Minutes of the
Lake Superior Technical Committee
Summer 2002 Meeting
July 31-August 1, 2002
Sault Ste. Marie, Michigan

List of Attendees:

Henry Quinlan, UFWFS
Mark Dryer, USFWS
Lee Newman, USFWS
Mike Fodale, USFWS
Glenn Miller, USFWS
Marilee Chase, OMNR
Mike Friday, OMNR
Mike Petzold, OMNR
Bob McNeely, OMNR
Chris Wilson, OMNR
Roger Greil, LSSU
Greg Fischer, RCFD
Tom Fratt, RCFD
Stephen Schram, WDNR
Rick Huber, Bad River
Don Schreiner, MNDNR
Gavin Christie, GLFC
Tom Pratt, DFO
Lisa O'Conner, DFO
Neville Ward, DFO
Lothar Dalhke, DFO
Doug Cuddy, DFO
Bill Mattes, GLIFWC
Shawn Sitar, MiDNR
Stephen Scott, MDNR
Mark Ebener, GLFC/CORA
Tom Hrbik, UMD
Brian Ray, UMD
Mike Hansen, UWSP
Kevin Kapuscinski, UWSP
Brian Linton, UWSP
Owen Gorman, USGS
Seth Moore, USGS
Wendy Stott, USGS
Silvia D'Amelio,
Ron Kinnunen, MI Sea Grant
Ben Whiting, Grand Portage
Scott Koproski, BMIC

Agenda Item 1 – Sea Lamprey Marking Workshop

Mark Ebener lead a workshop on classifying sea lamprey marks on Great Lakes fish. The structure of the workshop was:

1. Trial 1 - classification of sea lamprey marks on 14 fish (lake trout and whitefish)
2. Purpose of the workshop and review of the 1997 and 1998 workshops
3. Review of the King classification system.
4. Estimating sea lamprey-induced mortality
5. Statistical relationships between marking and mortality
6. IBM model of sea lamprey damage to lake trout in northern Lake Huron
7. Group review of marks on 12 fish from Trial 1
8. Trial 2 - classification of sea lamprey marks on 12 fish (lake trout and whitefish)

Three outstanding issues arose during the workshop concerning classifying sea lamprey marks;

1. distinguishing type-A and type-B marks,
2. classifying multiple marks,
3. classifying sliding marks.

Distinguishing Type-A and Type-B Marks

The difference between type-A and type-B marks is the presence of a pit caused by the sea lamprey teeth penetrating the skin of the fish and entering the muscle. Type-A marks have a pit

into the muscle whereas type-B marks do not penetrate the skin. Type-B marks are made when a sea lamprey attaches to a fish and removes the scales, but does not break the skin. Some type-B marks cause the skin of the fish to slough (fall) off and expose the muscle, but there is no pit into the muscle. It is the enzymes released by the sea lamprey that cause the skin to slough off after the sea lamprey detaches. These type-B marks often appear ugly and infected and many people incorrectly call these type-A marks, even though there is no pit into the muscle.

Classifying Multiple Marks and Sliding Marks

Classifying multiple and sliding marks on fish caused considerable confusion among the workshop participants. Ebener et al. (2002) in their SLIS2 paper recommends that:

- multiple type-A marks caused by the same sea lamprey should be recorded as one mark, and the most severe mark should be recorded, and
- for a sliding type-B mark the most recent mark should be recorded.

The reasoning for recording only one mark among a group of multiple marks caused by a single sea lamprey is that recording all the marks would inflate attack rates. Louis King in developing the original classification system recommended that the most recent mark on a sliding type-B mark should be recorded.

Multiple type-A marks caused by the same sea lamprey can be identified by the presence of a slide mark between the type-A pits. In each case, only the most severe of the wounds would be recorded.

Sliding type-B marks that have no pit and that show more than one stage of mark. Only the most recent marks should be recorded.

Agenda Item 2 – Request for Sea Lamprey Marking Data

Mark Ebener outlined his request to LSTC members and participants for biological information he is proposing to use to establish a database on sea lamprey marking of lake trout in the Great Lakes. Mark is looking to create essentially two databases. One database would summarize sea lamprey marking on various size classes of lake in each management unit and year in each Great Lake. The other database would contain the biological information for individual lake trout and include; location, length, weight, sex, age, and sea lamprey marks. The individual length and marking data would be used in a logistic equation developed by Rutter and Bence to estimate asymptotic wounding rates on lake trout. The asymptotic wounding rate is than used to estimate sea lamprey-induced mortality rate in specific areas and times. Mark will be contacting individuals within each agency that are responsible for maintaining databases.

Agenda Item 3 – Stable Isotope Proposal

Mark Ebener distributed a copy of a proposal he and Chris Harvey have submitted to the GLFC Internal Sea Lamprey Research Program for funding in FY2003. The objective of the proposal is to estimate what species are primarily supporting sea lamprey production in Lake Superior and what is the damage to these fish due to sea lamprey predation. Chris and Mark are proposing to use stable isotope ratios of ^{15}N and ^{13}C to estimate diets of sea lamprey in Lake Superior. Objectives of the project are:

1. To validate assumptions about stable isotope dynamics between sea lamprey and host fish through use of controlled experiments,
2. To measure stable isotope ratios of sea lamprey and potential host fishes throughout Lake Superior, and to identify the most likely dietary ontogeny of sea lamprey using a bioenergetics-based stable isotope dynamic model, and
3. To develop an IBM of sea lamprey feeding in Lake Superior that will estimate host mortality, and can thus be applied to revisions of economic injury levels.

