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# Moon River – Of Eastern Georgian Bay Walleye Rehabilitation Plan

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**A Joint Partnership Between**  
**The Eastern Georgian Bay Stewardship Council**  
**OMNR Upper Great Lakes Management Unit – Lake Huron Office**  
**Ministry of Natural Resources – Parry Sound District Office**



*Draft Version For Public Comment – May, 2007*

## Preamble:

The Ministry of Natural Resources has the legislated mandate to manage the fishery resources of Ontario, but broad-based community support is vital for management actions to be effective. This rehabilitation plan for the Moon River walleye fishery represents a multi-partner, community effort to restore this significant Eastern Georgian Bay fish population.

## 1.0 Strategic Direction:

The goal of this plan is to seek the rehabilitation of the Moon River walleye fishery to a condition that provides for the long-term health and natural sustainability of this provincially significant fishery resource. Implicit in this goal is the requirement of a healthy aquatic ecosystem including:

- high quality water and a sustainable quantity of water;
- healthy and productive fish habitat, and;
- a well balanced and stable fish community.

This goal is consistent with the Strategic Plan for Ontario Fisheries - SPOF II (OMNR, 1992), OMNR's guiding document for the Management of Ontario Fisheries.

Furthermore, this goal is also consistent with objectives identified by the Great Lakes Fishery Commission in their "Fish Community Objectives for Lake Huron" (DesJardine et al. 1995). The over-all objective for Lake Huron is:

*"Over the next two decades, restore an ecologically balanced fish community dominated by top predators and consisting largely of self-sustaining indigenous and naturalized species ... "*

The walleye objective is to:

*"Reestablish and/or maintain walleye as the dominant cool-water predator over its traditional range... The walleye was the dominant nearshore predator in Lake Huron and it should resume this role. ... Stocks in ... Eastern Georgian Bay have suffered from environmental degradation or from over-fishing and require rehabilitation."*

The Ministry of Natural Resources' strategic directions as contained in their latest guiding document entitled *Our Sustainable Future* (OMNR, 2005), calls for a vision of a healthy environment through sustainable development; a mission statement of ecological sustainability; and implementation through stewardship, partnerships and community involvement (amongst other organizational goals). This rehabilitation plan is consistent with this strategic direction.

## 2.0 Environmental Assessment Requirements:

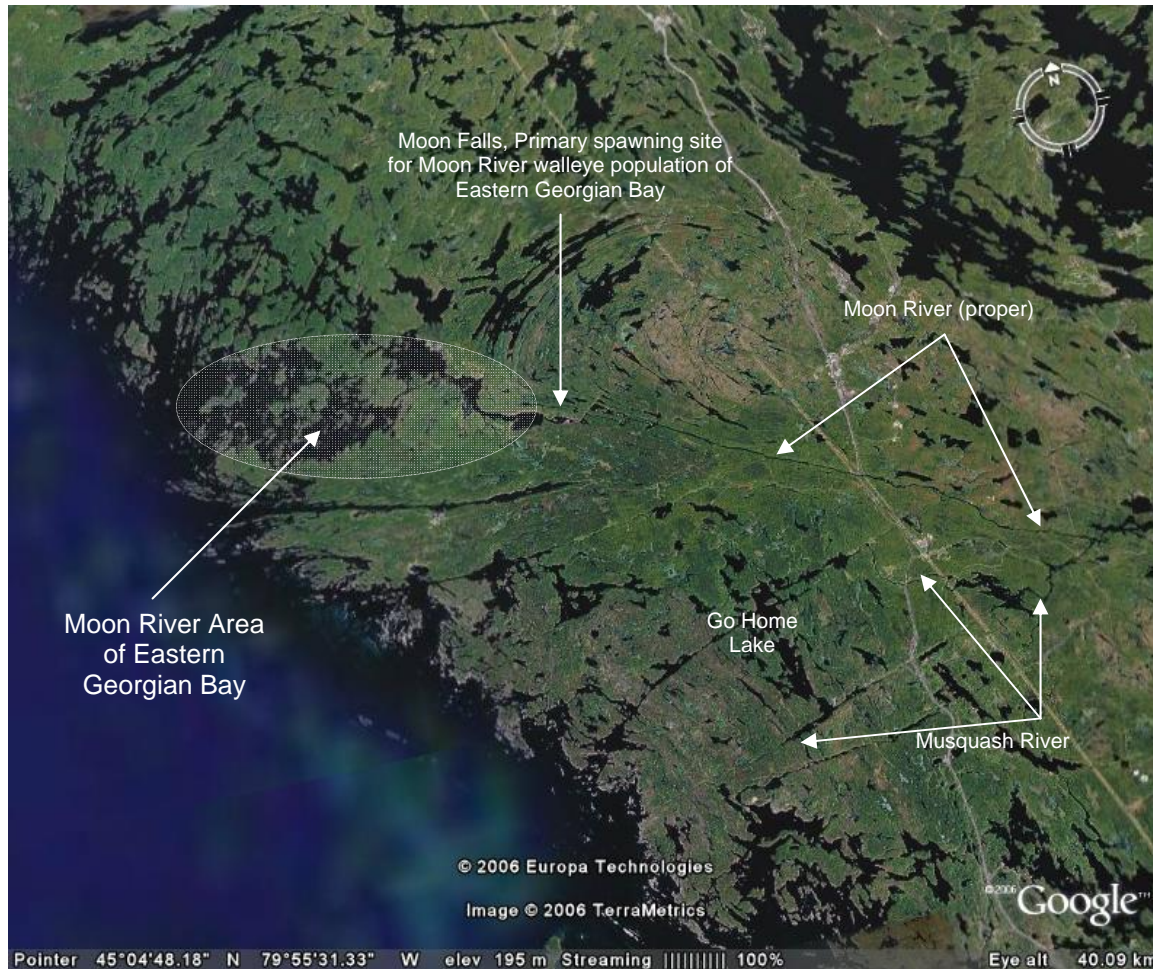
This project is located within the Lower Moon River Conservation Reserve (C90) and as such, is subject to the MNR Class Environmental Assessment for Provincial Parks and Conservation Reserves (Class EA-PPCR). OMNR Procedural Directive – EA 4.02.87 (Environmental Assessment Requirements – Partnership Projects) applies to this project.

An information posting will be made on the Environmental Bill of Rights Registry for public information and comment.

### 3.0 Overview:

The moniker - “Moon River walleye population” refers to an eastern Georgian Bay walleye stock whose primary spawning site is at the base of Moon Falls where the Moon River enters Georgian Bay (Figure 1 and cover photograph).

**Figure 1. Satellite photo of the Moon River area of Eastern Georgian Bay**



The Moon River walleye fishery has a long and illustrious history amongst the many walleye populations along the eastern shore of Georgian Bay. Its reputation as a trophy walleye fishery is almost ‘legend’ amongst anglers in the Province of Ontario. Regrettably, for several decades that reputation has been considerably diminished by the collapse of the walleye stock (Gonder in press).

Notwithstanding the reputation of this fishery, it was not until the late 1960s that a concerted effort was made to systematically commence sound scientific data collection on this population.

