



# THE BLUE HERON

The Bras d'Or Stewardship Society

P.O. Box 158, Baddeck, Nova Scotia B0E 1B0

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NO. 2

This issue of the Blue Heron has an excellent article by board member, Tim Lambert, regarding how global warming may affect the Bras d'Or Lakes during the next few years. The changes will be incremental, but note worthy, as shoreline configurations will be altered. Developing a public awareness of such potential transformations is warranted as the Society attempts to be proactive regarding future environmental changes that impact on the Bras d'Or Lakes.

Recent scientific work has suggested that the Bras d'Or Lakes may rise three quarters of a meter over the next one hundred years. If so, 40% of the current beaches maybe submerged! One hundred years represents about 125% of a person's lifetime based on a 80-year life expectancy. So, during the life of a person's earthly existence, the proposed reordering of the waterline level in the Bras d'Or Lakes will be

indeed a most significant event.

The potential of rising sea levels is being attributed to global warming as polar ice caps melt and the general atmosphere of the world heats up. Climactic change has been reordering global weather patterns creating a more volatile climate profile seriously altering the interface between man and Mother Nature. Hurricanes, tsunamis and the like have had devastating consequences around the globe during the last few years. As water temperatures warm up, the strength level and number of hurricanes generated along the eastern seaboard of North America has been increasing.

More immediate shoreline changes highlighted in the newsletter are those that are deliberately undertaken by property owners to alter shoreline configurations. There are numerous instances of individuals altering their shore front along the perimeter of the Bras d'Or lakes. Two specific locations along the Bras d'Or Lakes shoreline have been recently brought to the attention of the Society. One property owner has been found guilty of destroying a natural habitat by indiscriminate infilling. Details are found in the 'News Item' section of this newsletter.

Sharon Carter, the Bras d'Or Lakes co-coordinator for the Nova Scotia Dept. of Natural Resources, has provided a piece in this newsletter regarding the steps required in reporting infractions that are adverse to the ecological integrity of the watershed. Such

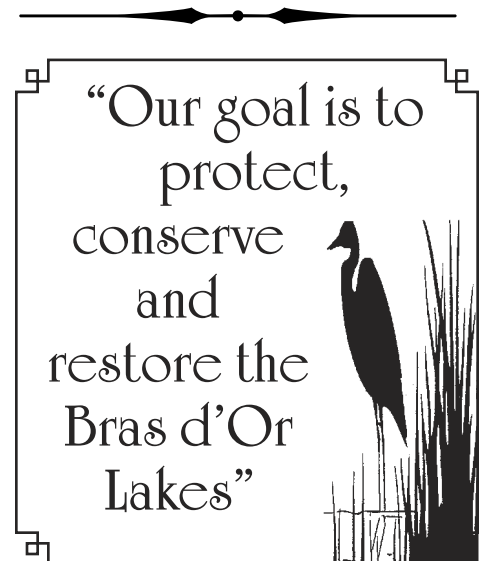
environmental transgressions focus on unpermitted infilling, destruction of wildlife habitat, unwarranted siltation from improperly constructed roads and shoreline alteration that changes the profile beaches.

It should be considered a legitimate right indeed a duty of any concerned individual to feel free to report observed actions that lead to creating adverse degradation of the environment. Often people are fearful to report because he or she may suffer some form of retribution. To the contrary, such individuals should be patted on the back for doing the right thing.

As in the January 2006 Blue Heron, the most recent issue of the Unama'ki Institute's newsletter is included with the Society's newsletter. By including this publication once again, our intention is to keep you better informed of First Nation's concerns. The Blue Heron is an important vehicle of communication. We hope you enjoy it!

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# NEWS ITEMS:

## **ANNUAL GENERAL MEETING:**

The Annual General Meeting of the Society was held at the Bell Museum in Baddeck on March 18, 2006. Close to forty individuals attended this meeting. Chairman, Pat Bates, provided an overview of the past year's activities. Ken Jardine, the guest speaker, talked about scuba diving in the Bras d'Or Lakes. Alan Nicholson gave a detailed presentation on the adverse effects of the proposed strip mining operation on Boularderie Island.

## **SHORELINE INFRACTIONS:**

A letter was received from a concerned individual in March regarding an infill of waterfront property in the Marble Mountain area. The infraction was reported to the Nova Scotia Dept. of Natural Resources. A property owner without appropriate permits undertook the infill. The Department of Natural Resources has inspected the sight. Charges are pending.

