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Lake Huron Committee Charge: Evaluation of Lake Trout Strains to Rehabilitation in Lake Huron

Lake Huron Technical Committee

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December, 2025

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INTRODUCTION

Lake trout were historically the dominant open water predator in Lake Huron and have often been referred to as a keystone species in the lake (Ebener et al 1995). Lake Huron hereafter refers to all three basins of the lake (the main basin, North Channel and Georgian Bay, Figure 1) unless otherwise specified. With European colonization in the Great Lakes basin, commercial scale fisheries emerged and dramatically increased Lake Trout harvests compared to pre-contact Indigenous harvests. The construction of the Welland Canal allowed sea lamprey to invade the upper Great Lakes, including Lake Huron in 1931 (Ebener et al., 1995), and in combination with continuing escalation of fisheries, ushered in an era of dramatic changes in the Lake Huron ecosystem. These changes led to the collapse and extirpation of Lake Trout populations in most of Lake Huron by the early 1950's.

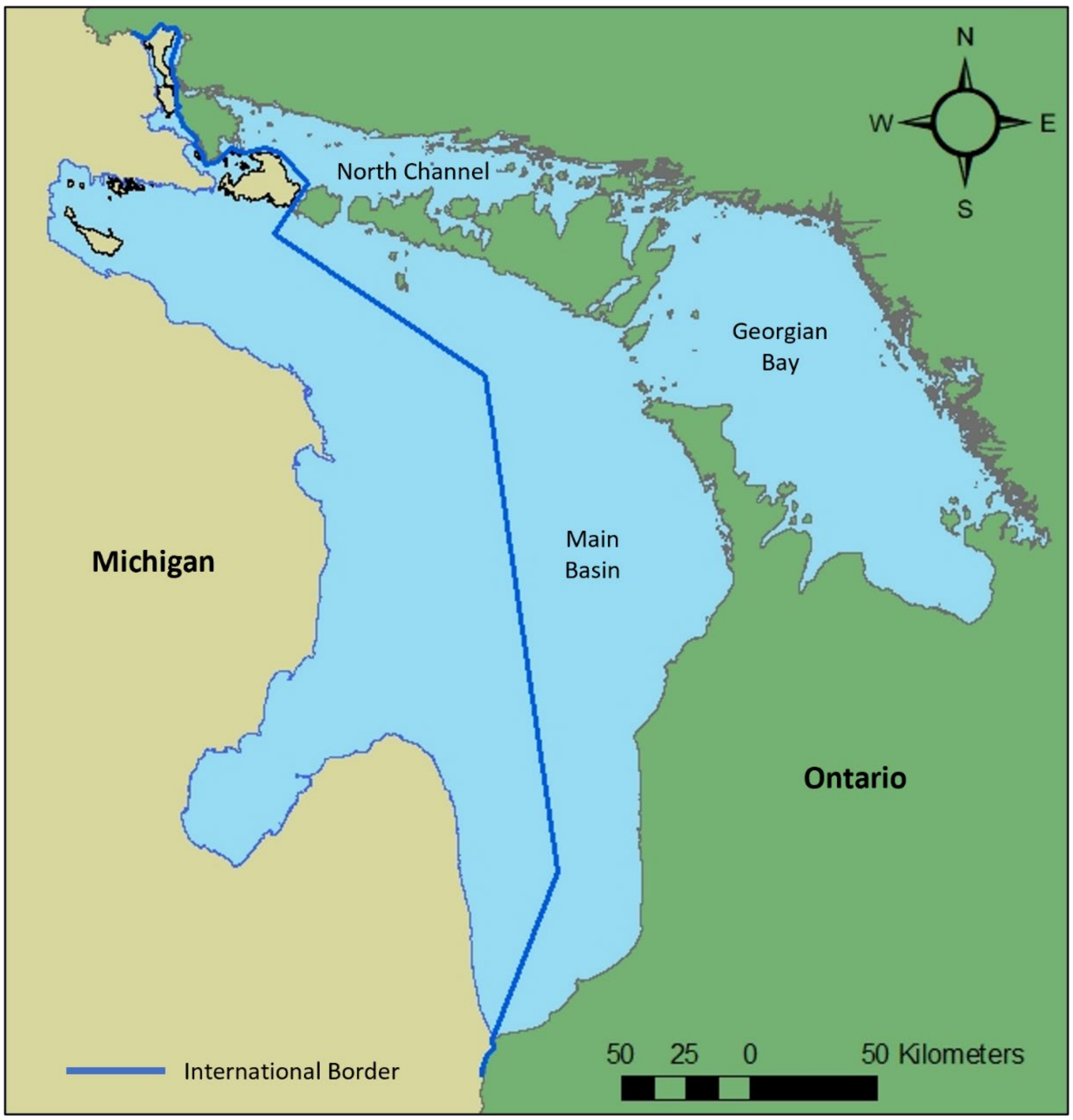

Figure 1. Map of Lake Huron.

In response to these major negative changes in Great Lake ecosystems, the Great Lakes Fisheries Commission (GLFC) was formed in 1955 by convention between Canada and the U.S. The GLFC has as its principle mandate the implementation of a sea lamprey control program and facilitation of cooperative fisheries research and management programs on the Great Lakes. To effectively implement the cooperative research and management aspects of it's mandate the GLFC led the development of the Joint Strategic Plan for Great Lakes Fishery Management (GLFC, 2007). This document lays out the approach and structure for consensus based management on each Great Lake. This includes a committee structure with lake management committees and lake technical committees, amongst others. The lake committees include management representatives from each agency with formal management authority on each lake and technical committees which often include biological staff from these same agencies and others that work on each lake.

Although sea lamprey was and continues to be an integral part of managing the Great Lakes, the extirpation of Lake Trout led to an accompanying stocking program for this species as a major component of rehabilitation programs for this species. It is worth noting that implementation of sea lamprey control also allowed implementation of stocking programs with the consequent reduction in sea lamprey mortality. In the case of the Lake Huron, this Lake Trout stocking program started in the 1960's.

Rehabilitation of Lake Trout in Lake Huron is of interest to management agencies on Lake Huron however this program has also been controversial with some Indigenous communities and stakeholders. To direct rehabilitation of this species in Lake Huron a number of guiding documents have been authored. These include Ontario's 1996 Rehabilitation Plan (OMNR, 1996), the Lake Huron Technical Committees (LHTC) Lake Trout Rehabilitation Guide (Ebener, 1998) and more recently Ontario's draft Revised Lake Trout Rehabilitation Plan (OMNR, 2012).

An important component in the Lake Trout rehabilitation process on Lake Huron, and captured in all guiding documents, is the need for a stocking program as part of the larger rehabilitation process. These documents all set criteria for the cessation of stocking with the development of spawning populations in the wild, based on hatchery adults. However, as Lake Trout populations were largely extirpated, stocking hatchery reared fish is a necessary first step in the creation of spawning populations.

Given the extirpation of most populations in Lake Huron, a number of different Lake Trout strains have been used in the lakewide stocking program through time (Figure 2). For example, several strains have been used from Lake Superior, the Seneca Lake strain from the New York Finger Lakes region as well as a number of inland lake strains. Given the variety of strains used in the stocking program in Lake Huron, and recent surges in Lake Trout natural reproduction since 2004 (Riley et al., 2007), questions have arisen regarding what strains have actually contributed to recent natural reproduction of Lake Trout.

