MEMORANDUM OF UNDERSTANDING
Between
The Red Lake Band of Chippewa Indians,
The Minnesota Department of Natural Resources, And
The United States Department of the Interior,
Bureau of Indian Affairs

I. PURPOSE.

WHEREAS, the Red Lake Band of Chippewa Indians (hereinafter, "Band"), Minnesota Department of Natural Resources (hereinafter, "Minnesota DNR"), and the United States Department of the Interior, Bureau of Indian Affairs (hereinafter, "BIA") are committed to the recovery of the walleye population in the Red Lakes and to the long term sustainable management of the fisheries resources of these lakes; and,

WHEREAS, the Band, Minnesota DNR, and BIA successfully entered into and executed a Memorandum of Understanding (April, 1999) that was highly successful in recovering walleye stocks in the Red Lakes; and,

WHEREAS, the Band, Minnesota DNR, and BIA renewed the Memorandum of Understanding for the period of January 2010 through December 2014; and,

WHEREAS, pursuant to the Revised Constitution and Bylaws of the Red Lake Band of Chippewa Indians, the Red Lake Tribal Council is the duly elected governing body of the Band, empowered with the sole right and authority to represent the Band and to negotiate with federal, state, and local governments; and,

WHEREAS, the Minnesota DNR is the wildlife authority for the State of Minnesota (hereinafter, "State") and is vested with the functions, powers, duties, rights, and responsibilities provided in Minnesota Statutes, Chapter 84 and other applicable law, and is charged with the duties for control of lands, parks, timber, waters, minerals, and wild animals of the State and, by its Commissioner, shall do all things deemed necessary to preserve, protect, and propagate desirable species of wild animals; and,

WHEREAS, the BIA is the agency responsible for the administration of Indian trust resources and for the enforcement of treaties, laws, and regulations pertaining to the affairs and welfare of the American Indian, and is the lead agency for the Secretary of Interior in fulfilling Departmental trust responsibilities and Indian self-determination policies; and whereas, the responsibility and authority for coordination and integration of management programs pertaining to Indian trust resources rests at all times with the BIA; and whereas, the authority to enter into this Memorandum of Understanding is in accordance with the Snyder Act, 25 USC, Section 13; and,

WHEREAS, the Band, Minnesota DNR, and BIA have responsibilities under tribal, state, and federal laws and regulations that affect fish;

NOW, THEREFORE, the Band, Minnesota DNR, and BIA hereby renew a Memorandum of Understanding to provide for joint management of the fisheries resources in the Red Lakes; and do mutually understand and agree as follows:

II. THE RED LAKES FISHERIES TECHNICAL COMMITTEE.

A. The Band, Minnesota DNR, and BIA will continue to support the Red Lakes Fisheries Technical Committee (hereinafter, "Committee") to review and assess fish stock status and management of the Red Lakes and to recommend to the respective governments, those procedures, regulations, policies, and practices that will rehabilitate and conserve the fishery resources of the Red Lakes.

B. The Committee shall continue to work together to determine and recommend management and regulatory steps necessary to ensure that fish stocks of the Red Lakes are conserved for the cultural, recreational, social, and economic benefit of all.

C. The Committee shall be composed of representatives from the Band's Department of Natural Resources; Red Lake Fisheries; Minnesota DNR's Section of Fisheries; BIA; the United States Fish and Wildlife Service; and the University of Minnesota, Department of Fisheries and Wildlife.

D. The Committee shall meet as needed and at least once per year; the duty of chairing each meeting shall alternate between the Band and Minnesota DNR; and the respective chair will be responsible for all logistical needs for preparation, hosting, and recording the meeting.

E. In order to support the long-term sustainability of the fishery resources of the Red Lakes, the Committee shall make every good faith effort to support, promote, follow, and implement the Harvest Management Plan for Red Lakes Walleye Stocks (hereinafter, "Harvest Plan") included and incorporated into this Memorandum of Understanding as Attachment A.

F. The Committee may modify the Harvest Plan if warranted based on new biological information without the need for amendment, but shall keep the signatories to this agreement, or their successors, informed in writing as they occur.

G. The signatories to this Memorandum of Understanding shall make every good faith effort to promote and support the efforts of the Committee, and shall make every good faith effort to assist the Committee in operating under the authority of consensus.

H. The signatories to this Memorandum of Understanding shall make every good faith effort to promote and support the efforts of Band and State conservation officers to enforce the Recovery Plan through implementation of an Enforcement Plan included and incorporated into this Memorandum of Understanding as Attachment B.

III. TERM OF AGREEMENT.

A. The terms of this Memorandum of Understanding shall remain in effect until January 1, 2020 at which time it may be renewed.

B. This Memorandum of Understanding may be amended at any time upon written agreement executed by the signatories below or their successors in office.

SIGNATURES

Date: 1-8-15

RED LAKE BAND OF CHIPPEWA INDIANS

By: [signature]
Chairman

Date: 1/8/15

UNITED STATES DEPARTMENT OF THE INTERIOR,
BUREAU OF INDIAN AFFAIRS

By: Diane K. Rosen
Regional Director

Date: Jan 8, 2015

STATE OF MINNESOTA,
DEPARTMENT OF NATURAL RESOURCES

By: [signature]
Commissioner

Attachment A
Harvest Plan for Red Lakes Walleye Stocks

Plan Objective
Develop a plan that outlines methods to identify and allocate safe harvest levels for Red Lakes walleye stocks, and allows the continued establishment and long-term maintenance of a fully recovered, self-sustaining walleye fishery.

Plan Components

1. Primary Population Criteria
2. Harvest Zones
3. Pre-season Management Strategies
4. In-season Management Actions
5. Fall Population Evaluation
6. Annual Harvest Evaluation
7. Decision Making Process
8. Time Frames

1. Primary Population Criteria

Two critical measures of sustainability will be age diversity of the female spawning stock, coupled with a minimum value for spawning stock biomass (Figure 1). Annual estimates of spawning stock biomass (SSB) will be generated from the fall assessment, using the Q_{abg} model (Excel version – by D. Logsdon, 11/19/2002) applied to total catch of mature female walleye in the 68 standardized experimental gill net samples collected through the joint monitoring program. Individual basin estimates will be added together for a total SSB estimate expressed in pounds per surface acre.