## **BADDECK BAY INFILL:**

The owner of a shore front property on Baddeck Bay has been found guilty of infilling a natural habitat. A fine of \$3,000.00 has been levied. The owner must remediate the property at personal expense. The fine is payable to the Society with the provision that the Society work with the Department of Fisheries and Oceans to create a brochure that will inform the public regarding accountable stewardship of shoreline habitat. (See Responsible Land Ownership article)

## **2006 SCHOLARSHIP ESSAY:**

The second annual scholarship award was presented to Kaitlynn Fennel of Johnstown for her essay which is printed in this newsletter. The scholarship award is \$500.00. The essay is printed in this newsletter. (The essay of the runner up Neal Nicholson has also been included.)

## **SUBDIVISION INVENTORY:**

Concerns have been raised about growing sub-division developments on the perimeters of the Bras d'Or Lakes. There are a number of new subdivisions offering lots for sale. Items of concern are availability of potable water, sewage disposal, the lack of set back regulations from the shoreline and infilling. It has been suggested that an inventory of subdivisions be updated from the 2001 study sponsored by the Society.

## **NEW BOARD MEMBER APPOINTED:**

In May on 2006, Steve Sober was appointed to the Society's Board. Steve resides in the River Deny's area. He has been a stalwart supporter of the Society. Steve has raised oysters fished in the Bras d'Or Lakes. Steve has a background in geology. His input will be much welcomed as a board member.

## **SEMI-ANNUAL MEETING:**

It has been decided by the Society's board of directors not to hold a semi-annual meeting in August 2006. This decision was made based on time constraints on various board members with regards to the available meeting dates.

## **GRAND NARROWS MARINA:**

In April a representative from the Grand Narrows Marina met with the board to clarify the status of the infrastructure. Concerns had been raised regarding the condition of the facility and the pump out system. We were informed that lack of funds had prevented repairs to the pump out equipment. An application for funding support has been made to carry out required repairs to the facility to insure that the pump out system works and repair damage to the wave break and existing dock facilities. (See article by Pat Bates)

## **BEN EOIN GOLF COURSE:**

Recent press releases in the Cape

Breton Post have focused on a renewed effort by private interests to develop an eighteen-hole golf course adjacent to the Ben Eoin ski hill in East Bay. Two Society board members have attended a meeting regarding the proposal. The Society is concerned about siltation during the construction phase and the use of chemicals in future course maintenance. Currently, the proponents are seeking to raise equity contributions from the private sector.

## **BRAS D'OR LAKES DESIGNATION:**

On Thursday July 6, 2006 an official announcement was made at Ben Eoin beach by representatives of the federal Minister of Foreign Affairs, Peter Mackay, that the lakes have been officially designated a 'no dumping' zone. This means that boats are not allowed to dump raw sewage into the waters of the Bras d'Or Lakes. The Society worked in a cooperative effort with local communities and various government departments for the no-dumping designation. (See enclosed copy of article from July 7, 2006 Chronicle Herald article)

## **GREEN CRAB INFESTATION:**

Two recent articles in the Halifax Chronicle Herald have highlighted the perils of the green crab. One article postulated that the green crab might have arrived in Maritime waters via ballast water. This article also suggested that the green crab might have transported from Norway. A second article focused on Tatamagouche Bay in Northumberland Strait as the green crab infestation threatens both the oyster and mussel shellfish industry. The oyster fisher in the Bras d'Or Lakes has been already devastated by the MSX parasite which is also believed to have arrived in ballast water evacuated in the Bras d'Or Lakes from gypsum boats.

# BARRA STRAIT MARINA UPDATE

By Pat Bates

The Bras d'Or Lakes can be a sailors' paradise, however, it can also be a rough and dangerous body of water under high winds and storm conditions. This is what happened to (the operators of) the marina at Grand Narrows in 2004 and last year when storm conditions caused significant damage to the wharf and floating dock area. Bad luck didn't end there, when a malfunctioning valve disabled the boat pump out sewage equipment leaving the marina out of business for that service.

Marine service stations for boaters are being installed throughout the Maritimes and the North Eastern U.S. and will become an essential part of recreational boating infrastructure in the future. Nowhere are these facilities more important than on the enclosed water of the Bras d'Or Lakes. We are pleased to say that the essential repairs have been made at Barra Strait Marina and their full range of services to boaters has been restored.

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## ENVIRONMENTAL PROTECTION

**WE ALL HAVE A PART TO PLAY!**

By: Sharon Carter

Stewardship – what does it mean and how can I be a steward? Well, if you are reading this newsletter, you probably have a good idea of what stewardship means. The question becomes, how can I effectively become a steward of the land, air and

water? One way is to ensure that the activities we undertake in everyday life leave a minimal footprint. Another way is to work with our regulatory agencies when we see something we feel is adversely affecting the environment. The agency we report our concern to will vary according to the type of activity, but there is common information we need to provide to ensure the agency is able to take action.

