



Wye Marsh Trumpeter Swan Population:

A Database Analysis

ERS 490B Final Report



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2.0 Acknowledgements

Special thanks go out to many people involved in the Trumpeter Swan Re-introduction program in Ontario. I would like to thank the Wye Marsh Wildlife Centre and staff for their continued support, especially executive director Laurie Schutt. I am grateful to Harry Lumsden for providing me with some of the information found within the database and I look forward to continuing my research with him in the future. Thanks to Greg Michalenko for direction and support over the last eight months in preparing this thesis. I especially would like to thank April Mathes, the current Trumpeter Swan Re-introduction Program Coordinator at the Wye Marsh Wildlife Centre, for putting up with my constant questions. Without her help, finding and compiling data for this project would have been much harder and taken longer. Thanks to everyone.

3.0 Abstract

Wye Marsh, located on the southeastern shore of Georgian Bay on the boundary of Midland, Ontario, contains about 500 hectares of provincially significant wetland. The Wye Marsh Wildlife Centre, managed by the Friends of Wye Marsh Inc., has been a main co-operator since 1988 in the Trumpeter Swan reintroduction program in Ontario, co-ordinated by Harry G. Lumsden. In 2002, 115 individual Trumpeters visited the Wye Marsh; 86 of these are tagged and/or banded. This represents nearly one-third of the total Ontario population, estimated to number 406 swans in 2002 (Lumsden, 2003). The creation of a Microsoft Access database now holds all of the available information on every Trumpeter Swan that has visited the Wye Marsh in the last 15 years, since the Friends of Wye Marsh Inc. became a co-operator. With 191 entries on individual swans, much has been learned about the general population characteristics. The Wye Marsh population has now reached 89 marked swans, since starting with a captive breeding pair in 1988. As of December 31, 2002, the average age of presently living swans is 4.40 years for males and 4.77 for female. For swans that have died, the average lifespan for males is 3.07 years and 3.45 years for females. The total number of pairs nesting is 29 (27 wild, 2 captive) with 24 pairs producing offspring that have fledged. Lead poisoning is the major known cause of death with 30 confirmed cases; 33 cases have been treated for lead poisoning, resulting in 14 deaths during treatment and 19 released after treatment. The juvenile age class appears to be the class most affected by lead poisoning, with 16 of the 30 deaths; this should be studied further in the future.

4.0 Introduction

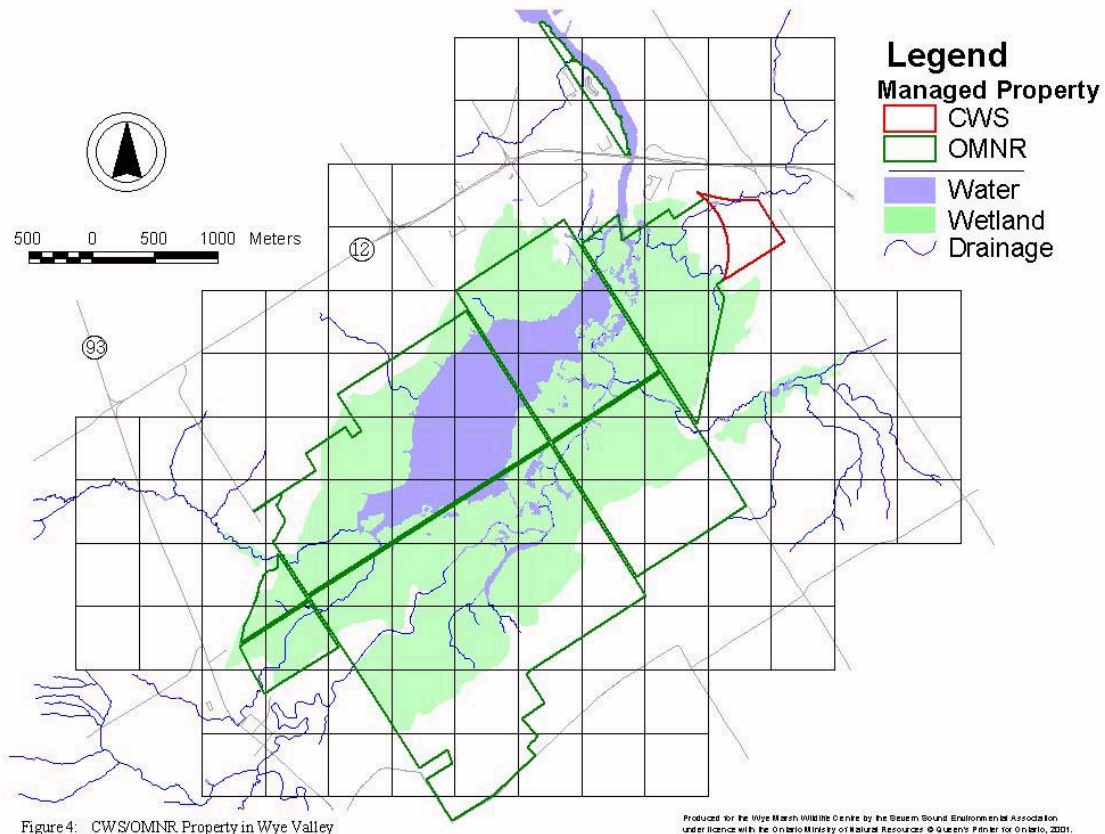
4.1 Purpose

The purpose of this thesis is to create and analyze a Microsoft Access Database that contains information on every Trumpeter Swan that has visited the Wye Marsh. Analysis of this database will provide a greater understanding of the Trumpeter Swan population visiting the Wye Marsh throughout each year since 1988 when the Wye Marsh Wildlife Centre became the main co-operator in the Trumpeter Swan Re-introduction Program in Ontario.

4.2 Background

4.2.1 Wye Marsh

Becoming recognized as a Provincially Significant wetland in 1987, the 500 ha Wye Marsh is nestled on the southeastern shore of Georgian Bay in the Wye Valley. Located just outside the town of Midland, Ontario (a two hour drive northwest of Toronto), the Wye Valley (See Figure 1) includes the 920-hectare provincially owned Wildlife Area and 60 hectares of federally owned property (Bowles 2002).



(Figure 1 - Canadian Wildlife Service/Ontario Ministry of Natural Resources Property in Wye Valley) (Severn Sound Environmental Association, 2001)

The Wye Marsh can be considered outstanding in that three different types of wetland exist there: marsh, fen and swamp, each adding to the complexity and natural beauty of the marsh. Mud Lake, found within the Wye Marsh, is slowly being filled by floating mats of cattails, the dominant vegetation found in the marsh, but also provides prime habitat for many nesting bird species. The Wye Marsh is also recognized as an Important Bird Area because several Species at Risk, as designated by the Ontario Ministry of Natural Resources, use the Wye Marsh for nesting and staging. These bird species include: the Trumpeter Swan (*Cygnus buccinator*, indeterminate), the Black Tern

(*Chlidonias niger*, vulnerable), the Least Bittern (*Ixobrychus exilis*, vulnerable), the King Rail (*Rallus elegans*, endangered), and the Yellow Rail (*Coturnicops noveboracensis*, vulnerable) (OMNR 2002).

4.2.2 Wye Marsh Wildlife Centre

The Wye Marsh Wildlife Centre is situated on the federally owned property, in the northeastern portion of the Wye Valley (See Appendix A), and hosts many environmental education programs and events. Opened in 1970 by the honourable Jean Chretien who at the time was the Minister of Indian and Northern Affairs, the centre became an international tourist attraction along side with Ste. Marie Among the Hurons, a historical Jesuit Missionary site and Martyr's Shrine, a Catholic church in honour of the many historical martyrs in the Midland area. These three attractions see hundreds of thousands of tourists and visitors each year, with the Wye Marsh Wildlife Centre receiving about 30,000.

In 1987, management was passed from the federal government of Canada to the non-profit organization, Friends of Wye Marsh Inc. In 1988 the Friends of Wye Marsh became a co-operator in the Ontario Trumpeter Swan Re-introduction program by purchasing a captive breeding pair of swans.