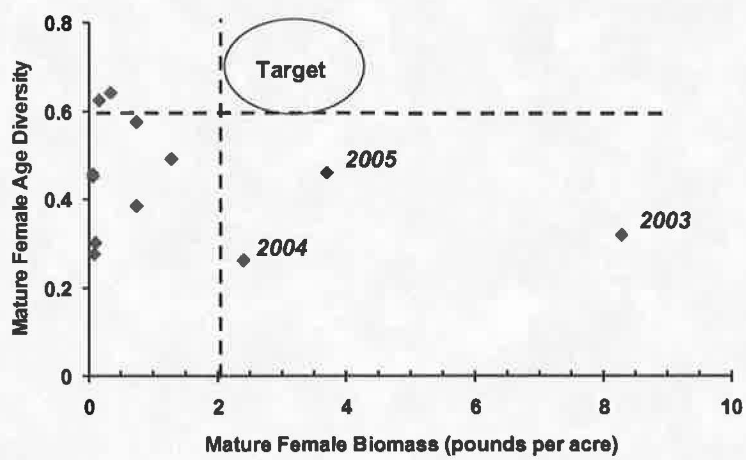

Figure 1. Primary population criteria for walleye of the Red Lakes, MN.

The annual SSB estimate will be categorized prior to each harvest year (December 1 – November 30) into one of the following SSB Conditions.

SSB Lbs/acre	SSB Condition
>3	Surplus
2-3	Optimal
1-2	Marginal
<1	Closed

Surplus: This is a condition where SSB may exceed the level necessary for a self-sustaining fishery. This condition may be expected with a recovering fishery due to artificially high spikes in recruitment to the spawning stock from recovery stocking events. A surplus condition may also occur after recovery has stabilized if measures to protect spawning stock are effective, essentially stockpiling excess SSB. Surplus conditions will also happen randomly in a healthy fishery when a new, strong year class recruits to the spawning stock; however, such recruitment events will likely be ephemeral in nature, with condition falling back down to Optimal, perhaps in the following year.

Optimal: The relationship between past estimates of SSB and spring fry estimates have helped determine that this condition represents an optimal range where SSB should be maintained.

Marginal: This condition represents a marginal state of SSB where some harvest at a reduced level could be safely maintained.

Closed: This level of SSB is considered critical and no harvest should occur under this condition.

2. Harvest Zones

Harvest zones have been identified for each of the various SSB Conditions[1].

SSB Lb/acre	SSB Condition	Harvest Zones (lbs/acre)			
		Opportunity	Target	Caution	Cap
>3	Surplus	0-1.75	1.75-3.5	3.5-5.0	5.0
2-3	Optimal	0-1.75	1.75-3.5	3.5-4.5	4.5
1-2	Marginal	0	0-2.0	2.0-2.5	2.5
<1	Closed	0	0	0	0

Opportunity: Harvest levels that fall within this zone are an indication that there may be an opportunity to increase annual harvests. A single annual harvest estimate that falls within this

[1] Specific poundage relating to jurisdictional acreage is listed in Appendix Table 1.

zone would not likely trigger a regulation change the following year. Two consecutive years in the opportunity zone may suggest relaxing regulations.

Target: The target zone is the range where harvest should be maintained, preferably on an annual basis, but definitely on a three year running average[2]. Proposed regulations will be modeled to project harvest within the target zone. *Note: There is no difference in the target harvest ranges for surplus and optimal conditions due to uncertainty of the population in the surplus condition, such as may arise from density dependent effects associated with excess SSB.*

Caution: Harvest levels that fall within the caution zone will be tolerated within a given year without a harvest closure. Regulation adjustments will be necessary prior to the following harvest year in order to bring the average annual harvest back within the target zone. Note: *There is a wider caution zone for the surplus condition, providing more flexibility during times of surplus SSB.*

Cap: The defined harvest cap for the SSB condition will function as a safety net and represents a level that annual harvest will not be allowed to exceed. In-season projections of harvest exceeding this level will trigger a harvest closure to occur before the cap is exceeded.

3. Pre-season Management Strategies

Prior to the onset of a new harvest year, the SSB Condition must be determined so that the appropriate target harvest zone (THZ) can be identified. Each jurisdiction will then attempt to tailor its fishing regulations to yield a total annual harvest within the THZ[3]. There are two possible strategies to manage harvest within the THZ.

1. Initiate harvest with liberal regulations and a programmed closure at or near the upper limit of the THZ.
2. Formulate restrictive regulations intended to result in total annual harvest near the midpoint of the THZ, with the intent of operating the fishery throughout most of the harvest year.

East Upper Red: The preferred method for setting Recreational angling regulations will be Strategy 2. Various regulation options will be modeled to predict total annual harvest. A recreational angling regulation that has a high probability of resulting in a total annual harvest near the midpoint of the THZ will then be selected. This strategy acknowledges the difficulty and uncertainty in predicting angling pressure and catch rates, but increases the probability that actual harvest will fall within the THZ. Since this strategy lacks the precision of simply closing a fishery once target harvests have been achieved, reasonable levels of harvest outside the THZ (i.e., in the caution zone) will be tolerated and may be compensated for by maintaining a three-

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[2] Three year averaging is straightforward when SSB conditions remain unchanged. When SSB condition changes within a three-year period, the cumulative harvest for the period should not exceed the sum of the upper end of the target harvest ranges of each individual year.

[3] The 2006 open-water season represents one-half of a harvest year, and will result in all Harvest Zone values being reduced by half for this period.

year running average within the THZ. A mid season harvest closure is the least desirable measure for managing recreational harvest but provides a backup if harvest under the regulation greatly exceeds projections. Setting seasonal harvest caps may be desirable to allocate harvest between winter and open-water seasons. Annual and seasonal harvest caps will be adhered to and need to be clearly defined and communicated to the public, clarifying the level of harvest in any individual year or season at which harvest will need to cease.

Recreational angling regulations will likely include both restrictive bag and length limits to control total harvest. Length restrictions will be formulated to protect and maintain existing spawning stock.

