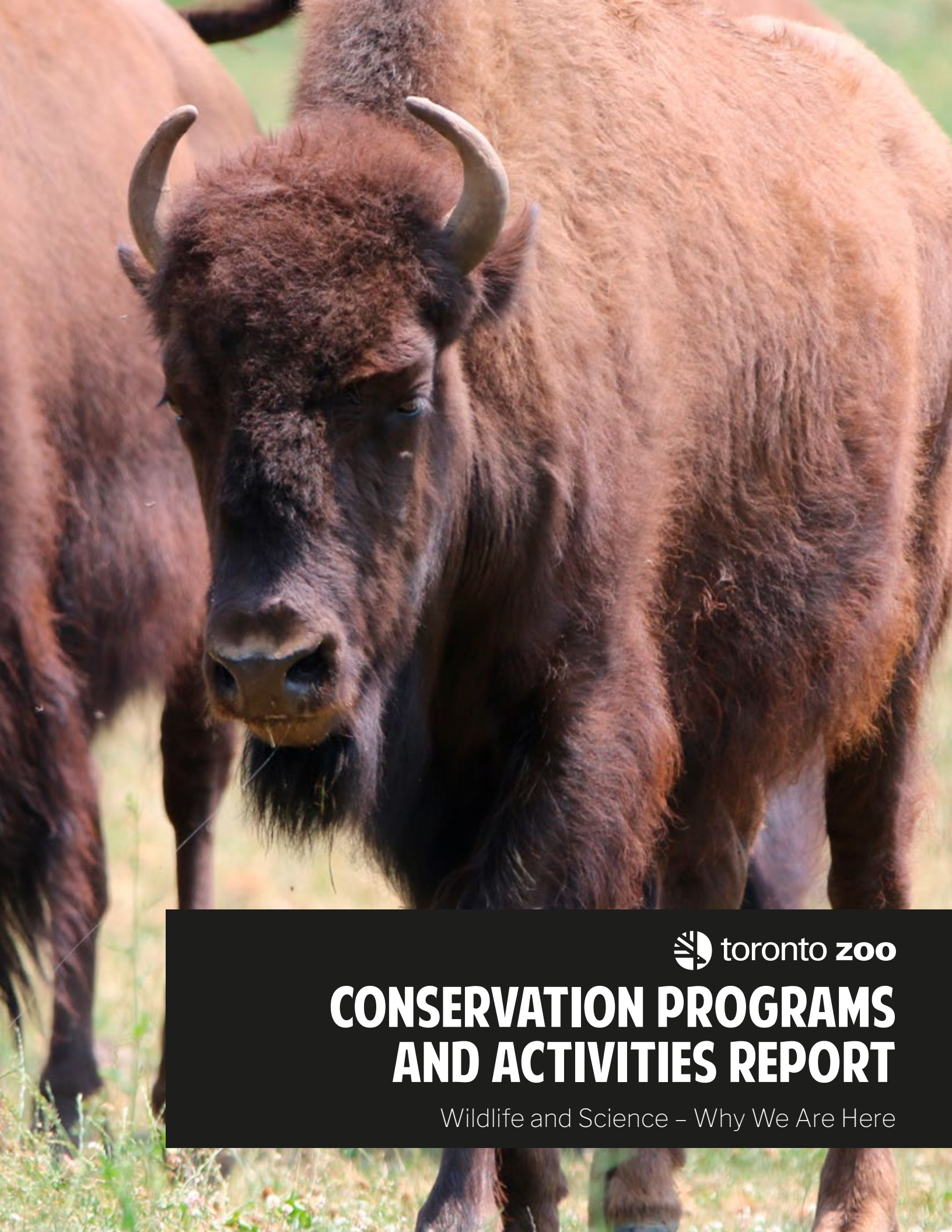
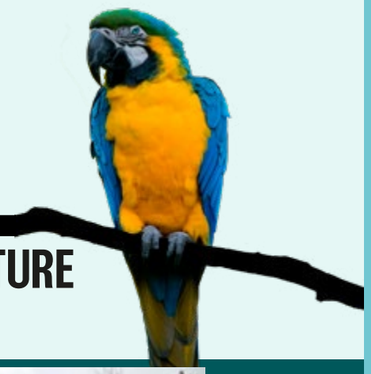


toronto zoo

CONSERVATION PROGRAMS AND ACTIVITIES REPORT

Wildlife and Science – Why We Are Here

2019 toronto zoo



A VISION FOR THE FUTURE

Dolf DeJong, CEO

Did you know? Really... did you? As I finish my first full year as the CEO of your incredible Toronto Zoo, I continue to be amazed by the huge amount of Conservation work done by the team and our partners. Year-end reports like this are an amazing tool to review and reflect on the activities of the past 365 days and for us, that means looking back on how we have served the animals in our care, served their wild counterparts and how we connected our 1.2 million guests to how they can help with challenges nature is facing.

While budget and attendance are our most frequently discussed metrics of success, the projects and accomplishments included in this book make us equally proud. These wins for wildlife and nature would not be possible without the tremendous support from local partners, elected officials, our Board of Management, as well as our community. With the establishment of the Toronto Zoo Wildlife Conservancy in 2019, we now have new ways to connect people to our mission with the goal of increasing our financial resources to support conservation programs and projects to help transform our Zoo and grow the impact it can have. I am excited about these possibilities and our future fundraising efforts!

I am grateful to be part of your Toronto Zoo team and couldn't be more proud of the great work being done as conservation champions! Our Toronto Zoo has earned its reputation as a premier conservation organization and living centre for education and science—we have great people who are experts in their fields and bring passion, pride, talent, and experience together to inspire future generations to protect species and their habitats!

We are looking forward to the year ahead and the launch of our new Strategic Plan. This new 5-year plan will be building on these successes and charting a path to increase the profile of these projects, the health and future of our natural world and the animals living there depend on it

OUR VISION

Canada's national leader in saving wildlife to ensure the rich diversity of nature for future generations.

OUR MISSION

A living centre for education and science, committed to providing compelling guest experiences and inspiring passion to protect wildlife and habitats.

OUR VALUES

Excellence
Conservation
Innovation
Collaboration
Integrity
Passion

STRATEGIC GOALS

Goal 1: Conservation Impact
Goal 2: Guest Engagement
Goal 3: Governance
Goal 4: Financial Stability
Goal 5: Strategic Alliances
Goal 6: People
Goal 7: Understanding & Caring

Photographs
Alex Bowman
Toronto Zoo Staff
Volunteers
Members

Editorial Team
Alex Bowman
Dyann Powley

Go Online For More:

Visit torontozoo.com for more information.

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TORONTO ZOO IS AN ACCREDITED MEMBER OF CANADA'S ACCREDITED ZOOS AND AQUARIUMS (CAZA) AND THE ASSOCIATION OF ZOOS & AQUARIUMS (AZA)

CAZA AZAC
CANADA'S ACCREDITED ZOOS AND AQUARIUMS
AQUARIUMS ET ZOOS ACCRÉDITÉS DU CANADA

Founded in 1975, Canada's Accredited Zoos and Aquariums (CAZA) is a private charitable organization representing the country's leading zoological parks and aquariums. CAZA is committed to the advancement of accredited zoos and aquariums as humane agencies of animal welfare, conservation, science and education. CAZA has 30 member institutions across the country who are Canada's leading zoos and aquariums, all of whom participate in CAZA's comprehensive accreditation program, abide by the Code of Professional Ethics , and meet the highest professional standards in animal care. CAZA member institutions also provide expert assistance and advice in animal investigations, partner with government and animal welfare agencies, and provide training to others.

Each year at CAZA's annual conference, the accomplishments of its member institutions are celebrated with the CAZA Achievement Awards. CAZA recognizes its members in the fields of conservation, exhibit design, educational programming, professional development, and volunteer engagement. In 2019 the Toronto Zoo received the following CAZA Achievement Award:

Colonel C. D. Dailey Award for *ex-situ* species propagation for the Wood Bison recovery program

This award recognizes ex-situ propagation and management programs that contribute to the long-term survival of animal species or populations.

The Toronto Zoo has been involved in wood bison conservation since 1977 with captive breeding and reintroduction of animals back in the wild. Since that time, efforts from various organizations have resulted in the species being down listed from "endangered" to "threatened". Ongoing disease concerns in remaining wood bison populations continue to threaten this species.

The Toronto Zoo's accomplishment with the Wood Bison recovery program is not only a one-of-a-kind success in Canada, but one of the few programs in the wild to repeatedly produce calves from insemination. Furthermore, no other conservation species, or Zoo-based species, has been successfully inseminated with 35-year frozen sperm!

ASSOCIATION OF ZOOS & AQUARIUMS

The Association of Zoos & Aquariums (AZA) is a non-profit organization dedicated to the advancement of zoos and aquariums in the areas of conservation, animal welfare, education, science, and recreation. AZA is the accrediting body for the top zoos and aquariums in the United States and seven other countries. AZA sets high standards and best practices necessary to be leaders and innovators in animal care, wildlife conservation and science, conservation education, the guest experience, and community engagement.

Every 5 years the Toronto Zoo must successfully complete a rigorous accreditation process in order to maintain its accreditation with AZA and CAZA. This includes undergoing a thorough review to ensure the Zoo has, and will continue to meet, ever-rising standards in animal care, veterinary programs, conservation, education, and safety.

The accreditation process includes a detailed application and a meticulous on-site inspection by a team of trained zoo and aquarium professionals. The inspecting team observes all aspects of the institution's operation, including animal care, keeper training, safety for guests, staff and animals, educational programs, conservation efforts, veterinary programs, financial stability,

AZA's Annual Report on Conservation and Science

Each year AZA publishes an Annual Report on Conservation and Science which summarizes the education programs, field conservation activities, green business practices, and scientific research of its AZA-accredited and certified related facilities. Submissions are reviewed by AZA's Field Conservation Committee and Research Technology Committee, and must meet defined criteria.

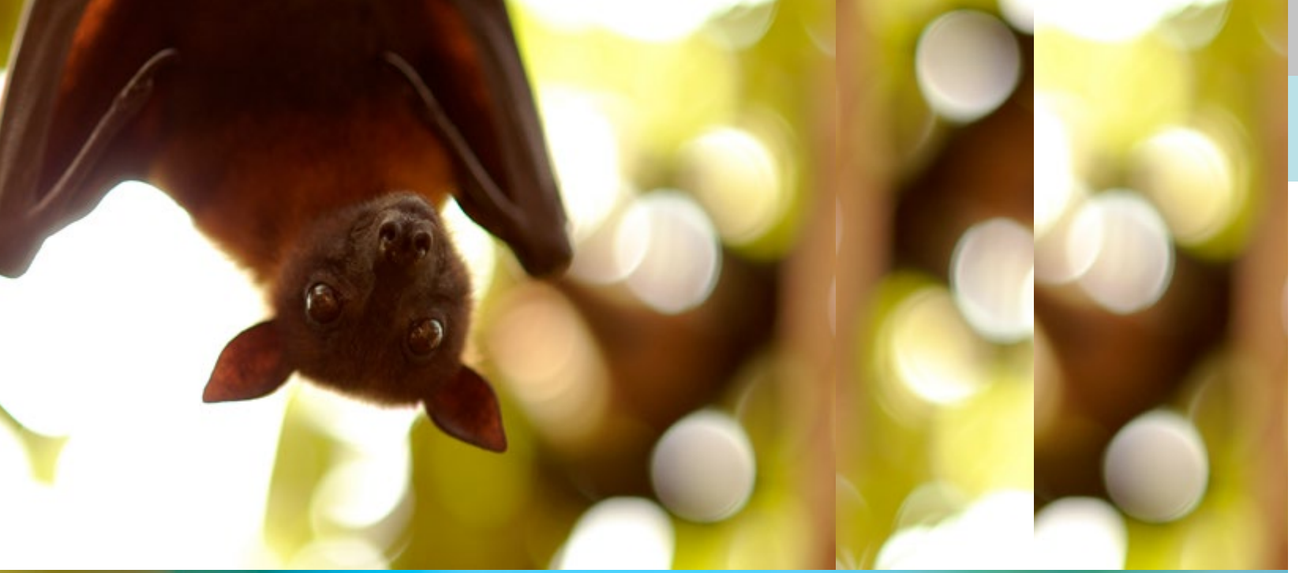
Field conservation focuses on efforts having a direct impact on animals and habitats in the wild. Education programming includes those with specific goals and delivery methods, defined content and a clear primary discipline and target audience.

