The Safina Center
at Stony Brook University

AND

Monterey Bay Aquarium
Seafood Watch®

Walleye

Sander vitreus

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Red Lakes, Minnesota

Handline and Bottom Gillnet

Fisheries Standard Version F3.1

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The Safina Center Seafood Analysts

About The Safina Center

The Safina Center (formerly Blue Ocean Institute) translates scientific information into language people can understand and serves as a unique voice of hope, guidance, and encouragement. The Safina Center (TSC) works through science, art, and literature to inspire solutions and a deeper connection with nature, especially the sea. Our mission is to inspire more people to actively engage as well-informed and highly motivated constituents for conservation.

Led by conservation pioneer and MacArthur fellow, Dr. Carl Safina, we show how nature, community, the economy and prospects for peace are all intertwined. Through Safina's books, essays, public speaking, PBS television series, our Fellows program and Sustainable Seafood program, we seek to inspire people to make better choices.

The Safina Center was founded in 2003 by Dr. Carl Safina and was built on three decades of research, writing and policy work by Dr. Safina.

The Safina Center's Sustainable Seafood Program
The Center's founders created the first seafood guide in 1998. Our online seafood guide now encompasses over 160-wild-caught species. All peer-reviewed seafood reports are transparent, authoritative, easy to understand and use. Seafood ratings and full reports are available on our website under Seafood Choices. TSC's Sustainable Seafood Program helps consumers, retailers, chefs and health professionals discover the connection between human health, a healthy ocean, fishing and sustainable seafood.

- Our online guide to sustainable seafood is based on scientific ratings for more than 160 wild-caught seafood species and provides simple guidelines. Through our expanded partnership with the Monterey Bay Aquarium, our guide now includes seafood ratings from both The Safina Center and the Seafood Watch® program.
- We partner with Whole Foods Market (WFM) to help educate their seafood suppliers and staff, and provide our scientific seafood ratings for WFM stores in the US and UK.
- Our website features tutorials, videos, blogs, links and discussions of the key issues such as mercury in seafood, bycatch, overfishing, etc.

Check out our Fellows Program, learn more about our Sustainable Seafood Program and Carl Safina's current work at www.safinacenter.org .

The Safina Center is a 501 (c) (3) nonprofit organization based in the School of Marine & Atmospheric Sciences at Stony Brook University, Long Island, NY. www.safinacenter.org
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About Seafood Watch®

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Guiding Principles

The Safina Center and Seafood Watch define sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch and the Safina Center have developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide and the Safina Center's online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught.

Avoid/Red: Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

Summary

This report assesses the sustainability of walleye *(Sander vitreus)* caught with handlines and gillnets in the Lower and Upper Red Lakes in Minnesota. In the Red Lakes, Minnesota, the commercial fishery is entirely conducted by the Red Lake Band of Chippewa Indians. This is the oldest and largest walleye fishery in the United States.

Walleye is a freshwater fish that is found in lakes and medium to large rivers throughout the northern part of North America. It is a dominant predator that can grow to over 100 cm in length and live to 25 years of age.

The walleye population in the Red Lakes collapsed in the 1990s and commercial fishing was closed in 1997. A restoration plan was put in place, which allowed the population to recover, and commercial fishing was reopened in 2006. Since the reopening of the fishery, walleye abundance has been closely monitored by management bodies and has remained at high levels, above target abundance goals. The catch of walleye has gradually increased over 2006 to 2015, as a reflection of the healthy abundance of walleye.

Bycatch in the walleye fishery is reported to be low and there are no overfished, endangered, threatened, or species of concern captured in the fishery. Occasional bycatch in the walleye fishery includes yellow perch *(Perca flavescens)*, black crappie *(Pomoxis nigromaculatus)*, northern pike *(Esox lucius)*, and lake whitefish *(Coregonus clupeaformis)*. The walleye fishery minimally impacts these species.

The walleye fishery in the Red Lakes is managed jointly by the Red Lake Department of Natural Resources Fisheries Program, the Minnesota Department of Natural Resources, and the United States Department of the Interior Bureau of Indian Affairs. Management of the fishery is highly effective and precautionary. There is a Harvest Plan in place that defines safe fishing levels based on the current abundance.

Most walleye are caught with handlines, which result in minimal damage to the bottom habitat. A small proportion of the catch is taken with bottom gillnets, which can cause low to moderate damage to the bottom habitat. But gillnet fishing in the Red Lakes is highly regulated, mitigating overall habitat impacts. There are no specific policies in place for the walleye fishery aimed at protecting ecosystem functioning, but detrimental food web impacts are unlikely.

Overall, walleye caught in the Minnesota Red Lakes is rated Green or "Best Choice."

Table of Conservation Concerns and Overall Recommendations

Species	Fishery	Criterion 1: Impacts on the Species Under Assessment	Criterion 2: Impacts on other Species	Criterion 3: Management Effectiveness	Criterion 4: Impacts on the Habitat and Ecosystem	Overall Recommendation
Walleye	Red Lakes, Handline	Green 5	Green 3.41	Green 5	Green 3.46	**GREEN/BEST CHOICE 4.144**
Walleye	Red Lakes, Bottom Gillnet	Green 5	Green 3.41	Green 5	Green 3.46	**GREEN/BEST CHOICE 4.144**

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, and either Criterion 1 or Criterion 3 (or both) is Green, and no Red Criteria.
- **Good Alternative/Yellow** = Final score >2.2, and no more than one Red Criterion, and does not meet the criteria for Best Choice/Green (above)
- **Avoid/Red** = Final Score ≤2.2, or two or more Red Criteria, or Management is Critical.

Introduction

Scope of the Analysis and Ensuing Recommendation

This assessment covers the walleye fishery in the Upper and Lower Red Lakes, Minnesota. The commercial fishery is entirely conducted by the Red Lake Band of Chippewa Indians. Fishers primarily catch walleye with handlines, but sometimes with bottom gillnets.

Overview of the Species and Management Bodies

Walleye *(Sander vitreus)* is a freshwater fish found in lakes and medium to large rivers throughout the northern part of North America (Dupont et al. 2007), including all of the Great Lakes (Roseman et al. 2010a). It prefers large, shallow waters with high turbidity. The walleye is the largest member of the perch family *(Percidae)* and is a dominant near-shore predator. It can grow to over 100 cm (39 in) in length (Scott and Crossman 1973) and may live to 25 years of age or more (Hugg 1996). Males typically reach sexual maturity between 2 and 4 years of age, whereas females mature between 3 and 6 years of age (Scott and Crossman 1973) (Colby et al 1979). In the spring, walleye males and females migrate to shallow waters to spawn, and females lay eggs over gravel and rock (Froese and Pauly 2016).