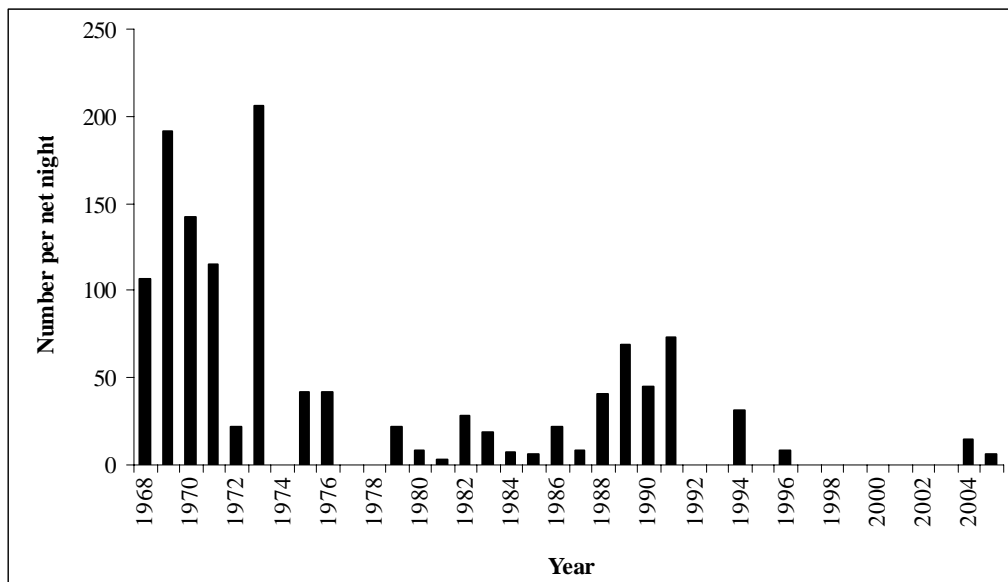
From 1968 to 1972, Winterton (1975) conducted extensive trapnetting and tagging operations during the walleye spawning run at Moon Falls. From 1968 to 1970, the Moon River walleye

spawning population was estimated at between 24,000 and 30,000 fish. This subsequently dropped to approximately 18,000 in 1971 and less than 13,000 in 1972. By 2004, the spawning population was estimated at approximately 4,800 and this was further reduced to its historic low of 1,200 by 2005 (Gonder in press).

Unfortunately, prior to Winterton’s work in the late 60’s and early 70’s, there is no objective data on the status of the Moon River walleye population. Consequently, we are largely left with vague and anecdotal accounts as to the historical magnitude of the Moon River walleye population.

Winterton’s work formed the genesis of a long-term, spring, walleye spawning survey program that continues to present day. The relative abundance index of walleye is measured by the walleye catch rate, or Catch-Per-Unit-Effort (CPUE – number of walleye caught per net night). Although fraught with some methodological inconsistencies, the index has effectively tracked gross changes in walleye spawning population abundance for almost 40 years. To generate this index, the Ministry of Natural Resources has collected data during spring, walleye spawning surveys at three netting locations below Moon Falls. Annual variability in Georgian Bay water levels and Moon River flow rates has necessitated multiple index netting sites. Information from the most recent surveys (1996 - 2005) documents some of the lowest indices of walleye abundance on record (Figure 2).

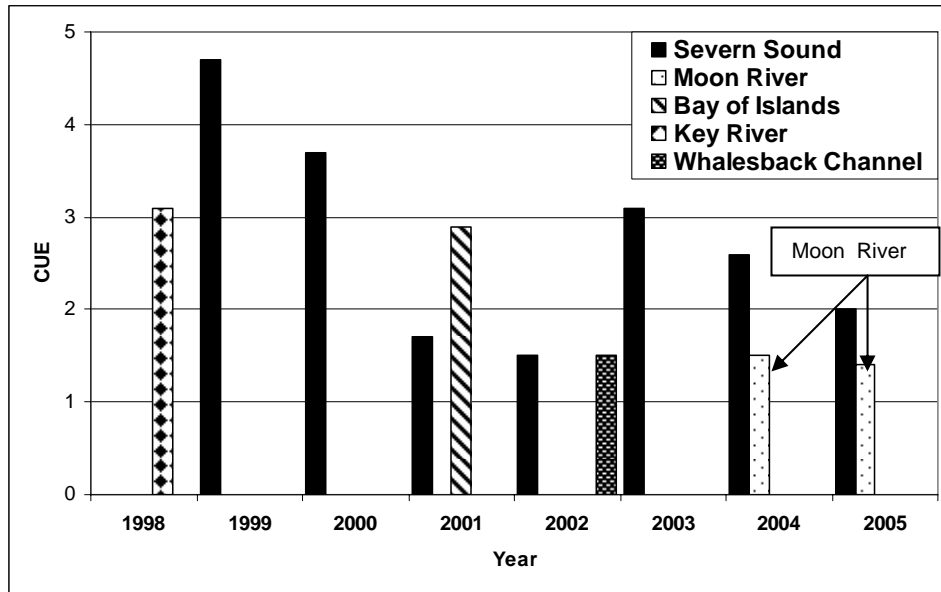
**Figure 2. Walleye catch per trap net night at sites below Moon Falls on the Moon River.**



In addition, in 2004 and 2005 the UGLMU conducted End-of-Spring-Trapnetting (ESTN) surveys in the Moon River area. The ESTN survey is a provincially standardized methodology that uses live-capture trap-nets to monitor walleye population status. When the walleye CUE for the 2005 Moon River ESTN survey is compared to other walleye populations surveyed along the eastern shore of Georgian Bay and the North Channel, walleye abundance appears “below average” (Figure 3). In this instance however, “average” should not be considered healthy or desirable. Rather, it is a reflection of the depleted state of many walleye stocks throughout Georgian Bay and the North Channel, of which the Moon River is one of many examples. When compared to

Provincial benchmarks, most of the populations along Eastern Georgian Bay rank as “poor” and amongst the lowest CUE values in the Provincial database.

**Figure 3. Relative Abundance of Walleye (as Measured by CUE) from ESTN surveys conducted on Georgian Bay and the North Channel of Lake Huron, 1998-2005.**



## 4.0 Potential factors contributing to walleye decline:

What are the factors that contributed to the decline in the Moon River walleye spawning population? The answer to this question has been both elusive and controversial.

### 4.1 Logging Industry:

In the latter half of the 1800's and the early part of the 1900's, the southern forests of the Precambrian Shield – including the Muskoka watershed, were intensively logged primarily for white pine as well as other softwood and hardwood species (Barry, 1992) . Waterways were essentially highways for the transportation of logs to mill sites. In many instances there were devastating impacts to fish habitat (especially spawning habitat) and fish populations as the result of dams, sluiceways, bark and log deposition in waterways, rivers choked with floating logs and even physical harm related to log jams and driving logs through spawning areas. To what extent these activities impacted the Moon River walleye spawning population is unknown. Today, the Moon River bears no scars related to these activities and it is not likely that the environmental transgressions of early logging practices are having a present-day impact on the population.