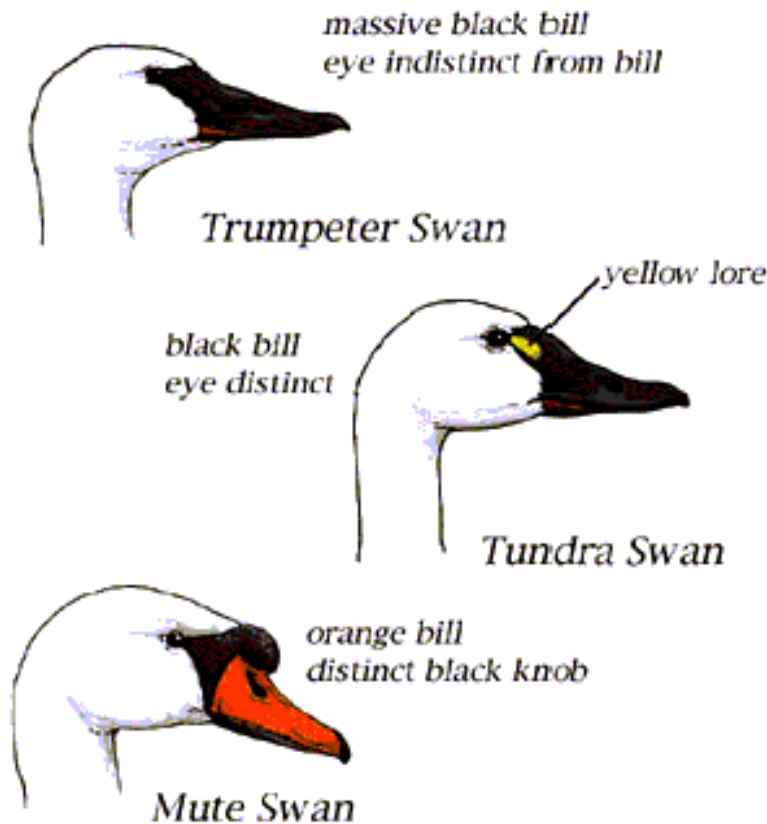
(Figure 2 - Aerial Photograph of the Wye Marsh Wildlife Centre)

4.2.3 The Trumpeter Swan

A former native breeding species in Ontario, the Trumpeter Swan was extirpated by the end of the 1800's (Coxon, 2002a). Populations remaining on the west coast of Canada and the United States were severely affected by over-hunting with the population thought to be extinct by 1900; however, it is now known that a population of several thousand Trumpeters survived in remote parts of Alaska and Canada (State of Wisconsin, 2003). Populations across North America have since rebounded with tens of thousands in the largest population on the West Coast.

The beautiful and intriguing Trumpeter Swan is one of two swan species native to Canada, the other being the Tundra Swan (*Cygnus columbianus*) that also suffered extreme population losses due to over hunting. The European Mute Swan (*Cygnus olor*) is now established in Ontario and the northern U.S (See Figure 3). The Tundra Swan

migrates over Ontario by the tens of thousands in early spring and late fall. Figure 3 outlines some of the distinguishing features of the two native species of swan, including the introduced Mute Swan. The Trumpeter Swan is North America's largest waterfowl, reaching a length of 1.5-1.8 metres and a wingspan of nearly 2.4 metres, while the Tundra Swan only reaches a length of 1.2-1.5 metres and a wingspan of 2.0 metres (Bezener, 2000). Male Trumpeters or 'cobs' typically reach 30 pounds while the female 'pens' can be 25 pounds; baby swans are called 'cygnets', coming from the Latin word *Cygnus*, meaning 'swan'. Each species of swan also has a distinctive call: a loud honking sound is made by the Trumpeter and a high pitched quivering or whistling sound by the Tundra Swan, historically named the Whistling Swan. The Tundra Swan has a characteristic yellow patch between the eye and the nostril, which the Trumpeter does not regularly exhibit. However, two Trumpeters seen at the Wye Marsh Wildlife Centre do exhibit these yellow patches; no connection has ever been made to the possibility of crossbreeding between the two species. The Trumpeter Swan is entirely white, with black feet, black bill and characteristic red mandibles (upper and lower). At hatching the cygnets weigh about 8 ounces and are grey with pinkish beaks, legs and feet. By the time cygnets become juveniles, the pinkish colours have almost entirely become black, but they still retain their grey feather colour. Trumpeter Swans become mature at three years of age, at which time their feathers are entirely white (Wye Marsh Wildlife Centre, 2003).

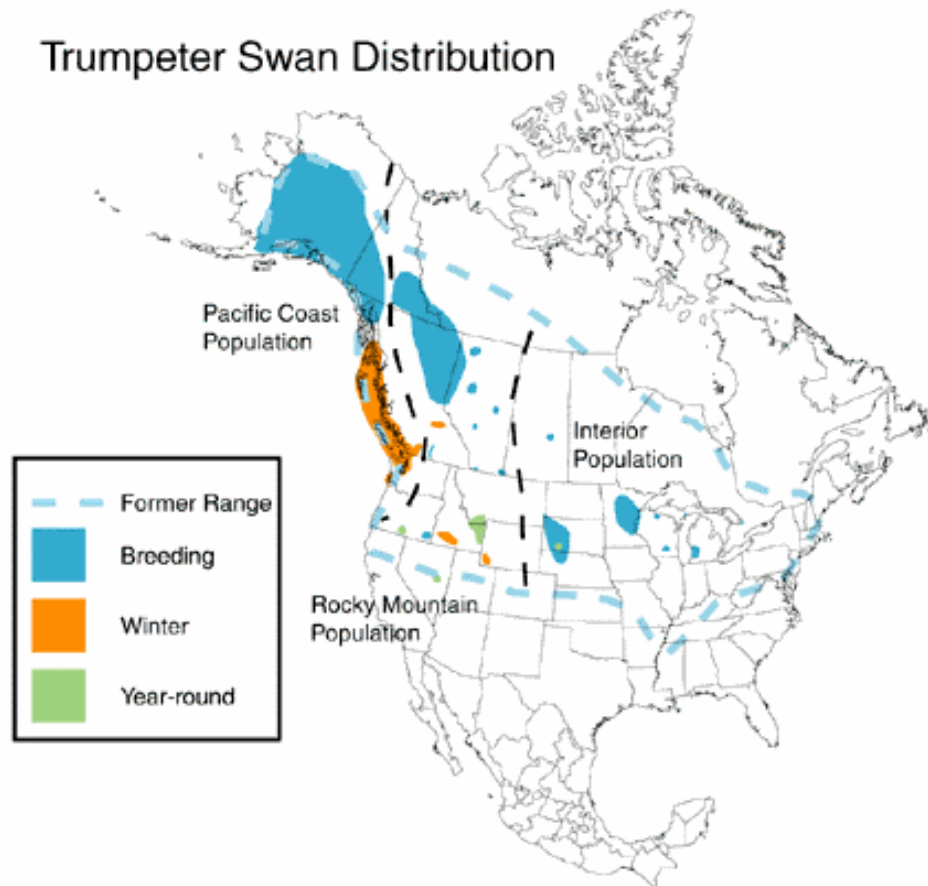


(Figure 3 - North American Swan Comparison) (WDNR, 2003)

4.2.4 Historical Populations

The Trumpeter Swans range once stretched across much of North America (Figure 4), with many explorers and fur traders reporting abundant numbers of swans on the St. Lawrence, lake St. Clair and Hudson Bay Lowlands of Manitoba, Ontario and Quebec. Figure 4 outlines the 1998 of the Trumpeter Swan, which has returned to some of its original range. Some earlier maps omit populations in Eastern Canada; however, archaeological sites in Newfoundland at Port au Choix and the Jesuit mission site at Ste. Marie-among-the-Hurons in Midland, Ontario, have found Trumpeter Swan bones, indicating a historical presence. It was unlikely, outside of the flightless moulting period, that aboriginals could kill large numbers of Trumpeter Swans with bow and arrow, but

once firearms arrived from Europe, populations were reduced and extirpated in many areas (Lumsden, 1984). The large populations of Trumpeters then began to decline due to market hunting and the millinery trade; skins were used for ladies' powder puffs and feathers were used to adorn fashionable hats in Europe. By 1900, Trumpeter Swans were thought to be extinct; however, two nests were found in Yellowstone National Park in 1919, and in 1932, 69 Trumpeters were documented in the Yellowstone region. We now know that a population of several thousand Trumpeters also survived in remote parts of Alaska and northwestern Canada (WDNR, 2003).



(Figure 4 - Trumpeter Swan Distribution) (TTSS, 1998)

4.2.5 Wye Marsh Population

In 1982 biologist Harry Lumsden initiated the Ontario Trumpeter Swan Re-introduction Program. The first captive pair was purchased by the Friends of Wye Marsh and arrived at the Wye Marsh Wildlife Centre in 1988. The female unfortunately died of natural causes in early 1989, but another pen was found and brought to the centre. This new pair was nicknamed Big Guy and Lady Girl (or Wye and Marie to some). In 1990, Wye Marsh staff witnessed the hatching of two eggs, the first Trumpeter Swan cygnets known to hatch in the Wye Marsh in over 200 years. A snapping turtle predated one of the cygnets shortly after hatching, while the other, a female, survived to become known affectionately as Pig Pen (Swan #100), who in 1993 raised the first known wild family of Trumpeter Swans in Ontario in over 200 years (Coxon, 2002a). The wild population of Trumpeter Swans visiting the Wye Marsh on a yearly basis is now estimated to be 115, 89 of which are either wing tagged, leg banded or both; the remaining 26 are unmarked birds. Figure 8 outlines the wild growth trend of marked swans from 5 in 1990 to 89 in 2002.

4.2.6 Ontario Population

Originally native to Ontario, the Trumpeter Swans extirpation from eastern Canada was primarily due to hunting pressure (Coxon, 2002a). Populations remaining in the western prairies were also severely affected by over-hunting and were eventually greatly reduced. These populations have since rebounded to the tens of thousands, while the Ontario population numbered 400 swans at the end of 2002 (Lumsden, 2002). The total Ontario population is now estimated at 406 after six additional cygnets were reported late in 2002 (Lumsden, 2003).

In June 1993, 50 eggs were taken from wild nests on the Minto Flats west of Fairbanks, Alaska. The eggs were artificially incubated and 42 cygnets were raised and pairs were moved to co-operators around Ontario for rearing purposes (Lumsden, no date). Co-operators have been responsible for raising captive stock for release into the wild Ontario population. Offspring are then moved to a holding facility at Fair Lake near Cambridge, Ontario, where they are held, tagged and released into the wild at two years of age. Releases occur across Ontario. Figure 8 outlines the Ontario population growth trend of all wild Trumpeter Swans. The main goal of the re-introduction program is to achieve a self-sustaining population in Ontario. The number of swans needed to achieve this is estimated to be 500-550 and, according to the data analysis, the trendline estimates this number to be reached in the year 2005 (Lumsden, 2003).