Mission-focused research projects involve application of the scientific method, are hypothesis- (or question-) driven, involve systematic data collection and analysis of those data, and draw conclusions from the research process.

Green business practices focus on the annual documentation and usage of key resources: energy, fuel for transportation, waste and water, as well as identification of specific green practices being implemented.

This annual report underscores what the AZA community accomplishes together.

In 2019, the Toronto Zoo submitted 71 field conservation and mission-focused projects for the 2018 publication.



CONSERVATION RESEARCH

Saving the Massasauga Rattlesnake

The massasauga rattlesnake is Ontario's only venomous snake and is at risk of extinction. With expanding human populations, habitat alteration and fragmentation from development, and unfounded fear due to the many myths surrounding this animal, the population is declining.

To ensure the future existence of the massasauga in Ontario, the Toronto Zoo has been working with a wide range of partners and even initiated the massasauga rattlesnake conservation strategy in the late 1980s in response to increasing interest from the public about the species.

By 1991 the federal government listed the massasauga rattlesnake as "threatened" which prompted the founding of the Massasauga Rattlesnake National Recovery Team, a network of researchers, biologists, government and park representatives, and zoo officials working jointly towards the conservation of this species. The Toronto Zoo was one of the team's founding members and has contributed to rattlesnake conservation through the use of its expertise in caring for the massasaugas housed here at the Zoo.

In addition, our staff visit with landowners throughout Ontario to deliver tailored advice on habitat conservation and wildlife stewardship. Using our veterinary expertise and participation in multiple field studies regarding population dynamics and animal behaviour, we are able to collaborate with many partners in Ontario as well as the United States to aid in the international recovery efforts for massasaugas. Our staff also provide recommendations for husbandry protocols of zoo populations throughout North America, to ensure optimal health of the snakes and encourage breeding efforts for the long term survival and fitness of individual animals and important genetic lineages. The Zoo's own massasauga rattlesnakes are also considered to be assurance populations that may serve to augment or re-establish wild populations in the future. Ongoing studies are helping to identify populations which may benefit from increased conservation efforts so that our contributions to the future of the massasauga rattlesnake can have the most meaningful impact.

As an AZA accredited zoo, we have been active members of the Massasauga Rattlesnake Species Survival Plan® (SSP) since its inception and have been assisting in long-term population monitoring in southwest Michigan. Each year the Zoo sends staff to participate in field surveys in hopes of better understanding the population dynamics (mortality, reproductive, and population growth rates) of this snake population.

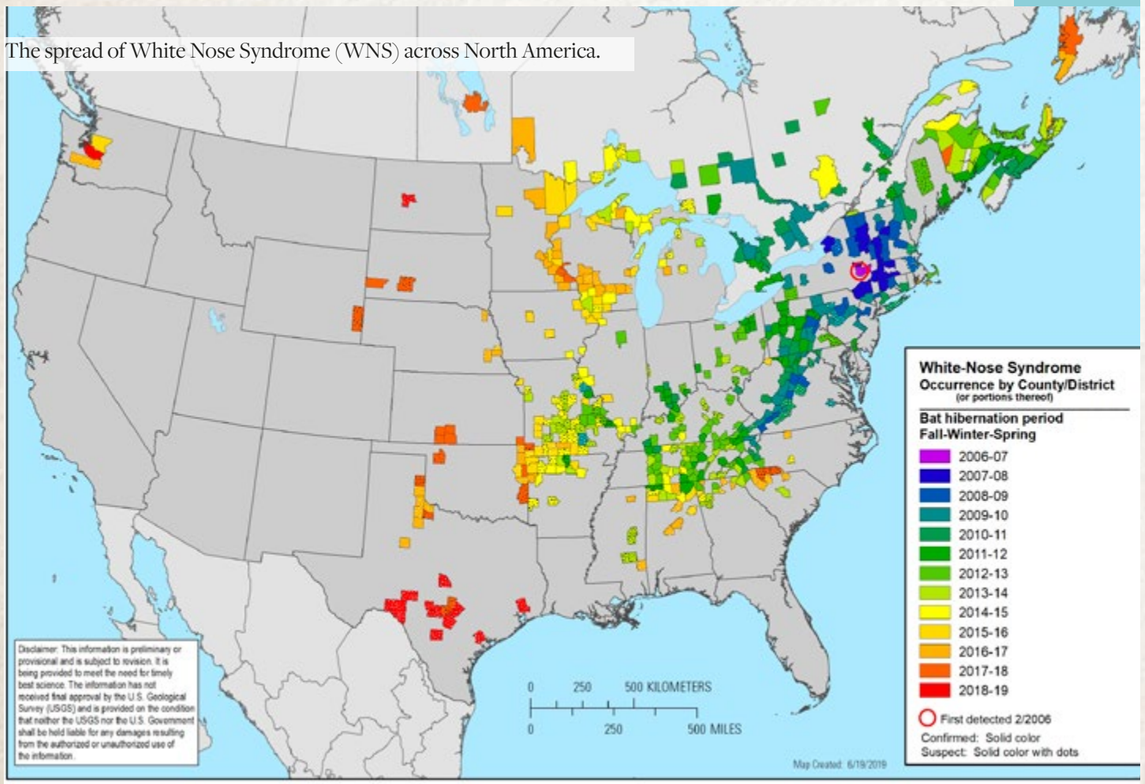
Over the years, we have produced a variety of outreach and education resources including informative posters, snake identifiers, guidebooks and stickers intended to demystify the massasauga rattlesnake and create a better understanding of these fascinating animals. The Toronto Zoo also hosts annual "Living with Rattlesnakes" workshops. This type of outreach is part of a study into the impact of the Zoo's educational presentations on long-term conservation actions for amphibians and reptiles. Attendees learn about the challenges facing the massasauga rattlesnake, the conservation efforts to save them, how the public can help, and even the snakes' biology and behavior. Guests also learn to identify the rattlesnake and other snake species that are similar in appearance. We also provide snakes on loan to Ontario conservation organizations that help spread the word about the importance of these animals.

BATS
Native Bat Conservation Program

Program Overview

Bats in North America face considerable threat from habitat loss, wind turbines and White Nose Syndrome (WNS), a fungal disease introduced to North America by human actions, and first recorded in 2006. The fungus affects cave hibernating species and has caused the deaths of millions of bats. In Ontario, WNS affects four of the eight bat species, which have been categorized as endangered since 2012. The Toronto Zoo's Native Bat Conservation Program is part of an international effort to conserve our bats! The program is growing, with a number of projects seeking to fill gaps in knowledge, conserve habitat, promote bats, and improve their public image.

The spread of White Nose Syndrome (WNS) across North America.



Citation: White-nose syndrome occurrence map - by year (2019). Data Last Updated: 6/19/2019. Available at: https://www.whitenosesyndrome.org/static-page/wns-spread-maps.

Monitoring Bat Populations in the Greater Toronto Area (GTA)

In 2017 the Native Bat Conservation Program was awarded $211,171 by Environment Canada to fund a three-year project monitoring bats in southern Ontario, and in particular the Greater Toronto Area (GTA). With matching funds from the Zoo and our partners, the project budget amounts to more than half a million dollars! Our major partners for this project are Toronto and Region Conservation Authority, Georgina Island First Nation Community, Nature Conservancy of Canada, and Bird Studies Canada.

The project began in 2017 and continued in 2018 with acoustic monitoring at sites across the GTA. Using automated monitors to record the echolocation calls of passing bats, we are able to identify areas of high activity. We were even able to discern species and compare activity levels at different times. Through this monitoring, we were able to identify a number of sites of interest. In early 2019 our acoustic data led us to discover a brand new roost of endangered little brown myotis bats in suburban GTA. We used radio-telemetry to track these bats and follow them as they flew through subdivisions and foraged in tiny urban parks. This fascinating insight into bat behavior highlights the importance of monitoring them, especially in urban areas and as the GTA continues to expand.

Northern Myotis Sightings - Exciting Discovery in the Field

Toronto Zoo's Native Bat Conservation Program continues to make exciting discoveries. The team was particularly enthusiastic to have identified several northern myotis (bats) flying around the GTA.

The northern myotis is one of three species in the myotis genus in Ontario and one of four endangered bats in Ontario, three of which are also federally endangered species in Canada. The classifications don't end there, the northern myotis is also considered threatened by U.S. Fish and Wildlife Service, and these are very substantial protections for a bat that weighs less than a toonie.

"*When we set out to do this project we had high hopes because we had recorded bat calls that made us think these species were here*," said Toby Thorne, Bat Researcher, at the Toronto Zoo. "*However, there is no proof like a bat in the hand. In 2018 we captured four breeding female northern myotis, and four juveniles that were born that year. This demonstrates unequivocally that this rare and threatened species is right here in the GTA. It's about the best result we could have hoped for.*"

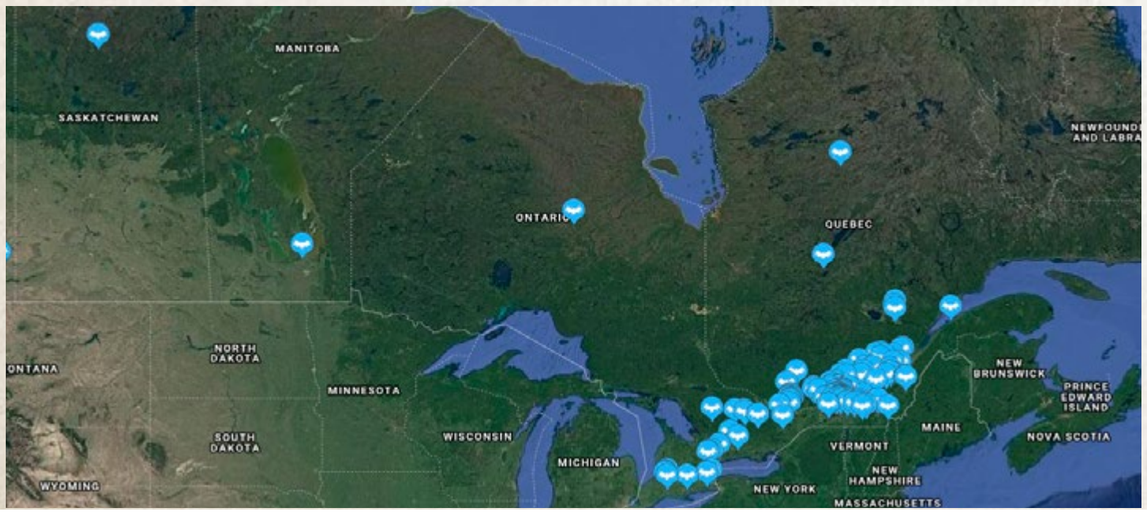
In 2019 the Zoo's bat program was awarded approximate;y $30,000 in funding through the United States Fish and Wildlife Service Small White Nose Syndrome Grants Funding Program to further investigate the population we discovered. With no published literature on this species' habits in urban areas, our investigation of this suburban population is groundbreaking research and may be relevant for conserving this species across the continent.