## 4.2 Sport Fishing

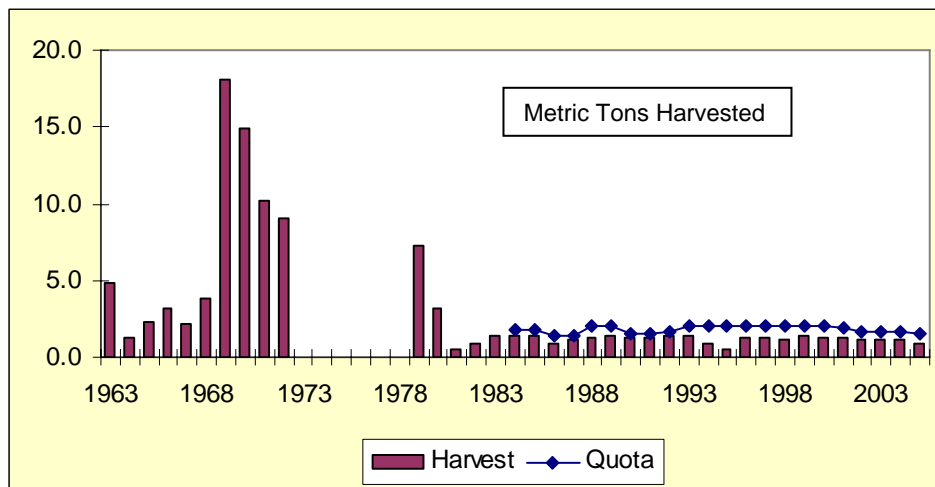
Close on the heels of the logging industry was the tourist industry. With the beauty of Georgian Bay and the abundance of fish in its pristine waters, a burgeoning tourist industry quickly sprang up in the late 1800s (Barry, 1992). Although a conservation ethic in sport fish harvesting was not likely inherent in this fledgling industry, it was probably not of sufficient magnitude such that considerable harm could be done to the fishery. However, with the addition of cottages, resorts and improved access throughout the 20<sup>th</sup> century, the impacts of the sport fishery undoubtedly became apparent. Unfortunately, we are unable to present any credible long-term creel data to substantiate to what degree sport fish harvest was and is impacting this population. The implementation of stringent sport fish harvest regulations throughout Georgian Bay in 2003 – and still in effect today, represents the first significant regulatory effort to control the harvest of walleye to meet the conservation needs of the resource. In no other walleye population was this more necessary than the Moon River stock of Eastern Georgian Bay, given the precipitous decline observed in this population.

## 4.3 Commercial Fishing

Also commensurate with the advent of the early logging industry was the commercial fishing industry on Georgian Bay. Although whitefish and lake trout were preferred species, eventually walleye also became a targeted species and one subject to considerable pressure from gill-netters. Tagging studies included in Winterton's (1975) thesis showed that Moon River walleye were harvested in the offshore commercial fishery in Georgian Bay. With modernization of the Ontario commercial fishery in the 1980s, harvest quotas, including those for walleye, were placed on the commercial fishery. This included the area where Moon River walleye are commercially harvested.

Today, commercial fishing pressure on the Moon River walleye population is light relative to a historical context (Figure 4) but relative to the current population size might be significant. To what extent commercial fishing may have historically contributed to the collapse of this population is difficult to ascertain. Nonetheless, even at low levels of harvest today, this is a stressor that likely continues to impede rehabilitation efforts.

**Figure 4. Commercial walleye harvest for quota management area 5-7. (This management area has a mixture of walleye stocks that includes the Moon River stock.)**



#### 4.4 First Nation Harvest

Constitutionally protected treaty fishing rights are often exercised in Crown waters such as the Moon River. In most cases, First Nation harvest on the Moon River has occurred during the walleye spawning run. It is unlikely that this harvest was a significant contributor to the collapse of this population. Nonetheless, even at low levels of harvest today, this may be a stressor that continues to impede rehabilitation efforts.

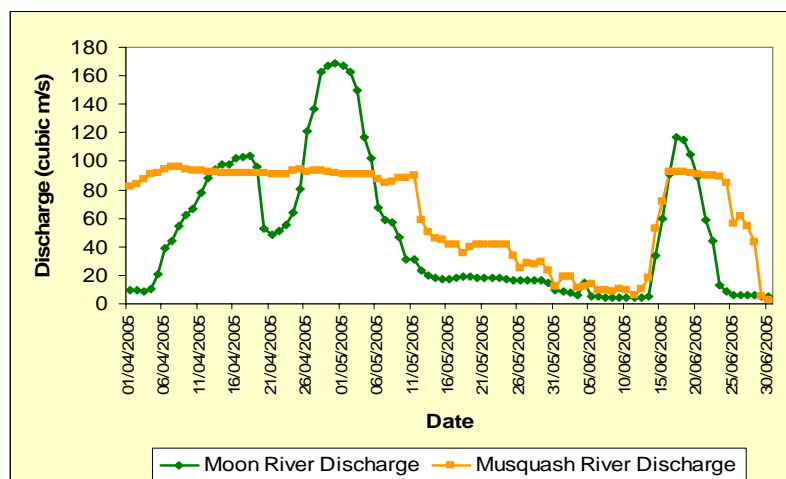
#### 4.5 Moon River Flow Regime

Another stressor on the population was and is the highly irregular flow regime down the Moon River during the walleye spawning and incubation period. In 1938 the “Moon Dam” was constructed just down-stream of the Bala Reach on the Moon River. This dam permitted the diversion of water from the Moon River to the adjacent Musquash River enabling enhanced hydro-electric generation at the Ragged Rapids generating station downstream on the Musquash River. (A second hydroelectric generating station – Big Eddy GS is located yet further downstream on the Musquash River.)

The manipulation of flow regimes, especially during the walleye spawning and incubation period, has undoubtedly contributed to reduced walleye spawning success on the Moon River. The highly variable flow regime observed during the 2005 spring freshet for the Moon River is an example of this unnatural, seasonal variability (Figure 5). In contrast, the flow regime for the Musquash River during the same period in 2005 is much more stable, presumably in an effort to optimize hydropower production (Figure 5).

Winterton (1975) attributed 86% of year class variability to the water flow regime. We are unable to speculate precisely to what degree water management has detrimentally affected the Moon River walleye population, both historically and present day. Certainly, the presence and at times high abundance of walleye over an 80 year period of water level manipulations on the Moon River, attests to the resiliency and sustainability of this population in the face of this stressor. However, population data also suggests that year class failures have occurred in several years where flow regulation is presumed to have played a large role. Unlike the logging industry, the impacts of this stressor continue to the present day.

**Figure 5. Discharge hydrograph for the Muskoka River watershed outflow channels during the spring 2005 period.**



## 4.6 Water Quality

European pioneers and their descendants have had a considerable impact on both the terrestrial and aquatic landscape within the Georgian Bay watershed. These impacts have been in the form of early agriculture, logging practices, dam construction, industry, cultural eutrophication and urban encroachment. Fortunately, most of those impacts have been of short duration and to a large extent are not presently impacting aquatic environments, or if they are, do so on a localized scale.

The Muskoka watershed, with its headwaters in Algonquin Park is largely blessed with low levels of industrial, agricultural and residential contamination. However, acid rain represents a potential threat. Waters on the Precambrian shield, including the Muskoka watershed, have low buffering capacity and are sensitive to acid rain deposition. Fortunately, international emission controls have reduced atmospheric inputs, but have not eliminated them. Studies to evaluate the impacts of acid rain on Moon River walleye reproduction (Chen and Sonstegard, 1981) indicated that pH levels were not low enough to impede walleye reproduction. The presence of viable walleye populations throughout the Muskoka watershed and many areas along Eastern Georgian Bay, as well as the successful incubation of walleye eggs at Arnold's Bay, is persuasive evidence that water quality and acid rain are not responsible for decreased walleye abundance on the Moon River.

## 4.7 Walleye Stocking

Stocking of non-indigenous walleye can pose a stress to a local population by:

- the unwitting introduction of disease agents
- The introduction of genes that evolved in a different aquatic ecosystem and may be less 'fit' than those from the local population.
- A reduction in gene pool variability by introducing large numbers of fish with the same parents.
- Predation of native fish by non-native, stocked fish, possibly resulting in a population shift to non-native fish.
- Increased angling stress on the native population that invariably accompanies fish stocking (Kerr et al. 1996).

Although the Moon River has received extensive walleye plantings dating back to 1973, almost all of these fish have been of Moon River origin. Plantings conducted throughout the 1980 probably made a significant contribution to the resurgence of walleye abundance observed in the early 1990s (Figure 2).

