Conservation and Education Activities Report 2011-2012

toronto zoo

Conservation is a state of harmony between men and land.
Aldo Leopold

CONSERVATION AND EDUCATION ACTIVITES REPORT
2011-2012

The 2011-2012 year was packed with some new and great conservation, education and wildlife initiatives. It was an exciting year, and everyone at the Toronto Zoo contributed to our success. The CEW Division remains the backbone of the "invisible Zoo", and our dedicated staff is grateful to all other Divisions for the support and resources they provide.

Some of the highlights for 2011-2012 include:

Wildlife Health Centre (WHC) –

In 2011, design of a new 20,000 sq. ft. WHC was commenced. This building will replace the current hospital with a much larger state-of-the-art facility. A number of the rooms, including treatment and surgery, will be visible from a large atrium to escorted tour groups, allowing close observation of any procedures. There will also be a new pathology suite.

2012 Bioblitz –

Toronto Zoo hosted the first ever Bioblitz for the Rouge Park, partnering with the Royal Ontario Museum (ROM), the Rouge Park Alliance, Rouge Park Conservation Center, the Toronto Region Conservation Authority (TRCA) and Ontario Nature. The event proved to be the most successful in North America for 2012. Over 1410 species were identified in a 24 hour collecting period from 3:00 pm June 15 until 3:00 pm June 16. Special thanks must be given to the staff of the Toronto Zoo, Rouge Park, students, and the University of Guelph.

Vancouver Island Marmot Recovery Team Program –

In 2011, 67 young marmots took their first steps on Vancouver Island. In total, 375 captive-born marmots have been reintroduced to the island since the first release in 2003. This year, 68 marmots were born in the wild, bringing the wild marmot population up to 320-360 individuals.

With the great success of the captive breeding program, the plan is to continue to increase the number of marmots released each year. Survival rates are encouraging as captive-born animals have now survived several hibernation periods and are now reproducing in the wild. As well, Vancouver Island marmots can now be found on several mountains where previous extirpations had occurred. In 2006, joint efforts between the four facilities were recognized as the program was presented with a Canadian Association of Zoos and Aquariums Conservation Award. In 2011, the Toronto Zoo and Calgary Zoo were awarded the Association of Zoos and Aquariums North American Conservation Award for their joint effort in the recovery program. We are very excited about our continued and growing success in the recovery of this highly-endangered Canadian species.

Carpooling Program –

Over 500 zoo employees must commute to and from the zoo from areas all across Southern Ontario. To alleviate the carbon footprint, CEW- staff initiated the Zoo's first Carpooling Program in October 2009. The program's objective was to make the commute to and from the zoo more convenient, while significantly reducing gas emissions and our overall carbon footprint. In 2012, the Carpooling Program expanded by reserving 5 parking spaces for carpoolers consisting of 3 or more occupants, as well as hybrid and electric vehicles. This is an incentive to encourage staff to choose more environmentally friendly ways to get to work.

William A. Rapley, D.V.M., M.Sc.
Executive Director
Conservation, Education & Wildlife

Adjunct Faculty
Department of Biological Sciences
University of Toronto at Scarborough

Vice Chair and Board Member
Canadian Organization for Tropical Education and rainforest Conservation (COTERC)

Advisor Graduate Faculty, Biology Department
York University

Adjunct Professor
Ontario Veterinary College
University of Guelph

Past President and former Board Member
Canadian Committee for IUNC (CCIUNCN)

Acting Chair, Ontario Ministry of Natural Resources
Species at Risk Program Advisory Committee

TABLE OF CONTENTS

APPENDICES

Mandate and Resources

The Conservation, Education and Wildlife Division is located in the Centre of the same name and works closely with the Animal Care branch. In order to fulfill the conservation mandate of the Zoo, the division prepares and implements numerous initiatives to preserve habitat, and also carries out significant research in the fields of animal and plant conservation. Emphasis in this division is placed on stewardship, education, outreach and maintaining biodiversity and natural ecosystems both on and off site.

To ensure that optimum standards of animal and plant husbandry are met, the Conservation, Education and Wildlife Division is divided into three branches. These three branches work in co-ordination with one another, coming together in dynamic ways for the health and safety of the plants and animals. It is the integration of the Toronto Zoo's efforts in the fields of clinical behaviour, nutrition, veterinary medicine and pathology, reproduction and species-specific research that contributes to our animals maintaining healthy and active lifestyles.

Toronto Zoo Vision:

The Toronto Zoo will be a dynamic and exciting action centre that inspires people to love, respect and protect wildlife and wild spaces.

To fulfill its mission and progress toward realizing its Vision, the Toronto Zoo will follow a strategy that encompasses strategic initiatives:

- Nurture a culture of best practice, passion and commitment.
- Protect wildlife populations and the places that sustain them by demonstrating environmental leadership through model conservation programs and partnerships.
- Offer compelling education and outreach experiences to inspire people to care about wildlife and protect habitats.
- Deliver a guest experience that is fun, welcoming, and interactive and shows our commitment to sustainable living.
- Create dynamic habitats that celebrate the spectrum of plants and animals and connect people with nature.
- Invest in renewal of the Zoo's infrastructure and support systems with a commitment to state-of-the-art facilities, equipment and environmental best practices.
- Build revenue streams, fundraising capacity and strategic relationships.

CONSERVATION, EDUCATION AND WILDLIFE STRATEGIC PLAN 2012

Goal 1: Maintain Conservation, Education and Wildlife as the primary Zoo focus

Objective 1 – Focus involvement in projects using priority conservation initiatives as outlined in the Strategic Plan

Objective 2 – Maintain and exhibit self-sustaining captive populations for the preservation and promotion of biodiversity

Objective 3 – Support Recovery Plans of Species of Concern as designated by country of origin

Objective 4 – Be considered a resource for schools and teachers

Objective 5 – Provide public programs and activities

Objective 6 – Provide an enjoyable learning experience for Zoo visitors who do not attend a program

Objective 7 – Increase awareness of Toronto Zoo's CEW mandate to general public

Goal 2: Reduce the Zoo's ecological footprint and take a leadership role in green initiatives

Objective 1 – Implement a Green Plan to guide Zoo procedures, policies, and staff and volunteer behaviour toward sustainable operation management

Objective 2 – Activate people to become better Environmental Citizens

Objective 3 – Support measures for the protection, rehabilitation, interpretation and enhancement of natural areas within and around the Zoo site, provincially, nationally and internationally to meet key focus areas

Objective 4 – Engage other Zoo branches in delivering and facilitating CEW goals

Goals 3: Secure financial and staff resources to implement the Conservation Strategy

Objective 1 – Based upon the Toronto Zoo Vision Statement, obtain sufficient funding to support and maintain the interactive Education and Conservation goals

Objective 2 – Strengthen partnership with Development

Objective 3 – Seek external partnerships and collaborations for funding

Objective 4 – Maintain financial accountability and restraints consistent with income and resources

Objective 5 – Revenue generation

Objective 6 – Support and promote the Endangered Species Fund

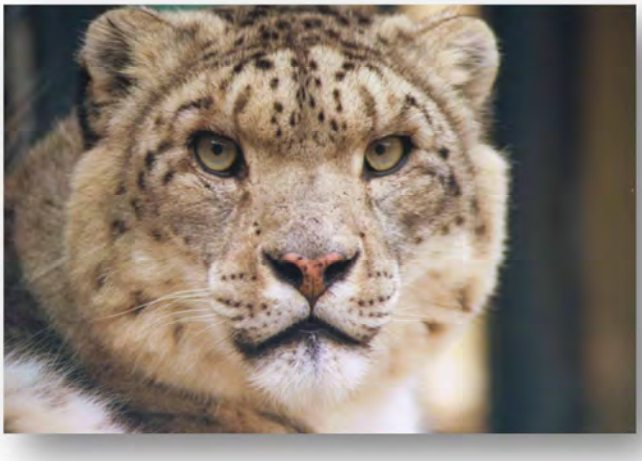
Objective 7 – Provide a financial plan to meet objectives for CEW Strategic Plan

CONSERVATION, EDUCATION AND WILDLIFE DIVISION

1.2 Toronto Zoo Conservation, Education and Wildlife Staff

Curatorial

William A. Rapley, D.V.M., M.Sc.
Dr. Rapley is the Executive Director of the Conservation, Education and Wildlife Division of the Toronto Zoo. Dr. Rapley serves as an adjunct professor for the Pathobiology Department of the Ontario Veterinary College (OVC), University of Guelph, as an advisor in the Faculty of Graduate Studies at York University, and as an adjunct faculty member for Department of Biological Sciences at the University of Toronto, Scarborough campus. Presently he serves on the Species at Risk Program Advisory Committee (SARPAC) for the Ontario Ministry of Natural Resources and as Vice-Chair for the Canadian Organization for Tropical Education and Rainforest Conservation (COTERC).



Dyann Powley
Dyann became Assistant to the Executive Director of Conservation, Education and Wildlife in May 2011. She is responsible for administrative support for the Conservation, Education and Wildlife Division and holds a Diploma in Veterinary Technology and Certificate in Medical Transcription.

Eldon Smith
Eldon is the Director of Wildlife at the Zoo. He coordinates activities for the wildlife branch, project management for the division, and manages the overall budget. In addition, Eldon provides assistance to the Curatorial Assistant for animal import/export issues. Eldon Smith retired at the end of January 2012. Eldon was a great contributor to the Division and will be missed.

David Barney, Ph.D.
Dr. Barney took the position of Acting Director of Wildlife in January 2012 (formerly manager of the Wildlife Care Branch). He holds a M.Sc. degree in Nutrition and a PhD. in Animal Behaviour and Nutrition. He is a member of the Nutrition Advisory Group and the Comparative Nutrition Society. He serves as an adjunct professor at the University of Guelph in the Department of Animal and Poultry Science, and is involved in nutritional and behavioural experiments at the Toronto Zoo. Dr. Barney is also a faculty member of Centre for the Study of Animal Welfare.

Maria Franke-Gunther, M.Sc.
Maria is the Curator of Mammals and is responsible for the mammal collection, including conservation recovery programs at the Toronto Zoo. She holds a M.Sc. in Biodiversity Management and a Diploma in Endangered Species Management through Kent University – Durrel Institute of Conservation and Ecology.

Bob Johnson, M.Sc.
Bob is the Curator of Amphibians and Reptiles and works closely in partnership with Andrew Lentini, Curatorial Keeper of Amphibians and Reptiles, to implement Toronto Zoo's Strategic Plan objectives to engage and inform our visitors and to manage the Amphibian and Reptile conservation and education programmes.

C. Lee
As Curator of Fishes and Marine Invertebrates, C. Lee is involved in conservation education initiatives, and increasing zoo participation in native aquatic species is of primary interest.

Thomas Mason, B.Sc.

As Curator of Birds and Invertebrates at Toronto Zoo, Tom is responsible for two of the most diverse taxon at the Toronto Zoo. He is the institutional representative (IR) for most of the orders of birds represented in the AZA taxon advisory groups.

The Curator of Conservation Programs and is responsible for guiding the Zoo toward sustainable management of on-site operations and facilities, and for communicating sustainable life and learning themes with visitors, staff and Volunteers, and the broader regional, national and international community. This position chairs the Toronto Zoo Green Team Committee.

Lydia Attard, B.Sc., M.Sc. (Student)
Lydia is the Curatorial Keeper of Invertebrates. She is involved with maintaining the Toronto Zoo's diverse Invertebrate collection in the Invertebrate Breeding Center (IBC) and establishing their husbandry protocols. She assists the Curator with exhibit design and species selection. She also provides assistance and direction to the keepers caring for the Invertebrates on exhibit.

Kyla Greenham, M.Sc.
As the Curatorial Keeper of Fishes and Marine Invertebrates, Kyla is responsible for the day to day operation of the Fish Lab; which includes developing husbandry protocols, technical support, staff training and assisting the Curator of Fishes with managing the Fish Collection. Her duties also include participation in conservation programs, such as the Lake Victoria Species Survival Plan, Atlantic Salmon Classroom Hatchery, Seahorse Conservation, Fish Rescue and Outreach.

Andrew Lentini, Ph.D.
Dr. Lentini is the Curatorial Keeper of Amphibians and Reptiles. He is the Institutional Representative for the AZA Eastern Massasauga Rattlesnake SSP and a member of the Eastern Massasauga Rattlesnake Recovery Team. Andrew is the husbandry co-coordinator for the AZA Puerto Rican Crested Toad SSP and a member of the AZA Lizard, Snake, Chelonian, and Amphibian TAGs.

Elaine Christens, M.Sc.
Elaine provides curatorial research support, as well as maintaining the Conservation, Education and Wildlife Centre's Library.

Andrea Drost, B.Sc. (Hons) Zoology
As the Curatorial Assistant, Andrea was responsible for coordinating activities for the curators and organizing the procurement and shipment of plant and animal specimens to and from the Zoo. She assisted both Canadian and foreign parties and outside agencies with information for shipping animals not at the Toronto Zoo. Andrea took a position as a Wildlife Supervisor in July 2012.

Rebecca Dalton, B.Sc. (Hons) Zoology
Rebecca was appointed the Curatorial Assistant position in July 2012. Rebecca is responsible for coordinating activities for the curators and organizing the procurement and shipment of plant and animal specimens to and from the Zoo. She assists both Canadian and foreign parties and outside agencies with information for shipping animals not at the Toronto Zoo.

Elaine Gabura, B.Sc. and Debby Martin, B.Sc.
Elaine and Debby are the Registrars for the Zoo's animal collection and are members of the Zoological Registrar's Association.

Julia Phillips, M.Sc.
Julia is the Coordinator of the Adopt-A-Pond Wetland Conservation Programme. She is responsible for overseeing the development of education and research programming to engage communities throughout Ontario in the protection of wetland wildlife and habitat. This position also oversees the administration of three citizen science monitoring initiatives: Ontario Turtle Tally, Frog Watch Ontario and the Wetland Guardians Registry.

Crystal Robertson
Crystal leads the stewardship, outreach, and marketing initiative of the Adopt-A-Pond Wetland Conservation Programme. She uses the principles and tools of Community-Based Social Marketing to research and develop outreach programs and presentations for specific audiences with the aim of eliciting behaviours that benefit reptiles and amphibians.

Vithuja Vijayakanthan, Hons B.Sc.
Vithuja is the Coordinator of the Great Lakes Program. She is responsible for booking and delivering presentations at schools and community events and developing the Program's educational materials. She visits more than 13, 000 students in over 600 classrooms annually. Vithuja also represents the Great Lakes Program at various events, reaching over 5, 000 participants each year. Vithuja has always been passionate about the environment, traveling, and lifelong learning, and is dedicated to conservation education.

Mary Kate Whibbs, B.Sc. (Hons), B.Ed.
Mary Kate is the Coordinator of the Aqua-Links Program. She is responsible for the planning, delivery and expansion of the program, which links students in Canada with students in East-Africa on the topic of water conservation. She facilitates this linking over the internet, monitors and troubleshoots classroom hatcheries in Canada and coordinates field trips for the live fish release. She also teaches participating students directly about water conservation issues in both of these significant freshwater regions of the world.

Kim Wheatley
Kim is the Aboriginal Programme Coordinator for the Ways of Knowing Partnership Turtle Island Conservation programme. Kim's Anishinaabe heritage facilitates First Nation community partnerships focused on the preservation of biodiversity incorporating First Nation Traditional Knowledge throughout Ontario.

Education

Heather House, B. A. (Hons), B.Ed., Certified Interpretive Guide
Heather is the Manager of Education and one of two Zoo School co-principals. She manages and directs education, volunteer and public program functions while ensuring efficient utilization of human and financial resources.

Kelly Bentley, B.A. (Hons), Museum Management & Curatorship Certification, M. A. Candidate, Certified Interpretive Guide and Trainer
Kelly is the Supervisor of Volunteer Services & Programs, responsible for developing and overseeing all aspects of the Volunteer program and informal learning opportunities at the Zoo, as well as the day to day operations of the Education Branch.

Steve Jones, B.Sc. (Hons), B.Ed., M.Ed Certified Interpretive Guide
Steve is the Supervisor of Education Programs responsible for developing and overseeing all aspects of public and school programs, as well as the day to day operations of the Education Branch. Steve

oversees a variety of education staff, including 36 seasonal camp staff, and is also co-principal of summer Zoo School.

Shawn Blackburn, B.Sc. (Hons), Fish and Wildlife Diploma, Certified Interpretive Guide
Shawn is the Programs Coordinator, responsible for developing, planning, advertising, and scheduling public programs for the Education Branch. This includes Zoo Camp, Serengeti Bush Camp, spring and fall programs, and youth badge programs.

Jacquie Kostoff, B.Sc. (Hons), B.Ed.
Jacquie is the Education Coordinator responsible for developing and promoting a variety of curriculum related programs and resources for school groups, plus providing professional development opportunities for teachers. She also oversees the day-to-day operation of school workshops which includes assisting with training and scheduling of workshop leaders.

Pinky Rivera, B.A., B.Ed. (Hons)
Pinky is the Education Assistant and is responsible for registration and administrative duties relating to education programs. She also assists in the preparation of program materials/resources and in the day to day operations of the Branch.

Nia Gibson B.Sc. (Hons), B.Ed., Certified Interpretive Guide
Nia is the Coordinator of Education for Sustainable Development Programs. She is responsible for the planning and teaching of Zoo School, an opportunity for students to earn their Grade 11 Biology credit. Nia also coordinates the ECOexecutives program, a full day series of workshops dedicated to engage the corporate world and inspire them to carry out their operations in a more sustainable manner.

Karen Conway, M.Sc., B.Sc. (Hons), Certified Interpretive Guide
Karen is the Co-coordinator of Volunteers; as such, she is responsible for recruiting, training and coordinating approximately 250 year-round, 60 summer, and 60 student Volunteers. She is also involved in the design and development of interactive educational stations operated by Volunteers both on and off site, and oversees the Zoo's extensive biofact collection.

Denise Hill-Fox, B. Sc. (Hons), B. Ed.
Denise is the Interpretation Coordinator, and is responsible for maintaining the Education Branch's biofact collection (skins, skulls, feathers etc.) as well as the interpretive areas on the Toronto Zoo site (e.g. Touch Tables, Wetlands Kiosk, Kesho Park Headquarters, etc.). This position also assists with the day to day operations of the Volunteer Program.

Wildlife Health

Graham Crawshaw, B.Vet.Med., M.S., M.R.C.V.S, Dipl. A.C.Z.M.
Dr. Crawshaw is the Senior Veterinarian at the Toronto Zoo, and holds an adjunct professorship, Pathobiology Department, Ontario Veterinary College at the University of Guelph.

Emeritus Kay G. Mehren, B.V.Sc., D.V.M., Dipl. A.C.Z.M.
Dr. Mehren continues as veterinary member of the Zoo's Animal Care and Research Committee. Kay is an active participant and advisor in many zoo and veterinary organizations such as the Ontario Animal Care Review Board, the American College of Zoological Medicine, American Association of Zoo Veterinarians, Wildlife Disease Association, Ministry of Natural Resources, Aquatic Research and Development Section, Animal Care Committee and Canadian Council on Animal Care.

Wally Nazarewycz
Wally is a Registered Master Laboratory Animal Technician. He has worked in the Wildlife Health Centre since 1991 as the Wildlife Health Supervisor and Veterinary Technologist.

Gabriela Mastromonaco, B.Sc., M.Sc., Ph.D.
Dr. Mastromonaco is the Curator of Reproductive Programs at the Toronto Zoo. She is an adjunct professor in the Department of Biomedical Sciences, University of Guelph and a member of the Reproductive Sciences Advisory Group. Her research has focused on the use of nuclear transfer technology as a method for genetic preservation and embryo production in wild cattle species, and the effects that the technology has on the developmental potential of the embryos.

Jaap Wensvoort, B.Sc., M.Sc.
Jaap is the Nutritionist at the Toronto Zoo, managing both the food production unit and nutrition research program. Jaap is a member of the Nutrition Advisory Group, Comparative Nutrition Society and the European Nutrition Group.

Christopher Dutton, B.Sc., B.V.Sc., M.Sc., Dipl. A.C.Z.M.
Dr. Dutton is a Staff Veterinarian at the Toronto Zoo, and holds an adjunct professorship, Pathobiology Department, Ontario Veterinary College at the University of Guelph.

Simon Hollamby B.A., B.V.Sc., M.S., Dipl. A.C.Z.M., M.R.C.V.S.
Dr. Hollamby is a Staff Veterinarian at the Toronto Zoo, and holds an adjunct professorship, Pathobiology Department, Ontario Veterinary College at the University of Guelph.

Iga Stasiak, D.V.M.
Iga is a second year graduate student in the Zoo Animal Medicine and Pathology D.V.Sc. program at the Ontario Veterinary College, University of Guelph and the Toronto Zoo. She is a graduate of the Ontario Veterinary College. She subsequently completed an internship in small animal medicine and surgery at the Michigan Veterinary Specialists. She has been a research assistant helping with a loggerhead sea turtle health assessment. Her research project is focused on the role of hepcidin in iron regulation in bats.

Pauline Delnatte, D.V.M.
Pauline joined the program in September 2010. She is a graduate of the National Veterinary School of Toulouse, France. She completed an internship in exotic pet medicine and bird of prey rehabilitation at St Hyacinthe Veterinary College in Quebec, and spent a year in mixed practice before the residency. Her research concerns the prevalence of a newly identified avian bornavirus in wild waterfowl and the susceptibility of domestic poultry species to this virus.

Horticulture

Anna-Marie (Rie) Burrows, B.Sc. (Grounds keeping)
As the Manager of Grounds keeping and member of the Green Team at Toronto Zoo, Rie oversees the Horticulture, Material Collection and Custodial units at the Toronto zoo. Rie is involved in a number of projects on site involving the development of green initiatives. Rie is actively involved in the Waste Diversion projects on site, helping to introduce new initiatives to divert waste from landfill, and participates on the Waste Diversion committee.

Bruce Cullen, B.Sc. (Horticulture)
Horticulture supervisor Bruce Cullen is responsible for the intensive grounds maintenance demanded daily by Toronto Zoo. These activities include: installation, use, and maintenance of an extensive site-wide irrigation system, heavy equipment operation, interlock installation and repairs, design and installation of exhibits, and browse collection.

David Ross, Horticulturalist (Horticulture North & Materials Collection)
Supervisor of Horticulture and Material Collection, David is responsible for garden maintenance, installation and design and works to provide safe efficient collection and disposal of materials at the

Toronto Zoo. David is involved with implementing green initiatives through landscapes such as developing naturalized grasslands and focusing on the use of native plants which will help conserve water and energy.

Wildlife Care

Eric Cole, B. A., B.Sc. (Hons)
Eric joined the Toronto Zoo in 1991, and was president of the AAZK Toronto chapter from 2003 to 2007 and served as co-chair for the 2001 AAZK National Conference. He was appointed Animal Care Supervisor in June 2007 and was responsible for the African Savanna and Elephant areas of the Zoo. In 2011 he assumed responsibility for the Americas and Canadian Domain. Eric is currently Acting Wildlife Care Manager.

Nicole Presley, B.Sc.
Nicole started as a full-time Keeper at the Toronto Zoo in January 1996, and currently oversees the IndoMalaya Pavilion and Paddocks and the Toronto Zoo Behavioural Husbandry Program. She has been a member of the American Association of Zoo Keepers since 1998 and has served on the AAZK Toronto Chapter board from 2002-2010. She has been involved with the AAZK National Membership Resources Committee since 2006. She is also a member of the Animal Behaviour Management Alliance.

Karen Hamilton
Karen joined the Toronto Zoo as a Keeper in 1996 in the Indo-Malaya section, and continued working as a Keeper in several other areas of the Zoo. She is a founding member of the Animal Behaviour Management Alliance and was co-chair for the first conference hosted outside of the USA for the International Association of Avian Trainers and Educators. She joined the team of Supervisors in 2009. Currently she supervises the Outreach and Discovery area.

Chris Dulong
Chris has worked the majority of his career with Elephants, Hippos and the Africa savanna area. He is an active member of the Elephant Managers Association and served on the board from 2003 to 2009 and as president in his last year. Chris is currently an instructor for the AZA's Principles of Elephant Management annual course, and has moved to the position of Wildlife care Supervisor of Elephants, Hippo, Africa Savanna and Penguins earlier this year.

Jeff Young, Hons. B.Sc.
Jeff began his career at the Toronto Zoo in 1990 as a Keeper, after completing a degree in Marine Biology. In 1996, he became the Curatorial Keeper of Fishes and Marine Invertebrates, a position that was held for 14 years. He moved to the Americas Pavilion as the Grade 4 Keeper in 2010. Jeff was appointed to the position of Wildlife Care Supervisor in February 2012 and currently oversees the Americas Pavilion, Tundra, Mayan Temple and Canadian Domain.

Dan Pearson
Dan Pearson joined the Toronto Zoo in 1979 as a keeper, and after working in several areas of the zoo became the Grade IV keeper of the Demonstration Unit (now Outreach and Discovery). Dan is a founding member of the International Association of Avian Trainers and Educators, serving as the International Board member for a total of eight years. Dan became the Acting Wildlife Care Supervisor for Australasia and Eurasia in May of 2012.

Oliver Claffey
Oliver Claffey started as a Zoo Keeper at the Toronto Zoo in 1974. Active in the American Association of Zoo Keepers since 1976, Ollie served as National President from 1990 to 1992. He has been involved in many breeding successes through the years including Tawny frogmouths, Hairy-nosed wombats, Tasmanian devils, Black-footed ferrets, Siberian tigers, Przeswalski's horses, Snow leopards and Komodo dragons. Oliver retired in April 2012.

Robert Smerage
Robert began his Zoo career in 1969 as a Keeper at Toronto's Riverdale Zoo. In 1974 he moved to the new Toronto Zoo and worked with the Zoo's Orangutan collection for over twelve years. He has worked on breeding the Renault's ground cuckoo, which resulted in the first captive breeding in Canada. As an Animal Care Supervisor, he was been responsible for various areas of the Zoo, most currently, Americas/Canadian Domain. Robert retired in September 2011.

Andrea Drost, B.Sc. Honours Zoology
Andrea started as a full-time Keeper at the Toronto Zoo in March 1995 and worked in various areas of the Zoo. In 1997 she joined a dedicated keeper team to the Black-footed Ferret and later the Vancouver Island Marmot and was fortunate enough to be involved in the captive breeding and release programs for these animals. In 2001 Andrea moved into the position of Curatorial Assistant which had the responsibility of managing all imports and exports of animals to and from the Toronto Zoo. In her time in this position she was responsible for over 2000 live animal shipments both domestically and internationally. In 2012 Andrea joined the Wildlife Care Supervisor team and currently has responsibility of the Africa Rainforest Pavilion.

1.3 Conservation, Education and Wildlife Facilities

1.3.1 Wildlife Health Centre

The Wildlife Health Centre (WHC) is home to staff of the Wildlife Health and Reproductive Physiology branches. Facilities include two reproductive research laboratories, an animal hospital, animal holding areas and a necropsy room. Within these, Wildlife Health staff can meet most medical and surgical needs of the Zoo's Animal Collection. A clinical laboratory is available for routine analysis of blood, fecal, urine and microbiology samples, and for water quality testing to monitor the status of aquaria and exhibit moats. The clinical area includes a large treatment room, X-ray room, sterile surgery and an ICU/nursery. It is equipped to provide gas anesthesia, dentistry, and ultrasound and endoscopic examinations in addition to standard clinical procedures.

The animal holding areas of the WHC include indoor and outdoor hospital/quarantine enclosures for birds and mammals. In addition, the WHC's Research Wing incorporates separate quarantine and holding/breeding rooms for reptiles, amphibians, fishes and invertebrates, including the conservation

breeding programs of the Puerto Rican crested toad, Eastern massasauga rattlesnake, ngege, seahorses, and several invertebrate species. The black-footed ferret and Vancouver Island marmot breeding programs also come under the auspices of this department.

Construction of the Quarantine Wing was completed in March 2008. The 5000 sq. ft. extension houses a variety of new arrivals to the zoo. Included in the Wing are hoofed stock pens, multipurpose rooms for small mammals, birds and reptiles, and a strong room for larger carnivores and primates. The facility was designed to meet Canadian Food Inspection Agency requirements for medium security quarantines.

In 2011, design of a new 20,000 sq. ft. WHC was commenced. This building will replace the current hospital with a much larger state-of-the-art facility. A number of the rooms, including treatment and surgery, will be visible from a large atrium to escorted tour groups, allowing close observation of any procedures. There will also be a new pathology suite. It is hoped that construction will start in 2012.

Wildlife Health Centre Resources

The Wildlife Health Centre includes veterinarians, technicians, animal keepers, and an administrative clerk. These people care for the wide variety of animals housed in the WHC and work closely with the zoo's curators, nutritionist and wildlife care staff to provide a broad preventative medicine program for the zoo's animal collection.

New animal keepers on zoo staff undergo a three-month training program in the WHC during which time; three curatorial keepers provide orientation to specialized areas of care for invertebrates, fish and reptiles/amphibians. In addition, new keepers gain experience in pen set-up, diet arrangements, restraint/handling, quarantine and disinfection.

Diagnostic, medical, surgical and pathology procedures are performed at the zoo, providing immediate care to all animals in the collection. In special circumstances, outside specialists in human or veterinary medicine, many of whom have volunteered their time and expertise to treat complex cases, are consulted. Occasionally, an animal may be sent to the Ontario Veterinary College for diagnosis, treatment or consultation. Wildlife Health Staff are actively involved in research and provide support to other investigators on research projects that will increase the Toronto Zoo's ability to care for the animal collection and contribute to conservation efforts. Since 1973 there has been collaboration with faculty of the Ontario Veterinary College and the University of Guelph for pathology, diagnostic and research activities. Wildlife Health Staff also add to the general knowledge of zoological medicine through presentations, publications and professional training programs as adjunct faculty.

1.3.2 Reproductive Physiology Laboratories

The Reproductive Physiology branch consists of two laboratories. Staff members in this area include a full-time Curator of Reproductive Programs, two full-time research assistants and a varying number of graduate and seasonal students. All staff members are dedicated to research and the practical applications of reproductive technologies as they pertain to promoting and enhancing conservation and breeding programs, both at the Toronto Zoo and other institutions across North America.

The purpose of the Reproductive Physiology research program is twofold; first, to systematically conduct research with domestic and non-domestic animals for the purpose of increasing the knowledge base of reproductive biology in wildlife species, and second, to use this information to assist in population management, and to overcome conservation and breeding barriers either through enhancing natural breeding or developing methods for assisted reproduction. Due to the

multi-faceted scope, this program is well integrated into the veterinary, conservation, education, research and animal management activities of the Toronto Zoo. Being the only one of its kind in Canada, the program also serves as an information and service resource to other Canadian zoos and to various SSPs® and TAGs across North America.

Endocrinology

Establishing reproductive characteristics through basic research is a critical component for improving reproduction in conservation breeding programs for wildlife species. Reproductive hormone profiles can be characterized and assessed from non-invasive samples, such as urine and feces, or, in trained animals, from serum or saliva. The hormone data can be used to conduct reproductive evaluations of estrous cycles, predict the timing of ovulation and detect pregnancy. These data can also be used to study the effectiveness of contraceptives in females and assess breeding potential and seasonality in males, thus evaluating reproductive status and improving species management. Furthermore, assessment of corticosteroids provides valuable information on the animal's response to external stimuli. This information is important for understanding the effects of exhibit design and enrichment programs on the animal. Novel studies investigating the levels of corticosteroids in hair and feathers may allow us to gain a better understanding of the effects of chronic or long-term elevations in these hormones on overall health. Endocrinology studies are conducted on a variety of species including: Bactrian camels, cheetahs, gorillas, Indian and white rhinos, lions, tigers, Vancouver Island marmots, giraffes, tree kangaroos, zebras, jaguars and wood bison.

