Mosquito Control Program

2002 Annual Report

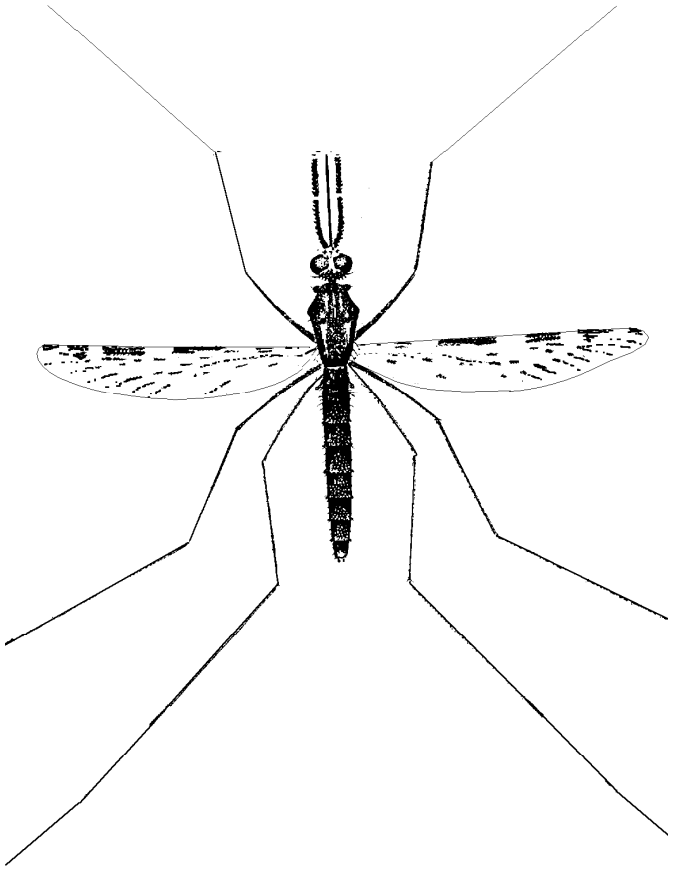

Table of Contents

General Director's Report

Letter of Submission

Dear Members:

It is my pleasure to submit to you the Annual Report of the Greater Moncton Pest Control Commission for 2002

You will notice that we have changed the annual report format this year in order to comply with the Board's request to have reports prepared in both English and French. Many of the details, which were provided during the past years, will be available on CD. Members wishing additional information are advised to contact Mr. Jeff Scott.

I wish to thank you for giving me the opportunity to serve as your General Director and should you have comments or suggestions on improving our operations, please do not hesitate to contact me.

Sincerely,

Louis LaPierre, Ph.D
General Director
Greater Moncton Pest Control Commission

Summary of Initiatives in 2002

Information and Education

The educational information brochure was finalized and distributed throughout the Greater Moncton Area prior to the start of the 2002 mosquito control season. It is felt that this approach can help individual homeowners to reduce breeding habitat in their own yards. We have participated to various media requests during the past season.

Inventory of Adult and Larval Mosquitoes

Completed the first year of a two-year field survey of the mosquito species present within the Greater Moncton Area. This program focused on a larval and adult trapping and identification program. The program will be continued in 2003.

Public Outreach

The Commission should continue to promote itself as a public partner in mosquito control. The public should be educated as to how they can fulfill their own responsibilities to control mosquito-breeding habitat. As well, developers and planners should be made aware of how they can control breeding habitat through design and construction practices. We will continue to update our web site in order to provide relevant information to the citizens of the Greater Moncton Area.

Management Priorities for 2003

- We will monitor any changes associated with the emergence of the West Nile virus and endeavour to work closely with the various Provincial and Federal Agencies to ensure that we are ready to address the issues if and when the virus is detected within our area. I will be meeting with the three Municipal Councils in order to discuss the operational procedures adopted by the Commission to deal with the West Niles Virus.

- We will continue exploring opportunities to work in close collaboration with private landowners. We will continue to track the highly productive breeding areas and continue to obtain the collaboration of the private landowners in assisting us to develop a comprehensive control program.
- We will initiate a comprehensive mapping program on the upper reaches of the Petitcodiac River to ensure that we have a complete coverage of the present waterway. This would provide the Commission with background data should the authorities proceed with an experimental opening of the gates as a result of the Environmental Impact Assessment of the Petitcodiac River.
- We will continue to work in close collaboration with the City of Moncton engineering staff in order to finalize the development of a comprehensive GIS database associated with the mosquito control program.
- We will also continue to work with the local press to continue our education and information program for the general public. We will also continue to support the Purple Martin Society and other groups interested in promoting the natural control of mosquitoes within the Tri-Community.
- We will continue to work towards the development of a five-year strategic plan aimed at making our operation more responsive to the changing landscape. This process will require a careful integration of the existing data sets. This work is time consuming and will require a considerable effort from our limited staff.

Mosquito Abatement

Introduction

This is the second year since changes to surveillance protocol have been implemented. These changes have resulted in more accurate portrayals of mosquito breeding activity, water retention characteristics of the Petitcodiac River marshes and larvicide materials needed to establish control of the mosquito population. Mapping of the maximum potential breeding area of each of the management sites along the Petitcodiac River has been completed and has enabled comparative analysis between the sites. A number of issues contributing to the nuisance mosquito population have been examined and a discussion of the results follows.

Discussion

Breeding Area

There was an increase in the area covered in the abatement program this year. The sources of this increase were due to the redefinition of existing management sites, the inclusion of new sites and the actual flooded area of the marshes, which fluctuate naturally. These are all a result of the maturing of the river marshes and weather patterns. The northern bank of the Petitcodiac between the two river crossings (in front of the old City of Moncton Landfill) was introduced into the program this year. Contributing factors are drainage channels that have silted in and no longer shed the collected water. As well, an old wharf section was deposited by high tides, creating a depression where water ponds and does not allow vegetation growth.

Reexaminations of the Dieppe marshes between the dyke system and the river have shown significant change in the maximum breeding area for mosquitoes.

Some of the historical site definitions were found to be half of that which is supported now. The accentuated rate of these increases was a result of a change of surveillance activities and do not reflect the actual rate of change being experienced by the marshes themselves. Nonetheless, time has shown that silting in of the Petitcodiac River and establishment of new marsh area has increased substantially and remains the single most contributing factor to the rising cost of mosquito control.