Repetitive plantings are possibly responsible for a low level of genetic variability now present in this stock. This low level of genetic variability may be an inhibitor to rehabilitation of this population through reduced fitness and adaptability. Notwithstanding the foregoing, the negative impacts of fish stocking must be weighed against the benefits, especially for this stock whose spawning population is at a critically low level.

#### **4.8 Aquatic and Terrestrial Community Interactions:**

The over-all ecology of Georgian Bay, including the Moon River area, is much changed from that observed by the lumbermen, sport anglers and commercial fishermen of the late 1800s and early 1900s. It is estimated that the Great Lakes now contain over 200 non-indigenous species of flora and fauna. Sea lamprey, spiny water flea, zebra mussels and round gobies are amongst the long list of introduced organisms that have harmed the Great Lakes aquatic ecosystem. Recent range expansion of the double-crested cormorant may have also altered the aquatic food chain in the area.

Although many introductions and fish community changes may have detrimentally impacted walleye productivity in the Moon River area, it is difficult to ascribe to what degree. However, based on the ability of other walleye populations along the eastern shore of Georgian Bay to do reasonably well in the face of these stressors, it is not likely they are responsible for the precipitous decline of walleye observed in the Moon River area. Undoubtedly however, this stress is an unwelcome and complicating factor likely to impede efforts to rehabilitate the Moon River walleye population.

#### **4.9 Spawning Habitat**

It is perplexing that the Moon River Falls area has a paucity of optimal walleye spawning area. This is notwithstanding the historically large walleye spawning runs that have been documented here. The rarity of optimal spawning habitat is a function of (Gonder in press):

- Limited areas of optimal size spawning substrate (2 – 25 cm rubble)
- An intermittent and irregular flow regime during the spawning and incubation periods that displaces walleye from suitable spawning substrate or these areas may subsequently be susceptible to egg-desiccation and/or lack of circulation when flows diminish
- Low Georgian Bay water levels that contribute to egg-desiccation and/or lack of circulation for incubating walleye eggs when spring-time flows diminish.
- Areas that may have suitable substrate but inappropriate depths or flow velocities.
- Suitable areas with respect to depth, substrate and flow; but walleye are excluded from these areas due to periodic high flow velocities.

Although spawning enhancement work has been previously conducted at the site (Rusk, 1973), this was largely done on a trial and error basis. Anecdotal accounts suggest the habitat improvements were unsuccessful on account of the deposited substrate being swept downstream by high flow velocities. Also, this habitat enhancement work was done immediately below the Moon Falls where flow velocities are most intense and likely to exclude walleye during periods of high flow. Under current low water levels for Georgian Bay, walleye do not have access to this area (Figure 6).

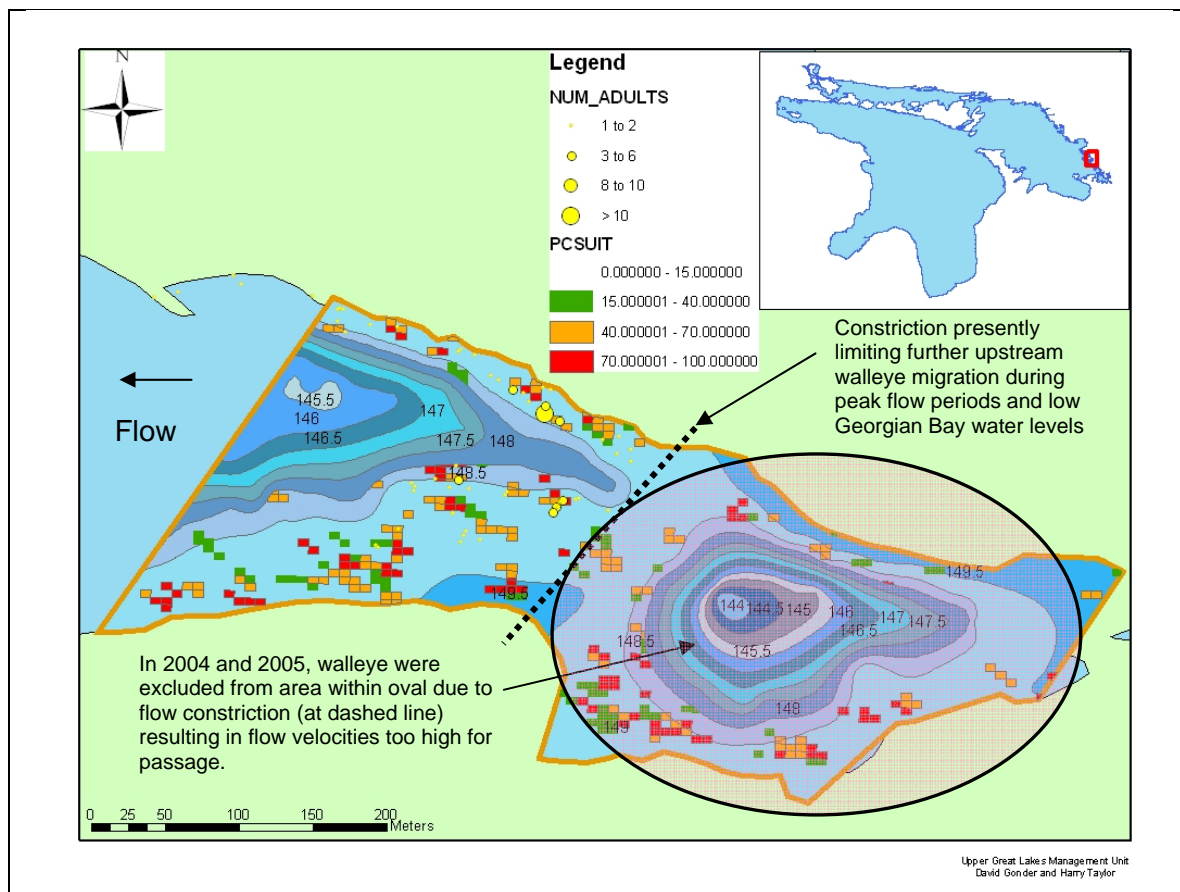
The first truly objective assessment of spawning habitat below Moon Falls was conducted by the Upper Great Lakes Management Unit in 2005. Suitable spawning habitat was documented on the basis of (Gonder in press):

- Pebble counts (suitable spawning substrate)
- Depth
- Flow velocities
- Wetted perimeter under various flow regimes and Georgian Bay water levels present in 2005
- Walleye spawning observations confirmed by egg deposition observations.

When spawning observations were conducted in 2005, a rock shelf constriction (shown as a dotted line in Figure 6) acted as an effective barrier to further upstream walleye migration due to high flow velocities. Although the spawning habitat present above this constriction was unused in 2005, walleye have historically spawned in this area and undoubtedly will have the opportunity to do so in future years when Georgian Bay water levels are higher.

Results of work conducted by the UGLMU clearly indicated there was very limited area of optimal walleye spawning habitat available in 2005 (Figure 6).

**Figure 6. 2005 assessment of walleye spawning habitat below Moon Falls conducted by the UGLMU.** (Note: PCSUIT refers to “Pebble Count Suitability.” Numbers refer to the % of quadrat covered by suitable spawning substrate. The higher the percentage, the greater the suitability as walleye spawning substrate. Yellow dots refer to number of walleye sightings during spawning period and are a good surrogate for actual spawning locations.)