Field collections will involve capture of sea lampreys and host species from throughout in Lake Superior. A $10 reward will be paid for the capture of parasitic sea lampreys in order to ensure collection of enough animals. Mark indicated that if the project is funded, he will also be contacting each agency to help in collecting fish for the analysis during 2003.

Agenda Item 4 - Splake

Lee Newman gave a presentation on the potential effects of stocking splake on other fish populations around North American and in Lake Superior. Splake are a sometimes fertile hybrid produced by fertilizing lake trout eggs with brook trout milt that were first produced in 1870s. Splake were stocked extensively in Lake Huron in the 1970s by Ontario as a fast growing and early maturing replacement for lake trout, but the splake program was abandoned in the 1980s by Ontario. Splake are currently stocked in Wisconsin and Michigan waters of Lake Superior. The issues, in Lee's opinion, with splake in Lake Superior are; (1) genetic because of the potential to interbreed with lake trout and brook trout, predation effects, and competition for food with native fish. GLIFWC, MnDNR, OMNR all do not stock splake and have a policy in place not to do so. In summary, Lee stated that:

- there are divergent policies among L. Superior agencies regarding stocking of splake
- splake exhibit inter-jurisdictional habitat use patterns
- published studies indicate a least a possibility that splake could have a major genetic, predatory, or competitive impact on native lake trout and brook trout.

Lee and USFWS are asking the LSTC to discuss the issue and put forth some recommendations that range from doing nothing, developing a policy for Lake Superior, or initiating an unbiased peer review of impacts and policies.

Currently, fish community objectives do nothing more than mention splake as part of the fish community. Issues of concern expressed by the LSTC included:

- potential genetic effects if splake are actually spawning with lake trout or brook trout
- the fact that we know very little about the interactions
- there does not appear to be any effects of splake in Lake Superior based on the amount of lake trout natural reproduction and reproduction of other species,
- this an ecological issue not a genetic issue because splake are basically infertile
- this a similar situation as the issue of salmon stocking was to the LSTC years ago

The primary question is whether this really an issue for the Lake Superior fish community that the LSTC wants to consider. When this question was posed to the LSTC the overwhelming response was no! What the LSTC decided to do was discuss this issue in terms of research priorities of the LSTC.

There is currently ongoing genetic research to "type" fish species in Lake Superior including brook trout and lake trout.

Agenda Item 5 – Brook Trout Workshop

Don Schreiner informed the LSTC that the GLFC has provided money from the Coordination Act Program to several members of the LSTC and LSC for a workshop on brook trout research and assessment priorities in the Great Lakes. The reason the workshop was proposed is because there are many people working on brook trout in Lake Superior, some on parallel tracks, but there has been little communication among the various researchers and managers. GLFC provided $10,000 U.S. funds for the workshop, as well, other agencies are also providing money for the workshop; OMNR providing $10,000, Minnesota Sea Grant $10-15,000, Trout Unlimited $20-25,000.

There will be three phases to the workshop. Phase 1 will be a workshop to synthesize the present information on brook trout throughout North America and the Great Lakes with a limited number of experts similar to the CLAR conference. The Phase 1 workshop will take place in late fall of 2002 or early winter of 2003 and will be structured around theme areas such as behavior, genetics, habitat-stream and lake, community interactions, and status/management. In Phase 2 a large meeting will held with all interested agencies and staff to share information from the synthesis of Phase 1. In Phase 2 they hope to produce a "Restore" type publication on brook trout. The Phase 2 workshop may be a symposium at the national AFS meeting in Madison in late summer 2004. Phase 3 will involve a Sea Grant extension outreach project to produce user friendly information from Phase 1 and 2 for agency and public use.

At this time Don is asking for input from the LSTC and its participants. Individuals with interest in the workshop should provide Don with names of brook trout experts if they know of any.

Agenda Item 6 – Brook Trout Genetics in Lake Superior

Silvia D'Amelio gave a presentation on genetics of brook trout from Nipigon Bay in Lake Superior. Silvia's research questions were:

- What are coaster brook trout?
- How do coasters relate to river populations?
- How are coasters related to each other?
- What is the relatedness of river populations to each other?

She used genetic marker that could identify individual fish. Her results were that:

- There is not one big population of brook trout in the bay, but rather several populations.
- Fish above rivers were genetically distinct from below barrier populations, but above and below barrier populations in the same river were genetically similar.
- Fish from below barriers on three different rivers were genetically very similar to each other, but distinct from the fourth tributary.

Basic conclusions:

- Coasters are not a genetically distinct strain, but similar to tributary fish.
- Coasters are vectors of gene flow among rivers,

- Not all rivers produce coasters,
- Not all brook trout populations produce coasters,
- There was more than one metapopulation----→some coasters collected from this study were not assigned to rivers in this study, but rather other tributaries.

Implications:
- Coasters come from river populations
- There is an interdependence of lake and river populations
- Making a coaster brood stock won't guarantee success. Need to know what produces a coaster.

