

Environmental Assessment

Proposed Additions

to the

Final Supplemental Environmental Impact Statement (August 2001) *A Long-Term Program of Sea Lamprey Control in Lake Champlain*

Prepared by
U.S. Fish and Wildlife Service



as a member of the

Lake Champlain Fish and Wildlife Management Cooperative

U.S. Fish and Wildlife Service
Vermont Department of Fish and Wildlife
New York State Department of Environmental Conservation

Executive Summary

This Environmental Assessment (EA) addresses the proposed expansion of the long-term sea lamprey control program on Lake Champlain. It is written pursuant to National Environmental Policy Act (NEPA) requirements.

Sea lamprey control began on Lake Champlain in 1990 as an eight-year experimental program after completing an Environmental Impact Statement (EIS; NYSDEC et al. 1990). Following the experimental program, extensive evaluation of the program's impacts on sea lamprey populations, the salmonid fisheries, forage fish populations, and the local economy was conducted (Lake Champlain Fisheries Technical Committee 1999). In 2001, a Supplemental Environmental Impact Statement (SEIS) was prepared outlining a long-term program of sea lamprey control for Lake Champlain (U.S. Fish and Wildlife Service et al. 2001). The long-term program included Lake Champlain tributaries and control strategies not originally included in the experimental program. Implementation of the long-term program is ongoing. In 2008, an Environmental Assessment was written to address the need to add 3, previously uncolonized, tributaries to the program (Bouffard 2008).

Lampricide treatments have been conducted on 17 tributary systems where that is the primary control method recommended in the SEIS. Lampricide has also been applied to 5 deltas in New York where deep-water electrofishing surveys identified substantial populations. Non-chemical control methods (i.e. different types of trap-integrated barriers) are used on 8 small streams around the basin. Trapping of spawning adult sea lamprey is used as a control method where feasible and when state and provincial concerns preclude the use of lampricide. New barrier technologies were developed in 2017 that will enhance effectiveness and efficiency of trapping operations.

Despite the increased efforts and measurable improvements in the program to control sea lamprey, wounding rates on monitored host species remain unacceptably high. For this reason, the Lake Champlain Fish and Wildlife Management Cooperative proposes to expand the sea lamprey control program to include two additional tributaries where sea lamprey populations have been discovered since the completion of the 2008 EA.

Alternatives presented and discussed in this Environmental Assessment

Alternative 1

(Proposed Action) - Expansion of the sea lamprey control program outlined in the SEIS

This alternative increases the scope of the ongoing, long-term sea lamprey control program by adding two Lake Champlain tributaries which have recently been identified as producers of parasitic sea lamprey. The streams proposed for inclusion are the Little Chazy River and Rea Brook in New York. Recent population surveys documented sea lamprey larvae in both streams at numbers that warrant control. Both streams were independently screened for technically feasible and environmentally and socially acceptable control techniques. Control strategies for each stream are outlined in section 3.1. Implementation of this alternative is expected to further reduce the parasitic sea lamprey population of Lake Champlain, increase the survival rates of all fish populations affected by sea lamprey parasitism, enhance Lake Champlain's sport-fisheries, and result in socio-economic benefits associated with these outcomes.

Alternative 2

(No Action) - Continue sea lamprey control program as outlined in the SEIS and subsequent EA

This alternative would maintain sea lamprey control at its current scope as outlined in the SEIS and subsequent EA. Sea lamprey would remain uncontrolled in the Little Chazy River and Rea Brook where they will continue to reproduce and contribute to the parasitic lamprey population of Lake Champlain. Wounding rates would remain unchanged or improved only through efficiency gains from other existing control efforts. No benefits to host species, sport-fisheries, or socio-economic gains would be realized.

The SEIS provides a detailed description of the environmental setting of Lake Champlain emphasizing water quality and basin characteristics, known sea lamprey distributions, and the human environment. It inventories state and federally-listed endangered and threatened species and their habitats and non-listed species of concern affected by ongoing sea lamprey control activities. Impacts to water, humans, wetlands, endangered and threatened species, plants, invertebrates, fish, amphibians, reptiles, birds, and mammals are discussed and mitigating measures are described. Unavoidable adverse impacts, beneficial impacts, irreversible and irretrievable commitments of resources, and growth-inducing impacts of long-term sea lamprey control are also discussed.