Bat Diversity in Rouge National Urban Park

Since 2015 the Toronto Zoo has partnered with Parks Canada to monitor bats in the fledgling Rouge National Urban Park. To date we have recorded several hundred thousand observations of bats in the Park. By monitoring at multiple sites over a number of years, we have confidently identified seven of the eight Ontario bat species and are beginning to learn about their seasonal activity patterns and spatial variation.

Bat Watch - We Want Your Roosts!

In early 2018 the Toronto Zoo became an official partner for the multi-province 'Neighbourhood Bat Watch' project. Currently covering five provinces, the project aims to link citizen scientists and people with bats in their homes with bat researchers seeking roosts. Anyone who knows the location of a bat roost can register on the website – www.batwatch.ca – and report the location. Precise location data is protected and only shared with project partners, who can contact homeowners and request to arrange a visit to roosts of interest. Locating roosts allows us to better understand bat populations and habitat requirements. Anyone knowing the location of a roost should consider reporting it on the Bat Watch website and can contact the Zoo's bat staff with any questions or concerns – bats@torontozoo.ca.



Bat Outreach

Meeting and learning about bats has proved very popular with Toronto Zoo members and non-members alike. Each year we aim to raise bats' profile with our summer 'Bat Awareness Weekend'. The activities include a ticketed evening talk and 'bat walk' around the Zoo looking for wild bats and listening to their echolocation with 'bat detectors'. In 2019, there were approximately 3,000 participants.

The opportunity to visit the Zoo at night always proves popular, and this event has been a sell out for the past few years. Due to the popularity, we also offer additional walks in August. To learn more about the event from this past year, turn to the achievements section of this publication. To learn about upcoming walks visit our website!

Bats in Happy Valley

In 2018, the Toronto Zoo entered a new partnership with the Nature Conservancy of Canada (NCC) to monitor bats in Happy Valley Forest, near King City. NCC owns a large portion of Happy Valley, which they manage for conservation.

Following a few recent acoustic observations of endangered bats in the forest, NCC purchased four acoustic monitors. In 2019 Natve Bat Program staff from the Toronto Zoo assisted with installation and training for these monitors, and will be analysing the data. We will also spend some time trying to catch bats in Happy Valley as part of our Environment Canada-funded monitoring.

Studying Bats with First Nations Communities

In 2018, the Native Bat Conservation Program (NBCP) received funding from the Species at Risk Stewardship Fund, provided by the Ontario Ministry of Natural Resources & Forestry.

Partnering with five First Nations communities across the province, this project used acoustic monitoring and roost examinations to learn about bat activity and to understand the populations in these understudied areas. NBCP also provided training on the maintenance of scientific equipment in order to conduct population surveys and to provide practical wildlife field skills to members of these First Nations. We also conducted Traditional Ecological Knowledge interviews to collect culturally significant stories and information regarding bats, which was then shared with the community. All of the data collected throughout this project belongs to each First Nation, and we encouraged data sharing with non-profit organizations such as Neighbourhood Bat Watch.

The overarching goal of this project is to teach members about the importance of these beneficial creatures and to gain a greater understanding of bats in these communities. We are continuing our work with these First Nation communities and have inspired a few of the communities to apply for funding to continue the work protecting bats on their lands.

Blanding's Turtle Head-Start Program

Photo Credit: Kelsey Bowles

Photo Credit: Kelsey Bowles

Since 1974 the Toronto Zoo has participated in some of the most significant conservation efforts in the zoological industry. One such program is the Blanding's Turtle Head-Start Program, where the Zoo participates in the annual release of threatened Blanding's turtles back into the Rouge Valley. The project was started in 1999 when the Urban Turtle Initiative observed seven Blanding's turtles while conducting research in the Rouge Park. Blanding's turtles were once abundant in the area but urban threats have caused their numbers to dwindle. Since they are listed as a threatened/endangered species in Ontario and Canada, and have been observed in declining numbers in Ontario over the past 50 years, this program is a prime example of how the unique strengths of accredited zoos can benefit species conservation.

The main issues Blanding's turtles face are low nest success and hatchling survivorship. This is because of high predation rates in urban areas, which have a higher proportion of predators as a result of human influences such as increases in food attractions (e.g. garbage, agricultural crops) and restrictions on hunting and trapping of top predators, In addition, road mortality has become an increasing problem.

What is Head-Starting?

Head-starting is the term used for raising individuals in a controlled protected environment during their early and most vulnerable stage of life. The mortality rate of turtles decreases as turtles grow larger, and as they develop larger and harder shells which are more difficult for predators to overcome. The goal of the Head-starting Program is to create a self-sustaining, natural population in the wild by rescuing eggs that have been laid in unsuitable conditions where they will not survive and then raising them until they can be released to have an approximate survival rate of 75 percent. According to our Population Viability Analysis, by releasing 50 hatchlings every year for 20 years (60 percent female-to-male ratio), we could reach a target population size of 150 which is required for a functional population that can sustain itself.

Reintroduction

Eggs are collected from at-risk areas, and brought to the Zoo and incubated for approximately two months under the watchful eye of our Wildlife Care staff. Turtles are fed and cleaned three times a week, shells are notched, and they are weighed and measured monthly. Once the eggs hatch, the turtles spend the first two years in the nursery under optimum conditions to help them grow big and strong for release. This two-year period is called "Turtle Bootcamp." The turtles undergo daily temperature and weather variations, are introduced to live food, and are acclimated to natural conditions and seasonal light cycles to refine their natural behaviours. They have a radio transmitter affixed to their carapace and Passive Integrated Transponder (PIT) tags

Finding suitable release sites.

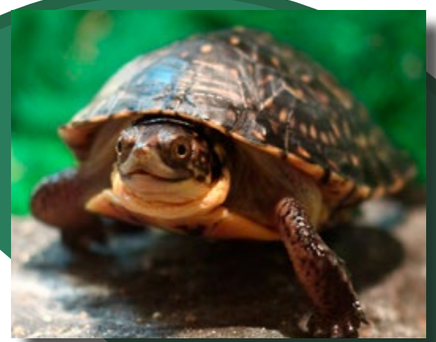
After the turtles spend two years in bootcamp, they are placed a soft-release enclosure for one week at a known habitat for Blanding's turtles (picture on the right). After final release, Zoo staff continue to monitor them to see how they interact with their new environment while they undergo important milestones such as migration and hibernation. With 213 turtles released so far, the information gained from monitoring these turtles helps inform us about their habitat requirements and what we can do to ensure they are continually provided with suitable areas to live.

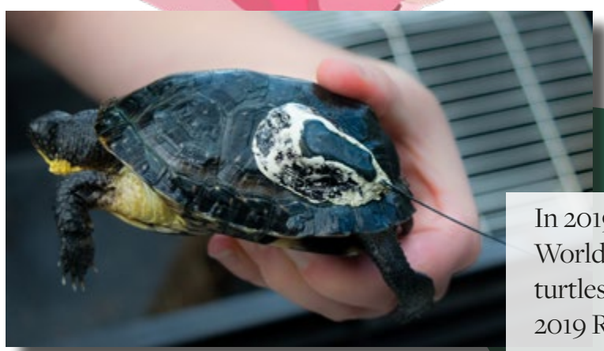
Restoration

In southern Ontario more than 75 percent of wetlands have disappeared, resulting in poor water quality, increased flooding and habitat loss for many species such as the Blanding's turtle. Alongside the Toronto Zoo, the Toronto Region Conservation Authority and Parks Canada are working to restore wetlands in the Rouge River Valley as well as locations on the Zoo site.

Reformation

Toronto Zoo actively participates in many outreach programs in order to increase awareness of urban turtles and highlight the importance of wetlands. Our citizen science programs help save species by allowing the public to submit their own turtle and frog observations. In 2018, Toronto Zoo officially opened a turtle nursery exhibit. This new exhibit gives the public the opportunity to see the animals up close and watch them develop throughout their first year of life, from hatchling to release!





In 2019, to commemorate the Toronto Raptors World Championship win, 37 out of 48 Blanding's turtles released into the wild were named after the 2019 Raptors team members, coaches, owners, and super fans. Pictured above is Blanding's turtle, Kawhi Leonard!

Giving the Wood Turtle a Head-Start

The Toronto Zoo has been assisting the Ministry of Natural Resources & Forestry and the Huron Stewardship Council with the recovery of the wood turtle in Ontario since 2010. Ministry staff monitor the wood turtles in their natural habitats and collect their eggs, which are raised in a protected zoo environment as part of a head-starting program. As with all turtles, the young have an extremely high mortality rate due to environmental pressures. The young turtles are brought to the Zoo where they are raised for two years before releasing them back into the wild. Once released, the turtles are monitored through the use of radio telemetry equipment to learn more about their behaviour and overall success. Toronto Zoo has head started over 400 turtles for release since joining this effort in 2010.

Eastern Loggerhead Shrike Program

The Eastern Loggerhead shrike is a remarkable songbird that breeds in Ontario and is one of several grassland birds that is declining in the province. In 1997, only 100 shrikes were estimated to remain in all of Canada, with a mere 18 pairs found in Ontario. The Toronto Zoo serves as one of the breeding facilities for the reintroduction program currently taking place in the province.

The program has released over 800 shrikes to date and has confirmed that some of these birds have returned to the province in subsequent years as breeding adults. Nearly 200 shrikes have been bred for the program at the Toronto Zoo, the majority of which have been released into the wild. In 2019, there were 14 fledglings released.

Breeding the Oregon Spotted Frog

The Oregon spotted frog is Canada's most endangered amphibian, with an estimated population of fewer than 340 adults in the wild. The Toronto Zoo is working with the Federal Recovery Team for the Oregon spotted frog to help recover this imperiled species. At the Toronto Zoo we have a breeding group of frogs in the Amphibian Rescue Centre (ARC) to support the recovery team's long-term goal to improve the Oregon spotted frog's chances for survival, prevent its extirpation, and to maintain or restore self-sustaining viable populations throughout its current, historic, and naturally occurring range.

Oregon spotted frogs have been successfully bred at Toronto Zoo, with over 250 offspring being sent to British Columbia for release to the wild. In 2018, the Zoo began applying the same technique of Artificial Reproductive Technologies (ART) that produced Dusky gopher frogs a year earlier and witnessed success with this new species. This was the first report of successful ART in Oregon spotted frogs and we are happy to say that the process was repeated again in 2019 with even more success!

The Vancouver Island Marmot Program

The Vancouver Island marmot (*Marmota vancouverensis*) is found only on Vancouver Island. It is one of the most rarest mammals in the world and is Canada's most endangered mammal - in 2003 there were only 30 individuals left in the wild.

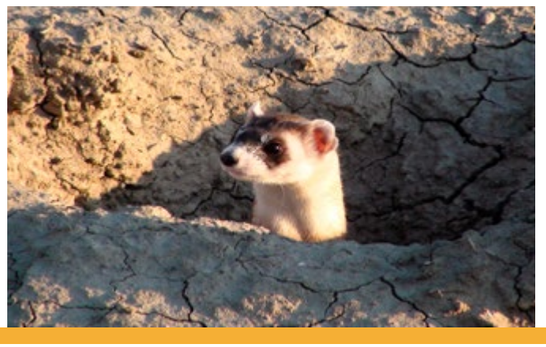
The year 2019 marked Toronto Zoo's twenty-second year of involvement in the conservation breeding program. At the Zoo, breeding pairs are kept out of the public eye in a specialized breeding centre. Pups that are born are sent to the Tony Barrett Mount Washington Marmot Recovery Centre in British Columbia where final preparations are made for their first over-winter hibernation and eventual release into the wild.