The Lower and Upper Red Lakes of Minnesota are connected and have similar habitats. The Lower Red Lake has a surface area of 167,000 acres and is entirely in the Red Lake Band of Chippewa Indians Reservation (hereafter referred to as "Band waters") (MNDNR 1997). The Upper Red Lake has a surface area of 108,000 acres, with 56% lying in Band waters and the remaining 44% in state waters (MNDNR 1997). The most abundant species in the Red Lakes are walleye and yellow perch, with a rise of freshwater drum in years when walleye abundance is low.

The Red Lake Band fishery for walleye is the oldest (first opened in 1917) and largest commercial walleye fishery in the United States (Red Lake DNR 2016c). The Red Lake Fisheries Program, created in 1987, is responsible for the management and conservation of fish in Band waters of the Upper and Lower Red Lakes as well as 135 smaller lakes and a surrounding 55 miles of streams and rivers (Red Lake DNR 2016c). There is a recreational fishery for walleye in state waters of the Red Lakes but no commercial fishery. The commercial and recreational fisheries for walleye in the Red Lakes are managed under a joint agreement between the Red Lake Department of Natural Resources Fisheries Program, the Minnesota Department of Natural Resources, and the United States Department of the Interior Bureau of Indian Affairs (Red Lake Band et al. 2015).

The walleye population in the Red Lakes collapsed in the 1990s; commercial fishing was suspended in 1997 and a restoration effort was put in place (HPAIED 2006). The walleye population recovered earlier than expected and the commercial fishery reopened in 2006 (RLFTC 2015). Since 2006, walleye has been managed under an annual catch limit (quota), size restrictions that protect spawning-sized fish, and a closed season during the spawning period (Red Lake Band et al. 2015). Prior to the closing of the commercial fishery in 1997, gillnets were

the primary gear used to catch walleye, but currently the only legal gear is handline, with an exception that later in the season crews employed by Red Lake Fisheries use bottom gillnets to catch the remaining quota (pers. comm., Pat Brown 2016). The gill net fishery that occurs today is much more tightly regulated than it was prior to the collapse of the walleye fishery.

Production Statistics

Since the commercial fishery for walleye reopened in 2006, the catch in Red Lake Band waters has gradually increased over time as a reflection of the population remaining at healthy levels. In 2006, the catch (harvest) was low at 14,092 lbs to reflect caution and in 2015 was highest at 960,427 lbs (pers. comm., Pat Brown 2016). Approximately 90% of the total catch in Band waters is taken by the commercial fishery and the remaining 10% is taken for personal use (Brown and Kennedy 2016).

Handline gear is the primary gear used to catch walleye, but later in the season there are two gillnet crews that are allowed to catch walleye to help fill the remaining quota (pers. comm., Pat Brown 2016). In 2015, for example, only handline gear was used from December (2014) to March, and accounted for 80% of the annual catch for the 2015 season. In May, the gillnet crews began to catch walleye and accounted for the majority of the catch from July to November, contributing to 20% of the total annual catch (Brown and Kennedy 2016).

In state waters of the Red Lakes, catches are much lower and only recreational fishing occurs.

Figure 1 shows the annual catch levels in Band and state waters since 2006, and Figure 2 shows the catch by gear type in Band waters for 2015.

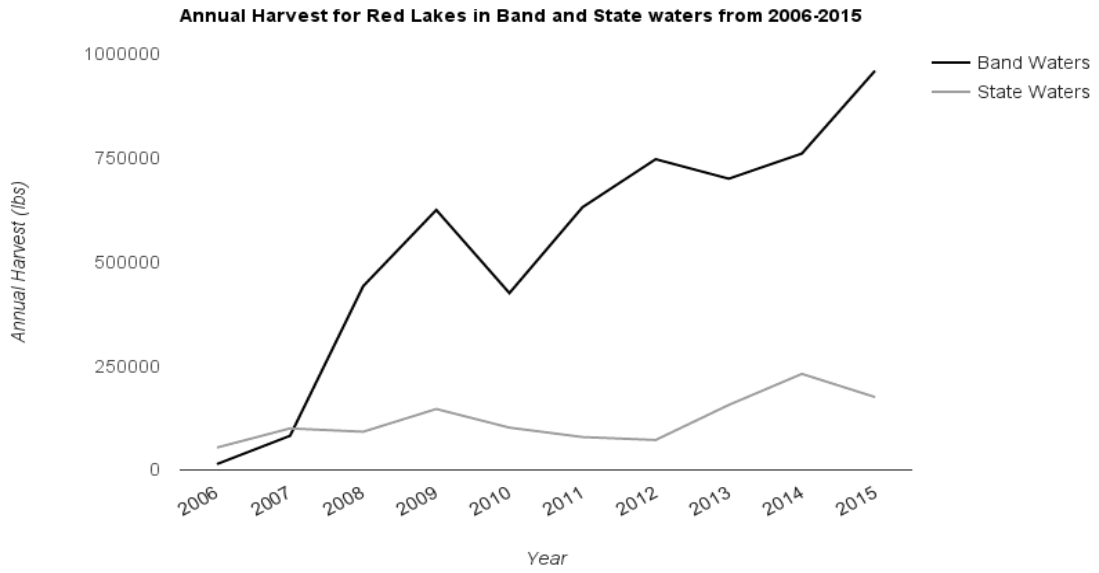

***Figure 1**. The annual catch (lbs) of walleye in Band and state waters from 2006–2015 (Data from (pers. comm., Pat Brown 2016) (MNDNR 2016g)).*

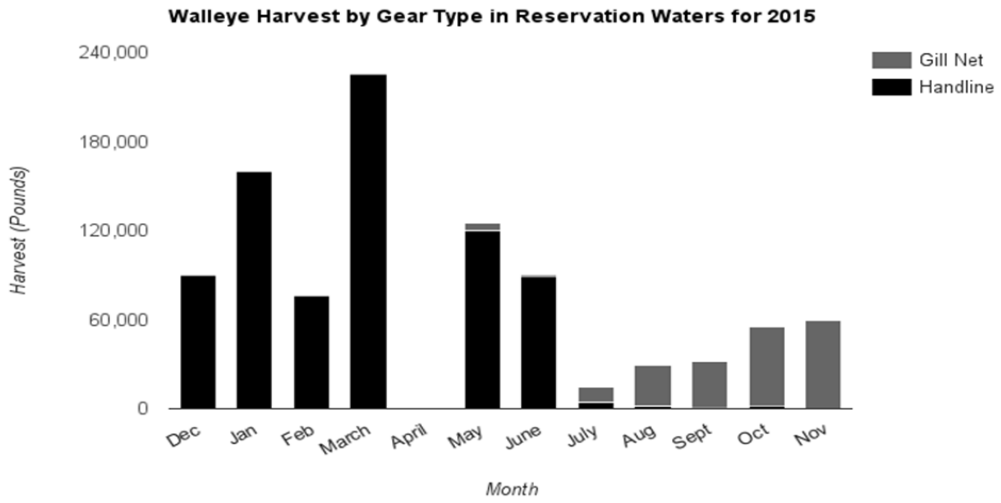

Figure 2*. The walleye catch in Reservation (Band) waters in 2015 by gear type (Data from (Brown and Kennedy 2015)).*

Importance to the US/North American Market

Walleye is not considered important on a global scale, and most of the catch remains in the region it was caught in. In the Red Lakes Band fishery, all the walleye that are caught are sold regionally or nationally and are not exported to other countries (pers. comm., Pat Brown 2016).