4.2.7 North American Population

Figure 5 outlines the 1992 North American distribution of the Trumpeter Swans. Their distribution is broken down into three main populations: the Pacific Coast population (~15,000 individuals), the Rocky Mountain population (~2500 individuals), and the interior population, including Ontario (~900 individuals) (Matteson et al, 1995). These three populations compromise roughly 18,500 swans, significantly more than the total population size at the beginning of the 20th century. The rebound in the total population is mainly due to re-introduction and protection programs across North America, with most populations still growing.

Distribution of the Trumpeter Swan



(Figure 5 – 1992 Distribution of the Trumpeter Swan) (McKelvey, 1992)

5.0 Scope and Objectives

5.1 Study Area/Scope

The study area for this project is the 500 hectare, provincially significant wetland known as the Wye Marsh.

5.2 Objectives

This project has one main objective, to create a database holding all available information of Trumpeter Swans visiting the Wye Marsh, and thus gain a better understanding of this population. A secondary objective is to shed some light on the issue of lead poisoning and specifically determine the age class (cygnet, juvenile, adult) that has been affected the most by lead poisoning. This report is also intended to educate many people about Trumpeter Swans at the Wye Marsh and the difficulties of reintroducing a species back to its former range.

6.0 Methods

6.1 Statement about the Database

The creation of the database was a very tedious task, with many hours of labour. For the sake of quality assurance within the database, only those swans that are marked in some way, either tagged, banded or both tagged and banded, are included in the database. Not every swan visiting the Wye Marsh on a yearly basis is marked, as there were only 89 marked birds by December 31st, 2002. It is estimated that a further 26 swans visit the marsh and are unmarked. These unmarked swans still represent a large portion of the Wye Marsh population but cannot be included in the database because of the ambiguity and lack of information on these particular swans. The database does include captive pairs, but to improve quality within the results these captive pairs are not included, except in the nesting productivity section. Therefore the results from the database do not completely represent the total population of Trumpeter Swans visiting the Wye Marsh. For example, if a tagged swan is caught for treatment of lead poisoning and dies during this treatment, this swan is included in the database because there is sufficient information about the swan. If an unmarked swan is similarly caught for lead poisoning treatment and dies it cannot be included in the database because we do not know where the swan came from, how old it is and so on.

6.2 Database Creation

The creation of the database is the major task of the project. This Microsoft Access Database is intended to hold all available information on every Trumpeter Swan that has been documented at the Wye Marsh at least once. The database will allow users to obtain and compile data much easier and faster and is to be used as an alternative to

paper records. Because there will constantly be additional new data, there is a need to maintain the database to keep information up to date and accurate. Appendix B contains a partial copy of the database to outline the organization and provide an example.

The headings of the database are as follows:

- Tag number, the wing(s) tagged, previous tag number
- Status (alive or dead), cause of death
- Wye Marsh bird (yes or no)
- Band number, the leg the band is on
- Name of the bird
- Sex
- Year born, year died, life span
- Location of birth
- Mother, father, sibling(s), mate
- Total eggs laid, total eggs hatched, total cygnets fledged
- Territory
- Medical attention/treatment (yes or no), location of treatment, type of treatment, cost of treatment
- Comments

6.3 Tagging and Banding

An important tool in the reintroduction program is a tagging and banding program. Every effort is taken by those involved in the reintroduction program to tag and band as many swans as possible for easier monitoring of individual swans. Feed is used to lure swans into a large trap with a closing mechanism for capture. Licensed banders

then catch the swans and attach two yellow wing tags, one on each wing, and a leg band (Figure 6). In addition males receive a band on the right leg and females on the left. The tagging process generally takes place in the fall after the cygnets have fledged and family groups can be caught together. The three black digits on the wing tag correspond to the last three digits on the leg band, as wing tags are occasionally lost and the leg band can identify the bird. These yellow wing tags (Figure 7) are large enough to be read by the human eye if the swan is within about 10 metres. If the swan is further away, binoculars or viewing scopes can be used to identify them.



Photographs by: Marg Killing (left) and Nick Bartok (right)

(Figures 6 and 7 - Tagging and Result)

6.4 Monitoring / Data Collection

Collection and monitoring of data have been time consuming and difficult. Information was kept on paper and filed away since 1988. It was not until 1998 that limited information was stored in a Microsoft Excel file and now all available information is stored in digital format within the Microsoft Access database.

Since 1988, a feeding program was used to supplement the swans diets, especially in the winter. The swans are fed a mixture of corn and duck grower pellets. This feeding program provides the swans with a known source of food and allows easier monitoring. Twice a day, the Trumpeters at the Wye Marsh are fed and tag numbers recorded. Many volunteers are involved in the feeding program along with Wye Marsh Wildlife Centre staff. Records are also kept of mated pairs, number of cygnets and swan behaviour. Each day a monitoring form is filled out (Appendix C) indicating which swans visited the marsh on that particular day; the data are then transferred to the database. All the swans that have been recorded at the Wye Marsh are included in the database.

Media releases also encourage people from across Ontario to call or email the Wye Marsh Wildlife Centre (1-705-526-7809 or www.wyemarsh.com) with Trumpeter Swan sightings throughout the year. These sightings are documented and filed for future reference and monitoring. This allows the Centre staff to track the swans that are moving outside of the Wye Marsh at the time and can also lead to the discovery of a nesting territory.

Trumpeter Swans generally mate for life (although separation is known to occur) and one of the difficult tasks is trying to identify these mated pairs, although many pairs have already been identified in previous years. The easiest way to identify a mated pair is to observe the pair with cygnets. However, in the interest of finding nests, these mated pairs need to be identified in the spring. After swans are consistently seen together they are designated as pairs and in some cases pairs can be observed copulating before moving to their established and defended territories. Once a list of mated pairs is produced, nests

and nesting territories need to be found; an aerial survey is one such way to find these territories.

In the summer of 2002, two aerial surveys were conducted, one on May 16 with pilot David Killing from the Midland Airport and one on July 16 with pilot Barry Parker from the Collingwood Airport. The survey conducted on May 16 provided the location of 5 nests in the Wye Marsh and immediate area. Nests are easy to find from the air as the female generally does not leave the nest and her large white body can easily be spotted. When a nest is spotted from the air, a picture of the nest is taken. This picture is then used for guidance while approaching the nest by canoe. Upon arriving at the nest the mated pair is identified and an egg count conducted. In 2002, nests were visited more than once, unless accessibility proved too difficult. For the purposes of the July 16 aerial survey, it was expected that nests within the Wye Marsh and surrounding area had hatched and families could be observed from the air. The aerial survey was used to monitor Trumpeter Swan movements, and to discover families that had not been found during the previous flight.

This procedure has been followed for many years now to determine nesting territories. Data are available for each of these nesting territories, and include the swans using the territory, the location of the nest, the number of eggs produced, the number of eggs hatched, and the number of cygnets fledging. All of these data have been incorporated into the database to provide background information of the historical nesting success. Appendix D provides a table of the known nesting pairs since 1988 and their success.

At the end of each year the head biologist, Harry Lumsden, conducts a fall swan count. The Wye Marsh Wildlife Centre provides Harry with monthly monitoring data and a list of swans known to visit the Wye Marsh in that year. If a swan has not been seen for one year, the swan is presumed dead. Harry then compiles these data along with the rest of Ontario and comes up with an Ontario total population that includes all of the year's production.

6.5 Health Monitoring - Lead Poisoning Detection

Constant monitoring of Trumpeter Swans allows biologists to monitor health conditions of the population. Illness can change the behaviour of the swans, and such changes in behaviour can thus be used to determine bird health.

