Marine Stewardship Council fisheries assessments

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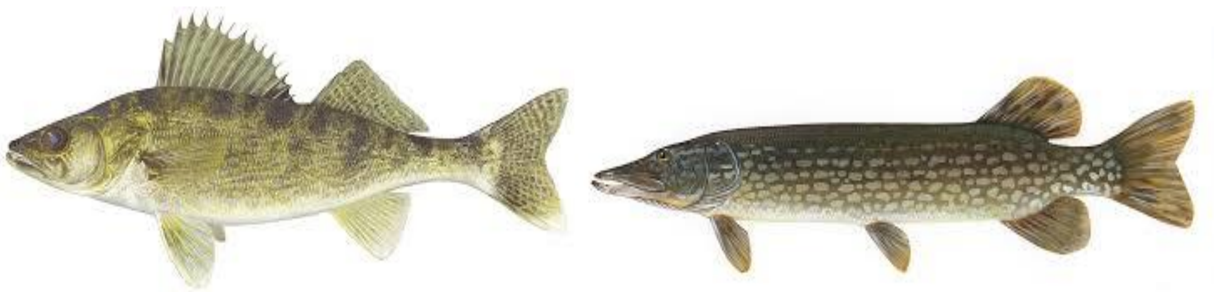
Cedar Lake Walleye and Northern Pike Fisheries



Announcement Comment Draft Report

Conformity Assessment Body (CAB)	Lloyd's Register
Assessment team	Paul Knapman, John Casselman, Rob Blyth-Skyrme, Ravindra Pawar
Fishery client	Cedar Lake Fisheries Inc
Assessment type	Initial Assessment
Date	November 2021

1 Assessment Data Sheet

CAB details		Lloyd's Register
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	P1 Assessor	John Casselman
	P2 Assessors	Rob Blyth-Skyrme Ravindra Pawar
	P3 Assessor	Paul Knapman

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2 Executive summary

This report is the Announcement Comment Draft Report (ACDR) which provides details of the MSC assessment process for the Cedar Lake Walley and Northern Pike Fishery. The process begins with publication of the ACDR on 17th of November 2021 and was concluded (to be determined at a later date).

A review of information presented by the client has been scored by the Assessment Team – please note this **does not** represent a final scoring outcome or a certification decision.

The scoring presented in this report has not been reviewed by stakeholders, peer reviewers or the client – these steps will all take place from here onwards. The site visit will take place remotely (due to Covid-19 MSC derogation) the w/c 17th January 2022.

Stakeholders are encouraged to review the scoring presented in this assessment and use the Stakeholder Input Form to provide evidence to the team of where changes to scoring are necessary.

All stakeholder comments will be published ahead of the site visit. Stakeholders can meet with the Assessment Team offsite the w/c 17th January 2022.

The **Target Eligibility Date** for this assessment is the date of certification

The Assessment Team for this fishery assessment comprised of Paul Knapman, who was Team Leader and primary Principle 3 specialist; John Casselman who was primarily responsible for evaluation of Principle 1 and Rob Blyth Skyrme & Ravindra Pawar who were primarily responsible for evaluation of Principle 2.

Client fishery strengths

- The walleye and northern pike stock status is at a level consistent with MSY.
- The harvest strategies incorporate timely monitoring and management that are responsive to the state of the stock.
- There are well-defined harvest control rules that use biologically meaningful proxies for reference points and are structured to maintain the stock at a level consistent with MSY and to reduce exploitation as PRI is approached.
- The impacts of the walleye and northern pike fisheries on Principle 1 target species, primary, secondary and ETP species and habitats are identified and the main functions of these components in the ecosystem are understood.
- The management system exists within an appropriate legal and/or customary framework which ensures that it is capable of delivering sustainability in the UoA(s) and observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood;
- The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Fisheries Standard, and incorporates the precautionary approach

Client fishery weaknesses

There is limited or no evidence of:
- A peer review of the stock assessment.
- Compliance monitoring, e.g., the number of patrol hours, number of inspections.
- Internal or external review of the management system.
- Quantitative information on catches (or lack of catch) of non-target species, e.g., birds.
- Clear evidence of the consultation and decision-making process.

Summary of key issues for further investigation

- Information on non-target species interactions, e.g., with birds, including when and where they are caught, and any other contextual information.
- The effectiveness of the dispute resolution process.

- The roles and responsibilities of organisations and individuals who are involved in the management process.
- Consultations, as described in the management plan, e.g., the number of patrol hours, number of inspections.
- Deterrents for non-compliance and evidence that they are consistently applied and thought to provide a deterrent.
- Evidence of decision-making processes, as described in the management plan, and how decisions take into account the precautionary approach.
- The processes/mechanisms in place to review and evaluate key parts of the fishery specific management system.

One recommendation was made by the Assessment Team with respect to northern pike: The annual assessment catch data be recorded and provided on an annual basis by species, including numbers, length, weight, and associated statistics. The previous annual data should also be included so that assessment catches can be evaluated on a long-term basis.

For interested readers, the report also provides background to the target species and fishery covered by the assessment, the wider impacts of the fishery and the management regime, supported by full details of the Assessment Team, a full list of references used and details of the stakeholder consultation process.

Lloyd's Register (LR) confirm that this fishery is within scope.

3 Report details

3.1 Authorship and peer review details

Peer reviewer information to be completed at Public Comment Draft Report stage

All team members listed below have completed all requisite training and signed all relevant forms for assessment team membership on this fishery.

Assessment Team Leader: Paul Knapman

Primarily responsible for assessment under Principle 3.

Paul is an independent consultant based in Halifax, Nova Scotia, Canada. Paul began his career in fisheries as a fisheries officer in the UK, responsible for the enforcement of UK and EU fisheries regulations. He then worked with the UK government's nature conservation advisors as their Fisheries Programme Manager, responsible for establishing and developing an extensive programme of work with fisheries managers, scientists, the fishing industry and ENGOs, researching the effects of fishing and integrating nature conservation requirements into national and European fisheries policy and legislation.

Paul was appointed Head of the largest inshore fisheries management organisation in England, with responsibility for managing an extensive area of inshore fisheries on the North Sea coast. The organisations responsibilities and roles included: stock assessments; setting and ensuring compliance with allowable catches; developing and applying regional fisheries regulations; the development and implementation of fisheries management plans; acting as the lead authority for the largest marine protected area in England.

Paul moved to Canada in 2005 and established his own consultancy providing analysis, advisory and developmental work on fisheries management policy in Canada and Europe.

Paul began working on MSC assessments in 2008 and in 2012 became head of a Conformity Assessment Body focusing on MSC fisheries and chain of custody assessments.

Paul returned to fisheries consultancy in 2015 and continues to work on MSC assessments as a P3 and P2 specialist. He has been involved as a lead assessor, team member and technical advisor/reviewer working on well over 100 assessments and audits on 60+ different fisheries in the MSC programme.

Paul has passed MSC training in April 2019 and has no 'Conflict of Interest' to declare. Full CV available upon request.

Team member: John Casselman

Primarily responsible for assessment under Principle 1

John M. Casselman, PhD, is a senior scientist and adjunct professor in the Department of Biology at Queen's University at Kingston, Ontario. He holds a BSA from the University of Toronto, MSc in fisheries from the University of Guelph, and a PhD in zoology and fisheries from the University of Toronto.

John has 50 years of experience in fisheries science and has conducted research internationality, ranging from the Canadian Arctic to the Tibetan Plateau and the Rift Valley lakes of Africa on a broad range of fisheries topics, for such organizations as the Chinese Academy of Sciences, the National Science Foundation, and various Canadian federal and provincial agencies.

He has concentrated on fisheries research but is also well trained and experienced in fisheries assessment and management and has been on many advisory committees, including the IUCN, the International Joint Commission, American Fisheries Society, Department of Fisheries and Oceans Canada, Great Lakes Fishery Commission, Ontario Ministry of Natural Resources and Forestry, Ontario Federation of Anglers and Hunters, and the Ontario Commercial Fisheries Association.
John has more than 180 publications in the scientific literature and authored or co-authored five publications in 2020 and has conducted numerous invited scientific reviews.

He has been actively involved in MSC certification projects, conducting the review of the MSC Pre-Assessment Evaluation of the Lake Erie Yellow Perch (Perca *flavescens*) Commercial Gillnet Fishery and participated as the P1 specialist for the assessment of the Waterhen Lake walleye and northern pike Commercial Gillnet Fishery. John was also a team member for subsequent audits of the fishery as well as the Lake Erie Multi-Species Fishery and was P1 team member for the fishery's re-assessment in 2020.

John passed MSC training in April 2019 and has no 'Conflict of Interest' to declare. Full CV available upon request.

Team members: Rob Blyth-Skyrme & Ravindra Pawar

Primarily responsible for assessment under Principle 2

Dr. Rob Blyth-Skyrme is a consultant with a strong interest and involvement in the development and assessment of all areas of fisheries management and policy. Rob completed a Masters in aquaculture in 1998, and a PhD that looked at the sociological and environmental performance of an inshore fishery in 2004. He now has more than 20 years post-graduate experience, having worked as a marine fish farmer, a scientist on a groundfish stock assessment project, a Deputy Chief Fishery Officer (inshore fisheries management and enforcement), a Government advisor on fisheries and nature conservation and, since 2009, as an independent fisheries consultant. He has now been involved in more than 100 MSC audits and assessments of fisheries for species including tuna, shellfish, groundfish, salmon and freshwater percids, employing gears including purse seines, demersal seines, trawls, dredges, gillnets, longlines, traps and pole and line.

Rob is a Third Party Expert for the MSC's Peer Review College, and is a trainer with the MSC's Capacity Building Programme.

Rob has passed MSC training in April 2019 and has no 'Conflict of Interest' to declare. Full CV available upon request.

Ravindra Pawar holds a PhD in Marine Biology from the Ocean University of China, Qingdao, China. He has over 24 years experience in finfish and shellfish population dynamics and stock assessment. Recent work includes, stock assessment projects on the Kiddy shrimp (*Parapenaeopsis stylifera*) and the Spineless cuttlefish (*Sepiella inermis*). His special research interests focus on bycatch, discards and ecosystem-based assessments of tropical fisheries. He has concluded research on these two aspects for the marine capture fisheries of Ratnagiri (West Coast of India) with his research outputs informing the sub-regional management agencies. Currently, he is: evaluating the Indian regional and sub-regional fisheries instruments in context to compliance with the UN Code of Conduct for Responsible Fisheries; and, conducting stock assessment studies on Indian mackerel (*Rastrelliger kanagurta*) and Indian oil sardine (*Sardinella longiceps*) along the Ratnagiri Coast of the Arabian Sea (Maharashtra, India).

Ravindra has passed MSC training in April 2019 and has no 'Conflict of Interest' to declare. Full CV available upon request.

3.2 Peer Reviewers

The MSC Peer Review College will propose the peer reviewers for this assessment at a later stage in the process.

3.3 RBF Training

Rob & Ravindra has been fully trained in the use of the MSC's Risk Based Framework (RBF).

3.4 Version details

Table 1. Fisheries program documents versions

Document	Version number
MSC Fisheries Certification Process	Version 2.2

Document	Version number
MSC Fisheries Standard	Version 2.01*
MSC General Certification Requirements	Version 2.4.1
MSC Reporting Template	Version 1.2

*Default assessment tree

4 Units of Assessment, Units of Certification and results overview

4.1 Units of Assessment and Units of Certification

4.1.1 Units of Assessment

Table 2. Units of Assessment (UoAs)

UoA 1	Description
Species	Walleye (*Sander Vitreus*)
Stock	Cedar Lake
Fishing gear type(s) and, if relevant, vessel type(s)	Bottom set gillnets (not less than 108 mm / 4¼ inches)
Client group	Cedar Lake Fisheries Inc (formerly, Napanee Bay Fisheries Coop Inc.)
Other eligible fishers	There is a 10,000 Kgs walleye allocation to fishers of Mosakahiken Cree Nation. It is not clear if they qualify as “other eligible fishers”. This will be confirmed at the site visit.
Geographical area	FAO Area 02 – Cedar Lake is located just north of Lake Winnipegosis. The lake’s main source is the Saskatchewan River, which forms a delta on the northwest side of the lake. The flow of the Saskatchewan River to Lake Winnipeg on the eastern end of Cedar Lake is regulated by the Grand Rapids dam.

UoA 2	Description
Species	Northern pike (*Esox lucius*). Subsequently in this report, northern pike may also be referred to simply as “pike”.
Stock	Cedar Lake
Fishing gear type(s) and, if relevant, vessel type(s)	Bottom set gillnets (not less than 108 mm / 4¼ inches)
Client group	Cedar Lake Fisheries Inc (formerly, Napanee Bay Fisheries Coop Inc.)
Other eligible fishers	No other eligible fishers
Geographical area	FAO Area 02 – Cedar Lake is located just north of Lake Winnipegosis. The lake’s main source is the Saskatchewan River, which forms a delta on the northwest side of the lake. The flow of the Saskatchewan River to Lake Winnipeg on the eastern end of Cedar Lake is regulated by the Grand Rapids dam.

4.1.2 Draft Units of Certification

Table 3. Proposed Units of Certification (UoCs) - To be confirmed at Public Certification Report stage

UoC 1	Description
Species	Walleye (*Sander Vitreus*)
Stock	Cedar Lake
Fishing gear type(s) and, if relevant, vessel type(s)	Bottom set gillnets (not less than 108 mm / 4¼ inches)
Client group	Cedar Lake Fisheries Inc (formerly, Napanee Bay Fisheries Coop Inc.)
Geographical area	FAO Area 02 – Cedar Lake is located just north of Lake Winnipegosis. The lake's main source is the Saskatchewan River, which forms a delta on the northwest side of the lake. The flow of the Saskatchewan River to Lake Winnipeg on the eastern end of Cedar Lake is regulated by the Grand Rapids dam.

UoC 2	Description
Species	Northern pike (*Esox lucius*). Subsequently in this report, northern pike may also be referred to simply as "pike".
Stock	Cedar Lake
Fishing gear type(s) and, if relevant, vessel type(s)	Bottom set gillnets (not less than 108 mm / 4¼ inches)
Client group	Cedar Lake Fisheries Inc (formerly, Napanee Bay Fisheries Coop Inc.)
Geographical area	FAO Area 02 – Cedar Lake is located just north of Lake Winnipegosis. The lake's main source is the Saskatchewan River, which forms a delta on the northwest side of the lake. The flow of the Saskatchewan River to Lake Winnipeg on the eastern end of Cedar Lake is regulated by the Grand Rapids dam.

5 Fishery background

The following text is adapted from the Cedar Lake Fisheries Management Plan (CLFMP) (Klein et al, 2020) and information provided by staff from Manitoba, Agriculture and Resource Development (Wildlife and Fisheries Branch), prior to the site visit.

5.1 Fishery location

Cedar Lake (53º18’54” N, 100º10’08 W) is in the Province of Manitoba, Canada, to the North of Lake Winnipegosis and the west of the northern extent of Lake Winnipeg, (Figure 1).

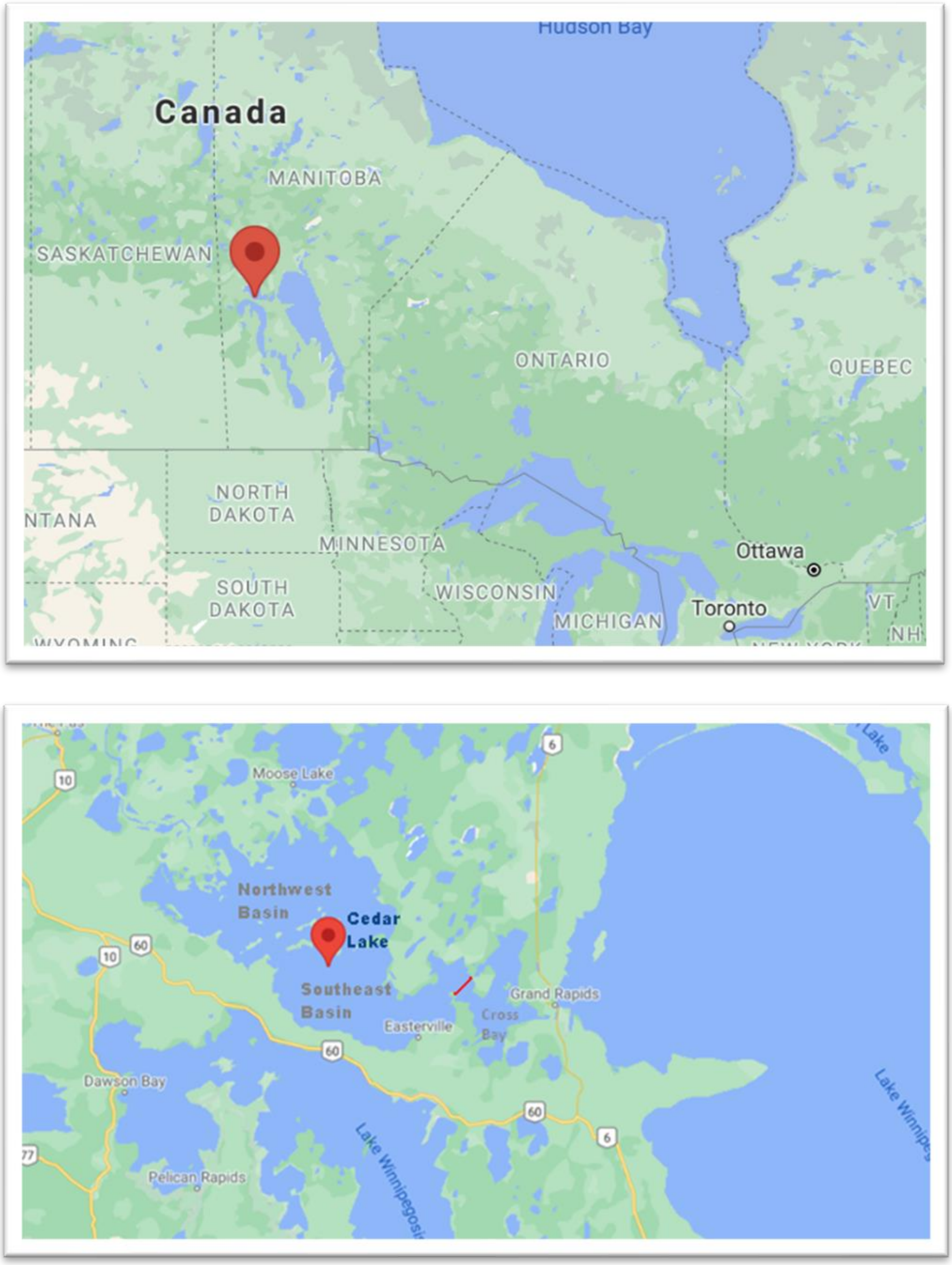

Figure 1. The location of Cedar Lake.

The second panel shows Cedar Lake, with its two basins. The area known as Cross Bay is closed to commercial fishing. The red line represents the boundary between the open and closed area (Source: Adapted from Google Maps)

Between 1960-64, the Grand Rapids hydro-electric dam was built on the Saskatchewan River, resulting in lake levels rising by 3.65 m, a doubling in the surface area and the severing of fish passage between the river and Lake Winnipeg. The resulting Cedar Lake is the fifth largest lake in Manitoba at 1,353 km^2 (522 $miles^2$) in surface area, 62.5 km long with a maximum depth of 16.6 m (54 feet). Its volume is controlled by the Grand Rapids Dam, with levels rising and falling about 1.8 m owing to draw down from hydro-electric power generation. The Saskatchewan River flows through Cedar Lake and outflows into Lake Winnipeg.

Cedar Lake has two major basins, the shallower upstream one, the Northwest Basin, and the more productive deeper downstream one, the Southeast Basin (Figure 1 and Figure 2) in the central portion of the lake; the forebay area of the dam is referred to as Cross Bay (Figure 1). The Southeast Basin currently has a mean depth of approximately 7.6 m and a maximum depth of 16.6 m (Figure 2). The Northwest Basin is appreciably shallower, usually less than 4 m depending upon drawdown (typical overwinter drawdown is about 2 m; 1.8 m – Klein et al. 2020) (CAMP 2017).

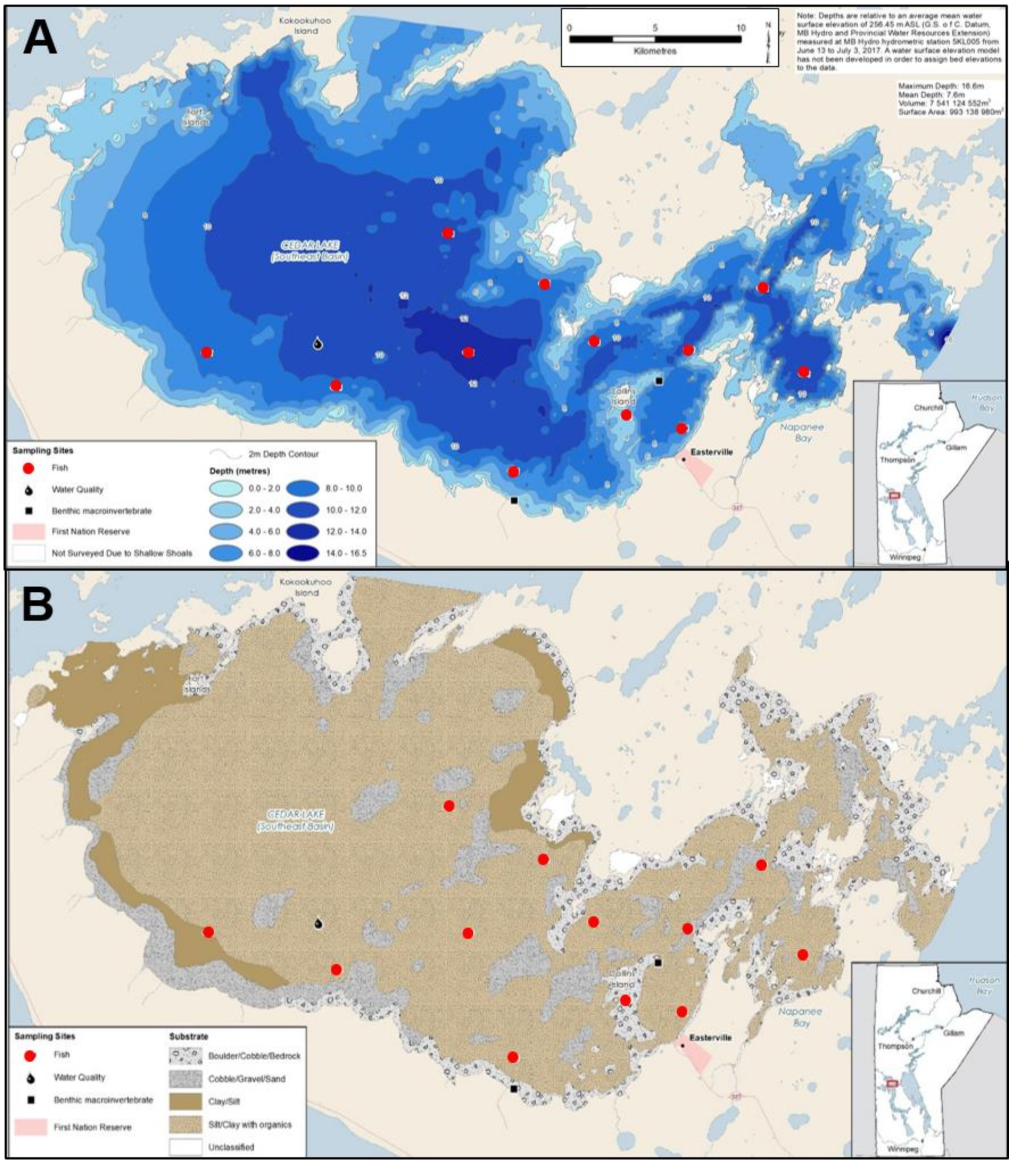

Figure 2. Southeast Basin, Cedar Lake, including annual fish-monitoring index-netting sites (closed red circles N = 12).

Figure shows A) bathymetry in 2-m depth contour intervals illustrated in inset (shaded blue), water quality and benthic invertebrate sampling sites also illustrated as in inset, scale provided, and B) substrate map illustrated as in inset with symbols and shading. Cedar Lake mean depth 7.6 m, maximum depth 16.6 m. Prepared from Cedar Lake Fisheries Management Plan (CLFMP), Figure 10 (Klein et al. 2020).

With the construction of the E.B. Campbell Dam further upstream on the Saskatchewan River around the same time as the Grand Rapids Dam, Cedar Lake has been described as having changed from a “natural” lake to a reservoir (Lysack, 2000).

The limnology of the reservoir was surveyed from 2009 to 2013 by the Coordinating Aquatic Monitoring Programs (CAMP) conducted in 2009–2010 in preliminary surveys reported in CAMPP (2014) and continued in 2011–2013, summarizing from 2009–2013 in CAMP (2017). This report documents the major limnological features, such as hydrology, water and sediment quality, and benthic fauna, as well as indexing the fish community and measuring contaminant levels. The 2009–2013 CAMP surveys indicate that the two primary basins of Cedar Lake are essentially homothermous and are typical of a north-temperate-region cool-water aquatic environment, with the Northwest Basin slightly warmer in midsummer than the Southeast Basin, in the 20–22 °C range, but several degrees cooler in some years, such as 2009, in the 18–20 °C range (CAMP 2017). The waters are quite turbid, with the Northwest Basin having a mean secchi depth of approximately 0.53 m over the 6-year period and the Southwest Basin less, 1.81 m (approximate range 1.0–3.5 m). Oxygen levels were generally higher although somewhat lower under winter ice conditions; values were similar with depth in the shallow Northwest Basin (≈ 81% air saturation) but somewhat more depressed at depth in the deeper Southeast Basin (bottom ≈ 74% air saturation). Oxygen concentrations are well within the Manitoba Protection of Aquatic Life levels (PAL). Total phosphorus concentrations in the Northwest Basin were 26.3 $\mu g \cdot L^{-1}$ (meso-eutrophic) and in the Southeast Basin 18.8 $\mu g \cdot L^{-1}$ (mesotrophic). Total dissolved solids across the lake were somewhat similar, with the Northwest Basin 269 $mg \cdot L^{-1}$ and the Southeast Basin 257 $mg \cdot L^{-1}$.

The rise in Cedar Lake water levels resulted in the Cree community of Chemawawin being flooded and the establishment of Chemawawin Cree Nation Reserve No.2 and the new adjacent community of Easterville (Figure 1). The 2016 federal census reports a population of 1,255 indigenous people on-reserve in Chemawawin, and 44 indigenous people in Easterville. Fishing and trapping are listed as providing the main economic base.

5.2 History of the commercial fishery

Lake Sturgeon (*Acipenser fulvescens*) were the target of the first commercial fishery in Cedar Lake and the Saskatchewan River in 1900 when market demand for the species was pushing fisheries northward to maintain supply. Deliveries peaked just four years later at nearly 100,000 kgs. By 1926, the sturgeon fishery had collapsed.

A fishery for walleye (*Sander vitreus*), lake whitefish (*Coregonus clupeaformis*), goldeye (*Hiodon alosoides*) and sauger (*Sander canadensis*) developed in the 1940s.

Owing to the trophic upsurge that resulted from the rise in Cedar Lake water-levels in the early 1960s, fish production increased. There was a temporary closure in the fishery in 1970/71, due to elevated mercury concentrations in fish, but on re-opening catch levels for all the main commercial species increased through the 1970s. Fish yields peaked 15-20 years after impoundment and then collapsed due to exhaustion of nutrients and overfishing (see Figure 3). Commercial harvest of walleye peaked in 1982 at about 435,000 kgs with pike catches peaking in 1988 at about 420,000 kgs.

Starting in 1992, the Cedar Lake fishery had a 496,600 kgs quota for walleye, goldeye, lake whitefish and sauger of which, not more than 300,000 kgs could be taken as walleye (increased to 330,000 kg in 1994). While the lake quota was divided into individual allocations, the lake-wide limit for walleye was left as a ‘lake tolerance’. This meant that once the lake walleye tolerance was filled, fishers who still had quota left in their individual allocations had to cease fishing (effectively negating the benefits of individual quota allocations). This resulted in a “goldrush fishery” where more aggressive fishers with larger, more efficient equipment caught greater than their proportional share of the walleye present. There were also increased incidences of fishing with illegal small mesh nets and discarding less valuable fish species as fishers tried to maximize income and economic returns. As a result, in 1997 Cedar Lake walleye stocks showed a significant decline after successive years of poor harvest. Based on these declining harvest levels, fishers voluntarily agreed not to commercially fish for five years (1998-2002).

In conjunction with the voluntary closure, the Chief and Council of the Chemawawin Cree Nation implemented an economic development initiative – the Chemawawin Cree Revitalization Program (February 12th, 1998). The plan involved rationalising and restructuring the fishery by reducing the number of licensed commercial fishers from 81 to 41 to establish more viable units; providing “bridging” employment for fishers who would return to the fishery once it re-opened; and supporting “new career” training for those who left the fishery and for young people who had expected to follow their parents into the fishery.

The Province of Manitoba, along with Indigenous Services Canada, cost shared on a 50:50 basis, a $1.6 million rationalization initiative on Cedar Lake. In 2006, 40 fishers were bought out through the restructuring initiative and the lake walleye tolerance was converted to individual walleye limits within the quota allocation of each fisher. It was anticipated that the rationalisation of the fishery into more economical business units would enhance conservation by reducing the need for fishers to chase fish (at times illegally) to meet reasonable income expectations. Additional conservation benefits would also accrue in that it was expected that fishers who participated would include individuals who held a larger allocation of quota (individual quota allocations at that time ranged from 3,615 – 13,633 kgs). This would mean that more quota would be surrendered than necessary to convert the 41 remaining fishers' quotas to walleye only (the primary objective of fishers and the community, and part of the anticipated rationalisation/management plan). This surplus quota would be held back and would provide additional protection for the fish stocks. Redistribution of this surplus ("conservation account") quota into the fishery would occur when fish stock recovery was more clearly achieved and according to the terms and conditions of the fishery management plan.

Manitoba, at the time, advised that a healthy fish stock in Cedar Lake fishery should have a sustainable walleye quota of 300,000 kgs which was the primary targeted species. Quota for the remaining 196,600 kilograms of other species would be re-allocated according to the terms of the fishery management plan.

The then, "*Cedar Lake Fishery Management Plan*", was signed by the Province and Napanee Bay Fisheries Coop Inc. on May 17, 2006. The restructured Cedar Lake fishery has been operating since the 2006/07 fishing year and the Plan has been amended four times (including the latest version - Klein et al, 2020) since the original document.

First Amendment (August 16, 2007)**:**

The open quota proposal raised concerns for both the Provincial Fisheries Department and the Chemawawin Resource Management Board in that it ran contrary to the rationalization objectives and potential conservation benefits of the fishery restructuring program. The Cedar Lake Fishery Management Plan was subsequently amended in 2007 to indicate the following:

- "Associated with each CF license is an individual quota. These individual quotas may be adjusted from time to time due to quota transfers. Each commercial fisherman (CF) is responsible for staying within (not exceeding) his/her own individual quota on an annual basis. Annual quotas are renewed on June 1st of each calendar year, at the start of the open water season. These quotas are valid until the end of the winter fishing season of the following calendar year (usually March 31st), at which time any un-harvested quota is cancelled in preparation for renewal of the individual quotas. Any un- harvested quota will not affect the renewed quota in any way."

- "Each individual licensed commercial fisher covered under this plan is eligible to fish in the winter season (first ice after November 1st) if he/she has at least 225 kilograms (497 pounds) of individual walleye quota remaining. Again, each fisher is responsible for not exceeding his/her own individual quota carried over from the open water season. These quotas are on an annual basis; they are *not* renewed at the start of the winter fishing season. During the winter fishery, fishers may harvest only that portion of their individual quota that remains left over from the open water season."

- "An open quota winter fishery may be authorized if a sufficient number of licensed fishers with quota remaining sign in for participation in the open quota winter fishery. The total quota made available through individual sign-ins must exceed 20,000 kilograms (44,000 pounds) of walleye before an open quota fishery can be authorized by Manitoba. This is a completely voluntary process; fishers who do not sign in shall retain their own individual quotas for their own purposes."

- The amended plan also confirmed the maximum number of regular commercial fishing licences to be 40.

Second Amendment (May 29, 2009)**:**

The second amendment was primarily an update of the appended list of quota allocations.

- One change was made regarding Retirement Licences: "Individuals must be 50 years of age or older to be eligible for a retirement licence."

- The maximum number of licences allowed is still 40. However, Chemawawin First Nation decided to buy out the four interested fishers from their discretional economic development funds. As of summer, 2009, these four quotas have not been reallocated to new fishers, and the current number of allocated regular licences on Cedar Lake is 36 (plus the 10 allowable retirement licences).

Third Amendment (February 4, 2016):

- “Both parties shall meet at least twice annually with scheduled meetings occurring at the end of April and the end of October.”
- “Applications for a quota transfer must be made between April 1 and May 15. No applications will be accepted outside of that period.”

Since the fishery was reopened in 2003, the primary commercial species are walleye, pike, lake whitefish and mullet (white sucker, longnose sucker, and shorthead redhorse - for marketing purposes, the three species are sold together as ‘mullet’). These fish have, on average, made up 99.7% of the overall harvest. Highly valued walleye are usually the prime target species in the commercial fisheries, with pike as an incidental catch that may be targeted from time to time, and mullet are essentially a by-catch of much lower value.

Commercial harvest of walleye affects catch and harvest of pike. As in most populations, there appears to be a negative relationship between walleye and pike catches. As indicated in **Error! Reference source not found.** and Figure 3, the harvest for 2003 to 2019 indicates that when walleye harvest was higher, as in 2003 to 2005 and in 2013 through to 2019, pike harvest was lower. When pike harvest was high in 2006 through to 2012, walleye harvest was lower; mullet harvest was always lower than that of both walleye and pike. The pike catch is influenced by walleye effort because of the large difference in landed value.

If delivered with head and viscera removed (headed and gutted), walleye are four to five more times valuable than pike and 17 times more valuable than mullet (see Table 2, Klein et al. 2020). Indeed, fishers say mullets are marketed because they “pay for the gas for the day of fishing”. Lake whitefish are highly valued but approximately two to three times less than walleye, however approximately 1.6 times more valuable than pike, and are an important part of the catch at certain times of the year and may be targeted spawning in late October. Sales of lake whitefish and cisco roe can occur from mid-September to the end of October.

In the past decade, the commercial harvest of walleye has stabilised around an average commercial harvest of 202,000 kgs and 172,000 kgs for pike (**Error! Reference source not found.** and Figure 3). The 2020-21 walleye TAC is 232,100 kgs and the pike TAC is 366,000 kgs. The pike stock is fished at a level well below the TAC owing to their low commercial value in comparison to walleye.

There is a 10,000 kgs walleye allocation to fishers of Mosakahiken Cree Nation. Mosakahiken is situated on Moose Lake Northwest of Cedar Lake. Mosakahiken fishers had historical commercial access to some small lakes in the Saskatchewan River delta that became part of the larger, impounded Cedar Lake when the Grand Rapids dam was completed. The 10,000 kgs quota recognizes their lost opportunity.

Table 4. Cedar Lake commercial fish harvest delivered to the Freshwater Fish Marketing Corporation, 1996 to 2019.

Weight in kilograms round weight. Years refer to the beginning of the fishing year, which starts on June 1 and ends the following year on April 30. Summary statistics (means, 95% confidence intervals, coefficient of variation) are provided for the fishing period of 17 years, from 2003 to 2019, after the 1998 to 2002 closure and the most recent 11-year period, from 2009 to 2019, when annual monitoring was conducted. Bold and italicized values for weight (kg) and per cent are the maximum by species. Mullet includes white sucker (Catostomus commersoni), longnose sucker (Catostomus catostomus), and shorthead redhorse (Moxostoma macrolepidotum). Table prepared from data presented in Table 4 of the 2020 Cedar Lake commercial fishery management plan (Klein et al. 2020).

	Walleye		Northern pike		Mullet		Lake whitefish		Cisco		Sauger		Carp		Yellow perch		
Year	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	Combined
1996	79,041	13.0	187,735	30.9	***312,543***	***51.4***	8,339	1.4	12,852	2.1	7,388	1.2	25	< 0.1	426	0.1	608,349
1997	31,366	8.8	133,261	37.5	***166,322***	***46.8***	8,740	2.5	11,862	3.3	3,792	1.1	12	< 0.1	178	0.1	355,533
1998	14	0.7	***1,539***	***72.3***	474	22.3	0		41	1.9	34	1.6	0		26	1.2	2,128
1999	0		0		0		0		0		0		0		0		0
2000	0		0		0		0		0		0		0		0		0
2001	0		0		0		0		0		0		0		0		0
2002	11	9.0	***84***	***68.9***	25	20.5	0		2	1.6	0		0		0		122
2003	***298,634***	***45.2***	187,798	28.5	159,045	24.1	9,853	1.5	4,736	0.7	16	< 0.1	0		0		660,082
2004	***298,159***	***43.9***	192,762	28.4	173,871	25.6	13,399	2.0	0		235	< 0.1	0		2	< 0.1	678,428
2005	***248,191***	***52.3***	114,265	24.1	104,701	22.1	6,853	1.4	0		600	0.1	0		12	< 0.1	474,622
2006	182,463	38.0	***200,177***	***41.7***	91,327	19.0	5,699	1.2	0		344	0.1	12	< 0.1	13	< 0.1	480,035
2007	108,630	27.3	***206,796***	***52.0***	76,908	19.3	4,988	1.3	0		555	0.1	1	< 0.1	10	< 0.1	397,888
2008	122,393	22.3	***226,398***	***41.3***	147,509	26.9	51,428	9.4	0		393	0.1	11	< 0.1	52	< 0.1	548,184
2009	185,650	28.9	***253,676***	***39.5***	138,897	21.6	63,913	9.9	0		509	0.1	0		67	< 0.1	642,712
2010	***253,530***	***40.7***	226,106	36.3	91,822	14.7	52,048	8.3	0		90	< 0.1	7	< 0.1	28	< 0.1	623,631
2011	213,640	39.9	***225,876***	***42.1***	72,420	13.5	23,724	4.4	0		256	< 0.1	0		19	< 0.1	535,935
2012	176,462	38.0	***207,973***	***44.7***	61,785	13.3	18,383	4.0	20	< 0.1	213	< 0.1	84	< 0.1	28	< 0.1	464,948
2013	***199,783***	***45.5***	115,063	26.2	107,657	24.5	16,513	3.8	40	< 0.1	44	< 0.1	0		3	< 0.1	439,103
2014	***162,086***	***35.3***	150,290	32.8	115,714	25.2	30,438	6.6	0		62	< 0.1	48	< 0.1	9	< 0.1	458,647
2015	***220,026***	***48.0***	98,237	21.4	116,217	25.3	23,944	5.2	206	< 0.1	4	< 0.1	0		1	< 0.1	458,635
2016	***188,705***	***36.5***	159,278	30.8	140,174	27.1	27,723	5.4	1,286	0.2	14	< 0.1	9	< 0.1	7	< 0.1	517,196
2017	***205,021***	***33.9***	199,125	32.9	183,110	30.2	17,442	2.9	629	0.1	97	< 0.1	0		1	< 0.1	605,425
2018	180,515	30.7	***197,497***	***33.6***	179,247	30.5	29,591	5.0	648	0.1	28	< 0.1	0		7	< 0.1	587,533
2019	***219,257***	***41.5***	136,599	25.9	129,611	24.5	20,688	3.9	22,093	4.2	18	< 0.1	19	< 0.1	1	< 0.1	528,286
2003–2019, n = 17																	
Mean kg	203,714		182,230		122,942		24,507		1,745		205		11		15		535,370
± 95% CI	26,556		23,332		19,464		8,773		2,761		106		11		10		43,620
CV (%)	25.4		24.9		30.8		69.6		307.8		100.7		198.7		124.0		15.8
Mean %		38.1		34.2		22.8		4.5		0.3		< 0.1		< 0.1		< 0.1	
± 95% CI		4.1		4.3		2.7		1.4		0.9							
2009–2019, n = 11																	
Mean kg	200,425		179,065		121,514		29,492		2,266		121		15		16		532,914
± 95% CI	17,195		33,725		25,981		10,136		4,427		103		18		13		49,027
CV (%)	12.8		28.0		31.8		51.1		290.8		125.7		178.2		127.9		13.7
Mean %		38.1		33.3		22.8		5.4		0.4		< 0.1		< 0.1		< 0.1	
± 95% CI		3.9		4.8		4.2		1.4		0.8							

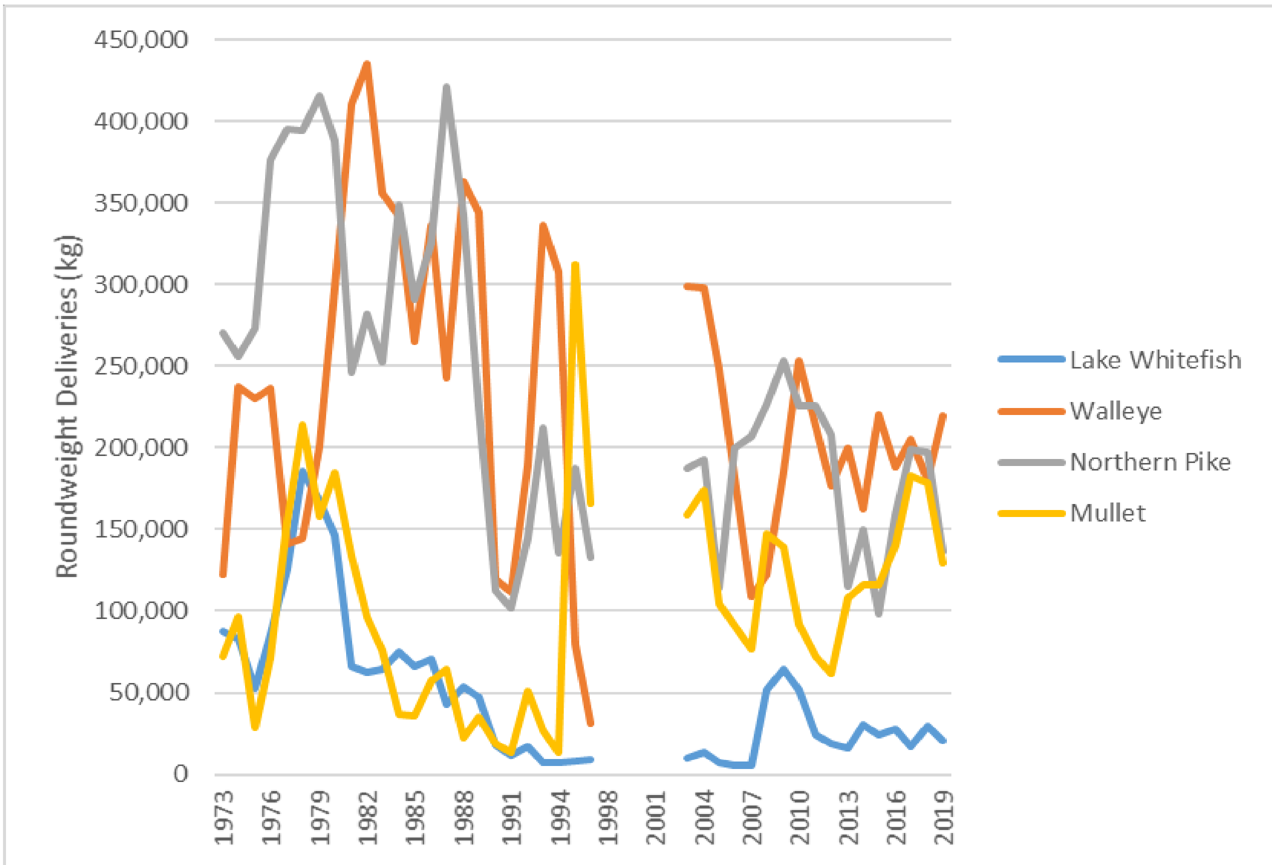

Figure 3. Main species commercial deliveries from Cedar Lake since 1973. (Klein et al, 2020)

5.3 Commercial fishing regulations

To participate in the Cedar Lake commercial fisheries, individuals are required to be members of the Cedar Lake Fisheries Inc. (formerly Napanee Bay Fisheries Coop Inc.).

All commercial fishers must have, in their possession, a valid and signed commercial fishing licence issued by the Province of Manitoba before they initiate their fishing activities. Commercial fishers must also comply with all terms (or conditions) of the licence. The cost of an annual commercial fishing licence for Cedar Lake is $12.50.

Quota species are walleye, goldeye, lake whitefish and sauger.

Cedar Lake total quota is 496,000 kgs, of which not more than 366,000 kgs may be walleye.

Cedar Lake is closed to fishing from May 1 to May 31 to protect spawning aggregations of walleye, pike and sauger.

Commercial net fishing for these species is permitted from June 1 to October 31.

Once ice forms in November, fishers can again set their nets, but they cannot set in the open water after October 31, nets must be set through the ice. This closure affords some protection to spawning aggregations of Lake Whitefish.

Winter fishing through the ice may continue until April 30.

Commercial fishers may not set in the area known as Cross Bay (see Figure 1), or within 1.5 km of where a stream or river enters Cedar Lake. This is intended to protect aggregation of pre-spawning and spawning fish.

Commercial net fishing may use gill nets of any depth, material and hanging ratio, but the mesh may not have a stretched measurement of less than 108 mm.

Maximum length of gill net is 1,400 m.

5.4 Fishing operation

The open water fishery (June 1 to October 31) is conducted from small fibreglass or aluminum boats (6-8 m), often referred to as skiffs or yawls, powered by outboard engines. The operational net configuration is highly dependent on factors such as weather, target species and seasonal use (Ian Kitch, pers. comm.). Individual bottom set gill nets are 80-100 m long and fishers usually set a string of several nets using a four-fluked anchor of 25-40 lbs, at each end of the string.

Nets are generally lifted on a daily basis. The net remains attached to the anchor and is brought up over the bow or amidships. The boat slides along the net with the prevailing wind and fishers pick any enmeshed fish from the net, sitting on the corks and leads of the net to stop the drift when required. The net falls back into the lake as the process advances until the next anchor.

The commercial fisheries tend to be focused in the Southeast Basin, although toward the end of the season Lake Whitefish are targeted in the eastern portion of the lake.

The winter fishery (November 1 to March 31) is concentrated along the southern shoreline near the community of Easterville and access points to Highway 6 (see Figure 1, second panel). Very limited winter fishing occurs elsewhere on the lake due to distance from the community. About 10 individuals' fish during the winter season.
For transportation across the lake winter fishers utilise snowmobiles and bombardiers.

The gillnets are set under the ice using jiggers, which is a plank of wood about six feet long equipped with a steel-tipped wooden arm hinged to an iron rod. A long rope is attached to the end of the iron rod (Klein and Galbraith, 2019; Figure 4).

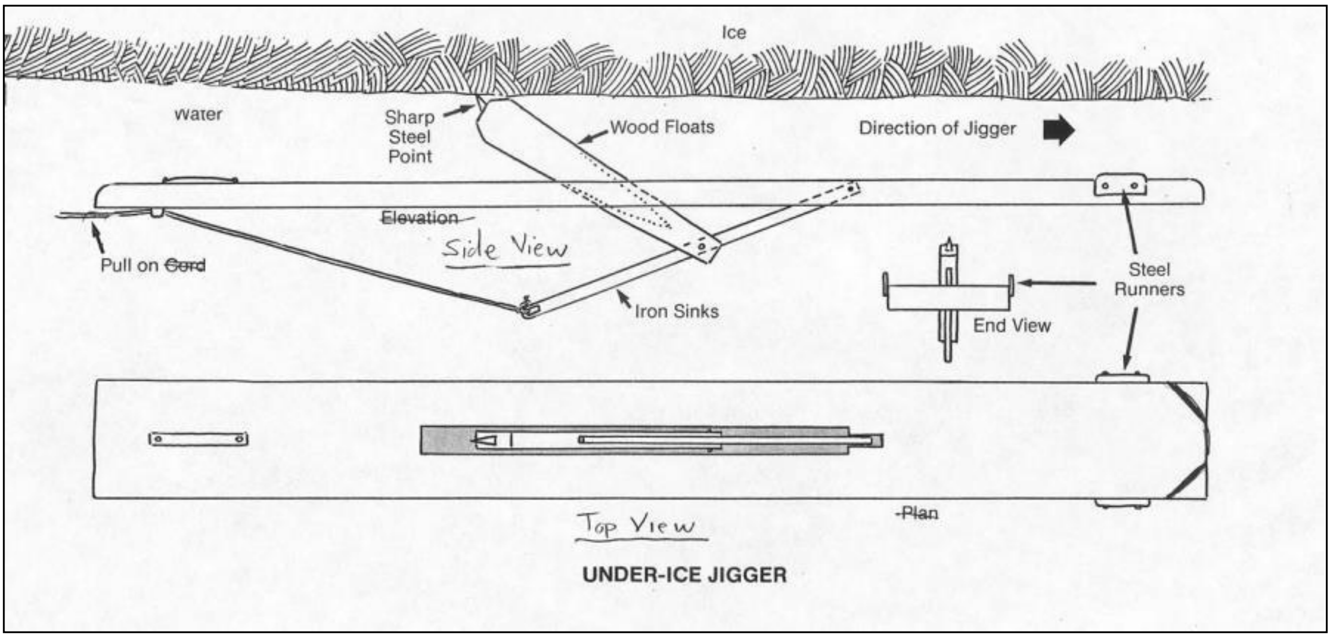

Figure 4. Diagram of an ice jigger (Source: Klein and Galbraith 2019)

To set nets under the ice, a hole is first drilled through the ice using an auger. Once the jigger is in the water, the operator pulls at the rope, forcing the steel tip to dig into the ice. When this happens, the jigger slides ahead a few feet. Then the rope is released and the steel tipped arm loses its grip on the ice. The operator then repeats the pull/release technique until the jigger has advanced the length of the net. When the jigger has advanced the required distance, a second hole is drilled and the jigger and rope is retrieved (Klein and Galbraith, 2019; Figure 5).

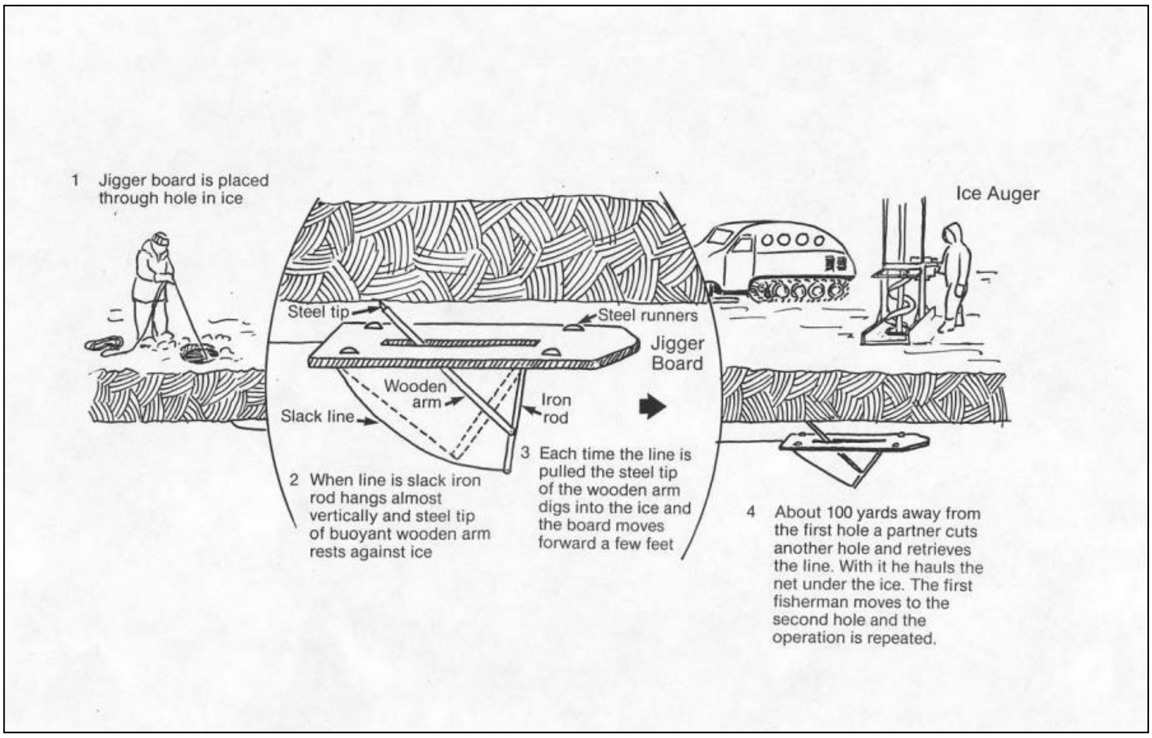

Figure 5. Jigging under the ice (Source: Klein and Galbraith, 2019)

Attached to the rope is the gill net. As the rope progresses under the ice, the gill net is gradually placed into position (Klein and Galbraith, 2019; Figure 6).

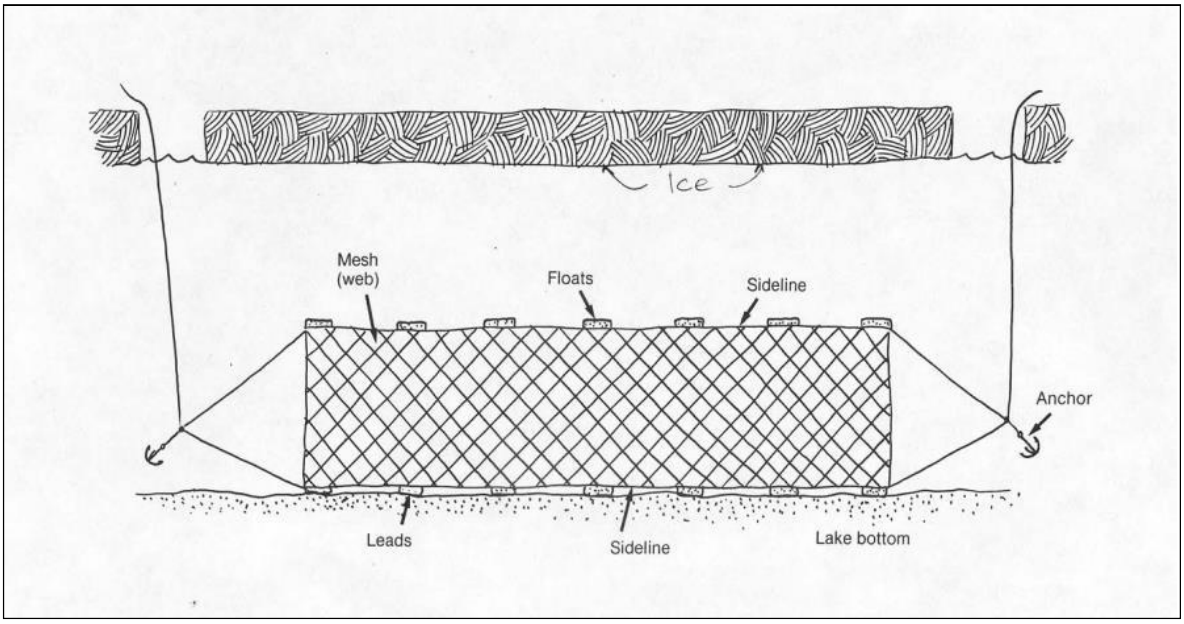

Figure 6. Diagram of gill net set under the ice. (Source: Klein and Galbraith, 2019)

Fishing is done mostly through 30 – 45 cm auger drilled holes in the ice that will not accommodate summer anchors and, without wave action, the large summer anchors are not necessary to hold nets in place, so ice-fishing anchors range in weight from one to five pounds and are usually concrete blocks or a piece of steel bar.

Nets may be left in place for 3 - 7 nights before lifting. The anchor is brought up onto the ice and the net is untied, then the net is untied from the anchor at the other end as well and the entire net is pulled out through one hole (with a running line attached to the far end) where the fish are picked as they come out of the water. When the net is picked clean, the running line is used to pull the net back between the two holes in the ice, and the net is retied to the anchors. The primary purpose of the small winter anchors is to ensure the bridles and downline do not freeze into the forming ice (Klein et al, 2020).

Summer fishers land at the Easterville harbour. The Easterville packing shed is located at the harbour. Winter fishers either land at the “Old Post” winter road or the community of Easterville. Daily Catch Records (DCRs) are summarised and reported by fish buyers to the Manitoba Agriculture and Resource Development weekly.

5.4.1 Subsistence Fishery

Subsistence fishing occurs on Cedar Lake through constitutionally protected Indigenous Treaty fishing rights. Most members of a household, men, women and children, participate in subsistence fishing. It typically involves setting gillnets as well as rod-and-reel fishing. There is no legal restriction on the number of nets as long as the catch is for personal and household consumption but all nets need to be tagged with the holder’s treaty number to establish the authority under which the net is set.

The level of subsistence harvest is not directly known. Manitoba Agriculture and Resource Development (Wildlife and Fisheries) does not formally track the number of domestic fishers or their catch, as they do not require permits to conduct this activity. Manitoba utilizes broad-based studies of Indigenous subsistence consumption to coarsely estimate subsistence harvest, e.g., walleye at 22 kgs per person per year (an estimate of 10 kgs of fillet per subsistence user with a 2.2 conversion applied for fillet to round weight) leading to a total estimate of the subsistence catch of walleye at 28,000 Kgs. The total estimate for pike is 16,000 kgs.

5.4.2 Recreational fishery

Recreational angling occurs during the open water season and is mainly confined to the east end of the lake in Cross Bay (see Figure 1, second panel).

The recreational fishery includes a commercial/recreational component of lodges in the Grand Rapids area which cater to visiting anglers who fish Cedar Lake and the tailwater of its generating station.

Cedar Lake has no specific angling regulations; however, the Manitoba Agriculture and Resource Development (Wildlife and Fisheries), North West Division has a number of applicable regionally-based angling regulations, including:

- From April 1 to April 30 inclusive, and from third Friday in May to May 31 inclusive, the walleye limit is 4.
- No live bait fish allowed.
- Lake trout (*Salvelinus namaycush*) over 65 cm must be released. Limit of 1 in possession.
- All northern pike over 75 cm must be released. Limit of 4 in possession.
- All walleye over 55 cm must be released. Limit of 4 in possession.
- Clients of commercial tourism operators and licenced outfitters must adhere to the Manitoba angling regulations with respect to fishing seasons, possession limits and size limits.

NB. Lake trout are not known to have occurred in Cedar Lake either before or after the closure of the Grand Rapids Dam.

Recreational harvest of walleye and northern pike is estimated from the recall survey of Manitoba recreational fishing administered by Manitoba Agriculture and Resource Development and the federal Department of Fisheries and Oceans (DFO). In the recall survey, 4,400 licensed anglers were sent questionnaires they could have answered by mail or online. For the 2015/16 angling year, 1,068 anglers responded. Respondents were asked to recall how many fish they caught of every species from each waterbody they fished, and how many fish of each species they released as well.

These data are available every five years. The 2015 data will be used to estimate recreational fishing on Cedar Lake until the 2020 survey data are available. Based on past experience of time required to complete distribution of the survey, this would likely be for the 2022 stock assessment. Estimates of recreational harvest of walleye and northern pike in 2015 is 27,000 kgs and 19,000 kgs, respectively (Klein et al, 2020).

5.5 Scope of assessment in relation to enhanced or introduced fisheries

Representatives of Manitoba, Agriculture and Resource Development (Wildlife and Fisheries Branch) confirmed that in 1990 and 1991 a total of 1.5 million walleye fry were introduced in Cedar Lake from the Grand Rapids Hatchery (a Provincial fish hatchery, which is no longer in existence) in an attempt to enhance the existing walleye population. The parent stock was from Lake Winnipeg. The success or otherwise of the initiative was not monitored or documented but is not considered to be the basis or origin of the existing stock (Ian Kitch pers. comm.).

Given the low level of stocking, the lapse of 30 years and the origin of the walleye fry was from parent stock that, prior to the Grand Rapids Dam, was connected to Cedar Lake, the assessment team conclude that this is not an enhanced fishery.

5.6 Assessment results overview

5.6.1 Determination, formal conclusion and agreement

To be drafted at Public Comment Draft Report stage

The CAB shall include in the report a formal statement as to the certification determination recommendation reached by the assessment team on whether the fishery should be certified.

The CAB shall include in the report a formal statement as to the certification action taken by the CAB's official decision-maker in response to the determination recommendation.

Reference(s): FCP v2.2, 7.20.3.h and Section 7.21

5.6.2 Principle level scores

To be drafted at Client and Peer Review Draft Report stage

The CAB shall include in the report the scores for each of the three MSC principles in the table below.