The cool wet spring conditions resulted in sustained maximum breeding area in the marshes for a longer than normal period. Concentrations of larvae are typically lower under these conditions, translating into more larvicide required per larva to achieve required control. Comparisons to the 2001 control season have shown consistently that the actual flooded areas of the marshes in 2002 were more extensive, largely due to the nature of the spring conditions.

Breeding Index

Initial examination of this year's data would indicate that the measured breeding index (BI) follows a consistent rise with the increase in sustained breeding area. Closer examination yields something different. A comparison between 2001 and 2002, from the start of the program until June 13, showed that marshes experiencing no appreciable changes in defined monitoring area show decreases in the BI of up to 40%. Marshes used as a reference were adjacent to the Point Park Subdivision in Riverview and along the dykes of the previously known village of St. Anselme. Since sustained breeding areas in these same marshes were up from last year it can be determined that mosquito control practices this year were more effective. Contributing factors to the increase in control quality could be:

1. Cooler water temperature slowed larvae development and allowed enough time to apply the required larvicide.

2. Changes in monitoring protocol (staff dedicated to specific regions) resulted in better understanding of breeding conditions and faster reaction time.

Breeding conditions were sustained through the month of July as more normal precipitation amounts were received. The 2001 control season experienced a drought and therefore cross comparisons between the two years will show quite different characteristics.

Larviciding

The control season of 2002 experienced a 30% increase in larvicide requirements from a typical year. A total of 467 bags (8453 kg) were used this season and more could have been required if the month of August was not so dry. Initial purchases of Vectobac, the larvicide used by the Commission, were not adequate and an additional shipment was arranged for the middle of July. The increase in larvicide required for the program is due to the change in marsh area recognized this year and is not an anomaly unique to 2002. This will require a significant increase in budget in order to maintain the quality of our program.

There are some areas that required less larvicide than last year. This is a result of both better surveillance and possibly a reduction in mosquito eggs due to last year's drought. The latter is a possibility that cannot be measured. Most areas requiring more larvicide reflect the reality that the sustained breeding areas were larger. Even though the BI for a flooded section might be lower, larvicides are primarily applied according to surface area covered and not by larvae concentration alone.

The majority of marshes treated in our program are not located within any of the municipal boundaries. The adjacent municipality, for ease of reference, is used to refer to their location. The distribution of larvicide is indicated in the following chart.

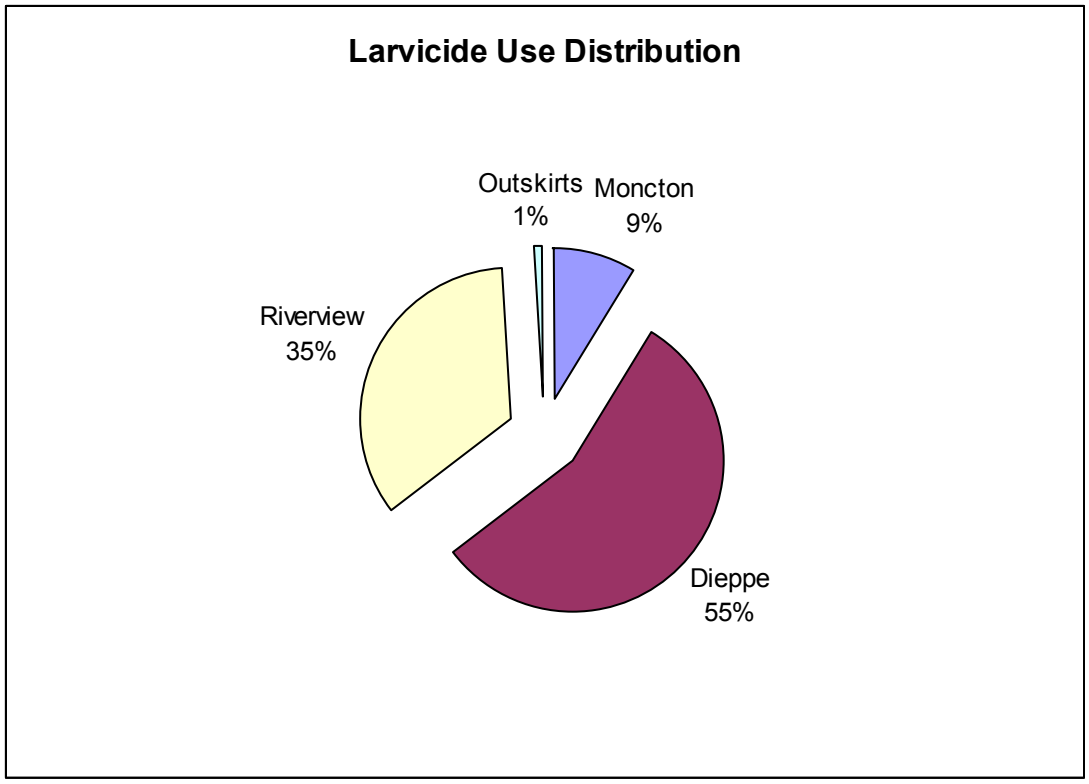

Figure 1: Larvicide Use Distribution

Nuisance Reduction

Throughout this year's program, landing rate counts were taken as part of the species identification program. The primary purpose of this exercise was to capture specimens for identification that potentially would not be attracted to any of our mechanical traps. The counts were also structured to give an indication of nuisance population so that effectiveness of our control program could be measured. Measurement of the reduction of nuisance mosquitoes in the Moncton area is very difficult. The region is very unique due to the extensive proportion salt marshes to other breeding environments and therefore finding a reference area to measure the population of mosquitoes where no control is carried out is not possible. In order to measure a minimum reduction in nuisance mosquitoes, a landing count was conducted in the Village of Memramcook and then compared to counts taken within the Municipalities of Greater Moncton. The count in Memramcook took place July 31, 9:30 PM. The counts in Greater

Moncton took place on Aug 1 from 6:20 PM to 7:35 PM. The weather conditions were consistent. Memramcook experienced a count of 3 per minute where Greater Moncton experienced an average of 0.25 per minute. This translates into a suggested nuisance reduction of 92% or more.

Conclusion

The control season of 2002 was successful despite unfavourable spring conditions and expanded breeding areas in the marshes. The nuisance reduction of 92% is a result of a number of factors including discovery of additional breeding habitat, assigning staff to specific regions, but most importantly a staff dedicated to quality work and service to their community. In order to maintain the nuisance reduction experienced this year, larvicide inventories will need to be increased. This will enable the Commission to respond to the changing nature of the breeding sites as well as unusual weather patterns.