The Black-Footed Ferret Program

The black-footed ferret breeding and reintroduction program involves more than 50 organizations across Canada, United States, and Mexico, where they were listed as extirpated in 1978. The combined threats of habitat loss and fragmentation, prey loss, and disease have been a big challenge for these small mammals as they try to re-establish themselves in their old range.

The Toronto Zoo started working on the captive breeding of this species, the total number of ferrets born and raised on site is over 400.

Four kits born at the Zoo were sent to the National Black-footed Ferret Conservation Center in Colorado, while two animals remained in Toronto to participate in breeding efforts. This program will continue through 2020.

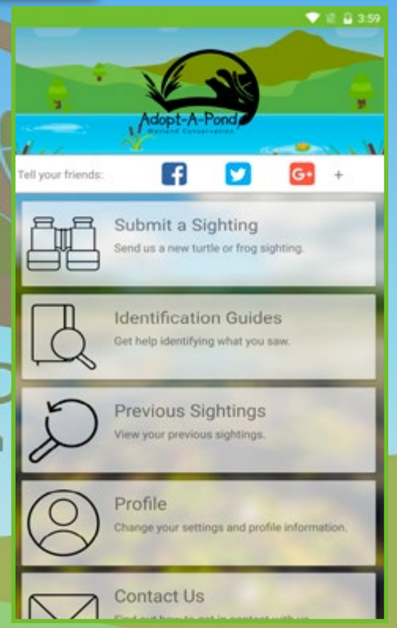


Adopt-A-Pond Programs

Toronto Zoo's Adopt-A-Pond Wetland Conservation Program works to design and deliver impactful conservation-focused research, restoration, and outreach that highlights the importance of saving Canada's sensitive wetland species and their habitats.

Over the last several decades, frogs, toads and salamanders — animals that rely on wetland habitat for most or part of their life — have become increasingly rare. In response, the Adopt-A-Pond Wetland Conservation Program was created to change this trend of decline by actively working with schools, community groups, and citizens to implement local initiatives that protect Ontario's wetland ecosystems and aquatic wildlife. Since its inception in 1991, Adopt-A-Pond has expanded and evolved into one of the Zoo's most active conservation programs. Today, Adopt-A-Pond includes a variety of citizen science programs, restoration initiatives, wildlife research, and targeted public engagement opportunities.

Download our Adopt-A-Pond App to submit any frog or turtle sightings, use our identification guide, and much more!



Urban Turtle Initiative

For over a decade, the Toronto Zoo's Adopt-A-Pond Wetland Conservation Program has undertaken a series of research projects, as a collective entitled the Urban Turtle Initiative, to learn more about what species of turtles are in the Rouge Valley, where they are living, and how they use the landscape to survive. After learning of the decline in local Blanding's turtle populations we began a head-starting and reintroduction program to boost their numbers. Over the past 10 years we have studied painted turtles, snapping turtles, Northern map turtles and Blanding's turtles. Many of the turtles in our project are monitored through radio tracking, to find out what habitats they are living in and to track their movements between those areas. We have radio tracked several hundred turtles through their travels in the Rouge Valley as part of this initiative.

Turtle Island Conservation

Toronto Zoo's Turtle Island Conservation (TIC) Program respectfully shares the hopes and goals of First Nations partners in our commitment for the preservation of biodiversity. The program celebrates culturally diverse and community-based approaches to conservation, recognizing that socially relevant programming is an imperative component to educating and motivating people to take action for the protection of wildlife and wildlife habitat.

The TIC Program has partnered with First Nation communities to develop culturally appropriate programming to protect and preserve community knowledge and significant natural and cultural landscapes since 2005. Our TIC staff visit numerous First Nations communities each year and have developed strong ties that enable a sharing of experiences and knowledge that fosters stewardship and sustainable practices.

Frogwatch Ontario

Toronto Zoo's Adopt-A-Pond Program is the Provincial Coordinator for the Canada-wide Frogwatch program, now nationally led by the University of Ottawa. This program monitors amphibian population health throughout the country, uses the information to collect data on the distribution of amphibian species, and shares this data with similar programs across Canada and around the world to contribute to scientific knowledge of the effects of global climate change.

Ontario Turtle Tally

Ontario Turtle Tally is a wildly popular program that encourages nature lovers from all walks of life to report observations of turtles they see in the wild to an online registry at the Zoo. This data, in turn, helps to implement habitat conservation projects and inspire participants to become advocates for turtles all across the province. The information gathered through Turtle Tally is made available to a number of local conservation groups so that they too can use it to help turtles across the province.

Wetland Conservation on the Toronto Zoo Site

Since 1999, the Toronto Zoo's Adopt-A-Pond Program and the Toronto and Region Conservation Authority have maintained a long-term partnership in order to restore wetlands for wildlife in the Rouge River Valley.

Our most recent project increased landscape connectivity for migrating wetland species in the Rouge River Valley and restored habitat for breeding amphibians that rely on vernal pools to complete their life cycle. Four ephemeral wetlands (Western Education Pond, Forest Ephemeral Pool, Salamander Ephemeral Pool and Historic Chorus Frog Pond) were restored, as the habitats were altered by infrastructure development or construction projects and no longer supported amphibian metamorphosis from egg to larvae to adult. The construction of the Chorus Frog Swale took place in fall 2018.

The removal of phragmites, an invasive perennial grass.

Road mortality is a major threat for many species, but there are many solutions to this issue where community support can be obtained. The XING exhibit installation in the Zoo's Americas Pavilion (in partnership with Ryerson University) highlights the emerging dialogue on landscape connectivity, engaging the public on the ways in which we collide and converge with wildlife and ultimately how we reconnect fragmented landscapes as part of a continental project to ensure safe passage for both humans and animals on and across our roads. There is powerful scientific evidence that wildlife road crossings are working. Together with these innovative and economical new technologies, public support and political leadership is needed to advance landscape connectivity.

Adopt-A-Pond and the Donkey Sanctuary of Canada

In the fall of 2018, Adopt-A-Pond (AAP) staff and the Donkey Sanctuary of Canada (DSC) staff and volunteers constructed a nesting beach for turtles living in the wetlands around the sanctuary, with funding provided by the Environment of Climate Change Canada's Habitat Stewardship Program. AAP and DSC selected an appropriate site on the property and began construction with an excavator, digging out the area which was then lined with perforated material (that allows for drainage, but also prevents vegetation from growing through). The area was filled with a layer of pea gravel, and then sand. Different species of turtles prefer different types of substrate in which to lay their eggs, so the mixture was tailored to accommodate multiple species. Since construction of the beach, painted turtles and snapping turtles have been observed around the nesting site, with a painted turtle seen digging around the beach! In 2019, Toronto Zoo provided informational resources.

Great Lakes Program

In-Class and Community Outreach

The Great Lakes Program offers free, bilingual, curriculum-based and interactive outreach programs to schools and community events from Chatham-Kent to Ottawa. As part of the in-class program, students receive take home materials and teachers receive a flash drive containing educational resources, including lesson plans and fish-focused games. Program materials are available in English, French, Mandarin, Punjabi and Urdu to meet the needs of the Great Lakes Program's diverse audience.

Participants learn how local aquatic Species at Risk such as the redside dace (endangered), pugnose shiner (endangered in Ontario) and freshwater mussels contribute to a healthy aquatic ecosystem and the actions they can take to ensure a future for these and other local aquatic species. Through in-class and community outreach at libraries, scout groups, and special events, the Great Lakes Program reaches over 20,000 participants annually.

This year the Great Lakes Program has been as busy as ever attending water festivals in the GTA and southwestern Ontario, delivering high-quality in-class outreach presentations in English and French, attending and hosting teacher's conferences, developing program resources and analyzing participant feedback.

Redside Dace

Recently up-listed to Schedule 1 of the Species at Risk Act, the redside dace is a federally recognized endangered species (COSEWIC). Formerly found in the Rouge River in Toronto Zoo's backyard, the redside dace represents the foundation of the Great Lakes Outreach Program. As a member of the National Redside Dace Implementation Team, Toronto Zoo and local partner, Ontario Streams, undertake habitat rehabilitation projects in the Morningside Tributary to support this locally endangered species. In 2020, we plan to mark the 10 year anniversary of the redside dace as a listed species at risk with a major outreach event and various stewardship initiatives.

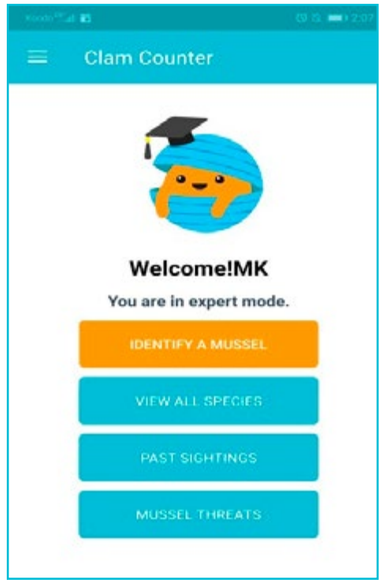
Regional Assistants

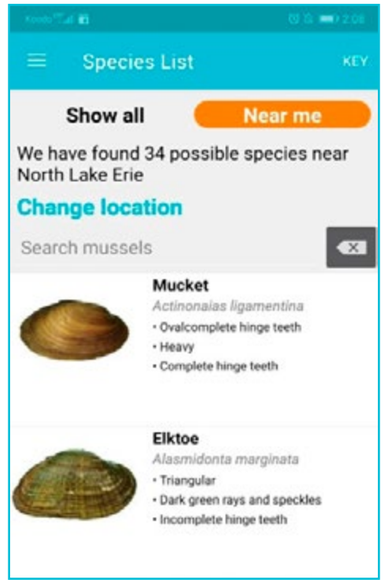
In 2019 the Great Lakes Program intensified efforts to deliver outreach in southwestern Ontario and along the eastern shores of Lake Ontario. Regional outreach staff completed in-class presentations and distributed support materials from Sarina to Chatham-Kent to Kitchener-Waterloo reaching over 10,000 students in the 2018-19 academic year. Additionally, program staff placed in the east region of Lake Ontario facilitated focused outreach delivery to approximately 3,000 students from Cobourg to Kingston. The program was fully booked for English and French program delivery in the three primary regions of the Lake Ontario watershed (southwest Ontario, GTA and east Lake Ontario) and an ongoing waiting list for new and returning schools is prepared for the upcoming academic year.

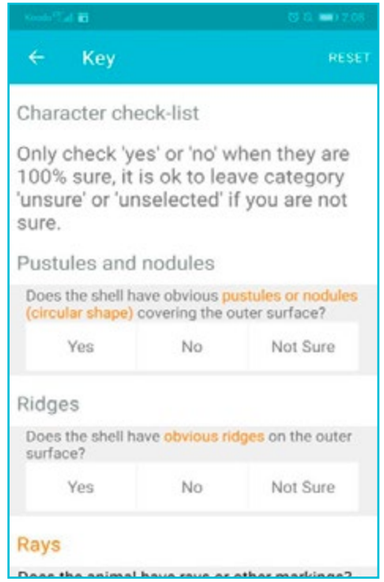
Freshwater Mussels Public Campaign: 'I am Important! I am Protected!'

Complementing Toronto Zoo's freshwater mussel field research, the "I am Important! I am Protected!" public campaign raises public (and scientific) awareness for these highly endangered invertebrates. Commonly referred to as clams, native freshwater mussels play a little known but vital role in the aquatic ecosystem. As part of Toronto Zoo's Great Lakes Program, this campaign offers educational in-class outreach focused on freshwater mussel biology and ecology, outdoor posters for waterfront property owners, public presentations, and static-cling decals for the fridge and windows. Since the launch of the Clam Counter app for freshwater mussel identification and reporting in spring 2017 (developed in partnership with Fisheries and Oceans Canada), the app has been installed over 200 times and approximately 40 reports were submitted during the first field season the app was in use. Through winter 2018 several updates were made based on user feedback including: the ability to manually enter coordinates and upload photos from the device gallery; the option to subscribe to the app mailing list; and redesigned identification key.