Reference(s): FCP v2.2 Section 7.17

Table 5. Principle level scores

Principle	UoA 1	UoA 2
Principle 1 – Target species		
Principle 2 – Ecosystem impacts		
Principle 3 – Management system		

5.6.3 Summary of conditions

To be drafted at Client and Peer Review Draft Report stage

The CAB shall include in the report a table summarising conditions raised in this assessment. Details of the conditions shall be provided in the appendices. If no conditions are required, the CAB shall include in the report a statement confirming this.

Reference(s): FCP v2.2 Section 7.18

Table 6. Summary of conditions

Condition number	Condition	Performance Indicator (PI)	Deadline	Exceptional circumstances?	Carried over from previous certificate?	Related to previous condition?
				Yes / No	Yes / No / NA	Yes / No / NA
				Yes / No	Yes / No / NA	Yes / No / NA
				Yes / No	Yes / No / NA	Yes / No / NA

5.6.4 Recommendations

To be drafted at Client and Peer Review Draft Report stage

If the CAB or assessment team wishes to include any recommendations to the client or notes for future assessments, these may be included in this section.

6 Traceability and eligibility

6.1 Eligibility date

The CAB shall include in the report the eligibility date and the justification for selecting this date, including consideration of whether the traceability and segregation systems in the fishery are appropriately implemented.

Reference(s): FCP v2.2 Section 7.8

The Target Eligibility Date for this assessment is the date of certification

6.2 Traceability within the fishery

Further information on traceability within the fishery will be gathered at the site visit. In the meantime, the responses under the heading “Description” in Table 7 below were provided by Manitoba Agriculture and Resource Development in their MSC Client Checklist submitted to the CAB in preparation for the ACDR.

Table 7. Traceability within the fishery

Factor	Description
Will the fishery use gears that are not part of the Unit of Certification (UoC)?	No

Factor	Description
If Yes, please describe: - If this may occur on the same trip, on the same vessels, or during the same season; - How any risks are mitigated.	
Will vessels in the UoC also fish outside the UoC geographic area? If Yes, please describe: - If this may occur on the same trip; - How any risks are mitigated.	No
Do the fishery client members ever handle certified and non-certified products during any of the activities covered by the fishery certificate? This refers to both at-sea activities and on-land activities. - Transport - Storage - Processing - Landing - Auction If Yes, please describe how any risks are mitigated.	The client group does not handle non-certified products. If successfully certified, the stock UoAs will be bounded by the lake. Fishers will harvest on the lake and deliver to the packing shed in Easterville on the Cedar Lake shore. No transhipment occurs. When fish leave the packing shed, they are out of the client group's custody. Manitoba Agriculture and Resource Development will investigate past delivery records to determine whether other fisheries have delivered to the Easterville shed in the past.
Does transhipment occur within the fishery? If Yes, please describe: - If transhipment takes place at-sea, in port, or both; - If the transhipment vessel may handle product from outside the UoC; - How any risks are mitigated.	No
Are there any other risks of mixing or substitution between certified and non-certified fish? If Yes, please describe how any risks are mitigated.	No, or, at least the Manitoba Agriculture and Resource Development do not believe so. We will look at historic deliveries to the shed to be sure there has been no fish originating in other fisheries in the shed in past.

6.3 Eligibility to enter further chains of custody

To be drafted at Client and Peer Review Draft Report stage

The CAB shall include in the report a determination of whether the seafood product will be eligible to enter certified chains of custody, and whether the seafood product is eligible to be sold as MSC certified or carry the MSC ecolabel.

The CAB shall include in the report a list of parties, or category of parties, eligible to use the fishery certificate, and sell product as MSC certified.

The CAB shall include in the report the point of intended change of ownership of product, a list of eligible landing points, and the point from which subsequent Chain of Custody certification is required.

If the CAB makes a negative determination under FCP v2.2 Section 7.9, the CAB shall state that fish and fish products from the fishery are not eligible to be sold as MSC certified or carry the MSC ecolabel. If the client group includes other entities such as agents, unloaders, or other parties involved with landing or sale of certified fish, this needs to be clearly stated in the report including the point from which Chain of Custody is required.

Reference(s): FCP v2.2 Section 7.9

6.4 Eligibility of Inseparable or Practicably Inseparable (IPI) stock(s) to enter further chains of custody

There are no IPI stocks in the fishery.

7 Scoring

7.1 Summary of Performance Indicator level scores

Table 8. Summary of Performance Indicator level scores

Principle	Component	Performance Indicator (PI)		UoA 1	UoA 2
1	Outcome	1.1.1	Stock status	≥80	≥80
		1.1.2	Stock rebuilding	NA	NA
	Management	1.2.1	Harvest strategy	≥80	≥80
		1.2.2	Harvest control rules & tools	≥80	≥80
		1.2.3	Information & monitoring	≥80	≥80
		1.2.4	Assessment of stock status	60-79	60-79
2	Primary species	2.1.1	Outcome	≥80	≥80
		2.1.2	Management	≥80	≥80
		2.1.3	Information	≥80	≥80
	Secondary species	2.2.1	Outcome	≥80	≥80
		2.2.2	Management	60-79	60-79
		2.2.3	Information	60-79	60-79
	ETP species	2.3.1	Outcome	≥80	≥80
		2.3.2	Management	≥80	≥80
		2.3.3	Information	60-79	60-79
	Habitats	2.4.1	Outcome	≥80	≥80
		2.4.2	Management	≥80	≥80
		2.4.3	Information	≥80	≥80
	Ecosystem	2.5.1	Outcome	≥80	≥80
		2.5.2	Management	≥80	≥80
		2.5.3	Information	≥80	≥80
3	Governance and policy	3.1.1	Legal & customary framework	60-79	60-79
		3.1.2	Consultation, roles & responsibilities	60-79	60-79
		3.1.3	Long term objectives	≥80	≥80
	Fishery specific management system	3.2.1	Fishery specific objectives	≥80	≥80
		3.2.2	Decision making processes	60-79	60-79
		3.2.3	Compliance & enforcement	60-79	60-79
		3.2.4	Monitoring & management performance evaluation	60-79	60-79

7.2 Principle 1

7.2.1 Walleye biology

Walleye is in the family Percidae (order Perciformes) and genus *Sander*, specific name *vitreum*. Walleye are particularly light-sensitive. Because of the occurrence of a *tapitum lucidum* in the retina of the eye, the species is negatively phototactic and is primarily crepuscular or nocturnal in its feeding behaviour. walleye are tolerant of a wide range of turbidities and are generally more active in turbid environments during daytime (Colby et al. 1979). They are native to fresh waters of North America and are most commonly found in fresh and only rarely in brackish waters. Scott and Crossman (1973a) documented North American distribution of the species. Indeed, the North American range extends from virtually the Gulf of Mexico to the Mackenzie River Delta, with Manitoba and Cedar Lake centrally located in the range. Greater details on taxonomy, physiology, life history, distribution, general biology, and ecology of walleye are available in Scott and Crossman (1973a), Colby et al. (1979), and Barton (2011). Walleye is a cool-water species. It has several colour phases but over most of its range is considered to be the yellow form. Walleye is a particularly important commercial and recreational fish and might be the most economically valuable one in Canadian inland waters. It is particularly valued and highly sought as a food fish.

Walleye is primarily a keystone predator in many North American freshwater environments, affecting forage fish communities and lower trophic levels through extensive and selective predation and encompassing a broad range of trophic conditions (Hartman 2009). Walleye spawn in spring in relatively shallow water, varying in depth from a few centimetres to several metres (Colby et al. 1979) but usually at a depth of less than 2 m. Eggs are broadcast, falling into crevices in the substrate or in mats of vegetation (Bozek et al. 2011b. Mature members of self-propagating walleye populations migrate from their overwinter grounds to the spawning area just after spring melt as water temperature approaches 7–9 °C (Scott and Crossman 1973a). Walleye can be lake-shoreline or stream-inflow spawners; the former is most likely in Cedar Lake. Males move to the spawning ground first, and spawning takes place at night with groups of one large female and one or several usually smaller males. The eggs are 1.5 to 2 mm in diameter and initially are sticky; they usually hatch within 12 to 18 days. After spawning the fish return, generally by the same route, with males remaining longer on the spawning area than females. On the feeding grounds, walleye are known to move vertically in the water column in response to light intensity, temperature, and available prey (DFO 2006, Park 2010). The preferred summer temperature of adults ranges from 11 to 25 °C (Lester et al. 2004) with an optimum temperature for growth of 22.2 °C (Casselman 2002). Walleye have a slightly lower optimum and preferred temperature compared with one of their preferred prey-fish species, Yellow Perch. Yellow Perch was the species most frequently caught in the fine-mesh index gillnets (CAMP 2017).

Size at age and growth rate of walleye are extremely variable across the broad range of the species (Colby et al. 1979). Growth is fairly rapid in the southern part of the range but slower in the north. A five-fold difference in growth exists across the range of the species. Latitudinal differences exist in seasonal growth patterns, and variations in annual growth rate have been well documented (Bozek et al. 2011a). These differences are largely due to variations in annual input of thermal energy, usually described as growing degree days (GDD) (Colby and Nepszy 1981). Bozek et al. (2011a) presented a bi-phase growth model, which predicts a rapid, virtually linear juvenile growth phase followed by a gradual reduction in growth rate after sexual maturity.

Size at age has been summarized graphically for walleye from the Southeast Basin of Cedar Lake from index-netted walleye for 2009–2013 (CAMP 2017) and von Bertalanffy growth rate parameters for 2009–2010 (CAMP 2014). It should be emphasized that the original length-at-age values were calculated from walleye caught in the growing season and from sampling conducted in August; the data were not separated by sex so include sexes combined. Unfortunately, none of the data provided in the Coordinated Aquatic Monitoring Program (CAMP) reports are separated by sex. These data are the only ones available at this time to examine size-at-age and growth. This limits interpretation of the data because for both target species, walleye and northern pike, it is well known that the sexes show dimorphic growth, with females growing faster than males.

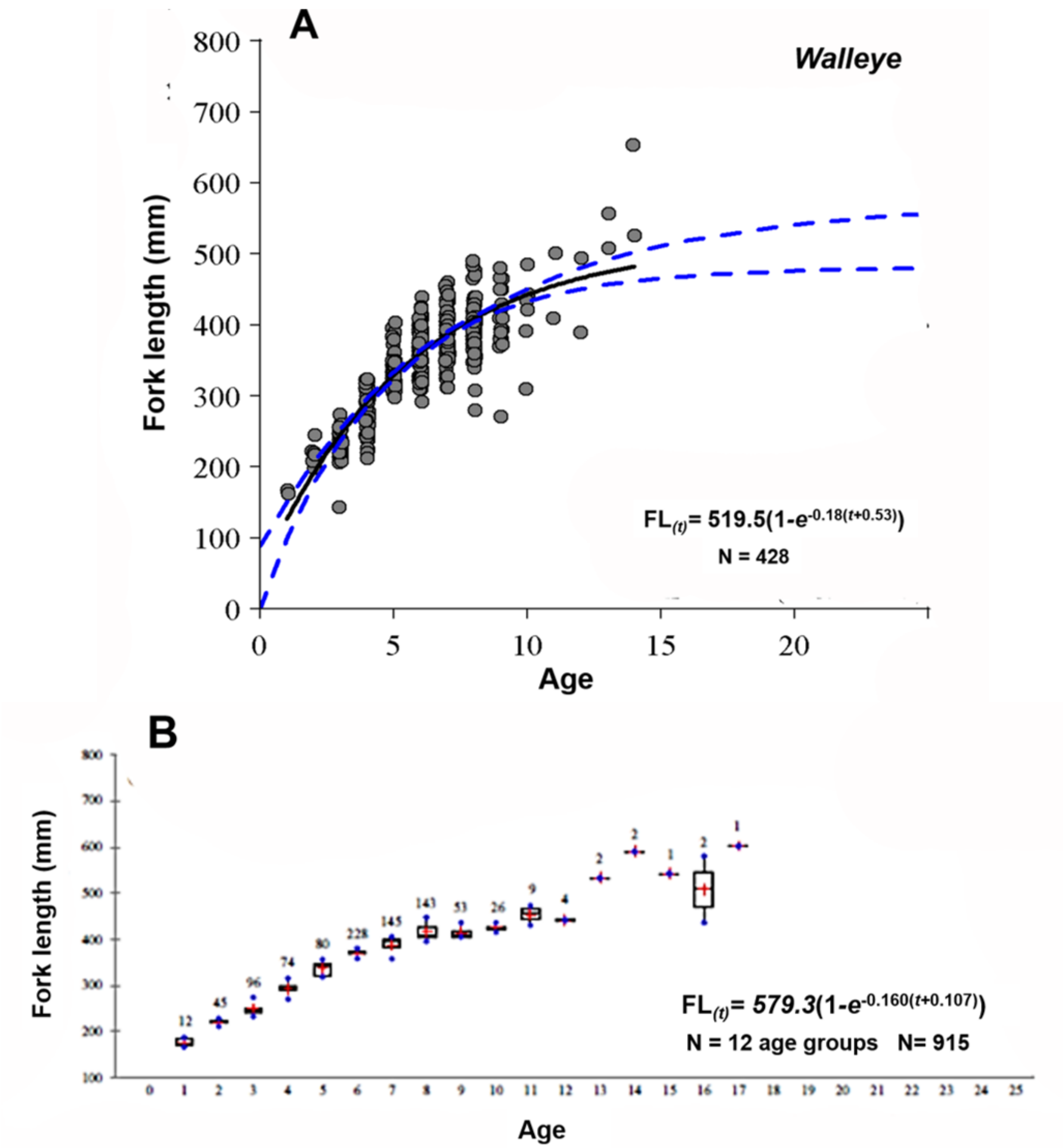

Figure 7. Walleye fork length at age and von Bertalanffy growth model fits and equations.

A) walleye captured in standard index gillnets from Cedar Lake 2009–2010, N = 428. Estimated von Bertalanffy growth model equation and parameters are provided. Reproduced from CAMPP (2014 – Figure 5.2.7–28). B) walleye captured in standard index gillnets from Cedar Lake 2009–2013, N = 923. Graph reproduced from CAMP (2017 – Figure 6-27). Number of fish used for each age is indicated above each age boxplot. Estimated von Bertalanffy growth model equation and parameters calculated here are provided for 12 age groups, ages 1–12, N = 915. Von Bertalanffy fit was calculated using estimated mean values. See Appendix 8.1.2 for von Bertalanffy estimates of fork length at age and associated parameters.

In the 2014 CAMPP report, actual size-at-age data are provided for 2009 and 2010 (summarized here in Appendix 8.1.1-A); these 2 years were combined (years equally weighted) to obtain an overall estimate of mean size at age. Von Bertalanffy equations and parameters were determined on the mean estimates (Appendix 8.1.1-B). L_∞ for the combined years was 488.2 cm fork length (FL). Von Bertalanffy equations and estimates were also provided for the pooled 2009–2010 data in CAMPP (2014 – Figure 5.2.7-28) (Figure 7A here), and length at age for this fit is provided in Appendix 8.1.2. The L_∞ for the pooled sample of walleye was 519.5 mm FL.

Summary FL at age was provided graphically from a large sample of walleye collected in the indexing program from 2009 to 2013 in CAMP (2017– Figure 6-27) (Figure 7B here). Mean values were estimated from the graphic presentation and used to calculate the von Bertalanffy fit and parameters and to estimate size at age. The L_∞ for this larger dataset was appreciably higher, 579.3 mm FL (Appendix 8.1.2). A growth index developed by Gallucci and Quinn (2019) was used to combine and compare the von Bertalanffy growth parameters. Their growth parameter omega $\omega = L_\infty \times K$ (Gallucci and Quinn 1979) ranged from 87.6 to 94.5, depending upon the dataset used (Appendices 8.1.1–B and 8.1.2).

To evaluate walleye FL at age and growth rate, Cedar Lake samples were compared with walleye results for Waterhen Lake, Manitoba, reported by Klein and Galbraith (2019). Cedar Lake is approximately 100 km North of Waterhen Lake, the first North American MSC-certified freshwater commercial fishery (for walleye and northern pike). However, length of walleye in Waterhen Lake reports (e.g., Klein and Galbraith 2019) is given as total length (TL). To perform this comparison, Waterhen Lake total lengths were converted to FL, using FL = 0.94321 TL, an average conversion from Colby et al. (1979 – Table XI). Klein and Galbraith (2019) also provided Waterhen Lake walleye growth models separated by sex. Converted L_∞ values for FL are 673 mm for females and 496 mm for males; equally weighted, the mean estimate is 585 mm FL. Using the various estimates of L_∞ for Cedar Lake, the mean estimate is approximately 542 mm FL. Therefore, ultimate length of walleye, sexes combined, is approximately 7% less than that of walleye in Waterhen Lake. The Gallucci and Quinn (1979) growth index indicates that ultimate length of walleye in Cedar Lake (ω = 92) is approximately 39% less than the estimate for Waterhen Lake (ω = 150). Overall, walleye in Cedar Lake are slower growing than walleye from Waterhen Lake. In Cedar Lake, samples collected in 2009 and 2010 were considerably slower growing and had a lower L_∞ than the larger 2009–2013 sample. These differences, however, are no doubt influenced to some extent by age distributions of the samples. Also, Cedar Lake may be somewhat cooler in summer than Waterhen Lake. A more specific comparison could have been conducted if length-at-age data for Cedar Lake were readily available for each sex.

Age and size of walleye at maturity vary with water temperature (climate) and probably food availability (lake fertility) within a given lake (Colby et al. 1979). Male walleye mature at an earlier age than do females. Scott and Crossman (1973a) reported that male walleye generally mature at 2 to 4 years of age and over 279 mm in length, and females at 3 to 6 years of age at 356 to 432 mm. In Manitoba, length when female walleye become sexually mature varies with population but is usually 420 to 480 mm (Klein et al. 2020). In Cedar Lake, female length at 50% maturity calculated from a logistic regression was 420 mm (415.6–424.6 mm, $1-\alpha = 0.95$) (Klein et al. 2020). Considering length at age for the various mean von Bertalanffy fits, walleye of this length would be in the 8-to-10-year-old range. This is for sexes combined; females that are faster growing would be somewhat younger.

According to the weight-at-age data, females in the pre-mature phase and post-mature phase would be separated by age 6 (see Figure 3 in Klein et al. 2020) (Figure 8 here). Females up to age 5 were considered pre-mature and above age 7 were considered mature (Klein et al. 2020). The weight-at-age analysis used in walleye modelling of Cedar Lake females at age 5 showed a mean weight of 305 g and, at age 7, 816 g. Length at age estimated from the summary von Bertalanffy data for walleye, sexes combined, provided for 2009 to 2013 (CAMP 2017) (Appendix 8.1.2), was 321 mm at age 5, 387 mm at age 7, and 357 mm at age 6. However, given that these sizes are within the growing season, they would be larger by approximately 30 mm at time of maturity the following spring. In Waterhen Lake, male walleye usually mature between the ages of 1 and 4 and usually spawn the following spring, between ages 2 and 5 (Klein and Galbraith 2019). Females in Waterhen Lake usually mature between ages 4 and 6 and spawn the following spring, between ages 5 and 7. Most males (approximately 92%) were mature at age 3, but no females were mature at that age. However, all females were mature at age 4 (Geisler 2012). In Cedar Lake, walleye maturity was somewhat older than in Waterhen Lake, but Cedar Lake walleye were also slightly slower-growing.

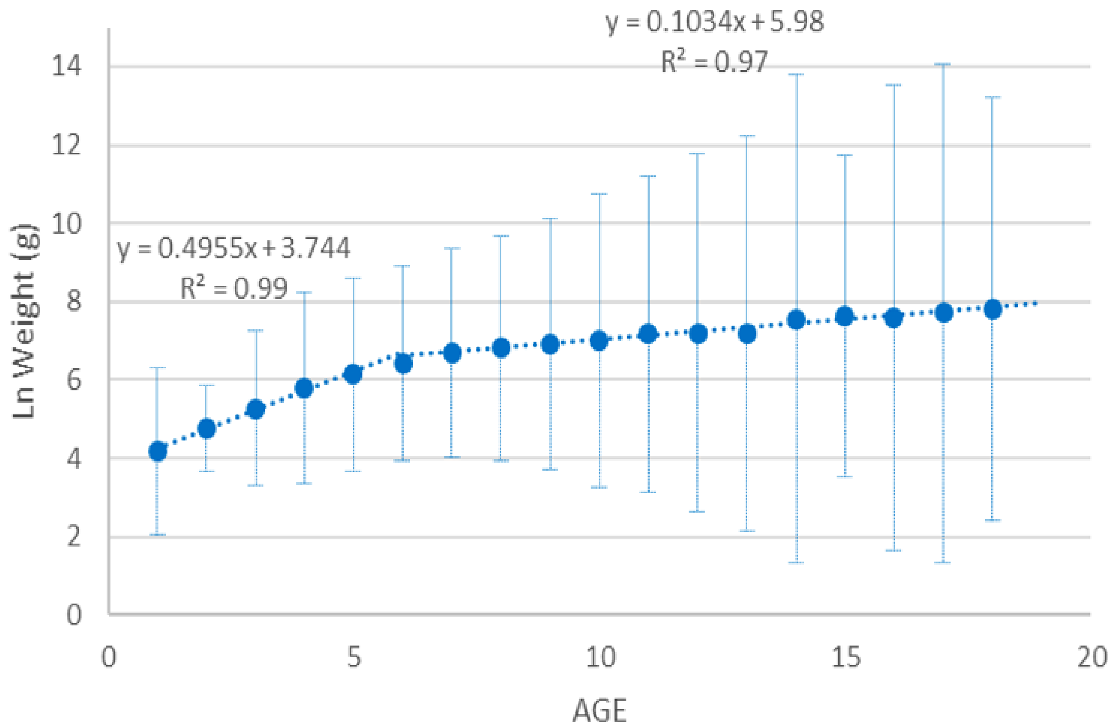

Figure 8. Natural log weight at age for female walleye caught in the Cedar Lake index netting program from 2009 to 2019.

Relationships are for walleye aged 1 to 5 and 7 to 18. Error bars represent standard error and increase with age because of numbers caught. Reproduced from CLFMP, Figure 3 (Klein et al. 2020).

In Manitoba, walleye spawning generally occurs from mid-April to late May. In Lake Winnipeg, approximately 175 km south of Cedar Lake, where the Wildlife and Fisheries Branch annually monitors spawning, from 2018 to 2020, 80% of female walleye finished spawning by approximately May 22 (W. Galbraith, Aboriginal Affairs and Northern Development Canada (AANDC), Winnipeg, pers. comm., P1 Q&A correspondence, March 22, 2021. Hereafter referred to as – Galbraith Q&A March 2021). This is taken into consideration when setting the closed season for commercial fishing in Cedar Lake, which occurs from April 1 to May 31.

Walleye are tolerant of a great range of environmental conditions but appear to reach greatest abundance in large, shallow, turbid lakes (Scott and Crossman 1973a). Temperature and light penetration greatly influence walleye summer habitat. The species' thermal-optimum habitat area is defined as the area of the lake bottom where summer temperatures are between 11 and 25 °C and light intensity is between 8 and 68 lx (Lester et al. 2004). Lester et al. examined the effects of these conditions on walleye abundance and production. Walleye habitat increased in proportion to the thermal optimal habitat area times the square root of the total dissolved solids (an index of nutrient level), and optimum water clarity for walleye typically is at a secchi depth of around 2 m. The increase in water clarity recently observed as a result of the invasion of dreissenids (fresh water mussels) in some water bodies, as well as resulting phosphorus control, has reduced the amount of thermally optimal walleye habitat and would negatively affect production. Cedar Lake is a shallow, turbid, mesotrophic environment and would be prime habitat for walleye. Summer secchi depths in the Southeast Basin are near optimal for the species (6-year summer mean 1.81 m, range 1.0–3.5 m). Given the temperature profiles reported in the CAMP (2017) surveys, however, summer temperatures may be slightly lower than optimum, particularly some years, when midsummer temperatures may not reach the optimum. For example, in the Southeast Basin in 2009 and 2013, temperature profiles were well below 20 °C (CAMP 2017). These temperature conditions would result in reduced growth of this cool-water species, which have an optimum temperature for growth in the 21–23 °C range. In fact, the lower summer temperatures reported to be in the 18–20 °C range are more optimal for northern pike (Casselman 1978).

Walleye longevity, like age at maturity, is inversely related to GDD (Colby and Nepszy 1981). The compilation of data by Bozek et al. (2011a) from populations spawning at 1,000 to 5,000 GDD indicates a longevity range of 4 to 32 years. In Canada, the maximum age of walleye likely varies from 10 to 12 years in the southern part of the range to 20 years in the northern part (DFO 2006). The oldest walleye caught in index sampling of Cedar Lake in 2011 to 2019 was 18 (Klein et al. 2020), an age only slightly below the maximum reported for the species in the northern part of the range. This seems quite appropriate since Cedar Lake is not at the northern edge of the species' range in Manitoba (Scott and Crossman 1973a).

Concerning population stock dynamics and productivity of walleye, Colby and Baccante (1996) concluded from their research and from the literature that a sustainable yield of walleye for Savanne Lake, Ontario, was about 1 $kg \cdot ha^{-1}$. Walter Lysack (pers. com.) believed that a sustainable yield of 1 $kg \cdot ha^{-1}$ was reasonable for many Manitoba walleye waters (Lysack 2000, 2004). When Waterhen Lake, to the south of Cedar Lake, was first MSC certified (Casselman et al. 2014), the walleye harvest was 1.1 $kg \cdot ha^{-1}$, and environmental conditions for walleye were considered ideal, additional evidence for the conclusions that approximately 1 $kg \cdot ha^{-1}$was a sustainable yield of walleye in many Manitoba lakes.

Longevity is inversely proportional to mortality rate, and mortality rate would increase with GDD (Bozek et al. 2011a). Assuming lightly exploited populations, it was demonstrated that *M* increases from approximately $0.13 \cdot yr^{-1}$ at 1,000 GDD to $0.39 \cdot yr^{-1}$ at 3,000 GDD. Recruitment influences longevity. walleye recruitment is sporadic and strongly influenced by environmental factors, especially rapid spring warming (Hartman 2009) and, in river-spawning stocks, is directly related to spring discharge (Winterton 1975). Young-of-the-year recruitment indices provide important insights concerning possible trends in spawning-stock biomass. Recruitment and mortality rate will be provided subsequently for walleye in Cedar Lake. Environmental conditions have a strong influence on recruitment and production. This has been reconfirmed in a detailed study of fish populations in Lake Erie. Zhang et al. (2018) reviewed the ecological and evolutionary mechanisms by which harvest could affect recruitment for a 4-decade period for populations, including walleye and yellow perch, in Lake Erie. They concluded that dynamics was affected more strongly by environment than by exploitation.

Fecundity increases roughly in proportion to body weight. There is a significant positive relationship between GGD and relative fecundity, but it is highly variable within climatic zones (Baccante and Colby 1996, Lester et al. 2000, and Morgan et al. 2003). Relative fecundity ranges from 20,000 $eggs \cdot kg^{-1}$ body weight in the north (GDD approximately 1,100) to 80,000 $eggs \cdot kg^{-1}$ at mid latitude (GDD approximately 2,500). Baccante and Colby (1996) estimated population fecundity for 10 walleye populations with GDD ranging from 1,200 to 2,500 and found that one million eggs are required to produce an average of 68 adults.

Diet shifts from invertebrates (e.g., copepods, crustaceans, etc.) and very small fish to a more piscivorous diet as walleye increase in size (Scott and Crossman 1973a). Piscivory in adult walleye depends upon available prey, but yellow perch, ciscoes, and centrarchids are common food items. Adult walleye has a diverse diet; besides eating invertebrates and fish, they also eat crayfish, snails, frogs, and occasionally small mammals when forage fish and insects are scarce. Adult walleye can be cannibalistic, feeding on juveniles. Northern pike are probably the most common predator of walleye of all age classes. Juvenile walleye is also consumed by yellow perch, saugers (*Sander canadensis*) and various fish-eating water birds, especially double-crested cormorants (*Phalacrocorax auritus*) (DFO 2006, Park 2010, Nate et al. 2011).

It should be emphasized that walleye in Cedar Lake do not fit the profile of a low-trophic-level species as defined by MSC Fisheries Standard V2.01 (MSC 2018).

7.2.2 Walleye stock assessment and status

Annual assessments are conducted in Cedar Lake as part of the Coordinated Aquatic Monitoring Program (CAMP) run jointly between Manitoba Agriculture and Resource Department and Manitoba Hydro. This long-term monitoring program for Cedar Lake was begun in 2009 and provides hydrology, limnological data, water quality, and macroinvertebrate monitoring, as well as a well-organized fisheries-independent assessment program with an established protocol (Appendix 8.1.3). The program involves using large-mesh index gillnets to provide information on stock assessment and samples of important fisheries species, as well as regular analysis of mercury levels. The coarse-mesh gillnetting program is an essential part of assessing population abundance and dynamics and stock status. In conjunction with this, small-mesh index gillnets are also set every year to catch small-bodied fish and important prey-fish species. Various aspects of these data are reported in CAMP reports, which summarize a number of annual programs (CAMPP 2014, CAMP 2017). The annual netting program occurs at 12 standard coarse-mesh gillnet sites in the Southeast Basin of Cedar Lake (Figure 9B). These sites are at fixed locations and were selected on a depth-stratified basis. The index netting program provides population data to support harvest strategies. The nets are set by a commercial fisher with one or two technicians, and the catch is processed jointly with Manitoba Agriculture and Resource Development staff. This assessment netting in the Southeast Basin is conducted annually, more intensively in this basin because it receives the greatest commercial fishing effort. But every 3 years, 12 similarly selected stations are fished in the shallow Northwest Basin to better understand the entire Cedar Lake fish community and populations (Figure 9A). The Northwest Basin was indexed in 2011, 2014, 2018, and 2020.

In years when Northwest Basin data is sampled, data from the two basins are averaged and the weight given to that year is halved so that the number of net sets does not inflate the year's contribution to the 3-year rolling average. For calculating mortality rates. The CUEs of the two basins are amalgamated. Growth rates of walleye between the two basins are not different and catch at age is not systematically different between the basins. However, there is some evidence that large-bodied fish in the Northwest Basin are somewhat older, possibly because fishing effort in this more remote basin is less; the commercial fishery is conducted primarily in the Southeast Basin (Galbraith Q&A March 2021).

Routine indexing had not been conducted in Cross Bay, which is restricted to commercial fishing but receives the majority of recreational fishing effort. However, index netting through the Co-operative Stock Monitoring Program was initiated in October 2020 in Cross Bay, and plans are to conduct it annually to 2023 (Galbraith Q&A March 2021). One of the primary reasons for this additional monitoring program is to better understand the status of lake whitefish, which are more abundant in this forebay area of the Grand Rapids Dam.

Sampling protocol for this assessment program is well documented and web-based at www.campmb.com/reports/ and is provided in Appendix 8.1.3. Netting protocol involves a coarse-mesh index gillnet that is composed of five panels each 23 m long (total length 115 m), 1.83 m deep, each panel separated by 2 m. Each of the five panels is one stretch-mesh size: 51 mm (2 in.), 76 mm (3 in.), 95 mm (3¾ in.), 108 mm (4¼ in.), and 127 mm (5 in.). The twine is light green twisted multifilament nylon, and nets have continuous lead and float lines. Meshes are hung on the half. The smallest three meshes are three-filament, 210 denier, 0.17, 0.20, and 0.21 diameter. The two largest meshes are four-strand, 210 denier, 0.25 and 0.33 diameter. Each of the combined nets has 4-m-long side-line bridles. These nets are designed specifically to sample large-bodied fish.

Nets were originally built on imperial measurement standards, but measurements are provided here as metric conversions. Sampling protocol for the large-bodied fish is provided in detail (Appendix 8.1.3). Manitoba Fisheries Branch specifies certain species of management interest and suggests that a minimum of 250 fish of each of these species may need to be sampled to ensure useful population statistics. Metrics collected are FL to 2 mm, weight to 10 g for fish <4 kg and 25 g for fish >4 kg, sex, maturity, and age determination structures — otoliths for walleye, sauger, and whitefish and cleithra for northern pike. Calcified structures are analysed to determine age, growth, mortality rate, and associated biometric data. All other species caught are separated by species and mesh size, counted, and weighed in bulk. Index gillnetting is conducted in late August and early September over approximately 5 to 7 days. Gillnets are bottom-set and fished overnight for two consecutive crepuscular dusk and dawn periods.

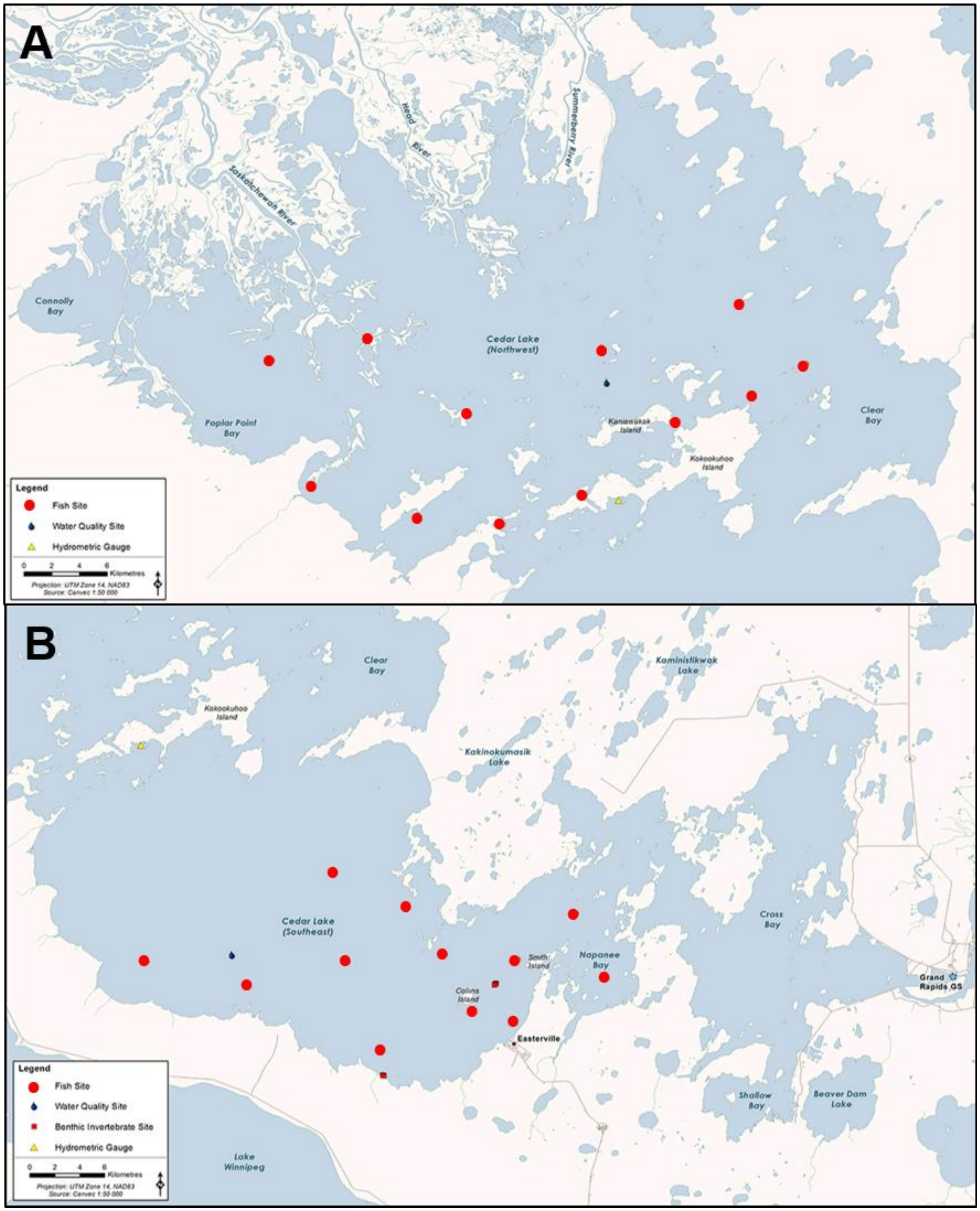

Figure 9. Cedar Lake, showing monitoring index-netting sites (closed red circles, N = 12).

Figure shows A) northwest basin index-netting sites, which are monitored every third year, and B) southeast basin netting sites, which are monitored annually. Water-quality sites and hydrometric gauge locations are also shown in insets. Scale provided in insets. Prepared from CLFMP, Figures 12 and 13 (Klein et al. 2020).

Fine-mesh gillnets are used to sample and index small-bodied fish. They consist of three mesh sizes, each a separate net. The nets are purchased from Sweden. Each is 10 m long and 1.8 m deep. They have integral float and lead lines, with stretch mesh sizes of 16 mm (0.63 in.), 20 mm (0.79 in.), and 25 mm (0.98 in.). The nets are multi-strand clear monofilament with the first two nets 0.10 mm diameter and the largest mesh 0.13 mm. The nets are assembled into a single gang by joining the float lines and lead lines, and the combined net has 4-m side-line bridles. Fine-mesh nets are set at every third or fourth location attached to the coarse-mesh index nets as tie-ons. Species are lumped together for a bulk weight measured to the nearest 25 g for each set, counted by species and set. No effort is made to separate fish by mesh size; neither is there separation based on size of fish caught, but general information is available about the abundance of a broad range of species for which average weight can be calculated. There is no attempt to use the data to reconstruct year-class strength, although the nets are designed to catch fish smaller than approximately 15 cm. This is a shortcoming of this fine-mesh gillnet indexing effort. It no doubt would have greater utility if length-frequency data were collected by mesh size. If more sorting of the small-mesh data were conducted, it would probably provide valuable early recruitment insights for a number of species (Galbraith Q&A March 2021).

The assessment program has been conducted in Cedar Lake since 2009 and is reported here up to 2019. Unfortunately, catch data for the coarse-mesh gillnet indexing is provided only in summary form, providing combined weights and numbers for the 11-year period. Results are not provided or available at present to examine annual trends in CUE for the various species. This limits the ability to fully understand species trends over time. The Assessment Team recommend that these annual data be made available as soon as possible. Whilst this does not limit the Team's ability to assess P1 Performance Indicators (PIs) it would provide considerable additional insights concerning past, present, and possibly future trends particularly associated with community structure and species interactions, along with population dynamics and trends of the target species.

Summary coarse-mesh index gillnetting data have been provided, however, separated by mesh size, and these provide some important insights (Table 9). A total of 11 species are summarized, three closely related species included as mullets. In summary, mullets and specifically white suckers constitute the greatest overall catch (40.2% by weight) followed by walleye (27.3%) and northern pike (16.0%) (Table 9A). Numbers caught per year were highest for walleye, averaging 197.7 for the 11-year period, followed by white suckers (180) and northern pike (56.8). It is obvious that goodly numbers of walleye, a primary target species, are available to examine the various biometrics needed to evaluate PIs (Table 9B). On a weight basis, the finest mesh (51 mm) produced the greatest biomass of three species — yellow perch (67.2% of overall assessment gillnet catch), followed by sauger (62.2%), and cisco (54.7%); of the species caught, these are three of the smallest-bodied fish caught in the coarse-mesh index nets (Table 9A). The next smallest mesh size (76 mm), caught the greatest biomass of shorthead redhorse, followed by the two target species, northern pike (37.3%) and walleye (35.6%). The fact that the walleye catch was greatest in this relatively fine mesh size (76 mm) is important, given that the commercial nets are limited to a mesh size that is appreciably larger (108 mm). In fact, only 15.7% of the biomass of walleye was caught in this larger mesh size. This is less than half the relative catch in the finer mesh. This 76-mm mesh size also caught the greatest biomass of goldeye (50.0%) and burbot (26.9%). However, these two species are not abundant; indeed, six of the 11 species caught had the greatest biomass in this mesh size.

The next largest mesh size (95 mm) caught the greatest biomass of white suckers (31.3%), which greatly influenced the overall mullet catch (30.7%), but this would be expected given that 93% of the mullet biomass is white suckers. The next largest mesh size (108 mm) in the coarse-mesh index gillnetting had the greatest biomass of lake whitefish (59.1%), followed by one of the mullets, longnose suckers (34.8%). As mentioned, this mesh size, which is the minimum allowed for the commercial fishery, had a considerably lower biomass of the target species, walleye (15.7%) and Northern pike (9.1%). No species had the highest biomass in the largest mesh size (127 mm), although lake whitefish and burbot were quite high (25.4 and 23.9%, respectively).

Considering a summary of the numbers of fish caught in the coarse-mesh index gillnet index for the 11-year period (Table 9B), the greatest numbers were walleye followed by mullet and then northern pike. Average weight of walleye caught was 656 g, mullet 1,055 g, and pike, the largest, 1,341 g. In fact, across all mesh sizes, pike were the heaviest fish caught except for the finest mesh (51 mm), where, on average, cisco were somewhat heavier than pike.

Table 9. Cedar Lake coarse-mesh index gillnetting combined catches for 2009–2019 by species and mesh size and combined.

Including all mesh sizes by species and combined by summing all mesh sizes by species. A) Weights in kg and per cent indicating relative catch for that species across all mesh sizes. Bold and *italicized* values for weight (kg) and per cent are maximum for the species across the various mesh sizes. Weight data from Klein et al. (2020 –Table 5). B) Numbers caught and mean weight of the fish caught by mesh size. Combined numbers caught during the 11 years of indexing are indicated, along with the calculated mean weight of the catch per year. The estimated mean number caught per year is also provided. For the combined catch, bold indicates the species with maximum values, and superscripts indicate rank order. Mullet as designated by the Freshwater Fisheries Marketing Corporation combines two sucker species and a redhorse. Mesh sizes 108 mm and 127 mm are legal sizes for the commercial fishery. Number data from W. Galbraith, AANDC, Winnipeg, pers. comm., P1 Q&A correspondence, March 22, 2021.

A

	Mesh size											
	51 mm		76 mm		95 mm		108 mm		127 mm		Combined	
Species	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Mullet	98.9	4.4	453.9	20.1	***694.6***	***30.7***	644.6	28.5	368.6	16.3	***2,260.5***	***43.2***
White sucker	86.4	4.1	413.8	19.7	***657.5***	***31.3***	595.6	28.3	349.7	16.6	***2,103.0***	***40.2***
Longnose sucker	7.1	6.0	24.6	20.9	27.3	23.2	***41.0***	***34.8***	17.8	15.1	117.8	2.3
Shorthead redhorse	5.4	13.6	***15.5***	***38.9***	9.8	24.6	8.0	20.0	1.2	2.9	39.7	0.8
Walleye	176.5	12.4	***508.0***	***35.6***	435.3	30.5	224.5	15.7	84.5	5.9	1,428.8	27.3
Northern pike	191.2	22.8	***312.7***	***37.3***	189.3	22.6	76.4	9.1	68.7	8.2	838.3	16.0
Cisco	***177.1***	***54.7***	106.7	33.0	31.0	9.6	4.9	1.5	4.0	1.2	323.6	6.2
Sauger	***160.7***	***62.6***	73.9	28.8	8.3	3.2	5.6	2.2	8.4	3.3	257.0	4.9
Yellow perch	***62.4***	***67.2***	27.9	30.1	2.2	2.4	0.3	0.3			92.8	1.8
Lake whitefish	0.6	3.9	0.6	3.9	1.2	7.6	***8.9***	***59.1***	3.8	25.4	15.1	0.3
Burbot	1.9	17.7	***2.9***	***26.9***	1.7	16.3	1.6	15.2	2.6	23.9	10.7	0.2
Goldeye	0.4	24.2	***0.9***	***50.0***	0.5	25.8					1.8	<0.1

B

	Mesh size										Combined		
	51 mm		76 mm		95 mm		108 mm		127 mm		11-yr. period		Mean
Species	N	x̄ wt. (g)	N	x̄ wt. (g)	N	x̄ wt. (g)	N	x̄ wt. (g)	N	x̄ wt. (g)	N	x̄ wt. (g)	N·yr.$^{-1}$
Mullet	282	351	559	812	619	1,122	467	1,380	216	1,707	2,143	1,055[4]	194.8[2]
White sucker	254	340	507	816	583	1,128	430	1,385	206	1,697	1,980	1,062[4b]	180.0[2a]
Longnose sucker	15	473	28	879	25	1,092	30	1,368	9	1,976	107	1,101[4a]	9.7[2b]
Shorthead redhorse	13	415	34	455	11	889	7	1,134	1	1,150	56	709[4c]	5.1[2c]
Walleye	548	322	823	617	528	824	219	1,025	59	1,433	***2,177***	656[5]	***197.7***[1]
Northern pike	186	1,028	267	1,171	115	1,646	36	2,122	21	3,273	625	***1,341***[1]	56.8[3]
Cisco	121	1,464	104	1,026	43	721	16	306	12	331	296	1,093[3]	26.9[5]
Sauger	238	675	126	587	19	435	21	268	19	443	423	607[6]	38.5[4]
Yellow perch	126	495	50	558	4	548	1	300			181	513[8]	16.5[6]
Lake whitefish	1	595	1	591	2	575	7	1,275	2	1,920	13	1,162[2]	1.2[8]
Burbot	9	210	7	411	2	870	1	1,630	1	2,560	20	535[7]	1.8[7]
Goldeye	2	220	4	228	1	470					7	260[9]	0.6[9]

Fine-mesh index gillnet catches were available on an annual basis and separated by basin, making it possible not only to examine differences between basins but to consider differences in annual trends over the 11-year period from 2009 to 2019 (Galbraith Q&A March 2021). However, interpretations are somewhat limited because lengths or length frequencies were not measured and only bulk weights are available. Capture of a few large individuals would skew the results considerably. As already indicated, if length were provided, these results would be much more informative and could provide valuable insights concerning recruitment, particularly for walleye. These fine-mesh nets generally sampled small-bodied fish <15 cm, although some larger individuals become entangled and are caught.

Keeping in mind the considerable differences between the two basins sampled in this netting program, it is possible to better understand the environmental requirements of some of the 16 species that are caught (Table 10A and 10B). The Northwest Basin is shallower, with an average depth <4 m, while the Southeast Basin has a mean depth of 7.6 m. The Northwest Basin is more turbid, having a mean secchi depth of 0.53 m, with the Southeast Basin approximately three times clearer, with a secchi depth of 1.81 m (1.0–3.5 m). The Northwest Basin has an average total phosphorus content 29% greater, and total dissolved solids are 4% higher (see average data CAMP 2017 reported earlier here). Of the 16 species, five (31%) were not captured in the Northwest Basin; these were logperch, longnose suckers, lake whitefish, mottled sculpin, and shorthead redhorse (Table 10). It should be taken into consideration, however, that fishing effort in the Northwest Basin was considerably less, conducted over fewer years, so some species were caught less frequently.

Only two species, goldeye and burbot, were not caught in the Southeast Basin (13%), and for several species only one or two individuals were caught — longnose suckers, lake whitefish, mottled sculpin, and shorthead redhorse (Table 10B). In the Northwest Basin, catches of trout-perch followed by emerald shiners, walleye, and spottail shiners were greatest. It is not possible to examine annual trends for the 3 years that were sampled in the Northwest Basin. In the Southeast Basin, yellow perch were caught most frequently, followed by spottail shiners, emerald shiners, trout-perch, sauger and cisco. Average weight of fish caught in these fine-mesh nets in the Northwest Basin was almost four times greater (85 g) than those caught in the Southeast Basin (22 g) (Table 10B).

A longer time series for this fine-mesh gillnet indexing program exists for the Southeast Basin. There is some evidence that fewer yellow perch were caught in recent years, and this may also be true of sauger. walleye show a somewhat different trend, with some evidence of increasing numbers of recent years. When these results are compared with the fisheries-dependent harvest data, there appears to be some agreement. For example, walleye harvest was considerably higher in recent years, from 2013 to 2019, and sauger and yellow perch were considerably lower. This somewhat reinforces that the annual catch data time series of the coarse-mesh index gillnets would be useful in evaluating species dynamics and conveying population trends and changes to others.

Table 10. Cedar Lake fine-mesh index gillnet catches by year for 3 years for the Southwest Basin (2011, 2014, and 2018) and 11 years for the Northeast Basin (2009–2019) by species (16).

Both total number and total weight of the catch and an estimated mean individual weight are provided, including summaries by basin. All species combined are also provided. Summaries by basin are provided, including the percentage of the years that species were caught, along with total number and mean number and individual weights. The number of net sets is also provided. Bold and italicized values indicate species caught most frequently and heaviest, as well as year of greatest combined total number and weight and mean individual weight of the catch. Table is separated into two sections: nine species in Part A and seven species and combined in Part B. Fine-mesh index nets (Swedish) are made up of three 10-m-long panels of stretch-mesh sizes of 16, 20, and 25 mm and attached as tie-ons to the standard coarse-mesh index nets, usually fished at three or four locations annually, indicated by number of sets. Data from W. Galbraith, AANDC, Winnipeg, pers. comm., P1 Q&A correspondence, March 22, 2021.

A			Yellow perch			Spottail shiner			Walleye			Emerald shiner			Troutperch			Sauger			Cisco			Logperch			Northern pike		
				Wt. (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)	
Year	Basin	Sets	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄
2011	NW	4	11	315	28.6	4	16	4.0	10	2,936	293.6	32	150	4.7	112	523	4.6	36	6,791	188.6	9	1,100	122.2				3	8,520	2,084.0
2014	NW	3	6	90	15.0	29	145	5.0	26	5,543	213.2	61	300	4.9	1	5	5.0	13	2,980	229.2	8	1,642	205.2				1	630	630.0
2018	NW	3				9	18	2.0	11	2,674	243.1	31	135	4.4	41	203	5.0	11	2,986	271.4	1	75	75.0				3	2,960	986.7
% of yrs.			66			100			100			100			100			100			100						100		
Total		10	17			42			47			124			***154***			60			18						7		
Mean		3.3	8.5		21.9	14.0		3.7	15.7		250.0	41.3		4.7	***51.3***		4.9	20.0		229.8	6.0		138.2				2.3		**1,485.6**
2009	SE	6	437	5,080	11.6	266	1,280	4.8	12	3,210	267.5				36	180	4.4	33	4,980	150.9	4	530	132.5	46	280	6.1			
2010	SE	3	39	1,245	31.9	91	504	5.5	38	2,878	75.7				15	68	4.5	75	4,920	65.6	97	2,755	28.4						
2011	SE	4	72	425	5.9	128	553	4.3	46	2,690	58.5	125	577	4.6	72	293	4.1	9	1,019	113.2	5	604	120.8	1	10.4	10.4			
2012	SE	4	438	3,135	5.7	241	1,115	4.6	96	3,545	36.9	11	45	4.1	39	125	3.2	22	2,945	133.9	8	1,045	130.6	16	50	3.1	3	1,465	488.3
2013	SE	4	19	85	4.5	29	125	4.3	31	345	11.1	35	180	5.1				6	1,060	176.7	9	35	3.9	4	30	7.5			
2014	SE	4	62	388	6.3	81	370	4.5	19	4,132	217.5	86	435	5.1	6	26.1	4.4	15	913	60.9	16	309	19.3	2	9.6	4.8	2	1,780	890.0
2015	SE	3	58	630	10.9	11	50	4.5	96	1,320	13.8	4	20	5.0	28	115	4.1	12	1,375	114.6	42	1,645	39.2	2	10	5.0	2	2,480	1,240.0
2016	SE	4		2,240			31			2,696			35			170			3,525			460			15			1,385	
2017	SE	4	30	650	21.7	14	70	5.0	126	970	7.7	2	10	5.0	16	65	4.1	11	920	83.6	1	5	5.0	24	185	7.7			
2018	SE	4	53	530	10.0	144	875	6.1	158	3,325	21.0	10	50	5.0	27	110	4.1	17	2,405	414.5	15	690	46.0	2	154	77.0	4	2,555	638.8
2019	SE	3	28	225	8.0	22	145	6.6	19	200	10.5	8	40	5.0	5	20	4.0	9	365	40.6							1	1,000	1,000.0
% of yrs.			91			91			91			73			82			91			82			73			45		
Total		44	**1,236**			1,027			641			281			244			209			197			97			12		
Mean		4	**123.6**		11.8	102.7		5.0	64.1		72.0	35.1		4.9	27.1		4.6	23.2		108.1	21.9		58.4	12.1		15.2	2.4		***851.4***

(Cont'd next page)

B

			White sucker			Goldeye			Longnose sucker			Burbot			Lake whitefish			Mottled sculpin			Shorthead redhorse			Combined		
			Wt. (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt (g)			Wt		
Year	Basin	Sets	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total	x̄	N	Total (kg)	x̄ wt. (g)
2011	NW	4				1	150	150.0																***218***	***20.5***	***94.0***
2014	NW	3	1	20	20.0	1	5	5.0																147	11.4	77.3
2018	NW	3				1	19	10.0				1	6	6.0										109	9.1	83.3
% of yrs.			33			100						33														
Total		10	1			3						1												474		
Mean		3.3	1.0		20.0	1.0		55.0				1.0		6.0										158.0		84.9
2009	SE	6	4	110	27.5																			838	***15.6***	18.7
2010	SE	3	3	173	57.7				1	64	64.0													359	12.6	***35.1***
2011	SE	4	1	134	135.0													1	2.4	2.4				460	6.3	13.7
2012	SE	4	5	1,410	282.0										1	285	285.0							***880***	15.2	17.2
2013	SE	4																						133	1.9	14.0
2014	SE	4																						289	8.4	28.9
2015	SE	3																						255	7.6	30.0
2016	SE	4																							10.6	
2017	SE	4							1	75	75.0													225	3.0	13.1
2018	SE	4	1	175	175.0																1	145	145.0	432	11.0	25.5
2019	SE	3	1	5	5.0																			93	2.0	21.5
% of yrs.			55						18						9			9			9					
Total		44	15						2						1			1			1			3,964		
Mean		4	2.5		113.7				1.0		69.5				1.0		285.0	1.0		2.4	1.0		145.0	396.4		21.8

The fisheries-dependent harvest data provide a useful indicator of walleye status, especially when compared with the other commercial species harvested. Over the 10-year period from 2010 to 2019, commercial catch of walleye has remained uniformly high at 201.9 ± 18.9 t, representing approximately 39.0 ± 3.8% of the overall harvest, and quite consistent, with a very low CV of 13.5%. This fisheries-dependent commercial harvest data suggests that in recent years, the walleye stock in Cedar Lake has been productive and quite stable.

Assessment sampling provides some evidence of species trends and, quite importantly, biological data that are important in evaluating important aspects of population status. For example, recruitment is an important variable, in this case determined from walleye 2 to 7 years old. In the Cedar Lake fisheries, walleye recruitment becomes apparent when they are approximately 3 years old (Klein et al. 2020). The recruitment index for Cedar Lake is provided on a relative scale involving a ratio in relation to the mean where 1 represents average strength, 0.5 weaker, and 1.5 stronger. At the present time, no strong year-classes of walleye appear to be entering the fishery. Relatively strong year-classes were produced in 2010 and 2011, but between 2012 and 2016, only one average year-class was produced and four relatively poor ones (Figure 10). These two stronger year-classes will help offset the poor recruitment seen in recent years.

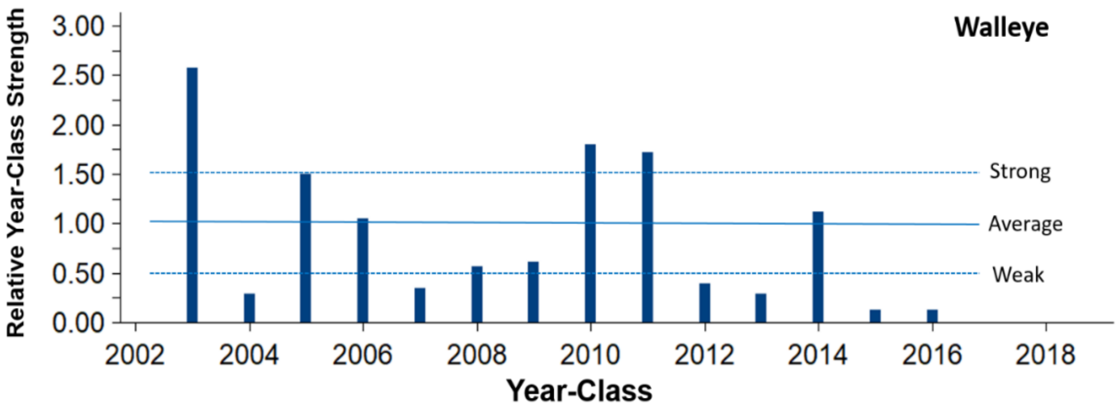

Figure 10. Recruitment index of relative year-class strength for walleye in Cedar Lake for 2003 to 2016, developed from commercial harvest age assessment for age classes 2 to 7, 2009 to 2019.

A strength of 1 indicates an average year-class with values of 1.5 as a strong year-class boundary and 0.5 as a weak year-class boundary. Strong year-classes of 2010 and 2011 maintained high commercial walleye production in the 2019-20 fishery. The 2015 and 2016 year-classes were as weak as have been seen in the past 14 years, although the 2014 year-class was slightly higher than average. Prepared from data in CLFMP, Figure 8 (Klein et al. 2020).

Because year-class strength is calculated from older individuals, it is not possible to use these data to evaluate recruitment since 2016. But in 2017 and 2018 in the Southeast Basin, there were above-average numbers (126 and 158, respectively; 11-yr mean 64.1 ± 36.6) of relatively small walleye (mean weights 7.7 and 21.0 g; 11-yr mean 72.0 ± 66.8 g) in the fine-mesh nets (Figure 7A). Given that these small walleye were probably young-of-the-year, recruitment strength may be increasing. The small-mesh index nets, if analysed for length of the catch, could provide a much more immediate assessment of recruitment rather than using the more delayed age year-class determinations of older individuals. This would be especially useful in tracking the status of the walleye population.

Primary annual assessment of the commercial fishery is conducted using coarse-mesh index gillnets in the Southeast Basin of Cedar Lake and involves 12 depth-stratified sets at fixed stations (Figure 9) and every third year the same effort in the Northwest Basin. Given the surface area of the Southeast Basin, 9,931 ha, this effort seems low. In other assessment programs such as the fall walleye index netting program (FWIN) routinely conducted in Ontario, it is recommended that water bodies in the range of 5,000 to 10,000 ha require 36 similar net sets (Appendix 8.1.4). It is apparent that when estimating abundance of walleye, the primary target species, with such species-independent catch data, the power of the existing index netting program is low. The CLFMP (Klein et al. 2020) acknowledges this, indicating that this effort averages about 50% of the effort required to detect a 20% decrease in the number of walleye caught in mesh sizes 76 mm and larger. To achieve a 70% power, the program would need to expand to 37 sets and for 80% would require 50 net sets. This amount of indexing effort was deemed to be impractical for the Cedar Lake assessment program, so data were amalgamated to provide some of the necessary biometrics (Klein et al. 2020).

Mortality rate was calculated by using running means for the most recent 3 years of effort: 2 years of 12 net sets and one year of 24, for a total of 48 sets. Given that the mean annual catch of walleye in the coarse-mesh index nets is 197.7 walleye (in 12 sets), this would give a large enough sample to provide a good estimate of mortality rate. This method sacrifices the precision of an annual estimate but provides appropriate amalgamations adequately supporting the harvest strategies and control rules.

The CLFMP uses a spawning potential ratio (SPR) analysis (Clark 1993, Slipke et al. 2002, Hordyk et al. 2015) to examine status of the walleye stock in Cedar Lake. It is simply a ratio of the average lifetime production of mature eggs per recruit in a fish population compared to what it would be if the population were not fished. Fishing mortality expressed as spawning potential ratio requires a reference point as an appropriate proxy for the fishing mortality that supports a maximum sustainable yield — F_{MSY}. In this case, the general level of $F_{35\%}$ is used (Clark 1993, 2002). The $F_{35\%}$ harvest strategy consists of fishing at a rate that reduces spawning biomass per recruit (equivalent to lifetime egg production) to 35% of the unfished value. The spawning potential ratio is an index to identify and prevent recruitment overfishing.

Examining the stock recruitment relationship for Cedar Lake walleye, the management plan provides the actual Ricker curve data and the 95% confidence interval (see Figure 4 in Klein et al. 2020). The data series available for stock recruitment analysis is short but indicates that the slope at low stock levels is 7.82 with confidence intervals of 7.10 at 70%, 6.69 at 80%, and 5.63 at 90%. For comparative purposes, the stock recruitment relationship was illustrated with the initial slope extrapolated drawn out for the existing stock data (Figure 11). It appears that the spawning stock biomass in 2008 was below the 95% CI for the point of recruitment impairment but not below the actual estimate (Klein et al. 2020). The previous year, 2007, the spawning stock was lower, even below the 80% lower limit. The most recent estimate of the spawning stock is 238,384 kg of mature walleye, well above the point where recruitment impairment would occur and well above the lower 95% CI. Therefore, it can be concluded from the stock recruitment assessment that it is highly likely the walleye spawning stock in Cedar Lake is above the point of recruitment impairment.