In an historical context, the existing limited walleye spawning habitat has clearly demonstrated it can support a large spawning population as well as maintain a remnant population on a long-term basis. However, by its small and limited nature, spawning success under the current flow regime can probably be greatly enhanced by increasing the area of optimal spawning habitat in suitable locations. This is especially true given the compounding effects of variable flow regimes on fish access and egg survival, and currently available spawning habitat. As will be discussed in the following section, enhancement of this habitat will be one of the cornerstones for rehabilitating this population.

## **5.0 Rehabilitation Plan Components or Action Items**

### *What can be done to rehabilitate this population?*

This rehabilitation plan is comprised of seven components or action items to rehabilitate the Moon River walleye population. These include:

1. Regulate flow regime during the walleye spawning and incubation periods to optimize reproductive success.
2. Enhancement of spawning habitat.
3. 5-Year rehabilitative plantings of native walleye.
4. Collaboration with First Nations.
5. Review appropriateness of current harvest controls (regulations) for both the sport and commercial fisheries.
6. Increase enforcement effort.
7. Monitoring and assessment.

A complete description of these components follows.

### **5.1 Consistent with the Muskoka River Water Management Plan (MRWMP), regulate the flow regime during the walleye spawning and incubation periods to optimize walleye reproductive success.**

The management of water and flow regime throughout the Muskoka River watershed is governed according to the Muskoka River Water Management Plan (Acres International, April 2006). The MRWMP came in effect on April 20, 2006. Public consultations regarding Plan preparation included an extensive review and selection of a preferred operating plans and rule curve for each of the regulated lakes within the watershed.

The Aquatic Ecosystem Guidelines was the principle guidance document considered for the development of the various lake operating plans and rule curves identified in the Muskoka River Water Management Plan (MRWMP). The guidelines call for flows and level regimes to be incorporated in the development of the operating plans that will better emulate natural (unregulated) watershed conditions.

The new rule curves and operating ranges for lakes within the Muskoka watershed provide for higher spring lake levels with gradually declining levels through the summer and fall period. The goal of the MRWMP is to maintain higher spring levels for a longer duration to improve access to spawning grounds, recharge groundwater, and improve riparian zones and lake communities in the long term.

The MRWMP identifies the benefits to the Moon River basin Walleye spawning population with the implementation of the new operating plan rule curves. Attenuating or “holding back” flows in the spring to create higher lake levels in the various watershed lakes will benefit the Moon River spawning location by reducing undesirable peak flows and providing a greater level of assurance in meeting minimum flow requirements through the egg incubation period.

Attenuation (increased storage capacity) of spring flows on Lake Muskoka and other watershed lakes through the use of the new rule curves will reduce spring time flow peaks associated with the Moon River spawning location. Under the previous lake operating plans, the objective was

to reduce lake levels to the summer range as quickly as possible. This practice contributed to the high spring peak Moon River flows experienced in past years.

Within the MRWMP, provision has been made to:

- Reduce spring flow peaks during the walleye spawning and egg incubation period by increasing the use of reservoir capacity in the Muskoka lakes as per the revised rule curves and level and flow objectives; and
- Provide for a minimum flow for the period of April 15 to June 1.

**Recommendation:**

Opportunities presented within the Muskoka River Water Management Plan will be utilized to the fullest extent possible to ameliorate peak flows on the Moon River. Furthermore, opportunities to provide consistent flows during the walleye incubation period, equal to or in excess of guaranteed minimum flows will also be utilized to the fullest extent.

**The Musquash River Connection:**

At the terminus of the Bala reach, the river splits into two forks – the Moon River proceeding in a northwesterly direction and the Musquash River proceeding in an approximate southwesterly direction, with both emptying into Georgian Bay. A short distance downstream of this fork, the *Moon River Dam* is located on the Moon River and the *Ragged Rapids Generating Station*, which also acts as dam, is located on the Musquash River.

The opportunity is seemingly present to ameliorate peak flows on the Moon River by diverting excess water down the Musquash River. However, flows in excess of 85 cms results in flooding damage on downstream Go Home Lake as well as creating a navigation and safety hazard at Haunted Narrows on the lake. This narrows is a significant constriction to water flow and at flows in excess of 85 cms causes a significant hydraulic back-up upstream of its location. The resulting water level differential on either side of the narrows poses a significant navigation and safety hazard.

For this reason, the MNR is not willing to increase peak flows down the Musquash River at this time. They have however committed to an engineering study to assess if some capacity exists to divert additional flows down the Musquash River. Tentatively, this study is scheduled from 2007 – 2010.

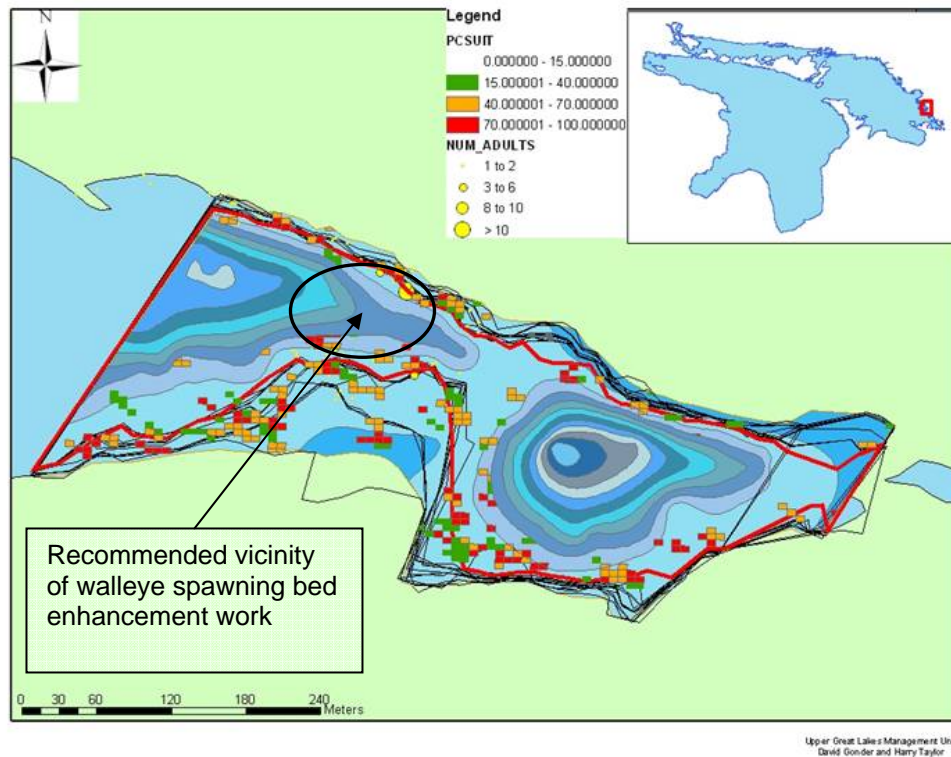
**5.2 Enhancement to walleye spawning habitat**

This target entails the construction of a high quality walleye spawning area that will accommodate spawning activities and egg-incubation over a wide-range of flow regimes and varying Georgian Bay water levels.

Discussions lead by the UGLMU relating to spawning habitat creation and enhancement have been on-going concurrent with the writing of this rehabilitation plan. Specific design details have not yet been drafted, but concrete themes have emerged that provide general direction as to the nature of spawning habitat enhancements. These themes are as follows:

- a) Work should be conducted downstream of the ‘narrows’ that currently acts as a barrier to further walleye migration (see Figure 6).
- b) Work should be cognizant of areas where existing suitable substrate and walleye spawning occurs and concentrate on near-by areas to increase the likelihood of walleye using newly created spawning habitat.
- c) Any newly created or enhanced walleye spawning areas must provide for suitable spawning and egg incubation habitat under a wide range of flow regimes. The low end of the range is the current guaranteed minimum flow specified in the MRWMP. However, the upper range is yet to be determined based on spawning bed design and modeling results being worked on concurrent with this Plan.