Future direction:
1. Lake-wide study to evaluate metapopulation structure and stock assessment
2. Nipigon River maybe important a coaster source
3. Habitat Study to identify trigger for producing coaster
4. Lake Nipigon
5. Stock structure
6. Effective population
7. Hatchery brood stock

Agenda Item 7 – Genetics of brook trout from Isle Royale

Wendylee Stott from the USGS Great Lakes Science Center gave a presentation describing the genetics of brook trout from Lake Superior including Isle Royale. This project is part of a larger project to evaluate brook trout genetics in National Parks across North America.

Goals of her project are to:
- Develop a set of informative genetic markers for brook trout
- Provide information about relationships among populations found throughout the species range.
- Document the levels of gene flow which occur naturally
- Provide information about the effects of stocking on wild brook trout populations

Wendy reported that she is working with genetic samples from over 30 sample sites.
She is using two genetic marker systems; mitochondrial DNA and microsatellite DNA for analysis. Mitochondrial DNA is used to detect large-scale and historical relationships, whereas microsatellite analysis is used to detect small scale patterns.

Mitochondrial DNA analysis:
Found 14-15 different kind of mitochondrial DNA, 12 of which were located in Lake Superior. 86% of the samples fell into three genetic lines, but 76% were in one line. Wendy found that:

- most of the genetic variation occurred within populations,
- there was no obvious patterns of relatedness,
  - above barrier populations grouped together and below barrier populations grouped together
- there was no obvious effect of stocking,

- coaster brook trout were not distinguishable by either frequency or by unique clone from brook trout.

Microsatellite DNA analysis:
She found that variation on Isle Royale was similar to other populations in North America and that the Isle Royale populations showed genetic relatedness of rivers in proximity to each other. Wendy did report that there are population genetic differences between Isle Royale and rest of Lake Superior populations.

Wendy's next step is to:
1. Complete genetic analysis of the remaining Lake Superior populations (increase sample sizes, evaluate status of coasters),
2. Calibrate databases among labs (loci, allele sizes), and
3. Itegrate ISRO genetic data with habitat study.

Agenda Item 8 – Isle Royale Management Plan
Henry Quinlan described results of the meetings and future direction that the Isle Royale National Park is taking to develop a fishery management plan for the waters within and adjacent to the island. Ten agencies represented by 25 individuals attended the first meeting in April 2002. Most of the plan is orientated to the inland waters, whereas for the waters of Lake Superior the approach will be to just coordinate more with other agencies. At the first meeting agencies provided an overview of their interest and jurisdiction in relation to the plan. The group is asking for some involvement from OMNR and Minnesota DNR in the process. There will be public open houses in Houghton and Duluth soon to get input on the contents of the plan.

Agenda Item 9 - Chequamegon Bay Bioenergetics Study
Mike Hansen from UW-SP gave a presentation summarizing Jeni Devine's MS Thesis to understand the food web of Chequamegon Bay fishery in Wisconsin waters of Lake Superior. The bay contains both a cool and cold-water fishery along with several tributaries. Objectives of the study are to: quantify the fish community effects of predators in the Bay using the bioenergetics model to estimate annual consumption by cool- and cold-water predators and to evaluate the effects of current fishery management actions on the food web dynamics. Cool-water predators are smallmouth bass, walleye, and northern pike, while cold-water predators are lake whitefish, splake, lake trout, brown trout, and burbot.
Fish were collected with gill nets, fyke nets, trap nets, seines, and angling during 1998-2001. Data loggers were used to measure temperature at 16 and 30 depths and temperature profiles were obtained every meter at two other sites that were 4 m and 18 m deep. Length-weight relationships were estimated for all species and growth in length and weight was estimated using a von Bertalanffy model. Total mortality was estimated from catch curves and natural mortality was estimated from Pauly's equation. Abundance of cool-water predators was estimated from mark-recapture data, whereas cold-water predator abundance was estimated from the ratio of catches of stock lake trout in gill net samples. Abundance at age estimated from exponential equation. Prey biomass was estimated area swept estimates made by USGS trawl data, while annual prey production estimated from P:B ratio.

Diet results:
- whitefish - ate lots of smelt particularly after age 5
- brown trout - eating primarily smelt

- lake trout - primarily eating smelt but switch to coregonines after age 7
- splake - eat primarily smelt, but do eat yellow perch and other fish
- burbot - eat smelt and also other fish
- smallmouth bass - eat primarily other fish, some invertebratess, some crayfish, and yellow perch
- walleye - primarily eat smelt at all ages, also some yellow perch
- northern pike - eat other fish at younger ages, then switch to smelt, but do eat yellow perch

In summary, rainbow smelt were the most predominate prey of many predators in Chequamegon Bay including walleye, splake, whitefish, and lake trout. Yellow perch were never a predominate prey of any predator, but they were eaten by some age classes of walleye, northern pike, and smallmouth bass.

Consumption results:

- Whitefish had the highest per capitia consumption and consume five times more prey than other species because of their longevity , but the exhibit a low gross conversion efficiency.
- Walleye are the predominate predator in the Bay, because they are so abundant, and consumed about 11 million pounds of fish annually and account for 84% of the estimated total consumption.
- Cool-water predators consumed 90% (11.1 million pounds) of total consumption.
- Peak consumption was at age 1 for all species except whitefish and burbot.
- Walleye were the primary predator of salmonines consuming about 700,000 lb. eating many newly stocked salmonines.
- Yellow perch are primarily eaten by walleye, followed by northern pike and splake, but the total consumption yellow perch was estimated to be about 417,000 lb. or 30% of the available yellow perch biomass.
- Predator demand did not exceed prey biomass estimates in Chequamegon Bay.