Mosquito Species Composition in Greater Moncton

Introduction

The goal of this study was to determine the species composition of mosquitoes in the Greater Moncton area. This kind of study is important considering the recent outbreak of West Nile virus in North America and the potential threat for the Greater Moncton area.

The collection of larval and adult samples in different habitats has led us to the identification of at least 34 different species. The Greater Moncton Pest Control Commission did a similar study, where larval samples were collected in 1997. Sixteen species were identified at the time in the Greater Moncton area.

This report includes a preliminary list of the identified species, an explanation of how they were collected and preserved, and a brief analysis of the data collected. It is important to note that these are preliminary results since the study in still underway and will be until the end of the mosquito season.

Sampling

The larvae were collected using a standard dipper. Most of the sites sampled were located within the Greater Moncton Pest Control Commission's site database and were located within the Greater Moncton area. The larvae were put in a bottle and brought to the lab where they were treated and identified. Site description, location and water characteristics were recorded. Larval sampling began on April 24th and ended on August 22nd. Adults were collected using different types of traps. During a three-day period, six light traps, six CO2 traps and two gravid traps were active. The gravid traps were placed in different

sample sites were adults were observed. Unlike the gravid traps, the CO2 and light traps were located in twelve permanent stations with six of the stations outfitted with CO2 traps and the other six with light traps. After three days, they were dismounted and prepared for the next rotation. There were two three-day rotations per week. The six stations that had the CO2 traps for the first rotation had light traps for the second rotation and vice versa. The adult sampling began on may 20th and will continue until no more mosquitoes are found in the traps.

Identification

Both the adults and larvae were identified using The Insects and Arachnids of Canada, Part 6 The Mosquitoes and Canada Diptera: Culicidae (Wood et al, 1979).

The larvae were placed in a sand bottom petri dish with ethanol and were observed under a dissecting microscope. The sand helped the larvae stay in place. Once identified, the specimen was put in a labeled bottle and separated by species.

The adults were also identified using a dissecting microscope. The adult mosquitoes were first mounted on pins as described in Wood et al 1979, but the identification was much easier when they were not mounted since the pins sometimes hid important structures. The time needed to mount and dry the specimen and the number of specimen collected was so much that that step was suppressed from the method early in the process. The adult mosquitoes were brought to the lab in petri dishes, were counted and then readied for identification. They were sorted under the microscope and were placed in other petri dishes for identification using the key in Wood et al 1979. They were then sorted by species and placed in labeled vials.

Results

A total of 27 197 adult mosquitoes and 75 larval samples were collected between April 24th and August 26th. Eighteen different species were collected using the larval method and 33 different species were collected using the adult mosquito trapping. The total number of different species collected and identified so far is 34. Of those 34 species, 11 have been associated with West Nile virus in the United States according to the Centre for Disease Control. The number of different species for the Greater Moncton area could change if more are found or if the species confirmation proves that some were falsely identified.

Table 1: Species Identified in Larvae Study

Aedes cantator	Culex pipiens
Aedes vexans	Culex restuens
Aedes sollicitans	Culex territans
Aedes canadensis	
Aedes cinereus	Culiseta morsitans
Aedes decticus	
Aedes fitchii	Wyeomyia smitthii
Aedes provocans	
Aedes punctor	
Aedes excrucians	
Aedes implicatus	
Aedes stimulans	
Aedes abserratus	

Table 2: Species Identified in Adult Trapping Study

Aedes cantator	Culex pipiens
Aedes vexans	Culex restuens
Aedes sollicitans	Culex territans
Aedes canadensis	
Aedes cinereus	Culiseta morsitans
Aedes decticus	Culiseta minnesotae
Aedes fitchii	Culiseta melanura
Aedes provocans	
Aedes punctor	Mansonia pertubens
Aedes excrucians	
Aedes implicatus	Anopheles punctipennis
Aedes stimulans	Anopheles walkeri
Aedes abserratus	Anopheles earlei
Aedes stricticus	
Aedes communis	
Aedes pionips	
Aedes hexodontus	
Aedes triseriatus	
Aedes flavescens	
Aedes atropalpus	
Aedes intrudens	
Aedes diantaeus	
Aedes mercurator	

The CO2 traps were the most efficient method of capturing adults mosquitoes, capturing on average 178 mosquitoes in a three night period versus 10 mosquitoes per three night period for the light trap. The light traps were more efficient in catching male adult mosquitoes. Nearly half the adults captured in the light traps were male compared to the CO2 traps that captured virtually only female adult mosquitoes. The CO2 traps were easier to sort since only mosquitoes, midges and black flies were captured. The light traps caught a greater variety of insects including flies, moths and caddis flies. The mosquitoes in the CO2 traps were also in better condition than the mosquitoes caught in the light traps. The gravid traps were the least efficient method, yielding on average 4 mosquitoes per rotation.

Conclusion

A total of 34 different species were identified to date in the course of this study. Of those 34 species, 33 were found as adults and 18 were found as larvae. The reason more species occur in the adult sampling is probably because of the difficulty in sampling some species as larvae. For example, Mansonia pertubens, which attaches itself to the emergent vegetation, would not be captured using the standard dipping technique. There is still some work left since the sampling will continue until there are no more adults captured in the traps. This will allow us to determine which species are present at the end of the season and give us a better idea of the species cycle for the whole year.

Marsh Bird Nesting Survey

Introduction

The marsh bird nesting survey is conducted to evaluate changes in the marsh avian population within the Greater Moncton area. This is in order to assess changes within the breeding bird populations.

Results and Discussion

There were a total number of 69 nests found within the mosquito control areas. A total of 64 nests found in non-mosquito control areas in the 2002 season. The number of bird nests found in mosquito control areas is fairly consistent with the 2001 season showing only a 1% increase. Species composition did however vary with eight total species found, two species in addition to the 2001 season. This is a 33% increase from the total number of species found in the 2001 season.