Common and Market Names

Walleye is also known as yellow pickerel, pickerel (Canada), yellow pike, and yellow walleye.

Primary Product Forms

Walleye is primarily sold as frozen fillets, but also as fresh whole fish, fresh fillets, and frozen block.

Criterion 1: Impact on the Species Under Assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*

Criterion 1 Summary

Species	Fishery	Factor 1.1 Abundance	Factor 1.2 Fishing Mortality	Criterion 1 Score	Criterion 1 Rating
Walleye	Red Lakes, Handline	Very low (5)	Low (5)	5	Green
Walleye	Red Lakes, Bottom Gillnet	Very low (5)	Low (5)	5	Green

Criterion 1 Assessment

WALLEYE

Factor 1.1 Abundance

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern)—Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) —Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern)—Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Red Lakes; Handline and Bottom Gillnet
Very Low Concern (5)

Key relevant information:
The walleye population in the Red Lakes collapsed in the 1990s and commercial fishing was closed in 1997 (Red Lake Band et al. 1999). In an effort to help the population recover, management instituted a restoration plan that included fry stocking, strong enforcement of the fishing ban, and a data collection program to track the health of the walleye population (Red Lake Band et al. 1999) (HPAIED 2006). The restoration plan was successful, and as of 2005, stocking was no longer necessary to maintain the population (Logsdon 2006) (pers. comm., Pat Brown 2016). The walleye fishery was reopened in 2006, which was much earlier than anticipated (HPAIED 2006). Since the walleye fishery reopened it, has been closely regulated and abundance has remained at a healthy level.

The Red Lakes Fisheries Technical Committee conducts annual assessments of walleye to generate estimates of spawning stock biomass (mature female biomass) and total abundance, and to provide information on the size and age structure of the population (Red Lake Band et al. 1999) (Red Lake Band et al. 2015). The Harvest Plan for walleye has identified spawning stock biomass (SSB) targets, which were recently revised in 2015 (see Table 1 (RLFTC 2015)). Since 2006, spawning stock biomass has remained above defined target or optimal levels and total biomass has remained high, despite the gradual increase in catch levels (RLFTC 2015) (Brown and Kennedy 2016). The recent 2015 assessment estimated that there are approximately 13 million walleye (approximately 10.29 million lbs) in the Red Lakes (Brown and Kennedy 2016). The assessment indicated that the 2009 and 2011 year classes, which include fish between 14 and 19 inches in length, are dominant in the population and should sustain the population for the next 5 years (MNDNR 2016b) (Red Lake DNR 2016b). Figure 3 shows the spawning stock biomass, and Figure 4 shows the total biomass estimates for walleye from 1987–2015.

Because population assessments have been completed and walleye abundance has remained above target reference points with no scientific controversy, abundance is considered a “very low” concern.

Detailed rationale:

***Table 1**. The original (2006) and updated (2015) spawning stock biomass (SSB) reference points for walleye in the Red Lakes. The surplus condition represents very high abundance, the optimal condition represents a healthy, sustainable population, and the marginal condition represents low abundance. If abundance falls below the marginal level, fishing is closed (Data from RLFTC 2015).*

SSB Reference Points		
	2006 Harvest Plan	**2015 Harvest Plan**
SSB Conditions	**Lbs/Acre**	**Lbs/Acre**
Surplus	> 3	> 4.5
Optimal	2–3	2.5–4.5
Marginal	1–2	1.0–2.5
Closed	< 1	< 1.0

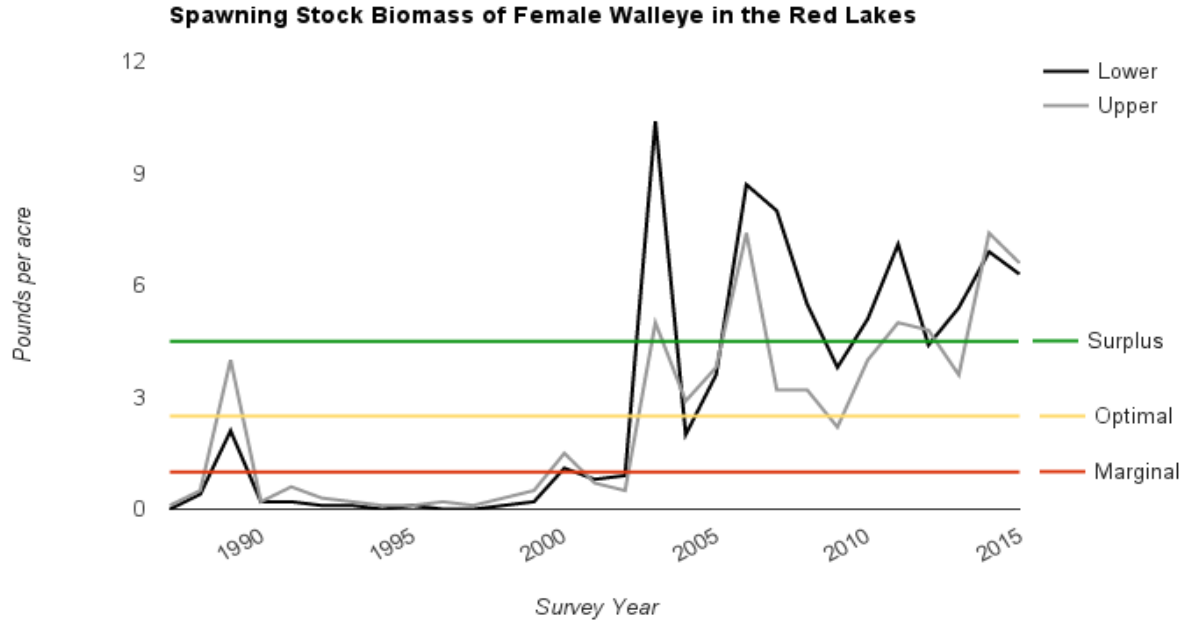

***Figure 3**. Estimated spawning stock biomass (SSB) of female walleye in the Red Lakes relative to the 2015 updated SSB targets. Data from RLFTC 2015.*