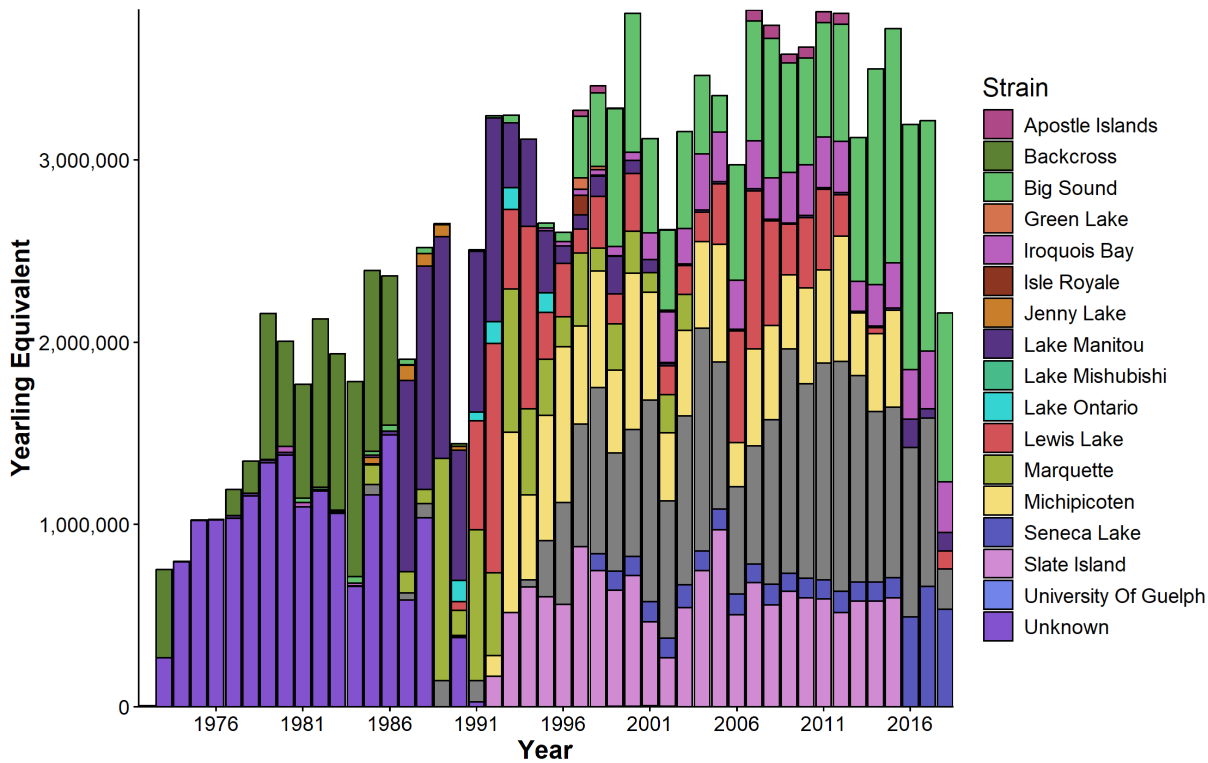

Figure 2. Lake Trout strains stocked in Lake Huron through time.

LAKE HURON COMMITTEE STRAIN EVALUATION CHARGE TO THE LHTC

In 2019 the Lake Huron Committee (LHC) authored a charge for the LHTC specifically focussed on the question of what strains amongst those stocked in Lake Huron have contributed to recent natural reproduction in the lake. Specifically the LHC charge to the LHTC was:

The LHC requests the LHTC to oversee an evaluation of the lake trout rehabilitation program in Lake Huron, with emphasis on the impact of various strains on the success of natural reproduction:

- History of strain stocking;
- Composition of strains in the population, as well as the commercial and sport harvest (Kim Scribner's recent paper addressed this, but it needs to be more management-friendly);
- Genetic composition of wild fish through time;
- Evaluation of Milestones in the 1998 Guide;
- Provide recommendations for the 2017 LHTC Lake Trout Stocking Change Evaluation Plan regarding strategies for use of strains going forward;
- Future research – synthesis paper? [e.g., Forces and changes that led to the explosion of natural reproduction].

This report is a summary of the LHTC response to this charge and provides a strain specific summary of the lakewide Lake Huron Lake Trout stocking program. An initial summary of the included information was presented at the 2020 summer LHTC meeting.

METHODS

Lake Trout stocking has largely been conducted by the U.S. Fish and Wildlife Service and the Ontario Ministry of Natural Resources (MNR) in Lake Huron. Data was sourced from either the GLFC stocking database in the case of USFWS data or from MNR databases in the case of stocking in Ontario waters. To simplify the long history of Lake Trout stocking in Lake Huron, data has been summarized from a lakewide perspective as well as by basin, and with a series of time stanzas.

Lake Trout stocking and related strain information was summarized beginning in 1965 when data is available and at approximately the same time when rehabilitative stocking started in Lake Huron. Strain contributions to stocking were summarized on a lakewide basis and by basin. The main basin of Lake Huron was also split into a northern and southern strata as well. A slightly modified version of the time stanza's presented in Scribner et al. (2018) were used to summarize stocking data, namely 1965-2000, 2001-2004, 2005-2009 and 2010-2018. The 1965-2000 time stanza captures the inception of the program and buildup of agency fish culture programs. The 2001-2004 stanza captures the period when available agency assessment data improves as well as the immediate period before alewives collapsed in 2004. The 2005-2009 period captures the period immediately following the alewife collapse in Lake Huron when Lake Trout natural reproduction increased notably (Riley et al. 2007). Lastly, the 2010-2018 stanza follows the period when natural reproduction increased and continued to build across all basins of the lake.

The second component of the LHC charge speaks to strain contributions to populations and fisheries, via the presence of hatchery reared fish. We determined that the most effective way to examine this part of the charge was to summarize coded wire tag (CWT) returns from agency data sources. These CWT tag returns were principally from both fisheries independent sources (agency index surveys) and fisheries dependent sources (commercial and recreational fishery returns). Unfortunately tag return numbers were not sufficient to parse out returns by strain, and by fishery type as the charge directed. As such, CWT return data was used to only examine returns by strain through time on a lakewide basis and by strain through time across basins rather than also by examining strain contributions to fisheries. Using the typical maturation schedule for Lake Trout in Lake Huron, a seven year gap between stocking and tag return timing was used to relate tag returns to stocking history for fish stocked with CWT's.

All hatchery reared Lake Trout stocked in Lake Huron are marked annually; all unmarked fish are presumed wild as a result. To examine what strains have contributed to natural reproduction, samples from unmarked, presumed wild fish were examined using a microsatellite DNA loci approach. The same loci and approach as per Scribner et al. (2018) were used. Slightly different time periods were used for the genetics components of this summary versus those used for summarizing stocking and CWT returns as the timing of genetics sample collections dictated when we could summarize these data. These periods include 1997-2001, 2002-2008 and 2009-2016. Thirteen hatchery strains stocked into Lake Huron were genotyped and served as a reference for samples from wild fish. The hatchery strains included:

- Lake Superior origin strains: Apostle Island, Isle Royale, Marquette, Slate Island, Michipicoten Island, Traverse Island
- Lake Michigan origin strains: Green Lake, Lewis Lake
- Lake Huron origin strains: Parry Sound, Lake Manitou, Iroquois Bay
- Outside the Great Lakes basin strains: Seneca Lake (MNR and USFWS data combined)

Lastly, the general outcomes of this review were used to examine the Milestones in the 1998 rehabilitation guide. Specific comments in this regard are included as well as strain related recommendations for the future of the Lake Huron Lake Trout rehabilitation program.