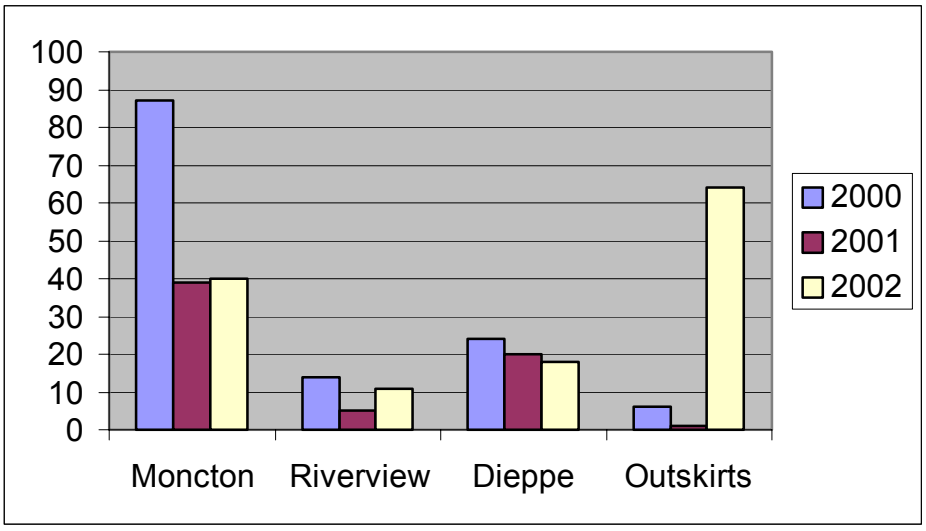

Figure 2: Comparison of bird nests by locality 2000-2002

Figure 2 demonstrates the similarities between birds nests found in each locality over the past three seasons. This year, there was a significant increase in nests found in the outlying areas. One reason that may explain this difference is that in contrast to at least the last two years the Dover Ducks Unlimited area was

monitored early in the season when vegetation was at optimal levels for nest monitoring. In Moncton, there are two sites (LaFrance and Maritime Products) that have undergone development over the past few years, which may contribute to explain the decrease in nests found in those areas. This accounts for the large number of nests found in Moncton in the 2000 season.

Conclusion

This year's marsh bird nesting survey illustrates a 1% increase from the 2001 season, but a 45% decrease in the 2000 season. The number of bird nests found in a particular season may be affected by several factors. Pollution (including noise), weather and food supply all contribute to whether or not a bird will nest in a certain location. The Greater Moncton Pest Control Commission provides a marsh bird nesting survey to assist the commission in assessing potential impacts of the application of their mosquito control program.

Muskrat Survey

Introduction

The purpose of conducting a muskrat survey in Greater Moncton and surrounding areas is to investigate the correlation between muskrat huts and mosquito populations. Areas inhabited by muskrats can support the presence and development of mosquito larvae. The huts indicate the presence of permanent pools of water and therefore provide information strategic to mosquito control. The water surrounding the huts tends to melt first in the spring due to the heat absorbed by the vegetation used to construct the hut. As a result, early populations of mosquitoes can be found in areas inhabited by muskrats.

Discussion

Hut Distribution

There has been an increase in hut numbers in all regions with the exception of Dieppe where a decrease of 20 huts was noted (Figure3). Overall, the hut count has increased by 42% from last year and 34% from 2000. A large increase has been shown for the Moncton Area this year; however, this is not an accurate comparison of the hut numbers. Upon investigation, it was noted that the Dutchill Ducks Unlimited site was not monitored in 2000 and that in 2001 it was monitored late in the season when it was difficult to see the huts. When this site was removed from the comparison, Moncton's 2002 surveillance shows only a 3% increase from the 2000 level, but a 68% increase from last year. Again, it appears that the Morton Uplands area was not monitored last year, accounting for a large increase in hut numbers.

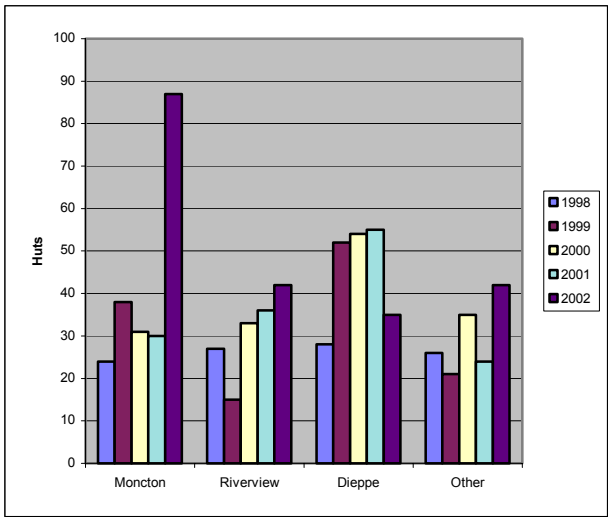

Figure 3: Hut Distribution by Municipality

The count decrease in Dieppe was not due to any inconsistencies in the marshes monitored. There was a 36% decrease from 2001 and a 35% decrease from 2000. A change in hut counts does not necessarily mean a change in the muskrat population. Muskrats are also known to burrow into the sides of banks. The hut decrease was found in one portion of the Petitcodiac marshes. If this marsh has become unsuitable habitat for huts construction, it may explain the decrease in hut numbers.

Water Depth and Area

Water depth and pond area are important factors in mosquito breeding sites. Mosquito larvae are not typically found in water deeper than 0.5 m. The distribution of water depth associated with the huts can be seen on Map 9. In sites such as Bahama Court and Hawkes, that have water depths around .5 m, very low concentrations of larvae have been found. In other locations, such as Selick, where the water depth is shallow around the huts but the area of water is very large, the larvae concentrations have also been low. This is because the larger water bodies are able to support natural larvae predators such as fish and frogs. In the deeper water, it is also more difficult for the larvae to survive due to the turbulent water surface.

The relationship between the depth of water and the size of the muskrat huts is illustrated in Fig 4. There is a general trend showing that the deeper the water, the larger the huts will be. Since the pond area as well as depth was measured at each hut, it may be possible in the future to map the area distribution of water depths in order to gain a better understanding of the larvae habitat surrounding them.

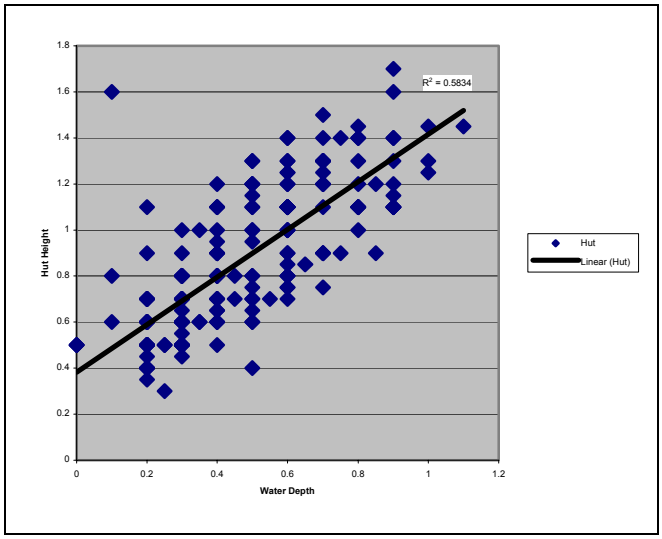

Figure 4: Comparison of hut height to depth of water

Conclusion

There are many factors that can affect the number of huts found in a particular marsh at any given time. One major reason is the amount of water found in the marsh. Water levels can be influenced by the amount of snowfall during the winter. If there is very little snowfall, the marshes may be drier than in the past, making them unsuitable for muskrat huts.

