ASSESSING TRADITIONAL AND CONTEMPORARY FISHERIES KNOWLEDGE WITHIN THE SHOAL LAKE WATERSHED: POSSIBILITIES FOR PARTNERSHIPS WITH SHOAL LAKE FIRST NATION #40

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By:

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A practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfilment of the requirements of the degree of Master of Natural Resources Management.

Abstract

The purpose of this research was to examine an alternative knowledge and management system, relating to the walleye fishery of Shoal Lake, Ontario. The study documented the traditional ecological knowledge relating to Walleye, compared and contrasted traditional ecological knowledge to scientific ecological knowledge, integrated traditional and scientific ecological knowledge into a map format; and recommended areas of further research. To conduct this work, three major research methods were employed: personal observations, personal interviews and a map biography approach.

The results of this study defined areas of critical walleye areas for consideration from the scientific and traditional ecological knowledge perspectives. Differing perspectives are held by representatives of Shoal Lake Band # 40 and by representatives of the Ontario Ministry of Natural Resources on the nature of the fishery as well as on the methods required for a sustainable harvest and recovery of the walleye population. Until these problems can be resolved and greater cooperation can be achieved between both parties, the fishery will not be effectively managed. However, this is not to say that the fishery will not recover on its own, but this will be by chance and will take time.

The recommendations of this study include: that the terms defined in fisheries management be clarified and mutually agreed upon, that further research be conducted to clarify these differing perspectives, that a research methodology be developed that would incorporate both scientific ecological knowledge and traditional ecological knowledge, and that the First Nations be brought into the scientific management process so that they can evaluate its potential to contribute to traditional ecological knowledge.

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CHAPTER ONE
INTRODUCTION

1.1 PREAMBLE

Shoal Lake (Ska-tay-gaut-gun in Ojibwa, meaning low water level or shallow) is situated on the Ontario/Manitoba border (Figure 1). Since the early part of the 20th century (1920's), a freshwater commercial fishery has taken walleye *(Stizostedion vitreum),* northern pike (*Esox lucius*) and lake whitefish *(Coregonus clupeaformis)* from Shoal Lake (Borecky, 1980).

The Ontario Ministry of Natural Resources (MNR) manages the walleye fishery of Shoal Lake and Lake of the Woods region through the Natural Resource Transfer Act of 1923 (MNR, 1977). In 1951, an agreement was reached between the Ontario Lands and Forests and the Manitoba Ministry of Natural Resources, in which "management and supervision [for the Manitoba portion of Shoal Lake] was given to Ontario Lands and Forests" (Macins, 1977). Currently, the Ontario Lands and Forests is the Ontario Ministry of Natural Resources.

The commercial fishery was managed by limited entry tenure system (MNR, 1982). Licences were allocated to Native bands, singularly or jointly, as band licences, "for the enjoyment of all band members" (Macins, 1977). Licences were granted to non-natives, as individual fishing operations, for their exclusive use (MNR, 1982). Seven commercial operations utilized Shoal Lake. From 1925 through 1951, six out of 7 licences were held by non-native commercial fishermen (Macins, 1977). The only licence held by Native Peoples was lot 12 (Figure 2). In 1951, licence areas 12a and 12b were assigned as Bands licences. The number of licences held by Native commercial fishermen further increased from 1961 to 1983. In 1962, licence areas lot 9 and lot 11 were purchased by Band #39 and #40 from Barb Machin (Macins, 1977). The local Elders and/or fishermen of Band #39 and #40 also utilized the Neutral Waters area, an area where no tenure was assigned to an individual licence holder.

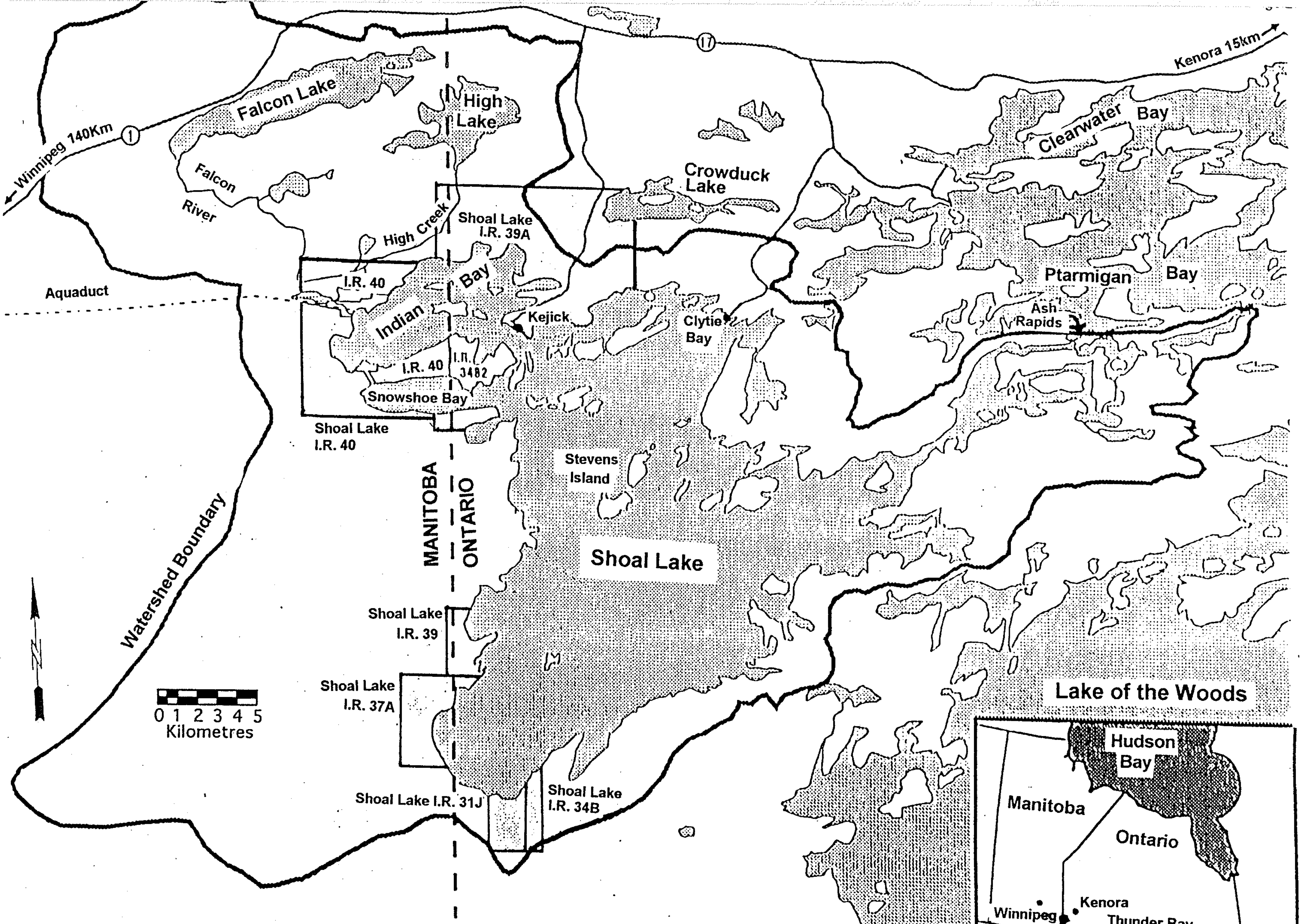


Figure 1. Shoal Lake Watershed Study Area

Source: Adapted From Hutchinson, 1995: unpublished

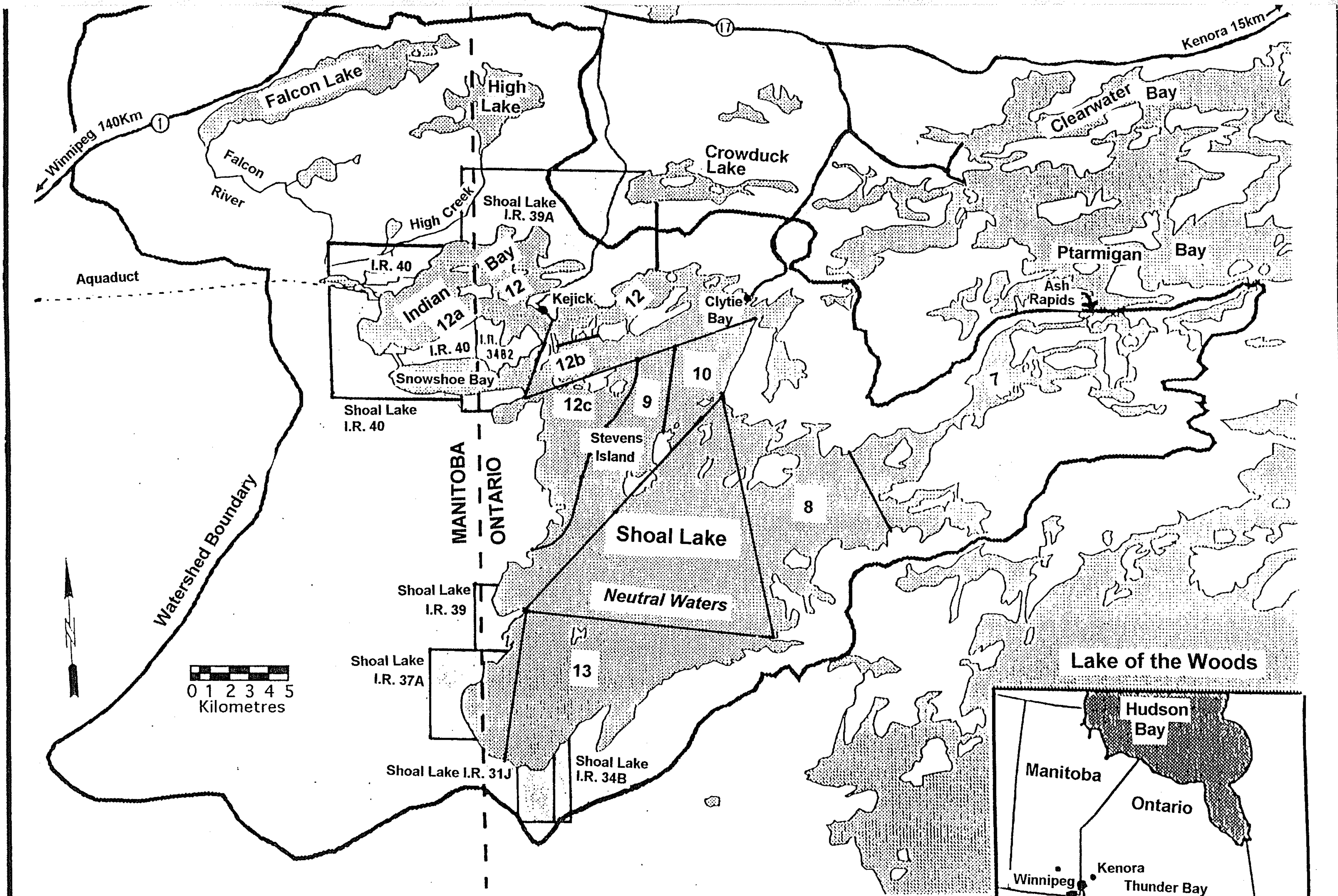


Figure 2. Licence Tenures at Shoal Lake, Ontario

Source: Adapted From Hutchinson, 1995: unpublished; Macins 1977

Commercial fishermen were regulated in terms of mesh size, season of operations, and size limits (Macins, 1977). Whereas, anglers were regulated in terms of season and size limits.

Historically, walleye and lake whitefish have been the two most important species in the domestic, subsistence and commercial fisheries (Rodgers, 1972). From the 1920's to 1978, commercial and subsistence fishing for walleye formed the base of the economy for Shoal Lake Bands #39 & #40. In 1978, the Ontario MNR limited the scale of commercial walleye fishing, and in 1983, closed the walleye fishery to subsistence, commercial and sports fishing. Also, quotas for other species such as lake whitefish were reduced and the use of gill nets for the commercial harvesting of other species (with the exception of lake whitefish) was prohibited (Redsky, J. , 1995: pers. com.).

The closure of both the commercial and subsistence fishery has caused undue economic hardships for the Shoal Lake First Nation Communities (Redsky J. 1994: pers. com). Commercial fishing along with wild rice harvesting were the primary economic activities within the Shoal Lake Watershed. Commercial fishing generated a large percentage of the local earning for members of the local communities.

Considerable in-kind food resources were also lost. Prior to 1978, subsistence fishing alone provided 62.5 kg/year/person, comprising an equivalent cash value of $828.00/person/year (Hilderman, et al. 1992). Conservatively, the First Nation communities of Band # 39 and Band # 40 had a combined estimated population of 400 people. If the subsistence fishing had been reduced to near zero levels for the twelve years of the closure, the losses from the restrictions on subsistence fishing to the community would approximate $ 4.0 million.

Today, the management of commercial, sport and subsistence walleye fisheries of Shoal Lake has become increasingly complex due to three issues. The first issue is that the cause of the closure of the walleye fishery and the ban on gill net fishing was attributed primarily to Native overfishing, and "overfishing by Native People through excessive use of gill nets was noted by MNR staff as early as 1961" (Macins, 1977:4). Strained relations between local fisherman and MNR personnel have resulted.

The second issue is the nature of Aboriginal treaty rights. Although subsistence fishing rights have been officially recognized, under the 1982 Constitution and cases such as Sparrow, the Ontario MNR has held the position that no special fishing treaty rights devolve from Treaty Three (MNR, 1982). Rights for the commercial sale of fish are especially contentious. Further, the Ontario MNR suggests that Native fishing rights are subject to provincial regulation under Treaty 3 (Waisbergand and Holzkamm 1992).. This assertion has lead to arrests of First Nation individuals for infractions of the Ontario Fisheries Act (Redsky, John Sr. 1994: pers. com).

The third issue which has increased complexity is that the management of the watershed now involves various levels of governance, resulting from the existence of a native Specific Treaty Land Claim -- a claim for damages where a treaty is in place (Appendix 1). As of 1989, the Ontario Government signed a Statement of Political Relations with the Ojibwa of Shoal Lake, Treaty 3, resulting in the creation of the Shoal Lake Watershed Committee (SLWC) (Campbell 1993: pers. com.). The SLWC is comprised of various representatives from the five First Nations within the watershed and the Ontario government. A Memorandum of Understanding -- a first draft of formal co-management agreement --has officially been signed, by the representatives of the Ontario government and the First Nations. The five First Nations have also reached and negotiated a five year agreement to jointly manage the watershed with the Ontario MNR. The agreement is currently in its second year of implementation and will last until 1998. The funds for the joint management agreement are to come from the Ontario MNR. The MNR has to date not lived up to its fiscal responsibility as it has attempted to limit the funds to minimal levels.

A formal "co-management agreement" has not been reached as Manitoba and the federal governments have not yet been asked to participate in the negotiations. Present relations between Shoal Lake # 40 and the Manitoba Government are strained. Shoal Lake # 40 has requested that lands expropriated for the construction of the Winnipeg Aqueduct be returned. Conflict also arises from a related issue -- the Manitoba Governments reluctance to provide Shoal Lake Band #40 with a permit for an all-weather road and a necessary right-of-way over the expropriated lands.

Another stumbling block in negotiations has been the inability of the five First Nations to jointly reach a consensus on how they would like to proceed. Different perspectives and priorities have emerged on how to "manage" the resources within the Shoal Lake Watershed. The five First Nations within the watershed have each conducted separate management projects, reflecting their different priorities. However, the Shoal Lake Watershed Committee is jointly developing a watershed management plan for the entirety of Shoal Lake. The SLWC, representing the various bands within the watershed, would like the chance to renew the fishery -- to enhance the social, cultural and economic well being of their people.

One potential way of achieving this aim is the integration of traditional ecological knowledge (TEK) with scientific ecological knowledge (SEK) in order to create a more comprehensive knowledge base and effective management approach. Integration in this sense will refer to "both ways of knowing being treated as equal partners in management," and not "the domination or extension of ideological control by one culture's science [or way of knowing] over another" (Colorado, 1988). There appears to be agreement among scientists, government and Aboriginal Peoples that integration of the two systems is required, given the pluralistic nature of society and given the fact that environmental impacts do not have defined boundaries (Johnson and Ruttan, 1991).