RESULTS

HISTORY OF LAKE TROUT STRAINS STOCKED IN LAKE HURON

A lakewide summary of stocking by strain displays the abundance of strains used in the Lake Huron rehabilitation program through time (Figure 2). It is worth noting that early in the program backcross (a hybrid of 75% Lake trout and 25% Brook Trout genetic material) and fish of unknown strain origin are prevalent in agency stocking data.

Beginning in the 1990's agencies diversified strains used in their stocking programs with Lake Superior strains prevalent in Ontario waters. More recently the number of strains in use has been simplified to include strains native to the Lake Huron basin (Parry Sound, Iroquois Bay and Lake Manitou) and the Seneca Lake strain (Figure 2).

Stratification of strain stocking data by basin clarifies the differences between basins through time (Figure 3). In Georgian Bay stocking transitioned from backcross to Lake Superior and Big Sound strains with small numbers of Seneca strain. Since 2016 Seneca strain numbers have been increased in this particular basin. Fewer fish overall have been stocked in the North Channel than other basins given its smaller surface area. Similar to Georgian Bay, strains stocked into the North Channel have transitioned through time from backcross to native strains (Parry Sound and Iroquois Bay). More recently Seneca strain has been stocked in greater numbers in this basin as well. Strains in use in the northern main basin has transitioned from a broad diversity of strains to Seneca strain and Big Sound more recently. Similarly, the southern main basin program has transitioned from a broad diversity of strains to Slate Island, Seneca, Lewis Lake and more recently, Big Sound strain (Figure 3).

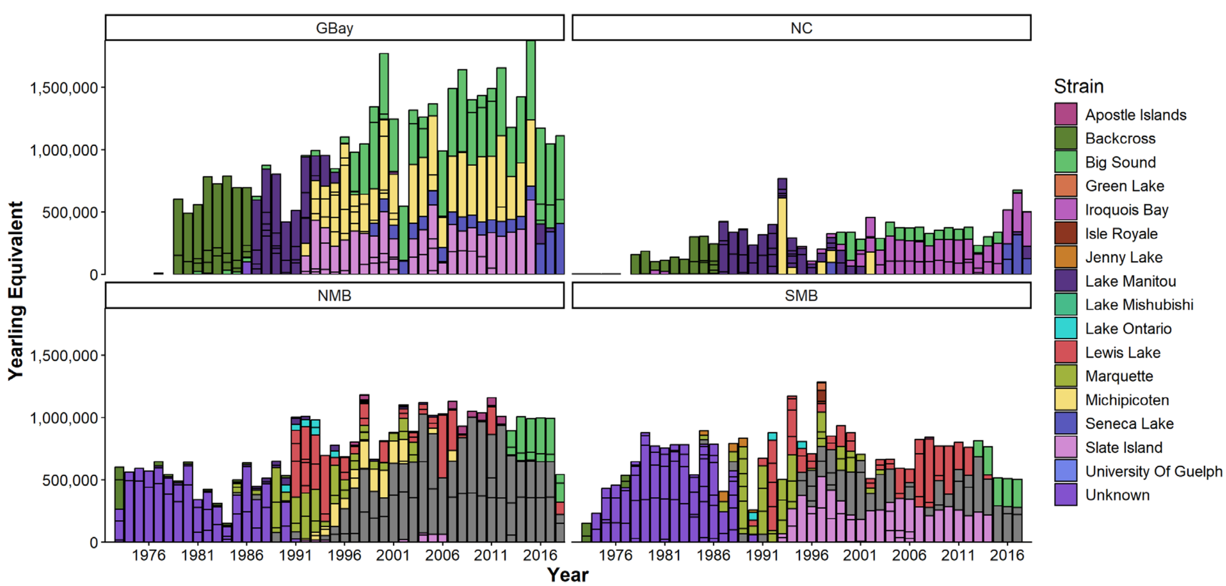

Figure 3. Lake Trout strains stocked in Lake Huron through time, by basin.

COMPOSITION OF STRAINS IN POPULATIONS

The second component of the LHC's charge was to determine the composition of strains in populations as well as fisheries. Coded wire tag returns were used as a proxy to relate stocking history with returns of stocked fish through time on a lakewide basis, as well as through time across basins. Our compilation of coded wire tag return data indicated that tag returns were not sufficiently large to determine strain contributions to fisheries however. As a result, our sense of strain contributions is on a broad population level through time and space (lake basins) only rather than also from a fisheries perspective as well.

On a lakewide basis through time CWT return data suggest that Lewis Lake and more recently Seneca Lake strains have contributed disproportionately to returns (Figure 4). The timing of stocking Lewis Lake strain (Figure 3) would appear to correspond with the CWT returns noted in our summary during the 2001-2004 and 2005-2009 time periods. However, CWTs from this strain were returned out of proportion to their proportion in the stocking history in these time periods. In the most recent time period the Seneca Lake strain appears to have contributed more than any other strain. Worth noting in the lakewide CWT return data are those strains that did not contribute to returns, and by extension, to the rehabilitation program or fisheries. Notably, Lake Superior strains have not contributed in any meaningful way to returns through time, particularly in the 2001-2004 and 2005-2009 time periods (Figure 4).

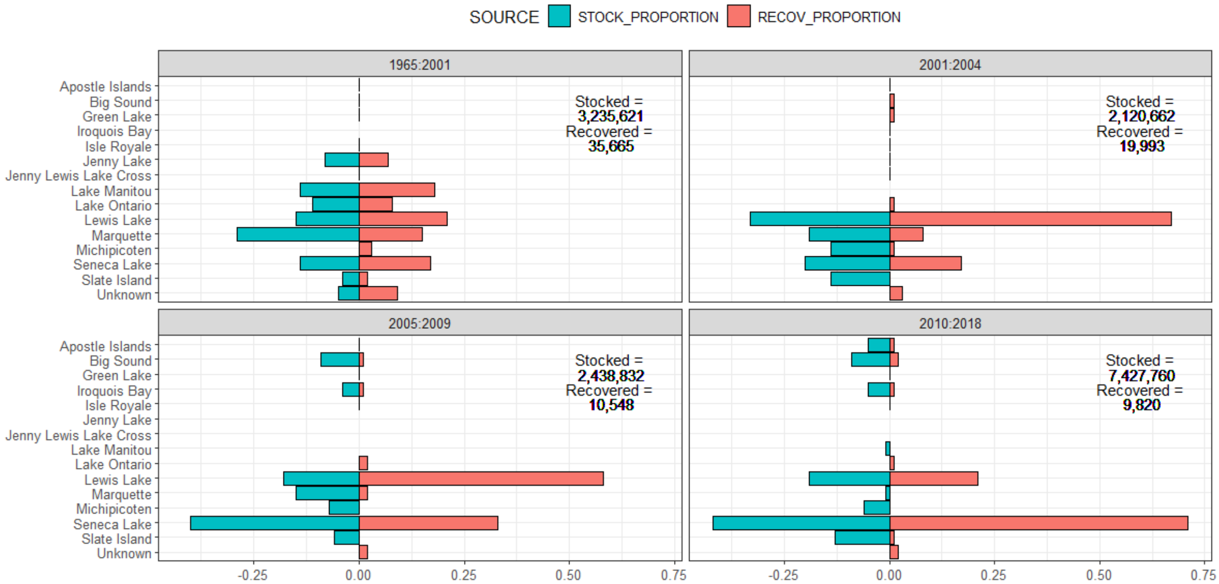

Figure 4. Lakewide strain contributions through time as observed through proportional stocking history and coded wire tag (CWT) returns. Time periods are when CWT returns occurred and stocking numbers are seven years prior to the respective time period.