The marshes are a dynamic ecosystem, constantly undergoing change. It is important to continue monitoring the marshes for muskrat huts in order to maintain an up-to-date record of potential mosquito breeding sites.

Stream Survey

Introduction

The purpose for conducting a survey of Humphrey's Brook was to reassess the potential of mosquito breeding habitat along the stream corridor as well as to document ecological changes within the stream. The Greater Moncton Pest Control Commission last surveyed Humphrey's Brook in 1996.

Discussion

Stream Conditions

Two hundred and fifty-nine points were surveyed along the stream. For easy reference and comparison, Humphrey's Brook has been divided into five distinct segments based on their visual stream characteristics (Sections A to E on Map 10).

For safety reasons, Section D of the stream was not surveyed. A large amount of industrial debris such as scrap metal, concrete and wooden palettes was found, making it difficult and unsafe to walk in or around the stream. The findings were reported to the NB Dept of Environment and Local Government.
The average water velocity (Figure 1) varies greatly depending on what section of the stream you are in and what types of flow conditions are present. In the case of Humphrey's Brook, riffled sections of the stream produce higher velocities than runs or pools. Where the water was deep, such as in Sections A and C, the average water velocities were extremely low. Velocity measurements at these locations are subject to a large amount of error. In some cases, the wind would carry the ball across the stream.

Overall, bank erosion is a concern. Steep banks border the majority of the stream. In most cases, these banks have little vegetation to secure soil in place

(Fig 2 to Fig 5). The banks have been designated as right or left as you stand looking down stream. Section B and E already display signs of severe erosion. Future development of the area may alter the hydrologic cycle, forcing more surface water into the stream. Since the streambed consists of bedrock, additional water will cause further bank erosion as the stream channel widens and water runs down its banks.

Mosquito Breeding Habitat

One major area has been identified as a mosquito-breeding site along Humphrey's Brook. The site is a ditch running along the base of the railroad track west of Mill Rd in Section E. The stream is separated from this ditch by a sewer access road that is undergoing severe erosion. The upper portion of the ditch is no longer draining properly. The ditch, as well as pools of water developed by the eroding road, have produced an ideal breeding location. Dips taken in this ditch produced larvae counts of over 100. The lower portion of the ditch eventually drains into Humphrey's Brook.

The upper portion of Humphrey's Creek, Sections A to D, also has potential breeding sites located along the stream course. In most places, steep embankments border the stream. Drainage channels have formed at the base of the embankments that are currently holding stagnant water. At the time of the survey, no larvae were found in these pools. This section of the stream flows through an unpopulated area. Access to these sites is limited and at the present time, they are not considered viable sites for larvae monitoring and abatement. If further development occurs in the area, the situation should be re-assessed.

Conclusion

At present, the only major concern in regards to the ecological health of Humphrey's Brook is the industrial waste found in Section D. In some locations, the natural streambed has been covered with wooden pallets and scrap metal.

This portion of the stream would be an ideal candidate for a stream restoration program.

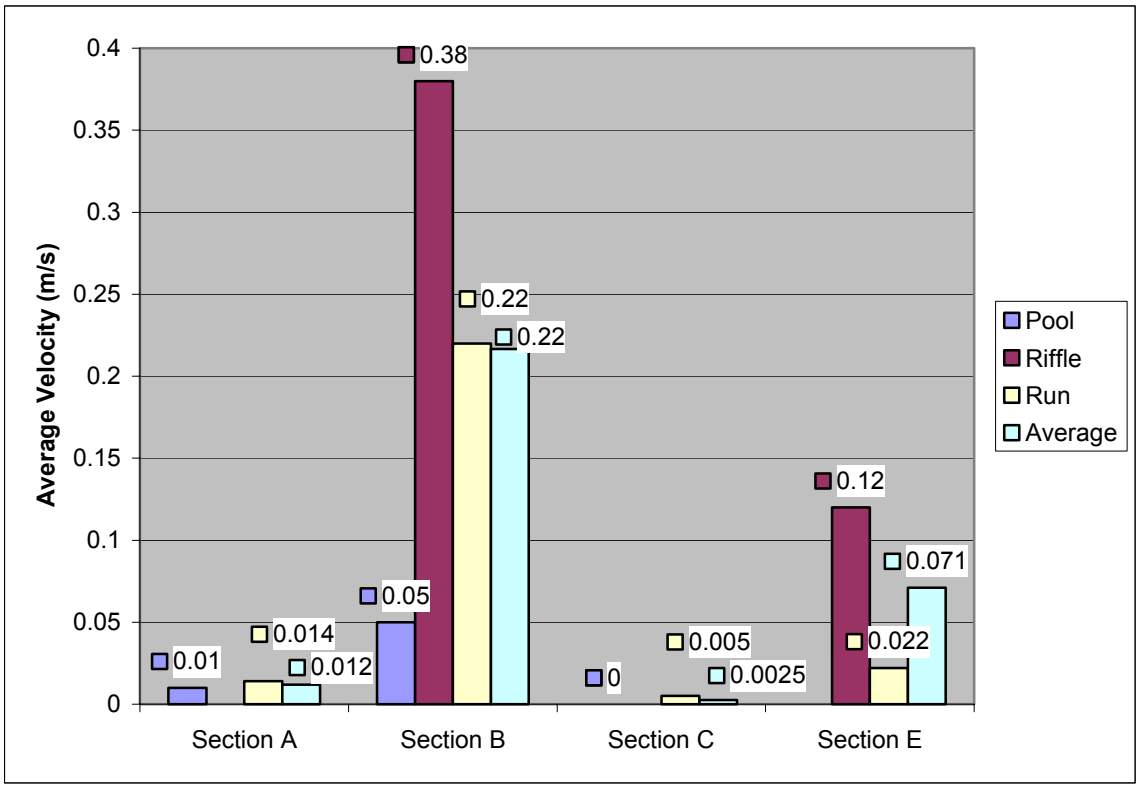

Figure 5: The average velocity for each stream flow type (pool, riffle, run) as well as the average velocity for the whole section.

