STRATEGIC PLAN FOR LAKE CHAMPLAIN FISHERIES

Prepared by the Management Committee and Fisheries Technical Committee of the Lake Champlain Fish and Wildlife Management Cooperative

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New York State Department of Environmental Conservation
Bureau of Fisheries
Route 86, P. O. Box 296
Ray Brook, NY 12977-0296

Vermont Fish and Wildlife Department
1 National Life Drive, Davis 2
Montpelier, VT 05620

U. S. Fish and Wildlife Service
Lake Champlain Fish and Wildlife Conservation Office
11 Lincoln St.
Essex Junction, VT 05452

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PREFACE

This plan was produced under the purview of the Lake Champlain Fisheries Technical Committee whose membership during production and review was as follows:

U.S. Fish and Wildlife Service:
Bradley Young, B.J. Allaire, William Ardren (FTC Chair),
Lincoln St., Essex Junction, Vermont
Nicholas Staats – Liaison to Vermont Fish and Wildlife Department – West St., Essex Junction, Vermont
Stephen Smith – Liaison to New York State Department of Environmental Conservation – Lincoln St., Essex Junction, Vermont
Henry Bouchard – North Chittenden, Vermont

Vermont Fish and Wildlife Department:
Brian Chipman *(retired)*, Bernie Pientka, Lee Simard - Essex Junction, Vermont
Chet MacKenzie *(retired)*, Shawn Good – Rutland, Vermont
Kevin Kelsey – Grande Isle, Vermont

New York State Department of Environmental Conservation:
Lance Durfey *(retired)*, Tom Shanahan, Nicole Balk – Ray Brook, New York
Rob Fiorentino, Jim Pinheiro – Warrensburg, New York

University of Vermont:
Ellen Marsden – Burlington, Vermont

Vermont Cooperative Fish and Wildlife Research Unit (U.S. Geological Survey):
Donna Parrish – Burlington, Vermont

Lake Champlain Sea Grant:
Mark Malchoff – Plattsburgh, New York

A Strategic Plan Update team met numerous times in 2018 and 2019 to review and consider information to include in this Strategic Plan Update. The core members of that team were:

Steve Hurst and Lance Durfey *(retired)*, New York State Department of Environmental Conservation, Chet Mackenzie *(retired)*, Vermont Fish and Wildlife Department, Bradley Young, U.S. Fish and Wildlife Service, Ellen Marsden, University of Vermont and Donna Parrish, U.S. Geological Survey. Additional input was provided by Eric Palmer, Vermont Fish and Wildlife Department and Andrew Milliken, U.S. Fish and Wildlife Service.

Based on discussions with that team, the Lake Champlain Fish and Wildlife Management Cooperative Management and Policy Committees decided to focus this version of the Strategic plan on the three species that all three agencies work most closely and consistently together on – Lake Trout, Atlantic Salmon and Sea Lamprey.

Information compiled and discussed during this strategic plan development process on the other species cooperatively managed in Lake Champlain and its tributaries will be captured as a report of the Fisheries Technical Committee and may be addressed in more detail in future strategic plan versions.

EXECUTIVE SUMMARY

This Strategic Plan (Plan) provides a framework for implementing the Lake Champlain Fish and Wildlife Management Cooperative's function of initiating, developing and providing direction to coordinated fisheries management programs in the Lake Champlain basin for the next five years. This Plan is focused on the species that all three agencies consistently work together to manage: Atlantic salmon, lake trout and sea lamprey within the larger context of the ecosystem, fish community and fisheries of Lake Champlain. The Plan is based on guiding principles for ecosystem management, sustainability, natural reproduction of native species, management of non-native and nuisance species, use of stocking, application of genetics, protection of habitats, use of science-based management, and management accountability, with specific reference to human dimensions of fisheries management.

Lake Champlain is a large, heterogeneous lake, comprising four distinct basins separated by a combination of geographic features and causeways constructed over shallow bars. Habitats, trophic state, watershed use, and fish fauna vary among these basins. The large watershed of the lake drains forested, agricultural, and urban areas. Lake Champlain and its tributaries currently contain 88 species of fishes, of which 16 are non-native.

Biological assessments of fish populations have occurred sporadically since the first formal survey conducted by New York in 1929. Historically, commercial fisheries primarily targeted lake whitefish, walleye, yellow perch, lake sturgeon, American eel, and lake trout. These fisheries may have contributed to the decline of lake sturgeon in the main lake and lake whitefish in Missisquoi Bay. The building of dams and degradation of riverine spawning areas undoubtedly contributed to the decline of lake sturgeon and disappearance of Atlantic salmon, but the disappearance of lake trout by the late 1890s is difficult to explain. The current fishery on the lake is almost entirely based on recreational fisheries, with the most popular species being lake trout, Atlantic salmon, steelhead, brown trout, walleye, yellow perch, basses, smelt, and pikes. Commercial harvest in the U.S. waters of Lake Champlain consists only of the sale of fish caught by fishing, or licensed sale of bait fish. While a number of fish species were stocked in the lake historically, stocking is currently limited to the four salmonid species, and walleye.