The following is an overview of the information needed when filing a complaint or concern with NS Environment and Labor (NSEL). We will also discuss the benchmarks used to determine if a complaint will proceed fully through the NSEL compliance program.

How do you start? If you feel someone is adversely affecting the environment, these are steps you should follow:

- Contact your local office of NS Environment and Labour. If the event occurs after hours, contact the environmental emergencies hotline at: [1-800-565-1663](tel:1-800-565-1663).
- Be very observant (before, during and after you have reported the incident). It is very important that you make written notes of your observations.
- Any notes you make should answer the 5 W's (who, what, when, where and why).

While there may be an expectation from the public that the Department has an unlimited authority to make decisions, we are bound by regulations, policies and procedures pursuant to applicable legislation.

NS Environment and Labour adheres to the following five-step procedure for responding to complaints.

Complaint Response Procedure

- Initial
- Inspection-information gathering
- Investigative
- Response
- Penalty
- The initial phase of complaint response is the creation of an operational file. The inspector

may or may not contact the complainant at this time.

Next is the inspection-information gathering phase. It is here that a determination of whether there has been a violation the Environment Act or its regulations is made. There are two benchmarks used to make this decision. The first is whether the activity occurring requires an approval. An Inspector would review the Act and the Activities Designation Regulations to aid in this determination. Undertaking a designated activity without an approval is a violation of the Act. The second benchmark is adverse effect. Could the activity being undertaken result in a release that would create an adverse effect?

Adverse Effect – an effect that impairs or damages the environment, including an adverse effect respecting the health of humans or the reasonable enjoyment of life or property.

Once the complaint is reviewed in consideration of our measuring sticks and a violation is confirmed or suspected, the file moves to the Investigative phase.

During this phase the Inspector must follow the same investigative protocol as other law enforcement agencies, including the police. The Canadian

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Charter of Rights and Freedoms provides the framework within which Environment Inspectors must work to investigate a complaint. This may include obtaining search warrants to collect evidence, requiring material witnesses to provide statements, and obtaining statements from suspects under caution. Cautioning suspects is required under the Charter of Rights and Freedoms and advises suspects that they need not say anything and provides them with an opportunity to contact a lawyer.

During the response phase all information is gathered and analyzed. The Inspector in consultation with the Regional Compliance and Inspection Coordinator recommend the most appropriate course of action. This may include a non-punitive approach (education), environmental warning, prosecution, or a ministerial order. If prosecution is recommended, the information gathered during the investigation is brought before the public prosecution service. The public prosecution service makes the final decision on the type of charge.

Penalties under the Environment Act can consist of a fine, imprisonment, or a fine and imprisonment. The Court also has discretion to impose additional fines based upon the profits accrued from illegal activity. The Court may also issue a "Court Order" directing the offender to take remedial action.

Regardless of the outcome of a complaint lodged with department, as a complainant you should expect the following from NS Environment and Labour:

- your complaint will be dealt with in a professional and

competent manner;

- you will be treated with courtesy and respect; and
- you will be contacted prior to the conclusion of the file.

*Sharon Carter is the Bras d'Or Lakes Coordinator and a former Inspector Specialist with NS Environment*

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## Responsible Land Ownership

By Gus Van Helvoort

**I**t may have come as a surprise to the landowner to learn that he wasn't going to be allowed to infill a tidal pond and drainage channel on his Bras d'Or Lake property. But it was an even bigger surprise when the Baddeck office of Fisheries and Oceans Canada (DFO) learned that the work was carried out anyway. The landowner's actions not only destroyed critical fish habitat but, following his conviction, cost him a \$3,000 fine and an order to completely undo all of the infill work.

The Fisheries Act contains a very important clause addressing harm to fish habitat – commonly referred to as HADD (Harmful Alteration, Disruption or Destruction). It prohibits – well – harmful alteration, disruption or destruction of fish habitat. Its effective use depends on teamwork and various levels of government working together. When DFO is notified of a project proposal that may impact on fish habitat, habitat officers review the project and visit the site before making a recommendation based on the potential of the proposed activity

to damage habitat. If it's their opinion that the work could harm fish habitat, the information is considered by the responsible regulating agency when making a final determination on issuing a permit.

Tidal ponds, with their protected, warm and shallow water, provide ideal habitats for plankton and nurseries for young fish. In the case of the above landowner, both DFO and the Province notified him that he should not proceed with the proposed work because it would likely destroy critical fish habitat.