Reservation Waters: The Band will determine allocation between recreational, subsistence, and commercial harvests. Differing harvest methods may be managed with a combination of strategies 1 and 2 above. Commercial harvest will be regulated to meet the predetermined commercial quota. At this time there is a large amount of uncertainty on how the Band plans to fish and how future harvest allocations may be split among the various types of fishing. If during the season it appears that the quota in one category may exceed the pre-determined allocation, it may be possible to reallocate from the remaining categories to prevent exceeding the reservation's total allowable catch. The commercial quota will be calculated by multiplying the upper limit of the target harvest zone by total reservation acres then applying the percentage of the harvest allocation that the Band has declared for commercial fishing. Size and age structure of the commercial catch will be managed by gear regulation to protect and maintain spawning stock. Once the quota has been reached, commercial fishing will be suspended until the following year. Estimates of subsistence and angling harvest will be less precise than estimates of the commercial harvest. The percentage of the quota allocated to these methods of harvest will be reduced to target near the mid-point of the harvest zone. The quota for these types of fishing will be determined by multiplying the mid point of the target zone by total reservation acres and then multiplied by the harvest allocation percentage declared for these types of fishing. Bag limits or size regulations have not been explored to regulate the recreational fishery on the reservation because of the limited amount of activity in the past. However, conservation enforcement staff has suggested daily bag limits to help prevent recreational harvest from becoming a vector for illegal fish sales in the future. These bag limits have not been established, but will revolve around a liberal amount of perch and walleye for personal use only. Size regulations could also be implemented if recreational fishing becomes a substantial component of the harvest. At the end of the season, all three harvest methods will be summed to provide an estimate of total walleye harvest on reservation waters.

4. In-season Actions

East Upper Red: Harvests from recreational angling will be estimated through creel surveys. Specific creel survey designs are outlined in Appendix A. Monitoring protocol will include methods to estimate related sources of mortality (e.g., angler release mortality). Preliminary harvest estimates will be generated on a biweekly basis in order to project total harvest through the end of the respective fishing season.

Total harvest projections falling within the THZ require no in-season action. Total projections exceeding the Harvest Cap will require a harvest closure before the Cap is exceeded. Total harvest projections falling within the Caution Zone will not require a regulation adjustment within the season, but may result in an adjustment for the following season or year. Two consecutive years of harvest within the Caution Zone will require a regulation change the following year to ensure that the three-year average harvest falls within the THZ. Total harvest projections falling within the Opportunity Zone will not stimulate in-season regulation changes but may result in relaxing regulations in future harvest years.

Reservation Waters: Commercial harvest will be directly measured as outlined in Appendix A. Harvests will be monitored daily, and weekly summaries will be recorded for all commercially important species during the fishing season. Harvest will be controlled on a daily, weekly, and seasonal basis to optimize profits. This may include setting limits on the number of fishing nights and/or the number of fishers, as well as processing capacity and current market conditions during the predetermined commercial season. The commercial fishing season will be closed upon reaching a predetermined allocation of the total Band quota. Commercial harvest estimates will include estimates of associated mortality such as sorting or culling.

Recreational angling and subsistence angling and/or netting harvests will be estimated as described in Appendix A. Higher than anticipated non-commercial harvest projected to exceed the cap could result in early closure or possibly reallocation of unused commercial quota. Totals of commercial, subsistence, and recreational harvests projected to fall within the Caution Zone would not require in-season regulation changes, but may require harvest adjustments the following harvest year. Total harvest projections falling within the Opportunity Zone will not stimulate in-season regulation changes but may result in relaxing regulations in future harvest years.

5. Fall Population Evaluation

The annual fall population evaluation is a critical component of the harvest plan. It will function as an error checking process and safety net to ensure that the walleye population is not being over-exploited, even if harvest estimates appear to be within target harvest ranges. Over-harvest could still be occurring under one, or any combination, of the following scenarios:

- Target ranges initially set too high.
- Under estimation of legitimate harvest and associated fishing mortality.
- Undetected illegal harvest mortality.

A description of the methodology used for the cooperative walleye population assessment is included in Appendix B. A variety of biological indicators will be measured and updated from the fall assessment results. Specific indicators include the following:

- Current SSB
- Estimates of total population biomass and/or harvestable biomass
- Spawning stock age diversity

- Mean age of mature females
- Gill net CPUE
- Length and age distributions
- Condition
- Growth increments by age
- Total length at age three
- Maturity rate
- Total annual mortality (from catch curves)
- Harvest year mortality (from Q_abg estimates)
- Mortality/recruitment balance
- Biological Performance Indicators (Gangl and Pereira, 2000)
- Year class strength index (recruitment predictions)

Basin and Sector Differences: It is the intent to manage the entire Upper and Lower Red Lakes as a combined system since there is documented interchange of adult walleye between basins, and fry stocking evaluations have documented that the Upper Basin will export considerable fry production to the Lower Basin. It is agreed that, at least initially, the primary criteria for setting harvest zones (SSB) will be the sum of both basins combined. This simplifies allocation issues and avoids the potential scenario of differing SSB condition and harvest levels for the two basins. However, it is recognized that considerable biological differences exist between the basins as determined by predictive yield models, as well as observed differences in growth, maturity and density. In addition, harvest methods will vary widely between jurisdictions. As agreed by the RLFTC when standardizing RLDNR and MNDNR monitoring programs, all data will continue to be collected, analyzed and reported separately for the Upper and Lower Basins. Some population indicators will also be combined to represent the entire system (e.g., SSB). Similarly, some analyses will need to distinguish jurisdictional sectors of the Upper basin. This approach will retain basin and jurisdiction resolution, and help detect trends related to differing harvest methods. The forecast model (Appendix C) will also be run separately for the Lower Basin, Upper Basin-east and Upper Basin-west due to differences in the type of fishing in each of these three sectors.

Trend Analysis: Many of the biological indicators are useful in monitoring trends over time and will aid in decision-making when adjustments are being considered. However, most of these indicators lack the short-term resolution to recognize excessive harvest in any individual year. Trends over time in one or more population indicators may support increases or decreases in future walleye harvest.

Yearly Change: Some biological indicators can be useful in evaluating the impact of the previous year's harvest. Those indicators can be based on relative or absolute change from the previous fall assessment period, essentially documenting the impact of the previous year's harvest on the existing population. While these indicators need to be sensitive to yearly change, they are also subject to the effects of normal sampling variability. Extreme caution should be exercised when making any decision based on change in a single year.