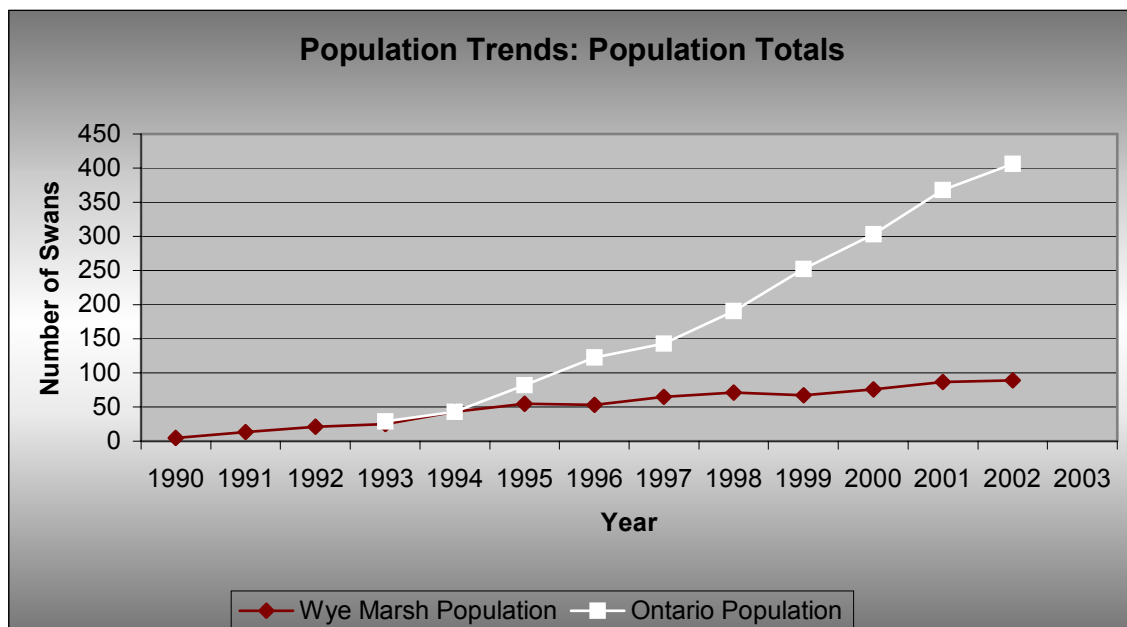
Trumpeter populations across North America are closely monitored for lead poisoning, which is a major cause of death. Lead shot from hunting waterfowl has been discharged for many years into the water bodies where swans and other waterfowl feed. Birds require stones and pebbles to help grind up food in their gizzards. Swans ingest lead shot because of the resemblance to stones and pebbles. The soft lead shot is then ground up by the hard stones in the gizzard and enters the blood stream causing the swans to become ill. Careful monitoring of the population identifies swans that are affected by lead poisoning. Affected swans exhibit signs of weakness (difficulty in flying), green feces, high pitched honking and are isolated from other swans. When it has been determined that a swan has lead poisoning, the swan is caught and taken for treatment to either the local Ontario Society for the Prevention of Cruelty to Animals (O.S.P.C.A) or the Wild Bird Clinic at the University of Guelph. The treatment involves injections every day, with a calcium based drug and an antibiotic to counteract the effects of the

injections. The analysis of this database will allow for an understanding of how many swans have died from lead poisoning, how many have been treated, and the success of the treatment. The results also consider other causes of death and the treatments associated.

7.0 Results from the Database

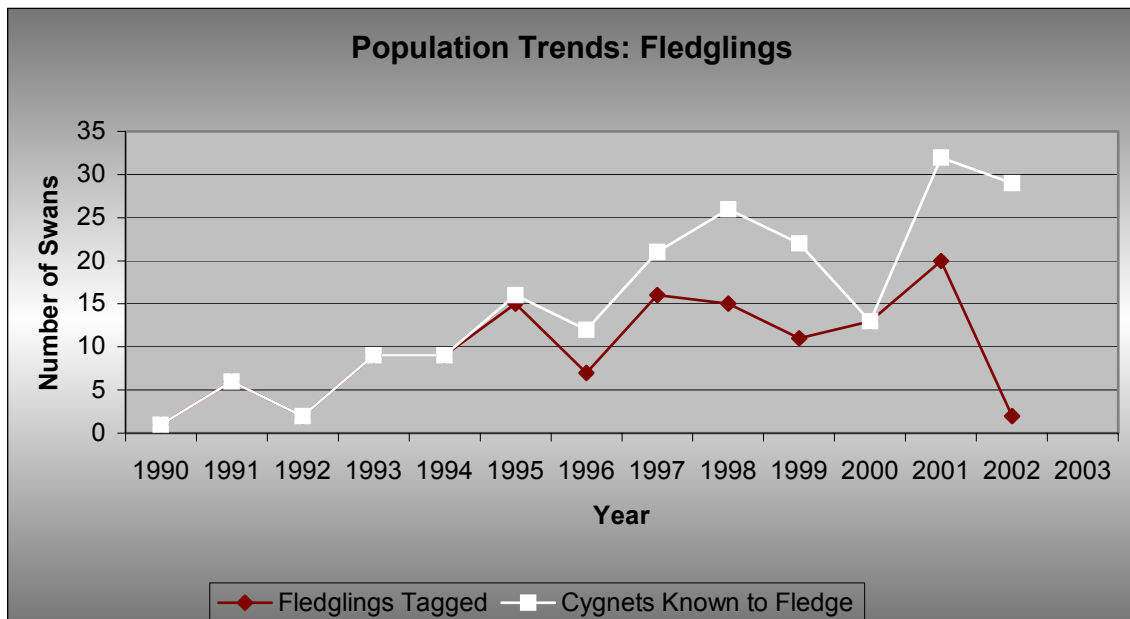
7.1 Wye Marsh Population and Sex Ratio

Figure 8 represents the population growth trend of swans at the Wye Marsh compared to the Ontario trend. During the fall swan count of 2002, it was determined that 89 tagged and banded wild swans visited the Wye Marsh that year, with a 52:48 female: male ratio (N=89). This total does not include the number of unmarked swans due to the large possibility of double counting; the total population including unmarked swans is estimated to be 115. In comparison to the wild Ontario population (which includes unmarked birds), the Wye Marsh population represents nearly one third of all the Trumpeter Swans in Ontario.



(Figure 8 - Trumpeter Swan Population Trend for Wye Marsh and Ontario)

Figure 9 shows the number of cygnets fledging from pairs known to visit the Wye Marsh and the number of these fledglings that have been tagged. In the earlier years of the re-introduction program most of the cygnet production came from captive raised young and therefore were easy to catch and tag before release. As the wild population of Trumpeters increased the difficulty in catching swans also increased. The figure shows a large drop in the 2002 number of fledglings that have been tagged compared to the total number of fledglings. Tagging efforts have been increased since the end of 2002 to increase the ratio of marked to unmarked swans, for more accurate monitoring.

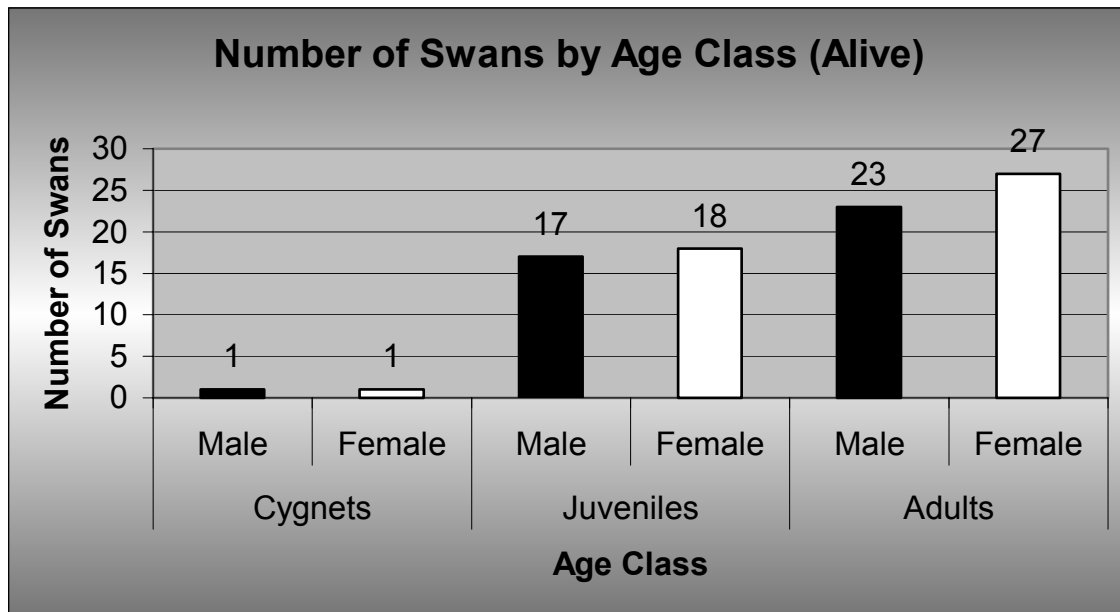


(Figure 9 - Population Trends: Fledglings)

7.1.1 Age Dynamics (Productivity)

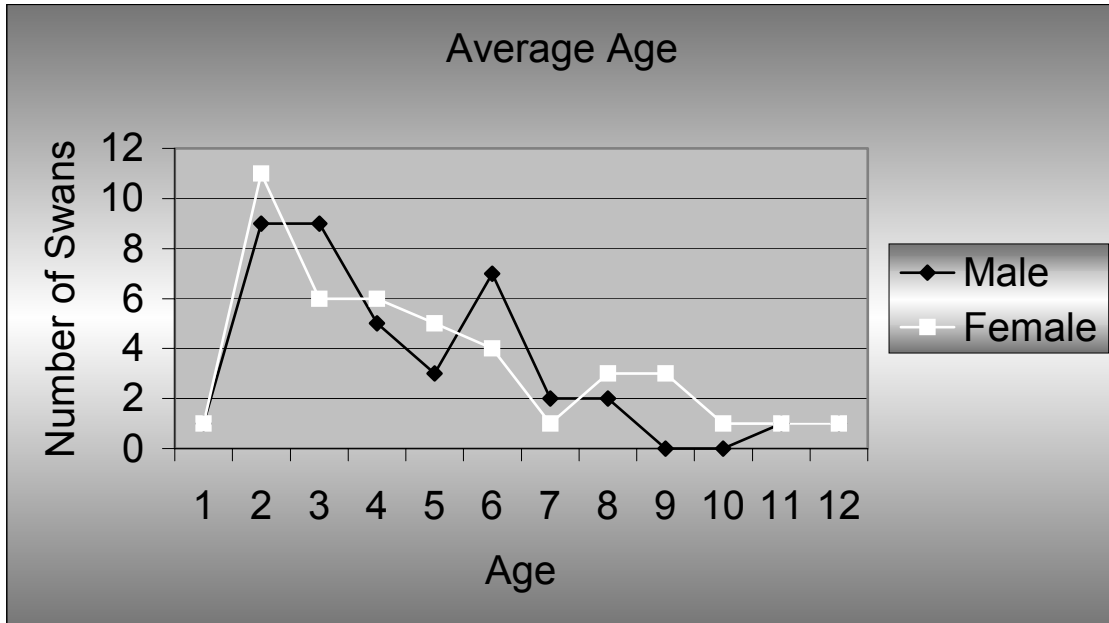
Figure 10 compares age classes by sex. It is important to note the low number of cygnets in the population compared to the juveniles and adults. This is because the figure only takes into consideration tagged and/or banded swans. As of December 31, 2002, only two cygnets born in 2002 had been marked, one male and one female. From the

population figure we know that 29 cygnets fledged in 2002. Similarly, with the juveniles and adults, the results only include those swans that are marked. It was necessary to consider only marked swans in the figures due to the high error and unknown number of unmarked swans.