Gamete Biology

The study of gamete and embryo physiology provides basic information that is necessary to better understand the complexities of their function and survival. These data are crucial for the development of advanced reproductive techniques, including semen handling and evaluation, artificial insemination, in vitro fertilization and gamete/embryo cryopreservation, which can provide alternative methods for the preservation of genetic material and management of captive and wild populations. Assisted reproductive technologies (ARTs) can be used to: 1) overcome poor reproductive function, 2) increase reproductive yield, 3) distribute genetics of valuable individuals or 4) overcome health or behavioural issues (e.g., physical handicaps, mate incompatibility). As part of the genetic banking program at the Toronto Zoo, animals are evaluated for chromosome content to identify any chromosome abnormalities that may contribute to reduced fertility. Identification of carrier individuals ensures proper breeding management by reducing the perpetuation of chromosome defects in the population and, thereby, reducing the occurrence of embryonic and fetal losses. As part of Toronto Zoo and SSP® recommendations, monitoring and banking of Toronto Zoo animals, as well as implementation of ARTs when necessary, are routinely carried out.

1.3.3 Wildlife Nutrition Centre

In 1974, Toronto Zoo was the first zoo in North America to employ a full-time nutritionist and, to date, remains the only zoo in Canada to do so. As a pioneer in the development of scientifically-designed feeding programs for captive exotic species, the Toronto Zoo's Wildlife Nutrition Centre has developed diets for a diversity of species to maintain optimal health and well-being. The Wildlife Nutrition Centre is comprised of two components that work together to improve animal health and wellbeing; the Food Production Unit and the Nutrition Research Unit.

Food Production Unit

The Toronto Zoo has a centralized Food Production Unit which produces nutritionally and economically sound diets to feed the over 6000 specimens that

comprise the zoo's animal collection. Animals are fed based on species-specific diet sheets that outline the amount of each food item in the animals' daily diets. Each food item is then carefully measured and packaged for every species and, in some cases, for each individual. By ensuring proper nutrition, this unit enhances the animals' wellbeing and supports preventative medicine.
Five nutrition assistants work from 6:00 am to 2:30 pm every day to ensure that diets are prepared as per specifications and delivered on site to be fed by the animal care staff. The practical knowledge and concerns of the Food Production Unit, the Wildlife Health Unit, the Curatorial department and the Wildlife Care Department grow into areas of study for the Research Unit. Significant amounts of fresh browse are provided and significant amounts of browse are preserved for winterfeeding to zoo animals by the Wildlife Nutrition Centre staff (see project description under Conservation-Research Initiatives).

Nutrition Research Unit

The Nutrition Research Unit, in conjunction with the Food Production Unit, continues to build on a program to improve the current nutrition knowledge of non-domestic species. For many exotic animals, metabolic and nutrient requirements are unknown; therefore, the zoo continues registering, testing and improving various feeding formulas to ensure the health of those animals and their offspring. A series of special feed formulations, such as the Toronto Zoo carnivore diets, have been made available commercially. Their production has been outsourced and they are being used at other zoological institutions throughout North America to provide balanced diets to an expansive population of exotic carnivores. Royalties received through the sale of zoo diets support further zoo nutrition studies at Toronto Zoo. Diets are reformulated as the knowledge of zoo animal nutrition improves. Factors that affect nutrient requirements such as nutrient digestibility, physiological state, and age, breeding requirements and general health, changes throughout an animal's lifetime are taking into consideration.

The Nutrition Research Unit collaborates closely with the University of Guelph and the University of York to perform research, summer projects and post graduate research. In addition, the Nutrition Research Unit works in conjunction with international zoo organizations and special research institutions to create dietary changes that may improve reproduction, health, behaviour, and the general well-being of the animal collection. Utilizing the experience of keepers, curators and veterinarians, the nutrition information is used to develop complete captive management plans for our animals.

1.3.4 Curatorial and Records Branch

The curators provide direction to staff in the use of progressive animal care and management practices. Moreover, they plan and co-ordinate exhibits and renovations in collaboration with other Zoo departments. The curators oversee the animal and plant collections, including additions and removals, planning and construction of displays, husbandry techniques, as well as educational initiatives.

The Curators develop and implement conservation projects. These projects increase the zoo's profile at the municipal, provincial, national, and international level, and also provide support for research initiated by staff. Programs are encouraged in behavioural enrichment, breeding, eco-education, wetland preservation, as well as habitat restoration and protection. Throughout the year, assistants are employed with the aid of grants to develop and work on various conservation initiatives. The following list represents areas highlighted within the Conservation, Education and Wildlife Division:

- Amphibians and Reptiles
- Birds
- Fishes and Marine Invertebrates
- Invertebrates
- Mammals

Registrar

The primary responsibility of the registrars is management of the Conservation, Education and Wildlife animal database. This includes information collection, entry, maintenance and development. The registrars also perform a number of important tasks for the organization and safety of the Zoo's Animal Collection, including:

- Providing statistical information and reports from records, including the Annual Animal Collections Inventory,
- Informing the Manager of Administration, curators and veterinarians of significant trends apparent from records by way of written and oral reports,
- Coordinating with Facilities & Site staff to maintain and update animal areas within the Site Identification Code System,

The registrars are the Toronto Zoo contacts for the International Species Information System (ISIS). They provide data on relevant Toronto Zoo animals to the International and Regional Studbooks, as well as correspond and provide data on SSP® species at the Zoo.

Research Library

The Toronto Zoo Library has a wide selection of conservation resources and an expanded library database. The library's collection includes diverse selections of journals, newsletters, a vertical file system for clippings and articles, as well as a large number of books covering various animal and plant subjects. The library is open to all staff and students. In addition, external students and researchers can also use the Zoo Library by making a special appointment with the library staff.

1.4 Affiliates and Partnerships

1.4.1 University Collaborations

To further increase resources offered at the Zoo, a number of external researchers work on various projects. As a result, strong partnerships have been developed with other research institutions. The Toronto Zoo encourages various students and researchers to work in collaboration with the Zoo on projects related to their area of interest.

YORK UNIVERSITY – Animal Behaviour

As part of its multi-disciplinary approach towards conservation research, the Zoo has developed a partnership with the Psychology and Biology Departments of York University. Dr. Suzanne MacDonald, a Professor at York University, collaborates as the Zoo's Animal Behaviourist. Currently, the Zoo is working with the various SSP® programs, integrating behavioural and hormonal research into the breeding of endangered species.

As a result of this partnership, not only are Dr. MacDonald and her students able to use the Zoo as a research facility, but the Zoo also has the opportunity to benefit from important and unique research. Dr. William Rapley is a faculty advisor for these programs and assists with student supervision, project review and examination.

UNIVERSITY OF GUELPH

Ontario Veterinary College Veterinary Fellowships

Specialty training in zoological medicine and pathology has been offered in collaboration with the Ontario Veterinary College (O.V.C.) since 1979. Presently, two graduate veterinarians are gaining first-hand clinical experience and working on original research projects as part of their three-year Doctor of Veterinary Science degree programs. The objective of the program is to train veterinarians to become clinically competent in zoological medicine, and to develop a strong understanding of diagnostic tools and the ability to perform pathological studies. Graduates of the program will have the background to practice and teach zoological medicine and to carry out conservation work and research, with the capability to contribute fully to the scientific activities expected in a modern zoo or wildlife-related organization.

Post-graduate Studies in Biomedical Sciences

Post-graduate level training has been offered in reproductive physiology and biotechnology for M.Sc. and Ph.D. programs and post-doctoral fellowships for over 15 years. Students gain a thorough understanding of experimental design and in-depth knowledge of reproductive physiology and laboratory techniques associated with different aspects of assisted reproductive technologies as applied to zoo species.

UNIVERSITY OF TORONTO (Scarborough Campus)

In 2008 Conservation, Education and Wildlife staff, including Curators, Vets, Nutritionists and the Executive Director, taught a 3rd / 4th level course in the Biology and Environmental Science program at UTSC. Lectures ranged from population management to animal care to greening initiates. After wonderful reviews from students and staff at UTSC, Toronto Zoo was invited to teach the course again. The course generated financial support for the Toronto Zoo's Endangered Species Reserve Fund. Dr. William Rapley has an adjunct appointment to UTSC.

TRENT UNIVERSITY

The Toronto Zoo collaborates with the Natural Resources DNA Profiling and Forensic Centre. Dr. Bradley N. White and Dr. Paul J. Wilson are presently working on Puerto Rican crested toad, Blanchard's cricket frog and Polar bear projects. The Wildlife Forensic DNA Laboratory works with a broad spectrum of species of Canadian and Ontario animals and plants. Past collaboration included Trumpeter swans, Massasauga rattlesnake and Tarantula Identification for CITES.

Post-graduate Studies in Environmental and Life Sciences

Post-graduate level training has been provided for M.Sc. and Ph.D. programs for over 2 years. This new collaboration has resulted in students gaining technical and theoretical expertise in reproductive and stress hormones and their effects on population dynamics in wild and captive species.

Laurentian University

Collaborations on undergraduate and post-graduate research studies have been on-going for over 2 years. This new collaboration has resulted in students gaining technical and theoretical expertise in sperm characteristics and stress hormones and their effects on population dynamics in wild and captive species.

1.4.2 Affiliate Researchers

Albrecht Schulte-Hostedde, M.Sc., Ph.D.:
Department of Biology, Laurentian University

Cathy Gartley, D.V.M., D.V.Sc.:
Department of Population Medicine, OVC, University of Guelph

Claire Jardine, D.V.M., M.Sc., Ph.D.:
Department of Pathobiology, OVC, University of Guelph

Dale Smith, D.V.M., D.V.Sc.:
Department of Pathobiology, OVC, University of Guelph

Ian Barker, D.V.M., M.Sc., Ph.D.: (retired)
Department of Pathobiology, OVC, University of Guelph

Ian Duncan, Ph.D.: (retired)
Department of Animal & Poultry Science, University of Guelph

James Atkinson, Ph.D.: (retired)
Department of Animal & Poultry Science, University of Guelph

Suzanne MacDonald, Ph.D.:
Director, Graduate Program, Department of Psychology, York University

Professor Bradley White, Ph.D.:
Wildlife DNA and Forensic Centre, Trent University

W. Allan King, M.Sc., Ph.D.:
Department of Biomedical Sciences, University of Guelph

1.4.3 Partnerships

AGF Funds Inc.

AZA (American Zoo and Aquarium Association)

Biodôme de Montréal

Canadian Environmental Assessment Agency

Canadian Wildlife Federation

CAZA (Canadian Association of Zoos and Aquariums)

COTERC

Ducks Unlimited

Endangered Species Recovery Fund of Canada

Evergreen Foundation

First Nations Partnerships

Georgian Bay Biosphere Reptile Awareness Program

Grasslands National Park – Saskatchewan

Helen McCrea Peacock Foundation

International Bear Management Association

Kawartha Turtle Trauma Centre

KPMG LLP Charitable Foundation

Milliken Meats Limited

Mountain Equipment Cooperation

National Science & Engineering Research Council of Canada

Nebraska Herpetological Society

Ontario Ministry of Energy

Ontario Ministry of Natural Resources

OMNR – Species at Risk

Ontario Parks

Ontario Power Authority

Ontario Streams/Habitat Stewardship Environment Canada

Ontario Veterinary College Pet Trust

Polar Bears International

Ralph Kirk Endowment Fund

Rentokil Tropical Plants

Rouge Park Alliance

Association of Reptile and Amphibian Veterinarians

Banrock Station Wetlands Foundation Canada

Bullfrog Power

Canadian Museums Association

Canadian Wildlife Service

Cochrane Polar Bear Habitat

Conservation Ontario

Direct Energy

ELSA Wild Animal Appeal of Canada

Environment Canada

Federation of Ontario Naturalists

Geoffrey H. Wood Foundation

Government of Canada, Habitat & Stewardship Fund

Greater Georgian Bay Reptile Awareness Program

Human Resources Development Canada

K.M. Hunter Charitable Foundation

Marmot Recovery Foundation

Morris Animal Foundation

National Heritage Information Centre

Natural Sciences and Engineering

Ontario Ministry of Education

Ontario Ministry of Environment

Ontario Ministry of Transportation

Ontario Nature

Ontario Streams

Ontario Vernal Pool Association

Parks Canada

Pond Life (Liverpool, UK)

Recovery of Nationally Endangered Wildlife

(RENEW) Recovery Teams

Research Council of Canada

Royal Botanical Gardens

Royal Ontario Museum

RBC Blue Water Project

Saskatchewan Ministry of Environment

Saskatchewan Ministry of Agriculture

Sydenham Conservation Foundation

Shell Environment Fund

The Richard Ivey Foundation

The Henry White Kinnear Foundation

Tippet Foundation

The W. Garfield Weston Foundation

Toronto Humane Society

Toronto Atmosphere Fund

Toronto Regional Conservation Authority

Toronto Parks and Recreation

Turtle S.H.E.L.L. Tortue

Toronto Zoo Development Division

University of British Columbia

United States Fish and Wildlife Service

Vancouver Island Marmot Foundation

US Fish and Wildlife Service

Wildlife Preservation Canada

Weston Family Foundation

World Wildlife Fund, USA

World Wildlife Fund, Canada

Young Canada Works – Canadian Museums Association

Youth Assisting Youth
Association of Reptile and Amphibian Veterinarians

Conservation- Education Initiatives

The Education Branch enriches the Toronto Zoo. It is a place where an urban population can connect with the natural world. The influence of the Education Branch can be felt throughout the Zoo in virtually all of its activities and programs. The opportunities to observe animals and their habitats first-hand give visitors a valuable experience in connection with nature. This bond creates an unparalleled opportunity to foster education.

In addition to the programs to follow, the Education Branch is also involved with: ongoing development and revision of educational materials; development of interpretive graphics; website fact sheets; requests for information; marketing of educational programs; Volunteer training; guided tours; 'Browse' and 'It's Happening' newsletters; and special events.

2. CONSERVATION EDUCATION INITIATIVES

2.1 Education Branch

The Education Branch enriches the Toronto Zoo. It is a place where an urban population can connect with the natural world. The influence of the Education Branch can be felt throughout the Zoo in virtually all of its activities and programs. The opportunities to observe animals and their habitats first-hand give visitors a valuable experience in connecting with nature. This bond creates an unparalleled opportunity to foster conservation through education.

In addition to the programs mentioned below, the Education Branch is also involved with: ongoing development and revision of educational resources, interpretive graphics/displays; marketing of educational programs; volunteer training; guided tours & outreach; plus assistance at special events.

2.2 Volunteers

The Volunteer Services Unit recruits, trains and co-ordinates a large group of volunteers who help to support the objectives of the Zoo, providing an educational experience for Zoo visitors and inspiring people to live in sustainable ways that promote the well-being of our natural world.

There are currently 372 Volunteers at the Toronto Zoo consisting of Year-Round Volunteers, Summer Volunteers and Zoo Ambassador Student Volunteers. All Volunteers assist in the delivery of the Zoo's educational programs, helping to raise public awareness of and involvement in conservation, interpreting the zoogeographic and ecological relationships of the animal and plant kingdoms, and most importantly, enhancing the experience of each Zoo visitor with whom they come in contact. These individuals are vital to the Zoo's many programs and activities. Volunteers conduct guided tours, operate interpretive areas around the Zoo, assist at special events, and present Outreach Programs in the community. Year-Round Volunteers undertake a rigorous training course and must complete an exam and practical before taking part in the duties of a Zoo Volunteer. These individuals agree to a two-year commitment consisting of four hours per week with a minimum of 75 hours/year.

During the summer, 60 additional Volunteers are recruited to assist during this very busy season. At Kesho Park headquarters they take on the role of Park Ranger. At the Backyard Wildlife kiosk in the Kids Zoo, Volunteers educate visitors on the importance of reptiles, amphibians, insects and spiders, and at the Wetlands Kiosk they help visitors to discover the diversity of life in the Zoo's ponds.

Zoo Ambassadors are secondary or postsecondary students who lend a hand at special events throughout the year. They also assist with Zoo Kids, a day camp for four and five year olds during the summer months, helping to instill a love for nature and wildlife in the very young.

As a whole, Volunteers contribute a total of 27,000 hours of their time per year to the Zoo, interacting with just fewer than 600,000 people. They are an invaluable resource for conservation and education at the Toronto Zoo.

2.3 Education Programs

2.3.1 Formal Education Programs

Student Workshops

The Toronto Zoo offers intensive and comprehensive student workshops that fulfill provincial curriculum requirements and provide a fun and educational learning experience. Formal programs combine lessons in a stimulating classroom setting with guided tours and interactive activities. Workshops cover science topics for Grades 1 to 7 and are supported by detailed packages of pre- and post-visit classroom activities that teachers receive before the workshop. Annual participation is about 10,000 students. A generous grant from a donor supported 485 students from disadvantaged schools in the former city of York, to attend Zoo workshops this past school year.

Teacher Workshops

Teacher workshops are offered for teacher candidates from the faculties of education at York and Western Universities, as well as the University of Toronto. Workshops are also conducted on a request basis for professional development days for local school boards. "Teacher's Day" is offered twice a year, in September and April, as an opportunity for teachers to come to the Zoo for a free visit with family members to learn the value of the Zoo as a learning destination by taking part in guided tours and attending our Education Centre Open House. The Toronto Zoo also seeks other promotional opportunities to showcase the Zoo to teachers, principals, and parents as an excellent resource for bringing conservation and the science curriculum to life.

Zoo School

The Toronto Zoo is registered with the Ministry of Education as a private school for the delivery of Grade 11 Biology, University Preparation (SBI3U) credit courses. Using the Zoo as a living classroom, students not only learn the complexities of biological systems, but see them in action through interactive lessons, behind-the-scenes tours, and discussions with Zoo staff. This intensive four week program is delivered in two sessions throughout the summer, one in July and one in August. For 2011 and 2012, both sessions were filled to capacity with 18 students per session.

Resources for Teachers/Educators

A variety of resources are available on the Zoo website to assist teachers/educators in planning a Zoo visit and supporting them in the delivery of certain topics in the classroom or at the Zoo. Science Curriculum Resource Booklets and Self-Guided Tour Scripts are available for grades 1-7 that support important concepts in the Life systems strand of the Ontario Ministry of Education and Training Science Curriculum for elementary grades. For secondary level students, Zoo assignments, available for

download, challenge students to observe, read, think, record data, and make their own discoveries while at the Zoo. Topics covered include: biomes, urbanization, and climate change, sustainability of ecosystems, biodiversity, environmental science, anthropology, and evolution.

Internship Programs

In 2011-2012 the Education Branch hosted five interns from three different institutions. Two interns from Queen's University assisted in the development of teacher's resources available to download from the Zoo's website. Two OISE/University of Toronto students assisted with the development of a new Teacher Resource Guide for giant pandas, and also designed an educational poster to help market school programming. In addition, one student enrolled in Early Childhood Education at Ryerson assisted with Zoo Camp and implementing new activities/games for the children. Internship programs such as these contribute immensely to the productivity of the Branch, allowing us to develop/revise the programs and resources we do, while at the same time provide practical work experience for these students helping them advance in their careers.

Operation Conservation

With the generous support from The Geoffrey H. Wood Foundation and Tippet Foundation, Operation Conservation, a two day immersive program at the Zoo, continues to touch the lives of youth from the Jane-Finch and Malvern communities, helping to expand their horizons and empower them to become positive role models in their schools and communities. Each year, approximately, 220 grade six students attended this program, and are treated like VIP's with behind the scenes tours, and hands-on educational activities.

2.3.2 Non-formal Education Programs

The Education Branch offers a wide variety of public programs throughout the year catering to audiences of all ages. From tots to teens, Girl Guides to Scouts, there's something to help everyone connect with nature.

In 2011, over 1,560 people participated in a variety of public program offerings including: Parent & Tot, Critter Crew, Zoo Crew, EnviroRangers, plus family and adult focused programming.

Family programs such as, Rise n' Shine with the Penguins, designed to coincide with the new endangered African penguin exhibit, attracted an additional 145 participants in 2011 who enjoyed breakfast, an informative talk, and interactive activities.

Youth Badge Programs were delivered to over 440 scouts, guides, brownies and cubs in the past year. This is one of the longest operating Zoo education programs, providing youth with the opportunity to earn any one of 14 environmental badges by attending a half day program at the Zoo.

Zoo Kids and Zoo Camp, our week long summer day camps, continue to be highly popular, providing wild experiences for children where learning is disguised as fun! Overall, in 2011, 1,723 children, ages 4 – 16, enjoyed weekly tours, games/activities, and unique opportunities to create enrichment items for the animals. In support of "International Year of the Forests", weekly activities were designed to educate campers about the importance of forests for animal habitat, plus each camper received an "I am a Friend of the Forest" button.

Serengeti Bush Camp continues to provide a unique overnight camping experience. There's nothing quite like having the Zoo to yourself at night and the sights and sounds that go along with it! Operating from May to Labour Day weekend, school classes, scouting and guiding groups as well as families attend on different nights throughout the spring and summer. In 2011, 2,787 participants enjoyed a variety of interactive educational activities, tours, behind the scenes opportunities, and roasting marshmallows over the campfire. T-shirts, crests, and ball caps were also available for purchase by participants as a keepsake of their one 'wild' night at the Zoo.

2.3.3 Informal Education Activities

Education also takes place in unstructured learning situations such as interacting with a volunteer, exploring one of the many interpretive displays throughout the Zoo site, attending an animal show or keeper talk, and through free play, interactions and discussions of observations/experiences with family members during a visit.

Volunteer-led Interpretive Experiences

Education is stressed throughout the Zoo with a variety of Volunteer-led interpretive experiences. The Zoo's 372 dedicated Volunteers are trained specifically to facilitate learning through a variety of means such as guided tours, operating interpretive areas/activities around the Zoo site, helping out with special events/programs, and delivering outreach presentations in the community.

In 2011, Volunteers contacted over 593,790 people providing visitors with an opportunity to ask questions and actively examine biofacts such as skulls, furs, feathers, and teeth/claws. The Wonders of Wetlands Kiosk, Kesho Park, Research Tent and Backyard Wildlife Kiosk in the Kids Zoo inspire discovery and learning, while encouraging the public to live in harmony with nature.

2.4 Curatorial Projects

2.4.1 Academic and Business Collaborations

Toronto Zoo staff members in the Conservation, Education and Wildlife Division have adjunct university appointments, through which they provide lectures, advice and/or assistance to student programs. Graduate studies are available through Zoo collaboration and include M.Sc., Ph.D., D.V.Sc., and Post-Doctoral programs. Each summer approximately fifteen university students complete their summer research at the Toronto Zoo. Research project topics range from green plans and wetland conservation to nutrition and reproduction.

University courses in Conservation Biology have special lecture tours conducted at the Zoo. These include the University of Toronto (Scarborough and Main campuses), McMaster University, the University of Guelph, Queen's University and McGill University.

UTSC Course – BIOC62 – The Role of Zoos in Conservation

Since 2007, the Zoo's scientists and educators have co-instructed a 3/4th year course at the University of Toronto at Scarborough. The course is a lecture / discussion format that examines the changing role of zoos through time and emphasizes contemporary topics such as: captive breeding and reintroduction of species vs. new technologies to assist reproduction in wild populations; the importance of nutrition and behavioural enrichment in captive animals; zoos and public involvement/education; endangered species in Canada; and habitat restoration. The UTSC provides a donation to the Zoo's Endangered Species Recovery Fund for our staff involvement.

THE TORONTO BIODIVERSITY GROUP

In 2006, the Zoo joined with other interested parties to help make the people of Toronto aware of the plight of migratory birds in cities. Over a billion birds die annually from colliding with buildings. This group has been working to reduce this problem. Two publications have been produced, one on developing bird "friendly" buildings, and a second on the birds of Toronto. In 2010, the group widened its horizons to include other aspects of the wildlife of Toronto. Publications include reptiles and amphibians, spiders and butterflies. Trees and fishes are also being produced. All work is voluntary and a subcommittee is developed for each of the topics. Zoo staff has had involvement in many of the booklets being produced. The booklets are part of the City of Toronto's contribution celebrating the Year of Biodiversity.

Nutrition Internship Program

In 2009, in cooperation with the University of Guelph, a Nutrition Internship position was approved to support training in Zoo nutrition. The internship is at MSc-level (by thesis) or higher and involves a minimum of two years research work in an animal nutrition related subject.
The Nutrition Intern works 50 % in the Food Production Unit to allow for practical experience and the other 50% in the Research Unit using the results of this research project for a thesis.

The NSERC Industrial Partnership

In 2010, Toronto Zoo joined with PhD candidate Crystal Vincent to approach the National Sciences and Engineering Research Council of Canada to lobby for Toronto Zoo to be an "Industrial Partner". The successful applicant becomes eligible to work with Masters and PhD students on projects that will lead towards the student degree at the same time enhance work carried out by the Zoo. Toronto Zoo was successful in their application and Crystal Vincent is the first student. Crystal finished her program with

Toronto Zoo in the spring of 2012 looking at the differences that male and female insects resisted and tolerated disease.

ECOexecutives Program

ECOexecutives the Zoo's unique sustainability workshop series engages the corporate world by connecting biodiversity to their bottom line. This business sector is the economic engine of our province and also the largest contributor of carbon emissions. Executives visit the Zoo for inspirational behind the scenes tours, a closer look at the Zoo's green technologies, and lessons in sustainability issues. They leave motivated to return to their businesses and implement change. ECOexecutives has seen over 120 members of the Ontario business community.

More information can be found at ECOexecutives.org.

2.4.2 Public Involvement & Curriculum Links

In many ways, education and conservation are inseparable. For many of the Zoo's research efforts to have an impact, the public must be made aware of the significance of good environmental stewardship and the need to maintain biodiversity in natural ecosystems. The Conservation, Education and Wildlife Centre have several projects that reflect the Zoo's dedication to the preservation of fellowship between biodiversity and the public.

The Toronto Zoo's conservation efforts coincide with global initiatives such as the declaration of UNESCO of 2005 to 2015 as the United Nations Decade of Education for Sustainable Development (UNDESD). The agency's proclamation stated its focus as "advocacy, communications and networking directed at facilitating all educators to include sustainable development concerns and goals in their own programs." This exciting and challenging initiative has been embraced by the Zoo and, as a result, educational programming and messages have been amended to support this theme. Our collaboration with other zoos, aquaria, government and non-government organizations provides motivation, collective experience and an increased critical mass to deliver the message to many more people.

ADOPT-A-POND WETLAND CONSERVATION PROGRAMME (with support from Environment Canada's Habitat Stewardship Program, OMNR's Species at Risk Stewardship Fund, OMNR's Species at Risk Research Fund, Rouge Park, Shell Canada, Natural Resources Canada's Science and Technology Internship Program, Environment Canada's Science Horizons Program, CAZA's Conservation and Education Fund and the Sustainability Network's Environment and Diversity Mini-Grants).

Adopt-A-Pond is a wetland conservation programme with six major off-site initiatives and a number of projects and events that take place on site at Toronto Zoo. Adopt-A-Pond also works to develop resources to assist community stewards in wetland preservation and restoration projects. The programme is proud to be celebrating its 21st anniversary in 2012! Originally established by a zoo-affiliated Amphibian Interest Group aiming to encourage local action in response to world-wide declines of amphibian populations, the programme has grown substantially in size and scope over time. Its general mandate, however, has remained the same: to promote conservation of wetland biodiversity through community-based education and stewardship. Currently 32% of the world's amphibians and 38% of the world's turtles (seven of eight Ontario species) are considered to be at risk of extinction, making conservation programmes that educate people about these fabulous creatures just as relevant today as they were 20 years ago. Under the umbrella of Adopt-A-Pond there are six distinct initiatives: *Ontario*

Turtle Tally, Frogwatch Ontario, Wetland Guardians, Urban Turtle Initiative, Healthy Waters - Healthy Wildlife, and Turtle Island Conservation.

- **FROGWATCH ONTARIO**

Frogwatch Ontario is a citizen naturalist program designed to engage individuals and families in wetland stewardship by providing them with a fun way to learn about the diversity of amphibians and the significance of wetland habitats. By listening for frog and toad calls in local wetlands Frogwatch Ontario participants learn the importance of community wetlands and provide critical information that helps conservationists learn about climate change, chart population trends and determine range maps for common and declining amphibian species.

Since the inception of Frogwatch Ontario in 1999, Environment Canada, with assistance from Toronto Zoo, has created a Frogwatch program in every other province in Canada. Additionally, the USA and Australia have now started similar programs using Frogwatch Canada as a model.

The main objective of Frogwatch Ontario is to educate and empower local landowners, families, and community groups to visit a favourite wetland habitat two to three times a week in the spring and early summer months to record the species of frogs and toads that are heard calling. Male frogs or toads call or 'sing' in the spring to attract mates, and each unique species can be recognized based on the distinctive call it makes. Learning these calls allows every-day naturalists to become scientists, giving them the ability to record their observations and report them to a central depot. Data is submitted online or through the mail, organized in a central database, and then forwarded to the Natural Heritage Information Centre (Ontario Ministry of Natural Resources) for the development of species distribution maps which help to track population dynamics throughout the province. Information about the presence or absence of frogs and toads in Ontario's wetlands will ultimately help scientists determine factors that are affecting amphibian declines at the global level.

Frogwatch Ontario staff offer training programs for naturalist clubs and community groups interested in contributing to this program. In addition, every individual that joins receives a resource package which includes a CD of all the frog calls in Ontario (also translated into Ojibway and Mohawk languages), a colour identification guide of the amphibians of Ontario, a poster of the amphibians of Ontario and information on how to submit sightings to our online database.

Since the inception of Frogwatch Ontario in 1999, over 710 participants have become involved. Ninety-two new participants joined in 2011 and long-time observers continued to participate in the program, with 355 people reporting calls and sightings in 2011 that also reported frog calls and sightings in previous years (total participation in 2011 = 447 people). With the passing of every year, the Frogwatch Ontario database continues to grow, as does the awareness for the plight of frogs and toads. Our

growing dataset provides the power necessary for scientists to clearly visualize long-term trends in frog and toad abundance!

For more information on Frogwatch Ontario visit: torontozoo.com/AdoptAPond/FrogwatchOntario.asp

- **ONTARIO TURTLE TALLY**

Ontario Turtle Tally is a community-based citizen naturalist program designed to inspire people to care for local wetland habitats and turtle populations. By submitting sightings of turtles seen in local wetlands to an online database Ontario Turtle Tally participants can provide critical information that helps conservationists map distributions of species across the province and determine priority areas for conservation. The objective of the program is to educate and empower citizens so that they can make a difference for wetlands and wildlife.

In 2008 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed seven of Ontario's eight native turtle species as Species at Risk (i.e. Endangered, Threatened or Special Concern), fueling the need to collect turtle sightings from all corners of the province. Participants are provided with information about each of Ontario's turtles and encouraged to record data when they see a turtle crossing the road, nesting, or even basking on a log. Observers are asked to record as much information as possible, but species identification and location are the fields of primary interest in our online database. Even if the turtle is seen during a one-time wetland visit Ontario Turtle Tally wants to hear about it! We are able to respond to reports from participants to help turtles. For example, road mortality reports have resulted in the installation of Turtle Crossing signs at mortality hotspots, the construction of turtle nesting areas in response to loss of nesting habitats; and in another area, a two year research project with MTO and local landowners on the habitat use of Blanding's turtles and the use of tunnels and exclusion fencing to protect turtles form road mortalities.

Ontario Turtle Tally staff offer training programs for naturalist clubs and community groups interested in contributing to the program. In addition, every individual that joins receives a resource package which includes a colour identification guide of the turtles of Ontario, a poster of the turtles of Ontario and information on how to submit sightings to our online database.

Involvement has increased dramatically since Ontario Turtle Tally began in 2003. In total, the program has received over 6700 submissions from 1671 participants, 394 of whom registered in 2011, and 249 of whom registered before the end of July in 2012 (submissions often include more than one sighting). Long-time observers also continue to participate in the program.

Observation numbers of common and rare species reflect, generally, their abundance in Ontario. For example, for records collected in 2011 alone, over 2,040 Midland Painted turtles have been observed compared to 193 Blanding's and 34 Spotted turtles.

For more information on Ontario Turtle Tally visit: torontozoo.com/AdoptAPond/TurtleTally.asp

- **CANADIAN WETLANDS GUARDIANS REGISTRY**

The Wetland Guardians program works with landowners, community groups, conservation authorities, park managers and government employees to protect, restore, and link wetland habitats for wildlife. We also create turtle nesting areas, snake hibernacula, and amphibian and reptile refugia where habitat has been degraded or is otherwise unavailable. Wetland Guardians staff offers advice and expertise towards collaborative projects with land managers who have identified critical habitats in need of protection, improvement or restoration.