This EA is a tiered document (40 CFR 1508.28 and 1502.20) which relies on the SEIS (U.S. Fish and Wildlife Service et al. 2001) and subsequent EA (Bouffard 2008). Specific information relating to the Proposed Action included in this document is to be considered in addition to the information included in the SEIS. The SEIS and other supporting materials are available online at <https://www.fws.gov/lcfwro/sealamprey/NEPA.html>

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Purpose of Proposed Action

The purpose of this Environmental Assessment (EA) is to examine impacts associated with enhancing the sea lamprey control program and to enable the use of federally-administered Sport Fish Restoration grant monies, other Federal funds, Federal equipment, and participation by Federal staff in the implementation of sea lamprey control on selected tributaries. The purpose of the Proposed Action is to further reduce the Lake Champlain parasitic sea lamprey population by adding two recently-colonized tributaries not covered in the Supplemental Environmental Impact Statement: *A Long-term Program of Sea Lamprey Control in Lake Champlain* (SEIS; U.S. Fish and Wildlife Service, et al. 2001). The experimental sea lamprey control program (1990-1998) and more recent long term control (2008-2017) have provided benefits to the Lake Champlain fishery, the local economy, the aquatic ecosystem (Lake Champlain Fisheries Technical Committee 1999, Marsden et al. 2003). Since the decrease of sea lamprey wounding rates by more than 60% since 2006, record returns of Atlantic salmon to the Ed Weed Fish Culture Station were seen in 2014 and again in 2015. Age and size structure of lake trout and Atlantic salmon populations has continued to increase. Fishing tournaments on Lake Champlain have shown ever-increasing lengths and weights among lake trout and Atlantic salmon entered. Economic valuations have estimated a favorable 3.48:1 economic benefit:cost ratio generating upwards of a net \$20 million for the basin (Gilbert 1999). Implementation of the Proposed Action would allow Federal and state agencies to deliver sea lamprey control to two new tributaries where sea lamprey populations have expanded thereby enabling increased effort directed at the restoration of Lake Champlain fish communities.

1. Need for Proposed Action

Wounding rates on salmonids have dropped and approached goals set forth in the SEIS, but appear to have plateaued at a level that remains unacceptably high (Figure 1). Currently, sea lamprey are controlled on 23 streams and deltas with the use of lampricides. Eight streams use barriers with integrated traps that block and capture migrating sea lamprey to prevent them from accessing suitable spawning habitat or redistributing to other habits. During the development of the long-term program of sea lamprey control, target wounding rates were set for lake trout, landlocked Atlantic salmon and walleye (Table 1). These targets were based on comparisons to wounding rates achieved in the Great Lakes sea lamprey control program, measured and achievable levels of host species survival and growth seen during the experimental program, and further reductions expected through increasing the scope of control efforts.

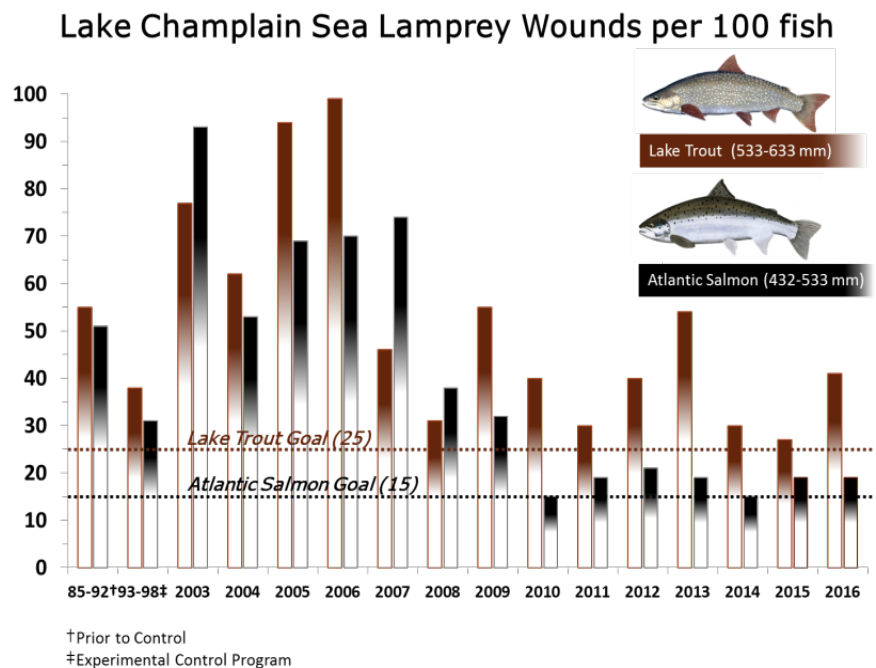


Figure 1. History of Lake Champlain lamprey wound monitoring on lake trout and Atlantic salmon.

Table 1. Sea lamprey wounding rates for Lake Champlain landlocked Atlantic salmon and Lake Trout: programmatic targets, historical extremes, and current status. Wounds per 100 fish have been rounded to the nearest whole number.

Species	Lamprey wounds per 100 fish			
	Objective	Lowest	Highest	2016
Lake trout	25	27 ⁽²⁰¹⁵⁾	99 ⁽²⁰⁰⁶⁾	41
Landlocked salmon	15	15 ⁽²⁰¹⁴⁾	93 ⁽²⁰⁰³⁾	19

Sea lamprey reproductive effort is geographically distributed among tributaries in response to the presence of sea lamprey larvae which are indicative of past reproductive success in a particular tributary. Adult sea lamprey do not home their natal rivers (Bergstedt and Seelye 1995); instead, adult sea lamprey are attracted to pheromone odorants released by river-resident larvae (Vrieze et al. 2011) and are believed to select rivers where the detected presence of larvae indicates favorable spawning and larval rearing conditions. While most spawning adults return to rivers with established larval populations, a certain level of straying into uncolonized tributaries does occur and can lead to populations becoming established in previously unoccupied rivers. The Proposed Action is needed to address two such larval populations.