1.2 ISSUE STATEMENT

The walleye fishery continues to remain closed on Shoal Lake. Past scientific management practices have not lead to the effective management of the fishery. Nor has it lead to the rehabilitation of the age class structure of the walleye population, despite a cessation of both commercial and sports harvesting (Appendix 1). Therefore, integration of alternative management approaches using alternative sources of knowledge may improve the effectiveness of fisheries management at Shoal Lake. This issue has three components:

1. Is there relevant local TEK within the Shoal Lake First Nation #40 community?
2. And if so, what are the benefits that integration of TEK may provide?
3. And if so, how may TEK be used to compliment scientifically derived ecological information to create an alternative management approach for the walleye fishery?

1.3 OBJECTIVES

The primary purpose of this research is to analyse TEK from Shoal Lake #40 and its associated management system, relating to fisheries and its potential to be integrated with SEK.

The specific objectives of this study are as follows:

1. To document TEK relating to:

   a) Biological characteristics of walleye;
      - Spawning and Nursing areas
      - Critical walleye habitats

   b) Harvesting considerations of walleye;
      - Harvesting areas
      - Harvesting practices
      - Conservation practices

   c) World view.
      - how fish and other resources are perceived and utilized within a first nation communities;

2. To compare and contrast TEK to SEK for spawning areas, critical walleye habitat, and nursery areas,

3. To integrate TEK and Scientific Ecological Knowledge into map format; and

4. To generate recommendations for the future management of the walleye population for the community of Shoal Lake #40.

1.4 SCOPE AND LIMITATIONS

The study is based primarily on individual interviews conducted during the summer months of 1994. Because of practical constraints, few events and details are updated beyond the winter months of 1995.

Due to strained relations between the First Nations communities in the Shoal Lake Watershed, this study is limited to residents of Shoal Lake #40 Band. Therefore, the views cited in the study reflect perspectives of the Elders and/or fishermen of this community.

The personal interviews were not rigidly structured so that people could focus on their own insights and experiences. Such an approach has both advantages and disadvantages. Though not as systematic as some methodologies, this approach was selected to encourage frank and open discussion with the Elders and/or fishermen. In this way, the author's own perceptions about key traits or experiences would likely be minimized and Elders' concerns emphasized.

1.5 CONCLUSION

The documentation and integration of TEK may prove critical to the overall management of the walleye fishery. Documentation of biological characteristics derived from TEK and SEK, will lead to the identification of critical habitat for walleye. Identified critical habitat can then be used for effective land use planning for the watershed, which in turn may lead to the recovery of the walleye population. Moreover, increased communication between Elders of the First Nation communities and resource managers of the Ontario MNR may lead to a sharing process by which a broader understanding of factors influencing walleye populations are exchanged.

CHAPTER TWO

STUDY AREA AND METHODS

2.1 STUDY AREA

The area of study is located in the south east corner of the province of Manitoba and the south west of Northern Ontario, approximately 60 kilometres from Kenora, Ontario. The watershed is located in the north-western corner of Lake of the Woods (Figure 1). The majority of the watershed in Shoal Lake is untenured "crown lands". The remaining tenured lands are in the forms of private or collective tenures. Private tenures include cottages, commercial ventures, and residential properties. Collective tenures include the land surrounding the Winnipeg Aqueduct under the City of Winnipeg, band reserves under federal trust, and provincial park lands under provincial jurisdiction. Shoal Lake is connected to Lake of the Woods. Water levels within the two lakes are related, depending upon the direction of flow through Ash Rapids (Redsky A. 1995: pers. com.). Water levels of Shoal Lake are regulated by the International Joint Commission -- a regulatory body governing international (Canada\US) waters.

2.1.1. Environmental Data

Shoal Lake covers a geographic area of 25,856 hectares, with a total shoreline greater than 600 km (Roos et al., 1983). The mean depth for Shoal Lake is 9.1 meters (with a maximum depth of 30.5 m.) (Roos et al., 1983). Shoal Lake is considered to be a very highly productive mesotrophic lake (Macins, 1979). It has overall total dissolved solids estimated at 108 PPM, ranging from 86 -132 PPM , and with secchi value ranging between .91m and 1. 82m and ph value ranging between 6.0 and 8.5 (Macins, 1979). A value for Ryders Morphoedaphic index (MEI) for Shoal Lake has been estimated at 14.2 (Appendix 1). MEI was calculated using the following formula: MEI = total dissolved solids (mg\l) divided by the estimated mean depth (m) (MNR, 1982).

Total sustainable fish yields were calculated using the following formula: sustainable yields (kg\ha\yr) =1.378 divided by the MEI to the power of 0.4454 (MNR, 1982) (Appendix 1). This results in an estimated sustainable yield of fish of 4.79 kg\ha\yr and a total productive yield for all species of 116,000 kg\year (MNR, 1982). However, Ryder's MEI provides a first estimate of the sustainable yield of all fish in a lake, not for a species. In allocating potential fish yields per species, the MNR estimated walleye and perch (percid species) to comprise 33% of the potential fish yields for Shoal Lake (MNR, 1982). Thus, the total sustained yield for walleye and perch was estimated at 38,000 kg per year (MNR, 1982). These figures are considered spurious by the Elders and/or fishermen of Shoal Lake # 40.

2.1.2 Species Presence and Absence Data

The species composition in Shoal Lake is similar to percid communities found in mesotrophic lakes in North America (Table 1). The common species present include: walleye, whitefish, northern pike, burbot (*Lota lota*), cisco (*Coregonus artedii*), yellow perch (*Perca flavescens)*, white sucker (*Catostomus commersoni*), and smallmouth bass (Micropterus dolomieui) (Macins, 1979). The common species absent from Shoal Lake but present in Lake of the Woods include: sturgeon (*Acipenser fluvescens*), lake trout (*Salvelinus namaycush*), and sauger (*Stizostedion canadense*) (Macins, 1979). Species absence may result from the lack of suitable habitat for these species (Mosindy, 1995: pers. com.). For instance, sturgeon are restricted by a lack of suitable spawning habitat, as sturgeon require high velocity flow for spawning (Mosindy, 1995: pers. com.). And, lake trout is a cold water species, preferring temperatures ranging around 10 degrees Celsius (Scott and Crossman, 1973). The warmer, shallower waters of Shoal Lake may present a thermal barrier to lake trout and also sauger (Scott and Crossman, 1973).

2.2 METHODS

Analytical research involves the systematic collection, analysis and interpretation of data in an attempt to interpret the natural world (Patton, 1980). This study has employed the systematic collection, analysis and interpretation of information related to the walleye fishery. Information was gained from both traditional ecological knowledge (TEK) and from scientific ecological knowledge (SEK). Biological Characteristics and harvest considerations were identified and mapped.

Table 1. Fish Species Present in Shoal Lake
Source: Scott and Crossman, 1973; Redsky, D. , 1994: pers. com.

Fish Species	Scientific Name	Ojibwa Name(s)
Black Crappie	Pomoxis nigromaculatus	*
Brown Bullhead	Ictalurus nebulosus	Owaasii
Burbot	Lota lota	Mizay
Emerald Shiner	Notrpis atheriniodes	*
Lake Whitefish	Coregonus clupeaformis	Atikameg
Minnow	Cyperinidae	*
Muskellunge	Esox masquinongy	Ozaawashko-Kinoozhe
Northern Pike, Jackfish	Esox lucius (Linnaeus)	Kinoozhe
Rock Bass	Amblopties rupestris	Ashigan
Slimy sculpin	Cottus cognatus	*
Smallmouth Bass	Micropterus dolomieui	Otazhegamoo
Spottail Shiner	Notrpis hudsonius	*
Tulibee, Cisco, Lake Herring	Coregonus artedii Lesueur	Otoonibiins
Walleye	Stizostedion vitreum	Ogaa
White Sucker, Mullet	Catostomus commersoni	Namebin
Yellow Perch	Perca flavescens	Asaawe

* No Objibwa name could be recalled for these species.

2.2.1 Data Acquisition

Data for this study were obtained from a number of sources and included both descriptive (qualitative) and prescriptive (quantitative) data. Sources include:

1. Secondary Data sources:

- topographic maps, hydrographic maps and remote sensing information;
- literature review.

2. Primary data sources:

- interviews with Elders and/or fishermen from Shoal Lake # 40 and with personnel of the Ontario MNR;
- conversations with and observations of fishermen and other residents of Shoal Lake # 40; and
- TEK derived information or information derived scientifically.

2.2.2 Individual or Community Meetings

Community protocol was followed as it can heavily dictate the quality of information gathered. Thus, the goals and objectives of the chief, council and local fishermen were ascertained, relating to the management of the fishery in the past, present and future, through community or individual meetings during the months of May to October 1994. The objectives for the project were modified accordingly. Parameters deemed acceptable to both the researcher and the community were developed, in terms of methodology. Suggestions to improve the quality and usefulness of the study were sought from local Elders and/or fishermen.

2.2.3 Personal Interviews

Quantitative biological (presence/absence) data and qualitative harvest data was gathered by conducting standardized open-ended interviews. Participants were Elders and/or experienced fishermen selected by the community. Twelve initial interviews and various follow up meetings were conducted (Appendix 2). Verification meetings were also conducted. Prior to conducting the interview, an introductory visit was made by the researcher to the participants home, if possible. The introductory visits served a dual purpose: to ensure the objectives of the project and the events of the interview were fully understood and to explain what would happen to the information gathered from the project. During the interview process, informants were asked to provide their perceptions of the nature of the walleye fishery and to describe traditional areas and use patterns. Participants were also asked to provide critical biological information such as the location of spawning, nursery and staging areas, the aquatic vegetation habitat requirements of such areas, and walleye life cycle and migration patterns.

Interviews were taped in the majority of cases. Permission to tape the interviews was obtained prior to commencing the interview. An Elders' Council provided assistance in the interpretation of language and data. An attempt was made by the researcher to understand the Ojibwa terms and concepts to ensure that meaning is not lost or distorted. Primary data was stored in an audio tape library. A data classification system was developed to group data into specific classes.

2.2.4 Map Biography

Map biographies were employed in conjunction with the personal interviews, in most cases. Informants were first asked to verbally and geographically locate spawning areas, other biological characteristics, and harvesting areas. To expedite the processes of mapping the data generated, informants were asked to transfer data to mylar overlays, using fine point marking pens. For persons unfamiliar with the mapping process, an oral description was obtained of a particular biological characteristics or harvesting practice. For instance, such participants were asked to verbally describe the conditions indicating the location of a particular spawning area. A label system was developed for the overlays to tie specific information to specific individuals. Labelling overlays serves to provide consistency in data generation (Hill, 1993). A colour/symbol scheme was devised, whereby differing colours and symbols represented certain biological characteristics or harvesting considerations.

2.3 DATA BASE CREATION

The methods used in database creation include remote sensing analysis and cartographic techniques. Remote sensing information was purchased from the Manitoba Remote Sensing Centre. A classification was undertaken and a legend created. The classified data served as a base map to which the mylar information was added as layers, in Adobe Photoshop. One layer of mylar information was created for both the SEK and TEK biological or harvesting information, if available. The layers were later combined for each of the biological characteristics. The files were then exported to Adobe Illustrator where the text, scale and a north arrow were added.

2. 4 FINAL PRODUCT

One map was created for each of the biological characteristics: the spawning areas, nursery areas, and wild rice areas. One map was created for the entirety of the harvest areas, delineated by season. Basic biological and harvest data characteristics were utilized to identify and outline the critical habitat for walleye for further analysis.

2. 5 DISSEMINATION OF RESULTS

The information derived from an analysis of TEK is considered the "property" of those who possess and understand it. Thus, the information derived in the project is considered the property of the Shoal Lake First Nation. As such, the information will flow back to the community. Any information deemed sensitive by the community was removed from the practicum document.

CHAPTER 3
MANAGEMENT APPROACHES

The overall purpose of this chapter is to provide a background of the current, and related literature surrounding the walleye fishery at Shoal Lake. This chapter provides a summary of the inherent differences within two divergent knowledge systems and two divergent world views. Finally, this chapter includes a summary of the management options for the fishery.

3.1 KNOWLEDGE SYSTEMS

Feit (1988) suggests that knowledge systems are the focus around which all culture organize themselves . Two divergent ways of understanding natural surroundings have been developed -- Traditional Ecological Knowledge (TEK) and Scientific Ecological Knowledge (SEK).

3.1.1 TEK Versus SEK

The survival of local peoples has been predicated upon the extent of their understanding of local circumstances and natural systems (Feit, 1988). Through close interaction with and observation of the environment, indigenous peoples have developed tremendously detailed models of the inter-relationships of local ecosystems (Feit, 1988). This knowledge, accumulated over centuries of direct contact with the natural environment, has been coined many terms such as Traditional Ecological Knowledge (TEK), Indigenous Knowledge (IK), and Knowledge of the Land (Berkes, 1988; Berkes, 1993; Feit ,1988; Gadgil, et al., 1993; Hunn, 1993; Johannes, 1993a; Lewis, 1993 ; and Kuhn , Duerden and Clyde, 1995). For the purpose of this document, the term *Traditional Ecological Knowledge or TEK* will be utilised, as "traditions are the product of intelligent reflection tested in the rigorous laboratory of survival" (Hunn,1993: 13).

Berkes (1993:3) provides a salient and working definition of TEK, as:

> a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment. Further TEK is an attribute of societies with historical continuity in resource use practices; by and large, these are non-industrial or less technologically advanced societies, many of them indigenous or tribal.

Just as in Aboriginal cultures, model building exists in western culture. The term used to describe such knowledge is Scientific Ecological Knowledge (SEK). Scientific Ecological Knowledge is primarily based upon statistical analysis, which blends the modes of inquiry -- field experiments and laboratory experiments (Table 2) . The aim of statistical analysis is to attempt to discover the underlying trends in the population through the sampling of a subset of the population (Kenkel, 1995 : per. com) .

Roberts (1994) suggests that TEK and SEK have many common attributes, including :

- continual gathering and processing of information;
- systematic accumulations of detailed observations;
- continual documenting and sharing of collected information;
- continually increasing knowledge base through increased experience, observation and interpretation; and
- continual monitoring of the same parameters as population indicators.

Berkes (1993:5) outlines several key differences between the two knowledge systems: TEK is mainly qualitative (as opposed to quantitative); TEK is moral, as opposed to value-free; It is based upon empirical observations and accumulations of facts by trial-and-error, as opposed to experimentation and systematic accumulation of fact; and TEK is holistic, as opposed to reductionist. It is based upon diachronic data, a long time series on information from one locality, as opposed to synchronic data, a short time series over a large area (Table 2) .

Table 2. Model Building of the Western and Indigenous Knowledge Systems
Source: (Adapted from Roberts, 1994; and Berkes, 1993)

Component	Scientific Method	Traditional Ecological Method
Type of Knowledge	Formalized, quantitative, systematic accumulation of fact.	Qualitative, systematic observations of animals and fish, including social organization, connection and behavior.
Collection of Information	Information is gathered by systematic accumulation of fact; Accumulations of knowledge by a limited and specialized group; Information is collected in short periods of time from small sample areas and extrapolated to the larger population.	Information is gathered by trial and error; Knowledge is gathered by all participants; however, specific individuals acts as recorders and keepers of TEK; Information is collected on an ongoing basis, over a long time period, during all seasons, for a defined spatial area.
Documentation of Knowledge	Information is recorded as written knowledge in forms, tables and reports.	Information is recorded within oral histories.
Analysis of Information	Analytical decision-making process, involving inductive and deductive reasoning, utilizing predictive models, and population dynamics.	Intuitive decision-making processes, involving discussion and inductive reasoning.
Interpretation of Information	Comparison of results in field or laboratory experiments to results of others.	Volume of knowledge available for a species is often larger than existing scientific knowledge.
Transfer of Knowledge	Written reports, publications, and data bases; Training occurs in the classroom.	Oral communication of knowledge through myths, legends and stories; Training occurs outside of the classroom.
Applicability	Knowledge system can adapt to uncertainties outside its frame of reference.	Knowledge system can not adapt to problems outside past experiences and oral histories.

3.2 WORLD VIEW -- The Context of Management

Berkes (1993) highlights the social and cultural context of TEK, including the following dimensions:

- symbolic meaning through oral history, place names and spiritual relationships;
- a distinct cosmology or world view; and
- relations based upon reciprocity and obligations towards both community members and other beings.