From July 2011 to July 2012 ten site consultations were made to improve wetland habitat for wildlife. Thirty-eight land managers were involved in pro-active consultations, two 20 m x 20 nesting sites were built for turtles and 260 m of wetlands bisected by a provincial highway were protected by the installation of fences to mitigate death of wetland wildlife on roads.

Participants in the Wetland Guardians program are encouraged to share information on their habitat improvement or restoration project by contributing to the ***Wetland Guardians Registry***. The registry serves as a Canada-wide forum where stewards can provide details about the challenges and successes they've had with wetland stewardship in their own communities, contributing to a growing inventory of protected wetland areas and providing future stewards with a context for discussion about best management practices.

The Wetland Guardians Registry is designed to promote wetland awareness, stewardship and protection. Wetland Guardians can "adopt" a local wetland by entering it into an online database of important Canadian wetlands. Wetlands can be large (>10 Ha) or small (backyard ponds). The information collected from participants includes a visual account of an existing wetland and a written account of community wetland features with stories, experiences, wildlife sightings and sounds, restoration techniques and protection efforts. The network created from these registries enables Wetland Guardians to share their creation and protection stories with a Canada-wide community of stewards striving to improve wetland awareness and conservation.

Some resources provided to Wetland Guardians include on-site (at the Toronto Zoo) and off-site workshops, a quarterly conservation newsletter and the Adopt-A-Pond Wetland Curriculum Resource Manual. Guardians are also encouraged to get involved with Turtle Tally and FrogWatch. It's a perfect fit!

Officially launched in 2004, The *Wetland Guardians Registry* currently has over 145 registered guardians. For more information on the Wetland Guardians Registry visit: torontozoo.com/AdoptAPond/WetlandGuardiansRegistry.asp

- **URBAN TURTLE INITIATIVE**

The Urban Turtle Initiative offers a means through which city dwellers can discover the richness of life in their own backyard. The program focuses on the ecology of stressed wetland ecosystems using turtles as a flagship species and provides urban stewards with opportunities to protect the vast diversity of wetlands and wildlife in the urban and urbanizing environments they call home.

In 2011 we worked with schools throughout cottage country areas in central and eastern Ontario to teach students the values of wetlands and how to identify the species that rely on them. Working in exciting partnerships with several of Ontario's lake associations we delivered workshops and educational activities for over 390 Ontario students, sharing information about threatened and endangered turtles, facilitating student-led projects to protect wetlands, and engaging students in action items to protect local species at risk.

Using a local man-made wetland and turtle nesting beach we trained naturalists from three Toronto area naturalist groups about turtle habitat needs, turtle distributions in Toronto, and actions to help local animals. We also conducted three workshops with naturalist groups outside of the GTA to equip more rural residents with the tools to protect the species' they share their properties with. Individuals left these events with the skills and knowledge required to lead stewardship action in their own segments of Ontario.

The Urban Turtle Initiative also maintains ongoing wetland research projects in the Rouge Valley in the Greater Toronto Area. Toronto Zoo staff has conducted research on species at risk turtle movement and habitat use in the Rouge Valley since 2003, tracking turtles through important seasonal migrations such as spring emergence, nesting, feeding, and overwintering. We are able to offer exciting and dynamic learning opportunities for members of the public that want to learn more about the ecology of human-dominated ecosystems in the city because of Toronto Zoo's situation within Rouge Park and our unique history conducting turtle and wetland research in the GTA.

Between 2002 and 2008, radio-telemetry equipment was used to track turtle movements from emergence in spring through to spring/summer foraging habitats and nesting grounds, and then to winter hibernation sites. Data collected included coarse and fine habitat characteristics, GPS (Geographic Positioning Systems) and GIS (Geographic Information Systems) movement information, and observations of individual turtle behaviours. Preliminary analysis of selected data showed that small wetlands and seepage areas are important over-wintering habitats; foraging sites and nesting beaches may be in distinct areas; male snapping turtles may hold linear territories in river habitat; and the surrounding urban landscape has an effect on the individual movement and the overall population connectivity of all urban turtle species.

In 2008, a 3 year plan was initiated to increase significant turtle habitat in Rouge Park based on information provided by the *Management Plan for Turtle Populations in the Rouge Park* prepared by Adopt-A-Pond's Urban Turtle Initiative, the *Recovery Strategy for Species at Risk Turtles in Ontario* prepared by OMSTARRT (Ontario Multi-Species Turtles at Risk Recovery Team), and the *Turtle Management Workshop* held at Toronto Zoo in March 2008. Research in 2008 focused on a nest site characterization analysis to determine the physical characteristics of successful nest sites in the Park, whereas research in 2009 focused on mapping the current distribution of high quality turtle habitat throughout the Rouge using GIS and locating suitable areas to build new nesting areas and overwintering sites. In 2010 to 2011, the research focus in the Rouge Park shifted to ground-truthing previously identified high quality turtle sites to confirm their value as potential habitat, and to monitoring movements and habitat use of Blanding's turtles using restored wetlands. In 2012 we continued to monitor the movements of Blanding's turtles using restored wetland habitats in Rouge Park, but we also initiated a long-term Blanding's turtle "head-starting" program in the Park. The project is intended to give declining Blanding's turtle populations in Rouge Park a 'boost' by rearing hatchling turtles in captivity until they

reach a size where they can avoid ending up as a meal for animals like a raccoons, pike, and herons. In 2012, eggs were collected from a portion of wild turtle nests to incubate and hatch at Toronto Zoo. The hatchlings will be raised for 1 – 2 years in captivity before being released back into wetlands in Rouge Park, and new turtle cohorts will be raised each year for the next several years to increase population sustainability.

The data collected from 2008-2012 will be used to create successful artificial nest sites in areas where traditional sites have been destroyed or degraded and build overwintering wetland habitat where current habitat availability is low. Important basking habitat will also be constructed in Rouge Park to ensure that focal species can achieve proper thermoregulation. All constructed and restored habitat will be monitored for turtle usage and ecological function. The GIS-based hydrological assessments and ground-truthing surveys will be used to determine the most ecologically sound locations for turtle habitat restoration activities in subsequent years.

An additional research component was added in 2010 and 2011 to learn more about turtle movement and habitat use in an area along Highway 24 (southwest of Brantford) where the Ministry of Transportation Ontario (MTO) established fencing beside wetland areas to prevent turtle road mortalities. Working in close partnership with MTO, and with support from the Ontario Ministry of Natural Resources' Species at Risk Stewardship Fund, UTI researchers used radio-telemetry equipment to track turtle movements during nesting, foraging, overwintering and spring emergence forays in wetlands adjacent to the highway. Radio-telemetry work combined with routine roadkill surveys helped to determine whether turtles used pre-existing sub-highway culverts as movement corridors to pass between roadside wetlands, and whether road mortality mitigation fencing provides an effective means for preventing turtle deaths on roads. Data collected from this research was analyzed in 2011 and used to provide government stakeholders, landowners adjacent to roads, and conservation agencies with a detailed report on the effectiveness of road mortality mitigation structures and best management practices for preventing turtle mortality on roads.

To date we have partnered with Laurentian University, University of Toronto, University of Waterloo, Trent University, Niagara College, Sir Sanford Fleming College and several other academic institutions to conduct research on turtles, perform genetic analyses, collaborate on habitat restoration projects, and partner on co-op placements, and undergraduate and graduate student supervision.

- **HEALTHY WATER: HEALTHY WILDLIFE**

The Healthy Waters, Healthy Wildlife (HWHW) program offers opportunities for individuals and community groups to learn about threats to local wetland species and get involved in stewardship projects that can build community spirit and preserve the natural heritage values that exist within the region. Through Community Based Social Marketing research HWHW staff identified a number of potential target audiences for such a program, but determined that waterfront property owners should serve as the primary audience for pilot programming. Waterfront property owners as a whole are anticipated to have the most significant impact on turtle and wetland conservation in Ontario.

To properly work with and engage this group we developed the Healthy Waters, Healthy Wildlife program in 2010. In its first two years this program has worked with community leaders in five lake communities (Leonard Lake – Muskokas; Bob's and Crowe Lake - Frontenac Region; Otty Lake – Frontenac Region; Stony Lake – Kawarthas; Baptiste Lake – Haliburton Highlands) to develop and lead stewardship action plans that focus on improvement of water quality and sustainability of healthy wildlife populations. Focus groups and Zoo staff attendance at AGMs will be used to assist lake communities in creating a stewardship action plan for their lake that considers the primary concerns and objectives of each lake community member for the preservation of their valuable local environment. Formal wetland assessments will be conducted on each lake (if warranted and agreeable within the lake community) to survey valuable habitat areas and inventory species at risk and wetland statuses (e.g. provincially significant wetlands within 750 m of the lake will be classified). This work will continue with other lake groups throughout Ontario on a priority basis over the next 5-10 years. The program has reached over 600 waterfront property owners in four different areas of Ontario in its first two years.

Other target audiences in and near target lake communities will also be addressed. Focus groups with agricultural landowners will provide feedback about what farmers need in terms of resources and assistance to preserve wetland health on their properties, focusing on water management practices that work in unison with their farming priorities. Workshops, "train-the-trainer" sessions and outreach presentations will be held for naturalist groups, natural area educators, and ecologically-focused camps and schools. Events that reach large numbers of people or provide information to focused audience groups likely to contribute to conservation programs such as Ontario Turtle Tally or FrogWatch Ontario will be attended.

- **CULTURAL PROGRAMME**

In 2011 Adopt-A-Pond set out to engage the local Scarborough community by identifying barriers to their participation in conservation and wetland focused events. We held focus groups with local settlement organizations and community centers to gather feedback on programs that they felt the community would be interested in. We are continuing to gather information from the community to improve our current programs and ensure we are reaching a diverse audience.

FIRST NATIONS WAYS OF KNOWING PARTNERSHIP: TURTLE ISLAND CONSERVATION

ways of knowing partnership
TURTLE ISLAND
conservation

Turtle Island Conservation (TIC) promotes awareness of the importance of turtle species and the wetlands that sustain them in First Nation communities. The vision of TIC is that Traditional Knowledge (TK) will foster and guide communities for generations to come. The mission statement of the programme is to develop Ways of Knowing Partnerships. Seven of Ontario's eight native turtle species are endangered, threatened or of special concern on the Species at Risk (SAR) list. TIC creates culturally relevant SAR conservation resources for First Nation partner (FN) communities.

TIC encourages FN communities to protect wetlands and monitor turtle populations by recognizing the importance of TK. The program also seeks to incorporate an understanding of TK into

current biodiversity and Species at Risk recovery strategies. This programme is supported by Environment Canada's Aboriginal Funds for Species at Risk.

Turtles are an important cultural teaching tool utilized in many FN communities. Through Turtle Teachings, First Nations people acquire their roles, responsibilities and interconnected relationships to all that exists in Creation. It is through these teachings, historically oral in nature, that TIC integrates Traditional Knowledge and Western Science as directed by our FN advisors.

There are five defined objectives to guide TIC which are as follows;

1. To foster respect for self, community, Mother Earth and the Creator.
2. To recognize and record significant landscapes valued by First Nations communities.
3. To integrate Traditional ways of knowing with western science to monitor, protect, respect and restore landscapes, biodiversity and species at risk.
4. To integrate language, art, and crafts to sustain traditional ways of knowing and living.
5. To facilitate understanding of diversity of First Nation culture and ways of knowing among non-Aboriginals.

Aboriginal youth are vastly underrepresented in the sciences and opportunities are lacking for FN youth to contribute to conservation programs. TIC provides a variety of mentorship opportunities through summer internships for First Nation youth, training in Species at Risk conservation efforts and First Nation community cultural mapping initiatives.

The goals of these projects include: a) demonstrating the value of alternative ways of learning integrating TK and western science and in wetland biodiversity recovery strategies, SAR conservation initiatives and b) exploring the significance of turtles in North American Aboriginal culture (e.g. Creation stories of North America as Turtle Island). This is a means of knowing and valuing turtles as a unifying symbol across time and through oral tradition that sustains Aboriginal culture. The outcome of these projects demonstrates that TK can be maintained as a cultural and spiritual perspective as well as a basis for learning while using scientific methodologies to collect and analyze data. TIC assists FN partners in "mapping" areas of biological, cultural, economic, spiritual and social importance to facilitate the preservation of TK. Non-Aboriginal and Aboriginal cultures can value turtles. First Nations cultural and ecological concepts can be a source of knowledge that supports conservation.

TIC's programme focus continues to be a combination of TK and Western science surrounding turtles, wetland biodiversity, SAR and their habitats. This direction includes Traditional Knowledge teachings that focus on conservation and sustainability practices including the Traditional Knowledge concepts of 7 Generations and the 13 Moons Lunar Calendar. TIC utilizes the Ways of Knowing Guide and Ways of Knowing Map to facilitate awareness of SAR. This on-line mapping is a geo referenced way to record significant cultural and natural landscapes to archive FN community knowledge through their own unique perspectives. For example, with information on milk snake overwintering areas, we partnered with the Mississaugas of the New Credit FN to construct a snake hibernacula or "Winter Snake House". TIC maintains language based resources, outreach presentations, and cross cultural awareness presentations both off and on the Toronto Zoo site. Utilizing specially created spaces such as the First Nation Art Garden. This garden immerses Toronto Zoo visitors in FN world views utilizing visual artworks that depict FN traditional turtle teachings.

A number of TIC resource materials are available to support wetland biodiversity and SAR conservation efforts. These resources contribute to language preservation and usage in Mohawk (Haudenosaunee Iroquois) and Ojibway (Anishinaabe) communities.

They include native language based turtle crossing signs, Ontario frog and Toad Calls CD's, language based SAR identifier guides, the Ways of Knowing Guide and the NEW Walking with Miskwaadesi & Walking with A'nó:wara Curriculum based educational bundle that utilizes a First Nation cultural lens to integrate Western science and Traditional Knowledge science. TIC's programme supports all FN communities in Ontario.

- **ADOPT-A-POND WETLAND CONSERVATION PROGRAMME WEBSITE**

The Adopt-A-Pond Programme's website (torontozoo.com/adoptapond) is easy to navigate and contains information on all of our resources, projects and events, including:

- Species identification pages for Ontario's reptiles and amphibians (with sound clips for frogs and toads)
- FrogWatch, Turtle Tally and Wetland Guardians registration forms and online databases
- Resources area with information on wetland and wildlife stewardship practices
- An events page detailing upcoming workshops, festivals and other important proceedings
- Games pages featuring our "At Risk" turtle survival challenge and other short games, quizzes and interactive activities
- Curriculum resources focused on Wetlands, Ontario Turtles, and The Massasauga Rattlesnake

ADOPT-A-POND OUTREACH EVENTS AND PRESENTATIONS

There is no better way to garner support for conservation than to go out and ask for it – and this is what 300 Toronto Zoo volunteers and AAP Programme staff do with classroom students, community groups and education programs on a weekly basis. Staff are enthusiastic, knowledgeable, and approachable. Adopt-A-Pond outreach events cater to the audience, and are flexible enough to suit any group. Generally, there is no fee for an outreach presentation (with some exceptions); however, it is the client's responsibility to reimburse the AAP Programme for transport of staff to and from the event (e.g. mileage charge). Adopt-A-Pond hosts public events several times per year, usually taking place on or near Toronto Zoo property. For example, our Annual Spring Toad Festival is held every year on the first weekend of May at the Americas Wetland Exhibit at the Zoo.

In 2011, 42 outreach events were attended by Adopt-A-Pond staff, reaching a total audience of more than 1600 people. Focus groups were held with two different target audiences to better understand their needs for implementing wetland conservation projects. Audiences addressed included settlement agencies in the Greater Toronto Area and waterfront property owners.

- **COMMUNITY BASED SOCIAL MARKETING**

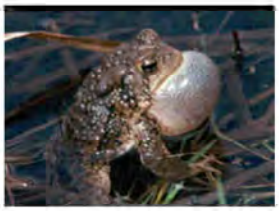
Previous work by many conservation organizations has focused primarily on informing and educating the public about conservation issues. This was done on the assumption that if a particular level of knowledge could be achieved, positive behavioural changes would follow. However, research suggests that the relationship between knowledge and behaviour is much more complex than this, and often times having knowledge of an issue will not elicit an associated behaviour change. The process of Community Based Social Marketing (CBSM) recognizes the complexity of this relationship, and aims to develop programs that foster a change in behaviour rather than simply a change in attitude. For this reason, the Adopt-A-Pond Wetland Conservation Programme has identified CBSM as a potential tool for changing behaviours related to turtle species at risk.

The process and tools of CBSM allow practitioners to develop marketing campaigns that target a specific group(s) and utilize messaging and approaches that research suggests to be effective for that group. The preliminary step in this process is to identify groups whose lifestyles relate to the threats to turtles and who may be able to undertake actions that can benefit these animals. Adopt-A-Pond has identified waterfront property owners (both private and commercial) and field naturalists as two such groups. In addition to these two groups, several others were identified whose actions may have a less significant impact on turtles but who consist of youth who are committed to environmental literacy and have a high level of enthusiasm, namely eco-schools/eco-camps and girl guides/boy scouts.

Survey and focus group research as well as evaluation of ongoing outreach initiatives and trial programs has allowed Adopt-A-Pond to build audience profiles of each of these groups. These profiles include the probability of individuals engaging in particular behaviours, the impact these behaviours may have on turtles if adopted, the barriers and benefits associated with these behaviours, and the appropriate phrasing and delivery of behaviour change messages. This research has led to increased audience targeting within the Adopt-A-Pond outreach program and in time is anticipated to lead to more involvement in the Ontario Turtle Tally as well as the adoption of behaviours (e.g., the creation of naturalized shorelines, nesting beaches, etc.) that have positive benefits for turtle species at risk. In the future, all program development will be guided by community input and feedback, and as such, should be better designed to have maximum impact and deliver the necessary resources and information that important key groups require.

ADOPT-A-POND RESOURCES

- **IDENTIFICATION GUIDES**



Species identification guides are available for the amphibians (frogs, toads, salamanders, and newts), turtles, lizard, snakes, and larval amphibians (tadpoles and salamander larvae) of Ontario. ID guides are laminated field sheets with full-colour species illustrations and are built to withstand the wear and tear of wetland adventures. All ID guides are free to individuals interested in participating in monitoring projects, teachers and group leaders (e.g. naturalist group leaders or park interpreters). We are currently developing a new folding-style version of each identification guide to improve portability in the field, as well as egg identification guides for all of Ontario's amphibians and reptiles; look for these to become available in 2013!

- **WETLAND CURRICULUM RESOURCE** (350 pp)

This guide includes four basic study modules: Water, Wetland Ecology, Amphibians, and Environmental Issues. Each module outlines the expected learning outcomes and provides background information for educators. The resource package consists of a variety of student activities geared to different levels, answers to the questions posed in the activities, and blackline master sheets for classroom photocopies. A variety of educators participated in the creation of this guide and the activities have been written to tie in with the learning outcomes outlined in the Ontario School's Common Curriculum. In fall 2009 this resource was updated to contain more accurate curriculum links, more cross-curricular activities and a more comprehensive First Nations Component. Wetland Curriculum resource packages are available under the Resources section of the AAP website, and limited hard copies

can be obtained while supplies last.

- **TURTLE CONSERVATION CURRICULUM GUIDE** (156 pp)

  The Turtle Conservation Curriculum Guide contains six units with educational activities, and a seventh unit containing the glossary and appendices. Unit topics include Turtle Biology and Ecology, Ethics and Culture, and Turtle Conservation. A table describing the science expectations met within the curriculum is provided on the first page of each study unit. Curriculum activities are designed to promote inquiry and research skills, and include both indoor and outdoor lessons that will help students become familiar with field and lab applications. Turtle Conservation Curriculum resource packages are available under the Resources section of the AAP website, and limited hard copies can be obtained while supplies last.

- **LIVING WITH WILDLIFE: MASSASAUGA RATTLESNAKE EDUCATOR CURRICULUM GUIDE** (128 pp)

  This resource contains background information designed to familiarize educators with the Massasauga rattlesnake. The curriculum package is aimed at helping educators feel confident while facilitating activities involving the Massasauga rattlesnake, and provides lesson preparation tools that will assist in communicating important facts about snake biology and ecology, safe snake handling practices, community-based participation in the recovery process, and changing persisting negative attitudes towards this often misunderstood species. The engaging activities included in this resource are cross-curricular and appropriate for various grade levels. Most of the activities do not require additional resources. Specific curriculum expectations met by each activity are listed. Massasauga Rattlesnake Educator Curriculum Guides are available under the Resources section of the AAP website, and limited hard copies can be obtained while supplies last.

- ***THE URBAN OUTBACK ~ WETLANDS FOR WILDLIFE*** (89pp + appendices)

  This publication outlines issues which first motivated the Toronto Zoo, the Ontario Horticultural Association, the Canadian Wildlife Service, and scientists across Canada to focus their attention on wetland conservation and the decline of amphibian populations. The guide also includes information that will help to protect existing wetlands and improve habitats for species other than fish and birds, the traditional beneficiaries of wetland projects. If you simply want to know how to build a pond, the section on frog-friendly backyards has information on pond construction and maintenance. The Urban Outback is available under the Resources section of the AAP website, and limited hard copies can be obtained while supplies last.

- ***AT RISK* VIDEO GAME**

Adopt-A-Pond's newly released video game "AT RISK: The Turtle Survivor Challenge" is an excellent resource for teachers, conservation leaders and members of the community to introduce students of all ages to the variety of threats that face Ontario's turtles, and actions we can take to protect local species from extinction. This fun and realistic video game challenges the player to survive through four different seasons as either a Blanding's Turtle or a Painted Turtle, navigating natural and human-induced threats

in each separate challenge. Some challenges focus on naturally occurring threats such as the risk of predators and the difficulty in finding a mate while other challenges focus on human-induced threats such as wetland pollution and degradation, habitat fragmentation and the introduction of exotic species. Information about how the game links to Ontario's curriculum expectations is available on the AAP website, and game-associated links to modules from AAP's Turtle Conservation Curriculum are provided under the Games section of the AAP website, so that teachers can take advantage of the interactive resource as a teaching tool to enhance lessons in ecology and biology.

- **TURTLES OF ONTARIO: A STEWARDSHIP GUIDE**

  Our new 80-page turtle stewardship guide will provide individuals of all audiences with critical advice about Ontario's turtles. Photos, maps, species profiles and examples of stewardship projects that aid in the recovery of turtle species at risk provide valuable information and key facts about each of Ontario's eight species. This publication also contains information about primary threats to turtles in the wild and recommends simple action steps that Ontarians can take to help protect these animals. A resource for committed individuals and communities, the guide will be distributed to stewards across Ontario.

- **TURTLES ON YOUR PROPERTY: WHAT TO KNOW AND DO**

  A great compliment to our turtle stewardship guide, this new 14-page booklet gives landowners living near wetlands a how-to guide for getting to know the turtle species on their property, and learning how best to protect them. Inside the cover you can find a quick reference guide to the turtle species of Ontario, tangible action items for would-be turtle stewards, and advice on how to secure funding for small-scale environmental projects that protect species at risk on your property. A great tool for landowners, this booklet will be distributed to conservation and stewardship groups throughout Ontario.

AQUA-LINKS - Lake Victoria Education Initiatives

Building upon the success of the Great Lakes Outreach Program, the goal of Aqua-Links is to educate students about the water quality issues facing these two Great Lakes regions of the world, and the importance of conserving this precious resource by putting them in direct contact via the internet. This linking is made possible through contacts gained from the Lake Victoria Species Survival Plan in East Africa. The program objectives are accomplished through classroom visits and lessons by program coordinators in both countries. Additionally, students in Toronto raise Atlantic salmon - a locally endangered species - right in the classroom and release them into the wild, while students in Uganda gain hands-on experience at NaFIRRI – the National Fisheries Resource Research Institute – with locally endangered cichlids.

2011/2012 marks year 3 of the Aqua-Links program with growth and successful linking of students and teachers in Southern Ontario with partner classrooms in East Africa. This year, students from 10 schools across 6 school boards in Ontario learned about aquatic conservation concerns and strategies in East Africa as well as right in their own backyards.

ATLANTIC SALMON - Classroom Hatchery: for the Atlantic Salmon Recovery Program

The Atlantic salmon restoration project's objective is to assist the Atlantic Salmon Recovery Team to provide classroom aquaria to rear Atlantic salmon, and links with the Great Lakes Outreach Program. Since December 2008, the Ontario Federation of Anglers and Hunters through Chris Robinson (Atlantic salmon Restoration Program Coordinator) has worked with the Toronto Zoo for assistance in purchasing equipment, and to hold salmon eggs for rearing at the Zoo from January to April. Each January approximately 100 "eyed" Atlantic salmon eggs are reared at the Zoo and distributed to participating

Aqua-Links schools. Each spring students from the Aqua-Links program release their fry at specific locations on designated rivers. Aqua-Links participants in 2011-2012 reared and released approximately 800 Atlantic salmon fry into local waterways helping to restore this native species.

Aqua-Links program delivery in East Africa

Classroom hatchery set-up

BLACK-FOOTED FERRET - Educational Outreach Program

Toronto Zoo runs an outreach campaign for its captive breeding and release programs. We have developed a curriculum-based black-footed ferret outreach program for students in grades 4-6. Topics including conservation, endangered species, habitats and the food chain are discussed in an interactive and interesting manner. The full teacher activity guide can be downloaded from the Zoo's website: http://www.torontozoo.com/conservation/bffguide.asp

Parks Canada and Toronto Zoo collaborated to produce a detailed online black-footed ferret game which can be viewed on the Parks Canada website:
http://www.pc.gc.ca/apprendre-learn/jeunes-youths/sec1/pa-bff/index_E.asp.

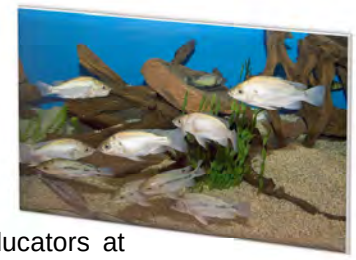
As the black-footed ferret is native to Canada, these projects will assist the national recovery efforts by increasing awareness and support.

CANADIAN ORGANIZATION FOR TROPICAL EDUCATION & RAINFOREST CONSERVATION

The turtle season was extremely busy this year. Turtles were coming to the beach as early as March 14 and eruptions and adults were still emerging at the October 31 season last official day. Students from North America and Europe participated and as many as four walks per day were taking place at the height of the season. The station had a record number of visitors with 42 volunteers, students and researchers visiting at one time. Projects included identification of plants taken by leaf cutter ants, plant cycling, mammal monitoring, community enrichment and environmental education and studies on snake morphometrics. Migratory bird studies continued for its 19th year. There was a change in the COTERC Board of Directors and a new Executive Director began in June of 2012. It is expected that several new efforts in fund raising and planning will take place in the coming year. Three Toronto Zoo staff are now on the Board including: Tom Mason, Nia Gibson and the new Chair; Shawn Blackburn.

The COTERC AGM was held at Toronto Zoo following their display at the International Migratory Bird Day event.

GREAT LAKES OUTREACH PROGRAM



The Great Lakes Program is a free, curriculum-based outreach program offered for the 2011/2012 school year. The program has been running successfully for over ten years. Students, educators and their families are encouraged to "Keep Our Great Lakes Great!", while learning about five local fish species at risk, and water conservation. During the 2011/2012 school year, more than 700 classroom presentations were made, reaching more than 19, 000 students and educators at over 160 schools. Outreach presentations are curriculum-based and complementary planning resources for teachers are provided for Grades 1, 2, 7 and 8. The Program focuses on these five species at risk: Atlantic salmon (extinct), redside dace (endangered), eastern sand darter (threatened), American eel (threatened), and lake sturgeon (threatened). In addition to classroom outreach, the Great Lakes Program has a presence at many community events throughout Ontario. The Program message enforces that our actions have direct consequences on our natural resources and the environment. Financial supporters include the Ontario Ministry of Natural Resources Species at Risk Program, the Environment Canada Habitat Stewardship Program, Rouge Park and Toronto Zoo Endangered Species Fund.

FISH RESCUE

Many calls to donate unwanted pet fishes to the Zoo are received throughout the year. As it is not possible to hold them here, the Toronto Zoo works with a diverse group of partners including: the Royal Ontario Museum (ROM); Ontario Ministry of Natural Resources (OMNR); Canadian Association of Aquarium Clubs; and the Pet Industry Joint Advisory Council on a home hobbyist awareness program. This program tries to relocate unwanted aquaria species by distributing flyers Ontario-wide through schools and pet shops and by establishing a website resource. By reducing the number of foreign aquarium fish and plants that are released by owners into Canadian ecosystems, the Fish Rescue program hopes to avoid problems with these introduced species that out-compete and prey on native flora and fauna.

Great Lakes: REDSIDE DACE (*Clinostomus elongatus*) - Conservation and Community Involvement

The Redside dace is federally recognized as an endangered species (COSEWIC). Since the redside dace was formerly found in the Rouge River located on Toronto Zoo property, it represents a conservation program in the Zoo's own backyard. The redside dace is now a Recovery Plan species and the Zoo is a participant in the development of this program. In 2009 the Recovery Strategy for the redside dace was completed. C. Lee is a member of the Redside Dace Recovery Team for this endangered species.

The Zoo is undertaking rehabilitation projects for the Morningside Tributary and local rivers with our partner Ontario Streams. An important component of this project is community involvement. During the spring and summer, the Zoo hosts volunteer days to bring local residents out to the Morningside Tributary and encourage them to contribute to conserving their natural resources.

INTERNATIONAL MIGRATORY BIRD DAY

Toronto Zoo celebrated its 13th annual International Migratory Bird Day this year. Every year visitors come to the Zoo, learn about bird conservation and celebrate the return of our migratory birds. Conservation groups

from Ontario join us in talking to visitors and lucky visitors wishing to see the "wilds" of the Zoo get to wander through the "core" woods looking for the elusive migrants hiding in the forest. The day was shared with the Science Rendezvous group from the University of Toronto Scarborough Campus. Other people displaying at the Zoo included: Wildlife Preservation Canada, Rouge Park, Scott's Canada, Toronto Field Naturalists and COTERC.

ONTARIO ROAD ECOLOGY GROUP

The Ontario Road Ecology Group (OREG) is a conservation program championed by the Toronto Zoo. Road ecology is the study of the interaction between roads and the environment, including wildlife populations. The Group is made up of government and non-government scientists and transportation planners that facilitate working partnerships, guide policy, collect and exchange data, raise awareness and promote stewardship in relation to road ecology.

With funding from Environment Canada, Toronto Zoo continues to support road ecology projects in Ontario and educate participants about integrating road ecology into policy and planning to help communities attain sustainable development.

PROJECT CRAYFISH

This year confirmed the presence of a tenth species of crayfish in Ontario. For the first time the spiny-cheek crayfish, *Orconectes limosus* was collected in eastern Ontario. Numbers of some species seem to have dropped and one other appears to have spread everywhere in southern Ontario. Unfortunately, there is little being done to record what is happening and what effects may come of it. Toronto Zoo studied the crayfish community in the Rouge in 2009. The most apparent changes were seen with two species, *Orconectes propinquus* and the invasive *Orconectes rusticus.* It appears that where ever the two species met the native, northern Clearwater crayfish lost ground to the larger more aggressive rusty crayfish. At this time the only purebred Clearwater crayfish that could be found was upstream of a couple barriers (dams and culverts) in the upper reaches of the Rouge. If those barriers are breached, the Clearwater crayfish will disappear from this water system.

Toronto Zoo has joined with other interested parties to create a resource to understand what is happening in these populations. In 2007, Toronto Zoo produced a pamphlet to help people identify the crayfish found in Ontario. The pamphlet was then assessed for its usefulness in the field. It has proved to be very helpful and thus in 2009, a second edition has been produced. Rules for the capture and use of crayfish have been updated and can be found in the Ontario Ministry of Natural Resources website. Remember that it is illegal to move live crayfish between river drainages.