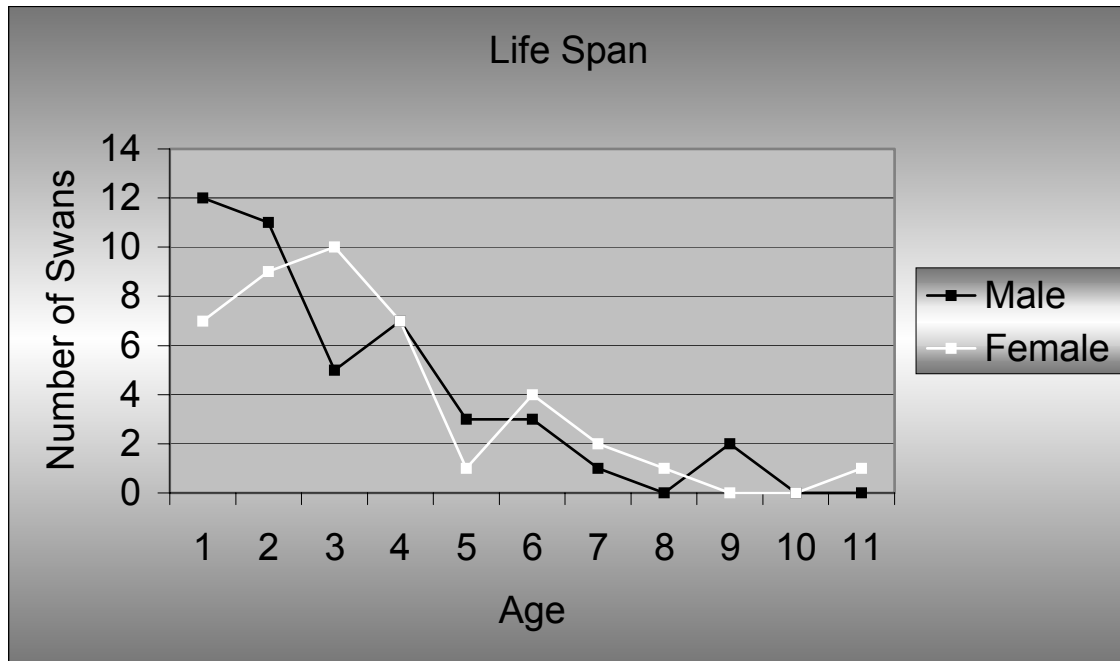
(Figure 10 - Number of Swans by Age Class and Sex, December 31st, 2002)

Analysis of the database also provides an estimate of the average age of the Wye Marsh Population. The average age of surviving males is 4.40 years with a standard deviation of 2.49 years (N=40). The average age of females is 4.77 years with a standard deviation of 2.83 years (N=43). Figure 11 presents these data.



(Figure 11 - Average Age by Sex, December 31st, 2002)

Analysis of the database also allows the user to understand, on a much sadder note, the number of swans that have died over the years and how they died. The average male life span is 3.07 years with a standard deviation of 2.12 years (N=44). The average female life span is 3.45 years with a standard deviation of 2.19 years (N=42). Figure 12 presents this data.



(Figure 12 - Life Span by Sex, December 31st, 2002)

7.1.2 Nesting Productivity

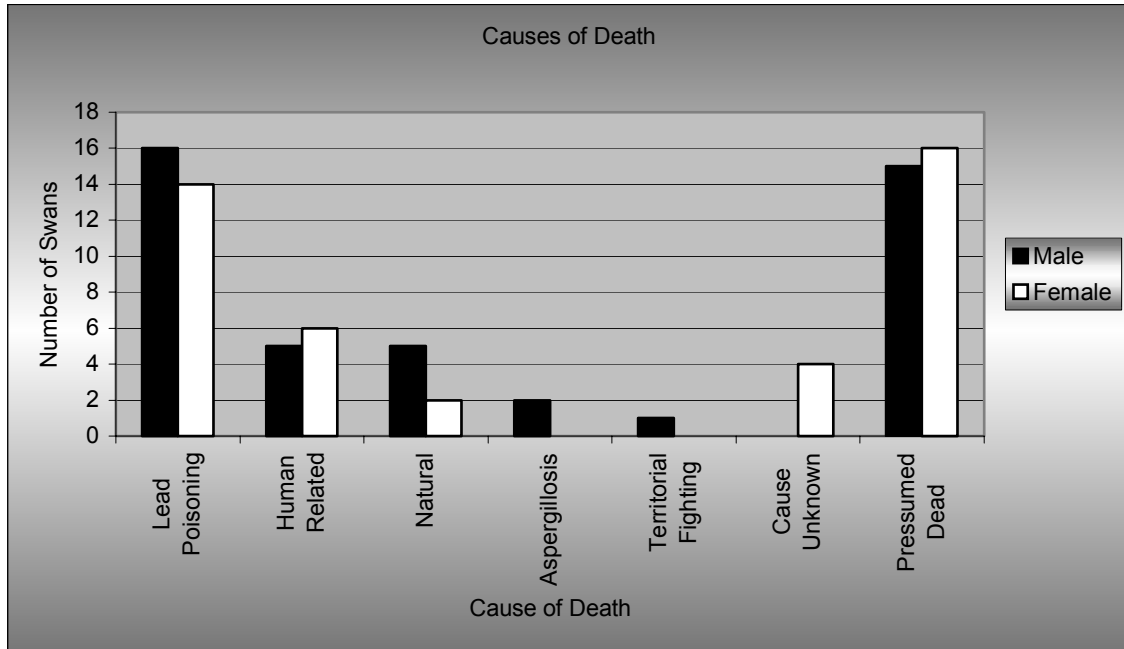
Each year nesting research is conducted, which involves visiting nests, counting eggs and determining the number of eggs hatched and the number of cygnets fledged. The database does not hold the information for production of each pair of swans for each year. However, the database does hold the total known number of eggs produced, the number of eggs known to hatch, the number of cygnets known to fledge by pair, and the number of fledglings tagged, banded or both. These data are also somewhat skewed due to the fact that not all nests were found and eggs counted, but the number of fledglings can be determined due to the return of nesting pairs to the Wye Marsh in fall staging. Appendix D outlines the database results.

The total number of pairs establishing nesting territories since 1988 is 29 (27 wild, 2 captive), with 24 pairs producing offspring that have fledged; pair 515 (Jack) and

516 (Diane) are the most productive. The total number of eggs produced by Wye Marsh pairs, including the two captive pairs is 339. The total number of these eggs that hatched is 245, the total number of these cygnets that fledged is 192, and the total number of these fledglings tagged is 126.

7.1.3 Causes of Death

The death of a swan is taken very seriously. Each and every swan found dead is sent to the Wild Bird Clinic at the University of Guelph for necropsy. The necropsy provides the cause of death, which is documented. The database holds information on swans that have died in the past and how they died. Figure 13 indicates the major causes of death by sex. Lead poisoning is a major causes of death with 16 males and 14 females succumbing to this horrible death. Swans that have not been seen for a year or more are presumed dead. The actual causes of these deaths are unknown, as carcasses are not found. Human related deaths, natural deaths, Aspergillosis and territorial fighting round out the list.