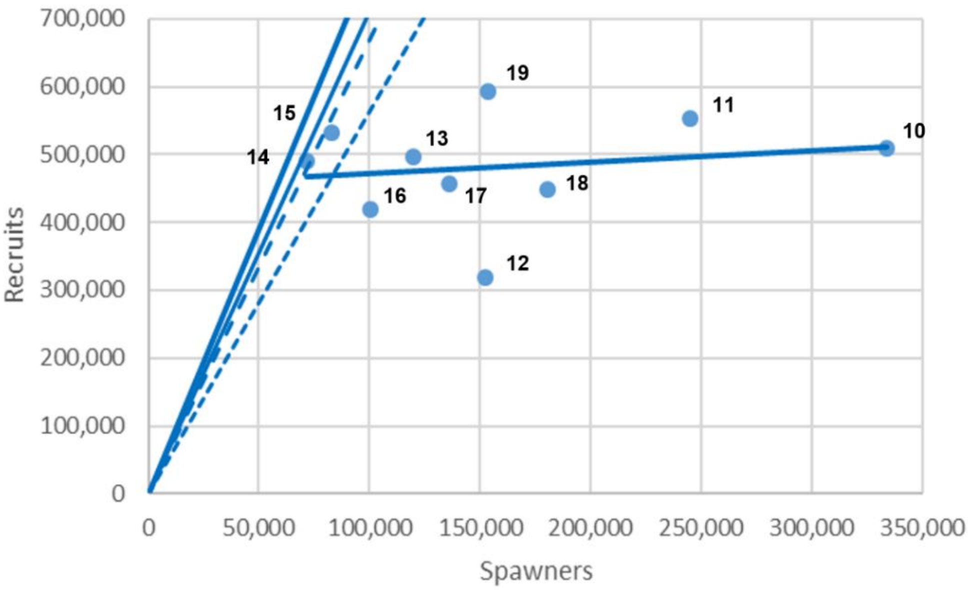

Figure 11. Stock-recruitment estimates for walleye from Cedar Lake, 2010 to 2019.

Initial slope estimate is in bold with lower bounds of the 70% confidence interval (thinner solid line, 80% confidence interval), long dashed line, and 95% interval (short dashed line). Reproduced from CLFMP, Figure 5 (Klein et al. 2020). The last two digits of year are indicated with data points.

For Cedar Lake walleye, the spawning potential ratio (SPR) $F_{35\%}$ (Clark 1993, 2002) was compared with the modelled maximum sustainable yield (see Figure 2 in Klein et al. 2020) (Figure 12 here). The modelling results are presented in relation to the fishing mortality rate target reference point (TRP) of $F_{35\%}$, along with the limit reference point (LRP) of $F_{20\%}$. Trends in the spawning potential ratio in relation to age are provided for SPR at maximum sustainable yield of 42%, along with the current SPR for the period 2015–2019, as well as the 80th and 95th percentiles. The maximum age of walleye in Cedar Lake, according to the index netting program, was 18, so the SPR was modelled out to that maximum age.

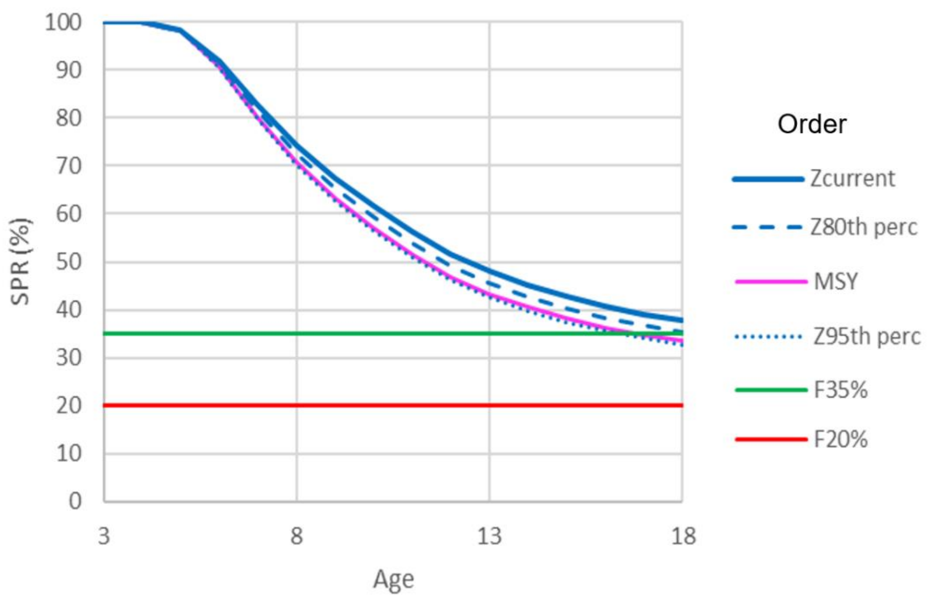

Figure 12. Spawning potential ratio (%) in relation to age for walleye from Cedar Lake.

Relationships are indicated in colour; relationships and legends are listed and depicted in the same order. The pink line (MSY) represents SPR at maximum sustainable yield of 42%. The red line represents the limit reference point (LRP) of $F_{20\%}$ and the green line, the target reference point (TRP) of $F_{35\%}$. The solid blue line is the current SPR for 2015 to 2019. The dashed line is the 80th percentile, and the dotted line is the 95th percentile of the current SPR. Reproduced from CLFMP, Figure 2 (Klein et al. 2020).

The most recent 5 years of index gillnetting, 2015–2019, were used to develop a catch curve that peaked at age 7 and to estimate total annual mortality. Two catch curve regressions were conducted: one for ages 7 to 11 for which there were extensive data and the unweighted coefficient of determination was very good, $R^2 = 0.99$, and also one for ages 2 to 16 where there were fewer old fish. The coefficient of determination was somewhat lower but still quite good, $R^2 = 0.95$. Weighted regressions were used to reduce the influence of small samples of the few older fish. Female weights were used in the SPR calculation, using data from all years separated into two growth phases to reflect pre- and post-maturity differences associated with weight at age.

The analysis conducted in the most recent CLFMP indicates that the current SPR is both above the $F_{35\%}$ target reference point and less than the MSY (Figure 12). The 80th percentile is also above the MSY, and the target reference point ($F_{35\%}$) confirms this with a high degree of certainty. The 95th percentile is slightly below MSY and falls below the target reference point at age 17, slightly younger than the maximum age of fish in the population. Considering the walleye stock status relative to recruitment impairment, the spawning potential ratio of $F_{35\%}$ of Clark (1993) compared well with the model MSY. SPR at MSY crosses the $F_{35\%}$ threshold at 17 years of age. It is highly likely that the walleye stock of Cedar Lake is above the point where recruitment impairment occurs.

As indicated, fishing mortality of walleye in Cedar Lake is the combination of three fisheries — commercial, recreational, and subsistence. The commercial fishery, the largest, accounts for approximately 80% of the annual fishing mortality and, through survey information, the recreational fishing harvest of 27 t of walleye would be 10.5% of the total annual mortality. Subsistence harvest calculated through various censuses and human consumption estimates for northern Manitoba (Klein et al. 2020) amount to 28 t and would represent 10.9% of the overall mortality (Klein et al. 2020). Total annual harvest of the three fisheries is estimated to be 257 t (G. Klein, pers. comm. May 2021). The average standing stock from 2009 to 2019 was calculated to be 643 t, whereas biomass over the most recent 5 years was 658 t. Current biomass relative to the biomass at MSY is 1.02 and $B:B_{limit} = 2.04$, where B_{limit} is set at $B_{20\%}$. This indicates that the walleye stock is at a level that would produce the maximum sustainable yield (Klein et al. 2020).

7.2.3 Harvest strategy, control rules, and reference points

The harvest strategy for walleye for Cedar Lake employs HCRs to ensure that walleye is not harvested at levels that would lead to a smaller stock than required to produce and sustain the MSY. The commercial fishery was closed in 1998 and reopened in 2002 under new structure to reduce over-capacity. This permitted the walleye stock to recover and be better maintained with appropriate management. The number of commercial licence holders was reduced by half to 41. A fixed quota of 10,000 kg was allocated to Mosakahiken fishers; this is not influenced by any changes in harvest strategy. As indicated, the commercial fishing season is specifically mandated. Cedar Lake is closed to fishing from May 1 to May 31 and is open in open water from June 1 to October 31 and during the ice-cover season from first ice in November to April 30. Commercial fishing is not allowed in open water after October 31; nets must be set through the ice. Commercial fishing is not allowed in Cross Bay, where the majority of the recreational fishery exists following Manitoba angling regulations, and as indicated, subsistence fishing occurs.

As previously described, commercial fishers may use gillnets of any depth, material, and hanging ratio, but the stretch mesh size must not be less than 108 mm (4¼ in). Yardage per licence is limited to 1,400 m, and harvest is monitored in DCRs and through deliveries to the FFMC. From a marketing and management perspective, there is essentially no unwanted catch in the Cedar Lake walleye fishery (Klein et al. 2020). Walleye are marketed as small in-the-round at a total length ranging from 27 to 41 cm; the minimum mesh size deployed is documented from index netting to have a zero catch of walleye below 35 cm. Of the walleye delivered in the 2019–2020 fishing season, only 1.9% of the catch was graded as small, <398 mm TL; this is a good approximation of the relative quantity of premature fish that are being caught in the fishery. Fishers receive less value (72.5%) for small grade than for medium grade. However, this value is relatively high, so discarding small walleye is not believed to occur in the commercial fishery (Klein et al. 2020). Discarding was not reported, but it appears quite unlikely even though no direct information is available. In discussions with commercial fishers, several species are referenced as possible discards, including suckers (mullets) and burbot in winter but nothing specific about walleye. Given the value of the species in the commercial fishery, discarding is quite unlikely.

Harvest of walleye in Cedar Lake is primarily associated with the commercial fishery, which is conducted in the Southeast Basin. However, there is a subsistence harvest that has been estimated. By virtue of its nature, it does not have an assigned quota. Similarly, there is a recreational fishery for walleye; it has been evaluated, and harvest levels are approximately the same as for the subsistence harvest. There are specific angling regulations, including a regulated season, a daily harvest limited to four, and a maximum size limit of 55 cm. However, the recreational fishery is almost exclusively associated with Cross Bay (see Figure 1), where commercial netting is not permitted (Klein et al. 2020).

The harvest strategy has very specific HCRs and reference points that were adopted in 2016 and implemented in 2017, and quotas are managed through them. Although the current HCRs were established recently, in 2016, they were developed from 11 years of assessment data back to 2009. They involve total annual mortality rate (A) and relative weight, which reflect changes in productivity, primarily induced by abundance and available forage base but would also be influenced by any factor that affects system productivity. The MSY for walleye is achieved at a total annual mortality rate of 42%. A total annual mortality rate 40% rule was chosen as a target reference point (the estimated A_{MSY}, Froese et al. 2020) because it is conservative and allows for potential error in estimating mortality (Klein et al. 2020). For instance, if natural mortality from long-term modelling increased from 21 to 23%, total annual mortality rate still would not exceed Z_{MSY}. As pointed out in the management plan, there may be some process uncertainty around the estimate, which is treated here as a fixed variable. Mortality rate was calculated by using combined data for the most recent 3 years, amalgamating data for 48 index net sets. The 21% estimate of natural mortality is the average of two meta-analyses that were conducted (Klein et al. 2020), one based on maximum observed age (Hoenig 1983) and one based on von Bertalanffy growth parameters (Pauly 1980). Total annual mortality of walleye for the 2019–2020 fishing year was calculated to be 38.6%. The 40% total annual mortality rate target reference point coincidentally represents the 80% confidence interval of the mortality estimate. The 95% confidence interval of the total mortality estimate was equal to the abundance maximum sustainable yield (A_{MSY}) (Klein et al. 2020). Therefore, there is a high degree of certainty that fishing rates are below F_{MSY}. The fishing mortality reference points are set at $F_{35\%}$ for TRP and $F_{20\%}$ for LRP.

The other walleye HCR reference point of growth impairment involves relative weight, which is a standardized measurement of the physical condition of the fish that permits broad comparisons across populations. Relative weight is a very powerful measure of well-being and the ability of a fish to respond to changing conditions if measured carefully and precisely and related to a standardized index and if determined by sampling at the same time each year. Relative weight (W_r) depends upon the size of the fish and requires a standard. In the case of Cedar Lake walleye, the standard used is the weight-length relationship provided by Murphy et al. (1991). It involves an equation that is modelled on the 75th percentile weight (g) and uses total length (mm). The walleye regression equation involving the percentile method is: $\log_{10} W_r = -5.453 + 3.180 \log_{10} TL$

For Cedar Lake, the performance indicator standard relationship was separated into two length classes, using categorization involving "stock" and "quality" total lengths, 25–38 cm and 38–51 cm, respectively Gabelhouse (1984). These relative length values have routinely been obtained for Cedar Lake walleye from the index netting program (Figure

13) providing 11 years of data (see Figure 7 in Klein et al. 2020). The mean value for stock size was 92 ± 2.9% and for quality size 94 ± 2.8% (determined from Figure 13). The coefficients of variation were low, 3.8 and 4.4%, respectively. Stock-size walleye in the 2019 index gillnetting program had the highest relative weights since 2009, 97% (SD, 7.0), and quality-size walleye had the highest relative value since 2010, 98% (SD, 6.8). Both size classes are showing very good condition, well above what is considered to be associated with impairment. As a point of reference, when relative weight of walleye in Lake Winnipeg fell below 80%, linear growth appeared to cease. This was chosen as the level for impairment (Figure 13). Quite generally, average relative weight of walleye in this ecoregion of Manitoba is about 85%.

It is known that commercial fisheries selectively harvest more active faster-growing fish (Galbraith Q&A March 2021). This standardized measure of condition is obtained for walleye captured quite consistently in late August and early September when gonadal development has not yet started so would not greatly influence the relationship. Weight would therefore be primarily associated with somatic condition; seasonality would greatly influence this relationship in mature walleye. So, standardizing the time of sampling, as is done in Cedar Lake, is especially important. The relative growth reference point would help address changes in productivity that would cause walleye growth and production to decrease, such as from dreissinid invasions. The relative weight reference point (percent removed) considering growth would be more robust if it took into consideration changes in the size of the walleye population, particularly to detect when condition was improving because the stock was decreasing. The annual CUE of the coarse-mesh gillnetting series would be useful to evaluate these changes in relative abundance. However, stock declines would be addressed through the total annual mortality rate target reference point of 40%. The fine-mesh gillnet index series, reported as bulk weight and numbers, gives some evidence that small walleye were appreciably more abundant in the Southeast Basin in 2017 and 2018. Although rather circumstantial, this might be expected to indicate increasing abundance and help in the interpretation of changes in relative weight. Relative weight indicates that walleye in Cedar Lake are in very good condition, that this condition has been improving and is now well above 95% at any level that indicates impairment (Figure 13).

Walleye HCRs that are currently in place for managing quota, or TAC, for the commercial fishery as provided in the current CLFMP (Klein et al. 2020) are as follows:

- The Annual Base Quota, or Recommended Allowable Harvest (RAH), for walleye is 211,000 kg:
- If total annual mortality is less than 40% and the base TAC is reached, TAC is increased by 10%·yr-1
- If relative weight is less than 80, TAC is increased by 10%·yr-1 until the relative weight is greater than 80.
- If total annual mortality is greater than 40%, TAC is reduced by 10%·yr-1 until AMSY is less than 40%.

The total mortality and relative weight reference points of growth impairment for indicators for 2019 were not at a level to trigger changes in the quota for 2020; however, as will be indicated subsequently, the quota was exceeded, triggering a 10% increase in quota for 2020.

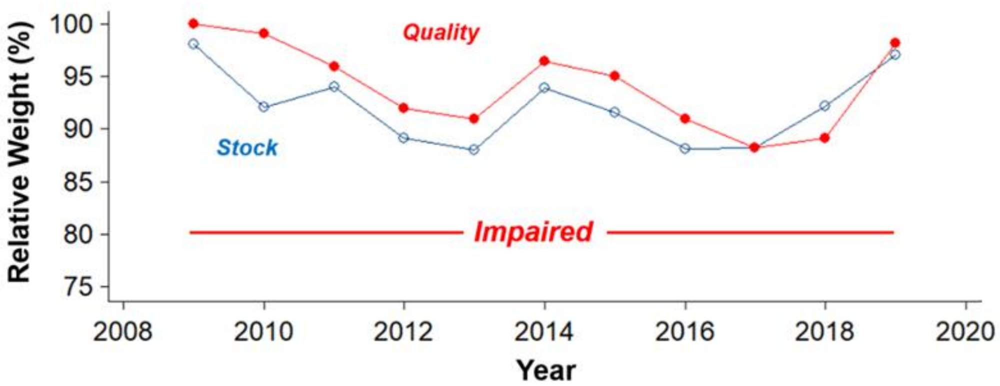

Figure 13. Relative weights of both stock (open blue circles) and quality (closed red circles) walleye from Cedar Lake southeastern basin index netting program by year from 2009 to 2019.

Average relative weight in the ecoregion is 85%. The level of impairment at 80% is associated with a cessation of growth seen in Lake Winnipeg walleye. Relative weight is compared with the weight standard provided by Murphy et al. (1991) categorized using size classes provided by Gabelhouse (1984). Walleye categorized as stock are fish ranging in total length from 25 to 38 cm and quality from 38 to 51 cm and prepared from data in CLFMP, Figure 7 (Klein et al. 2020).

7.2.4 Catch profiles

The commercial fishery produces the major catch of fish from Cedar Lake. It is estimated that approximately 80 to 82% of the annual fishing mortality is associated with this fishery (G. Klein, pers. comm. May 2021, Klein et al. 2020). The remaining catch and harvest is associated with the recreational and subsistence fisheries. The recreational fishery is conducted primarily in Cross Bay, which is excluded to commercial fishers. A number of well-known sport fishing outlets cater to sport fishing through location, accommodations, and services. Unfortunately, no creel or log data are available for these recreational fisheries and outlets. Recreational effort and catch are extracted from a recall survey that involves questionnaires sent to anglers who purchase licences; these surveys are conducted only once every 5 years in Manitoba. The most recent walleye responses, for the 2015–2016 angling year, were summarized and used to estimate that the annual harvest of walleye was 27 t (Klein et al. 2020). No other species information was reported in the CLFMP, so specific catch profiles are not available for the recreational fishery but it accounts for 10.5% of overall fishing mortality of walleye. It would be expected to be less for pike because they are less preferred as a food fish so would less likely be targeted unless it involved catch and release of trophy fish since angling regulations are that specimens over 750 mm TL must be released. Indeed, this area of Manitoba, including Cedar Lake, is known to have produced some of the largest Northern pike ever reported in North America. There is an important subsistence fishery. Specific catch data are not reported, but consumption estimates are calculated for walleye (Klein et al. 2020). However, it is known that a number of species are consumed. walleye consumption associated with the subsistence harvest is calculated to amount to 28 t annually. This suggests that consumption and catch of walleye are quite similar to the recreational harvest and account for 10.9% of the overall annual harvest.

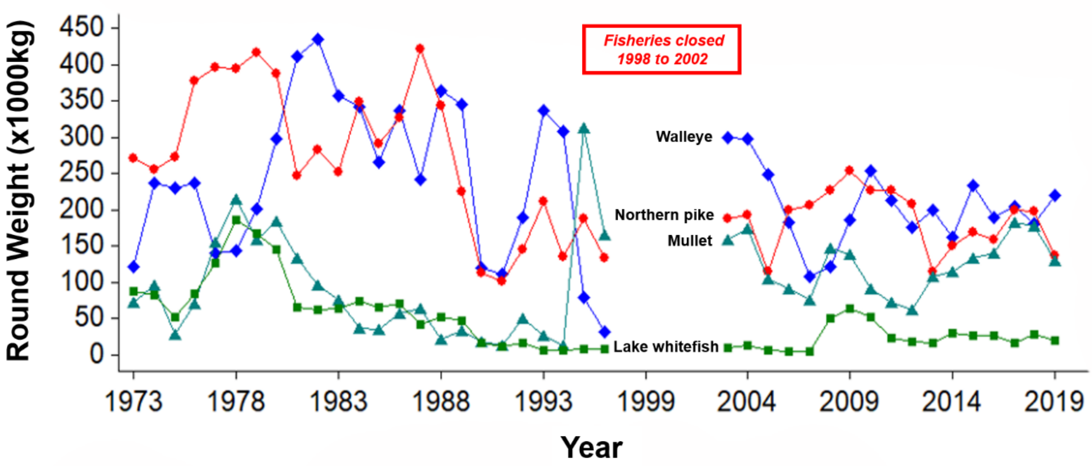

Figure 14. Cedar Lake commercial fish deliveries on a round-weight basis to the Freshwater Fish Marketing Corporation (FFMC) for the four most abundant species categories, including target species walleye and northern pike.

Illustrated for 1973 to 1997 and 2003 to 2019; the commercial fishery was closed from 1998 to 2002. Walleye closed blue diamonds, northern pike closed red circles, mullet (combined white and longnose suckers and shorthead redhorse) closed turquoise triangles, and lake whitefish closed green squares. Prepared from data provided by G. Klein, January 2021, used to prepare Figure 4 in Klein et al. (2020).

There are good long-term catch statistics for the commercial harvest. The primary commercial species are walleye, northern pike, mullet (three catostomids), and lake whitefish. Since the fishery was reopened in 2003, these fish have, on average, made up 99.7% of the overall harvest. Highly valued walleye are usually the prime target species in the commercial fisheries, with northern pike as an incidental catch that may be targeted from time to time, and mullet are essentially a by-catch of much lower value.

If delivered with head and viscera removed (headed and gutted), walleye are four to five more times valuable than northern pike and 17 times more valuable than mullet (see Table 2, Klein et al. 2020). Indeed, fishers say mullets are marketed because they “pay for the gas for the day of fishing.” Lake whitefish (a quota species) are highly valued but approximately two to three times less than walleye, however approximately 1.6 times more valuable than northern pike, and are an important part of the catch at certain times of the year and may be targeted spawning in late October. Sales of lake whitefish and cisco roe can occur from mid-September to the end of October. There is some recent evidence that Cisco have become an important commercial catch. The reasons for this are not fully understood. Catch of these primary commercial species has varied somewhat over time (Figure 14) - summarized from the harvest data reported in **Error! Reference source not found.**. Over the 17-yr period since the fishery was reopened in 2003, walleye have represented 38.1 ± 4.1% (CV, 25.4%) of the catch; northern pike 34.2 ± 4.2% (CV, 24.9%); mullet 22.8 ± 2.7% (CV, 30.8%), and lake whitefish 4.5 ± 1.4% (CV, 69.6%). During this period, overall annual harvest reported for seven species plus the three catostomids referred to as Mullet has averaged 535 ± 4.4 t (CV, 15.8%) (**Error! Reference source not found.**).

7.2.5 Total allowable catch (TAC) and catch data

Prior to the 1998–2001 closure, walleye TAC, also referred to here as quota, was unsustainably high, varying from 330 to 350 t. When the fishery was reopened in 2003, the quota was set at 300 t up to and including 2016. The new quota was caught in each of the first 2 years following the reopening (Figure 14). The standing stock of walleye that had built up during the closure was quickly fished down. In the past decade, the commercial fishery has stabilized at average walleye production of around 201.9 ± 18.9 t (CV, 13.1%). This harvest is slightly less than, but not far off, the expected MSY of 211 t modelled for walleye by Baccante and Colby (1996).

Current HCRs and reference points were adopted in 2016. That year the actual harvest was 188.7 t, well below the 300 t quota. Commencing in 2017, the recommended annual harvest was changed in response to the HCRs. Following additional modelling and discussion with the fishers in 2017, it was agreed to reduce the walleye TAC from 300 t to the 211 t base TAC (Baccante and Colby 1996) but subject to change, depending upon the HCRs (Table 11). This new recommended annual harvest was in place for 3 years. Even though the 2019 commercial fishing season was somewhat shorter, the recommended annual harvest of 211 t was reached (219.2) and exceeded it by 8.2 t (3.9%), so according to the HCRs, the TAC for 2020 was increased by 10% to 232 t (Klein et al. 2020) (Table 11, Figure 15 here). Included in this is a fixed allocation of 10.0 t to fishers of the Mosakahiken Cree Nation.

Total annual harvest by the three fisheries (commercial, subsistence, and recreational) is estimated to be 257 t (G. Klein, pers. comm. May 2021). Early in 2020, a worldwide viral pandemic developed. The fishery response to this COVID-19 pandemic is still underway (Galbraith Q&A March 2021). The 2020 commercial fishing terminated in March, shortened by approximately 6 weeks, and the fishing season was essentially closed then, because the pandemic had universally affected fish marketing and fisheries. No commercial fishing occurred in the 2020–2021 fishing year until September (Galbraith Q&A March 2021). Commercial fishing and associated management have been greatly affected by the pandemic.

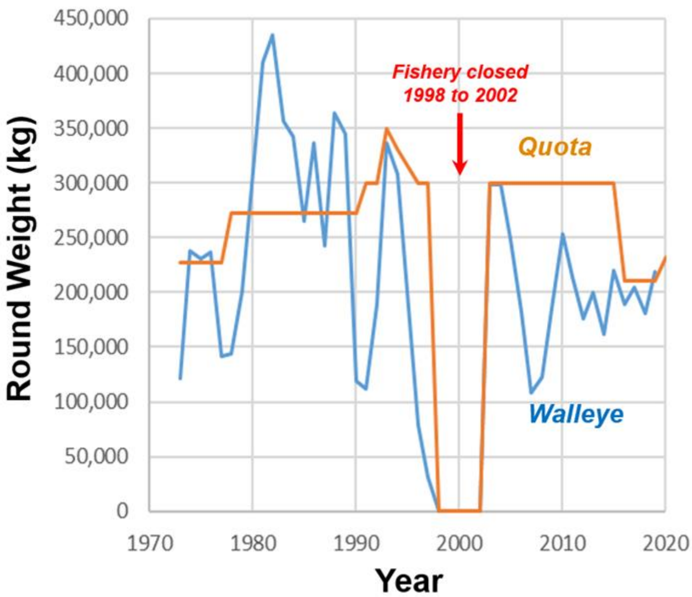

Figure 15. Commercial walleye harvest deliveries to the Freshwater Fisheries Marketing Corporation compared with quota or total allowable catch (TAC) before and after the commercial fishery closure from 1998 to 2002.

Current harvest control rules were adopted in 2016. Reproduced from CLFMP, Figure 9 (Klein et al. 2020). The TAC was actually decreased in 2017 from 300,000 kg in 2016 to 211,000 kg as indicated in the CLFMP 2020, page 13 (Klein et al. 2020), with the following statement: “In 2017, the Napanee Bay fishers agreed to a reduction in the walleye total allowable catch from 300 tonnes to a 211 tonne base quota …”

Table 11. Cedar Lake walleye Total Allowable Catch (TAC) and commercial harvest (kg) 2009–2020, including relative change in harvest and harvest in relation to TAC.

Harvest data from Freshwater Fish Marketing Corporation deliveries. Data from Table 4 of the 2020 Cedar Lake Commercial Fishery Management Plan (Klein et al. 2020). Year is fishing year, which starts on June 1 and ends the following year on April 30. a The 2020 commercial fishing terminated in March, shortened by approximately 6 weeks, and the fishing season was essentially closed then, not for administrative reasons but because buyers were not accepting fish because of a worldwide pandemic that universally affected fish marketing and fisheries (Galbraith Q&A March 2021). b The COVID-19 pandemic will affect fishing effort and harvest.

Year	Total Allowable Catch (TAC) (kg)	Change in TAC (%)	Harvest: Actual (kg)	Harvest: Change in harvest (%)	Harvest: Relative to TAC (%)
2009	300,000		185,650	+51.7	-38.1
2010	300,000		253,530	+36.6	-15.5
2011	300,000		213,640	-15.7	-28.8
2012	300,000		176,462	-17.4	-41.2
2013	300,000		199,783	+13.2	-33.4
2014	300,000		162,086	-18.9	-46.0
2015	300,000		220,026	+35.7	-26.7
2016	300,000		188,705	-18.9	-37.1
2017	211,000	-30	205,021	+8.6	-2.8
2018	211,000	0	180,515	-12.0	-14.4
2019[a]	211,000	0	219,257	+21.5	+3.9
2020[b]	232,000	+10			
2009–2019, N = 11					
Mean			200,425	7.7	-25.5
± 95% CI			17,195	17.5	10.9
CV			12.8		
2016–2019, n = 4					
Mean			198,375	0.2	-12.6
± 95% CI			27,450	29.6	28.6
CV			8.7		

For the 11-year period from 2009 to 2019, when the assessment program was conducted on Cedar Lake, the average annual commercial harvest of walleye was 200.4 ± 17.2 t (CV, 12.8%) (Table 11); this represented 38.1 ± 3.9% of the overall annual harvest (Table 12). The change in annual harvest over this time was 7.7% and the harvest averaged 25.5 ± 10.9% lower than the TAC; only one year, 2019, exceeded it. This created a change through the HCRs, which resulted in the TAC in 2021 increasing to 232,000 kg (Table 12). The harvest has been appreciably lower than the TAC over the past 11 years.

Modelling indicates that over the past 11 years, the standing stock of walleye was estimated to be 643 t and, over the past 5 years, slightly higher, 658 t (Klein et al. 2020). Comparing the standing stock of walleye for the most recent 5-year period with the 4 years that the most recent HCRs have been applied, the average annual commercial harvest of walleye was 198.4 ± 27.5 t (CV, 8.7%) (Table 12), 30.2% of the standing stock. However, the commercial harvest of walleye is estimated to be approximately 80% (78.6%) of the overall harvest, which has also been estimated to be 27 t (10.5%) for the recreational harvest and 28 t (10.9%) for the subsistence harvest. If these are added to the commercial harvest for the most recent 4-year period, the resulting total estimate of 253.4 t is 38.5% of the standing stock.

7.2.6 Northern Pike

Northern pike is an important keystone piscivore in north temperate fish communities and has global distribution. The species is found primarily in fresh water in a circumpolar band at 35 to 75 °N latitude (Crossman and Casselman 1987). The species has commercial, recreational, and subsistence value. Northern pike were once very abundant in the eutrophic lower Great Lakes; commercial harvest of the species reached a high of 1,600 t just after the turn of the last century. Northern pike were most abundant in Lakes Erie and Ontario, but abundance declined greatly with the draining and degrading of wetlands and marshes that resulted from industrial development. In the 1980s, total commercial harvest in North America was approximately 3,200 t. Commercial fisheries are generally restricted to the northern portions of the range, whereas in the southern portion, they provide important recreational fisheries. The northern pike is sometimes referred to as “Great Northern Pike” and in some places in North America is also referred to as “Pickerel” or “Northern Pickerel”. This seems at odds with the local name pickerel, sometimes assigned to walleye. The name pickerel is properly restricted to two small members of the pike or esocid family. Well-known common names include jack, jackfish or, in the case of anglers if the fish caught are disappointingly small, they may be referred to as “hammer handles”. Here, northern pike will sometimes be referred to simply as pike.

In general, native distribution of pike in North America extends from Alaska to Missouri and Nebraska, east of the Rocky Mountains and west of the Appalachian Mountains (Scott and Crossman 1973b). pike have been introduced widely, both officially and unofficially and even illegally. They have also invaded extensively in various southern parts of the range. There is some evidence that their distribution is expanding northward with climate change (e.g., Yukon, Northwest Territories, and Nunavut). Manitoba, by virtue of its location, is more or less at the geographic centre of the North American distribution and, by its topography, is ideally suited to the species and may be the centre of abundance in North America. The terrain is flat, is part of the ancient glacial Lake Agassiz Basin (Ecoinformatics International 2007), and contains numerous relatively shallow mesotrophic lakes, which are prone to spring flooding, producing ideal wetlands for pike spawning and nursery habitat (Casselman and Lewis 1996). Flooded shallow areas are important in producing strong year-classes because they warm up more quickly than the adjacent lake, so juvenile pike grow rapidly at optimum temperatures (22–24 °C) in these eutrophic plankton-rich backwaters (Casselman and Lewis 1996). This is borne out by the fact that not only are pike abundant in Manitoba but they are an important commercial species. Landing statistics reported in 2017 for the period 2009 to 2015 indicated that 1,673 t of pike was harvested annually in Manitoba, accounting for 14.7% of the overall commercial fish harvest for the province (MSD 2017). Also, Manitoba accounts for over half (56%) of the commercial freshwater fish production in Canada.

7.2.7 Biology

Pike are large-bodied piscivores that tolerate a wide range of environmental conditions (Casselman 1978). However, they are primarily a cool-water fish with an optimum temperature for growth of approximately 20 °C (Casselman 1978). Pike are also found in warm- and cold-water fish communities. Spawning and nursery conditions and habitats are the factors that most often exclude pike or limit their abundance. Shallow vegetated areas and flooded wetlands provide the most suitable of these types of habitats, and year-class strength is correlated with water levels (Casselman and Lewis 1996), pike do not do well when water level fluctuates widely during the spring spawning season (commencing when water-body temperatures have warmed to 8 to12 °C) or during drought conditions (Casselman 1996). Optimum temperature for growth of young-of-the-year pike is in the range of 22 to 24 °C. Abundance of young-of-the-year and older life stages is positively correlated with depth (Inskip 1982, Casselman 1996); they are usually found in <10 m of water. In gillnetting surveys of Great Slave Lake, 90% of the pike were caught in <10 m of water within 400 m of shore (Rawson 1951). In oligotrophic lakes, pike are typically confined to the shoreline. Habitat preference changes with life stage (Inskip 1982), but vegetative cover is of primary importance (Bry 1996).

The pike is a common and abundant keystone predator found in 45% of the total freshwater area of North America (Casselman and Lewis 1996). It is a rather sedentary species that shows evidence of territoriality. Numerous field studies have confirmed that home ranges are usually limited (Raat 1988), and if adequate vegetation and cover is present, the summer area might be as little as 100 to 1,400 m^2 (Malinin 1972). Movement is most extensive in spring and fall, the former related to spawning and the latter to improving foraging opportunities supporting gonadal development, often involving large females. pike are tolerant of a broad range of temperatures and oxygen concentrations and move locally and within the water column to respond to changes in these environmental factors. In summer, adults may move deeper to cooler and more optimal temperature conditions (approximately 20 °C or lower) and, if prey is scarce, may move to cooler temperatures, where metabolic rate would be lower. Winter activity patterns associated with oxygen reductions affect distribution (Casselman and Harvey 1975). In winter, pike approach the ice-water interface as oxygen is depleted in deeper waters. They stop feeding and cease moving when oxygen levels fall below 2 $mg \cdot L^{-1}$ (Casselman 1978). Swimming is maximal at the optimum temperature of approximately 20 °C and decreases below 6 °C.

If spawning habitat is abundant, spawning migrations are not extensive, usually only several kilometres from summer habitat. There is some evidence that after spawning, pike consistently return to the same area of summer habitat. Spawning occurs in spring, usually just after ice-out, but with climate change, there is evidence that it is occurring appreciably earlier at the Southern part of the range, from 4 to 6 weeks earlier in the past 4 decades in Southern Ontario (Casselman, unpubl. data). Fall movements are less well understood, usually involving feeding forays associated with gonadal development in large mature females. Seasonal activity patterns indicate that faster-growing mature females are more vulnerable to capture by static gear and angling in midsummer and late winter (Casselman 1975). This can result in selective harvest of mature females at a time when gonadal development is greatest. This selective mortality must be taken into consideration when managing sustainable fisheries. Winter fisheries, both commercial and recreational but particularly the former, involving winter gillnetting would, by virtue of time of year, harvest disproportionately more maturing female fish.

Stock structure is well documented for some pike populations; one of the best general summaries is found in Raat (1988). Raat's review includes populations over a broad geographic range exposed to different levels of exploitation and encompassing various time periods. For 56 populations, mean pike density was 39 fish/ha, biomass was 32.2 kg/ha, and mean individual weight was 826 g. However, for comparison of pike populations in central Canada, the most up-to-date and thorough data can be found in Malette and Morgan (2005) for pike from 412 Ontario lakes sampled by FWIN from 1993 to 2002. The indexing program was conducted to evaluate walleye populations, but pike were frequently captured, providing an extensive pike dataset. Mean annual mortality (A) for males was higher, 49.6% (P_{25} – 41.9 and P_{75} – 57.9), than for females, 35.5% (P_{25} – 27.5 and P_{75} – 44.1), indicating that for these populations, females were, on average, considerably older and longer-lived. Indeed, mean age of the oldest age group that had four or more individuals was 3.9 years (P_{25} – 3 and P_{75} – 5) for males compared with 4.6 (P_{25} – 3 and P_{75} – 6) for females. pike can live up to 30 years of age in unexploited lakes in northern Saskatchewan (Casselman, unpubl. data) but in most exploited populations are considerably younger, usually not greater than 8 to 10 years of age, and in heavily exploited populations can be as little as 2 to 3 years old. In Cedar Lake, maximum age of pike taken in the index gillnetting program has varied over the years, from 11 to 14 years. Modelling was conducted up to 13 years of age, which was the maximum age of female pike caught in the indexing program between 2009 and 2019.

Seasonal sampling and associated activity patterns can greatly affect the interpretation of stock structure and status, particularly when using passive index methods such as gillnetting. Since seasonal activity patterns vary with sex (Casselman 1975) and pike show strong sexually dimorphic growth and differential survival, it is particularly important to take sex into consideration when sampling and assessing stock structure and status.

Limnological characteristics of typical pike lakes are described in a review of the extensive Ontario lake inventory survey (Johnson et al. 1977). Nearly 70% of the lakes that contained pike had either only pike or pike and walleye. pike lakes typically had a mean depth of 2 to 6 m, littoral zones (<6.1 m) that were 60 to 80% of the total surface area, secchi disc transparency of 2 to 4 m, total dissolved solid levels between 50 and 128 $mg \cdot L^{-1}$ and were nearly neutral or slightly acidic.

The Ontario FWIN program, 1993–2002, sampling more than 400 lakes that contained pike, provided a good overview of what constitutes a "typical" northern pike lake and its habitat (Malette and Morgan 2005). Water-body means and percentiles were: surface area 2,939 ha (P_{25} – 202 and P_{75} – 1,820); mean depth 6.9 m (P_{25} – 3.6 and P_{75} – 8.5); littoral zone 63% (P_{25} – 44 and P_{75} – 84); maximum depth 25.1 m (P_{25} – 11.6 and P_{75} – 32.0); secchi depth 3.2 m (P_{25} – 2.3 and P_{75} – 4.0); and growing degree days >5 °C were 1,519 (P_{25} – 1,376 and P_{75} – 1,686).

Cedar Lake is a reservoir that provides good pike habitat. The Southeast Basin has a mean depth of approximately 7.6 m and a maximum depth of 16.6 m. The shallower Northwest Basin is usually less than 4 m deep, depending on drawdown, and annual fluctuations can be up to 3 m. Depth, particularly of the Southeast Basin, fits well in a typical pike lake and its habitat, which in the FWIN survey in Ontario, showed that for the 400 lakes that contained pike, mean depth was 6.9 m, very similar to the large Southeast Basin. However, Cedar Lake appears to be somewhat more turbid than might be ideal for pike. Mean secchi depth for the set of Ontario pike lakes was 3.2 m, whereas in Cedar Lake, the Southeast Basin has a mean summer secchi depth of 1.81 m, approximate range 1 to 3.5 m, and the Northwest Basin is much lower, at only 0.53 m. Fine-mesh index netting indicated that pike probably were equally abundant in both basins. These turbidity values may not hinder visual predation and growth of pike. Pike could compensate by feeding at higher light intensities during daytime. Indeed, in other water bodies that are clearer, pike feed four times more actively on cloudy than on bright, sunny days, and their activity is much more crepuscular (Casselman 1978). Cedar Lake is polymictic; in midsummer, temperature is near the optimum for juvenile pike but, with global warming, could start to exceed this. Pike have a slightly lower optimum temperature for growth than do walleye (Casselman 1978, Christie and Regier 1988). The amount of submerged vegetation is not reported for Cedar Lake, but it is ideal cover for pike. Its extent is not reported for Cedar Lake; however, the increased turbidity may make this less important. Trees that were not removed prior to impoundment would provide added cover and habitat for pike in an area that, because of woody debris, would not be suitable for gillnetting, providing the pike with increased protection.

A summary of depth-stratified multi-mesh gillnetting in northwestern Ontario lakes (Laine 1989) provided empirical evidence that pike were more abundant in shallow waters regardless of trophic status of the water body; 60% of the pike caught were shallower than 6.5 m, 33% from 6.5 to 13.0 m, and only 7% deeper. More productive ecosystems produced greater catches; 68% of the catch came from mesotrophic lakes, which had the highest average pike densities of 7.76/ha, 24% from mesotrophic lakes with a density of 2.80/ha, and 8% from oligotrophic lakes with a density of 0.69/ha.

Adult abundance and distribution are related to the extent of macrophyte cover, which is optimal from 35 to 80%, and association is inversely related to body size (Casselman and Lewis 1996). Summer habitat can be limited if surface temperatures greatly exceed the optimum (20 °C) or oxygen concentration falls below 1.5 $mg{\cdot}L^{-1}$ (Casselman 1978). Temperature is a major controlling factor affecting growth, which rises rapidly above 10 °C, is maximal between 19 and 21 °C, and declines abruptly at higher temperatures. The upper lethal temperature is 29.4 °C, and in winter, pike can tolerate temperatures as low as 0.1 °C (Casselman 1978). If oxygen is depressed in midsummer in shallow backwater areas of heavily respiring vegetation (on cloudy, calm days), summer kills can occur, but winterkills related to late-winter oxygen depletion are more common and are exacerbated by long, cold winters with thick ice and heavy snow cover and are more prevalent in shallow lakes (Casselman 1978, 1996). Winterkills are accentuated by low water and winters that lack a mid-winter thaw. The species is remarkably tolerant, however, surviving in oxygen concentrations as low as 0.04 $mg{\cdot}L^{-1}$ (0.3% air saturation) and caught alive at these levels. Pike begin to seek higher oxygen levels when the concentration falls below 4 $mg{\cdot}L^{-1}$, and they cease feeding below 2 $mg{\cdot}L^{-1}$. Critical oxygen concentrations depend on temperature; the upper range of the lower incipient lethal oxygen concentration varies between 0.5 and 2.0 $mg{\cdot}L^{-1}$.

Winterkills can greatly affect standing stock and can be quite selective. Partial winterkills and low winter oxygen can have a profound effect on structure of the population, selecting against fish that are faster growing, old, large, and female, leaving populations with individuals that are significantly smaller, younger, slower growing, and male (Casselman and Harvey 1975). Winterkills have been known to occur in Manitoba pike populations. Lysack (2004) reported that dead pike were found in December 2001 in the Rocky Lake-Reader-Root Marsh complex, and winterkill was implicated, associated with lower than normal water levels and large quantities of decaying vegetation. Also, commercial fishers of Waterhen Lake, in Manitoba, reported that a winterkill occurred in the late 1970s (Intertek, 2014). Winterkills were very prevalent in shallow water bodies of central North America during the winters of 1976–1977 and 1977–1978. This coincides with fishers' observations and underlines the importance of local observations in understanding and explaining fish distribution and dynamics.

Temperature is an important controlling factor influencing fish growth and production. Freshwater fish can be divided into three general thermal guilds, depending upon temperature preference and optimum temperature for growth. The three thermal guilds are: warm-water fish, which have very high temperature preferences and optima (greater than approximately 25 °C), cool-water fish, which do best at intermediate temperatures (approximately 15–25 °C), and cold-water fish at the lowest temperatures (less than approximately 15 °C). Both pike and walleye would be classified as cool-water fish. Midsummer thermal habitat in Cedar Lake is probably ideal for pike and would be more optimal for pike than for walleye, particularly in years when temperatures do not exceed 20 to 21 °C. However, if temperatures increase substantially, pike growth, recruitment, and production would be reduced, particularly if midsummer temperatures significantly exceeded the optimum and if water levels decreased because of drought; these could also exacerbate winter oxygen depletion, which could become an important concern.

Pike growth has two major components, somatic and reproductive. Optimum temperature for somatic growth has been thoroughly studied; it is greatest at 19 °C for weight and 21 °C for length (Casselman 1978). Indeed, swimming activity is correlated, peaking at 20 °C (Casselman 1978, 1996). If summer conditions are optimal, pike can reach a large ultimate size. Pike populations in Ontario, as documented from the FWIN series, 1993–2002, provide good specific insights into size and growth (Malette and Morgan 2005). Females are faster growing and live to a larger ultimate total length: mean L_∞ for females was 1,052 mm (P_{25} – 957 and P_{75} – 1,140) and for males 854 (P_{25} – 803 and P_{75} – 95); K for females was 0.171 (P_{25} – 0.147 and P_{75} – 0.193) and for males 0.200 (P_{25} – 0.177 and P_{75} – 0.220), with a mean ω value for females of 18.0 and males 17.1. pike show sexually dimorphic growth, with females growing faster and larger than males.

Fork length at age and growth of Cedar Lake pike have been summarized in the CAMP reports. Results for pike captured in the standard index gillnetting program of 2009 and 2010 were fitted with a von Bertalanffy growth model, using 65 fish in CAMPP (2014 – Figure 5.2.7-27) (Figure 16A here). Fork length at age is provided from the equation in Appendix 8.1.2 L∞ for fork length is 790.8 mm, and the growth coefficient K is 0.22. Total length for L∞, using the conversion relationship of TL = 4.42 + 1.048 FL (Casselman 1996), produces a value of 833.2. This value is somewhat less than the mean L∞ of 953.0, combined by sex, reported by Malette and Morgan (2005) for 400 Ontario lakes. The Cedar Lake length data were not separated by sex and are equally weighted by sex. A larger dataset of 178 pike from Cedar Lake that summarized sampling from 2009 to 2013 is provided graphically in CAMP (2017 – Figure 6-25) (Figure 16B here). Mean fork length at age extracted from the graph was analysed for two sets of age groups: 1 to 7 and 1 to 9. Von Bertalanffy equations gave slightly different results (Figure 16B), and fork lengths at age estimated from these equations were somewhat different (Appendix 8.1.2). The shorter series was averaged with the 2009–2010 lengths to produce a mean, which was also fitted. The shorter series gave a lower L∞ of 533.6, with the mean intermediate at 657.1. The longer series, because of increased sizes at age for the older fish, gave a higher L∞ of 1,048.3. The mean fork length L∞ of 657.1 and 1,048.3, when converted to total length, gave L∞ of 693.1 and 1,136.6. Considering the various L∞ that were calculated, the mean is approximately 807 mm TL for sexes combined. Compared with Ontario pike lakes, this L∞ is possibly 15.3% lower, suggesting a somewhat slower average growth. However, it is obvious that some individuals in Cedar Lake can reach a very large size, well over 1 m in length.

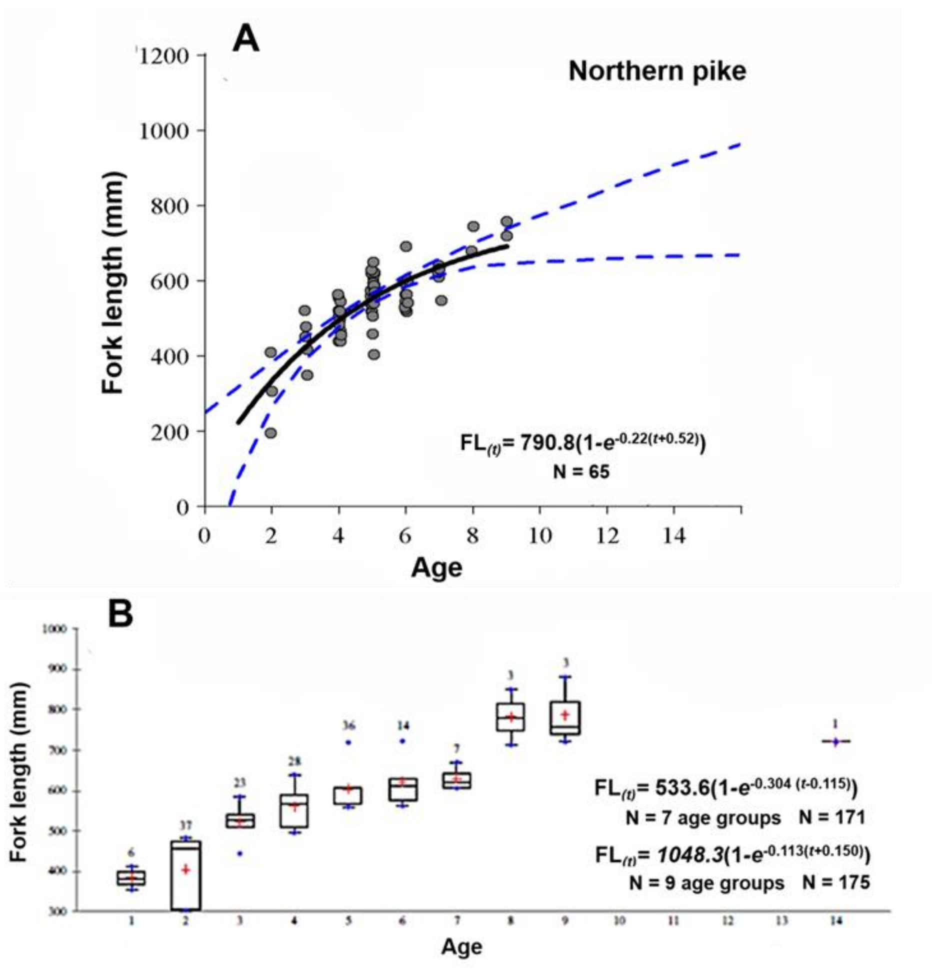

Figure 16. Northern pike fork length at age and von Bertalanffy growth model fits and equations.

A) Pike captured in standard index gillnets from Cedar Lake 2009–2010, N = 65. Estimated von Bertalanffy growth model equation and parameters are provided. Reproduced from CAMPP (2014 –Figure 5.2.7-27). B) Pike captured in standard index gillnets from Cedar Lake 2009–2013, N = 178. Graph reproduced from CAMP (2017 – Figure 6-25). Number of fish used for each age indicated above each age boxplot. Estimated von Bertalanffy growth model equation and parameters calculated here are provided for seven age groups, ages 1–7, N = 171. Also estimated von Bertalanffy growth model equation and parameters calculated here are provided for 9 age groups, ages 1–9, N = 177. Von Bertalanffy fit was calculated using estimated mean values. See Appendix 8.1.2 for von Bertalanffy estimates of fork length at age and associated parameters.

Pike can best be classified simply as omnivorous carnivores and will feed on carrion and dead fish, although live prey Mean von Bertalanffy fork length at age for Cedar Lake pike was compared with the fork length at age growth standard for 82 circumpolar pike water bodies (see Table 4.1 in Casselman 1996). These datasets represent fish caught in the growing season, as was the case with Cedar Lake, and were independent of sex. Across seven age groups (1–7), fork length at age of Cedar Lake pike was on average only 88.8 ± 3.3% of the growth standard, again suggesting that pike in Cedar Lake are somewhat slower growing than other studied pike populations, and this appears to be the case throughout the entire age of the fish. Using results calculated for Waterhen Lake, pike were growing slightly, but not significantly, faster than the growth standard (102.5 ± 2.7%), and pike from 400 lakes sampled in Ontario from 1993 to 2003, corrected for calendar age, showed more variable growth, somewhat similar to Waterhen Lake (103.3 ± 14.8%) (Casselman et al. 2014). Growth rate of pike from Rocky Lake-Root-Reader Marsh, Manitoba, in 1999 (Lysack 2004), using age determined from anal fin sections, was slightly faster than that of Waterhen Lake pike in 2011 (Pellissier 2012). Lysack (2004) reported that a 2003 sample of pike reached a maximum size of approximately 800 mm FL in 13 years. Age composition changed seasonally, with a modal age of 4 to 5 at spawning time and 1 to 2 at other times of year.

Age determination of pike can be difficult and even problematic. Scales generally do not provide a reliable age in older fish. Cleithra have been shown not only to provide validated and accurate ages but to be easily and precisely measured to estimate back-calculated length at age (Casselman 1996). Fortunately, the Cedar Lake assessment program for pike uses this more accurate calcified-structure age-determination method. Accurate age determination is critically important in providing data for assessing exploitation and sustainability of fish populations. Five of the seven major parameters used to examine overexploitation involve age: age structure, mortality rate estimates, variations in year-class strength, growth rate, and age at first maturity.

is preferred. Optimum food size has been calculated to be between one-third and one-half the length of the pike. pike are also competitors of walleye, competing for important prey such as yellow perch, although they coexist productively in most lakes, with pike consuming larger prey fish. Pike are much more piscivorous than walleye and have few predators. There is some evidence that cormorants can be significant predators of small pike (Casselman, unpubl. data). Pike are essentially crepuscular ambush predators that rely on camouflage and cover (Casselman 1996) but can switch very adaptively to invertebrate feeding (Lysack 2004). They are important in stabilizing community structure and can be strongly cannibalistic. Top-down control has a well-documented and important effect on community structure (Casselman 1996).

Pike are strongly piscivorous, and availability of prey fish is particularly important. Lysack (2004) showed that pike >400 mm FL (424 mm TL) in Manitoba pike populations were primarily piscivorous, eating suckers, small pike, yellow perch, and other prey fish. Although smaller pike also ate some fish, they were primarily insectivorous. Cannibalism in pike can be prevalent. In a controlled laboratory rearing study, Beyerle and Williams (1968) documented that pike specifically selected soft-rayed species over spiny-rayed ones. Pike can also be significant predators on all sizes of walleye (Park 2010). Observational evidence suggests that large pike prefer large prey fish, and soft-rayed species such as redhorse and white suckers are heavily consumed (Casselman, unpubl. data).

Large pike are important predators, stabilizing the fish community, removing the largest prey fish and appropriately decreasing their overall abundance. Selective removal of large pike by either recreational or commercial (size-selective gillnet) fisheries can destabilize the fish community and, in the extreme, produce an undesirable abundance of small “hammer handle” pike. Lysack (2004) considered that the proportion of pike >600 mm FL (633 mm TL) was a good measure of this effect. If large pike are present, cannibalism can be a mechanism for natural population control (Mann 1996). So, an estimate of the proportion of the population that is >600 mm is a good measure of whether this stabilizing effect would be realized. Selective harvest of large pike by either anglers or coarse-mesh commercial gillnets can greatly affect size distribution of the population. This is somewhat ameliorated by sports regulations that mandate that all pike over 75 cm TL must be released. Commercial gillnets fished in Cedar Lake would catch these larger pike because in Waterhen Lake, total length of a large sample of pike caught in various mesh sizes of North American standard graded-mesh gillnets indicates that only eight pike were caught in mesh sizes of 108-mm stretch mesh and larger but all were larger than 600 mm TL (Klein and Galbraith 2019).

Large pike not only reduce prey fish abundance but at high population density can be strongly cannibalistic (Casselman et al. 2014), reducing the number of small pike, which, if abundant, are prone to stunting. This results in greater prey abundance for walleye (Lysack 2013). An index of relative abundance of pike >600 mm FL (633 mm TL) provides a measure of the stabilizing effect the pike population can provide through top predator-prey interaction. Frequency distributions of the size of Cedar Lake pike summarized in CAMP (2014 – Figure 5.2.7-23) indicates from the coarse-mesh index netting of 34 pike in 2009 that approximately 17.2% were >600 mm, and in 2010, in a sample of 31 pike, the frequency was 32%. Considering both years, mean frequency of occurrence of these large piscivorous pike was approximately 25%, indicating that at that time, large pike in Cedar Lake are probably abundant enough to stabilize the fish community through top predator-prey interactions involving cannibalism of small pike, a common phenomenon, and controlling other fish prey species (e.g., yellow perch and catostomids).

Weight of pike can be extremely variable and change greatly on a seasonal basis, influenced primarily by gonadal development. But if weight is corrected for gonadal development and stomach contents, it can be an extremely descriptive measure of somatic condition. Relative weight standardized for fish collected at the same time of year can be very informative. Weight of pike caught in fall can be affected by gonadal development. Gonadal development in both sexes normally commences in early September. Females in good condition can produce ovaries that are 30% of their body weight. The FWIN data indicates that the gonadosomatic index, even for the females from these populations, can be quite low, usually <5%. Mean length-weight relationships for these datasets can be used for general length (mm) - weight (g) conversions and are: mean female total weight = $10^{0.00000212}$ total length$^{3.22}$ and mean male total weight = $10^{0.00000415}$ total length$^{3.14}$.

Pike are early-spring spawners, using sedge and grass hummocks in inundated wetlands and the edges of bogs and rush beds. Environmental-habitat conditions associated with spawning and nursery areas have been studied and reviewed in detail, and a system for classifying and ranking major physical characteristics and requirements has been developed (Casselman and Lewis 1996). Hummocks of grasses and sedges are the most actively used areas for broadcasting eggs, and depth of the nursery habitat is directly correlated with fish size and age. Rules of thumb for the first year of life are that water depth is approximately 10 cm for every 10 mm of body length for every week after peak spawning (Casselman and Lewis 1996). Spawning habitat is usually less critical or limiting than nursery or juvenile habitat.

Number of eggs per female increases with body size. Scott and Crossman (1973b) suggested that an average female pike would produce 32,000 eggs. However, a review by Raat (1988) suggested a mean absolute fecundity for the species that was almost twice as great (N = 15, mean and 95%CI – 60,000 ± 17,000) and a relative fecundity of 25 ± 4 eggs/g. The species is highly fecund, probably considerably greater than reported by Froese and Pauly (2013) and approaches the fecundity of walleye.

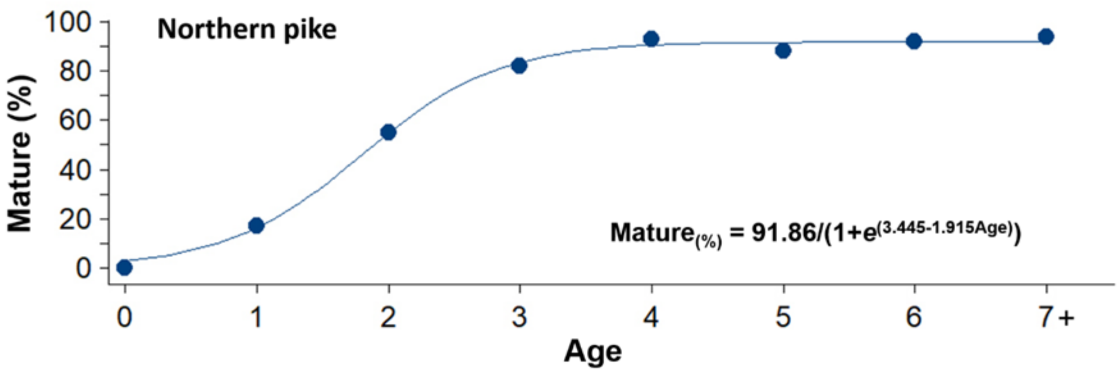

Figure 17. Maturity rates at age for female northern pike caught in Cedar Lake index netting program from 2009 to 2019.

Prepared from data in CLFMP, Table 3 (Klein et al. 2020). The equation for the fitted logistic curve provided.

Pike populations in Ontario, as documented from the FWIN series, 1993–2002, provide some general data on age and length at 50% maturity. On average, females were first mature at 1.97 years of age (P_{25} – 1.42 and P_{75} – 2.41) and a total length of 462 mm (P_{25} – 421 and P_{75} – 500), whereas first maturity for males was at 1.82 years (P_{25} – 1.31 and P – 2.48) and a total length of 424 mm (P_{25} – 375 and P_{75} – 466). When determining age and size at spawning time, it is important to put size and age in context in relation to time of year sampled. FWIN netting is conducted in fall, so at time of spawning, size would be somewhat greater and age the next spring would actually be designated as 1 year older, corresponding to the number of growing seasons or calendar years of life. Maturity rates by age for female pike caught in Cedar Lake were evaluated using coarse-mesh index-netting data from 2009 to 2013. The maturity-at-age relationship was well fitted with a logistic curve (Figure 17). Some female pike became mature at age 1, in their second calendar year of life, and reached 50% maturity at age 2, in their third year of life. Female pike are fully recruited to 108-mm mesh size at age 6, when around 90% of female pike are mature and have been since age 4, spawning in the spring of their fifth calendar year of life (Figure 17). Fewer than 10% of mature females appear to be at a resting stage in any given year (Klein et al. 2020). It should be emphasized that pike in Cedar Lake do not fit the profile of a low-trophic-level species as defined by MSC Fisheries Standard V2.01 (MSC 2018).

7.2.8 Stock assessment and status

Assessment of the pike stock in Cedar Lake is heavily integrated with walleye assessment, both using similar indexing methods with the same coarse-mesh and fine-mesh gillnets set annually at fixed stations throughout the Southeast Basin and every 3 years in the Northwest Basin and, commencing in 2020, in Cross Bay. The protocol for pike is, as is the walleye assessment, provided in Appendix 8.1.3 and outlined and detailed in Section 7.2.2.