Toronto Zoo staff attended the Canadian Freshwater Mollusk Research Meeting in 2019 to continue to introduce the app and solicit feedback.







Freshwater Mussels Field Program

The 2017 field season marked the 5th year of Toronto Zoo's field surveys to document freshwater mussel abundance and distribution in the inland watersheds of Lake Ontario. Four native mussel species were documented across the 5 watersheds surveyed in 2017. Surveys on Credit River were intensified to increase the likelihood of documenting live mussels following the initial discovery of live mussels in the Credit River in 2016. Humber, Don and Rouge Rivers were also surveyed as select sites in the Kawartha Lakes. In addition to documenting mussel species, water chemistry parameters are also measured and analyzed to determine trends in the aquatic ecosystem at survey locations. A summary of the results from Toronto Zoo's 5-year field survey of freshwater mussel distribution and abundance was presented at the Canadian Freshwater Mussel Research Meeting at the Canada Centre for Inland Waters in Burlington in the fall of 2017. This research contributes to the growing knowledge of mussel species at risk at a time when the pressures of urban development and climate change continue to grow and evolve.

Aqua-Links Program

Classroom Hatchery: Lake Ontario Atlantic Salmon Recovery Program

The Toronto Zoo's Aqua-Links Program has participated in the Lake Ontario Atlantic Salmon Recovery Program (LOASRP) for 10 years. In partnership with the Ontario Federation of Anglers and Hunters (OFAH) and the Ministry of Natural Resources and Forestry, the Zoo distributes 100 "eyed" Atlantic salmon eggs to participating schools each year. Approximately 500 eggs are also kept at the Zoo for rearing. In the spring, participating students personally release their salmon fry with Aqua-Links Program staff at specific locations on designated tributaries of Lake Ontario to help restore this extirpated species.

In 2019, 26 schools participated in the classroom hatchery program thanks in part to a partnership with the Toronto District School Board. Toronto Zoo program staff facilitated a pre-program workshop to introduce new teachers to the salmon rearing program, demonstrate hatchery set-up and maintenance, and facilitate idea sharing among participants. In total, 3,000 Atlantic salmon fry were released in spring 2019 into Duffin's Creek, Credit River, and Cobourg Creek through the Aqua-Links Program.

"Eyed" salmon eggs for participating schools.

"Alevin", 8 week old Atlantic salmon.

Releasing Atlantic salmon fry.

Atlantic salmon "Fry".

Full grown Atlantic salmon.

Kat Lucas, collecting the Atlantic salmon fry for release.

Linking Students in Ontario and East Africa: Lake Victoria Education Initiatives

Building on the success of the Great Lakes Outreach Program, Aqua-Links educates students about water quality issues facing two Great Lakes regions of the world: North America and East Africa. Focusing on the importance of conserving these precious freshwater resources, Toronto Zoo links students in Ontario and East Africa via the Internet to share water stories and conservation ideas. For example, Kelsey from Gayaza High School in Uganda shared, "*I love Uganda because it has one of the biggest lakes in Africa, which is Lake Victoria, and I would love to have a pen pal from Canada so they can know more about the country*" in a video sent to Ontario students. Linking is made possible through contacts gained from the Lake Victoria Species Survival Plan in East Africa. Program coordinators in both countries visit classrooms to provide lessons and facilitate program delivery.

Additionally, Ontario students gain hands-on experience caring for Atlantic salmon right in their classroom. At the same time, students in East Africa visit the National Fisheries Resource Research Institute in Jinja, Uganda to learn about locally endangered Lake Victoria cichlids.

Resources are available to teachers and Toronto Zoo continues to facilitate and build linkages with the lesson plans.

Blue Schools

The Toronto Zoo created the Blue Schools Program to address the strain that high water consumption places on both infrastructure and ecosystems. On average, Canadians use more than 300 litres of water everyday, not including 'hidden water' used to manufacture everyday items like clothes and prepared food. This ranks Canada near the top in water-consumption per capita, second only to the United States. The Blue Schools Program, running for it's second year under the Great Lakes Program "umbrella", is a STEM-based program (science, technology, engineering and mathematics) linked to multiple areas of the Ontario Curriculum and allows for four certification levels to foster deeper learning. It allows for classes across the GTA to participate in hands-on experiences for both staff and students and runs for the full school year. This year, with 8 classes participating, students were able to conduct water audits and develop an action plan to conserve water at their own school!

These Blue School Programs run throughout the year and involve a step-by-step process. From September to October, students establish support and make a plan for their academic year. Then from November to December, students conduct a school-wide water audit, collecting and analyzing school baseline data. In January, the class then prepares an action plan to reduce water consumption in their school. From February to May these students finally implement the action plan, and in June they receive their certification for successful achievement of Action Plan goals.

Featured in 2019 was the Allan A. Martin Public Schools Rain Garden, where rain water is diverted into a school garden. This garden will re-use rain water and trap pollutants such as oil, salt and fertilizer to prevent untreated water runoff into local water bodies!

Grand opening of the Allan A. Martin Public School Rain Garden.

Getting Involved

Our programs are delivered in both English and French for visiting students and community members, and offer brochures as well in many additional languages such asMandarin, Punjabi, and Urdu to ensure that our program can be as accessible as possible to the Toronto region! Brochures in these languages are handed out to different organizations across the GTA to try and get as many people involved as possible.

Partnerships

One of our key partners for the Aqua-Links program is the Toronto District School Board. They help us coordinate the hatchery set up workshop for teachers, the distribution and maintenance of the hatcheries, and any administrative troubleshooting we encounter. This 5-year partnership with the Toronto District School Board has helped the Zoo expand the program across Toronto.

Through the Aqua-Links Program we are also partners in the Lake Ontario Atlantic Salmon Restoration Program which collaborates with organizations on the municipal, provincial, and federal level. In addition, we work closely with the Ontario Federation of Anglers and Hunters who run a program similar to Aqua-Links but with a larger reach across Ontario. With the Ontario Ministry of Natural Resources providing the Zoo with Atlantic salmon eggs, as well as running large scale hatcheries across the province, as a team, we have a goal of establishing a self-sustaining population of Atlantic salmon in Lake Ontario by 2025.

Staff Feature: Aqua-Links

Mary-Kate Whibbs, Aqua-Links Program Coordinator

Mary-Kate Whibbs is the Great Lakes Program Coordinator at the Toronto Zoo and manages our aquatic conservation programs which include the Great Lakes Program, Aqua-Links Program, Freshwater Mussels Field Program, and Blue Schools Programs. In addition, she also writes grants to fund these programs, develops educational/community resources, liaises with local and international partners, and conducts field research on freshwater mussels. She holds Bachelor of Science and Bachelor of Education degrees from Trent University, as well as a Masters degree in Museum Studies from the University of Toronto. She started working at the Zoo in 2008 as a field technician on the Blanding's and snapping turtle research programs for Adopt-A-Pond. In 2010 she joined the fish team and the Great Lakes Program.

Kat Lucas, Aqua-Links Program Assistant

Kat Lucas is our Aqua-Links Program Assistant at the Toronto Zoo. In this role, she helps coordinate the Aqua-Links and Blue Schools programs and often leads classroom presentations and community outreach through our Great Lakes Program as well. In addition, she previously worked at the Zoo as an interpreter in the Wildlife Health Gallery and as a bilingual outreach lead with the Great Lakes Program. She has a Masters of Environmental Science degree, which studied the effects of pharmaceuticals on fish reproduction. She is extremely passionate about aquatic ecosystems and loves teaching others about how to help wildlife and the environment.

BEYOND BORDERS

The Zoo's impact on wildlife and their habitats extends beyond our 700 acre site. We release endangered species bred at the Toronto Zoo into the wild, which has helped to make great strides in preserving many threatened and endangered animals. Our work extends beyond Canadian borders, with the breeding and re-introduction of the Puerto Rican crested toad and the dusky gopher frog, field work with fish in Madagascar, and contributing to many Species Survival Plans throughout North America.

Dusky Gopher Frog

The wild population of the dusky gopher frog hovers around 100 individuals, and they have only a single ephemeral pond where they can breed, making the dusky gopher frog the most critically endangered frog in the United States.

The wild population is threatened by habitat degradation (fire suppression), ongoing and vigorous commercial development in the immediate vicinity of the breeding pond, disease, a genetic bottleneck, and critically low population size. Thus, this is truly a case where the Zoo population is an assurance colony to prevent complete extinction of the species in the event the last remaining wild population disappears, something that could happen with little warning. Toronto Zoo responded to this crisis situation by providing housing and breeding space to the Dusky Gopher Frog Species Survival Plan®.

Since their arrival at the Zoo in 2014, we have succeeded in naturally cycling the frogs, with females producing eggs. In 2017, Amphibian & Reptile Curatorial staff and the Reproductive Physiology team overcame challenges of natural breeding using techniques developed by Dr. Andy Kouba in Mississippi. Following hormone injections, egg and sperm collection, and in vitro fertilization, the first dusky gopher frog embryos developed in Canada, metamorphosing into tadpoles and juvenile frogs, and set for release into the wilds of southern Mississippi in the summer of 2019.

Puerto Rican Crested Toad

Our most successful breeding project involves the critically endangered Puerto Rican crested toad. The Puerto Rican crested toad is listed as critically endangered by the International Union for Conservation of Nature (IUCN), and is found only in Puerto Rico. In collaboration with the U.S. Fish and Wildlife Service and the AZA Puerto Rican Crested Toad Species Survival Plan®, tadpoles hatched at Toronto Zoo are released in Puerto Rico each year for the purpose of sustaining and rebuilding the wild population. Toronto Zoo has been an active participant in the breeding program for over 30 years and we are proud of the fact that we have released a total of 156,556 Puerto Rican crested toads into the wild, including sending 8,700 tadpoles to Puerto Rico in 2019.

Madagascar Fishes

The fish lab at Toronto Zoo has been breeding different species of Madagascar fish since 2014, when one of our Keepers, Tim McCaskie, travelled to East Africa and brought the fish back with him. Over the past 4 years we have successfully bred multiple groups of Rheocles vatasoa, a Madagascar rainbowfish. We have been sending some of our offspring groups to other accredited zoos and aquariums around the world to help increase the captive numbers and ensure the species survival. In the past year, we have also been breeding Ptychochromis insolitus, a cichlid thought to be extinct and have increased the numbers to over 300 individuals.

We are still continuing to work with the four other species collected in Madagascar: Ptychochromis loisellei, Paretroplus loisellei, Paratilapia sp. Andapa, and Bedotia sp. Sambava. We have had some success in breeding these last four species but we are working to improve our breeding techniques and document all of our findings to help ensure the species future.

Toronto Zoo has also received the last remaining *Bedotia marojeyj* in captivity. As we have been the only successful zoo to breed this valuable endangered species, the Species Survival Plan has put their faith in us to breed this very difficult species and bring their numbers back from the brink of extinction. Since their arrival, we have been successful in breeding them and look forward to increasing their numbers again acting as mentors to others willing to try again.

In 2019, 70 Madagascar fishes were sent to Germany and 40 were sent to London, England.

Pictured: Puerto Rican Crested Toad

SPECIES SURVIVAL PLAN®

The Species Survival Plan®(SSP) is a cooperatively managed program overseen by the Association of Zoos and Aquariums (AZA). The main objective of the program is to oversee the population management of select species within AZA member institutions and to enhance conservation of this species in the wild. Each SSP program coordinates the individual activities of participating member institutions through a variety of species conservation, research, husbandry, management, and educational activities.