(Figure 13 - Causes of Death, December 31st, 2002)

7.2 Lead Poisoning

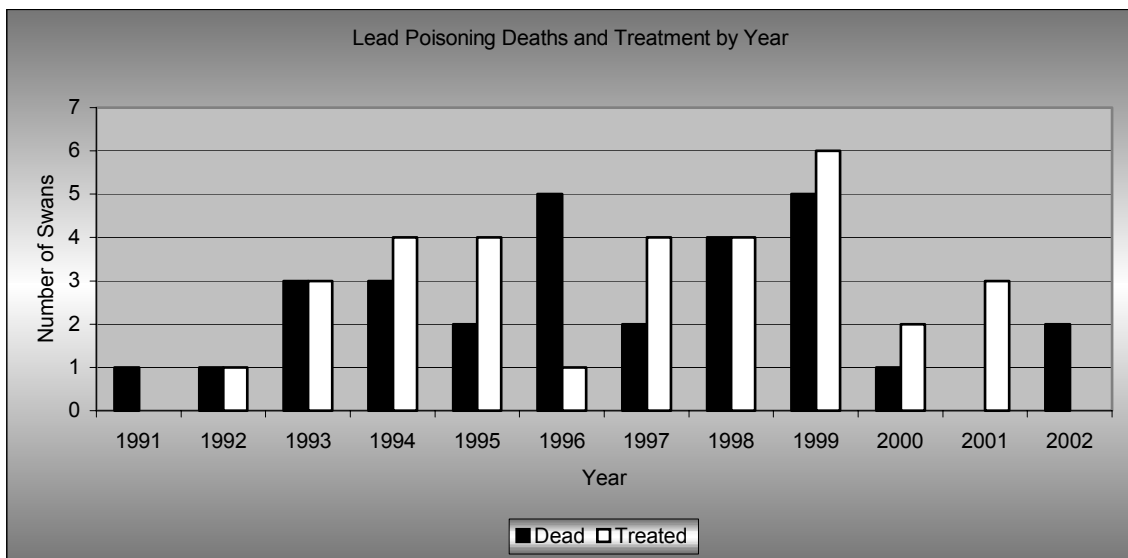
7.2.1 Number of Deaths and Number Treated

Every swan is of value to the reintroduction efforts and if the behaviour of a swan changes to indicate an illness, the swan is caught for treatment. Table 1 indicates the number of swans included in the database that received treatment.

Type of Treatment	Number of Swans
Lead	33
Wing	3
Foot/Leg	2
Blindness	1
Not Recorded	1

(Table 1 - Number of Swans Treated by Type of Treatment, December 31st, 2002)

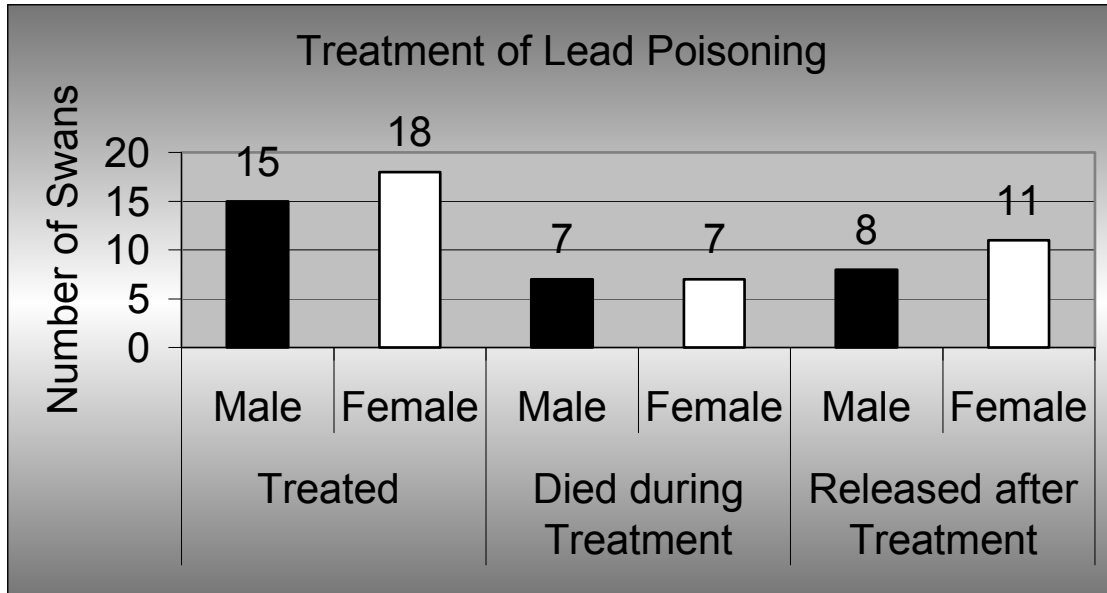
Lead poisoning cases have been a major setback of the Trumpeter Swan Reintroduction Program in Ontario; this was unanticipated. Lead poisoning cases have been well documented and have been incorporated into the database. Figure 14 indicates the number of lead poisoning deaths and number of swans treated by year. Many more cases of lead poisoning have been seen and documented over the years; however, in many of these cases the birds have either been unmarked or disappeared after showing signs of lead poisoning and thus bodies are not found for necropsy. Both of these types of cases, are excluded from the database because of the ambiguity of the situation. The results in Figure 14 are for those swans tagged or banded and are thus in the database.



(Figure 14 - Lead Poisoning Deaths and Treatment by Year)

If a swan is showing signs of lead poisoning, all attempts are made to capture the swan for treatment. Treatment is generally a long process and very costly. Figure 15 shows

the number of swans treated for lead poisoning, the number that have died during treatment and the number released after successful treatment.

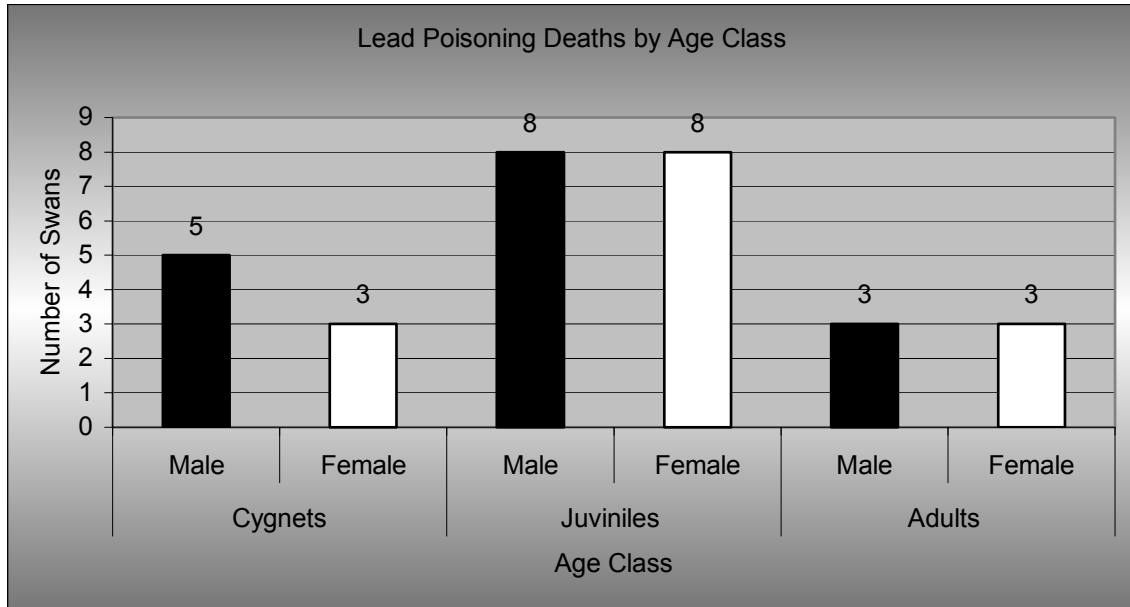


(Figure 15 - Treatment of Lead Poisoning by Sex, December 31st, 2002)

These results indicate that there are slightly more female lead poisoning treatment cases than male cases, with more being released after treatment. Treatment of unmarked swans does occur, but are not included in the results.

7.2.2 Age Class Affected

There has been some discussion pertaining to the age class most affected by lead poisoning; this information can be derived from the database. Figure 16 indicates the number of lead poisoning deaths by age class.



(Figure 16 - Lead Poisoning deaths by Age Class, December 31st, 2002)

The results show that about half (53%) of 30 cases of lead poisoning deaths occur in the juvenile age class.

8.0 Discussion

8.1 Quality and Quantity of Data

The quantity of data found within the database is substantial, with 15 years of data and 191 entries combined into one file. The quality of this data is good, but there are some gaps. For instance, if a wild unmarked swan is caught for tagging purposes, little information about this swan is known prior to capture. The results in this report are compiled in such a way as to improve the quality of the information from the database, as the database simply holds all the available information on 191 marked swans, including many captive birds. To ensure the quality of the results, data in this study are only

considered for those swans that are marked, have visited the Wye Marsh, and are wild. Therefore the results are accurate based on the data found within the database.

8.2 Population Projections (growth)

Both the Wye Marsh population of Trumpeter Swans and the total wild Ontario population are growing and increasing their range across the province and into the U.S. Starting with two captive swans in 1988 and many wild releases, the Wye Marsh saw an estimated 115 swans in 2002 (89 marked, 26 unmarked), with the total Ontario population sitting at 406, as of December 31st, 2002. The main goal of the Ontario reintroduction program is to establish a self-sustaining population of Trumpeter Swans with a target of 500-550 swans. At the current rate of growth, the population should reach this level in 2005. Lead poisoning has slowed the rate of population growth across Ontario and has also had severe effects on western populations of Trumpeter Swans.

8.3 Nesting Dynamics

Every year since 1988 nesting research has been conducted to gather information on the number of eggs laid, the number of eggs hatched and the number of cygnets fledged. As the number of free-flying swans increases, the number of nesting pairs and the number of nesting territories increase in turn. This increases the complexity and time needed for the nesting research. The following information was not directly obtained from the database, but highlights the nesting successes during the last three years of research.

It is important to note that these data include pairs that visit the Wye Marsh as well as pairs that do not. In their research, the Friends of Wye Marsh Staff focuses on Wye Marsh pairs, but they also visit other nests of pairs that do not visit the marsh.

