

River fisheries for landlocked salmon are confined primarily to Management Regions D, E, F, and G **(Table 10)**, but there are a few notable exceptions. For example, Grand Lake Stream in Region C is nationally recognized for its salmon fishery, and the Presumpscot River in Region A supports another popular salmon fishery. Currently, there are 50 river reaches totaling 321.4 miles that provide moderate-to-high quality sport fisheries for landlocked salmon. River fisheries are often associated with lake fisheries and may be seasonal rather than year-round.

Landlocked Atlantic Salmon Quick Facts

- Native to Maine: Yes
- Maine counties where this species occurs: 15 of 16; Androscoggin, Aroostook, Cumberland, Franklin, Hancock, Kennebec, Knox, Lincoln, Oxford, P enobscot, Piscataquis, Somerset, Waldo, Washington, York
- State record: 22 pounds, 8 ounces, 1907, Sebago Lake
- Average length of a mature adult: 12–20 inches
- Propagated in State hatcheries: Yes - stocked out as fall fingerling, spring yearling, fall yearling, and adult (retired brood)

Table 10. Landlocked Atlantic salmon river reaches with moderate-to-high fishing quality by Management Region.

RIVER REACHES CONTAINING LANDLOCKED ATLANTIC SALMON		
FISHERIES MANAGEMENT REGION	NUMBER OF RIVER REACHES	NUMBER OF MILES
A	3	33.8
B	1	3.9
C	2	3.5
D	10	80.3
E	16	93.8
F	10	57.8
G	8	48.3
STATEWIDE TOTAL	**50**	**321.4**

VIII. RAINBOW SMELT

Osmerus mordax

Introduction

Rainbow smelt *Osmerus mordax* (hereafter smelt) are a small-bodied fish species native to Maine. They provide a forage base for many coldwater sport fish species, making them a popular baitfish collected by anglers and sold by many baitfish dealers. In addition, many anglers target smelt throughout the state for their value as food. Statewide, smelt populations have been negatively affected by habitat degradation, and the illegal stocking of smelt has led to an ecosystem imbalance in numerous lakes and ponds. All the factors mentioned above have contributed to MDIFW placing a high priority on smelt management throughout the state.

Life History

Smelt are small, slender fish with a large mouth and prominent teeth. This species can be distinguished from other small-bodied species in Maine by the presence of a deeply forked tail and a small adipose fin.

Smelt typically inhabit cool, oxygen-rich, stratified lakes where, depending on lake-specific conditions, they may become extremely abundant. Smelt exhibit both anadromous and landlocked life history strategies. Anadromous populations — which spend much of their life in the ocean and ascend freshwater streams during the spring to spawn — are distributed along the east coast of North America from New Jersey to Labrador. Unlike anadromous populations, landlocked populations spend their entire life in freshwater. Established populations of landlocked smelt are found throughout the northeastern U.S. and eastern Canada, including many landlocked populations throughout Maine. This assessment is specific to landlocked populations of smelt, as the Maine Department of Marine Resources manages anadromous populations.

Smelt generally become sexually mature when they are one to two years old. Spawning is closely tied to ice-out, which can be as early as February/March in southern Maine and as late as May/June in northern Maine. Shortly after ice-out, smelt congregate at night in tributaries of lakes and ponds to spawn. Smelt will also spawn along shorelines or over offshore shoals when tributaries are limited or non-existent. Because smelt are not strong swimmers, spawning is often confined to the downstream-most slow-moving reaches of tributaries. Each female can release tens of thousands of eggs. After the eggs are released, they are quickly fertilized by nearby male smelt before settling and attaching to the substrate. Hatching generally occurs in two–three weeks depending upon water temperature. Newly hatched smelt are too weak to navigate through currents, so those spawned in streams eventually drift downstream into the lake or pond where their parents originated. Those that are spawned in the lake are carried into currents within the lake, where they remain until they grow large enough to navigate for themselves.

Growth rates of smelt vary depending on food availability. If there is an abundant food supply, smelt growth rate can be rapid. Assuming adequate forage from the time they hatch in late May, age-0 smelt can reach three to 3.5 inches long by late November. Smelt vary in size from water to water, but most mature individuals are three to six inches long. Smelt are carnivorous but will feed on a variety of food items, and their feeding habits are primarily size-dependent. Plankton and small aquatic invertebrates make up the diet of juvenile smelt, whereas older smelt target bigger forms of zooplankton, aquatic invertebrates, and even small fish. Smelt are also cannibalistic and will often feed on smaller smelt.

Management

While smelt are now widely distributed throughout Maine, their historical distribution may only have extended 50 to 60 miles inland from the coast. MDIFW established many of these new populations by introducing adult smelt or eggs to create or augment a forage base — primarily for salmonids — and to create additional opportunities for anglers to harvest smelt.

In the late 1990s, a group of stakeholders and state biologists recommended that MDIFW revisit the details regarding the legal transfer (stocking) of smelt between waters. This working group determined there was a substantial risk of introducing new diseases or parasites, particularly the parasite Glugea hertwigi, during live (i.e., after hatching) transfers. Consequently, a new policy was enacted which requires a peer review and subsequent approval by a Fisheries Administrator before transferring live smelt between waters. This policy also dictated that smelt eggs could only be transferred after a proper salt dip to treat against any potential Glugea hertwigi contamination. Currently, most of the State's smelt transfers are done using salt-treated eggs. Live transfers are rarely used due to the risks involved and the added time and resources required.

In addition to smelt egg transfers conducted by MDIFW, smelt populations have also been established through unauthorized introductions. Illegal movement of smelt is often done by people attempting to establish smelt populations to improve their own personal opportunities without regard to the interest of other anglers or ecosystem health. However, stocking smelt into new waters has the same potential risks as introducing any new species to an ecosystem, including the extirpation of native fish. Removing illegally introduced smelt populations can cost tens of thousands of dollars, if not more, and is often impossible based on the physical characteristics of these waters.

Smelt habitat degradation and other negative impacts have also increased dramatically in recent years. As the areas surrounding lakes and ponds become more developed, environmental impacts to smelt habitats increase. For example, shoreline development has led to accelerated eutrophication in some lakes (e.g., Sabattus Pond, Cobbosseecontee Lake, and Sebasticook Lake). Because eutrophication leads to oxygen depletion and smelt require oxygen-rich water, most areas within these water bodies eventually become so depleted in oxygen that smelt struggle to survive. In addition, increased siltation in streams caused by poorly managed forestry and agricultural practices has, in some cases, buried spawning substrates and drastically reduced the amount of available spawning habitat. Due to the fall in beaver pelt prices, beaver dams are becoming more abundant throughout Maine and are limiting the amount of available stream spawning habitat for many smelt populations. Finally, the spread of invasive species has had a detrimental effect on smelt populations through competition for forage and space.

MDIFW's smelt management objectives, in order of priority, are:

1. Provide forage for salmonids.
2. Provide a recreational fishery for smelt where it will not adversely impact salmonid forage.
3. Provide an opportunity for commercial smelt fisheries that will not conflict with salmonid forage or recreational smelt fishing.