The Plan outlines objectives, actions and timelines for the three focus species consistent with our overall goals for the coldwater fish community:

- Maintain a healthy Atlantic Salmon population in Lake Champlain and its tributaries that supports a quality recreational fishery while striving to increase the number of wild fish in the fishery
- Maintain an abundant lake trout population that supports a quality recreational fishery while striving to increase the number of wild fish in the fishery
- Suppress sea lamprey populations to a level that supports a robust fishery and allows restoration of native salmonids, lake sturgeon, and other species of concern

In addition, management actions will, when possible, prevent new introductions of aquatic species and suppress non-native nuisance species to minimize their impact on native species and ecosystem function.

The Plan and its supporting documents are focused on action priorities that will directly facilitate management decisions and actions, and research that will lead to a better understanding of factors and processes that affect the lake and its fishes.

GOAL STATEMENT

To secure fish communities, based on foundations of stable self-sustaining stocks, supplemented by judicious stocking of hatchery-reared fish, and provide from these communities an optimum contribution of fish, fishing opportunities, and associated benefits to meet needs identified by society for: wholesome food, recreation, cultural heritage, employment and income, and a healthy aquatic ecosystem (Great Lakes Fishery Commission 1997)

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INTRODUCTION

The Lake Champlain Fish and Wildlife Management Cooperative (Cooperative) was organized in 1972 by the directors of the fish and wildlife agencies of Vermont and New York and the Northeast Region of the U.S. Fish and Wildlife Service. The Province of Quebec is not a signatory party, but the Cooperative maintains close communication and coordination with the Province. A Memorandum of Understanding renewing the Lake Champlain Fish and Wildlife Management Cooperative (July 2009 and as amended July 2011) calls for coordinated fish and wildlife programs of interstate significance in Lake Champlain under the guidance of a Policy Committee and a Management Committee. The specific responsibilities of the Cooperative, as outlined in the MOU and addendum, are to:

- Coordinate evaluation of environmental impacts on fish and wildlife resources and formulate appropriate responses
- Develop a comprehensive fish and wildlife management plan for species of interstate significance
- Encourage implementation of the comprehensive plan by the agencies with primary responsibility
- Cooperate on the control of sea lamprey with the U.S. Fish and Wildlife Service taking a lead role as federal funding allows

The Cooperative is currently working under the 2010 strategic plan: *A Strategic Plan for Lake Champlain Fisheries* (Marsden et al. 2010). That plan broadened the scope of the 1977 *Strategic Plan for the Development of Salmonid Fisheries in Lake Champlain (Fisheries Technical Committee. 1977)*, recognizing the importance of additional sportfish species, including walleye, yellow perch, and basses as well as fish that do not support current fisheries, including lake sturgeon and American eel.

This Plan provides a framework for implementing the Cooperative's function of initiating, developing and providing direction to coordinated fisheries management and fish restoration programs in the Lake Champlain basin focusing on the species that all three agencies cooperatively manage on a regular basis: Atlantic salmon[1], lake trout and sea lamprey. Each agency's role in the coordinated fish and wildlife programs is flexible, depending on the agency's mission, funding, capability, and the Cooperative's needs. Agency roles for these species as of the date of this report are described below.

Interjurisdictional fisheries in Lake Champlain are fish populations that, because of their geographic distribution and/or migratory patterns, fall under the jurisdiction of both Vermont and New York, and are managed by both States and, to a lesser degree, by Quebec. This plan is written with the understanding that the U.S. Fish and Wildlife Service, Vermont Fish and Wildlife Department, and New York State Department of Environmental Conservation, will each provide staffing and funding to assume the following specific, long-term, interjurisdictional fisheries management roles for the Cooperative, except when appropriations are insufficient to support staffing or funding.

[1] Throughout this document, Atlantic salmon refers to landlocked Atlantic salmon in Lake Champlain

- Support, as needed, harvestable lake trout and Atlantic salmon populations through the stocking of hatchery produced fish.
- Evaluate status and management actions to enhance restoration of self-sustaining lake trout
- Enhance restoration of naturally-reproducing, river-run Atlantic salmon through assessment, applied research, modifications to culture and stocking, fish passage and habitat restoration
- Conduct sea lamprey assessment and control activities to reduce impacts to and support populations of lake trout, Atlantic salmon, lake sturgeon, walleye and other species.

In addition to cooperation to restore or manage these interjurisdictional fisheries, the U.S. Fish and Wildlife Service and the States of New York and Vermont and other partners will work individually and together as needed on management of other fisheries, and fish and habitat restoration and aquatic nuisance species in the Lake Champlain basin.

Several additional characteristics of the ecosystem affect fish populations, including land use management to reduce siltation, nutrients and contaminants in Lake Champlain; however, management of land use and contaminants is not the primary responsibility of the Cooperative, and is not addressed in this plan.

The purpose of this Plan is to outline goals, objectives, actions and timelines in the categories of restoration, propagation, assessment and monitoring and applied research. The Plan will be updated on a regular basis, not to exceed every 5 years.