Sea lamprey control has been shown to contribute to the restoration of biological and ecological form and function. In the 1990s, the Great Lakes Fishery Commission declared success in rehabilitating lake trout populations in Lake Superior after more than 35 years of sea lamprey control and subsequently, stocking was halted in most Lake Superior waters in 1996 (Heinrich et al. 2003). In Lake Champlain, record numbers and record sizes of Atlantic salmon are being seen by both anglers and fishery managers as survival and condition of this species has improved in response to sea lamprey control. The increased abundance of adult landlocked Atlantic salmon in spawning runs has resulted in documented successful natural reproduction in the Winooski River for the first time in over 150 years (USFWS, unpublished data).

Sea lamprey control in Lake Champlain benefits the lake-wide fish community, not just sport fish. While few monitoring data exist, native members of the cold-water fish community such as burbot and whitefish are documented to be parasitized by sea lamprey and suffer unknown levels of mortality in response. The recent Lake Champlain Lake Sturgeon Recovery Plan attributes sea lamprey control and the reduction of lamprey-induced mortality on the state-endangered lake sturgeon as a critical step in sturgeon recovery and largely responsible for recent improvements in the Lake Champlain lake sturgeon population (MacKenzie 2016). While not their preferred host species, sea lamprey have been found on walleye, northern pike, catfish species, and bass species. Although their effect on these species' populations has not been quantified, the size of mature sea lamprey exceeds the capacity of these species to survive as hosts and contributes some level of undesired mortality to these species.

Sea lamprey control in the Great Lakes has produced dramatic improvements in the fishery and major economic benefits to the Great Lakes states' economy. Lupi et al. (2003) estimated that sea lamprey control on the St. Mary's River alone would equate to a \$2.6 to \$4.7 million dollar benefit to Michigan's recreational angling economy. The Congressional Office of Technology Assessment (OTA 1993) estimated that terminating sea lamprey control on the Great Lakes would result in a \$675 million annual cost for lost fishing opportunities and indirect economic impacts. Sturtevant and Cangelosi (2000) estimated that sea lamprey control produced a benefit of \$2.1 to \$4.3 billion per year for the Great Lakes states.

Substantial economic benefits are also a factor in justifying sea lamprey control on Lake Champlain. Estimated benefits and costs of the eight-year experimental sea lamprey control program indicated a favorable benefit:cost ratio of 3.48:1. Continuation of sea lamprey control on Lake Champlain has been estimated to generate up to an additional 1.2 million days of fishing and \$42.2 million in fishing-related expenditures, as well as an estimated \$59.3 million in additional water-based recreation expenditures each year (Gilbert 1999).

More and larger sport fish, with fewer attached lamprey and prominent lamprey scars, provide socio-economic benefits as the result of increased angling satisfaction and effort. Emerging improvements in tributary fisheries for landlocked Atlantic salmon are a particularly unique and highly-prized opportunity for anglers without boats and provide non-anglers with new opportunities to observe migrating salmonids at fishways and falls. Other water-based recreationists benefit from successful sea lamprey control by experiencing fewer lamprey attachments on their boats, kayaks, watercraft, and in rare cases, themselves.

In addition to the above benefits, the Proposed Action responds to contingencies for expansion established in long-term sea lamprey control program. SEIS, p. 324:

“In addition to the streams discussed in Section VIII.A above, several streams provide the potential for the establishment of additional sea lamprey populations (Table VIII-22). Alternative 1 (Proposed Action) recognizes the need for the program to be flexible in terms of the streams included for control. These streams should be periodically assessed for presence of larval sea lamprey infestations. Should new or previously undiscovered populations of sea lamprey be found, the stream will be subjected to sea lamprey control screening as described for the Proposed Action. Should inclusion into the sea lamprey control program be recommended, appropriate environmental review and permitting would be addressed prior to implementation of a control strategy.”

Studies in the Great Lakes show that a single sea lamprey-producing tributary, left untreated, can have a relatively large impact on the lake-wide population of sea lamprey (Wells 1980). For this reason, it is important that the Lake Champlain Sea Lamprey Control Program continues to monitor and adapt to the changing scope of tributary colonization as detected through regular surveys of larval lamprey populations in the basin.

2. Alternatives

2.1. Alternative 1 (Proposed Action)

Expansion of the sea lamprey control program outlined in the SEIS.