Therefore, a water will not be open to commercial harvest unless there's adequate forage for salmonids and the commercial fishery doesn't impact the recreational fishery. Similarly, a water will not be open to recreational harvest unless there is adequate forage for salmonids. For those waters open to harvest, MDIFW General Law limits anglers to no more than two quarts of smelt per day, and special laws on some waters limit harvest to one quart. These limits help ensure enough smelt remain after harvest to spawn and sustain the population. Smelt harvested by commercial smelt dealers are commonly sold through both wholesale and retail bait markets. A Maine smelt wholesaler's license ($71.00 in 2020) allows holders to: capture smelt by hook-and-line, dipnet, and dropnet; harvest up to eight quarts of smelt daily from select waters, or two quarts from all other waters open to the taking of smelt; possess more than the daily allotted harvest level as long as they were legally taken; and sell smelt. The daily eight-quart harvest limit is restricted to waters designated by the Department, which are selected in accordance with the overall smelt management objectives.

Smelt population abundances can be highly variable year-to-year and are therefore difficult to quantify and track over time. In the early 2000s, the Division started using hydroacoustics to survey smelt populations and develop abundance and biomass estimates. These methods provided important information on the status of some of Maine's smelt populations but were eventually discontinued due to unforeseen cost-prohibitive software updates and the time-consuming nature of the data collection and analysis. Smelt populations are currently monitored through several indirect observations, including inferring abundance based on salmonid growth and condition, determining the relative abundance of smelt within salmon and togue stomachs, visually observing and estimating the density of spawning smelt runs, interpreting the quality of hook-and-line fisheries, and by reviewing miscellaneous reports from user groups and game wardens. Salmon growth and condition tend to provide the best objective indicator of smelt abundance, though there is often a substantial lag time between when the change in smelt abundance occurs and when salmon start showing the effects. This lag further delays corrective actions and, consequently, the recovery of the forage base. Furthermore, many of our smelt lakes do not support salmon populations. A new smelt population estimation method is currently (started in 2017) being tested on a tributary of Moosehead Lake with the expectation that it will circumvent some of the issues outlined above. This project involves sampling emerging smelt fry as they drift downstream, followed by sampling age-0 smelt in the lake. If successful, these methods may be replicated in other lakes and ponds to more accurately estimate smelt abundance.

While smelt management is far from cut and dry, fishery biologists emphasize ensuring populations are abundant enough to provide adequate forage for salmonids. Without a robust forage base, many of Maine's renowned coldwater fisheries would begin to collapse. However, when data suggests that smelt provide adequate forage with a surplus, managers open those waters to harvest. With so many factors at play, smelt are considered the most dynamically managed freshwater species in Maine.

Current Status and Distribution

Smelt are found in 569 lakes and ponds throughout the state **(Figure 9, Table 11)**. Once believed to occur only in deep, coldwater lakes, they are now known to inhabit a variety of lake environments including small, shallow, and even some eutrophic water bodies. The only types of standing water habitat where smelt have not been found are bogs, very shallow homothermous ponds with high summer water temperatures, and temporary ponds created by beavers.

Smelt populations are found throughout Maine, though principal fisheries are most common in the northern portion (particularly Regions F, and G) of the State. The majority (61%) of waters open to commercial harvest are in the three coastal regions (A, B, and C; see **Table 11**), with the bulk of those waters located in central Maine.

Rainbow Smelt Quick Facts

- Native to Maine: Yes
- Maine counties where this species occurs: All 16 counties
- State record: N/A
- Average length of a mature adult: 3–6 inches
- Propagated in Maine state hatcheries: No, but MDIFW occasionally transfers eggs between waters to augment existing populations.

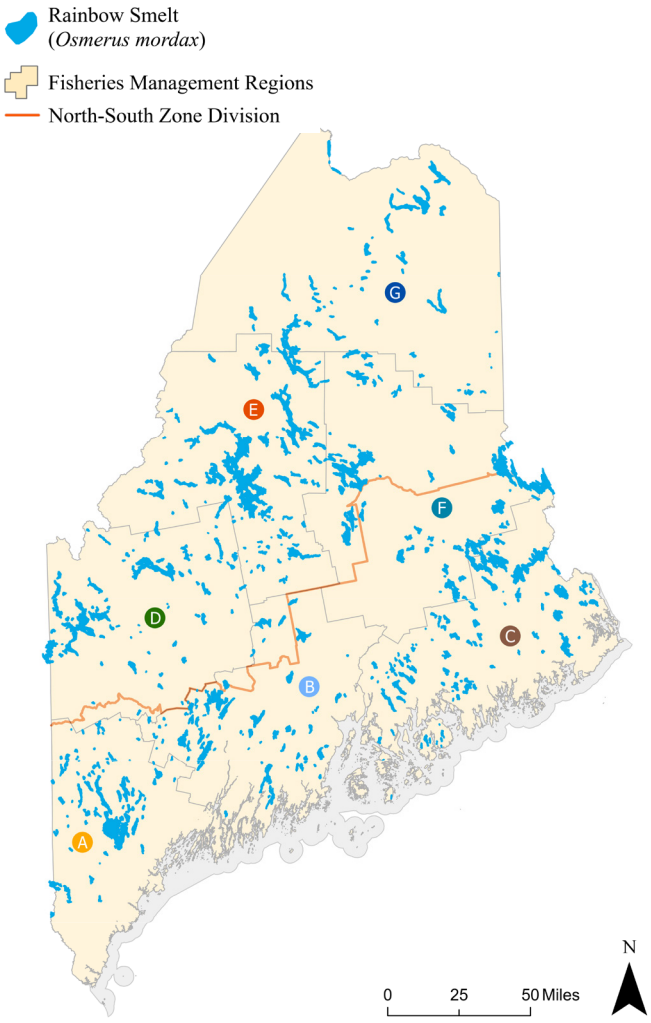


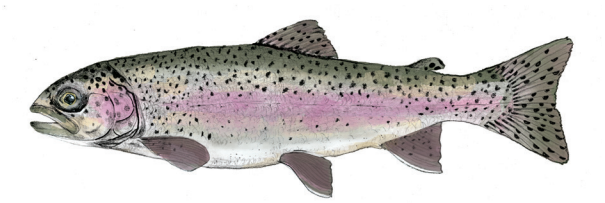
Figure 9. Lakes and ponds containing rainbow smelt (569 waterbodies).

Table 11. Statewide distribution of lakes and ponds containing rainbow smelt, 2020.

LAKES/PONDS CONTAINING RAINBOW SMELT				
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING RAINBOW SMELT	# OF WATERS OPEN TO COMMERCIAL HARVEST	% OF WATERS OPEN TO COMMERCIAL HARVEST
A	85	81%	34	40%
B	84	73%	66	79%
C	107	70%	39	36%
D	76	88%	29	38%
E	88	87%	41	47%
F	73	72%	20	27%
G	56	78%	9	16%
STATEWIDE TOTAL	569	79%	229	40%

IX. RAINBOW TROUT

Oncorhynchus mykiss



Introduction

Rainbow trout *Oncorhynchus mykiss* are not native to Maine but have been intermittently stocked throughout the state by federal and state agencies since the 1930s. In 2007, MDIFW established a more permanent rainbow trout stocking program that has been well received by anglers and has created some excellent fishing opportunities. About 10% of Maine anglers currently target rainbow trout during the open water and ice fishing seasons (Responsive Management 2016). This seemingly low participation rate for such a desired species is likely influenced by their limited distribution, mostly restricted to southern and central Maine. Given its recent success, a gradual expansion of the rainbow trout stocking program is anticipated, though likely still with limited scope due to concerns regarding interspecific impacts with Maine's native salmonid species.