8.3.1 2002 Nesting Results

There were a total of 13 nests. Of these, ten pairs of Trumpeters successfully hatched eggs, while eight pairs raised cygnets to fledglings. A total of 55 eggs were found in the 10 nests that could be examined, giving an average clutch size of 5.5. 37 of 52 eggs hatched (it is unknown if 3 eggs hatched from a pair that nested in the Wye Marsh), which is a 71 percent hatch rate. A further 20 of these 37 known hatched cygnets have been classified as missing or lost; some of these disappearances may be due to predation, but no acts of predation were actually witnessed in 2002. 10 of the 13 nests were successful, which is a 77 percent success rate. As of January 2003 there are 27 cygnets at the Wye Marsh, 17 from known nests and 10 from unknown nests that returned in the 2002 fall staging at the Wye Marsh (Bartok, 2003). Tables 2 and 3 summarize these data. The pairs that nested on Lake Simcoe, in Lindsey and LeFroy are not considered Wye Marsh pairs, as they are not known to have visited the Wye Marsh.

Female Tag #	Male Tag #	Nest Location	Number of Eggs	Hatch Date	Number of Eggs Hatched	Number of Cygnets Fledged	Number of Cygnets Lost
438	641	Wye Marsh Sanctuary	3	June 8	3	2	1
516	515	Wye Marsh Sanctuary	8	June 11	7	4	3
538	368	Wye Marsh	4	June 17	3	2	1
205	219	Wye Marsh	3	Unknown	Unknown	0	----

Table 2 - 2002 results for Trumpeter swan pairs known to nest within the Wye Marsh.

Female Tag #	Male Tag #	Nest Location	Number of Eggs	Hatch Date	Number of Cygnets Hatched	Number of Cygnets Fledged	Number of Cygnets Lost
341	364	Port McNicol	7*	June 5	5	5	0
Unknown	Unknown	Matchedash Bay	9	~ June-08	8	Unknown	Unknown
UTUB**	UTUB	Lake Simcoe	9	~ June-06	8	6	4
UTUB	UTUB	Lindsey	3	~ May-25	3	Unknown	Unknown
496	402	Pond off Old Fort Rd	5	Failed	0	0	----
396	390	LeFroy	4	Failed	0	0	----
UTUB	370	Unknown	Unknown	Unknown	Unknown	4	Unknown
367	UTUB	Unknown	Unknown	Unknown	Unknown	4	Unknown
UTUB	UTUB	Unknown	Unknown	Unknown	Unknown	2	Unknown

* 7 eggs were laid, 2 were found outside the nest

** UTUB refers to untagged and unbanded

Table 3 - 2002 results for Trumpeter swan pairs known to nest outside the Wye Marsh.

8.3.2 2000-2002 Nesting Results Comparison

The overall nesting of the Trumpeter Swans within the study area in 2002 was less productive than 2001 and slightly better than 2000. In 2000, 11 pairs of Trumpeter Swans were known to have nested in the Wye Marsh and surrounding area; 26 cygnets fledged. In 2001, a total of 17 pairs of Trumpeters nested, but only 11 nests were successful. Egg counts are available for only 5 of these 17 nests, with 24 eggs found; 10 hatched. A total of 33 cygnets from the 11 nests survived to fledge (Coxon 2002b). In 2002, 13 pairs of Trumpeters were known to nest; 10 of these nests were found and 10 were successful. A total of 55 eggs were found, and 37 of these hatched. A total of 29 cygnets fledged (Bartok, 2003). Table 4 summarizes these data.

Year	Number of Nests Found	Number of Nests Successful	Nest Success Rate	Number of Eggs	Average Clutch Size	Range of Clutch Size	Number of Eggs Hatched	Hatching Rate	Number of Cygnets Fledged
2000	11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	26
2001	17	11	65%	24	4.8*	1/9	10	42%	32
2002	13	10	77%	55	5.5	3/9	37	71%**	29

* Egg counts are available for only 5 of the 17 nests

** 37 of 52 eggs, as the hatching status of 3 eggs is unknown

Table 4: Nesting comparison of known nests in the Wye Marsh and surrounding area, 2000-2002

8.3.3 Comparison between Wild and Captive Nesting Productivity

Comparison between wild and captive nesting pairs is important due to the fact that nesting conditions are different. The territories of the wild nesting pairs are not all known and therefore complete egg counts cannot be made. Thus data are missing for the number of eggs laid and hatched, although fledgling totals can be determined by the return of the wild pairs to the Wye Marsh for fall staging. Captive pairs are confined to enclosures and eggs counts, hatching, and fledging can easily be determined.

8.4 Lead Poisoning

8.4.1 History of Lead Poisoning at Wye Marsh

The first recorded death from lead poisoning at the Wye Marsh, a fledged cygnet, occurred in 1991. Since then more deaths have occurred, now totaling 30 confirmed with many suspected. A treatment program is now in place to treat injured or ill swans, with lead poisoning being the major type of treatment. Treatment is lengthy, costly and not all swans respond to treatment.

The following excerpt taken from the University of Guelph, Wild Bird Clinic Website (2003) describes how the lead affects waterfowl after ingestion of the shot.

“The gizzard slowly grinds at the spent lead shot, causing local irritation and allowing the body to slowly absorb the poison, which damages red blood cell function, nervous tissue and kidneys. The swan becomes anaemic and as its nervous system is affected, it becomes weak and its neck starts to droop. Its immune system may also become affected which makes it susceptible to other diseases. If it were mating season, the swan may lay abnormal eggs and may also have a reduction in fertility. As the swan becomes depressed and weakened, it is vulnerable to predation. If it continues to survive, the lead eventually causes paralysis of the upper digestive tract, which then becomes impacted; the swan eventually starves to death. Unknowingly, an eagle finds an easy catch and is affected through secondary lead poisoning. It will eventually suffer a similar fate.”

The Wild Bird Clinic takes care of and treats most of the severely injured or poisoned swans from the Wye Marsh and around Ontario. The reported 1994 average case treatment cost per swan was \$1200. With 26 cases of treatment for lead poisoning from Wye Marsh birds since 1991, roughly \$30,000 has been spent on treatment for lead poisoning.

In 1994, use of lead shot was banned within the Wye Marsh. By 1996, this ban was expanded to Simcoe County for all waterfowl hunting, and by 1997 the ban on lead

shot was nation wide; the U.S. banned lead shot for waterfowl hunting in 1991 (WBC, 2003).

In 1996, the Severn Sound Environmental Association and Wye Marsh staff developed a innovative way to clean up lead shot hot spots. The piece of equipment is basically a back loader mounted on a barge, but the bucket has been replaced by one metre metal rods that are inserted into sediment suspected to have a high lead shot concentration. The machine vibrates these metal rods causing the lead shot to sink further down into the sediments, thus out of reach of waterfowl, including swans. However, the process is time consuming and costly. Most of the Wye Marsh has been cleaned up in this way, with Hall's Pond (See Appendix A) being the most recent.

8.4.2 Age Classes Affected by Lead Poisoning

At the 2003 Trumpeter Swan Society Conference in Vancouver, British Columbia, there was some discussion about which age class was affected most by lead poisoning (Figure 16). From a sample size of 30 confirmed lead poisoning deaths, 16, or more than half, occur in the juvenile class; there were eight in the cygnet class and six in the adult class. There was no literature found suggesting a theory as to why juveniles are more susceptible to lead poisoning than adults and cygnets.

9.0 Conclusion

The creation of this Microsoft Access database will prove valuable for future research. Much has been learned about reintroduction efforts and Trumpeter Swan behaviour, with much more still to go. The database approach is a good way to store and obtain data quickly and easily.

10.0 Recommendations and Future Study

- 1) As the Trumpeter Swan population increases at the Wye Marsh, continued tracking and monitoring of swan movements must be maintained and documented. This includes encouraging many volunteers and swan spotters from the area to call in and email swan sightings.

- 2) Maintenance of the Microsoft Access database must be ensured, kept up to date, accurate, and includes as much information as possible. This will take a lot of work and time, but in order for the database to be effective, data must be inputted regularly.

- 3) Emphasis needs to be put on tagging swans in order to lower the percentage of unmarked swans. This will allow the database to grow, improve the quality of the data in it, and give a better representation of the Wye Marsh population.

- 4) Lead poisoning has been a major setback of the Ontario reintroduction program. Many lead poisoning cases still appear each year, with many going unnoticed. Information in this report has shown that juveniles are more affected by lead poisoning than adults or cygnets, but for unknown reasons. Have adult swans built up a resistance to lead? Are juveniles different in their feeding behaviour? Are the prime, safe nesting territories already taken by adult pairs, thus forcing juveniles to move further away from the Wye Marsh to areas high in lead shot, increasing the risk of lead poisoning? These are just some of the questions that

need to be studied and answered in order to understand the issue of lead poisoning better.

- 5) There have been many published and unpublished reports containing various information about Trumpeter Swans in Ontario, these reports should be posted on the Wye Marsh Website.

