

# Lesser Slave Lake Habitat Mapping Project Summary



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## ***Introduction:***

Lesser Slave Lake, with 241 kilometers of shoreline, is the second largest body of water in Alberta (Bentz and Saxena 1993). This area supports a wide range of user groups including: agriculture, forestry, oil and gas, municipalities, commercial fishing, tourism, and recreation. Human activity throughout any watershed alters riparian areas and nearshore littoral zone habitat (Jennings et al. 1999), ultimately affecting water quality. The issue of cumulative effects has acknowledged importance in the conservation and management of aquatic systems (Panek 1979; Burns 1991), yet only recently have studies addressed the association between incremental shoreline habitat modifications and effects on riparian areas, near-shore habitat, littoral habitat, and aquatic communities (Bryan and Scarnecchia 1992; Beauchamp et al. 1994; Ward et al. 1994; Christensen et al. 1996; Jennings et al. 1999). The Lesser Slave Lake Habitat Mapping Project was created in response to concerns over the current status of the shoreline and the surrounding nearshore land use. The project was a preliminary investigation to identify related riparian projects and to propose methods to address data deficiencies concerning the riparian habitat of Lesser Slave Lake. The main objectives for this project were the following:

### **1. Literature review of riparian studies completed on Lesser Slave Lake**

A literature search was completed for studies related to riparian inventory or developmental impact assessments on Lesser Slave Lake. This summary will include only those studies that are the most relevant to riparian inventories of the Lesser Slave Lake shoreline.

**Collet, T. and T. R. Rhodes. 1995. An investigation of critical shoreline fisheries habitat in Lesser Slave Lake, 1994 and 1995. Prepared for Fisheries Management Division, Alberta Environmental Protection. 40 pp. + app.**

In 1994 and 1995 investigations on the critical shoreline habitat were conducted on Lesser Slave Lake. The intention was to quantify the habitat types to allow for the impacts of development on each type to be tracked over time. These habitat types were directly associated with sportfish species spawning or rearing requirements, providing a basis for protecting and maintaining those habitats viewed as critical. Spawning and rearing data were collected using various fish capture methods. The mapping of the shoreline involved videotaping from a helicopter as well as taking 35mm photographs of shoreline development. Coverage from the videotape was transferred to 1:50,000 shoreline maps. Area measurements were calculated using a planimeter and scaled aerial photos. The mapped shoreline data was digitized from a hard copy map and has been incorporated as a GIS layer.

**Chabaylo, R.M. and S. Knight. 1997. Ecological assessment of the Lesser Slave Lake shoreline. Report prepared for Alberta Environmental Protection, Resource Information Division, Edmonton. 105 pp. + maps.**

In 1997 an ecological assessment was conducted on the Lesser Slave Lake shoreline. The primary areas of focus were the nearshore (*area between the shoreline and the high water mark*) and backshore (*area immediately above the high water mark*) zones (distance of 400m for both zones) in which the terrestrial and aquatic habitats were assessed. The nearshore analysis included all the information collected by the Fisheries Management Division staff in 1994/95 for the fisheries habitat component. The objectives were:

- To provide an overview of existing baseline environmental conditions at Lesser Slave Lake and evaluate the potential environmental impacts associated with recreation facility development around the lakeshore. This assessment also allowed for an evaluation of environmental sensitivity around the shoreline.
- Provide a preliminary evaluation of potential environmental impacts associated with specific types of shoreline development at various locations on the lakeshore. Valued environmental components (VECs) were selected and used as priority points of assessment, and to focus study efforts. These VECs included aquatic and terrestrial components (resources) as well as biological (ecosystem) and socio-economic attributes (campgrounds, marinas etc). They were typically identified on the basis of abundance or status, public concern and values, professional concern, and economic importance.

Specific sites were chosen along both the north and south shore of Lesser Slave Lake for evaluation. The north shore sites included: Shaw Creek, Big Point, Site C, Site D, Site E, and Oilman's Creek. The South shore sites included Joussard West, Joussard East, Faust, Spruce Point Park, Spruce Point North, Auger Bay, and Canyon Creek West. The sensitivity ratings for the shoreline that were evaluated have been digitized into a mapping layer.