Life History

Rainbow trout exhibit both landlocked and anadromous (referred to as "steelhead") life history strategies, though there are no anadromous populations of rainbow trout in Maine. The original range of rainbow trout included freshwater habitats and coastal areas extending from northwestern Mexico to the southwestern coast of Alaska and west to Russia. Within the U.S., freshwater populations were predominantly located as far inland as the Rocky Mountains. Rainbow trout are one of the more plastic species of salmonids, with a wide range of subspecies that can vary in physical appearance, habitat requirements, and behavior. Their popularity as a sport and food fish and the variety of subspecies available for hatchery propagation have resulted in human introductions that have greatly expanded their distribution. Rainbow trout now occur in suitable habitats throughout North America and every other continent except for Antarctica. Life history strategies can vary among the subspecies of rainbow trout; what follows is a general description that covers most of the subspecies.

Rainbow trout are typically spring spawners, spawning almost exclusively in streams between mid-April and late June. River-resident (fish that complete their life cycle within flowing water) rainbow trout generally spawn in headwater areas of the mainstem river or smaller tributaries. Mature rainbow trout, which are 2–3 years of age or older, may start to ascend spawning tributaries as early as late fall in search of suitable spawning habitat. Spawning behavior generally occurs at water temperatures between 50°F and 60°F. Females typically select redd sites in riffle sections located upstream of holding pools or in tailouts below pools where water depth, flow, and gravel size are appropriate. Multiple redds are often dug, and each female will spawn with one or more males. Once the eggs have been fertilized, the female moves upstream of the redd and uses her caudal fin to cover the eggs with gravel. Rainbow trout can spawn multiple times within their lifespan.

Like most fish species, water temperatures heavily influence the rainbow trout's incubation period, but eggs generally hatch in four to seven weeks. Sac-fry (recently hatched, egg sac still attached) remain in the gravel for about a week while they absorb their egg sacs. Once the egg sac is absorbed, small fry emerge from the gravel and begin feeding on drifting zooplankton. Fry of river-resident adults remain in the stream system. In contrast, the fry of lake-resident adults may emigrate to their parent's home lake before growing to a larger size.

Juvenile and adult rainbow trout are opportunistic feeders that consume a wide variety of food. Aquatic insects are their most common prey, but zooplankton, terrestrial insects, crustaceans, mollusks, amphibians, leeches, and fish can be seasonally or locally important. Rainbow trout, like other salmonids, generally shift their diet from smaller-sized food items to larger items as they grow. Fish generally do not become an important part of their diet until they reach approximately 12 inches in length.

Rainbow trout growth is highly variable and depends on several factors, including climate, habitat, population size, subspecies (including hatchery strain), and food availability. Rainbow trout exceeding 40 pounds have been documented, but most adult fish weigh anywhere from 0.75 to 9 pounds and are 10–27 inches long.

Life expectancy can also vary considerably, but 2–4 years is typical for rainbow trout in streams and small lakes and ponds.

Management

The federal government stocked rainbow trout fry and fingerlings throughout Maine during the late 1930s and early 1940s. These early stockings established the wild populations currently found in portions of the Androscoggin and Kennebec Rivers. Rainbow trout were not stocked anywhere in Maine from the mid-1940s to 1968, and management was limited to protecting spawning fish within select Kennebec River tributaries by postponing the opening day of the fishing season until June 1. Expanding the distribution of rainbow trout during this time was discouraged mainly due to concerns regarding straying tendencies of stocked rainbow trout, potential competition with native coldwater species, and hatchery infrastructure constraints.

Between 1968 and 1973, the Department initiated an experimental rainbow trout stocking program to compare their performance to brook trout in terms of growth, holdover ability, summer fishing opportunity, and resistance to competition. Results from the study were mixed: rainbow trout performance exceeded, fell short of, or resembled brook trout performance depending on the study site. A post-project review of the study methods and data, as well as discussions with staff, indicated the study faced several problems (e.g., hatchery strain variations and limited seasonal creel censuses) which may have contributed to the ambiguous results. Regardless, rainbow trout were found to grow well on several study waters by utilizing a variety of fish and insects for forage, suggesting they might perform well on moderately sized lakes where unreliable supplies of smelt limited salmon production.

Between 1974 and 1978, MDIFW reexamined rainbow trout performance on 15 different lakes ranging from 60 to 1,220 acres in size, where forage opportunities limited landlocked Atlantic salmon returns.

During this time, the Department also enacted a 12-inch minimum length limit on rainbow trout in lakes and ponds due to high catch rates and to make the regulations more closely match those of landlocked Atlantic salmon. Creel censuses on six of the study waters demonstrated that rainbows grew well but provided low angler returns (census was done during the ice fishing season, which typically has lower catch rates than the open-water season). Much like the previous study (1968–1973), this rainbow trout evaluation also had some design flaws. The state had trouble acquiring disease-free eggs from year to year, which resulted in five different hatchery strains being used throughout the study period. This complicated the study results because biologists could not determine if performance issues were related to the strain of fish being used or lake-specific conditions. The Department discontinued the rainbow trout stocking program in 1979 because of the difficulties associated with acquiring disease-free egg sources, the danger of accidentally mixing and releasing rainbow trout with other species in the hatchery system, and the program failing to meet general expectations consistently.

The termination of the rainbow trout stocking program in 1979 did not go unnoticed by the angling public and eventually led to a growing demand to stock rainbows again, particularly in southern and central Maine. At the same time, fishery biologists in some Management Regions believed rainbow trout might provide improved angling opportunities in some management situations. Therefore, in the fall of 1997, the Department established a committee to revisit the prospect of establishing a stocking program for rainbow trout. The committee reviewed supporting evidence from a combination of professional knowledge, scientific literature, and discussions with other fisheries management agencies. It ultimately determined rainbow trout had the potential to provide some benefits for Maine anglers. These benefits included higher catch rates than brown trout, better ability to tolerate marginal water quality and competition than brook trout, longer seasonal availability (including better holdover ability) to the angler than brook trout, and more opportunistic feeders than brook trout. The committee and fisheries management staff agreed that a pilot study was needed before starting a routine stocking program. The study's premise was to thoroughly evaluate the relative performance of rainbow trout against both brook trout and brown trout in several Maine waters. Experimental stockings were initiated in the spring of 2001. Formal evaluations began in the winter of 2002, continued until 2006, and were reported in 2007 (Pellerin 2007). Favorable results led to the establishment of a small stocking program (i.e., about 25 waters were stocked annually) with the intention of a gradual expansion into the future.

Current Status and Distribution

Lakes and Ponds

Rainbow trout are currently found in 31 lakes and ponds comprising 2% of Maine's total surveyed lake/pond acreage **(Figure 10, Table 13)**. The distribution of rainbow trout in lakes is primarily limited to southern, central, and coastal Maine. Their occurrence is restricted compared to other coldwater salmonids in the state for several reasons: they are not native to the state; historical stockings were limited and typically failed to produce self-sustaining populations; and until relatively recently, they were not part of any regular state-sponsored stocking program.

Rivers and Streams

Rainbow trout fisheries in Maine rivers and streams are comprised of both stocked and wild populations. Stocked populations are currently limited and predominantly restricted to rivers in southern, central, and western Maine, including portions of the Little Androscoggin, Androscoggin, Megunticook, Carrabassett, and Swift Rivers **(Figure 11)**. Wild populations of rainbow trout occur in segments of only a few large to moderate-sized rivers in Western Maine, including the Kennebec, Androscoggin, and Dead River drainages.