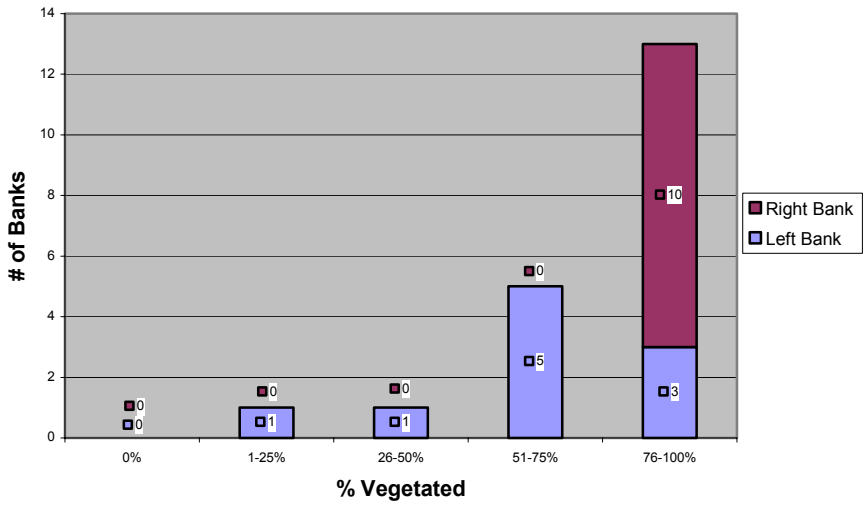

Figure 6: Distribution vegetation densities found in section A.

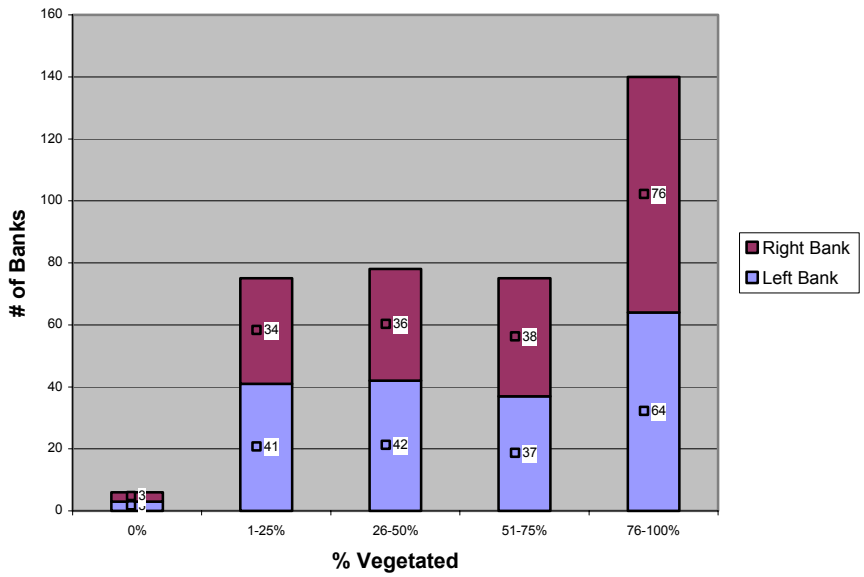

Figure 7: Distribution of vegetation densities found in Section B.

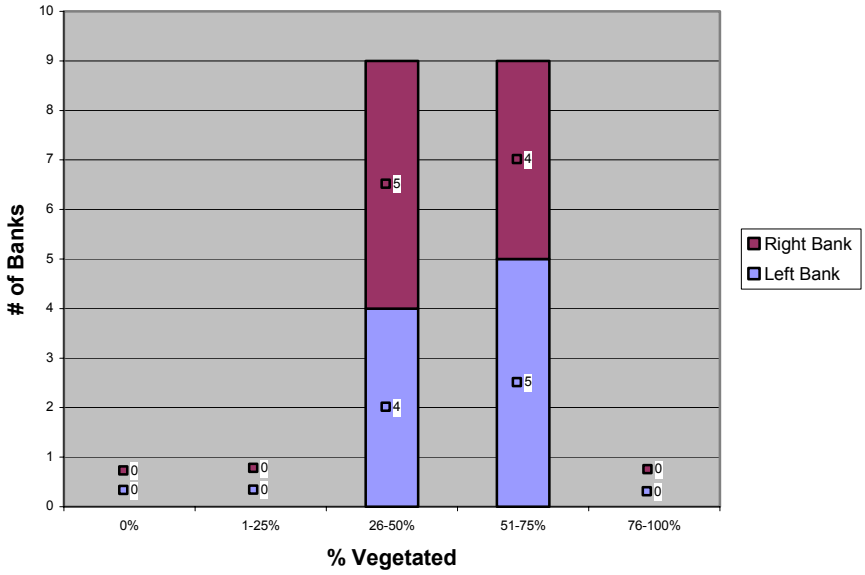

Figure 8: Distribution of vegetation densities found in Section C.

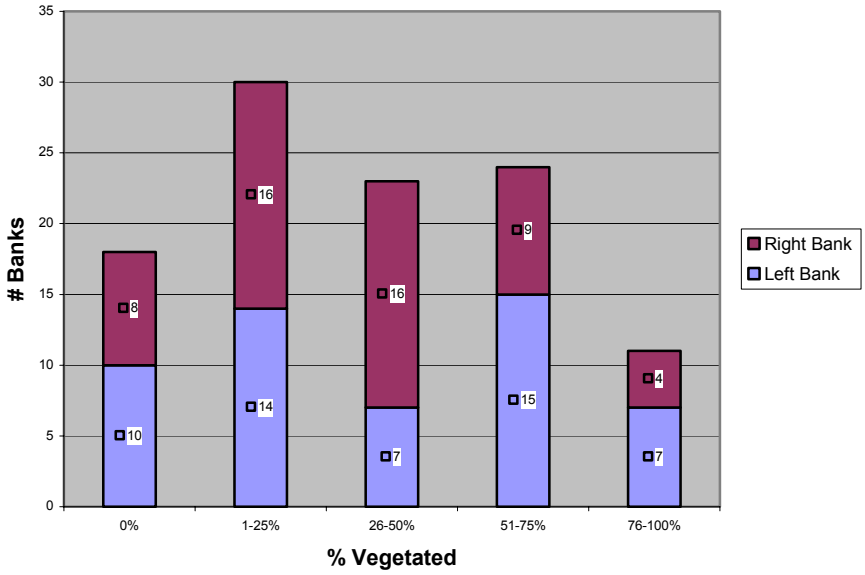

Figure 9: Distribution of vegetation densities found in Section

Weather

Introduction

Meteorological summaries from Environment Canada are tracked in the Commission's databases. Yearly reviews are made to evaluate the impact of fluctuating weather patterns on yearly mosquito control requirements.