Although convictions under section 35(1) of the Fisheries Act are not uncommon, the sentencing on this particular conviction was unusual; the landowner was ordered to pay the fine to the Bras d'Or Stewardship Society to support local habitat enhancement projects. He must also completely restore the old pond and drainage channel to their former state – a project he estimates will run between \$8,000 and \$10,000.

A costly lesson, to be sure. But, with so few remaining tidal ponds and the important role they play in the Bras d'Or Lakes ecosystem, the price of not repairing the damage done would have been far greater.

Gus van Helvoort is the DFO Area Director for Eastern Nova Scotia.

Questions about this column? Or would you like to read about other DFO issues that affect you and your community in future columns? Send en emails to [CommEnquire@mar.dfo-mpo.gc.ca](mailto:CommEnquire@mar.dfo-mpo.gc.ca) or call (902) 426-3550. This article was reprinted by permission after appearing in The Reporter.



## CHALLENGES THAT WE MUST MEET!

Protection of our environment is a concept that we all embrace. However, to practice sound environmental safeguard habits requires a continual awareness and a discipline to act responsibly as individuals and to encourage and support others to act responsibly.

The Bras d'Or Lake, a special body of water that is an inland sea is a great attraction for home and cottage owners, recreation boaters, commercial shippers, and various types of fisheries. Increased activity within the watershed such as poorly functioning septic tanks, improper design and construction of roadways and clearing of lands to the waters edge is having a damaging effect on the health of the Lake. The increase in the construction of new and larger subdivisions around the Bras d'Or Lake, increased home and cottage construction, as well as construction of wood harvesting roads points to the pressing need for new or vastly updated recommendations for best practices and/or regulations.

We always hope that awareness building and education will cause a change in human behavior fostering a greater respect toward our environment. Unfortunately, this does not always work and solutions to problems of environmental abuse are left to the slow but more rigid installation of ever more regulations.

Another example is the all too frequent practice of unauthorized in-filling of beach and wetland areas as well as the alteration and destruction of barrochois, marine, fish and animal habitat areas. We may not be

aware that this type of activity is illegal and offenders can be subject to legal action. The Nova Scotia Department of Natural Resources must be contacted in advance of action to change or significantly alter a beach or shoreline area.

The Bras d'Or Stewardship Society will be making the case with the respective departments of the relevant governments to conduct a program of education featuring specific guidelines and designs for constructing roads on private properties. The emphasis will be on the control and prevention of drainage of soils into the Bras d'Or Lake. We will be recommending that special attention be paid to construction of logging roads or roads to mining and special projects.

Of the many risks to the Lake none is so silent or seldom recognized as the choking off the supply of oxygen in the water due to mass accumulation and build up of mud and siltation from indiscriminate land clearing and private road construction. The growth in distasteful algae with its obnoxious smells is clear evidence of a Lake that is injured.

Surely we can solve this problem!

Pat Bates,  
Chairman

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### 2006 Scholarship Essays

#### **“Should the Bras d’Or Lake and Its Watershed Become a United Nations World Biosphere Reserve?”**

By Kaitlynn Fennel

The name Bras d’Or translates into “Arm of Gold”,

presumably referring to the sun reflecting from its waters. Located in the heart of Cape Breton, Nova Scotia, the Bras d’Or Lakes is a deep inland sea with brackish waters covering 1100 square kilometers. The Bras d’Or has been recognized internationally for its unique beauty, which has resulted in increased tourism, especially recreational boaters. At present there are a number of threats to the health of the ecosystem. Sewage, bio-invaders and shoreline development problems require more attention. The Bras d’Or Lakes and its watershed should be designated a United Nations World Biosphere Reserve to help promote and encourage experimentation with traditional and modern resource management; and to establish opportunities for remediation and improvement in this sheltered and relatively closed laboratory like system.

The area of the Bras d’Or Lakes Watershed has great historic value and is of high cultural significance to the native Mi’kmaq. It is also a center of Scottish heritage. The natural resources of the Bras d’Or Lakes Watershed contribute strongly to the local economy. Two of the major resources are logging and gypsum extraction, which provide full time jobs. It is home to a beautiful array of wildlife. The largely undeveloped shorelines and relatively healthy fish populations have attracted a remarkable number of Bald Eagles. There are few protected conservation areas. Clear cutting

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and largely unregulated shoreline development need to be addressed. Erosion from residential and commercial development is a major source of siltation. Silt is lethal to young fish. Lobster and herring have been overexploited and the herring fishery was closed in 1999. A designation would increase awareness of these problems.