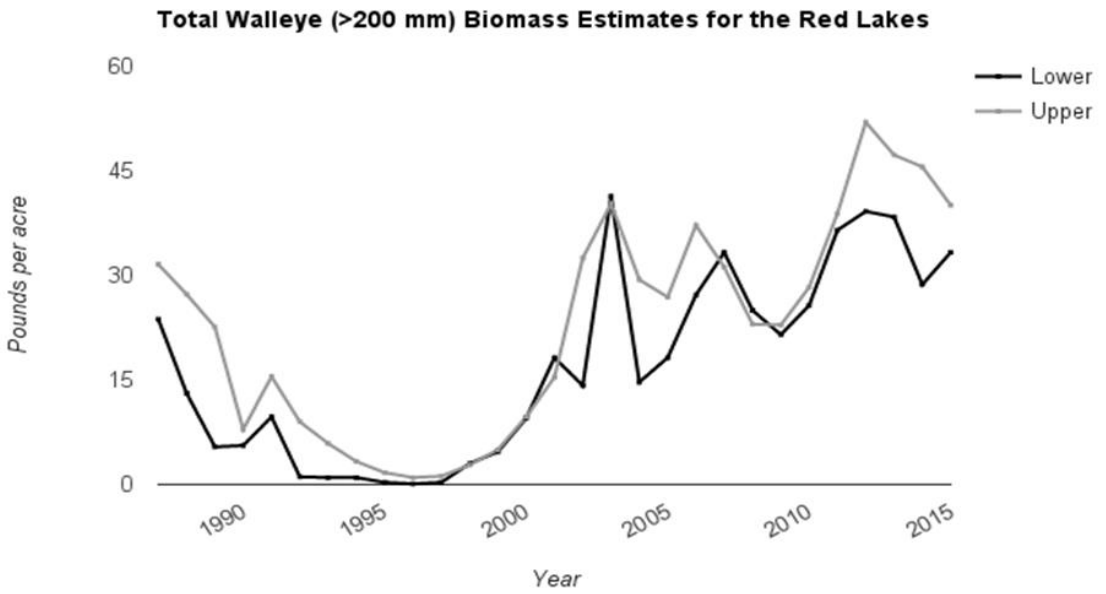

Figure 4*. The total walleye biomass (fish > 200 mm) for the Red Lakes as estimated by the Red Lakes DNR and Minnesota DNR using data from annual fall abundance surveys. (Note: The Lower Red Lake is entirely in reservation (Band) waters and the Upper Red Lake is 56% Band waters and 44% state waters) (Data from Brown and Kennedy 2016).*

Factor 1.2 Fishing mortality

Scoring Guidelines

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern)— Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern)—Probable that fishing mortality from all source is above a sustainable level.*

Red Lakes; Handline and Bottom Gillnet
Low Concern (5)

Key relevant information:
Each year, the appropriate Target Fishing/Harvest Zone (THZ) for walleye is determined based on the current abundance condition (surplus, optimal, marginal, or closed; see Factor 1.1 and Table 2), as outlined in the Walleye Harvest Plan (Red Lake Band et al. 1999) (Red Lake Band et al. 2015). Once the THZ has been identified, this is used to set the target annual catch limit and a catch cap (a level that fishing should not exceed) for the Reservation (Band) and state walleye

fisheries. If the annual catch exceeds the target level in a given year but is below the cap level, a fishing closure is not required, but regulations may be adjusted the following year to reduce catches. On the other hand, if the catch is consistently below the target level, regulations may be relaxed (RLFTC 2015).

Since the walleye fishery reopened in 2006, catches in both Band and state waters of the Red Lakes have remained within the established Target Fishing/Harvest Zone in most years, and despite increasing catches of walleye, abundance has remained high (Figures 5 and 6). In 2015, walleye catches did exceed the target level at the time, but not the catch cap (Brown and Kennedy 2016). Additionally, during 2015, managers updated and increased the Target Fishing/Harvest Zones for walleye because of the quite healthy state of the population. The 2015 commercial and recreational catch would not exceed the new, revised target fishing level (RLFTC 2015). Because it is probable that fishing mortality on walleye is below a sustainable level, we have awarded a "low" concern.

Detailed rationale (optional):

Table 2. *The original (2006) and updated (2015) Target Harvest Zones (THZ) for walleye in the Red Lakes. The Target Harvest Zone is dependent on the current abundance condition. Currently, walleye abundance is categorized as "surplus" (Data from RLFTC 2015).*

Target Harvest Zones		
	2006 Harvest Plan	**2015 Harvest Plan**
Abundance Condition	**Lbs/Acre**	**Lbs/Acre**
Surplus	1.75–3.5	5.0–7.0
Optimal	1.75–3.5	2.5–5.0
Marginal	0–2	0–2.5
Closed	0	0

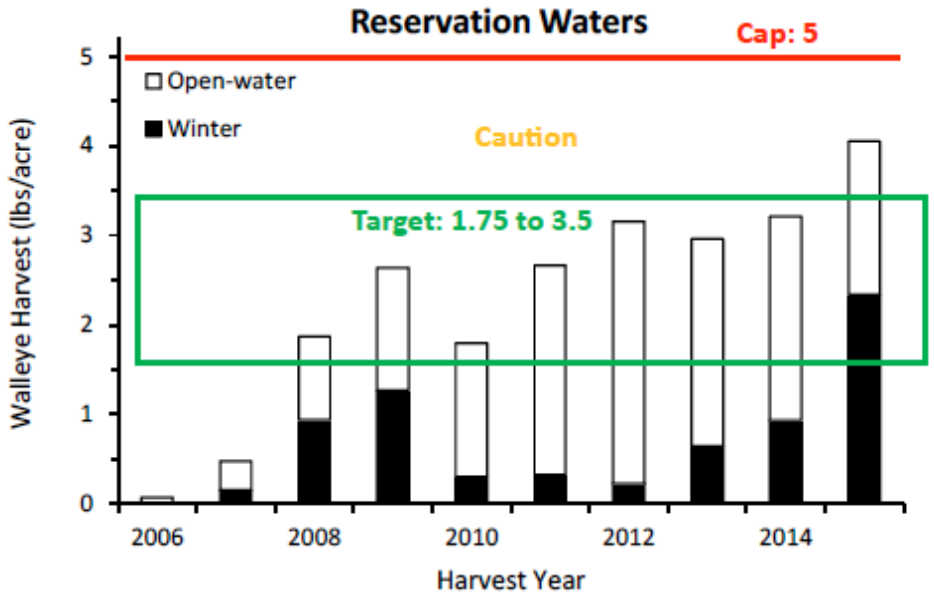

***Figure 5**: Red Lake Band Reservation Catch (lbs/acre) from 2006–2015, relative to the target catch level and cap established in the 2006 Harvest Plan. Note that the harvest zones do not reflect the recent 2015 revisions, and the 2015 catch would not exceed the current target catch level (5.0–7.0 lbs/acre) (Figure from (Brown and Kennedy 2016)).*