The annual assessments conducted in Cedar Lake are part of the CAMP, which were begun in 2009 and conducted annually until 2019 for this assessment. The program involves using coarse-mesh index gillnets to provide important information on large-bodied fish. Generally, the data are summarized for a number of years in CAMP reports (CAMPP 2014 and CAMP 2017). The annual netting program, which is conducted in the Southeast Basin, involves 12 standard coarse-mesh gillnets. These nets are composed of five 35-m-long panels of stretch mesh — sizes 51 mm (2 in.), 76 mm (3 in.), 95 mm (3¼ in.), 108 mm (4¼ in.), and 127 mm (5 in.). Specifics concerning the nets and the protocol for sampling the large-bodied fish that are caught are detailed in Appendix 8.1.3 and are provided in the section involving walleye assessment (Section 7.2.2). The walleye assessment section should be consulted to fully understand the integrated assessment program, which includes the pike assessment. The shallower Northwest Basin is sampled with the same effort every 3 years. At every third or fourth site, a fine-mesh gillnet composed of three 10-m-long panels of stretch-mesh sizes is also set: 16 mm (0.63 in.), 20 mm (0.79 in.), and 25 mm (0.98 in.) (for specific annual effort, see Table 10). The fine-mesh net is tied on to the coarse-mesh net. This net is designed to sample small-bodied fish, usually <15 cm in length. However, the fine-mesh net sometimes entangles larger fish, and since lengths of the catch in the fine-mesh nets are not measured, this prevents a full understanding of the catch. These index gillnets are bottom-set, at fixed sites, and the sites are located throughout the basins and determined on a depth-stratified basis (Figure 9).

As indicated in the walleye assessment, catch in the coarse-mesh gillnet index on a weight and numbers basis is provided only in summary form in the most recent management report (Klein et al. 2020) and the data subsequently provided (Galbraith Q&A March 2021) (Table 9). So, as with walleye, it is not possible to better understand temporal changes of pike in the primary index gillnet series. As mentioned in the walleye assessment Section 7.2.3, annual species CUE data would also help better understand changes in pike abundance and status. Even though the indexing effort might not be considered appropriately large, if variance estimates were also provided, these long-term data would be informative. Also, as reported previously, the species catch for the fine-mesh gillnet index catch is provided only on a numbers and bulk-weight basis, and neither length nor length frequency of the catch is available.

The summary of the coarse-mesh gillnet index assessment catches by mesh size indicated that pike, on a weight and numbers basis, were most frequently caught in the 76-mm mesh nets (Table 9). They accounted for 37.3% of the overall biomass; average weight is 1,171 g, intermediate in size, with light pike caught in the finer mesh and heavier in the coarse mesh. A total of 17.3% of the biomass of pike was caught in the two largest mesh sizes used in the commercial gillnets, with pike overall accounting for 16% of the total biomass of the species caught in these coarse-mesh index nets. On an average weight basis, pike are the heaviest species caught, at 1,341 g. Over the 11-year period that the indexing has been conducted, the average number of pike caught per year was 56.8, which was only about 29% as many as the number of walleye caught. This is not a very large sample of pike for assessing the biometrics required to manage the species; however, the primary management regime in Cedar Lake is associated with walleye, which is the primary target species, with pike essentially an incidental capture that needs to be assessed so that the population and fishery remain sustainable. Annual samples were amalgamated to better inform their assessment power. The sample size may be adequate, given the mortality rate and the relatively few mature fish that would be harvested in the large-mesh commercial gillnets. Also, mortality rates are calculated using the most recent 5 years of indexing data (Klein et al. 2020).

The fine-mesh indexing data are provided on an annual basis for both basins (Table 10), annually for 11 years from 2009 to 2019 in the Southeast Basin and every third year for 3 years in the Northwest Basin. Pike catches were small in both basins and were reported over the years, 3 years for the Northwest Basin and 11 years for the Southeast Basin. Most notably, pike caught in these fine-mesh nets were large, ranging from 448 to 2,084 g. They were notably larger in the Northwest Basin, at an average rate of 1,485.6 g, and not quite half that weight (851.4 g) in the Southeast Basin. No appreciable trends exist over time in these few data; however, it is notable that the pike caught in these nets were much larger than those that would be considered to have gilled conventionally. Given the weight of the pike caught, it is unlikely that they were young, so this fine-mesh gillnet series would not provide a good measure of early recruitment even if pike lengths were provided. This seems surprising and may suggest that the depth stratification used for setting these nets did not include the very shallow areas where small, young pike reside. As indicated earlier, there is a rule of thumb that can be used to estimate depth distribution of small, young pike. For the first few years of life, pike occupy a water depth of approximately 10 cm for every 10 mm of body length (Casselman and Lewis 1996). According to bathymetry for the Southeast Basin (Figure 2), most of the index sites appear to be offshore in water that may be >2 m. Since Cedar Lake was created by impoundment, the shallows may be difficult to gillnet because of flooded forests and woody debris. Also, given the large size of the pike that were entangled in these fine-mesh nets, it might be speculated that they were baited into the mesh by the presence of gilled smaller prey fish. This is further evidence that the pike catch in these fine-mesh nets may not be useful for creating an early index of small pike abundance and recruitment, as may be possible for walleye.

The coarse-mesh gillnet index series provides recruitment information using cleithral age to determine year-class for pike 2 to 5 years of age. As with walleye, year-class strength is provided on a ratio basis in relation to mean size of the year-class, in this case for a 12-year period from 2005 to 2016 (Figure 18). During that time, four year-classes were relatively strong; specifically, 2011 was the strongest, followed closely by 2010. Lower and slightly below the level that was considered to be strong were the two most recent year-classes, 2015 and 2016. Four year-classes were close to average and four were generally weak, with 2007 and 2008 the weakest during this 12-year period. Current year-class strength is not available because the coarse-mesh indexing program catches few, if any, fish younger than age 2, so 2016 is the most recent year for which year-class strength data can be evaluated (Figure 18). Given that fine-mesh gillnets do not appear to catch young pike and coarse-mesh index gillnets are too large to do so, more recent recruitment information is not available. However, given what appears to be the size of the pike population and its status, more recent recruitment information may not be necessary. The index netting program not only identifies year-class strength but provides sex ratio, age, length and maturity by sex, and growth rates. This is used to assess stock structure and productivity.

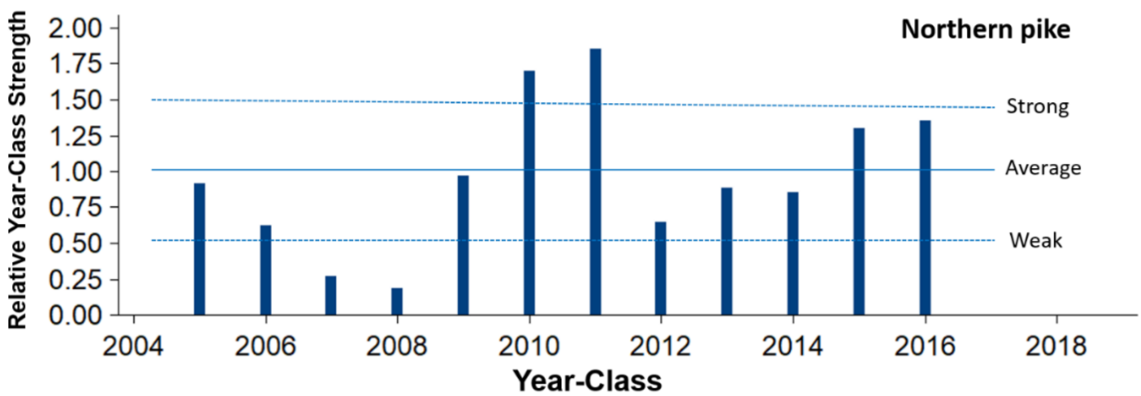

Figure 18. Recruitment index of relative year-class strength for northern pike in Cedar Lake for 2005 to 2016, developed from commercial harvest age assessment for age classes 2 to 5, 2009 to 2019.

A strength of 1 indicates an average year-class with values of 1.5 as a strong year-class boundary and 0.5 as a weak year-class boundary. Northern pike year-classes in 2010 and 2011 were exceptionally strong, similar to walleye. Year-classes 2015 and 2016 were above average in strength but do not reach the boundary designated as strong. Prepared from data in CLFMP, Figure 8 (Klein et al. 2020).

The power to detect real change in CUE is lower for pike in the index sampling program than for walleye and is low because the catch rate for pike is more than one-third that for walleye. Mean annual catch of pike in the coarse-mesh index nets was 56.8 fish, while the same index netting effort had a mean annual catch of 197.7 walleye, almost 3.5 times greater. However, fewer nets are required to achieve higher power for pike than for walleye because variability among the nets is lower for pike (Klein et al. 2020). Sampling power for pike is low; using the 2014 catch data for 12 nets, the power was only 43%; for walleye, this was 50%. To achieve 70% power to detect a decrease of 20% in the pike stock would require setting 32 nets and a set of 44 nets for 80% power. To avoid artificially low pike estimates that might occur around such important measures as mortality, mortality rates were calculated using the most recent 5 years of index netting data. This considerably improved the power of detecting change.

The harvest of pike by all three fisheries during the past 5 years (2015–2019) was 193.1 t. The modelled annual fishing mortality rate for pike was 13.1% for the period. This indicates a standing stock of harvestable pike that was 1,473 t (Klein et al. 2020). The standing stock at point of recruitment impairment was 314 t, only 21.3% of the harvestable standing stock, for a ratio of 4.7. Even the 95th percentile estimate of annual fishing mortality at 21.2% still implied the stock size was 2.9 times larger than the point of recruitment impairment. There is a high degree of certainty that the pike stock was above the point where recruitment impairment would occur because female pike mature young, with 50% reaching maturity at age 2, spawning in their third year of life (Figure 18), and are not fully recruited to the minimum allowable gillnet mesh size of 108 mm and the fishery until age 6.

Mortality rate was generated through relative abundances of fully recruited pike in the sample from the coarse-mesh gillnet index catch by using the most recent 5 years of indexing catch data. The fishing rate at maximum sustainable yield was set using natural mortality estimates from Haugen et al. (2007) and Malette and Morgan (2005) and also from maximum age estimates from Hoenig (1983). Since the annual meeting of the fishers in 2017, the maximum age of pike in Cedar Lake, determined from the index netting program, increased from 11 to 14 years, reducing the total annual mortality rate, estimated A_{MSY} (Froese et al. 2020) from 64% to 57% (Klein et al. 2020). This was determined by equally weighting the results provided by Hoenig (1983) and an average result from Haugen et al. (2007) and Malette and Morgan (2005). The modelled fishing mortality of pike is estimated to be 13.1%. Assuming the total annual mortality target reference point is 64%, the natural mortality used for pike is 32%. Total annual mortality for the 5-year period 2015 to 2019 is 45.1%.

The CLFMP used a spawning potential ratio analysis (Clark 1993, Slipke et al. 2002, Hordyk et al. 2015) to examine the status of both pike and walleye stocks in Cedar Lake (Klein et al. 2020). Modelling results for spawning potential ratio for pike in relation to age are provided (Figure 19). The point where pike recruitment might be impaired would be at $F_{35\%}$. This is provided in relation to the A_{MSY}, which represents the expected spawning potential ratio at F_{MSY}, using a minimum gillnet mesh size of 180 mm. MSY represents the modelling fishing rate required to achieve $F_{35\%}$ at age 13. The various percentile bounds are also illustrated. The 95% confidence limit of mortality rate of pike is above the point where recruitment would be impaired, so there is a high degree of certainty that the pike stock is above the point of recruitment impairment.

The $F_{35\%}$ harvest strategy consists of fishing at a rate that reduces spawning stock biomass per recruit to 35% of the unfished level. The pike fishery in Cedar Lake is well above the point of recruitment impairment as indicated in the modelling of the spawning potential ratio (Figure 19). Even if fished at the F_{MSY}, the spawning potential ratios are well above $F_{35\%}$ modelled to the maximum female age of 13 determined from the Cedar Lake index gillnetting program because pike are not vulnerable to the large minimum mesh size (108 mm and larger) used in the Cedar Lake commercial fishery until they are 3 years old and are not fully recruited until age 6. Around 90% of female pike are mature at age 4.

Appropriately, Klein et al. (2020) considered that for pike, the spawning potential ratio is likely a better measure of recruitment impairment than is the stock recruitment relationship. Harvest of pike in Cedar Lake is compounded by the fact that the commercial fishery targets primarily walleye. As indicated, there appears to be an inverse relationship between walleye and pike harvests, and pike are essentially an incidental catch that might be considered as a by-catch in the walleye fishery and not valuable enough to warrant targeting other than under certain conditions and by certain fishers. In a walleye fishery, more fishing effort will simply produce more pike, which explains why there probably is little value in trying to interpret the stock recruitment relationship from the pike catch. However, when pike are caught, they are valuable enough to be marketed. There is little unwanted pike catch in the commercial gillnet fishery (Klein et al. 2020). Pike are marketable to a minimal round weight of 0.5 kg if sold in the round. Although Klein et al. (2020 – Figure 15) thought the stock recruitment relationship, which involved recruitment related to the stock 5 years earlier, was of little value in assessing the point of recruitment, they emphasized that it hinted of depensation, a decrease in the number of mature individuals resulting in a reduction in production and survival of eggs or fry, and this was possibly due to cannibalism at high population levels, a well-known phenomenon in pike populations.

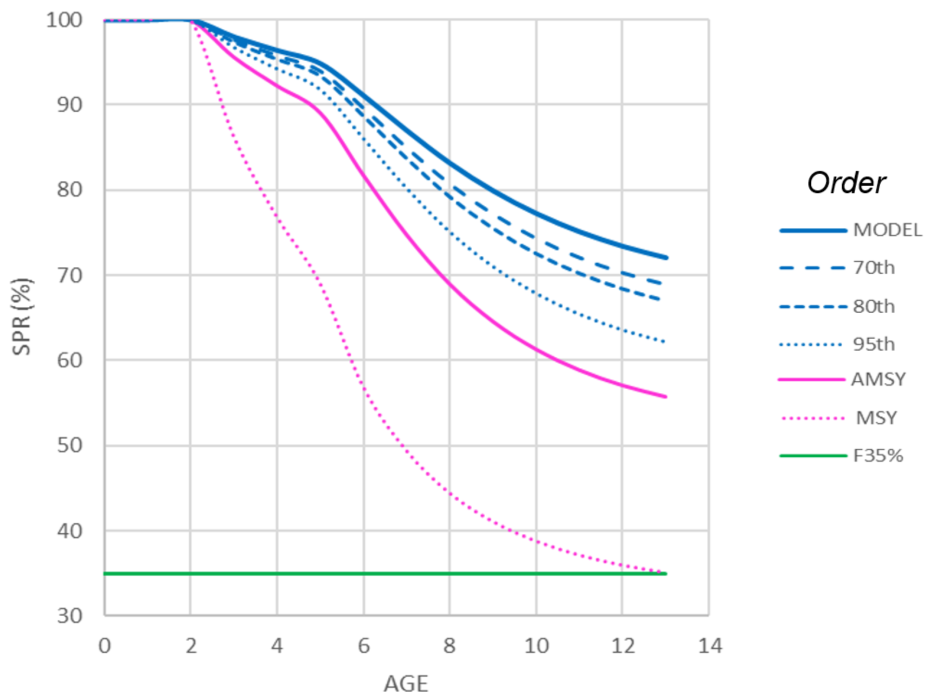

Figure 19. Spawning potential ratio (%) in relation to age modelled for northern pike from Cedar Lake under a 108-mm minimum mesh gill-net commercial fishery.

Recruitment impairment may occur at $F_{35\%}$. Relationships are indicated in colour; relationships and legends are listed and depicted in the same order. Data were modelled up to 13 years of age, which was the maximum age of females caught in the index netting program from 2009 to 2019. A_{MSY} represents the expected SPR at F_{MSY} under 108-mm minimum gill-net mesh size. MSY represents the modelled fishing rate required to achieve $F_{35\%}$ at age 13. MODEL is the SPR at the present fishing rate (2015–2019), and 70th, 80th, and 95th are the corresponding percentiles around the estimation of mortality rate. Reproduced from CLFMP, Figure 14 (Klein et al. 2020).

7.2.9 Harvest strategy, control rules, and reference points

The harvest strategy for northern pike employs harvest control rules involving TAC and a total annual mortality rate (the estimated A_{MSY}) target reference point to ensure that pike are not harvested at levels that would reduce the stock to a level that would not produce and sustain the MSY. Pike are considered as a target species, although they are primarily an incidental commercial catch in a walleye commercial fishery and apparently are rarely the target species. However, it is appropriate that there be a specific harvest strategy, control rules, and a reference point for precautionary management of the species. Quotas have been established, and seasons, gear, and effort are specifically mandated.
Harvest of pike in Cedar Lake is primarily associated with the commercial fishery, which is conducted in the Southeast Basin. There is a subsistence harvest, which has been estimated and is somewhat smaller than that of walleye, and there is a recreational harvest that is also smaller than that of walleye and has been evaluated but is conducted primarily in Cross Bay, where commercial fishing is not allowed. Pike have a regulated angling season. Recreational harvest of angled pike is limited to smaller individuals since regulations impose a maximum size limit of 75 cm.

The commercial fishery in Cedar Lake is closed from May 1 to May 31 and is open in open water from June 1 to October 31 and during the ice-cover season from first ice in November to April 30. Commercial fishing is not allowed in open water after October 31; nets must be set through the ice. As previously described, commercial fishers may use gillnets of any depth, material, and hanging ratio, but the stretch mesh size must not be less than 108 mm (4¼ in.). Yardage per licence is limited to 1,400 m, and harvest is monitored through DCRs and deliveries to the FFMC. From a marketing and management perspective, there is essentially little to no unwanted catch of pike in the Cedar Lake commercial fishery (Klein et al. 2020). Small pike can be marketed down to a round weight of 0.5 kg. Pike <1 kg accounted for only 8.6% of the pike caught in commercial-size meshes of the index gillnets. Although specific sizes of these fish are not available, the twine in the commercial nets is monofilament and would catch fewer small fish than the multifilament index nets, so the catch of even smaller fish in the commercial nets is expected to be appreciably lower than the 8.6% reported here for the index nets. Discarding of pike is not reported and is considered to be unlikely, given the value of the catch, especially when commercial fishers market large quantities of the less valuable mullets in order to cover operating expenses.

The harvest strategy and current HCRs for pike were developed in 2016, and quota management was established then. This harvest strategy, which the commercial fishers' association agreed to in 2017, has been in place for 3 years (Klein et al. 2020). The management plan indicates that the HCRs will be revisited in the future. At the present time, it is unlikely that fishing rate would trigger a change in the rules even at A_{MSY} of 57%; the spawning stock biomass is well above recruitment impairment. It is considered that as long as the commercial net minimum mesh size remains at 108 mm, the existing HCR would reduce the spawning potential ratio to just 51% if it came into effect (Klein et al. 2020), well above the 35% where recruitment would be impaired. Given the size and age of pike caught in the large-mesh commercial gillnets, the delayed harvest in relation to age at maturity, and the fishing rate reference point used in the HCRs, pike are being harvested quite conservatively and sustainably. The 2020 CLFMP appropriately states, "Given the delayed harvest relative to the age of maturity for Cedar Lake pike, the fishing rate trigger used in the harvest control rule that follows below is still quite conservative." The harvest strategy has not been fully tested but was developed through modelling. The primary reason why pike are fished at very low levels relative to their potential is that the commercial fishery targets primarily walleye, which are much more highly valued, depending upon size and processing, and can be four to five times more valuable than pike. Generally, the cost of fishing makes targeting pike prohibitive; however, it is indicated that under certain conditions, certain fishers may target this less valuable species.
The long-term quota, or TAC, of pike has been 366,000 kg, and this was retained as a base quota for 2017.

The HCRs for pike adopted in 2017 were:

- The Annual Base Quota, or Recommended Allowable Harvest (RAH), for pike is 366,000 kg:
- **If** total annual mortality is less than 64% and the base TAC has been reached, **TAC is increased** by $10\%\cdot yr^{-1}$
- **If** total annual mortality is greater than 64%, the base **TAC is reduced** by $10\%\cdot yr^{-1}$ until A_{MSY} is less than 64%.

The total mortality rate is calculated annually. The harvest strategy is reviewed annually by Manitoba Agriculture and Resource Development, taking into consideration the total annual mortality reference point developed from the most recent index netting data. The harvest strategy is reviewed twice a year when Fish and Wildlife staff meet with Cedar Lake commercial fishers in Easterville (Klein et al. 2020). The current harvest strategy for pike is, however, extremely resilient to measurement uncertainty because even at $A_{MSY,}$ the spawning potential ratio is well above a level that would result in recruitment impairment.

7.2.10 Catch profiles

The major harvest of northern pike from Cedar Lake is from the commercial fishery representing approximately 82% of the overall annual harvest of the species. It is estimated that over the past 5 years, the average annual overall harvest of pike was 193.1 t. The average annual harvest of the commercial fishery during this 5-year period was 158.1 ± 53.0 t (CV, 27.0%) and pike represented 28.9 ± 6.4% of the overall commercial harvest. Quite generally, this fishery accounts for 81.9% of the overall pike harvest. The recall survey estimates that recreational fishery has an annual harvest of 19 t, or 9.8% of the overall harvest. The estimated annual harvest by the subsistence fishery was calculated from the 2016 Statistics Canada census data, and pike consumption was estimated at 16 t, or 8.3% of the overall pike harvest. The subsistence fishery for pike is lower than that for walleye by 23.8% because pike are less valued as a food fish, no doubt because of the presence of intramuscular bones.

Pike has always been an important commercial species in Cedar Lake. For the 24 years from 1973 to 1997 before the 5-year closure of the commercial fishery from 1998 to 2002, the average annual pike harvest was large, at 272.2 ± 42.6 t (CV, 37.1%), representing 40.4 ± 2.8% of the overall commercial harvest (Table 4, Figure 14). During this time, the average annual harvest of pike was 11.2% higher than that of walleye. Pike were also caught more consistently than walleye; annual variability in pike catches was 17.7% lower than that of walleye. Not only were relatively more pike caught during this early period when walleye was overexploited, but pike were also caught more consistently.

After the closure, for the 17-year period from 2003 to 2019, annual pike harvest was 182.2 ± 23.3 t (CV, 24.9%), 34.2 ± 4.3% of the overall harvest (**Error! Reference source not found.**, Figure 14). During this time, the average annual harvest of pike was 10.6% lower than that of walleye. After the closure, annual harvest of pike was 33.2% lower than before, while the walleye harvest was 16.9% lower than before. The variance in annual harvest of pike was 32.9% lower than before the closure. After the closure, when walleye was harvested more sustainably, relatively fewer pike were caught and were caught more consistently. This may be related to the fact that after closure, fewer walleye, the primary target species, were caught, possibly requiring less fishing effort, giving more consistent results. The HCRs ensured increased sustainability of the population and fishery.

7.2.11 Total allowable catch (TAC) and catch data

The quota, or TAC, of northern pike has always been high, well above harvest levels. The TAC remained at 366 t (Klein et al. 2020). Average annual commercial harvest of pike during the 11-year assessment period was 179.1 ± 34.7 t (CV, 28.0%), representing 33.3 ± 4.8% of the overall harvest (Table 12). The commercial harvest has been appreciably lower than the TAC for the past 11 years, by 44.1 ± 20.3%, and in the past 4 years by 52.7 ± 13.3% (Table 12). The change in harvest over the period averaged -12.1%. Generally, pike harvest has been about half the TAC or somewhat less. Modelling indicated that the standing stock of harvestable pike for the most recent 5-year period was 1,473 t (Klein et al. 2020) and that the standing stock at point of recruitment impairment was 314 t, only 21.3% of the standing stock (a ratio of 4.7). Comparing the standing stock of pike for the most recent 5-year period with the 4 years that the most recent HCRs have been applied, the commercial harvest of pike of 173.1 ± 48.6 t (CV, 17.6%) (Table 12) is only 11.8% of the standing stock and 55.1% of the stock at point of recruitment impairment. However, the commercial harvest of pike is estimated to be approximately 82% of the overall harvest, which includes an annual recreational harvest of 19 t (9.8%) and a subsistence harvest of 16 t (8.3%). If these are added to the commercial harvest for the most recent 4-year period, the resulting estimate of total harvest is 208.1 t, which would be 14.1% of the standing stock and 66.3% of the standing stock at the point of recruitment impairment.

Table 12. Cedar Lake northern pike Total Allowable Catch (TAC) and commercial harvest (kg) 2009–2020, including relative change in harvest and harvest in relation to TAC.

Harvest data from Freshwater Fish Marketing Corporation deliveries. Data from Table 4 of the 2020 Cedar Lake Commercial Fishery Management Plan (Klein et al. 2020). Year is fishing year, which starts on June 1 and ends the following year on April 30. a COVID-19 pandemic will affect fishing effort and harvest. a The 2020 commercial fishing terminated in March, shortened by approximately 6 weeks, and the fishing season was essentially closed then, not for administrative reasons but because buyers were not accepting fish because of a worldwide pandemic that universally affected fish marketing and fisheries (Galbraith Q&A March 2021). b The COVID-19 pandemic will affect fishing effort and harvest.

Year	Total Allowable Catch (TAC) (kg)	Change in TAC (%)	Harvest Actual (kg)	Harvest Change in harvest (%)	Harvest Relative to 2016–19 TAC (%)
2009			253,676	+10.8	-30.7
2010			226,106	-12.2	-38.2
2011			225,876	-0.1	-38.2
2012			207,973	-8.7	-43.2
2013			115,063	-80.7	-68.6
2014			150,290	+23.4	-58.9
2015			98,237	-34.6	-73.2
2016	366,000		159,278	-6.1	-56.5
2017	366,000	0	199,125	+20.0	-45.6
2018	366,000	0	197,497	-0.8	-46.0
2019[a]	366,000	0	136,599	-44.6	-62.7
2020[b]	366,000	0			
2009–2019, N = 11					
Mean			179,065	-12.1	-44.1
± 95% CI			34,725	20.6	20.3
CV			28.0		
2016–2019, n = 4					
Mean			173,125	7.9	-52.7
± 95% CI			48,577	42.9	13.3
CV			17.6		

7.2.12 Total Allowable Catch (TAC) and catch data

Table 13. Total Allowable Catch (TAC) and catch data

Walleye

TAC	Year	2019	Amount	211,000 kgs
UoA share of TAC	Year	2019	Amount	211,000 kgs
UoA share of total TAC	Year	2019	Amount	211,000 kgs
Total green weight catch by UoC	Year (most recent)	2019	Amount	219,257 kgs
Total green weight catch by UoC	Year (second most recent)	2018	Amount	180,515 kgs

Northern pike

TAC	Year	2019	Amount	366,000 kgs
UoA share of TAC	Year	2019	Amount	366,000 kgs
UoA share of total TAC	Year	2019	Amount	366,000 kgs
Total green weight catch by UoC	Year (most recent)	2019	Amount	136,599 kgs
Total green weight catch by UoC	Year (second most recent)	2018	Amount	197,497 kgs

7.3 Principle 1 Performance Indicator scores and rationales

PI 1.1.1 – Stock status – Walleye (UoA1)

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Stock status relative to recruitment impairment			
	Guide post	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

The MSC standard (MSC 2018) allows for the use of surrogate, or proxy, reference points to evaluate stock status with respect to PRI and BMSY (GSA2.2.3). The stock status reference points used here for walleye are the total annual mortality rate and the relative weight growth impairment indicator. The walleye stock is at a level that maintains high productivity and has a low probability of recruitment overfishing. A spawning potential ratio analysis in relation to age (Clark 1993, Slipke et al. 2002, Hordyk et al. 2015) was conducted to better understand the current status of the walleye stock (Figure 12). The Spawning Potential Ratio (SPR) is a simple ratio of averaging lifetime production of mature eggs per recruit to what would be expected if the population were not fished. Fishing mortality, expressed as SPR, requires a reference point as an appropriate proxy for fishing mortality that supports a maximum sustainable yield - FMSY. In this analysis, the general level of F35% was used as the fishing mortality target reference point (Clark 1993, 2002), and the level of F20% was considered to be the fishing mortality limit reference point. Importantly, this SPR is an index to identify and prevent recruitment overfishing.

Trends in the SPR in relation to age are provided at a maximum sustainable yield of 42% (Klein et al. 2020). The maximum age of walleye in Cedar Lake, according to the index netting, was 18, so the SPR was modelled out to this maximum age (Figure 12). The current fishing level from 2015 to 2019 was used, and the analysis indicated that the current SPR is both above the F35% target reference point and less than the MSY. Indeed, there is a high degree of certainty that the 90th percentile is also above MSY and the target reference point (F35%). The 95th percentile is slightly below MSY and falls below the target reference point at age 17, slightly younger than possibly the maximum age of fish in the population. The relative weight (Murphy et al. 1991) growth impairment reference point uses two walleye length categories, stock and quality (Gabelhouse 1984), and the point of impairment was set at 80. Both length categories for 2019 were well above the point of impairment, stock 97 and quality 98. Considering the walleye stock status relative to recruitment impairment, the spawning potential ratio of F35% of Clark (1993) compares well with the model MSY. It is likely that the walleye stock of Cedar Lake is above the point where recruitment impairment would occur.

It is likely that the stock is above the point where recruitment would be impaired (PRI). SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

In addition to what is provided above in the evidence indicating that SG 60 is met, the following is provided in support of SG 80 being met. The average standing stock for walleye for Cedar Lake from 2009 to 2019 was calculated to be 643 t, whereas biomass over the most recent 5 years was 658 t. The current biomass relative to the biomass at MSY is 1.02 and B:Blimit = 2.04, where the Blimit is set at B20%. This indicates that the walleye stock is at a level that would produce the maximum sustainable yield (Klein et al. 2020). The time series is short. The stock biomass in 2008 was below the lower 95% confidence interval of the point of recruitment impairment but not below the estimate (Klein et al. 2020). In 2007, the spawning stock was below even the 80% confidence limit of the estimate (Klein et al. 2020). The most recent estimate of the spawning stock is 238.4 t of mature female walleye (Klein et al. 2020) and well above where recruitment impairment would occur. The spawning stock biomass is also well above the lower 95% confidence interval. From the stock recruitment assessment in the 2020 CLFMP, it is highly likely that the Cedar Lake walleye spawning stock is above the point of recruitment impairment (Figure 12). The relative weight (Murphy et al. 1991) growth impairment reference point uses two walleye size categories, stock and quality (Gabelhouse 1984), and the point of impairment is set at 80. Total annual mortality of walleye for the 2019–2020 fishing year was calculated to be 38.6%. The 40% total annual mortality rate target reference point coincidentally represents the 80% confidence interval of the mortality estimate. The 95% confidence interval of the total mortality estimate was equal to the abundance maximum sustainable yield (AMSY) (Klein et al. 2020). There is a high degree of certainty that fishing rates are below FMSY.

It is highly likely that the stock is above the PRI. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

The current SPR modelled for 2015 to 2019 was above the MSY, as was the 80th percentile, but the 90th percentile very much followed MSY over the age range modelled (Figure 12). Total annual mortality of walleye for the 2019–2020 fishing year was calculated to be 38.6%. The 40% total annual mortality rate target reference point coincidentally represents the 80% confidence interval of the mortality estimate. The 95% confidence interval of the total mortality estimate was equal to AMSY (Klein et al. 20 20). It is not possible to conclude with a high degree of certainty that the stock is above the point of recruitment impairment also because the dataset is short; there are only two HCR stock status indicators and one with only one 3-year index. Thus, requirements are not met at the SG 100 level.

	Stock status in relation to achievement of Maximum Sustainable Yield (MSY)			
b	Guide post		The stock is at or fluctuating around a level consistent with MSY.	There is **a high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Yes	No
Rationale				

The following evidence indicates SG 80 is met:

The maximum sustainable yield is achieved at a total annual mortality of 42%, so the 40% total annual mortality target reference point used is conservative, allowing for potential error in mortality estimate. For instance, if natural mortality increases from the long-term modelled estimate of 21% to 23%, total annual mortality rate would not exceed Z_{MSY}. There is little process uncertainty around the 21% estimate of natural mortality, but it was treated as a fixed variable (Klein et al. 2020). The 21% estimate of natural mortality is the average of two meta-analyses, one based on maximum observed age (Hoenig 1983) and the other on the von Bertalanffy growth parameters (Pauly 1990). The 40% TRP represents the 80% confidence interval of the mortality estimate. The 95% confidence interval of the total mortality estimate equals A_{MSY}. There is a high degree of certainty that walleye fishing rates are below F_{MSY}. Total annual mortality was monitored for the 2015 to 2019 period and, at 38.6%, is below the TRP value of 40%. The spawning potential ratio analysis, using 2015 to 2019 data, indicated that the stock has been around a level consistent with MSY. The 95th percentile is slightly below MSY and falls below the TRP at age 18. The current biomass, relative to the biomass at MSY, is 1.02. The stock is at a level consistent with a level that would produce MSY. For the total annual mortality indicator, the stock is around a level consistent with MSY in recent years, permitting appropriate scoring at the SG 80 level.

The stock is at, or fluctuating around, a level consistent with MSY. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

The spawning potential ratio analysis was conducted for the period 2015 to 2019 and confirms that during that period, the walleye stock was at a level consistent with MSY. However, there are no long-term data to substantiate this. The proxy indicator of stock status (GSA2.2.3.1), total annual mortality, is available for only one 3-year period, 2017 to 2019. Total annual mortality estimates are made by combining 3 years of data. Earlier estimates may have been made but are not provided. Nevertheless, the earliest would be from 2017. Harvest control rules have been in place since 2017; the time series would be too short for the HCR stock status indicator in place. Therefore, there is no evidence to conclude with a high degree of certainty that the walleye stock has been fluctuating around or above a level consistent with MSY, primarily because there is not an adequate time series; there are only two HCR stock status indicators and one with only one 3-year index, and the SPR analysis is a composite that uses the amalgamated data for a 5-year period.

Therefore, the SG 100 for SIb is not met.

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Stock status relative to reference points			
	Type of reference point	Value of reference point	Current stock status relative to reference point
Reference point used in scoring stock relative to PRI (SIa)	Relative weight growth impairment reference point Total annual mortality rate (TRP)	“Stock” length category 80 “Quality” length category 80 0.40 (A)	“Stock” length category 97 “Quality” length category 98 0.386 (A) Combined 3-year period 2017–2019
Reference point used in scoring stock relative to MSY (SIb)	Relative weight growth impairment reference point Total annual mortality rate (TRP)	“Stock” length category 80 “Quality” length category 80 0.40 (A)	“Stock” length category 97 “Quality” length category 98 0.386 (A) Combined 3-year period 2017–2019
Draft scoring range	≥80		
Information gap indicator	N/A		

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.1.2 – Stock rebuilding – Walleye (UoA1)

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guide post	A rebuilding timeframe is specified for the stock that is the **shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
Rationale				

SIa SG 60 and SG 100

The present stock score of 80 or above on PI 1.1.1 (SA2.3.2) indicates that rebuilding is not currently necessary. The stock was rebuilt from 1998 to 2002, when the fishery was closed and restructured. This was done primarily because walleye had declined previously and the commercial catch just prior to the closure and restructuring was no longer the largest catch in the fishery but was third after northern pike and mullet. In 1996 and 1997, mullet was the most abundant harvest (mean = 49.1%), followed by northern pike (34.2%), then walleye (10.9%), obviously indicating that rebuilding and restructuring was needed for the prime commercial species, walleye (Figure 14). This rebuilding was done approximately 20 years earlier and more than two generation times for the primary target species, walleye. Commercial fishing effort was reduced to approximately half the former licences and effort (Klein et al. 2020). The walleye stock is currently at a level that would be productive and sustainable, and there is a low probability of recruitment overfishing. Therefore, PI 1.1.2 associated with walleye stock rebuilding is not evaluated.

Appropriately, rebuilding has not been included in the Cedar Lake Fisheries Management Plan (Klein et al. 2020), nor does there need to be a timeframe associated with rebuilding the walleye stock.

b	**Rebuilding evaluation**			
	Guide post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is **evidence** that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the **specified timeframe**.	There is **strong evidence** that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the **specified timeframe**.
	Met?	N/A	N/A	N/A
Rationale				

SIb SG 60, SG 80, and SG 100

The present stock score of 80 or above on PI 1.1.1 (SA2.3.2) indicates that rebuilding is not currently necessary. A well-designed walleye monitoring program is in place and would be applicable if rebuilding strategies were necessary. However, the stock does not require rebuilding, and it is obvious that if it required rebuilding, strategies are in place based on simulation modelling, exploitation rates, or previous performance that rebuilding would be possible if a specific framework were applied. Under present conditions, it is not necessary to determine whether there is strong evidence that a strategy for rebuilding stocks is in place or adequate. walleye HCRs, including TAC and reference points, are appropriate to determine whether rebuilding is necessary and provide the tools for evaluating whether rebuilding is needed.

References

Draft scoring range	**N/A**
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.1 – Harvest strategy – Walleye (UoA1)

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guide post	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Yes	Yes	Yes
Rationale				

The following evidence indicates SG 60 is met:

The harvest strategy for walleye in Cedar Lake employs two stock status indicators, one involving a relative weight indicator that considers a body-condition growth impairment using a relative-weight index and the other using total mortality rate with a target reference point used to manage the HCRs. The HCR is designed to respond to the state of the stock. Annual pre-commercial season index monitoring is conducted, primarily in late August and early September for a 5-to-7-day period (Appendix 8.1.3). This is a pre-fishing season assessment that comes just before the commercial fishing year in Cedar Lake, which starts on June 1 of the next year and ends the following year on April 30. For the fishing year, the commercial fishing season is closed from May 1 to 31 and opens for open-water commercial gillnetting from June 1 to October 31. The commercial ice-fishing season for the year commences after ice first forms after November 1 and lasts until April 30. The relative weight indicator has a reference point of 80 and two size categories considering stock and quality; in 2019, the values were high, 97 and 98, respectively (Figure 13). Total annual mortality (TRP) in the HCRs results in management action to change fishing effort. If total mortality (A) exceeds 40% (the estimated A_{MSY}), as determined from the pre-season assessment, then the quota, or recommended allowable harvest, of 211 t is triggered (Table 11, Figure 15). If total annual mortality is <40% and the base TAC of 211 t is reached, the TAC is increased by 10% per year. However, if the total annual mortality is >40%, the TAC is reduced by 10% per year until the A_{MSY} is <40%. Also, considering the relative weight indicator, if it is <80, the TAC is increased by 10% per year until the relative weight is >80 (Klein et al. 2020). This harvest strategy is expected to achieve appropriate management of the walleye stock in Cedar Lake.

The harvest strategy is expected to achieve stock management objectives reflected in PI 1.1.1 SG 80. SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

Taking into consideration the reference points in the HCRs outlined in SG 60 SIa above, the HCR will be responsive to the state of the walleye stock. Thus, the harvest strategy incorporates an appropriate monitoring and management response that will achieve the stock management objectives reflected in PI 1.1.1 SG 80.

The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together toward achieving stock management objectives reflected in PI 1.1.1 SG 80. SG 80 for SIa is met.

The following evidence indicates SG 100 is met:

The harvest strategy for walleye in Cedar Lake employs two stock status indicators, one involving a relative weight indicator that considers growth impairment involving body condition, using a relative-weight index, and the other using total mortality rate with a target reference point used to manage the HCRs. The HCR was adopted in 2017. In 2019, the recommended allowable catch, or quota, of 211 t of commercially caught walleye was actually exceeded, with a catch of 219.2 t (Table 11, Figure 15), which was associated with an increase in the harvest of +21.5% from the former year and 3.9% above the TAC. Therefore, the total allowable catch for 2020 was increased by 10% as recommended in the HCRs. The TAC for 2020 was increased to 232 t of walleye caught in the commercial gillnet fishery (Table 11). For the period that the HCRs have been in effect, the walleye harvest has been 12.6% below the TAC. This provided evidence that the harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives as reflected in PI 1.1.1 SG 80. The harvest strategy incorporates timely monitoring and management that will be responsive to the state of the stock, which should keep the stock above the PRI and at or above the MSY surrogate.

The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG 80. SG 100 for SIa is met.

b	**Harvest strategy evaluation**			
	Guide post	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Although the HCRs have not been in place long, they are based on considerable assessment data and experience. Eight years before the harvest strategy and rules were implemented, assessment was conducted on walleye in Cedar Lake using the standard assessment program of coarse-mesh and fine-mesh gillnetting (Appendix 8.1.3), as has been used in the assessment monitoring since the HCRs were adopted in 2017. Although the harvest strategy has not been fully tested, the strategy appears to be achieving its objectives because the harvest in 2019 exceeded the TAC and, through the HCRs, resulted in a 10% increase in the TAC for 2020. The total annual mortality rate has not been exceeded. The harvest appears to be oscillating around the TAC, not just for the past few years but back to 2009 (Figure 14). Likewise, the relative weight index has always remained high, well above the 80 value that would indicate condition and growth impairment. In 2019, the relative growth index, depending upon whether stock or quality walleye size, was at the 97 and 98 levels, respectively (Figure 13). Some aspects of the HCRs, particularly the use of the proxy TRP, are similar to those that have effectively and sustainably managed another walleye fishery in a nearby MSC-certified walleye and pike fishery in Waterhen Lake, Manitoba (Casselman et al. 2014, Bostrom 2020). The performance of the index gillnetting, walleye HCRs, and management responses since 2017 are also provided in SIc 1.2.2. The SG 60 level is achieved.

The harvest strategy is likely to work based on prior experience or plausible argument. SG 60 for SIb is met.

The following evidence indicates SG 80 is met:

The HCRs for walleye were adopted and implemented in 2017, and evidence exists that they are achieving their objectives because the harvest in 2019 resulted in a change of the TAC in 2020. The total mortality rate has not reached a level that has triggered the reduction in the TAC, and the relative weight indicator has always remained well above the 80 reference point (Figure 13), so the harvest strategy and control rules appear to be achieving their objectives but there is no evidence that the harvest has been tested fully.

The harvest strategy may not have been fully tested, but evidence exists that it is achieving its objectives. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

The harvest strategy has been in effect since 2017, and although there is evidence that it is achieving its objectives, it has not been fully evaluated so does not meet the SG 100 level.

The performance of the harvest strategy has not been fully evaluated nor does adequate evidence exists to show that it is achieving its objectives, including being clearly able to maintain the stock at target levels. SG 100 for SIb is not met.

C	**Harvest strategy monitoring**

	Guide post	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Yes		
Rationale				

The following evidence indicates SG 60 is met:

Monitoring is in place to evaluate the harvest strategy. Coarse-mesh and fine-mesh index gillnet monitoring has been carried out consistently since 2009 in the Southeast Basin of Cedar Lake, where the commercial gillnet fishery is conducted. The protocol for the monitoring program is provided in Appendix 8.1.3. The harvest strategy for walleye is well established, has been conducted for 11 years, and provides relevant information to evaluate the harvest strategy and stock status of this target species, walleye. The assessment program can be considered to be pre-season monitoring because it is conducted in late summer and fall the year before the commercial fishing season, which commences the following June. The monitoring is annual; catches over the past 11 seasons have averaged 197.7 walleye (**Error! Reference source not found.**). Results from this assessment since 2017 have provided evidence that the harvest strategy for walleye is working. It provides the two reference point indicators that are primarily involved in guiding the HCRs. The specific performance of the index gillnetting survey, harvest control rules, and management responses since 2017 is discussed in PI 1.2.2 SIc.

Monitoring is in place that is expected to determine whether the harvest strategy is working. SG 60 for SIc is met.

d	**Harvest strategy review**			
	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Yes
Rationale				

The following evidence indicates SG 100 is met:

According to the CLFMP, managers review and improve the harvest strategy as necessary. It is updated annually at the commercial fishers' meeting held in the Easterville Community Centre (Klein et al. 2020). It is reviewed twice a year in Easterville on Cedar Lake by Manitoba Agriculture and Resource Development Wildlife and Fisheries Branch staff in collaboration with the commercial fishers. The two annual meetings held with the commercial fishers come out of a third amendment of 2016, which was agreed upon for the CLFMP of May 2006. This amendment stated specifically that the fishers and Manitoba Agriculture and Resource Development staff, "shall meet at least twice annually with scheduled meetings occurring at the end of April and the end of October." The CLFMP reports that the fishers work together with the staff to provide information important to the management of the fisheries through these meetings. Monitoring and research are also presented and discussed, and material is distributed at the annual Cedar Lake commercial fishers' meeting, which is followed by a general public meeting held in the Cedar Lake area. As indicated in the 2020 CLFMP, the harvest rules in place will be revisited and discussed with the commercial fishers in the future. It is obvious that there is a lot of interest in the harvest strategy and that it is reviewed regularly and improvements made where thought necessary.

The harvest strategy is reviewed periodically and improved as necessary. SG 100 for SId is met.

e	**Shark finning**			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NA	NA	NA
Rationale				

Shark are not present in this freshwater environment.

	Review of alternative measures			
f	Guide post	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.
	Met?	NA	NA	NA
Rationale				

Concerning SG 60:

As pointed out in the 2020 CLFMP, there is no practical way to execute the walleye fishery in Cedar Lake using alternative procedures. There is no review of potential effectiveness and practicality of alternative measures to minimise mortality of unwanted catch of walleye, a target species, because walleye of all sizes, even small individuals, are valued in all three fisheries—commercial, recreational, and subsistence. It is documented throughout the 2020 CLFMP that there is no unwanted catch of this species (Klein et al. 2020).

Concerning SG 80:

There is no regular review of the potential effectiveness and practicality of alternative measures to minimise mortality of unwanted catch of walleye, a target species, because walleye of all sizes, even small individuals, are valued in all three fisheries—commercial, recreational, and subsistence. It is documented throughout the 2020 CLFMP that there is no unwanted catch of this species (Klein et al. 2020).

Concerning SG 100:

There is no biannual review of the potential effectiveness and practicality of alternative measures to minimise mortality of unwanted walleye, a target species, because walleye of all sizes, even small individuals, are valued in all three fisheries—commercial, recreational, and subsistence. It is documented throughout the 2020 CLFMP that there is no unwanted catch of this species (Klein et al. 2020).

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Bostrom, J., S. Adlerstein-Gonzalez, and T. Jagielo. 2020. Waterhen Lake walleye and northern pike UoAs. Public certification report. MRAG Americas, Inc. Marine Stewardship Council Assessment, October 2020. 197 pages.

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Draft scoring range	≥80
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.2 – Harvest control rules and tools – Walleye (UoA1)

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**HCRs design and application**			
	Guide post	**Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Harvest control rules for the walleye commercial fishery were developed in 2016 and adopted in 2017. These HCRs use two reference points: one pertaining to total annual mortality rate (TRP), an estimation of A_{MSY} currently set at 40%, the other pertaining to growth impairment measured using a standardized measure of condition involving relative weight. Other studies in Manitoba indicate that this growth impairment occurs at a relative weight of 80% standardized by comparing it to a walleye length-weight growth standard (Murphy et al. 1991) involving two size categories, stock and quality size (Gabelhouse 1984). These reference points are triggers that affect the annual base quota, or recommended allowable harvest (RAH), which becomes the annual TAC, which was set at 300 t up to 2017 but in 2017 was reduced to 211 t (Figure 15, Table 11). If triggered, the quota changes 10% per year. These HCRs are currently in place for managing this quota, or TAC, which was a fundamental part of the CLFMP 2020 pertaining to harvest of walleye, the most valuable and targeted commercial species (Klein et al. 2020).

The HCRs for walleye are as follows:

- The Annual Base Quota, or Recommended Annual Harvest, for walleye is 211,000 kg:
- **IF** total annual mortality is less than 40% and the base TAC is reached, **TAC is increased** by $10\%{\cdot}yr^{-1}$
- **IF** relative weight is less than 80, **TAC is increased** by $10\%{\cdot}yr^{-1}$ until the relative weight is greater than 80.
- **IF** total annual mortality is greater than 40%, **TAC is reduced** by $10\%{\cdot}yr^{-1}$ until A_{MSY} is less than 40%.

The indicators total mortality and relative weight reference points of growth impairment did not trigger changes in the TAC since 2017. Total mortality was less (38.6%) than the target reference point (40%) and was 3.5% lower. But as indicated, the harvest in 2019 exceeded the TAC by 3.9%, so the quota for 2020 was set 10% higher, at 232 t (Table 11). However, the COVID-19 pandemic developed that affected marketing and fisheries, which will no doubt affect harvest and immediate future management decisions. For the 11-year period from 2009 to 2019, the harvest was 25.5% lower than the TAC and in the recent period, from 2016 to 2019, when control rules have been in place, was 12.6% lower.

Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment is approached. SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

The harvest control rules for walleye are well defined, having two clear reference points in place to trigger changes in effort when appropriate for the commercial walleye gillnet fishery. A rule is in place that uses a proxy stock status indicator for total mortality (A). It triggers an effort reduction as the index of total mortality of pike in Cedar Lake increases beyond a level considered to be consistent with MSY (A_{MSY}) and is designed to reduce the exploitation rate as the PRI is approached and keep the stock fluctuating around a proxy level consistent with MSY. Specifically, if the total mortality

TRP should happen to exceed 40% (the estimated A_{MSY}), a base quota, or recommended allowable harvest, of 211 t is reduced by 10% every year that this performance indicator is above 40%. If the mortality rate falls below 40%, the quota is increased by 10% per year as long as the quota is caught (Klein et al. 2020). The other reference point involves a relative weight performance indicator, which considers growth and body condition impairment, comparing total body weight with a length-weight growth standard. If the relative weight is <80 (% relative weight) in relation to the relative weight standard, the quota is increased by 10% per year until the relative weight is >80. This is a proxy for addressing decreased carrying capacity or loss of productivity, possibly associated with the establishment of an invasive species. These are well-defined HCRs that use biologically meaningful proxies for reference points and are structured to maintain the stock at a level consistent with MSY and to reduce exploitation as PRI is approached.

Well-defined HCRs are in place that ensure the exploitation rate is reduced as the PRI is approached and are expected to keep the stock fluctuating around a target level consistent with (or above) MSY. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

More evidence provided by a longer implementation time would be needed to ensure the stock is fluctuating around a proxy level consistent with MSY. The relative weight indicator provides a rule for addressing changes in productivity that would negatively affect walleye production. The relative weight indicator has limited application. Additional corroborating stock status indicators with associated HCRs would be required to meet this scoring guidepost.

Therefore, the SG 100 for SIa is not met.

b	**HCRs robustness to uncertainty**			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Yes	No
Rationale				

The following evidence indicates SG 80 is met:

The HCRs for walleye were designed to address the main uncertainties associated with the annual stock assessment. They do this by providing scientific advice around a proxy stock status indicator for total mortality and taking into consideration any possible changes associated with walleye productivity through the relative weight indicator. Observational error associated with sampling is taken into consideration in the fixed-station depth-stratified sampling design in the coarse-mesh gillnet indexing program. Index sampling effort is moderate, and mortality estimates are calculated by amalgamating 3 years of walleye index catch data to increase sample size. Although there no doubt is process error related to the mortality estimate, this has been addressed by using a total mortality rule of 40%, lowered from 42%, the total annual mortality at which maximum sustainable yield is achieved. Therefore, the rule is more conservative and allows for potential error in the mortality estimate. For example, if natural mortality were to increase from the long-term modelled estimates of 21 to 23%, the total annual mortality rate still would not exceed Z_{MSY} (Klein et al. 2020). There is empirical evidence that the HCRs are applied as designed when the quota was increased for 2020.

The HCRs are likely to be robust to the main uncertainties. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

The HCRs do not fully take into consideration some important uncertainties. Direct measures of walleye removals by the subsistence fishery are not used and would be better, but the indirect estimates should be verified. Although there appears to be no direct overlap between the recreational and the commercial fisheries by virtue of location, commercial fishers are not allowed to fish in Cross Bay; however, recreational fishers may fish in the Southeast Basin, where the commercial fishery is conducted. A better understanding of the specific locations of the recreational fisheries and more direct measures of removals by diaries or voluntary creels would be helpful. Also, even though there appears to be spatial separation in effort, some species might move back and forth; no reference to this has been reported. If a younger recruitment index for walleye could be developed, possibly using the fine-mesh index gillnet catches in conjunction with length measurements, this would better inform stock status. Also, a surrogate indicator of stock status is used, so the HCRs do not take into account a broad range of uncertainties.

Therefore, the SG 100 for SIb is not met.

c	HCRs evaluation			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Available evidence indicates that the walleye HCRs have been applied effectively in managing the Cedar Lake commercial walleye fishery and in achieving exploitation levels required under the HCRs. Although the target reference point has not been triggered since its adoption in 2017, it is expected that they would control harvest appropriately, particularly since the commercial fishery uses large-mesh nets of 108 mm and larger. Some aspects of the HCRs, particularly the use of the proxy TRP, are similar to those that have effectively and sustainably managed another walleye fishery in a nearby MSC-certified walleye and pike fishery in Waterhen Lake, Manitoba (Casselman et al. 2014, Bostrom 2020). Even though implementation of the HCRs for walleye is relatively recent, the walleye harvest appears to be sustainable and has fluctuated just below the TAC, approximately 12.6% lower except in 2019, when the harvest exceeded the TAC by 3.9% (Table 11). Following the HCRs, this resulted in a recommended TAC for 2020 that was 10% larger. This suggests that the TAC and the HCRs, including the relative weight index, which is very high, around 95 to 98 compared with a level of impairment of 80, appear appropriate and effective.

This provides some supporting evidence that the tools and rules being applied here are appropriate even though the management plan and HCRs have been implemented only recently, since 2017.

There is some evidence that tools used or available to implement HCRs are appropriate and effective in controlling exploitation. SG 60 for SIc is met.

The following evidence indicates SG 80 is met:

The primary tool to control harvest is the annual TAC, and it is based on scientific evidence assembled in the Cedar Lake management plan, including a spawning potential analysis. For the Cedar Lake walleye commercial fishery, the RAH prior to 2017 was 300 t and was adjusted down to 211 t in 2017 when the HCRs were adopted. This was done to ensure a more sustainable level of harvest according to the expected maximum sustainable yield modelled by Baccante and Colby (1996). This provides supporting evidence that the tools and rules being applied are appropriate through the management plan and HCRs even though they have been in effect only since 2017 and the TRP has not been triggered. The total annual mortality rate was 38.6% and was 0.965 of the TRP, 40%. Following the HCRs, the quota has been adjusted upwards in response to increased harvest. In 2019 the harvest exceeded the TAC by 3.9%. This resulted in a 10% increase in the TAC to 232 t in 2020 (Table 11). There is some evidence that the tools used in the HCRs are appropriate in affecting walleye exploitation.

Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs. SG 80 for SIc is met.

The following evidence indicates SG 100 is not met:

A longer time series of evidence is needed in order to reach the requirements of the SG 100 level. Evidence does not clearly shows that the tools in use are effective in achieving the exploitation levels required under the HCRs. SG 100 for SIc is not met.

References

Baccante, D.A., and P.J. Colby. 1996. Harvest, density and reproductive characteristics of North American walleye populations. Annles Zoologici Fennici 33:601–615.

Bostrom, J., S. Adlerstein-Gonzalez, and T. Jagielo. 2020. Waterhen Lake walleye and northern pike UoAs. Public certification report. MRAG Americas, Inc. Marine Stewardship Council Assessment, October 2020. 197 pages.

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Gabelhouse, D.W., Jr. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273–285.

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Draft scoring range	≥80
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.3 – Information and monitoring – Walleye (UoA1)

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	**Range of information**			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Relevant information related to stock structure and productivity of walleye is available to support the harvest strategy. Indexing is conducted annually at 12 depth-stratified fixed stations in the Southeast Basin, using a range of five mesh sizes of coarse-mesh multifilament gillnets (35-m-long panels of stretch mesh — sizes 51 mm (2 in.), 76 mm (3 in.), 95 mm (3¼ in.), 108 mm (4¼ in.), and 127 mm (5 in.)), including the minimum size (180-mm stretch mesh) and the larger mesh regulated for the commercial fishery (Appendix 8.1.3, CAMP 2021). Also, a set of fine-mesh monofilament index gillnets, using a range of three mesh sizes, is set with the coarse-mesh nets but less intensively; at every third site, fine-mesh nets are attached to the coarse-mesh nets. The coarse-mesh nets are multifilament twine, different from the commercial nets, which are monofilament. The different twine types could catch species somewhat differently, but as pointed out in the management plan (Klein et al. 2020), differences would remain relative and provide an appropriate measure of changes in abundance and size. Every third year, the same indexing effort is conducted in the shallower Northwest Basin (Figure 9) and the results are combined with those of the Southeast Basin to provide an overall fisheries assessment index. In Cross Bay, where commercial fishing is not allowed but the primary recreational fishery is conducted, indexing for 3 years was started in 2020 to explore differences in the fish communities. Catches are summarized on a number and weight basis for each species and mesh size for the 11-year indexing period from 2009 to 2019 (Table 9). It is possible to use the bulk weight and numbers to calculate mean weights of the individuals caught. Annual CUE by species for the coarse-mesh nets is not provided but is available for the fine-mesh index nets for 11 years in the Southeast Basin and for the 3 years they were fished in the Northwest Basin. Length by species is not provided for the fine-mesh nets, but average weight can be calculated. The index net assessment is adequate to provide relevant information supporting the harvest strategy at the SG 60 level.

Some relevant information related to stock structure and productivity is available to support the harvest strategy. SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

Sufficient information is available concerning relative stock structure, stock productivity, and general harvest and associated data to support the harvest strategy. The walleye catch in the indexing gear is sufficient to provide the important insights necessary to adequately apply the harvest strategy; on average, 197.7 walleye are caught annually in the coarse-mesh gillnet sampling program in the Southeast Basin (Table 9). Age data for walleye are determined by the otolith method (Appendix 8.1.3, CAMP 2021). This method is accurate and reliable and provides appropriate data for determining the total annual mortality rate. The fine-mesh gillnets catch fairly large numbers of small walleye as indicated by mean weights and give some useful insights concerning their abundance, which can help inform concerning early recruitment. However, if individual lengths were available, the catches would be more informative. Summary CAMP reports (CAMPP 2014, CAMP 2017) provide important environmental data concerning temperature profiles and abiotic conditions such as depth and turbidity. However, it would be informative to have these data, particularly temperature, measured directly at the nets when they are set. There appears to be no unwanted catch, and the CLFMP reports that discards are very low, given the value and the size of the walleye caught (Klein et al. 2020). No specific data are provided concerning walleye discards, although during specific questions and answers with the fishers, some species were mentioned as possible discards but walleye were not (Galbraith Q&A March 2021), suggesting by inference that discarding must be low. Sufficient relevant information is available from the index netting conducted to inform and support the harvest strategy.

Sufficient relevant information related to stock size and productivity is available to support the harvest strategy. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

A comprehensive range of information on the stock and environmental conditions is somewhat lacking and if provided would be more informative concerning harvest strategy and could be improved upon relatively easily. For example, annual CUE by species should be provided for the coarse-mesh index nets. This would help provide an indicator of changes in relative abundance and status of not only walleye but other species. If lengths were acquired for the individuals caught in the fine-mesh index nets, these catches would better inform early recruitment, particularly for walleye. Direct measures of recruitment are not available other than indirectly from age of older individuals, 7 to 11 years (Figure 10). Indexing effort was not as great as might be expected to provide comprehensive annual information, as has been available for a certified similar Manitoba fishery in Waterhen Lake (Klein and Galbraith 2019). As indicated, indexing effort based on the power of detecting change was relatively low (Klein et al. 2020). For example, total annual mortality rate for walleye is calculated by the accumulation of three years of sampling effort. It would be more informative to have this calculated more frequently than every 3 years; it should be explored to see if fewer years of data could be used to provide an appropriate estimate and decrease the timeframe involved. Currently for a 3-year period, on average just under 600 individuals must be used in the estimate. Fewer individuals (from fewer years) might still provide a statistically valid sample. Even though there is considered to be no unwanted catch, even of small walleye (Klein et al. 2020), discarding is not documented and should be verified by regular survey or direct observation. Catch of small walleye in the fine-mesh index gillnets should be analysed to determine if they can provide early recruitment information. If the species' CUE were reported annually for the coarse-mesh gillnet indexing program, dynamics and trends over time for walleye could be reviewed, analysed, and reported to others and perhaps provide a useful indicator of possible changes in abundance. The difference in twine type between the indexing and commercial nets could result in slightly different catches because of differences in catchability associated with these two types of filaments. If possible, more direct estimates of natural mortality should be explored, along with inter-basin movement and more directly determined measures of local recreational and subsistence removals.