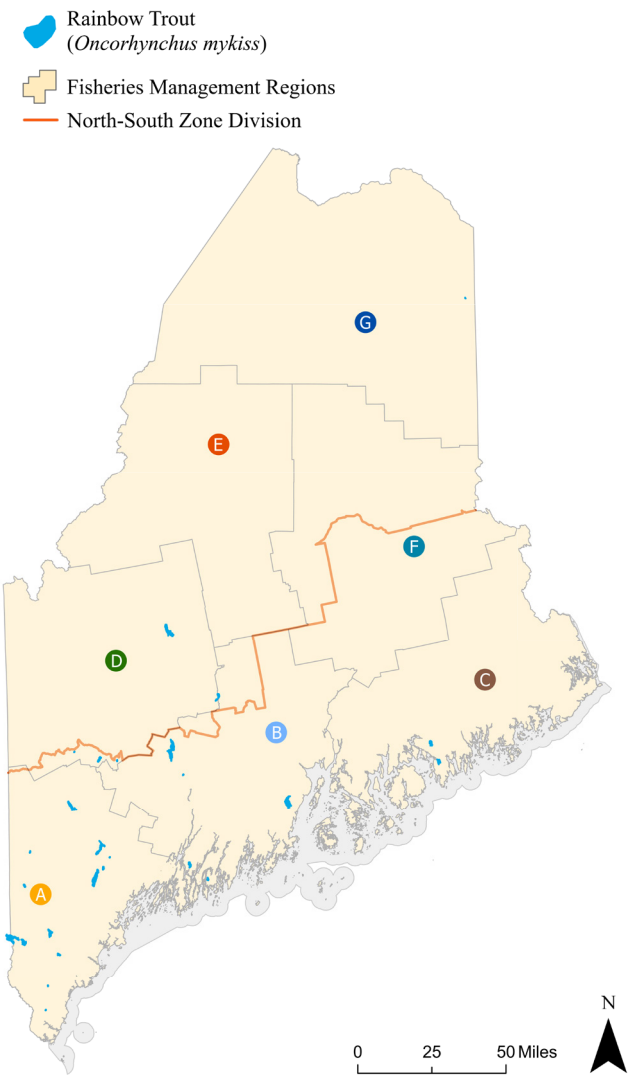


Figure 10. Lakes and ponds containing rainbow trout (31 waterbodies).

Table 13. Statewide distribution of lakes and ponds containing rainbow trout, 2020.

LAKES/PONDS CONTAINING RAINBOW TROUT			
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	# OF DIRECTLY STOCKED LAKES/PONDS (INCLUDING AS % OF TOTAL)	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING RAINBOW TROUT
A	19	14 (74%)	9%
B	8	6 (75%)	8%
C	2	2 (100%)	1%
D	1	0	< 1%
E	0	0	0%
F	0	0	0%
G	1	0	< 1%
STATEWIDE TOTAL	31	22 (71%)	2%

The Kennebec River population is predominantly located in the mainstem and tributaries from the village of The Forks to several miles below Solon Dam, including Wyman Lake. This population was established from federal stockings that occurred in the late 1930s and early 1940s. The upper Androscoggin River, primarily from the Maine/New Hampshire border to Bethel, and many of its tributaries support rainbow trout populations which may have developed as early as the 1940s. However, numerous stockings have occurred upstream on the New Hampshire side of the border since the 1940s, making it difficult to determine precisely when and how the Maine population developed. Natural rainbow trout reproduction has also been documented in a reach of the Dead River and several associated tributaries downstream of the Long Falls Dam on Flagstaff Lake. This population is believed to be the result of fish that escaped a private hatchery located on a nearby tributary. Other self-reproducing populations occurred in the past (e.g., within the Aroostook River), but these populations eventually died out with time as the stockings were discontinued.

Even though rainbow trout have been stocked in various habitats throughout Maine, they have produced relatively few wild, self-sustaining populations. Interestingly, all the waters with self-sustaining populations have the following similarities: a large to moderate-sized river system; relatively good water quality; cold, freestone tributaries for reproduction; and a location with mountainous topography. These features may be important considerations to select against, to discourage the establishment of self-sustaining populations and to protect native species.

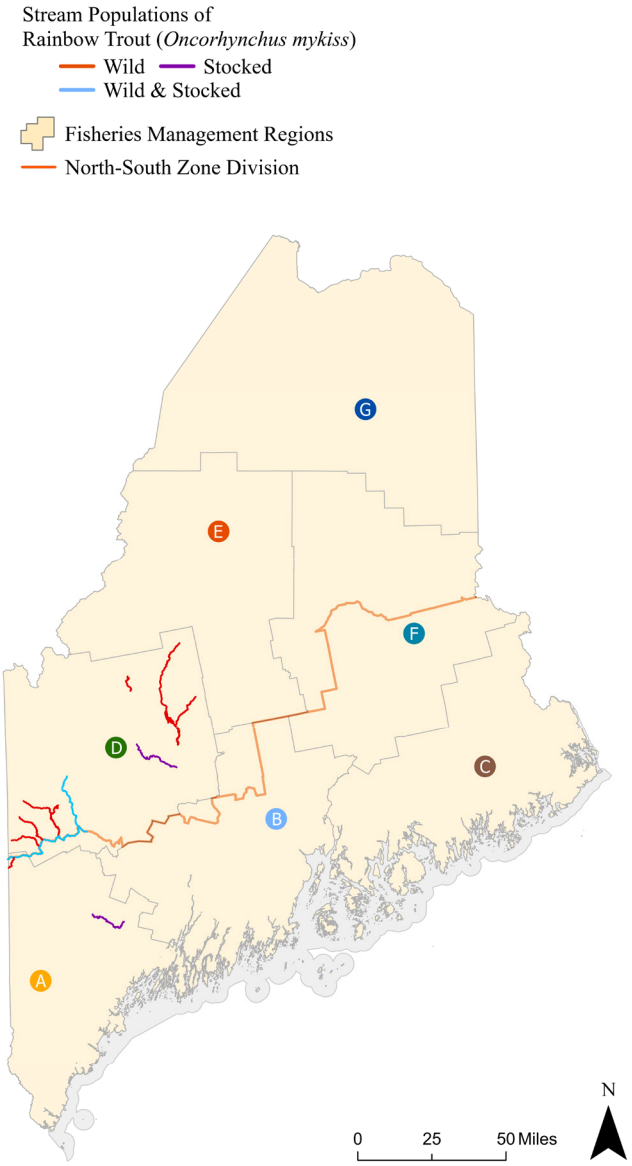


Figure 11. Riverine populations of rainbow trout.