17 Red SSP Programs

- Captive populations of very few individuals and are not sustainable in the long term at present time

19 Green SSP Programs

- Captive populations that are thriving

90 Yellow SSP Programs

- Captive populations present but are not yet strong enough to persist long term

14 Candidates for SSP Programs

- Populations that need to grow to meet minimum criteria to be an SSP®

SSP Species at Toronto Zoo

Of the 5,000 animals here at Toronto Zoo, 141 are part of the Species Survival Plan. Our staff work hard to participate in this important program, assisting in SSP planned births of 32 different species! For example, the list below highlights which SSP program they fall under. The column on the right classifies them under IUCN Red listings (least concern, near threatened, vulnerable, endangered, critically endangered, extinct in the wild, and extinct).

SPECIES	GREEN SSP	YELLOW SSP	RED	Candidate	IUCN
MAMMALS					
African cheetah (*Acinonyx jubatus jubatus*)		X			VU
African lion (*Panthera leo*)	X				VU
American beaver (*Castor canadensis*)				X	LC
American moose (*Alces alces canadensis*)			X		LC
Amur tiger *(Panthera tigris altaica)*	X				EN
Babirusa (*Babyrousa celebensis*)		X			VU
Bactrian camel (*Camelus bactrianus*)				X	CR
Bennett's wallaby (*Macropus rufogriseus*)	X				LC
Bettong (*Bettongia penicillata (no subsp)*)		X			CR
Bison (*Bison bison*)				X	NT
Black-footed ferret (*Mustela nigripes*)		X			EN
Black-handed spider monkey (*Ateles geoffroyi geoffroyi*)		X			CR
Canadian Lynx (*Lynx canadensis*)		X			LC
Capybara (*Hydrochoerus hydrochaeris*)		X			LC
Clouded leopard (*Panthera nebulosa*)		X			VU
Cougar (*Felis concolor*)		X			LC
Crested porcupine (*Hystrix africaeaustralis*)		X			LC
Eland (*Taurotragus oryx)*		X			LC
Feather-tailed glider (*Acrobates pgmaeus*)				X	LC
Gaur (*Bos gaurus*) **offsite**				X	VU
Golden-lion tamarin (*Leontopithecus rosalia*)	X				EN
Great Indian rhinoceros (*Rhinoceros unicornis*)		X			VU
Greater Kudu (*Tragelaphus strepsiceros*)		X			LC
Grevy's zebra (*Equus grevyi*)	X				EN
Jaguar (*Panthera onca*)	X				NT
Lion-tailed macaque (*Macaca silenus*)			X		EN
Long-tailed chinchilla (*Chincilla lanigera*)				X	EN
Malayan tapir (*Tapirus indicus*) **offsite**			X		EN
Masai giraffe (*Giraffa camelopardalis tippelskirc* i)		X			LC
Matschie's tree kangaroo (*Dendrolagus matschiei*)			X		EN
Mouflon (Ovis*)*				X	VU
North American river otter (*Lontra canadensis*)	X				LC
Polar bear (*Ursus maritimus*)		X			VU
Prehensile-tailed porcupine (*Coendou prehensilis*)		X			LC
Przewalski's horse (*Equus przewalskii*)		X			EN
Pygmy hippopotamus (*Choeropsis liberiensis*)			X		EN
Pygmy marmoset (*Cebuella pygmaea*)		X			LC
Red panda (*Ailurus fulgens fulgens/styani*)	X				VU
Red River Hog (*Potamochoerus porcus*)		X			LC
Ring-tailed lemur (*Lemur catta*)	X				EN
River Hippo (*Hippopotamus amphibious*)		X			VU
Sable antelope (*Hippotragus niger*) **offsite**		X			LC
Serval (*Leptailurus serval*) **offsite**		X			LC
Short-beaked echidna (*Tachyglossus aculeatus*)			X		LC
Slender-tailed meerkat (*Suricata suricatta*)		X			LC
Snow leopard (*Uncia uncia*)		X			EN
Southern hairy-nosed wombat (*Lasiorhinus latifrons*)				X	LC
Spotted hyena (*Crocuta crocuta*)		X			LC
Spotted-necked otter (*Lutra maculicollis*)			X		LC
Straw coloured fruit bat (*Eidolon hellvum*)		X			NT
Sumatran orangutan (*Pongo pygmaeus abelii*)	X				CR
Sumatran tiger (Panthera tigris sumatrae)		X			CR
Two-toed sloth (*Choloepus didactylus*)		X			LC
Warthog (*Phacochoerus africanus*)		X			LC
Western grey kangaroo (*Macropus fuliginosus melanops*)		X			LC
Western lowland gorilla (*Gorilla gorilla gorilla*)	X				CR
White rhinoceros (*Ceratotherium simum simum*)		X			NT
White-faced saki monkey (*Pithecia pithecia*)		X			LC
White-handed gibbon (*Hylobates lar*)		X			EN
Wildebeest (*Connochaetes taurinus*)		X			LC
TOTAL	11	34	7	8	

Leaf frog secured for shipment.

Butterfly pupae ready for shipment.

Puerto Rican crested tadpoles, a species that is a part of our Conservation Breeding Program.

Animal Transfers & Shipments

Shipping live animals is challenging. Every shipment is different than the last and many factors must be considered in order to get the animal to their final destination. What species are involved and how many are there? Where are they going or coming from? What are the permitting and health testing requirements? What is the best mode of transportation? What sort of shipping crate/container should be used? How does weather restrict the shipment? How will the animal be loaded/unloaded? The list can be endless!

Animal welfare is always a priority so shipments must occur quickly and efficiently which requires a great deal of planning. Toronto Zoo employs an Animal Logistics Coordinator to tackle more than 100 transfers each year. Many shipments facilitate SSP breeding recommendations as well as breed and release programs.

For example, this year, we swapped female Matschie's tree kangaroos with the Kansas City Zoo, and also received a male greater kudu from the North Carolina Zoo, both SSP breeding recommendations. We also bred Oregon spotted frogs and Vancouver Island marmots which were sent back to their native range for release into the wild. So, whether it's a tarantula or a rhinoceros, travelling down the road or across the ocean, all live cargo is precious. Preparedness is key in ensuring a transfer goes smoothly.

Nandu, our Indian Rhino, being lifted by crane onto a truck set for Safari Niagara.

Our Role in the International Zoo Community

Species 360

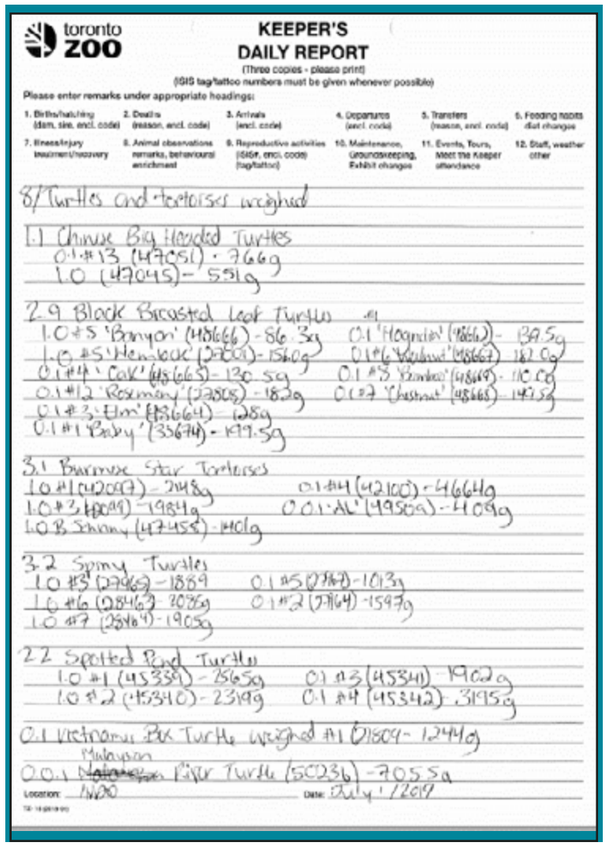
Toronto Zoo is a contributing member to Species360, a non-profit organization (NGO) and global leader in wildlife care and conservation. With over 1,100 zoo, aquarium, university, research and governmental members worldwide, the organization and its members work to improve animal welfare and species conservation by addressing today's most urgent wildlife issues. This includes establishing best practices in husbandry, enrichment, medical care, welfare, reproduction, population management, and biodiversity. The Species360 Conservation Science Alliance, is comprised of researchers that provide conservationists with evidence-based findings, which encompass a full range of global data including IUCN Red List, CITES, TRAFFIC, EDGE, AZE, ZIMS, and more. Research led in collaboration with IUCN Species Survival Commission, Convention on International Trade in Endangered Species of Flora and Fauna (CITES), and others, can provide data to create decisions such as enforcing illegal wildlife trade laws or even calculating the viability of insurance populations.

ZIMS (Zoological Information Management System)

Species360 members curate the zoological information management system (ZIMS), the world's most comprehensive open database of knowledge on more than 22,000 species. Wildlife professionals within zoos and aquariums as well as refuge, research and education centres across 97 countries, contributions to this system vastly increases what is known about thousands of species, and is instrumental in identifying sustainability strategies for many of the species assessed as vulnerable, endangered, and extinct in the wild. This data is also used to update Regional and International Studbooks and help to advise Species Survival Plan (SSP) decisions. Toronto Zoo has been contributing data on our animals since 1973, working hard every day to record information about our animals in our care. Since then, we have added critical information on 34,723 birds, reptiles, amphibians and mammals of 1,177 species!

Sharing Information

It is the job of the Registrar to input all data collected from various sources all around the Zoo site. Keeper daily notes, medical records, behavioural and welfare observations, maximum and minimum room temperature monthly reports, and weight spreadsheets are just some of the documents. Once the data is entered into ZIMS it can be accessed by staff to keep them up to date on animal care and any new changes or trends. Since ZIMS is shared among members, individual animal information can also be shared. When an animal is transferred to another location, often as part of an SSP recommendation, that animal's data can be shared with the new zoo, allowing the full history of the animal to be in one place to insure proper care as well as allowing the new zoo to contribute new information.


toronto ZOO

KEEPER'S DAILY REPORT

(Three copies - please print)

(GHS tag/tattoo numbers must be given whenever possible)

Please enter remarks under appropriate headings:

1. Births/hatching (date, sex, excl. code) 2. Deaths (reason, excl. code) 3. Arrivals (excl. code) 4. Departures (excl. code) 5. Transfers (reason, excl. code) 6. Feeding habits diet change

7. Illness/injury treatment/recovery 8. Animal observations remarks, behavioural enrichment 9. Reproductive activities (GS#, excl. code) (tag/tattoo) 10. Maintenance, Groundskeeping, Exhibit changes 11. Events, Tours, Meet the Keeper attendance 12. Staff, weather other

8/ Turtles and tortoises weighed

1.1 Chinese Big Headed Turtles
0.1 #13 (47051) - 766g
1.0 (47045) - 551g

2.9 Black Breasted Leaf Turtles
1.0 #5 'Banyan' (48666) - 86.3g
1.0 #5 'Hemlock' (27001) - 156g
0.1 #4 'Oak' (48665) - 130.5g
0.1 #12 'Rosemary' (27005) - 182g
0.1 #3 'Elm' (48664) - 128g
0.1 #1 'Baby' (33674) - 119.5g
0.1 'Hogmen' (48662) - 137.5g
0.1 #6 'Walnut' (48667) - 162.0g
0.1 #5 'Bamboo' (48669) - 110.0g
0.1 #7 'Chestnut' (48668) - 140.5g

3.1 Burmese Star Tortoises
1.0 #1 (42007) - 2148g
1.0 #3 (42099) - 1984g
1.0 B. Shiny (47455) - 1410g
0.1 #4 (42100) - 4664g
0.0.1 'AL' (49504) - 4109g