**Figure 7. Diagram showing recommended vicinity of walleye spawning bed enhancement work.** (Note: Heavy red line indicates wetted perimeter at 7.8 cms flow on June 2, 2005 with Geo. Bay water levels at 176.21 m ASL).



Details of the design will be finalized by MNR over the course of the 2006 winter and should be available in the spring of 2007. Other partners for this initiative (as listed on cover page) as well as the general public will have the opportunity to comment on the design through direct consultations or via the Environmental Assessment process.

The EGBSC and MNR will be jointly responsible for the construction phase of the initiative as well as meeting Environmental Assessment requirements.

It is anticipated the foregoing spawning bed construction project may cost anywhere from 100 to 200 thousand dollars. The EGBSC will spearhead the fund-raising for this project through government grants and funding programs as well as seeking donations from other government agencies, corporate donors, private individuals and non-government agencies.

### **5.3 Rehabilitative Plantings of Native Walleye**

Walleye spawning stocks in the Moon River are presently at historically low levels. The EGBSC believes there is an acute need for rehabilitative plantings of progeny originating from the Moon River walleye stock. These plantings are intended to be rehabilitative in nature by temporarily bolstering what has been chronically poor natural reproduction in recent decades. They are intended to re-build the spawning stock and thereby greatly increase natural spawning success and accelerate the rehabilitation process.

Historically, there have been three 'pulses' of stocking in the Moon River. The first pulse was the stocking of approximately 8 million fry between 1973 and 1976 (Unpublished OMNR stocking record, Appendix A). These plantings appeared ineffective as no change was subsequently observed in the walleye CUE from spawning index surveys. However, from 1980 to 1989 – the second pulse resulted in over 24,000 fall fingerling and almost 900,000 summer fingerlings being planted. It is most probable these plantings were responsible for the resurgent high CUE observed in the 1990 spawning survey (Figure 2). The third pulse of plantings occurred from 1997 to 2006. Reports for these plantings have been rather irregular. However, approximately 4.3 million fry and 3,400 summer fingerlings have been reported planted in this time frame. Like the first pulse of fry plantings, this later pulse also appears to have been ineffective as no subsequent improvement has been observed in the walleye CUE from spawning surveys.

Given the resurgence of fish noted in the 1990 spawning survey, it appears that the groundwork for rehabilitation was laid at that time, however rehabilitation was subsequently unsuccessful. This was possibly due to the absence of any abatement in harvest levels and poor reproductive success related to flow regime and limited spawning habitat. This rehabilitation plan aims to remove these inhibitors.

Considerable discussion has arisen as to what is an appropriate number of fish to culture and at what stage they should be stocked? Considering the depleted state of spawning stocks and chronic lack of spawning success, the Eastern Georgian Bay Stewardship Council is of the opinion that a stocking effort equivalent to that of the 1980s is appropriate. Moreover, considering the extensive home range of this stock in Georgian Bay, extending from Giants Tomb Island in the south to Sandy Island in the north and comprising a significant portion of the 30,000 islands in between, it is likely difficult to over-stock this area given the expected capacity for fish production. In practical terms, our target numbers for stocking are limited only by our capacity to raise them; which is unfortunately quite limited.

Stocking of walleye will be consistent with the MNR's Guidelines for Stocking Fish in Inland Waters in Ontario (OMNR, 2002) and recommendations contained in the Ministry's Percid

Community Synthesis Report: Walleye Stocking as a Management Tool (Kerr et al. 1996).  
(Note: Recommended stocking rate as per the Guidelines for Stocking Fish in Inland Waters of Ontario (OMNR, 2002) are not appropriate in this instance due the immense home range area for this population.)

In accordance with the MNR's stocking guidelines: "... hatchery reared walleye should be released at the earliest life state possible (i.e. summer fingerling) considering the trade-off between adult return rate and advantages of minimized rearing time." However, the guidelines further states: "Advanced (fall) fingerlings should only be used in those waters having a complex fish community with an abundance of predators ...," which applies in the case of the Moon River. The MNR is of the opinion that the complex fish community of the Moon River dictates that fall fingerling is the best stage to stock. This option has the distinct advantage of allowing stocked fish to be marked (i.e. fin clipped), thereby greatly assisting in subsequent stocking assessment studies.

The foregoing does not necessarily preclude the stocking of summer fingerlings however. The Eastern Georgian Bay Stewardship Council is currently exploring a number of avenues to secure Moon River walleye for stocking. These include:

- i) Continuing to raising fry and summer fingerlings locally through the Ministry sponsored Community Fisheries and Wildlife Involvement Program (CF/WIP). This has been done since 1997, but production numbers have been too small to have a significant impact on year-class production (Appendix A).
- ii) Contract private industry to raise Moon River walleye to the summer or fall fingerling stage.
- iii) Have the Provincial Fish Culture System raise substantive numbers of Moon River fall fingerling walleye. This option has the requirement of lethal sampling of parents for disease testing in order to allow progeny into the Provincial Fish Culture System.

For genetic considerations, only Moon River walleye stock will be used for egg collection purposes.

**Recommendation:**

It is recommended that the UGLMU submit a request to MNR's Fish Culture staff for the collection and rearing of Moon River walleye in Ontario's fish culture system. Further to this request, the EGBSC will evaluate future direction for walleye culture depending on MNR's direction within the Provincial hatchery system.

#### **5.4 Collaboration with First Nations**

The Ministry recognizes the relationship that First Nations have with their lands, waters and environment and the benefits of securing their participation in the conservation and management of the fisheries resources, including Moon River walleye.

It has been the experience of the Parry Sound Office of the Ministry of Natural Resources that First Nation Councils in the Parry Sound Area are extremely cooperative, responsible and interested in working cooperatively with MNR for the benefit of the fishery resource and for the benefit of present and future generations.

**Recommendation:**

It is recommended that MNR pursue an approach whereby the First Nations with interest in rehabilitation of the Moon River walleye population can work in a cooperative fisheries management framework with Ontario on rehabilitation of this fishery.

## 5.5 Harvest Controls

### 5.5.1 Sport Fishery Harvest Controls:

Fishing Division 16, comprising Georgian Bay, has a long history of liberal fishing regulations for walleye. Up to and including 2002, anglers were allowed a daily limit of 6 walleye (2 for Conservation Licence holders) and the season was only closed from March 15<sup>th</sup> to May 1<sup>st</sup>. These liberal regulations, in conjunction with the fishing pressure exerted by anglers, were likely contributors to the decline of the Moon River walleye stock.

The last creel surveys conducted in the Moon River area were in 1984 (Thurston and McIntyre, 1987) and 1988 (Thurston and Emerson, 1989). Estimated total fishing effort was 25.8 rod hours / hectare (total area 1,368 ha.) in 1984 and 27.2 rod hours / hectare (total area 2,418 ha.) in 1988. Baccante and Colby (1991) concluded that walleye population abundance declined rapidly when annual effort was in excess of 10 rod-hours / hectare. As such, past fishing effort has been of sufficient magnitude to have had a considerable negative impact on walleye abundance in the Moon River area.

In 2003, new walleye sport fishing regulations were implemented for Georgian Bay. The daily catch limit was reduced to 2 fish (1 for conservation licence holders) and a possession limit of 4 (2 for conservation licence holders). Furthermore, a size limit of zero fish between 41 and 56 cm and only one greater than 56 cm in total length, was imposed. Also, the season was reduced such that the period between March 1<sup>st</sup> and May 1 was closed. These regulations currently remain in effect.