Management Actions: Jeni also evaluated the effect on consumption of several management actions such as reduced stocking or changing size limits. She found that:

- Eliminating stocking of all species and implementing a 20 inch minimum size limit on walleyes and enacting a 18 inch minimum length limit on smallmouth bass would reduce total consumption by only 10% or 1.2 million pounds.
- Consumption by walleyes did not change under any of the proposed management actions (changes in size limits, stocking).
- There was no affect on SMB consumption that could be achieved by lowering the size limit to 17-19 inches because most of the consumption occurred at young ages.
- Eliminating stocking of brown and splake virtually eliminated their consumption because both populations are sustained through stocking.
- The stocking sites for brown trout and splake should be moved to reduce predation by walleyes.

Agenda Item 10 - Catch at Age Analysis of Lake Trout

Brian Linton from UW-SP summarized his MS Thesis to develop a statistical catch at age model for lake trout in WI-2 of Lake Superior. The goal of the project was to develop a model of lake trout populations in Wisconsin waters that could be used to (1) set short term fishery harvest limits, and to evaluate long-term fishery management strategies.

Brian developed separate SCAA models for wild and hatchery fish using AD Model Builder and fit the model with maximum likelihood methods. Inputs to the model included:

- harvest, age composition, and effort for the recreational and commercial fisheries,
- age composition and CPUE from the large-mesh and graded-mesh gill net surveys
- the model included only the non-refuge area of WI-2,
- used ages 4-15+ in the model,
- time series ran from 1980-2001
- used the same L-infinity, k-value, and water temperature values for both wild and hatchery lake trout in Pauly's equation for estimating M

Brian used the population scaling method to estimate abundance of wild lake trout, whereas he used the number of yearling equivalents and post-stocking survival to estimate abundance of hatchery lake trout.

Results:

- The commerical harvest of wild lake trout has been declining while the sport harvest has been increasing from 1980-2001
- Wild fish abundance increased from about 800,000 fish in 1980 to about 2.2 million fish in 2001.
- Hatchery fish abundance declined from about 750,000 fish in 1980 to 300,000 fish in 2001.
- Estimated recruitment of wild fish was constant at about 400,000 age 4 fish annually, but was also highly variable ranging from 250,000 to 800,000 during 1980-2001.
- Estimated similar selectivity curves for spring survey data and commercial fishery data.
- Recreational fishery selectivity was estimated to be similar to commercial and spring survey selectivity because survey age composition data was used to generate recreational fishery age composition.
- Wild lake trout average annual mortality declined through time, as did sea lamprey mortality..
- Total mortality (Z) less than 0.4 in most years after 1988.
- Trends in total mortality of wild lake trout directly related to sea lamprey mortality; as sea lamprey mortality changed, so did wild fish total mortality
- Estimated that selectivity to hatchery fish by most gears was substantially different than for wild fish.
- Total mortality substantially greater for hatchery than for wild fish.
- Stocked lake trout abundance most influenced by commercial fishery, while wild fish abundance most influenced by sea lamprey mortality

Recommendations**:**

- Collect age data from angler creel surveys
- Build stock-recruitment models for projections
- Build long-term probabilistic simulation projections instead of deterministic projections in spreadsheets

Agenda Item 11 - Movement of lake trout in Lake Superior

Kevin Kapuscinski from UW-SP summarized his MS Thesis to estimate movement matrices for lake trout between management units in Lake Superior. Objectives of the study were to; (1)

determine rates at which lake trout move across jurisdictional boundaries, and (2) determine if total length, origin, gender, time at large, and age were related to distance moved.

Kevin's methods involve looking at tagging of roughly 46,400 fish by seven different agencies from throughout U.S. waters of Lake Superior during spring, summer, and fall assessments in 21 different years. Recapture methods included assessment, commercial, and recreational fisheries. During analysis Kevin standardized recaptures by effort and calculated movement rates. Distance and direction moved by lake trout was determined with vector-based GIS. In the vector-based GIS analysis Kevin calculated the distance from the center of the tagging grid to the center of the recapture grid for each fish. A general linear model and ANCOVA were used to quantify the relationship between total length, origin, time at large, and age and the distance moved.

Summary results:

- There were 2,763 useful recaptures from all methods. Many recaptures could not be used because grid of recapture was unknown.
- 5.5% of the tagged fish were recaptured
- On average, lake trout travel less than 33 miles while at large
- Lake trout tagged in MI-4 tended to have the smallest average movement

WI-1 - average distance moved was about 36 miles
- the distance moved did not differ with length, age, or time at large

WI-2 - average distance moved was 28 miles
- there was considerable movement to WI-1 and other units from WI-2
- the distance moved did not differ with length, age, or time at large

MI-2 - average distance moved was about 36 miles
- the vast majority of lake trout tagged in the unit stayed in MI-2
- many fish moved into MI-2 from other units
- the distance moved did not differ with length, age, or time at large

MI-3 - average distance moved was 36 miles
- many fish moved into MI-3 from other places
- the distance moved did not differ with time at large

MI-4 - average distance moved was only about 20 miles
- fish do not appear to move as far as fish from other U.S. management units
- many fish moved to MI-5
- the distance moved did not differ with length or time

MI-5 - average distance moved was about 36 miles
- many fished moved to MI-2
- the distance moved differed significantly with time.