A comprehensive range of information on stock and removals and other information, such as environmental information, is not available. SG 100 for SIa is not met.

b	**Monitoring**			
	Guide post	Stock abundance and UoA removals are monitored and **at least one indicator** is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and **one or more indicators** are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

The walleye stock is monitored primarily through the coarse-mesh gillnet indexing program conducted annually in the Southeast Basin and every 3 years in the Northwest Basin. This indexing program involves fixed sites that are depth-stratified and provides reasonably good coverage of Cedar Lake. A fairly large sample of walleye is caught and provides reasonably good assessment data for evaluating stock abundance and the performance indicators used to support the HCRs. The commercial catch of walleye is well documented through deliveries to the Freshwater Fisheries Marketing

Corporation (FFMC) and the commercial harvest monitoring system in place. The performance indicators that are used to evaluate the quota or RAH and trigger the HCRs are total annual mortality and an index of walleye condition standardized as relative weight. Total annual mortality rate is calculated by using a 3-year running mean compared with a natural mortality rate determined by Klein et al. (2020) based on combined estimates of Hoenig (1983) and Pauly (1980). Relative weight uses a well-defined method of standardizing condition, including a standard condition relationship for walleye (Murphy et al. 1991) separated into two size categories referred to as “stock” and “quality” size (Gabelhouse 1984). This measure of condition permits an understanding of, and takes into consideration, the productivity of the system, particularly if it changes and results in walleye impairment (Klein et al. 2020). The annual data collected in the assessment program also take into consideration catch data from a fine-mesh gillnet indexing program. It is not used to directly calculate the performance indicators but provides insights concerning abundance, which, if small walleye are taken into consideration, could possibly provide useful insights concerning earlier recruitment (Table 10). The annual CUE from the coarse-mesh gillnet indexing program is not provided for walleye, although 11 years of indexing data exist, but only overall weights and numbers are provided by mesh size (Table 9). Stock removals of walleye are primarily associated with the commercial fishery, which accounts for approximately 80% of the removals. The remaining removals, approximately 21.4%, associated with the recreational fishery (10.5%) and the subsistence fishery (10.9%) are estimated from multi-year recall statistics and estimates that are somewhat indirect but give a relative measure of these fisheries and associated mortalities.

Stock abundance and removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the HCRs. SG 60 for SIb is met.

The following evidence indicates SG 80 is met:

As indicated, stock abundance and removals are monitored regularly. The walleye stock is assessed through the annual coarse-mesh gillnet indexing program, which provides samples for evaluating total annual mortality rate and a measure of walleye body condition expressed as a relative weight index. The program is conducted in the Southeast Basin, which receives most of the commercial fishing effort and commercial catches delivered to the FFMC, where they are well documented (**Error! Reference source not found.**). There is regular evaluation of other walleye removals associated with the recreational and subsistence fisheries. Removals for the recreational fishery are evaluated by using summary angling recall survey data and, for the subsistence fishery, by using statistics estimating the size of the local resident population and applying estimates of human fish consumption in northern Manitoba (Klein et al. 2020). Monitoring of these lesser removals is regular enough to estimate their relative contributions. The HCRs apply most specifically to regulating the TAC associated with the commercial fishery, which accounts for approximately 80% of overall walleye removals. The commercial harvest appears to be monitored quite well and the other removals on an absolute and relative basis to provide at least adequate estimates. Since they involve an analysis of estimates for a number of years, approximately 5, they would be appropriate until another set of recall statistics and human consumption population estimates is available. Both these removals are relatively minor compared to the removals associated with the commercial fishery and are probably quite stable over time. The commercial fishery harvest and removals are regulated through changes in the commercial-fishery TAC. The HCRs are applied annually, and monitoring is sufficiently frequent to support this. Some differences in the recreational and subsistence removal estimates in the management plan are due to changes detected over time (G. Klein, pers. comm. May 2021). Stock abundance indicators and removals are monitored with a frequency and a level of accuracy sufficient to support the walleye HCRs.

It is concluded that stock abundance and removals are monitored regularly at a level of accuracy and coverage consistent with the HCRs, and one or more indicators are available and monitored with sufficient frequency to support the HCRs. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

Walleye stock exploitation and individual well-being and condition are monitored and regulated by two indicators and commercial fish harvests (**Error! Reference source not found.**). However, it is felt that the information required by the HCR is not monitored with a high degree of frequency, for example, through annual estimates of total mortality, and with a high degree of certainty, primarily because of the number of samples collected and the powers of detecting change related to overall sampling effort (Klein et al. 2020). For example, total annual mortality rate for walleye is calculated by the accumulation of 3 years of sampling effort. It would be more informative to have this calculated more frequently than every 3 years; it should be explored to see if fewer years of data could be used yet still be statistically valid. Also, although relative weight is informative in understanding impairment, it does not completely address high relative weights related to reduced abundance also reflecting low population densities. However, the other performance indicator, total mortality rate, would inform and respond to lower densities, which would trigger a reduction in the TAC. Although discards are reported to be few, this is not well documented with direct survey or observational data particularly related to the commercial fishery. Although it is documented that there is no unwanted catch of walleye in the commercial fishery (Klein et al. 2020), this needs some confirmation and, as such, creates a measure of uncertainty in total removal estimates. This lack of direct reporting results in a degree of uncertainty in the total removal estimates. For these reasons, important information is lacking that would strengthen the HCRs and improve the degree of certainty around the information available.

All information required by the HCRs is not monitored with high frequency or with a high degree of certainty that permits the required understanding of the inherent uncertainties in the information. SG 100 for SIb is not met.

c	**Comprehensiveness of information**			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Yes	
Rationale				

The following evidence indicates SG 80 is met:

Given the area and the types of fisheries conducted, there is good and comprehensive information on commercial fish harvest and removals. The commercial fishery is the major fishery for walleye, accounting for approximately 80% (78.6%) of the overall exploitation of this species. There is a recreational fishery that has been evaluated through a 5-year recall survey. Given the remoteness of the area and the unpredictable nature of this fishery, the data provided are reasonably comprehensive. The recreational fishery is considered to account for 10.5% of the overall walleye harvest. Quite importantly, as has been indicated, the recreational fishery and the commercial fishery are somewhat spatially separated. The recreational fishery is conducted in Cross Bay, whereas most of the commercial fishery is conducted in the Southeast Basin (Klein et al. 2020). But if one is to evaluate the overall fishery in Cedar Lake, these two locations would need to be considered and species movement between them evaluated. A comprehensive on-water creel census would probably not be practical, but there are a few resorts and lodges that cater to recreational fishers, and voluntary angler creels, logbooks, fishing-lodge logs and interviews would provide more specific information on recreational removals. It is recommended that such data be acquired to make these removals more local and timely. The subsistence fishery is extremely important and obviously walleye is a desired food fish, accounting for 10.9% of the overall walleye harvest. Given the type of subsistence fishery conducted, it would be difficult to acquire direct information, but statistical data on populations and a number of detailed studies looking at consumption rates provide a good general insight concerning exploitation of walleye by the subsistence fishery (Klein et al. 2020). These estimates are adequate for the present understanding; however, it would be useful to acquire local consumption information more directly. A survey of the residents of Easterville and the Chemawawin Cree Nation would provide very specific information. There appears to be no unwanted catch in the subsistence fishery or discarding, given the food value of all fish species, in particular walleye, and the cultural attitudes of these fishers in respecting all fish; broad use is confirmed by historic evidence. Because of the obvious value of walleye, discarding would not be expected in any of the fisheries, given the financial value of walleye and its desirability as a fish food; nevertheless, direct evidence would be more informative. Recreational removal of walleye might change over time, but like other removals, if significant, there would be a detectable change in the total mortality estimate. Subsistence removal is probably relatively stable and associated only with population changes, which would be expected to be low. Nevertheless, it is recommended that more direct local evidence be acquired for the recreational and subsistence fisheries. A survey should be conducted to update local consumption to better assess subsistence removals. Commercial harvest is more easily managed than the other removals, has the potential for the greatest change, and is more directly related through the TAC, so it is the primary harvest to be managed through the harvest strategy and the HCRs.

There is good information on all fish removals from the stock. SG 80 for SIc is met.

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Draft scoring range	≥80
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.4 – Assessment of stock status – Walleye (UoA1)

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Yes	No
Rationale				

The following evidence indicates SG 80 is met:

The walleye assessment uses two reference point performance indicators to evaluate empirical stock status in relation to a base quota or RAH of 211 t (Klein et al. 2020). These indicators are derived from the annual coarse-mesh index gillnetting survey conducted primarily in the Southeast Basin of Cedar Lake but also to a lesser degree in the shallower Northwest Basin. These proxy indices have been developed around a spawning potential ratio analysis and respond to changes in total mortality rate and body condition. Total annual mortality rate of walleye is assessed by using sampling conducted over a 3-year period. The average annual catch of walleye in the coarse-mesh gillnet indexing program for the 11-year period that indexing has been conducted is quite large, with a mean of 197.7 individuals (Table 9). The other indicator involves an annual measure of relative weight and is calculated for two size categories of walleye; both have a relatively low variance and are currently at a very high level. Although the assessment is not model-based, it seems quite appropriate for the walleye stock and for assessing the HCRs, adjusting the annual RAH, and determining an appropriate TAC.

The assessment is appropriate for the stock and the harvest control rule. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

The walleye assessment takes into account some features relevant to the biology of the species, but other major features are lacking. For example, the recreational and subsistence fish removals are calculated using amalgamated and delayed estimates from recall surveys and human fish-consumption estimates for northern Manitoba. Direct local measures are needed to improve the precision of these estimates. These are not as timely or as directly measured as would be desired, and harvest in these fisheries amounts to an estimated 21.5% of the walleye harvest. Inter-basin movements, particularly those associated with Cross Bay and Southeast Basin, should be evaluated. It is known, for example, that lake whitefish move between Cross Bay and the Southeast Basin, so movement of walleye, particularly the larger individuals, should be examined even though it may not be as significant as the lake whitefish movement which, according to commercial harvest in the Southeast Basin, can be quite large. The recent initiation of assessment netting for 3 years in Cross Bay will be useful in better understanding whether these two locations have similar or different stock structure. It would also be important to estimate natural mortality more directly and estimate the total annual mortality rate more frequently to increase the precision of this important target reference point estimator. Some of these important information gaps are also discussed in PI 1.2.3 SG 100 for SIa and SIb.

The assessment does not take into account the major features relevant to the biology of the species and the nature of the UoA. SG 100 for SIa is not met.

b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Yes	Yes	

Rationale

The following evidence indicates SG 60 is met:

The assessment estimates stock status appropriate for generic reference points: total annual mortality rate (TRP) and relative weight are used here. These are estimated appropriately for walleye, using the assessment approach provided here.

The assessment estimates stock status relative to generic reference points appropriate to the species category. SG 60 for SIb is met.

The following evidence indicates SG 80 is met:

The assessment estimates stock status appropriate for the two proxy reference points that are used here: total annual mortality rate (TRP) and relative weight. These are estimated appropriately for walleye, using the assessment approach provided here.

The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated. SG 80 for SIb is met.

c	**Uncertainty in the assessment**			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Yes	Yes	No

Rationale

The following evidence indicates SG 60 is met:

The assessment addresses major aspects of the walleye commercial fishery, which account for the majority of the harvest of the species in Cedar Lake, approximately 78.5%; this removal is well documented. This commercial harvest is conducted primarily in the Southeast Basin, where the majority of the assessment is carried out, using both coarse- and fine-mesh gillnet indexing. This assessment identifies the major sources of uncertainty. SG 60 for SIc is met.

The following evidence indicates SG 80 is met:

It is apparent that the assessment evaluates stock status, taking uncertainty into consideration, and uses two indicators to evaluate this. Two indicators somewhat reduce uncertainty, compared with the use of just one. This seems appropriate, given the nature of the fishery. The assessment takes uncertainty into account. SG 80 for SIc is met.

The following evidence indicates SG 100 is not met:

The assessment takes uncertainty into account, but not in a probabilistic way. Therefore, the SG 100 for SIc is not met.

d	**Evaluation of assessment**			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			No

Rationale

The following evidence indicates SG 100 is not met:

The assessment has not been tested, so it is not possible to ascertain whether it is robust. Alternative hypotheses and assessment approaches have not been rigorously explored. SG 100 for SId is not met.

e	**Peer review of assessment**			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		No	No
Rationale				

The following evidence indicates SG 80 is not met:

The assessment of stock status has not been subject to peer review. SG 80 for SIe is not met.

The following evidence indicates SG 100 is not met:

The assessment has not been internally and externally peer reviewed. SG 100 for SIe not met.

References

Klein, G., W. Galbraith, and I. Kitch. 2020. Cedar Lake Fisheries Management Plan. Manitoba Agriculture and Resource Development. Manuscript Report No. 20-01. 66 pages. [In this document also referred to as CLFMP 2020.]

Draft scoring range	
Information gap indicator	SI (e) There is no evidence that a peer review, either internal or external, has been conducted.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.1.1 – Stock status – Northern pike (UoA2)

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guide post	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Yes	Yes	Yes
Rationale				

The following evidence indicates SG 60 is met:

The MSC standard (MSC 2018) allows for the use of surrogate, or proxy, reference points to evaluate stock status with respect to PRI and B_{MSY} (GSA2.2.3). The stock status reference point used is total annual mortality rate. The northern pike stock is at a level that maintains high productivity and has a low probability of recruitment overfishing. A spawning potential ratio analysis in relation to age (Clark 1993, Slipke et al. 2002, Hordyk et al. 2015) was conducted to better understand the current status of the pike stock (Figure 19). The SPR is a simple ratio of averaging lifetime production of mature eggs per recruit to what would be expected if the population were not fished. Fishing mortality expressed as spawning potential ratio requires a reference point as an appropriate proxy for fishing mortality that supports a maximum sustainable yield, F_{MSY}. In this SPR analysis, the general target fishing mortality level of $F_{35\%}$ was used (Clark 1993, 2002). The fishing mortality target reference point is the point where pike recruitment might be impaired. MSY was considered and represented the modelling fishing rate required to achieve $F_{35\%}$ at age 13 (Figure 19). Various percentile bounds permitted a comparison of current SPR conditions in relation to age and A_{MSY} and MSY. It was apparent that the 95% confidence limit of mortality of pike is above the point where recruitment would be impaired, so it is not only likely, but there is considerable certainty, that the pike stock is above the point of recruitment impairment.

It is likely that the stock is above the point where recruitment would be impaired (PRI). SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

The spawning potential ratio analysis indicates that the pike fishery in Cedar Lake is well above the point of recruitment impairment; even if fishing at F_{MSY}, the spawning potential ratios are well above $F_{35\%}$ modelled to the maximum female age of 13 (Figure 19). This is primarily because pike are not vulnerable to the large minimum mesh size used in the Cedar Lake commercial fishery (108 mm and larger) until they are 3 years of age and are not fully recruited until age 6. Around 90% of female pike are immature at age 4. The pike harvest of all three fisheries during the past 5 years was 193.1 t. Modelling indicated that for the past 5 years, annual fishing mortality for pike was 13.1%. This suggests that the standing stock of harvestable pike was 1,473 t (Klein et al. 2020). The standing stock at the point of recruitment impairment was estimated to be 314 t, only 21.3% of the harvestable standing stock. Even the 95th percentile estimate of annual fishing mortality at 21.2% still implies the stock size is 2.9 times larger than the point of recruitment impairment. There is a high degree of certainty that the pike stock is above the point of recruitment impairment, primarily because female pike mature young and are not fully recruited to the minimum allowable gillnet mesh size of 108 mm and the commercial gillnet fishery until age 6.

It is highly likely that the stock is above the PRI. SG 80 for SIa is met.

The following evidence indicates SG 100 is met:

The spawning potential ratio analysis indicates that the pike fishery in Cedar Lake is well above the point of recruitment impairment (Figure 19). During the most recent 5-year period, the standing stock of harvestable pike in Cedar Lake was estimated to be 1,473 t (Klein et al. 2020). The standing stock at the point of recruitment impairment was estimated to be 314 t, only 21.3% of the harvestable standing stock. Even the 95th percentile estimate of annual fishing mortality at 21.2% still implies the stock size is 2.9 times larger than the point of recruitment impairment. The modelled annual fishing mortality of pike is estimated at just 13.1%, well below the fishing mortality at maximum sustainable yield. pike are being fished well below their potential. Total annual mortality rate of pike for 2019–2020 was 45.1%, whereas the total annual mortality rate target reference point (the estimate of A_{MSY}) is 64%. Also, the current SPR modelled for 2015 to 2019 is well above the MSY, as are the 70th, 80th, and 90th percentiles over the age range modelled (Figure 19).

There is a high degree of certainty that pike fishing rates are well below F_{MSY}. It is possible to conclude with a high degree of certainty that the stock is above PRI even though the dataset is short and there is only one HCR stock status indicator.

There is a high degree of certainty that the stock is above the PRI. SG 100 for SIa is met.

b	**Stock status in relation to achievement of Maximum Sustainable Yield (MSY)**			
	Guide post		The stock is at or fluctuating around a level consistent with MSY.	There is **a high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Yes	No
Rationale				

The following evidence indicates SG 80 is met:

The HCR stock status indicator (total annual mortality rate) for northern pike has been in place since 2017. Only one index value is provided, which amalgamates 5 years of catch data, 2015–2019. At 45.1%, it is considerably less than the TRP value of 64%, and it has been well below this target reference point. The spawning potential ratio analysis, using 2015 to 2019 data, indicated that the stock has been around a level consistent with MSY. The current SPR modelled for 2015 to 2019 is well above the MSY, as are the 70th, 80th, and 90th percentiles over the age range considered, 1 to 13. The surrogate for stock status, as well as the SPR analysis, confirms that the pike stock is at least at a level consistent with MSY.

The stock is at, or fluctuating around, a level consistent with MSY. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

The spawning potential ratio analysis was conducted for the period 2015 to 2019 and confirms that during that period, the northern pike stock was at a level consistent with MSY. However, there are no long-term data to substantiate this, and only one proxy indicator of stock status (GSA2.2.3.1), total annual mortality, is available for only one combined 5-year period, 2015 to 2019. Total annual mortality estimates are made by combining 5 years of data. Harvest control rules have been in place since 2017; the time series would be too short for the HCR stock status indicator in place. Therefore, there is no evidence to conclude with a high degree of certainty that the pike stock has been fluctuating around or above a level consistent with MSY, primarily because there is no available time series and the SPR analysis is a composite that uses the amalgamated data for a 5-year period.

There is not a high degree of certainty that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years. SG 100 for SIb is not met.

References

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Stock status relative to reference points			
	Type of reference point	Value of reference point	Current stock status relative to reference point
Reference point used in scoring stock relative to PRI (SIa)	Total annual mortality rate (TRP)	0.64 (A)	0.451 (A) For combined 5-year period 2015–2019
Reference point used in scoring stock relative to MSY (SIb)	Total annual mortality rate (TRP)	0.64 (A)	0.451 (A) For combined 5-year period 2015–2019
Draft scoring range	≥80		
Information gap indicator	N/A		

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.1.2 – Stock rebuilding – Northern pike (UoA2)

PI 1.1.2		**Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guide post	A rebuilding timeframe is specified for the stock that is the **shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
Rationale				

SIa SG 60 and SG 100

The present stock score of 80 or above on PI 1.1.1 (SA2.3.2) indicates that rebuilding is not currently necessary. From time to time, the northern pike stock is considered as a target species for the commercial fishery. However, the primary target species is walleye, and for most of the commercial fishing effort, pike are an important incidental catch. The pike stock has always been strong and matures late in life and has not required rebuilding because of fishing effort. The walleye stock was rebuilt in relation to a commercial fishing closure from 1998 to 2002, when effort was reduced and there was substantial restructuring of the fish. Just prior to the closure in 1996–1997, when walleye harvest showed reductions, pike remained moderately abundant, the second most important overall commercial catch after mullet (Figure 14) at 34.2% when mullet were 49.1% and walleye were only 10.9%. After the closure, the commercial fishing effort was reduced essentially by half, reducing the number of licences (Klein et al. 2020). This was focused primarily around walleye commercial fishing effort but would naturally affect pike. But the pike stock at no time required rebuilding. More than 20 years ago, the commercial fishery for walleye collapsed and was rebuilt with a closure from 1998 to 2002. The pike population no doubt benefited from this closure, and that was more than two generation times earlier. Therefore, PI 1.1.2 associated with northern pike stock rebuilding is not evaluated.

The Cedar Lake Fisheries Management Plan makes no reference, nor does it need to, concerning a timeframe for rebuilding the pike stock.

b	**Rebuilding evaluation**			
	Guide Post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is **evidence** that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the **specified timeframe**.	There is **strong evidence** that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the **specified timeframe**.
	Met?	NA	NA	NA
Rationale				

SIb SG 60, SG 80, and SG 100

The present stock score of 80 or above on PI 1.1.1 (SA2.3.2) indicates that rebuilding is not currently necessary. No rebuilding plan for pike is discussed in the CLFMP, so no timeframe or rebuilding evaluation is necessary. The pike stock is strong and has remained strong in Cedar Lake over much of the commercial fishery, primarily after flooding, when the pike stock flourished. And although pike are a target species on occasion, they are not the primary species. They mature late and are not particularly vulnerable to the coarse-mesh commercial nets that are fished and regulated. The environment is conducive to spring flooding of wetlands and regular moderately strong recruitment (Figure 18). Rebuilding of the pike stock in Cedar Lake is not required or envisaged.

A well-designed monitoring program is in place and would be applicable if rebuilding strategies were necessary. However, the pike stock has never required rebuilding, and it is obvious that if it required rebuilding, strategies are in place based on simulation modelling, exploitation rates, or previous performance that rebuilding would be possible if a specific framework were applied. Under present conditions, it is not necessary to determine whether there is strong evidence that a strategy for rebuilding stocks is in place or adequate. Pike HCRs, including TAC and reference points, are appropriate to determine whether rebuilding is necessary and provide the tools for evaluating whether rebuilding is needed. Therefore, PI 1.1.2 associated with pike stock rebuilding is not evaluated.

References

Draft scoring range	N/A
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.1 – Harvest strategy – Northern pike (UoA2)

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Harvest strategy design			
	Guide post	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Yes	Yes	Yes
Rationale				

The following evidence indicates SG 60 is met:

The harvest strategy for northern pike in Cedar Lake employs one stock status indicator with an HCR based on managing total annual mortality rate. The HCR is designed to respond to the state of the stock. Annual pre-commercial season index monitoring is conducted, primarily in late August and early September for a 5-to-7-day period (Appendix 8.1.3). This is a pre-fishing season assessment that comes just before the commercial fishing year in Cedar Lake, which starts on June 1 of the next year and ends the following year on April 30. For the fishing year, the commercial fishing season is closed from May 1 to 31 and opens for the open-water commercial gillnetting from June1 to October 31. The commercial ice-fishing season for the year commences after ice first forms after November 1 and lasts until April 30. Total annual mortality (TRP) in the HCR results in management action to reduce fishing effort. If total mortality (A) exceeds 64% (the estimated A_{MSY}), as determined from the pre-season assessment, then the quota, or recommended allowable harvest, of 366 t is triggered (Table 12). If the total annual mortality is <64% and this base TAC of 366 t is reached, the TAC is increased by 10% per year. However, if total annual mortality is >64%, the base TAC is reduced by 10% per year until A_{MSY} is <64% (Klein et al 2020).The quota set on pike is high but appropriate, given that female pike are fully recruited to 108-mm mesh size at age 6, when around 90% of female pike are mature and have been since age 4, spawning in the spring of their fifth calendar year of life (Figure 17), given that the commercial harvest over at least the past 17-year period since the commercial fishery was closed and restructured has never reached this level (Figure 14). This harvest strategy is expected to achieve the appropriate management of the pike stock in Cedar Lake.

The harvest strategy is expected to achieve stock management objectives reflected in PI 1.1.1 SG 80. SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

Taking into consideration the HCR outlined in SG 60 SIa above, the HCR will be responsive to the state of the northern pike stock. Thus, the harvest strategy incorporates an appropriate monitoring and management response that will achieve the stock management objectives reflected in PI 1.1.1 SG 80.

The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together toward achieving stock management objectives reflected in PI 1.1.1 SG 80. SG 80 for SIa is met.

The following evidence indicates SG 100 is met:

The harvest strategy employs one stock status indicator with an HCR based on managing the northern pike stock in relation to the total annual mortality rate. The basic annual pike TAC or recommended allowable harvest of 366 t has never been caught in the past 17 years since the fishery was closed and restructured. Since the HCRs were adopted in 2017, the harvest of pike has been an average of 52.7% below the quota (Table 13). Also, the total annual mortality rate has not exceeded the target reference point of 64%. Given the delayed harvest related to age of maturity in Cedar Lake pike, the fishing rate trigger used in the HCR is appropriately conservative. This provides evidence that the harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives as reflected in PI 1.1.1 SG 80. The harvest strategy incorporates timely monitoring and management that will be responsive to the state of the stock, which should keep the stock above the PRI and at or above the MSY surrogate.

The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG 80. SG 100 for SIa is met.

b	**Harvest strategy evaluation**			
	Guide post	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Although the HCR has not been in place long, it is based on considerable assessment data and monitoring. Eight years before the harvest strategy and rules were implemented, assessment was conducted on northern pike in Cedar Lake using the standard assessment program of coarse-mesh and fine-mesh index gillnetting (Appendix 8.1.3), as has been used in the assessment program since the HCR for pike was adopted in 2017. Although the harvest strategy has not been fully tested, the strategy appears to be achieving its objectives because the total annual mortality rate (TRP) of 64% has not been exceeded. The harvest appears to be oscillating well below the TAC of 366 t and has actually been, on average, 44.1% lower for the past 11 years (Table 12). The TRP has not been triggered, and since 2016, the mean has been even lower, -52.7% (Table 12). The performance of the index gillnetting, northern pike HCRs, and management responses since 2017 are also provided in SIc 1.2.2. Although the TACs are different, the TRP used here is the same as that used in the Waterhen Lake, Manitoba, commercial gillnet fishery, where pike are MSC certified and sustainably managed in a somewhat similar fishery (Klein and Galbraith 2019). The SG 60 level is achieved.

The harvest strategy is likely to work based on prior experience or plausible argument. SG 60 for SIb is met.

The following evidence indicates SG 80 is met:

The HCRs for northern pike were adopted and implemented in 2017, and evidence exists that they are achieving their objectives. The total mortality rate has not reached a level that has triggered a reduction in the TAC. The annual mortality rate for pike from 2015 to 2019 was estimated to be 45.1%, well below the TRP of 64%, and the quota of 366 t was not reached; indeed, the harvest of pike was well below this. In fact, since 2016, the mean annual harvest has been 173.1 t, 52.7% below TAC (Table 12), so the harvest, which is essentially an incidental harvest in a targeted walleye fishery, did not need to be constrained. The harvest strategy and control rules appear to be achieving their objectives, but there is no evidence that the harvest has been tested fully.

The harvest strategy may not have been fully tested, but evidence exists that it is achieving its objectives. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

The harvest strategy has been in effect since 2017, and although there is evidence that it is achieving its objectives, it has not been fully evaluated so does not meet the SG 100 level.

The performance of the harvest strategy has not been fully evaluated, nor does evidence exist to show that it is achieving its objectives, including being clearly able to maintain the stock at target levels. SG 100 for SIb is not met.

c	**Harvest strategy monitoring**			
	Guide post	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Yes		

Rationale

The following evidence indicates SG 60 is met:

Monitoring is in place to evaluate the harvest strategy. The protocol for the monitoring program is provided in Appendix 8.1.3. Coarse-mesh and fine-mesh index gillnetting has been carried out in a consistent fashion since 2009 in the Southeast Basin of Cedar Lake, where the commercial gillnet fishery is conducted. The harvest strategy for northern pike was adopted in 2017. Although the HCRs have been implemented for only a short time, the harvest strategy was developed from an assessment program that is well established, having been conducted for 11 years, and providing relevant information to develop and evaluate the harvest strategy and stock status of this target species, pike. The assessment program is pre-season monitoring because it is conducted in late summer and fall the year before the commercial fishing season, which commences the following June, the next growing season. The monitoring has caught an average of 56.6 pike annually over the past 11 seasons (Table 9). Results from this assessment since 2017 have provided evidence that the harvest strategy for pike is working. The HCR has one reference point, total annual mortality, which effects changes and reductions in recommended allowable harvest, or TAC, which for pike is set at 366 t. pike are essentially an incidental catch in a much more valuable walleye commercial fishery, and pike harvest has been at a considerably lower level than the base TAC (Table 12). Specific performance of the index gillnetting survey, harvest control rules, and management responses since 2017 is discussed in PI 1.2.2 SIc.

Monitoring is in place that is expected to determine whether the harvest strategy is working. SG 60 for SIc is met.

d	**Harvest strategy review**			
	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Yes

Rationale

The following evidence indicates SG 100 is met:

As indicated in the 2020 CLFMP, the managers review and improve the strategy regularly in consultation with the commercial fishers. Klein et al. (2020) indicated that it is updated annually at the commercial fishers' meeting held in the Easterville Community Centre. It is reviewed twice a year in Easterville on Cedar Lake by Manitoba Agriculture and Resource Development Wildlife and Fisheries Branch staff in collaboration with the commercial fishers. These two annual meetings were mandated by a third amendment in 2016 to the CLFMP of May 2006. That amendment states that the commercial fishers and Manitoba Agriculture and Resource Development Wildlife and Fisheries Branch staff, "shall meet at least twice annually with scheduled meetings occurring at the end of April and the end of October." The CLFMP states that the HCRs will be revisited and discussed with the commercial fishers in the future. It is obvious that there is collaboration associated with the pike harvest strategy and all parties work together well and frequently to review and improve where necessary.

The harvest strategy is reviewed periodically and improved as necessary. SG 100 for SId is met.

e	**Shark finning**			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NA	NA	NA

Rationale

Shark are not present in this freshwater environment.

f	**Review of alternative measures**

	Guide post	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.
	Met?	NA	NA	NA
Rationale				

Concerning SG 60:

As pointed out in the 2020 CLFMP, there is no practical way to execute the pike fishery in Cedar Lake using alternative procedures. There has been no review of potential effectiveness and practicality of alternative measures to minimise mortality of unwanted catch of northern pike, a target species, because pike of all sizes, even small individuals, are valued and utilized in all three fisheries—commercial, recreational, and subsistence. It is documented throughout the 2020 CLFMP that there is little to no unwanted catch of this species (Klein et al. 2020).

Concerning SG 80:

There is no regular review of the potential effectiveness and practically of alternative measures to minimise mortality of unwanted catch of pike, a target species, because pike of all sizes, even small individuals, are valued and utilized in all three fisheries—commercial, recreational, and subsistence. It is documented throughout the 2020 CLFMP that there is little to no unwanted catch of this species (Klein et al. 2020).

Concerning SG 100:

There is no biannual review of the potential effectiveness and practicality of alternative measures to minimise mortality of unwanted pike, a target species, because pike of all sizes, even small individuals, are valued and utilized in all three fisheries—commercial, recreational, and subsistence. It is documented throughout the 2020 CLFMP that there is little to no unwanted catch of this species (Klein et al. 2020).

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Draft scoring range	≥80
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.2 – Harvest control rules and tools – Northern pike (UoA2)

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Under certain conditions, northern pike are a target species. However, most of the harvest is associated with a catch in commercial nets when the primary and most valuable target species is harvested. Nevertheless, sustainable management of a commercial fishery for pike is sought; an HCR is in place to ensure this (Klein et al. 2020). The annual base quota, or recommended allowable harvest (RAH), for pike is 366 t. This quota was retained and adopted in 2017 (Table 11). The control rule uses the total annual mortality target reference point of 64%. Over the past 5 years, the total annual mortality rate (45.1%) has been 20.1% lower than the target reference point (64%) and has not triggered a reduction in the quota. In recent years, this reference point has not been triggered, so the annual quota has not been changed. In fact, harvest in recent years has been lower than the TAC by about 50% (Table 11).

The HCR for pike are as follows:

- The Annual Base Quota, or Recommended Allowable Harvest (RAH) for pike is 366,000 kg:
- **IF** total annual mortality is less than 64% and the base TAC has been reached, **TAC is increased** by 10%·yr^{-1}
- **IF** total annual mortality is greater than 64%, the base **TAC is reduced** by 10%·yr^{-1} until A_{MSY} is less than 64%.

Total mortality rate is calculated annually, using a 5-year running mean. The harvest strategy is reviewed annually by Manitoba Agriculture and Resource Development, taking into consideration the total annual mortality reference point developed from the most recent index netting data. The harvest strategy is reviewed twice a year when Fish and Wildlife staff meet with Cedar Lake commercial fishers in Easterville (Klein et al. 2020).

Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment is approached. SG 60 for SIa is met.

The following evidence indicates SG 80 is met:

The harvest control rule for northern pike is well defined, having one clear reference point in place to trigger reductions in effort and catch when appropriate for the commercial gillnet fishery. An HCR is in place that uses a proxy stock status indicator for total mortality. The trigger index value of A_{MSY} is 64% and corresponds to a value for total mortality consistent with MSY under the assumption that A_{MSY} is equal to 2M (twice the value of natural mortality). Natural mortality (0.32) was estimated by using maximum age (Hoenig 1983) and an average result from et al. (2007) and Malette and Morgan (2005) (Klein et al. 2020). Specifically, if the total mortality TRP should happen to exceed 64% (the estimated A_{MSY}), a quota of 366 t is triggered and the quota is reduced by 10% every year that the performance indicator is above 64%. If the mortality rate falls below 64%, the quota is increased by 10% per year as long as the quota is caught. The pike HCR is well defined, with a biologically meaningful reference point, and is designed to maintain the stock at a level consistent with MSY and to reduce exploitation as PRI is approached.

Well-defined HCRs are in place that ensure the exploitation rate is reduced as the PRI is approached and are expected to keep the stock fluctuating around a target level consistent with (or above) MSY. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

The HCRs are well defined and are in place to ensure sustainable management of the northern pike commercial gillnet fishery. However, more time is required to ensure, with a high degree of certainty, that the HCR provides for the stock to fluctuate most of the time at or above the proxy MSY. Additional corroborating stock status indicators with associated HCRs would be required to meet this scoring guidepost. SG 100 for SIa is not met.

b	**HCRs robustness to uncertainty**			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Yes	No
Rationale				

The following evidence indicates SG 80 is met:

The single HCR for northern pike uses a 10% step-wise approach in adjusting quota that is responsive to the proxy total annual mortality (TRP). Given the size of the pike population, the early maturity of the females, and the delayed harvest related to the age of maturity, the HCR is likely to be robust enough to address major uncertainties. In 2017, maximum age of pike in the Cedar Lake index netting program increased from 11 to 14; that would reduce the estimated A_{MSY} from 64% to 57%. The HCR trigger would still remain conservative. It is unlikely that the rule will be triggered for pike at an A_{MSY} of 57, since it maintains a spawning stock biomass well above the point of recruitment impairment, especially if the minimum mesh size remains at 108 mm. The existing HCR would reduce the spawning potential ratio to just 51% if it were triggered, well above the 35% where recruitment would be impaired (Klein et al. 2020).

The HCRs are likely to be robust to the main uncertainties. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

There are a number of uncertainties concerning the HCRs. Direct measures concerning recreational and subsistence removals would better evaluate overall harvest, and current estimates, although useful, are not measured directly and are somewhat imprecise. Also, some movement of larger pike might be expected between the Southeast Basin, where the commercial fishery is conducted, and Cross Bay, where the primary recreational fishery is conducted (Klein et al. 2020). Either fishery could selectively remove larger pike; however, this cannot be evaluated without length data. For pike, it would be useful to have a better understanding of the size of pike harvested by the various commercial net sizes and also for the graded series used in the coarse-mesh gillnet indexing program. Discarding of pike in the commercial fishery is reported to be low, but this has not been verified with direct evidence. Annual assessment CUE data are not provided and would be quite informative, as would size distribution of the pike caught. This would help inform a better understanding of the ecological role of the stock. Also, more frequent analysis of the total annual mortality estimate would reduce some of the uncertainty around this important performance indicator. Also, a surrogate indicator of stock status is used, so the HCRs do not take into account a broad range of uncertainties. SG 100 for SIb is not met.

c	**HCRs evaluation**			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

The HCRs for northern pike have not been triggered since their fairly recent implementation in 2017. Even though implementation of the HCRs for pike is relatively recent, the harvest appears to be quite sustainable and has fluctuated well below the TAC of 366 t. From 2016 to 2019, a period when the HCRs were in effect, the harvest was, on average, 52.7% below the TAC (Table 12). The Cedar Lake pike population has limited vulnerability to the large-mesh 108-mm commercial nets, and the species is very early-maturing, so it is expected that the tools in use will be effective in achieving the exploitation levels required under the HCRs. Furthermore, pike are targeted only rarely and are an incidental catch in a more important walleye fishery but valuable enough to be harvested. Although the TACs are different, the TRP used here is the same as that used in the Waterhen Lake, Manitoba, commercial gillnet fishery, where pike are certified and sustainably managed in a somewhat similar fishery (Klein and Galbraith 2019). This provides some supporting evidence that the tools and rules being applied here are appropriate even though the management plan and HCRs have been implemented only since 2017.

There is some evidence that tools used or available to implement HCRs are appropriate and effective in controlling exploitation. SG 60 for SIc is met.

The following evidence indicates SG 80 is met:

Even though the HCRs for northern pike have been in place only since 2017, the pike harvest seems quite sustainable, well below the long-time TAC of 366 t. The TRP has not been triggered since the fairly recent implementation of the plan in 2017. The total annual mortality rate was 45.1% and was 0.705 of the TRP, 64%. Indeed, in the past few years it has averaged considerably lower, 52.7% (Table 11). The Cedar Lake pike population has limited vulnerability to the commercial gillnets that are large-mesh. The species is very early-maturing, rarely targeted, and is essentially an incidental catch and harvested in a much more valuable commercial walleye fishery. This provides some supporting evidence that the tools and rules being applied are appropriate even though the management plan and HCRs have been in effect only since 2017.

Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs. SG 80 for SIc is met.

The following evidence indicates SG 100 is not met:

A longer time series of evidence is needed in order to reach the requirements of the SG 100 level. Evidence does not clearly shows that the tools in use are effective in achieving the exploitation levels required under the HCRs. SG 100 for SIc is not met.

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Draft scoring range	≥80
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.3 – Information and monitoring – Northern pike (UoA2)

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	**Range of information**			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

Relevant information related to stock structure and productivity of northern pike is available to support the harvest strategy. Indexing is conducted annually in the Southeast Basin using a range of sizes of five coarse-mesh multifilament index gillnets (35-m-long panels of stretch mesh — sizes 51 mm (2 in.), 76 mm (3 in.), 95 mm (3¼ in.), 108 mm (4¼ in.), and 127 mm (5 in.)), including the minimum size used by the commercial fishery (180-mm stretch mesh) and one mesh size larger (127 mm) (Appendix 8.1.3, CAMP 2021). Although these index nets, which still use multifilament twine, are a different type of filament from that currently used by the commercial fishery, which uses monofilament twine, the index nets are considered to provide catches that change in synchrony with the monofilament nets (Klein et al. 2020). Coarse-mesh gillnet indexing is also conducted in the shallower Northwest Basin on a 3-year rotational basis, and these data are used to combine with the catches from the Southeast Basin to inform stock status and productivity. The index catches are provided for an 11-year period, from 2009 to 2019, only in summary form based on numbers and weight by species and mesh size (Table 9). It is possible to use bulk weight and numbers to estimate mean weight of the individuals caught. Annual CUE by species for the coarse-mesh nets is not provided. Coarse-mesh index gillnets are used to determine changes in total mortality rate calculated from ages amalgamated for 5 years of indexing. Age interpretation is acquired from cleithra, an accurate method for determining age of esocids (Casselman 1996).

Some relevant information related to stock structure and productivity is available to support the harvest strategy. SG 60 SIa is met.

The following evidence indicates SG 80 is met:

Sufficient information is available concerning stock structure, stock productivity, and general harvest and associated data to support the harvest strategy. The catch of northern pike in the indexing gear is sufficient to provide the insights necessary to apply the harvest strategy. On average, over the 11 years of indexing, 56.8 pike were caught annually (Table 9). This is not a large number, but when several years are combined, it is appropriate to understand total annual mortality over the period. Age data is determined by cleithra (CAMP 2021), an accurate and reliable method for determining age of pike (Casselman 1996) and determining the annual mortality rate. The time interval could be reduced if larger numbers of pike were caught and sampled, but pike, although considered a target species, is not the primary target species. pike are essentially an incidental catch in a more valuable walleye fishery, although they are sometimes targeted (Klein et al. 2020). As indicated, although fine-mesh index gillnets are also fished, pike catches are too few to be informative and certainly do not contain small young pike that would better inform recruitment. The reason for this is not fully understood but is suspected to be that fine-mesh index gillnets are not fished shallow enough, since young pike frequent shallow water (Casselman and Lewis 1996). However, it may be impractical to gillnet in the shallows in this flooded impoundment because of persisting trees and woody debris. If this is the case, then this area of woody cover would be an important refugium for small fish. Summary CAMP reports (CAMPP 2014, CAMP 2017) provide important environmental data that indicate that Cedar Lake, even the deeper Southeast Basin, is probably homothermous in midsummer. Temperature data indicate that Cedar Lake is ideal thermal pike habitat, having midsummer temperatures close to the optimum for growth (Casselman 1978) and slightly lower than that which would be thermally optimal for walleye (Casselman 2002). It would also be useful and is recommended that CUE be reported annually for pike and other species for the coarse-mesh index gillnet series so that the dynamics and trends could be analysed, along with possible trends in prey species abundance. It is recommended that for pike, it would also be useful to have length-frequency data for the annual catch, making it possible to evaluate the abundance of pike >600 mm FL to determine what proportion of the population is available to provide predatory ecological services by keeping prey species and small pike at appropriate levels for a well-balanced fish community (Lysack 2004, 2013). There appears to be little unwanted catch of pike in the commercial gillnet fishery, which accounts for approximately 82% of the pike removal. Discards are probably very low, given that even small pike are valuable enough to be marketed (Klein et al. 2020). Pike were not reported as discards in the commercial fishery when fishers were interviewed concerning discarding (Galbraith Q&A March 2021).

Sufficient relevant information related to stock size and productivity is available to support the harvest strategy. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

A comprehensive range of information on the stock and environmental conditions is somewhat lacking and, if available, would be more informative concerning the harvest strategy. Information on early recruitment in pike is not available because small pike (young-of-the-year and yearling) are not sampled; recruitment indices are calculated less precisely from older individuals 2 to 5 years of age (Figure 18). Indexing effort is good but not extensive and has a moderately low power of detecting change (Klein et al. 2020). More intensive indexing, including a broader range of index gillnet mesh sizes, is used in another certified commercial fishery on Waterhen Lake (Klein and Galbraith 2019). Likewise, it would be more informative to have an annual catch per unit effort for pike from the coarse-mesh gillnet indexing program to evaluate changes in pike abundance to better inform status and trends. This can be acquired from the existing data but has not been provided. It is recommended that this be provided annually. Also, annual indexing CUE for prey species such as small catostomids and cisco would provide indirect insights concerning pike population, status, and abundance. Total annual mortality is accumulated by combining 5 years of sampling effort. This is not as precise as it could be if sampling effort were greater. Greater sampling effort would better inform changes in total annual mortality. Even though there is considered to be no unwanted catch of small pike in the commercial fishery, all pike, including small ones, appear to be marketed (Klein et al., 2020). Discarding is not documented, even after specific discussions with the commercial fishers (Galbraith Q&A March 2021). Nevertheless, discarding should be verified by survey and direct observations. Also, recreational fishers would be expected to release some small pike and are regulated to do so for large ones >75 cm. The species is known to survive very well in catch-and-release fisheries, so mortalities related to the recreational fishery for pike would be expected to be low (Crane et al. 2015), but estimates are not provided. Consumption of pike associated with subsistence removal (8.3%) is less than that of walleye (10.9%) and is estimated from general statistics (Klein et al. 2020) but would be better assessed directly through surveys and interviews of local residents. To provide more comprehensive information, it is recommended that recreational and subsistence removals be determined more directly from local surveys, and as well, more direct estimates of natural mortality should be explored, along with inter-basin movement, particularly for large, more predatory pike.

A comprehensive range of information on stock and removals and other information, such as environmental information, is not available. SG 100 for SIa is not met.

b	**Monitoring**			
	Guide post	Stock abundance and UoA removals are monitored and **at least one indicator** is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and **one or more indicators** are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

The pike stock is monitored primarily through the coarse-mesh gillnet monitoring program conducted annually in the Southeast Basin. This was begun in 2009 and has continued for 11 years to 2019 and less frequently, every 3 years, in the shallow Northwest Basin. This indexing program involves fixed stations that are depth-stratified and provides reasonable coverage for Cedar Lake. The annual index sample of pike caught is only moderate; the annual mean for the 11-year period is 56.8 fish (Table 9). The harvest is well documented for pike through deliveries to the FFMC (**Error! Reference source not found.**), and the commercial harvest monitoring system is in place through DCRs. The performance indicator used to adjust the TAC and trigger reductions is total annual mortality rate, which is estimated by calculating the mean for 5 years of coarse-mesh gillnet index assessment data. The natural mortality rate was assessed by using results equally weighted given by the Hoenig maximum-age estimate (1983) and an average from Haugen et al. (2007) and Malette and Morgan (2005). pike catches in coarse-mesh index gillnets are summarized for an 11-year period, providing total weights and numbers by mesh size (Table 9). pike removals are associated primarily with the commercial fishery, which accounts for 82% of overall annual removals. The remaining removals are associated with the recreational fishery, 9.8%, and the subsistence fishery, 8.3%; these estimates, by virtue of recall procedures and historic consumption estimates for northern Manitoba, are not as current as would be desirable or as accurate as would be measured with local surveys. Although the recreational and subsistence estimates are somewhat indirect, they provide the relative extent of these somewhat diverse fisheries and appropriate estimates of associated pike mortalities. They are acquired with sufficient frequency to support the harvest strategy.

Stock abundance and removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the HCRs. SG 60 for SIb is met.

The following evidence indicates SG 80 is met:

As indicated, stock abundance and removals are monitored regularly. The stock is assessed through an annual coarse-mesh gillnet indexing program, which provides samples for evaluating the annual mortality rate. The assessment program is conducted in the Southeast Basin, which receives most of the commercial fishing gillnet effort, and the harvest is delivered to FFMC, where it is documented (**Error! Reference source not found.**). As indicated, there is regular evaluation of other pike removals associated with the recreational and subsistence fisheries. These removals are evaluated by using 5-year recall summary survey data and statistics associated with the local population who use this subsistence fishery. Monitoring of removals other than those associated with the commercial fishery is regular enough to estimate their contributions. The HCRs and the total annual mortality rate target reference point are applied to adjust the commercial fishing TAC, which accounts for approximately 82% of overall pike removals. The commercial harvest is monitored quite thoroughly, and other removals on an absolute and relative basis at least provide adequate estimates of removals. Both these estimates for removals by the recreational and subsistence fisheries are relatively minor compared with those associated with the commercial fishery. Pike are monitored regularly at a level of accuracy and coverage to well inform the HCR and the indicator used. The HCRs are applied annually, and monitoring is sufficiently frequent to support this. Some differences in the recreational and subsistence removal estimates in the management plan are due to changes detected over time (G. Klein, pers. comm. May 2021). Stock abundance indicators and removals are monitored with a frequency and a level of accuracy sufficient to support the pike HCRs.

Stock abundance and removals are monitored regularly at a level of accuracy and coverage consistent with the HCRs, and one or more indicators are available and monitored with sufficient frequency to support the HCRs. SG 80 for SIb is met.

The following evidence indicates SG 100 is not met:

Northern pike exploitation is monitored by one performance indicator—total annual mortality rate—and by harvest of the commercial fishery through deliveries to the FFMC (**Error! Reference source not found.**). However, total annual mortality rate is not monitored very precisely, using only 5-year running means. This assessment is performed because the samples that are collected and the powers of detection are not adequate to evaluate them more frequently (Klein et al. 2020). More frequent estimates of mortality rate would be preferred to provide a comprehensive evaluation. However, this would require greater sampling effort. Furthermore, although there is very little unwanted catch in the primary fishery involving commercial harvest, the unwanted catch is not well documented and discard information is not provided. Similarly, there is no direct evidence of discards associated with the subsistence fishery, and mortalities associated with the recreational fishery are similarly not available. Even though unwanted catch is probably low, evidence is needed to confirm this. This lack of information creates a degree of uncertainty in the total removal estimates. Therefore, important information is lacking to strengthen the evaluation and application of the HCRs and to improve the degree of certainty around the information provided. Pike abundance and trends would be better informed if the annual CUE of the coarse-mesh gillnet indexing program were made available and not just in summary form for the 11-year period. Annual CUE could also provide a useful indicator to help better understand the abundance and dynamics of the pike population.

All information required by the HCRs is not monitored with high frequency or with a high degree of certainty that permits the required understanding of the inherent uncertainties in the information. SG 100 for SIb is not met.

c	**Comprehensiveness of information**			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Yes	
Rationale				

The following evidence indicates SG 80 is met:

Given the types of fisheries considered, there is good and comprehensive information on commercial harvest and reasonably good information on removals by the recreational and subsistence fisheries. The commercial fishery harvests the major proportion of pike, estimated to be 82% of overall exploitation of the species. The commercial harvest is well documented from deliveries to the FFMC. The recreational fishery is evaluated through a 5-year angler recall survey and, given the area covered and the diversity of the recreational fishery, the information provided is fairly comprehensive. The recreational fishery in Cross Bay, however, has spatial separation from the commercial fishery conducted in the Southeast Basin. Given the limited movement of medium and small pike in such productive environments (Casselman 1996), there is probably little population and exploitation overlap of these two fisheries by virtue of the areas fished; however, movement of large pike between these two areas should be evaluated. The recreational fishery takes place in Cross Bay, and the commercial fishery is conducted primarily in the Southeast Basin but is restricted from Cross Bay (Klein et al. 2020). Voluntary angler creels, logbooks, fishing-lodge logs and interviews would help better inform recreational pike removals and would add to a better understanding of the recreational fishery. The subsistence fishery is considered to constitute 8.3% of overall pike removals. The subsistence fishery may not be targeting pike because pike are not considered to be as desirable a food fish as walleye, whereas the recreational fishery is estimated to account for 9.8% of the overall harvest. Consumption analysis from numerous studies and resident statistics for Easterville and the Chemawawin Cree Nation is used to estimate the consumption and subsistence harvest of pike (Klein et al. 2020). These estimates could be improved if a local fish consumption survey of the residents in the Cedar Lake area were conducted. More direct evidence of current fish-consumption practices would no doubt improve the subsistence removal estimate. It is possible that the recreational or subsistence removals would not change much over time. However, it is recommended that this be evaluated. The assessment of the commercial fishery, which represents the greatest removal of pike, is the most important one, most easily managed, and most practically obtained and precisely measured and is the one used to adjust harvest through the HCRs. There appears to be little unwanted catch or discarding of pike in the subsistence fishery because given the food value of all species and the cultural attitudes of these fishers in respecting all fish, when caught in this fishery, they would no doubt be consumed and not discarded. There is no reported evidence that pike are discarded in any of the fisheries, but direct measures are not available and should be acquired. When consulted, fishers did not report unwanted catch or discards of this species even though it was mentioned to occur for other species such as mullets and burbot (Galbraith Q&A March 2021). It would also be informative to have a measure of relative abundance of pike >600 mm FL in both the indexing series and the various catches to better understand size distribution of the population and evaluate whether there is strong size selectivity. This 600-mm length index provides important insights concerning the ability of the pike population to stabilize prey-fish abundance and control over population and stunting of small pike through cannibalism. Lysack (2004, 2013) emphasized the importance of having larger pike in the population to provide an important predatory stabilizing effect on prey fish and small pike abundance. Although fine-mesh gillnets are used in the indexing program, they do not catch many pike and mainly large individuals (Table 10), possibly because the nets cannot be set shallow enough (<2 m) to assess small pike abundance and early recruitment (Casselman and Lewis 1996). It is recommended that distribution of small pike should be evaluated with a few additional shallow-water index net sets.

There is good information on all fish removals from the stock. SG 80 for SIc is met.

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Draft scoring range	≥80
Information gap indicator	N/A

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 1.2.4 – Assessment of stock status – Northern pike (UoA2)

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	**Appropriateness of assessment to stock under consideration**			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Yes	No
Rationale				

The following evidence indicates SG 80 is met:

The northern pike assessment uses one reference point to evaluate empirical stock status in relation to a base quota of 366 t (Klein et al. 2020). This reference point involves the total annual mortality (TRP) and is derived from the annual coarse-mesh index gillnetting survey conducted primarily in the Southeast Basin of Cedar Lake but also to a limited degree in the shallower Northwest Basin. This proxy index has been developed around a spawning potential ratio analysis to evaluate stock status and respond to changes in total annual mortality rate, which is assessed for pike by sampling over a 5-year period. The average annual catch of pike in the coarse-mesh gillnet indexing program for the 11-year period is not large, with a mean of 56.8 individuals (Table 9). The amalgamation of 5 years of data provides an adequate sample for assessing total mortality rate of the stock. The species is not usually targeted in the commercial fishery and is caught incidentally with the more valuable walleye catch, and the stock appears to be abundant and early-maturing such that there are no foreseeable concerns around overexploitation; the catch is essentially a by-catch. Although the assessment is not model-based, it seems appropriate for the pike stock and for assessing the HCR and adjusting the annual recommended allowable harvest.

The assessment is appropriate for the stock and the harvest control rule. SG 80 for SIa is met.

The following evidence indicates SG 100 is not met:

The northern pike assessment takes into account some features relevant to the biology of the species, but other important aspects are quite limited. For example, recreational and subsistence removals are not as timely or as directly measured as would be best. Harvest in the recreational and subsistence fisheries amounts to an estimated 18.1% of the overall pike harvest. The recreational and subsistence fish removals are calculated using amalgamated and delayed estimates from recall surveys and human consumption estimates. Direct measures are needed to improve the precision of these estimates. Also, large pike are known to show rather prominent seasonal movements, which can be quite extensive, particularly in the fall (Casselman and Lewis 1996). Inter-basin movements, particularly those associated with Cross Bay and Southeast Basin, should be evaluated. Lake whitefish appear to move from Cross Bay into the Southeast Basin, and it is quite possible that there are seasonal movements of pike, so these need to be examined. The recent establishment of an assessment netting program in 2020 in Cross Bay may help inform concerning the population structure and stock differences, which will provide insights through, for example, year-class strength and size distributions to assess stocks in these two basins. Also, size distributions would better inform concerning potential prey control (e.g., white suckers and cannibalism reducing the abundance of small pike) by this important apex predator (Lysack 2004, 2013). Total mortality estimates of the pike population are an amalgamation of 5 years of data; these may be adequate for understanding changes in the status of the pike population but are less precise than would be optimal. More frequent estimates of total mortality would be preferable. Given that the pike population is relatively large and early-maturing and that harvest in relation to age of maturity is delayed, the assessment may be adequate; however, a better understanding of some of these major features of the pike population would greatly increase the reliability of the assessment. If possible, direct measures of natural mortality should be acquired for the Cedar Lake pike population. Some of these important information gaps are also discussed in PI 1.2.3 SG 100 for SIa and SIb.

The assessment does not take into account the major features relevant to the biology of the species and the nature of the UoA. SG 100 for SIa is not met.

b	Assessment approach

	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Yes	Yes	
Rationale				

The following evidence indicates SG 60 is met:

The assessment estimates stock status appropriate for a generic reference point; total annual mortality rate (TRP) is used here. This is estimated appropriately for northern pike, using the assessment approach provided here.

The assessment estimates stock status relative to generic reference points appropriate to the species category. SG 60 for SIb is met.

The following evidence indicates SG 80 is met:

The assessment estimates stock status appropriate for the one proxy reference point that is used here, total annual mortality rate (TRP). This is estimated appropriately for northern pike, using the assessment approach provided here.

The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated. SG 80 for SIb is met.

c	**Uncertainty in the assessment**			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Yes	Yes	No
Rationale				

The following evidence indicates SG 60 is met:

The assessment addresses major aspects of the northern pike commercial fishery, which account for the majority of the harvest of the species in Cedar Lake, approximately 81.9%; these removals are well documented. This commercial harvest is conducted primarily in the Southeast Basin, where the majority of the assessment is carried out, using both coarse- and fine-mesh gillnet indexing. This assessment identifies the major sources of uncertainty.

The assessment identifies major sources of uncertainty. SG 60 for SIc is met.

The following evidence indicates SG 80 is met:

It is apparent that the assessment evaluates stock status, taking uncertainty into consideration, and uses one reference point indicator to evaluate this. Given that pike are rarely targeted, the population is strong, fish removals are well understood, and the species is early-maturing, the assessment appropriately takes uncertainty into account. Given the nature of the pike fishery and the relatively low harvest (approximately 50%) in relation to the quota, the pike population appears to be effectively protected from overexploitation.

The assessment takes uncertainty into account. SG 80 for SIc is met.

The following evidence indicates SG 100 is not met:

The assessment takes uncertainty into account, but not in a probabilistic way. SG 100 for SIc is not met.

d	**Evaluation of assessment**

	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			No
Rationale				

The following evidence indicates SG 100 is not met:

The assessment has not been tested, so it is not possible to ascertain whether it is robust. There is no evidence that alternative hypotheses or assessment approaches have been explored. SG 100 for SId is not met.

e	**Peer review of assessment**			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		No	No
Rationale				

The following evidence indicates SG 80 is not met:

The assessment of stock status has not been subject to peer review. SG 80 for SIe is not met.

The following evidence indicates SG 100 is not met:

The assessment has not been internally and externally peer-reviewed. SG 100 for SIe is not met.

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Lysack, W. 2013. What happens to big pike in Manitoba? MS Report provided to J. Casselman, April 2013. 8 pages.

Draft scoring range	60-79
Information gap indicator	SI (e) There is no evidence that a peer review, either internal or external, has been conducted.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage	
Overall Performance Indicator score	
Condition number (if relevant)	

7.4 Principle 1 References

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7.5 Principle 2

7.5.1 Primary and Secondary Species

As per MSC (2018), primary species are the managed, in-scope (e.g., fish and shellfish) species. Primary species will usually be species of commercial value to either the UoA or fisheries outside the UoA, where management tools and measures are in place, intended to achieve stock management objectives reflected in either limit or target reference points.

Secondary species include fish and shellfish species that are not managed according to reference points (i.e., are not primary species), as well as birds, mammals, reptiles and amphibians (all species that are out of scope of the standard) that are not ETP species. Secondary species could in some cases be landed intentionally to be used either as bait or as food for the crew or for other subsistence uses but may also in some cases represent incidental catches that are undesired but somewhat unavoidable in the fishery. There are unlikely to be reference points for biomass or fishing mortality in place for secondary species, and there is often a general lack of data on status.

For primary and secondary species, a ‘main’ designation is then given where either: i) “the catch of a species by the UoA comprises 5% or more by weight of the total catch of all species by the UoA”, ii) “the species is classified as ‘less resilient’ and the catch of the species by the UoA comprises 2% or more by weight of the total catch of all species by the UoA”, or iii) in cases where the total catch of the UoA is exceptionally large, such that even small catch proportions of a P2 species significantly impact the affected stocks/populations (SA3.4.2, MSC 2018).

Based on these definitions and on the catch data provided in the Cedar Lake FMP (Klein et al., 2020), the primary and secondary species from Cedar Lake are listed below (Table 14). The same have been arranged as per their ‘main’ and ‘minor’ designations.

7.5.2 Main Primary Species

In all, there are three main primary species, namely walleye, northern pike, and lake whitefish. Both walleye and northern pike are also the P1, target species for the fishery, but each is scored as a main primary species only in the UoA for the other species. Therefore, while scoring UoA 1 (walleye), northern pike and whitefish form the main primary species, but when scoring UoA 2 (northern pike), walleye and whitefish constitute the main primary species. This requirement is as per SA 3.1.3.1 (MSC 2014). Background information on walleye and northern pike is provided in the Principle 1 introduction (Section 7.2), earlier in this report.

7.5.3 Lake whitefish

Lake whitefish (*Coregonus clupeaformis*) is distributed in North America: Atlantic, Arctic and Pacific basins throughout most of Canada south into New England, the Great Lakes basin, and central Minnesota, USA; Copper and Susitna river drainages in Alaska. Introduced in northwestern USA. Lake whitefish inhabits large lakes and large rivers and is primarily a lake dweller. The species appears to be rather sedentary and its movement in large lakes can be described in four stages: (a) movement from deep to shallow water in the spring; (b) movement back to deep water in the summer as the shoal water warms; (c) migration to shallow-water spawning areas in the fall and early winter; and (d) post-spawning movement back to deeper water. The species forms separate populations in large lakes. Adult whitefish feed mainly on aquatic insect larvae, mollusks and amphipods; also other fishes and fish eggs, including their own Extensive hatchery programs for the propagation have been carried out on the Great Lakes and other areas for years. The above information is summarized from https://www.fishbase.se/summary/234.