Harvest Year Mortality: The mortality estimate for the previous harvest year will provide a benchmark to compare the harvest estimates. Though it is difficult to partition natural mortality from fishing mortality, or separate additive from compensatory effects, it is total mortality, or annual survival, that will determine long-term sustainability. Harvest year mortality will be calculated from the previous year's Q-abg population estimate of age-2 and older walleye minus the current year's population estimate of age-3 and older walleye. The difference divided by the previous year's estimate (age-2 and older) represents a rate of total annual mortality for the current harvest year. Individual harvest year mortality for Upper Red Lake from 1988-1997 was frequently greater than 80% and averaged 66% for that time period (Appendix Figure 1). During the period from 1998-2004 when most harvest was closed[4] yearly mortality averaged 31%. As we gather more data after reopening the fisheries, we may be able to determine a 'sustainable' level of total mortality. One goal, borrowing from large-scale marine fisheries, may be to manage fishing mortality so it is less than natural mortality (M). Specifically, we recognize a fishing mortality rate (F), approaching or greater than 0.8M, as threshold requiring immediate action to limit further exploitation.[5] This would require an independent estimate of natural mortality, which could be derived from an established empirical formula.[6]

Population Forecasting: Forecasting with probability-based modeling will be a critical component of population monitoring since regulations will be designed to protect mature fish, with harvest primarily concentrated on juvenile walleye, resulting in delayed affects to SSB. Forecasting will be limited to three-year projections to reduce the uncertainty of variable recruitment. Three-year projections are adequate since the majority of harvestable fish (ages 2-4) will recruit to SSB over the next few years[7].

The most current population parameters from fall assessments will provide model input, including the current population estimate, size distribution, growth rate, and rate of maturity. Several levels of yield will be projected forward to determine harvest levels that have reasonable odds of causing a decline in SSB (see Appendix C for forecast model structure). Thus, if such harvest levels are realized within the next year or two, we have an objective basis for considering further reductions in harvest. Model output will be projected SSB levels for future years 1-3 and spawner age diversity. After each fall assessment the model may be run again using the new population estimates and parameters. Thus, if we forecast potential problems two years forward starting in time *t*, revised estimates with new assessment data in time *t+1* will be useful to increase our confidence in the previous forecast.

6. Annual Harvest Evaluation

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[4] Commercial harvest closed 1997, State waters initiated 2 fish bag in 1998, total harvest closure in 1999.

[5] Thompson, G. G. 1993. A proposal for a threshold stock size and maximum fishing mortality rate. Can. Spec. Publ. Of Fish and Aquat. Sci. 120:303-320.

[6] An example may be Pauly's method of estimating natural mortality; (Pauly, D. 1979. On the interrelationships between natural mortality, growth parameters, and mean environmental temperature in 175 fish stocks. Journal du Conseil, Conseil International pour l'Exploration de la Mer 39:175-192).

[7] In years 2000-2004, 90% of Upper Red walleye age 2 and over were ages 2, 3, or 4.

A full harvest year will be defined as December 1 – November 30. System harvest is total annual harvest by all methods, including estimates of associated mortality (release mortality, commercial culling, etc.) expressed in pounds per surface acre. Jurisdictional harvest is total annual harvest by all methods, including estimates of associated mortality (release mortality, commercial culling, etc.) expressed in pounds per surface acre for each jurisdiction. Several different methods will be utilized to estimate total annual harvests in each jurisdiction. Specific survey designs are outlined in Appendix A.

Allocation Triggers: Initially, harvests may not occur at equitable levels (pounds per acre) between jurisdictions. Since biological indicators of population health may not be sensitive to over-exploitation within one jurisdiction if total harvest within the entire system is not excessive, harvests that exceed the THZ may result in regulation changes even though overall harvest may be low, and biological indicators positive.

Harvest Within the Opportunity Zone: Consistent harvest estimates that are less than the lower end of the THZ may indicate an opportunity for additional safe harvest. Additional harvest may even be beneficial if it resulted in increased growth and recruitment. However, population criteria must also support such a change (e.g., SSB projections maintained in surplus or optimal conditions).

Harvest Within the Target Harvest Zone: Total annual harvest within the THZ for the programmed SSB condition will be considered optimal. However, such harvest will be evaluated to verify that it is sustainable as a safeguard against unreported, illegal, or underestimated sources of fishing mortality. Adjustments to specific values representing the various harvest zones will be required if total annual harvests are consistently within the THZ, but population indicators reveal biological signs of over-exploitation. (e.g., SSB projections dropping into marginal or closed conditions)

Harvest Within the Caution Zone: Total annual harvest exceeding the THZ will likely result in regulation adjustments for the following season, especially if population indicators reveal biological signs of over-exploitation (e.g., SSB projections dropping into marginal or closed conditions). If harvest estimates consistently exceed the THZ, but population indicators do not reveal biological signs of over-exploitation, adjustments to specific values representing the various harvest zones may be warranted (e.g., SSB projections maintained in surplus or optimal conditions).

Exceeding the Cap: The intent of this plan is to avoid exceeding the Harvest Cap by projecting harvest within a season to anticipate and program season closure before the Cap is reached. Should unanticipated harvest beyond the Cap occur, significant regulation changes will be required to adjust harvest back within the THZ the following year.

7. Decision Making Process

Within the framework of this plan there are distinct areas where decision-making processes differ:

Predetermined triggers: Specific threshold values or "hard triggers" within this plan such as harvest caps or SSB Condition have been defined and agreed to by the full Technical Committee. These triggers have been established to dictate specific actions.
Examples:

- Current SSB will be calculated from fall assessment netting.
- THZ and Caps are set by the SSB condition.
- Harvest projections exceeding a Cap will dictate a harvest closure before that Cap is exceeded.

Jurisdictional decisions: Selection of regulation options to manage harvest within the target range are jurisdictional decisions. Methodology of harvest projections and rationale for specific regulation setting will be shared between jurisdictions, but do not require formal RLFTC approval.
Examples:

- Specific fishing methods and regulations.
- Allocation between fishing methods.
- Allocation between seasons.

Harvest plan adjustments: Adjustments to THZ, harvest caps, or other specific indicators in this document require RLFTC approval. No single "hard trigger" dictates a specific action. A variety of indicators such as BPI's or model output will provide data for Technical Committee consideration.
Examples:

- Harvest stays within the THZ but BPI's or predictive models project future SSB problems. THZ may need to be adjusted downward.
- Harvest estimates are consistently in the caution zone, but BPI's and predictive models look good. Possibly THZ could be adjusted upward.
- Harvest stays within the THZ but Harvest Year Mortality estimates indicate leakage. Harvest estimates may need to include leakage, or THZ adjusted, or enforcement efforts redirected.