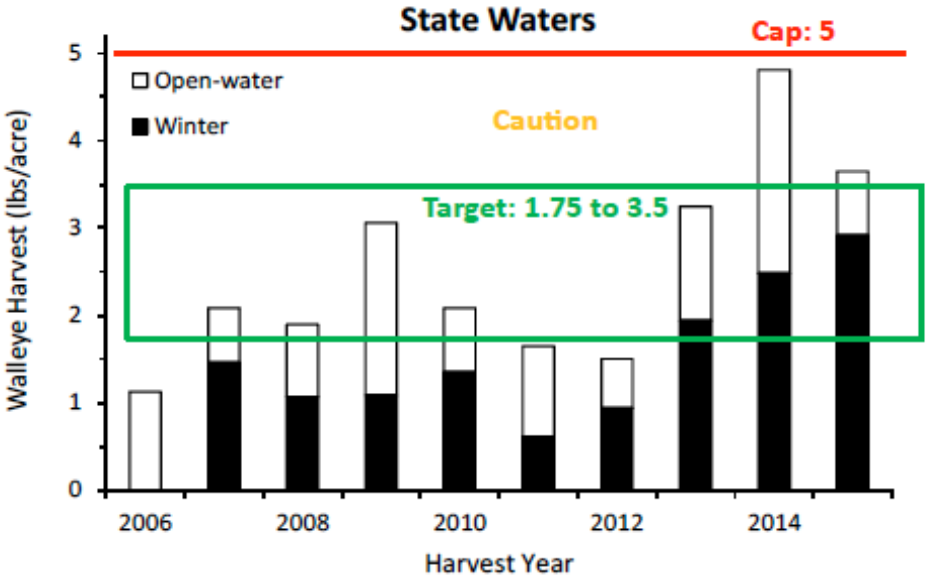

***Figure 6**: Red Lake State Recreational Catch (lbs/acre) from 2006–2015, relative to the target catch level and cap established in the 2006 Harvest Plan. Note that the harvest zones do not reflect the recent 2015 revisions, and the 2015 catch would not exceed the current target catch level (5.0–7.0 lbs/acre) (Figure from (Brown and Kennedy 2016)).*

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch® defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait modifier score (ranges from 0.75-1.00). The Criterion 2 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*

Criterion 2 Summary

Red Lakes, Handline

Species	**Factor 2.1 Abundance**	**Factor 2.2 Fishing Mortality**	**Subscore**	**Criterion 2 Score** (subscore*discard/ bait modifier (1.00))	**Criterion 2 Rating**
Lake Whitefish	Moderate (2.33)	Low (5)	3.41	3.41	Green
Black Crappie	Moderate (2.33)	Low (5)	3.41	3.41	Green
Northern Pike	Moderate (2.33)	Low (5)	3.41	3.41	Green
Yellow Perch	Moderate (2.33)	Low (5)	3.41	3.41	Green

Red Lakes, Bottom Gillnet

Species	Factor 2.1 Abundance	Factor 2.2 Fishing Mortality	Subscore	Criterion 2 Score (subscore*discard + bait use modifier)	Criterion 2 Rating
Lake Whitefish	Moderate (2.33)	Low (5)	3.41	3.41	Green
Black Crappie	Moderate (2.33)	Low (5)	3.41	3.41	Green
Northern Pike	Moderate (2.33)	Low (5)	3.41	3.41	Green
Yellow Perch	Moderate (2.33)	Low (5)	3.41	3.41	Green

Bycatch in the Red Lakes walleye fishery is reported to be low, and no overfished, endangered, threatened, or species of concern are captured. Occasional bycatch in the walleye fishery may include yellow perch *(Perca flavescens)*, black crappie *(Pomoxis nigromaculatus)*, northern pike *(Esox lucius)*, and lake whitefish *(Coregonus clupeaformis)* (Brown and Kennedy 2016). Catches of these species are generally higher later in the summer in the short time when bottom gillnets are used to catch walleye. All fish that are caught are commercially sold; most are sold as fillets for human consumption, except for black crappie, which are ground and sold as animal feed for local farmers (pers. comm., Pat Brown 2016).

Available information on catches for the commercial Red Lakes fishery for 2013–2015 indicates that walleye made up 95%–98% of the total catch for gillnet and handline gears combined, with yellow perch contributing to an average of 2% of the catch, lake whitefish 1% of the catch, northern pike 0.6%, and black crappie 0.15% (see Table 3 (Brown and Kennedy 2016)).

Table 3*. The commercial catch of species caught in the combined gillnet and handline walleye fishery in the Red Lakes in lbs and as a percent of the total estimated catch (Data from (Brown and Kennedy 2016)).*

Fishing Year	Walleye Lbs (%)	Yellow Perch Lbs (%)	Black Crappie Lbs (%)	Northern Pike Lbs (%)	Lake Whitefish Lbs (%)
2013	700,699 (95%)	17,961 (2.43%)	926 (0.13%)	7,816 (1.06%)	11,900 (1.61%)
2014	761,255 (96%)	22,360 (2.83%)	1,044 (0.13%)	1,263 (0.16%)	4,637 (0.59%)

2015	960,427 (98%)	4,864 (0.50%)	1,917 (0.20%)	5,810 (0.59%)	5,597 (0.57%)

There is no information on bycatch available from 2006–2012, but because effort was lower in those years, it is extremely likely that bycatch levels were equal to or less than the levels of recent years (pers. comm., Pat Brown 2016). Although catches of other species in the walleye fishery appear to be quite low, they have been included in the analysis because the walleye fishery is a major contributor (> 20%) to fishing mortality on these species in the Red Lakes. But given the low catch levels, impacts on these species by the walleye fishery are expected to be low. Discards and bait use in the walleye fishery are minimal. Handline fishers target walleye with shiners, worms, leeches, and various types of artificial bait.

Criterion 2 Assessment

LAKE WHITEFISH

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Red Lakes; Handline and Bottom Gillnet
Moderate Concern (2.33)

Key relevant information:
Lake whitefish is monitored by the Red Lake Fisheries Technical Committee through annual abundance surveys. Overall, the abundance of lake whitefish appears to be variable and low in the Red Lakes (Brown and Kennedy 2016). Abundance of lake whitefish in relation to a target reference point is unknown, and the species has not been assessed by the International Union for the Conservation of Nature (IUCN). Because there are no broad estimates of abundance, the Productivity-Susceptibility Analysis (PSA) scoring tool was used to evaluate the vulnerability of lake whitefish and to score abundance. According to the PSA, lake whitefish has a medium vulnerability to fishing (see detailed scoring below). Abundance is therefore scored as "moderate" concern.

Detailed rationale:

Productivity-Susceptibility Analysis:
Scoring Guidelines
1.) Productivity score (P) = average of the productivity attribute scores (p1, p2, p3, p4 (finfish only), p5 (finfish only), p6, p7, and p8 (invertebrates only))
2.) Susceptibility score (S) = product of the susceptibility attribute scores (s1, s2, s3, s4), rescaled as follows: $S = [(s1 * s2 * s3 * s4) - 1/40] + 1$.