SEAFOOD WATCH PARTNERSHIP (Monterey Bay Aquarium, Toronto Zoo)

The Toronto Zoo has been a partner of Seafood Watch since 2008. In June 2010, the Zoo's Marketing and Communications staff hosted its third annual "Seafood for Thought" fundraiser event. Over 350 guests joined the Zoo for the event, which featured sustainable seafood dishes cooked by several of Toronto's top chefs, as well as speeches, and displays that highlighted "sustainable foods" for Torontonians, and the effects bycatch have on marine species such as sharks.

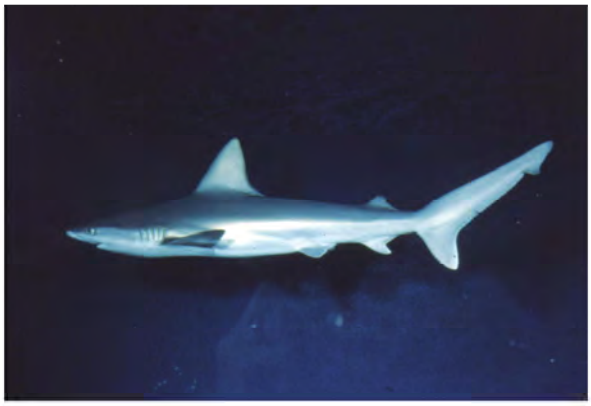
Over 2000 Seafood Watch pocket guides have been given to students participating

in the 2011/2012 Great Lakes Program, and over 4000 have been distributed to Zoo visitors at the Conservation Connection Centre and by Zoo volunteers.

In 1997, Monterey Bay Aquarium, California initiated Seafood Watch, a program dedicated to raising awareness on sustainable seafood issues, and encouraging sustainable consumer behaviour. 80% of world fish stocks are overfished, or being fished to capacity. This program categorizes seafood into three levels of sustainability recommendations (Best Choices, Good Alternatives, or Avoid), which are then made available to the public via pocket guides, staff, mobile phone applications, and the Zoo's website.

SHARK CONSERVATION

The movie *Jaws* and media sensationalism behind shark attacks detract from the fact that sharks are important components of ocean ecosystems. An annual average of only 4.4 shark related fatalities occurred from 1999-2009. People are more likely to die from other causes such as car accidents, heart disease, and lightning. Upwards of 73 million sharks are harvested per year, 50% of which is due to bycatch. Tuna and swordfish fishery catches can sometimes be 30-100%+ sharks. In most areas, shark populations have decreased by over 90%, including the Northwest Atlantic which borders Canada's east coast. Removal of top predators such as sharks from the food web causes cascading effects that may result in ecosystem degradation and fishery collapse. A century-old bay scallop fishery has already collapsed due to this, and many other bivalve fisheries may follow. The main economic driver for the shark trade is increasing affluence and demand for shark products, including shark fin soup within ethnic communities.



The Toronto Zoo aims to raise awareness of sustainable seafood and shark conservation issues, dispel myths surrounding sharks, and to ultimately decrease consumption and use of shark products. 2010 was the shark conservation program's first year, and extensive background research on shark conservation status, shark products (including their health claims), eco-system cascades and impacts of fisheries has been done. In addition, effective social marketing techniques have been researched so future efforts are sensitive to the fact that shark conservation has cultural implications. Early development of the Toronto Zoo's shark conservation program will focus on promoting Seafood Watch, working with existing international organizations, and collaborating with university environmental and cultural clubs. A great white shark conservation poster has already been made and placed on the Zoo site to educate visitors; additional brochures, pamphlets, and a new webpage will be available in the future.

VENOMOUS AND DANGEROUS REPTILE TRAINING WORKSHOPS

Workshops provide a framework to address staff health and safety; and place the risks of dangerous reptiles in perspective; and to promote the benefits snake conservation. These workshops provide techniques for understanding and avoiding snakebite, analyzing first aid and treatment options to improve outcomes, and realistically assessing of the potential danger from snake bite. To assist in understanding the threats that dangerous reptiles may present to specialized professionals, Toronto Zoo provides all day training workshops for:

- Canadian Forces deployed to Afghanistan and Sierra Leone (with training manual)
- Toronto Animal services
- Durham Animal services
- Toronto Emergency Medical Services
- St. John's Ambulance
- Poison Control Centre
- Emergency department; Sunnybrook and Scarborough Centenary hospitals
- Safety training for consultants and contractors working in areas with dangerous reptiles

Workshops cover snake identification, antivenom therapy, safety and handling, emergency kits, and recognizing dangers from giant snakes, large lizards, crocodilians, poisonous amphibians and zoonotic diseases (i.e. diseases passed between animals and humans). Toronto Zoo staff are on call to assist in the case of medical emergencies associated with snake or other reptile bites and escapes.

BIOBLITZ

Toronto Zoo hosted the first bioblitz for the Rouge Park ever held. Partnering with the Royal Ontario Museum (ROM), the Rouge Park Alliance, Rouge Park Conservation Center, the Toronto Region Conservation authority and Ontario Nature, the event proved to be the most successful in North America for 2012. Over 1410 species were identified in a 24 hour collecting period from 3:00 pm June 15 until 3:00 pm June 16. Special thanks must be given to the staff of the ROM, the Zoo, the Park and staff and students from the University of Guelph. This single event probably enhanced Toronto Zoo's reputation among researchers across North America more than any other single thing done in 2012.

2.4.3 Animal Outreach and Discovery

Meet-the-Keeper Talks

Toronto Zoo keepers provide educational talks to visitors at scheduled times throughout the day. These talks vary in length from ten to fifteen minutes, during which visitors are able to ask their own questions to gain a greater appreciation for the zoo animals. During Meet-the-Keeper talks, keepers discuss the age and names of individuals along with topics such as their feeding habits in the wild and captivity, family dynamics, gender-based differences, threats to survival in the wild, and conservation efforts that are currently in place or are needed to guarantee species survival.

Not all animals have keeper talks, but those featured include: Polar Bear, African Penguin, Komodo dragon, Orangutan, Grizzly Bear, Snake, Gorilla, Indian Rhinoceros, Elephant, White Rhinoceros, Cheetah, Lion, Giraffe, and Hippopotamus. In addition to this, Zoo visitors can also watch otter feedings and feedings at the breathtaking Lake Malawi Aquarium.

Amazing Animal Show

The Amazing Animal Show is an interactive opportunity for visitors to see first-hand some of the zoo's amazing animals, in action! Located at the Waterside Theatre, this show is a must-see for visitors of all ages, captivating their awe and interest as the performers fly overhead or show-off their incredible natural talents through activities on stage. Throughout the show, the commentator discusses information pertaining to the species in the show, as well as information specific to the animal on display. The end of

the performance is left to a question and answer period for those who are interested in learning more about the animals.

Sharks at Stingray Bay - A Touching Experience

Only the Toronto Zoo offers up interaction and fun with the exclusive live exhibit, Sharks at Stingray Bay - A Touching Experience. Situated in our Group Events Tent within Discovery Zone, Sharks at Stingray Bay features nurse sharks and bamboo sharks, as well as cownose and Southern stingrays. The exhibit aims to increase public knowledge and appreciation of these creatures through hands-on experience. Visitors can participate in special feedings and learn all about these mysterious animals during Meet-the-Keeper talks.

Kids Zoo

The Kids Zoo opened in 2004. It is a dynamic and interactive feature geared toward children nine years of age and younger. Kids Zoo stimulates the senses of young children as they explore touch tables, storyboards, and use their imagination. This area is divided into different Canadian habitat sections, each packed with several fun and interactive activities. The Kids Zoo represents the Toronto Zoo's belief that early positive exposure to animals fosters greater compassion and concern for animals later in life.

Waterside Theatre

This spectacular theatre, which opened to the public in 2003, invites visitors to participate in family-friendly events such as animal shows, cultural festivals and concerts. The theatre is completely barrier free and is pleasantly landscaped with surrounding natural plantings. Utilizing the surrounding grass section, it can seat up to 1,300 people for an event and it houses a state-of-the art sound system and animal holdings. Waterside Theatre is a must-see destination for kids of all ages and is free with the price of general admission.

Animal Outreach Program

The Toronto Zoo's outreach program introduces some of the Zoo's amazing animals to the community and to further the Zoo's vision of "inspiring people to love, respect and protect wildlife and wild spaces." The animals used in Outreach events, including Bactrian camels, reindeer, bald eagles, falcons, and a variety of reptiles and invertebrates, all have some background doing events.

Please visit torontozoo.com/Animal Outreach for more details.

Conservation-Research Initiatives

Our goal is to provide staff expertise and resources for the recovery of local, national and international Species at Risk and to preserve biodiversity in urbanizing environments. We link exhibits at the Zoo with field conservation projects to ensure the protection of habitats which sustain wild populations.

Zoo signage promotes awareness of such programs and identifies significant habitats and habitat management programs. Symposia related to these issues are held at the Toronto Zoo to foster cross institutional collaborations.

3. CONSERVATION-RESEARCH INITIATIVES

3.1 Habitat- and Species-Specific Research

AXOLOTL - Axolotl and Lake Xochimilco, Mexico, Creating Sanctuaries and Habitat Restoration (B. Johnson, L. Zambrano, E. Valente)

The goal of this project is provide lake remediation and to save a species from extinction. The axolotl is a Critically Endangered Species only found in Lake Xochimilco, in Mexico City. The Toronto Zoo participated in a stakeholder meeting to develop conservation actions with Mexican partners. These include long term biological monitoring and research on metapopulation structuring within the lake and captive assurance populations; ecotoxicology of lake sediments; impacts and control of introduced species; zoo based disease screening and pathology studies of captive and wild axolotl populations; zoo and community outreach programs; community based social studies to evaluate stakeholder attitudes and participation; collaborations with local food producers, farmers (chanamperos) and fishers to restore traditional agricultural practices; and training for Lake Xochimilco boat operators (remeros) to provide ecotourism income and axolotl conservation awareness.

Perhaps the most important aspect of support for these projects is the re-enforcement of fledgling conservation partnerships among different and diverse stakeholders. Conservation of the Lake Xochimilco ecosystem in the face of overwhelming ecological challenges will require sustaining such partnerships and integrating results to benefit residents of the Lake Xochimilco community, those earning a living from ecotourism, the health of communities around the lake, removal of invasive species, and remediation of the stressed lake ecosystem itself. Indeed, the axolotl and whole Lake Xochimilco ecosystem will benefit from non-traditional sustainable collaborations.

The completion of an “Axolotl Species Habitat Action Plan” provides an opportunity to contribute to existing in-country led and executed conservation priorities. These in situ projects will support a stakeholder driven Conservation Action Plan and foster newly developed partnerships and collaborations under the umbrella of GIA-X, a multi partner alliance of stakeholders for axolotl and Lake Xochimilco conservation. Partners include Government agencies; two universities; researchers and graduate students; educators, biologists and sociologists; farmers, fishers, remero boat operators; two Mexico City zoos; with participation of the AZA ATAG.

With over 9 million visitors a year Chapultepec Zoo has axolotl education programs developed by zoo educators. Additional support is required for printing of resources to be distributed to zoo visitors and education programs. Chapultepec Zoo will provide disease screening and pathology for all captive axolotl colonies and as a resource in case of sudden mortalities of axolotl within Lake Xochimilco. Toronto Zoo supports zoo based collaborations.

BLANCHARD'S CRICKET FROG - Genetic Assessment of Historic and Extant Blanchard's Cricket Frog *(Acris crepitans blanchardi)* (P. Wilson, K. Beuaclerc, B. Johnson)

This study will examine DNA profiles of Blanchard's cricket frogs across the present and historic range of live and museum specimens. Museum specimens will represent the original Canadian range and frogs from the United States will determine potential source animals for release on Pelee Island, Ontario (Recovery Plan Objective). The Recovery Plan for the cricket frog has been submitted; its focus is on renewed field surveys for extant populations and to map habitats.

BUTTERFLY INVENTORY (T. Mason, North American Butterfly Association, Toronto Entomologist's Association, Rouge Park)

Since 1993, the Zoo has participated in an annual butterfly survey conducted across North America, from Canada to Mexico. The survey is conducted for, and in association with, the North American Butterfly Association (NABA) and the Toronto Entomologist's Association (TEA). Every year on July 1st, the survey is performed to examine the cycling of butterflies in East Toronto. The Eastern Toronto count covers a 15-mile diameter, including the Rouge Valley, the eastern portion of the Don Valley and Petticoat Creek. The 2010 count found 42 species. The early spring and constant warm damp weather created quite a change in the species count and the types of butterflies observed. The total inventory takes place between the months of May and September. Over 70 species have been observed in the Rouge since the Zoo began the surveys.

CONSERVATION OF URBAN AMPHIBIANS AND REPTILES (B. Johnson)

For over 27 years, data on the distribution of amphibians and reptiles has been collected for the Toronto area. The distribution data is mapped in a GIS database and used in species inventories and watershed planning. Reptile and amphibian conservation hotspots and threatened habitats are identified. Habitat restoration projects are also identified, including the construction of snake hibernacula, turtle nesting areas, and signs for turtle and amphibian road crossings. Although data is used for the recovery of threatened species, maintaining the abundance of common species is a parallel goal in the urban landscape. Identifiers for all of Ontario's amphibians and reptiles can be found under 'Identifiers' on the Adopt-A-Pond website (www.torontozoo.com/adoptapond). Our primary research focus is in partnership with the Rouge Park Alliance and Toronto and Region Conservation Authority to provide habitat use data for amphibian and reptile species at risk and to develop and implement management recommendations. A Stewardship Guide for turtles at risk provides a focus on conservation of urban turtle populations.

CONSERVATION PARTNERSHIPS FOR RECOVERY OF CANADIAN AND OTHER AMPHIBIANS AND REPTILES (B. Johnson; TZ Endangered Species Recovery Fund; Adopt-A-Pond)

Toronto Zoo Amphibian and Reptile curatorial staff, through the Endangered Species Reserve Fund, targets programmes that demonstrate innovation, community partnerships, and applied research projects for the recovery of species at risk. Past and current projects include:

- Blandings turtle research in Algonquin Provincial Park, Ontario
- Fox snake hiberanculum construction, Ontario
- Black rat snake interpretive programme, Murphy's Point Provincial Park, Ontario

- Altona Forest amphibian breeding pond construction, Ontario
- Facilitating Species At Risk monitoring and habitat protection in First Nations communities.
- Nk"Mip Indian Reserve Western rattlesnake habitat use and fencing project, British Columbia
- Okanagan Valley Tiger Salamander and pond restoration, British Columbia.
- Red-sided garter snake habitat protection, Manitoba
- Leatherback sea turtle fishermen surveys and newsletter, Nova Scotia
- Puerto Rican crested toad Juan Rivero Zoo outreach student guides, Puerto Rico
- Wyoming toad population and habitat surveys, USA
- Oregon Spotted frog population monitoring, British Columbia
- Axolotl population surveys Lake Xochimilco, Mexico
- Axolotl husbandry and rearing facility, Chapultepec Zoo, Mexico
- Beaded lizard community outreach programme, Guatemala.
- El Valle Amphibian Conservation Centre, Panama.
- Asian turtle crisis- training of biologists and veterinarians, Vietnam/Thailand.
- Asian turtle crisis- printing of turtle awareness and conservation booklet in Mandarin for Chinese Zoo Association, China
- False gharial crocodile population monitoring in two Indonesian Parks
- West African dwarf crocodile population monitoring, Ivory Coast.
- Madagascan tortoise conservation
- Community Based conservation of the Golden Mantella frog in Madagascar

CROCODILES AND TORTOISES - **Mitigation of the impacts of bushmeat on crocodiles and tortoises in African parks** (B. Johnson, A. Lentini, zoo staff Africa, Wildlife Health Centre)

Bushmeat is a term used to describe the hunt of wild animals in their habitat for their meat, traditionally for self consumption by hunters without regular access to markets or meat from domesticated animals. The bushmeat market is not limited to gorillas and other primates but also includes crocodiles, turtles, monitor lizards and other reptiles. This practice has been taking place for thousands of years and kept in balance due to low human populations and inaccessibility of forests to humans. However, in the last century, overexploitation and illegal hunting of wild animals have placed many species at risk of extinction.

Factors contributing to the bushmeat trade are:

- Logging: Large scale logging is clearing the forests of Central West Africa, so what used to be impermeable habitat is now an access road to the inner parts of the forests. This makes it possible for hunters to capture animals in distant areas.
- Poverty: Bushmeat is cheap to obtain and considered a luxury item in the cities. With no alternatives available, many villagers living in poverty hunt wild animals to either eat them as a source of protein, or to sell them to traders as a supplement to their income. Traditional hunters have increased impact with shotguns in combination with snares and traps.
- International demand: Many animals are kept alive to be transported illegally in the international pet trade, or butchered for their body parts, such as skins, shells, bones, or limbs to be used as decorative items, fashion items or in traditional medicine. With higher accessibility to the animals' habitats and growing human populations, hunters capture or kill animals that may be some distance away as a valuable source of income.

The dwarf crocodile is listed as Vulnerable by IUCN and listed in Appendix I by CITES, which means trade in this species is prohibited. The Crocodile Specialist Group (CSG) is a network of Biologists, government

officials, NGO representatives, farmers, traders, fashion leaders, and private companies, who work together for the conservation of crocodilian species. This group examines means to utilize the dwarf crocodile in a sustainable manner while protecting the crocodile's natural habitat and wild populations. CSG Experts collect information about the species' distribution in the wild and monitor its trade in bushmeat markets. Home's hinge-back tortoise is listed as Vulnerable by IUCN. The Tortoise and Freshwater Turtle Specialist Group is a network of over 7,000 scientists working to conserve this species. Information about the species distribution in the wild is updated regularly, and its trade is monitored closely. This group also develops plans to establish protected areas in natural habitats of the hinge-back tortoises, particularly where they are worshiped as holy animals. The Toronto Zoo provides support to protect the biodiversity of several African parks and conservation partnerships.

ELEPHANTS – Using Science to Understand Zoo Elephant Welfare (J. Brown, M. Franke) REF. NO. 2011-03-01

The purpose of this study is to determine the environmental and husbandry factors that are most important to elephant welfare. Using a multi-disciplinary approach, we will establish science-based benchmarks for assessing individual elephant welfare by studying the population housed at Association of Zoos and Aquariums (ZAZ) – accredited zoos (290 elephants in 8 facilities). When completed, this project will provide detailed, science-based welfare outcomes that can be used by managers to optimize care and promote well-being of zoo elephants. The primary goal of this study is to produce scientific data that will aid decision-making with regard to best practices in elephant management.

FRESHWATER MUSSELS - Field Research and Public Awareness Campaign

The Great Lakes Program launched a 2011 initiative for freshwater mussels, as a field research project and a public outreach campaign entitled "*I am Important, I am Protected*". In spite of being cited by the IUCN as one of the world's most endangered species assemblages, freshwater mussels, especially those in Lake Ontario inland waters, are little studied and fairly unknown. To fill this knowledge and awareness gap, the Toronto Zoo is focusing its efforts on Central Ontario's Kawartha Lakes and Kingston regions, with plans to expand in the future.

A field study to determine species presence has been initiated for 2012 in the Kawartha Lakes region and multiple locations within the Rouge watershed, including sites on Toronto Zoo property. The public

awareness campaign will introduce these unique invertebrates to the public, highlighting their role in keeping our waters clean. As part of this initiative, the Toronto Zoo has developed resources such as a *Campaign poster*, several *Species fact sheets*, and a *Mussel species database*. Only by fostering an appreciation and understanding of freshwater mussels can we hope to engage the public in their conservation.

LAKE VICTORIA – Cichlids Species Survival Plan (C. Lee)

The perch-like fishes of Lake Victoria, Africa have the dubious distinction of being documented in the IUCN Red Book as the greatest extinction in recent times. North American Zoos are working together holding breeding populations of these fishes under an SSP. Toronto Zoo has been an active participant since the program's inception in the late 1980s. We currently hold five species including the pelagic Oreochromis esculentus. The Toronto Zoo's Aqua-Links program focuses on connecting students in Ontario with E. African classes and represents a novel approach to public awareness of Great Lakes issues.

Madagascar Freshwater Fishes Breeding and Conservation efforts (T.McCaskie & C. Lee)

The Toronto Zoo has sent a keeper to Madagascar in 2010 and 2011. We hold and exhibit three species of Madagascar fishes. We have developed breeding guidelines for these species and having successfully bred all three species and dispersed two to other AZA institutions. We are on our second generation for all three species.

In 1998 *Bedotia marojejy* was found in abundance in Madagascar. Last year we tried to find this species again with no luck. The villagers received mosquito nets which they fished with during the day and prevented malaria at night. The mosquito nets prevent all fish from going through where the old traditional fishing baskets allowed the fry to go through. There has been talk about reintroducing this species back into the wild. There are several institutions inquiring about this species.

In 2013 when I return to Madagascar I plan to do a mark and recapture census on Paretroplus menerambo. Paretroplus menerambo were considered extinct in 2004. In 2010 Alex Saunders and I confirmed that the species was not extinct and established that their habitat was pristine except for the exotics located in the lake. We also plan to start collecting information on Sauvagella robusta, which makes up about 60 percent of Lake Tseny's fishery.

MASSASAUGA RATTLESNAKE - Long-term monitoring of an eastern Massasauga rattlesnake population in Southwest Michigan (Project Investigators: L. Faust, M. Redmer, J. Earnhardt, M. McCuistion: Toronto Zoo participants: A. Lentini, R. Vos, T. Long)

Toronto Zoo is participating in multi-year population surveys being conducted as part of a field conservation project run by the Massasauga Species Survival Plan (SSP) at the Edward Lowe Foundation, a private foundation with property in SW Michigan. The Massasauga is listed as a Threatened species in Canada and is a candidate species for federal listing in the USA. This long-term monitoring project uses mark-recapture methods for up to five years to study population dynamics over time for these snakes.

Field research has been combined with the annual Massasauga SSP meeting with participants surveying via visual searches and snake-friendly traps (funnel traps with drift fences and coverboards). Snakes that are located are captured to collect morphological data, blood samples, and individually marked using transponders (PIT tags). The snakes are then re-released at their capture location. The numbers of snakes recaptured at

subsequent surveying sessions will then be used to help estimate the ratio of marked to unmarked animals in the population, rates of population growth or decline, and individual survival.

The Toronto Zoo team made a significant contribution by finding nearly 25% of all snakes processed during the 2011 SSP meeting. Temperature data we were able to collect combined with habitat observation we made will be helpful in establishing target environmental and habitat parameters for Toronto Zoo snakes.

MASSASAUGA RATTLESNAKE – Management, Outreach, Research and Husbandry Program (A. Lentini, B. Johnson)

The Massasauga is Ontario's only venomous species and Toronto Zoo is a founding member of the National Recovery team for this species. The Massasauga is considered endangered, threatened or of special concern within its current range. The Zoo holds two public workshops "Living with Wildlife" that features the Massasauga and other species at risk snakes. An SSP was established in 2006 to enhance conservation efforts in the field while increasing public awareness through educational programs and exhibits. An AZA Husbandry Manual for the care and breeding of these rattlesnakes was developed for the SSP. Toronto zoo actively participates in a multi-year field project conducted by the SSP in south-western Michigan. The goal of the research is to gather baseline demographic data, habitat use and behavioral ecology for this species in the wild.

MILK SNAKE - Population Monitoring in Rouge Park. (A. Lentini, B. Johnson) REF No. 2011-05-01

Milk snake reports for Rouge Park have been anecdotal. Road mortalities and a forest to meadow habitat corridor were documented in 1984 and hibernacula locations plotted for the Rouge Park Natural Features inventory. Multiple dead-on-road findings of milk snakes were recorded in the 2010 OREG road mortality survey. A comprehensive study of the Rouge Park milk snake population and habitat use is necessary to better understand the ecology (e.g. abundance, habitat use, distribution, movements, road mortality impact on population sustainability, etc.) of this Species At Risk (SAR). This study will ultimately result in the development of a Management Plan that may include habitat restoration and more comprehensive road mitigation measures (i.e. ecopassages) that target protection of this SAR. Mitigation (habitat mitigation, stewardship and snake crossing road signs) may be necessary to raise awareness and help reduce the occurrence of snake/vehicle collisions. The tablelands between the Little Rouge and Rouge Rivers, south of Steeles Avenue, are being investigated with the cooperation of Rouge Park tenants and landowners to search anthropogenic habitats near buildings and abandoned structures (foundations, wells and barns).

Coverboards have been laid out across the study site to attract snakes already present in the area. Coverboards are checked regularly for evidence of snake use, snakes, rodents and other features of interest are also noted. Data collected will be submitted to Rouge Park to inform habitat restoration (e.g. hibernacula, gestation and egg laying sites) and will enable OREG to prioritize road mitigation practices to restore habitat permeability.

ODONATE SURVEY (Bev Edwards, Richard Aaron, Rouge Park Volunteers, Rouge Park, Tom Mason, Lydia Attard)

This year, the Rouge Park began a monitoring program for the dragonflies and damselflies of the Rouge Park. Toronto Zoo had done a survey using one student and had established a base of 30 species on the Zoo property. With Bev Edwards as the lead, a large survey group was utilized to cover much of the valley with a result of 58 species being covered. This is a great contribution to the knowledge of biodiversity within the Park.

PUERTO RICAN CRESTED TOAD – Management, Outreach, Husbandry, Research and Re-introduction Program (A. Lentini, B. Johnson, E. Gabura, D. Martin, C. Dutton, G. Crawshaw)

Toronto Zoo has maintained an assurance population of this species since its re-discovery in 1985. Captive animals provide a genetic resource to supplement wild populations through re-introduction of over 125,000 tadpoles. An AZA Husbandry Manual for the care and breeding of the Puerto Rican crested toad was developed at the Toronto Zoo and has been translated into Spanish. An International Studbook was completed and published. This important document provided essential demographic and genetic data to the Species Survival Plan (SSP) to genetically and demographically manage the species for re-introduction to the wild. Research into a potential nutritional imbalance (hypovitaminosis A) is currently being conducted.

RESEARCHING THE USE OF CELL CULTURES FOR FRESHWATER FISHES CONSERVATION (G. Mastromonaco, C. Lee, M. Filice, K. Greenham)

In November 2010 at the 4th International Seahorse Husbandry Symposium held at Chester Zoo, Chester England, the IUCN's Freshwater Fishes Specialty Group announced the development of a regional cell culture bank of native endangered fishes as a priority endeavour in response to the global decline of freshwater and marine fishes. The mandate is to systematically bank genetic material in the form of gametes, embryos, cells and DNA from as many species as possible around the globe.

Although cryopreservation of gametes and embryos is the most beneficial resource for future fish population management, reproductive cells can be difficult to handle and cryopreserve. Complex species-specific protocols are required to optimize post-thaw survival. An equally important source of genetic material is found in somatic cells. These cells are easily acquired and, being more robust, survive the freeze-thaw process with greater success. Studies in mammals have shown that culture characteristics are influenced by culture establishment techniques; however there is very little information in published literature for fishes. An understanding of cell culture parameters is necessary in fishes so that the production of healthy cell lines can be ensured. The goals of this study are to evaluate tissue storage and processing techniques on the viability, longevity and normality of fish cell cultures. This will provide us with the information required to establish adequate protocols for initiating a genome resource bank for endangered freshwater fishes.

RESPONSE TO ASIAN TURTLE CRISIS AND BUSHMEAT TRADE (B. Johnson; A. Lentini; zoo staff Africa, Indo Malaya; Animal Health Centre)

With 90 species, Asia has the richest turtle and tortoise diversity in the world. However, in recent decades, the future of almost every such species has been put at risk for various reasons.

10- 20% of South East Asia land cover is forest, which is the natural habitat for most turtle and tortoise species in the region, and ten percent of the world's turtle and tortoise species are found in the forests of Indonesia alone. In recent years there has been a sharp increase in demand for forest products from the region and deforestation rates have been steadily increasing. Loss of natural forest threatens over 65 of the 90 turtle and tortoise species in South East Asia.

A second major problem is that increasing income in the region and decreasing numbers of turtles and tortoises in the wild has triggered a massive, mainly illegal, trade in hundreds of thousands of turtles and tortoises a year. Turtles and tortoises have been used by Southeast Asian cultures for thousands of years for nutritional, medicinal and cultural purposes. However, the more recent rise in demand for these species has led to unsustainable and illegal harvesting of turtles and tortoises from the wild, including species listed as threatened by IUCN and/or CITES species at risk with either restricted or prohibited trade.

Certified Wood Products are one solution to this crisis, as they come from forests managed in a sustainable way. This means that forest products, such as wood, timber, and fruit, are obtained

responsibly, avoiding the destruction of wildlife habitat while providing dependable livelihood for humans. This project spreads awareness of the Asian turtle crisis and bushmeat trade, and educates visitors on how they can help to conserve turtle and tortoise species by supporting Certified Wood Products.

The project also encourages donations to support turtle conservation for our Endangered Species fund and public donations. Keepers have also organized 'Toonies for Turtles' fundraising events which draw attention to some of our rarest species and breeding programmes. The Toronto Zoo provides funding for turtle conservation partnerships to help turtles in the wild and supports:

- Asian Scholarship Program to train South East Asian Biologists to help turtles and tortoises in trouble in their countries of origin.
- Conservation education partnerships with Chinese Association of Zoological Gardens.
- Creation and production of turtle conservation pamphlets.
- Support of the Turtle survival Alliance, which provides funding for:
    - Research and protected areas to help wild turtles and tortoises
    - Support of park staff, who care for thousands of turtles and tortoises confiscated from food and pet markets
    - Captive breeding programs to save turtle and tortoise species from extinction
    - Support for researchers and officials monitoring the illegal turtle trade
    - Training of Trade Enforcement Inspectors

The Toronto Zoo also helps turtles and tortoises on the zoo's site:

- Our Indo-Malaya animal keepers have contributed their expertise to protect assurance populations (captive populations of wild species to save the species from extinction) through captive breeding programs for:
    - Spiny turtle *(Heosemys spinosa)*
    - Malaysian painted turtle *(Callagur borneoensis)*
    - Black breasted leaf turtle *(Geoemyda spengleri)*
    - Burmese star tortoise *(Geochelone platynota)*
    - Brown tortoise *(Manouria emys emys)*
    - Vietnamese box turtle *(Cistoclemmys galbinifrons)*
- Accommodating, relocating and providing medical care for turtles and tortoises confiscated on their way to food and pet markets by the Ontario Society for the Prevention of Cruelty to Animals (OSPCA), the Humane society of Canada and the Canadian Food Inspection Agency.
- Encouraging individuals on exhibit to breed by providing them with spacious enclosures with appropriate egg laying areas, specialized diets, monitoring their behaviour, health, reproductive physiology, and x-raying females to monitor egg development of South East Asian turtles.
- Partnership in the Asian Giant River Turtle Consortium.

RESPONSE TO GLOBAL AMPHIBIAN DECLINES (B. Johnson, A. Lentini, zoo staff Africa, Americas, Australasia, Indo Malaya; Wildlife Health Centre)

Global declines of amphibians require an urgent response. For many years staff at Toronto Zoo has contributed to the recovery of endangered amphibians (i.e. member of American and Canadian Zoo Associations Amphibian Taxon Advisory Groups, Puerto Rican crested toad, Wyoming toad, Fowler's Toad, Cricket Frog, Oregon spotted frog and Dusky Salamander Recovery Teams). This is in part due to our success in breeding many amphibian species to maintain demographically and genetically managed assurance populations in case of loss of wild populations and developing educational resources for community involvement in backyard conservation. In fact, our popular Adopt-A-Pond Program was initiated by zoo staff to protect and restore wetland habitats in response to 1989 reports of amphibian

declines. Unfortunately, amphibians face ongoing threats. We are now witnessing a crisis that is decimating a whole vertebrate class. The causes of decline are not easily reversible, nor immediately preventable and traditional conservation approaches have been inadequate in meeting these challenges. Recent extinctions and extirpations have occurred around the world, including those in Canada. Many amphibian extinctions are not random. The primary cause of recent population declines appears to be chytridiomycosis, a pathogenic fungal infection commonly referred to as chytrid. Because there are many cases where chytrid fungus is decimating populations from pristine habitat, conventional *in situ* conservation techniques are not going to work.