There are only three narrow openings to the Bras d'Or Lakes from the Atlantic Ocean: two natural outlets to the northeast and an artificial connection to the southwest called the St. Peters Canal. These long and narrow channels cause a significant lack of exchange with the ocean. Low exchange with the ocean coupled with runoff from the surrounding highlands concentrates land based pollutants. With the extremely low rate of water circulation, the flushing rate can slow to 40 years in some coves and inner bays of the Lakes. This slow exchange means that pollution is more cumulative and more connected to the components of this relatively closed ecosystem. The waters of the Bras d'Or Lakes are threatened by sewage discharge from municipal sewage treatment facilities, inadequate domestic septic systems, and recreational boaters. Insufficient pump-out stations on the Lakes, and a lack of raw sewage holding tanks in boats have contributed to a high level of fecal coliform contamination. During the last few years, a growing number of shellfish beds have been closed due to fecal coliform contamination.

Like recreational boaters, shellfish growers also favor sheltered bays, which are particularly susceptible to fecal coliform build-up due to low exchange.

The warm water temperatures of the Bras d'Or allows for suitable growth and development of the American Oyster. The Lakes' commercial oyster industry is worth approximately one million dollars each year. The oyster population in the Bras D'Or Lakes contributes significantly to the overall habitat as natural and effective filters, which recycle nutrients. The green crab is a bio-invader that has the ability to pry open small oyster shells; dig up buried clams, and devours a large number of mussels a day. The species consumes shellfish, bivalves and other crabs. It has invaded the Bras d'Or Lakes and breeds quickly in the warmer water temperatures. This green crab has the potential to create ecological problems by disturbing the Bras d'Or Lakes' ecological balance. In 2002, tests detected an outbreak of the Multinucleated Sphere X parasite in the Bras d'Or Lakes. This microscopic parasite causes extensive tissue damage in oysters and death in 95% of the oyster it infects. Appearing to be related to lower salinity levels and higher water temperatures, the MSX outbreak is the first incidence in Canadian waters. The outbreak of MSX was possibly caused by the discharging of ballast water from ships travelling from MSX infected areas, such as the Chesapeake Bay area. Approximately 29 shell-fishing sites are currently closed due to the contamination

of MSX. There is also concern for the potential of ocean-going ships spreading other water-borne parasites, such as Dermo, a disease that threatens all species of shellfish. The spreading of the MSX parasite has demonstrated the environmental consequences of unregulated ballast water discharge. The effects of bio-invaders are more cumulative and more connected in this relatively closed ecosystem. The designation of the United Nations biosphere will help exert more pressure on the government to enforce more strict Canadian ballast water regulations for the Bras d'Or Lakes and also regulations to restrict dumping of sewage from recreational boaters. Maybe these changes in this more intimate ecosystem can better increase our understanding of the interactions of these organisms and the changes to their environment.

The possible threats to the ecosystem need to be recognized through environmental education and awareness, which will demonstrate the importance of the unique Bras d'Or ecology. The lack of funding for science management and monitoring is issues in the assessment of threats to the Lakes. The United Nations biosphere designation will increase awareness and interest in the unique potential to better understand marine ecosystems. The demographic growth and the continuous increasement of consumption throughout the world have created severe pressures on all ecosystems. These factors

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risk causing the destruction of the earth's life support system. A long term vision, collaborative research and management are key to supporting the Bras d'Or and the Bras d'Or Stewardship Society's goals of preserving, protecting and restoring the Bras d'Or Lake and its watershed. With this designation, we will truly attract the world's attention towards this beautiful and unique ecosystem.

*Kaitlynn Fennel recently graduated from St. Peters Academy*

★ ★ ★

By Neal Nicholson

**T**he world we know is changing quickly. Shopping malls stand where our continent's mightiest forests once grew. Our oceans, which were once clear, clean and abundant with life, are now populated more with garbage than fish. Do we really want our beautiful Bras d'Or Lake to become one more of nature's wonders lost to mankind's growth and greed?

Time is short. Each day Man's progress claims another piece of the Earth. Unless something is

done, and done fast, the Bras d'Or Lake we know and love could very well be lost. However, if the United Nations were to make the Lake into a World Biosphere Reserve, who knows? Maybe we will have saved one of Nova Scotia's (and the world's) greatest landmarks from catastrophe. Won't that be worth the price, however high it might be?

The Bras d'Or Lake is a sight, which has given inspiration and insight to thousands of people, including one of the world's greatest minds, Alexander Graham Bell. Don't we owe it to Dr. Bell, who gave mankind so much and our town so much pride - to preserve the lake he loved so much? It would be an insult to the man to not do our best to protect it.