Firstly, there was no duality between natural and human systems (Callicott, 1989) . Thus, natural systems were considered as being sacred. Within the Native ethos, the natural, spiritual and human realms are not separate and distinct but are interconnected. Just as the human, spiritual and natural realms are interconnected, everything in nature is believed to possess a spirit, granted it by the "Grandfather Spirit," to which everything flows (Tanner, 1979; Callicott, 1989). Everything in nature was perceived as not only possessing a spirit but also possessing a conscious, volition and reason equal to that of human beings (Callicott, 1989). Thus, nature can not be controlled and must be respected (Young, 1989). Animals were seen as possessing similar emotions and purposes in life and as leading similar existence (Tanner, 1979). The main difference between animals and humans was considered to "lie chiefly in the outward form" (Speck, 1977). Social relations were perceived as being possible and desirable between human and other species (IISD, 1993; Callicott, 1989).

The scientific or dominant world view stems from scientific ecological knowledge; it is the basis for decision-making. Within the dominant world view, there is a duality between the human and natural realms. The sacredness found in the alternative view is lacking. Within the dominant world view, only a few animals of the ape family are perceived as having a "consciousness" or "soul" comparable to humans. Humans are considered, under Cartesian science, an underlying principle of the dominant world view, as the only beings possessing a *self-consciousness* (Callicott, 1989). These sentiments have been used as a rationale for human dominance over other species (Callicott, 1989). Animals not possessing a "consciousness" or sentience are deemed less deserving of respect and dignity. As such, no social relations are deemed desirable between animals not and human beings (Callicott, 1989). Other species are treated as objects to be managed rather than subjects, existing by their own right (Callicott, 1989; Johnson, 1992). The elements of the natural realm are treated as inert or non-sentient objects.

3.3 MANAGEMENT SYSTEMS

Divergent forms of knowledge and differing world views have resulted in differing forms of management being created (Table 3). Rules of access to or rights of use of "natural resources" were delineated (Chapeskie, 1992) (Table 3). In all cultures, the prevailing world view delineates how people perceive and utilise "resources" of the natural realm on which a society survival is based. A world view will delineate a moral or practical code, ascribed to by its members, in terms of relating to the natural realm. Additionally, a world view will set penalties for transgressions of this code. This moral code will result in a management regime which will prescribe rights of access and use of natural resources. Through use of resources and survival, all cultures alter the nature of their environment. The same is true for Aboriginal cultures. Aboriginal Peoples have "managed" and subsequently altered the shape of their natural surroundings. Usher (1987:67) suggests that the management applied by both Aboriginal Peoples and western resource managers have similar traits, including:

> An information base and a paradigm or set of mental constraints that organises and interprets it into useful knowledge ; a set of practitioners with a distinct world view or culture that includes this paradigm and certain normative values; a system of rules, norms, a custom concerning rights and responsibilities that are intended to govern the behaviour of all who partake of its benefits; and an overall set of objectives which are embodied in the institutions and ideology of the society as a whole.

Local level or self management was based upon a system of communal property rights, in which the harvesters had the duties and responsibilities for "management" (Usher, 1987). Rights to the use of a "resource" were allocated within the local communities, and "members within the group either have equal access to communal lands, or are assigned places within them in an ordered basis" (Usher, 1987: 6).

Table 3. Components of Western and Indigenous Fisheries Management Systems
Source: (Adapted from Roberts, 1994)

Component	Western Management	Indigenous Management
Rationality	The western management system is based upon the premise that individuals acts in their best interest.	The Indigenous management system is based upon the premise that individuals act in the collective best interest.
Authority	Centralized, in this case, the governing agency is the Ontario Ministry of Natural Resources.	Decentralized.
Administration	Government personnel	Elders and fishing leaders
Goals of Management	Sustainable yield to maintain population levels.	Sustainable yield to supply food; continued social relations with other species.
Rules and Enforcement	Regulation, driven command and control approach; Formal regulatory and enforcement system existing outside the community.	Value-driven; enforcement is based upon community norms, social relations, and cultural values.
Decision-making	Decisions made outside of the community and non-consensus based .	Decisions made within the community; consensus decision-making process involving whole community or persons with knowledge and experience.
Allocation	Based upon licensing regime.	Based on community norms and customs.
Harvesting practices	Non-selective harvesting, focused on the protection of females and young of species, and individual harvesting and use of resources.	Selective harvesting based upon knowledge of social behavior and organization of animals.
Conservation	Conducted by an external agency.	Communal use of resources; conducted by resource users.
Redistribution	Non-existent as people were acting in their self-interest.	Communal distribution of resources based upon kinship groups.
Jurisdiction	External.	Internal.

Usher (1987) further suggests common property system is characterised by (communal) self-interest and social arrangements constraining individuals. Communal use of a resource required both collective decision-making and action -- the collective enforcement of culturally based rules of use of a resource. Decisions for resource allocation were primarily based upon TEK, and "Leadership and authority were based upon the acquisition of knowledge and the demonstrated ability to use it effectively" (Usher, 1987:7).

Scientific management is akin to state management, a generalised term proposed by Usher (1987). State management is characterised by a regulatory approach based upon jurisdiction (Provincial and/or Federal) to regulate natural resources. This regulatory approach is based upon laws, rules and regulations of access and use of natural resources (Roberts, 1994). The basis of the management approach is individual rationality.

3.3.1 Indigenous Management Versus Western Management

In summary, Indigenous management is characteristic of self-management of a particular resource. Whereas, western management is characteristic of state management. Self - management is not precluded by state management; it may act simultaneously with the state management system. Self-management is based upon the cultural norm of collective or communal interest. Western management is based upon the ideal of individual self-interest. Under self-management, decisions are made within the community, usually by consenual decision-making. Under state management, the decisions are made outside the community in a centralised agency. The scientific approach is characterised by written knowledge. The Indigenous management approach is characterised by oral histories.

3.4 CO-MANAGEMENT

Another alternative for management of particular resources is a co-management arrangement. Pinkerton (1989b) suggests that the aim of co-management arrangement is to produce a more efficient and equitable management system, for a particular "resource" of a particular area. Pinkerton (1989b) further contends that the effectiveness of management may be improved by the inclusion of the community in decision-making and in the creation of a co-management regime.

Increased effectiveness may result in the following areas:

- data acquisition and collection;
- decision allocation on rights of use;
- enforcement and protection of a resource;
- planning; and
- decision-making.

Various barriers exists to the establishment of a co-management arrangement. For instance, Roberts (1994: 18) outlines the barriers to Native participation in a co-management agreement, including :

- lack of familiarity with power or control over management decisions;
- a history of learned dependency;
- different interpretations of language;
- socio-cultural differences;
- government managers unwillingness to share power; and
- non-native interests in resources.

If barriers are surmounted, any system of co-management should have the following principles as a frame work for development (Johnson and Rattan, 1991):

- enhance cross-cultural communication and understanding and promote the growth of both knowledge systems ;
- accept the validity of each system ;
- recognise human and biological interrelationships;
- recognise the fact that traditional knowledge belongs to those who possess and understand it and that they are most able to document and apply it effectively;
- support local initiatives to document TEK ;
- encourage cross-cultural training in SEK and TEK; and
- provide local peoples with access to scientific expertise and appropriate resources to participate in managing resources

Pinkerton (1989b) further suggests that the following specific benefits may also be obtained, including:

- increased commitment of harvesters to share the costs of management;
- a higher degree of organisation among the users;
- increased motivation to negotiate ;
- increased equity in negotiation between user groups;
- increased credibility of users;
- greater sense of self-reliance;
- improved ability to develop and successfully implement enforcement regimes;
- increased willingness among governments to allow self-management responsibilities;
- better data gathering and analysis; and
- co-operation.

Chapeskie (1995: pers. com.) warns that the divergent nature of management systems will preclude much of the benefits received. There are various levels of co-management arrangements, ranging from self-management as one extreme to state management as another extreme. The benefits derived from the co-management arrangement -- in terms of increased effective -- will depend upon the level of the co-management arrangement. Co-management arrangements range from isolation (state management) to community control (self-management) (Table 4).

Table 4. Levels of Co-management and associated knowledge systems
Source: Berkes, 1994; and Haugh, 1994

8. **Community Control**	**Power delegated to the community which has the final say in Decision - making. Does not require real communication only that the community has jurisdiction and sovereignty. TEK dominates the decision-making process although SEK may be utilized.**
7. Partnership	Partnership of Equals; joint decision - making in the operational and nominal decision-making. **Provincial representatives still have the final say. Requires real communication. Ideally, SEK and TEK would be integrated as equal partners.**
6. Management Boards	Community Participation in Decision-making primarily in operational but some nominal stages . **Provincial representatives have the final say. General decisions are based upon conclusions derived from SEK. TEK may be present, although underutilized.**
5. **Open Communication**	**Start of real communication processes, resulting in understanding of world view and knowledge systems. Generally, decisions are still based upon conclusions derived from SEK. But TEK is acknowledged as a valid system.**
4. Advisory Committees	Communities influence and provide input into decision-making. **TEK gains importance.**
3. Consultation	Community given opportunity to provide input on the research agenda. **TEK starting to enter the decision-making process. SEK and TEK come into conflict, but SEK dominates.**
2. Information	Community is informed about decisions already made and implemented. **No interaction between knowledge systems.**
1. Isolation	Community is neither informed nor involved in decision-making. **SEK based conclusions are the basis for decision-making. TEK based in the communities.**

Two questions variably come up in planning for a co-management arrangement. These include: Who has the final say? And, who has the jurisdiction to manage? Berkes et al. (1991) suggest that unless there is a recognition of joint responsibilities and jurisdiction for management, real co-management (the upper levels of partnership and community control) is impossible to attain. Generally, real co-management requires the creation of an act such as the Shoal Lake Watershed Act or the modification of a series of acts (Provincial and Federal) (Pinkerton, 1992).

Limitations exist to the establishment of a co-management agreement and the attainment of the benefit of a co-management agreement. For instance, a lack of integration of the components of an alternative world view, alternative tenure systems and an alternative form of knowledge severely restrict the attainment of the higher stages of partnership and community control in a co-management agreement. These higher stages are exactly the stages in which a co-existence of culture are attained. Thus, it is argued here that the utilisation of TEK in a co-management agreement is critical to its success. If these higher stages are attained, the arrangement may provide a co-existence or a pluralism of cultures.

3.5 MANAGEMENT OF THE WALLEYE FISHERY

Charles (1992) suggested that scientific fisheries management generally has three main objectives: biological -- conservation of stocks, economic -- maximising economic efficiency and return on investment, and communal -- maximising social and cultural objectives. The Ontario MNR has followed a management regime based upon the concept of sustainable levels of harvests and sustainable yield. Thereby, the Ontario MNR has attempted to maximise both biological and economic objectives. These objectives are reflective of the dominant scientific world view. Communal objectives have not been included as a primary goal in fisheries management in Ontario. Until relatively recently, there has been little interest in involving the local communities in the management of the fishery. Likewise, there has been little interest in traditional knowledge as an alternative knowledge source.

3.5.1 Holistic Resource Management

Historically, the walleye fishery has not been managed in a holistic manner. Significant but subtle factors, may have significantly reduced the spawning success of the walleye populations, but they were not considered to be primary contributors to the walleye decline.

Significant factors may include: changes in water quality, changes in water levels and/or temperatures, predation from other fish species such as brown bullheads and yellow perch or bird species such as cormorants, and competition from other species such as northern pike and lake whitefish (MNR, 1985; MNR, 1988; Mosindy, 1994: pers. com.).

Effective resource management may require the utilization and integration of alternative source of knowledge and management systems, such as TEK, to preserve the resilience of ecosystems, the ability to adapt to surprises and the effects of multiple stresses acting simultaneously (Gadgil et al., 1993). This may be accomplished by providing an expanded information base; creating rules - of thumb; contributing to resource planning, monitoring and prediction, as users of a particular resource are aware of changes in natural ecosystems well before resource managers.

TEK may become important for the management of the walleye fishery at Shoal Lake, for instance, by providing an expanded information base. This expanded information base may become the foundation from which decision-making processes are undertaken for the entire watershed and may lead to a more effective utilisation of natural resources. Scientific ecological knowledge and fisheries management have not lead to the rehabilitation of the walleye fishery, even with the closure of the fishery. In addition to the capacity of the TEK to provide an expanded information base, it has contributed to traditional community based and later to scientific based resource management in the past. It has considerable potential to contribute further to scientific based resource management in the present and future. TEK has been the focus around which a particular belief system and world view has developed and has lead to a set of *"rules of thumb"* being implemented, which in turn, have been enforced by social and cultural means and have lead to sustainable land-use practices. Berkes and Farvar (1989) suggest that solely because of these `rules -of -thumb,' resulting from the accumulation of TEK, significant resources are left, to be managed. These rules of thumb may be abstracted and utilised in contemporary forms of resource management (Gadgil et al., 1993). For instance, the rotation of fish harvesting areas recently has been incorporated into government fisheries management policy and long has been incorporated into efficient agricultural techniques (Gadgil et al., 1993). Thus, TEK represents one key to effective application of knowledge to management practice, ensuring survival of a society by the sustainable use of natural capital (Feit, 1988).

In addition to the potential contributions of TEK in providing an expanded information base and in resource management, there is potential applicability of TEK in resource planning. It may provide increased knowledge for assessing and evaluating environment, natural resources and production systems (Berkes, 1993). TEK has potential applications to resource and/or wildlife management. Nakashima (1993) suggests that by examining TEK, resource managers may be able to further predict harvests, congregation areas and wildlife/ fish migration routes. To date, TEK has yet to be effectively integrated into a contemporary form of resource management.

3.6 PROBLEMS IN THE APPLICATION OF TEK TO RESOURCE \ FISHERIES MANAGEMENT

Usher (1993) hints that TEK of Indigenous Peoples has, to date, not been adequately, understood, utilised, integrated with other form of knowledge or incorporated into management decision-making processes. Johnson and Rattan (1991) highlights barriers to TEK application to and integration with scientific management. These barriers include: the devaluing of TEK and an alternative world view by resource managers, and related to this, cultural biases and a lack of understanding of the nature and value of TEK among most non-native administrators. Other problems have included (Johnson and Rattan, 1991):

- the lack of comprehensive and accurate documentation (in written form) in most Native communities because of their oral traditions;
- the lack of co-ordination of the terms and categories of the different knowledge systems;
- the perception that given the significant socio-cultural and economic changes occurring amongst First Nation cultures, any indigenous knowledge that existed in the past no longer continues to function effectively today;
- the lack of recognition that TEK has been given as a credible source of information. Because of the qualitative knowledge of TEK it is regarded by scientists as lacking scientific rigour and objectivity;
- identifying what role TEK and western science should each play in Environmental Management process; and
- the failure to understand that TEK is the *property* of those who possess and understand it and to understand that these people are the most able to apply it effectively.

CHAPTER FOUR
RESULTS

4. 1 BIOLOGICAL AND HARVEST DATA - TEK

Local Shoal Lake Elders and/or fishermen have accumulated first - hand knowledge of the movements and spawning patterns of walleye through detailed observation of natural ecosystems. Various local examples of TEK are held by Elders of Shoal Lake Band # 40 (Campbell, 1993: pers. com.) (Table 5).

Table 5. Examples of TEK held by Elders of Shoal Lake Band # 40
Source: Oral Histories from the Elders of Shoal Lake Band # 40 (May 1994 - May 1995).

Examples of TEK	Biological Characteristic or Harvesting Consideration
Whitefish scales washing up to shore	Indication of spawning
A specific water temperature determined through observation of the natural environment	Indication of spawning areas
Dragging for a particular bottom	Indication of walleye habitat/harvest areas
Fish start to move when the ice turns black and the ice is melting	Indication of migration, time for harvest.
Whitefish scrape algae off boulders during spawning time due to spawning pattern	Indication of spawning time and location
Walleye and/or whitefish eggs spotted in a given location	Indication of spawning
A specific water temperature determined through observances of the natural environment	Indication of nursery areas

The extent of TEK data was somewhat difficult to determine at times, as the Elders of Band # 40 obtained technical scientific knowledge (SEK), participating in test fisheries research projects. The Ontario MNR completed research projects yearly, from the implementation of the closure to the present. The Elders of Shoal Lake # 40 participated in experimental test fishery programs for the years of 1990 -1993. Water temperature was identified as a component, based in the scientific realm, utilized by the Elders of Shoal Lake in efforts to identify the locations of walleye populations (Redsky, F. 1995: pers. com.). However, as this knowledge has been incorporated into the TEK of the community, and as TEK is a dynamic rather than a static process, no distinction will be made.