GUIDING PRINCIPLES FOR LAKE CHAMPLAIN

(modified from 2010 Plan)

Ecosystem management

Manage the lake as a whole ecosystem, recognizing the complex interrelationship of all species, including humans, and their environment.

- An ecosystem approach to management recognizes and incorporates all aspects of the ecosystem, and is conducted within natural rather than political boundaries. Ecosystem management requires various agencies that manage different components of the ecosystem – water quality, habitat, fisheries, and human and political dimensions – to work together toward a common goal of a healthy ecosystem.

Sustainability

Recognize limits on lake productivity

- A healthy aquatic ecosystem is characterized by a diverse array of species with a functional, adaptive organization that has evolved naturally and continues to evolve. Management should strive to maintain ecosystem health while recognizing the inherently fluctuating states that are natural to such a system.
- The amount of fish that can be harvested from a healthy aquatic ecosystem without adverse consequences is limited and is largely determined by the nutrients in the environment, habitat variables, and the ability of a fish population to respond to exploitation.
- Because humans may diminish this productive capability, healthy, naturally reproducing fish communities can only be ensured by managing human activities as part of the ecosystem. Fish populations at all trophic levels can be endangered by factors causing excessive mortality, such as 1) overfishing, 2) stocking more predators than the forage base can sustain, 3) failing to control undesirable non-native species, and 4) loss of critical habitats and degradation of water quality caused by changes in flows, dams, dredging, sedimentation and excessive nutrient inputs. Impacts of climate change on the lake, tributaries, fish communities must also be considered including increased air and water temperatures, increased frequency and intensity of floods and droughts, reduced snow pack and lower and higher lake levels. Management actions to increase fish production and expand distribution should emphasize the identification, protection, and rehabilitation of fish spawning, nursery, and other critical habitats.

Natural reproduction

Maintain and enhance natural reproduction of fish populations

- Fisheries and fish communities comprised of naturally-reproducing native fish populations provide the most predictable, sustainable, and cost-effective benefits for management and to society, including social, cultural, and economic benefits.
- Self-sustainability is important to the biological integrity of the fish community. Natural feedbacks between predator and prey can provide more effective self-organization and system resilience than external controls can provide. Changes in harvest or stocking are often too late because of the time required for detection. Genetic fitness of self-sustaining populations is likely to exceed that of stocked populations because they may benefit from natural selection through adaptations to unique and specific conditions in localized environments. Therefore, wild reproducing populations can be expected to have better survival and productivity than stocked populations.

Native Species

Preserve native species and support biodiversity.

- All native fish species, not just those that are exploited by humans, and including rare and threatened species, are important to the integrity of the fish community.

- Indigenous species that are currently abundant should be maintained, and those that are depleted should be protected and enhanced.

Exotics/non-native/naturalized species

Prevent the introduction of non-native species.

- The unintentional or unauthorized introduction of non-native species should be actively and aggressively discouraged. Establishment of nuisance non-native species can disrupt native fish communities and challenge management objectives. The risk of additional introductions of non-native species must be minimized. New introductions should elicit a rapid response to eliminate the species or limit its spread. No new non-native species or populations will be intentionally introduced into the Lake Champlain watershed by fisheries managers without careful consideration of impacts on the ecosystem, and a thorough environmental review and public input process.
- Non-native species that have become established in Lake Champlain and are likely to remain indefinitely (e.g., carp, largemouth bass, white perch, alewife) must be viewed as parts of the fish community. In addition, steelhead/rainbow trout and brown trout have become established in some tributaries, and they continue to be stocked in order to provide continued benefits to the fishery. The term rehabilitation, when applied to communities containing such species, means the recovery of lost fishery production and fishery values and not a complete return to a pristine fish community.

Nuisance species

Develop management strategies for species that become nuisances.

- Fish and wildlife populations in most natural situations occur in a healthy balance within their ecosystem. Certain conditions can alter this balance, causing native or introduced species to become nuisances, overabundant, or problematic in achieving fish restoration or fishery objectives. Where appropriate, develop and implement techniques to control and mitigate nuisance fish and wildlife damage and conflicts.
- Fish pathogens have the potential to alter fish communities, therefore it may be necessary to modify culture operations and management actions to address the threat of potential pathogens.

Stocking

Use stocked fish wisely

- Stocked fish are important for: 1) providing fishing opportunities, 2) developing spawning populations of species needing rehabilitation, and 3) continuing progress in restoring the biological integrity of the fish community. Stocking must be conducted judiciously to balance these needs.

Genetics

Maintain genetic fitness of fish populations

- Genetic diversity, both within and among fish stocks, is important to overall species fitness and adaptability.
- Managers have a responsibility to maintain genetic diversity through protection of locally adapted stocks and be cautious in the selection and stocking of particular strains of fish intended to support the recovery of native species (Fraser 2008).
- Managers should assess the relative survival and condition of strains of fish stocked and make decisions on what strains to stock based on an understanding of the factors affecting the survival and condition (Harder et al. 2020).
- Outbreeding depression can occur when hatchery fish interbreed with wild fish. Although the within-population genetic diversity increases with outbreeding, fitness may decline (Waples 1991). Genetic and behavioral interactions between wild and hatchery fish must be considered in order to protect native stocks. Also, if stocked fish are very abundant in comparison to wild fish, the fishing effort used to harvest stocked fish may deplete wild fish (Evans and Willox 1991, Araki et al., 2007).