Discussion

Total Precipitation

Precipitation amounts for April to August 2002 conformed much more to normal amounts than the same period in 2001. The month of April experienced levels 50% above normal, the majority of that being in the form of rain. May through June was very close to normal. August shows as normal but closer examination reveals that almost all of the rain came in a 2-day period. The rest of the month was very dry.

Relative Humidity

Normal relative humidity levels are not published by Environment Canada. Comparisons to 2001 show that maximum humidity levels were consistent. The differences were noted in minimum humidity levels. High humidity levels impact the felt nuisance mosquito problem by allowing the adult mosquitoes to leave their resting areas for longer periods of time. It will also impact the drying capabilities of each day resulting in more or less evaporation of water in the marshes.

Degree-Days

"Many entomological model use day-degree or temperature summation models that assume development rate is proportional to temperature." – Mosquito Model Description, International Research Institute for Climate Prediction. Since

mosquitoes cannot regulate their own temperature, their development rate is dependant on water temperature. The temperature of the water is dependant on the heating capacity of each day. Heating degree-days for April and May were below normal, which corresponds to the slower evaporation rate of marsh water as well as slower developmental rates of the mosquito larvae.

Conclusion

Weather experienced in 2002 was much more typical that that of 2001. Increases in mosquito control requirements due to weather changes are not temporary but indicate a continuing trend. It will be interesting to observe degree-day trends over time to observe potential climate change impacts.