A recent IUCN/SSC Amphibian Conservation Summit, attended by the Toronto Zoo's Curator of Amphibians and Reptiles, developed an Amphibian Conservation Action Plan that called for emergency conservation centres for *ex situ* assurance colonies within the natural ranges of affected populations. While there is a global response to declining amphibian populations, the zoo community has proposed the development of a global network of captive breeding programs that are linked to conservation within countries where amphibian declines are occurring or predicted to occur. In mounting a rapid response to these issues, the Toronto Zoo and our partners continue to seek sponsors for these facilities that will serve as amphibian rescue centres operated within range countries. These centres will also provide opportunities for zoos to support and train those who live with the frogs. Toronto Zoo has provided support for the first *in situ* captive breeding facility, the El Valle amphibian conservation Centre, coordinated by Houston Zoo at El Nespero Zoo in El Valle, Panama. Toronto Zoo, after an appeal for assistance, sent two keepers to Panama to participate in an international frog rescue and set up of the El Valle Amphibian Conservation Centre. Most recently we provided funding for additional amphibian breeding facilities at Summitt Zoo in Panama City. As a result of our success in amphibian reproduction at the Toronto Zoo and experience with over 25 years of pond construction and reintroduction of zoo-bred tadpoles in Puerto Rico, we will be receiving captive bred rescue frogs from Central America. It is sad indeed to know that the frogs to be received have already become extinct in the wild as a result of an emerging disease we seem unable to stop.

More recently, Toronto Zoo funded staff to assist the Wyoming toad Recovery Team and SSP in field surveys to determine over winter survival of toads introduced to the wild on newly protected watersheds. Toronto Zoo opened an Amphibian Breeding Centre and a new Amphibian Rescue centre with 2 new dedicated isolation rooms to increase our capacity to hold and breed at-risk amphibian species from Canada and amphibian decline hotspots.

TURTLE SPECIES AT RISK– Head-Starting Program (A. Lentini, B. Johnson, J. Phillips, E. Nadeau)

Toronto Zoo participates in head-starting programs for two species of Canadian turtles. Working with partners in the Ontario Ministry of Natural Resources and Parks Canada, hatchling Species At Risk turtles are being raised at Toronto Zoo until they are two years old and ready for release back to the wild.

URBAN TURTLE INITIATIVE – Management of Turtle Populations in Rouge Park (B. Johnson, J. Phillips; Crystal Robertson; Shannon Ritchie)

The Urban Turtle Initiative (UTI) is a research project that began in 1999, in an effort to determine critical habitat use by Snapping turtles in areas of Rouge Park situated on or near Toronto Zoo property. Since the project's initiation, two additional Species at Risk (COSEWIC), the Northern Map turtle (*Graptemys geographica*) and the Blanding's turtle (*Emydoidea blandingii*), have been added to the project's focus. Additionally, the project's original study area has now expanded to include Rouge Park wetland areas southward to Lake Ontario and northward to Highway 407. and a new study area was added to the project in 2010: wetlands adjacent to the Highway 24 corridor southwest of Brantford.

Between 2002 and 2008, radio-telemetry equipment was used to track turtle movements from emergence in spring through to spring/summer foraging habitats and nesting grounds, and then to winter hibernation sites. Data collected included coarse and fine habitat characteristics, GPS and GIS movement information, and observations of individual turtle behaviours. Preliminary analysis of selected data

showed that small wetlands and seepage areas are important over-wintering habitats; foraging sites and nesting beaches may be in distinct areas; male snapping turtles may hold linear territories in river habitat; and the surrounding urban landscape has an effect on the individual movement and the overall population connectivity of all urban turtle species.

With support from the Rouge Park Cultural and Natural Heritage Fund and Environment Canada's Habitat Stewardship Fund, data from over nine years of UTI research was collected and combined with literature reviews and conference proceedings to write a Turtle Management Plan for the Rouge Park valley and tablelands in 2007. In 2008, the project initiated a 3 year plan to increase significant turtle habitat in Rouge Park based on information provided by the *Management Plan for Turtle Populations in the Rouge Park* prepared by Adopt-A-Pond's Urban Turtle Initiative, the *Recovery Strategy for Species at Risk Turtles in Ontario* prepared by OMSTARRT (Ontario Multi-Species Turtles at Risk Recovery Team), and the *Turtle Management Workshop* held at Toronto Zoo in March 2008. Research in 2008 focused on a nest site characterization analysis to determine the physical characteristics of successful nest sites in the Park, whereas research in 2009 focused on mapping the current distribution of high quality turtle habitat throughout the Rouge and locating suitable areas to target for building new nesting areas and over wintering sites using Geographic Information Systems (GIS). In 2010, the focus of the UTI's research in Rouge Park has shifted to ground-truthing previously identified high quality turtle sites to confirm their value as potential habitat, and to monitoring movements and habitat use of Blanding's turtles currently using restored wetlands.

The data collected over the past few years will be used to create successful artificial nest sites in areas where traditional sites have been destroyed or degraded (online resources detail the steps to constructing turtle nesting habitat) and build over wintering wetland habitat where current habitat availability is low. Important basking habitat will also be constructed in Rouge Park to ensure that our focal species can achieve proper thermoregulation. All constructed and restored habitat will be monitored for turtle usage and ecological function. The GIS-based hydrological assessments will be used to determine the most ecologically sound locations for ground-truthing and turtle habitat creation/restoration activities in subsequent years.

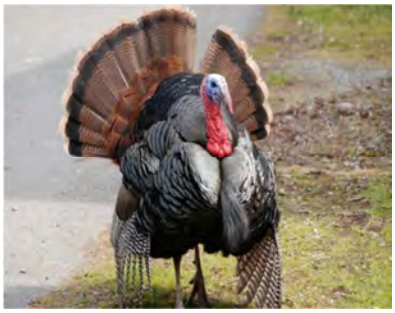
An additional research component was added to the UTI in 2011 to learn more about turtle movement and habitat use in an area along Highway 24 (southwest of Brantford) where the Ministry of Transportation Ontario (MTO) established fencing beside wetland areas to prevent turtle road mortalities. Working in close partnership with MTO, and with support from the Ontario Ministry of Natural Resources' Species at Risk Stewardship Fund, UTI researchers are using radio-telemetry equipment to track turtle movements during nesting, foraging, overwintering and spring emergence forays in wetlands adjacent to the highway. Radio-telemetry work combined with routine road kill surveys will help determine whether turtles use pre-existing sub-highway culverts as movement corridors to pass between roadside wetlands, and whether road mortality mitigation fencing provides an effective means for preventing turtle deaths on roads. Turtle movement and road mortality data will ultimately be paired with literature studies of road mortality mitigation techniques to provide government stakeholders, landowners adjacent to roads and conservation agencies with information on the efficacy of road mortality mitigation structures and best management practices for preventing turtle death on roads.

Running parallel to the Urban Turtle Initiative's research objectives is AAP's goal to communicate turtle conservation issues and habitat stewardship practices to as many people as possible. Environment Canada's Habitat Stewardship Program (HSP) and the Ontario Ministry of Natural Resources' Species at Risk Stewardship Fund have provided AAP with the financial support to achieve this objective by sponsoring a Social Marketing and Stewardship Coordinator, two Wetland Evaluation Technicians, two

Turtle Research Technicians, a GIS consultant, habitat assessments, stewardship workshops and meetings, the writing of a Turtle Stewardship Guide, and the production of several other outreach resources over the past two years.

3.2 Captive Breeding and Reintroduction

The Toronto Zoo works with a number of species in captive breeding and reintroduction programs in three main categories:

Toronto Zoo Animal Re-introduction & Recovery Program Participation	**Re-introduction underway where Toronto Zoo exhibits and BREED these species for survival**	**Re-introductions with Toronto Zoo Staff involved**
• Black-footed ferret • Loggerhead shrike • Vancouver Island marmot • Trumpeter swan • Puerto Rican crested toad • Massasauga rattlesnake • Wood turtle • Blanding's turtle • Atlantic salmon • Wyoming toad • Mallorcan midwife toad • Wood bison 	• Przewalski's horse • Golden lion tamarin • Scimitar-horned oryx • Axolotl • Oregon spotted frog • African penguins • Blue and yellow macaws • Karner blue butterfly • Sumatran orangutan  	• Bald eagle • Wild turkey in Ontario • Piping plover  

BLACK-FOOTED FERRET - Conservation Recovery Program (M. Franke, G. Crawshaw, P. Roberts, K. Murphy)

In 1992, the Toronto Zoo joined the recovery program for the endangered black-footed ferret (*Mustela nigripes*). Since then, ferrets at the Zoo have produced 102 litters and 439 kits, many of which have been reintroduced to the United States, Mexico and Canada. The most genetically-valuable animals are kept in the Species Survival Plan program for future breeding. This program is a high priority for the Zoo as we attempt to re-establish black-footed ferret populations across North America. 2009 marked the first Canadian release of black-footed ferrets into the wild – the crowning achievement of the Canadian recovery program.

The black-footed ferrets historical range included the western parts of the Canadian prairies (southern Alberta to southern Saskatchewan) but the species was listed as extirpated in 1978 by COSEWIC. In 2003, the Toronto Zoo spearheaded black-footed ferret recovery in Canada and in 2004, in partnership with Parks Canada, US Fish & Wildlife Service, the Calgary Zoo, private stakeholders and other organizations, a joint Black-footed Ferret/Black-tailed Prairie Dog Recovery Team was established to set up the reintroduction of black-footed ferrets into Canada.

The area in and around Grasslands National Park (GNP), Saskatchewan contains the largest black-tailed prairie dog population in Canada and prairie dogs are protected within the park borders. As prairie dogs are the primary prey of black-footed ferrets, this site is ideal for ferret reintroductions. Prior to the release of ferrets into GNP, Toronto Zoo staff helped survey the park's prairie dog population. Zoo veterinarians also conducted a study to determine the risk of infectious disease transmission to ferrets from GNP's other wildlife.

As a result of extensive planning, 34 ferrets were released on to Canadian soil in October 2009. In each of the two following years, 15 additional ferrets were released into the park. GNP now supports Canada's first wild population of black-footed ferrets since they disappeared from the country several decades ago. Since the reintroduction, frequent monitoring sessions take place to examine the threats to black-footed ferret populations, how populations are faring in the wild, and to determine when the wild population needs to be supplemented with additional animals. With funding from the Canadian Wildlife Federation and the Toronto Zoo Endangered Species Reserve Fund, Toronto Zoo staff took part in the first post-release monitoring sessions in 2010. This research revealed an excellent winter survival rate and soon afterwards three ferret kits were observed – the first Canadian-born kits in over 70 years!

In addition to population monitoring, the Zoo helps maintain the health of the wild ferrets. In 2010 and 2011, Toronto Zoo veterinarians traveled to GNP to assess the health of the adult ferrets and to vaccinate any new wild-born kits. As well, the new kits are microchipped so they can be identified again in the future. Annual monitoring and health assessments will continue to ensure the survival of released animals.

Reintroducing the black-footed ferret into Canada is of great conservation significance as we established a population in the species' most northern historical range. By reintroducing an extirpated species back into the Canadian prairies, the Toronto Zoo and its many partners have proven that species-at-risk recovery programs can be successful. Along with our international collaborators, we are very excited and hopeful for the recovery of the black-footed ferret.

EASTERN LOGGERHEAD SHRIKE - Captive Breeding Program (T. Mason, Wildlife Preservation Trust, McGill University, CWS, OMNR)

In 2010, shrikes from Toronto Zoo were sent to Carden to be part of the captive breeding and release experiments for the recovery program of this species. In 2011, 46 shrikes were released in the wild. Over the years over 500 shrikes have been released and it is now recognized that a significant proportion of the birds returning to breed each year have been produced through captive breeding. Despite this survival rate of the birds was not as high as expected. Increased predation, increased numbers of mosquitoes and the presence of West Nile Virus all were factors that affected birds in captivity and the wild. The loggerhead shrike recovery program has gained some recognition in conservation circles and several zoos in the United States have expressed interest in becoming involved. This could be a tremendous aide to the future of our program.

KARNER BLUE BUTTERFLY - Captive Breeding (T. Mason)

In 1991, the last Karner blue (*Lycaeides melissa samuelis*) was observed in Ontario. The Toronto Zoo joined the Karner Blue Recovery Team in 1992 to actively pursue the re-introduction of this species into Ontario. For five years a protocol was developed and produced to rear this species in captivity. Since recovery efforts of the release sites were lagging behind captive breeding efforts, Toronto Zoo stopped working on the captive breeding and put more emphasis into the study of the microhabitats of restored release sites. In 2002, Gary Lee compiled reports, and acted as a coordinator for the Recovery Team. Thomas Mason and Gary Lee also participated in a Karner blue workshop in Toledo, Ohio. The program has experienced a lull in the past three years. In 2010 the Zoo worked on bringing government officials and NGO representatives together to further the cause of this beautiful species. In 2008 the Karner Blue was upgraded from “Endangered” to “Extirpated”. This simple change has caused several changes in the way that governments look at the species. The Karner Blue has gone from Provincial jurisdiction to Federal jurisdiction and the movement in the conservation of this species now will require different assessments and studies. Toronto Zoo will continue to work on returning it to Canada.

SPIDER SURVEY OF ROUGE PARK (Gerbin Blagoev, Tiffany Yau, Tom Mason)

2012 was spent finishing the identification of spiders collected in the 2011 survey. Also some intensive survey work during the June bioblitz produced another 20 species for the Park. One species collected was the Northern purseweb spider, *Sphodros niger.* This was the first time this rare mygalomorph (primitive spiders including the tarantulas) was found within the Toronto City limits. In total less than 20 have ever been found in Ontario and just over 100 have ever been seen. Other finds included several new species for Ontario, 30 new species for the City of Toronto and one new species for Canada. In 2013 it is hoped that the project will continue, working with the Canadian Institute for Biodiversity at the University of Guelph.

KUDA (*Hippocampus sp.*) - Captive Breeding and Conservation (C. Lee, K. Greenham)

The Kuda seahorse (*Hippocampus kuda*) is one of the more heavily exploited species in both traditional medicines and marine aquarium trades. The Toronto Zoo Seahorse Breeding and Conservation program working with Project Seahorse is designed to investigate improved husbandry and breeding protocols of captive seahorses. The breeding program will assist aquariums to meet Marine Fishes Taxanomic Advisory Group recommendations to obtain captive bred animals and reduce harvesting of wild fishes for exhibit purposes. In 2011, Toronto Zoo raised over 400 Kuda seahorse fry with 100 juveniles being sent to other zoos and aquariums across North America for exhibit. In past years, juveniles have been

shipped as far as Africa for aquarium exhibits. Toronto Zoo will continue to investigate nutritional deficiencies and requirements identified by a previous research project. In November 2011, preliminary breeding results were presented at the 5th International Seahorse Husbandry Symposium.

MANAGED COOPERATIVE BREEDING PROGRAMMES (B. Johnson; A. Lentini)

Many species at risk of extinction have managed assurance populations. Toronto Zoo Records staff, Curatorial staff, Animal Health Centre and Nutrition staff maintain studbook and animal care data to ensure that populations are managed scientifically to maintain demographic and genetic health. Animal Care staff maintains appropriate breeding pairs and environmental conditions to facilitate breeding recommendations each year. Through the Curatorial Collection plan, all amphibian and reptile species in the collection are managed to sustain their populations and are linked to conservation of the species and its habitat in the wild through conservation programmes. In addition to Toronto Zoo's own conservation priorities, some species programmes are managed cooperatively between zoos and these include formal programs for 4 amphibians and 21 reptiles of the 70 species in our collection.

OREGON SPOTTED FROG - Amphibian Rescue Centre (ARC) Husbandry and Reintroduction Program (B. Johnson; A. Lentini)

Due to population crashes in the wild, the Oregon spotted frog received an emergency listing as endangered In Canada and is only known from three breeding ponds in British Columbia. At the request of the BC government and the National Recovery Team, Toronto Zoo will hold an assurance colony to ensure that the remaining genetic biodiversity is not lost and to provide frogs for re-introduction to the wild. One of two isolation quarantine rooms in Toronto Zoo's Amphibian Rescue Centre (ARC) is dedicated to this species.

PUERTO RICAN CRESTED TOAD - Captive Reproduction in the Male Puerto Rican Crested Toad (A. Lentini, B. Johnson, G. Mastromonaco, S. Hayden; Dr. V. Trudeau, University of Ottawa; Environment Canada)

The Puerto Rican crested toad is a threatened species found in southern Puerto Rico. In collaboration with the US Fish and Wildlife Service and the AZA SSP®, tadpoles hatched at the Toronto Zoo are released in Puerto Rico each year for the purposes of sustaining and rebuilding the wild population. However, captive reproductive success remains erratic for unknown reasons. The objective of this study is to determine the optimum husbandry protocol required to induce spermination, and thus ensure consistent reproductive success of this species in captivity. Different environmental conditions and hormone treatments are being tested and the males' responses in terms of sperm production will also be assessed. To date dosages of hormones have been compared and HCG has proved to be more effective in male sperm production then LHRH. Additional study will determine the impact of cooling on sperm production and compare HCG and LHRH in female toads.

PUERTO RICAN CRESTED TOAD – Management, Outreach, Husbandry, and Re-introduction Program (A. Lentini, B. Johnson, E. Gabura, D. Martin, G. Crawshaw)

Toronto Zoo has maintained an assurance population of this species since its re-discovery in 2004. Captive animals provide a genetic resource to supplement wild populations through re-introduction of over 125,000 tadpoles. A management program for the care and breeding of the Puerto Rican crested toad was developed at the Toronto Zoo. It has been updated as an AZA Husbandry Manual and

translated into Spanish. This captive management protocol covers various aspects of care for this threatened species and it guides over 20 institutions in the SSP. A complete historical studbook was completed and published and an International Studbook completed. This important document provided essential demographic and genetic data to the Species Survival Plan which made breeding and transfer recommendations based on the mean kinship value and age of toads. This management tool provides the data to genetically and demographically manage the species for re-introduction to the wild. The Husbandry Manual and Studbook Keepers will publish an annual studbook update on the AZA website

SEAHORSE - Captive Breeding, Research and Conservation (K. Greenham, C. Lee)

Toronto Zoo holds two species of seahorse and participates in conservation for these species on several levels. The Kuda seahorse (*Hippocampus sp.*) is one of the more heavily exploited species in both traditional medicines and marine aquarium trades. The Toronto Zoo Seahorse Breeding and Conservation program has supported *in situ* conservation efforts working with *Project Seahorse* in the Philippines and Vietnam.

As well, Toronto has designed improved husbandry and breeding protocols for captive seahorses. The breeding program assists aquariums to meet the AZA Marine Fishes Taxanomic Advisory Group Collection Sustainability recommendations to obtain captive bred marine species and reduce harvesting of wild fishes for exhibit purposes. In 2011, Toronto Zoo raised over 400 Kuda seahorse fry with 100 juveniles being sent to other zoos and aquariums across North America for exhibit. In past years, juveniles have been shipped as far as Africa for aquarium exhibits.

Toronto Zoo research efforts will continue to investigate nutritional requirements for captive seahorse building upon previous projects on fatty acid composition of seahorse diets. Toronto Zoo staff participated in the November, 2011 5th Seahorse Symposium at the Shedd Aquarium, Chicago.

VANCOUVER ISLAND MARMOTS - Conservation Recovery Program (M. Franke, H. Tomaso)

One of only six mammals endemic to Canada, the Vancouver Island marmot (*Marmota vancouverensis*) is a critically-endangered species found only on Vancouver Island, British Columbia. These animals live in small family units and inhabit steep, alpine meadows. Unfortunately, marmot numbers have steadily declined over the past 30 years, mainly due habitat alteration and predation. In 2003, the population reached a critical level with less than 30 individuals remaining in the wild. This made the Vancouver Island marmot North America's most endangered mammal.

In 1997, the Vancouver Island Marmot Recovery Team determined that a captive breeding and reintroduction program was the only viable solution to save the species from extinction. That year, the Toronto Zoo received the first six wild-caught marmots and the program now includes three other institutions: Calgary Zoo, Mountain View Conservation Centre and the Tony Barrett Mount Washington Marmot Recovery Centre. Many initiatives have been undertaken to identify and restore habitat for the species and also to mitigate the disturbance of these areas. Two logging companies on Vancouver Island are active in marmot recovery projects,

and educational outreach campaigns have been launched to raise awareness and funds for reintroduction efforts.

The main goal of the Marmot Recovery Team is to establish a self-sustaining wild population of 400-600 individuals. Captive breeding efforts have been very successful at the Toronto Zoo. In 2011, we had 15 marmot pups born from four litters. Since our first litter in 2002, the Zoo's marmots have produced 109 pups. We currently house eight breeding pairs at the Zoo and there are more than 120 marmots living amongst the four captive breeding facilities.

Captive-born marmots are released into the wild each year. In 2011, 67 young marmots took their first steps on Vancouver Island. In total, 375 captive-born marmots have been reintroduced to the island since the first release in 2003. This year, 68 marmots were born in the wild, bringing the wild marmot population up to 320-360 individuals.

With the great success of the captive breeding program, the plan is to continue to increase the number of marmots released each year. Survival rates are encouraging as captive-born animals have now survived several hibernation periods and are now reproducing in the wild. As well, Vancouver Island marmots can now be found on several mountains where previous extirpations had occurred. In 2006, joint efforts between the four facilities were recognized as the program was presented with a Canadian Association of Zoos and Aquariums Conservation Award. In 2011, the Toronto Zoo and Calgary Zoo were awarded the Association of Zoos and Aquariums North American Conservation Award for their joint effort in the recovery program. We are very excited about our continued and growing success in the recovery of this highly-endangered Canadian species.

WYOMING TOAD - Amphibian Rescue Centre (ARC) Husbandry and Reintroduction Program (B. Johnson; A. Lentini)

In 1990 Toronto zoo was invited to assist the US Fish and Wildlife Service to provide management recommendations to ensure the survival of the Wyoming toad. Since these first discussions the species was declared extinct in the wild and only survives from captive managed populations. One of two isolation quarantine rooms in Toronto Zoo's Amphibian Rescue Centre (ARC) is dedicated to this species

AMPHIBIAN BREEDING CENTRE - Americas Staff

The Amphibian Breeding Centre in the Americas pavilion provides a window into some of the zoo's important breeding initiatives. This area is dedicated to explain the plight of several Central American frogs, including the iconic Panamanian Golden Frog (Atelopus zeteki), theatened by the chytrid fungus, an emerging disease that is responsible for global amphibian declines.

3.3 Veterinary Research

PIPING PLOVER - Canadian Wildlife Service Volunteer Veterinary Care and Advisors (C. Dutton, W. Rapley)

The purpose of this project is to conduct a health assessment of any apparently diseased or injured wild-reared Piping Plover chicks at Wasaga Beach or Sauble Beach, determine best course of action, transport birds to most appropriate location for necessary treatment (on site, local veterinary clinic, or Toronto Zoo) and return birds to the site in the attendance of Canadian Wildlife Service staff. Dr. Dutton acted as an advisor. Staff at Toronto Zoo also helped the CWS find a local veterinarian to help in case of emergency at the sites. Dr. Rapley has served as an advisor and observer for this project for CWS.

SNAKES - Physiological and Pathological Effects of Surgical Implantation and Handling Procedures in African House Snakes. (G. Crawshaw, A. Lentini) REF No. 2009-11-05

In a previous study at Toronto Zoo, the physiological and pathological effects of intracoelomic implants were examined in a group of 24 Eastern massasauga rattlesnakes (*Sistrurus catenatus catenatus*). Inflammation and infection occurred despite careful surgical procedures and advanced veterinary care. Reaction to the transmitters was likely a result of unsuitable implant coating. This study is designed to continue that work by comparing the responses of the snakes to implants with different coatings.

We are also assessing if the stresses associated with surgery and handling are reflected in changes in corticosterone in the shed skin of the snakes. This is a potential tool of great value to those caring for captive wildlife, and for assessing ecological changes in wild animals. There is no published work on the use of this technique in reptiles but handling stress was reflected in elevated stress hormone (corticosterone) metabolite levels in the previous implant study. Initial studies at Toronto Zoo have shown that it is possible to quantify corticosterone in shed reptile skin.

We are comparing the fecal and skin shed corticosterone concentrations, and examining the physiological and pathological changes in snakes implanted with transmitters. All snakes have been randomly assigned to three groups and received surgically implanted transmitters and are being maintained for 12 months until surgical removal of the implants. At that time the reaction to the transmitters will be assessed by histological and microbiological methods.

WATERFOWL – Prevalence of Avian Bornavirus Infection in Wild Waterfowl in Southern Ontario and Susceptibility of Domestic Poultry to Experimental Infection with Avian Bornavirus (P. Delnatte, D. Smith, E. Nagy, S. Hollamby) REF. NO. 2011-06-02

Avian Bornavirus, a newly discovered virus of birds, has recently been identified as a cause of neurologic disease in wild waterfowl in Ontario, with several cases diagnosed at the Toronto Zoo (retrospective study). This virus is the cause of a neurological disease in psittacine birds (proventricular dilation disease), and other avian species may also be susceptible to infection. Infection spreads naturally through the fecal oral route, thus wild Canada geese could be a source of environmental contamination. Zoos and poultry industries are at risk, as both zoo and commercially reared birds (backyard, open range, and organic producers) can be housed outdoors were contact with wild waterfowl can occur.

The first goal of this project is to collect blood samples and cloacal swabs from wild Canada geese, Trumpeter swans, mute swans and mallard ducks, in order to determine the prevalence of this virus in wild populations in Southern Ontario and at the Toronto Zoo. Samples will be collected in conjunction with waterfowl banding activities carried out by the Canadian Wildlife Service (for the locations outside of the Toronto Zoo) or purposely collected at the zoo. We will gain knowledge as to how common infection with avian Bornavirus is in Ontario waterfowl and at the Toronto Zoo, helping us to understand and identify cause of disease and mortality in wild birds, and to anticipate a potential impact on captive zoo birds or domestic poultry species.

The second purpose of this research is to determine whether domestic chickens, ducks and geese are susceptible to experimental infection with Avian Bornavirus, and if so, to characterize viral distribution, seroconversion and viral shedding in order to develop a preliminary assessment of the danger to Ontario's poultry industries. Pathologic lesions in the brain mimic those caused by other neurotropic viruses, including paramyxoviruses such as Newcastle Disease virus (reportable in Ontario) and could be an important cause of misdiagnosis.

3.4 Reproductive Research

HORMONAL EVALUATION OF REPRODUCTIVE AND ADRENAL FUNCTION (G. Mastromonaco, C. Gilman, S. O'Handley)

As part of service activities in the Reproductive Physiology Laboratory, urine, fecal and serum hormone analyses are conducted to aid in:

- evaluation of normal reproductive cycles
- assessment of reproductive seasonality
- detection of early pregnancy
- evaluation of contraceptive effectiveness
- gender determination
- effects of stress and environmental changes

Services are provided for a variety of species, including: tiger, cheetah, gorilla, orangutan, caribou, rhinoceros, zebra, wood bison and many others.

In order to understand reproductive and stress parameters in these species, research studies are carried out using samples collected from captive and wild animals. These studies are done in collaboration with other zoos, universities or wildlife organizations.

AFRICAN ELEPHANT – Assessment of Stress Levels in Captive Elephants through Fecal Glucocorticoid Analysis (K. Jensen, J. Stone, C.D. Rollo) REF. NO. 2010-05-01

The secretion of glucocorticoids, a type of steroid hormone, is a classic physiological response to environmental stress. In all mammals, glucocorticoids act by stimulating glucose metabolism to provide the energy required for flight-or-fight responses in individuals undergoing crisis situations. However, prolonged elevation of glucocorticoid levels has been shown to cause a number of health concerns, including immune system suppression, diabetes, muscular breakdown, weight gain and reproductive system suppression. These health conditions are particularly concerning for animals whose conservation is already at risk, such as the African bush elephant.

Glucocorticoid levels of adult African elephants at the Toronto Zoo will be measures by sampling feces. The goal of this study is to uncover the environmental pressures experiences by Toronto Zoo elephants, in an attempt to optimize their care and habitat design. The preservation of this important keystone and flagship species hinges on maintaining the physiological health of captive and wild individuals.

BACTRIAN CAMELS - Development of Assisted Reproduction Techniques to Revitalize the Bactrian Camel Population (G. Mastromonaco, S. Hayden, C. Gartley, M. Franke, G. Crawshaw) REF NO. 2003-05-02

The global wild Bactrian camel population is critically endangered. Once found over a vast range in Asia, only 100 Bactrian camels now inhabit Mongolia's remote Gobi Desert. The Toronto Zoo and its collaborator Dr. Cathy Gartley, from the University of Guelph, have embarked upon an intensive program to develop assisted breeding techniques that will allow for the maintenance of the maximum degree of extant genetic diversity. Semen collection and cryopreservation will be used to store sperm from genetically valuable males and potentially transport such genetic material between captive populations. To determine the appropriate timing for artificial insemination, a combined approach of fecal hormone analyses and ultrasound imaging is being used to assess the phase of the female's reproductive cycle and optimal time for insemination. This will add to the database of knowledge that is building regarding reproduction in this species.

CHEETAHS - Non-surgical Artificial Insemination in Cheetahs (G. Mastromonaco, C. Gartley, M. Franke) REF No. 2009-05-04

Artificial insemination (AI) is a valuable tool for overcoming behavioural issues and allowing the dissemination of genetic material. AI has been successfully implemented in cheetahs using a laparoscopic technique whereby two small incisions are made in the abdomen and the sperm is then injected into the uterine horns. This is considered minor surgery and some time is required for the incisions to heal post-insemination. However, recent advancements in AI technique and equipment in small animals (canids and felids) bring about the possibility of obtaining success using a non-surgical approach: transcervical insemination. With this technique, a semi-rigid catheter is guided through the cervix using an endoscope and the sperm is deposited directly into the uterus. No incisions or healing time are required. This will decrease the amount of time required to perform the insemination and, therefore, also decrease the amount of anaesthesia being used on the female. This is a novel approach in large non-domestic cats and a valuable, stress-reducing modification to the AI technique. For both techniques, sperm collection from the males is done using standard electroejaculation protocols for large cats.

CYTOGENETICS - Cytogenetic Evaluation of Captive and Free-Ranging Non-Domestic Animals (G. Mastromonaco, S. Hayden) REF NO. 2009-03-01

Screening for chromosome abnormalities is an important prerequisite for all animal breeding strategies as they play a role in reduced fertility. Compromised reproductive performance is due to the production of chromosomally unbalanced sperm and oocytes, which lead to the death of the embryos and/or fetuses at early stages of development. In 2004, we reported a chromosome translocation in a female gaur at Toronto Zoo. Characterization of the translocation indicated that it was an inherited chromosome rearrangement, suggesting that other gaur in the captive population must be carriers of this abnormality. Identification of carrier individuals ensures proper breeding management by reducing the perpetuation of chromosome defects in the population and, thereby, reducing the occurrence of embryonic and fetal losses. This allows a more effective use of the short reproductive lifespan of genetically valuable individuals. Selection of normal donor animals for long-term banking of their genetic material is crucial to the successful production of future embryos and offspring.

FISHES - Establishment and Characterization of Cell Culture from Freshwater Fishes (G. Mastromonaco, C. Lee, M. Filice, K. Greenham) REF. NO. 2011-05-02

In November 2010 at the 4th International Seahorse Husbandry Symposium held at Chester Zoo, Chester England, the IUCN's Freshwater Fishes Specialty Group announced the development of a regional cell culture bank of native endangered fishes as a priority endeavour in response to the global decline of freshwater and marine fishes. The mandate is to systematically bank genetic material in the form of gametes, embryos, cells and DNA from as many species as possible around the globe. Although cryopreservation of gametes and embryos is the most beneficial resource for future fish population management, reproductive cells can be difficult to handle and cryopreserve. Complex species-specific protocols are required to optimize post-thaw survival. An equally important source of genetic material is found in somatic cells. These cells are easily acquired and, being more robust, survive the freeze-thaw process with greater success. Studies in mammals have shown that culture characteristics are influenced by culture establishment techniques; however there is very little information in published literature for fishes. An understanding of cell culture parameters is necessary in fishes so that the production of healthy cell lines can be ensured. The goals of this study are to evaluate tissue storage and processing techniques on the viability, longevity and normality of fish cell cultures. This will provide us with the

information required to establish adequate protocols for initiating a genome resource bank for endangered freshwater fishes.