Rainbow Trout Quick Facts

- Native to Maine: No
- Maine counties where this species currently occurs: 12 of 16; Androscoggin, Aroostook, Cumberland, Hancock, Kennebec, Knox, Lincoln, Oxford, Sagadahoc, Somerset, Waldo, and York
- State record: 13 pounds, 7 ounces, and 32.5 inches long, caught in 2016 at a quarry pond in Vinalhaven, Maine
- Average length of a mature adult: 13–18 inches
- Propagated in Maine state hatcheries: Yes - stocked out as spring yearling, fall yearling, and adult (retired brood)

X. SPLAKE

Salvelinus namaycush x Salvelinus fontinalis

Introduction

Splake *Salvelinus namaycush x Salvelinus fontinalis* are a hatchery-produced hybrid trout (cross between a male brook trout and female togue) stocked to provide additional coldwater fisheries across the state. Past studies in Maine found that splake outperform (e.g., grow faster, survive longer) hatchery brook trout in many cases. Because of their superior performance, splake are often stocked in waters where hatchery brook trout do not meet performance expectations. While they are a fertile hybrid, successful reproduction is rare, if not practically non-existent, and has never been documented in Maine. Being reliant entirely upon hatchery production means these fish occur less frequently than any other coldwater fish species in Maine. Their limited distribution (not lack of angling quality) likely explains why less than 10% of Maine anglers target this hybrid species (Responsive Management 2016).

Life History

Splake have been cultured in North America since the early 1870s. Although they are the only salmonid cross capable of reproducing for an indefinite number of generations, successful reproduction has only occurred in hatcheries. Splake have been introduced into a variety of waters across North America since the late 19th century. Nevertheless, there is no credible documentation of any wild, self-reproducing splake populations.

Morphologically, splake lie between both lake and brook trout. Identification of splake is sometimes tricky by external examination. Splake and brook trout have very similar color patterns, but splake tend to have a slight fork in the tail, a trait passed down from its togue parent, while brook trout tend to have no fork. Although it requires cutting the fish open, splake can be distinguished from other species by counting the number of pyloric caeca (small sac-like structures in the stomach/intestine area); brook trout have 23 to 55, splake 65 to 85, and togue 93 or more. Due to the difficulties associated with distinguishing between the three species, they are often regulated under the same bag and length limits in waters where they coexist.

Splake have swim bladder gas retention characteristics that enable them to inhabit deepwater habitats. They require similar dissolved oxygen concentrations as togue and brook trout and prefer water temperatures somewhere between togue and brook trout (upper limit is about 54°F and 61°F, respectively).

The rate of maturation for splake is more characteristic of brook trout than togue. Spangler and Berst (1976) found that in Lake Huron, 34% of male and 4% of female splake examined were sexually mature by age 2, and by age 4, 100% of both sexes were mature. Splake have been observed on togue spawning shoals in Lake Huron and brook trout spawning areas in Redrock Lake, Ontario, but natural reproduction has never been documented in these waters or any waters in Maine. Characteristics of either parental strain may control growth. Therefore, a slow-growing strain of either parent could produce a slower-growing splake.

Environmental conditions, such as poor water quality and extreme competition, may also limit growth potential. Splake express "hybrid vigor" in the first generation (F1), often exhibited through faster growth rates than either parental stock. However, this characteristic fades as progeny are taken to the second generation (F2) and beyond. At the Governor Hill Hatchery in Augusta, where Maine's splake are reared, Manitoba strain togue and Phillips strain brook trout were used as female and male parents from 1981 to 1996. From 1996 to 1999, wild strains of togue and brook trout from within the Maine hatchery system were used to create splake. Unfortunately, these wild crosses resulted in slower-growing fish and a decline in some splake fisheries. Therefore, since 1999, only domesticated parental strains have been used for splake production.

Until they are a year old, splake feed almost exclusively on invertebrates, but fish make up most of their diet by age two. In Maine, splake exhibit flexible food habits, and although they are most likely to feed on smelt and white perch, they will also feed on yellow perch, crayfish, sunfish, and minnows. This adaptative behavior allows splake to maintain good growth and condition during years when smelt are not abundant.

Management

The first introduction of splake in Maine took place at Long Pond in Washington County in 1958. Returns to anglers were encouraging, with splake outperforming paired stockings of rainbow trout, landlocked Atlantic salmon, and brook trout. However, it was not until 1980 that MDIFW reexplored the use of splake as a sport fish. The first-year class of this restored stocking program was stocked into Basin Pond and Minnehonk Lake in 1981. Splake now occur in 73 waters spread throughout the state.

In the early years (1986-1996) of the splake program, most waters were regulated under a General Law five-fish bag limit and 6-inch minimum length limit. Data collected during a five-year splake study indicated that more restrictive regulations would improve survival to older ages and enhance the quality of most splake fisheries. In 1996, the Class I trout regulations, which included a two-fish bag limit with a 12-inch minimum length limit where only one fish may exceed 14 inches, replaced General Law regulations on most splake waters. In addition, high quality or trophy regulations were put in place to provide opportunities to catch larger than average splake in a select number of waters. These regulations, which are still in place, include a one-fish bag limit with either a 14- or 18-inch minimum length limit. More liberal regulations may apply where there is concurrent management for other species, such as stocked brook trout.

Current Status and Distribution

Maine's splake sport fisheries are maintained entirely through stocking in lakes and ponds. In most cases, Maine's flowing waters do not have sufficient water quality in the summer to support splake. However, stocked fish may temporarily utilize flowing waters during the cooler periods of the year. Splake populations are distributed throughout the state **(Figure 12, Table 14)**, with the majority located in Management Regions C and E. These regions had early success with creating high-quality splake fisheries in several waters, and anglers were very receptive to these newly created fisheries. In addition, splake are often used in these regions to create fisheries where other hatchery species cannot be used because of potential interactions with native species.

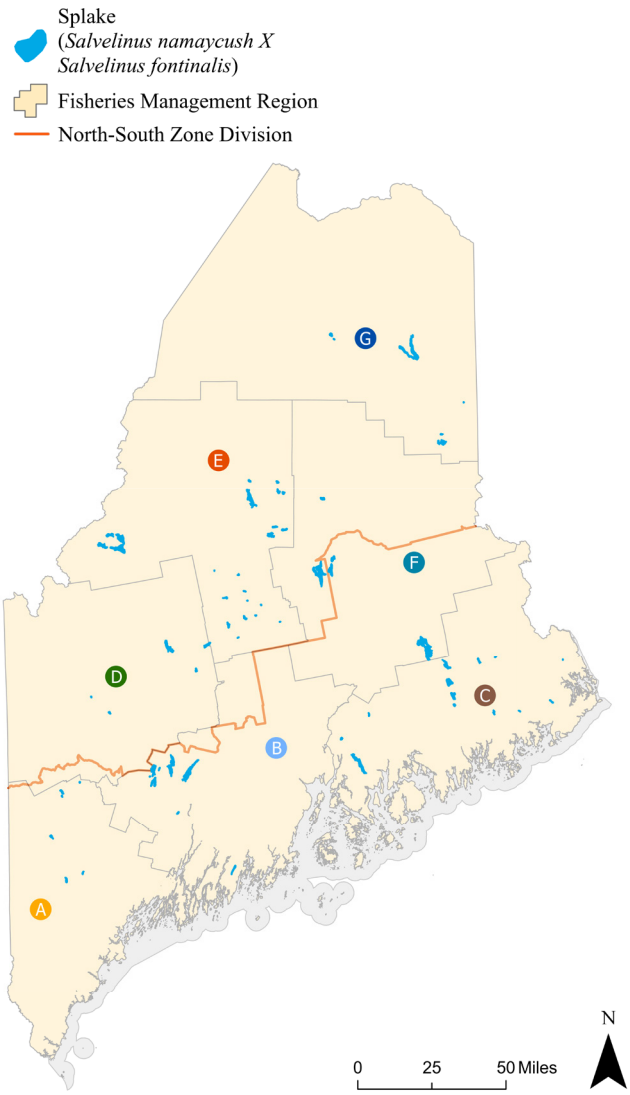


Figure 12. Lakes and ponds containing splake (73 waterbodies).