3.2 Spiny Turtles
1.0 #5 (27962) - 1889
1.6 #6 (28463) - 2086g
1.0 #7 (28464) - 1905g
0.1 #5 (27967) - 1013g
0.1 #2 (27964) - 1597g

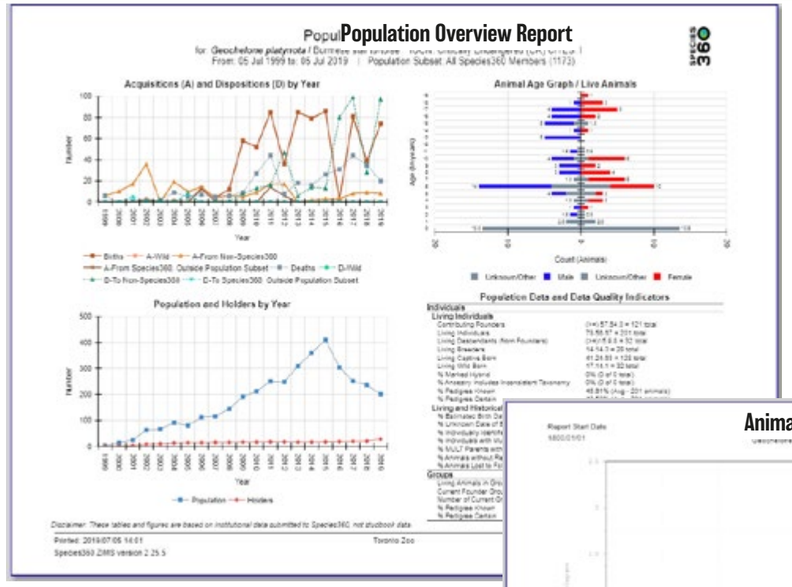
2.2 Spotted Pond Turtles
1.0 #1 (45339) - 1865g
1.0 #2 (45340) - 2319g
0.1 #3 (45341) - 1902g
0.1 #4 (45342) - 3195g

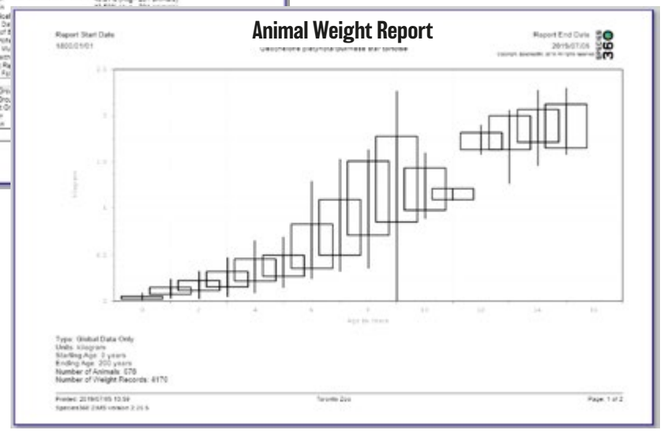
0.1 Vietnamese Pin Turtle weighed #1 (01809 - 1244g

0.0.1 Malayan Box Turtle (5C036) - 705.5g

Location: NWDO Date: July 12 2019

One of the daily reports our registrar receives.





Samples of reports pulled from ZIMS using data from zoos all over the world.

Toronto Zoo Delivers Missing Information Critical to Sustaining Biodiversity

Although currently there seems to be an overwhelming amount of information on mankind with volumes of data and research, we surprisingly know little about other species we share this planet with. According to a paper published in the journal ***Proceedings of the National Academy of Sciences*** (PNAS), critical information such as fertility and survival rates, is missing from global data for more than 98 percent of known species of mammals, birds, reptiles, and amphibians! This gap in knowledge has massive implications for conservationists attempting to reduce the impact of mass extinctions. To make more informed decisions, we require more complete data, especially for scientists working worldwide on behalf of organizations such as IUCN Red List or CITES.

Using data recorded in ZIMS by Toronto Zoo and other zoos and aquariums worldwide, key missing information was filled in, allowing a multi-disciplinary team led by the Species360 Conservation Science Alliance with participants from 19 different institutions, analyze this important data which was previously overlooked. When it comes to predicting when species are at risk or how to best bolster populations, it is necessary to understand when females reproduce (at what age), how many hatchlings or juveniles survive to adolescence and how long adults live. This is why researchers developed a Species Knowledge Index (SKI), which is able to classify available demographic information for 32,144 species of mammals, birds, reptiles and amphibians. However, when analyzing global sources of information, the index registers comprehensive birth and death rates for only 1.3 percent of these major classes of species. By adding the information collected in ZIMS by Species360 members, "it was like turning on the lights in an otherwise very dim room", boosting the Species Knowledge Index by eightfold - with information on the age of first reproduction for females growing as much as 73 percent.

Animal Care & Research Process

Toronto Zoo takes great pride in the care it provides to its animals and its involvement in the various conservation programs and research projects.

The Toronto Zoo is not only a state-of-the-art animal care facility but is also a registered research facility. The Toronto Zoo is overseen by the Canadian Council on Animal Care (CCAC) and the Ontario Ministry of Food, Agriculture and Rural Affairs (OMAFRA).

CCAC CCPA
CANADIAN COUNCIL ON ANIMAL CARE
CONSEIL CANADIEN DE PROTECTION DES ANIMAUX

Toronto Zoo participates in animal-based science programs and maintains a Canadian Council on Animal Care (CCAC) Certificate of GAP – Good Animal Practice which is an ongoing process that recognizes an institution's commitment to achieving high standards of animal ethics and care in science.

Toronto Zoo is enrolled in the CCAC Assessment and Certification Program and is certified every three years based on its compliance with CCAC policies, guidelines and other CCAC-recognized standards as evaluated by an assessment panel composed of scientists, veterinarians, community members, and CCAC Assessment and Certification Committee.

Each participating institutions must set up a local institutional animal care committee. Toronto Zoo's Animal Care & Research Committee (ACRC) is responsible for overseeing all aspects of animal ethics and care at the Zoo, undertakes animal care protocol review and approval, and must adhere to the CCAC's guidelines and policies.

Ontario
MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

Toronto Zoo is registered as an animal research facility under the Animals for Research Act of Ontario which is overseen by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

To maintain an annual license renewal the Zoo must meet various requirements for registration including:

- Having an established institutional Animal Care Committee who are responsible for reviewing animal use protocols and providing animal oversight at the Zoo including ensuring that animals are housed in appropriate facilities under suitable conditions;
- The Committee ensures that researchers and animal care staff are appropriately trained and qualified to care for the animals;
- The Zoo has the necessities to properly care for and handle animals that are in the research facility, and abide by the Act and the regulations.
- Due to its research status, Toronto Zoo is exempt from the Ontario Society for the Prevention and Cruelty of Animals Act, so OMAFRA is responsible for conducting site visits of Toronto Zoo throughout the year.

VETERINARY SCIENCE

A BUSY MULTI-FACETED AREA THAT STRIVES EVERYDAY TO ACHIEVE EXCELLENCE IN WILDLIFE HEALTH, WILDLIFE CARE, & RESEARCH.

The Wildlife Health Centre

Once coined the "hidden zoo," Toronto Zoo's Wildlife Health Centre is now very much visible and available for the public to view. Completed in 2017, it is a $19.1 million state-of-the-art facility and the first of its kind in Canada. In total, it is approximately 50,000 square feet in size, which includes over 32,000 square feet of new interior space, plus 17,000 square feet of the original animal hospital.

The new building offers medical facilities, such as treatment, surgery, diagnostic imaging rooms, a clinical laboratory, various multi-purpose animal wards, an expansive quarantine wing, as well as office and laboratory space for reproductive programs and research. Of particular note is the "Windows on Wildlife Science Gallery," where visitors have a close-up, behind-the-scenes view of the exceptional medical care provided to our animals, and where ongoing research can be showcased.

Staffed by three veterinarians, two veterinary residents, three veterinary technicians, a supervisor, and seven zookeepers, the Wildlife, Health & Veterinary Science Branch provides exemplary care to the Zoo's animals. Their health is maintained through preventive and interventional medicine, and surgical, diagnostic, and pathology programs. Providing a high standard of veterinary care to over 5,000 animals is no easy feat. Over 490 anesthetic events, 236 radiographic examinations and 19,455 internal laboratory tests took place in 2019 alone, as part of the comprehensive care provided to the Zoo's animal population. Staff also develop or support important comparative research in many scientific disciplines, providing information which can be used to improve conservation, education, and management programs for select threatened or endangered species.

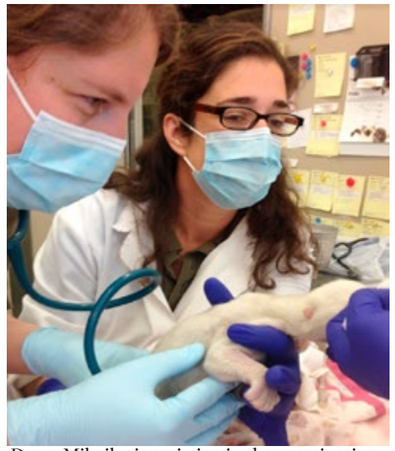
An African penguin getting an X-ray.

Outside of Wildlife Health Centre building.

A digital X-ray of a chameleon.

Public viewing windows at the Wildlife Health Centre.

Feature: Wildlife Health Technicians



Dawn Mihailovic assisting in the examination of polar bear cub, Juno.

Cassia Devison feeding clouded leopard cubs.

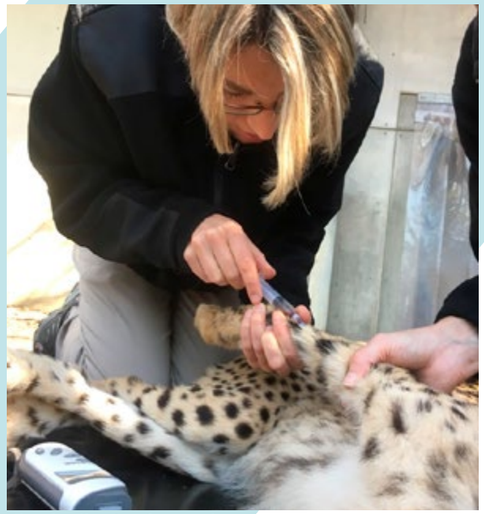
Michelle Lovering feeding polar bear, Juno.

Our Wildlife Health technicians, along with our Wildlife Health Supervisor, are a group of specially trained, highly skilled individuals, who assist our veterinarians in the care of the Zoo's diverse wildlife population. Routine tasks may include, but are not limited to, assisting with general exams, restraining animals for examination or procedures; preparing animals for surgery, anesthetic monitoring, maintaining patient records, the preparation and taking of radiographs; administering fluids, injections, and various medications; and collecting samples and performing diagnostic tests. From ensuring inventory is stocked, to keeping the rooms clean and organized, to preparing and collecting materials and equipment for procedures taking place, our Wildlife Health technicians provide invaluable support to ensure the Wildlife Health Centre is running in tip-top shape!