This alternative increases the scope of the ongoing, long-term sea lamprey control program by adding two Lake Champlain tributaries which have recently been identified as producers of parasitic sea lamprey. The streams proposed for inclusion are the Little Chazy River and Rea Brook in New York. Recent population surveys documented sea lamprey larvae in both streams at numbers that warrant control. Both streams were independently screened for technically feasible and environmentally and socially acceptable control techniques. Implementation of this alternative is expected to further reduce the parasitic sea lamprey population of Lake Champlain, increase the survival rates of all fish populations affected by sea lamprey parasitism, enhance Lake Champlain’s sport-fisheries, and result in socio-economic benefits associated with these outcomes.

In the following sections, we analyze the potential control options based on technical feasibility, cost and impacts to non-target organisms, humans, and the environment. We have identified unique impacts of each control strategy on the streams proposed for inclusion. For a general discussion of impacts and proposed mitigation of various control options common to all streams, please refer to SEIS section VII.A (p.89-211).

2.1.1. Little Chazy River

Sea lamprey habitat and population

The Little Chazy River (Figure 2) flows into Lake Champlain just south of King Bay in the town of Chazy, New York. Sea lamprey have access to approximately 10.9 km (6.8 mi) of stream from its confluence with Lake Champlain to a dam in the Village of Chazy. Larval sea lamprey were first collected in the Little Chazy River by USFWS staff in 2014. A quantitative assessment survey conducted in 2015 estimated a larval population of 48,450. Given the population estimate we expect a considerable number of juvenile parasitic lamprey to begin emigrating from the Little Chazy River in the coming years.



Figure 2. Map of Little Chazy River

Control Options

For an explanation of the chemical structure, mode of action, properties, and different formulations of **TFM**: 3-trifluoromethyl, 4-nitrophenol and **Niclosamide**: 5-Chloro-N-(2-chloro-4-nitrophenyl)-2-hydroxybenzamide, please refer to pages 17-19 and Appendices B, C, and F of the SEIS.

TFM Treatment

- **Technical considerations:** A TFM treatment of Little Chazy River is technically feasible. Water chemistry analyses will be required prior to conducting a TFM treatment. A dye plume or plume modeling study may also be required prior to conducting a TFM treatment.
- **Non-target concerns:** There are no known populations of Federal or State threatened or endangered species in the Little Chazy River. There would be no unique non-target effects from a TFM application.
- **Human Impacts:** A TFM treatment may impact riparian landowners who draw water for domestic use from the stream or surrounding lakeshore area and any farms which use the affected water for irrigation of crops or watering livestock. Water-use advisories, notification of landowners, and provision of alternative water supplies for domestic and agricultural use will mitigate any adverse impacts. Water-use advisories for a Little Chazy River treatment would likely overlap with the advisory zone of the Great Chazy River. To lessen impacts on landowners who may be located in both advisory zones, the treatment of the two rivers would be timed to minimize the duration of the water use advisory in the area of overlap.
- **Habitat Impacts:** No unique impacts that differ from those addressed in sections VII and VIII of the SEIS.
- **Cost:** A TFM treatment of the Little Chazy River would cost approximately \$4,000 depending on the discharge and water chemistry at the time of treatment.

TFM/Niclosamide Treatment

- **Technical considerations:** The low discharge and short extent of the Little Chazy River present no opportunities for significant cost savings typically realized from combined TFM/Niclosamide treatments. The low discharge and water chemistry of the Little Chazy River would make a combination treatment technically complicated and challenging and therefore, susceptible to wider fluctuations in lethal concentrations than would result from a TFM-only treatment.

Bayluscide 3.2% granules Treatment

- **Technical considerations:** The riverine setting of the Little Chazy River is unsuited for use of Bayluscide granules and it is not proposed for use there.

Installation of Barrier

- Technical considerations: An abandoned hydropower structure is present in the channel of the Little Chazy River at river mile 3.5. Any feasibility investigations for a sea lamprey barrier should begin with a thorough inspection and assessment of this structure. Currently, the spill gates are open and the river flows freely through the structure. There is sea lamprey spawning habitat located downstream from this dam making this location questionable as part of an effective control technique. The elevation of the stream and surrounding land downstream from this dam is at or less than 100 feet above sea level which eliminates the possibility of a low-head type barrier. A flow-through barrier to sea lamprey like that currently in use in Morpion Stream (a tributary of Lake Champlain in Quebec) would likely be physically feasible in the Little Chazy River.
- Non-target concerns: There are no known Federal or State threatened or endangered species that would be affected by the construction of a barrier. If the historic dam was able to successfully block sea lamprey then other migratory fish from Lake Champlain would also be impacted, such as smallmouth bass.
- Human impacts: No unique impacts that differ from those addressed in pages 101-104 of the SEIS.
- Habitat impacts: No unique impacts that differ from those addressed in sections VI and VII of the SEIS.
- Cost: The cost of a barrier on the Little Chazy River will depend on the design and location. Land easements would also have to be included in any cost associated with construction. A feasibility study would be required prior to barrier construction that would include a more accurate estimate of cost. The seasonal flow-through barrier with flood prevention capacity built on Morpion Stream, Quebec, in 2013 cost over 1 million dollars.