LOGGERHEAD SHRIKE – Investigation of key physiological measures to evaluate loggerhead shrike success in captivity (T. Luloff, G. Mastromonaco, G. Burness)

The loggerhead shrike (*Lanius ludovicianus*) is currently classified as nationally endangered and ongoing threats from habitat loss and other human-related pressures have resulted in a drastic decline in the number of breeding pairs remaining in southern Ontario. The captive environment presents its own challenges. Factors affecting reproductive output in captive animals include behavioural incompatibility, suboptimal environmental conditions, general health status, and genetic make-up. Studies have shown that chronic stress resulting from prolonged exposure to negative stimuli has a significant impact on reproductive potential. Data from the different captive loggerhead shrike populations indicate that breeding outcomes vary significantly with some sites having better success than the others. The underlying factors for these differences are not known and, thus, modifications to improve offspring production and survival cannot be made. Hormone analyses can be used to determine changes in homeostasis in response to environmental stress, disease, and genetic factors. Chronic increases in stress hormones are known to suppress reproductive hormone levels, as well as influence metabolism and immune function. The goals of this study are: to evaluate reproductive and stress hormone levels in feces and feathers from loggerhead shrikes in various southern Ontario captive breeding sites in an attempt to understand the underlying factors influencing reproductive success among breeding pairs in the different captive populations and ii) to evaluate triglyceride and antibody levels in serum to determine downstream effects of potential stress. This study will provide valuable information to enhance loggerhead shrike captive breeding programs.

POLAR BEAR - Non-invasive Reproductive Monitoring and Pregnancy Diagnosis in the Polar Bear (T. Roth, M. Stoops) REF No. 2010-03-03

Zoos are strategically breeding polar bears in efforts to develop a self-sustaining, captive population, and to educate visitors about global warming and wildlife conservation. Unfortunately, high neonatal mortality and poor reproductive success overall in captive bears threaten the genetic health and long-term viability of this species in zoos. Furthermore, population management by the SSP is particularly challenging because of the pronounced seasonality of this species and associated timing of breeding and cubbing seasons. In a previous study, the use of fecal hormone metabolite monitoring for characterizing reproductive function in female bears was developed and validated. The first goal of this research is to expand on previous work by adding male bears to the study. Because so few bears have given birth over the last two years, the database of pregnant bear hormone profiles is quite small. Continuous monitoring of bears in breeding situations will hopefully add data to the database in an attempt to achieve levels of statistical significance. This information hopefully will identify a means of distinguishing pregnancy from pseudo-pregnancy, so that zoos prepare accordingly for cubs or the next breeding season in a more timely fashion. The second goal is to begin monitoring male bears for testosterone concentrations throughout the year. This information is important to characterize the natural reproductive seasonality of males, to help determine if peak reproductive function in males is synchronized with the females estrus and mating behaviours, and provide some preliminary data on the potential effects of latitude and climate differences on male polar bear reproductive function. The latter could have implications for the impact of climate change on this species.

REPTILE EMBRYO STUDY (Dr. J. Richman) REF NO. 2006-09-03

Presently, two types of reptiles are used to address questions about 1) molecular basis for tooth replacement and attachment and 2) early cues that define the position and shapes of the jaw bones. In studying the first question, snake embryos are used because they form several generations of teeth and in one specimen early, middle and late developing teeth can be seen. Snakes were also selected because the tooth roots are naturally fused to the bone. The relationship of the snake tooth studies to human disease is very close. There are many conditions that affect the numbers of teeth in humans, indeed extra or missing teeth are relatively common. Embryos will be collected from fertilized eggs of several reptile species, and their tissues collected and cultured in the laboratory.

The second research question uses the turtle to analyze the earliest cues setting up the pattern of the jaw bones. Human craniofacial abnormalities such as jaw size discrepancies and clefting are also common but the causes are not well understood. Important differences in the jaws of mammals, birds and reptiles will be studied. Through recombining tissues between different species and then culturing them to allow development to proceed, it will be possible to determine whether there are differences or similarities in gene networks that lead to distinct bone patterns such as fused and nonfused palates. These studies will be some of the first information on the snake and turtle embryonic facial development and will significantly increase our understanding of how human jaws and teeth evolved.

VANCOUVER ISLAND MARMOTS - Developing Assisted Reproduction Techniques in the Vancouver Island Marmot (L. Graham, M. McAdie,) REF No. 2010-05-02

The Vancouver Island marmot is one of the most endangered mammalian species in the world. The remaining population of marmots is now under intense reproductive management to maintain genetic diversity of the captive population and to use the captive population to help increase wild populations to sustainable levels. The overall goal of the proposed study is to develop assisted reproduction techniques as one method of solving these reproductive issues. Sperm assessment can be used to diagnose fertility problems in male marmots. Ovarian stimulation techniques can maximize the chances of genetically valuable females breeding successfully with unfamiliar males in order to meet the genetic management goals of the recovery program. Assisted reproduction techniques such as artificial insemination could help avoid breaking established social ties between bonded pairs, increasing individual animals' welfare; and semen cryopreservation would allow the fast-tracking of the re-introduction of genetically valuable males to the wild population without the worry of losing their genes from the captive population. The animals to be used in this study are assigned by the Vancouver Island Recovery Team and Captive Management Group based on the needs of the Vancouver Island Recovery Program.

VANCOUVER ISLAND MARMOT – Sperm Collection in the Vancouver Island Marmot (L. Graham, G. Mastromonaco, D. Whiteside, S. Hayden, M. Franke) REF NO. 2009-03-03

Currently, the remaining population of Vancouver Island marmots is under intense reproductive management to increase wild populations to sustainable levels. While the captive breeding/release program has been very successful, the development of methods for diagnosing fertility problems could greatly improve the efficient management of breeding pairs. Furthermore, the development of assisted reproductive techniques, such as artificial insemination, could help overcome some of the current problems with uneven breeding success among individuals in the captive population. This study represents one of the initial stages of a larger research program aimed at developing assisted reproduction techniques for the Vancouver Island marmot. An important step in evaluating male fertility and developing artificial insemination techniques is the development of standard semen collection and evaluation protocols. Although semen can often be collected with an artificial vagina in many domesticated species, the most commonly used technique for semen collection in non-tractable wild species is electroejaculation. Samples collected using this method will provide information on sperm characteristics and fertility parameters in captive marmots.

VEILED CHAMELEON - Manipulation of the reproductive cycle in veiled chameleons (G. Mastromonaco, R. Pimm, B. Johnson, A. Lentini) REF No. 2011-05-04

Captive female reptiles are prone to the potential loss of body condition resulting from the continuous production of eggs, or loss of reproductive function due to pre- or post-ovulatory egg retention. There is great interest at this time in developing a reversible contraceptive to prevent loss of ovarian resources and body condition and to maintain reproductive function in valuable females. The goals of this study are to evaluate the effects of readily available contraceptives on reproductive hormone levels in female reptiles in an attempt to block egg production. Veiled chameleons (Chamaeleo calyptratus) will be used due to their size and ease of maintenance, but also because of our previous work characterizing the reproductive cycles of normal and egg-bound females. Contraceptive treatments will be initiated immediately following egg laying, at the start of the reproductive cycle. Fecal samples will be collected daily and assessed for fecal estrogen, progesterone and testosterone metabolites by enzyme immunoassay (previously validated for this species) for 2 cycles (~8 months). Changes in hormone levels, skin color patterns, behavior, and numbers of eggs laid will be compared among the treatment groups. This research will provide valuable information for the development of contraceptive protocols to assist with the management of captive reptile populations.

WOOD BISON - Assisted Reproductive Technologies as a Method of Embryo Production (G. Mastromonaco, A. King, P. Mackie, M. Franke, G. Crawshaw, Bison Reproduction Research Group [BRRG]) REF NO. 2008-02-01

Wood bison are currently listed as threatened and the conservation of the remaining free-ranging populations is at risk due to the ongoing presence of disease (tuberculosis, brucellosis). Reproductive biotechnologies may be the best way to preserve the germplasm of the remaining individuals and develop methods to produce non-infected offspring. Although related to domestic cattle, species-specific differences in bison reproduction have limited the success of reproductive techniques. The first major objective of the study is to examine basic mechanisms that are involved in embryo development. In vitro produced domestic bison embryos are used to investigate cellular parameters that provide us with valuable information to further our understanding of some of the problems related to embryo growth in vitro. The second major objective of the study is to assist the BRRG with the development of appropriate techniques for embryo production in bison, including ovarian synchronization, superovulation, artificial insemination and embryo transfer. The Toronto Zoo bison are an ideal group of study animals due to the free-ranging nature of their management. Their response to the treatments will more closely represent that of the animals in the wild. Differences in stress levels and other factors that affect reproductive function in these animals, compared to domesticated animals, may greatly influence the outcome of the applied techniques. These data will ultimately be beneficial in understanding why in vitro embryo production techniques have not been overly successful in a variety of bovid species.

3.5 Nutrition Research

AN EVALUATION OF BROWSE SILAGE PRODUCTION AS A FEED COMPONENT FOR ZOO HERBIVORES. (T. Lachance, J. Wensvoort and J. Atkinson).

This study was part of a M.Sc. study by thesis through the University of Guelph and has been completed in 2011. The MSc degree by thesis was successfully defended in 2012.

Browse is the collective term for edible leaves, twigs, bark, buds and flowers from trees and shrubs. The availability of browse is for many zoo animals an essential daily requirement for nutrition and welfare and there is a strong demand for browse at Toronto Zoo.

Scientific studies have indicated that browse provides unique nourishment and is essential for the animal's well-being. Zoo-animals that are genetically predisposed to consume browse and are provided significant amounts of it every day generally have better health, increased welfare and increased longevity. Common nutrients and also very specific compounds are provided by browse. Along with this supply comes the variable morphology of branches, volume and generally a low nutritional density typing browse as a "Slow Food" important to provide essential psychological stimulation for captive animals. For example: Recent research findings at Toronto Zoo (Gorilla behaviour/nutrition study 2010) indicate significantly reduced negative behaviour (i.e. Regurgitation and Re-ingestion of food), more time spent foraging and digesting by captive Gorillas when browse supply was increased daily.

At Toronto Zoo, the plant species suitable to be used as browse have already been identified and fresh browse is normally supplied from pruning in pavilions, greenhouses and open areas throughout the Zoo site; however, especially in the winter season the amount supplied is not enough. For this reason a research project has started to better provide preserved browse in the winter. Nutritional comparisons of browse silage and bark, packing browse silage partly-mechanical instead of manual and evaluations of browse harvesting were done. Besides the fresh browse, trees provided major amounts (approximately 20 truckloads per year) of branches (2-1/2 " thick) which are being used throughout the zoo as nutriment and enrichment. These branches are debarked by the animals and are very much preferred.

In order to better fulfill the large demand for browse during the summer, new sites dedicated for fresh browse supply had to be established inside the TZ perimeter fence and close to animal enclosures. The collection and packing for preservation of browse (i.e. browse silage for use in the winter) can be done farther away from enclosures because it is done with the mobile browse press.

Dedicated browse silage plantation

Collection and packing of browse silage has to be done efficiently as cost of labour is high. To secure efficiency, plantations have to be relatively close by, large and easily accessible with an efficient lay-out. These plantations require being limited to plants species already known to be acceptable to Zoo animals in general and having a high resilience against regular pruning. Before planting the soil needs to be prepared and tested, for residual herbicides. Planting should be in rows and spaced to allow efficient harvest. Advice has been obtained from a forestry specialist from the NRCan/Canadian Forest Service. Toronto Zoo has established one of such plantations (10.000 trees) in 2011, located just 10 minutes north of the Toronto Zoo on land arranged in cooperation with the Toronto Regional Conservation Authority (TRCA) and the Rouge Park (RP) and with help from NRCan/Canadian Forest Service and our community partners.

This project has been presented on the biannual 2011 Nutrition Advisory Group (NAG) conference in Kansas City, MO, USA and on the 2012 CAZA conference in Toronto, ON, Canada.

FORMULATION OF A NEW FEEDER CRICKET DIET AND DEVELOPMENT OF FEEDING PROCEDURES FOR FEEDER CRICKETS AT THE TORONTO ZOO (L. Attard, J. Wensvoort, J. Atkinson) REF No. 2005-10-01

The purpose of this study is to formulate a Toronto Zoo feeder cricket diet and to evaluate this diet to be used as a gut loading agent to provide improved and more balanced nutrition for reptiles and amphibians at the Toronto Zoo. This study is part of a M.Sc. study by thesis through the University of Guelph and experimentation is planned to be completed in 2012.

The first part involved the development of a new diet to feed to the crickets and for use as a dusting powder to improve the nutritive quality of the crickets. The second part of the study involves the examination of different cricket feeding strategies in order to determine which one provides the most nutritious crickets. This strategy will then evolve into a new feeding protocol which will be implemented throughout the Zoo in order to improve the nutritive quality of crickets as they are fed to the collection.
This project has been presented on the biannual 2011 Nutrition Advisory Group (NAG) conference in Kansas City, MO, USA and a MSc thesis is in preparation.

FUTURE RESEARCH INTO THE NUTRITION OF AMPHIBIANS AND REPTILES (J. Wensvoort, B. Johnson, A. Lentini, G. Crawshaw, L. Attard, T. Mason)

Strategies are currently worked out in cooperation with curators and veterinarians for further investigations in the next 10 years. These will include the dynamics of nutrients in feeder insects, the comparison of the nutritional values of a variety of feeder insects, the validation of a new cricket gut loading diet and investigations into the diets for tadpoles. It is currently considered as a Nutrition Intern or a Veterinary Resident project.

PILOT STUDY: PALATABILITY STUDY WITH SURPLUS INVERTEBRATES. (E. Lee, T. Mason and J. Wensvoort)

Insectivorous/omnivorous animals in their native environments will generally consume a wide range of insect species. In captivity such animals may not have the options to express these natural feeding behaviours which support a balanced diet and ensure that nutritional deficiencies do not develop.

A pilot study was carried out during the summer of 2011 in which several different surplus invertebrate species were fed to several insectivorous/omnivorous species. Observations were made and documented to establish the palatability of the invertebrate species.

Several successful prey and predator pairings have been identified. The collected data also indicate that palatable prey species can induce increased physical and mental activities in the form of predatory behaviours and learning.

There is a lot of scope in this project, including the dynamics of nutrients in feeder insects, the comparison of the nutritional values of a variety of feeder insects, comparisons of native diets with (captive) zoo diets, dynamics of nutritional behaviours and investigations into the diets for many species
On a larger scale this project has the potential to expand and encompass various fields in conservation, natural resource management and environmental impact measurement.

GORILLA BEHAVIOUR AND NUTRITION STUDY (J. Wensvoort, E. Di Nuzzo, Allison Von Slack and E. Hoellein-Less)

The purpose of this study was to ascertain the effect of a diet change on unnatural Regurgitation and Re-ingestion of Food (R/R) behaviour. There were two parts to the study. The first part of the study began with observations taken on exhibit starting April 16th for a period of 32 days. During this time the gorillas were on a diet of vegetables, fruit, gorilla chow/biscuits, gels, flax meal, tofu, browse/silage, hay, and

enrichment food including popcorn and cranberries. After this observation period ended, the gorillas were slowly transitioned onto a new diet consisting of vegetables, flax meal, tofu, unlimited fresh browse and enrichment food including almonds, sunflower seeds, and mixed shelled nuts. The second observation period began September 13th for a period of 14 days. The main differences in the two diets consisted of the absence of fruit and the addition of unlimited browse to the second diet. All gorillas received the new diet with the exception of Ngozi (nursing mother) and Nassir (infant) who received breakfast and dinner rations of gorilla chow and gel in addition to the new diet.

This study has been a great success because it has been found that by giving the gorillas more browse they have decreased the abnormal behaviour of R/R dramatically. In addition, foraging and feeding times seem to be increased and the gorillas may be moving towards a healthier lifestyle. By providing a variety of browse to the gorillas, they are occupied for longer periods of time and have a more natural method for foraging and eating. Quantity and variety of browse appear to both be important factors to consider when providing a suitable browse diet. As such, it is recommended that old browse be left on exhibit until consumed as dried browse offers further variety to the gorillas who seem to enjoy the differences provided by the dried leaves. Also, a small supply of fruit does not seem to affect the gorillas overall well-being negatively as they have been enjoying the apples from the apple browse during the study. Throughout the entire study, only one bout of repeated R/R could be linked to apple consumption. Overall, the gorillas showed positive outcomes during this study with a decrease in abnormal behaviour, an increase in foraging and feeding activity, and an overall weight loss to improve health. A paper is in preparation.

CAPTIVE STUIDIES TO IMPROVE DIET ESTIMATES AND BIOENERGETIC MODELLING OF POLAR BEARS IN THE WILD (G. Thiemann and B. Laforest of York University, I. Duncan of Guelph University, G. Crawshaw, J. Young, E. Di Nuzzo and J. Wensvoort of Toronto Zoo, C. Robbins of Washington State University, Peter Molnar of Princeton University, K. Rode of US Fish and Wildlife Service, S. Cherry of Parks Canada.)

Sea ice habitat in many parts of the Arctic is changing rapidly through the effects of climate change. Many species depend on the predictable availability of sea ice for such key natural processes as feeding, migration and reproduction. One species which depends heavily on the sea ice for all three of these processes is the polar bear. The ongoing reduction of sea ice habitat has led to predictions that the foraging patterns and energy budgets of polar bears will shift accordingly, given the reduced hunting time and altered prey availability associated with decreased ice cover. A deeper understanding of these foraging shifts, and their consequences for polar bear energy budgets, will allow scientists to better predict the effects of climate change on polar bear populations and give managers and policy makers the ability to make more informed management decisions. An understanding of polar bear nutritional physiology is critical for wild polar bear conservation, and can only be obtained through studies of captive polar bears.

By carefully observing and quantifying the amount of food the polar bears consume, and through a detailed observation of their energy allocation to maintenance, movement and growth, an energy budget can be created. The proposed study will validate and improve two widely employed techniques for estimating the diets of free-ranging predators: stable isotope analysis and fatty acid signature analysis. The polar bears in this study will be fed a controlled, nutritionally complete, highly palatable diet over a time period sufficient to allow their bodily tissues to incorporate the components of the diet in a predictable fashion. In coordination with the Toronto Zoo veterinary staff, and in correspondence with periods when the bears are scheduled to be immobilized, small samples of blood, fat, fur and claw will be collected in a way to minimize any pain or disturbance to the animal. These samples will then be analyzed to determine how dietary components are integrated into the polar bears' tissues. These data will then be used to develop improved models for estimating the diets of polar bears in the wild. The results of this study will

provide critical insights into the ecological impacts of ongoing and future environmental change on polar bears.

Within the framework of the above the following research projects were established at Toronto Zoo where implementation was possible.

- **A study of energy intake, growth and activity in a captive polar bear cub.**
The 'orphaned' polar bear cub, Hudson, provided a unique opportunity to study food (energy) intake, growth rate and activity in a growing polar bear. His daily food intake was regimented and intake and growth were measured and documented from 16 weeks of age until 1 year. During the summer of 2012 ethograms were made during a period of 6 weeks and local weather data were documented. These data will be combined and evaluated.

-Stable isotope and fatty acid signature validations.
Samples from a female polar bear (Aurora) were opportunistically obtained. Her "zoo diet" will be homogenized for sampling.

Two male polar bears (Inukshuk and Ganuk) currently stationed at the Cochrane Polar Bear habitat will be fed a mimicked wild diet (Meat bone and blubber) from sustainably harvested harp Seal (*Pagophilus groenlandicus*) or Ring Seal (*Pusa hispidia*) for a period of 8 -12 weeks. The diet will be homogenized and sampled. The bears will be immobilized and sampled after the feeding period.

These samples will be analysed for stable isotopes (carbon ^{13}C and nitrogen ^{15}N) and fatty acid profile and the results will be used for validation.

-**Validation of a body composition model as prepared by Molnar et al, 2009**.
Whenever the opportunity arises the body mass and the recumbent body length of polar bears will be measured and documented to validate Molnar's model.

Potential additional projects are:
-Calibration of photographic techniques for measuring body length to relate to recumbent body length.
-Collaboration in testing new Collar hardware.
-Body mass changes and appetite patterns in relation to season and psychological status.
-Development of Fecal Near Infra-Red Scans (FNIRS) related to diet.

MASS PRODUCING NATIVE INSECTS FOR THE PANAMA FROG RESCUE PROGRAM
(T. Mason, L. Perrotti of Roger Williams Park Zoo, Rhode Island)

For several years Toronto Zoo has helped with the Panama Frog Rescue Program run by Houston Zoo. This has involved financial and active aid directly involved with the frogs. In 2007, Lou Perrotti, Manager of Conservation Projects at Roger Williams Park Zoo in Rhode Island found out that EVACC, the El Valle Amphibian Conservation Center in Panama was having to collect insects from the wild to feed the 500 + frogs in their collection. He was asked to develop a system whereby native Panamanian insects could be mass reared to be used as food for the frogs. This would reduce the time taken in procuring the food, provide more consistent food for the frogs and reduce the impact on the insect populations in the wild. In 2008, Lou asked Tom Mason to join him in the program. In two trips to El Valle, the facility has been successful in developing methods of producing 4 species of katydids and taught staff at EVACC how to collect insect species such as termites in an efficient manner. Other invertebrates such as springtails and sow bugs have also been cultured. It is hoped that the systems developed will aid in the maintenance and conservation of the frogs and that what is learned can be transferred to similar conservation programs around the world.

POLAR BEAR ENERGETICS STUDY – Captive Studies to Improve Diet Estimates and Bioenergetics Modeling of Polar Bears in the Wild (G. Thiemann)

The proposed study will validate and improve two widely employed techniques for estimating the diets of free-ranging predators: stable isotope analysis and fatty acid signature analysis. The polar bears in this study will be fed a controlled, nutritionally complete, highly palatable diet over a time period sufficient to allow their tissues to incorporate the components of the diet in a predictable fashion.

In coordination with the Toronto Zoo veterinary staff, and in correspondence with periods when the bears are scheduled to be immobilized, small samples of blood, fat, fur and claw will be collected in a way to minimize any pain or disturbance to the animal. These samples will then be analyzed to determine how dietary components are integrated into the polar bears' tissues. These data will then be used to develop improved models for estimating the diets of polar bears in the wild. By carefully observing and quantifying the amount of food the polar bears consume, and through a detailed observation of their energy allocation to maintenance, movement and growth, an energy budget will be created. At this time the Zoo's bears will not be immobilized for this study alone, although this may be requested subsequently if there is no opportunity for sample collection. Attempts will be made to train animals for these procedures.

The results of this study will provide critical insights into the ecological impacts of ongoing and future environmental change on polar bears.

3.6 Behaviour Research

CHEETAHS - Cheetahs in Captivity: Behaviour, Husbandry, Biomechanics and Genetics (T. Quirke)
REF No. 2010-03-02

The project focuses mainly on the behaviour of captive cheetahs in relation to husbandry practices, as well as other variables in captivity in which cheetahs may be reacting behaviourally, e.g. visitors. The main goal of the research is to determine what factors cause observed cheetah behaviour in captivity. This information can then be used to understand the effect of captivity on cheetah behaviour, as well as possibly resulting in changes to husbandry practices in order to improve the behavioural diversity seen in captivity, while also decreasing the incidence of abnormal behaviours.

EFFECT OF VISITORS ON THE BEHAVIOUR OF ZOO ANIMALS (Dr. S. MacDonald)

The behavior of many species may be affected, both positively and negatively, by the presence of visitors. The number of visitors, traffic patterns, and noise may all have an impact on activity levels, social behavior, and overall health of the animals. This summer, the behavior of the Sumatran and Siberian tigers, as well as mandrills, will be assessed with the behavior of zoo visitors to those exhibit areas.

ORANGUTANS - Behavioural Assessment
(Dr. S. MacDonald, H. Marsh, L. Adams, S. Ritvo)

The effects and documentation of effective enrichment techniques, including finger-painting, spatial foraging tasks, and computer touch-screen games will be recorded. The purpose of these tasks is to keep the orangutans mentally stimulated and occupied while 'off exhibit' in the holding area. All of the orangutans, including the juveniles, participate enthusiastically in the various 'games'.

POLAR BEARS - Ongoing behavioural assessment (Dr. S. MacDonald, K, Kelly, M. Franke)

Behavioral observations have been done on a regular basis since 2009 to assess how the bears have adapted to their new exhibit, and to each other. Activity levels (including mating behaviors, relative frequency of play and stereotypical behaviors such as pacing) are assessed.

POLAR BEARS – Olfactory Communication in Polar Bears - Implications for Conservation in the Face of Increasing Habitat Fragmentation (M. Owen, R. Swaisgood) REF No. 2010-03-01

Polar bears are largely solitary and breed seasonally. As such, the need to find appropriate mates at the right time is dependent upon effective, and long-range, social communication. Intra-specific communication in the polar bear is not well understood. Theoretically, polar bears should rely on olfactory signals, especially during the early phases of estrus to locate appropriate mates. The goal of this research is to determine whether chemical communication may be an important part of intra-specific communication for the polar bear. Scent discrimination tests will be performed on captive adult polar bears and to test the differential responsiveness to male versus female pedal scents, as well as estrus versus non-estrus females. This study utilizes pedal swabs that have been collected from wild bears on Alaska's North Slope. Samples will be presented to captive bears at a variety of N. American zoos. Bears will have olfactory access only to the scents and gustatory or tactile access will be precluded during scent presentation. Scents will be presented to subject bears in a plexi-glass "sandwich." Data collection during scent presentation trials will follow methods developed and used in previous studies with polar bears and giant pandas. All scent presentations will be videotaped and behavioural responses will be decoded.

Polar Bear Provincial Park –Toronto Zoo ESRF supports studies on polar bear health, status and determines the effects of global change on Polar Bear populations in the region.

SUMATRAN AND SIBERIAN TIGERS, CLOUDED AND SNOW LEOPARDS - Scent as an Enrichment Tool in Felines (Dr. S. MacDonald)

The objective of this study is to examine the use of scents, such as perfume, as enrichment devices. Scents will be placed throughout the animals' exhibit, and the behaviour of the felines will be recorded to determine which scents provide the most positive stimulation.

VANCOUVER ISLAND MARMOTS - Maternal care and pup development study (Dr. S. MacDonald, Jean-Francois Nankoo, M. Franke)

Maternal behavior toward altricial young is an important predictor of the pup's resistance to stress in later life. Maternal behavior has not been studied in Vancouver Island marmots, Canada's most endangered mammal, and thus we know little about what types of behaviors occur, and whether there are individual differences between marmot mothers in maternal care. In this study, 24-hour videotapes of the first seven days post-parturition will be studied for four pairs of marmots. Maternal and paternal behavior will be examined, including amount and frequency of pup care (grooming, licking, nursing), number and duration of nest leaves by the mother, and parental interactions.

Horticulture Initiatives

The Toronto Zoo is about much more than just animals! You may be surprised to know that the Zoo's plant collection is even more extensive than its animal collection. The programs developed in the Horticulture Unit include conservation studies of endangered plants and habitats and an international seed exchange. They are also involved in restoration ecology, wetland and meadow creation, and forest recovery projects that occur on and off site

4. HORTICULTURE INITIATIVES

4.1 Horticulture Centre

Horticulture's heavy equipment operation is a vital link to other units on site who depend on our trained drivers and vehicles to regularly assist them in providing continuous uninterrupted service to the visiting public.

All staff undertakes tropical plant maintenance in the Zoo's five pavilions. With limited light sources and plant material that is continuously stressed by indoor living, these enclosed environments provide a special challenge. Constant refreshing of distressed specimens is an ongoing activity. In the pavilions insect pests tend to multiply exponentially if given the opportunity. Horticulture staffs are well versed in biocontrol agents to curb their numbers. No harsh chemicals are used in pavilions or on site to control insect pests because of the potential threat to zoo animals and the fragile ecology of the Rouge Valley. This poses a perpetual pest control challenge for supervisors and staff of the Horticulture branch.

A functional greenhouse is also maintained behind the scenes and serves as a plant hospital for the restoration of exhibit-worn plants, plant propagation and production, a base of operations for over-wintering, and a repository for vital stock plants that are continuously drawn upon for additional greenery in the pavilions.

Horticulture's heavy equipment and operators are also instrumental in the collection of various materials on site. Organic waste, including animal manures and food waste from administrative facilities, is regularly collected and taken to Toronto Zoo's functional compost facility. From here, processed (composted) organic material is reintroduced as top dressing for lawns and as an organic supplement for flower and shrub beds.

Materials collection also includes the disposal of inorganic material as well. Disposable waste is regularly taken to the transfer site, and contracted removal of recyclable waste takes place on a regular basis. Hazardous waste removal is also arranged through a licensed contractor. New recycling programs implemented this past year, include batteries, ink and laser printer cartridges and digital cameras.

In winter the heavy equipment is outfitted with an assortment of snow removal equipment to maintain the site both for winter visitors and the keepers who must tend to the animals 365 days a year. Salting/sanding the roads, ploughing, and ice-melting pedestrian pathways all become the responsibility of Horticulture staff at this time of year. When spring arrives, a street sweeper and heavy equipment sweeper attachment clear the roads of winter granular.

Several staff is members of the Association of Zoological Horticulture (AZH). AZH is an organization that encourages horticulture staff from all over the world to communicate and share their ideas, successes and failures when dealing with exhibits in a Zoo setting. The association offers courses that the staff can take to further their knowledge of browse material, and exhibit design.

Horticulture is involved in a pilot study to investigate the effectiveness of injecting Ash trees with a substance to protect them from the invasive Emerald Ash borer beetle. They are also actively planting native tree species to replace Ash trees that are lost.

4.2 Botany

LANDSCAPE DEVELOPMENT

Creating and renovating gardens, animal exhibits and picnic areas are ongoing projects for the Horticulture staff. Ongoing projects include the continuous updated design and planting of Kids Zoo, design and installation of flower beds flanking a new portable classroom, creating recreational meadow areas as outdoor classroom areas. Privacy berms planted with an eclectic combination of native plant material add an environmentally acceptable exclusivity to functions held at picnic facilities on site.

CULTURAL CONNECTIONS

Shamba Farm - With the cooperation of Horticulture staff and African Cultural Advisors, an authentic West African garden is established annually in Savannah. Volunteers from the African Community plant, weed, and then harvest the garden. Plants typical of West Africa are sourced by the Curatorial Gardener, and the volunteers devise a planting scheme that imitates techniques typical of the region.

PLANT RECORD SYSTEM

The Plant collection continues to be inventoried and will be an ongoing project. Site identification codes have been assigned to the planting beds in the pavilions, and will soon be completed for outside beds. A label engraver donated to Horticulture's Botany unit by *Scotts Canada Ltd.* has already produced outdoor quality plastic labels to permanently identify notable plant species in several pavilions. Visible plant identification will raise the profile of the plant collection to Zoo visitors and the education value of the botanical collection. It is speculated that plant identification will encourage a greater number of gardeners to visit the Zoo.

BROWSE (C. Wharton, Staff)

Horticulture staff is cooperating with the curator of invertebrates to determine the best techniques for supplying sufficient insect browse all year round. A more formal browse plant nursery for the invertebrates has been established and a more reliable supply of certain browse material is expected to become available in future years as the plants mature.

The gardening staff takes an ongoing interest in providing browse to animals throughout the Zoo. Staff continues to establish browse-able material at various areas around site in an attempt to provide more conveniently available living plant material to the animals. Browse material that has been planted in the past include bamboo, apple trees,

willow, raspberries, and popular. Landscaping completed at the Penguin Project in 2010 included material that could be browsed for animals in the surrounding area.

AFRICAN RAINFOREST PAVILION

The African Rainforest Pavilion was renovated with a collection of plants native to Africa. The staff contributed to the success of the newly renovated area, and continues to add more plants to enhance the animal exhibits and planting beds surrounding them.