Human dimensions

Recognize that fisheries are an important social and cultural heritage

- Desired conditions and the means by which we choose to achieve these conditions are social values. Stakeholders include all who use or benefit from the aquatic natural resources of the Lake Champlain basin, and their preferences may change over time. Managers will do their best to be aware of the social values and preferences of all stakeholders. Managers must recognize that social, cultural, and economic benefits to various stakeholders – both in the present and the future – are important considerations in making fishery-management decisions.
- Managing a fish community requires a long-term perspective that recognizes the shorter-term social, cultural and economic requirements.
- Stakeholders contribute critical biological, social, economic and cultural information to fisheries management agencies in support of fisheries management decision making; with decision making comes a duty to learn from stakeholders and share accountability and stewardship.

Habitats

Protect and restore fish habitats and water quality

- Protecting and rehabilitating critical fish habitat and restoring and maintaining good water quality, including in tributary, embayment, and inshore spawning and nursery areas, is required to sustain productive fisheries over the long term. Maintenance of quality habitat is fundamental to fish and fish-community conservation; preservation and restoration of habitat must be the foremost concern for achieving these objectives.

Science-based adaptive management and accountability

Use sound science to make management decisions.

- Good ecosystem management decisions depend on a science-based approach using an adaptive, iterative process that requires timely scientific information provided through conventional surveys, broad-based, long-term monitoring and research.
- Public understanding and support will be improved when management decisions are clear, are based on the best available information, and require accountability.
- Fish population goals and objectives should be quantifiable and measurable.
- Management must be coordinated among agencies. Lake Champlain fisheries-management agencies must share information, work toward consensus, and be accountable for their actions.
- Collaborative decision-making must be sensitive to the different mandates, sub-goals, and constituencies of the agencies involved in the Management Cooperative.

DESCRIPTION OF LAKE CHAMPLAIN

Lake Champlain has a surface area of 1,130 km^2 (435 sq. miles) and a volume of 26 km^2 (6.2 $miles^2$). The lake is long (approximately 200 km [120 mi]), narrow (19 km [12 mi] at its widest), and deep (19.5 m average [64 ft], 122 m maximum [400 ft]). Sixty-two percent of the surface area lies in Vermont, to the east, 34.5 percent in New York, to the west, and 3.5 percent in Quebec, to the north. The lake flows from tributary inputs in the south to its outlet, the Richelieu River, at the north end. Lake Champlain is naturally connected to the St. Lawrence River via the Richelieu River, and to Lake George via LaChute River, which flows into the lake at Ticonderoga, NY. The Champlain Canal, opened in 1823, connects the lake to the Hudson and Mohawk River drainages and to the Great Lakes via the Erie Barge Canal system (Figure 1).

The lake is divided into four distinct basins by a combination of geographic features and causeways constructed over shallow bars. In addition, the South Lake, contiguous with the Main Lake, is generally recognized as a separate basin due to its trophic characteristics:

- The South Lake extends from Whitehall, NY, northward to the Crown Point bridge, and includes South Bay on the west side. This area is eutrophic and essentially riverine, with extensive wetlands on both shores.

- The Main Lake extends from Crown Point to Rouse's Point, NY, and includes the deepest section of the lake near Split Rock Point, NY. This basin is meso- to oligotrophic and contains most of the deep, coldwater salmonid habitat in the lake. The two largest population centers in the basin, Burlington, VT, and Plattsburgh, NY, are located on the shores of the Main Lake; the Vermont shoreline has considerable agricultural use, whereas the New York shore is generally steeper, more forested, and is mostly contained within the Adirondack Park.