Splake Quick Facts

- Native to Maine: No
- Maine counties where these species occur: 11 of 16; Aroostook, Cumberland, Franklin, Hancock, Kennebec, Lincoln, Oxford, Penobscot, Piscataquis, Somerset, and Washington
- State record: 14.7 pounds caught at Pleasant Pond (Turner, Maine) in 2019
- Average length of a mature adult: 12–18 inches
- Propagated in Maine state hatcheries: Yes - stocked out as fall fingerling, spring yearling, and fall yearling

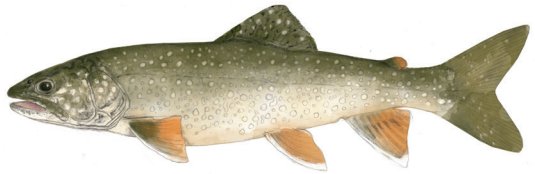
Table 14. Statewide distribution of lakes and ponds containing splake, 2020.

LAKES/PONDS CONTAINING SPLAKE			
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	# OF DIRECTLY STOCKED LAKES/PONDS (INCLUDING AS % OF TOTAL)*	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING SPLAKE
A	6	6 (100%)	1%
B	9	7 (78%)	12%
C	16	14 (88%)	5%
D	3	3 (100%)	< 1%
E	27	21 (78%)	6%
F	6	5 (83%)	7%
G	6	6 (100%)	7%
STATEWIDE TOTAL	**73**	**62 (85%)**	**6%**

**All splake in Maine are hatchery produced; wild reproduction (brook trout x togue) has never been documented in the state. Values in this field do not include waters that are indirectly stocked.*

XI. TOGUE

Salvelinus namaycush



Introduction

Togue *Salvelinus namaycush* are one of Maine's most popular native coldwater sport fish species and are known by a variety of common names, including lake trout, mackinaw, and laker. A recent Maine angler survey found togue were the third most targeted species during the ice fishing season and fifth most targeted during the open-water season (Responsive Management 2016). In the winter, they provide excellent action throughout the entire ice-fishing season and can be caught by anglers of all levels of experience. Soon after ice-out, togue can be taken near the surface with light tackle. As late spring approaches, they move into deep water where, until recently with the advent of downriggers, special angling techniques such as wire and lead line have been required to provide fishing success. Togue are a valuable fishery resource because of their excellent quality as a food, low incidence of disease and parasites, adaptability to suitable environments, attractiveness as potential trophy game fish, and responsiveness to various management strategies.

Life History

Togue lack the distinctive bright coloration of their close relative, the brook trout. Instead, togue are usually dark green or grayish-brown in color, with white or pale-yellow bean-shaped spots. In clear waters, togue are often so silvery that their spots are faded and difficult to see. In stained waters, their bodies are very dark, almost black. Generally, a narrow border of white is present along the anterior margins of the pectoral, pelvic, and anal fins. These white margins are most pronounced during spawning; however, at no time are they as accentuated as they are on brook trout. In addition, togue fins are not orange or red-orange like those of brook trout.

Togue are native to northern New England, the Great Lakes basin, Alaska, and much of Canada. Because togue have been successfully reared in hatcheries, their range has been extended considerably within Maine and the United States. Togue are the third largest member of the salmon and trout family (Taimen and Chinook salmon are larger). In 1961, a togue weighing 102 pounds was caught in a gill net in Lake Athabasca, Canada. The North American rod and reel record is a 72.25-pound fish taken in 1995 from Great Bear Lake, Northwest Territories, Canada. Maine's rod and reel record fish of 39.2 pounds was caught in 2020 at Lower Richardson Lake in Township C, but such large fish are exceptions rather than the rule. In most Maine waters, even those where togue live under optimum conditions, adults do not commonly attain weights over 5 pounds.

In Maine, togue habitat typically consists of large, deep, coldwater lakes with irregular bottom contours and rocky shorelines. From fall to early spring, when water temperatures are cool, togue are often found in shallow water around the shore. As surface water warms in the late spring/early summer, they retreat to deeper water where they remain until the fall. Because togue are sensitive to water quality, they are most abundant in lakes with large volumes of deep water where temperatures do not exceed 60°F throughout the year and where dissolved oxygen remains above 6 ppm.

While the life span of the togue varies considerably, they are the longest-lived of all of Maine's salmonids. Individuals exceeding 20 years in age are not uncommon in Maine, and biologists have even documented some fish that are more than 25 years old. Togue grow at a rate of two to four inches per year for the first six years of their lives. However, as individuals mature, their growth rate slows, often to ≤ one inch per year beyond age seven or eight. Males usually mature at younger ages and smaller sizes than females. Some males mature as early as age five when they are about 16 inches long, but most mature at age six when they are 16–18 inches long. Females will mature as early as age six when they are about 18 inches long, but most do not mature until age seven or eight when they are 20+ inches long. Although males may spawn every year, females often spawn only once every two to three years.

Togue spawn in the fall from mid-October (most southern Maine waters) to mid-November (most northern Maine waters) as surface water temperatures cool below 60°F. Mature fish typically congregate near exposed, shallow shoals or rocky shorelines. Spawning occurs at night, typically in depths less than six feet. They often spawn within 30 feet of shore over broken ledge, large rocks, boulders, or rubble ranging in size from five to 25 inches in diameter. Eggs are broadcast over the substrate where they eventually settle and become sheltered in spaces between the rocks. The eggs then incubate over winter and hatch in five–six months, usually in April. Freshly hatched fish remain close to the rocks where they were born until they've absorbed their yolk sacs. As soon as the yolk sac is absorbed, they move into deep water where they are less susceptible to predation.

During the togue's early years of life, its diet consists mainly of insects and crustaceans. Individuals begin to feed on fish when they attain lengths of 8–10 inches. Once togue begin to feed on fish, they adapt their feeding habits to utilize a variety of forage fishes. Their growth and condition are dependent upon the type and abundance of forage available. In Maine, togue historically fed on whitefish, suckers, minnows, sunfish, slimy sculpins, white and yellow perch, cusk, and sticklebacks. It is important to note that smelt did not coexist with togue under natural (i.e., historical) conditions. However, where smelt have been introduced, togue feed on this species almost to the exclusion of all other forage, no matter how abundant other suitable species seem to be. It is unknown whether this phenomenon results from a preference for smelt by togue, or simply a case of smelts being easier prey. In addition, togue will feed almost exclusively on landlocked alewives in waters where the two species occur. Although food habit studies do not indicate that small togue comprise a significant food item in the diet of adult fish, togue will prey upon their young, especially upon newly stocked togue before the young fish have an opportunity to disperse.

Management

Wherever self-sustaining populations of togue occur, fishery management emphasizes protecting these wild fish resources. Due to undocumented stockings that happened throughout the early 1900s, it is nearly impossible to determine the exact natural distribution of togue in Maine. Over the years, stocking has certainly increased their distribution and abundance throughout the state and has created self-sustaining populations in waters where they were historically absent. Stocking records indicate 21 togue waters (19 of which are in Management Regions E, F, and G) have never been stocked with or influenced by togue stocked elsewhere within the drainage; therefore, the populations in these 21 waters are assumed to be native. The following practices have been in place to protect the genetic integrity of these native populations: a recommendation to not stock other predators, competitors, or prey; protection of the aquatic and riparian habitat that supports the native populations; routine monitoring of water quality; and creation of regulations that ensure both spawning escapement and protection of older age classes in each native population.