Trapping

- Technical considerations: The Little Chazy River is poorly suited for sea lamprey trapping operations as the channel is wider and deeper than what we have determined as our limit of effectively trapped rivers. Trapping is not proposed.

2.1.1.1. Little Chazy River control strategy

It is technically feasible to construct a flow-through type barrier and apply lampricide (TFM) to control sea lamprey on the Little Chazy River. Under the current set of circumstances the following sea lamprey control strategy is recommended:

- 1. Until a seasonally removable flow-through barrier can be established and proven effective, treat the Little Chazy River at river mile 6.8 with TFM at four-year intervals. The time interval may be adjusted should assessment surveys indicate slow recolonization or early metamorphosis.*
- 2. Investigate cost, feasibility and effectiveness of a seasonally removable, flow-through lamprey barrier, downstream of available spawning habitat.*

2.1.2. Rea Brook

Sea lamprey habitat and population

Rea Brook (Figure 3) flows into Cumberland Bay on Lake Champlain in the town of Plattsburgh, New York. Sea lamprey have access to approximately 2.9 km (1.8 mi) of stream from its confluence with Scotion Creek to a natural falls just to the Northeast of East Beekmantown Cemetery on Ashley Rd. Rea Brook's confluence with Scotion Creek is approximately 4.0 km (2.5 mi) from Lake Champlain. Larval sea lamprey were first collected in Rea Brook by USFWS staff in 2010. In spring of 2012, an adult sea lamprey trap was set in Rea Brook to document and assess the size of a spawning run. Experimental adult trapping has occurred from 2012 – 2017. Adult catches have fluctuated over the years from just 9 in 2012 to 128 in 2014. Limited larval surveys were done in 2013 and 2014. A quantitative assessment survey conducted in 2015 and estimated a larval population of 17,528 and a transformer population of 168. Given the population estimate and the significant catch of adults in 2014, Rea Brook has the potential to produce far more than 168 transformers per year.



Figure 3. Map of Rea Brook

Control Options

For an explanation of the chemical structure, mode of action, properties, and different formulations of **TFM**: 3-trifluoromethyl, 4-nitrophenol and **Niclosamide**: 5-Chloro-N-(2-chloro-4-nitrophenyl)-2-hydroxybenzamide, please refer to pages 17-19 and Appendices B, C, and F of the SEIS.

TFM Treatment

- Technical considerations: A TFM treatment of Rea Brook is technically feasible. Water chemistry analyses will be required prior to conducting a TFM treatment. A dye plume or plume modeling study may also be required prior to conducting a TFM treatment
- Non-target concerns: There are no known populations of Federal or State threatened or endangered species in Rea Brook. There would be no unique non-target effects from a TFM application.
- Human Impacts: A TFM treatment may impact riparian landowners who draw water for domestic use from the stream or surrounding lakeshore area and any farms which use the affected water for irrigation of crops or watering livestock. Water-use advisories, notification of landowners, and providing alternative water supplies for domestic and agricultural use will mitigate any adverse impacts. Water-use advisories for a Rea Brook TFM may extend up to a ½ mile in opposite directions from its mouth in Cumberland Bay. This impact would be mitigated by timing a TFM treatment of Rea Brook to overlap with water-use advisories associated with a Saranac River TFM treatment or Saranac Delta granular Bayluscide treatment.
- Habitat Impacts: No unique impacts that differ from those addressed in sections VI and VII of the SEIS.
- Cost: A TFM treatment of Rea Brook would cost approximately \$4,000 depending on the discharge and water chemistry at the time of treatment.

TFM/Niclosamide Treatment

- Technical considerations: The low discharge and short extent of Rea Brook present no opportunities for significant cost savings typically realized from combined TFM/Niclosamide treatments. The low discharge and water chemistry Rea Brook would make a combination treatment technically complicated and challenging and therefore, susceptible to wider fluctuations in lethal concentrations than would result from a TFM-only treatment.

Bayluscide 3.2% granule Treatment

- Technical considerations: The riverine setting of Rea Brook is unsuited for use of Bayluscide granules and it is not proposed for use there.

Installation of Barrier

- Technical considerations: The topography in the downstream sections of Rea Brook is not conducive to establishment of a low-head sea lamprey barrier. A seasonal, flow-through barrier could have potential in Rea Brook.
- Non-target concerns: There are no known threatened or endangered species in Ray Brook that would be affected by the construction of a barrier. Seasonal migrations of fish within the stream would be impacted.
- Human impacts: No impacts that differ from those addressed on pages 101-104 in the SEIS.
- Habitat impacts: A barrier of any type installed in the stream will alter the habitat of the stream. Some impoundment of water will occur and any type of structure will require covering some portion of stream bed and armoring of the adjacent stream banks.