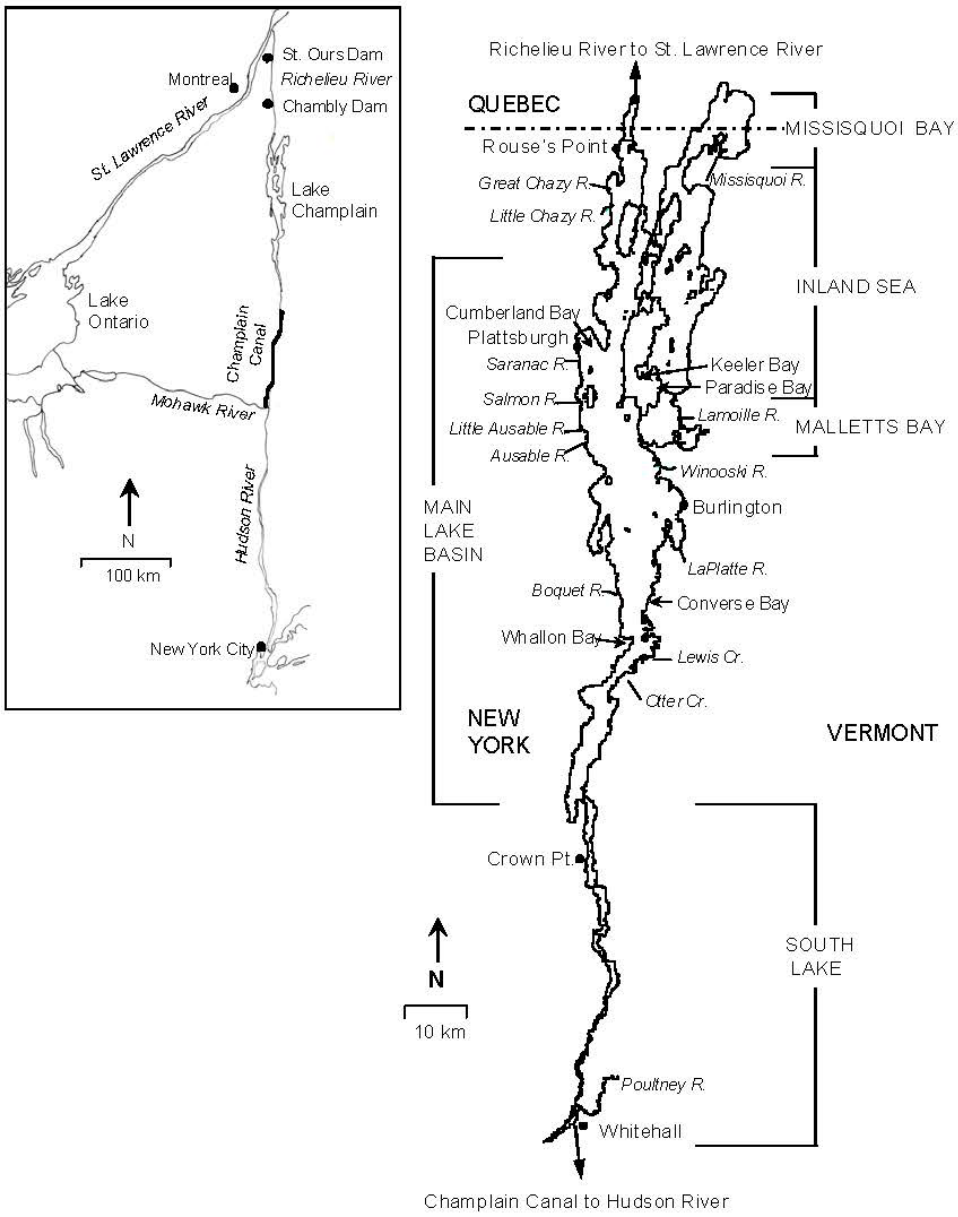
- Malletts Bay is located north of Burlington on the east side of the lake, and is separated from the Main Lake by a railroad causeway to the west and from the Inland Sea by a road causeway (Route 2) to the north. The basin consists of a moderately deep outer bay and a smaller and shallower inner bay, and is primarily mesotrophic.

- The Inland Sea is located to the east of the islands of North and South Hero, VT. The Inland Sea is generally mesotrophic, and receives water from Missisquoi Bay to the north. No major tributaries drain into this basin, and there are no major urban areas in the watershed. The Inland Sea and Malletts Bay lie entirely within Vermont.

- Missisquoi Bay is located to the north of the Inland Sea and drains south. The northern two thirds of the bay lie within Quebec. This shallow basin, with a maximum depth of 4.3 m (14 ft), is eutrophic and supports primarily warmwater fish species. Land use in the area is largely agricultural.

Lake Champlain has a very large watershed (21,326 km^2 or 8,234 $miles^2$) compared to its surface area. In consequence, the lake level varies considerably, with an annual fluctuation of 1-2 m (3- 6.5 ft). Mean lake level is 29.1 m (95.5 feet) above sea level; record low was 28.1 m (92.4 ft) and record high was 31 m (102 ft). The watershed drains the largely forested Adirondack Mountains on the west, the Green Mountains on the east, and extensive agricultural areas in Quebec and the Champlain Valley of Vermont. The total population of the Lake Champlain basin was estimated at 580,000 in 2010, of which approximately 70% live in Vermont, 30% in New York, and 25,000 people in Quebec (Lake Champlain Basin Program, Lake Champlain Basin Atlas).

Figure 1. Map of Lake Champlain showing major basins and tributaries. Inset shows geographic region, connecting rivers and canal, and the two dams on the Richelieu River, which drains Lake Champlain.



Lake Champlain and its tributaries currently contain 88 species of fishes, of which 16 are non-native. The native fish fauna is similar to that of the Great Lakes, although there are fewer species found in Lake Champlain. The coldwater predator population is dominated by lake trout, Atlantic salmon, brown trout, and steelhead. Coolwater species include yellow perch and walleye. Coregonid species are limited to lake whitefish and lake herring/cisco, and major forage for piscivores are native rainbow smelt and yellow perch; alewives were found in the lake in 2002 and rapidly increased in abundance. Important warmwater sport fishes include largemouth and smallmouth bass, northern pike, pumpkinseed, and white and black crappies. Seven fish species are classified as endangered (E), threatened (T), or susceptible (S) in Vermont, New York, or Quebec: northern brook lamprey (E-VT), American brook lamprey (T-VT), lake sturgeon (T-NY, E-VT, S-QC), mooneye (T-NY), stonecat (E-VT), eastern sand darter (T-NY, VT), and channel darter (E-VT, S-QC). An additional 14 species are listed as of special concern in Vermont, and lake sturgeon, lake herring/cisco, redfin pickerel, channel darter, and brassy minnow are listed as susceptible in Quebec. Lake sturgeon was petitioned for listing under the U.S. Endangered Species Act in 2019 and the USFWS is conducting a species status assessment to determine if lake sturgeon should be listed in any parts of its range.