4.1.1. Spawning Areas -- TEK

Walleye spawning areas were identified by confirmed positive sightings of walleye, or walleye eggs or scales in a particular area, during the spawning months of April and May (Figure 3). Walleye spawning area were defined as those areas possessing the following characteristics:

1. flowing water -- river current or current generated between islands -- lake spawning areas were located on the windward side of islands;
2. clean substrate -- gravel and small rocks, boulders;
3. shallow water levels -- > 1 m of water during the months of April\May;
4. attenuated light levels.

The Elders of Shoal Lake described several spawning areas with the Shoal Lake area, as listed in Table 6.

Table 6. Important Walleye River and Lake Spawning Areas of Shoal Lake
Source: (Oral Histories from the Elders of Shoal Lake Band # 40 [May 1994 through May 1995]).

River Spawning Areas	Lake Spawning Areas
1. Falcon River	1. Falcon Bay \ Waugh;
2. Powawassan Creek	2. Powawassan Creek area
3. Creek at Gull Bay, Shoal Lake Band #39	3. Snowshoe Bay
4. Creek at Rice Bay # 40	4. Indian Bay
5. Creek at Clytie Bay	5. Snake Lake
6. Creek stemming Canoe Lake	6. The city of Winnipeg water intake area
7. Creek at Bag Bay	7. North of Cash Island
	8. Mission Point \ New Bay\ Moosin Bay
	9. Rice Bay # 39
	10. Mackey and Black Fox Islands
	11. Silver Fox Island
	12. Rice Bay #40

Of the areas identified by the Elders of Shoal Lake #40, there are three critical spawning areas. First, the Falcon River area is still believed to be the primary spawning area for walleye. There is concern within the local community however, regarding the reductions in both the stream flow and river depth and its impact upon the spawning areas. There has

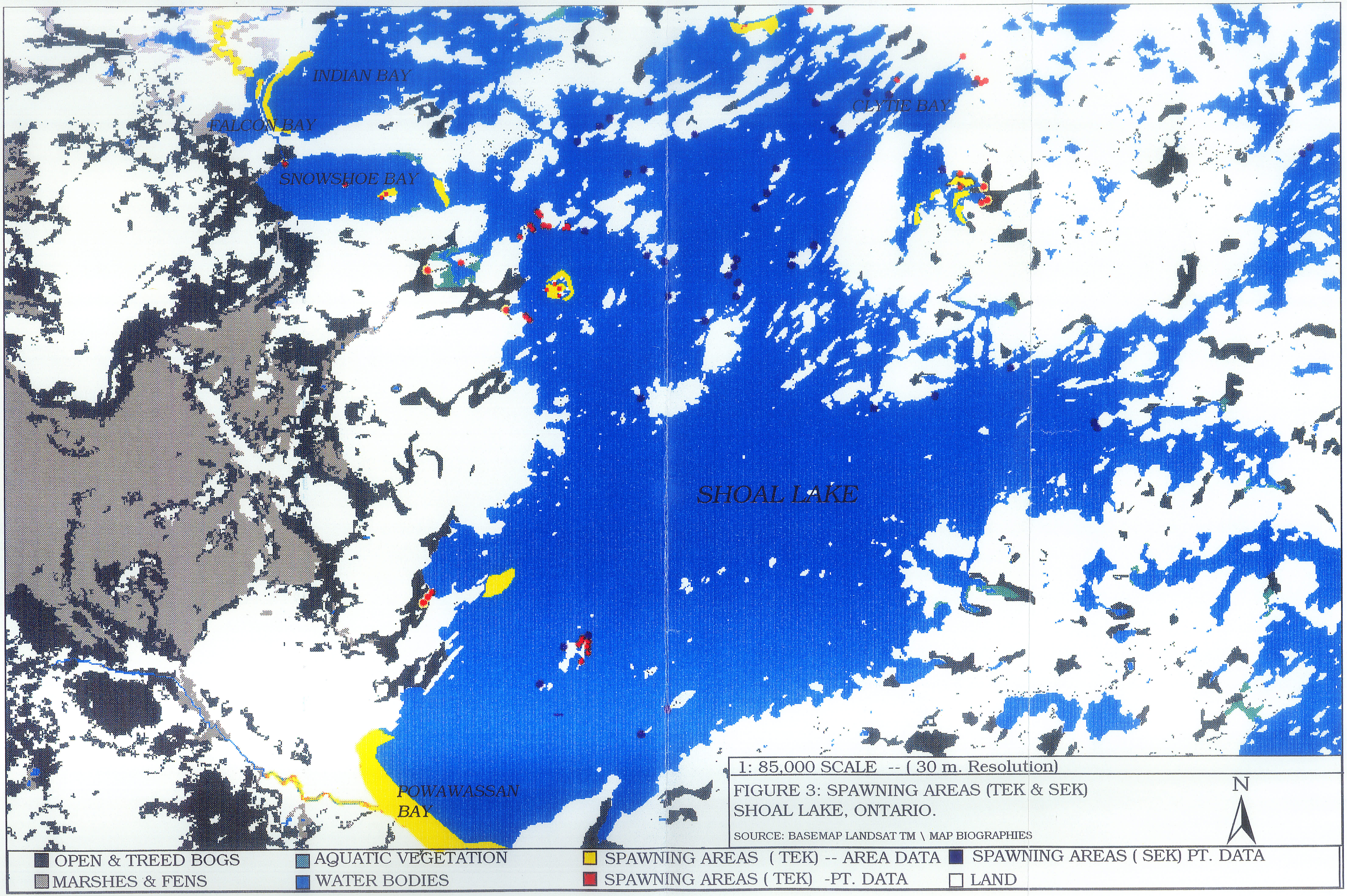


FIGURE 3: SPAWNING AREAS (TEK & SEK)
SHOAL LAKE, ONTARIO.

been a very appreciable drop in the river depth of Falcon River, in the last 25 years affecting accessibility of this riparian area (Redsky, F. ; 1994: pers. com.) . Redsky, F. (1994: pers. com.) suggests that reductions in the river depths may under certain environmental conditions -- low water runoff conditions -- lead to the stranding of walleye young -of-the - year or walleye eggs. Likewise, there is concern regarding the eutrophication of Falcon River and High Creek stemming from the cottage areas of Falcon Lake and the impacts upon spawning areas.

Second, the Falcon Bay \ Waugh area is considered to be one of the primary spawning area. The area is still considered to be of critical importance for the success of the walleye population.

Finally, the Powawassan Creek area is considered the an important spawning area. Walleyes are considered to be able to circumnavigate the beaver dams by swimming under the dams. There have been positive sighting of walleyes considerable distance upstream.

4.1.2 Nursery Areas -- TEK.

The term nursery area has no equivalent meaning in Ojibwa. Thus, determining such areas was problematic. However, areas were identified by asking where juvenile walleye may congregate after spawning (Figure 4). Nursery areas were identified by the affirmed presence of juvenile walleye during the months of April and/or May. Nursery areas were determined as having the following characteristics:

1. dense aquatic vegetation -- providing shelter from predators;
2. little velocity of flow and wave currents -- indicating shallow water;
3. proximity to spawning areas.

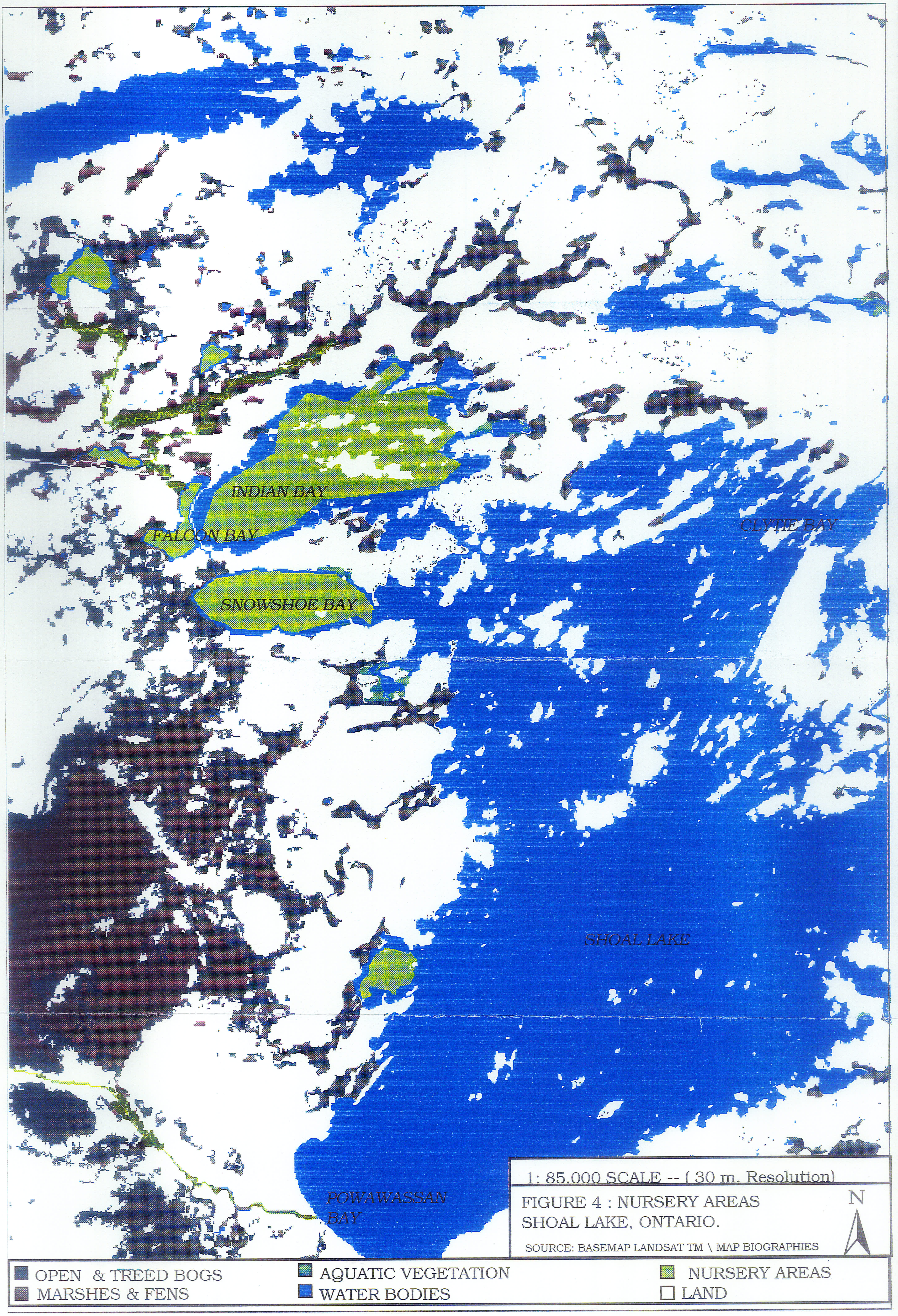


FIGURE 4 : NURSERY AREAS SHOAL LAKE, ONTARIO.

The following areas have been identified as potential nursery areas:

1. Snake Lake;
2. Falcon River;
3. Falcon Bay \ Waugh;
4. Indian Bay;
5. The north side of Snowshoe Bay;
6. Powawassan Creek;
7. Normandy Lake;
8. Mud Lake.

4.1.3 Biological Characteristics of Wild Rice Areas -- TEK.

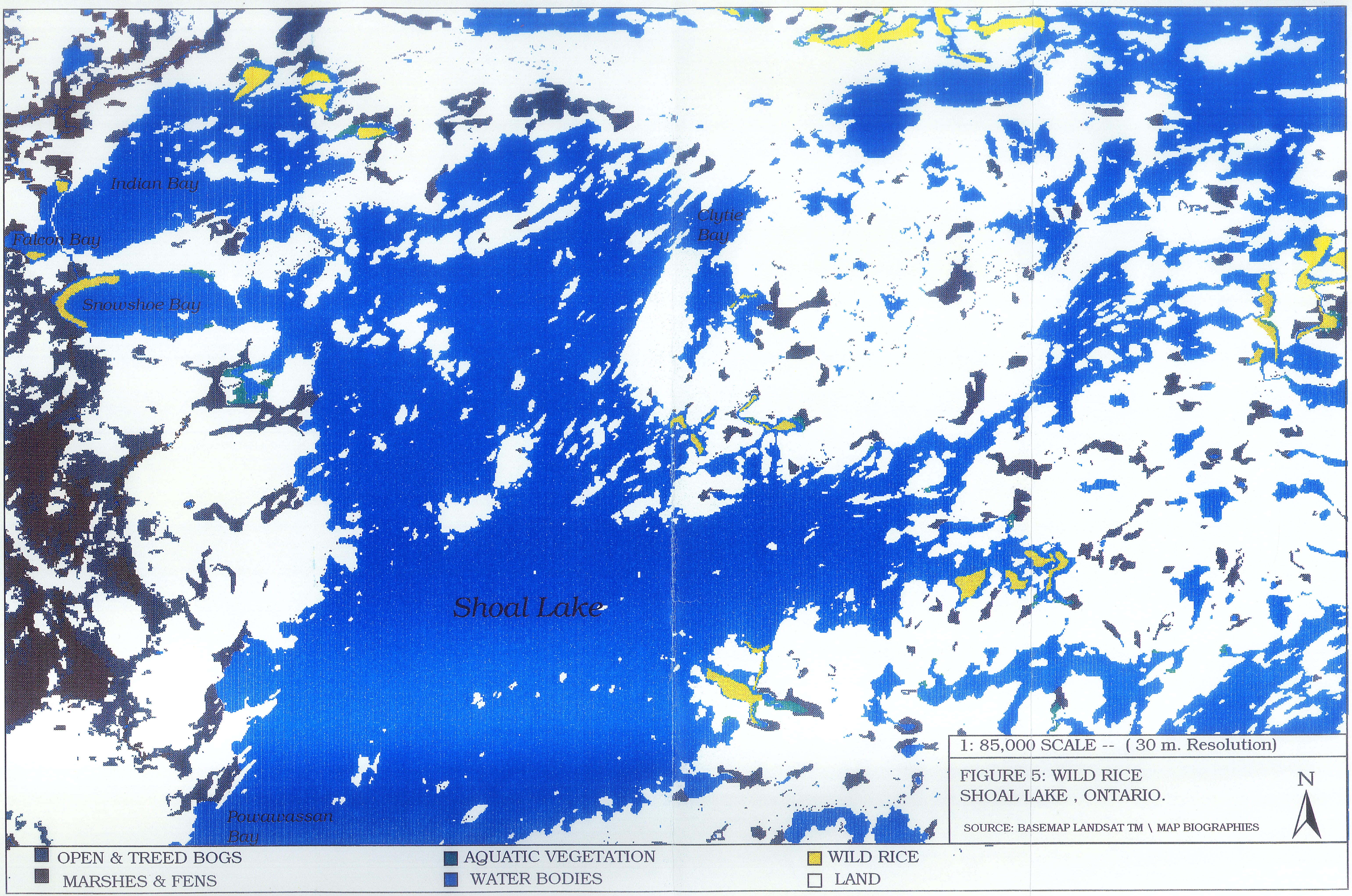
Wild rice areas which may also serves as important nursery areas, including (Figure 5) :

1. Snake Lake ;
2. Falcon Bay;
3. Snowshoe Bay;
4. First Bay;
5. Rice Bay # 39;
6. Bay past Rice Bay # 39 -- Indian Bay;
7. 2nd Bay past Rice Bay # 39 -- Indian Bay;
8. Crowduck Lake;
9. Bag Bay;
10. Labyrinth Bay;
11. Pine Island; and
12. Carl Island.

4.1.4 Biological Characteristics of Walleye (TEK) - Migration Routes.

Walleye migration routes were determined by cumulative experience of Elders and/or fishermen -- by the locations of harvest areas in specific time periods which were determined by trial and error and by observation of local conditions. In other words, walleye migrations were determined by asking, "where fish could be caught in different times of the year." Migrations were determined to follow broad patterns but vary seasonally with environmental conditions. The migration routes will of course be dependent upon the original spawning areas from which walleye disperse. For example, the primary spawning areas were determined to be the Falcon River\Falcon Bay and Snowshoe Bay areas.