3.) Vulnerability score (V) = the Euclidean distance of P and S using the following formula: $V = \sqrt{(P^2 + S^2)}$

Vulnerability Score Range

- *< 2.64 = Low vulnerability*
- *≥ 2.64 and ≤ 3.18 = Medium vulnerability*
- *> 3.18 = High vulnerability*

For details on the PSA method and scoring, please see the Seafood Watch Criteria.

The PSA score for lake whitefish = 2.81. For this reason, the species is deemed as having a "medium" vulnerability. Detailed scoring of each attribute is shown below.

Productivity Attribute	**Relevant Information**	**Score (1 = low risk, 2 = medium risk, 3 = high risk)**
Average age at maturity	3–4 years (Woldt et al. 2007)	1
Average maximum age	50 (Power 1978)	3
Fecundity	8,000–40,000 eggs/spawning event; 10,000–130,000 eggs/year (Jensen 1981) (MNDNR 2016h)	1
Average maximum size (fish only)	100 cm (Frimodt 1995)	2
Average size at maturity (fish only)	24 cm (Froese and Pauly 2016)	1
Reproductive strategy	Broadcast spawner (Froese and Pauly 2016)	1
Trophic level	3.2 ± 0.2 (Froese and Pauly 2016)	2
Density dependence (invertebrates only)	N/A	N/A

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	High overlap	3
Vertical overlap (Considers all fisheries)	High overlap	3
Selectivity of fishery (Specific to fishery under assessment)	Species is targeted and is not likely to escape the gear, but conditions under "high risk" do not apply	2
Post-capture mortality (Specific to fishery under assessment)	Retained species	3

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Red Lakes; Handline and Bottom Gillnet
Low Concern (5)

Key relevant information:
Catches of lake whitefish in the Red Lakes walleye handline and gillnet fisheries are small ((Brown and Kennedy 2016); see Table 3 in the Criterion 2 summary). The walleye fishery is therefore expected to minimally affect this species. Fishing mortality is rated "low" concern.

BLACK CRAPPIE

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Red Lakes; Handline and Bottom Gillnet
Moderate Concern (2.33)

Key relevant information:
Black crappie *(Pomoxis nigromaculatusis)* is monitored by the Red Lake Fisheries Technical Committee through annual abundance surveys. Abundance has fluctuated from year to year (Brown and Kennedy 2016). The abundance relative to target reference points is unknown; however, black crappie is listed as a species of Least Concern by the International Union for the Conservation of Nature (IUCN) because of the large number of subpopulations, large population sizes, and minimal levels of threats on the species (NatureServe 2013a). Based on the IUCN assessment but unknown abundance relative to reference points for the Red Lakes, abundance for black crappie is considered of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Red Lakes; Handline and Bottom Gillnet
Low Concern (5)

Key relevant information:
Black crappie are caught by commercial and recreational fishers in the Red Lakes. Catches of black crappie in the commercial walleye handline and gillnet fisheries are small ((Brown and Kennedy 2016); see Table 3 in the Criterion 2 summary). The walleye fishery is therefore expected to minimally affect this species. Fishing mortality is rated "low" concern.

NORTHERN PIKE

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Red Lakes; Handline and Bottom Gillnet
Moderate Concern (2.33)

Key relevant information:
The abundance of northern pike *(Esox lucius)* relative to target reference points in the Red Lakes is unknown. In state waters of the Upper Red Lake, the density of northern pike is currently low, which is considered a desirable condition for the lake and allows fish to reach large sizes (MNDNR 2016b). Northern pike is listed as a species of Least Concern by the International Union for the Conservation of Nature (IUCN) because of the large number of subpopulations, large population sizes, and minimal levels of threats on the species (NatureServe 2013c). Based on the IUCN assessment but unknown abundance relative to reference points for the Red Lakes, abundance for northern pike is considered "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Red Lakes; Handline and Bottom Gillnet
Low Concern (5)

Key relevant information:
Northern pike are caught in the commercial walleye fishery, in a small targeted spear fishery in the Lower Red Lake, and by recreational fishers. Catches of northern pike in the commercial walleye handline and gillnet fisheries are small ((Brown and Kennedy 2016); see Table 3 in the Criterion 2 summary). The walleye fishery is therefore expected to minimally affect this species. Fishing mortality is rated "low" concern.

YELLOW PERCH

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Red Lakes; Handline and Bottom Gillnet
Moderate Concern (2.33)

Key relevant information:
Yellow perch *(Perca flavescens)* is monitored by the Red Lake Fisheries Technical Committee through annual abundance surveys. Abundance of yellow perch has fluctuated over the years, with abundance lower in recent years compared to the late 1990s and early 2000s (Brown and Kennedy 2016). In state waters of the Upper Red Lake, abundance of yellow perch is reported to be improving in recent years, with strong numbers of large fish (MNDNR 2016). The abundance of yellow perch relative to target reference points is unknown. Yellow perch is listed as a species of Least Concern by the International Union for the Conservation of Nature (IUCN) because of the large number of subpopulations, large population sizes, and minimal levels of threats on the species (NatureServe 2013b). Based on the IUCN assessment but unknown abundance relative to reference points for the Red Lakes, abundance for yellow perch is considered "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Red Lakes; Handline and Bottom Gillnet
Low Concern (5)

Key relevant information:
Yellow perch are caught by commercial and recreational fishers in the Red Lakes. Yellow perch is the most common bycatch in the commercial walleye handline and gillnet fisheries, but overall, catches are small ((Brown and Kennedy 2016); see Table 3 in the Criterion 2 summary). The walleye fishery is therefore expected to minimally affect this species. Fishing mortality is rated "low" concern.

Factor 2.3 Modifying Factor: Discards and Bait Use

Scoring Guidelines
The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

Ratio of bait + discards/landings	Factor 2.4 score
<100%	1
≥100	0.75

Red Lakes; Handline and Bottom Gillnet
<100% (1)

Key relevant information:
Discards in the walleye fishery are minimal. All fish caught are commercially sold (pers. comm., Pat Brown 2016). Bait use is also minimal. When fishing for walleye, handline fishers bait their lines with shiners, worms, leeches, and various types of artificial bait.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- *5 (Very Low Concern)—Meets the standards of 'highly effective' for all five factors considered.*
- *4 (Low Concern)—Meets the standards of 'highly effective' for Management Strategy and Implementation and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern)—Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern)—At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern)— Management Strategy and Implementation and/or Bycatch Strategy are 'ineffective.'*
- *0 (Critical)—Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2 = Red or High Concern*

Rating is Critical if Management Strategy and Implementation is Critical.