CURRENT FISHERY AND FISH COMMUNITY

The current fishery in Lake Champlain is almost entirely based on recreational fishing; although commercial licenses are still permitted in Quebec, the commercial fishery has not been active since 2004. Popular sport fisheries include the four salmonid species, walleye, yellow perch, basses, and pikes. Summer tournaments bring substantial revenues to the area, with several focusing on bass fishing. Ice fishing, mainly for yellow perch, walleye, lake trout and salmon, is popular, as even when the main lake is open, many bays are ice-covered for several months. Charter fishing has declined since the mid-1990s due to an overall reduction in the salmonid fishery as a consequence of sea lamprey predation.

Currently, commercial harvest in the U.S. waters of Lake Champlain consists only of the sale of fish caught by angling, or licensed harvest and sale of bait fish. The majority of the fish sold are yellow perch and other panfish.

Non-native, invasive species are a significant concern in Lake Champlain; 51 known aquatic non-native and invasive species have been identified in the lake including 16 non-native fish species, 13 non-native plant species, in addition to 22 mollusks, crustaceans, zooplankton, and other invertebrates, and two fish pathogens: largemouth bass virus, first seen in 2002, and pike lymphosarcoma, first seen in the late 1990s. In addition, water chestnut (*Trapa natans*) and Eurasian water milfoil (*Myriophyllum spicatum*), which are found in dense beds particularly in the southern portion of the lake, have significantly altered fish habitat. Zebra mussels, introduced in the south lake in 1993 and now found throughout the lake, are also altering benthic habitats and invertebrate communities (Marsden and Hauser 2009). Recent discoveries include the spiny waterflea in 2014 and the fishhook waterflea in 2018. As a result of concerns about introduction of non-native species, use of bait fish in Vermont was restricted in 2002 to a list of 16 native species.

New York and Vermont work together to have their respective fishing regulations on Lake Champlain match as closely as possible, given political constraints. A reciprocal license agreement allows anglers from either state to fish portions of the lake that share the state boundary (http://www.dec.ny.gov/permits/6411.html, http://www.eregulations.com/vermont/fishing/lake-champlain-regulations/).

ADAPTIVE MANAGEMENT FRAMEWORK OF THIS PLAN

Fisheries management is frequently challenged by rapidly changing pressures on the fish community, insufficient information about the current status of fish populations, and limited resources to acquire data to establish realistic management goals. This plan is designed as an adaptive management process, in which indicators of desired outcomes are established, data are collected to inform the indicators, and management activities (harvest regulations, stocking rates, and habitat modifications) are adjusted, in an iterative process. The following sections identify target species for management, with performance indicators, actions and timelines for each species, and reference points for each indicator.

Atlantic Salmon

Objectives

Restore natural reproduction, maintain lake and tributary fisheries

Management Actions

Monitoring and assessment, planning, propagation, habitat restoration, applied research, sea lamprey control

Goal – Maintain a healthy Atlantic Salmon population in Lake Champlain and its tributaries that supports a quality recreational fishery while striving to increase the number of wild fish in the fishery		
Objectives and Metrics	Actions	Timeline
Restore Natural Reproduction		
Restore natural reproduction in three tributaries: Winooski River, Boquet River and Saranac River and explore opportunities for restoration in other tributaries. • Increase and then maintain annual fall salmon run of at least 150 spawning adults in each of the three rivers. • Achieve a redd to spawning female ratio of 0.75-1.0. • Evaluate contribution of wild fish to adult returns and fisheries. • Maintain and evaluate the use of different broodstocks to increase survival and river returns. • Evaluate and improve habitat and upstream and downstream fish passage at dams • Evaluate and expand Atlantic salmon spawning and rearing habitat where possible • Complete Atlantic salmon river run restoration plan.	<u>Monitoring and Assessment</u> • Conduct redd surveys • Evaluate success of spawning events by snorkeling fry surveys and electro-fishing. • Assess headwater tributaries for suitable spawning habitat and stocked fry survival. • Use telemetry to track survival, movement and passage of returning adults in the Winooski and Boquet Rivers • Conduct initial assessments on the Ausable River for potential returns and natural reproduction below the first barrier; for suitable spawning habitat and stocked fry survival in headwater tributaries; and downstream fish passage at hydropower dams.	Annual Annual 2020-2025 2020-2025 2020-2025