Although it is difficult to evaluate the impacts of these regulation changes on the Moon River walleye population, recent netting surveys have not yet detected an improvement in walleye abundance. This is not surprising considering the short period of time the regulations have had to make an impact in conjunction with the depressed state of the walleye stock and the many confounding factors.

**Recommendation:**

It is recommended that the Upper Great Lakes Management Unit monitor walleye sport fishing regulations to gauge their effectiveness in providing protection for the Moon River walleye population. This will require the acquisition of information such as creel survey data.

### 5.5.2 Commercial Fishing Harvest Controls:

Commercial fishing was ubiquitous throughout Georgian Bay almost concurrent with European settlement along its shores (Barry, 1992). Not surprising, the bulk of this commercial activity was concentrated around southern Georgian Bay where the nucleus of the population was centered and the transportation network allowed exports to major fish markets.

Commercial catch statistics for Georgian Bay indicate that walleye harvest peaked at approximately 300 metric tones around 1900 (Reckhan and Thurston, 1989). There was a precipitous drop following this peak and then an extended period of slow decline to the 1970s.

In the early 1980's the commercial fishing industry was restructured under the Ministry of Natural Resources' Commercial Fishery Modernization Program. The loosely regulated fishery was replaced with one that specified species quotas, defined fishing zones (quota management areas - QMA) and an auditable paper trail for the harvesting and marketing of fish. At this time (early 1980s), the walleye quota in QMA 5-7 where the commercial harvest of Moon River walleye occurs, was set at approximately 2.5 metric tones (Figure 4). This quota limit and its harvest have essentially remained consistent to present day.

The regulation of the harvest of the Moon River walleye stock in the commercial fishery is complicated by the fact they range over extensive areas and mix with other stocks. Given this knowledge and the fact that this population has been in severe decline, commercial quotas for walleye have been reduced in recent years, much in the same manner as recreational limits were changed in 2003. Returns of tagged Moon River walleye gathered during Winterton's (1975) work and recent UGLMU commercial fisheries assessment efforts highlight the need for continued assessment of the commercial walleye fishery in QMA 5-7.

#### **Recommendation:**

As a result of the above, the following recommendation is suggested; that the status of the Moon River walleye population be considered when setting yearly walleye quotas for QMA 5-7. Additionally, it is recommended that efforts to assess the commercial walleye fishery in QMA 5-7 be increased.

### 5.6 Increased Enforcement Effort

The Moon River area has a dubious reputation and anecdotal history of being a problem area with respect to poaching. Reports of unscrupulous activity continue to present day. Obviously such activities are a direct impediment to achieving the goal of rehabilitating this walleye population.

#### **Recommendation:**

It is recommended that additional effort by UGLMU enforcement staff be directed at the Moon River area whenever possible.

## 5.7 Monitoring and Assessment

There is a need for consistent and scientifically sound monitoring of this population throughout the rehabilitation process and beyond. There have been a multitude of assessment methodologies applied to the Moon River walleye population over the past 40 years (e.g. spring spawning index surveys, creel surveys, fall electrofishing surveys, synoptic trapnet surveys, Early Summer Trapnet surveys (ESTN), commercial catch statistics, fry trapping to evaluate fry hatching success and spring muskellunge index surveys).

Of the various methodologies used, spring spawning index surveys and Early Summer Trapnetting (ESTN) surveys are probably the most cost-effective at meeting the data requirements of an effective monitoring program. There is an extensive database for spring index spawning surveys dating back to Winterton's work in the late 1960s. Despite some difficulties with consistency in methodology, these surveys have been very effective at tracking gross trends in walleye spawning population abundance (Figure 2).

### **Recommendation**

It is recommended that spring, walleye spawning surveys continue to be conducted on an annual basis in conjunction with the walleye egg collection / culture and stocking component of this plan. In this regard, a much more concerted and onerous collection of monitoring data needs to be incorporated into the egg collection. This data needs to be collected, stored and analyzed in a standardized manner such that it is compatible with the existing UGLMU databases and maximizes its utility in tracking spawning population status over time. The EGBSC will be responsible for egg collection and the collection of spawning population assessment data associated with it.

The End of Spring Trapnetting (ESTN) survey is a Provincial standard methodology used by the Ministry of Natural Resources to assess walleye population status. It is a relatively new sampling methodology that uses live capture 6'-trapnets. It has the distinct advantage of allowing direct comparisons between walleye populations sampled in various surveys, in different locations. As such, walleye abundance (as measured by Catch-Per-Unit-Effort) can be ranked according to benchmarks established by surveys conducted throughout the Province. This does have shortcomings however, as walleye populations are very different throughout the Province and therefore not directly comparable. Ideally, reference data should be stratified such that walleye populations being compared are similar in biology and habitat (i.e. lake size, climate (growing degree days), productivity (total dissolved solids) and water clarity (secchi reading)).

Although there is an absence of long-term, trend through time data for ESTN surveys on Georgian Bay and the North Channel, this methodology represents the first Provincially standardized and approved methodology for assessing over-all walleye population status.

The other Provincially standardized and approved methodology for assessing walleye population status is the "Fall Walleye Index Netting" (FWIN) protocol. This methodology uses over-night gill net sets with intended lethal sampling of all fish that contact the net. Considering the depleted state of walleye stocks in the Moon River area, we do not consider this a viable tool to monitor Moon River walleye population status.

**Recommendation:**

That the ESTN survey protocol be used as the primary tool for assessing over-all walleye population status in the Moon River Area. An ESTN survey should be conducted every 5 years, the next one in 2010.

Although spring spawning and ESTN surveys portray the status of the walleye population in response to all stressors that are impinging upon it, they fail to isolate the specific impacts of the sport fishery. The nature of the sport fishery in terms of effort (i.e. fishing pressure), fishing quality and harvest, are 'key pieces of the puzzle' in understanding the dynamics of the Moon River walleye population and one that requires periodic monitoring. Unfortunately, these are complex surveys that are highly demanding in terms of effort (long periods), design, supervision and operational funding. The last ones conducted on the Moon River were in 1984 (Thurston and McIntyre, 1987) and 1988 (Thurston and Emerson, 1989). Clearly, there is an information gap in this regard.

**Recommendation**

That the UGLMU plan for an open-water, creel survey to be conducted within the next five years (2007 – 2012). It would be highly preferable that such a survey be conducted as soon as possible in the above time frame. This is especially prescient should future modifications to sport fishing regulations be considered. Such a survey would effectively characterize the sport fishery "before treatment" (i.e. under current regulations) to establish a benchmark to facilitate comparisons "after treatment" (i.e. under modified regulations).

To the extent possible, the EGBSC and partner associations will assist the UGLMU in the operations of such a creel survey. This could include: a search for accommodations, possible provision of a boat and motor and limited supervision of a creel clerk.

Other sampling protocols have proven effective at providing specific information relating to the Moon River population. For instance, extensive electrofishing surveys conducted during the 1980s were useful at determining young-of-the year and yearling recruitment to the population. Rechan and Thurston (1989) also used these surveys for assessing walleye stocking success. Also, in the 1970s, fry traps were used to monitor spawning success to this stage. Although all these techniques were useful for specific objectives, their present day utility is rather limited. This is due to a completely different fiscal climate, policy framework, organizational set-up, as well as equipment and manpower limitations that presently beset the Ministry of Natural Resources today. It is not likely that these tools are available for present-day Moon River walleye population assessment. Nonetheless, it should be emphasized that *Spring Walleye Spawning Surveys*, *ESTN surveys* and *creel surveys* are quite capable of effectively assessing and tracking walleye population status over time.