8. Time Frames

- September-October
  - Fall population assessment.

- November 1
  - Fall assessment data will be compiled and SSB Condition set.
  - Harvest Ranges and/or Caps are set for the next harvest year as defined by the new SSB condition.

- December 1
  - Start of new harvest year.[8]
  - Walleye aging completed from fall assessment.
  - Q-abg estimates run by age and sex.
  - Finalize harvest statistics from previous harvest year.

- December RLFTC meeting
  - Joint population assessment report reviewed.
  - Final harvest year statistics reviewed.
  - Evaluate previous harvest year.
  - Review Enforcement measures.
  - Jurisdictions provide preliminary plans for harvest adjustments in response to current SSB condition, or exceeding the THZ.[9]

- February 1
  - Walleye aging completed
  - Calculate harvest year mortality.
  - BPI's updated.
  - Forecast model output generated.

- March RLFTC meeting
  - Jurisdictions report final regulation adjustments for open water season.
  - Compare reported harvest + predicted natural mortality, to harvest year mortality estimate.
  - Discuss potential sources of significant unaccounted mortality.
  - Present output from population forecasting model.
  - Recommend adjustments to THZ or caps for the following harvest year.

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[8] Preliminary harvest statistics will be generated on a bi-weekly time frame throughout the harvest year and shared between jurisdictions within two weeks of the end of a period.

[9] Implementing regulation changes may not be logistically possible before the winter portion of the coming harvest year, but changes in the Cap level or three year averaging may result in an earlier winter harvest closure.

Appendix A

Annual Harvest Estimates

Annual harvest information from the Red Lakes will be required to implement the walleye harvest plan aimed at cooperative management of the shared resource that supports multiple fisheries in two jurisdictions. Walleye yield estimates from each jurisdiction will be used in conjunction with population estimates and forecast models to determine the amount of surplus production available for harvest on an annual basis. Yield estimates will also be used to allocate allowable harvest among various harvest methods or between harvest seasons. Walleye kill-at-age data will be utilized to implement statistical catch-at-age models in the future.

East Upper Red

Waters falling under the jurisdiction of the State of Minnesota will support a recreational angling fishery. To estimate total annual walleye harvest of this fishery, an annual creel survey covering both the open-water and winter periods will be conducted. The primary objective is to generate minimally biased and precise estimates of angling pressure (effort) and associated harvest and size structure of all species caught. Secondary objectives include estimating catch and release rates (all species), release mortality (walleye only, using release mortality model developed by Keith Reeves, MN DNR), and age structure of harvested walleye. For within-season harvest monitoring, preliminary harvest estimates will need to be generated every two weeks to ensure that the respective harvest cap will not be exceeded.

Open-water Creel Survey: An angler creel survey will be conducted from mid-May through mid-October of each year. One creel clerk will be employed to collect information from various access points around the lake. The clerks will work within a spatiotemporal sampling framework determined by a stratified random, two-stage, non-uniform probability design. Creel clerks will make counts of boat landings at each access point and will interview anglers to obtain information such as party size, trip length, species sought, number of fish harvested and released, and fish lengths. Otoliths for making estimates of the age distribution of walleye harvested will be collected from various fish cleaning facilities. Monitoring of lake water temperatures will be conducted throughout the open-water season for implementation of the release mortality model.

Winter Creel Survey: An angler creel survey will be conducted from early December through at least the end of walleye season each year. A single creel clerk will work within a spatio-temporal framework determined by stratified random, two-stage, uniform probability sampling. The creel clerk will make counts of angler parties leaving the lake via ice roads after completing their fishing trips. The clerk will interview angler parties to obtain information such as party size, trip length, species sought, number of fish harvested and released, and fish lengths. Bony parts for making estimates of the age distribution of walleye harvested will be collected from various fish cleaning facilities.

Reservation Waters

Waters falling under the jurisdiction of the Red Lake Band may support commercial, subsistence, and recreational fishing. At this time the Band has not made any final decisions, but this document includes ideas, protocols, and potential regulations to adequately monitor the catch and to assist the Tribal wardens in controlling the catch. Each harvest method will require different sampling designs to adequately predict harvest from the reservation waters. Primary objectives will include determining the pounds of walleye harvested by each method and to allow for the construction of an associated age structure of harvested walleye. Individual age structures will be computed for recreational angling, and for commercial and subsistence netting (if same gear is deployed). If the same gear is not deployed for commercial and subsistence harvest, then a third age structure will be constructed.

Commercial Fishery: The commercial netting season will be set by April 15th each year. Historically, the netting season commenced on June 1st and continued until the predetermined quota was reached or thru mid to late November. However, winter anglers may harvest a portion of the quota if the commercial fishery decides to purchase, process, and market hand caught fish during the winter months. Daily catch records will be recorded for all commercial operations and weekly summaries will be computed and subtracted from the annual quota. Daily records will include total pounds for each species caught and total number of fishers and/or nets lifted daily. Walleye caught during the winter months and sold to the fishery will be subtracted from the annual commercial quota. Once the quota is reached, commercial netting will cease until the following season. A weekly random sub-sample of the commercial catch will be processed from each basin. Fifty randomly selected walleye will be measured (TLmm) and weighed (nearest gram), and sex and maturity will be determined. Length-at-age keys will be constructed for October-March (combined), June, July, August, and September. Otoliths, 2nd dorsal spine, and scales will be removed from 5 walleye per 10 mm size class by sex for each previously mentioned time period.

Subsistence Fishery: In the past, the commercial and subsistence gill nets were identical. The number of set nights will be determined by participation, percent of the harvest allocation for this type of fishing, and remaining amount of the subsistence quota. Weekly totals will be subtracted from the quota, and once the predetermined quota is reached, subsistence netting will cease until the following season. To assist in determining total effort per set night, a permitting system will be developed. This likely will include a permitting number that will identify and authorize the setting of each subsistence or personal use net for each night that subsistence fishing is authorized. If the same gear is deployed for both commercial and subsistence netting, we will take a weekly average of the number of walleye captured per commercial gill net lift and multiply this by the number of permits issued that week. Information collected from the commercial fishery will assist in constructing age-at-kill keys for this type of fishing. If the commercial gear is different or not set, then a random sub-sample of the daily permitting numbers will be selected and interviews will be conducted. During the interview, total number and weight of each species will be recorded, and a sub-sample of up to 50 walleye will be measured (TLmm), weight (nearest gram), and sex and maturity will be determined. Scales, otoliths, and 2nd dorsal spines will be removed to assist in constructing age-at-kill keys by sex and seasons as described in the previous section.