- **Cost:** The cost of a barrier on Rea Brook will depend on the design and location. Land easements would also have to be included in any cost associated with construction. A feasibility study would be required prior to barrier construction that would include a more accurate estimate of cost. A seasonal flow-through barrier with flood prevention capacity was built on Morpion Stream, Quebec, in 2013 for the price of over 1 million dollars.

Trapping

- **Technical considerations:** Trapping has been tried in Rea Brook for 6 years and proved to be successful at blocking and collecting many sea lamprey. Despite that effort, enough lamprey evade the trapping setup to render it ineffective; substantial larvae production has been documented upstream of the trap site.
- **Non-target concerns:** There are no known Federal or State threatened or endangered species in Rea Brook that would be affected by the installation of a seasonal barrier and trapping operations. See SEIS section VII.A.1 for additional information regarding non-target impacts and section VII.A.2 for mitigation measures.
- **Human Impacts:** No impacts that differ from those addressed on pages 101-104 in the SEIS
- **Habitat Impacts:** No unique impacts that differ from those addressed in sections VI and VII of the SEIS.
- **Cost:** The estimated cost of trapping Rea Brook is \$5,000 per year using portable assessment traps. A permanent trapping site, including bank stabilization, would have a one-time cost of approximately \$10,000 for construction and would cost an additional \$5,000 to operate and maintain annually.

2.1.2.1. Rea Brook control strategy

Technically feasible control strategies for Rea Brook include TFM application and the construction of a permanent trap structure. The following sea lamprey control strategy is proposed:

- 1. Until a permanent trap structure can be established and proven effective, treat Rea Brook at river mile 1.8 with TFM at approximately four-year intervals. The time interval could be adjusted should assessment surveys indicate slow recolonization or early metamorphosis.*
- 2. Investigate cost, feasibility and effectiveness of a permanent trapping structure in Rea Brook*

3.2. Alternative 2 (No Action)

Continue sea lamprey control program as outlined in the SEIS and Subsequent EA.

Selection of this ‘No Action’ alternative would limit sea lamprey control to the streams currently included in the long-term sea lamprey control program as outlined in the SEIS. Future changes to the program (e.g. inclusion of other streams and/or control techniques) may still be considered following the appropriate environmental review in accordance with NEPA.

3.3. Alternatives considered but dismissed

During the development of the long-term sea lamprey control program, a number of alternatives were either considered and dismissed (SEIS section V.D.), or deemed unacceptable (SEIS section V.E.). The evaluation of the applicability and acceptability of those alternatives has not changed. The following alternatives were considered but dismissed during the development of a potentially expanded sea lamprey control program as outlined in the Proposed Action.

3.3.1. Abandon sea lamprey control

This alternative was deemed socially and ecologically unacceptable. Abandoning sea lamprey control while continuing salmonid restoration efforts provides limited to marginal opportunities for successfully achieving those goals. Efforts and funds directed toward the culture and stocking of Atlantic salmon and lake trout for the purpose of restoring those native species would no longer be justified considering the probability of success and the benefit:cost ratio. The goal of the Proposed Action is to achieve greater benefits from the sea lamprey control program. Abandoning both sea lamprey control and salmonid stocking was addressed in SEIS section V.D.1. This alternative was dismissed because of the favorable economic assessment of the experimental program, because it would be socially unacceptable, and because this management action would result in increased wounding and subsequent mortality of non-salmonid fishes.

3.3.2. Incremental expansion of the long-term sea lamprey control program

This alternative would allow fisheries managers to expand control efforts to only one of the sea lamprey producing streams identified in the Proposed Action. Sea lamprey do not home to their natal streams (Bergstedt and Seelye 1995) and are known to range throughout Lake Champlain (Howe et al. 2006). Therefore, this alternative was dismissed because a single untreated sea lamprey producing stream can have lake-wide effects (Wells 1980). Leaving one or more sea lamprey-producing streams untreated would impact the entire fishery and provide a continual source of adult lamprey which could then colonize or recolonize streams elsewhere in the Lake Champlain basin. Twenty-five years of experience and data have shown that implementing a comprehensive sea lamprey control strategy is the only way to achieve current Lake Champlain fishery restoration goals.

3.4. Control techniques under development

3.4.1. Use of pheromones to control sea lamprey populations

Research into new sea lamprey control techniques such as the use of sea lamprey pheromones continues in the Great Lakes. Research is currently focused on identifying optimal scenarios for implementation of pheromones as a control measure. While this research is promising, techniques are still in the initial phases of development and testing. Prior to implementation of pheromone-mediated control, additional review and pesticide registration needs to take place. When and if pheromones become a feasible control technique, their use may reduce the sea lamprey control program's reliance on pesticides. Proper NEPA review will also be necessary before sea lamprey pheromones can be used for control on Lake Champlain.

4. Affected Environment

4.1. General Description

For a general description of the Lake Champlain Basin, please refer to SEIS section VI.A.

4.2. Lake Basins and Sea Lamprey-producing Tributaries

For a full description of all Lake Basins, including land use patterns, recreational activities, and water usage, please refer to SEIS section VI.B.