**Collet, T. and T. R. Rhodes. 1995. Walleye egg and substrate sampling program for the Buffalo Bay, West Prairie/South Heart River, Grouard Channel and Lesser Slave Lake spawning areas, 1992-93. Prepared for Fisheries Management Division, Alberta Environmental Protection. 48 pp. + app.**

In 1992-93, a walleye egg and substrate-sampling program was conducted for the Buffalo Bay, West Prairie / South Heart River, Grouard Channel and Lesser Slave Lake. The main objectives of the program were to map and assess the exact locations of the walleye spawning grounds, and to document the quality of

the spawning substrates. The substrate quality was categorized with respect to walleye spawning potential (good, marginal, or poor) and mapped accordingly. Although this extensive study concentrated on specific areas of the west basin, it provided baseline knowledge of the habitat (substrate) present within those areas. Future monitoring of the substrates will indicate whether the spawning areas of walleye are being maintained or degraded.

**Ash, G.R., and L.R. Noton. 1979. Lesser Slave Lake Regulation Study – Volume IV Fisheries Impact Assessment Final Report. Report prepared by R.L. & L. Environmental Services Ltd. for Alberta Environment Planning Division.**

A fisheries impact study was conducted in 1979 as part of an environmental impact assessment on the regulation project that was proposed for the lake. Major fisheries habitats within the lake and lower sections of major tributaries were mapped at a scale of 1:50000. Habitat information was obtained from existing reports, through personal communications with researchers working on the lake, and during the helicopter reconnaissance of the lake conducted in July (Ash and Noton 1979). A habitat map was redrawn from preliminary data provided by D. Berry. The littoral communities of the lake were not investigated in this study.



## **2. Propose methods to quantify and qualify riparian health**

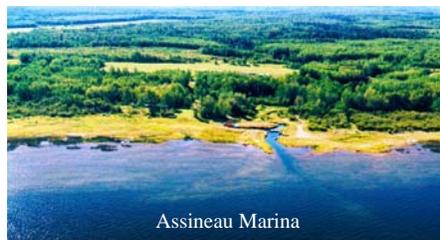
Potential methods were reviewed that could be applied to Lesser Slave Lake to properly define, quantify, and assess the riparian habitat. The methods were graded according to their potential effectiveness to assess the Lesser Slave Lake shoreline.

### **A. Riparian Habitat Assessment Project Alberta Conservation Association Contact: Blake Mills (Northeast Region)**

This project used geo-referenced aerial videography assessment and GIS mapping methods. The project is still at the inception stage and has methodological issues that are being addressed. However, the preliminary results show that this system could be applied for quantifying and assessing the

health of the riparian zone of Lesser Slave Lake. Currently 16 lakes have been videographed in the Northeast region with several more lakes prioritized for the upcoming 2003/04 season.

| Pros:  | Cons:   |
|--|---|
| <ul style="list-style-type: none"> <li>• Conceptually endorsed by different agencies including Cows and Fish, and the Alberta Government (Fisheries Management and Public Lands).</li> <li>• Provides a method to quantify and qualify the riparian health of the shoreline in an efficient and effective fashion.</li> <li>• Methodologies utilize the most recent technologies in aerial videography and GIS mapping technologies.</li> <li>• Data can be updated easily and is provided in a format that can be used and viewed in a contemporary fashion.</li> </ul> | <ul style="list-style-type: none"> <li>• The methodology is new and therefore more testing is needed to ensure an accurate standard of data collection.</li> <li>• Limited access to the technology. Should this becomes a Province-wide initiative, all lakes will have to become prioritized creating a long waiting list and delay in getting the assessment completed.</li> <li>• Costs associated with purchasing the necessary program software/hardware, and associated equipment. The training required for the post – processing of the video to make the riparian assessments will also be costly.</li> <li>• Flight proficiency training, aircraft familiarization, maintenance, system improvements, and safety activities are still on-going.</li> </ul> |