Summer and Winter Angling Creel Survey: A roving angler creel survey will be conducted during the summer and winter seasons on the reservation. A team of clerks will work within a spatiotemporal sampling framework determined by a stratified random, two-stage, non-uniform probability design. The team will make counts of boats or fishing parties, trip length, fish harvested and released, and lengths. If parties are observed completing their trip, the team will attempt to make contact and update records to include the completed trip. 2nd dorsal spines will be removed from a sub-sample of walleye to construct age-at-kill estimates of the harvest during October-March, June, July, August, and September. Attempts will be made to collect 5 bony structures per 10 mm size groups for each season for walleye. Sexes will not be separated for these keys because fish will not be cleaned on the lake.

Appendix B

Walleye Population Evaluation

Fall Gill Net Sampling

In September of each year, 68 standard 250-foot (76.2 m) experimental gill nets will be fished at established locations throughout the Red Lakes (48 sets in Reservation waters and 20 sets in State waters). Nets will be set overnight (approximately 24-hours). All captured fish will be identified and enumerated. Data should be recorded separately for each of the five mesh sizes. All fish will be individually measured to the nearest millimeter and weighed to the nearest gram. Sex and maturity will be documented for each individual walleye. Otoliths and scales will be collected from all walleye sampled, and associated length, weight, sex, and maturity will be recorded. Individual fish ages will be determined from otoliths. Maturity of female walleye is a very critical determination from fall netting, ultimately determining SSB. Female maturity for SSB calculations will be defined as visible gamete development indicating probable spawning the following spring. Mature fish with no egg development will be noted separately.

Annual SSB Estimates and Q_{abg} Modeling

Annual estimates of SSB will be generated from the fall gill net data using the Q_{abg} model (Excel version – by D. Logsdon, 11/19/2002) applied to total catch of mature female walleye in the 68 standardized experimental gill net samples collected through the joint monitoring program. Individual basin estimates will be added together for a total SSB estimate expressed in pounds per surface acre.

The Q_{abg} model will also be applied to all walleye caught in gill nets each year by jurisdiction/lake basin, sex, and age. Resulting population estimates (along with associated standard deviations and confidence intervals), mean sizes (along with associated standard errors), and weight-length relationships will be used as input data into the population forecast model (Appendix C).

Other Sampling

Shoreline Seining: Thirteen stations (8 in Reservation waters and 5 in State waters) will be sampled weekly for a 6-week period from July through mid-August. A single haul will be conducted at each station using an untreated, 100 foot (30.5 m) long, 5 foot (1.5 m) deep, 1/4 inch (6 mm) mesh, bag seine. Because of the extensive shallow nature of Upper Red Lake in near-shore areas, parallel- or perpendicular-to-shore methods will be used, rather than the traditional fixed-pole method. All adult fish, excluding most cyprinids and other small species, will be enumerated and released immediately after a haul. The remainder of the sample, including all young-of-the-year (YOY) walleye, will be preserved on ice for subsequent laboratory processing. For large catches, a sub-sample may be taken and all remaining fish bulkweighed and released. Total catch should then be extrapolated from the sub-sample by weight. In the laboratory, fish will be identified, enumerated, measured to the nearest millimeter and weighed to the nearest gram.

Bottom Trawling: In the past, annual trawling has been conducted at 30 stations each on Upper and Lower Red Lake during mid-August. An otter trawl equipped with a 16-foot (4.9 m) headrope and 1/4 inch (6 mm) mesh cod end liner was used. A five-minute haul was conducted at each station at a trawling speed of 1.2 miles per hour (2.0 km/hour). Captured fish were identified and enumerated. All captured walleye were measured to the nearest millimeter. Trawling was not conducted in 2005, and the program is currently being reviewed to determine its long-term usefulness.

Water Quality Sampling: Water samples will be collected annually from State waters at three standardized locations on or near August 1 of each year. The Minnesota Department of Agriculture Chemistry Laboratory in St. Paul, Minnesota will analyze these samples for total phosphorus concentration, chlorophyll *a,* pH, total alkalinity and total dissolved solids. The Red Lake Department of Natural Resources collects water samples from Lower and Upper Red Lake as well as the major tributaries, from both Tribal and State waters. Samples are taken two times per month from June through September, and include 5 standardized stations in each basin. Samples are analyzed by an EPA-certified facility, ERA Labs of Duluth, and include at a minimum, dissolved oxygen, temperature, turbidity, conductivity, pH, total and ortho phosphorus, TKN and nitrate+nitrite-nitrogen.

Other lake data to be compiled and reported annually will include mean monthly water temperature and water surface elevation.

Appendix C

Population Forecasting

This appendix explains how we will forecast the impacts of various amounts of fishery yields on spawning stock biomass and age diversity in the Red Lakes.

The following assumptions and details from the management framework form the basis for how the forecasting system is constructed:

1. Our primary management goal will be to maintain female spawning stock biomass in a range of 2 to 3 lbs per acre. Thus, the central challenge in forecasting is to assess the odds of SSB falling below 2 lbs per acre, into the marginal zone. Also, upon full recovery we will have a diverse age structure of female spawners (e.g. the age diversity statistic, 'H', will be above a threshold of 0.6 as established for healthy, self-sustaining walleye populations).
2. It is difficult, if not impossible, to reliably forecast a sport fishery for the coming year and the specific harvest from new regulations. The Mille Lacs experience indicates highly variable catchability and variable effort, and this challenge is compounded on the Red Lakes because we are dealing with a new and different fishery.
3. Mechanics of the fishing process. Fishing mortality (F) is the product of fishing effort (f), maximum catchability (q), and selectivity (s). So, selectivity will be 1.0 for the size with maximum catchability, and between 0 and 1 otherwise. For a given size of fish, fishing mortality will therefore be: $F = f*q*s$. This basic mechanic can be applied to gill nets as well as sport fishing. For sport fishing, we can start with the selectivity function developed from Mille Lacs data. Gill net selectivity functions can be derived for the Qabg model parameters. Further details on modeling fishing mortality are presented below.
4. Compliance. The effect of compliance on the forecasting procedure is through changes in the force of fishing relative to the anticipated pattern of size selectivity. If there is illegal fishing but with the same type of gear, then this may simply be manifested as higher mortality evenly spread across the entire size range of fish being caught. There will be some degree of noncompliance, especially close to the boundaries of a length limit. For example, if anglers must release fish between 17" and 26", there will be a certain level of noncompliance for fish above 17", but this rate will decay with increasing fish size. The MN DNR has data from other studies to use for this. Other forms of noncompliance could apply to other fishing methods, through deployment of different fishing gears other than angling or gill nets with specific mesh sizes that have been specifically addressed in the forecast model.
5. Hooking mortality. For hooking mortality, we will adopt the model by K. Reeves on Mille Lacs based on temperature and fish size. However, as an approximation, we will adjust compliance rates to reflect a reasonable level of hooking mortality. Further data gathered during the initial Red Lakes fisheries will allow us to better quantify both hooking mortality and compliance rates.
6. The fishing season will start in December. This is convenient for a number of reasons. Our netting in September will be near the end of the open water season, and new recruits

to the fishery will occur after the big pulse of fishing mortality that occurs in the spring, and before a new winter fishery starts.

7. Fish movement. We know that there is some movement of adult fish throughout the system, but we do not know how much. We will model assumed proportions of fish movement to examine initial impacts on potential changes in the populations in the three sectors of the system. We will simplify this mathematically by assuming that all fish movement occurs after the open water fishery and before the winter fishery. This approximation is at least consistent with what we know about walleye behavior. We know that walleye undergo seasonal movements such as dispersal following spawning, and then pre-staging for spawning that we believe occurs in the fall (e.g. as illustrated with tagging studies in Lake Winnibigoshish). If most of the pre-staging movement occurs after most of the fishing mortality in the open water season and before the winter fishery, then the way we are incorporating inter-sector movement in the forecast should be reasonable, assuming that most of the inter-sector movement is motivated by pre-spawn staging. Future tagging studies may help us relieve some of the uncertainty in this component of the system.
8. We assume that growth, maturity and natural mortality are constant over the three years in the forecasting period. We may run the forecasts with several values for these various rates, as deemed necessary. For example, two rates of natural mortality (M) may be 0.24 and 0.29, as used for other walleye fisheries, namely Mille Lacs. This assumption is conservative if the population will be going from high density to lower density, as we expect with the newly opened fishery, because these rates may increase if they change at all.
9. While we are managing both basins as one system regarding SSB management goals and target harvests, population parameters such as growth and maturity rates differ by basin. Furthermore, fishing is a size selective process, and fishing selectivities will differ between basins because of differences in fishing gear (e.g. angling versus gill nets). We will therefore conduct the forecasts separately for three sectors of the two lakes: Upper East, Upper West, and Lower. Forecast output can be easily combined for comparison with system-wide management goals.

Rather than trying to forecast what the fishery kill will be in the next three years (mainly because it is futile to do so with the current state of our science), we will forecast what the implications will be to the population based on a number of assumed levels of kill. For example, if the 2006 fishery takes 3.5 lbs per acre of fish, what would be the consequences for the next three years if we harvested at several levels, such as 2.5, 3.5 or 4.5 lbs per acre. The committee would have to make decisions based on the most recent data to determine what level of yield to model. Based on what we know about size selectivity, we would apportion the modeled yield across sizes and ages, adjusting for regulations where necessary. Given the mechanics of fishing mortality (F) as presented below, modeling a certain level of yield will mean that we will calibrate the model for a certain value of ($q*f$), or catchability*effort that will result in the desired amount of yield to model. The primary fishery management tool that will be explicitly modeled is changes to size selectivity (the component 's' in the details below), as may arise from changing angling size regulations or the mesh size of gill nets used for harvest. If we assume that bag limits are not size selective (noting some inaccuracy here due to potential for high grading), then there is no need to explicitly address this management regulatory tool in the forecast as this would simply affect the overall calibration value ($q*f$) needed to achieve a certain level of yield. This is because the effect of bag limits will primarily be on the amount of fishing effort (f), with more restrictive bag limits either decreasing the average length of an individual fishing trip, or causing some anglers to go fish a different lake with a more liberal limit.

This system will focus on forecasting changes to spawning stock biomass. Because most fish do not mature until they are 5 years old, we do not have to forecast recruitment, which is a very positive aspect of the exercise because predicting recruitment is even harder than predicting fishery performance. So, if we have an estimate from our gill nets of two year and older fish at the start of the three year forecasting period, then we should be able to forecast changes to spawning stock in the next three years as these young ages die off but at the same time grow and begin to reach sexual maturity. In the third year of the forecast, we may be a bit short on adding new recruits because there will be some young four-year-old fish that should be maturing but we will not have estimates for them. We can adjust for this as needed by adding a minimal amount of four-year-old females recruiting to the spawning stock for the third year of the forecast.

Mechanics for modeling fishery yields

The basic forecast model uses Baranov's catch equation for estimating yield based on estimated population abundance by age (actually size), and an assumed level of natural mortality (M):

$$C_i = u_i \times N_i = \frac{F_i \times A_i \times N_i}{Z_i}, \text{ and}$$

$$Z_i = F_i + M,$$

where C is catch in numbers, u is exploitation rate, N is the number in the population at the start of the fishing season, F is instantaneous fishing mortality rate, A is annual total mortality rate, Z is instantaneous total mortality rate, M is instantaneous natural mortality rate, and the subscript i indexes length for all rates except for M because we assume the rate of natural mortality is the same across all size classes included in the forecast.