## 6.0 Synopsis of Rehabilitation Actions:

<b>1. Implement spring-time flow regime modifications</b>	
Goal:	Provide a flow regime that will facilitate successful walleye spawning and incubation.
Objective	<ol style="list-style-type: none"> <li>1. Reduce peak flows</li> <li>2. Flatten the descending limb of the hydrograph during the walleye egg incubation period.</li> <li>3. Maintain minimum flow specification as per MRWMP. (Minimum flow may be altered based on design of habitat enhancement project.)</li> <li>4. Reduce the proportion of suitable spawning substrate that is dewatered (joint objective with habitat enhancement)</li> </ol>
Responsibility	This activity will be lead by OMNR Parry Sound District (Bracebridge Office) – water control staff. Appropriate consultations will continue between the Upper Great Lakes Management Unit, Ontario Power Generation (OPG) and Parry Sound District water control staff to ensure all flow regime efforts to optimize walleye production are being employed.
Timeframe:	<p>Proposed operations are in compliance with the existing Muskoka River Water Management Plan and will therefore be implemented on an on-going basis.</p> <p>Any future modifications not in compliance with the Muskoka Water Management Plan will require an amendment to the Plan and will be implemented subsequent to the amendment.</p>

<b>2. Enhancement of Walleye Spawning Habitat</b>			
Goal:	Enhance walleye spawning habitat to facilitate improved walleye reproductive success and year-class strength		
Objective	Increase the area of suitable spawning substrate that are accessible/useable for spawning walleye under high flow conditions and are not subject to dewatering under low flow conditions.		
Target	Flow Rate	Formerly – Suitable spawning habitat wetted	Desired – Suitable spawning habitat wetted
	167 cms	100%	100%
	103 cms	79%	95%
	53 cms	57%	85%
	31 cms	32%	75%
	8 cms	32%	75%

Responsibility	<p>Design of the enhancement work will be conducted by the UGLMU in consultation with the OMNR Northeast Science and Information Section. Other partners for this initiative and the general public will also have opportunity to comment on the design through direct negotiations or via the Environmental Assessment process.</p> <p>The EGBSC will be responsible for the construction phase of the initiative as well as meeting Environmental Assessment requirements. The EGBSC will spearhead fund-raising efforts.</p>
Timeframe	Enhancement work scheduled for summer 2008.

<b>3. Rehabilitative Walleye Plantings</b>	
Goal	Increase the adult biomass/number so that when environmental conditions are suitable there is sufficient egg deposition to facilitate the production of significant year classes.
Objective	<p>Stock sufficient number of walleye to increase adult biomass.</p> <p>Past plantings of summer fingerling walleye throughout the 1980s (Appendix A) averaged approximately 115,000 per year. These plantings were highly correlated with a significant increase in the walleye CUE observed in index spawning surveys (Figure 2). Based on these observations, it would appear that the planting of approximately 115,000 summer fingerlings per year is a legitimate target for rehabilitation.</p>
Targets	<p>Stock 115,000 summer fingerlings (or equivalent fall fingerlings – 37,000) for a five year period.</p> <p>Mark stocked fish to facilitate future assessment.</p>
Responsibility	<p>This initiative will share joint responsibility between the EGBSC and the UGLMU. The EGBSC will be responsible for the walleye egg collection. The responsibility for stocking will reside with the appropriate party depending on who ultimately rears fish for Moon River stocking. Walleye raised within the Provincial Fish Culture system will be the responsibility of the UGLMU; those raised outside the Provincial Fish Culture system will be the responsibility of the EGBSC.</p> <p>All stocking will be in accordance with OMNR stocking guidelines and policies.</p>
Timelines	5-year stocking period: 2007- 2011.

#### 4. Collaboration with First Nations

Goal:	Increased First Nation participation in the conservation of Moon River walleye.
Objective	Educate First Nation Communities as to the status of the population and rehabilitative actions being undertaken.  Encourage First Nation Communities to limit walleye harvest at a level commensurate with rehabilitation goals.
Target	Conduct face-to-face consultation with First Nations communities who have an interest in this matter.
Responsibility	OMNR Parry Sound District Office.
Timeline	2007

#### 5. Harvest Controls - Sport and Commercial Fishery Regulations/Quotas

Goal:	Minimize legal harvest of Moon River walleye while recognizing social, economic and industry (tourism, commercial fishing) realities.
Objective	Minimize harvest of Moon River walleye, especially mature fish.
Target	The UGLMU to conduct an internal review of the appropriateness of existing sport and commercial fishing regulations/quotas given the current state and rehabilitative needs of the population.
Responsibility	UGLMU
Timeline	2007 – 08

<b>6. Enhanced Compliance</b>	
Goal:	Reduce the number of walleye that are harvested illegally.
Objective	Increase enforcement patrols in the Moon River area. Promote compliance through public promotion and by-in to the rehabilitation plan.
Target	Over the next 5 years (2007-2011), increase enforcement patrols by 30% over the previous 5-year period. Targeted promotion of plan to potential partners/supporters listed on cover page.
Responsibility	UGLMU The EGBSC will be responsible for public promotion of the rehabilitation plan.
Timeframe	2007 – 2011

<b>7. Monitoring and Assessment</b>	
Goal:	Effectively monitor population status and rehabilitation progress within the Moon River walleye population.
Objective	Monitor long-term trend in spawning stock abundance and spatial distribution. Assess effectiveness of current sport and commercial fishing regulations and quotas.
Target	Conduct annual spring spawners survey (2007 – 2011) Conduct End-of-Spring-Trapnetting (ESTN) survey on a 5-year rotational basis. The next ESTN survey is due in 2010. Conduct intensive open-water creel survey between 2007 and 2011, with a preference for as early as possible within this time period.
Responsibility	The EGBSC will be responsible for index spawners surveys. The EGBSC and UGLMU will share joint responsibility for the 2010 ESTN survey and the intensive, open water creel survey with the UGLMU taking the lead.



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## Appendix A.

### Moon River Stocking Record:

	Year	Stage	Number	Marks / Comments
1 <sup>st</sup> Wave	1973	Fry	3,048,000	No mark
	1975	Fry	1,836,000	No mark
	1976	Fry	3,246,000	No mark
2 <sup>nd</sup> Wave	1980	Fall fingerling (4 ½ mo.)	20,900	RV fin clip
	1981	Fall fingerling (4 ½ mo.)	3,700	LV fin clip
	1982	Summer fingerling (1 ½ mo.)	11,750	No mark
	1983	Summer fingerling (1 ½ mo.)	59,000	No mark
	1984	Summer fingerling	114,600	No mark
	1985	Summer fingerling	179,300	No mark
	1986	Summer fingerling	146,400	No mark
	1987	Summer fingerling	72,900	No mark
	1988	Summer fingerling	144,300	No mark
1989	Summer fingerling	161,700	No mark	
3 <sup>rd</sup> Wave	1997	Fry	Unknown	No report submitted
	1998	Fry	500,000	
	1999			No record of planting
	2000	Fry	2,700,000	
	2001	Fry	Unknown	Unreported
	2002	Fry	163,000	
		Summer fingerling	67	
	2003	Fry	60,000	
	2004	Summer fingerling	1,260	
		Fry	650,000	
	2005	Summer fingerling	1,820	
Fry		221,000		
2006	Summer fingerling	257		
	Fry	180,000		