**B. Update the aerial photography of the shoreline**

It was initially planned for this component to collect aerial photographs from around the lakeshore, and to then quantify the land use. However it was discovered that the aerial photos for the lake were not consistent. The majority of the photos for the area were outdated or incomplete with missing negatives. The East basin had the greatest deficiencies, with the most recent photos being from 1999 (some areas were 1992).

| Pros:   | Cons:  |
|---|--|
| <ul style="list-style-type: none"> <li>• Aerial photographs allow for an accurate portrayal of land use/development on the landscape.</li> <li>• Can quantify and compare the corresponding pristine habitat from altered shoreline.</li> <li>• A cost sharing initiative could be realized with several different groups interested in the same information (ie. MD's, different levels and divisions of government, Forestry etc).</li> </ul> | <ul style="list-style-type: none"> <li>• Outdated once the photo is taken.</li> <li>• Photo quality is dependent on several variables including the weather, cloud cover, and season.</li> <li>• High expense to cover such a vast area.</li> <li>• This method would not qualify the health of the riparian\shoreline.</li> </ul> |

An estimated cost assessment to aerial photograph Lesser Slave Lake's shoreline was requested of Tarin Resource in Edmonton. The cost to supply a 1.0 m pixel resolution digital orthophoto covering the shoreline and about 2 miles around using 1999 color photography would be approximately \$11,000. To update the files for 2002/03 photography (re-fly the shoreline) would cost approximately \$33,000.

**C. Cows and Fish Program**

**Contacts: Kelsey Spicer-Rawe (Northern\Central Alberta Regional Co-ordinator and Michael Gerrand (Southern Alberta Co-ordinator)**

This program was conceived in 1992 and has been a success in addressing the issues surrounding riparian health, ecological processes, and land use. The methods employed involve in-depth measurements of riparian health providing detailed, comprehensive data. Riparian health assessment and inventory methods were developed and refined by riparian and plant community ecologists, fish and wildlife specialists, botanists and hydrologists (Cows and Fish brochure). Cows and Fish have created three options available to stratify the project area. This information was taken from a Riparian Health Inventory Proposal sent by Michael Gerrand (Southern Alberta Co-ordinator).

**Comprehensive Sampling – A Watershed Approach:** The most detailed and intensive approach to conducting the riparian health inventories. This method utilizes current aerial photography and landholding information. This option provides the baseline information needed to develop management strategies on a watershed basis as well as provide benchmark information needed to monitor trends in riparian health over time.

**Representative Sampling – An Overall Snapshot:** This option breaks down into either sampling by reach segments or by landholding. Both methods use representative polygons of either a third of a watershed reach, or through selected landholdings within a watershed. This cuts down on the cost and time

associated with sampling an entire watershed, and concentrates on representative sample plots for the area.

**Selective Sampling – A Site Specific Approach:** This method is recommended for very large project areas and/or limited budgets as it limits the inventory work to selected landholdings. It is based more on community groups and landowner involvement in the assessment process. The riparian polygons are selected based on the criteria outlined by each community group. However, unless sufficient landholdings are inventoried, only individual landowner reports will be prepared as compared to a wrap-up community report. This ultimately reduces the overall cost of the program.

| Pros:   | Cons:  |
|---|--|
| <ul style="list-style-type: none"> <li>• Methods are proven and accepted by a wide range of government and non-government agencies.</li> <li>• Program staff has strong academic and field training in riparian ecology.</li> <li>• Assessments can document the cause of any detrimental activity on the shoreline</li> <li>• Community involvement would heighten the awareness and the need for healthy riparian areas.</li> </ul> | <ul style="list-style-type: none"> <li>• The high costs associated with these assessments.</li> <li>• The lengthy turn-around time from getting the assessments completed to when the report would be provided.</li> <li>• Limited to priority areas; the whole shoreline would require too much effort, time and cost. Full assessment for the whole shoreline would take longer than one season.</li> <li>• Community involvement would slow the process; time would be needed for public 'buy-in'.</li> </ul> |

Costs associated with the Cows and Fish Program were estimated by M. Gerrand to be approximately \$600 per 1000m long polygon assessed.