When examined by basin through time, additional resolution is gained regarding strain contributions (Figures 5 through 8). In the early time period (1965-2000) of particular interest were the returns of Seneca strain fish in the North Channel where none had been stocked. Seneca strain contributions were also notable in the northern main basin in this time period (Figure 5).

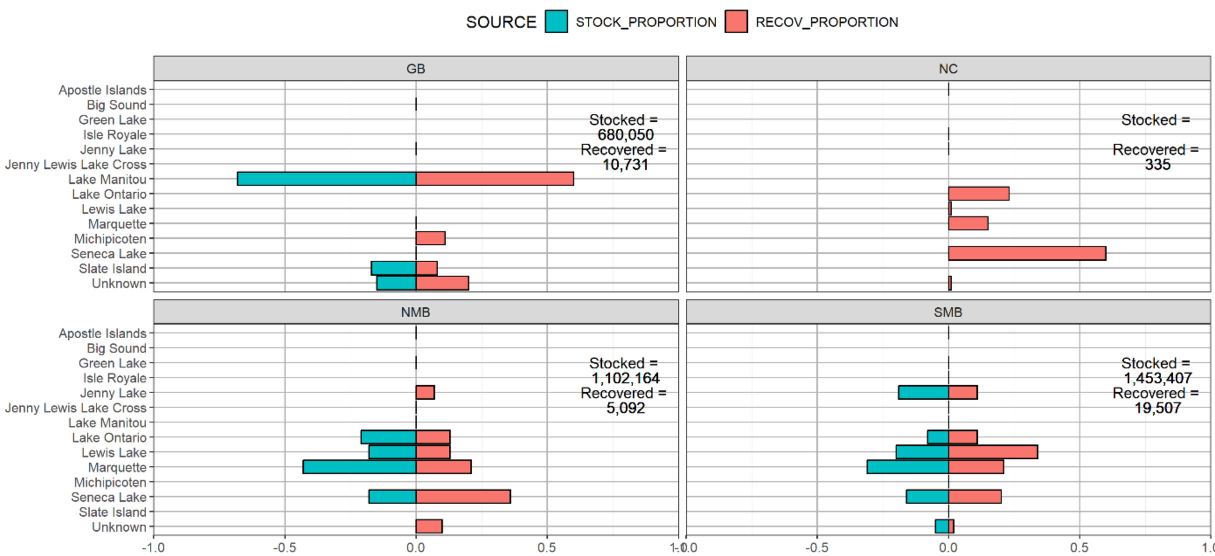

Figure 5. Strain contributions by basin from 1965-2000 as observed through proportional stocking history and coded wire tag (CWT) returns. Time periods are when CWT returns occurred and stocking numbers are seven years prior to the respective time period.

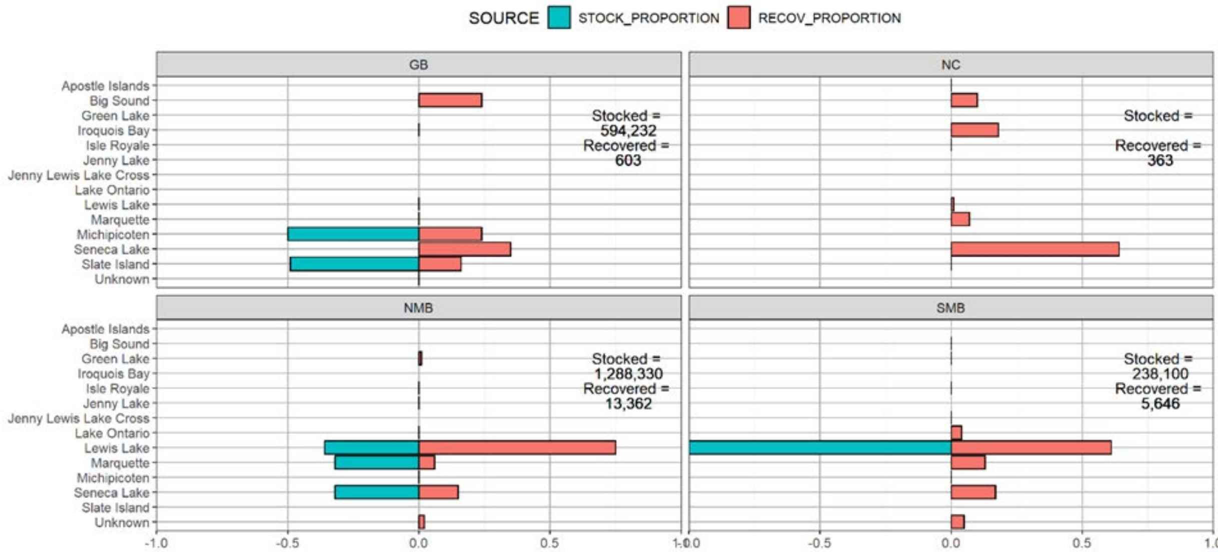

Figure 6. Strain contributions by basin from 2001-2004 as observed through proportional stocking history and coded wire tag (CWT) returns. Time periods are when CWT returns occurred and stocking numbers are seven years prior to the respective time period.

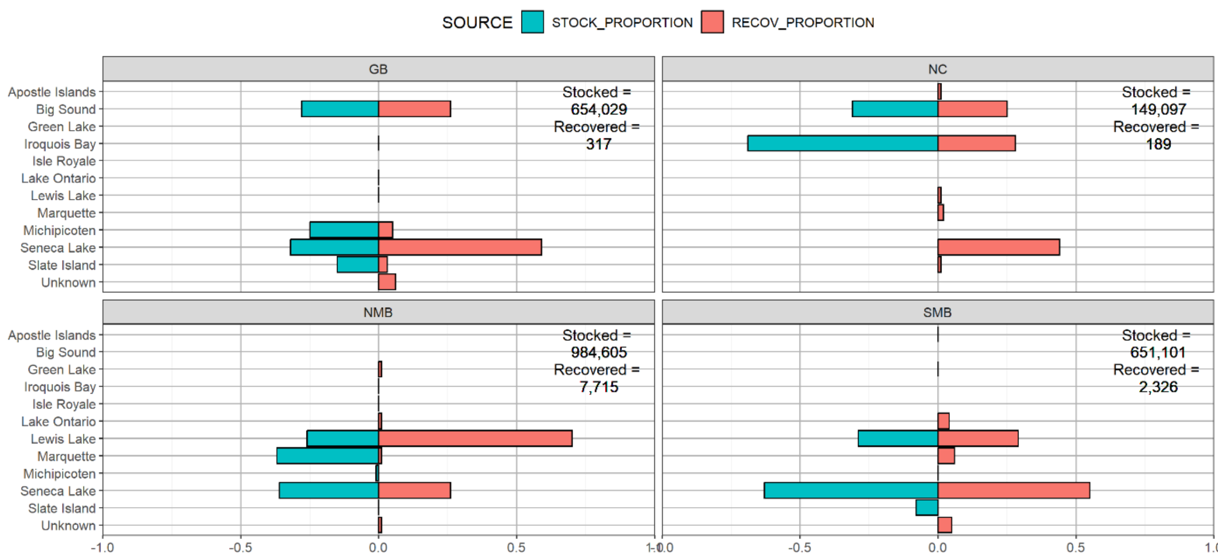

Figure 7. Strain contributions by basin from 2005-2009 as observed through proportional stocking history and coded wire tag (CWT) returns. Time periods are when CWT returns occurred and stocking numbers are seven years prior to the respective time period.