For these areas, walleyes remain in the nursery areas of Snake Lake, and Snowshoe Bay, until the end of April. In May\June, walleyes disperse and begin to enter the areas of Snowshoe and Indian Bays. By June, walleyes move out of Snowshoe and


Indian Bay
Falcon Bay
Snowshoe Bay
Clytie Bay
Shoal Lake
Powawassan Bay
1: 85,000 SCALE -- (30 m. Resolution)
FIGURE 5: WILD RICE
SHOAL LAKE , ONTARIO.
N
SOURCE: BASEMAP LANDSAT TM \ MAP BIOGRAPHIES
OPEN & TREED BOGS
MARSHES & FENS
AQUATIC VEGETATION
WATER BODIES
WILD RICE
LAND

Indian Bays and migrate towards the more southerly parts of the lake. In July, walleye move into the weeds for protection from predators and due to their preference for muted light conditions. Around the end of July, walleyes disperse further out on the lake to deeper water or the area of neutral water or they may remain in the weedy areas. The particular dispersion seems to depend upon the environmental conditions during this time, including wave conditions, sun light, and lake temperature. Walleyes remain either in the weeds or in the deeper water until the middle\end of August when they to congregate on the shorelines. During the fall, walleyes congregate in large numbers on the shorelines and will be caught in various shoreline locations. During late fall, walleye begin to move into the shallower water and main spawning areas of Snowshoe Bay and Indian Bay. In winter, walleyes may be found in the shallow waters at the mouth of Indian Bay

4.1. 5 Harvest Data - TEK

Harvest data was collected through personal interviews and observations of the Elders and was recorded using map biographies. The exact location of use of harvest areas followed the seasonal migration of walleye and varied, depending on seasonal environmental conditions (Figure 6). Overlap areas are those use areas which were utilized in both the spring and fall.

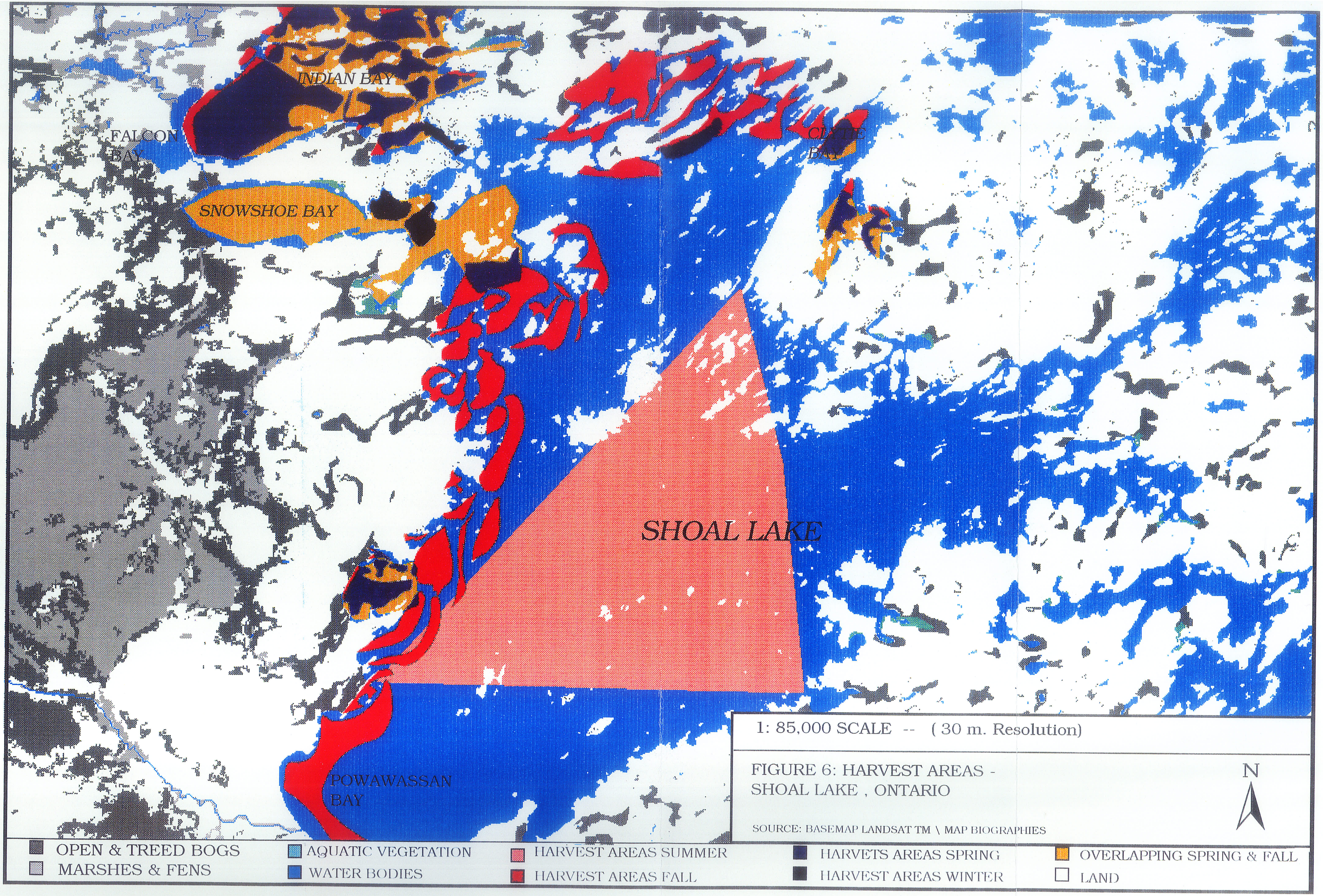
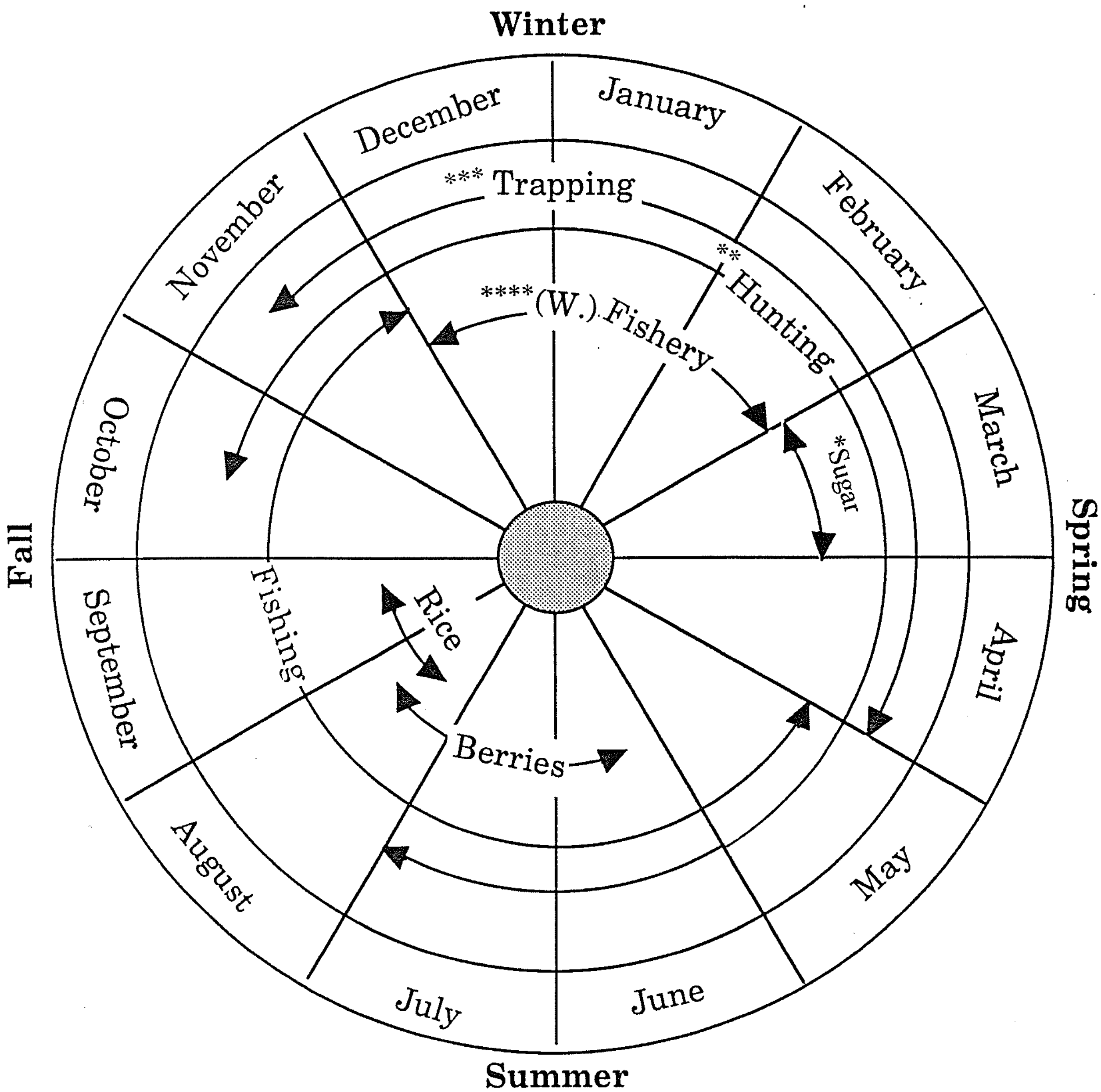


FIGURE 6: HARVEST AREAS - SHOAL LAKE , ONTARIO

Use areas were identified using "clues to locations" derived from trial-and-error and accumulated knowledge. For instance, for whitefish fishing, one would expect whitefish to be found in particular locations, having a clay bottom, deep water and colder temperatures. The Elders of Shoal Lake # 40 completed depth soundings of the lake. Rocks were dragged in a transverse pattern, attempting to identify areas of the lake possessing a clay bottom. These areas were identified as potential whitefish areas. The same procedure was undertaken in an attempt to identify walleye use areas. However, in this case, metal pipes were utilised to identify rocky ridges.

4.1.6 Harvesting & Conservation Practices.

Prior to the nineteenth century, both gill nets and trap nets were used in the area, during nineteenth and twentieth centuries (Redsky, 1972). Nets were made of birch bark for lake whitefish and walleye fishing (Redsky, 1972). The spring spawn fishery was a major event within the Shoal Lake communities and was an important part of their seasonal cycle. The seasonal cycles was based upon the arrival of certain species depicted by moon or sun phases. The Native People (Anishnaabe in Ojibwa) of the Shoal Lake Watershed moved with the seasons and seasonal activities (Figure 7) (Table 7) .



* Maple Sugar
** Hunting includes waterfowl, deer, moose, bear, and rabbits
*** Trapping includes muskrat, beaver, ermine, mink, marten, and otter
**** Winter Fishing

Figure 7. The Seasonal Land Use of Shoal Lake #40 Band

Table 7. Seasonal Activities based upon Sun cycles, Shoal Lake, Ontario.
Source: (Oral Histories from the Elders of Shoal Lake Band # 40 [May 1994 - May 1995]).

Month (English & Ojibwa)	Seasonal Activity
December (Manitou-geezisohns -- the little sun spirit)	ice fishing season, lasting until February
Early March (Namaebini-geezis – the sucker sun)	the sucker spring fishery, and the muskrat trapping season, lasting until May
March\April	the northern pike and walleye spawn fishing season, lasting until May waterfowl hunting season, lasting until late April maple sugar tapping of the Manitoba Maples, lasting until the end of April
Mid June (Odaemine-geezis -- the strawberry sun)	the berry picking season, lasting until late August
Late August to early September (Minomini-geezis -- the wild rice sun)	the wild rice season which would last until mid - September
October (Benauquae-geezis -- the fall leaves sun)	the whitefish spawn fishing which would last until mid November
November (Kushshkudini-geezis -- the freeze up sun).	trapping season, lasting until May

During the winter months, Indian Bay would primarily be fished in the late fall (after the fall whitefish fishery). When this area would freeze up, the Anishnaabe of Shoal Lake Band #40 would move out to the regions of the "big lake " the unprotected parts of Shoal Lake (Redsky F., 1994: pers. com.). Hunting and trapping would also occur at this time.

During the spring, fishing was the principle seasonal activity. The spring fishery was communally used and owned. Communal feasts were held at the beginning of the spawn fishing seasons and the duck hunting (Redsky, H., 1995: pers. com.). Fishing was an individual or kinship based activity and fishing areas were utilized by particular families (Redsky, H., 1995: pers. com.). For instance, the Powawassan Creek area was a spring use area utilized by the Redsky extended family. Due to the lack of refrigeration, fish and meat (pemmican) were dried and stored for future use. Coarse fish were used for feed for dog teams.

During the summer months, berry picking, fishing and agriculture were the primary activities. Berries were dried and smoked on a smoke rack in the past and would be store in bark baskets for future use (Redsky, F. , 1995: pers. com.). Berries were sold in Kenora in order to buy staples. During the spring and summer months corn, pumpkin, potatoes and other root vegetables were grown which were stored in root cellars (Redsky, H., 1995: pers. com.).

During the fall months, wild rice picking, fishing, hunting and trapping were the primary activities. A feast (Wekwandah) was also held prior to the wild rice harvest (Redsky, F. 1995: pers. com.). The rice harvest was controlled by a Rice Committee, as "the Elders knew when to go picking by knowing the ripeness of the wild rice" (Redsky , F. , 1995: pers. com). The committee would be chosen by the community (Rogers, 1982). Harvesting was set and allocated by the committee (Rogers, 1972:28). The harvest would last on average "three to four weeks of good picking time" (Redsky , F. 1995: pers. com.). Wild rice would be roasted and processed. Hunting deer and moose, and whitefish spawn fishing would also occur at this time. Species trapped at this time included: beaver, muskrat, ermine, mink, marten, and otter (Table 7). The trapping season was the main source of income generation.

4.1.7 World View -- TEK

Firstly, the terms "management", "manage" , " resource" and "land" have no equivalent in Ojibwa (Chapeskie, 1995: pers. com. written). When these terms are used in potential management agreements, they have critical cultural significance. More specifically, the tenants of an alternative world view which have existed within the Shoal Lake communities in the past and may still exist in some form include: utilising what was needed ; minimising waste -- nothing was thrown away; and connecting with the land (Redsky, A, 1995: pers. com; Redsky, F., 1995: pers. com. ; and Redsky H., 1995: pers. com.). The alternative world view of the Anishnaabe had directly resulted in a system of management of the natural resources that sustained the resource. The Anishnaabe common property arrangements were concerned primarily with equity and the regulation of access to and use of the resource (Chapeskie, 1995: pers. com. written). Simply, people would not overexploit a resource as "you needed to leave some seed for a rainy day ... in order to have deer, moose fish available next year, in five or ten years time" (Redsky , F. 1995: pers. com.).

Although somewhat isolated, Shoal Lake was not immune to acculturation. For instance, the particular details of the management system could not be recalled. The traditional harvesting practices of local fishermen have been altered dramatically due to the granting of non-native licenses over the commercial fishery. Due to the implementation of a licensing system and an "open waters " open access area, the fishery was relegated to a common property system (rivalous and non-exclusive) with all the problems of such a system. Western ideals such as competition were encouraged by the Ontario MNR and traditional ideals such as sharing and conservation were discouraged. Kinship based redistribution systems have deteriorated in favour of competition and personal gain. Kinship based redistribution systems do not exist on the scale they once were, but they still remain.

In addition, the influence of Presbyterian and Roman Catholic missionaries was far reaching. Presently, there exists a split between traditional and Christian sections of the populations at Shoal Lake. Christianity has undoubtedly further impacted upon the conservation practices employed by the Elders and/or fishermen at Shoal Lake. Christianity has led directly to the demise of some local rituals, myths and stories (Redsky 1972). For instance, no myths or legends related to the fishery could be recalled by the Elders and/or fishermen of Shoal Lake Band # 40. Such myths do exist for hunting and trapping. This lack of myths related to the fishery seems improbable as the Anishnaabe of Shoal Lake were primarily a fishing culture. Redsky (1972) suggests that myths and legends have been lost. Perhaps, this is the case. Nonetheless, Shoal Lake Band # 40 is a traditional community. Local rituals and cultural activities are gradually being revitalized and are increasingly practised (Redsky 1995: pers. com.).

4.2 Biological and Harvest Data - SEK

4.2.1 Spawning Areas - SEK

Walleye spawning areas were identified by positive sighting of walleye or walleye eggs in a particular area, during the months of March\April -- walleye spawning time, during annual test fishery projects .