**D. Re-assessing Priority Sites using a Seasonal Crew**

Reports that dealt directly with inventorying the riparian habitat of whole lakes have been conducted on smaller waterbodies (Turtle Lake area = 74.3 km<sup>2</sup>; Last Mountain Lake area = 231.9 km<sup>2</sup>; Vincent Lake area = 54.6 km<sup>2</sup>). These are in comparison to Lesser Slave Lake with an area of 1160 km<sup>2</sup>. The methods used on Turtle and Last Mountain Lake included:

- a. Examining the littoral zone (defined as the 0-2 m deep area) for emergent and submerged vegetation, as well as for bottom substrate at numerous points.
- b. Foreshore (*area between the shoreline and the high water mark*) and backshore (*area immediately above the high water mark*) were surveyed for substrate, vegetation cover, slope, and development features.

A GPS unit was utilized to capture spatial and habitat data for generation of a GIS database. ArcView® was used to display, perform data queries, and print maps.

This type of sampling effort for Lesser Slave Lake can be carried out with two different approaches. One method would be to concentrate on the previous surveys that have identified key areas where sampling gathered site-specific data. Those sites could be re-assessed, providing a data series that could be easily compared. Another approach would be to concentrate on areas where shoreline development/alteration is proposed or actually occurring. Concentrating the riparian assessments on these areas would allow for an accurate measure of riparian habitat and health for those sites. Both approaches would involve narrowing the study area down to priority sites. This way a more intensified sampling effort could be realized with a seasonal crew.

| Pros:   | Cons:   |
|---|---|
| <ul style="list-style-type: none"><li>• Data are collected and analysed 'in-house' utilizing available equipment and resources.</li><li>• Crews would become familiar with the local issues and priority areas.</li><li>• Overall costs for the project would be less than other inventory methods using an outside contractor.</li></ul> | <ul style="list-style-type: none"><li>• Proper riparian health assessment and GIS/GPS training would be necessary for inventory crew.</li><li>• Additional sampling and scheduling of existing GIS equipment would be required and the associated costs.</li><li>• Selection of priority areas would omit large parcels of riparian habitat that would not get sampled.</li><li>• Database available to house and analyze lentic habitat data currently does not exist.</li></ul> |



Common assessment methods for measuring aquatic lentic habitat can be referenced from Bain and Stevenson (1999). Assessing habitat quality, as it pertains to fish production, involves identifying the critical minimum requirements for fish survival.

### 3. Quantifying the Riparian Health of Lesser Slave Lake

Through a joint effort between the SRD Mapping Division (Tricia Hill / Peace River) and ACA, a data set for the lake with approximately 5 km boundary around the shoreline was compiled. It included previously collected and digitized data (Collet and Rhodes 1995, Chabaylo and Knight 1997), a prioritized list of relevant reservations and dispositions, as well as all associated land ownership attributes (M.D., Parks, Native Reserves etc). This ArcView® project with all existing digital data, is stored on the Citrix server and is available to those with access permission (edmgwb6:NWB\workareas\SL\_fishwild\sl\_habitat.apr). Hard copy maps were created depicting the historical shoreline habitat (Collet and Rhodes 1995) and current aerial photos of land use and typical habitat on the Lesser Slave Lake landscape. These maps can be used as visual tools for Fish and Wildlife resource managers as well as for general display purposes.

An attempt was made to collect all aerial photos for the lakeshore, however this effort proved to be more time consuming than productive. Many shoreline photos were outdated or missing from the Aerial Photo Division in Edmonton. Different agencies (Forestry, Public Lands etc) may have access to a different library for these photos, however time restraints for this project required that this initiative be dropped. Although more recent photography was available for the west basin (1999-2000), the time required to geo-reference and digitize the photos was not feasible for the time allotted to the project. The goal of recording the current status of land use for the riparian zone could not be realized at this time. However, proposed methodologies would address this objective and provide the information in an accurate and, in some cases, digitally spatial format.