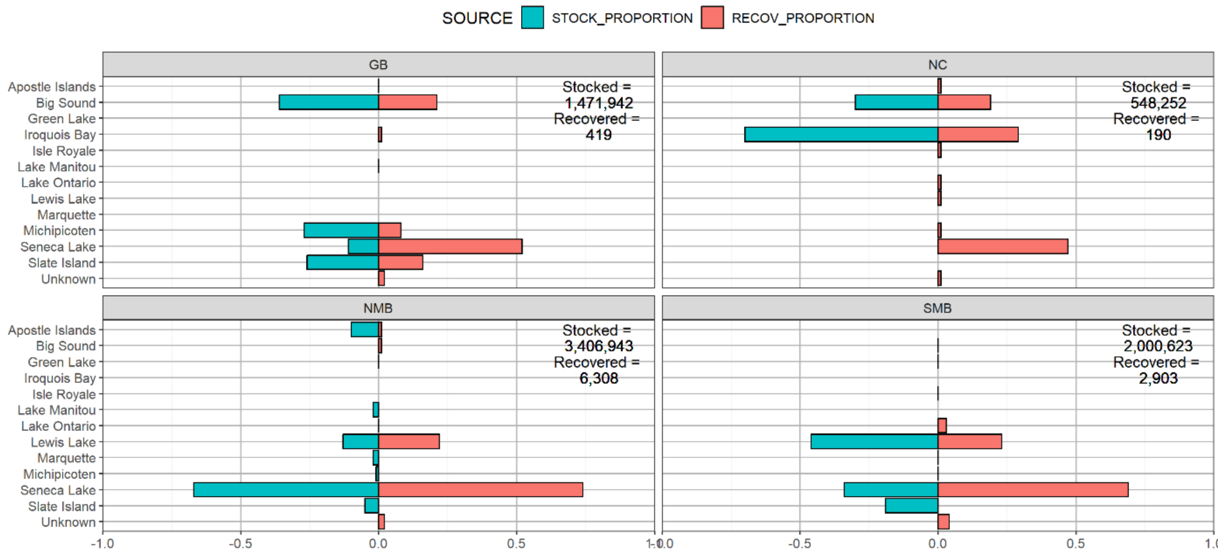

Figure 8. Strain contributions by basin from 2010-2018 as observed through proportional stocking history and coded wire tag (CWT) returns. Time periods are when CWT returns occurred and stocking numbers are seven years prior to the respective time period.

In the 2001-2004 time period Seneca strain contributions to returns continued to be disproportionally high (Figure 6). Additionally, Lewis Lake strain contributed to returns in the main basin (Figure 6). As was discussed from a lakewide perspective, examining CWT returns by basin through time also highlights the lack of returns and contributions by Lake Superior strains in the 2001-2004 time period (Figure 6). From 2005 to 2009 the trend of disproportionate contributions by Seneca strain continued across basins as well as Lewis Lake strain in the main basin (Figure 7). The introduction of new strains into stocking programs, in particular Big Sound and Iroquois Bay strains in Georgian Bay and the North Channel, were noted in CWT return data from this same time period however CWT returns were low in these basins. The trends noted in the 2005-2009 time generally continued into the final time period examined, 2010-2018, however Lewis Lake strain contributions began to decline (Figure 8).

GENETIC COMPOSITION OF WILD FISH

Of particular interest to the LHC and broader Lake Huron management community are the contributions of strains that have been stocked, to the production of wild fish. Lake Trout natural reproduction has notably increased since 2004 (Riley et al., 2008) and consequently, which strains have contributed to this production of wild fish is of particular importance for the rehabilitation program moving forward.

On a lakewide basis irrespective of time, Seneca strain fish have contributed to production of wild young in the main basin and the North Channel (Figure 9). Additionally, Lake Manitou strain has contributed across all basins as has Big Sound strain in Georgian Bay (Figure 9). However, sample size issues likely influence the results from earlier time periods and skew a lakewide perspective towards more recent time periods where sample sizes are larger (Figures 10 and 11).

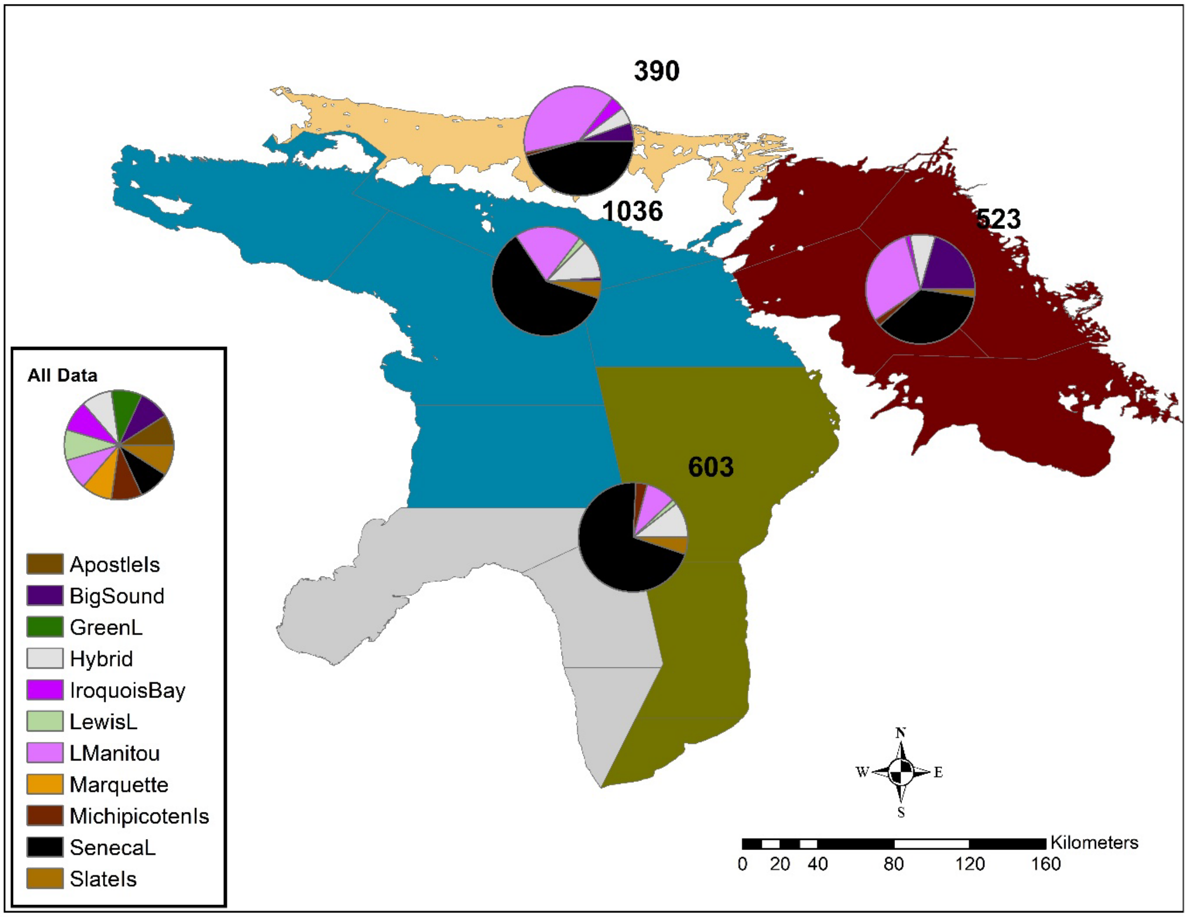

Figure 9. Lakewide strain contributions to production of wild Lake Trout in Lake Huron from 1997-2018.