And wouldn't it be to the advantage of our own economy to make the lake a Biosphere Reserve? After all, it is the tourism industry that keeps small towns like Baddeck alive. And what is Baddeck's greatest attraction for tourists? Well gee wiz, it just happens to be the Bras d'Or Lake. If the lake is not preserved, and loses its beauty, (which will surely happen if we do not change our ways, and fast) the tourism industry will die. And if the tourism industry dies, Baddeck and so many other towns like it will

be ruined. Preserving the Bras d'Or Lakes will also help to preserve ourselves.

The Bras d'Or Lake is the heart that keeps the blood pumping through our home. They say it is a foolish animal which will foul its own nest. If this is the case, why do we continue to do so? If the Bras d'Or Lake is made into a United Nations Biosphere Reserve, we might be able to halt (and maybe even slowly reverse) the adverse affects we have had on our great lake. We like to pride ourselves on the beauty of our country, so why not do something to help save that beauty, before it slips away forever.

*Neal Nicholson recently graduated from Baddeck Academy*



***The Bras d'Or Stewardship Society is interested in contributions from our members. If you have something to contribute to the Newsletter or would like to work with the society's board, please let us know. The society is an all volunteer organization that welcomes input from individuals interested in promoting the conservation, protection and restoration of the Bras d'Or Lakes and its watershed.***

# **The Bras d'Or Stewardship Society**

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**Bras d'Or Watch**  
 to report any observed acts, incidents and  
 violations that threaten the integrity of  
 Bras d'Or Lakes please call:

# 1 800 565 1633

Our Email: [stewardship@baddeck.com](mailto:stewardship@baddeck.com)

**2006**

## **BRAS D'OR STEWARDSHIP SOCIETY**

- |                 |                          |          |         |  |
|-----------------|--------------------------|----------|---------|--|
| MEMBER          | <input type="checkbox"/> | \$15.00  |         | <input type="checkbox"/> Yes, I am in favour of conserving and restoring the |
| FAMILY          | <input type="checkbox"/> | \$25.00  |         | Bras d'Or Lake and watershed through   |
| CONTRIBUTOR     | <input type="checkbox"/> | \$50.00  |         | responsible stewardship.   |
| SUPPORTER       | <input type="checkbox"/> | \$100.00 | Name    |  |
| LIFETIME MEMBER | <input type="checkbox"/> | \$500.00 | Address |  |

*Mail check or money order along with your name  
 and address to:*

**Bras d'Or Stewardship Society**  
**P.O. Box 158**  
**Baddeck, Nova Scotia, B0E 1B0**

Phone

e-mail

Fax



# Sea Level Rise and the Bras d'Or Lakes

By Dr. Timothy Lamberty, PHD

When undertaking repairs to the dock at Fortress Louisbourg, during the restoration project which began at this historic site by Parks Canada in 1961, workers noticed ring bolts set into its wall. Although these had obviously been used to tie up boats, strangely, they were now about three feet underwater at high tide. The conclusion was inescapable; sea level was now much higher than when the fortress was built in the early eighteenth century.

Geologists are well aware of this rise in sea level and have documented this phenomenon in studies designed to shed light on the prehistoric timing and rates of sea-level change. Quite simply, the cause of this fluctuation in sea level can be attributed to ice. During ice ages, the normal water cycle was disrupted as vast quantities of water fell as snow, compressed to ice and formed vast ice caps, which covered most of the northern continents. Trapped as ice, this water did not



return to the ocean and as a result sea levels dropped. During the last ice age, which ended about 10,000 years ago, sea level off Cape Breton was about 50 m below its present height. As the ice retreated, lakes were formed where the glaciers' movements had scoured the land. At that time, the Bras d'Or Lakes, seen below, were much smaller and connected by rivers. Then, the entrance to the Lakes was about 25 metres above the sea level. As the glaciers melted, water was returned to the oceans, which began to rise. About 6350 years ago sea level had risen 25 metres, at which point the ocean broke through to the Lakes. With further rise in sea level, the Lakes grew in size and became increasingly salty, until saline enough to support marine life, which invaded from the ocean outside. At the time the inundation of the Lakes began, the rise in sea level was in the order of 79 cm per century, but this rate declined over the past

6000 years and today is about 37 cm per century. You may wonder why sea level kept rising long after the glaciers had melted. This is because of something geologists term glacio-isostatic crustal subsidence. Although hard to believe, the earth's crust is actually quite elastic and if deformed by pressure, The Bras d'Or Lakes ~10,000 years ago, can rebound when this pressure is released, albeit very slowly. In this case, the tremendous weight of glaciers on the continents depressed the earth's surface beneath the ice. As a result of this deformation, the earth actually bulged upwards at the margins of the ice cap to compensate. Thus with the melting and removal of ice, the earth directly beneath the ice cap gradually rose to its pre-glaciation height, whereas, the land at the periphery of the continent (i.e. Nova Scotia) began to subside to former levels.