#### **Summary**

Habitat is the principle determinant of the biological potential of a watershed. Maintaining a healthy functioning littoral zone in the lake is paramount to this potential. To accomplish this goal, it is imperative that the current health and human caused stresses on the riparian habitat of Lesser Slave Lake be quantified and qualified. Habitat that is recognized as essential for a biological resource or function within the watershed could then be protected or upgraded.

Habitat degradation and water quality within the Lesser Slave Lake watershed have become major issues for both government agencies and the general public. Groups have formed in an effort to address these issues. The High Prairie Riparian Action Team was formed in 2001 and is made up of government and non-government agencies. Their goal is to encourage and facilitate teamwork amongst the different agencies in order to deliver projects that maintain or improve the health of the riparian zones in the High Prairie area. The Lesser Slave Lake Watershed Committee was created in 2000 to address the low lake water levels. This committee, consisting of concerned area residents,

municipalities and interested stakeholders, is focused on addressing the water level needs of the municipalities (MD of Big Lakes and the MD of Lesser Slave River), industry, and tourism on the lake and the Lesser Slave River. This group is one of the main committees advising for the Lesser Slave Lake and River Basin (SLS/RB) Water Management Plan initiated in 2002. The Habitat Mapping Project would allow for an updated, full-scale view of the Lesser Slave Lake riparian zone and identify those areas in need of protection. Support can be realized for this project from these established groups.

Lakeshore activities are currently recorded through color photographs taken during fixed wing flights, and are spatially limited as the photos are not directly geo-referenced. Computer software has now been purchased to address this limitation. The MediaMapper Software® allows for an interactive, computerized map using the digital pictures and GPS location data collected in the field. Geographically referenced images can be exported to a GIS platform, so information can be easily viewed and shared with colleagues. The MediaMapper requires GPS Pathfinder® Office version 2.80 which is included with any upgraded GPS such as Trimble GeoExplorer® 3. The software is compatible with any digital cameras that use the Design Rule for Camera File (DCF) system standard (established in 1998).

The importance of the Habitat Mapping Project is clear, though it also brings about the following concerns:

**Data Use:** Previous reports and studies have already addressed shoreline development issues and concerns over cumulative effects of long-term development on Lesser Slave Lake. Despite these various documentations, little change has occurred in addressing these issues or incorporating them into a developmental plan for the shoreline of Lesser Slave Lake. The concern is that more time and effort will be invested into data collection identifying critical areas, which in turn are not protected from development or agricultural use.

**Magnitude of the Task:** Lesser Slave Lake is one of the largest lakes in Alberta. The time and resources required to map out the entire shoreline in detail would be extensive. However, only concentrating on site specific issues may result in too narrow a focus to address the cumulative impacts to the overall ecosystem or populations of individual species.

**Lack of priority goal for the project:** The success of habitat management does not start with choosing methods but with applying the fisheries management process (Krueger and Decker 1993 as cited in Bain and Stevenson 1999). The process involves (1) setting goals, (2) defining objectives, (3) identifying problems, (4) implementing actions to address problems, and (5) evaluating actions to determine if objectives have been achieved (Bain and Stevenson 1999). A direct indication of what is needed and the purpose for which the data would be used

needs to be made clear. Until a specific goal is identified, a general dilution of content will result.

Many protocols exist for habitat analysis, and vary in purpose and types of data gathered dependent on the goal of the project. The type of habitat analysis program selected for this lake needs to be standardized and repeatable to be effective. Data storage and analysis also need to be addressed in order for the project to be a powerful monitoring tool that can be easily updated. Once these concerns are addressed, the project has the potential to be one of the most important activities to occur for the Lesser Slave Lake watershed and its users.

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