Conclusions:

Lake trout move across jurisdictional boundaries at substantial rates for all management units and distance moved differed significantly with time at liberty for lake trout tagged in MI-5.
Movement ratess of lake trout between management units can now be accounted for in catch-at-age models.
Movements of lake trout tagged in WI-1, WI-2, MI-2, MI-3, and MI-4 are undirected.

Recommendations:

Work on getting more info out of recaptures instead of tagging more fish. Kevin could not use many of the recaptured because there was little to no recapture information available for these fish

Agenda Item 12 - Fish Diet Project

Brian Ray from UMD updated the LSTC on the USFWS Restoration Act funded study to analyze diet information from salmonines collected from Lake Superior since the Conner et al. (1993) paper that included data only through 1987. Since that time the forage base has shifted as smelt abundance has declined and coregonines have increased, there appears to be likely an increase predator demand on forage fish, and prey size distribution has likely changed since Conner et al.

The basic hypothesis being tested in this study is that we expect lake trout and other predators to show preference for rainbow smelt over native coregonids. Alternative hypotheses may be that:

- Salmonid predators may feed on prey as they occur in the environment
- Salmonids may show selection for coregonids
- Prey size may be the overriding factor for determining predator diet.

Objectives of the study are to:

1. Test for differences in prey communities among management units to identify appropriate resolution for analysis of predator selectivity.
2. Test for species and size selectivity of each predator species with in each area.
3. Determine diet overlap among predatory salmonids.
4. Establish an up to date diet data set incorporating appropriate spatial scales.

Methods for the study will involve combining data collected by tribal, state, and federal agencies around Lake Superior with an established diet data set to be stored at GLSC. He will then perform quality control checks on the data, and lastly link diet data to the forage fish data complied by the GLSC.

Analysis of the data will involve using NMDS-ordination to assess forage fish spatial heterogeneity by identifying spatial patterns in community structure of forage fish species in each year for which adequate data exist for the Lake Superior food web. The diet information will be analyzed by regression analysis with agency of collection, method of collection, and units of measure. Percent overlap (e.g. Schoener 1970) will be used to assess diet overlap among predatory salmonids, and Chesson's index (1983) of selection will be used to test for species and size specific prey selection by salmonid predators.

The minimum data requirements include predator diets that contain units of mass or length of prey by prey class for seasons other than spring, location of each fish collection site (GIS coordinates), gear used to collect the fish, date of collection, and methodological or other caveats that may influence results

Action Item: All agencies should provide Brian with their data as soon as possible in any format they want. Brian will format the data to fit his need. Brian will send the minimum requirements for the data to Ebener, and Ebener will provide that list to everyone.

Agenda Item 13 - Identification of Lake Trout

Mike Petzold distributed a CD-ROM that illustrates the various forms of lake trout caught during Ontario spring lake trout surveys and asked various agency staff to classify fish as leans or non-leans. Mike presented some initial results from that analysis that included only CORA and OMNR staff.

Mike Petzold reported that the agency staff, CORA and to a lessor extent OMNR reported many hatchery leans as non-leans (70% CORA and 40% OMNR). Stephen Schram and Shawn Sitar also provided picture in a slide presentation of what they called leans and siscowets.

Action Item: Other agencies should contact Mike Petzold to obtain copies of his CD and send the review back to Mike. In addition, each agency should try to reproduce Mike Petzold's CD and distribute it to other agencies.

Agenda Item 14 - LSTC Outstanding Issues and Research Priorities

The LSTC has several outstanding high priorities research projects that remain incomplete or that have not yet begun. The projects involve application of acoustic sampling to Lake Superior and mapping of important fish habitat.

For both GLFC Fishery Research Program and USFWS Restoration Act have changed their time lines for submitting proposals. Pre-proposals are due December 15, requests for full proposals will be made by mid February and full proposals due May 30. Decisions on funding will be made in December, but researchers should know in advance if their proposal was funded. The LSTC will know have identify important project for funding during the summer meeting instead of the winter meeting as has been done in the past.

Ebener indicated that the basic tasks of the LSTC revolve around the following charges to;

- monitor the status of fish populations,
- evaluate our ability to achieve fish community objectives,
- suggest and promote research,
- develop rehabilitation plans for depleted native species such as lake trout, brook trout, walleye, and lake sturgeon, and to
- recommend broad management strategies.

The LSTC agreed that try and keep these charges in mind when developing a prioritized list of research questions and developing research ideas.

The technical committee identified several broad categories of research that are important for meeting our charges and these include:

1. Sustainability of Lake Trout Populations,
2. Food Web Dynamics,
3. Restoration of Depleted Native Species,
4. Lower Trophic Level Monitoring, and
5. Effects of Introduced Species.

Basic research questions were developed by the LSTC under each of these broad topics, and then the LSTC classified each of the research questions as high, moderate, or low priority for funding. The LSTC also decided to develop a list of the top five high priority research questions for Lake Superior that would be recommended to the Lake Superior Committee. Research proposals targeted at the lake could then be developed that would attempt to answer these questions. The LSTC also agreed that once the high priority research questions have been addressed by specific proposal(s), the moderate and low priority research questions would then rise in level of importance. The broad research topics and associated research questions are listed below along with the priority assigned to them by the LSTC.