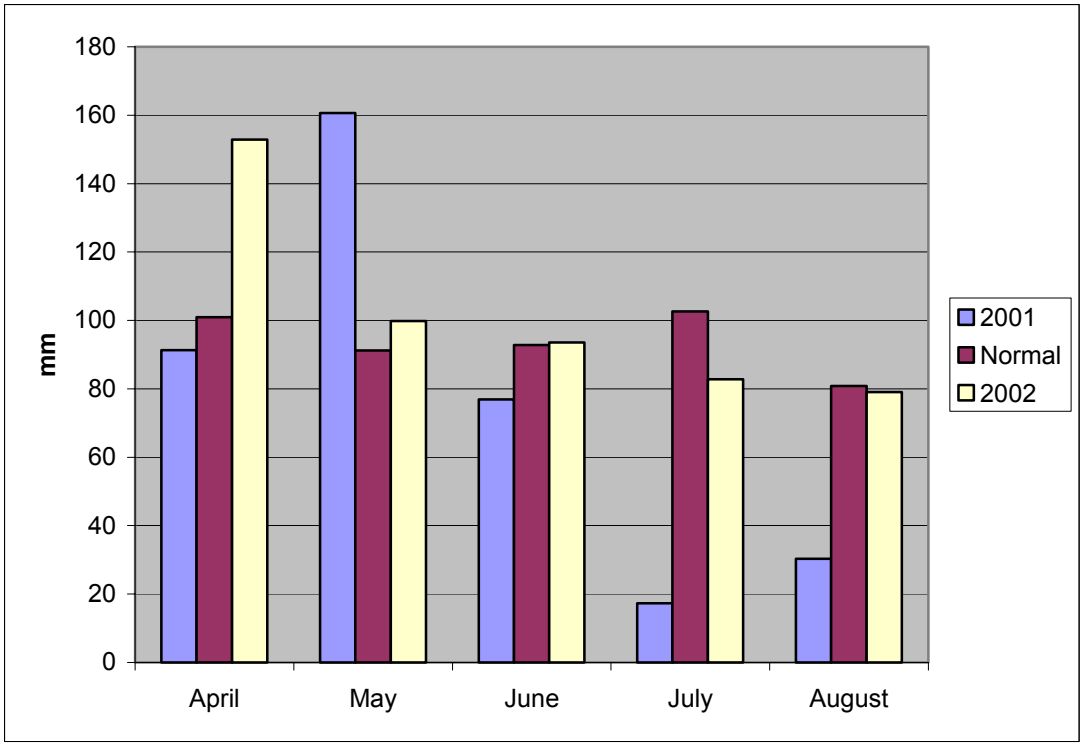

Figure 10: Total Precipitation

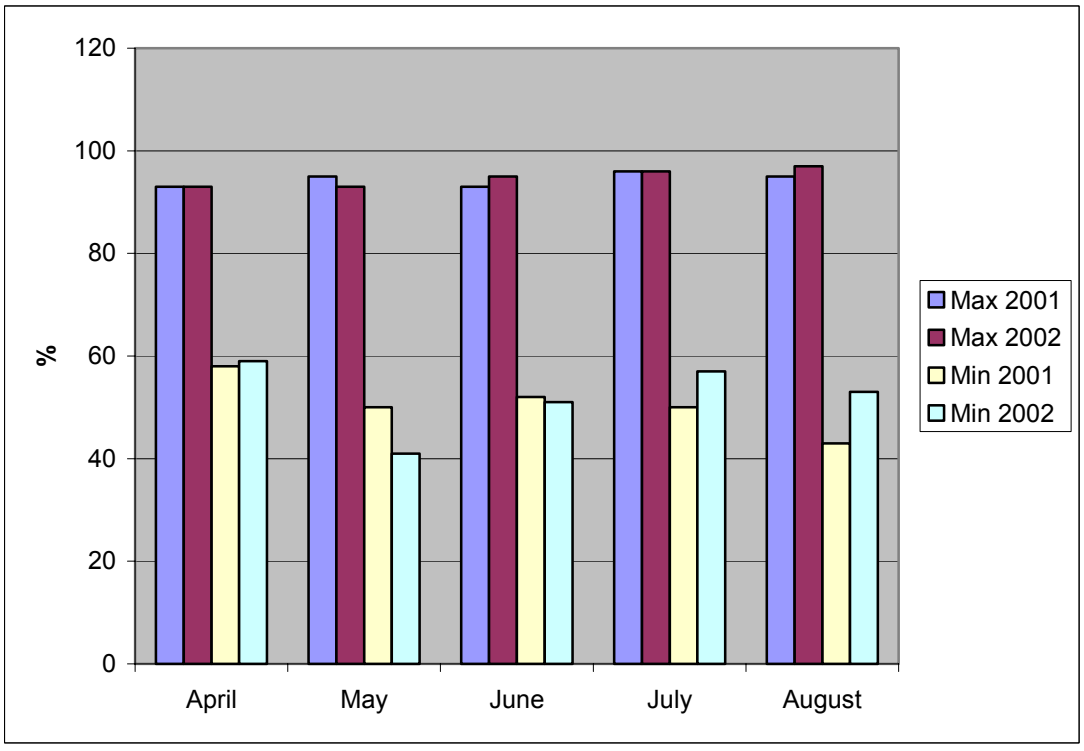

Figure 11: Relative Humidity

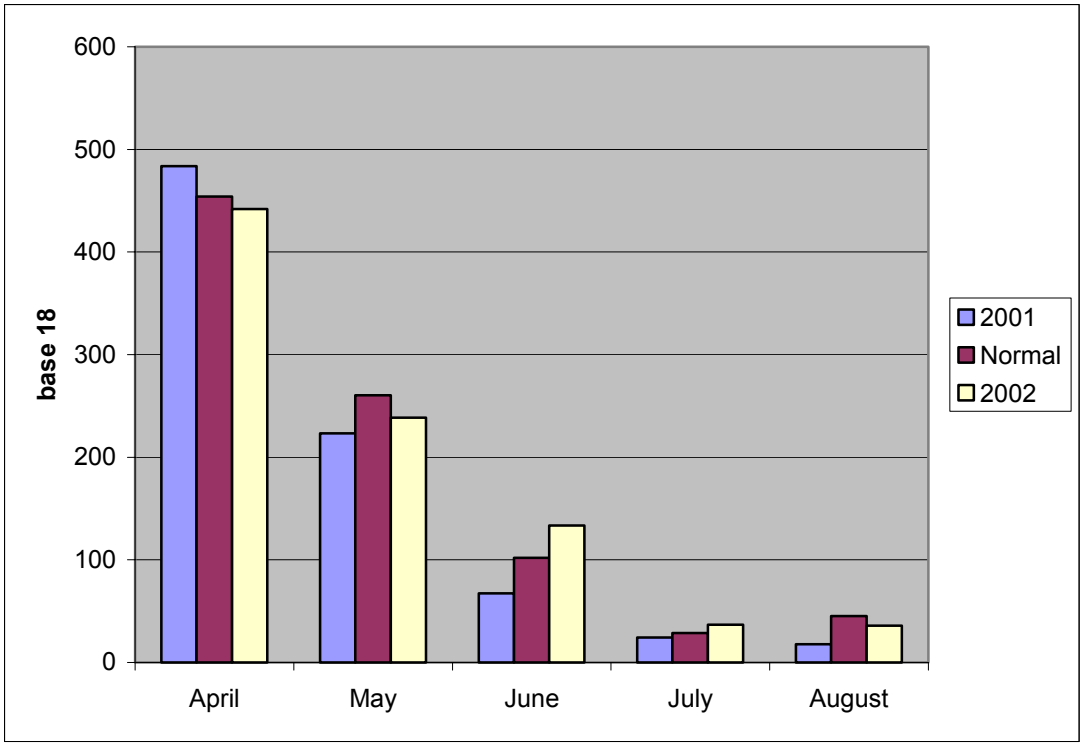

Figure 12: Degree-Days, Heating

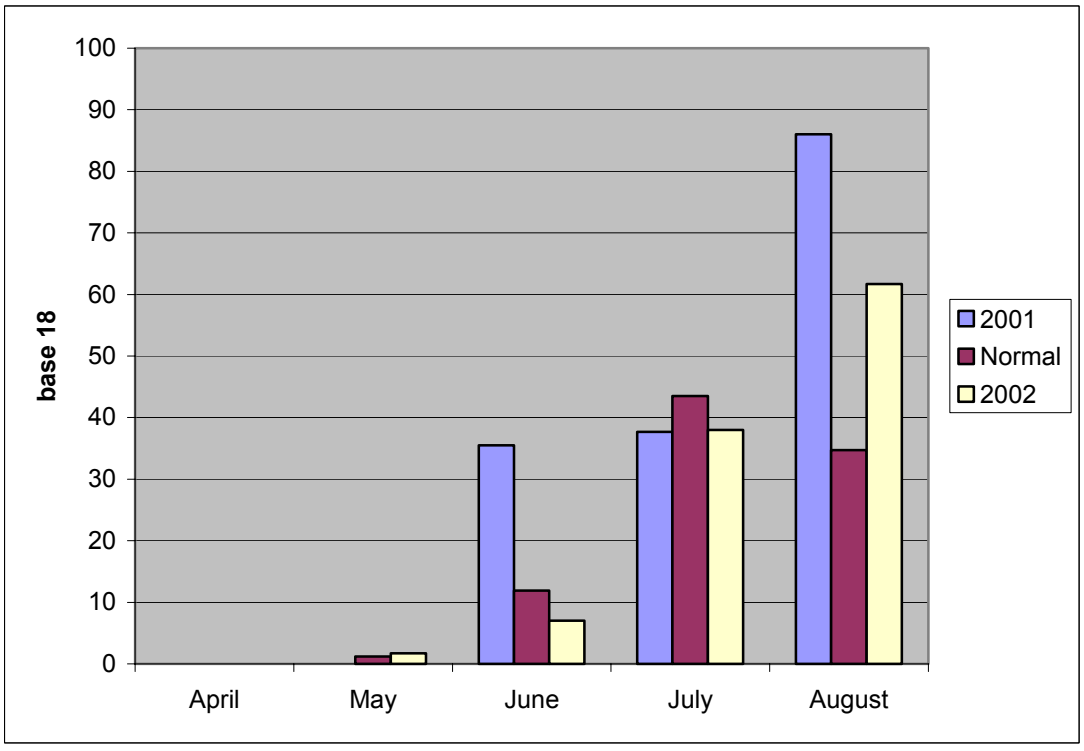

Figure 13: Degree-Days, Cooling

Appendix 1 – Board of Directors

City of Moncton

Dr. Brian Newbold
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Mr. Alan Miller
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Counc. Michael J. C. Cyr
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J. Alan Cunningham
% City Hall

Province of New Brunswick

Municipal Services Representative
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P.O. Box 5001
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Town of Dieppe

Mr. Patrick Maltais
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