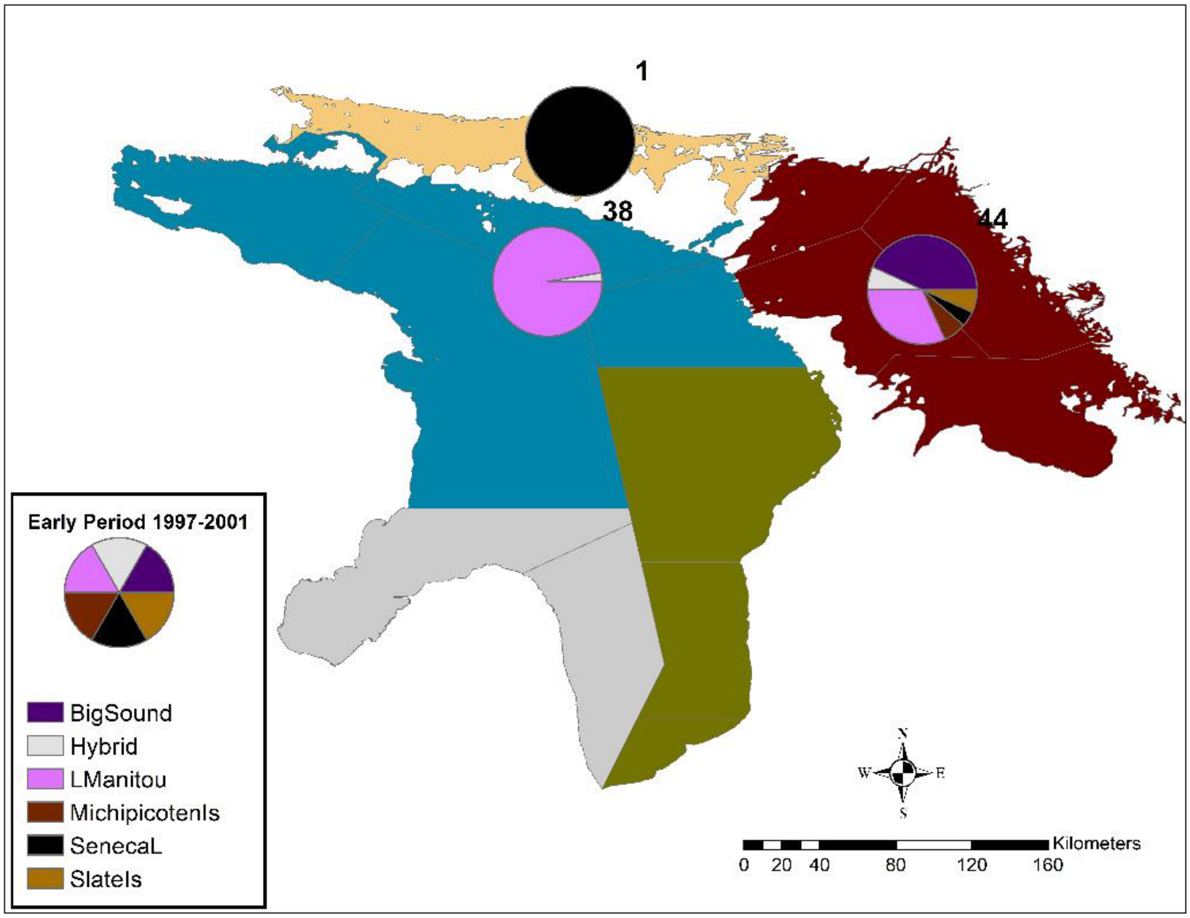

Figure 10. Lakewide strain contributions to production of wild Lake Trout in Lake Huron from 1997-2001.

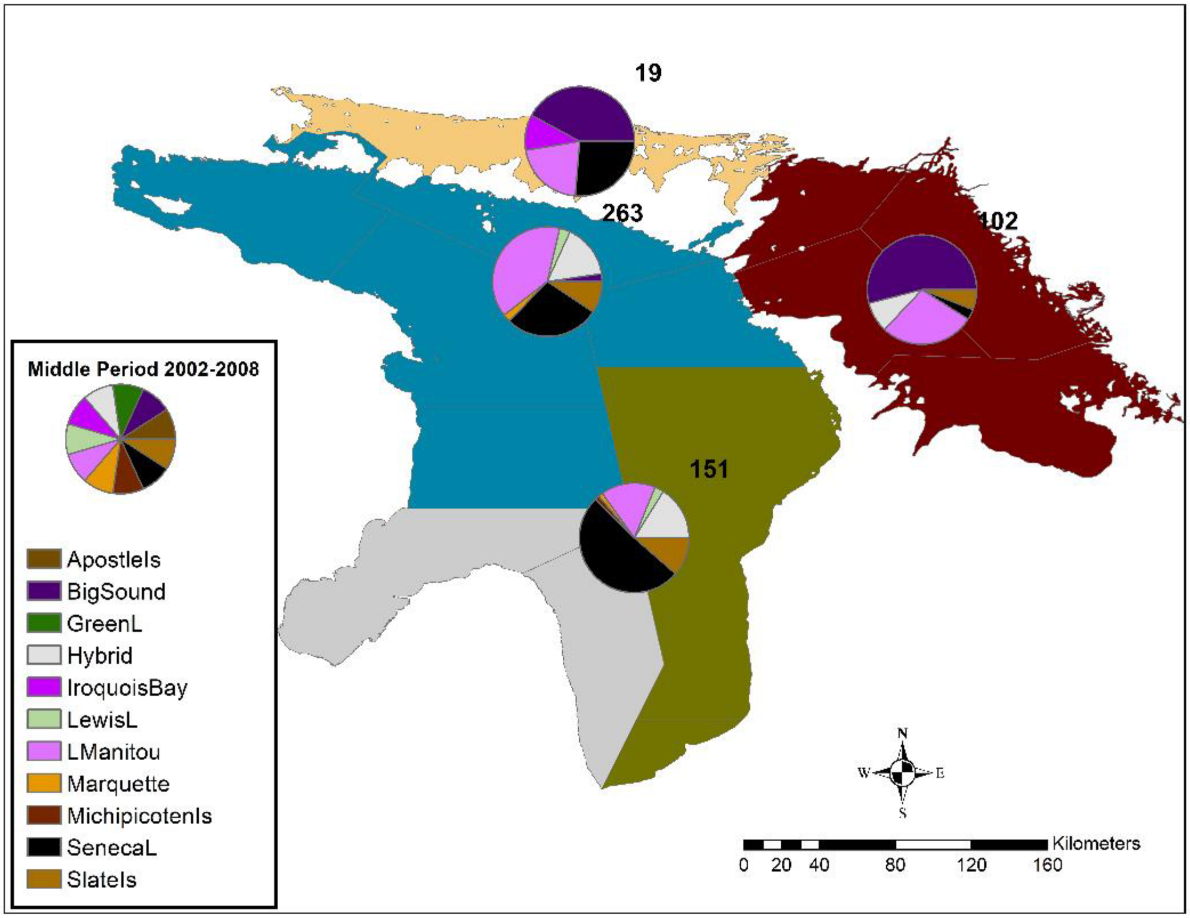

Figure 11. Lakewide strain contributions to production of wild Lake Trout in Lake Huron from 2002-2008.