Criterion 3 Summary

Fishery	Factor 3.1 Management Strategy & Implement.	Factor 3.2 Bycatch Strategy	Factor 3.3 Scientific Research & Monitoring	Factor 3.4 Enforcement of Regs.	Factor 3.5 Stakeholder Inclusion	Criterion 3 Score	Criterion 3 Rating
Red Lakes, Handline	Highly Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective	Very Low Concern (5)	Green
Red Lakes, Bottom Gillnet	Highly Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective	Very Low Concern (5)	Green

Criterion 3 Assessment

Factor 3.1 Management Strategy and Implementation
Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Red Lakes; Handline and Bottom Gillnet
Highly Effective

Key relevant information:
The walleye fishery in the Red Lakes is managed jointly by the Red Lake Department of Natural Resources Fisheries Program, the Minnesota Department of Natural Resources (MNDNR), and the United States Department of the Interior Bureau of Indian Affairs (BIA). The Red Lake Fisheries Program was started in 1987 and is the responsible party for the management and conservation of fish in Chippewa Indian Reservation waters of the Upper and Lower Red Lakes (Red Lake DNR 2016c).

When the walleye population in the Red Lakes collapsed in the 1990s, commercial fishing was suspended and a recovery plan was put in place. The recovery plan included fry stocking, strong enforcement of the fishing ban, and a data collection program to track the health of the walleye population (HPAIED 2006). The recovery plan was highly successful and the fishery was reopened in 2006, which was much earlier than anticipated.

When the fishery reopened in 2006, a Harvest Plan was adopted. This Harvest Plan was recently revised in 2015 (RLFTC 2015). The goal of the Harvest Plan is to define safe fishing levels that will maintain the spawning population at optimal levels and facilitate the long-term maintenance of the walleye population. The plan defines target abundance and fishing goals, as well as a catch cap (a level that fishing is not to exceed) (RLFTC 2015). Each year, the Red Lake Fisheries Technical Committee estimates spawning stock biomass (mature female biomass) through fall abundance surveys; this information is then used to determine the appropriate target fishing level for the upcoming fishing season, and set the annual catch limits for Reservation (Band) and state waters (see Table 4 in the Detailed Rationale section).

Fishing in Band waters of the Red Lakes is open to Band members only. Of the annual catch limit for Band waters, 90% is allocated to the commercial fishery, while the rest is left for personal use (RLFTC 2015). The Red Lakes Fisheries Program regulates fishing by setting gear, size, and daily bag limit restrictions. Regulations change yearly for the commercial fishery, but currently there is a daily limit of 100 walleye, and only walleye between 14 and 22 inches may be retained (Red Lake DNR 2016a). For the personal use or recreational fishery, there is a daily limit of 10 walleye, walleye under 22 inches may be kept, walleye between 22 and 28 inches

must be released, and one walleye over 28 inches may be kept per day (Red Lake DNR 2016a). In Minnesota state waters of the Red Lakes, only recreational fishing is permitted. The state recreational fishery is also regulated through size and bag limit restrictions (MNDNR 2015) (MNDNR 2016e).

If fishing levels exceed target levels in a given year, regulations will be adjusted the following season to reduce catches. Adjustments to in-season regulations or closures to fishing are only required if catches are expected to exceed the defined cap level (RLFTC 2015). Recently, regulations were relaxed in both Reservation and state waters because of the healthy abundance of the walleye population (MNDNR 2015) (MNDNR 2016f).

Given the management measures in place, defined abundance and fishing targets, precautionary polices, and success with the recovery of walleye, the management strategy is deemed "highly effective."

Detailed Rationale

Table 4. The Spawning Stock Biomass (SSB) conditions and corresponding Harvest Scenarios for walleye for state and Band waters in the Red Lakes as of 2015 (Table from RLFTC 2015).

SSB condition	Harvest Scenarios	State Waters pounds	Band Waters pounds
Surplus	Harvest in any individual year will not exceed the cap of 8.5 lbs/acre.	408,000	2,014,500
	Harvest will be maintained below 7.0 lbs/acre on a three-year average.	336,000	1,659,000
	Harvest of less than 5.0 lbs/acre for two consecutive years may trigger relaxing of regulations to allow additional harvest.	240,000	1,185,500
Optimal	Harvest in any individual year will not exceed the cap of 6.0 lbs/acre.	288,000	1,422,000
	Harvest will be maintained below 5.0 lbs/acre on a three-year average.	240,000	1,185,000
	Harvest of less than 2.5 lbs/acre for two consecutive years may trigger relaxing of regulations to allow additional harvest.	120,000	592,500
Marginal	Harvest in any individual year will not exceed the cap of 3.0 lbs/acre.	144,000	711,000
	Harvest will be maintained below 2.5 lbs/acre on a three-year average.	120,000	592,500
	There will be no opportunity for relaxing regulations while SSB is in the Marginal Condition.	0	0
Closed	Harvest will be closed.	0	0

Factor 3.2 Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Red Lakes; Handline and Bottom Gillnet
Highly Effective

Key relevant information:

There is little information available on bycatch in the walleye fisheries, but data from 2013–2015 suggest that walleye make up the majority of the catch in the handline and gillnet fisheries, and that catches of other species are limited (< 5% of the total catch) (Brown and Kennedy 2016). Fish species that are caught along with walleye may include northern pike, yellow perch, black crappie, freshwater drum, and lake whitefish, but all species caught are commercially sold (Brown and Kennedy 2011) (pers. comm., Pat Brown 2016). Prior to the fishing closure in the 1990s, the primary gear used to catch walleye in the Red Lakes was gillnets, but since the reopening of the fishery in 2006, most commercial fishing occurs with handlines. The handline fishery allows for more directed targeting of walleye (Brown and Kennedy 2016). Additionally, the handline fishery has a low impact on undersized walleye that may be discarded, because these fish can be released unharmed. There are only two gillnet crews that fish for walleye toward the end of the season, to catch the remaining annual quota (pers. comm., Pat Brown 2016). Because bycatch in the walleye fishery is considered very low and the fishery has transitioned to a more selective fishing method, management of bycatch is considered "highly effective."

Factor 3.3 Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Red Lakes; Handline and Bottom Gillnet
Highly Effective

Key relevant information:

Scientists conduct annual fall surveys throughout the Red Lakes to estimate walleye abundance and provide information on the age, size, and sex structure of the population. These data are used in annual population assessments to estimate the total population biomass and spawning stock biomass (SSB = mature female biomass). Scientists have determined target or optimal SSB levels required to maintain a healthy population, and SSB is categorized into one of the

following conditions each year: surplus, optimal, marginal, or closed. Managers then set the target fishing level and annual catch quotas based on the current SSB condition (see Factor 3.1) (Red Lake Band et al. 2015) (RLFTC 2015). Commercial fishing is monitored on a daily basis and fishing is controlled on a daily, weekly, and seasonal basis (Red Lake Band et al. 2015). Recreational fishing is monitored through surveys of angler catch and harvest (RLFTC 2015). Other species caught in the walleye fishery, including lake whitefish, black crappie, northern pike, and yellow perch, are also monitored to some degree through abundance surveys, and catch levels are recorded (Brown and Kennedy 2016).