Both the Little Chazy River and Rea Brook flow into the North Main Lake Basin of Lake Champlain.

4.3. Human Resources

For a description of human resources please refer to SEIS section IV.C.

4.4. Water Resources

For a description of water quality and water usage please refer to SEIS section IV.D.

4.5. Biological Resources

For a general description of the biological resources including wetlands, plants, invertebrates, fish, amphibians, reptiles, birds, and mammals, their protection status, and their potential for adverse impacts, please refer to SEIS, section VI.E. Table 2 lists the species of fish known to be present in the tributaries proposed in this EA for inclusion in the long-term sea lamprey control program (NYSDEC survey collection data). While site-specific information on the mussel populations is not available, Table 3 provides information on the mussel species present in New York waters of Lake Champlain.

Table 2. Fish species known to be present in reaches of tributaries accessible to sea lamprey in Little Chazy River and Rea Brook. Scientific names can be found in SEIS section VI.E.9.

Species	Little Chazy River	Rea Brook
American eel	X	X
Bluegill		X
Brook stickleback		X
Brook trout		X
Brown bullhead		X
Brown trout		X
Burbot		X
Central mudminnow		X
Chain pickerel		X
Common shiner	X	X
Creek chub	X	X
Cutlips minnow	X	
Eastern blacknose dace	X	X
Eastern silvery minnow		X
Emerald shiner		X
Fallfish	X	X
Fathead minnow		X
Golden shiner		X
Largemouth bass	X	
Longnose dace		X
Northern pike		X
Northern redbelly dace		X
Pearl dace		X
Pumpkinseed		X
Rainbow trout		X
Rock bass	X	
Rudd		X
Slimy sculpin		X
Smallmouth bass	X	
Spottail shiner		X
Tench		X
Tessellated darter	X	X
White sucker	X	X
Yellow perch		X

Table 3. Mussel species known to occur in New York tributaries to Lake Champlain. Scientific names can be found in SEIS section VI.E.9.

Common Name	Occurs in tributaries adjacent to Little Chazy and Rea Brook	Occurs in other NY tributaries to Lake Champlain
Eastern elliptio	X	X
Eastern lamp mussel	X	X
Pocketbook mussel		X
Giant floater		X
Creeper (Squawfoot)	X	
Eastern floater	X	X

5. Environmental Consequences

5.1. Alternative 1 (Proposed Action)

Expansion of the sea lamprey control program outlined in the SEIS

5.1.1. Adverse Impacts

For a discussion of adverse impacts to water, humans, wetlands, threatened and endangered species, plants, invertebrates, fish, amphibians, reptiles, birds, mammals, and user conflicts related to Alternative 1, please refer to SEIS section VII.A.1 and the subsequent EA section 5. The toxicity of lampricides to non-target aquatic organisms continues to be evaluated. While none of the more recent toxicity work has direct, species-specific relevance to the streams presented here, two recent cases are of interest.

First, a recent study has for the first time investigated the toxicity of TFM on the early life stages of freshwater mussels. The effects of TFM on mussel glochidia have long been of interest, but difficulty in culturing them has led to an inability to perform toxicity tests on that life stage until now. Boogaard et al. (2015) published a study that determined the acute toxicity of TFM to selected life stages of the snuffbox mussel (*Epioblasma triquetra*): a Great Lakes species and candidate for federal listing under the Endangered Species Act. The study found no significant difference in survival among life stages at concentrations of up to 1.8 times the minimum lethal dose for sea lamprey and in excess of the highest concentrations permitted for lampricide application during treatments. While snuffbox is not a species that occurs in Lake Champlain, it does show for the first time that there is no evidence of additional sensitivity in the glochidia stage.

Second, toxicity of TFM to stonecats was investigated in the Lake Champlain Basin in 2011. The USFWS Lake Champlain Fish and Wildlife Resource Office conducted a series of three bioassays for stonecats with the lampricide TFM during the summer and fall of 2011 (Calloway 2012). Results indicated that 10% of the stonecat population may suffer mortality at 1.2 times the TFM concentration needed to kill 99% of larval sea lamprey. Because stonecats reside in streams adjacent to Rea Brook and the Little Chazy River, their presence in either or both streams would not be unexpected, but remains currently undocumented in each.

Adverse impacts resulting from the implementation of Alternative 1 would be similar to those encountered under the current sea lamprey control program. Only spatial differences exist as sea lamprey control activities are carried out in new locations. Water users in the vicinity of the Little Chazy River and Rea Brook would receive water-use advisories, typical of lampricide treatments. Impacts to wetlands resulting from lampricide treatments (SEIS section VII.A.1.c.) would be limited to wetlands lying within areas influenced by Lake Champlain at lake levels below 102 feet or 31.1 meters in elevation.