Walleye spawning areas were determined as having the following characteristics (Scott and Crossman, 1973; Kitchell et al., 1977; Mathias, 1994 : pers. com.):

1. water depth < 1 meter;
2. water flow of 0.6 - 1.1 meters per second -- indicating high oxygen content;
3. clean substrate -- cobble sized stones \ gravel bottoms (may also utilise sandy bottom areas that meet the additional conditions;
4. water temperature of between 6-8 Celsius;
5. prevailing westerly winds -- SW, NW;
6. reduced light penetration.

Scott and Crossman (1973) suggest that walleye populations remain in discrete stocks with separate and distinct spawning grounds. Distinct stocks were found in the following areas:

1. Falcon River;
2. Mackey and Black Fox Islands;
3. Silver Fox Island ;
4. Big and Little Cameron Islands;
5. Starting Point and the Island off Starting Point;
6. Islands in Clytie and Bag Bays.

Preferred spawning areas were determined to be the river locations; and the locations of walleye lake spawning areas which mimic river habitat (Mosindy, 1994: pers. com). The primary river spawning area has been identified as Falcon River (Figure 3). The Falcon River area has declined in importance as a spawning area over time due to a deterioration of walleye spawning habitat, despite periodic improvements to spawning habitat in the Waugh area (Mosindy 1994: pers. com). Threats to fish habitat which may be present in the Falcon River area include: blockage of stream flow and subsequent reductions in stream flow and stream depth; increases in algae growth and decreases in oxygen content; and releases of municipal waste water from the municipality of Falcon Lake.

The importance of the lake spawning areas has increased over time. The walleye are believed to have adjusted to lake spawning areas (Mosindy 1994: pers. com). The other rivers in the watershed were primarily dismissed as important spawning areas, as they were determined to be intermittent. Beaver dams have become more visible on the spawning areas due to the drop in the price of beaver pelts. It is believed that spawning walleye can not negotiate the beaver dams to reach spawning areas beyond the dams. Thus, these other river systems are believed to have limited spawning potential.

4.2.2 Biological Characteristics of Walleye Nursery areas -- SEK

Walleye nursery areas were identified by the presence of juvenile walleye caught in random trap nets, during yearly sample testing for walleye. Nursery areas were determined to have the following characteristics :

1. cover - indicating aquatic vegetation or lake structure; and
2. shallow water -- less than 1.0 meter deep.

4.2.3 Biological Characteristics of Walleye (SEK) - Migration Routes

Migration routes for walleye were determined by the use of tagging and recovery of walleye in prior testing programs, conducted at Waugh. Walleye migration was dependent on the water temperature of the lake, and subsequently, upon the spring and fall overturn -- the mixing of upper and lower strata in the lake. As the temperature increased in the summer, walleye dispersed into deeper water. And , as the temperature decreased in the fall, walleye dispersed to shallower water along the shore. Scott and Crossman (1973) suggest that walleye movement result from spawning activities, daily movements in response to light conditions and daily or seasonal movements in response to temperature or food availability.

Scientific evidence seem to suggest that there is not a strong migration from Shoal Lake to Lake of the Woods. The few migrants that do migrate to Lake-of-the-Woods from Shoal Lake are treated as outliers and are not considered as scientific proof of strong migration.

4.3 THE SHOAL LAKE CO-MANAGEMENT AGREEMENT

Although a formal agreement was never entered into by the Anishnaabe fishermen from Shoal Lake #39 and #40, they were involved in a series of meetings with district and manager level personnel from the Ontario Ministry of Natural Resources, regarding the whitefish and walleye fisheries (Chapeskie, 1995: pers. com. written). Both parties were sincere in and committed to their participation in the agreement and there was a consensus on the need for a formalised arrangement (Chapeskie, 1995: pers. com. written).

Regarding the walleye and whitefish fisheries, the level of co-management was originally at the isolation level of co-management in which the community is neither informed nor involved in the decision-making process (Table 4). The closure of the walleye fishery and the reduction of the whitefish fishery were implemented with no consultation with or input from the community and no advanced warning was provided for the community (Redsky, J. 1995 : pers. com.) . For instance, more than one of the Elders and/or fishermen had bought new nets for the 1983 fishing season. Later, the community was informed about the decision by a notice that was posted at the Band offices of Shoal Lake Band # 39 and #40. During this time the Elders and/or commercial fishermen were highly regulated by the Ontario MNR. At both levels of co-management --isolation and informing -- the local user of the resources, the Elders and/or fishermen governed their actions but were subject to provincial regulations and enforcement .

In 1989, the informal co-management agreement had reached the consultation level in which the community was given input into the research agenda (Table 4). The Elders and/or fishermen of Bands # 39 and # 40 wished to commence increased commercial fishing quotas for whitefish and believed that whitefish could be harvested without negatively impacting upon walleye stocks (Redsky , F. 1995: pers. com.). The MNR concern was that any increase in whitefish commercial fishery would detrimentally impact walleye stocks which were in low numbers (Mosindy, 1995: pers. com.).

The result of the meetings were:

1. that many of the Elders/fishermen were not willing to participate further in the project, the Elders and/or fishermen were frustrated by the fact that their custom and world view relating to the fishery had not influenced the decision-making process (Chapeskie,1994: pers. com. written report);

2. that the project was concluded;

3. that the local communities basically ignored the MNR licensing quotas and created their own management strategy -- setting and enforcing quotas locally (Chapeskie, 1994);

4. that the meetings proved fruitless. Community concerns had not adequately entered the research agenda and real communication had not been established. Thus, the co-management arrangement never reached past the consultation stage of a co-management arrangement despite commitment on both sides. The communities had little effective power of influence due to provincial jurisdiction to manage the inland fisheries and subsequently their threat of legal sanctions (Chapeskie, 1994). The process was heavily weighted towards the dominant world view and its concepts of scientific Management (Redsky, F. 1995: pers. com.);

5. that the divergence of the two knowledge systems (on certain aspects of management) was highlighted . For instance, the location of the initial test sites for the test netting program proved to be one of the most formidable problems. The Elders at Shoal Lake Band # 40 were perplexed by the selection of the sites. The selection criteria for scientific knowledge emphasises randomization and replication of test sites. However, the Elders held the perspective that walleye could not be caught in such sites and the results would not accurately answer the proposed questions and the specific objectives of the program (Redsky, J. 1995: pers. com).

TEK and scientific techniques have access to different information bases and derive different data; TEK derives qualitative rather than quantitative data obtained through scientific techniques (Johnson, 1993). Not surprisingly, the differing systems of knowledge conflicted and lead to specific conclusions on the appropriate testing procedure to be employed and the overall nature of the fishery. In addition, the differing systems of knowledge had lead to conflicting conclusions concerning the health of the fishery and the steps to manage the resource (Table 3).

CHAPTER FIVE

DISCUSSION

5. 0 BARRIERS TO EFFECTIVE MANAGEMENT

The barriers to effective management primarily stem from two different knowledge systems, TEK and SEK. Stemming from divergent knowledge systems, two differing conclusions of the status of the walleye fishery and the actions required to effectively manage the walleye resource have emerged. In addition, the terms used in fisheries management have different interpretations. These differences have resulted in misunderstanding and mistrust which has hindered the establishment of a co-operative process to manage the watershed.

5.1 CONFLICTING TERMS

While completing research at Shoal Lake, it became readily apparent that differing interpretations existed as to the nature of the terms involved in fisheries management (Table 8). For example, the term "coarse fish" had two distinct meanings: the secondary prey species, involving species such as yellow perch, tullibees, shallow water ciscos and white sucker; and the secondary species for commercial marketing, involving species such as northern pike, whitefish, and white suckers. This lack of commonality of terms and differing shades of meaning have led directly to misunderstandings between the parties concerned. Subsequent misunderstandings have negatively impacted upon the effectiveness of fisheries management, as the Shoal Lake Elders and/or fishermen have indirectly opposed and directly confronted the fishery regulations .

5.2 CONFLICTING VIEWS ON THE NATURE OF THE FISHERY

While conducting the literature review and primary interviews with the community members, it became readily apparent that conflicting perspectives existed on various issues concerning the fishery (Table 9). These views are presented in the order they appear in the table.

Table 8. Summary of Conflicting Terms
Source: (personal interviews of Elders of Shoal Lake Band # 40; Mosindy, T., 1995: pers. com.)

Term	Ojibwa Interpretation	MNR interpretation
1. Coarse Fish	Non - commercial species; the term is applied to suckers, but may also include northern pike and lake whitefish.	The secondary prey species; the term includes yellow perch, tullibees, ciscos and white suckers.
2. Migration	The term (Pemeayahway) refers to the travelling or movements of fish species in large numbers, related to food abundance.	Mass migration of species in and out of Lake-of-the-Woods.
3. Land	The term (aki) refers to earth, rocks, and other land forms which is not owned or tenured. Likewise, the term (Nokomis) applies to the spiritual relations with the land; it is believed to be alive and a trust for future generations.	Earth or other land forms which is owned or tenured; rights of use preclude other peoples use of and access to the area.
4. Allocation	No equivalent	The rights to access and use to an area.
5. Nursery Area	No equivalent	An area in which juvenile walleye will congregate for food and shelter prior to going out on the larger part of the lake.
6. Management	No equivalent	The system in place which defines rights of use and access to a particular resource.
7. Resources	No equivalent	Various definitions of this term exists; however, it usually applies to organic and inorganic parts of local ecosystems which can be utilized for human benefit.
8. Juvenile walleye	No equivalent	Young-of the year walleye.

Table 9. Summary of Incongruities over Walleye Fishery Management at Shoal Lake
Source:(personal interviews of Elders of Shoal Lake Band # 40; Mosindy, T., 1995: pers. com.)

Incongruity	Scientific View	Traditional View
Did a walleye fishery problem originally exist?	Yes, a problem existed with the age class within the population.	No, low levels were perceived to be part of natural fluctuations.
What are the effects of "over harvesting?;"	Serious changes have occurred in the population structure of the walleye.	Fish can be over fished to cause impacts but not to a point of collapse due to migration of walleye.
What are the impacts of the closure?	The closure should have lead to an increase in the walleye population.	The closure has done more harm than good. Lack of fishing has resulted in increased growth of other species.
Why has the walleye population not recovered?	It has been due to environmental reasons and deteriorating walleye habitat, especially at the Waugh, Falcon River area.	It has been due to increases in the #s of coarse fish which have displaced walleye niches.
What is the current state of the walleye population?	The fishery is starting to recover but the protection of the dominant age classes is critical.	The walleye population is "overgrown." There is concern over the heath of the population due to increasing signs of disease.
What are the impacts of the fishery closure?	The removal of pressure on a species should lead to an increase in its abundance and an increase in the age classes.	The closure has done more harm than good; the lack of fishing has resulted in increased growth of other species.
Do walleye migrate to Lake of the Woods and back?	Only a few individuals migrate.	The walleye migrate frequently between lakes.
How do you manage the walleye effectively to produce a sustainable harvest?	Continue the fishery closure.	Continued use of the walleye is required but with "rest" periods. The implementation of experimental fisheries designed to reduce the numbers of "coarse" fish, primarily suckers and northern pike.

The Elders and/or fishermen of Shoal Lake Band # 40 suggested that there was not a problem in the fishery at the time of the closure and that the available stock of walleye exceeded MNR quota levels. The Elders and/or fishermen disputed the findings of the Ontario MNR and contend that the walleye fishery had not collapsed. For instance, they suggest that the scientific analysis of the walleye fishery had missed critical spawning areas (Campbell, 1993: pers. com.). In other words, the random placement of the test netting sites directly affected the conclusion that there had been a collapse of the walleye population. Periodic declines were deemed part of natural cycles where highs and lows were indicative of the appropriateness of the use of the walleye. Declines were also perceived to be directly induced by conflicting land uses, including: increased cottage development and associated angling by non-native fishermen, and increased infrastructure development such as the Winnipeg Aqueduct, causing associated disruption and alteration of water flow patterns.

Representatives of the Ontario MNR contend random sampling is critical for and the basis of statistical inquiry and that there are strong statistical reasons for random sampling. Fisheries biologists emphasize that there were serious problems with the age class structure of the walleye population and few strong age classes were thought to exist within the walleye population (Macins, 1979; Borecky, 1980; Roos et al., 1983; and Wilgress, 1989). For instance, in 1981, one age class was thought to comprise most of the walleye population, the 1979 year class or the two years age class (Roos et al., 1982). In 1980, a quota system was believed to be necessary to limit harvesting and ease pressure on walleye populations (MNR, 1982). In 1983, the Ontario MNR initiated a full closure of both the commercial and sports walleye fisheries (MNR, 1985; MNR, 1982). The initiation of the closure was a result of a perceived problem with the age class structure and a result of a series of observations, including: MEI related to harvest-- a first estimate of population abundance; the percentage of immature fish in the harvest, the growth rate, and the catch-per-unit-effort (CPUE) (Mathias, 1995: pers. com.). The closure was primarily intended to protect the (1979) year class, the dominant class in the walleye sample population (MNR, 1986). Walleye spawning success was believed to be inevitably dependent upon one dominant (1979) year class (MNR, 1988; Wilgress, 1989). The age class distribution was perceived as an indication of a stressed population (Borecky, 1980; Pope and Foster, 1982; and Roos et al., 1983).

Within the local community there exists a perspective that fishing out a particular species is very difficult due to the migration of walleye, resulting from food availability and subsequent dispersion into Lake-of-the-Woods or different parts of Shoal Lake. Due to the overlapping territories and conglomeration of fish species for most periods of the year, it is difficult to separate walleye as a species. Thus, walleye would not be the only species caught.

The current scientific perspective is that over-harvesting of walleye directly resulted in not only an inadequate age classes structure within the walleye population but also increased harvesting of immature walleye (MNR, 1982; MNR , 1992). MNR officials concluded that problems with the total population were inevitable due to the stresses on the population - primarily overfishing. Macins (1979) contends that the usual signs of a stressed population which occurred in Shoal Lake included:

1. high fluctuations in the harvest rates/catch Per Unit Effort (CPUE) of the species under stress - which was an indication of the destabilization of the fishery;

2. accelerated growth rates -- which caused immature walleye to become increasingly susceptible to capture in commercial gill nets of fixed mesh size;

3. decreasing mean age and size of the species under stress -- which was experienced in walleye populations;

4. high percentage of immature females in the spring harvest, which removed the females from the population before they could spawn, and subsequently, reduced the spawning stock;

5. decreasing importance of the walleye population in the total fish community;

6. increasing importance of other species and the increasing ability of other species to displace walleye populations or take over the "niches " vacated which caused walleye populations to be displaced by northern pike and lake whitefish populations;

7. a marked shortage of young walleye in the populations, which provided an indication of poor survival of juvenile walleye.

Under scientific fisheries management, excessive fishing pressure was perceived to cause serious changes in the structure of the fish population, including (Evans et al., 1987):

1. inflicting increased and differential mortality - resulting in reduction of the average size of the population, and simultaneously reducing intraspecific competition, suggesting increased growth rates;
2. reducing the number of cohorts comprising the spawning stock;
3. reduction of the size of prey taken and increasing the number of potential predators.

Excess harvesting rates disrupted both size and niche structures of the walleye population and brought immature fish into the fishery (Evans et al., 1987). Increased food abundance, stemming from the removal of part of the fish community resulted in increased growth rates among immature walleye (MNR, 1982). Increased growth rates subsequently resulted in increased vulnerability to capture and an eventual decrease in the overall spawning stock (MNR, 1982). Evidence supporting this position was an indication of a potential collapse of the walleye population and the oscillation in the fishing yield and catch per unit effort figures from year to year. Catch-per-unit-effort variation in MNR test net fishing is represented in Figure 10.