4.3 Natural Areas Management

WATERWAY

In 2009 a Waterway Committee was formed and consists of Curatorial, Horticulture and Facilities and Services staff. The committee will sit 4-5 times per year and will report to the CEO. The committee builds upon over 20 years of knowledge from a dedicated group of veteran staff, and will work towards implementing recommendations from past studies to improve water quality and wildlife value.

The artificial waterway has a history of chronic problems associated with storm water runoff, nitrogen loading, and algal blooms notably during the summer heat. The waterway is a partially closed loop system with pumps at the terminus that send water flow back to a waterfall at the system head. Some runoff at the terminus is held in a pond at the south end of the Zoo. The system is approximately 2km long and extends throughout the tablelands of the site.

A Waterway Study was initiated at the end of 2004. After careful investigation and discussion with the Zoo, Harrington and Hoyle Ltd. landscape architects proposed man-made structures such as fencing to restrict movement of waterfowl, as well as dredging and wetland construction. Some recommendations from the study were implemented, and many were not. Horticulture staff restricts the use of waterway water for irrigation, particularly on turf areas accessible by the public. This study will continue to be used to plan future improvements to the waterway.

Due to the size and nature of this project, as well as the Zoo's high environmental expectations, we anticipate waterway improvements to be ongoing for a number of years.

EDUCATION PORTABLE LANDSCAPE NATURALIZATION

Horticulture staff, the Adopt-A-Pond Wetland Conservation Program, the Education branch, and GEZT members collaborated on an exciting new outdoor exhibit behind the Discovery Zone, next to the Education Portable. This area was transformed into a celebration of local, native plant species, and into habitat for native animal species like toads, frogs, butterflies, birds, and insects of all kinds. The display is large and includes a "Carolinian" section, a boreal section, and a temperate deciduous zone section. Some species of plants were purchased, but many were salvaged from other construction projects and development on the Zoo site. Notably,

2 hop trees (*Ptelea trifoliata)* were found by Horticulture staff and transplanted in the emerging gardens. Hop trees are a rare tree species in Ontario, maybe only 600-800 individuals total, and are a member of *Rutaceae*, known as the Citrus family. The 2 individuals found and planted in the "garden" may well represent the most northern extent of the species range. In addition, we will be building a small wetland and restoring the riparian edge of the waterway to accommodate the colonization of native insects, frogs and birds.

AMERICAS PICNIC AREA LANDSCAPE NATURALIZATION

As part of the North Zoo Site Redevelopment project – Phase I Tundra Trek, Horticulture staff restored a 0.6Ha parcel of forest and designed a unique picnic site for Zoo visitors. The site was cleared of invasive species, including an infestation of dog-strangling vine and replanted with our own native plants grown in the greenhouses and other native plants from local providers. Picnic tables and a limestone/mulch pathway allow visitors to eat their lunch or just have a break in a relatively secluded wooded grove! The site is now a demonstration piece for visitors on the natural ecosystems we have in Ontario.

4.4 Invasive Species Management Program

Currently, Toronto Zoo is monitoring and actively managing several invasive species threatening the Great Lakes and the Rouge Valley, including:

CANADA GOOSE (*Branta canadensis*)

A large population of Canada Goose remains on Zoo grounds throughout the year and causes detrimental eutrophication in our waterways. Goose feces is either directly deposited into waterways or it leaches in via rain and run-off. The Toronto Zoo is currently managing the growing population by removing all goose eggs on site. Several techniques have also been used to eliminate or decrease the goose population have been attempted, including:

- A laser gun: a concentrated red laser beam projected towards the geese, aimed to intimidate the birds; a non-invasive deterrent
- Egg-oiling: In the spring, all nests are located and eggs are oiled. This method has substantially decreased the number of goslings on-site
- Horticulture staff and volunteers planted trees and shrubs along the waterway to reduce the movement of geese from the waterway to the pathways during moulting season. Since Canada geese prefer open grassy areas, the number of geese can be reduced on site by creating natural areas with meadows and forests.

GARLIC MUSTARD (*Alliaria petiolata*)

What is it?

- An invasive species; the UN has proclaimed invasive alien species as the second leading threat to biodiversity globally.
- Garlic mustard is a member of the mustard family and originates from Europe and parts of Asia and Africa
- The biennial plant was introduced to North America in the 1860s where it was used for culinary and medicinal purposes.

What's the big deal?

- Garlic mustard, when established, has the ability to greatly alter the soil composition, killing off mycorrhizal fungi communities that are necessary for native plant growth and success (this plant displaces and strangles native vegetation and tree saplings).

- This alteration results in the loss of native flora and domination of garlic mustard, leading to the creation of monocultures. Unlike in their native ranges, there is a lack of herbivory which greatly increases their competitive ability and subsequent chance of survival.
- Garlic mustard populations in the Great Lakes basin has exploded in the last 10-20 years, and many woodland areas are threatened

What is being done at the Toronto Zoo?

Garlic mustard has become a prominent species within the Rouge Park and Toronto Zoo site. A scientifically approved management technique is to pull the plants during the flowering period in mid-May, and continue to do so until the seed bank is exhausted. Seeds remain dormant in the soil for 5 years. Disturbed soil should ideally be replanted with native ephemeral flowers, shrubs and tree species.

In 2009, the Zoo and community partners pulled over 4200 pounds of Garlic Mustard in the Annual Garlic Mustard Pull! The following day a group of high school students joined CEW and Horticulture staff and planted 350 native ephemeral flowers, several shrubs and a ceremonial tree.

In 2010, the Zoo and partners from Symcor, TELUS, XEROX, Leaf (Local Enhancement and Appreciation of Forests), Seaton House, University of Toronto and Anishinaabe First Nation Elders, pulled 4 tonnes of garlic mustard out of ~12Ha of the Core Woods area of the Zoo (a relative fragment of the Rouge Park) and replaced with over 750 native shrubs and forest plants.

With continuing efforts for the next several years the Toronto Zoo hopes to significantly reduce the garlic mustard population within the zoo.

DOG STRANGLER VINE (*Vincetoxicum rossicum*)

What is it?

Dog-strangling vine (DSV) or Pale Swallow-wort is:

- An herbaceous perennial native to Ukraine and Parts of Russia.
- Member of the Milkweed Family.
- DSV spreads rapidly as it reproduces through seed dispersal and rhizome growth.

What's the Big Deal?

- DSV is found in areas where there have been moderate disturbances and where gaps in the canopy allow DSV colonies to establish.
- These vines are aggressive, forming dense colonies and choking out other flora such as trees and shrubs.
- Dog-strangling vine populations thrive because there are no native species present to consume and control them. An effective method for DSV removal has not yet been determined. However, both mechanical and chemical control strategies are used to help limit the spread of species.

What is being done at the Toronto Zoo?

The Toronto Zoo in partnership with several universities is conducting studies on site to quantify mechanical and biological removal applications for DSV. These studies will hopefully give insight into better management methodology of DSV in the Toronto Zoo site and surrounding areas. DSV samples are currently collected from the Toronto Zoo and Highland Creek (University of Toronto Scarborough) to be used in research. In some situations pesticides must be used to buffer our native plant and woodland areas from the threat of DSV monocultures.

ZOO PLOT

The plots at the zoo were set up to compare different methods of suppressing or controlling the growth of the Dog Strangling Vine (DSV), an invasive plant species. Two methods of suppression are being compared, one using mulch and the other using both mulch and plastic placed on the ground. In order to compare the effectiveness of these conditions at suppressing DSV growth, the number of DSV plants growing in each condition is being counted and the heights of the DSV plants are being recorded. In addition, the state (healthy, damaged) of the DSV plants is also being noted. Furthermore, the plants growing in the plots with DSV are being identified to see which plant species are able to coexist or compete with DSV. These two experimental plots are then compared to a control plot, where the DSV is growing normally with no mulch or plastic to see if the experimental conditions are actually effective in controlling the growth of DSV. The results from these plots can contribute to the design of an effective method to control the growth of the invasive DSV.

Green Initiatives

An objective of the 21st century zoo or aquarium is to demonstrate to visitors the connection between wildlife conservation and human sustainable development. The Toronto Zoo has a strong record of environmental protection and of energy efficient operation management. The Zoo has stimulated staff, volunteers and the public to live sustainably in balance with Nature.

Education and passing on our passion for biodiversity conservation is something at the heart of our Toronto Zoo mission. By informing visitors about the amazing animals we have in our collection, engaging them in discussions on conservation issues and providing tangible solutions to people, we hope to foster an appreciation of all living things and an attitude towards ecosystem stewardship, and encourage people to lessen their ecological footprint on the earth.

5. GREEN INITIATIVES

5.1 Green Vision Statement

The Toronto Zoo has a strong record of environmental protection and of energy efficient operation management. The Zoo has stimulated staff, volunteers and the public to live sustainably in balance with Nature. We understand and accept that climate change is a real threat to earth's biodiversity, perhaps most acutely to our own species. We accept that humans are largely responsible for global warming as a result of our use of non-renewable energy resources and the emission of greenhouse gases. We encourage people to lessen their ecological footprint on the earth.

5.2 Green Eco-Zoo Team

The Green Eco-Zoo Team (GEZT) is a non-technical advisory committee to the General Manager. The organizational structure of the GEZT incorporates all divisions and units of the Zoo.

The GEZT was created in 2007 and replaced the Environmental Protection Committee that had been in place since 1995. The "Green Team" addresses the environmental impacts of Zoo operations, policies and procedures, and makes recommendations that will lessen our ecological footprint in the Rouge Valley and on the earth. Dr. W. Rapley and Nia Gibson co-chair the GEZT. Members appointed to the committee are from a wide range of Zoo divisions and units. Zoo staff and volunteers are encouraged to address issues concerning our environmental impact on the site.

5.3 Green Plan 2010-2015

The Green Eco-Zoo Team (GEZT) met with a professional facilitator over 3 intense meetings in 2007 to develop the Green Plan 2007-2010.
In September 2010, the new Green Plan 2010-2015: "Wildlife Conservation and Sustainable Living 2011" was developed and was approved by the Board of Management on April 7, 2011. The action-based, goal oriented plan will guide the long-term sustainability of Zoo operations and our impact on the Rouge Park and, more holistically, our earth. The initial document represented our short-term goals while providing the framework for a carbon-neutral Zoo by 2027. The Green Plan sets out ambitious targets of a 95% reduction of GHG emissions and a 40% reduction in water consumption by 2027. Three broad strategies embodied the Plan: 1) creating a green corporate culture at the Zoo, 2) developing and communicating leading edge education for sustainable development programs at the local, regional and national levels, and 3) managing Zoo operations, facilities and natural areas in a sustainable way. Nine 3-year action steps were developed for each broad strategy. Toronto Zoo staff and volunteers embraced the plan and achieved 23 of the 27 action steps.

The GEZT continue to meet to discuss new initiatives and monitor existing ones, including our water and energy use, and waste production.

They are discussed in this and future CEW Activity reports.

5.4 Green Policies and Reports

Environment First Policy (GEN-001)

The purpose of this policy is to encourage operational practices that promote a high standard of environmental protection. As a result, the Zoo has undertaken many environmental initiatives in waste and pollution reduction, energy and water conservation, and habitat restoration. The Environmental First Policy was updated and approved by the Green Eco-Zoo Team in November 2007.

Environmental Purchasing Policy (FIN-007)

The purpose of this policy is to encourage eco-ethical partnerships with our many suppliers. The use of this policy has created opportunities for our Graphics, Custodial and Stores Units to source new products that illustrate a marked decrease in their overall ecological footprint. The Environmental Purchasing Policy was updated and approved by the Green Eco-Zoo Team in November 2007.

Environmental Initiatives Report – Annual

The first Environmental Initiatives Report was submitted to the Board of Management in 1995. This annual report summarizes the activities and items initiated across all divisions in the current year. The Chief Executive Officer presents this report to the Board of Management in April of a given year.

Toronto Zoo Greenprint – 2007

Since the inception of the Zoo in 1974, staff and volunteers have been on the leading edge of the environmental movement. Over the years, many small and large "green" initiatives have occurred, thanks to our dedicated staff and volunteer base. Although the Environmental Protection Committee (EPC) formed in 1995 to account for this movement and to maintain documents on progress, there was still no single source that staff and volunteers could turn to for information on past activities. Linda Ervine, CEW staff emeritus, authored an exhaustive account of all activities from 1989 through to 2006. This document is dynamic and will continue to be updated by GEZT members, incorporating all new initiatives and reports so that we will have an accurate account of our progress toward our targets described in the Green Plan (described above). The Greenprint does need to be printed, as the virtual Table of Contents allows users to surf the large document much like an online webpage.

5.5 Green Events, Programs and Projects

GEZT staff members from the Conservation, Education and Research division coordinate and develop events for Zoo staff, volunteers and visitors, as well as the broader community. In 2011/12, the several events were attended and lectures/workshops/presentations were offered.
Events included:

- Solar cooling feasibility at the Education Centre and Retail Shop,
- Participation in Earth Hour (March),
- Earth Day – Party For The Planet (April),
- International Biodiversity Day (May),
- Presentations and seminars to Zoo Camps and programs,
- 'Green' training to Zoo volunteers and Camp Councillors,
- Booth at the City of Toronto Live Green Festival,
- Zoo Camp, Critter Crew, EnviroRangers and Operation Conservation include education for sustainable development messages (waste management, energy efficiencies),
- University lectures, including McGill University, University of Toronto at Scarborough, Trent University, McMaster University and the University of Guelph,

- Inaugural National Tree Day was celebrated across Canada, with the Toronto Zoo being chosen as one of the Ontario locations,
- Tree planting events with Trees Ontario and Acres for the Atmosphere,
- Participation in National Forest Week (September),
- Great Canadian Shoreline Clean-up (September),
- E-blasts of newsletters, event invitations, special projects, and zoo news and used online order and donation forms and event ticketing.
- Custodial staff have implemented using microfiber clothes to reduce chemical cleaners used
- Custodial staff are now using cleaning product capsules to reduce the amount of plastic waste created

ICE Bear System

The latest green technology is the Ice Bear storage system and can be seen just outside the Caribou Café. The Ice Bear unit uses off-peak electricity in the middle of the night to make a big block of ice. The ice then slowly melts through-out the next day. This energy is used during the day in the building's air conditioning system to cool the air! If this type of technology is used in cooling systems around the city, our daytime peak demand will be lower, and the need to build more power stations to cope with peak demand will be reduced. More power stations mean more greenhouse gases being emitted into the atmosphere. Greenhouse gases increase the global warming effect; this results in less sea ice for polar bears. By reducing peak demand this type of technology can reduce greenhouse gas emissions.

Biogas Facility

In December 2010, a MOU was signed with ZooShare Biogas Co-operative Inc. a non-profit, non-share capital renewable energy co-operative to build and operate a 500 kW biogas facility. The facility will be built on three hectares of land east of Meadowvale Road and will combine Zoo waste and food waste from a major grocery retailer to be converted into electricity, heat and fertilizer. The project represents an investment of $ 5.4 million, the majority of which will be raised from the community through the sale of Community Bonds. The project will be the first co-operatively owned biogas plant in Canada and the first zoo-based biogas plant of its kind in North America. Using renewable energy sources, such as biogas helps in the fight against climate change by reducing greenhouse gas emissions into the atmosphere. Zooshare have sold many of the Founders Club bonds and community bonds will be available spring 2013.

More information about ZooShare, the biogas project at the Toronto Zoo and its progress are available at www.zooshare.ca.

Solar Photovoltaic Panels - Aurora borealis Weather Station

Facilities and Services, Exhibit Design and CEW staff continue to demonstrate sustainable building design one step at a time. The new 1.2KW solar PV system on the Aurora Borealis Weather Station provides electricity to the fan system in the building and demonstrates to the public the benefits to renewable electricity systems used in the high arctic where fuel is more expensive and the sun shines continuously for half the year. Although the system is small and is not responsible for offsetting significant emissions, this is a first step for the Zoo toward implementing larger-scale solar PV systems on-site.

Solar Thermal Panels – Administration Support Centre

The roof of the Toronto Zoo Administrative Support Centre has been equipped with 50 solar thermal panels. The system transfers the energy from the sun to the hot water supply for the building – reducing carbon dioxide by 40 tonnes per year and natural gas use by 50%.

The roof of the Toronto Zoo Administrative Support Centre has been equipped with 50 solar thermal panels. The system transfers the energy from the sun to the hot water supply for the building – reducing carbon dioxide by 40 tonnes per year and natural gas use by 50%.

PhoneApes™ Program

In March 2010, the Toronto Zoo launched their very own cell phone recycling program named "Phone Apes".

Since 2006, the Toronto Zoo has provided cell phone recycling services and collaborated with 145 participating zoos, aquariums and wildlife institutions across North America toward educating visitors and the public about the negative impact of the growing cell phone industry on wildlife, particularly on Gorillas and their habitat in Africa. Cell phone usage has spiked dramatically in the past several years. In Canada alone, over 20 million phones are retired every year. Cell phones contain a metal called tantalum which is excessively mined in Africa; endangering and destroying Gorilla habitat, as well as the habitat of a great many other species. By recycling cell phones, pagers, blackberries, and other electronic devices, we ultimately decrease the demand for the raw materials used to make them. All money raised by the Toronto Zoo is donated to in situ conservation of lowland gorillas.

Our program was awarded top honors among North American zoos, aquaria and wildlife organizations in 2007 and 2009. The Toronto Zoo has collected 20,787 phones between 2007 and November 2012 and remains the most trusted cell phone recycler in the Greater Toronto Area & throughout Ontario

Green Macaques! Project

In June 2008, the Toronto Zoo opened its first geothermal exhibit for the lion-tailed macaques. The goal of the Green Macaques! Project is to raise awareness about energy demand for space heating and cooling in Ontario, and to educate and inspire our visitors about sustainable alternatives. This exhibit uses the earth's radiant energy to heat and cool itself throughout the year. Conventional space heating and cooling represents ~60% of energy use in Ontario, and the dominant source of fuel comes from the non-renewable sector. Conservation and energy efficiency is very important, but to achieve sustainable development a change in fuel source is necessary as well. Natural Resources Canada states that geothermal systems (renewable energy), have the least environmental impact of any space heating technology on the market today.

The Green Macaques! Project was generously funded by the Ontario Ministry of Energy's Community Conservation Initiative, the Toronto Atmospheric Fund and Bullfrog Power. The exhibit demonstrates the power of geothermal energy on a scale understandable by students and our public and is currently undergoing expansion. The Toronto Zoo is in the process of installing an earth wall in the exhibit where the geothermal piping will heat.

The 112m^2 (1200sf) outdoor area of the exhibit will be an oasis of heat in the middle of winter, contrasted against the snow and ice of the Rouge Valley. The Green Macaques! Project will visually and textually demonstrate geothermal technology in action, and visitors will be permitted to touch and feel the warmth

of a (non-animal) section of the exhibit. The project was completed February 2009 – check the website **www.torontozoo.ca/conservation** for updates.

Carpooling Program

Over 500 zoo employees must commute to and from the zoo from areas all across Southern Ontario. To alleviate the carbon footprint, CEW- staff initiated the Zoo's first Carpooling Program in October 2009. The program objective is to make the commute to and from the zoo more convenient, while significantly reducing gas emissions and our overall carbon footprint.

The program continues to grow as more employees sign up. Two large laminated maps of the area encompassing employee travel were posted in the Administrative Support-Centre and the Front Entrance buildings and a colour-coded sticker system was used to allow "drivers" and "passengers" to easily determine where they could provide and find rides, respectively.

In 2012, the Carpooling Program has reserved 5 parking spaces for carpoolers consisting of 3 or more occupants, as well as hybrid and electric vehicles. This is an incentive to encourage staff to choose more environmentally friendly ways to get to work.

Green Roofs

Green roofs, also known as 'living roofs' or 'eco-roofs', are the wave of the future in sustainable design, and the Toronto Zoo is surfin' right along with them! While the term 'green roof' could mean many things, it refers here to a roof with one or more extra membranes, including a waterproof and root-proof section that is covered by various types of vegetation. Below, an illustration of the various layers that makes up a green roof.

What will green roofs do for the Zoo and its visitors?

- Filter particles from the air and turn carbon dioxide into oxygen. 1.0 m^2 (10.76 $ft.^2$) of uncut grass can remove 0.2 kg of particulates from the air and fulfill one person's oxygen requirements during one year!

- Cool air around the building, reducing the *urban heat island effect*. This effect describes the phenomenon of cities being several degrees hotter than the surrounding countryside due to the replacement of natural landscape with hard, impermeable surfaces. Recent studies have indicated that greening just 6% of the City of Toronto's rooftops could reduce summer temperatures by 1 – 2℃, saving an estimated $1.0 m illion in energy costs/year.

Australasia green roof – June 2008

Australasia green roof –August 2010

Polar bear holding, Tundra Trek, 5000sf intensive green roof – Year 2 (2010)

General Conservation Initiatives by Zoo Staff and Volunteers


Browse

CEO's Update

Zoo staff and volunteers are by nature environmentalists. Many "green" efforts happen every day at the Zoo, and we list just a few of them here:

- "Think Recycle" (GreenTEc) boxes have been placed on site to collect cameras, ink cartridges, and batteries
- Zoo restaurants provide shade-grown coffee
- Paperless Meetings are regularly held by PR staff, GEZT meetings, and large AHC meetings
- Marketing Dept. reduced the number of media kits printed by posting resources online
- Zoo newsletter, Browse electronically issued by Education Dept. and Development.
- Zoo staff and volunteers are provided with stainless steel water bottles (sponsored by Klean Kanteen™) to encourage the healthy use of municipal water
- Lights are turned off when facilities are not in use, including walk-in freezers in the ANC
- LCD computer monitors are replacing older, less efficient models
- Small compost containers provided to individual units for organic matter have succeeded in diverting useful organic waste from the landfill
- Printed banners for marketing promotions have increased since 2003. Graphics staff has been successfully recycling worn-out or outdated banners as drop sheets for the numerous painting projects around the Zoo
- Wildlife Care staff routinely evaluate protocols to increase energy and water conservation
- Facilities and Services and Project Management staff adhere to and encourage consultants to adhere to the City of Toronto Green Development Standard (links found on the Zoo website)

5.6 Energy and Waste Management

Energy Management

Achieving our Green Plan targets depends equally on staff conservation behaviour, and decisions made and projects completed by our Facilities and Services staff. Energy and water consumption and waste production must be reduced substantially over the next 20 years if we are to lower or eliminate our ecological footprint on the Rouge Valley ecosystem and the earth.

Zoo operations required over **314,500,000 litres of treated, municipal water in 2008**, down 222% since 2007, but almost equal to 2005 usage levels. Staff respect water as a fundamental resource and conserve wherever possible, but most operations, from Wildlife Care to Splash Island to public services, must also be respected. It will require creativity, wise use of new technologies, and a continued culture of conservation to reach our goal of 40% reduction (from 1990 levels) by 2027.

The total cost of all fuel, including the 22.3% water component, for 2011 was $2,466,500. It is, therefore, in our collective best interest to achieve our Green Plan targets.

The Total GHG Emissions by fuel type (tonnes of CO_2) for 2006, 2007, 2008, 2009, and 2010 (after adjusting for billing period, weather conditions and energy costs). Our cumulative target goal for 2012 is also shown.

Year	Electricity	Natural Gas	Heating Oil	Petrol	Diesel	Propane	*TOTAL*
2007	2546	3556	51	199	131	68	**6550**
2008	2567	3434	51	170	160	79	**6460**
2009	2587	3578	42	174	187	84	**6652**
2010	2619	3206	47	136	69	44	**6120**
2011	2608	3504	51	150	56	50	**6419**
2012 target (6% below 1990 level)							**5405**

Smog Alert Plan

Staff continued to implement a Smog Alert Plan for the Zoo as a component of the City of Toronto Corporate Smog Alert Response Plan. The plan is activated on Smog Alert days and Zoo operations are modified to reduce emissions that contribute to poor air quality and smog. We have committed to suspend pesticide spraying; postpone non-essential use of vehicles on and off site for deliveries and errands; suspend the use of oil-based paints, solvent and cleaners unless required for disinfection; suspend the use of horticultural equipment and sweepers except where required for public or animal health and safety; and refuel essential vehicles early in the morning or after sundown whenever possible. The GEZT reviewed the existing plan further improving the Zoo's contribution to air quality.

Waste Management

Co-mingled recycling started in earnest at the Zoo in 2002 in response to the closure of the Keele Valley landfill site and the inevitable levy of 64$/tonne placed on garbage by the City of Toronto. Our waste diversion rate in 2003 of 31% was the start of our aggressive plan to divert >80% by 2010, in alignment with City operations. In 2006, our diversion rate was just over 50% and was 54% in 2007. New blue boxes were added to keeper rooms and office areas, and the Get A G.R.I.P Program! Has organized area monitors' to coordinate staff and volunteer participation in this important process.

Management of our organic or wet waste is important because we produce ~2000 tonnes per year. In 2007, the Zoo processed 2150 tonnes of organic waste; processing includes the collection of waste from animal areas, offices and other buildings, and the Horticulture Centre. In 2007, a detailed concept report was submitted to Division Heads by the GEZT on the feasibility of anaerobic digestion as a means to harness energy stored in organic waste. In December 2010, a MOU was signed with ZooShare Biogas Co-operative Inc. a non-profit, non-share capital renewable energy co-operative to build and operate a 500 kW biogas facility.

A comprehensive composting system was initiated on site in 2003 to better educate school groups continues to be a valuable example of organic recycling. Participants in Zoo programs are made aware of the system's function and importance. Individual units equipped with small green compost containers continues to provide minor savings for the Zoo as the weight of organic waste that can be composted is diverted from the landfill.

The total waste (metric tonnes) diverted from landfills itemized by material and year is provided below:

MATERIAL	2007	2008	2009	2010	2011
Bones	33	16.8	17.1	4.36	4.2
Cardboard	63	69	42	44.57	44.06
Co-mingled recyclables	149	128	132	184.87	176.11
Fluorescent light-bulbs	0.25	.31	.38	1.12	0.95
Hazardous waste products	0.75	4.1	5.2	4.2	5.9
Organic waste	2050	2130	28	29.5	30.6
Paper	4.1	9.5	6.2	6.8	8.2
Plastics	2.5	6.7	5.8	4.3	-
Skids / Pallets	1.6	10.5	11.2	22	14
Wood	36	38	27	47.55	23.93
Misc. Items*	7.1	49.5	81.2	95.6	181.68
Total weight recycled	**308 tonnes**	**335 tonnes**	**361 tonnes**	**445 tonnes**	**490.53**
Total weight to landfill	**255 tonnes**	**245 tonnes**	**182 tonnes**	**189 tonnes**	**204 tonnes**
Waste Diversion	**55%**	**58%**	**66%**	**70%**	**70%**

* Misc. Items include oil filters, batteries, scrap metal, tires, cell phones, and furniture

Transit

The Transit Unit is responsible for the maintenance of 22 medium or large vans and trucks, 10 very large trucks, a garbage packer, an ambulance, several all-purpose Gators, a fleet of electric golf carts, and a fleet of propane powered Zoomobiles. We take the environmental impact of our vehicles seriously at the Zoo. Our Transit staff has initiated many improvements, for example the conversion of 12 vehicles to propane/gas hybrid engines. The conversion allows for the operation of vehicles on smog days. In 2007 and 2008, Transit staff tested solar power golf cart technology on-site. Conclusions and recommendations were positive, and in 2009 the Zoo purchased 3 solar powered gold carts and 2 solar powered utility carts. An exciting project that was initiated in 2009 was the full conversion of one of our Zoomobiles from propane to electric with the bulk of the energy coming from 16 solar photovoltaic panels mounted to the roof. This project was executed completely in-house with Transit staff installing and testing the new vehicle and is now showcased as the world's first solar-powered Zoomobile.

In 2011, the Wildlife Health Centre replaced the old ambulance with a new Mercedes Sprinter which is blue tech (diesel) and has very efficient engine (same mileage as Dodge Caravan)

5.7 Partnerships

Zoo staff and GEZT members work with other Departmental and ABCCD staff on the following committees and working groups:

City of Toronto, Climate Change and Clean Air Plan (CCCA)
Mayor David Miller established this committee to engage City departments and affiliated boards and agencies (ABC's) in an integrated process to develop a Green Plan and facilitate programs across the City. Dr. Rapley and Dave Ireland participate in numerous workshops and planning sessions. The exercise resulted in an extensive networking of departments and agencies coordinated by the Toronto Environment Office. Council adopted City of Toronto's official Green Plan in July 2007.

Green Tourism Association
As a member of the Green Tourism Association, the Toronto Zoo supports the development of an urban green tourism sector in Toronto and can be found listed among the members on their website. The Green Tourism Association is a non-profit organization that works collaboratively with a network of businesses, community and environmental groups, government agencies, heritage and cultural organizations, and individuals. The mission of this association and its affiliates is to develop and cultivate a green tourism industry within the Toronto region. An ecologically sound industry fosters appreciation of and respect for diverse cultural and natural heritage, and strengthens local economies and communities.

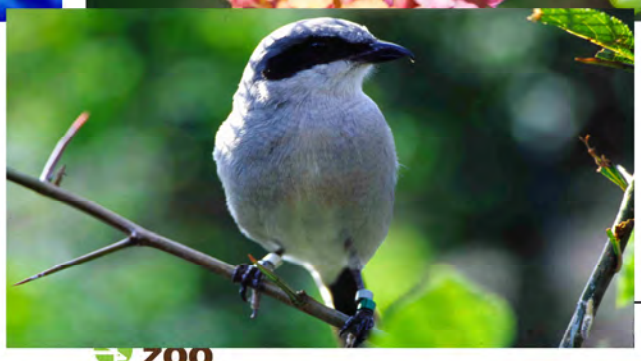
Renewable Energy Action Group
CEW staff is active participants on this new advisory group to the Mayor Miller's executive Clean Air and Climate Change committee. This group researches new and emerging technologies that will reduce our dependencies on non-renewable resources and concepts for generating renewable energy within the GTA, particularly at or near City ABCCD's.

Smog Alert Response Team
Facilities and Service staff are providing valuable input to the City of Toronto Smog Alert Team and the Zoo is capable of running our operations uninterrupted due to our use of propane during smog events. GEZT members assist Facilities and Service staff review the Zoo's smog Alert Policy every year.

West Nile Mosquito Monitoring Program
Wildlife Health Centre staff is leaders in animal disease research. As such, vets and student research assistants have helped further policies on mosquito monitoring (larval and adult) as well as analyzing the vectors responsible for the transmission of the West Nile Virus. All standing water, ditches and holding containers and natural ponds are monitored and larval of the genus Culex are routinely eliminated with the safe use of larvicides specific to these invertebrates.

Waste Diversion Committee
Horticulture and Materials staff participate with other City of Toronto ABCCD's on this committee with the objective to cumulatively achieve a 70% waste diversion level for all City of Toronto operations. The committee continues to meet in 2012.

Appendices



To further increase resources offered at the Zoo, a number of external researchers work on various projects. As a result, strong partnerships have been developed with other research institutions.

The Toronto Zoo encourages various students and researchers to work in collaboration with the Zoo on projects related to their area of interest.

APPENDIX I
TORONTO ZOO DEVELOPMENT DIVISION

The Toronto Zoo Development Division raises funds to support the conservation, education and research endeavours of the Toronto Zoo. Philanthropic support from individuals, grant-making foundations and corporations enables the Zoo to embark on and continue the various programs and projects that aim to preserve our environment and maintain biodiversity. In addition to raising funds to support Zoo programs and research, the Development Division represents the interests of its donors and stewards the gifts entrusted to it.

The Development Division raises funds through:

Major gifts from individuals, corporations and other partners
Planned gifts, such as bequests, gifts of life insurance and stocks
Annual mailings to donors and prospects
Special events such as ***ZooDo*** and ***ZooRun***
Third party events
Adopt-an-Animal Program
Wild Walk Program

Some of the Conservation projects and activities funded by the Development Division:

Veterinary Residency Fellowships
Veterinary Resident Research
Nutritional Research Program
Reproductive Physiology Research Program
Wildlife Health Centre
Adopt-a-Pond Wetland Conservation Program
Education Programs
Conservation Programs

To support the Toronto Zoo Development Division call 416-392-9114 or visit www.torontozoo.com

Mission of the Toronto Zoo Development Division:

The Toronto Zoo Development Division is dedicated to the financial support of the Toronto Zoo in its efforts to conserve species diversity through conservation, education and research.