Sustainability of Lake Trout Population

1) What are the sustainable levels of whitefish, herring and lake trout harvest that can be obtained from Lake Superior? **high priority**
2) Have we reached full lake trout rehabilitation in Lake Superior? **low priority**
3) What are useful biological references for whitefish, herring, and lake trout in Lake Superior (i.e. mortality, exploitation, and abundance). **moderate priority**

Food Web Dynamics,

4) What is the present lake-wide biomass of prey fishes in Lake Superior? **high priority**
5) What is the minimum level of acoustics and trawl sampling necessary for accurate and precise estimates of forage abundance (linked to no. 4)? **moderate priority**
6) Is the present biomass of prey species in Lake Superior abundant enough to support the present and potential biomass of predators (need to know no. 4)? **low priority**
7) What is the ecology of the deepwater fish community in Lake Superior? **moderate priority**
8) What are the species-habitat relationships for the fish community addressed in FCOs (part of 9)?
9) What is the linkage between habitat supply and fish production that can be obtained through describing the distribution and quantity of that habitat? **high priority**

Restoration of Depleted Native Species

10) What is distribution and abundance of populations of lake sturgeon, walleye, and brook trout? **high priority**
11) What are the remaining genetic resources for brook trout and sturgeon that can be used for rehabilitation? **low priority**
12) What is the quantity of habitat for lake sturgeon, walleye, and brook trout in the Lake Superior basin? **low priority**
13) Do we want brook trout along the coast or coaster brook trout? Quote to remember! **not prioritized**
14) Is stocking an appropriate management tool to rehabilitate brook trout, walleye, and lake sturgeon in Lake Superior, if so, what are the appropriate strains? **low priority**
15) What is the basic ecology of brook trout and sturgeon? **low priority**

Lower Trophic Level Monitoring

research questions not formed

Effects of Introduced Species

16) What is the impact of splake on native fish species? **low priority**

17) What are the most effective means of minimizing sea lamprey damage to fish in Lake Superior? **high priority**

The five high priority research questions for Lake Superior are:

1. What are the sustainable levels of whitefish, herring and lake trout harvest that can be obtained from Lake Superior?
2. What is the present lake-wide biomass of prey fishes in Lake Superior?
3. What is the linkage between habitat supply and fish production that can be obtained through describing the distribution and quantity of that habitat?
4. What is distribution and abundance of populations of lake sturgeon, walleye, and brook trout?
5. What are the most effective means of minimizing sea lamprey damage to fish in Lake Superior?

Agenda Item 15 – Protocols for Spring Lake Trout Survey

Ken Cullis has asked that the LSTC discuss the protocols for the spring lake trout surveys to make sure that everyone is reporting the data the same way. Mike Petzold outlined some of the issues related to the protocols for expressing CPUE in the spring lean lake trout survey. These issues were:

1. Whether to include lake trout <17 inches in the CPUE estimates. OMNR catches are typically 40% less than 17 inches.
Answer: The LSTC agreed that agencies should include lake trout <17 inches long in CPUE calculations.

2. Whether or not to include catches of non-leans in the gill net saturation estimates.
Answer: The LSTC agreed this is an issue because the saturation curves developed by Hansen et al. was only for lean lake trout, but we recognize that large catches of siscowets could affect the saturation parameters.

Shawn Sitar will go back and review the catches used to compute the saturation estimates and evaluate the catches of other species and how this effects the estimates.

The LSTC recommends that agencies standardize CPUE by net night, then apportion out lake trout forms other than leans out of the CPUE values.

3. Agencies are free to go to one or two night sets because CPUE is expressed as one night sets.

Agenda Item 16 – LSTC Updates

Brief updates concerning spring lake trout surveys, lake sturgeon research, and other relevant (i.e. Thermal/depth study archival study) were provided by LSTC members and participants.

Ongoing studies by each agency are listed below.

OMNR
1. Completed lake trout surveys at Marathon and Pukasawa
2. Conducting sturgeon survey in Goulais River
3. Ground water intrusion studies using aerial surveys to evaluate brook trout habitat

4. FLIN netting in Black Bay for walleye
5. Electrofishing for walleye in Nipigon River
6. Developing water management strategies for several rivers (Nipigon)
7. Conducting telemetry studies with sturgeon on the Kamistiaquia River
8. Index netting on Black River for sturgeon and dip netting at the same time
9. Contaminant study being expanded for new consumption advisories

Mike Petzold briefly described the work he has done cooperatively with USGS to assess abundance and harvest potential of chubs in Ontario waters of Lake Superior. Mike used commercial gill nets to assess status of the populations as well as USGS bottom trawl surveys to assess abundance. Mike found that the current quota generally fell slightly within the 95% confidence limit of potential yield, but below the average potential yield based on multiplying biomass from bottom trawls times natural mortality divided by 2.