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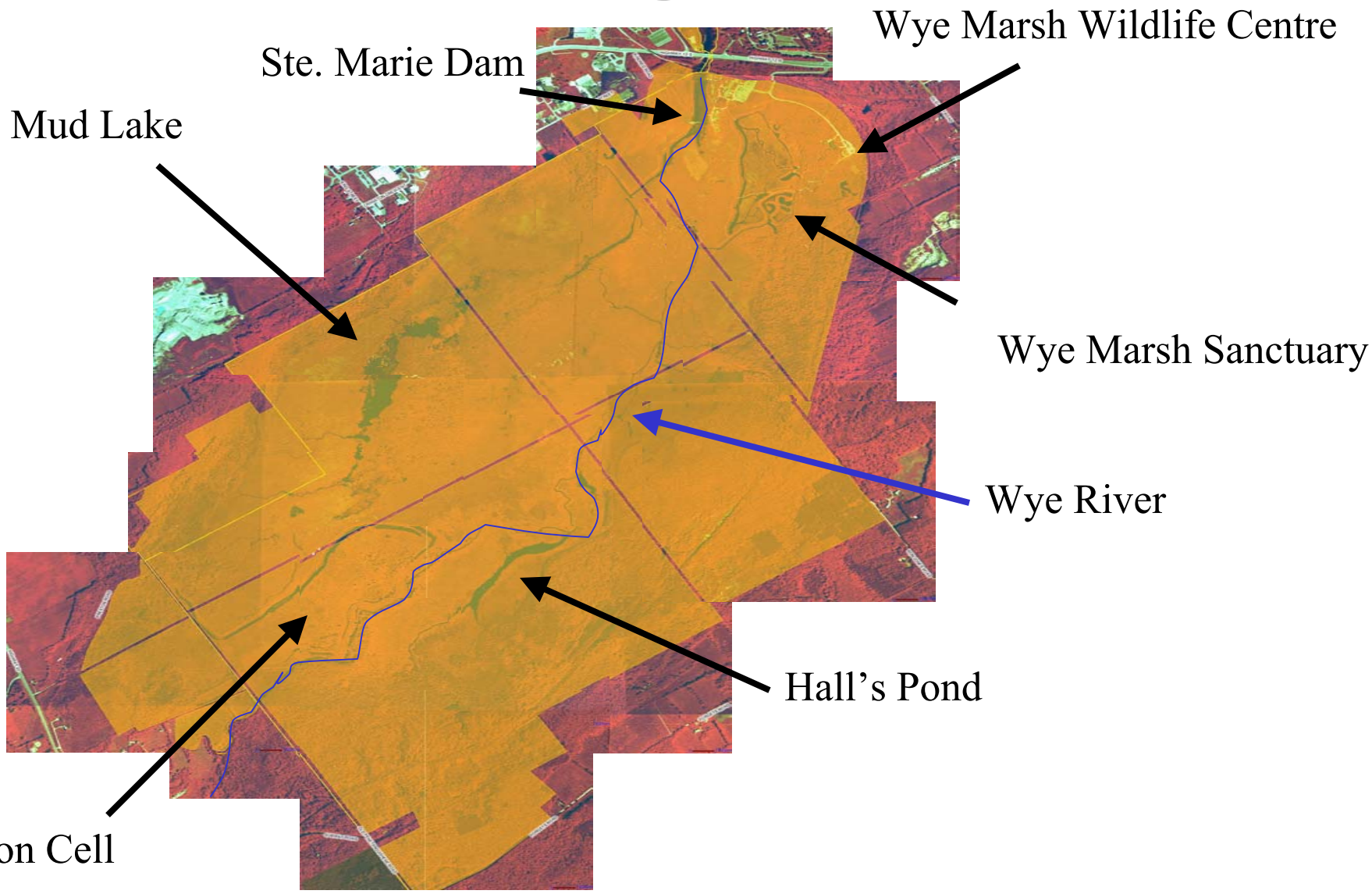
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Appendix A

Satellite Image of the Wye Valley

Wye Marsh: Satellite Image



Source of Maps: Simcoe County Website

Appendix C

Daily Monitoring Form

SWAN MONITORING FORM

Date

Observer(s) Name(s): _____

Weather: _____

General Observation	Total Visible					
	# S		(# A)		(# C)	
Location & Codes	am	pm	am	pm	am	pm
Canoe Dock (CD)						
Tower (TO)						
Cygnets Pond (CP)						
Litz's Pond (LP)						
Controls (CO)						
Muskrat Bridge (MB)						
Total:						

S = Swans
A = Identifiable Adults
C = Cygnets

			Location Code					Location Code					Location Code	
			am	pm				am	pm				am	pm
#138		M 97			#504	Joker	M 99							
#139	Lippy	F 96			#505		F 99			#624			M 01	
#205		F 91			#506	Squirt	M 00			#625	Tippy		M01	
#219		M 92			#507	Fluffy	M 00			#626			F 01	
#220	Mary	F 92			#508	Serena	F 00			#627			F 01	
#328		F 95			#510	Snowflake	F 00			#628			F 01	
#330		F 95			#511	Cobweb	M 00			#629	Gypsy		F 01	
#341		F 95			#512	Mote	M 00			#630			F 01	
#342		M 95			#513	Mustardseed	M 00			#635			M 01	
#343					#514	Peaseblossom	F 00			# 637			F03	
#360	Lefty	F 97			#515	Jack	M 91			#638			M9?	
#364		M 97			#516	Diane	F 93			#639			M02	
#366		M 97			#524		M 01			#640	Snowball		M 02	
#367	Sneezy	F 97			#525		F 01			#641	Brutus		M 98	
#368		M 97			#534		F 99			#642	Sarenpat		F 02	
#369		M 97			#536		M 99			#667			F00	
#370		M 97			#537	Duke	M 96			#669			F00	
#402	Tim	M 97			#538	Curly	F 97			#672			M00	
#438	Amazon	F 94			#539	Hangman	M 99			#738			F00	
#451	Tundra	F 98			#555	Taffi's Trilogy	M 00			#739				
#452	Rascal	M 98			#556		F 9?			#740			M02	
#455	Quincy	M 99			#557		? 00			#741			M02	
#456	Safety Pin	F 97			#591		F 00			#742			F98	
#458		M 97			#582					#743			F99	
#459	Sturgeon	M 96			#593					#745			02	
#460		F 94			#596	Angie	F 00			#748	Kimkev		F02	
#468		F 98			#608		F 99			#749	Patern		F02	
#486		M 98			#610		M 01			#750			F03	
#487		M 98			#611	Willow	F ?			#751			F03	
#489		F 98			#612		F 01			#752			F03	
#491		M 98			#613		M 01			#753			M03	
#493	Sparky	F 98			#614		F 01			#754			M03	
#496	Punky	F 98			#615		F 01							
#498	Stewy	F 99			#616		F 01							
#499	Lightning	F 99			#618	Sidekick	F 94							
#500	Princess	F 99			#619		M 01							
#501		M 99			#620	Ulysses	M 9?							
#503	Rocky	F 99			#621	Prince Billy	M 01							
					#622		M 01							
					#623		F 01							

NOTE: Grey shading indicated this years cygnets

Comments on reverse if needed

Appendix D

Known Nesting Pairs Since 1988 and Their Success

Nesting Pairs Visiting the Wye Marsh since 1988

Wild	Male Tag#	Male Name	Female Tag #	Female Name	First Year Nesting	Last Year Nesting	Eggs Laid	Eggs Hatched	Cygnets Fledged	Fledglings Tagged	Comments
No	-	Big Guy	-	Lady Girl	1990	1996	47	22	21	21	
No	789	Donald	788	Daisey	1994	2000	30	30	24	24	
Yes	206	-	100	Pig Pen	1993	1998	36	26	21	13	No Data for 1999
Yes	515	Jack	100	Pig Pen	1995	1995	9	8	7	6	
Yes	366	-	100	Pig Pen	2000	2000	3	3	1	1	
Yes	402	Tim	496	Punky	2002	-	5	0	0	0	
Yes	515	Jack	516	Diane	1997	-	47	45	34	29	
Yes	322	-	311	-	1997	1998	Unk**	3	Unk	0	
Yes	UTUB*	-	367	-	2002	-	Unk	4+	4	0	
Yes	238	-	224	-	1994	1994	3	0	0	0	
Yes	UTUB	-	UTUB	-	2002	-	Unk	2+	2	0	
Yes	257	-	224	-	1996	1996	6	6	3	2	
Yes	138	-	139	Lippy	2001	-	6+***	6	4	2	
Yes	257	-	255	-	1997	1997	6	4	4	1	
Yes	370	-	UTUB	-	2001	-	8+	8+	8	0	
Yes	251	-	239	-	1995	1995	5	4	2	2	
Yes	537	-	330	-	2001	-	6+	6+	4	4	
Yes	342	-	239	-	1998	1999	8+	8+	2	0	
Yes	219	-	216	-	1995	1995	4	0	0	0	
Yes	219	-	205	-	1996	-	15+	12+	6	3	No Data for 2000-01
Yes	617	Buckwheat	324	-	1997	1997	6	2	2	0	
Yes	617	Buckwheat	618	Sidekick	1998	2001	8+	1	0	0	
Yes	314	-	323	-	1998	1999	18	18	11	0	
Yes	309	Don	220	Mary	1998	2001	16+	4+	4	4	No Data for 2000
Yes	364	-	341	-	1999	-	21+	18+	15+	4	
Yes	368	-	538	Curly	2000	-	6+	5+	3	1	
Yes	641	Brutus	438	Amazon	2001	-	9	7	2	2	
Yes	620	Ulysses	468	-	2001	-	8+	8+	5	5	
Yes	487	-	556	-	2001	-	3+	3+	3	2	
Totals							339	245	192	126	

* - Untagged, Unbanded

** - Unknown

*** - Numbers thought to be higher than documentation shows