	Planning	
	• Develop life cycle models for salmon in Winooski, Boquet and Saranac Rivers to set quantitative metrics for restoration and rank restoration actions based on population-specific needs.	2020-2021
	• Complete Lake Champlain Atlantic Salmon River Run Plan with tributary-specific goals and actions.	2020-2021
	Propagation	
	• Adjust annual smolt and fry stocking numbers and location based on assessment and evaluation data.	2020-2025
	• Maintain thiamine deficiency tolerant and maximum diversity broodstocks.	2020-2025
	Habitat Restoration	
	• Assess, improve, and expand salmon spawning and rearing habitat in North Branch of the Boquet River.	2020-2022
	• Continue to evaluate and improve fish passage at dams to ensure both upstream and downstream facilities are operating as efficiently as possible.	2020-2025
	Applied Research	
	• Investigate alternative stocking strategies that improve salmon imprinting and improve adult returns in the Winooski River (broodstock source and stocking location) and Saranac River (direct stocking into the river vs. held in net pen at mouth).	2020-2025
	• Investigate fitness of smolts stocked from thiamine deficiency tolerant broodstock into Winooski River, Boquet River and Saranac River.	2020-2025
	• Use genetic parental based tagging to mark all hatchery salmon stocked in New York and potentially Vermont and evaluate success of strains and stocking strategies.	2020-2025
	• Share research results, learn from and collaborate with partners conducting salmon research and management in North America and Europe	2020-2025

Maintain Lake and Tributary Fisheries		
Maintain a population of Atlantic salmon commensurate with the productivity of the system as assessed by fish length-at-age and condition to support the recreational fishery • Angler catch rate of 0.25/hr. in lake • Average size of 19” • Average weight of top 10 salmon caught during LCI tournament within the 25th and 75th percentiles (6.3 to 8.1 pounds with a median weight of 7.25 pounds, calculated from data collected from 2011 to 2017. • Meet sea lamprey control target of ≤ 15 wounds per 100 salmon Assess tributary fisheries to set realistic catch rate objectives in each of seven tributaries: Winooski, Boquet, Otter, Lamoille, Missisquoi, Ausable, and Saranac See additional detail and updates in *Protocol for Summarizing Indicators of Lake Champlain Salmonid Condition*	<u>Monitoring and Assessment</u> • Assess trends in the population by monitoring metrics listed in the *Protocol for Summarizing Indicators of Lake Champlain Salmonid Condition* • Monitor fall returns to spawning sites (e.g., hatchery brook, Winooski River, etc.) • Conduct near shore electrofishing to assess condition factor, length at age. • Conduct creel surveys on main lake • Conduct angler creel surveys on tributaries • Establish self-creel boxes at key river access areas <u>Propagation</u> • Stock smolts in the main lake to support the recreational fishery • Evaluate and adjust the historic stocking number (85,000 smolts (TL >= 180 mm) to account for increase in natural recruitment or other changes to the fishery • Adjust the historic stocking number and locations of smolts or smolt equivalents among the tributaries according to tributary-specific targets to account for increase in natural recruitment or other changes to the fishery <u>Sea Lamprey Control</u> • Continue coordinated sea lamprey control (see separate section below)	 Annual Annual Annual TBD TBD Annual Annual Annual 2020-2025 Annual

Lake Trout

Objectives
Restore natural reproduction, Maintain lake fishery

Management
Monitoring and assessment, applied research, propagation, sea lamprey control

Goal – Maintain an abundant lake trout population that supports a quality recreational fishery while striving to increase the number of wild fish in the fishery		
Objectives	Actions	Timeline
Restore Natural Reproduction		
Establish and then maintain a population of at least 10 year classes of wild lake trout comprising an increasing proportion of the total population	<u>Monitoring and Assessment</u> • Monitor abundance (CPUE) and distribution of juvenile lake trout (ages 0-3) as an early indicator of natural recruitment • Conduct fishery independent assessments of the spawning population in fall using trap nets at Gordon Landing and electroshocking in Whallon Bay to measure condition factor, lamprey wounding, size structure of the population, and proportion of wild fish • Assess feasibility and value of additional assessment areas in the lake • Work with partners to assess revised approach for forage fish assessment that would provide results useful for making management decisions along with the Salmonid Condition Indicators <u>Applied Research</u> • Determine genetic strain composition of wild lake trout to identify similarity to Seneca strain (stocked by New York) vs. Champlain strain (stocked by Vermont). o Collect wild lake trout and compare with	Annual Annual TBD TBD TBD TBD