USFWS

1. Describe lake sturgeon population genetic structure within Great Lakes basin
2. Spawning lake sturgeon surveys in Bad and White Rivers
3. Lake sturgeon assessment assistance from commercial fisher's
4. Habitat mapping project Bad River
5. Brook trout surveys at Isle Royale
6. Surveillance of ruffe along south shore
7. Lake whitefish surveys in 1836 ceded waters

DFO GLIFAS

1. Assisting USFWS with sturgeon survey on Pic River, maybe three or four rivers next year

Minnesota

1. Completed spring survey, CPUE down slightly, more smaller fish, slightly less sea lamprey marking, proportion wild in survey increasing substantially. Continue to see many stocked lake trout in the diet of adults caught in spring survey
2. Working on getting lake trout catch-at-age model developed in Minnesota
3. Also trying to get SCAA models for lake herring
4. In the process of revising steelhead plan that was completed ten years ago
5. Conducting quite a few studies on brook trout. They have obtained money to conduct ground water intrusion study along entire Minnesota shore line.
6. Conducting brook trout spawning assessments in tributaries so there is possibility to collect tissues for genetics samples

Wisconsin

1. Went to one day sets for spring lake trout survey in 2002, abundance increased, diet analyzed
2. Starting *Diporeia* sampling as pilot study including processing the samples
3. Finishing burbot study to determine long term trends in abundance, appear to be declining
4. Many fish of the 1998 year class of lake herring
5. Finishing brook trout plan for Wisconsin waters
6. Starting to get quite a few sturgeon tag returns now
7. Ceased stocking lake sturgeon in St. Louis River, seeing adult in rapids in St. Louis river

Michigan

1. Spring surveys were conducted using 3-night sets
2. Survey at Big Reef in MI-6 this year and found high abundance of large fish, modal size was 650-699 mm long
3. Substantial amount of sea lamprey marking
4. Lean lake trout abundance in MI-3 increasing, whereas other units declining or stable
5. Sea lamprey marking in 2002 substantial in MI-4, MI-5, MI-6, and MI-7, not MI-3

USGS

1. Provided copy of spring surveys summary as well as annual report for Ashland office
2. Will make presentation at winter meeting that summarizes 24 year analysis of USGS trawl surveys in Lake Superior
3. Conducted deepwater trawl assessments in Ontario waters. Sampled 27 stations. Depth exceeding 240 m or 800 ft. Abundance of siscowets declined at increasing depth over 150 m. Abundance of deepwater sculpins greater in deepest parts where siscowet are much less abundant. Deepwater sculpins very large in these areas. In other areas sculpins were much less abundant and smaller.
4. Continuing ruffe surveys in St. Louis River
5. Conducted surveys in Chequamegon Bay to look at recovery of Hexagenia in the Great Lakes
6. Plan study to evaluate habitat for brook trout on Isle Royale for development of habitat model for coaster brook trout.
7. Hydroacoustics project to be completed in September

GLIFWC

1. Collecting additional samples of lake trout for contaminant monitoring.
2. Testing whitefish for dioxin
3. Bill Mattes provided the LSTC with a reviewed of the archival depth and bathymetric study of lake trout he is conducting.
    - project funded by USFWS Restoration Act
    - objectives are to capture and tag lake trout with Lotek archival tags over the next two years and to provide data to researchers for use in modeling lake trout and sea lamprey populations.
    - three recaptures thus far
    - fish are making huge vertical migrations from 20 ft down to 280 ft and back
    - fish spending considerable amount of time in waters less than 39^{o}F, down to 32^{o}F
4. Received grant to conduct lake trout catch-at-age modeling in MI-2, and considering applying SCAA analysis on siscowets in MI-3 and MI-4

Sea Lamprey Control

1. Conducting radio telemetry study with lampreys in St. Marys River
2. Conducting larval surveys in St. Marys River as a leadup to a potential treatment
3. Red Cliff Band denied the control agencts the use of Bayer to survey offshore (lentic) population of larval sea lampreys. As well National Park Service has asked control program to only conduct Bayer surveys every five years to avoid mollusk incidental mortality
4. SLIL2 publication to come out in 2003 with a 2002 publication date.
5. OMNR is seeing substantial increase in sea lamprey marking on fish in the Thunder, Black, and Nipigon Bays probably as a result established lentic populations in these areas
6. conducting study to determine efficiency of granular Bayer as a quantitative survey tool

Agenda Item 17 – DFO Habitat Management in Lake Superior Basin

Neville Ward of the DFO Fish Habitat Management Branch provided the LSTC with an update describing DFO's increased presence in Ontario and the Lake Superior basin**.** The link to the DFO habitat website is located at**:** http://www.dfo-mpo.gc.ca/regions/central/habitat**.**

The DFO Habitat Branch in Ontario is part of the DFO Central and Artic Regions with headquarters in Burlington, Ontario and district offices in Burlington, Parry Sound, Peterborough, Prescott, Sarnia, Sault Ste. Marie, Sudbury, and Thunder Bay/Kenora. Their mandate is to implement a fish habitat program in Ontario and throughout Canda, focusing on habitat provisions of the Fisheries Act in cooperation with other provinces and regulatory partners. The priorities are to strengthen existing relationships, (e.g. technical committees), develop key partnerships, and build capacity for DFO and partners through training and guideline development.