Because fishing mortality can be strongly size dependent, and there will be different types of fishing gears deployed in the different sectors of the system (e.g. angling in the State waters and gill nets in the Band waters), we need the following elaboration on fishing mortality:

$$F_{i,j} = q_j \times f_j \times s_{i,j} \times c_{i,j},$$

where q is fishery catchability for fishery j, f is fishing effort for fishery j, s is selectivity for length group i and fishery j, and c is compliance for length group i and fishery j. The value c_i is used for compliance, and also to approximate hooking mortality. Modeling hooking mortality may be modified in future updates to the forecasting procedure.
For calibration we only have to solve for $q*f$ to achieve the particular amount of yield in the fishery. We use *Solver* in *Excel* to determine the values of $q*f$ to achieve the desired amount of yield in each sector of the fishery. This will be done sequentially by year. For example, we start

the forecast by designating an amount of yield in each season (i.e. winter, then summer), and in each fishery (e.g. the State's sport fishery, the Band's gillnet fishery). We then use *Solver* to determine the level of fishing mortality ($q*f$) in each sector, given the type of fishery and the starting numbers of fish and their mean length at age. We determine the selectivity component of mortality by the type of gear being fished (e.g. sport angling, or gill nets of a particular size). Effects of gear selectivity are incorporated in the values for s_i; and sizes of fish to be protected by specific fishery restrictions, such as a protected slot limit in an angling fishery, arise from the product of s_i and c_i. Size will only be modeled using the mean size for a given age group. Further refinements may use a finer breakdown by length for each age group.

Temporal sequence of the forecasting procedure

The following sequence, starting with fall population assessment, indicates how the forecast system will proceed:

1. Conduct fall gill net assessment and determine population estimates by age and sex, size at age and by sex, and maturity rates by size.
2. Use the new input data for the fall assessment, and forecast the winter fishery based on the regulations in place, and desired levels of yield to model in each year and each geographic sector. Note that this will not be done until the age-structured data are available from the gill net assessment, and thus most of the winter fishery will have already taken place. However, we can use our initial estimates of winter yield in the forecast for the first year.
3. Take the population numbers at age resulting after the winter fishery, and run the summer fishery, based on assumed levels of yield to model.
4. After the summer fishery, move fish between basins based on the assumed fish movement matrix (see number seven above).
5. After moving fish, we now have the age structure at the end of the first forecasted year. Summarize critical information, namely SSB and spawner age diversity, and others of interest, such as annual survival and fishing mortality by age. These fish are now aged one year, and become the new age structure at the start of the next fishing year, or the second year to be forecasted.
6. Repeat steps one through five twice to forecast years two and three.

Appendix Table 1.

SSB condition	Harvest Scenarios	State Waters pounds	Band Waters pounds
Surplus	Harvest in any individual year will not exceed the cap of 5 lb/acre.	240,000	1,185,000
	Harvest will be maintained below 3.5 lb/acre on a three-year average.	168,000	829,500
	Harvest of less than 1.75 lb/acre for two consecutive years may trigger relaxing of regulations to allow additional harvest.	84,000	414,750
Optimal	Harvest in any individual year will not exceed the cap of 4.5 lb/acre.	216,000	1,066,500
	Harvest will be maintained below 3.5 lb/acre on a three-year average.	168,000	829,500
	Harvest of less than 1.75 lb/acre for two consecutive years may trigger relaxing of regulations to allow additional harvest.	84,000	414,750
Marginal	Harvest in any individual year will not exceed the cap of 2.5 lb/acre.	120,000	592,500
	Harvest will be maintained below 2 lb/acre on a three-year average.	96,000	474,000
	There will be no opportunity for relaxing regulations while SSB is in the marginal condition.	0	0
Closed	Harvest will be closed.	0	0

Final acreage calculations agreed to by Red Lake Nation DNR and Minnesota DNR GIS specialists, February 27, 2006.
Upper Red Lake- 119,274.43 acres.
Lower Red Lake- 164,989.60 acres.
Total- 284,264.03 acres.
Minnesota portion of Upper Red Lake- 47,725.02 acres.
Red Lake Nation portion of Total- 236,539.01 acres.

Acreage rounded for harvest management purposes.
State of Minnesota- 48,000 acres.
Red Lake Nation- 237,000 acres.

Appendix Figure 1. Harvest year mortality, Upper Red Lake, MN, 1988-2004.

Attachment B

Enforcement Plan

The Red Lake Band of Chippewa Indians (hereinafter, "Band"), the Minnesota Department of Natural Resources (hereinafter, "Minnesota DNR"), and the United States Department of the Interior, Bureau of Indian Affairs (hereinafter, "BIA") are committed to the recovery of the walleye population in the Red Lakes, and to the long term sustainable management of the fisheries resources of these lakes.

One of the components of the Harvest Management Plan for Red Lakes Walleye Stocks (hereinafter, "Harvest Plan") is strict enforcement of all aspects of the Harvest Plan. This Enforcement Plan describes a collaborative effort and cooperative planning by all parties to ensure the continuing success of the Harvest Plan. It is recognized that the Band and the Minnesota DNR shall be the lead agencies in determining and carrying out enforcement efforts relating to the Harvest Plan.

Geographically, the Red Lakes encompass specific areas of the Red Lake Indian Reservation and State of Minnesota (hereinafter, "State"). Because the State has no jurisdiction on the Red Lake Reservation, and because the Band has no jurisdiction on State property, dual or cross jurisdictional enforcement agreements are not feasible, as they would require extensive statutory change at state and tribal levels. For enforcement purposes, jurisdictional boundaries of the Band and State shall at all times be recognized and respected.

This Enforcement Plan represents a working agreement coordinated between the participating governments and agencies, and shall include:

1. Meetings of Band and Minnesota DNR enforcement personnel shall be held as often as needed, but at a minimum of two times each year concurrent with meetings of the Red Lake Fisheries Technical Committee, to plan and discuss enforcement activity reporting, cooperative work projects, intelligence, staffing levels, and jurisdictional issues.

2. Each agency shall develop and maintain a systematic method of tracking the work effort and associated costs for all enforcement efforts related to the Harvest Plan.

3. Band and Minnesota DNR biologists shall notify their respective enforcement agencies of their scheduled assessment activities and locations on the Red Lakes in advance of such activities.

4. The Red Lake Fisheries Technical Committee, through their respective agency fisheries representatives, shall seek input from the respective Band and State enforcement agencies prior to changes in harvest regulations and shall inform Band and State enforcement agencies of changes in harvest regulations.

5. The Band and the State enforcement agencies will continue to dedicate necessary resources to Red Lake to ensure the sustainability of the fishery and compliance with sport fishing and commercial harvest regulations. The Band, State, and BIA shall be called upon to support the enforcement effort with financial resources sufficient to accomplish Harvest Plan goals.