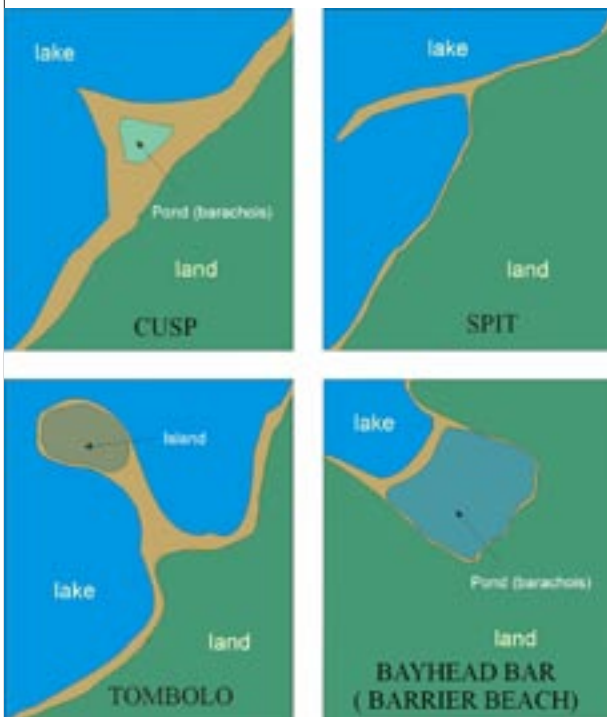
With the retreat of the glaciers in Atlantic Canada, sea level began to rise rapidly due to addition of melt waters and also subsidence of the land mass. As mentioned above, this rate of subsidence of land slowed as it approached former pre-glaciation levels.

However, routine measurements of sea level indicate that the rate of rise is now increasing. There is currently little doubt that this is due to global warming causing the erosion of the ice caps of

Greenland and Antarctica. It has been calculated that the rate of increase in sea level will rise from the present rate of 36.7 cm per century to 60 cm per century by 2030 AD, 99.2 cm per century by 2080 AD and 115.1 cm per century by the year 2100. This means that sea level around Cape Breton will probably rise by about 76 cm (2 1/2 ft) in the next 100 years. What does this mean for the Bras d'Or Lakes?

Although the tide in Sydney Bight outside the Lakes rises and falls about 37 cm, the tidal amplitude in most of the Lakes is a mere 3 to 4 cm. The biggest decrease occurs at the entrance to the Great Bras d'Or Channel, from 37 to 16 cm, and in the short distance to the Seal Island Bridge there is a further rapid drop to 7.3 cm. The entrance to the Lakes through the Great Bras d'Or Channel is too narrow and shallow to allow enough water through on a rising tide to enable the Lakes to equal the water level in Sydney Bight before the tide starts to fall again. However, the rise and fall of water in the Lakes is often far more than can be attributed to the gravitational pull of the moon and sun. Increases ten times greater than these lunar tides can be caused by an inverted atmospheric pressure effect. Simply put, sea levels are higher when low-pressure systems overlie the ocean and vice versa, lower levels with high pressure. These pressure systems usually last for days and sometimes weeks. Thus when Cape Breton experiences a prolonged low pressure system, the water in Sydney Bight stays higher than normal for a period of time long enough to allow sufficient water to flow into the Lakes to raise the water level far higher than that caused by a lunar tide.