	hatchery and wild broodstock from Vermont and New York for at least two years • Determine origin of wild lake trout juveniles by identifying additional spawning locations. o Identify spawning areas in the central Main Lake and other locations	 TBD
Maintain Lake Fishery		
Manage the fishery through a combination of stocked fish and natural reproduction. Maintain a population of lake trout commensurate with the productivity of the system as assessed by fish length-at-age and condition to support the recreational fishery Maintain a quality main lake fishery based on: • angler catch rate of 0.45/hr. • average size of 24” • average weight of top 10 lake trout caught during LCI is 13.5 lbs. (range of 11.9-15.2) • Meet sea lamprey control target of ≤ 25 wounds per 100 lake trout (see section on sea lamprey below) See additional detail and updates in *Protocol for Summarizing Indicators of Lake Champlain Salmonid Condition*	<u>Propagation</u> • Stock fall fingerlings annually in the main lake to support the recreational fishery • Adjust the historic stocking number of 82,000 to account for increase in natural recruitment or other changes to the fishery • Reduce stocking numbers by 25% when proportion of naturally produced spawners in age 4 and 5 year classes exceeds 15%. • In the absence of earlier reductions in stocking, in 2024 stocking will be reduced by 10% to stimulate a positive change in the number of wild fish in the fishery <u>Monitoring and Assessment</u> • Conduct creel surveys on main lake to determine average catch rate and average size • Monitor the LCI tournament results to determine whether the weight of lake trout remains stable or increases • Assess trends in the population by monitoring metrics listed in the Protocol for *Summarizing Indicators of Lake Champlain Salmonid Condition* <u>Sea Lamprey Control</u> • Continue coordinated sea lamprey control (see separate section below)	Annual 2020-2025 Review annually 2024 TBD by states Annual Annual Annual

Sea Lamprey

Objectives

Restore host species, natural reproduction and recruitment
Maintain host species lake and tributary fisheries

Management

Suppression, monitoring and assessment, applied research

Goal – Suppress sea lamprey populations to a level that supports a robust fishery and allows restoration of native salmonids, lake sturgeon, and other species of concern		
Objectives	Actions	Timeline
Restore Host Species Natural Reproduction and Recruitment and Maintain Host Species Lake and Tributary Fisheries		

Reduce the level and impacts of sea lamprey on native species and fisheries in Lake Champlain
• Meet the wounds per 100 fish targets for:
  ○ Walleye = 2
  ○ Atlantic salmon = 15
  ○ Lake trout = 25
• Reduce wounds on sturgeon from those seen from 1998-2002
• Reduce wounds on northern pike based on levels seen in traps net collections
• Authorize comprehensive control of sea lamprey in all tributaries where they occurRaise lampricide treatment effectiveness to ≥ 95%
• Evaluate impact of parasitic population as a function of wounding rates
• Evaluate density and distribution of existing larval populations
• Increase sea lamprey suppression effectiveness and reduce use of sea lamprey chemical by introducing new and revised technologies and techniques
	<u>Suppression</u>
	• Use traps and barriers to prevent adult spawning
	• Use lampricides to kill larval populations in rivers and on deltas
	• Develop and approve new EIS to authorize the modernized program
	<u>Monitoring and Assessment</u>
	• Electrofish streams and deltas to identify density and distribution of existing and new larval populations
	• Electrofish streams following treatments to assess effectiveness of control
	• Collect host species in the fall and record wounding rates
	• Detect potential newly colonized larval populations
	<u>Applied Research</u>
	• Evaluate resistance board weir in Malletts Creek
	• Repair and restore functionality of Great Chazy dam as a lamprey barrier
	• Build barrier at Shelburne Falls to limit adult access above that point
	• Collaborate with partners conducting sea lamprey control and management in the Great Lakes
		Annual
		
		Four-year Rotation Initiate in 2021
		
		Annual
		
		Annual
		
		Annual
		
		Annual
		
		2020
		
		2020
		
		2020
		
		Annual

OTHER COOPERATIVE EFFORTS

Although the focus of this Strategic Plan is on three species that represent the majority of regular cooperative efforts by the New York State Department of Environmental Conservation, Vermont Fish and Wildlife Department and the U.S. Fish and Wildlife Service, these three agencies also cooperate on monitoring and assessment, research, species and habitat restoration and management, invasive and nuisance species control and outreach for a broader set of fish and wildlife species in the Lake Champlain basin. Lake sturgeon was petitioned for listing under the U.S. Endangered Species Act in 2019 and the U.S. Fish and Wildlife Service will continue to work with both states on restoration and as part of a larger species status assessment to determine if lake sturgeon should be listed in any parts of its range. The U.S. Fish and Wildlife Service will also continue to assist with efforts to monitor and restore the American eel as part of range-wide efforts for this catadromous species. The Fisheries Technical Committee of the Cooperative will continue to exchange information and cooperation for a broader set of species. As part of the process of developing this plan, the three agencies compiled information and objectives on additional species including: lake sturgeon, American eel, rainbow trout, brown trout, yellow perch, walleye, sauger, northern pike, muskellunge, smallmouth bass, largemouth bass, white crappie, black crappie, eastern sand darter and channel darter. This information included significant input from staff that were about to retire. The information and objectives on these other species will be captured in a separate report of the Fisheries Technical Committee.

CONCLUSION

As the Lake Champlain system continues to change, further changes in the fish community and fisheries are likely to occur. Changes in nutrient levels and climate may affect the fish community and the latitude for fisheries management. Stocking, harvest controls, habitat protection and rehabilitation, sea lamprey control, and public outreach are tools that fisheries managers can use to achieve the goals outlined in this document. Fish-community and fisheries monitoring programs provide information to track changes and assess potential changes in the future. Information-based decision making is important in a rapidly changing system where uncertainty and risk are high. The Fisheries Technical Committee and cooperative will strive to achieve the fish-community goals described in this document as well as other cooperative efforts.

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