Policy for the Management of Fish Habitat (1986) guides DFO in the administration of the habitat protection provisions found within the federal *Fisheries Act*. The objective is to achieve a net gain of habitat for Canada's fisheries resources. The goals are conservation, restoration, and development of habitat. The *Fisheries Act* applies to all fishing zones, territorial seas, and inland waters and is binding on federal, provincial, and territorial governments. The *Fisheries Act* defines fish habitat as "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

DFO's Great Lakes habitat interests include:

- management and technical input
- monitoring
- mapping/classification systems
- information sharing
- integrated resources planning – forestry, fish and water management plans
- enforcement
- fish habitat – fish community connections

The Great Lakes Habitat section is particularly interested in playing a regular role in and assisting lake technical committees, and determining how the technical committees can help DFO in their duties. An example would be the issue of fish passage on Lake Superior tributaries. DFO is particularly interested in protecting important fish spawning, nursery, and feeding areas like in the Black River. DFO is also concerned about the effects of perched culverts that block fish passage, and increased velocities through culverts that exceed fish swimming speeds. Some initial strategies for Lake Superior include public information and education, habitat improvement, and research on brook trout passage through culverts.

Agenda Item 18 – Status of Montreal River Stream Flow

Mike Petzold updated the LSTC on issues related to stream flow on the Montreal River in eastern Ontario. The river is listed in FCO's as a place for concern regarding stream flows and lake trout rehabilitation. District biologist is looking for support to show importance of river to lake trout

rehabilitation in his dealings with Great Lakes Power. Ebener write letter to biologist regarding importance of Montreal River to lake trout rehabilitation.

Agenda Item 19 – Written State of Lake Report

It is now time to turn the oral state of lake presentations into a written report. Since Ebener will be the editor of the state of lake report he lead a discussion on format and content of the written report. Mark provide a handout to the LSTC outlining how references are to be written, format for figures, and format for written text. These formats are:

- Times New Roman 12 pt text in 1.5 inch spacing and 1 inch margins,
- all figures in Times New Roman 12 pt,
- all data in spreadsheet format should accompany each figure
- no grid lines on figures.
- label axis as Catch per Unit Effort, Year, Length Interval, etc.
- for multiple bar charts try to avoid shades of gray, but if use shades of gray apply the shades to 3 or less bars so they stand out,
- use CJFAS format for references
- last name first for all authors followed by initials
- bold volume number
- abbreviate journal names and agency names
- keep methods to a minimum; no more than 2 sentences, or just reference published paper
- state FCO up-front in each section if a FCO applies to your section,
- submit list of recommendations with each written section if applicable

Action Item: All authors should provide written sections to Ebener before December 2002, in turn Ebener will provide an example of the structure and sections from the Lake Huron SOL report.

Agenda Item 20 – Aquatic Committee

Henry Quinlan updated the LSTC on activities of the Aquatic Committee of the Lake Superior Work Group. Henry Quinlan and Sue Greenwood are the new co-chairs of the Aquatic Committee. There are three broad areas of activity for the AC from now until the release of LaMP 2002 and these are;

1. to track committed projects and complete annual progress reports,
2. search for funding implement projects identified in LaMP 2000, and
3. develop an integrated ecosystem chapter jointly with the Habitat and Terrestrial Wildlife Committees for LaMP 2004.

Henry also provided the LSTC with the work plan for the AC during 2002-2004.

Agenda Item 21 – Standardized Whitefish Surveys

Ebener described the standardized whitefish survey developed for the 1836 ceded waters of the Great Lakes and implemented by the modeling subcommittee of the TFC. Objectives of the study in order of importance are to:

1. develop fishery independent estimates of age-structured abundance,

2. develop estimates of recruitment prior to entrance to the fishery,
3. define growth, maturity, and condition indices,
4. estimate sea lamprey-induced mortality
5. collect information on diet, and
6. collect information on general health/disease status

The protocol has the following structure:

- conducted between May and end of August
- uses nylon multifilament gill nets of 2 to 6 inch stretched mesh in ½-inch increments and hung on the ½ basis
- gangs should be 2,700 ft.
- there is two depth strata; < 100 ft. and >100 ft.
- sets are one night in duration
- should sample from at least two port in each management unit
- two sample locations will surveyed at each port

Agenda Item 22 – Statistical Catch at Age Analysis of Whitefish

Mark Ebener summarize the whitefish catch at age analysis in the 1836 ceded waters of Lake Superior. Mark provided each agency with a CD-ROM copy of the written report that describes the "Summary Status of Lake Trout and Lake Whitefish Populations in the 1836 Treaty-ceded Waters of lakes Superior, Huron, and Michigan in 2000, with recommended yield and effort levels for 2001." Mark also gave a presentation on the methods used to generate catch-at-age estimates of mortality and abundance for whitefish in each management unit within the 1836 ceded waters. Harvest limits for individual management units ranged from 63,000 to 487,000 lb in 2001 and from 52,000 to 642,000 lb in 2002.

Agenda Item 23 – Lake Herring – where to from here?

The LSTC has an ongoing charge to itself to update the 1973 lake herring report. How will we go about that task?

Action Item: The LSTC agreed to make this the number one agenda item for our winter 2003 meeting.

Agenda Item 24 – Topic for Winter 2003 Meeting

The LSTC briefly discussed the agenda items for our winter 2003 meeting. Potential topics will include:

- lake herring report
- siscowet surveys
- state of the lake report
- Aquatic Committee report
- Sea lamprey information on ESTR estimates of larval and transformer abundance, parasitic and transformer abundance, movement of transformers
- Fish community overview based on USGS trawl surveys
- GLIFWC stock assessment model development MI-2

Agenda Item 24 – Time and Place of Winter 2003 Meeting

The winter meeting will be in Duluth, Minnesota on January 14-16, 2003. Don Schreiner will make arrangements.