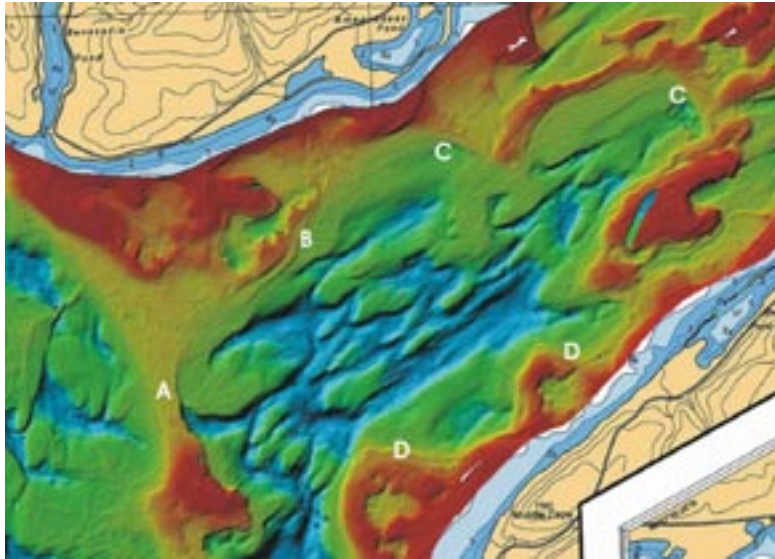
The total shoreline length of the Bras d'Or Lakes is 1272 km, including 285 km of island shore. This amounts to 14.4% of the total Nova Scotia coastline. A recent mapping study classified the Lake's shores into four main types; rocky (10%), unconsolidated beach and cliff (43.3%), vegetated (30.4 %) and artificial (2.6%). A further 13.7% were not mapped but were mostly vegetated or fringing beach with sloping backshore. Of these types, unconsolidated beach and cliff are the most susceptible to erosion by wave and current action. Four types of unconsolidated beach common to the Bras d'Or Lakes are illustrated to the left. The erosion of headlands made up of glacial till creates these barrier forms. The sediment eroded from these cliffs is transported by alongshore currents and deposited to add to gradually forming spits etc. When the supply of sediment is exhausted (cliffs greatly reduced by erosion) these beach forms will often break down and be removed by wave action. Presently at 76 locations around the Bras d'Or Lakes, it is estimated that 39% of these coastal barriers are in building or established phases, 43.9% are in breakdown and collapse phases, 13.4% are in a transition phase (not clear whether about to break down or aggregate) and 3.7% are significantly constrained by human activity.



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If sea level rises faster than the barrier beach forms can be supplied sediment from eroding headlands

and cliffs, they will all be broken down by wave action or submerged. Sea level rise immediately post glaciation was very rapid and since there is little tide in the Lakes, as we have seen, and also wave action is minor compared to the open coast, many barrier beach forms were submerged intact and can be seen on multibeam sonar images of the bottom of the Lakes.



Multibeam sonar image of the entrance to East Bay off Benadacie. Red signifies shallow water and blue is deep. Submerged features are: A) tombolo, B) spit, C) bayhead barrier beaches and D) rounded cusps.

Since unconsolidated cliffs and headlands supply the sediment for barrier beaches, it is obvious they are subject to severe erosion. Measurements within the Lakes indicate that headland retreat is on the order of 0.1 to 0.3 metres per year. This would be greater if the Lakes experienced higher

wave action; for instance, just outside the Lakes at the entrance to the Great Bras d'Or Channel similar measurements indicate rates of 0.4 to 1.5 metres per year. During the next century, as the rate of sea level rise increases, the rate of erosion of cliffs will also increase.



Thus it would be prudent not to build anywhere near eroding cliff tops or at low elevations around the Lakes. Constructing habitations on or behind coastal barrier beaches, whether or not artificial protective structures are built, would seem extremely foolish, yet this is done either through foolhardiness or ignorance. An extreme example of this can be seen at Gillis Beach, Jamesville where a residence has been built on a barrier beach. At its northerly end, the beach is comprised of a number of parallel ridges, the landward ones being formed prehistorically. The house is sited on one of these old beach ridges behind the front (seaward and youngest) beach ridge. The elevation of the front ridge is 1.0 metre above sea level and the height of the ridge upon which the house is built is 0.5 metres.



Even now, as can be seen by the seaweed deposition lines in the lower photograph, water levels have reached the top of the outer protective beach ridge. Erosion of vegetation at the crest of the ridge has caused a 'blowout' strip (middle right of photograph) and waves have actually carried seaweed and woody debris across the ridge to the other side. Water levels have no doubt reached this height due to the inverted atmospheric pressure effect as described earlier. Even without the dismal outlook on sea level change predicted by scientists for the coming century this habitation would appear to be in immediate peril. Extreme storm surge water levels accompanying tropical storm or hurricane remnants with their associated high winds and waves could easily breach this barrier beach with most unfortunate consequences. The most disturbing detail of this unfortunate Gillis Beach, Jamesville house sitting is that the owner of the house received planning permission for its construction.

Basing their inferences on the drowning of prehistorical shorelines, scientists predict that complete destruction and submergence of barrier beaches may become frequent by 2030 and typical by 2045. Artificial shores are also rated as highly vulnerable and will require increased maintenance as they become increasingly ineffective in protecting backshores as sea level rises. By the end of the century, the rates of sea level rise will be in excess of 1.0 metre per century. By then, the impact on the coastline of the Bras d'Or Lakes may be very severe, particularly in low-lying areas.



***This essay was based largely on a manuscript authored by John Shaw, Bob Taylor and colleagues of the Atlantic Geoscience Centre, Natural Resources Canada. I am indebted to them for access to it although still in preparation. This informative work will be available through the Bras d'Or Stewardship Society when published.***