Table 14. Cedar Lake commercial landings data for gillnets from 2010-2019

Species	2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		Mean kg	Mean %
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%		
Primary: Main																						
Walleye	253,530	40.7	213,640	39.9	176,462	38.0	199,783	45.5	162,086	35.3	220,026	48.0	188,705	36.5	205,021	33.9	180,515	30.8	219,257	41.5	201,903	38.99
Northern Pike	226,106	36.3	225,876	42.1	207,973	44.7	115,063	26.2	150,290	32.8	98,237	21.4	159,278	30.8	199,125	32.9	197,497	33.7	136,599	25.9	171,604	32.67
Lake Whitefish	52,048	8.3	23,724	4.4	18,383	4.0	16,513	3.8	30,438	6.6	23,944	5.2	27,723	5.4	17,442	2.9	29,591	5.0	20,688	3.9	26,049	4.95
Primary: Minor																						
Sauger	90	0.0	256	0.0	213	0.0	44	0.0	62	0.0	4	0.0	14	0.0	97	0.0	28	0.0	18	0.0	83	0.02
Secondary: Main																						
Mullet	91,822	14.7	72,420	13.5	61,785	13.3	107,657	24.5	115,714	25.2	116,217	25.3	140,174	27.1	183,110	30.2	178,247	30.4	129,611	24.5	119,676	22.89
Secondary: Minor																						
Lake Cisco	0	0.0	0	0.0	20	0.0	40	0.0	0	0.0	206	0.0	1,286	0.2	629	0.1	648	0.1	22,093	4.2	2,492	0.47
Carp	7	0.0	0	0.0	84	0.0	0	0.0	48	0.0	0	0.0	9	0.0	0	0.0	0	0.0	19	0.0	17	0.00
Yellow Perch	28	0.0	19	0.0	28	0.0	3	0.0	9	0.0	1	0.0	7	0.0	1	0.0	7	0.0	1	0.0	10	0.00
Totals	623,631	100	535,935	100	464,948	100	439,103	100	458,647	100	458,635	100	517,196	100	605,425	100	586,533	100	528,286	100	521,834	100

Overall, the Cedar Lake index netting program returns few lake whitefish. For example, in the 11 years of index netting conducted, only 14 lake whitefish have been caught out of which about 71% were reported in 2012 itself. Over the period of last 10 years, contribution of lake whitefish to the total fish catches of Cedar Lake has fluctuated between 2.9–8.3% with the mean proportion during the period being 4.95 or 5% (Table 14). Mean proportion of lake whitefish was a little higher (7.6%) from the preceding period from 1965–1998 (Lysack, 2000). From a precautionary perspective, lake whitefish is assessed as a 'Main' primary species. Lake whitefish appears to be not evenly distributed in Cedar Lake. The Cross Bay area of the lake is stated to be the most preferred habitat of the whitefish. However, the same has been closed for commercial fishing for quite some time.

Lake Whitefish harvest is subject to the same season, gear and licensing restrictions as that of walleye and northern pike. A harvest control rule adopted in 2018 for lake whitefish has determined a base quota of 45,000 kg with a 10% adjustable margin for the next year depending on whether the target is achieved or not (Klein et al., 2020). The quota was not caught/could not be attempted from 2018/19–2020/21. No recent data on stock assessment of the species are available. Given the overall weak representation of the species in the commercial catches and/or index netting samples, it is difficult to arrive at any scientific consensus about the reasons for low abundance (stock collapse, fragmented distribution, etc.). A new index netting program targeting the most preferred habitat of the species–Cross Bay has been planned, which can then provide an updated stock status of the species.

7.5.4 Minor Primary Species

The Cedar Lake FMP 2020 (Klein et al. 2020) designated goldeye and sauger as the 'main primary species.' However, the commercial deliveries data provided in the FMP (Table 4, p. 30) have no entries against goldeye. The only data mentioned in the FMP (Table 5) pertains to total catch of the species from the index netting program, where only 1.8 kg of goldeye was landed in the 10 years from 2009–2019. Thus, sauger remains the only species that represents the minor primary species group in a meaningful manner.

Sauger (*Sander canadensis*) is distributed widely in North America: St. Lawrence-Great Lakes, Hudson Bay, and Mississippi River basins from Quebec to Alberta in Canada, and south to northern Alabama and Louisiana in the USA. Introduced into Atlantic, Gulf and southern Mississippi River drainages. The species inhabits sand and gravel runs, sandy and muddy pools and backwaters of small to large rivers. Less frequent in lake and impoundments. Larvae feed on cladocerans, copepods, and midge larvae, while juveniles consume fishes. They spawn between March and June in pairs or small aggregations. The above information has been summarised from https://www.fishbase.de/summary/3515.

Similar to the lake whitefish, sauger harvests are subject to the same season, gear and licensing restrictions as that of walleye and northern pike. The species is covered by an 'omnibus' quota. No information on the stock status of the species is available.

7.5.5 Secondary Species

The secondary species intercepted by both UoAs are mullet (Main Secondary); lake sturgeon, lake cisco, carp and yellow perch (Minor Secondary). Three out-of-scope bird species also need to be considered as Main Secondary species – Double-crested cormorant, Lesser scaup, and Common loon.

Mullet is a collective term representing three different species, namely white sucker, longnose sucker, and shorthead redhorse. Collectively, mullet contribute 22.9% of Cedar Lake landings (Table 14) and are, therefore, categorised as main secondary. Technically speaking, however, the white sucker alone qualifies as the main secondary species by individually contributing 21% and 28.1% respectively based on the commercial and the index netting data as provided in the Cedar Lake FMP 2020 (Klein et al., 2020). Proportions of the longnose sucker and the shorthead redhorse range from 1.3–1.6% and 0.2–0.5% respectively according to the two datasets. Thus, the latter two species fit the technical description of 'minor secondary'. Nonetheless, given the extremely minor contributions of both to the 'mullet' group, this was disregarded. All mullet are bought as 'lake-run', that is, there is no size grading, since all classes have the same value as minced product. Mullet flesh is ground and sold as a binder for gefilte fish, a minced fish product (Klein et al., 2020). In total, about 130 tonnes mullet were landed in 2019.

The most dominant of the mullets, the white sucker (*Catostomus commersonii*) is a demersal, freshwater and/or brackish water species distributed throughout most of Canada to the Atlantic Coast (North America) and through North Carolina to New Mexico in the south, becoming less common further in the southern High Plains. The species inhabits a wide range of habitats, from rocky pools and riffles of headwaters to large lakes. It usually occurs in small, clear, cool creeks and small to medium rivers. This species may be found at a depth greater than 45 m but moves to shallower water near sunrise and sunset to feed. Fry are mostly planktivorous and may feed on other small invertebrates; bottom feeding commences upon reaching a length of 1.6-1.8 cm. White sucker is preyed upon by birds, fishes, lamprey, and mammals (https://www.fishbase.se/summary/catostomus-commersonii.html).

The Longnose sucker (*Catostomus catostomus*) and the Shorthead redhorse (*Moxostoma macrolepidotum*) distribution is very similar to that of the white sucker. The former occurs in clear, cold, deep water of lakes and tributary streams. It moves from lakes into inlet streams or from slow, deep pools into shallow, gravel-bottomed portions of streams to spawn. The sucker feeds on benthic invertebrates. Young of the species are preyed upon by other fishes and fish-eating birds; while adults in spawning streams are taken by mammals, osprey and eagles (https://www.fishbase.se/summary/Catostomus-catostomus.html). The latter inhabits rocky pools, runs and riffles in small to large rivers and also occur in lakes. While the adults feed on benthic insect larvae, juveniles consume microcrustacea and midge larvae (https://www.fishbase.se/summary/3008). While the two species respectively account for about 6% and 1% of the mullet landings, their proportion in the total catch is only about 1.3% and 0.2% (Klein et al., 2020).

Lake sturgeon is another main secondary species encountered by the fishery. Lake sturgeon originally existed as a single population but got fragmented into several sub-populations upon construction of hydro-electric dams in the Saskatchewan River Region watershed (McLeod et al., 1999). The Saskatchewan River Region watershed includes the Grand Rapids Dam that led to the formation of Cedar Lake, although the Dam is not considered to have truncated the species significantly owing to the lengthy stretches of the Saskatchewan River and its tributaries in the Cedar Lake region (Klein et al., 2020). Lake sturgeon was first assessed by COSEWIC[1] in 1986, when it was assessed as a single distinguished unit and was considered 'Not at Risk'. However, a population decline led to a permanent commercial harvest ban that has been in effect in Manitoba since 1996. Lake sturgeon was subsequently split by COSEWIC into eight distinguished units in 2005, when the Saskatchewan River population (including Cedar Lake) was assessed as 'Endangered'. In 2017, lake sturgeon was reassessed by COSEWIC as four distinguished units, with the Saskatchewan-Nelson River distinguished unit (including Cedar lake) again being assessed as 'Endangered'. COSEWIC listing does not confer national protection to a species, and the Saskatchewan-Nelson River lake sturgeon population is currently not listed under the Species at Risk Act (SARA). Results of the sturgeon tagging program run by the Saskatchewan River Sturgeon Management Board since mid 1990s indicate a recovering lake sturgeon population, with their numbers increasing from 272 fishes in 2002 to around 14,000 in 2016 (Klein et al., 2020). Interestingly, the same report notes that the eleven years of index netting from 2009 to 2019 did not yield even a single sturgeon in the test nets.

Besides mullet, remainder secondary species are taken in extremely small quantities and there is limited information on their status. They are not monitored or managed against reference points, and so for the purpose of this MSC assessment are designated as 'minor secondary'.

Three bird species are also known to interact with the fishery, namely Double-crested cormorant, Lesser scaup, and Common loon. Being out-of-scope species, they have been considered as main secondary according to GSA3 (MSC, 2018).

The overall frequency of occurrence and/or discard of bird species is thought to be extremely low. For example, no double-crested cormorant has been encountered in Cedar Lake since 2019/2020; and about one common loon is caught per fisher per year (ARD pers. comm.). Fish are the preferred food of the cormorant and the common loon; aquatic invertebrates is the preferred food of the lesser scaup (Cornell Lab 2021). All three species are quite widespread throughout North America and are all designated as LC (Least Concern) according to the IUCN.
All primary species, secondary species, as also the out-of-scope species interacting with the UoAs conform to the IUCN status of LC barring lake whitefish, which has been assigned NE (not evaluated) status. None of the species appear in the SARA registry.

7.5.6 ETP Species

ETP species are defined by the MSC (2018) as species that are:

i. Recognised by national ETP legislation,
ii. Listed on Appendix I of CITES (unless it can be shown that the particular stock of the CITES listed species impacted by the UoA under assessment is not endangered),

[1] COSEWIC = Committee on the Status of Endangered Wildlife in Canada

iii. Listed in any binding agreements concluded under the Convention on Migratory Species (CMS), or
iv. Classified as 'out of scope' (amphibians, reptiles, birds and mammals) that are listed in the IUCN Red list as vulnerable (VU), endangered (EN) or critically endangered (CE).

Based on the UoAs' catch data and the Species at Risk Action (SARA) registry (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html), there are no ETP fish species that interact with these UoAs. The Assessment Team in its review of the species listed under SARA which may have the potential to interact with the fishery, found that the horned grebe and the western grebe (SARA - listed species) may occur on the lake. However, no reports or records, including fishers' pers. comm., make any mention of these species of ever having being taken.

7.5.7 Habitats

Habitats are defined as the chemical and bio-physical environment, including biogenic structures, where fishing takes place (MSC 2018). A detailed habitat profile of the Cedar Lake is available owing to the Coordinated Aquatic Monitoring Program (CAMP), a joint program run by the Government of Manitoba and Manitoba Hydro starting 2008/2009. The primary objectives of sampling under CAMP are: (a) to monitor and document the physical, chemical, and biological conditions of Manitoba Hydro's existing hydraulic system, in accordance with established scientific protocols, and (b) to provide long-term information on key physical, chemical, and biological parameters that can be used to assess environmental conditions and track aquatic ecosystem health over time (CAMP 2017a). As is evident, any sampling performed toward fulfilling these aims would end up generating a comprehensive profile of the studied water bodies. This has been true in the case of Cedar Lake too and has been outlined in the following account.

Fishing activities in Cedar Lake target two basins of the lake, namely the Southeast Basin and the West Basin. The former is the most important contributor to the commercial landings from the lake. Incidentally, habitat and ecosystem-oriented sampling under CAMP is conducted in the same two basins of the lake. While the Southeast Basin is sampled annually, the West Basin is sampled after every three years. Sampling of Cedar Lake under CAMP was initiated in 2009/2010. Some salient habitat features of the two basins as evident from the CAMP surveys are highlighted in Table 15 (CAMP 2017b).

Table 15. Habitat features of Cedar Lake

Feature	West Basin	Southeast Basin
Lake morphology		
Surface area (km^2)	1216.0	1246.0
Shoreline length (km)	1098.0	851.0
Shoreline development ratio	8.9	6.8
Depth (nearshore, m)	–	0.58
Depth (offshore, m)	–	6.18
Benthic substrate (nearshore)	–	boulder, cobble
Benthic substrate (offshore)	–	clay loam, silt loam
Water parameters (open water, mean)		
Dissolved oxygen (surface, mg/L)	9.39	9.13
Dissolved oxygen (bottom, mg/L)	9.08	8.71
Secchi disk depth (m)	0.43	1.81
Total suspended solids (TSS, mg/L)	42.40	3.80
Turbidity (NTU)	20.73	3.39
Nutrients		
Total phosphorous (TP, mg/L)	0.0327	0.0204
Trophic status	Meso-Eutrophic	Meso-Eutrophic
Total nitrogen (TN, mg/L)	0.83	0.45
Trophic status	Eutrophic	Mesotrophic
Chlorophyll-a (Chl-a, μg/L)	9.53	8.81
Trophic status	Eutrophic	Eutrophic

Water parameters (DO, Secchi depth, turbidity) indicate that the lake waters are optimal for fish growth. The lake's shoreline development ratio and nutrient profiles (TP, TN, Chl-a) all indicate that the lake is highly productive. Heavy metals profile of the lake indicate that Cedar Lake is free of heavy metal pollution (CAMP 2017b). Data are also available on the sediment quality and BMI (benthic macroinvertebrates) has been regularly recorded for the nearshore and offshore areas of the lake. CAMP uses several indicators/metrics in determining BMI quality, such as total abundance of BMI species, species richness, and species diversity. This is besides the habitat type and texture mentioned earlier (CAMP 2017a). Specifically, the ecological status of habitats is determined based on total number of invertebrates, EPT:C ratio (of combined abundances of Ephemeroptera [mayflies], Plecoptera [stoneflies], Trichoptera [caddisflies] to the abundance of Chironomidae [non-biting midges]), total taxon richness, etc.

Trophic status of both basins inferred based on TP, TN, and Chl-a values indicate that Cedar Lake is highly and most productive in the entire Saskatchewan River Region. The same is evident from the comparative account on the trophic status waterbodies from the region in Table 3-3 of the CAMP report (CAMP 2017b). Overall, the indices provide ample indication about the highly productive and healthy status of Cedar Lake habitat.

Offshore areas of Cedar Lake are mostly soft-bottomed and covered with clay and/or silt loam sediments; the inshore areas are prominently occupied by cobble or boulder (Table 15). The soft bottoms of the lake are composed of sand (0.6%), silt (34.6%) and clay (64.8%) (CAMP 2017a). Cobble or boulders from the nearshore areas of the lake are preferred egg-laying sites for several species, such as lake whitefish. Smothering of the spawning grounds (cobble and boulders) with fine sediments could hamper egg-laying and/or their development. Gear used for commercial fishing such as the bottom-set gillnets have limited potential to bring about such perturbations since they come into contact with the soft offshore sediments. However, such contact is only brief when the gears are deployed for fishing and studies have shown that this has only minor impacts on the bottom habitats and their structure (e.g., ICES 1995, Morgan and Chuenpagdee 2003).

7.5.8 Ecosystem

Ecosystem includes elements such as trophic structure and function, community composition, and biological diversity (MSC, 2018). Cedar Lake belongs to the 'Boreal Plain' ecozone and the 'Mid-Boreal Lowland' ecoregion. The majority of the lake's watershed is made up of cultivated crops.

In the absence of fishing, fish communities are known to be shaped by and/or represent the ecosystem health of any water body. CAMP uses several quantitative metrics for routine determination of ecosystem health and/or of the fish communities of the Lake. Commonly monitored indicators (and their metrics) include: fish abundance (CPUE), community diversity (Hill's diversity index), species condition (Fulton's condition factor), and species growth (length-at-age and/or weight-at-age measurements). Of these, CPUE or the index of abundance can potentially serve as a proxy for fish stock status. A total of four water bodies from the Saskatchewan River Region are routinely monitored under CAMP. The outcomes of this monitoring– the Six-year summary report (2008-2013) indicates that Cedar Lake possesses the best values for several indices. For example, the Hill's diversity index (6.7–7.1) and CPUE (59.0–59.6, standard gang) values of Cedar Lake are the best in the entire region (CAMP 2017b).

The foregoing profiles on Cedar Lake habitat and ecosystem strongly indicate that the lake's ecosystem is very healthy and robust. They also indicate that the structure and functioning of the ecosystem have not been compromised by any action/s of the UoAs.

Table 16. Scoring elements

Component	Scoring elements	UoA 1 Walleye	UoA 2 Northern pike	Data-deficient
P2 – Primary	Walleye	N/A	Main	No
	Northern pike	Main	N/A	No
	Lake Whitefish	Main	Main	No
	Sauger	Minor	Minor	No
	Goldeye	Minor	Minor	No
P2 – Secondary	Mullet	Main	Main	Yes
	Lake sturgeon	Main	Main	No
	Double-crested cormorant*	Main	Main	No

Component	Scoring elements	UoA 1 Walleye	UoA 2 Northern pike	Data-deficient
	Lesser scaup*	Main	Main	No
	Common loon*	Main	Main	No
	Other species (including lake cisco, carp, yellow perch, burbot)	Minor	Minor	Yes
P2 – ETP	N/A	–	–	–
P2 – Habitats	Boulders and cobble (commonly encountered in nearshore areas)	Main	Main	No
	Clay loam and silt loam (commonly encountered in offshore areas)	Main	Main	No
P2 – Ecosystem	Fish community structure and function	Main	Main	No
	Benthic community structure	Main	Main	No

* Out-of-scope species

7.6 Principle 2 Performance Indicator scores and rationales

PI 2.1.1 – Primary species outcome

PI 2.1.1		The UoA aims to maintain primary species above the point where recruitment would be impaired (PRI) and does not hinder recovery of primary species if they are below the PRI		
Scoring Issue		SG 60	SG 80	SG 100
a	Main primary species stock status			
	Guide post	Main primary species are **likely** to be above the PRI. OR If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding.	Main primary species are **highly likely** to be above the PRI. OR If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs Walleye & Pike – Yes Lake Whitefish – No
Rationale				

‘Primary species’ are defined by the MSC as: (a) species in the catch that are not covered under P1 because they are not included in the UoA; (b) Species that are within scope of the MSC program as defined in FCP Section 7.4; and (c) Species where management tools and measures are in place, intended to achieve stock management objectives reflected in either limit or target reference points (MSC 2018).

A ‘main’ designation is then given where either: (a) the catch of a species by the UoA comprises 5% or more by weight of the total catch of all species by the UoA, (b) the species is classified as ‘less resilient’ and the catch of the species by the UoA comprises 2% or more by weight of the total catch of all species by the UoA, or (c) in cases where the total catch of the UoA is exceptionally large, such that even small catch proportions of a P2 species significantly impact the affected stocks/populations (MSC 2018).

Cedar Lake fishery has three main primary species: walleye, northern pike, and lake whitefish (Table 14). Both walleye and northern pike are also the P1, target species for the fishery, but each is scored as a main primary species only in the UoA for the other species. Therefore, while scoring UoA 1 (walleye), northern pike and whitefish form the main primary species, but when scoring UoA 2 (northern pike), walleye and whitefish constitute the main primary species.

The following evidence indicates SG 60 is met:

Lake whitefish – see SG 80.

Walleye – see SG 100.

Northern pike - see SG 100.

The following evidence indicates SG 80 is met:

Lake whitefish (Main primary species for UoAs 1 and 2): During the 23 years period from 1996–2019, lake whitefish accounted for 5% of the commercial landings. On the other hand, the average proportion of the species in the index nets during 2009–2019 was only 0.2% (Klein et al., 2020). Similarly, the mean CPUE of lake whitefish for standard gangs operated in the Saskatchewan River Region is generally low ranging from a high of 2 fish/100 m/24 h in South Moose Lake to a low of zero fish in Cedar Lake (West Basin) and the Saskatchewan River (CAMP, 2017b). How (and why) the catchability of the index vs commercial nets varies has been explained by the ARD in response to several related queries by the Assessment Team. The basic difference lies in the webbing of the two gears. The index and commercial nets respectively are of multifilament and monofilament type. Besides, the material used for the 51, 76, and 95 mm mesh panels of the index nets is twisted nylon; commercial nets are of monofilament type. Commercial monofilament nets are known to possess higher efficiencies than the index nets in general. Even among the monofilament nets, catchability is known to vary depending on the twine diameters used. Another source of variation in the catchabilities of the two nets relates to different months of operation. For example, the index netting occurs in late August/early September (prior to lake whitefish spawning), whereas commercial fishing occurs in October (in lake whitefish spawning areas). An entirely different variation of the commercial net exists in the form of a three-stranded (monofilament) net with each strand having a diameter of 0.18 mm (ARD pers. comm.).

Whitefish quota (adjusted annually by 10%) for 2018/19 of 45 tonnes was not caught and had to be lowered to 40.5 tonnes for 2019/20 and the same was retained for 2020/21 fishing year (Klein et al. 2020). The UoAs have failed by an overwhelming margin in achieving this quota. The 2019 landings of whitefish were 20.7 tonnes or almost half of the target set for the species. This raises several concerns as to the exact abundance of the species. According to ARD, the best whitefish habitat in the entire Cedar Lake lies in Cross Bay but the area is closed for commercial fishing (Klein et al. 2020). Also, the commercial landings of the species from the Southeast Basin are thought to be strays from the bay area. Nonetheless, Cross Bay has never been subjected to index netting as yet and joint sampling has been planned by CAMP and the Napanee Bay fishers. Once this outcome becomes available, it will help address the data deficit/uncertainties surrounding the species.

The following evidence indicates SG 100 is met:

Northern pike (Main primary species for UoA 1). Northern pike forms about 33% of the Cedar Lake catch based on the 1996–2019 data as provided in FMP (2020). Proportion wise this indicates a drop of 10% as compared to an earlier period from 1965–1998 (Lysack, 2000). Stock assessment indicates that the 95th percentile confidence limit of the current mortality rate is above the point where recruitment would be impaired, so there is a high degree of certainty the stock is above the point of recruitment impairment. The modeled annual fishing mortality rate is 13.1%. Additionally, the 95th percentile estimate of annual fishing mortality at 21.2% implies the stock size is 2.9 times larger than the point of recruitment impairment. The spawner-per-recruit model for Cedar Lake northern pike (Fig. 14; FMP, 2020) also suggests similar status with respect to MSY. More details on the stock status of the species can be found in section 7.2.8 of this report. SG 100 is met.

Walleye (Main primary species for UoA 2). Walleye is currently the most dominant component of Cedar Lake catch with a mean contribution of about 39% over the last decade (Klein et al. 2020). The current SPR (spawner potential ratio) is above the F35% threshold with the 80th percentile confidence interval also being above MSY, both indicating that the stock is above PRI. Walleye fishery was closed in 1998 and later reopened in 2002. The total allowable catch of walleye was reduced from 300 tonnes to 211 tonne base quota in 2017 and is subject to downward or upward revision depending on whether annual mortality exceeds 40% or remains under 40%, respectively. Since walleye MSY is achieved at A = 42%, the 40% mortality threshold appears conservative while still allowing for potential error in estimating mortality (Klein et al. 2020). Since the revision in the harvestable quota of walleye in 2017, it was crossed in 2019 (Table 14). Some uncertainties do exist, however, with the natural mortality estimates for the species from Cedar Lake. For more details on the stock status of the species, please refer to section 7.2.2. SG 100 is met.

Lake Whitefish **-** too many uncertainties prevail with regard to the abundance of lake whitefish and the present catches do not seem to meet the 95% confidence limit of fluctuating around MSY. Thus, SG 100 is not met.

	Minor primary species stock status			
b	Guide post			Minor primary species are highly likely to be above the PRI. OR If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species.
	Met?			Both UoAs Goldeye – No

				Sauger – Yes

Rationale

The following evidence indicates SG 100 is met:

Both the UoAs catch goldeye (*Hiodon alosoides*), and sauger (*Sander canadensis*). According to Lysack (2000) and Klein et al. (2020), the catch proportions of the two species were 1.1 and 0.9%, and 0.0 and 0.02% respectively. Given these proportions and being quota species, both are considered as minor primary species and are common to both UoAs. Both species are governed under a single (omnibus) quota of 300 tonnes of which a single P1 species– walleye– accounts for about 202 tonnes since 2009. A major proportion of the remaining catch is contributed by lake whitefish while the two minor primary species– goldeye and sauger– contribute minor proportions as mentioned above. Both the minor primary species have smaller mean lengths than the whitefish (FishBase 2021). By itself, the minimum mesh size of 108 mm of the commercial gillnets makes the two species less susceptible to capture in the UoAs. Besides, the relative abundance of the two species appears to be very low. This observation is supported by the index netting data (Table 5, FMP 2020) and the DCRs made available by the ARD for the 2016–2020 period. This was further validated from the low retention rates computed for the two species (goldeye, 0.05%; sauger, 3.4%) in the several small-meshed gillnets employed in index netting. Again, similar trends are evident with the retention of these two minor primary species in the legal sized commercial 108 and 127 mm gillnets operated in the Lake.

For sauger, the M and Z mortality estimates are available. However, both rates are very close meaning that almost all of the sauger Z could have been deduced as being from M and that F must be very low (p. 34, FMP 2020). Also, index netting data for sauger show low catches in commercial gears and F is very low too. And on that basis, even if sauger was below the PRI, there is evidence that the UOAs do not hinder recovery. For goldeye, however, none such estimates are available meaning that the species' stock status remains doubtful. Given this, goldeye does not meet SG100; sauger meets SG 100.

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Draft scoring range	UoA 1 = ≥80	UoA 2 = ≥80
Information gap indicator	Information sufficient to score PI Further information on Lake Whitefish is needed in order to confirm whether the RBF will need to be used to assess this main primary species	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.1.1 Scoring calculation

UoA	Species	Main / minor	SIa (60, 80, 100)	SIb (100 only)	Element Score	PI Score
1	Northern pike	Main	100	-	100	90
	Lake whitefish	Main	80	-	80	
	Goldeye	minor	-	default 80	80	
	Sauger	minor	-	100	100	

UoA	Species	Main / minor	SIa (60, 80, 100)	SIb (100 only)	Element Score	PI Score
2	Walleye	Main	100	-	100	90
	Lake whitefish	Main	80	-	80	
	Goldeye	minor	-	default 80	80	
	Sauger	minor	-	100	100	

PI 2.1.2 – Primary species management strategy

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to be above the PRI.	There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the PRI.	There is a **strategy** in place for the UoA for managing main and minor primary species.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Stocks are managed principally through effort management through licensing, and quota setting based on managing total mortality of main primary species around MSY. Base quotas for main primary species are adjusted based on a combination of annual mortality and relative weight (whitefish), annual mortality (pike) and whether the quota is caught (lake whitefish), informed through commercial catch monitoring and fishery independent abundance monitoring. There is also mesh size regulation that minimses the catch of undersized (below market size) fish from the target populations to minimise the risk or discarding. Quota enforcement and uptake as well as mesh regulations are monitored routinely. The fishery is also spatially constrained, particularly in the winter when access is limited to near shore, less remote locations, but fishing is also not permitted within 1.5 km of the location where a stream enters the lake, and the Cross Bay area, an important habitat of the lake whitefish, has been completely closed for commercial fishing; this limits the potential for the fishery to impact other target stocks, also.

For main primary species, there is a strategy in place to contain the effects of the UoAs such that the stock status of the main primary species are maintained and their rebuilding is not hindered. The management is focused on these main species, however, with less emphasis on the minor primary species (sauger and goldeye) which are managed more as a bycatch within the fishery as a whole (including through setting a global quota for primary species other than pike). As such, it is not apparent that there is a full strategy in place for minor primary species. Given the above, the fishery meets SG 60 and SG 80, but SG 100 is not met.

b	**Management strategy evaluation**			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

The management of primary species is based around effort management, quota setting, mesh size regulations and spatial management. Management evaluations are undertaken annually, informed through both catch data and an annual index netting program that is conducted in the commercially significant Southeast Basin of Cedar Lake (and triennially in the West Basin). Several quantitative metrics are used for routine determination of health of the fish communities from the Lake. Metrics include Hill's diversity index, CPUE, Fulton's condition factor, and length-at-age measurements. Of these, CPUE or the index of abundance can potentially serve as a proxy for fish stock status. Overall, these constitute a strategy and indicate to a healthy fish community structure in the lake. The index netting is undertaken with nets using a variety of mesh sizes, which provides good information on incoming year classes as well as selectivity in the commercial fishery. Stock data indicate that the main primary species have a healthy status. It is considered that there is at least some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and species involved – SG 60 and SG 80 are met.

The following evidence indicates SG 100 is not met:

It is not clear that there has been specific testing of the strategy, so SG 100 is not met.

c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a).
	Met?		Both UoAs – Yes	Both UoAs – Yes
Rationale				

The following evidence indicates SG 80 is met:

See SG 100.

The following evidence indicates SG 100 is met:

The management of based around effort management, quota setting, mesh size regulations and spatial management. It is evident that the catch quotas are being followed stringently over time. Catch reporting and index monitoring is undertaken routinely, and status of main primary species is reviewed annually. Also, there is evidence that the partial strategy is being implemented and meeting the objective (maintain main primary stocks at healthy status and, through mesh size regulation, minimise mortality of minor primary species) is being achieved. It's also a small scale, low intensity fishery, so much monitoring and information as for a big, commercial marine fishery cannot be expected under these conditions. Thus, SG 100 is met.

d	**Shark finning**			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A
Rationale				

Cedar Lake is a freshwater body and therefore there are no sharks to score this SI.

e	**Review of alternative measures**			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-

		related mortality of unwanted catch of main primary species.	related mortality of unwanted catch of main primary species and they are implemented as appropriate.	related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A

Rationale

For primary species, there is no unwanted catch since all landed fish are utilised (Klein et al., 2020). For primary species, therefore, this SI is scored as N/A (GSA3.5.3, MSC 2020).

References

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

MSC (2018). MSC Fisheries Standard (and Guidance), v.2.01, 31. August 2018. Marine Stewardship Council, London, 156 pp. Available at: https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-v2-01.pdf?sfvrsn=8ecb3272_11.

Draft scoring range	UoA 1 = ≥80	UoA 2 = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.1.3 – Primary species information

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information adequacy for assessment of impact on main primary species**			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species.	Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Basic information required for managing any species relates to their annual harvestable quota/s. For the three main primary species, base quotas are established relative to MSY and index netting and catch data inform annual evaluations of stock status. Species-specific quotas for the other two species (goldeye and sauger) have not been established. However, an umbrella or a single omnibus quota is declared for four of the five primary species (not including pike).

Barring walleye and northern pike, which are also the P1 target species, the fishery engages only lightly with the whitefish the other main primary species. Status of the primary species, and more so of the P1 target species, has been stable for almost two decades. In itself, this is a strong indication of the species not being adversely impacted by the UoAs. Trends from both the fishery independent and the fishery dependent annual data on the species seems to adequately affirm the healthy status of the concerned species' stocks. Thus, SG 80 is met.

The following evidence indicates SG 100 is not met:

Major data deficiency exists with respect to gaining insights into the stock status of lake whitefish. It is felt that available quantitative information is not entirely adequate to assess the impact of the fishery on all main primary species with a high degree of certainty. SG 100 is not met.

b	**Information adequacy for assessment of impact on minor primary species**			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?			Both UoAs – No

Rationale

The following evidence indicates SG 100 is met:

As mentioned in SI(a), quantitative information representing the status of minor primary species is available from fishery dependent (catch data) and fishery independent (index netting data). Additional metrics on fish abundance or CPUE provide further insights into the temporal trends on stock status of minor species. These quantitative inputs are deemed not entirely adequate in estimating the impacts of the UoAs on minor species status. Thus, SG 100 is not met.

c	**Information adequacy for management strategy**			
	Guide post	Information is adequate to support **measures** to manage **main** primary species.	Information is adequate to support a **partial strategy** to manage **main** primary species.	Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the strategy is achieving its objective.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No

Rationale

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Management of the fishery is relatively intensive in the Cedar Lake. The key strategies employed include annual fishery-independent surveys and assessments, control on fishing effort, quota controls, and area and/or habitat closures for fishing. Overall, these features mean that information is adequate to support a partial strategy to manage all primary species.

The following evidence indicates SG 100 is not met:

It cannot be said with a high degree of certainty the objectives are being achieved. SG100 is not met.

References

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA 1 = ≥80	UoA 2 = ≥80
Information gap indicator	Information sufficient to score PI Further information on Lake Whitefish is needed in order to confirm whether the RBF will need to be used to assess this main primary species	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.2.1 – Secondary species outcome

PI 2.2.1		The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit		
Scoring Issue		SG 60	SG 80	SG 100
a	Main secondary species stock status			
	Guide post	Main secondary species are **likely** to be above biologically based limits. OR If below biologically based limits, there are **measures** in place expected to ensure that the UoA does not hinder recovery and rebuilding.	Main secondary species are **highly likely** to be above biologically based limits. OR If below biologically based limits, there is either **evidence of recovery** or a **demonstrably effective partial strategy** in place such that the UoA does not hinder recovery and rebuilding. AND Where catches of a main secondary species outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main secondary species are above biologically based limits.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs White Sucker, Double Crested Cormorant, Lesser Scaup & Common Loon – Yes Lake Sturgeon - No
Rationale				

There are five main secondary species caught or potentially caught by the fishery – white sucker, lake sturgeon and three bird species – double crested cormorant, lesser scaup and common loon. The latter three belong to the 'out-of-scope' category (MSC 2018).

The following evidence indicates SG 60 is met:

Lake sturgeon – see SG 80.

Other species – See SG 100.

The following evidence indicates SG 80 is met:

Lake sturgeon – Under commercial licence conditions, fishers are required to release any lake sturgeon they may catch in their nets but may retain lake sturgeon under indigenous harvest rights where appropriate. Fishers are not required to report captures of lake sturgeon, but the number caught annually within the fishery is estimated at around 10 per fisher per year, for a total of 400, although the number retained is estimated to be lower, at around 80 in total (Cedar Lake fishers, pers. comm.). This estimate is consistent with the estimates provided by the ARD lake sturgeon monitoring programme biologist, who estimated that fishers caught 'a few hundred per year' from the Cedar Lake / Saskatchewan River (ARD, pers. comm.). Current trends in sturgeon numbers indicate the positive impacts of ban and/or restrictions imposed on the commercial and recreational harvest of the species.

Although no recent attempts at stock assessment of the lake sturgeon populations from Cedar Lake have been undertaken, the Saskatchewan River Sturgeon Management Board has run a tagging program led by Manitoba Agriculture and Resource Development (ARD) since the mid-1990s. The results indicate a recovering sturgeon population in the Manitoba portion of the Saskatchewan River following the end of commercial sturgeon harvest, from an estimated low of 272 fish in 2002 to around 14,000 animals in 2016, based on the Jolly-Seber mark-recapture estimate for 2018 (Figure 17, Cedar Lake FMP; Klein et al., 2020). Based on the significant and rapid growth in the population it is considered highly likely that lake sturgeon is above biologically based limits, so SG60 and SG80 are met. It is not clear that there is a high degree of certainty, though, so SG 100 is not met.

Other species – See SG100.

The following evidence indicates SG 100 is met:

White sucker – Together with two of the minor secondary species namely, longnose sucker and shorthead redhorse, the group is known as suckers and collectively marketed as 'mullet'. The white sucker accounts for about 92–93% of mullet landings and is the highest landed species apart from the P1 species (Table 14). White sucker is relatively short-lived as compared to the primary species. The species is exposed to the same management measures of commercial fishing as that of the other quota species from Cedar Lake. Given their consistently large proportion in the total landings of the lake and also given that each specimen gets to spawns at least twice before being captured by the 108 mm meshed legal gillnets (Klein et al., 2020) indicate to a high degree of certainty that white sucker is above biologically based limits. The UoAs comfortably meet SG 60, SG 80, and SG 100.

Double crested cormorant, lesser scaup and common loon: Double crested cormorant (known to fishers as 'crow ducks'), lesser scaup (known to fishers as bluebill duck) and common loon may be taken in the gillnets employed in the fishery during the open water period (the birds migrate south or to the coast during the ice-covered winter), although precise numbers of captures are not known because records are not kept. We note that information issues are addressed in PI 2.2.3.

All three species are very widespread in North America and are abundant. The double crested cormorant population was estimated to have undergone a 2,200 % increase from 1967 to 2007, and is now subject to management in the USA because of concerns over human health and safety, impacts to threatened and protected species, and conflict with State- and Tribal-owned aquaculture programmes[2] – the species is listed as least concern (LC) by the IUCN (Birdlife International 2018a). Lesser scaup has undergone a minor decline in population size but is still considered to be the most abundant diving duck in North America, with a breeding population estimated at 3.8 million birds (Cornell Lab 2021). Lesser scaup is also listed as LC by the IUCN (Birdlife International 2016). Common loon has a stable population or has undergone a small increase over the last 40 years, with a population around 612,000 – 640,000 individuals; it is listed by the IUCN as LC (Birdlife International 2018b). There is a high degree of confidence that all three species are above biologically-based limits – SG 60, SG 80 and SG 100 are met.

	Minor secondary species stock status			
b	Guide post			Minor secondary species are highly likely to be above biologically based limits. OR If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species
	Met?			Both UoAs – No
Rationale				

The following evidence indicates SG 100 is not met:

There are five secondary minor species, longnose sucker (*Catostomus catostomus*), shorthead redhorse (*Moxostoma macrolepidotum*), yellow perch (*Perca flavescens*), lake cisco (*Coregonus artedii*) and winter burbot (*Lota lota*) that interact with the UoAs. Besides catch trends from index netting, no other quantitative information is available on the stock status of the minor secondary species. Therefore, SG 100 is not met. In order to score this SI the RBF would need

[2] https://www.govinfo.gov/content/pkg/FR-2020-12-29/pdf/2020-28742.pdf#page=21

to be used (NSC FCO, Annex PF). This will require additional work. The client will need to decide whether they would like the RBF to be applied in this instance or whether they would be content to have the score at SG 80.

References

Birdlife International (2016). *Aythya affinis*. *The IUCN Red List of Threatened Species* 2016: e.T22680402A92861095. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22680402A92861095.en. Downloaded on 27 April 2021.

Birdlife International (2018a). *Nannopterum auritus*. The IUCN Red List of Threatened Species 2018: e.T22696776A133552919. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22696776A133552919.en. Downloaded on 26 April 2021.

BirdLife International (2018b). *Gavia immer*. *The IUCN Red List of Threatened Species* 2018: e.T22697842A132607418. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22697842A132607418.en. Downloaded on 27 April 2021.

Cornell Lab (2021). All about birds – lesser scaup. https://www.allaboutbirds.org/guide/Lesser_Scaup/overview.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA 1 = ≥80	UoA 2 = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.2.2 – Secondary species management strategy

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **strategy** in place for the UoA for managing main and minor secondary species.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

White sucker, lake sturgeon, double crested cormorant, lesser scaup and common loon are required to be scored as main secondary species. Longnose Sucker, shorthead redhorse, yellow perch, lake cisco and winter burbot are scored as minor secondary species. However, no commercial landings data is available for burbot (Table 14) and totally about 10.7 kg was encountered during the index netting sampling conducted from 2009–2019 (Table 5 FMP; Klein et al. 2020).

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

For both UoAs, impacts on secondary species are limited through effort management (licensing), mesh size regulation (minimum mesh of 108 mm that minimses the catch of undersized (below market size) fish from the target populations), spatial management (fishing is not permitted within 1.5 km of the location where a stream enters the lake, and the Cross Bay area), and for lake sturgeon through a ban on retention under commercial licence conditions (with a high post-release survival rate expected – mortality from tagging is estimated to be 3.0 – 4.7% - ARD, pers. comm.). No secondary species is a targeted, valuable commercial catch, and so catches of secondary species are incidental to the fishing activity. For cormorants, lesser scaup and common loon, there is a seasonal risk from fishing, only, as the birds are not present during the winter.

For secondary fish species, it is apparent that the effort and mesh size regulations (white sucker) and bn on commercial retention with a high post-release survival (lake sturgeon) are sufficient to meet the definition of a partial strategy, which is that a partial strategy “represents a cohesive arrangement which may comprise one or more measures, an understanding of how it/they work to achieve an outcome and an awareness of the need to change the measures should they cease to be effective. It may not have been designed to manage the impact on that component specifically” (Table SA8, MSC 2018).

For double crested cormorant, lesser scaup and common loon, in the context that these species are vulnerable to fishing only during the summer, ice-free period, that all three are considered LC and very widespread in North America, with a population that was estimated to have undergone a 2,200 % increase from 1967 to 2007 (double crested cormorant - Birdlife International 2018a), have a population of 3.8 million birds (lesser scaup – Birdlife International 2016) and have a stable or slightly increasing population of around 612,000 – 640,000 individuals (common loon – Birdlife International 2018b) it is considered the effort controls and spatial management are sufficient to qualify as a partial strategy, also.

For white sucker, lake sturgeon, double crested cormorant, lesser scaup and common loon, there is a partial strategy in place that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery – SG 60 and SG 80 are met.

The following evidence indicates SG 100 is not met:

In the absence of quantified total catch data for the UoA for main secondary species, SG 100 cannot be met.

b	**Management strategy evaluation**			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar UoAs/species).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80

The following evidence indicates SG 80 is met:

Apart from lake sturgeon (for which there are no quantitative catch data), proportions of most secondary fish species have remained relatively constant as highlighted in Table 14. The trends do not differ significantly when compared to an earlier period from 1965–1998 (Lysack 2000). The exceptions are mullet (including white sucker – increasing trend) and lake cisco (decreasing trend). For white sucker as a main secondary species, there is also evidence collected on maturity that indicates females will spawn at least twice before being vulnerable to the 108 mm mesh employed in the fishery (Klein et al. 2020). There are no commercial catch data for lake sturgeon, but the tagging programme data show a very low post-release mortality of 3.0–4.7%, while the population has increased from an estimated low of 272 fish in 2002 to around 14,000 animals in 2016 (Klein et al. 2020). In the absence of specific targeting, and given the stringent conditions under which the fishery operates, there is some objective basis that the partial strategy will work for white sucker and lake sturgeon as main secondary species – SG 60 and SG 80 are met for these species.

For double crested cormorant, lesser scaup and common loon as the other main secondary species, their very wide range and rapid population growth since the 1960s (double crested cormorant), and very wide range and large population sizes (lesser scaup and common loon), there is some objective basis for confidence that the partial strategy will work. SG 60 and SG 80 is met.

The following evidence indicates SG 100 is not met:

SG 100 is not met since there is no testing to support high confidence for all secondary species.

c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

The partial strategy for secondary species is based around effort management, mesh size regulations, spatial management and, for lake sturgeon, absolute non-retention. According to the Cedar Lake FMP, the commercial fishing activities in the lake appear to comply with the regulations that are in vogue. There is no reason to indicate that there is non-negligible discarding for white sucker and landings of fish species are monitored. Fishers report very few interactions with bird species (pers. comm.). As such, there is some evidence that the partial strategy is being implemented and SG 80 is met.

The following evidence indicates SG 100 is not met:

In the absence of any clear evidence of successful implementation of the partial strategy, the SG 100 is not met.

d	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Both – N/A	Both – N/A	Both – N/A
Rationale				

No secondary species are sharks so this SI is not scored.

e	**Review of alternative measures to minimise mortality of unwanted catch**			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and they are implemented, as appropriate.
	Met?	Both UoAs White Sucker – N/A Lake Sturgeon, Double Crested Cormorant, Lesser Scaup and Common Loon – Yes	Both UoAs White Sucker – N/A Lake Sturgeon, Double Crested Cormorant, Lesser Scaup and Common Loon – No	Both UoAs White Sucker & minor species– N/A Lake Sturgeon, Double Crested Cormorant, Lesser Scaup and Common Loon – No
Rationale				

For white sucker as a main secondary species, and other minor secondary species, there is no unwanted catch since all landed fish are utilised (Klein et al., 2020). Further, monitoring of the fish species interacting with the gillnets is kept through the annual and/or triennial index gillnetting program conducted through the CAMP initiative. Composite metrics provided by the CAMP reports could possibly flag aberrant changes in fish communities (CAMP 2017b). As such, for white sucker and other minor secondary species, this is scored as N/A (GSA3.5.3, MSC 2018).

The following evidence indicates SG 60 is met:

Lake sturgeon are not permitted to be retained under commercial fishery licence conditions but may be retained under indigenous harvest rights. Data from the tagging programme data show a very low post-release mortality of 3.0 – 4.7%, while the population has increased from an estimated low of 272 fish in 2002 to around 14,000 animals in 2016 (Klein et al. 2020). A full, formal review of the potential effectiveness and practicality of alternative measures to minimize UoA-related mortality of unwanted catch of lake sturgeon has not been undertaken, but the issues have been considered by managers (Pers. comm.) and it is not thought possible to substantially reduce any bycatch mortality given the low catch rate and high expected post-release survival within the context of the 'as appropriate' criteria specified under SA3.5.3.3 (MSC 2018). This is sufficient to meet SG 60 here, in a small scale, low intensity fishery, but there is no evidence of a regular review, so SG 80 is not met.

Double crested cormorant, lesser scaup and common loon are potential bycatch species within the fishery, although only in the ice-free, summer period when the birds are present, and fishers report that there are very few interactions with any bird species (Pers. comm.). A full, formal review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of these species has not been undertaken, but the issues has been considered by managers (Pers. comm.) and it is not thought possible to substantially reduce any bycatch within the context of the 'as appropriate' criteria specified under SA3.5.3.3 (MSC 2018). This is sufficient to meet SG 60 for a small scale, low intensity fishery.

The following evidence indicates SG 80 is not met:

There is no evidence of a regular review, so SG 80 is not met.

References

BirdLife International. 2016. *Aythya affinis*. *The IUCN Red List of Threatened Species* 2016: e.T22680402A92861095. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22680402A92861095.en. Downloaded on 27 April 2021.

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MSC (2018). MSC Fisheries Standard (and Guidance), v.2.01, 31. August 2018. Marine Stewardship Council, London, 156 pp. Available at: https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-v2-01.pdf?sfvrsn=8ecb3272_11.

Draft scoring range	UoA 1 = 60-79	UoA 2 = 60-79
Information gap indicator	**More information sought** Any information pointing to a thorough and regular review of alternative measures for main secondary species would support and potentially improve scoring.	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.2.3 – Secondary species information

PI 2.2.3		Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information adequacy for assessment of impacts on main secondary species**			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status. OR If RBF is used to score PI 2.2.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status. OR If RBF is used to score PI 2.2.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status.
	Met?	Both UoAs – Yes	Both UoAs White Sucker – Yes Lake Sturgeon, Double Crested Cormorant, Lesser Scaup and Common Loon – No	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

White sucker – see SG 80

Lake sturgeon – fishers are not required to keep records of catches of lake sturgeon but are reported to catch a few hundred a year (ARD, pers. comm.). This is consistent with estimates provided by commercial fishers, who estimated that around 400 were caught each year, with around 80 retained under indigenous harvest rights (fishers, pers. comm.). Based on their rapid and significant population growth since the 1960s (double crested cormorant), and very wide range and large population size (lesser scaup and common loon), the qualitative data are adequate to estimate the impact of the UoA on these species – SG 60 is met.

Double crested cormorant, lesser scaup and common loon – fishers are not required to keep records of catches of double crested cormorant, lesser scaup or common loon, but are reported to catch 'some' (ARD, pers. comm.). Fishers reported catching no double crested cormorant in the last season, a single lesser scaup in the last ten years, and on average around one common loon each per year. The qualitative catch data are adequate to estimate the impact of the UoA on main secondary bird species – SG 60 is met.

The following evidence indicates SG 80 is met:

White sucker – Based on the data presented in Table 14, and the trends since 1965 as reported in Klein et al. (2020), the contribution of white sucker to the total catch from Cedar Lake is on the increase. Also, given the minimum legal mesh size of commercial gillnets fixed at 108 mm, any and all of the White suckers retained by the UoAs are confirmed to have spawned at least twice before being caught. It can therefore be safely assumed that the stock status of the species is maintained and so SG 60 and SG 80 are met.

Lake sturgeon, double crested cormorant, lesser scaup and common loon Lake Sturgeon - In the absence of some quantitative data on captures (or lack of captures), SG 80 is not met.

The following evidence indicates SG 100 is met:

White sucker - In the absence of a high degree of certainty of the impacts of UoAs, SG 100 is not met.

Lake sturgeon, double crested cormorant, lesser scaup and common loon Lake Sturgeon – not scored.

b	**Information adequacy for assessment of impacts on minor secondary species**			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.
	Met?			Both UoAs – No
Rationale				

The following evidence indicates SG 100 is not met:

While catch data and relative proportions are available for most minor secondary species, the effect/s of UoAs on stock status of the same are far from known. So, SG 100 is not met.

c	**Information adequacy for management strategy**			
	Guide post	Information is adequate to support **measures** to manage **main** secondary species.	Information is adequate to support a **partial strategy** to manage **main** secondary species.	Information is adequate to support a **strategy** to manage **all** secondary species, and **evaluate** with a **high degree of certainty** whether the strategy is **achieving its objective**.
	Met?	Both UoAs – Yes	Both UoAs White Sucker – Yes Lake Sturgeon, Double Crested Cormorant, Lesser Scaup and Common Loon – No	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

White sucker – see SG 80

Lake sturgeon, double crested cormorant, lesser scaup and common loon – fishers are not required to keep records of catches of lake sturgeon or any bird species but are reported to catch around 400 lake sturgeon and ‘some’ double crested cormorant, lesser scaup and common loon, albeit that fishers stated that very few if any were caught annually (pers. comm.). The risk of interaction (i.e., where and when on the lake that the lake sturgeon or birds are vulnerable to capture) is known at a general level and is adequate to support measures to manage these species – SG 60 is met.

The following evidence indicates SG 80 is met:

White sucker – That the white sucker is maintaining a stable or increasing trend for quite some time is evident as mentioned earlier. The level of information on white sucker, including that the species is able to spawn at least twice before being vulnerable to capture in the 108 mm mesh nets employed in the fishery (Klein et al. 2020) supports the partial strategy thereby meeting requirements under SG 60 and SG 80.

Lake sturgeon, double crested cormorant, lesser scaup and common loon - In the absence of more detailed, quantitative information on captures (or lack of captures), it is not possible to say that information is adequate to support a partial strategy – SG 80 is not met.

The following evidence indicates SG 100 is met:

White sucker - In the absence of a high degree of certainty on the efficacy of the strategy, and more information on the other minor secondary fish species, SG 100 is not met.

Lake sturgeon, double crested cormorant, lesser scaup and common loon Lake Sturgeon – not scored.

References

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA 1 = 60-79
Information gap indicator	**More information sought** More detailed catch data for birds, including when and where they are caught, and any other contextual information, may support or improve scoring.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.3.1 – ETP species outcome

PI 2.3.1		The UoA meets national and international requirements for the protection of ETP species The UoA does not hinder recovery of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Effects of the UoA on population/stock within national or international limits, where applicable**			
	Guide post	Where national and/or international requirements set limits for ETP species, the **effects of the UoA** on the population/ stock are known and **likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population /stock are known and **highly likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty** that the **combined effects of the MSC UoAs** are within these limits.
	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A
Rationale				

There are no species taken in the fishery for which there are national and/or international setting limits for ETP species. This SI is scored N/A.

b	**Direct effects**			
	Guide post	Known direct effects of the UoA are likely to not **hinder recovery** of ETP species.	Direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

There are no species taken in the fishery which meet the MSC definition of 'ETP' (SA3.1.5, MSC 2018); direct effects of the UoA are therefore highly likely to not hinder recovery of ETP species, so the SG 60 and SG 80 are met.

The following evidence indicates SG 100 is met:

In the absence of some independent monitoring data, it is not possible to confirm there is a high degree of confidence that there are no significant detrimental direct effects of the UoAs on any ETP species, for example bird species that may be very rare visitors to Cedar Lake. SG100 is not met.

c	**Indirect effects**			
	Guide post		Indirect effects have been considered for the UoA and are thought to be **highly likely** to not create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species.
	Met?		Both UoAs – Yes	Both UoAs – Yes
Rationale				

The following evidence indicates SG 80 is met:

See SG100.

The following evidence indicates SG 100 is met:

Indirect effects from the fishery might include impacts resulting from habitat loss and/or degradation, loss of food species or changes in community composition, and loss/destruction of preferred spawning substrate. The six-yearly CAMP reports (CAMP, 2017a & b) strongly indicate that the Cedar Lake ecosystem is in a robust and healthy state based on hydrology, water quality, sediment quality, benthic macroinvertebrates (BMI), and the fish community structure. According to CAMP (2017b), the total abundance, richness, and diversity of Cedar Lake BMI was highly stable over the reported years and that it was least impacted by the lake hydrology. The same can be inferred based on a comprehensive set of metrics used in describing the ecosystem/habitat status of Cedar Lake as a whole. Details on these metrics could be found in the habitat and ecosystem SIs sections of this report below. Given that major indirect effects acting through the biotic and/or abiotic environment of the species, the Cedar Lake ecosystem appears to be quite robust to external influences. As a result, both SG 80 and SG 100 are met.

References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA 1 = ≥80	UoA 2 = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.3.2 – ETP species management strategy

PI 2.3.2		The UoA has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the UoA does not hinder recovery of ETP species. Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place (national and international requirements)**			
	Guide post	There are **measures** in place that minimise the UoA-related mortality of ETP species, and are expected to be **highly likely to achieve** national and international requirements for the protection of ETP species.	There is a **strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be **highly likely to achieve** national and international requirements for the protection of ETP species.	There is a **comprehensive strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to **achieve above** national and international requirements for the protection of ETP species.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

This SI might be scored for a species listed under SARA, where a recovery strategy or management plan had established national requirements for protection. Although, no species is taken in the fishery that has this status, this SI must still be scored (GSA3.5.1, MSC 2018).

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

There are no species taken in the fishery which meet the MSC definition of 'ETP', and specifically no species that is listed under SARA (SA3.1.5, MSC 2018). In this context, then, and on the basis that the Cedar Lake fishery is small scale and low intensity, the general limits on effort, spatial restrictions and mesh size, together with the effective minimisation of potential interactions with bird or other out-of-scope species that exists as a result of the seasonal ice cover on the lake comprises a strategy to manage potential impacts on ETP species. Both UoAs thus meet SG 60 and SG 80. SG 100 is not met as there is not a comprehensive strategy in place, which is a "complete and tested strategy made up of linked monitoring, analyses and management measures and responses" (Table SA8, MSC 2018).".

b	**Management strategy in place (alternative)**			
	Guide post	There are **measures** in place that are expected to ensure the UoA does not hinder the recovery of ETP species.	There is a **strategy** in place that is expected to ensure the UoA does not hinder the recovery of ETP species.	There is a **comprehensive strategy** in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species.
	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A
Rationale				

There are no species taken in the fishery which meet the MSC definition of 'ETP' (SA3.1.5, MSC 2018); because SIa is scored, this SI is not scored (SA3.11.2, MSC 2018).

c	**Management strategy evaluation**			

	Guide post	The measures are **considered likely** to work, based on **plausible argument** (e.g., general experience, theory or comparison with similar fisheries/species).	There is an **objective basis for confidence** that the measures/strategy will work, based on **information** directly about the fishery and/or the species involved.	The strategy/comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a **quantitative analysis** supports **high confidence** that the strategy will work.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

The Assessment Team undertook a careful review of the species listed under SARA which may occur in the Manitoba Province and have the potential to interact with the fishery. Only horned grebe and western grebe are SARA -listed species that have the potential to occur on the lake, but there are no reports or records of these species being taken (fishers, pers. comm.). Also, there are no reports of these species being taken during the index netting programme. As such and given that birds are only vulnerable to the fishery in the ice-free summer season, it is considered that there is an objective basis for confidence that the strategy will work – SG60 and SG80 are met.

The following evidence indicates SG 100 is not met:

SG100 is not met because there is not a quantitative analysis supporting high confidence that the strategy will work.

d	**Management strategy implementation**			
	Guide post		There is some **evidence** that the measures/strategy is being implemented successfully.	There is **clear evidence** that the strategy/comprehensive strategy is being implemented successfully and **is achieving its objective as set out in scoring issue (a) or (b).**
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

The strategy for ETP species is based around effort management, mesh size regulations, spatial management and the seasonal operation of the fishery around the seasonal formation and break-up of ice on the lake. Besides, most if not all, UoA-habitat interactions are of the healthy type as discussed earlier. Cedar Lake fishers report very few interactions with bird species, and none with SARA-listed species (fishers, pers. comm.). As such, there is some evidence that strategy is being implemented successfully and so SG 80 is met.

The following evidence indicates SG 100 is not met:

In the absence of any clear evidence of successful implementation of the strategy, the SG 100 is not met.

e	**Review of alternative measures to minimise mortality of ETP species**			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.

	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A
Rationale				

In the absence of any evidence indicating that ETP species are taken in the fishery, this SI is scored N/A (GSA3.5.3, MSC 2020).

References

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

MSC (2018). MSC Fisheries Standard (and Guidance), v.2.01, 31. August 2018. Marine Stewardship Council, London, 156 pp. Available at: https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-v2-01.pdf?sfvrsn=8ecb3272_11.

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.3.3 – ETP species information

PI 2.3.3		Relevant information is collected to support the management of UoA impacts on ETP species, including: - Information for the development of the management strategy; - Information to assess the effectiveness of the management strategy; and - Information to determine the outcome status of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information adequacy for assessment of impacts**			
	Guide post	Qualitative information is **adequate to estimate** the UoA related mortality on ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species.	Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.	Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species.
	Met?	Both UoAs – Yes	Both UoAs – No	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

The assessment team undertook a careful review of the species listed under SARA which may occur in the Manitoba Province and have the potential to interact with the fishery. Only horned grebe and western grebe are SARA -listed species that have the potential to occur on the lake, but there are no reports or records of these species being taken (fishers, pers. comm.). Fishers are not required to keep records of catches of species not landed but are reported to catch no individuals of these species No individuals have been taken in the index netting programme (ARD pers. comm.). It is considered that the qualitative data indicating no captures are adequate to estimate the UoA related mortality on ETP species – SG 60 is met.

The following evidence indicates SG 80 is not met:

In the absence of some quantitative data on captures (or lack of captures), SG 80 is not met.

b	**Information adequacy for management strategy**			
	Guide post	Information is adequate to support **measures** to manage the impacts on ETP species.	Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species.	Information is adequate to support a **comprehensive strategy** to manage impacts, minimise mortality and injury of ETP species, and evaluate with a **high degree of certainty** whether a strategy is achieving its objectives.
	Met?	Both UoAs – Yes	Both UoAs – No	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

Fishers are not required to keep records of catches of non-commercial species, albeit that fishers stated that very few if any were caught annually (pers. comm.). The risk of interaction (i.e., where and when on the lake that birds are vulnerable to capture) is known at a general level and is adequate to support measures to manage impacts on these species. SG 60 is met.

The following evidence indicates SG 80 is met:

In the absence of more detailed, quantitative information on captures (or lack of captures), it is not possible to say that information is adequate to support a strategy. SG 80 is not met.

References

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA = 60-79	UoA = 60-79
Information gap indicator	More information sought More detailed, quantitative information on captures (or lack of captures) of non-commercial species would likely raise the score.	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.4.1 – Habitats outcome

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates		
Scoring Issue		SG 60	SG 80	SG 100
a	**Commonly encountered habitat status**			
	Guide post	The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Bottom-set gillnets are the only commercial fishing engine allowed in the Cedar Lake. Open water gillnets operated in the UoA are rigged with anchors weighing 25 to 40 lb and are left in place on the bottom while the nets are hauled onboard to land fish. In the absence of wave action, winter nets use very light anchors weighing only one to five lb (Klein et al., 2020). Thus, there appears to be very little interaction between the gear and the soft clayey and/or silty loam sediments, which are the most commonly encountered type of benthic substrate in the lake. Invariably gillnets are operated in the offshore areas of the lake (say beyond 1.5m depth). That such conditions do not cause significant adverse effects on the bottom sediments and communities is strongly supported by several studies (e.g., ICES, 1995; Kaiser et al., 1996; and Morgan and Cheunpagdee, 2003).

Even in the event of the sediments getting disturbed, these disturbances are far away from the nearshore area to smother the sensitive habitats required for the attachment of demersal eggs of spawning fish such as the cobbles or boulders which are away and abundant in the nearshore areas. These conditions are true for both the open water and winter fishing activities in the UoAs. Therefore, it is highly unlikely that the UoAs are reducing structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. SG 60 and SG 80 are met.