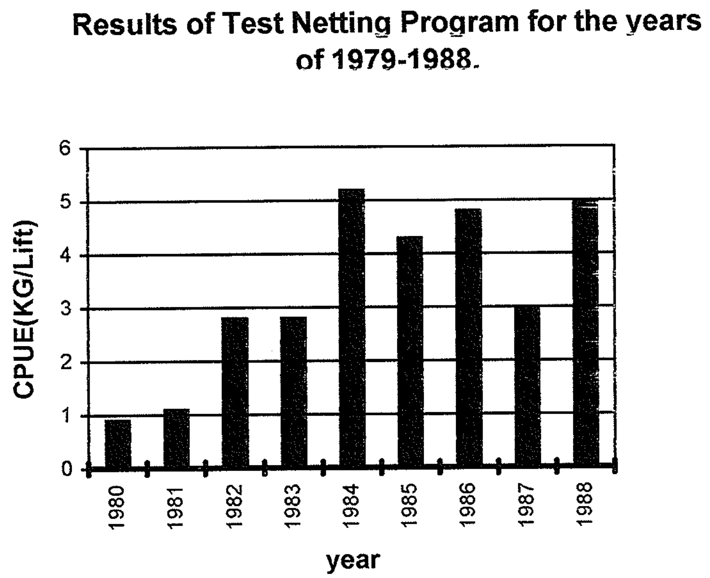


Figure 8. Summary of Catch Per Unit Effort for Walleye (Kg/Lift)

The test netting program was based upon the statistical procedures of randomization and repetition. It timed to coincide with the walleye spawning run and was completed during the same time period. In the past, the test netting program was comprised of a series of mesh sizes from 3.8 cm. to 12.7 cm. in 1.3 cm. increments (Roos et al., 1983). More recently, trap nets have been utilized (Wilgress 1989). The length of the set was 24 hours (Roos et al., 1983). The variables recorded included: age, total length, weight, stomach contents, signs of disease, and sexual maturity (Roos et al., 1983; Wilgress, 1989). The primary test area was the Waugh Falcon River/ Falcon Bay area (Figure1).The data provided "trend-through -time data" for population dynamics – relative abundance, growth rates, and age class and year class structures (MNR, 1982; Roos et al., 1983; Wilgress, 1989).

The Elders of Shoal Lake Band # 40 suggest that as a direct result of the fishery closure, walleye stocks have reached a state of imbalance. Other species have displaced walleye from their niches. Thus, the closure did more harm than good as it removed pressure not only on the walleye stocks but also on other populations, allowing for their increased growth. The Elders of Shoal Lake contend that the walleye fishery is now overrun with coarse fish - primarily white suckers, northern pike and lake whitefish. They suggest a continuation of the walleye fishery which would remove not only a percentage of the walleye populations but would trim all other species. Also, the Elders and/or fishermen suggest fishing out the coarse fish. The Elders of Shoal Lake #40 further suggest that walleye can be isolated by lake temperature. Whitefish have a preferred lake temperature to which they gravitate which is cooler than temperatures preferred by walleyes. Further, walleye or coarse fish may potentially be isolated by differing harvesting periods. The isolation of coarse fish during different temporal periods may also be possible, as "walleye catches are restricted almost exclusively during the dark", whereas, "pike catches were restricted to daylight periods" (Bodaly, 1980).

Prior to the closure, coarse fish -- perch, white suckers, and mullets -- were sold for external markets (Redsky, J., 1994: pers. com). For instance, a market existed for white suckers supplied to mink farms for feed. These external markets removed a percentage of the coarse fish population and allowed for their continued use. These markets disappeared with the emergence of the Freshwater Fish Marketing Board due to the emphasis on more commercially profitable species such as walleye. The Elders and/or fishermen of Band # 40 suggest that these external markets also disappeared due to the implementation of gear restrictions associated with the closure of the walleye fishery. They also contend that there are markets for not only suckers, but also whitefish, northern pike and perch which are not being utilized.

This suggestion that walleye numbers have not recovered with the closure of the fishery flies contrary to current fisheries management analysis. The removal of pressure on a particular resource should lead to its increased abundance - barring other factors. An increased representation within the age class structure of the walleye population should also have resulted.

Generally, in fisheries management, there exists a dynamic equilibrium with finite limits around which fish populations fluctuate with steady variance (Evans et al., 1987). Natural fluctuations are part of cyclical relationships in walleye populations and can be substantial. Typically, strong year classes occur every 4-5 years cycles and they will reoccur if reasonable conditions are present (Mathias, 1994: pers. com.). The conditions which may result in a strong year class in river spawning walleye include:

1. high water levels and stream flow at spawning time ;
2. high spring run-off (strong run off after the peak flow); and
3. rising water temperatures without temperature reversals

Source: (Bodaly, 1980; Craig and Babuluk, 1989).

The conditions which indicate a strong year class in lake spawning walleye include:

1. gradual warming lake temperatures without reversals of ice pans (surface conditions which prevent mixing of water layers) ;and

2. calm lake conditions without excess wave action which may lead to grinding of wave on the spawning areas, dislodging walleye eggs

Source: (Mathias, 1994: pers. com.)

Walleye and other top predators play an important role in freshwater aquatic ecosystems, as *"allogenic engineers,"* altering the structure of their environment through alterations of energy flows and nutrient cycles (Kristofferson, 1994). Under population ecology, walleye populations have a stabilizing effect on the abundance of prey species (Evans et al., 1987). The implication of these statements is that the removal of large numbers of walleye may have resulted in a change in both the fish community and the environmental structure. An increase in the available prey species of yellow perch and brown bullheads may result in reduced spawning success of the walleye population due to their predation on walleye eggs and larvae (Wilgress, 1989). Colby et al. (1987) suggest that the recovery of walleye in the Bay of Quinte in the Great Lakes region was the direct result of the reduction of predation of White perch (Morone americanus) on walleye larvae (Evans et al., 1987).

Previously, there was little concern about the impacts of increasing numbers of coarse fish in fisheries management at Shoal Lake. Northern pike numbers were also decreasing and age class problems existed within the population (Macins, 1979). But, declines and age class problems within northern pike populations did not exist to a similar extent of those in walleye populations.

The Elders of Shoal Lake Band # 40 contend that the primary cause of the lack of recovery of the walleye fishery is the increasing numbers of coarse fish in Shoal Lake. Due to the interval of inactivity on the lake, a change in the dominant constituents of the fish community has taken place. They base this conclusion on the catch changes within the subsistence fishery; they are now catching whitefish and northern pike where they once caught walleye. There is also a concern about the increased relative uniformity among the walleye population and its impact on the survival of younger walleye, as large walleye will consume their own species.

The Elders of Shoal Lake Band #40 perceive a secondary cause for the lack of recovery of the walleye population is sustained angling pressure. Catch rates for angling were greatly underestimated in the past (Redsky, J., 1994: pers. com.). Present angling by non-native cottagers is substantial (Redsky, H., 1995: pers. com.). Younger walleyes (approximately 2-4 year olds) are preferred by the band members to older individuals of the population (Redsky, J. Jr., 1994: pers. com). Thus, angling has an increasingly selective effect on the walleye population, primarily affecting the immature cohorts of the populations, and reducing their survival rates.

A tertiary cause of the lack of recovery of the walleye populations has been identified in both the scientific and local communities as environmental (Wilgress, 1989). Unseasonable weather conditions have been identified as a critical factor in spawning success of walleye at Shoal Lake (Wilgress, 1989). Bodaly (1980) suggested that walleye spawning requires a minimum stream temperature of 5 degrees Celsius. Critical conditions for a suitable spawning run include: rapid and steady increases in temperatures and constant moderate stream flow (Bodaly 1980).

Various environmental factors may affect the spawning success of the walleye population, including:

1. A temperature inversion -- the onset of unseasonably cool weather after the commencement of the spawning run -- can seriously impact on the success of the spawning run. A slowing or complete stoppage of the run can result due to cooler stream temperatures and/or increases in stream discharge;

2. A drop in temperature after the spawning time when the larvae are starting to feed can again result in drastically reduced spawning success;

3. A reversal of the pan ice in the spawning shore will result in grinding of the rocks and the dislodging of walleye eggs. This dislodging of walleye eggs will result in drastically reduced spawning success;

4. A reversal of the pan ice prior to the spawning activity can prevent access to the spawning beds and result in drastically reduced spawning success;

5. Other species which may spawn over walleye eggs or roil up silt and cover walleye eggs and may deter a recovery of a walleye populations

Source: (Bodaly, 1980; Mathias, 1994: pers. com. ;MNR, 1982; Scott and Crossman, 1973).

The Elders of Shoal Lake Band #40 suggest that the walleye within Shoal Lake *"are overgrown"*, denoting the dominance of the 1979 year class or 15 year age class within the population. They are very concerned about the health of the population due to an increased sightings of unusual marking, coloring and tumors on individual walleyes and increasing uniformity of the population. The community of Shoal Lake Band # 40 have instigated a research program in which fish having any unusual markings are kept for analysis. The Elders and/or fishermen suggest that the large walleye should be reduced in numbers on a limited basis, using large mesh gill nets. The intent of this suggestion is to reduce or remove the diseased portion of the population, resulting in a healthier population .

The current scientific perspective on the walleye fishery is that the walleye population is slowly beginning to rebuild, for instance, a strong year class was documented by Ontario MNR personnel for 1987 (Mosindy, 1994 : pers. com.) This conclusion was based upon signs of spawning success, occurring for the years of 1991, 1993 and 1994 (Mosindy, 1994: pers. com.). However, the walleye population is still dependent upon three dominant year classes -- the 1979, the 1983 and 1987 year classes (Mosindy, 1994: pers. com.). These age groups suggest that "strong age classes do not arise in six year cycles from previous strong age classes, assuming the fish do not mature until six years of age" (Mathias, 1995: pers. com.).

There is also concern in the scientific community that this older cohort of the population -- the 1979 year class -- representing the spawning stock of the populations is beginning to die out. As ages of 26 years of age are possible, this concern may be premature

(Mathias, 1995: pers. com.). Scott and Crossman (1973) estimate maximum age of walleye at approximately 20 years in Northwestern Ontario.

The reproductive capacity of walleye is 60,000 eggs per kilogram on average (Mathias, 1994: pers. com.). Reproductive capacity is found by using the following formula: the number of eggs per female times the size of the female (Mathias, 1995: pers com.). Scott and Crossman (1973) suggest that walleyes of 15 years in age and 69.5 cm. in length, reaching a weight of 4.85 kg have a reproductive capacity per female walleye of 291,600 eggs. However, Scott and Crossman (1973) further suggests that a high of 612,000 eggs per female walleye 81 cm in length has been cited. Walleye of similar size may be found in Shoal Lake. Thus, MNR officials emphasize the importance of protecting the walleye stock, and in particular, this older cohort. Any potential renewal of the walleye fishery or alternative fisheries that would negatively impact walleye populations will be opposed.

The Elders of Shoal Lake Band # 40 suggested that walleye and all other species of fish migrate through Ash Rapids to Lake of the Woods. There exists a local belief that walleye do migrate (Redsky, F. 1994: pers. com.).

The current scientific perspective is that the few migrants which do travel to Lake-of the-Woods do not provide scientific proof of migration. MNR personnel cite evidence which they feel suggests that walleye do not migrate, including:

1. differences in mercury levels in walleyes -- walleye caught in Shoal Lake have low levels of mercury , conversely, walleyes caught in Lake of the Woods have relatively high levels of mercury in sample tissues;

2. differences in population dynamics--Saugers (*Stizostedion canadense*) not being present in Shoal Lake but being present in Lake-of - the -Woods;

3. differences in age class structure -- the age class structure is dependent primarily upon one dominant age class and one moderate age class. The age class structure within Lake-of-the-Woods is relatively dispersed over the population;

4. genetic analysis undertaken, revealing that the two populations have genetic differences, and that they stem directly from genetic isolation

Source: (MNR 1982; Mosindy 1994: pers. com.)

Kristofferson (1994) suggests that both environmental changes and increased turbidity levels can effect local migration and distribution patterns of walleyes. Thus, migration may adjust to seasonal conditions. In summary, evidence (genetic and age structure) seems to suggest an integrity for the Shoal Lake walleye population; however, this fact does not preclude migration. The question of mass migration needs to be examined further since walleye and other species could move into a different fishery regime. If mass migration does occur, Shoal Lake can not be managed as it has been -- as an isolated unit. No extensive tagging program has been undertaken to date, which would reveal more categorically whether walleyes migrate en masse. The limited walleye tagging programs experienced low tag return by Shoal Lake fishermen. Low tag return directly resulted from the distrust held by Shoal Lake fishermen of MNR officials.

A tagging program does not fit within the Indigenous world view. Elders and/or fishermen from Shoal Lake Band # 40 have grave misgiving concerning their participation in a tagging program, as the insertion of tags and the clipping of fins portrays a lack of respect for the walleye (Redsky, A., 1995: pers. com).

Within local communities, there exists a collective belief that continued use of a particular resource is required to achieve a healthy walleye population. However, the terms management and sustainable productive harvest have no equivalents in traditional Ojibwa language and beliefs (Redsky, F., 1995: pers. com.) (Table 5). The Elders of Shoal Lake band # 40 suggest that proper management of the fishery will include continual use of the fishery but with certain conditions:

1. rotations or rest periods;
2. a closure of commercial fishing for walleye until one month after the spawn;
3. a program of fishing for coarse fish prior to the walleye spawning run. Both northern pike and suckers spawn before walleye and are congregated at that time; and

4. a program of increasing the commercial mesh size back to 4 1/2 " nets so that the young-of-the year and two to five year olds would not make up as much of the catch.

These suggestions seem feasible and should be carefully considered in a co-management arrangement. However, Scott and Crossman (1983) suggest that a 4 1/2 inch (114 mm mesh) net will take walleyes before they have contributed to the population. Perhaps, a larger size mesh size of 5 1\2 inches (137.5 mm) may be more appropriate.

Scientific management of the fishery would prescribe a continuation of the closure until such time as there is scientific evidence (SEK) which indicates that the age class structure within the population and CPUE has stabilized. The current perspective held by MNR officials is that the walleye population is so sensitive that removing 100--200 of the population will have a detrimental long term impact (Mosindy, 1995: pers. com.). MNR representatives would be in support of programs to cull coarse fish, providing Shoal Lake Band #40 Elders and/or fishermen could provide (scientific) proof that other species could be harvested without reducing walleye populations (Mosindy, 1995: pers. com.). For proof, the numbers of walleyes taken as incidental catch in an experimental fishery would be examined. To date, only one program has fit this condition of selective fishing -- the fall whitefish fishery.

Possibilities exists for expanded partnerships in experimental fisheries programs designed to cull coarse fish -- during limited daylight periods. Selectively fishing the northern pike during the day, during the spring spawning season -- when they congregate -- would be an example. The MNR perspective is that walleye are not active during the day, during the spring and fall fishing seasons (Mosindy, 1995: pers. com).

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6. 0 SUMMARY

The First Nation community of Shoal Lake Band # 40 has an on reserve population of 150 and an off-reserve population of approximately 200. During the summer and fall of 1994, twelve people, ranging in age from 35 to 70 were interviewed (Appendix 2). The primary purposes of the project were to document the First Nation perspective -- on the nature of the walleye fishery and how it should be managed -- and to record the TEK (Traditional Ecological Knowledge) held within the local First Nation community. Personal observations and interviews and a map biography approach formed the basis for recording biological characteristics and harvesting considerations. Ground data and the use of aerial photographs aided in the identification of spawning areas and nursery areas. Hydrographic maps were also used to identify the exact extent of harvest and spawning areas.

Four members of the scientific community were interviewed to provide the scientific perspective -- on the nature of the fishery and how it should be managed and to record the current SEK (Scientific Ecological Knowledge) held within the Ministry of Natural Resources.

It is expected that the information provided will serve as a base for land use planning. The information can provide baseline data of the biological characteristics, harvesting considerations and critical walleye habitat. Further, an additional benefit of the partnership was the creation of a remote sensing classification for the entirety of the watershed.

6.1 THE STATUS OF THE WALLEYE POPULATION

Two distinct and opposing knowledge systems have resulted in the formation of distinct conclusions regarding the present and past states of the fishery and the proper management of the walleye fishery. Divergent conclusions resulted in two distinct courses of action being prescribed and followed to the detriment of the walleye population:

1. a regulatory approach pursued by the Ontario MNR; and
2. a resistance to this regulatory approach and a local self-management approach.

During the 1990's, two distinct factions managed the walleye populations separately. The Ontario MNR managed and enforce the regulations governing the walleye population. However, in practice, the local First Nation communities governed the use of and access to the resource for their members. Presently, this dynamic seems to still be in place. This duality has negatively impacted the effectiveness of fisheries management, as the Shoal Lake Elders and/or fishermen have again indirectly opposed and directly confronted fishery regulations. It is very doubtful that effective management of the lake will be achieved as long as these conditions of misunderstanding exist.

Additional research is needed to address the uncertainty involved in research and management of the walleye population: the past and current status of the walleye population, the lack of recovery of the walleye population, the migration of walleye, and the steps to achieve a sustainable harvest (Table 7). A full fisheries assessment is beyond the scope of this study. However, a preferable approach to research would be a combined methodology, using both forms of knowledge (SEK and TEK). Through using such a methodology, a communication process may lead to improved understanding, providing one form of knowledge does not dominate the research process.