APPENDIX II
INTERNATIONAL CONSERVATION PROGRAMS

THE WORLD CONSERVATION UNION (IUCN) Headquarters in Gland, Switzerland

The International Union for the Conservation of Nature and Natural Resources (IUCN) was established in 1948 and is the world's largest conservation-related organization. IUCN include over 1000 organizations in 40 countries including states, government agencies and non-government organizations (NGOs) who work in co-operation with conservation organizations, such as the World Wide Fund for Nature and others, as well as the United Nations Environmental Program. The IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. It is the world's largest environmental knowledge network, and has six specialist volunteer commissions, including the Species Survival Commission (SSC) with over 7,500 members. The SSC produces the Red List of threatened animals, and is an unmatched source of information about biological diversity and its conservation. Within the framework of global conventions, IUCN has promoted sustainability and helped over 160 countries to prepare and implement national conservation and biodiversity strategies.

CONSERVATION BREEDING SPECIALIST GROUP (CBSG)

The Conservation Breeding Specialist Group is part of the IUCN and one of more than 120 Specialist Groups belonging to the Species Survival Commission (SSC). CBSG is an international conservation organization dedicated to protecting our planet's biodiversity. Their mission is "to conserve and establish viable populations of threatened species through conservation breeding programs and through intensive protection and management of these plant and animal populations in the wild". Global action programs include Population and Habitat Viability Assessments (PHVA's), Conservation Assessment Management Plans (Camp's), and Global Captive Action Recommendations (GCAR's). Programs that are also carried out by CBSG include Global Animal Survival Plans (GASP's) and Genome Resource Banks (GRB's).

INTERNATIONAL SPECIES INFORMATION SYSTEM (ISIS)

The International Species Information System (ISIS) maintains computer-based information systems used by the worldwide zoological community. ISIS members use the basic biologic information (age, sex, parentage, place of birth, circumstance of death, etc.) collected in the ISIS system to manage genetic and demographic programs for their animal collections. The ISIS central database contains information on 2.6 million animals, more than 10, 000 species, held in zoological institutions, and some animals in the wild. Today, 800 institutions representing almost 80 countries share information about their arrival collections through the ISIS network. The Toronto Zoo has participated in ISIS since 1974 and the Registrars submit data on amphibians, birds, fish, mammals, and reptiles monthly.

ISIS is currently implementing the Zoological Information Management System (ZIMS). ZIMS is a quantum leap forward in information management for the thousands of museum professionals whose collections include living creatures. ZIMS is a real-time unified global database on animal health and well-being - the first such database in the world.

STUDBOOKS

A studbook is a true record of the history of a population held in a zoo or aquarium. It includes pedigrees of animals, and a listing of the various locations in which animals have been held. The studbook traces the entire history of each individual in a population; these collective histories are known as the population's genetic and demographic identity. Studbooks also contain a wealth of other information: data on the general biology and ecology of the species and the status and distribution of wild populations. Studbooks are primarily used for monitoring and managing populations in zoos and aquariums. The data is used to make breeding decisions so that genetic variation can be retained and close inbreeding avoided. The data can also be used to assess whether a population is stable, increasing, or decreasing in numbers. Current editions of many studbooks are now available online via the AZA website.

SPECIES SURVIVAL PLANS (SSPs®)

The Species Survival Plan program began in 1981 as a cooperative population management and conservation program for selected species in zoos and aquariums in North America. Each SSP manages the breeding of a species in order to maintain a healthy and self-sustaining population that is both genetically diverse and demographically stable. Whole North American populations of rare animals, such as Black-footed ferrets, are managed by coordinators who direct effective breeding and management practices, which will ensure species survival. A high priority is given to research on SSP® animals. As of 2012, the Toronto Zoo's SSPs include: 51 mammals, 31 birds, 12 reptiles, 2 amphibians, 4 fish.

TAXON ADVISORY GROUPS (TAGs)

Taxon Advisory Groups (TAGs) are another important element of conservation activities at the Zoo. These programs, developed through the AZA, are similar to SSPs®, but focus on entire taxa (related groups) instead of one particular species. The goal of TAGs is to make SSPs® more effective and provide a broad international perspective for species and taxon management. TAGs promote international co-operation and co-ordination of planning efforts by linking North American SSPs® to conservation initiatives world-wide.

SCIENTIFIC ADVISORY GROUPS (SAGs)

The AZA established Scientific Advisory Groups in 1991 to help facilitate, support, network and co-ordinate the relevant research activities of its member institutions. These AZA advisory groups focus on particular scientific areas, such as nutrition and behaviour, and serve as support groups to the TAGs and SSPs®. SAG members include veterinarians, researchers, zoo and aquarium curators with appropriate scientific training, as well as scientists, working in universities, government and other institutions, with a commitment to sharing their particular expertise.

CONSERVATION ACTION PARTNERSHIPS (CAPs)

In recognition of the importance of conserving diversity of species in their natural habitat, the AZA established the Conservation Action Partnerships (CAPs). CAPs' main focus is to help address the conservation needs of regions rich in biodiversity. CAPs, established in 1991, are special committees designed to help co-ordinate the conservation and scientific activities of AZA institutions working in specific geographical regions of the world. Attention is being focused on regions abundant in unique wildlife and habitat.

AZA - NUTRITION ADVISORY GROUP

Formed in 1994, the mission of the Nutrition Advisory Group is to promote the welfare of animals in captivity by incorporating the science of animal nutrition into their husbandry. Their long-term goals are to: 1) identify nutritional and dietary problems in zoos and facilitate their resolution; 2) establish a

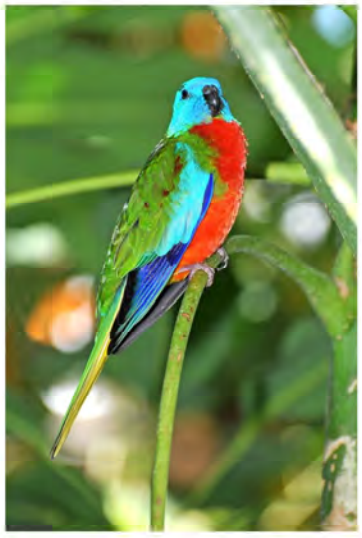
mechanism for the review of nutritional and dietary information provided by AZA committees and subgroups; 3) co-ordinate acquisition and dissemination of information regarding nutrition, such as nutrient requirements, food composition, guidelines and diet records; 4) encourage and co-ordinate nutrition-related investigations among zoos and collaborating institutions.

BOTANIC GARDENS CONSERVATION INTERNATIONAL (BGCI)

Botanic Gardens Conservation International (BGCI) was founded in 1987 to link botanic gardens as a co-operating global network for effective plant conservation. BGCI provides technical guidance, data and support for botanic gardens in almost 100 countries and has helped to create or strengthen national and regional networks of gardens in many parts of the world. The Toronto Zoo is an associate member of this organization and contributes to conference symposia and discussions, and receives materials and information relevant to Zoo exhibits and presentations.

THE CANADIAN ORGANIZATION FOR TROPICAL EDUCATION AND RAINFOREST CONSERVATION (COTERC)

COTERC is a charitable foundation first conceived by a keeper at Toronto Zoo. Since its inception staff and volunteers at Toronto Zoo have played an essential role in support and directing the program. In Canada, the Board of Directors includes biologists, educators, environmentalists, zoo professionals, lawyers and media personalities. On the COTERC website (www.coterc.org), it is also possible to download an Ontario curriculum based manual on rainforests for Grades 9, 10 and 11. In Costa Rica COTERC is the owner of Caño Palma Biological Station. The station is at the south end of the Barro de Colorado Wildlife Refuge. The habitat consists of lowland flooded forest, and is essentially a large unexplored area only accessible by boat. Studies include migratory bird surveys, nesting birds, faunal surveys of freshwater fish, amphibians and reptiles, large mammals and plants. The proximity to the Caribbean also allows for sea turtle work to take place. The station also works on sustainable management of the forest. Staff at the station will learn and disseminate this information to local eco-tourism centers wishing to minimize their impact on the area.



APPENDIX III
MEMBERSHIPS

Association of Zoos and Aquariums (AZA)

The American Zoo and Aquarium Association was founded in 1924, and is a professional organization dedicated to the advancement of North American zoos and aquariums through conservation, education, scientific studies and recreation. The AZA represents virtually every professionally operated zoological park, aquarium, wildlife park and oceanarium on the North American continent. To become a member of the AZA, a facility needs to be accredited. This process was designed to evaluate zoos and aquariums in order to certify that an institution meets certain standards.

AFRICAN ASSOCIATION OF ZOOS AND AQUARIA (PAAZAB)

The African Association of Zoos and Aquaria (PAAZAB) was formed in 1989 at the National Zoological Gardens of South Africa, Pretoria, South Africa as an organization aimed at representing the interest of bona fide zoos and aquaria on the African continent. The association upholds modern zoo best practices in the provision of supportive environments for the animals, personnel and public; active involvement in the maintenance of biodiversity; management for the wide benefit of the community and the provision of education opportunities for learning about animals and their environments. The PAAZAB mission is "Conservation Through Cooperation". PAAZAB sees one of the primary functions of zoos and aquariums as healing the relationship between man, animal and their mutual environments.

BIODIVERSITY EDUCATION AND AWARENESS NETWORK (BEAN)

The Biodiversity Education and Awareness Network is a third Green education group that was active in Ontario in 2007. Performing the function of providing the education plan for the Biodiversity Strategy of Ontario (2005) and functioning as a specialized sub-group of EASO, the BEAN was very active in 2007. A working group consists of 30 members representing institutions, organizations, universities, colleges, aboriginals, outdoor recreation, agriculture and media in Ontario.

BOTANIC GARDENS CONSERVATION INTERNATIONAL (BGCI)

Botanic Gardens Conservation International is an organization that originated out of the IUCN "Botanical Gardens and the World Conservation Strategy" Las Palmas Conference of 1985. Its mission is to build and maintain a world network of botanical gardens for plant conservation. It continues to host botanical conservation conferences every few years and publishes journals, including informative education for conservation review of programming around the world.

CANADA'S ACCREDITED ZOOS AND AQUARIUMS (CAZA)

The Canadian Association of Zoos and Aquariums is a non-profit organization established to promote the welfare and encourage the advancement and improvement of zoology, recreation, education, conservation and science. Established in 1975, CAZA is operated by the members for the members. The Toronto Zoo has had an accredited membership with CAZA since 1975 and was in fact one of the founders of the organization.

CANADIAN BOTANICAL CONSERVATION NETWORK (CBCN)

The Canadian Botanical Conservation Network originated in September of 1996 at the Royal Botanical Gardens, Hamilton. The objective of this organization is to preserve the biological diversity of Canada's rare and endangered native plant species, wild habitats and ecosystems through the education and conservation programs of their member botanical gardens and arboreta. With funding for a coordinator, the network is able to provide meaningful and timely support for communication between botanical institutions in Canada, and with programs here and around the world. The Toronto Zoo is a founding member of CBCN.

CANADIAN COUNCIL ON ANIMAL CARE (CCAC)

The CCAC comprises 22 national organizations, whose representatives include scientists, educators, veterinarians and delegates from industry and the animal welfare movement. The CCAC conducts assessment visits to each participating institution using animals at least every three years, and follow up visits by the CCAC are also carried out. Assessments are based upon several documents, including the CCAC guidelines and policies. Participants that have successfully completed the assessment process and that have been assigned a CCAC status of Compliance or Conditional Compliance receive a CCAC Certificate of GAP – Good Animal Practice®.

CANADIAN MUSEUMS ASSOCIATION (CMA)

The Canadian Museums Association (CMA) is the national organization for the advancement of the Canadian museum sector, representing Canadian museum professionals both within Canada and internationally. The CMA works for the recognition, growth, and stability of the sector. It was established by a small group of people in Quebec City in 1947. As the quantity of Canadian museums increased, so did the need for the CMA. Today, the CMA has nearly 2,000 members, and supports them with training and professional development programs, conferences, publications, networking opportunities, a body of knowledge, and a dedicated staff. Over the past 60 years, Canada's museums have developed an international reputation for excellent programming, dedicated public service, and high standards of professionalism.

CONSERVATION COUNCIL OF ONTARIO (CCO)

Founded in 1951, the Conservation Council of Ontario is a not-for-profit association with 58 member organizations and over 60 individual, honorary and consulting members who work to promote effective action on environmental issues. The CCO works for the conservation of natural resources and protection of the environment for the common good and a sustainable future in Ontario. The CCO promotes networking for conservation and environmental professionals at its meetings, works to inform and influence decision makers in government, as well as the private sector, educates the public and conducts research and consulting activities.

EDUCATION ALLIANCE FOR A SUSTAINABLE ONTARIO (EASO)

The Education Alliance for a Sustainable Ontario is a consortium of over 50 agencies, NGO's, school boards, colleges and universities in Ontario that support education for sustainable development throughout the province of Ontario. The vision of EASO is to "provide a forum for collaboration and leadership to advance education for thriving, diverse communities and ecosystems". EASO aims to integrate sustainability education in Ontario through policy, curriculum, capacity building and communication.

INTERNATIONAL ASSOCIATION OF AMUSEMENT PARKS AND ATTRACTIONS (IAAPA)

Founded in 1918, IAAPA is the largest international trade association for permanently situated amusement facilities worldwide. IAAPA strives to help members improve their efficiency, marketing, safety, and profitability while maintaining highest possible professional standards in the industry. The mission statement of the IAAPA is to serve the membership by promoting safe operations, global development, professional growth, and commercial success of the amusement parks and attractions industry.

ONTARIO ENVIRONMENT NETWORK (OEN)

The Ontario Environment Network (OEN) is a non-governmental, non-profit, organization which serves Ontario's environmental non-profit, non-governmental community. Currently there are over 500 environmental groups in Ontario ranging from national to neighborhood-based, which focus on a wide range of issues. The OEN's goal is to increase awareness of these organizations and encourage discussions about ways to protect the environment. The Network provides a central referral service for anyone seeking environmental information, organizes workshops and conferences, publishes resource materials and facilitates issue-specific caucuses. By linking environmental groups together, the OEN assists them in sharing ideas and strategies.

POLAR BEARS INTERNATIONAL (PBI)

Polar Bears International is a non-profit organization dedicated to the worldwide conservation of the polar bear and its habitat through research, stewardship, and education. They provide scientific resources and information on polar bears and their habitat to institutions and the general public worldwide.

As the Arctic sea ice continues to diminish, members of PBI's Zoological Advisory Council have focused their efforts on creating a set of contingency plans that will help save the polar bear as a species, with major objectives including a rescue and rehab team, an orphaned cub and nuisance bear placement team, a refuse and protection team and a research team.

RECYCLING COUNCIL OF ONTARIO (RCO)

Founded in 1978, the Recycling Council of Ontario is a not-for-profit organization committed to minimizing society's impact on the environment by eliminating waste. Its mission is to inform and educate all members of society about the generation of waste, the avoidance of waste, the more efficient use of resources, as well as the benefits and/or consequences of these activities. The Toronto Zoo joined the RCO in 1990, and has made full use of its resources for planning and implementing recycling and composting programs.

WORLD ASSOCIATION OF ZOO AND AQUARIUMS (WAZA)

The World Association of Zoos and Aquariums (WAZA) is a modern institution which works at a global level to build cooperative approaches to common needs, to tackle common issues and to share information and knowledge. Since the beginning, International Studbooks for rare and endangered species have been kept under the auspices of WAZA. WAZA's mission is to "provide leadership and support for zoos, aquariums and partner organizations of the world in animal care and welfare, conservation of biodiversity, environmental education and global sustainability".

APPENDIX IV
ADVISORY/INTEREST/PRESERVATION GROUP AFFILIATIONS

Graham Crawshaw – Senior Veterinarian

- **MNR:** Wildlife Animal Care Committee
- **MNR:** Wildlife rehabilitation Advisory Committee
- **CAZWV Instructor:** Chemical Immobilization of Wildlife Courses

Maria Franke-Gunther – Curator of Mammals

- **Vancouver Island Marmot:** Captive Management & Recovery Team
- **Canadian Black-footed ferret & Prairie Dog Recovery Team**
- **Black-footed Ferret Recovery Implementation Team**
- **CAZA:** Conservation Science Committee;
- **CAZA:** Canadian Tiger CSSP Coordinator;
- **CAZA:** Canadian Snow Leopard CSSP Coordinator
- **Institutional Representative (IR) and Member** of the Following:
- **AZA TAG:** Tiger TAG : Steering Committee (elected)
- **AZA TAG:** Monotreme & Marsupial - Institutional Rep & Member
- **AZA TAG:** Antelope & Giraffe - Institutional Rep & Member
- **AZA TAG:** Ape - Institutional Rep & Member
- **AZA TAG:** Bear - Institutional Rep & Member
- **AZA TAG:** Bison - Institutional Rep & Member
- **AZA TAG:** Buffalo - Institutional Rep & Member
- **AZA TAG:** Cattle - Institutional Rep & Member
- **AZA TAG:** Canid & Hyaenid - Institutional Rep & Member
- **AZA TAG:** Deer - Institutional Rep & Member
- **AZA TAG:** Elephant - Institutional Rep & Member
- **AZA TAG:** Equid - Institutional Rep & Member
- **AZA TAG:** Felid - Institutional Rep & Member
- **AZA TAG:** Marine Mammal - Institutional Rep & Member
- **AZA TAG:** New World Primate - Institutional Rep & Member
- **AZA TAG:** Old World Primate - Institutional Rep & Member
- **AZA TAG:** Rhinoceros - Institutional Rep & Member
- **AZA TAG:** Rodent - Institutional Rep & Member
- **AZA TAG:** Insectivore - Institutional Rep & Member
- **AZA TAG:** Lagomorph - Institutional Rep & Member
- **AZA TAG:** Sheep & Goat - Institutional Rep & Member
- **AZA TAG:** Small Carnivore - Institutional Rep & Member
- **AZA TAG:** Tapir - Institutional Rep & Member
- **AZA TAG:** Wild pig - Institutional Rep & Member
- **AZA TAG:** Peccary & Hippo - Institutional Rep & Member
- **AZA TAG:** Chiropteran - Institutional Rep & Member
- **AZA SSP®:** Black-footed ferret
- **AZA SSP®:** Cheetah
- **AZA SSP®:** Sumatran tiger
- **AZA SSP®:** Amur tiger
- **AZA SSP®:** White rhino
- **AZA SSP®:** Indian rhino
- **AZA SSP®:** Clouded leopard
- **AZA SSP®:** Red panda
- **AZA SSP®:** Przewalski's horse
- **AZA SSP®:** Golden lion tamarin
- **AZA SSP®:** Grevy's zebra
- **AZA SSP®:** Tree kangaroo
- **AZA SSP®:** Orangutan
- **AZA SSP®:** Macaques
- **AZA SSP®:** Snow leopard
- **AZA SSP®:** Gorilla
- **AZA SSP®:** Pygmy hippopotamus
- **AZA SSP®:** Polar bear
- **AZA SSP®:** Baboon

- **AZA SSP®:** Jaguar
- **AZA SSP®:** Lion
- **AZA SSP®:** Spider monkey
- **AZA SSP®:** Malayan tapir
- **AZA SSP®:** Gibbon
- **AZA SSP®:** African elephant

Bob Johnson – Curator of Reptiles and Amphibians

- **CAZA TAG:** Member – CAZA Amphibian TAG/Conservation Committee
- **AZA TAG:** Steering Committee (elected)
- **AZA:** Amphibian TAG
- **AZA TAG:** Amphibian – Working Member
- **AZA TAG:** Amphibian - Institutional Rep
- **AZA TAG:** Lizard - Working Member
- **AZA TAG:** Lizard - Institutional Rep
- **AZA TAG:** Turtle - Working Member
- **AZA TAG:** Turtle - Institutional Rep
- **AZA TAG:** Snake - Working Member (Institutional Representative Andrew Lentini)
- **AZA SAG:** AZA Re-Introduction Scientific Group – Working Member
- **AZA** Ecological Restoration Scientific Group – Working Member
- **AZA SSP®:** Komodo dragon SSP
- **AZA SSP®:** Komodo dragon Steering Committee – member-elected
- **AZA SSP®:** Puerto Rican crested toad SSP
- **AZA SSP®:** Puerto Rican crested toad - Habitat Restoration
- **AZA SSP®:** SE Asian Forest monitors SSP – Institutional Rep.
- **AZA SSP®:** Golden Frog SSP – Institutional Rep.
- **AZA SSP®:** Mexican beaded lizard SSP – Institutional Rep.
- **AZA SSP®:** False gharial SSP – Institutional Rep.
- **AZA SSP®:** Radiated tortoise SSP – Institutional Rep.
- **AZA SSP®:** Flat shelled spider tortoise SSP – Institutional Rep
- **AZA SSP®:** Burmese star tortoise SSP – Institutional Rep.
- **AZA SSP®:** Wyoming toad SSP – Institutional Rep.
- **AZA SSP®:** Massasauga rattlesnake (Andrew Lentini, IR)
- **AZA** Professional Training: Instructor, Amphibian Biology, Conservation and Management Professional Development Course
- **IUCN:** IUCN Re-introduction Specialist Group – Member
- **IUCN** Amphibian Specialist Group
- **CBSG:** Herpetology Group, Member
- **RENEW:** Massasauga Rattlesnake Recovery Team – Advisor
- **RENEW:** Spiny Softshell Recovery Team – Member
- **RENEW:** Cricket Frog Recovery Team – Co-Chair
- **RENEW:** Fowler's Toad Recovery Team – Member
- **RENEW:** Dusky Salamander Recovery Team – Member
- **RENEW:** Ontario Multi Species Turtle Recovery Team – Member
- **RENEW:** Oregon Spotted Frog Recovery Team – Advisor
- **RENEW:** Chorus Frog Recovery Team- collaborator
- **Rouge Park:** Natural Heritage Committee- Zoo Rep
- **US Fish and Wildlife Recovery Teams:** Puerto Rican crested toad; Wyoming toad

C. Lee – Curator of Fishes and Marine Invertebrates

- **AZA TAG:** Freshwater fishes – TAG Chair;
- **AZA TAG:** Marine fishes – Member;
- **AZA TAG:** Aquatic invertebrates – Member
- **AZA SSP®:** Lake Victoria fishes – Member
- **CAP:** Coral - Member
- **AZA:** Project Seahorse – Working Member;
- **AZA:** Mycobacteria Working Group – Member
- **Recovery Team:** Redside dace – Member
- **The Ocean Project:** Institutional Representative
- **CSEB:** Canadian Society of Environmental Biologists

Thomas Mason- Curator of Invertebrates and Birds

- **Lights Out Toronto:** City of Toronto Biodiversity Committee – Steering committee
- **Recovery Group:** Karner Blue Butterfly
- **Recovery Group:** Loggerhead Shrike
- **AZA SSP®:** Hornbill - Institutional Rep
- **AZA SSP®:** African Penguin - Institutional Rep
- **AZA SSP®:** Ciconiformes - Institutional Rep
- **AZA SSP®:** Colliformes - Institutional Rep
- **AZA SSP®:** Coraciformes - Institutional Rep
- **AZA SSP®:** Ratites - Institutional Rep
- **AZA SSP®:** Red Kneed Tarantula - Institutional Rep & Advisor
- **AZA SSP®:** Tanagers - Institutional Rep
- **AZA SSP®:** Softbills - Institutional Rep
- **AZA SSP®:** Charadriiformes - Institutional Rep
- **AZA SSP®:** Tawny Frogmouth - Institutional Rep
- **AZA SSP®:** Flamingos - Institutional Rep
- **Panama Frog Rescue:** Invertebrate Production Team Entomological Societies
- **ESO:** Entomological Society of Ontario Member
- **ESC:** Entomological Society of Canada member
- **TEA:** Toronto Entomological Association
- **CAOAC:** Canadian Association of Aquarium Clubs – Futures committee – Fish Rescue Coordinator
- **TZ representative for CFIA regulations:** Import and possession of controlled arthropods into Canada for education and exhibit purposes
- **COTERC:** Canadian Organization for Tropical Education and Rainforest Conservation – Advisor
- **Ventanas del Corcovado:** Conservation center in Osa Peninsula, Costa Rica Advisor

Gabriela Mastromonaco – Curator of Reproductive Programs & Research

- **AZA:** Endocrine Science Advisory Group Steering – Committee Member
- **AZA:** Reproduction Scientific Advisory Group – Member
- **Fleming College:** Biotechnology- Technologist/Forensics Advisory Committee - Member
- **IETS CANDES Research Subcommittee** – Member
- **IETS CANDES Technology Subcommittee** – Co-Chair

Jaap Wensvoort – Wildlife Nutritionist

- **Comparative Nutrition Society** – Member
- **AZA: Nutrition Advisory Group (NAG)** – Member
- **AZA: Nutrition Advisory Group (NAG) Steering** – Committee Member

David Barney – Acting Director of Wildlife

- **AZA:** Nutrition Advisory Group (NAG) – Member
- **CAZA:** Centre for the Study of Animal Welfare (U of G) – Advisory Faculty

William Rapley – Executive Director of Conservation, Education and Wildlife

- **Ontario Recovery Team:** Trumpeter Swan, Member
- **IUCN:** Canadian National Committee (CCIUCN) – Past President and Board Member
- **IUCN:** Species Survival Commission (SSC) – Member
- **IUCN:** Conservation Specialist Group (CBSG) Steering – Committee Member
- **IUCN:** Commission on Communication and Education – Member
- **AZA:** Green Scientific Advisory Committee
- **AZA:** Nutrition Advisory Group (NAG) – Member
- **AZA:** Field Conservation Committee Member - ARCS
- **AZA:** Avian Scientific Committee (ASAG)
- **AZA SSP®:** Waterfowl TAG – Member
- **AZA SSP®:** Polar Bear – Member
- **AZA SSP®:** Giant Panda – Member
- **AZA:** Giant Panda Conservation Foundation – Member
- **CAZA:** Conservation Committee Member
- **CCO:** Conservation Council of Ontario – Member
- **COTERC:** Canadian Organization for Tropical Education and Rainforest Conservation – former Board Member and Vice Chair;
- **CSEB:** Canadian Society for Environmental Biologists – Member

- **Brodie Club Toronto:** Member
- **UNRCE:** United Nations Regional Centre of Expertise on Education for Sustainable Development, Steering Committee
- **EASO:** Education Alliance for a Sustainable Toronto (East) – Steering Committee
- **OMNR BEAN:** Biodiversity Education and Awareness Network – Steering Committee
- **SARPAC:** Ministry of Natural Resources, Ontario, Species at Risk Program Advisory Committee
- **POLAR BEARS INTERNATIONAL:** Polar Bear Sustainability Alliance – Program Advisor, Advisory Committee, Arctic Ambassador Centre, Chair
- **American Society of Mammalogists** – Member
- **Canadian Society of Environmental Biologists** – Member
- **Piping plover recovery Ontario** - Advisor
- **Long point Causeway Project** - Advisor
- **Parks Canada, Bruce Peninsula Park** - Advisor
- **Rouge Park:** Trial Advisory Committee – Member
- **Rouge Park:** Heritage Committee – Member
- **Rouge Park:** Alliance Committee – alternate

APPENDIX V
2012 PROJECTS SUPPORTED BY THE ENDANGERED SPECIES RESERVE FUND

PROJECT	Curator
BFF Canadian Reintroduction - Post release Monitoring	M. Franke
Cell cultures from Lake Victoria cichlids	G. Mastromonaco
Rouge Park Species at Risk Monitoring	B. Johnson
Healthy Waters, Healthy Wild Species at Risk Conservation	B. Johnson
Ape TAG	M. Franke
Loggerhead Shrike	T. Mason
Panama Frog Rescue Program (Invert Production)	T. Mason
Great Lakes Program	C. Lee
Toronto Zoo Aqua-Links	C. Lee
Asian Turtle Crisis Range Country Conservation	B. Johnson
NA Save the Rhino Campaign	M. Franke
Malayan Tapir	M. Franke
African penguins	T. Mason
Project Punde Kundo (Red Panda)	M. Franke
Madagascan tortoise	B. Johnson
Wyoming Toad SSP Disease Screening / Population Monitoring	B. Johnson
False Gharial Conservation in Indonesia	B. Johnson
Golden Mantella Frog	B. Johnson
Polar Bear Biodiversity Studies	W. Rapley
Giant Panda	W. Rapley
Lewa Veterinary Conservancy & Vet Program	G. Crawshaw
Golden Lion Tamarin Conservation	M. Franke
Hutan Reforestation Efforts in Kinabatangan	M. Franke
Sulawesi Habitat Preservation and Education Programming	M. Franke
Tree Kangaroo & Biodiversity Conservation in Papua New Guinea	M. Franke

APPENDIX VI
2012 OPERATING PROJECT LIST

PROJECTS:

- **Gorilla Outdoor Mesh Replacement (Upper)**
- **Americas Alligator Exhibit Safety Improvements**
- **Sumatran Tiger Exhibit Perimeter Fence**
- **GBR – Expansion to Community Tank Servicing Platform**
- **Bison Catch Up Pen Gates**
- **Commissary Freezer Upgrades (Total of 2)**
- **Internal Wall and Re-directing**
- **Matchie's Tree Kangaroo Humidification**
- **Education Washrooms Renovation**

APPENDIX VII
TORONTO ZOO PUBLICATIONS
2011-2012

ECOLOGY/FIELD CONSERVATION/REINTRODUCTION

Connolly, K., Powley, D. and Rapley, W. A. TORONTO ZOO CONSERVATION AND EDUCATION ACTIVITIES REPORT 2011-2012. July 2012.

REPRODUCTIVE PHYSIOLOGY/TECHNOLOGY

Wong, P. B. Y., Wiley, E.O., Johnson, W. E., Ryder, O.A., O'Brien, S.J., Haussler, D., Koepfli, K-P., Houck, M. L., Perelman, P., Mastromonaco, G., Bentley, A.C., Venkatesh, B., Genome 10K Community of Scientists, Zhang, Y-P and Murphy, R.W. Tissue sampling methods and standards for vertebrate genomics. GigaScience (2012) 1:8 doi: 10.1186/2047-217X-1-8.
Mastromonaco, G.F., Houck, M. L. and Bergfelt, D. R. Disorders of sexual development in wild and captive exotic animals. Sexual Development (2012) 6:84-95.

Seaby, R., Mackie, P., King, W. and Mastromonaco, G. Investigation into developmental potential and nuclear/mitochondrial function in early wood and plains bison hybrid embryos. Reproduction in Domestic Animals (2011) doi:10.1111/j.1439-0531.2011.01936.x.

Morden, C.C., Weladji, R.B., Ropstad, E., Dahl, E., Holand, O., Mastromonaco, G. and Nieminen, M. Faecal hormones as a non-invasive population monitoring method for reindeer. Journal of Wildlife Management (2011) 75:1426-1435.

Wang, Q., Chow, J., Hong, J., Smith, A. F., Moreno, C., Seaby, P., Vrana, P., Miri, K., Tak, J., Chung, E. D., Mastromonaco, G., Caniggia, I. and Varmuza, S. Recent acquisition of imprinting at the rodent Sfmbt2 locus correlates with insertion of a large block of miRNAs. BMC Genomics (2011) 12:204 doi: 10.1186/1471-2164-12-204.

VETERINARY MEDICINE/PHYSIOLOGY

Lentini AM, Crawshaw GJ, Licht LE, McLelland DJ. 2011. Pathologic and hematologic responses to surgically implanted transmitters in eastern massasauga rattlesnakes (Sistrurus catenatus catenatus). Journal of Wildlife Diseases 47: 107-125.

Crawshaw GJ. 2011. Amphibian Viral Diseases. In. In: Miller R.E, and Fowler M.E. Zoo and Wild Animal Medicine Current Therapy 7. Elsevier, St Louis. Pp 231-238.

Delnatte P, Berkvens C, Kummrow M, Smith DA, Crawshaw G, Ojkic D, DeLay, J. New genotype of avian bornavirus in wild geese and trumpeter swans in Canada. 2011. Veterinary Record 169: 108.