5.1.2. Mitigating Measures

For a discussion of mitigating measures related to water, humans, wetlands, threatened and endangered species, plants, invertebrates, fish, amphibians, reptiles, birds, mammals, and user conflicts related to the long-term sea lamprey control program, please refer to SEIS section VII.A.2. No additional mitigating measures are required for the implementation of Alternative 1.

5.1.3. Unavoidable Adverse Impacts

For a discussion of unavoidable adverse impacts related to the long-term sea lamprey control program, please refer to SEIS section VII.A.3. Implementation of Alternative 1 would cause no additional adverse impacts above and beyond those identified in the SEIS.

5.1.4. Beneficial Impacts

For a discussion of beneficial impacts related to the long-term sea lamprey control program, please refer to SEIS section VII.A.4. Implementation of Alternative 1 would further enhance the beneficial impacts identified in the SEIS.

5.1.5. Irreversible and Irretrievable Commitments of Resources

For a discussion of irreversible and irretrievable commitments of resources related to the long-term sea lamprey control program, please refer to SEIS section VII.A.5. Implementation of Alternative 1 would cause no greater commitments of irreversible or irretrievable resources above and beyond those identified in the SEIS.

5.1.6. Growth Inducing Impacts

For a discussion of growth inducing impacts including types of growth, characterization of the Lake Champlain fisheries, ancillary growth, competition for growth, and infrastructure capacity related to the long-term sea lamprey control program, please refer to SEIS section VII.A.6. Implementation of Alternative 1 could potentially increase the growth related to Lake Champlain's fisheries.

5.2. Alternative 2 (No Action)

Continue sea lamprey control program as outlined in the SEIS.

5.2.1. Adverse Impacts

Under Alternative 2 there would be no adverse impacts to water quality, humans, or the flora and fauna of the streams identified in the Proposed Action. Adverse impacts to fish populations, sport fisheries, non-fishing related lake activities on Lake Champlain and derived economic benefits may result from the failure to successfully control sea lamprey. Sales of fishing licenses, fishing tackle, live bait, and services associated with the angling public may suffer declines under Alternative 2. Adverse impacts to the fishery may increase, despite no change in the level of control, because sea lamprey are capable of exploiting uncontrolled habitats at increasing rates over time.

5.2.2. Mitigating Measures

Adverse impacts identified under Alternative 2 could be partially mitigated by fisheries managers through a redirection of effort away from the salmonid fishery. If the effects of sea lamprey parasitism on the salmonid fishery increase, fishery management efforts may be reprioritized and directed toward fish species better able to survive among rising numbers of sea lamprey.

5.2.3. Unavoidable Adverse Impacts

Adverse impacts to fish populations, sport fisheries, non-fishing related lake activities on Lake Champlain, and derived economic benefits may result from the failure to successfully control sea lamprey. Sales of fishing licenses, fishing tackle, live bait, and services associated with the angling public may suffer declines under Alternative 2.

5.2.4. Beneficial Impacts

Beneficial impacts associated with the implementation of Alternative 2 would include no addition of pesticide to the environment, the lack of additional temporary water-use advisories associated with lampricide treatments, no additional risks to aquatic organisms, and no agency funds directed toward sea lamprey control on the tributaries identified in the Proposed Action.

5.2.5. Irreversible and Irretrievable Commitments of Resources

Under alternative 2 there would be no additional commitments of resources.

5.2.6. Growth Inducing Impacts

There would be no additional growth inducing impacts above and beyond those identified in the SEIS.

5.3. Cumulative Impacts

SEIS section VII.D. describes the cumulative impacts of the long-term sea lamprey control program on Lake Champlain's fisheries, fish community dynamics, mussel species, and the region's social and economic structure. The addition of Rea Brook and the Little Chazy River to the existing Lake Champlain Sea Lamprey Control Program does not pose new cumulative impacts beyond those addressed in the SEIS and the 2008 EA.

The inclusion of these streams would increase the total amount of lampricides applied within the Lake Champlain basin. However, the additional treatments will not have a cumulative impact of accumulating lampricides in the environment because both TFM and Niclosamide are readily detoxified by biotic and abiotic processes and do not accumulate in the environment (Hubert 2003; Dawson 2003).

Since the start of the long-term sea lamprey control program, two species of exotic fish have been discovered in Lake Champlain. Tench (*Tinca tinca*) were first discovered in the northern portion of Lake Champlain in 2002. The introduction of tench to Lake Champlain resulted from escaped fish from an unauthorized aquaculture operation in Quebec. Alewife (*Alosa pseudoharengus*) were first documented in Lake Champlain in 2003. The introduction of alewife most likely was the result of a bait-bucket introduction. Of these two species, the alewife has the greatest potential to affect the Lake Champlain fish community. Alewife are a significant portion of the diet of Lake Champlain salmonid species and are known to produce thiamine deficiency among certain salmonid species. Lake trout and Atlantic salmon populations suffer from "early mortality syndrome" (EMS) resulting from the thiamine deficiency. EMS requires additional research efforts and culture practices to successfully restore native salmonids, in addition to providing sea lamprey control.

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