The lack of effective management to date does not mean that the walleye population will not recover by itself, over time. Current research (SEK) seems to indicate that the walleye population is heading towards a recovery, but this recovery seems fragile and may not develop. Deteriorating habitat and conflicting land uses may halt or stall a recovery.

6.2 CRITICAL WALLEYE HABITAT

Critical walleye habitat was defined using biological characteristics and harvesting consideration such as spawning and nursery areas and were defined previously as important spawning or nursery areas (TEK and/or SEK). Specific area which have a high probability of being utilized by walleye were also included (Table 10).

Table 10. Areas identified as Critical Walleye Habitat
Source:(personal interviews of Elders of Shoal Lake Band # 40; Mosindy, T., 1995: pers. com.)

Area	Knowledge System	Biological Characteristic
1. Falcon River	SEK/TEK	Key spawning and nursery area
2. Falcon Bay/Waugh	SEK/TEK	Key Spawning and nursery area, and wild rice (staging) area
3. Powawassan Creek	TEK	Key spawning and nursery area
4. Powawassan Bay/Moosin Bay	TEK	Spawning area/ Nursery area
5. Snowshoe Bay	TEK	Spawning area, wild rice (staging) and nursery area
6. Snake Lake/Mud Lake/Normandy Lake	SEK/TEK	Spawning area, key nursery area
7. Mackey and Black Fox Islands	SEK/TEK	Spawning areas
8. Indian Bay	SEK/ TEK	Spawning area, nursery area
9. Silver Fox Island	SEK/TEK	Spawning area

While there is recent disagreement concerning its importance, the Waugh\Falcon Bay and Falcon River areas remain the most important critical habitat areas for the spawning success of walleye. These areas are also critical as nursery and staging areas for walleye. Research is needed on the impacts of eutrophication and declining water levels on spawning and nursery habitat in the Falcon River/Falcon Bay/Waugh system. Other areas which have been identified as critical walleye habitat in the Falcon River system include: Snake Lake, Mud Lake and Normandy Lake. These areas are important nursery and staging areas and may play a role as spawning areas. Snowshoe Bay and Indian Bay are not as important as spawning areas but are essential as nursery and staging areas.

Powawassan Creek is an important spawning area and nursery area. Powawassan Bay also has high potential to be utilized by walleye as spawning habitat and may be important in the spawning success of the walleye population. The islands in Powawassan Bay -- Mackney Island and Black Fox island have also been identified as important spawning areas both in TEK and SEK. Moosin Bay may play a role as an important nursery area.

6.3 THE INTEGRATION OF TEK INTO SCIENTIFIC FISHERIES MANAGEMENT

TEK is beginning to be recognized as an alternative knowledge systems with considerable potential to be integrated into scientific fisheries management. The application of TEK and its integration with scientific management was assessed using the criteria outlined by Johnson and Rattan (1991). The primary barriers to the application of TEK include: an equal weighting of power in decision-making and management; a divergence of world views, and a lack of cultural awareness of MNR representatives.

TEK represents a legacy created over centuries. The Ontario MNR has failed to recognize that TEK is "the property of those who posses and understand it and these people are the most able to apply it effectively" (Johnson and Rattan, 1991). It seems unlikely that Native communities will assent to the application of such knowledge, unless the benefits of effective management are shared equally and they are participating fully in the decision-making process. TEK needs to be applied in a partnership or community control (self-management) arrangement -- an upper level of co-management, as it is one of the last resources held in Native communities. Although there seems to be willingness to accept TEK as a valid and credible source of knowledge and to integrate it into a scientific management system, SEK will remain the bottom line for decision-making when conflicts arise. Similarly, SEK is reflective of a dominant world view which is not compatible with components of the alternative world view such as the importance of social relations with other non-human species .

There is a perception held among MNR officials that the knowledge held at Shoal Lake continues to evolve and function effectively. However, a lack of understanding of the nature of TEK and its role in traditional management and decision -making seems to further prevent its application. Considerable cultural education on both sides is required for integration to be achieved.

6.4 PAST AND EXISTING MANAGEMENT PRACTICES.

Due to the nature of past fisheries management practices of an outside agency -- the Ontario MNR - local control of the fisheries resource has been limited, since the transfer of jurisdiction to the province of Ontario. The cultural institutions held by the First Nation communities at Shoal Lake have been degraded. Due to the competition imposed by the creation of a non-native system of management and allocation of the resource, there was no incentive for the community of Shoal Lake # 40 to control the actions of its members. The benefits of restraint would not have gone to the local community. If the fishery is to become sustainable in the long run, local cultural institutions needed to be recreated or rejuvenated to make sense today. The First Nation communities within the Shoal Lake Watershed must be given the benefits of restraint and some control over the resource. The Ontario MNR is unable to effectively regulate access to the resource, even with strong deterrents such as fines, and the seizure of cars and boats and other accessories used in the course of fishing.

6.5 CO-MANAGEMENT

To date, the co-management found at Shoal Lake has not reached the upper stages of *Management Boards, Partnerships or Community Control* (Table 4). Three factors have limited the success of this informal co-management, including:

1. the absence of constitutionally entrenched rights to self-government (Haugh 1995);
2. the lack of willingness on part of the Ontario MNR to devolve jurisdiction and control over the fish and other resources within the Shoal Lake Watershed to the local First Nations;
3. the differing knowledge systems, world views, and prescribed courses of action which are held within the local First Nation communities and the MNR.

In the negotiations, all the power was vested in one of the participants in negotiations - the Ontario MNR. Despite the inequality of power, both sides entered into the agreement with good faith and were committed to creating an agreement . This commitment helped sustain the negotiations. The unequal weighting of power eventually resulted in a lessening of mutual trust (Chapeskie, 1995: pers. com.)

The creation of joint jurisdiction to govern the resource within the watershed would involve the modification of acts governing the resources within the watershed or the creation of a Shoal Lake Watershed Management Act. For instance, the Migratory Birds Convention Act would have to be modified as it specifies the conditions and areas in which waterfowl may be hunted. Co-management agreements which devolve jurisdiction to local communities and contain effective feedback mechanisms are perceived by local resource users as legitimate (Haugh 1995). These two factors ensure that information is returned to the community and decision-making power is shared.

If jurisdiction and responsibilities had been devolved to the local resource users, the co-management agreement should have resulted in a more effective alternative management regime. The questions then become:

1. How will resources be managed within the watershed, among the five First Nations, in conjunction with the Ontario government?
2. Will the Manitoba and Ontario governments participate in decision-making ?
3. And, how will stakeholders be included in the decision-making?

A lack of understanding and real communication acted as a barrier to the progress of the informal co-management agreement to higher stages. Lack of understanding is one of the reasons why the original agreement did not devolve more power to the local First Nation communities.

The attempted co-management arrangement at Shoal Lake was further evaluated using the suggested framework presented by Johnson and Rattan (1991). It did present an opportunity for cross-cultural communication and sharing of knowledge. However, due to the unequal positions of power that were created, the co-management attempt did not promote the growth of both knowledge systems. Similarly, although there was an interest in TEK as an alternative knowledge base, there was not an acceptance that each system as equal, valid and reliable. In meetings with MNR officials, it became obvious that SEK was the bottom line for decision-making for MNR representatives. Thus Shoal Lake Band # 40 and the other First Nations within the watershed are demanding the " final say" in decision - making process, as "the provincial government having the last say in decision-making is not good enough, as it does not work " (Redsky, H., 1995: pers. com.).

Within this informal co-management there was no recognition that the traditional knowledge belongs to those who possess and understand it and that they are most able to apply it effectively. On the positive side, the attempt did result in the revival of a whitefish fishery. The attempt also did provide local people with access to scientific expertise but did not included them in research analysis, decision-making, and the creation of a management plan. The attempt did not encourage cross-cultural training in western science and TEK as the Elders felt that they had gained little from the experience (Chapeskie, 1995: pers. com. written).

For present and future agreements, the real challenge in creating a workable co-management agreement will be to get beyond the adversarial relationship between the Ontario MNR and the First Nation communities within Shoal Lake Watershed. Building an agreement will require commitment and cooperation on both sides. On the government side, this will require a willingness to devolve power to the local communities. Additionally, it will require a cultural understanding. A large stumbling block in the 1990 informal co-management agreement was the open contradiction of an Elder's view by a younger MNR official which was a serious breach of local cultural protocol and norms. On the First Nations side, the process of building a workable agreement will require a commitment to develop the technical skills to manage the watershed, involving both SEK and TEK. This is required as the watershed will be impacted upon by activities outside the watershed. Similarly, the rationale for not devolving power to First Nations is often their lack of management experience and technical skills.

Building a workable co-management arrangement at Shoal Lake is complicated by the fact that diverse perspectives exist on the nature of the walleye fishery and how to mange the fishery. Outside interests are present within the watershed. For instance, the city of

Winnipeg will most likely oppose any development on Shoal Lake, such as a walleye hatchery, as the Shoal Lake Watershed is the primary source of drinking water for the city of Winnipeg. The city of Winnipeg will also oppose any subsequent co-management agreement as Shoal Lake Band # 40 has claimed part of the aqueduct and water rights in a specific land claims (Redsky, H. , 1995: pers. com.).

Several key elements are required for the establishment of a co-management and for the recovery and effective management of the walleye fishery, including

1. Cooperation between the local First Nations and the representative of the Ontario MNR be established. Cooperation will require commitment and a process by which real communication is established. Real communication will require cultural education and sensitivity training;
2. Jurisdiction and responsibility for the management of the resource will also have to be transferred to the local community. This will involve either the creation of a Shoal Lake Watershed Management Act or the revisal of several provincial and federal acts;
3. The creation of equal positions of power in negotiations;
4. Sufficient funding to undertake research and management;
5. The integration of SEK and TEK to create a comprehensive knowledge base.

As long as differing perceptions exists and real understanding remains elusive, it is probable that these required components of effective management will not be met. Thus, a proactive co-management regime should be established, by emphasizing real communication as a basis for negotiation as opposed to the token communication so prevalent in co-management regimes in Manitoba and elsewhere to date (Haugh, 1995).

6.6 Aspects of how Shoal Lake Band # 40 would manage the Fishery under a self-management or a partnership level Co-management Agreement

The first step would be to get back to the principles of an alternative world view, to revitalize the culture, as "people have to have respect for themselves, for the land" (Redsky, H., 1995: pers. com.). A second step would be to create balance in the fish community, as "right now there isn't that balance" (Redsky, H., 1995: pers. com.). A third step would be to create an enforcement approach with the jurisdiction to act. Enforcement of the fishery regulations would be undertaken as community objective. Local representatives would act as enforcement officers and would regulate the commercial, subsistence and sports fisheries on a daily basis.

The approach would be a decentralized community approach to management -- an upper rung of a co-management agreement -- as "the only way its going to work is if the fishery and the watershed are managed by the people it impacts" (Redsky, H., 1995: pers. Com.). This approach would provide the local First Nations within the Shoal Lake Watershed both the rights and the responsibilities of management. It would also provide an incentive for the sustainable use of the resource.

6. 7. Recommendations for the improvement of the Effectiveness of Management of the Walleye Population

The specific recommendations included in this document were derived from sections 4, 5 and 6 of the study and from the objectives: 1 c) To document TEK relating to World view and 2) To compare and contrast TEK and SEK for spawning areas, nursery areas, and critical walleye habitat.

The recommendations are:

1. That terms defining fisheries management be clarified and mutually agreed upon. Presently , there is confusion resulting from the use of terms with differing interpretations (section 5.1).

2. That further research be carried out to ascertain more definitive answers to the questions posed in this document (section 5.2). An independent study should be carried out to assess the biological uncertainties of the current state of the fishery, the health of the fishery, and the migration of the walleye populations. More specifically, research should be undertaken to assess the impact of eutrophication on the Falcon River and the Falcon Bay \ Waugh areas -- critical walleye habitat.

3. That a research methodology be developed that would incorporate both SEK and TEK. First of all, a combined methodology for comparing present CPUE levels with past may start by repeating the test netting program, in the same locations as previous scientific testing. A second step would be to repeat the testing with spots chosen from utilizing TEK. The timing of the tests could be determined by both water temperature and TEK -- observations of the natural conditions. This information could provide a baseline of the benefits of utilizing TEK in fisheries management and provide a comparison of CPUE levels. Likewise, this method may provide insights into whether walleye can be effectively isolated by using TEK.

   What is needed to be included in fisheries analysis is a measure of variability (age contributions of species and the effects of strong year classes on increases or decreases in vulnerability) (Mosindy, 1995; pers. com).

4. That a fisheries research program be undertaken to assess the importance of the Waugh Falcon River area in the spawning success of walleye populations.

5. That First Nations be "brought into " the scientific management process, so that they can evaluate its potential to contribute to TEK. However, the First Nations should be aware that SEK reflects an underlying world view and is not objective and unbiased.

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Appendix One

List of Definitions

- **Age class structure** refers to the representative numbers of age classes within a population.

- **Bi-cultural research** is a research project in which two cultures are jointly involved in the conception and development of the project, as well as the analysis of the research.

- **Co-management agreement** is "an agreement designed to share power and responsibility between the government and the resource users (Berkes et al, 1991).

- **Co-management** is "the sharing of power and responsibility between the government and the resource users" (Berkes et al, 1991).

- **Memorandum of understanding** is an agreement in which the parties involved (First Nations, Provincial or Territorial Governments and\or the Federal Government) define the terms of understanding by which they will negotiate or impliment an agreement or an interm agreement (Coates 1994).

- **Mesotrophic** is "literally a moderately nourished lake", refering to both succession and the natural eutrophication process in lakes. Eutrophication results from increases in plant nutrients -- nitrogen, phosphorus, iron and carbon (Goldman and Horne 1983).

- **Morhoedaphic index** is **a** methodology most prevalent for estimating or predicting the productivity of a lake or its annual sustainable yield.

- **Neutral Waters** was an area of Shoal Lake to which there was no official licence tenure, subsequently, any fisherman could fish these waters.

- **Oligotrophic** is "literally a poorly nourished lake," refering to both succession and the natural eutrophication process in lakes. Eutrophication results from increases in plant nutrients -- nitrogen, phosphorus, iron and carbon (Goldman and Horne 1983).

- **Participatory Research** refers to a participatory approach in which the community defines the scope of the research conducted and is involved in the collection and analysis of such knowledge. Bicultural resrach emphasizes working with communities rather than for communities. The approach emphasizes creating trustworthy relationships between all participants in the process.

- **Specific Land Claim** is "an allegation by Native People that the Crown its servants or agents has committted a wrong by maladministration of Native matters or by breach of a treaty for which it ought to pay compensation" (Moss, 1991:6).

- **Statement of Political Relations** an agreement in which the parties involved (First Nations, Provincial or Territorial Governments and\or the Federal Government) define political framework by which they will negotiate or impliment an agreement or an interm agreement (Coates 1994).

- **Sustainable yield** refers to the productivity of a lake or how much fish stock can be cropped off within reducing the biological stock.

Appendix Two

List of Elders and \ or Fishermen and dates of Personal Interviews.

1.	Lawrence Redsky	June 6, 1994
2.	John Redsky jr.	June 7, 1994
3.	Alfred Redsky	June 6, 1994 ; June 15,1994; July 26, 1994; August 15, 1994; May 11, 1995
4.	Frank Redsky	June 15, 1994; July 24, 1994; November 7,1994; December 21,1994; May 12, 1995
5.	Doug Redsky	June 20 ,1994; June 22, 1994
6.	Herb Redsky	June 22, 1994; July 26, 1994; May 12, 1995
7.	John Redsky Sr.	July 14, 1994 ; July 21, 1994 ; July 28,1994
8.	Jimmy Redsky	June 23, 1994
9.	Louie Morrison	
10.	Ron Redsky	July 20, 1994
11.	Verna Redsky	August 4, 1994
12.	Tom Campbell	January 18,1995; May 4, 1995

Dates of Trips with Elders:

1. Herb Redsky ; Frank Redsky and Tom Campbell -- June 29
2. Frank Redsky -- May 11, 1994; July 15, 1995 ; July 26,1994; August 2, 1994; August 3,1994
3. Jimmy Redsky and Tom Campbell -- August 18, 1994; August 19,1994
4. Jimmy Redsky -- October 11 - 12, 1994.

Meetings in Shoal Lake:

1. January 26 - 27, 1995 -- Watershed Conference