The following evidence indicates SG 100 is not met:

SG 100 is not met owing to the absence of dedicated studies/evidence addressing habitat-level impacts.

b	**VME habitat status**			
	Guide post	The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.
	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A
Rationale				

Cedar Lake is a freshwater lake and no VMEs are present. This SI is deemed not relevant and therefore not scored.

	Minor habitat status			
c	Guide post			There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.
	Met?			Both UoAs – No
Rationale				

The following evidence indicates SG 100 is not met:

Data are available on the routine monitoring of the habitat status of both basins of Cedar Lake conducted by CAMP. Specifically, information on sediment quality and BMI has been regularly recorded for the nearshore and offshore areas of the lake. Besides habitat type and texture, the ecological status of habitats is determined based on several metrics, such as total number of invertebrates, EPT:C ratio (of combined abundances of Ephemeroptera [mayflies], Plecoptera [stoneflies], Trichoptera [caddisflies] to the abundance of Chironomidae [non-biting midges]), total taxon richness, etc. (CAMP, 2017a). Despite this, in the absence of any specific evidence and/or monitoring of UoAs with respect to their potential impacts on minor habitats, SG 100 is not met.

References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

ICES (1995). Report of the study group on ecosystem effects of fishing activities, Copenhagen, Denmark, 7-14 April 1992. ICES Cooperative Research Report, Number 200, 120pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Morgan LE, Chuenpagdee R (2003). Shifting gears: Addressing the collateral impacts of fishing methods in U.S.

waters.https://www.pewtrusts.org/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/protecting_ocean_life/environmentpewscienceseriesshiftpdf.pdf

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.4.2 – Habitats management strategy

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

A major part of the commercial fishing occurs in the Southeast Basin of the lake which is known to possess soft bottom made up of clayey/silty loam and organic sediment. Regular assessments conducted by CAMP on sediment and benthic faunal diversity strongly point to a robust structure and function of the bottom habitat/s of the lake. Details of the same have been published in the CAMP Report (CAMP, 2017a).

Commercial fishing activities in Cedar Lake are strongly regulated through licensing, mesh and fleet size regulations, effort limitations and spatial closures, as outlined in the Cedar Lake FMP (Klein et al., 2020). In addition, the gear is fished statically, with very lightweight anchors (25 – 40 lbs in summer, with the nets left in place and simply hauled over the bow in situ, and 1 – 5 lbs under ice in winter with the nets hauled onto the ice and reset in the same location). These practices minimize impacts in an already low impact fishery.

According to the ARD, lost gear is not reported nor is there any gear compensation program. However, this very absence of any compensation for lost gear itself seems to make the fishers more diligent toward not losing any gear given the financial implications. During the open water season, high wind events may lead to tangling and loss of nets. Reportedly, these nets eventually become tangled and roll into a ball, which eventually drift ashore. This has been confirmed by the Cedar Lake Fishers' Executive while interacting with ARD. Existence of such a phenomenon should generally mean an absence of ghost fishing, which too has been confirmed by the ARD. However, what happens in the meantime and how fast do the nets get tangled, roll up into a ball, and wash ashore is not clear and likely to be influenced by a variety of factors including where the gear is lost, the depth of water and the weather conditions. Thus, SG 60 and SG80 are met.

The following evidence indicates SG 100 is not met:

There is no strategy in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats. SG 100 is not met.

b	**Management strategy evaluation**			
	Guide post	The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG80.

The following evidence indicates SG 80 is met:

The nature of the fishing activity (static nets with lightweight anchors, with the gear remaining in place and being hauled over the bow in situ in summer, or retrieved from the same holes in winter) and the soft-sediment nature of the lake bed provides at least some objective basis for confidence that the partial strategy will work. Cedar Lake is one of the most productive lakes among all the waterbodies from the Saskatchewan River Region, Manitoba. The hydrology, water quality, sediment quality, benthic macroinvertebrates (BMI), and the fish community trends published in the six-yearly CAMP reports for Cedar Lake (CAMP, 2017a, b) also support this conclusion. Thus, the fishery meets SG 60 and SG 80.

The following evidence indicates SG 100 is met:

To the knowledge of the Assessment Team, no testing has been undertaken to support high confidence on this SI, while there is also something of a gap in the FMP regarding the non-reporting of lost gear. SG 100 is not met.

c	**Management strategy implementation**			
	Guide post		There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully.	There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

Cedar Lake FMP has been in effect since 2006 and has been amended three times with the Third Amendment coming into force on 04-Feb-2016 (Klein et al., 2020). Overall, the nature of the fishery and what is known about compliance with respect to fishing gears at this stage provides some quantitative evidence that the partial strategy is being implemented successfully. Therefore, SG 80 is met.

The following evidence indicates SG 100 is met:

The reporting of lost gear is not mandatory. Given the situation, the Assessment Team finds that the fishery does not meet the SG 100.

d	**Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs**			
	Guide post	There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs.	There is **some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	Both UoAs – N/A	Both UoAs – N/A	Both UoAs – N/A
Rationale				

Being a freshwater lake, and with no other commercial fishing other than the UoAs, this SI is deemed not relevant to Cedar Lake and therefore not scored.

References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.4.3 – Habitats information

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information quality**			
	Guide post	The types and distribution of the main habitats are **broadly understood**. OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the types and distribution of the main habitats.	The nature, distribution and **vulnerability** of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA. OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.	The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Nearshore and offshore habitats of Cedar Lake are known to differ markedly in terms of benthic substrate texture and type (Table 15). The offshore substrate texture is mostly the clay/silty loam category. Nearshore substrate type is boulder or cobble; offshore areas have substrate type belonging to organic matter and/or silt. The disturbance of the soft sediments brought about by the gillnet anchors has been identified as the main interaction between the gear and the bottoms sediments. However, given the small scale and low intensity nature of the fishery, the resultant impact of such disturbances is deemed negligible. The foregoing description applies equally to both basins of Cedar Lake. The EPT:C ratio, which is indicative of stressed habitats, revealed no adverse impacts on the lake habitats. The various BMI indices indicates that the lake is rich in benthic diversity. It is considered that the nature, distribution and vulnerability of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA; therefore, SG 80 is met.

The following evidence indicates SG 100 is not met:

Not all habitat types existing throughout the two basins of the lake are known so thoroughly, so SG 100 is not met.

b	**Information adequacy for assessment of impacts**			
	Guide post	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear. OR	Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. OR	The physical impacts of the gear on all habitats have been quantified fully.

		If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.	If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.	
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Cedar Lake has a spatial expanse of 2,462 Km^2 and fishers are limited to 41 individuals. Bottom-set gillnets are the only approved commercial fishing engine allowed in Cedar Lake, which have a very limited and/or negligible impact on the lake bottom. Fishing is known to be focused in the southeast part of the lake, with more effort towards the easternmost boundary of the fishing are during October to target whitefish, and along the shore and road access points during the winter. Thus, the overall spatial expanse of the UoAs interaction/s with the lake bottom are highly limited, and information is considered adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear – SG 60 and SG 80 are met.

The following evidence indicates SG 100 is not met:

Owing to an absence of any requirement of reporting lost gear and uncertainty if any ghost fishing occurs in the period prior to a lost net becoming tangled, 'balling up' and washing ashore, the fishery does not meet the requirements at SG 100.

c	**Monitoring**			
	Guide post		Adequate information continues to be collected to detect any increase in risk to the main habitats.	Changes in all habitat distributions over time are measured.
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

Temporal changes in the habitat health through water quality and fish/BMI diversity indices are regularly mapped or assessed by CAMP in both basins of the lake. Both nearshore and offshore sites appear to be sampled under this program annually in the commercially important Southeast Basin and after every three years for the West Basin of the lake. Given the scale and intensity of the UoAs, collected information is found to be adequate in determining risk to the main habitats. Therefore, the SG 80 is met.

The following evidence indicates SG 100 is met:

Since changes are not measured for all habitat distributions over time, SG 100 is not met.

References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.5.1 – Ecosystem outcome

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	**Ecosystem status**			
	Guide post	The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – Yes
Rationale				

The key ecosystem elements that could be used as scoring elements for Cedar Lake are: the fish community structure and function and the benthic community structure. These elements have been selected given their significance in determining the ecosystem health of Cedar Lake in general.

The following evidence indicates SG 60 is met:

See SG 100.

The following evidence indicates SG 80 is met:

See SG 100.

The following evidence indicates SG 100 is met:

<u>Fish community structure and function</u>: Cedar Lake was formed as a result of the impoundment of the Saskatchewan River by the Grand Rapids hydro-electric dam in 1965. The 1973 catches were dominated by a single species walleye (67.7%). With respect to ichthyofaunal diversity, a total of 22 fish species were recorded by Garside et al. (1973) including all the P1 and P2 species being considered for the current assessment. The index netting conducted during 2008–2013, however, revealed the presence of 15 species of which 11 were regular and four infrequent species. Based on the annual monitoring data, a long-term dominance shift in species composition has been recorded in Cedar Lake since 1973 from high to low-valued, from large to small-sized, long to short-lived, and from ‘K-selected’ to ‘r-selected’ (Lysack 2000). These shifts were associated with and resulted from persistent overfishing in the lake till 1998 when the fishery was closed for restructuring and rebuilding for four years (up to 2002). Thus, the current fish diversity can be considered as a paradigm shift or the new normal. Since then, however, the fishery has rebuilt itself and contributing to the commercial, subsistence, and recreational fishing of the Saskatchewan River Region of Manitoba.

Comprehensive sampling of fish communities from the Saskatchewan River Region in general and Cedar Lake in particular is carried out annually for the Southeast Basin of Cedar Lake and triennially for the West Basin through CAMP surveys. A general understanding on the structure and function of the fish communities from the lake can be obtained from the four metrics outlined in the CAMP reports. They are: Hill’s (effective species richness) index, CPUE (or fish abundance), Fulton’s condition factor, and length-at-age values for the sampled species. Results of the survey published in CAMP Doc. 3 (CAMP, 2017) are strongly indicative of a robust structure and function of the fish communities from Cedar Lake. Some of these indices actually reflect the hydro-biological health condition of the lake itself. For example, CPUE or fish abundance is under the direct influence of physical (e.g., substrate type, flow conditions), biological (e.g., benthos productivity, predator/prey interactions), and chemical (e.g., DO) factors. Compared to other waterbodies from Saskatchewan River Region, Cedar Lake (West Basin) recorded the highest CPUE at 60 fish/100 m/24 h. Furthermore, catch rates did not differ significantly in Cedar Lake over the six-year report period from 2008–2013. Also, the Hill’s index (7.1) was highest for Cedar Lake (West Basin). Ichthyofaunal species richness ranged from 11–15 species. With respect to length-at-age, available information for Cedar Lake suggests a negligible change to the relative abundance of large-bodied species since 1999 (Janesen and Dawson, 2007).

<u>Benthic community structure</u>: Information on the benthic community structure provides a link between the benthic macroinvertebrate (BMI) metrics and key hydrological conditions. Thus, BMI can double up as an indicator of ecosystem

health since they serve as natural food for higher-level consumers such as fish. BMI surveys conducted annually in the Saskatchewan River Region (including Cedar Lake) use several quantitative metrics such as total number of invertebrates, EPT:C ratio, total taxonomic richness (family-level), EPT richness, etc. All of these metrics have indicated that the Cedar Lake ecosystem is healthy and functioning optimally (CAMP 2017b).

Overall, the above provides a compelling evidence that the UoAs are unlikely to disrupt the structure and function of the two key ecosystem elements underlying the Cedar Lake ecosystem. Also, it is envisaged that no serious or irreversible harm would occur. Thus, SG 60, SG 80, and SG 100 are met for both UoAs.

References

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Garside ET, Derksen AJ, Howard WN (1973). Summer food relations and aspects of the distribution of the principal percid fishes of the Saskatchewan River delta prior to 1965 impoundment. Manitoba Dept. Mines, Res. And Envt. Mgmt. Res. Br. MS Report No. 73-18. 16 pp.

Jansen WA, Dawson K (2007). Biological data from fish sampling on Cedar Lake, Manitoba, 2006. A report prepared for Manitoba Hydro. 122 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba ARD MS Report No. 20-01. 66 pp.

Lysack W (2000). Commercial fisheries of the Saskatchewan River System. Manitoba Conservation Fisheries Branch MS Report No. 00-01. 104 pp.

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary which take into account the **potential impacts** of the UoA on key elements of the ecosystem.	There is a **partial strategy** in place, if necessary, which takes into account **available information and is expected to restrain impacts** of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – Yes
Rationale				

The following evidence indicates SG 60 is met:

See SG100

The following evidence indicates SG 80 is met:

See SG100

The following evidence indicates SG 100 is met:

Cedar Lake is subjected to regular fishery-independent surveys conducted following standard methodologies, the frequency of which is annual for the Southeast Basin (the basin where most commercial fishing occurs) and triennially in the West Basin (CAMP 2017a). Surveys related to ichthyofaunal communities are reported with the help of four indices: species diversity, abundance, fish condition, and fish growth. Fishery-independent sampling is also conducted under the index netting program and the sampled fish catch are reported by species and by mesh size (e.g., Table 5, FMP). As such, a suit of multi-faceted data informs fisheries management of the lake. The proper FMP for Cedar Lake constitutes an array of several federal and provincial regulations. Management actions deemed necessary for quota species, thus, are a result of pro-active adjustments in response to the situation at hand. Fine tuning of management actions is mostly affected through declaration of new quotas/targets for every ensuing season.

Additionally, comprehensive data are collected in determining the health of the lake habitats. This is brought about by monitoring for sediment and water quality, BMI, and heavy metals pollution using a varied set of metrics as outlined earlier with respect to a few P2 species SIs. The CAMP protocols for monitoring the lake habitats and ecosystem appear robust and effective in assessing the overall health of the lake. Taken together, the above measures constitute both a strategy and a plan that addresses all main impacts of UoAs on the Cedar Lake ecosystem. Given the monitoring and the measures in place to manage the fishery – SG 100 is met.

b	Management strategy evaluation			
	Guide post	The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar UoAs/ ecosystems).	There is **some objective basis for confidence** that the measures/ partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved.	**Testing** supports **high confidence** that the partial strategy/ strategy will work, based on information directly about the UoA and/or ecosystem involved.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – Yes
Rationale				

The following evidence indicates SG 60 is met:

See SG 100.

The following evidence indicates SG 80 is met:

See SG 100.

The following evidence indicates SG 100 is met:

Management measures, such as strict mesh size regulations, quota system, and licenses are well-defined for the fishery. Based on plausible argument, some objective basis exists for confidence that the strategy will work. Also, the long-term ecosystem monitoring datasets generated through CAMP essentially constitutes 'testing.' Thus, SG 60, SG 80, and SG 100 are met.

c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Both UoAs – Yes	Both UoAs – Yes
Rationale				

The following evidence indicates SG 80 is met:

See SG 100.

The following evidence indicates SG 100 is met:

Cedar Lake has its own FMP which came into effect on 17-May-2006. Currently, its Third Amendment is in force since 04-Feb-2016. This is testimony to the fact that the Cedar Lake FMP is reviewed and updated regularly. Given what is known about the size of Cedar Lake in relation to the scale and intensity of the UoAs' fishing vis-a-vis the measures and regulations that are in place, the lake's overall ecosystem appears to be perfectly healthy. Records of inspection and/or enforcement of any measures included in the ecosystem management strategy indicates a successful implementation of the strategy. The Assessment Team considers that the strategies being implemented by the UoAs are eligible for meeting SG 100.

References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information quality**			
	Guide post	Information is adequate to **identify** the key elements of the ecosystem.	Information is adequate to **broadly understand** the key elements of the ecosystem.	
	Met?	Both UoAs – Yes	Both UoAs – Yes	
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

Available information points that the impacts resulting from fishing activities are negligible given the stringent HCRs governing the UoAs and because of the responsive quota system in place. Detailed ecosystem status reports are available for the Cedar Lake as a result of the CAMP initiative of Manitoba. A typical CAMP Report provides detailed information on the various aspects of the ecosystem that are routinely monitored including aquatic habitat, water quality, sediment quality, BMI, and fish communities. Details on the metrics and methodology adopted for assessing these indices, and on the sampling frequencies and locations are found in CAMP (2017a). Outcomes of the studies for the six-year period from 2008–2013 are published in CAMP (2017b). The latest CAMP annual activity report is available for the year 2018–2019. Salient findings of the reports are used to inform management decisions. All the aforementioned reports indicate to a robustly healthy Cedar Lake ecosystem. The Assessment Team believes that the fishery meets both SG 60 and SG 80.

b	**Investigation of UoA impacts**			
	Guide post	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**.	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**.
	Met?	Both UoAs – Yes	Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

As mentioned earlier for this PI under SI(a), a majority of the main interactions between the UoAs and the ecosystem elements can be inferred from the existing information. Given that no major changes in fish composition over time have been observed in Cedar Lake in the recent period since the fishery reopened, fishing does not appear to be the main driver of change in the species composition, CPUE, and age structure of other fish communities in the UoA. Overall, there appears to be a great degree of certainty that most UoA interactions are harmless. The SG 60 and SG 80 are met.

The following evidence indicates SG 100 is met:

It appears that all the main interactions have not yet been investigated in detail. Therefore, SG 100 is not met.

c	**Understanding of component functions**

	Guide post		The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**.	The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood**.
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

The impact of the UoAs on the P1 target species, primary, secondary and ETP species, and habitats have been identified and the main functions of these components in the ecosystem are understood. P1 species, namely walleye and northern pike are high in the trophic structure as they are the top predators. The remainder species are lower in the trophic cascade. Based on the Cedar Lake FMP, the UoAs have no known impacts on the ETP species, and there is negligible interaction between the UoAs and the main habitats. Also, given the spatial scale and intensity of the fishery, SG 80 is met.

The following evidence indicates SG 100 is not met:

In the absence of complete understanding on the functions of all components, SG 100 is not met.

d	**Information relevance**			
	Guide post		Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred.	Adequate information is available on the impacts of the UoA on the components **and elements** to allow the main consequences for the ecosystem to be inferred.
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

As mentioned earlier, a great deal is known about the Cedar Lake ecosystem and the effects of the bottom-set gillnets on lake habitats. This adequately explains the related ecosystem consequences thus meeting SG 80.

The following evidence indicates SG 100 is not met:

In the absence of a complete understanding on all relates aspects, SG 100 is not met.

e	**Monitoring**			
	Guide post		Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?		Both UoAs – Yes	Both UoAs – No
Rationale				

The following evidence indicates SG 80 is met:

Adequate data on both the target and non-target species are collected annually in order to control the ecosystem-level risks. Also, given that only gillnets of controlled mesh sizes are allowed to undertake commercial fishing and that lost gear appear to pose no major threats, major ecosystem threats are been accounted for. This data adequacy meets SG 80 requirements.

The following evidence indicates SG 100 is met:

The Assessment Team feels that information is not entirely adequate to meet SG 100.

References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Klein G, Galbraith W, Kitch I (2020). Cedar Lake Fisheries Management Plan: 2020. Manitoba Agriculture and Resource Development, Manuscript Report No. 20-01, 66 pp.

Draft scoring range	UoA = ≥80	UoA = ≥80
Information gap indicator	Information sufficient to score PI	

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

7.7 Principle 2 References

CAMP (2017a). Six-year summary report (2008–2013): Technical Document 1. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 187 pp.

CAMP (2017b). Six-year summary report (2008–2013): Technical Document 3. Report prepared for Manitoba/Manitoba Hydro MOU Working Group by North/South Consultants Inc., Winnipeg, MB, 216 pp.

Cornell Lab (2021). All About Birds. https://www.allaboutbirds.org/. Accessed on 28 April 2021.

FishBase (2021). https://www.fishbase.de. Accessed on 28 April 2021.

ICES (1995). Report of the study group on ecosystem effects of fishing activities, Copenhagen, Denmark, 7-14 April 1992. ICES Cooperative Research Report, Number 200, 120pp.

McLeod C, Hilderbrand L, Radford D (1999). A synopsis of lake sturgeon management in Alberta, Canada. Journal of Applied Ichthyology 15, 173–179.

Morgan LE, Chuenpagdee R (2003). Shifting gears: Addressing the collateral impacts of fishing methods in U.S. waters. https://www.pewtrusts.org/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/protecting_ocean_life/environmentpewscienceseriesshiftpdf.pdf

MSC (2018). MSC Fisheries Standard (and Guidance), v.2.01, 31. August 2018. Marine Stewardship Council, London, 156 pp. Available at: https://www.msc.org/docs/default-source/default-document-library/for-business/programdocuments/fisheries-program-documents/msc-fisheries-standard-v2-01.pdf?sfvrsn=8ecb3272_11

7.8 Principle 3

7.8.1 Principle 3 background

The intent of Principle 3 (P3) is to ensure that there is an institutional and operational framework appropriate to the size and scale of the UoAs for implementing Principles 1 and 2, and that this framework is capable of delivering sustainable fisheries in accordance with the outcomes articulated in these Principles.

In the following sections a description of the broad, high-level context of the fishery management system and the fishery specific management system is provided with the intent of supporting the scoring rationales used in section 0 of this report. The headings of each section reflect the themes covered in the scoring issues (SI) within each P3 Performance indicator (PI).

7.8.2 Area of operation and jurisdiction

The fishery takes place within Cedar Lake, Province of Manitoba, 53°19' 100°42' (Figure 1). The fishery is undertaken throughout the year with an open water and ice fishery. The open water commercial fishing season is open from June 1st to, and including October 30th. The winter commercial fishing opens when ice makes on or after November 1st to, and including, April 30th.

Freshwater fisheries in the Province of Manitoba are subject to mixed Federal and Provincial jurisdictions. Protection, ownership, allocation, use and management of fish, and fish habitat in Manitoba are governed by the Canadian constitution, duly signed treaties, and federal and provincial legislation (Klein et al, 2020).

7.8.3 Legal and/or customary framework

The Legislative Framework Overview is found in the Manitoba Government official website.

Conservation of Fish Resources under Federal Jurisdiction:

Under section 92.12 of the Constitution Act, 1867, the Canadian Parliament has exclusive legislative authority to make laws respecting “Sea Coast and Inland Fisheries”. This has been judicially interpreted to mean that only the federal parliament, and not the provincial legislatures, can make laws that are essentially about the conservation and preservation of fisheries.

Under the authority of s. 91.12 of the Constitution Act, 1867, Parliament has enacted the Fisheries Act 1985 (Canada). Under the authority of the Fisheries Act 1985 (Canada), regulations have been made to address specific fish management issues in each of the provinces. In Manitoba, fish are managed under the Manitoba Fishery Regulations, made under the Fisheries Act 1985 (Canada).

Fish on Crown Property are a Provincial Resource:

Until 1930, the Government of Canada administered and controlled all Crown lands and resources in Manitoba, Alberta and Saskatchewan. The Constitution Act of 1930 gave legal effect to Natural Resources Transfer Agreements in each of the prairie provinces.

These agreements transferred administrative control of Crown lands and resources to provincial governments, in order that the Governments of Manitoba, Saskatchewan and Alberta would be in the same position as the other provinces of Canada.

Para. 10 of the Manitoba Natural Resources Transfer Agreement (1929), states:

> “*10. Except as herein otherwise provided, all rights of fishery shall, after the coming into force of this agreement, belong to and be administered by the Province, and the Province shall have the right to dispose of all such rights of fishery by sales, licence or otherwise, subject to the exercise by the Parliament of Canada of its legislative jurisdiction over sea-coast and inland fisheries*.”

Therefore, since 1930, the Legislature of Manitoba has been able to make laws relating to the use of its own property, under the authority of s. 92(5) of the Constitution Act, 1867 (“*the Management and Sale of the Public Lands belonging to the Province and of the Timber and Wood thereon*”).

Mixed Federal and Provincial Jurisdiction:

Consequently:

1. The Canadian Parliament has exclusive constitutional jurisdiction to make laws for the conservation of fish, including setting fishing seasons, quotas, size limits, licence and gear restrictions, and does this under the authority of the Fisheries Act 1985 (Canada) and regulations to that Act; while,
2. The Legislature of Manitoba maintains constitutional jurisdiction to make laws relating to the use and allocation of fish in Crown (Manitoba) waters as part of the public property. This includes the right to determine who can fish on provincial Crown land (licencing), what conditions may be included in a licence and what fee would be paid for the licence. This authority is exercised under The Fisheries Act of Manitoba and regulations to that Act.

Simply, those matters dealing with the conservation of the fish resource are addressed by the Fisheries Act (Canada) and the Manitoba Fishery Regulations (1987) made under the Act. Those matters relating to property rights in fish on Manitoba Crown land (water) are covered by The Fisheries Act (Manitoba) and regulations to that Act.
Fish Management and Administration:

While the Government of Canada retains ultimate legal authority and responsibility for fish and fish habitat conservation matters, some of the day-to-day management and administration of federal fisheries regulations has effectively been delegated to Manitoba officials: The Minister of Agriculture and Resource Development, the Director of Fish and Wildlife and fishery officers employed by Manitoba Department of Conservation and Climate Change.

Under the Manitoba Fishery Regulations (1987), the Minister of Agriculture and Resource Development and the Director of Fish and Wildlife have been given the authority to licence commercial and recreational fishing, and establish fees for such licences, vary close times, quotas and gear types, regulate the marketing of commercially caught fish, including the licencing of fish buyers/sellers and fish processors and reporting requirements.

Changes to the Manitoba Fishery Regulations (1987) are proposed by the Minister of Agriculture and Resource Development to Fisheries and Oceans Canada (aka Department of Fisheries and Oceans - DFO). DFO then reviews the proposed changes and forwards them for approval by Federal Cabinet (Governor in Council).
Legislative responsibility for management of fish habitat has not been specifically legislatively delegated to Manitoba officials. However, Manitoba Agriculture and Resource Development continues to manage habitat as an adjunct to other fish management activities.

Fish and Wildlife also operates under, amongst others, the authority of The Wildlife Act (Manitoba), The Fisheries Act (Manitoba), The Endangered Species and Ecosystems Act (Manitoba), and The Water Protection Act (Manitoba).

7.8.4 Dispute resolution

The Federal Courts Act 1985, provides a mechanism for parties to challenge decisions of administrative bodies or tribunals. Unresolved disputes within the Canadian fisheries management system can be, and have been, taken to the Canadian judicial system for a final decision. The most notable of these over the last three decades in relation to fishing rights have been the “Sparrow” and “Marshall” decisions. The Sparrow Decision (1990) resolved that aboriginal groups have a right to fish for food, societal and ceremonial purposes and that this use-right is surpassed only by conservation of the resource. The Marshall Decision (1999) stated that Treaties signed in 1760 and 1761 by Mi’kmaq and Maliseet communities include a communal right to hunt, fish and gather in pursuit of a moderate livelihood (Marshall Decision 1999).

At the fishery specific level, the CLFMP (Klein et al, 2020), highlights that many disputes can be proactively resolved through stakeholder consultation and has a section that describes the dispute resolution process:

- All disputes originating from either Cedar Lake Fisheries Inc., Manitoba Agriculture and Resource Development (Wildlife and Fisheries) and/or other pertinent stakeholders can be submitted as a written resolution for discussion and deliberation at the post season analysis meeting (note: subject to the urgency of an issue an emergency meeting could be called if circumstances warranted).

- Copies of the resolution can be provided to all parties at least one week prior to the scheduled meeting by Manitoba Agriculture and Resource Development (Wildlife and Fisheries). It is the responsibility of the Board of Directors of Cedar Lake Fisheries Inc. to ensure all of its members receive copies of the resolution.
- All disputes can be identified and dealt with as separate items in the meeting's agenda.
- The dispute can be read out by the President of Cedar Lake Fisheries Inc., followed by a brief verbal explanation as to the reason/nature of the dispute by the originating party/individual.
- A discussion, chaired by the President of Cedar Lake Fisheries Inc., can follow that will permit all participants an opportunity to present their opinion in a respectful and transparent environment.
- A decision based on mutual respect and consent of the majority of participants can serve as the basis for resolution of the dispute notwithstanding that decisions must maintain the integrity of the management plan, including the harvest strategy, and all parties commit that decisions will be made in the best interest of conservation and the Cedar Lake fishery resource.
- A record of all dispute resolution decisions can be incorporated as part of the written report of the annual post seasonal analysis session.

7.8.5 Respect of rights

The Constitution Act 1982 (Part II, Section 35) recognises and confirms Aboriginal and treaty rights of the Aboriginal peoples of Canada, including the legal rights to fish for food and livelihood. This has been litigated and confirmed by the Supreme Court on several occasions (R.v Sparrow, R.v Marshall).

In Manitoba, there are seven Treaties with First Nations (1, 2, 3, 4, 5, 6, 10). Treaties were signed to define, among other things, the respective rights of First Nations people and governments to use and enjoy lands that First Nations people traditionally occupied.

Cedar Lake is located within the area covered under Treaty 5 which was signed by the largest number of First Nation communities in Manitoba, including the Chemawawin Cree Nation. Crown obligations under includes:

> "... *shall have right to pursue their avocations of hunting and fishing throughout the tract surrendered as hereinbefore described, subject to such regulations as may from time to time be made by Her Government of Her Dominion of Canada, and saving and excepting such tracts as may from time to time be required or taken up for settlement, mining, lumbering or other purposes, by Her said Government of the Dominion of Canada, or by any of the subjects thereof duly authorized therefore by the said Government*."

When a fishing license system was adopted for Manitoba and closed seasons were introduced, under the new regulations, Treaty-right holders were allowed to fish for their own needs without a licence. Canadian courts have established that subsistence fisheries of indigenous people have priority over all other uses of the resource. Fishing occurs through constitutionally protected Treaty fishing rights and the fishery does not come under direct government regulation (except if there were species and areas closed for conservation reasons) (Klein et al, 2020).

7.8.6 Organisations involved in the management process

The CLFMP (Klein et al, 2020) identifies the various organisations involved in the management process. This includes organisations and departments charged/empowered with management responsibilities and organisations and groups of users and stakeholders:

Manitoba Provincial Government

- The Manitoba, Agriculture and Resource Development Fish and Wildlife Branch, develop assessment and monitoring programs, policies and legislation for fishing, hunting, trapping, conserving biodiversity, species and ecosystems at risk, fish and wildlife habitat, human-wildlife interaction management, and land and water management on Crown and private land. The Branch prepares and reports on programs, budgets, standards and guidelines in coordination with other areas of the department including regional staff. Fish and Wildlife have implemented a strategy to secure eco-certification of Manitoba's commercial fisheries. An organogram for the Fish and Wildlife branch is provided in Figure 20.

- Manitoba Conservation and Climate, role and mission is to, "sustainably manage and protect the province's environment and biodiversity of natural resources such as water, wildlife and forests by working cooperatively with the public, Indigenous communities, and other agencies, governments and stakeholders to strike a balance between protecting the integrity of the environment and meeting the social and economic needs of Manitobans.". The Department carries out its role and mission through, amongst other things:
    - development and administration of legislation and regulations pertaining to natural resources, the environment, water and pollution prevention;
    - monitoring and allocating sustainable natural resource use;
    - ensuring environmental protection by leading the review, assessment, approval, licensing and appeals processes for development activities;
    - managing and monitoring of environmental and water quality;
    - administration of funding programs to support departmental and government priorities; and, respecting and upholding the honour of the Crown with respect to Treaty and Aboriginal rights.

With respect to Cedar Lake, enforcement of fishery regulations, inclusive of the commercial, recreational, and subsistence fisheries, is the responsibility of the Manitoba Department of Conservation and Climate Change.

Federal Government:

DFO Ontario and Prairie Regions, based in Winnipeg, the department's main activities within the region are:

- freshwater research of aquatic species and ecosystems;
- management and prevention of aquatic invasive species;
- conservation, protection, restoration and recovery of aquatic species and their habitats through project reviews, engagement and partnerships;
- management of federally owned small craft harbours; and
- production of navigational products and providing services and information to ensure safety of vessels and boaters on the Great Lakes, St Lawrence River and inland waterways.

The federal government maintains an interest in Manitoba's activities and actions in exercising its delegated authority. The Canada-Manitoba Fisheries Advisory Committee (CMFAC) is the mechanism that allows both provincial and federal parties to understand the direction and activities of each government in fisheries-related matters. The CMFAC does not play a direct role in the management of the Cedar Lake fishery, it is simply advised of the activities that are being conducted there (Brian Parker, pers. comm.).

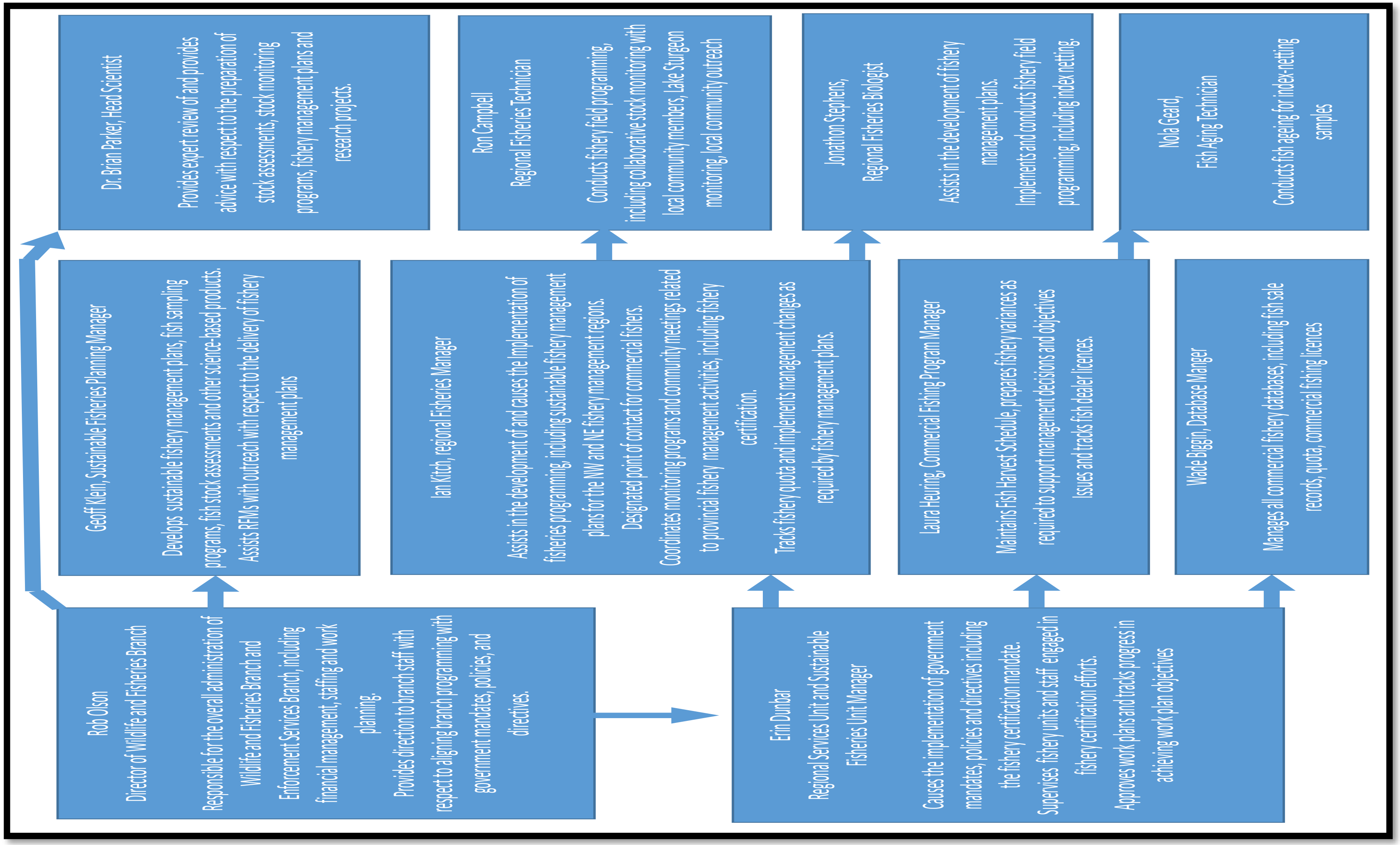

Figure 20. Organogram for Manitoba, Agriculture and Resource Development Fish and Wildlife Branch (Source: Fish and Wildlife Branch)

Fishers

Cedar Lake Fisheries Inc (formerly known as Napanee Bay Fishers Association) is the association that represents all of the Cedar Lake commercial fishers. In order to participate in the Cedar Lake commercial fishery, individuals are required to be members of the Cedar Lake Fisheries Inc. There are 41 commercial fishing licence holders on Cedar Lake.

Cedar Lake Fisheries Inc. has a President and an elected seven-member Executive Board. They meet regularly to discuss all commercial fishing matters. The Fish and Wildlife Branch meets with the Board at least twice a year, as well as having additional meetings, as required (Klein et al, 2020).

The Cedar Lake Resource Management Board (CLRMB) consist of members from Chemawawin First Nation and Easterville community. The objectives of this Board are to promote land use planning, resource management and environmental monitoring. Cedar Lake commercial fishing updates are provided to the CLRMB by representatives from the Fish and Wildlife Branch

Further information will be sought at the site visit to better understand how Cedar Lake Fisheries Inc. operates and also the relationship it has with Mosakahiken Cree Nation who holds a 10,000 Kgs walleye allocation.

Interested Stakeholder groups

All of the following are identified in the FMP (Klien et al, 2020) as stakeholders in the fisheries:

Recreational anglers/groups associations.

- Three commercial tourism lodge / outfitting operations that offer recreational angling opportunities on Cedar Lake (Moak Lodge and Camping, Hobb's Resort, Cook's Cabins and Campground).
- Fish Dealers / Freshwater Fish Marketing Corporation.
- Aboriginal Affairs and Northern Development Canada (AANDC) (formerly Indian and Northern Affairs Canada)

Indigenous Services Canada appears to have a supporting role in the fishery but it is not clear from the information available to the Assessment Team what this entails. Further information will be sought at the site visit.

7.8.7 Consultation processes

DFO advertises consultations on national policy and legislative issues on the DFO website and, where appropriate also conducts regional consultation on national and regional policy initiatives.

Through DFO national and regional websites, consultation are widely available and are considered to provide opportunity and encouragement for all interested and affected parties to be involved, e.g. "Open Consultations". Evidence through feedback provided on, "what we heard" links, suggests a level of effective engagement.

A consultation process section is included in the CLFMP (Klein et al, 2020). It describes a commitment by Manitoba Agriculture and Resource Development (Wildlife and Fisheries) to discuss all management actions, prior to their final decision and implementation, with the Cedar Lake Fisheries Inc. and all other pertinent resource users/stakeholders, and agreed upon, i.e., Manitoba Agriculture and Resource Development (Wildlife and Fisheries) and, in so doing, will:

- Conduct post seasonal analysis sessions with resource users/stakeholders, e.g., Cedar Lake Fisheries Inc., Manitoba Conservation and Climate Change recreational angler groups/associations, commercial tourism lodge operators and outfitters, to review the previous year's fishing activities and to make recommendations on implementing any management measures as might be required to meet the Plan's Harvest Strategy.
- Keep an annual written record of dates and events in the Cedar Lake fishery concerning overtures for consultation by all sectors, information received, and how any information was considered. This will include, but not necessarily be limited to, dates of meetings, list of invited stakeholders, formal attendance to the meetings, items of discussion, how information is used and not used, and outcomes.

The consultation section also confirms that monitoring and research results, including an annual stock assessment report detailing the state of the Cedar Lake fishery resource, will be disseminated to the general public through the Manitoba Agriculture and Resource Development (Wildlife and Fisheries) website as will published research or citations related to any related university research projects (subject to copyright restrictions).

Furthermore, for directly involved stakeholders and interested parties, all monitoring and research results and associated materials, including university-based research projects, will be presented, discussed and distributed at the annual Cedar Lake commercial fisher meeting, which will be followed by a general public meeting to be held in the Cedar Lake area. These materials will also be made available upon request to the Department of Agriculture and Resource Development (Wildlife and Fisheries) Branch head office.

7.8.8 Long term objectives

At the Federal level, fish stock conservation, other ecosystem sustainability objectives and the precautionary approach stem from Canadian legislation such as the Fisheries Act and Species at Risk Act (SARA), and policy initiatives such as the Sustainable Fisheries Framework and, more recently, Canada's commitment to the United Nations' Global Sustainable Development Goals, as set out in the Federal Sustainable Development Strategy development.

The Fisheries Act provides absolute discretion to the Minister for the management of fisheries and, in so doing, section 6 of the Act explicitly requires the Minister to consider fisheries management objectives before a regulation is made. The SARA (section 46) explicitly requires the Minister to report on the progress toward meeting recovery objectives of ETP species.

DFO's freshwater activities adhere to the department's sustainable development principles and objectives set out in one of the 13 goals as stated in the Federal Sustainable Development Strategy, which includes: shared stewardship, integrated management, an ecosystems approach, continuous improvement, the precautionary approach, and pollution prevention.

The precautionary and ecosystem approaches are required to be incorporated into all fishery management decisions while protecting biodiversity and fisheries habitat by virtue of the Sustainable Fisheries Framework (DFO 2009).

At the Provincial level, according to the CLFMP (Klein et al, 2020) the overarching objectives of Manitoba Agriculture and Resource Development (Wildlife and Fisheries Branch) is to meet its "Public Trust" obligations by ensuring the rational, orderly use of Manitoba's fisheries resource within the resource's capacity to produce a harvestable surplus. In achieving this mandate, the goals are to:

- ensure "No Net Loss" of quality and quantity of fish habitats;
- ensure that adequate supply exists to meet Constitutional obligations for Indigenous peoples to fish for food;
- have sustainable, community supported fishery management strategies;
- provide a diversity of angling opportunities;
- provide consistent, professional, high quality service to our clients and recommendations to elected decision makers; and,
- facilitate public participation in resource management and decision-making process.

Furthermore, three current ministerial mandates delivered from the Premier of Manitoba to the Minister of Agriculture and Resource Development in 2019 apply. These are:

1. Developing and implementing a strategy to secure the sustainability and certification of Manitoba's commercial fisheries.
2. Advancing a meaningful and respectful approach to shared management that works collaboratively with First Nations, Metis, landowners, licensed hunters, fishers and anglers to provide local communities a greater voice and ensure long-term sustainability of our fish and wildlife, forestry and other resources.
3. Implementing and publishing innovative fish and game surveys that engage Manitobans in the collection and interpretation of the data and enhance the quality and transparency of population data for biologists.

7.8.9 Fisheries specific objectives

According to the CLFMP (Klein et al, 2020), Manitoba Agriculture and Resource Development (Wildlife and Fisheries Branch) will manage the Cedar Lake commercial gillnet fishery based on the following objectives:

- The fishery must be conducted in a manner that does not lead to over-fishing or depletion of the harvested populations and, for those populations that are depleted the fishery must be conducted in a manner that demonstrates activities leading to stock recovery.
- Fishing operations (commercial, recreational and domestic/subsistence) should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.
- The fishery is subject to an effective management system that incorporates applicable federal and provincial legislation, policies, regulations, mandates and operational frameworks that require use of the resource to be responsible and sustainable.

To achieve and maintain these objectives, decisions made under the management plan are to be based upon the following principles:

- Fish Habitat **-** Healthy aquatic ecosystems / fish habitat is a prerequisite to healthy fish stocks.
- Public Trust **-** Fish stocks represent a public trust managed by Manitoba on behalf of all Manitobans.
- Biological sustainability - Sustainability of fish stocks is paramount for long-term industry viability.
- Pre-cautionary Principle - Fish management decisions and actions, whose impacts are not entirely certain but which, on reasonable and well-informed grounds appear to pose serious threats to either the economy, the environment, human health or social well-being will be anticipated, mitigated and prevented to the greatest extent possible as avoidance of serious threats to the fishery is less costly than rehabilitating a collapsed fish stock.
- Integrated Management - Consultation with government agencies, development proponents, fishers and the public will enhance awareness and understanding and the efficiency of fisheries management.
- Tenure - Individual allocations and tenure of access right will reduce over-capitalization and facilitate fishery rationalization.
- Fairness - Where adjustments to tenure or reallocation to another use or user is necessary, a fair process will facilitate transition to a desired state.

7.8.10 Decision making processes

According to the CLFMP (Klein et al, 2020), "The Province of Manitoba, through existing acts and regulations, retains primary authority and the legal right to make decisions in the best interest of conservation and the fishery resources of Manitoba. However, in the spirit of shared-management and collaboration, all management actions relating to the Cedar Lake commercial gillnet fishery will be consistent with the Plan's Harvest Strategy and corresponding Harvest Control Rules. All other management decisions and regulatory changes relating to other resource use, such as recreational angling and/or commercial tourism, will be implemented within a scope congruous to the Plan's Harvest Strategy and corresponding Harvest Control Rules.".

Manitoba Agriculture and Resource Development (Wildlife and Fisheries) commits that all management actions, prior to their final decision and implementation, will first be discussed with the Cedar Lake Fisheries Inc. and all other pertinent resource users/stakeholders, and agreed upon, as described in section 7.8.7 above.

An example of the decision-making process with respect to the harvest control role was provided. Actions guiding total allowable catch are triggered when harvest totals for the fishing year and assessment data for the same year become available before the subsequent fishing year. For example, at the conclusion of the 2018/19 fishing year, the total Lake Whitefish harvest in the Cedar Lake commercial fishery did not meet the agreed trigger of 45,000 kg. The total allowable catch for the 2019/20 fishing year was therefore reduced by 10% as per the HCR to 40,500. The 2019/20 fishing year was truncated by COVID-19 however, so the 2019/20 TAC was carried over to the 2020/21 fishing year. Fishers were informed of the triggering and adjusted TAC in regular fisher meetings and through their licenses (Brian Parker, pers. comm.).

An example of application of the precautionary approach in decision-making was also provided: commercial net fishers have asked for winter access to Cross Bay – the area of Cedar Lake closed to commercial netting – to access Lake Whitefish concentrated there. They propose to only use very large mesh expected to deliver very little bycatch and select for only mature, post-spawn whitefish. Cross Bay offers the best Lake Whitefish habitat in Cedar Lake, and the winter-only access avoids conflicts between recreational and commercial fishers by separating them in time; most recreational fishing occurs in the open water season. The request has been denied however, pending a complete assessment of the evolution of the post-impoundment Lake Whitefish population, and assessment of the potential bycatch in a large mesh, winter Cross Bay fishery (Brian Parker, pers. comm.).

7.8.11 Control and enforcement

According to the CLFMP (Klein et al, 2020), the Manitoba Department of Conservation and Climate Change are responsible for monitoring, control and surveillance (MCS) of commercial, recreational and subsistence fisheries.

Four Conservation officers from the Pas District Office currently enforce the commercial fishing regulations on Cedar Lake (Ian Kitch, pers. comm.).

Conservation Officers conduct compliance monitoring of Cedar Lake through patrols over the course of the year. Open water patrols primarily address recreational angling, commercial gillnet fishing and subsistence/domestic fishing; while winter patrols focus primarily on commercial gillnet fishing. When notified of potential violations, Conservation Officers investigate and have an increased presence on the lake. Conservation Officers also review commercial fish production records to determine potential issues/violations with respect to quotas (Klein et al, 2020).

Through liaison with staff from both Manitoba Agriculture and Resource Development (Wildlife and Fisheries) and Manitoba Conservation and Climate Change, commercial fishers and other agents working within the fishery are provided regular information on the management of the Cedar Lake fishery, and regulatory requirements concerning the operations of the commercial gillnet fishery.

Enforcement and compliance issues are also discussed between fishers and government officials on a regular basis. Fishers also collaborate with the Province to provide information of importance to the management of the fishery through participation in annual meetings with Fisheries staff and conservation officers (Klein et al, 2020).

Conditions of licence are either conveyed on all commercial fishing licences or as appendices to the licence. While season, limits and conditions are generally lake/fishery specific, a list of regulations apply to all regulated commercial fisheries throughout the Province. The most commonly applied regulations are set out in the CLFMP (Klein et al, 2020) and attached to fishing licences in the form of the Manitoba Commercial Fishing Guide, which is also available on the Manitoba Agriculture and Resource Development (Wildlife and Fisheries) website.

The following commercial season, limits and conditions are applicable to Cedar Lake:

- Quota Species: walleye, Goldeye, Lake Whitefish, and Sauger.
- Total Round Weight Quota (measured in round weight kilograms): 496,600 kilograms of which not more than 300,000 kilograms may be walleye.
- Seasons: The open water commercial fishing season is open from June 1st to, and including October 30th. The winter commercial fishing opens when ice makes on or after November 1st to, and including, April 30th.
- Gear Type: gillnet net with a minimum mesh size not less than 108 mm.

Financial and administrative sanctions are applied in the fishery: fines, quota reduction and licence suspension can be applied, the latter coming under the Minister's authority.

The Cedar Lake Fisheries Inc. Executive Board may also make recommendations as follows (Brian Parker, pers. comm.):

- A fisher convicted of a charge involving fishing may have his/her licence suspended for a period of time on the recommendation by the Board to Wildlife and Fisheries.
- A fisher convicted of exceeding the allowable quota by 200 kilograms or more shall on the second offence (in two out of three seasons) have his/her licence suspended for a period of one complete season.
- A fisher convicted for unattended and/or rotten fish will have his/her licence suspended for one complete season.
- A fisher convicted for using small mesh nets shall on the second offence (in two out of three seasons) have his/her licence suspended for one season.
- A fisher who abuses the rules under this policy will be subject to licence suspension as determined by the Board.
- A suspension of licence will not take place until the following fishing year.
- A suspension of licence may be appealed to the Board, Wildlife and Fisheries, or, both at the same time during the suspension. An appeal hearing will be held in conjunction with the Board and Wildlife and Fisheries.

The CLFMP (Klein et al, 2020), also indicates that DFO is the responsible body with respect to ensuring the sustainability and on-going productivity of commercial, recreational and aboriginal fisheries. This is done by ensuring no person can carry on any work, undertaking or activity that results in serious harm to fish and/or fish habitat. The DFO has several provisions that allow for enhanced protection of important fisheries including fines and penalties for offences, inspector powers and a “duty to notify” which requires a person whose actions harm fish habitat to report it and take corrective measures.

7.8.12 Management performance evaluation

According to the CLFMP (Klein et al, 2020), In order to determine if the Management Plan achieves its goals, a variety of management, science and enforcement performance indicators may be internally reviewed as appropriate:

- Assess the quality of data obtained from the Commercial Fishery Patrol Reports.
- Assess population status through the Cedar Lake collaborative stock monitoring program and any other pertinent monitoring programs, research/surveys and annual commercial harvest/production data.

The CLFMP also states that an external reviewer, independent of the Province or Department will assess the management of the fishery at least once within a 5-year period, on the presumption of the fishery being MSC certified.

7.9 Principle 3 Performance Indicator scores and rationales

The intent of Principle 3 (P3) is to ensure that there is an institutional and operational framework appropriate to the size and scale of the UoAs for implementing Principles 1 and 2, and that this framework is capable of delivering sustainable fisheries in accordance with the outcomes articulated in these Principles.

The "Governance and Policy" component of Principle 3 (the PIs pre-fixed with 3.1) focuses on the high-level context of the fishery management system within the UoAs. The "Fishery-Specific Management System" component of Principle 3 (the PIs pre-fixed with 3.2) focuses on the management system directly applied to the fisheries.

Freshwater fisheries in the Province of Manitoba are subject to mixed Federal and Provincial jurisdictions. Therefore, the following P3 evaluation considers the Federal and Provincial roles in the management of the UoAs, where applicable. By and large, this means both Federal and Provincial jurisdictions are considered under "Governance and Policy", whereas, only Provincial jurisdiction is considered in relation to the Fishery-Specific Management System.

PI 3.1.1 – Legal and/or customary framework

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: - Is capable of delivering sustainability in the UoA(s); - Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework		
Scoring Issue		SG 60	SG 80	SG 100
a	Compatibility of laws or standards with effective management			
	Guide post	There is an effective national legal system **and a framework for cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and **organised and effective cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and **binding procedures governing cooperation with other parties** which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = Yes
Rationale				

<u>Federal and Provincial</u>

The following evidence indicates SG 60 is met:

While the Government of Canada, under the authority of the Fisheries Act (1985, as amended), retains ultimate legal authority and responsibility for fish and fish habitat conservation matters, daily management and administration of Federal fisheries regulations are delegated to Manitoba officials. As such, Manitoban fisheries policy is based on the Federal legal framework as supported by Manitoba's Provincial laws and regulations. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is met:

Under the Manitoba Fishery Regulations (1987), the Minister of Agriculture and Resource Development and the Director of Fish and Wildlife have been given the authority to licence commercial and recreational fishing, and establish fees for such licences, vary close times, quotas and gear types, regulate the marketing of commercially caught fish, including the licencing of fish buyers/sellers and fish processors and reporting requirements.

The Agriculture and Resource Development, Fish and Wildlife Branch also operates under the authority of The Wildlife Act (Manitoba), The Fisheries Act (Manitoba), The Endangered Species and Ecosystems Act (Manitoba), and The Water Protection Act (Manitoba).

Legislative responsibility for management of fish habitat has not been legislatively delegated to Manitoba officials, however, Manitoba Agriculture and Resource Development Fish and Wildlife manages habitat as an adjunct to other fish management activities. Therefore, the SG 80 is met

The following evidence indicates SG 100 is met:

Changes to the Manitoba Fishery Regulations (1987) are proposed by Manitoba's Minister of Agriculture and Resource Development to the Fisheries and Oceans Canada (aka Department of Fisheries and Oceans - DFO). DFO then reviews the proposed changes and forwards them for approval by the Federal Cabinet. The defined approaches are legally binding on the Federal and Provincial management bodies. Therefore, the SG 100 is met.

b	**Resolution of disputes**			
	Guide post	The management system incorporates or is subject by law to a **mechanism** for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes which is **considered to be effective** in dealing with most issues and that is appropriate to the context of the UoA.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes that is appropriate to the context of the fishery and has been **tested and proven to be effective**.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

Federal

The following evidence indicates SG 60 is met:

The Federal Courts Act 1985, provides a mechanism for parties to appeal decisions of administrative bodies or tribunals and receive a hearing before a justice of the court. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is met:

Federal court hearings are open to the public and media and are therefore considered to be transparent, effective and appropriate for dealing with all issues in the context of the UoA. Therefore, the SG 80 is met.

The following evidence indicates SG 100 is met:

The system has been tested and proven to be effective on several occasions, for example, in 1990 at the Supreme Court of Canada, "The Sparrow Decision" resolved that aboriginal groups have a right to fish for food, societal and ceremonial purposes and that this use-right is surpassed only by conservation of the resource. Therefore, the SG 100 is met.

Provincial

The following evidence indicates SG 60 is met:

The CLFMP highlights that in many instances, disputes can be proactively resolved through stakeholder consultation. However, when this is not the case, a "Dispute Resolution Process", as described in the management plan, can be followed. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is not met:

The Dispute Resolution Process is described as follows:

All disputes originating from either Cedar Lake Fisheries Inc., Manitoba Agriculture and Resource Development (Wildlife and Fisheries) and/or other pertinent stakeholders can be submitted as a written resolution for discussion and deliberation at the post season analysis meeting (note: subject to the urgency of an issue an emergency meeting could be called if circumstances warranted).

Copies of the resolution can be provided to all parties at least one week prior to the scheduled meeting by Manitoba Agriculture and Resource Development (Wildlife and Fisheries). It is the responsibility of the Board of Directors of Cedar Lake Fisheries Inc. to ensure all of its members receive copies of the resolution.

All disputes can be identified and dealt with as separate items in the meeting's agenda.

The dispute can be read out by the President of Cedar Lake Fisheries Inc., followed by a brief verbal explanation as to the reason/nature of the dispute by the originating party/individual.

A discussion, chaired by the President of Cedar Lake Fisheries Inc., can follow that will permit all participants an opportunity to present their opinion in a respectful and transparent environment.

A decision based on mutual respect and consent of the majority of participants can serve as the basis for resolution of the dispute notwithstanding that, decisions must maintain the integrity of the management plan, including the harvest strategy, and all parties commit that, decisions will be made in the best interest of conservation and the Cedar Lake fishery resource.

A record of all dispute resolution decisions can be incorporated as part of the written report of the annual post seasonal analysis session.

This process is considered to be transparent, however it is not possible to evaluate its effectiveness without further evidence and discussion with fisheries managers and stakeholders. Therefore, the SG 80 is not met.

	Respect for rights			
c	Guide post	The management system has a mechanism to **generally respect** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to **observe** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to **formally commit** to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = Yes
Rationale				

Federal

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

The Constitution Act 1982 Part II, section 35), recognises and confirms Aboriginal and treaty rights of the Aboriginal peoples of Canada, including the legal rights to fish for food and livelihood.

This section of the Act has been litigated and confirmed by the Supreme Court on several occasions and constitutes a formal commitment to the rights of aboriginal peoples. Disputes regarding aboriginal fishing rights have been resolved, e.g., R. v Sparrow (1990). Therefore, the SG 80 is met.

The following evidence indicates SG 100 is met:

The Canadian constitution and subsequent Supreme Court of Canada judgements provide a tested and proven mechanism to formally commit to the legal rights of aboriginal peoples to fish for food and livelihood. Therefore, the SG 100 is met.

Provincial

The following evidence indicates SG 60 is met:

In Manitoba, there are seven Treaties with First Nations (1, 2, 3, 4, 5, 6, 10). Treaties were signed to define, among other things, the respective rights of First Nations people and governments to use and enjoy lands that First Nations people traditionally occupied. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is met:

See SG 100.

The following evidence indicates SG 100 is met:

Cedar Lake is located within the area covered under Treaty 5 which was signed by the largest number of First Nation communities in Manitoba, including the Chemawawin Cree Nation.

Crown obligations under includes:

> "... shall have right to pursue their avocations of hunting and fishing throughout the tract surrendered as hereinbefore described, subject to such regulations as may from time to time be made by Her Government of Her Dominion of Canada, and saving and excepting such tracts as may from time to time be required or taken up for settlement, mining, lumbering or other purposes, by Her said Government of the Dominion of Canada, or by any of the subjects thereof duly authorized therefore by the said Government."

When a fishing license system was adopted for Manitoba and closed seasons were introduced, under the new regulations, Treaty-right holders were allowed to fish for their own needs without a licence, in accordance with Treaty 5. Therefore, there is a mechanism to observe and formally commit to the legal rights of people dependent on fishing for food and livelihood. Therefore, SG 80 and 100 are met.

References

Manitoba Provincial Government, Legislative Framework Overview https://www.gov.mb.ca/sd/pubs/fish_wildlife/fish/leg.pdf

Constitution Act, 1867 https://laws-lois.justice.gc.ca/eng/const

Fisheries Act 1985 (Canada) https://laws-lois.justice.gc.ca/eng/acts/f-14/

Manitoba Natural Resources Transfer Agreement https://web2.gov.mb.ca/laws/statutes/ccsm/n030e.pdf

Fisheries Act of Manitoba https://web2.gov.mb.ca/laws/statutes/ccsm/f090e.php

Manitoba Fishery Regulations (1987) https://laws-lois.justice.gc.ca/eng/regulations/sor-87-509/index.html

The Wildlife Act (Manitoba) https://web2.gov.mb.ca/laws/statutes/ccsm/w130e.php

The Endangered Species and Ecosystems Act (Manitoba) https://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php

Federal Courts Act 1985 https://laws-lois.justice.gc.ca/eng/acts/f-7/

Sparrow Decision (1990) https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/609/index.do

Marshall Decision (1999) https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/1739/index.do

Treaty No. 5 http://www.trcm.ca/treaties/treaties-in-manitoba/treaty-no-5-2/

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

Draft scoring range	60-79
Information gap indicator	More information sought: It is not possible to evaluate the effectiveness of the dispute resolution process adopted within the Cedar Lake Fisheries Management Plan without further evidence and discussion with fisheries managers and stakeholders.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 3.1.1 scoring calculation

	Element	SIa (60,80,100)	SIb (60,80,100)	SIc (60,80,100)	PI Score
UoA 1 & 2	Federal	100	100	100	75
	Provincial	100	60	100	

PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2		The management system has effective consultation processes that are open to interested and affected parties The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties		
Scoring Issue		SG 60	SG 80	SG 100
a	**Roles and responsibilities**			
	Guide post	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **generally understood**.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for key areas** of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for all areas** of responsibility and interaction.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

The CLFMP identifies the various organisations involved in the management process. This includes Federal and Provincial departments and organisations empowered with management responsibilities. The functions of the departments and organisations are explicitly defined in their corresponding websites.

Organisations and groups of users and interested stakeholders are also identified in the management plan, however, some are identified in generic terms, e.g., recreational angler groups/associations. Limited information was provided within the management plan or from other sources, e.g., minutes of meetings, websites, showing participants and affiliation.