Using the slightly different time periods dictated by the availability of genetics samples (versus those used for summarizing stocking and CWT return data), genetics samples from the early time period (1997-2001) suggest that Lake Manitou strain contributed in the main basin and Georgian Bay. However, the Big Sound strain was dominant in Georgian Bay. Lake Superior strains (Michipicoten and Slate Island) contributed to natural reproduction in Georgian Bay at low levels although this was disproportionate in a negative sense when compared to their stocking history in this basin (Figure 3). Samples sizes were low in the early period and likely complicate our analysis however (Figure 10).

The second time period in which genetics samples were analyzed (2002-2008) bracketed the period when alewives collapsed and natural reproduction of Lake Trout surged. Again, Lake Manitou strain contributed across all three basins of the lake. Big Sound strain continued to be the dominant contributor in Georgian Bay and also contributed to natural reproduction in the North Channel in this time period. Seneca strain was the dominant contributor in the southern main basin and contributed notably across all three basins, the main basin and North Channel in particular. The Slate Island strain contributed to natural reproduction in Georgian Bay and the main basin, although, as in the earlier time period, not in proportion to its stocking history (Figures 11 and 3).

Genetic analysis of samples from wild fish in the most recent time period (2009-2016) indicate that Seneca strain fish have become the dominant producer of wild fish in Lake Huron (Figure 12). This is disproportionately higher than their stocking history in all but the northern main basin (Figure 3). However, Lake Manitou strain is still a notable contributor particularly in Georgian Bay and the North Channel (Figure 12). Big Sound strain continues to contribute to natural reproduction in Georgian Bay albeit at lower levels than observed in earlier time periods (Figures 11 and 12). Slate Island strain contributions declined to low levels in this time period (Figure 12). Of interest across all time periods was the very low level of contributions of Lewis Lake or Marquette strains. Although CWT returns of the Lewis Lake strain were notable, they do not appear to have contributed to natural reproduction in any significant way. CWT returns were observed for the Marquette strain in some time periods but this strain contributed very little to natural reproduction (Figures 5, 9-12). Lastly, we should also note that inter-strain hybrids were produced in measurable amounts in the two most recent time periods.

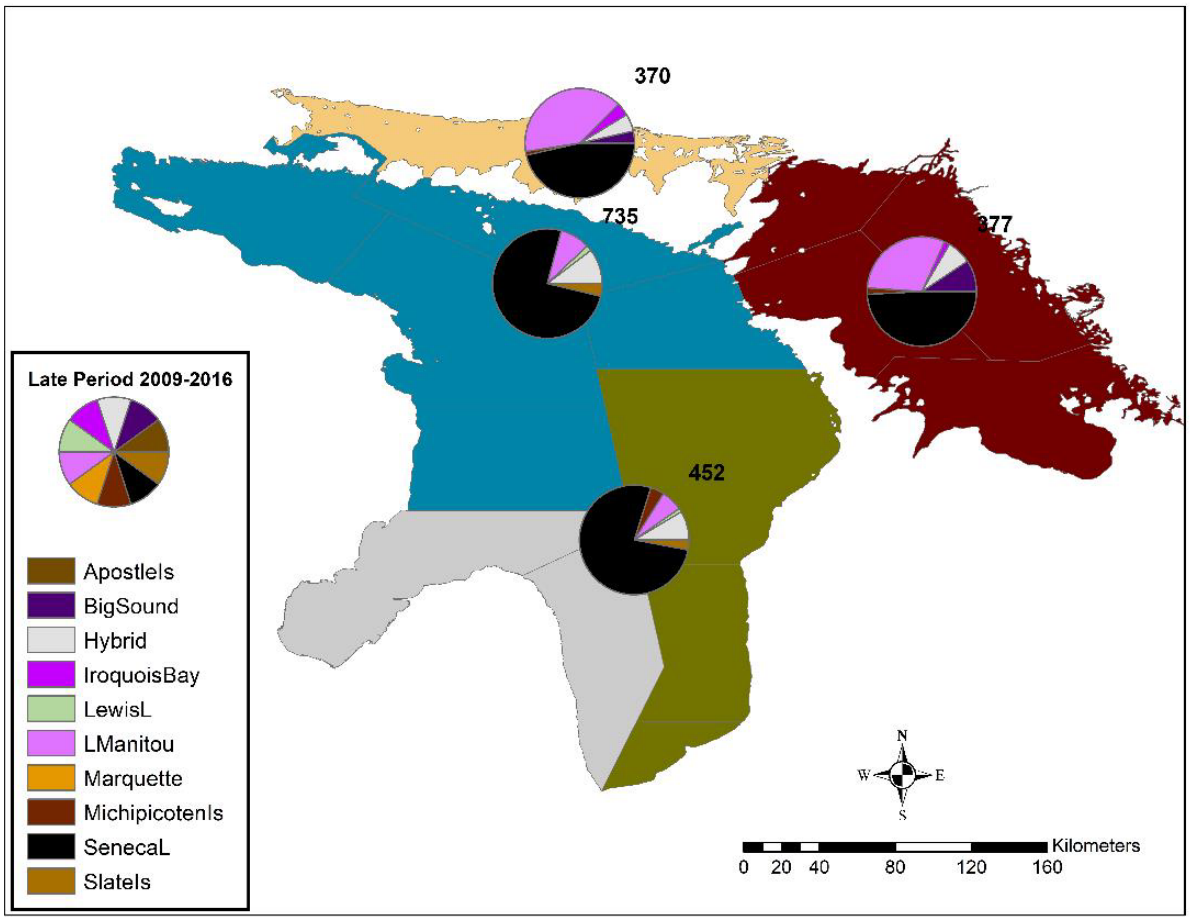

Figure 12. Lakewide strain contributions to production of wild Lake Trout in Lake Huron from 2009-2016.

DISCUSSION

With the extirpation of Lake Trout in most of Lake Huron, stocking hatchery reared fish was and continues to be a necessary part of the rehabilitation program for this species. However, continued concern over the presence of hatchery reared Lake Trout in the fish community and perceptions of negative consequences for Lake Whitefish continue to challenge the need for the rehabilitative stocking. Although concern regarding the Lake Huron Lake Trout rehabilitation program exists, continual stocking of this species into the future is not an agency goal. Rather, using hatchery reared fish to found spawning populations of Lake Trout that produce wild fish is the desired outcome for management agencies (Ebener, 1998 and OMNR, 2012). Stocking will only be needed until this occurs.

Consequently, management agencies around Lake Huron have stocked Lake Trout for a number of years. This program has included a variety of strains given the extirpation of native populations in most of Lake Huron (Figures 2 and 3). Early in the stocking program a variety of strains were used. More recently, stocking programs have been largely refined to include the two surviving native strains (Big Sound and Iroquois Bay), a native in-basin strain (Lake Manitou) and the Seneca Lake strain.

To begin this examination of strain contributions, CWT returns were used to examine what strains contributed to populations of hatchery derived fish in Lake Huron (versus contributions to natural production of wild fish). It seems reasonably clear from CWT returns that only a subset of those strains stocked with CWT's have survived in sufficient numbers to yield tag returns at older life stages. Notably, Seneca strain contributed disproportionally higher than expected to CWT returns, through all the time periods examined. Lewis Lake strain CWT returns were also high through the intermediate time periods. The more recent introduction of the native Big Sound and Iroquois Bay strains into the stocking program has resulted in CWT returns as well.