Since the late 1970s, improvements in the size and condition of spring yearlings reared in Maine hatcheries, combined with advances in the transportation and methods of stocking fish, have greatly increased post-stocking survival. Thus, the number of fish stocked each year has decreased without negatively affecting angler opportunities. For example, in the 1970s over 400,000 spring yearlings were stocked in over 50 waters, but current production calls for only around 10,000 fish in 20 waters. Furthermore, due to the increase in survival, some togue waters no longer need to be stocked annually and instead are stocked every other year; and for some, every third year. In a growing number of waters, wild populations have established, eliminating the need for stocking.

Togue reared in Maine's hatcheries have originated from out-of-state and in-state sources. The most recent out-of-state source came from New York in 1976. This deep-spawning strain from the Finger Lakes was selected for its ability to do well in deep lakes like Sebago, where severe overwinter drawdowns occur. The last togue progeny of the Finger Lake strain were stocked out in 2002. Most of the togue used to stock Maine's waters have been sourced from broodstock created from wild populations in Maine, including Allagash Lake, Cold Stream Pond, and Lower Wilson Pond. In 2010, togue from Schoodic Lake were collected to establish a new hatchery brood line which is now the state's only source of togue. In addition, eggs from this brood line are combined with male brook trout sperm to create all the state's splake.

For many years, Maine's togue populations were managed and maintained with liberal fishing regulations. However, during the past 50 years, increases in leisure time and angler mobility, improvements in access to many areas, and improvements in fishing gear and techniques have led to an overall increase in angling pressure and harvest of togue. Statewide General Law regulations have changed in response. Since 1950, when a 25-fish bag and possession limit was in effect, bag limits have been reduced five times. The present General Law bag limit permitting only two togue per day was initiated in 1982.

The current General Law regulation (two fish, 18-inch minimum length) has been very successful in maintaining most of Maine's togue populations; and in some cases, more successful than desired. Increased spawning escapement resulting from the 18-inch minimum length limit produced an overabundance of wild fish in some waters. Reproduction within these populations resulted in large numbers of young, wild fish. In some cases, these abundant populations of small fish have negatively impacted the available forage (mainly smelt) and the management of other species. Special regulations have recently been implemented that decrease length limits, often in combination with increases in bag limits, to encourage harvest of small (i.e., <18 inch) fish and help maintain quality togue fisheries.

In 2006, MDIFW reviewed the special regulations for togue to simplify the law book, offer additional harvest opportunities where appropriate, and provide additional protection for vulnerable populations. Regulations designed to promote additional harvest in waters with an overabundance of togue included low length limits and high bag limits (5 togue ≥ 14 inches, only 1 over 18 inches; and 6 togue ≥14 inches, only 1 over 23 inches). These special regulations have since been modified and combined into one special regulation: 3 togue ≥ 14 inches, only 1 over 18 inches (Special Law Code S-26).

Togue populations in several waters, including Moosehead Lake and Sebago Lake, are managed under water-specific special regulations. In 2008, a special regulation that included a no bag limit on togue less than 18 inches was implemented at Moosehead Lake to decrease the abundance of small togue. This special regulation led to a drastic reduction in the abundance of small togue and improved the togue and landlocked Atlantic salmon fisheries. Similar liberal special regulations were implemented at Sebago Lake. In 2011, as a result of public interaction facilitated through the Sebago Lake Fisheries Focus Group, a new management model was developed to reduce the number of togue. At the time, togue were consuming a substantial amount of forage, thus limiting the available forage for the coexisting, highly prized landlocked Atlantic salmon population. Once developed, this model directed the Department to initiate a "top-down" biological management system to limit togue recruitment. This new management matrix permitted unlimited harvest of togue < 23 inches to encourage directed recreational harvest at younger age classes as a primary means to reduce togue abundance. In addition, a protective, no-harvest slot (23–33 inches) was implemented to shift the size structure towards more large fish, increase the abundance of 23–33 inch fish (which are large enough to prey upon and displace smaller togue, further reducing their abundance), and increase smelt abundance (large togue consume fewer smelt than small togue). Since 2012, several additional waters across the state have adopted a variation of these management strategies for togue, specifically in the Downeast Region where six waterbodies have some variant of this regulation matrix. It is also worth noting that while these regulations have been effective in other waters throughout the state, they did not produce desired effect at Sebago Lake and were further liberalized in 2020 to include no bag limit for togue under 26 inches and no minimum length limit.

Current Status and Distribution

Togue occur in 154 lakes and ponds throughout Maine **(Table 15, Figure 13)**. All of Maine's seven Fisheries Management Regions contain multiple waters with togue fisheries, though most of these waters are in the northern half of the state. When water temperatures are cold, togue can be found in the tributaries and outlets of the lakes they occupy. However, no populations in Maine live exclusively in flowing water, thus all management is concentrated on lakes and ponds.

Togue Quick Facts

- Native to Maine: Yes
- Maine counties where togue occur: 14 of 16 (no populations in Knox and Sagadahoc counties)
- State record: 39.2 pounds caught at Richardson Lake (Andover, Maine) in 2020
- Average length of a mature adult: 22–24 inches
- Propagated in Maine state hatcheries: Yes - stocked out as spring yearling and adult (retired brood)

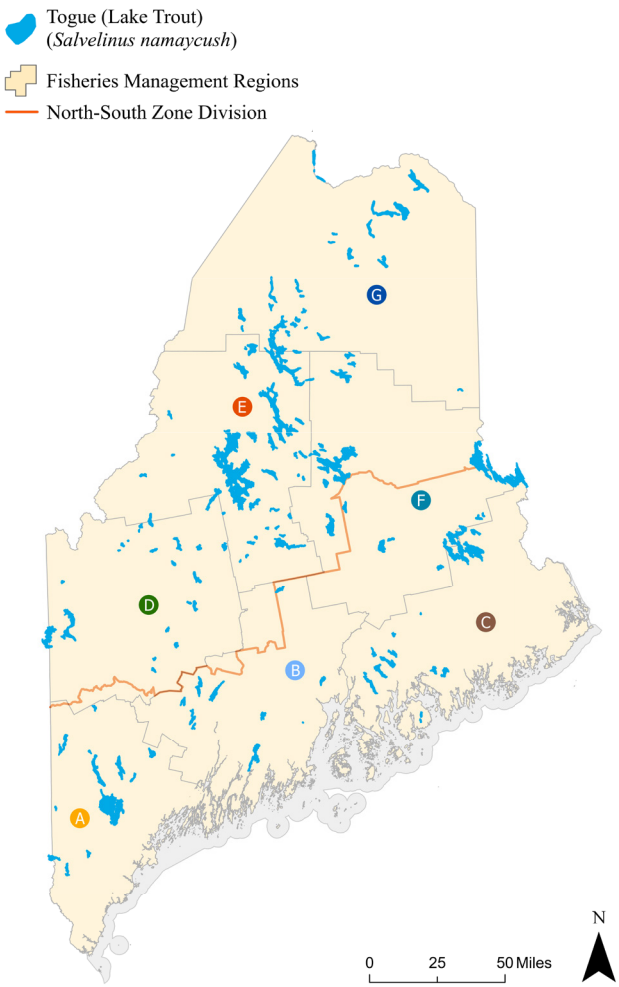


Figure 13. Lakes and ponds containing togue (154 waterbodies).