While it is often the case that those involved in a fishery on a day-to-day basis understand who is involved in the management process and understand most or all of the participants functions, roles and responsibility, this is not readily apparent to the Assessment Team from the information provided by the client. Therefore, it is not possible to provide a scoring range above SG 60 at his point. Further information and clarification will be sought at the site visit.

b	**Consultation processes**			
	Guide post	The management system includes consultation processes that **obtain relevant information** from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system demonstrates consideration of the information and **explains how it is used or not used**.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

<ins>Federal</ins>

The following evidence indicates SG 60 is met:

DFO advertises consultations on national policy and legislative issues on the DFO website and, where appropriate also conducts regional consultation on national and regional policy initiatives. Therefore, the SG 60 is met.

Through DFO national and regional websites, consultations are widely available and are considered to provide opportunity and encouragement for all interested and affected parties to be involved, e.g. “Open Consultations”

The following evidence indicates SG 80 is met:

DFO also demonstrates through their website the input and consideration of local knowledge and information obtained from consultations, e.g., information that was provided to DFO following the consultation on proposed amendments to the Fisheries Act. Therefore, the SG 80 is met.

The following evidence indicates SG 100 is not met:

There was no evidence to show that the Federal management system explains how information is not used. Therefore, the SG 100 is not met.

Provincial

The following evidence indicates SG 60 is met:

A “Consultation Process” section is included in the CLFMP. It describes a commitment by Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch to discuss all management actions with the Cedar Lake Fisheries Inc. and all other pertinent resource users/stakeholders, prior to their final decision and implementation. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is not met:

The consultation process section of the CLFMP describes what consultations will take place and how they will be recorded and reported, e.g.:

- Conduct post seasonal analysis sessions with resource users/stakeholders, (Cedar Lake Fisheries Inc., Manitoba Conservation and Climate Change, recreational angler groups/associations, commercial tourism lodge operators and outfitters) to review the previous year’s fishing activities and to make recommendations on implementing any management measures as might be required to meet the plan’s Harvest Strategy.
- Keep an annual written record of dates and events in the Cedar Lake fishery concerning overtures for consultation by all sectors, information received, and how any information was considered. This will include, but not necessarily be limited to, dates of meetings, list of invited stakeholders, formal attendance to the meetings, items of discussion, how information is used and not used, and outcomes.

The consultation section also confirms that monitoring and research results, including an annual stock assessment report detailing the state of the Cedar Lake fishery resource, will be disseminated to the general public through the Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch website as will published research or citations related to any related university research projects (subject to copyright restrictions).

Evidence of consultations, as described in the management plan, i.e., written records of consultation, were not available. Notification, agendas and informal notes/ minutes were provided to the Assessment Team which appear to show annual or biannual meetings between representatives of Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and Napanee Bay Fishers Association (now known as Cedar Lake Fisheries Inc.). Further information and discussion with Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and stakeholders will be required in order to achieve the SG 80 or higher. Therefore, the SG 80 is not met.

c	**Participation**			
	Guide post		The consultation process **provides opportunity** for all interested and affected parties to be involved.	The consultation process provides **opportunity and encouragement** for all interested and affected parties to be involved, and **facilitates** their effective engagement.
	Met?		All UoAs = No	All UoAs = No
Rationale				

Federal

The following evidence indicates SG 80 is met:

Through the DFO national website, consultations are available and are considered to provide opportunity and encouragement for all interested and affected parties to be involved. Therefore, the SG 80 is met. It is noted that consultations are also publicised on most of DFO regional websites, however, this is not the case for DFO's Ontario and Prairie Region.

The following evidence indicates SG 100 is not met:

Evidence through feedback provided on DFO's national website "what we heard" link, suggests a level of effective engagement. Therefore, the SG 100 is met.

Province

The following evidence indicates SG 80 is not met:

According to the CLFMP, any interested stakeholder has the opportunity to attend scheduled meetings with the fishery managers, e.g., Post-season analysis meetings. Notification, agendas and informal notes/ minutes were provided to the Assessment Team which appear to show annual or biannual meetings between representatives of Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and Napanee Bay Fishers Association (now known as Cedar Lake Fisheries Inc.). Further information and discussion with Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and stakeholders will be required in order for the Assessment Team to evaluate this scoring issue. Therefore, the SG 80 is not met.

References

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

DFO National Website, "Consultations and Reviews" webpage https://www.dfo-mpo.gc.ca/fisheries-peches/consultation/index-eng.html

DFO National Website, "Open Consultations" webpage https://www.dfo-mpo.gc.ca/about-notre-sujet/engagement/open-ouvert-eng.html

Draft scoring range	60-79
Information gap indicator	More information sought: • The CLFMP describes a co-management approach, however, clearer information is needed in order for the Assessment Team to understand which organisations and individuals are involved in the management process and what functions, roles and responsibilities they have. Furthermore, it appears that Indigenous Service Canada play an important role in supporting/facilitating the management of the fishery, however, there is no information relating to them. As indicated in the MSC guidance on this PI, "To verify the extent to which roles and responsibilities are defined across the management system, CABs may need to work with stakeholders to prepare simple governance, institutional or system maps". • Evidence is needed of consultations, as described in the management plan, e.g., written records of consultation, to support the scoring of SIb and SIc.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 3.1.2 scoring calculation

	Element	SIa (60,80,100)	SIb (60,80,100)	SIc (80,100)	PI Score
UoA 1 & 2	Federal	60	100	100	65
	Provincial		60	60	

PI 3.1.3 – Long term objectives

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Fisheries Standard, and incorporates the precautionary approach		
Scoring Issue		SG 60	SG 80	SG 100
a	**Objectives**			
	Guide post	Long-term objectives to guide decision-making, consistent with the MSC Fisheries Standard and the precautionary approach, are **implicit** within management policy.	**Clear** long-term objectives that guide decision-making, consistent with MSC Fisheries Standard and the precautionary approach are **explicit** within management policy.	**Clear** long-term objectives that guide decision-making, consistent with MSC Fisheries Standard and the precautionary approach, are **explicit** within **and required by** management policy.
	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = Yes
Rationale				

Federal

The following evidence indicates SG 60 is met:

Fish stock conservation and other ecosystem sustainability objectives and the precautionary approach stem from Canadian legislation such as the Fisheries Act and Species at Risk Act, and policy initiatives such as the Sustainable Fisheries Framework and, more recently, Canada's commitment to the United Nations' Global Sustainable Development Goals, as set out in the Federal Sustainable Development Strategy development. Therefore, the SG 60 is met for all UoAs.

The following evidence indicates SG 80 is met:

The Fisheries Act provides absolute discretion to the Minister for the management of fisheries and, in so doing, section 6 of the Act explicitly requires the Minister to consider fisheries management objectives before a regulation is made.

The Species at Risk Act (section 46) explicitly requires the Minister to report on the progress toward meeting recovery objectives of ETP species.

DFO's freshwater activities adhere to the department's sustainable development principles and objectives set out in one of the 13 goals as stated in the Federal Sustainable Development Strategy, which includes: shared stewardship, integrated management, an ecosystems approach, continuous improvement, the precautionary approach, and pollution prevention. Therefore, the SG 80 is met.

The following evidence indicates SG 100 is met:

The precautionary and ecosystem approaches are required to be incorporated into all fishery management decisions while protecting biodiversity and fisheries habitat by virtue of the Sustainable Fisheries Framework. Therefore, the SG 100 is met.

Provincial

The following evidence indicates SG 60 is met:

According to the CLFMP (Klein et al, 2020) the overarching objectives of Manitoba Agriculture and Resource Development (Wildlife and Fisheries Branch) is to meet its "Public Trust" obligations by ensuring the rational, orderly use of Manitoba's fisheries resource within the resource's capacity to produce a harvestable surplus. In achieving this mandate, the goals are to:

- ensure "No Net Loss" of quality and quantity of fish habitats;
- ensure that adequate supply exists to meet Constitutional obligations for Indigenous peoples to fish for food;
- have sustainable, community supported fishery management strategies;

- provide a diversity of angling opportunities;
- provide consistent, professional, high quality service to our clients and recommendations to elected decision makers; and,
- facilitate public participation in resource management and decision-making process.

Therefore, the SG 60 is met.

The following evidence indicates SG 80 is met:

See SG 100.

The following evidence indicates SG 100 is met:

Furthermore, three current ministerial mandates delivered from the Premier of Manitoba to the Minister of Agriculture and Resource Development in 2019 apply. These are:

- Developing and implementing a strategy to secure the sustainability and certification of Manitoba's commercial fisheries.
- Advancing a meaningful and respectful approach to shared management that works collaboratively with First Nations, Metis, landowners, licensed hunters, fishers and anglers to provide local communities a greater voice and ensure long-term sustainability of our fish and wildlife, forestry and other resources.
- Implementing and publishing innovative fish and game surveys that engage Manitobans in the collection and interpretation of the data and enhance the quality and transparency of population data for biologists.

As indicated in PI 3.1.1 above, while Manitoba's fisheries are managed under the delegated responsibility of Manitoba's Minister of Agriculture and Resource Development, vetting and approval of any regulatory changes are required by the Minister of Fisheries and Oceans Canada, and so, given the legislative requirements and policy commitments, the application of the precautionary approach is adhered to. Therefore, the SG 80 and 100 are met.

References

Fisheries Act 1985 (Canada) https://laws-lois.justice.gc.ca/eng/acts/f-14/

Species at Risk Act (2002) http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf

Sustainable Fisheries Framework https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/overview-cadre-eng.htm

United Nations' Global Sustainable Development Goals https://www.international.gc.ca/world-monde/issues_development-enjeux_developpement/priorities-priorites/agenda-programme.aspx?lang=eng&_ga=2.24837310.528186103.1527172327-1521526801.1524682106

Federal Sustainable Development Strategy https://www.canada.ca/en/services/environment/conservation/sustainability/federal-sustainable-development-strategy.html

13 Goals of the Sustainable Develop Strategy https://www.fsds-sfdd.ca/en/goals

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 3.2.1 – Fishery-specific objectives

PI 3.2.1		The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2		
Scoring Issue		SG 60	SG 80	SG 100
a	**Objectives**			
	Guide post	**Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system.	**Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.	**Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.
	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

According to the CLFMP, Manitoba Agriculture and Resource Development (Wildlife and Fisheries Branch) will manage the Cedar Lake commercial gillnet fishery based on the following objectives:

- The fishery must be conducted in a manner that does not lead to over-fishing or depletion of the harvested populations and, for those populations that are depleted the fishery must be conducted in a manner that demonstrates activities leading to stock recovery.
- Fishing operations (commercial, recreational and domestic/subsistence) should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.
- The fishery is subject to an effective management system that incorporates applicable federal and provincial legislation, policies, regulations, mandates and operational frameworks that require use of the resource to be responsible and sustainable.

These objectives can be viewed in both the short and long term and are consistent with the outcomes expressed by MSC's Principles 1 and 2, i.e., in relation to target species, primary and secondary species, ETP species, habitats and ecosystems. Therefore, the SG 60 and 80 are met.

The following evidence indicates SG 100 is not met:

The SG 100 is not met as the objectives need to be operationally defined in such a way that the performance against the objective can be measured.

References

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 3.2.2 – Decision-making processes

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery		
Scoring Issue		SG 60	SG 80	SG 100
a	**Decision-making processes**			
	Guide post	There are **some** decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	All UoAs = Yes	All UoAs = Yes	
Rationale				

The following evidence indicates SG 60 is met:

The CLFMP has a section describing the current decision-making process:

"The Province of Manitoba, through existing acts and regulations, retains primary authority and the legal right to make decisions in the best interest of conservation and the fishery resources of Manitoba. However, in the spirit of shared-management and collaboration, all management actions relating to the Cedar Lake commercial gillnet fishery will be consistent with the Plan's Harvest Strategy and corresponding Harvest Control Rules. All other management decisions and regulatory changes relating to other resource use, such as recreational angling and/or commercial tourism, will be implemented within a scope congruous to the Plan's Harvest Strategy and corresponding Harvest Control Rules.

Manitoba Agriculture and Resource Development (Wildlife and Fisheries) commits that all management actions, prior to their final decision and implementation, will first be discussed with the Cedar Lake Fisheries Inc. and all other pertinent resource users/stakeholders, and agreed upon, as described in the Consultation Process section of the FMP.".

The following evidence indicates SG 80 is met:

Notification, agendas and informal notes/ minutes were provided to the Assessment Team which appear to show annual or biannual meetings between representatives of Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and Napanee Bay Fishers Association (now known as Cedar Lake Fisheries Inc.).

An example of the decision-making process with respect to the harvest control role was provided. Actions guiding total allowable catch are triggered when harvest totals for the fishing year and assessment data for the same year become available before the subsequent fishing year. For example, at the conclusion of the 2018/19 fishing year, the total Lake Whitefish harvest in the Cedar Lake commercial fishery did not meet the agreed trigger of 45,000 kg. The total allowable catch for the 2019/20 fishing year was therefore reduced by 10% as per the HCR to 40,500. The 2019/20 fishing year was truncated by COVID-19 however, so the 2019/20 TAC was carried over to the 2020/21 fishing year. Fishers were informed of the triggering and adjusted TAC in regular fisher meetings and through their licenses (Brian Parker, pers. comm.).

Therefore, the SG 80 is met.

b	**Responsiveness of decision-making processes**			
	Guide post	Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

The CLFMP describes the evolution of the Cedar Lake fisheries and the outcome of various decisions over the years resulting from research, monitoring, evaluation and consultation, e.g., the closure of the fisheries in the early 1970s and late 1990s due to elevated mercury concentrations in fish and decline in the walleye stock, respectively; the allocation of quotas for the main commercial species combined with a "lake tolerance" for walleye; introduction of specified fishing gear; closed season and areas; rationalising and restructuring of the fishery; the development and implementation of a management plan in 2006 with subsequent amendments; and, introduction of a harvest strategy and control rule for walleye and Northern pike in 2017. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is met:

Notification, agendas and informal notes/ minutes were provided to the Assessment Team which appear to show annual or biannual meetings between representatives of Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and Napanee Bay Fishers Association (now known as Cedar Lake Fisheries Inc.).

An example of the decision-making process with respect to the harvest control role was provided. Actions guiding total allowable catch are triggered when harvest totals for the fishing year and assessment data for the same year become available before the subsequent fishing year. For example, at the conclusion of the 2018/19 fishing year, the total Lake Whitefish harvest in the Cedar Lake commercial fishery did not meet the agreed trigger of 45,000 kg. The total allowable catch for the 2019/20 fishing year was therefore reduced by 10% as per the HCR to 40,500. The 2019/20 fishing year was truncated by COVID-19 however, so the 2019/20 TAC was carried over to the 2020/21 fishing year. Fishers were informed of the triggering and adjusted TAC in regular fisher meetings and through their licenses (Brian Parker, pers. comm.). Therefore, the SG 80 is met.

The following evidence indicates SG 100 is not met:

Information was not available to indicate that decision making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. Therefore SG 100 is not met.

c	**Use of precautionary approach**			
	Guide post		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		All UoAs = Yes	
Rationale				

The following evidence indicates SG 80 is met:

The CLFMP explicitly defines the Precautionary Approach (PA) as, "Management decisions and actions, whose impacts are not entirely certain but which, on reasonable and well-informed grounds appear to pose serious threats to either the economy, the environment, human health or social well-being will be anticipated, mitigated and prevented as avoidance of serious threats to the fishery is less costly than rehabilitating a collapsed fish stock.".

However, the FMP does not indicate that the PA is required in application of the plan.

That said, the FMP states that a PA has been applied regarding the maintenance of a closed area, known as Cross Bay (Figure 1), to commercial fishing with the intent of protecting Lake Whitefish, pending data collection, stock assessment, consultation with the adjacent three First Nations and meetings with angling stakeholders.

Furthermore, an example of application of the PA in decision-making was also provided: commercial net fishers have asked for winter access to Cross Bay – the area of Cedar Lake closed to commercial netting – to access Lake Whitefish concentrated there. They propose to only use very large mesh expected to deliver very little bycatch and select for only mature, post-spawn whitefish. Cross Bay offers the best Lake Whitefish habitat in Cedar Lake, and the winter-only access avoids conflicts between recreational and commercial fishers by separating them in time; most recreational fishing occurs in the open water season. The request has been denied however, pending a complete assessment of the evolution of the post-impoundment Lake Whitefish population, and assessment of the potential bycatch in a large mesh, winter Cross Bay fishery (Brian Parker, pers. comm.).

On-going monitoring of the walleye and Northern pike stocks through annual index netting and the estimate of fishing mortality from the commercial, recreational and subsistence provides the best available information to inform the decision-making process for the harvest control rules of the up-coming season.

Therefore, the SG 80 is met.

	Accountability and transparency of management system and decision-making process			
d	Guide post	Some information on the fishery's performance and management action is generally available on request to stakeholders.	**Information on the fishery's performance and management action is available on request**, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders **provides comprehensive information on the fishery's performance and management actions** and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

The CLFMP indicates that information on the fisheries performance and management measures is made available at the post-season analysis meetings with, "Cedar Lake Fisheries Inc., Manitoba Agriculture and Resource Development (Wildlife and Fisheries), Manitoba Conservation and Climate Change and other pertinent resource users/stakeholders, such as recreational angler groups/associations, commercial tourism lodge operators and outfitters", and in so doing, "…review the previous year's fishing activities and to make recommendations on implementing any management measures as might be required to meet the Plan's Harvest Strategy.". Therefore, the SG 60 is met.

The following evidence indicates SG 80 is not met:

Notification, agendas and informal notes/ minutes were provided to the Assessment Team which appear to show annual or biannual meetings between representatives of Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and Napanee Bay Fishers Association (now known as Cedar Lake Fisheries Inc.). Further information and discussion with Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch and stakeholders will be required in order for the Assessment Team to evaluate this scoring issue. Therefore, the SG 80 is not met.

	Approach to disputes			
e	Guide post	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = Yes
Rationale				

The following evidence indicates SG 60 is met:

The Assessment Team is not aware of:

1. Any court challenges against the fisheries or management authority or reports of any concerns or evidence of a disrespect or defiance of the law by repeated violation of the same law or regulation necessary for the sustainability for the fishery;
2. Legal challenges that have resulted in judicial decisions that the management system or fishery is attempting to comply with.

According to the CLFMP the proactive consultation combined with the dispute resolution process are considered to provide a proactive approach in avoiding legal disputes by working closely with the stakeholders. Therefore, the SG 60 is met

The following evidence indicates SG 80 and SG 100 are met:

A representative from Manitoba Agriculture and Resource Development, Wildlife and Fisheries Branch confirmed there are no known legal challenges with respect to the fishery and the co-management approach adopted within the fishery helps to ensure legal challenges are mitigated through dialogue and the dispute resolution mechanisms (Brian Parker, pers. comm.). Therefore, the SG 80 and SG 100 are met.

References

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

Draft scoring range	60 - 79
Information gap indicator	More information sought: • In order to demonstrate, accountability and transparency of the management system and decision-making process by, as a minimum, providing evidence that the fisheries performance and any management actions is generally available on request to stakeholders.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 3.2.3 – Compliance and enforcement

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with		
Scoring Issue		SG 60	SG 80	SG 100
a	**MCS implementation**			
	Guide post	Monitoring, control and surveillance **mechanisms** exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance **system** has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A **comprehensive** monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

According to the CLFMP, the Manitoba Department of Conservation and Climate Change are responsible for monitoring, control and surveillance (MCS) of commercial, recreational and subsistence fisheries. Conservation Officers conduct compliance monitoring of Cedar Lake through patrols over the course of the year. Open water patrols primarily address commercial gillnet fishing, recreational angling and subsistence fishing; while winter patrols focus primarily on commercial gillnet fishing. When notified of potential violations, Conservation Officers investigate and have an increased presence on the lake. Conservation Officers also review commercial fish production records to determine potential issues/violations.

Four Conservation Officers from the Pas District Office currently enforce the commercial fishing regulations on Cedar Lake (Ian Kitch, pers. comm.).

Therefore, the SG 60 is met.

The following evidence indicates SG 80 is not met:

Limited information was available with respect to the compliance monitoring, e.g., No detailed information on the number of patrols, number of inspections, outcome of inspections. This will be further investigated at the site visit through discussion with representative from the Manitoba Department of Conservation and Climate Change and other stakeholders. Until then, based on the information available to the Assessment Team, it is not possible to confirm that the UoAs meet the SG 80 or higher.

b	**Sanctions**			
	Guide post	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, **are consistently applied** and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and **demonstrably** provide effective deterrence.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

On review of the Manitoba Wildlife and Fisheries Branch website, it appears that financial and administrative sanctions appear to be applicable in the fishery in the form of fines, quota reduction and licence suspension and the website indicates they are applied.

Furthermore, the Executive Board of the Cedar Lake Fisheries Inc. can make recommendations to the Manitoba Wildlife and Fisheries Branch with respect to penalties/sanctions these include:

- A fisher convicted of a charge involving fishing may have his/her licence suspended for a period of time on the recommendation by the Board.
- A fisher convicted of exceeding the allowable quota by 200 kilograms or more shall on the second offence (in two out of three seasons) have his/her licence suspended for a period of one complete season.
- A fisher convicted for unattended and/or rotten fish will have his/her licence suspended for one complete season.
- A fisher convicted for using small mesh nets shall on the second offence (in two out of three seasons) have his/her licence suspended for one season.
- A fisher who abuses the rules under this policy will be subject to licence suspension as determined by the Board.
- A suspension of licence will not take place until the following fishing year.
- A suspension of licence may be appealed to the Board, Wildlife and Fisheries, or, both at the same time during the suspension. An appeal hearing will be held in conjunction with the Board and Wildlife and Fisheries.

The CLFMP (Klein et al, 2020), also indicates that DFO is the responsible body with respect to ensuring the sustainability and on-going productivity of commercial, recreational and aboriginal fisheries. This is done by ensuring no person can carry on any work, undertaking or activity that results in serious harm to fish and/or fish habitat. The DFO has several provisions that allow for enhanced protection of important fisheries including fines and penalties for offences, inspector powers and a “duty to notify” which requires a person whose actions harm fish habitat to report it and take corrective measures.

The following evidence indicates SG 80 is not met:

Further evidence is necessary in order to confirm whether sanctions are consistently applied and are either thought or, it can be demonstrated, that they provide an effective deterrent. This will be further investigated at the site visit. Until then, based on the information available to the Assessment Team, it is not possible to confirm that the UoAs meet the SG 60, 80 or 100.

c	**Compliance**			
	Guide post	Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	**Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

Given the fishery is progressing with MSC assessment it is thought that the fishers generally comply with the management system and, when required provide information of importance to the effective management of the fishery. Therefore, the SG 60 is met.

The following evidence indicates SG 80 is not met:

No evidence was available to evaluate this scoring issue. This will be further investigated at the site visit. Therefore, the SG 80 is not met.

d	**Systematic non-compliance**			
	Guide post		There is no evidence of systematic non-compliance.	

	Met?		All UoAs = No	
Rationale				

The following evidence indicates SG 80 is not met:

No evidence was available to evaluate this scoring issue, that said, it seems highly unlikely that a fishery would progress with a MSC assessment if there was systematic non-compliance. However, until this can be validated at the site visit it is not possible to confirm that the UoAs meet the SG 80.

References

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

Manitoba Wildlife and Fisheries Branch https://www.gov.mb.ca/fish-wildlife/pubs/fish_wildlife/fish/comm_fish_sus_dir.pdf

Draft scoring range	60 – 79
Information gap indicator	More information sought In order to demonstrate: • MCS mechanisms or a system exist, and have been implemented and there is either a reasonable expectation they are effective or it has been demonstrated that they have an ability to enforce relevant management measures, strategies and/or rules. • Sanctions to deal with non-compliance exist and there is some evidence that they are applied or consistently applied and thought to provide a deterrent. • Whether fishers are generally thought to comply or evidence exists to demonstrate they comply, including when required, providing information of importance to the effective management of the fishery. • There is no evidence of systematic non-compliance.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4	There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives There is effective and timely review of the fishery-specific management system			
Scoring Issue		SG 60	SG 80	SG 100
a	**Evaluation coverage**			
	Guide post	There are mechanisms in place to evaluate **some** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **key** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **all** parts of the fishery-specific management system.
	Met?	All UoAs = Yes	All UoAs = Yes	All UoAs = No
Rationale				

The following evidence indicates SG 60 is met:

See SG 80.

The following evidence indicates SG 80 is met:

The CLFMP has a "Performance Review" section, it states that:

> "*In order to determine if the FMP achieves its goals, a variety of management, science and enforcement performance indicators may be internally reviewed as appropriate, i.e.:*
>
> - *Assess the quality of data obtained from the Commercial Fishery Patrol Reports.*
> - *Assess population status through the Cedar Lake collaborative stock monitoring program and any other pertinent monitoring programs, research/surveys and annual commercial harvest/production data.*"

Furthermore, in the FMPs "Consultation Process" section, it states that:

> "*Post seasonal analysis sessions will be conducted with Cedar Lake Fisheries Inc., Manitoba Agriculture and Resource Development (Wildlife and Fisheries), Manitoba Conservation and Climate Change and other pertinent resource users/stakeholders, such as recreational angler groups/associations, commercial tourism lodge operators and outfitters to review the previous year's fishing activities and to make recommendations on implementing any management measures as might be required to meet the Plan's Harvest Strategy*."

The Assessment Team were uncertain what the first bullet point above entails and the overall intent and will seek clarification at the site visit. That said, the CLFMP does indicate that mechanisms are in place to evaluate key parts of the fishery specific management system. Therefore, the SG 60 and 80 are met.

The following evidence indicates SG 100 is not met:

The SG 100 is not met as there is no evidence that mechanisms are in place to review all parts of the fishery specific management system.

b	**Internal and/or external review**			
	Guide post	The fishery-specific management system is subject to **occasional internal** review.	The fishery-specific management system is subject to **regular internal** and **occasional external** review.	The fishery-specific management system is subject to **regular internal and external** review.
	Met?	All UoAs = Yes	All UoAs = No	All UoAs = No

Rationale

The following evidence indicates SG 60 is met:

The CLFMP "Performance Review" section states that,

> "*The Cedar Lake fishery management system will be subjected to regular internal and at least one external review...The Cedar Lake fishery management plan will be assessed by an external reviewer, independent of the Province or Department. This action will be completed at least once during the 5-year period of Cedar Lake's certification and prior to reassessment… Manitoba Agriculture and Resource Development (Wildlife and Fisheries) will record evidence that the Cedar Lake management system has been reviewed internally and externally.".*

The Assessment Team will seek further evidence of internal review of the Cedar Lake fisheries management system at the site visit. However, it seems highly likely that given the evolution of the fishery over many years, further evidence of occasional/regular, internal review can be provided to the Assessment Team. Therefore, the SG 60 is met

The following evidence indicates SG 80 is not met:

It does not appear that there has been an external review of the fishery, although, the CLFMP clearly indicates that this will happen if the fishery is MSC certified. Therefore, the UoAs do net meet the SG 80 or 100.

References

Klein, G.; Galbraith, W. and Kitch, I., 2020. Cedar Lake Fisheries Management Plan

Draft scoring range	60 - 79
Information gap indicator	More information sought • The Assessment Team will seek clarification on the processes/mechanisms in place to evaluate key parts of the fishery specific management system. • The Assessment Team will seek further evidence of an occasional / regular internal review and an occasional external review of the Cedar Lake fisheries management system.

Overall Performance Indicator scores added from Client and Peer Review Draft Report stage

Overall Performance Indicator score	
Condition number (if relevant)	

7.10 Principle 3 References

Constitution Act, 1867 https://laws-lois.justice.gc.ca/eng/const

Fisheries Act 1985 (Canada) https://laws-lois.justice.gc.ca/eng/acts/f-14/

Manitoba Natural Resources Transfer Agreement https://web2.gov.mb.ca/laws/statutes/ccsm/n030e.pdf

Fisheries Act of Manitoba https://web2.gov.mb.ca/laws/statutes/ccsm/f090e.php

Manitoba Fishery Regulations (1987) https://laws-lois.justice.gc.ca/eng/regulations/sor-87-509/index.html

The Wildlife Act (Manitoba) https://web2.gov.mb.ca/laws/statutes/ccsm/w130e.php

The Endangered Species and Ecosystems Act (Manitoba) https://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php

The Water Protection Act (Manitoba). https://web2.gov.mb.ca/laws/statutes/ccsm/w065e.php

The Freshwater Fish Marketing Act https://laws-lois.justice.gc.ca/eng/acts/f-13/fulltext.html

Federal Courts Act 1985 https://laws-lois.justice.gc.ca/eng/acts/f-7/

Sparrow Decision https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/609/index.do

Marshall Decision (1999) https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/1739/index.do

The Manitoba, Agriculture and Resource Development Fish and Wildlife Branch, https://www.gov.mb.ca/fish-wildlife/index.html

Fisheries Act 1985 (Canada) https://laws-lois.justice.gc.ca/eng/acts/f-14/

Species at Risk Act (2002) http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf

Sustainable Fisheries Framework (2009) https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/overview-cadre-eng.htm

United Nations' Global Sustainable Development Goals https://www.international.gc.ca/world-monde/issues_development-enjeux_developpement/priorities-priorites/agenda-programme.aspx?lang=eng&_ga=2.24837310.528186103.1527172327-1521526801.1524682106

Federal Sustainable Development Strategy https://www.canada.ca/en/services/environment/conservation/sustainability/federal-sustainable-development-strategy.html

13 Goals of the Sustainable Develop Strategy https://www.fsds-sfdd.ca/en/goals

Manitoba Commercial Fishing Guide, https://www.gov.mb.ca/fish-wildlife/pubs/fish_wildlife/fish/commercial_fishing_guide_2019_2020.pdf

Klein, G., and Galbraith, W. Waterhen Lake Fisheries Managament Plan 2019. https://gov.mb.ca/fish-wildlife/pubs/fish_wildlife/fish/waterhen_mgt_plan.pdf

8 Appendices

8.1 Background information

8.1.1 Fork length and total weight at age of walleye, from data for Cedar Lake, 2009–2010, provided in CAMPP (2014).

Fork length (mm) and total weight (g) for walleye from Cedar Lake, Southeast Basin, coarse-mesh index sampling, A) 2009 and 2010, as well as B) 2009 and 2010 combined (years equally weighted), including calculated von Bertalanffy fork length at age data and parameters. Number of samples and mean values are provided and 95% confidence intervals are calculated. From CAMPP (2014 – Table 5.2.7-18). Sexes combined; data were not separated by sex in the CAMPP (2014) report. The conversion from fork length to total length for walleye is TL = 1.06021 FL from Colby et al. (1979 – Table XI).

A

	2009 Sample					2010 Sample				
		Fork length (mm)		Total weight (g)			Fork length (mm)		Total weight (g)	
Age	N	Mean	± 95% CI	Mean	± 95% CI	N	Mean	± 95% CI	Mean	± 95% CI
1	2	166	5.5	55	29.1					
2	4	211	9.8	113	20.6	3	222	26.0	118	31.7
3	34	232	7.7	146	20.1	2	252	22.2	175	48.5
4	31	269	11.3	245	28.5	9	293	18.9	291	55.5
5	8	346	27.7	473	39.6	26	342	8.5	466	45.0
6	112	370	5.6	641	29.4	4	374	30.4	678	170.0
7	38	384	10.2	712	56.3	45	399	10.8	802	69.2
8	47	395	9.4	818	62.3	28	405	14.4	861	95.2
9						21	406	19.7	915	130.0
10						6	415	48.0	939	310.0
11	2	456	88.7	1,300	686.0					
12						2	442	103.0	1,195	303.0
13	2	533	48.5	1,935	520.0					
14						2	590	126.0	2,528	126.0
Total	280					148				

B

		2009 and 2010 samples combined		
		Fork length (mm)		
Age	N	Mean	von Bertalanffy	Total weight (g)
1	2	166	155	55
2	7	217	210	116
3	36	242	256	161
4	40	281	294	268
5	34	344	326	470
6	116	372	352	660
7	83	392	375	457
8	75	400	393	835
9	21	406	409	915
10	6	415	422	939
11	2	456	433	1,300
12	2	442	442	1,195
13	2	533	450	1,935
14	2	590	456	2,528
Parameters				
L_∞			488.2	
K			0.179	
t_0			-1.132	
ω–omega			87.6	
N	428			
Age group means			1–12	

Lloyd's Register

8.1.2 Von Bertalanffy fork length at age estimates for walleye and northern pike, 2009–2013, from data provided in CAMPP (2014) and CAMP (2017).

Von Bertalanffy mean fork length at age estimates and parameters for walleye and northern pike, Cedar Lake, 2009–2013. walleye values for 2009–2010 were calculated using von Bertalanffy parameters in CAMPP (2014 – Figure 5.2.7-28). walleye estimates for 2009–2013 were calculated from von Bertalanffy model fits of mean length at age extracted from figure in CAMP (2017 – Figure 6-27). Northern pike values for 2009–2010 were calculated using von Bertalanffy parameters in CAMPP (2014 – Figure 5.2.7-27). Northern pike estimates for 2009–2013 were calculated from von Bertalanffy model fits of mean length at age extracted from figure in CAMP (2017 – Figure 6-25). Omega (ω) is a growth parameter using $L\infty \times K$ (Gallucci and Quinn 1979). Sexes are combined; sex or sex ratios were not provided in the CAMPP (2014) and CAMP (2017) reports. Samples were pooled for years indicated. The conversion from fork length to total length for walleye is TL = 1.06021 FL from Colby et al. (1979 – Table XI). The conversion from fork length to total length in millimetres for northern pike is TL = 4.42 + 1.048 FL for pike >123 mm (Casselman 1996).

	Walleye fork length			Northern pike fork length			
Age and parameters	2009–2010 (CAMP 2014) (mm)	2009–2013 (CAMP 2017) (mm)	Mean (mm)	2009–2010 (CAMP 2014) (mm)	2009–2013 (CAMP 2017) (mm)	Mean (mm)	2009–2013 (CAMP 2017) (mm)
1	125	94	109	225	126	176	128
2	190	166	178	337	233	285	226
3	244	227	236	426	311	369	314
4	290	278	284	498	370	434	392
5	328	321	324	556	413	485	462
6	359	357	358	602	444	524	525
7	386	387	386	640	468	554	581
8	408	412	410	669			631
9	426	433	430	693			675
10	441	451	446				
11	454	466	460				
12	465	478	472				
13	474						
14	482						
15	488						
Parameters							
$L\infty$	519.5	579.3	531.1	790.8	533.6	657.1	1,048.3
K	0.18	0.160	0.178	0.22	0.304	0.257	0.113
t_0	-0.53	-0.107	-0.295	-0.52	0.115	-0.211	-0.150
ω–omega	93.5	92.7	94.5	411.2	162.2	168.6	118.5
N	428	915		65	171		175
Age group means		1–12			1–7		1–9

8.1.3 Coordinating Aquatic Monitoring Program, CAMP Fish Community Sampling Protocol

Coordinating Aquatic Monitoring Program, CAMP Fish Community Sampling Protocol (2021) from the program description. Monitoring components, 4. Fish Community. 4 pages. From website. Available at: URL www.campmb.com, then go to menu The Program, then to Monitoring Components, then to Fish Community, then to link CAMP Fish Community Sampling Protocol. Accessed February 2021. This protocol describes the fish sampling for large-bodied and small-bodied fish species netting procedures and data collection standard for the Saskatchewan River basin and, in particular, Cedar Lake, the water body, populations, and fisheries assessed in this MSC certification consideration. Reference to Appendix 4 in this protocol pertains to website www.campmb.com/reports/. Three Year Summary Report (2008–2010), Volume 12: Appendix 4.0, Results (CAMPP for 2009/2010).

CAMP Fish Community Sampling Protocol

Sampling Gear Standards

Large Bodied Fish Sampling Index Net

Index netting gangs for large bodied fish consist of 5 mesh sizes, each constructed as a separate net. Each net is 25 yards long, and is cut to approximately 2 yards deep. Each net is seamed on to #30 leadline and 3/8" floatline. All mesh is tied on the half. All mesh is twisted nylon and coloured light green.

The specifications for each mesh are:

- 2" stretched mesh measure 210-3, 45 mesh deep
- 3" stretched mesh measure 210-3, 30 mesh deep
- 3 ¾" stretched mesh measure 210-3, 24 mesh deep
- 4 ¼" stretched mesh measure 210-4, 21 mesh deep
- 5" stretched mesh measure 210-4, 18 mesh deep

Gangs are assembled by joining the nets floatline to floatline and leadline to leadline. Gangs are organized with the meshes in sequence (2", 3", 3 ¾", 4 ¼" and 5"). The ends of each gang have 4 m long sideline bridles.

Small Bodied Fish Sampling Net

Index netting gangs for small bodied fish will consist of 3 mesh sizes, each constructed as a separate net. Each net is 10 m long and 1.8 m deep. These nets are purchased with integral float and leadline (Swedish gill nets). Mesh sizes are 16 mm, 20 mm and 25 mm stretched mesh measure. All mesh is multi-strand clear monofilament.

Gangs are assembled by joining the nets floatline to floatline and leadline to leadline. Gangs are organized with the meshes in sequence (16 mm, 20 mm and 25 mm). The ends of each gang have 4 m long sideline bridles.

Data Collection Standard

The standard index gang specifications for large bodied and small bodied fishes are described in Appendix 4. For lacustrine sites, set locations are distributed as evenly as possible across the waterbody or basin. Set locations were selected to avoid bias towards certain habitat types or species preferences. Since most of the lakes being sampled in the Pilot Program already have a history of sampling programs, maintaining consistency with previous programs was a valid consideration when selecting set locations. Set locations will be used consistently in future years.

For riverine sites, set locations were selected based on the practicality of setting at a given location. Set locations were chosen to encompass the full extent of the sample area, and as many habitat types as possible given flow conditions.

Gangs are set to be pulled, with the net tied to an anchor, which is then tied to the buoy. Each gang is clearly marked with either Fisheries Branch flags or the Scientific Collection Permit number and agency name on net buoys.

A large bodied fish gang is set at every sample location. At every third set location a small bodied fish gang is attached to the large bodied fish gang. The largest mesh end of the small bodied gang is attached to the smallest mesh end of the large bodied gang. If fewer than nine large bodied fish gangs are set, a minimum of three small bodied fish gangs are set.

The following information is collected for every gill net set:

- Type of index net: large bodied gang only (labelled as GN#) or large and small bodied gang (labelled as GN# and SN#);
- Date and time set;
- Field crew initials;
- GPS coordinate at each end of the gang. GPS coordinates should be UTM, NAD 83 and should identify the UTM Zone (14 or 15);
- A digital photo of the nearest shoreline to each set location;
- Water depth at each end of the gang to the nearest decametre;
- Water temperature;
- Secchi disc depth;
- Proximity and orientation to shore: main channel, flow, perpendicular, parallel;
- Shoreline conditions (if applicable) (e.g., bedrock, treed, boulder, etc.);
- Local weather conditions (e.g., wind direction and velocity and air temperature);
- Water velocity for riverine sets (low, medium, high);
- Aquatic vegetation present (low, medium, high); and
- Set locations should be clearly identified on field maps.

The following information is collected for every gill net lift:

- Date and time lifted;
- Field crew initials;
- Local weather conditions;
- Substrate (based on the anchors): compaction: hard vs. soft; composition: gravel, boulder, bedrock, sand, mud, etc.;
- Water temperature;
- Secchi disc depth;
- Water velocity for riverine sets (low, medium, high);
- Quantity of debris present in the net (none 0%, low <5%, medium 5-15%, high 16-25%, very high >26%, gang destroyed, gang lost); and
- Type and percentage of debris present (e.g., aquatic vegetation, aquatic moss, silt/mud, sticks, algae, terrestrial vegetation).

Manitoba Fisheries Branch has identified certain fish species to be of management interest on specific waterbodies (Table A1). On these waterbodies individual metrics are collected from all fish of that species captured in the large bodied gangs only. In addition, a minimum of 250 fish of that species may have to be caught and sampled in order to ensure that the sample is large enough to provide useful population statistics.

The metrics are:

- Fork length (FL) to 2 mm;
- Weight to 10 gm for fish <4 kg, and 25 gm for fish > 4kg;
- Sex and maturity;
- Occurrence of DELTs (external Deformities, Erosions, Lesions or Tumours);
- Ageing structures are collected and placed in an envelope marked with the waterbody, date, set number, species and sample number. Ageing structures are:
  - Walleye – otolith
  - Sauger - otolith
  - Whitefish – otolith
  - Pike – cleithra

All other species of fish caught in each net are sampled as follows:

- Fish from each mesh in the large bodied gang are separated by species, counted and bulk weighed to the nearest 25 gm;
- Fish from the small bodied gang are not separated by mesh, but are separated by species, counted and bulk weighed to the nearest 25 gm; and
- All target species caught in the large bodied gang are examined for DELTs (external Deformities, Erosion, Lesions or Tumours), which are noted for each species and mesh.

Lake sturgeon are of specific management interest in all locations. Although not specifically targeted in the CAMP program, all sturgeon caught are sampled as follows and released alive:

- Total length (TL) and fork length to 2 mm;
- Weight to 250 gm for fish > 10,000 gm, 10 gm for fish <=10,000 gm;
- Occurrence of DELTs.

Efforts to reduce sturgeon mortality have been implemented in the CAMP fish sampling protocol. However, in the event of incidental sturgeon mortality, the following additional information will be collected from individuals:

- Identification of stomach contents;
- Tissue sample for mercury analysis;
- An ageing structure; and
- Internal examination to determine sex and maturity.

Table 1. Waterbodies sampled under the CAMP fish sampling program.

Waterbody	Type of Site	Species of management interest	Requirement for individual metrics	Minimum Number of Sets
Winnipeg River				
Lac du Bonnet	Annual / On-system	Walleye, sauger, pike	All walleye, sauger and pike	9
Winnipeg River (u/s Pointe. Du Bois)	Annual / On-system	Walleye, sauger, pike	All walleye, sauger and pike	9
Manigotagan Lake	Annual / Off-system	Walleye, pike	All walleye and pike	6
Eaglenest Lake	Rotational / On-system	Walleye, pike	All walleye and pike	6
Pine Falls Reservoir	Rotational / On-system	Walleye, pike	All walleye and pike	6
Lake Winnipeg				
Lake Winnipeg (North basin)	Annual / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Lake Winnipegosis	Annual / Off-system	Walleye	All walleye and pike	12
Saskatchewan River				
Cedar Lake (middle basin)	Annual / On-system	Walleye, whitefish	Walleye - Min. 250 All whitefish.and pike	12
Cormorant Lake	Annual / Off-system	Walleye, whitefish	All walleye, whitefish and pike	12
Moose Lake	Rotational / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Saskatchewan River	Rotational / On-system	Walleye, pike	All walleye and pike	12
Cedar Lake (west basin)	Rotational / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Upper Nelson River				
Cross Lake (west basin)	Annual / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Setting Lake	Annual / Off-system	Walleye, whitefish	Walleye - Min. 250 All whitefish and pike	12
Playgreen Lake	Rotational / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Little Playgreen Lake	Rotational / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Walker Lake	Rotational / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Sipiwesk Lake	Rotational / On-system	Walleye, whitefish	All walleye, whitefish and pike	12
Nelson River btwn Sipiwesk and Kelsey	Rotational / On-system	Walleye	All walleye and pike	9

8.1.4 Recommended index netting sampling effort using Ontario Ministry of Natural Resources Fall Walleye Index Netting program protocols

Recommended index netting sampling effort for Ontario Ministry of Natural Resources Fall walleye Index Netting programs (FWIN) providing number of nets recommended for lakes, based on surface area. Reproduced from Morgan et al. (2003). The Southeast Basin of Cedar Lake, where most of the commercial fishing is conducted, is 9,931.1 ha (Klein et al. 2020).

Water-body surface area (range in ha)	Effort Number of FWIN net sets
< 200	8
201–500	12
501–1,000	14
1,001–2000	18
2,001–3,000	22
3,001–5,000	28
5,001–10,000	36
10,001–20,000	48

8.1.5 Small-scale fisheries

Table 17. Small-scale fisheries

Unit of Assessment (UoA)	Percentage of vessels with length <15m	Percentage of fishing activity completed within 12 nautical miles of shore
UoA 1	100%	Not applicable
UoA 2	100%	Not applicable

8.2 Evaluation processes and techniques

8.2.1 Site visits

The assessment was announced on the MSC website and stakeholders that were identified by the client and also by Lloyd's Register, using stakeholder list from other MSC assessments within the region, were contacted directly by Lloyd's Register.

A site visit will take place in by remote calls in the week commencing the 17th of January 2022. The assessment team prepared an audit itinerary prior to the site visit, and meetings were conducted with the following individuals & organisations: -
[list all stakeholders / clients / etc.]

Note:
Where observers attended meetings, stakeholders and the client were informed of their role and asked if they were happy with their attendance prior to starting the meeting.

8.2.2 Stakeholder participation

The CAB shall include in the report:

- Details of people interviewed: local residents, representatives of stakeholder organisations including contacts with any regional MSC representatives.
- A description of stakeholder engagement strategy and opportunities available.

Reference(s): FCP v2.2 Section 7.16

A total of 8 stakeholder organisations and individuals having relevant interest in the assessment were identified and notified, via e-mail, of the surveillance process. This highlighted the potential process for engagement in the surveillance, if desired. In addition, the interest of others not appearing on this list was solicited through the postings on the MSC website.

8.2.3 Evaluation techniques

At Announcement Comment Draft report stage, if the use of the RBF is triggered for this assessment, the CAB shall include in the report:

- The plan for RBF activities that the team will undertake at the site visit.
- The justification for using the RBF, which can be copied from previous RBF announcements, and stakeholder comments on its use.
- The RBF stakeholder consultation strategy to ensure effective participation from a range of stakeholders including any participatory tools used.
- The full list of activities and components to be discussed or evaluated in the assessment.

At Client Draft Report stage, if the RBF was used for this assessment, the CAB shall include in the report:
- A summary of the information obtained from the stakeholder meetings including the range of opinions.
- The full list of activities and components that have been discussed or evaluated in the assessment, regardless of the final risk-based outcome.

The stakeholder input should be reported in the stakeholder input appendix and incorporated in the rationales directly in the scoring tables.

Reference(s): FCP v2.2 Section 7.16, FCP v2.2 Annex PF Section PF2.1

8.2.4 Public Announcements

The full assessment was publicly announced on the 17th March 2021 at the MSC website as well as sent by email in the MSC Fishery Announcements newsletter to all registered recipients. The announcement was also distributed to all LR stakeholders via the LR Mailchimp system (see Section 8.2.2). This was also the method used for consultation on subsequent steps (e.g., peer reviewer announcement, new UoA, etc.). See Section 8.4 for a detailed list of all consultations that took place at different stages along the process. At this time, LR also announced the assessment site visit dates and location, as well as the assessment team. This was done according to the process requirements in MSC's Fisheries Certification Process v2.2, and in the MSC Fisheries Standard v2.0/2.01. Together, these media presented the announcement to a wide audience representing industry, agencies, and other stakeholders. Meetings and conference calls held during the site visit constituted the main tool in guaranteeing the participation of relevant stakeholders.

8.2.5 Information gathering

The assessment team reviewed documents sent by the client ahead of the onsite visit (e.g., the client checklist, the Cedar Lake Fisheries Management Plan, stock assessment data, index netting data). See 7.4, 7.7 and 7.10 for a detailed list of references used. Discussions with the clients and management agencies centred on the content within the provided documentation. In cases where relevant documentation was not provided in advance of the meeting, it was requested by the assessment team and should subsequently be supplied during, or shortly after the meeting (within 30-days). The assessment team and the clients will set up meetings with the relevant stakeholders during the site visit, as per MSC FCP v2.2, Section 7.16.

8.2.6 Scoring

Scoring was performed according to the procedure established in Certification Requirement 7.10 (MSC FCR v2.01). In the Fisheries Standard v2.01 default assessment tree used for this assessment, the MSC has 28 PIs, six in Principle 1, 15 in Principle 2, and seven in Principle 3. The PIs are grouped in each principle by 'component.' Principle 1 has two components, Principle 2 has five, and Principle 3 has two. Each PI consists of one or more 'scoring issues;' a scoring issue is a specific topic for evaluation. 'Scoring Guideposts' define the requirements for meeting each scoring issue at the 60 (conditional pass), 80 (full pass), and 100 (state of the art) levels.

Note that some scoring issues may not have a scoring guidepost at each of the 60, 80, and 100 levels; in the case of the example above, scoring issue (b) does not have a scoring issue at the SG60 level. The scoring issues and scoring guideposts are cumulative; this means that a PI is scored first at the SG60 levels. If not all of the SG scoring issues meet the 60 requirements, the fishery fails, and no further scoring occurs. If all of the SG60 scoring issues are met, the fishery meets the 60 level, and the scoring moves to SG80 scoring issues. If no scoring issues meet the requirements at the SG80 level, the fishery receives a score of 60. As the fishery meets increasing numbers of SG80 scoring issues, the score increases above 60 in proportion to the number of scoring issues met; PI scoring occurs at 5-point intervals. If the fishery meets half the scoring issues at the 80 level, the PI would score 70; if it meets a quarter, then it would score 65; and it would score 75 by meeting three-quarters of the scoring issues. If the fishery meets all of the SG80 scoring issues, the scoring moves to the SG100 level. Scoring at the SG100 level follows the same pattern as for SG80. Principle scores result from averaging the scores within each component, and then from averaging the component scores within each Principle. If a Principle averages less than 80, the fishery fails. Scoring for this fishery followed a consensus process in which the assessment team discussed the information available for evaluating PIs to develop a broad opinion of performance of the fishery against each PI. Review of sections 7.2, 7.5 and 7.8 by all team members assured that the assessment team was aware of the issues for each PI.

The assessment team held preliminary scoring meetings along the site visit where the Performance Indicators of the fishery were evaluated jointly by the team in order to assess whether there was still information needs to be communicated to the client. After the site visit, each team member was assigned their relevant section in the report to complete before proceeding to a joint evaluation of every PI and the pertaining scoring systems and rationales through scoring meetings which took place via conference calls. Team members are responsible for completely their relevant scoring tables and providing a provisional score. PI scores were entered into MSC's Fishery Assessment Scoring Worksheet (Section 7.1) to arrive at Principle-level scores.

8.2.7 Scoring elements

A complete list of the different scoring elements as used in the scoring tables is presented below in Table 18.

Table 18. List of all scoring elements as used in scoring tables in section 7.3, 7.6 and 7.9

Component	Scoring elements	UoA 1 Walleye	UoA 2 Northern pike	Data-deficient
P2 – Primary	Walleye	N/A	Main	No
	Northern pike	Main	N/A	No
	Lake Whitefish	Main	Main	No
	Sauger	Minor	Minor	No
	Goldeye	Minor	Minor	No
P2 – Secondary	Mullet	Main	Main	No
	Lake sturgeon	Main	Main	No
	Double-crested cormorant*	Main	Main	No
	Lesser scaup*	Main	Main	No
	Common loon*	Main	Main	No
	Other species (including lake cisco, carp, yellow perch, burbot)	Minor	Minor	No
P2 – ETP	N/A	–	–	–
P2 – Habitats	Boulders and cobble (commonly encountered in nearshore areas)	Main	Main	No
	Clay loam and silt loam (commonly encountered in offshore areas)	Main	Main	No
P2 – Ecosystem	Fish community structure and function	Main	Main	No
	Benthic community structure	Main	Main	No

* Out-of-scope species

8.2.8 Use of the RBF

The RBF may need to be used in relation to lake whitefish (main primary species) and minor secondary species owing to possible data deficiencies. This will need to be confirmed and included in any future announcement of the fishery progressing with the assessment. If it is confirmed that the RBF is required, the Assessment Team will develop a questionnaire that will be provided to stakeholders prior to the site visit and then responses would be discussed at the site visit and allow the Team to complete the RBF evaluation and assign a score to relevant PIs.

8.3 Peer Review reports

To be drafted at Public Comment Draft Report stage

The CAB shall include in the report unattributed reports of the Peer Reviewers in full using the relevant templates. The CAB shall include in the report explicit responses of the team that include:

- Identification of specifically what (if any) changes to scoring, rationales, or conditions have been made; and,
- A substantiated justification for not making changes where Peer Reviewers suggest changes, but the team disagrees.

Reference(s): FCP v2.2 Section 7.14

8.4 Stakeholder input

To be drafted at Client and Peer Review Draft Report stage

The CAB shall use the 'MSC Template for Stakeholder Input into Fishery Assessments' to include all written stakeholder input during the stakeholder input opportunities (Announcement Comment Draft Report, site visit and Public Comment Draft Report). Using the 'MSC Template for Stakeholder Input into Fishery Assessments', the team shall respond to all written stakeholder input identifying what changes to scoring, rationales and conditions have been made in response, where the changes have been made, and assigning a 'CAB response code'.

The 'MSC Template for Stakeholder Input into Fishery Assessments' shall also be used to provide a summary of verbal submissions received during the site visit likely to cause a material difference to the outcome of the assessment. Using the 'MSC Template for Stakeholder Input into Fishery Assessments' the team shall respond to the summary of verbal submissions identifying what changes to scoring, rationales and conditions have been made in response, where the changes have been made, and assigning a 'CAB response code'.

Reference(s): FCP v2.2 Sections 7.15, 7.20.5 and 7.22.3

8.5 MSC Technical Oversight

To be drafted at Public Comment Draft Report

8.6 Conditions

To be drafted at Client and Peer Review Draft Report stage

The CAB shall document in the report all conditions in separate tables.

Reference(s): FCP v2.2 Section 7.18, 7.30.5 and 7.30.6

Table 19. Condition 1

Performance Indicator	
Score	State score for Performance Indicator.
Justification	Cross reference to page number containing scoring template table or copy justification text here.
Condition	State condition.
Condition deadline	State deadline for the condition.
Exceptional circumstances ☐	Check the box if exceptional circumstances apply and condition deadline is longer than the period of certification (FCP v2.2 7.18.1.6). Provide a justification.
Milestones	State milestones and resulting scores where applicable.
Verification with other entities	Include details of any verification required to meet requirements in FCP v2.2 7.19.8.

8.7 Client Action Plan

To be drafted at Public Comment Draft Report stage

The CAB shall include in the report the Client Action Plan from the fishery client to address conditions.

Reference(s): FCP v2.2 Section 7.19

8.8 Harmonisation

MSC Fisheries Certification Process (FCR) v 2.1 states, “Teams assessing overlapping UoAs shall ensure consistency of outcome so as not to undermine the integrity of MSC fishery assessments.”. The following interpretation has been used to determine the need for harmonisation between overlapping fisheries:

https://mscportal.force.com/interpret/s/article/What-are-the-MSC-requirements-on-harmonisation-multiple-questions-1527586957701

Table 20. A summary of the harmonisation requirements for overlapping fisheries

Performance Indicator / Scoring Issue	Harmonise?	Comments
All P1 PIs	Yes	P1 always considers the impacts of all fisheries on a stock, so any fisheries which have the same P1 species (stocks) should be harmonised.
PI 2.1.1a	Partially	For stocks that are ‘main’ in both UoAs, harmonise status relative to Point of Recruitment Impairment (PRI) (at SG 60, 80 and 100) and, if below, harmonise cumulative impacts at SG 80 (not at SG 60).
PI 2.2.1a	Partially	For stocks that are ‘main’ in both UoAs, harmonise status relative to Biologically Based Limits (BBL) (at SG 60, 80, 100), and if below the BBL, harmonise cumulative impacts at SG 80 (not at SG 60).
PI 2.3.1a	Partially	Harmonise recognition of any limits applicable to both UoAs (SG 60, 80, 100) and cumulative effects of the UoA at SG 60, 80, 100 (not at SG 60)
PI 2.4.1b	Partially	Harmonise recognition of VMEs where both UoAs operate in the same ‘managed area/s’ (as in SA3.13.5).
PI 2.4.2a, c	Partially	Harmonise scoring at SG 100, since all fishery impacts are considered (not at SG 60 or 80)
All P2 PIs	Yes if…	Two UoAs are identical in scope, even if the UoCs are different (e.g., separate clients).
PI 3.1.1-3	Yes if…	Both UoAs are part of the same larger fishery or fleet, or have stocks either P1 or P2 which are at least partially managed by the same jurisdiction/s (nation states, RFMOs or others) or under the same agreements. Harmonisation may sometimes be possible for those management arrangements that apply to both UoAs (noting the limitations accepted in GPB3). The MSC accepts that it may be impractical to attempt full harmonisation, due to the large number of fisheries that may be managed under the relevant policy framework, and the differences in application between them.
PI 3.2.1-4	Yes if…	Both UoAs have stocks within either P1 or P2 which are at least partially managed by the same jurisdiction/s (nation states, RFMs or others) or under the same agreements. Harmonisation is needed for those management arrangements that apply to both UoAs, e.g. at the RFMOS level but not the national level in the case of two separate national fleets both fishing the same regional stock.

MSC have also confirmed that harmonisation of similar fisheries using different versions of the default assessment tree, i.e., v1.3 and v2.0, should still take place where they are materially unchanged (MSC Interpretations webpage).

At the time of writing, the only other fishery that has been MSC assessed in Manitoba is Waterhen Lake walleye and northern pike gillnet fishery.

Using guidance provided in Table 20, the following harmonisation of PI / SIs has been undertaken between Cedar Lake and Waterhen Lake:

PI / SIs	Harmonise or not ?
All P1 PIs	The P1 target stocks of walleye and northern pike in Cedar Lake are different and have no connectivity to those stocks in Waterhen Lake. No Harmonisation is required.
PI 2.1.1a	The stocks of primary species in Cedar Lake are different and have no connectivity to those stocks in Waterhen Lake. No Harmonisation is required.
PI 2.2.1a	The stocks of secondary species in Cedar Lake are different and have no connectivity to those stocks in Waterhen Lake. No Harmonisation is required.
PI 2.3.1a	No ETP species were identified in Cedar Lake. No Harmonisation is required.
PI 2.4.1b	Cedar Lake and Waterhen Lake are not connected and so do not share the same habitats. No Harmonisation is required.
PI 2.4.2 a, c	Cedar Lake and Waterhen Lake are not connected and so do not share the same habitats. No Harmonisation is required.
All P2 PIs	Cedar Lake and Waterhen Lake are not identical; therefore, harmonisation is not applicable.
PIs 3.1.1 – 3.1.3	Cedar Lake and Waterhen Lake share aspects of the “Governance and Policy” component of Principle 3 (the PIs pre-fixed with 3.1), i.e., focusing on the high-level context of the fishery management system within the UoAs. The following table shows the scores assigned to Waterhen Lake and the scoring range assigned to Cedar Lake: **MSC Certified Fisheries** / **3.1.1** / **3.1.2** / **3.1.3** Waterhen Lake / 100 / 75 / 80 Cedar Lake / 60-79 / 60-79 / >80 It is notable that the scoring range presently assigned to PI 3.1.1 is lower than the score assigned to Waterhen Lake. This is a result of further information being sought at the site visit by the Cedar Lake Assessment Team on the effectiveness of the dispute resolution process. Harmonisation will be re-visited following the site visit.
PI 3.2.1 – 3.2.4	The Cedar Lake and Waterhen Lake walleye and northern pike fisheries are conducted in separate lakes, under different lake specific management plans and so harmonisation is not applicable in this instance.

8.9 Surveillance

To be drafted at Client and Peer Review Draft Report stage

The CAB shall include in the report the program for surveillance, timing of surveillance audits and a supporting justification.

Reference(s): FCP v2.2 Section 7.28

Table 21. Fishery surveillance program

- Surveillance level	- Year 1	- Year 2	- Year 3	- Year 4
- e.g., Level 5	- e.g., On-site surveillance audit	- e.g., On-site surveillance audit	- e.g., On-site surveillance audit	- e.g., On-site surveillance audit & re-certification site visit
-	-	-	-	-

Table 22. Timing of surveillance audit

Year	- Anniversary date of certificate	- Proposed date of surveillance audit	- Rationale

e.g. 1	- e.g. May 2018	- e.g. July 2018	- e.g. Scientific advice to be released in June 2018, proposal to postpone audit to include findings of scientific advice
	-	-	-

Table 23. Surveillance level justification

Year	- Surveillance activity	- Number of auditors	- Rationale
e.g.3	- e.g. On-site audit	- e.g. 1 auditor on-site with remote support from 1 auditor	- e.g. From client action plan it can be deduced that information needed to verify progress towards conditions 1.2.1, 2.2.3 and 3.2.3 can be provided remotely in year 3. Considering that milestones indicate that most conditions will be closed out in year 3, the CAB proposes to have an on-site audit with 1 auditor on-site with remote support – this is to ensure that all information is collected and because the information can be provided remotely.
	-	-	-

8.10 Objection Procedure

To be added at Public Certification Report stage

The CAB shall include in the report all written decisions arising from the Objection Procedure.

Reference(s): MSC Disputes Process v1.0

9 Template information and copyright

This document was drafted using the 'MSC Reporting Template v1.2'.

Template version control		
Version	Date of publication	Description of amendment
1.0	17 December 2018	Date of first release
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A controlled document list of MSC program documents is available on the MSC website (msc.org).

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