In addition to which strains contributed CWT returns, it is worthwhile to highlight those that did not. Lake Superior strains were not observed in any meaningful way in CWT returns which would suggest that these strains are not worth pursuing in future stocking efforts. It is also worth highlighting that given the number of coded wire tagged fish stocked into Lake Huron, the total number of tag returns is quite low. We would suggest that any future CWT programs devote more effort to securing tag returns otherwise the investment in tagging is questionable.

Since 2004 Lake Trout natural reproduction has surged in many parts of Lake Huron (Riley et al., 2008), which is a desired outcome of the rehabilitation program. Strain contributions to this natural reproduction is of interest to management agencies to understand and refine future stocking efforts. Microsatellite DNA techniques have clarified that Seneca and Lake Manitou strains have been contributing strains to natural reproduction across all the time periods examined. Big Sound and Iroquois Bay strains were also evident in the genetics analysis which we view as a positive outcome of their use in the Lake Huron program given they are the two sole native strains that escaped extirpation.

Slate Island and Michipicoten strains were evident, although at relatively low levels, in the genetics analysis, particularly in the intermediate time stanza (2002-2008). Their contributions waned through the most recent time period (2009-2016). This is of interest given their general absence in the CWT return data. However the recent decline in their presence in genetics data would seem to confirm the lack of contributions that the CWT data suggested.

Some disparity does seem to exist between the CWT and the genetics data. In particular, CWT returns for Lewis Lake and Marquette strains are not substantiated in the genetics data. This would seem to suggest that although these strains survived to older life stages, in the main basin in particular given their stocking history there, they have not contributed to producing wild fish in any meaningful way. Marquette strain has since been discontinued for stocking in Lake Huron.

It also seems clear that Seneca strain has emerged as a dominant contributor both as hatchery reared adults in the lakewide population and as a producer of wild fish since 2004. These results are in disproportion to their stocking history, particularly in the North Channel and Georgian Bay. We would suggest continued use of this strain in Lake Huron stocking program although dialogue may be required about its continued use given it is an out of basin strain.

It should also be highlighted that inter-strain hybrids are evident in genetics analysis which complicates determining which strains are contributing to natural reproduction.

EXPECTATIONS VERSUS REALITY: STOCKING HISTORY VERSUS CONTRIBUTIONS TO WILD PRODUCTION

To refine the outcomes of this report with respect to what strains are contributing to recent natural reproduction in Lake Huron, as per the LHC's charge, we offer the following:

- Seneca, Big Sound and Lake Manitou strains are most recently producing the bulk of wild fish in Lake Huron;
    - Seneca strain in particular is producing wild fish out of proportion to its stocking history
- Lake Superior strains and the Lewis Lake strain have not contributed in a meaningful way to recent natural reproduction in Lake Huron;
- Inter-strain hybrids are being produced which complicates genetics analysis of which strains are producing wild fish;
- Management agencies may wish to discuss and consider what strains to use in future stocking programs given the outcomes of this review;

COMMENTS ON THE LHTC REHABILITATION GUIDE MILESTONES

Complementary to the assessment of which stocked Lake Trout strains have contributed to rehabilitation, the LHC charge also requested a review of the continued pertinence of the rehabilitation milestones in the LHTC Lake Trout Rehabilitation Guide (Ebener, 1998). Our experience in compiling this review, as well as participation in agency Lake Trout rehabilitation programs, has educated our review and response to this component of the LHC charge.

Milestone One

The first Milestone highlighted in the Guide is focused on the creation of hatchery derived spawning populations in a reasonable time period based on the expected maturation schedule for Lake Trout in Lake Huron. It includes three indicators which provide quantifiable metrics focused on mean age and catch rates of both adults and wild juveniles in fisheries independent surveys.

We feel this is still a useful milestone and one that logically reflects where Lake Trout rehabilitation programs need to start from. Additionally, the metrics associated with this milestone continue to be relevant in terms of what agency assessment programs can deliver.

Milestone Two

The second milestone builds on Milestone One and is focused on the development of a spawning population comprised of wild fish. Similar to Milestone One, the timing for Milestone Two is based on the expected Lake Trout maturation schedule. This milestone also includes three indicators which provide quantifiable metrics focused on mean age and catch rates of both adults and wild juveniles in fisheries independent surveys. The mean age indicator is of course older than that used in Milestone One with the expected presence of older fish in robust spawning populations based on wild fish.

Similar to Milestone One we feel this is still a useful milestone and one that logically reflects where Lake Trout rehabilitation programs should progress too after hatchery derived spawning populations have developed. Additionally, the metrics associated with this milestone continue to also be relevant in terms of what agency assessment programs can deliver.

Milestone Three

Milestone Three is generally focused on the broader fish community and conditions that support self-sustaining Lake Trout populations. Associated with this milestone is a metric regarding egg to yearling survival.

We feel that although this milestone conceptually makes sense, the data required for the related metric is not collected in agency assessment programs. Agency assessment programs do not regularly focus on or collect Lake trout egg or yearling abundance data. As such, we suggest that this milestone is of limited practicality. At a minimum we would suggest that the LHC and LHTC re-evaluate this milestone and develop an alternative that is supported by a metric based on data that agency assessment programs regularly collect. An alternative approach that could be considered is a combination of metrics focused on proportions of wild fish, catch rates and spatial aspects of where wild populations exist.

CONCLUSIONS AND FUTURE NEEDS

In an effort satisfy the LHC charge we wanted to offer some concluding statements and our perspectives on several items for the LHC to consider for the future. These include:

- A number of strains have been stocked as part of the Lake Huron Lake Trout rehabilitation program;
- Coded wire tags returns through time indicated select strains contributed to populations disproportionate to their stocking history although this did not follow through to genetic contributions to wild fish for the Lewis Lake strain in particular;
- Coded wire tag returns have generally been low when contrasted against the number of coded wire tagged fish that have been stocked; any future stocking programs using coded wire tags should include a significant recovery component to justify the cost of tagging;
- Seneca, Big Sound and Lake Manitou strain have supported the majority of natural reproduction in recent years;
- Wild fish from Seneca strain have been produced early in the time series in Ontario waters where they were not stocked;
- Lake Superior and Lewis Lake strains underperformed in terms of their contributions to wild production, given their stocking history particularly in Ontario waters;
    - We don't recommend their continued use in stocking programs as a result;
- It may be too early to clearly determine the contributions of Iroquois Bay strain in Ontario waters;
    - We recommend it's continued use as a native strain and further genetics analysis to examine its potential contribution to natural reproduction.

With respect to future needs as a result of this synthesis we offer the following:

- Although it may not be necessary, we suggest that this analysis may benefit from more statistical rigor when comparing the expectations based on stocking programs and the realities of what was observed through the genetics analysis;
- We strongly recommend continuing the collection of genetics tissue samples from wild Lake Trout to further our understanding of Lake Trout natural reproduction in Lake Huron;
- Examination of the effects of differential movements across strains, in combination with seasonal aspects of this movement, on natural reproduction;
- Examination and identification of the potential mechanisms that allow Seneca strain to contribute to populations and to natural reproduction;
- A peer reviewed paper is a possibility from this synthesis.

To conclude, we trust this satisfies the July 2019 Lake Huron Committee charge.

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