Table 15. Statewide distribution of lakes and ponds containing togue, 2020.

LAKES/PONDS CONTAINING TOGUE			
FISHERIES MANAGEMENT REGION	TOTAL # OF LAKES/PONDS	# OF DIRECTLY STOCKED LAKES/PONDS (INCLUDING AS % OF TOTAL)	% OF TOTAL SURVEYED LAKE/POND ACREAGE CONTAINING TOGUE
A	14	2 (14%)	52%
B	12	5 (42%)	20%
C	16	2 (13%)	23%
D	21	0	27%
E	35	1 (3%)	69%
F	23	3 (13%)	52%
G	33	6 (18%)	63%
STATEWIDE TOTAL	154	19 (12%)	46%

OTHER TARGETED FISH SPECIES IN MAINE

Several fish species in Maine are targeted by anglers, but not actively managed due to their status as an invasive species or because their populations tend to do well without directed management **(Table 16)**. MDIFW continues to monitor the overall status of these species but places a greater emphasis on monitoring native and more recreationally valuable species. Most monitoring data for these fish species are collected only incidentally when targeting other species, through angler reports, or when monitoring for invasive species impacts.

Table 16. Targeted fish species not actively managed in Maine.

SPECIES	NATIVE TO MAINE?	COUNTIES WHERE POPULATIONS OCCUR
Black Crappie *Pomoxis nigromaculatus*	No	Androscoggin, Cumberland, Franklin, Hancock, Kennebec, Knox, Lincoln, Oxford, Penobscot, Sagadahoc, Somerset, Waldo, and York
Brown Bullhead *Ameiurus nebulosus*	Yes	All of Maine's 16 counties
Chain Pickerel *Esox niger*	Yes	All of Maine's 16 counties
Fallfish *Semotilus corporalis*	Yes	All of Maine's 16 counties
Muskellunge *Esox masquinongy*	No	Aroostook, Somerset
Northern Pike *Esox lucius*	No	Androscoggin, Cumberland, Kennebec, Knox, Lincoln, Oxford, Penobscot, Sagadahoc, York
Pumpkinseed Sunfish *Lepomis gibbosus*	Yes	All of Maine's 16 counties
Redbreast Sunfish *Lepomis auritus*	Yes	All of Maine's 16 counties
White Perch *Morone americana*	Yes	All of Maine's 16 counties
Yellow Perch *Perca flavescens*	Yes	All of Maine's 16 counties

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GLOSSARY

- **Bass club:** Any organized group of five or more bass anglers that can satisfy one of the following criteria: 1) Provide current documentation of being a member club in Bass Anglers Sportsmen Society (BASS) or other nationally recognized bass fishing organization; or 2) Provide a current listing of club officers and members along with a signed affidavit affirming that the group is a bona fide independent fishing club. The affidavit must include a list of all members with contact information and must indicate those members who have participated in an aquatic plant and livewell inspection training program endorsed by the Maine Department of Environmental Protection (MDEP) within the last two years.
- **Broodstock:** Mature fish with desirable characteristics that are kept in hatcheries to serve as the source population for future hatchery stocks.
- **Captive Brood:** Fish reared and mature in the hatchery environment that contribute gametes to produce future hatchery cohorts.
- **Commercial Fishery:** A population of fish, of the same species, that is directly targeted by commercial harvesters for profit.
- **Commissioner:** A position appointed by the Governor of Maine that serves in the top authority role of the Maine Department of Inland Fisheries and Wildlife.
- **Diadromous:** A life history strategy where fish spend a portion of their life in freshwater and saltwater.
- **Egg Take:** A general term to describe the collection of gametes (eggs and milt) from adult fish.
- **Endemic:** A native species with a distribution that is confined to a limited geographic area.
- **Extirpated:** A term that is used to describe a fish species that no longer exists in a particular location.
- **Feral Brood:** Fish stocked in the wild and then later captured as gravid adults. The adults are released after eggs and milt are stripped. Fertilized eggs are brought back to the hatchery and reared to support future stocking needs.
- **Fishery:** A population of fish that is directly targeted by anglers.
- **Gamete:** Reproductive cells. In fish, eggs from the female and milt (sperm) from the male are considered gametes.
- **General Law:** Laws and rules that govern fishing in all water bodies unless there are other more specific regulations listed. More specifically, general law covers any legal terminal gear, daily bag and possession limits, season dates and species.
- **Great Pond:** Any inland body of water that exceeds 10 acres of surface area in its natural state, or any inland body of water that has been artificially formed or increased to exceed 30 acres of surface area.
- **Ice Fishing:** Taking freshwater fish during the ice fishing season through man-made openings in the ice by the use of ice fishing implements.
- **Inland Waters:** All waters within Maine above the rise and fall of the tide and wholly or partially within the territorial limits of Maine.
- **Invasive Species:** A nonnative species that causes negative ecological and economic impacts in its new environment.
- **Native Fish Species:** Any fish species that occurs or has occurred in Maine waters without the intercession of humans. Brook trout, togue, Arctic charr, landlocked Atlantic salmon, white perch, and chain pickerel are among Maine's many native fish species.
- **Non-governmental Organization (NGO):** Non-profit organizations not affiliated with any state or federal government agencies.
- **Nonnative Species:** Any fish species that occurs or has occurred in a water or waters, but only through the intercession of humans. Some fish that have been transported to Maine from waters outside of the state include largemouth bass, smallmouth bass, rainbow trout, brown trout, northern pike and muskellunge. These species are all nonnative to Maine.
- **Open Water Fishing:** Taking freshwater fish during the open water fishing season by means of hook and line in hand, or attached to a rod, or by casting or trolling artificial flies, lures, or baited hooks, provided that the person angling does not take fish though a man-made hole in the ice, from the ice or from any object supported by the ice.
- **Progeny:** Offspring
- **Principal Fishery:** A particular species, in a particular water, that is abundant enough to sustain fishing quality and is readily captured by anglers and routinely sampled during biological surveys.
- **Salmonid:** Term used to describe fish species in the family Salmonidae. Salmonids that occur in Maine include Arctic charr, brook trout, brown trout, lake whitefish, landlocked and sea-run Atlantic salmon, rainbow trout, round whitefish, splake, and togue.
- **Sport Fish:** Any fish species routinely targeted by Maine anglers.
- **Stocked Species:** Any fish species that are produced in the state's hatcheries and then released into public waters.
- **Stocking (Stock):** To introduce fish purposefully and legally into a waterbody to provide angling opportunity or conservation benefits.
- **Substrate:** The material that is found on the bottom of waterbodies, including clay, silt, sand, gravel, cobble, boulders, and bedrock.
- **Terminal Gear:** Tackle at the end of a line used to catch fish, including baited and unbaited hooks, artificial lures and baits, and artificial flies.
- **Togue:** A local common name used to describe Salvelinus namaycush. Other common names for this species include lake trout and laker.
- **Tributary:** A river, stream, or brook flowing directly or indirectly into a lake, pond, or another river, stream, or brook.
- **Wild Species:** Any fish species that successfully reproduces in the wild, regardless of origin (includes native and nonnative species).

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