Because population assessments of walleye are robust, regularly conducted, and based on a variety of scientific information, scientific research and monitoring is considered "highly effective."

Factor 3.4 Enforcement of Management Regulations
Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Red Lakes; Handline and Bottom Gillnet
Highly Effective

Key relevant information:
Walleye fishing regulations in the Red Lakes are enforced by the Red Lake Department of Natural Resources in Reservation (Band) waters and by the Minnesota Department of Natural Resources (MNDNR) in state waters (Red Lake Band et al. 2015). It is required that meetings of the Red Lakes Band and MNDNR are held a minimum of two times per year to ensure that management goals are being met (Red Lake Band et al. 2015). The fishery is tightly regulated in Band waters where commercial fishing occurs. There are six to eight game wardens monitoring the fishery (pers. comm., Pat Brown 2016). Samples of the catch occur weekly with length, weight, and sex data recorded (Red Lake Band et al. 2015). In state waters where recreational fishing occurs, angler surveys are conducted and officers monitor the participants to ensure enforcement of regulations (MNDNR 2014). Since the fishery reopened in 2006, catch levels have typically remained within the target catch range and have never exceeded the cap (Brown and Kennedy 2016). Because of the strong enforcement of management regulations, this factor is rated "highly effective."

Factor 3.5 Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Red Lakes; Handline and Bottom Gillnet
Highly Effective

Key relevant information:

The walleye recovery effort and management program is a multi-agency effort between the Red Lake Department of Natural Resources (DNR), the Minnesota Department of Natural Resources (MNDNR), and the Bureau of Indian Affairs (Red Lake DNR 2016c). Information is made publicly available on the Red Lake DNR and MNDNR websites, and management officials and biologists are able to be contacted with concerns and conflicts. There are public meetings held by MNDNR in regard to regulation changes that are open to the public and fishers (MNDNR 2016i) (pers. comm., MNDNR 2016). Overall, stakeholder inclusion is considered "highly effective."

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.
The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1a + 4.1b) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*

Criterion 4 Summary

Fishery	Factor 4.1a Physical Impact of Gear on the Habitat	Factor 4.1b Mitigation of Gear Impacts	Factor 4.2 Ecosystem Based Fishery Management	Criterion 4 Score	Criterion 4 Rating
Red Lakes, Handline	4	0	Moderate Concern (3)	3.46	Green
Red Lakes, Bottom Gillnet	3	+1	Moderate Concern (3)	3.46	Green

Criterion 4 Assessment

Factor 4.1a Physical Impact of Fishing Gear on the Habitat/Substrate

Scoring Guidelines

- *5 —Fishing gear does not contact the bottom*
- *4 —Vertical line gear*
- *3 —Gear that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*

- *2 —Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 —Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 —Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*

Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Red Lakes; Handline
4

Key relevant information:
Handline is the primary gear used to catch walleye in the Red Lakes. Handline fisheries typically have little to no contact with the bottom habitat and cause minimal damage (Morgan and Chuenpagdee 2003). The Red Lakes are large shallow basins with a uniform shoreline, turbid consistency, and sandy substrate with some gravel mixed in (MNDNR 1997). Handline gear receives a score of "4" for this factor.

Red Lakes; Bottom Gillnet
3

Key relevant information:
A small portion of the commercial walleye catch in the Red Lakes is caught using bottom gillnets (pers. comm., Pat Brown 2016). Gillnets are only used if there is an additional quota remaining at the end of the summer, and in 2015 gillnets contributed to approximately 20% of the total annual catch (Brown and Kennedy 2016) (pers. comm., Pat Brown 2016). Gillnets are vertical hanging net walls that catch fish by their gills. Bottom gillnets are secured to the bottom habitat with anchors or weights. Although bottom gillnets do contact the bottom habitat and can cause some damage, the impacts are considered to be less than mobile gears such as trawls and dredges (Fuller et al. 2008) (Morgan and Chuenpagdee 2003). The Red Lakes are large shallow basins with a uniform shoreline, turbid consistency, and sandy substrate with some gravel mixed in (MNDNR 1997). Bottom gillnets fished in the Red Lakes do not encounter sensitive habitats, such as rocky reefs or coral. Bottom gillnets therefore receive a score of "3" for this factor.

Factor 4.1b Modifying factor: Mitigation of gear impacts

Scoring Guidelines

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in 4.1*

Red Lakes; Handline
0

Key relevant information:
There are no known spatial closures in place in the Red Lakes for the handline fishery to protect walleye habitats, so no mitigation points are awarded.

Red Lakes; Bottom Gillnet
+1

Key relevant information:
In the Red Lakes, the use of gillnets to capture walleye is strongly regulated, and fishing intensity is quite low and limited to two fishing crews (pers. comm., Pat Brown 2016). Prior to the fishing ban in the 1990s, gillnets were the primary gear used to capture walleye in the Red Lakes. When the fishery reopened, the primary gear type was switched from gillnets to handline in an effort to conserve the resource. Mitigation of impacts for this gear type is strong, and a score of +1 is awarded.

Factor 4.2 Ecosystem-based Fisheries Management

Scoring Guidelines

- *5 (Very Low Concern)—Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 (Low Concern)—Policies are in place to protect species' ecological roles and ecosystem functioning that are believed to be effective but conclusive scientific evidence is not yet available and at least some spatial management is used.*
- *3 (Moderate Concern) — Some policies (e.g. spatial management) are in place to protect species 'ecological roles and ecosystem functioning but further efforts are required. Or policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely.*
- *2 (High Concern)— Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 (Very High Concern)—Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Red Lakes; Handline and Bottom Gillnet
Moderate Concern (3)

Key relevant information:
Walleye is considered a top predator in lake ecosystems. It primarily feeds on other fish including yellow perch, emerald shiners, and spot tail shiners, as well as invertebrates. Walleye eggs and larvae are an important food source for other fish species and are primarily eaten by yellow perch. As juveniles and adults, walleye are occasionally prey for largemouth bass, smallmouth bass, muskellunge, yellow perch, northern pike, and other walleyes (Nate et al. 2011).

The current management in place for walleye has been effective at rebuilding and maintaining the walleye population at a high abundance, but specific management policies aimed at protecting ecosystem functioning are not in place (Red Lake Band et al. 1999) (Red Lake Band et al. 2015). But having enough and the right size forage to sustain the walleye population is a chief concern. Scientists monitor the abundance of several fish species in the Red Lakes and

also sample zooplankton to measure secondary productivity and ensure early detection of aquatic invasive species (RLFTC 2015).

Because specific policies are not in place to protect the ecological role of walleye, but detrimental food web impacts are not likely given this species' high abundance, this factor is assessed as "moderate" concern.

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Scientific review does not constitute an endorsement of The Safina Center or Seafood Watch® programs, or its seafood recommendations, on the part of the reviewing scientists. The Safina Center and Seafood Watch® are solely responsible for the conclusions reached in this report.

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