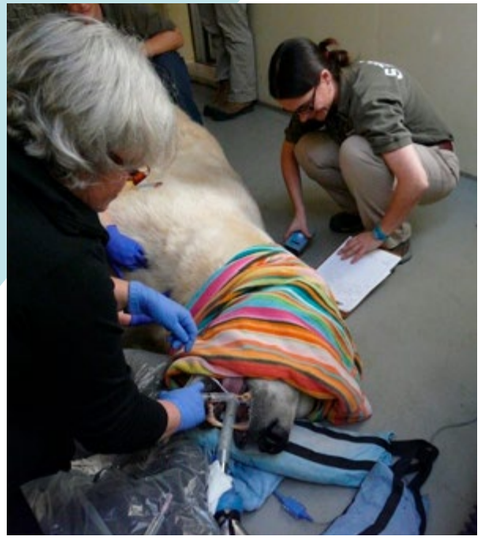
Our Wildlife Health technicians also work closely with the keepers, such as when neonate animals require hand rearing or during the training of animals for voluntary procedures. If it is deemed necessary to hand raise a newborn animal, it is typically transferred to the NICU in the Wildlife Health Centre and the Wildlife Health technicians take over. Hand rearing involves round-the-clock care including maintaining the animal's feeding schedule, providing general husbandry, and medical care until the animal is deemed ready to return to the keeper's care. Certain animals are trained to participate in voluntary procedures. This means the animal is participating as much or as little as they choose to. Voluntary procedures may include tasks such as blood collection, receiving injections, having blood pressure taken, or participating in ultrasound and/or radiographs. Animals trained to participate in voluntary procedures often experience less stress when requiring medical intervention which often reduces the need for general anesthesia.

Tasha Long monitoring the wound repair of one of our Grevy's zebras.

Preparing a lion for surgery (ovariohysterectomy).



Blood collection from a cheetah.



Specialist veterinary dentist Dr. Sharon French performing a root canal treatment on a polar bear.

Former Veterinary Resident Dr. Ellie Milnes and Wildlife Health Technician Dawn Mihailovic prepare a cheetah cub for surgery to repair an umbilical hernia.

Veterinary Research

The use of midazolam, isoflurane, and nitrous oxide for sedation and anesthesia of ball pythons (*Python regius*)

C. B. Larouche, C. Dutton, D. Bienzle, N. Nemeth, H. Beaufrère, C. Mosley, R. Johnson

Snakes are commonly anesthetized for research purposes, diagnostic testing, as well as medical and surgical treatments. However, inhalation anesthesia is complicated by their unique anatomy and physiology. For example, their blood can shunt from one side of the heart to the other and bypass the lungs, and some species can survive prolonged periods with very low levels of oxygen. Despite an increasing number of studies in the last decade, clinical studies regarding snake anesthesia remain scarce. The objectives of this project were to characterize the pharmacodynamics (sedative and cardiovascular effects) and pharmacokinetics (absorption, distribution, and elimination) of midazolam in the ball python (*Python regius*), and to evaluate the effects of midazolam and nitrous oxide (N_2O) on the minimum anesthetic concentration of isoflurane in this species.

Relationship between diet, lipid metabolism, body composition, and hibernation in the critically endangered Vancouver Island marmot (*Marmota vancouverensis*)

J. Aymen, P. Delnatte, H. Beaufrère, J. Wensvoort, S. Gourlie, M. McAddie, S. Abood

Vancouver Island marmots are large rodents related to squirrels, and are a critically endangered species endemic to Vancouver Island, British Columbia. Captive breeding and release programs aim to recover their wild population. The Toronto Zoo is one of three institutions involved in this conservation program. However, the captive-bred animals appear to have lower overwinter survival rates compared to wild ones. As fat-storing hibernators, the diet and fatty acid profiles prior to release may play a role in their reduced hibernation survival. This study aims to evaluate the lipid metabolism and body composition in captive-bred Vancouver Island marmots and to compare them to their wild counterparts. The effect of a diet reflecting natural changes in polyunsaturated fatty acids, on hibernation, will be assessed on a marmot model, woodchucks (*Marmota monax*). The findings of this study may ultimately lead to an understanding or improvement of the survival of captive-bred Vancouver Island marmots, thus contributing to the ongoing conservation efforts that hope to restore the wild population of this important Canadian species.

Assessment of physiologic parameters during anaesthesia in Przewalski's horses (*Equus przewalskii*)

E. Milnes, A. Skelding, C. B. Larouche, P. Delnatte, C. Dutton, A. Ferro

The Przewalski's horse (*Equus przewalskii*) is a flagship species for the role of ex situ programs in wildlife conservation. Immobilization of non-domestic equids, such as Przewalski's horses, is challenging, and every anesthetic event bears a small, but significant, risk of injury and potential death. In the domestic horse, the mortality risk is around 1% (1 case in 100) for healthy, elective cases, which is significantly higher than for other domestic species. In species where anesthetic information is lacking, veterinarians depend on extrapolation of data from similar animal groups, which may or may not be accurate. The aim of our study is to use the twice-yearly immobilizations (routine health checks) of Przewalski's horses at the Toronto Zoo as an opportunity to gather data about the physiologic status of these animals during anesthesia with two different drug regimens. Our anticipated research outcome is to inform zoo veterinarians about the anesthetic options for this species beyond the traditional narcotic combinations.

Investigating the molecular determinants of mammalian lifespan

R. Kafri, M. Ginzberg, N. Patel, C. Tan

A novel correlation was recently identified between the size of pancreatic cells and the maximum lifespan of the species – mammals that have smaller cells tend to live longer. This association was further shown to be independent of other well-known correlates of lifespan such as body weight and basal metabolic rate. Since then, a similar reciprocity has also been observed in liver cells, salivary gland cells, and to a lesser extent in skeletal muscle cells. Although correlations do not imply causations, links of cell size and lifespan are also suggested on a molecular level: both are products of the same regulatory pathway within cells. To understand the mechanisms underlying the correlation between mammalian lifespan and cell size, one aspect of this project is to explore the tissues in which a similar reciprocity exists. Understanding which organs demonstrate this correlation may hint towards the biology that drives the association. To this end, researchers at the Hospital for Sick Kids have partnered with the veterinary staff at the Toronto Zoo to acquire different tissue samples from mammals. Preliminary results indicate an absence of the correlation among kidney cells, which suggests to that the association would manifest more strongly in tissues directly involved in anabolic functions (building molecules instead of breaking them down). Because of the tight link between cell size and animal lifespan, how cell size is regulated in the lab is also being concurrently investigated.

SickKids®

REPRODUCTIVE SCIENCES

The program focuses on improving our understanding of the reproductive biology of diverse species and developing assisted reproductive technologies (ARTs) to enhance ex-situ conservation breeding and in-situ population management programs. Our primary objective is to provide scientific and technical knowledge to improve reproductive outcomes for both zoo-based and free-ranging populations through active partnerships with other zoological, academic, and governmental organizations.

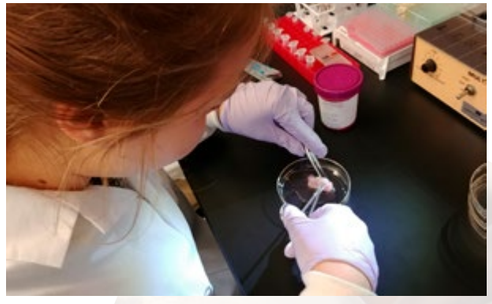
Hormone Monitoring & Therapy

We carry out hormone analyses on more than 25,000 samples per year. Longitudinal analysis of reproductive hormones (estrogen, testosterone, progesterone) allows us to establish seasonal breeding periods, predict ovulation for breeding introductions, and detect pregnancies, to name a few. More importantly, changes in normal hormone patterns are identified and treatment protocols, including ovulation induction and contraception, can then be developed to overcome any potential concerns.

Reproductive dysfunction is known to be correlated with stress. For zoo animals, stressful events could include a move to a new enclosure or competition within a social group. Free-ranging populations experience even greater challenges, such as evading predators, foraging for food, or responding to an ever-changing ecosystem resulting from human activities. Monitoring stress-related hormones (cortisol, corticosterone) can provide insight into the health and well-being of a population and identify potential factors leading to population decline or reproductive failure.

Gamete Collection & Preservation

Various factors, including environment and nutrition, can impact gamete quality and quantity. We assess gamete fitness of breeding individuals for more than 50 species. Any observed fertility-related changes lead to the development of assisted fertilization techniques, including artificial insemination and in-vitro production of embryos. These assisted reproductive technologies (ARTs) are not only necessary to overcome infertility, but facilitate the distribution of genetic material between institutions and continents. In 2017, a wood bison calf was born following the transfer of an embryo produced by in vitro fertilization from wild-caught wood bison at the University of Saskatchewan and shipped frozen to Toronto Zoo.



In the Zoo's cryogenic biobank, sperm, eggs, embryos, and skin cells are stored from more than 50 species, the largest repository of living frozen cells from endangered species in Canada. Long-term preservation of viable biological material, combined with ARTs, will one day play an important role in re-establishing genetically healthy and sustainable populations. These tools will ensure that individuals can contribute to the gene pool long after they are gone.

Toronto Zoo has been involved in wood bison conservation since 1977, and since that time, efforts from various organizations have resulted in the species being down listed from "endangered" to "threatened".

Wildlife Infometrics

CARIBOU

UNIVERSITY OF CALGARY

CARIBOU MUSKOX

calgaryzoo

GIANT PANDA

Icefield Wildlife Research

MOUNTAIN BIGHORN SHEEP

Manitoba

MOOSE

McMaster University

HUMAN SALIVA

Environment and Climate Change Canada

CARIBOU

Universität Zürich[UZH]

VEILED CHAMELEON

ALDABRA TORTOISE

BRITISH COLUMBIA

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

MOOSE

MOUNTAIN GOAT

DALL'S SHEEP

STONE SHEEP

ROCKY MOUNTAIN GOAT

Zoo Assiniboine Park

POLAR BEARS

LaurentianUniversity UniversitéLaurentienne

UNIVERSITÉ LAVAL

ROCKY MOUNTAIN GOAT

BIRD FEATHERS

Carleton UNIVERSITY

POINT DEFIANCE ZOO & AQUARIUM Metro Parks Tacoma

SUMATRAN TIGER

CLOUDED LEOPARD

esencial COSTA RICA

UNC Universidad Nacional de Córdoba

SNAKE

CHINCHILLA

VANCOUVER ISLAND MARMOTS

UNIVERSITY OF TORONTO

BAT

HUMMINGBIRD

TREE SWALLOW

DALHOUSIE UNIVERSITY

MANDRILL

ELEPHANT

ZOO GRANBY

UNIVERSITY of TASMANIA

TASMANIAN DEVIL

Our Reproductive Science team is sought after all over the world and is Canada's national leader in this field. The image above highlights the organizations, companies, zoological parks,and universities the "Repro" team is currently collaborating with, along with the corresponding species of interest!

Training Highly Qualified Personnel

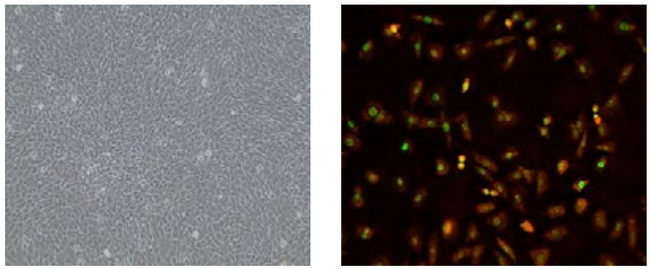
Our branch is committed to the educational growth and technical training of graduate and post-graduate students interested in natural and assisted reproduction research.

Elucidating variation in somatic cell lines that influence reprogramming potential

T. Toorani (MSc Candidate), L. Favetta (Co-Advisor), G. Mastromonaco (Co-Advisor)
Toronto Zoo and University of Guelph

Somatic cell biobanking and related technologies, such as somatic cell nuclear transfer (SCNT), offer significant promise as methods for embryo production for the conservation of wildlife species. However, these technologies have yet to achieve optimal success and fail to produce consistent results. Cell lines from the same individual may also yield different outcomes, corroborating the existence of intra- and inter-individual differences. Researchers evaluate some basic cellular characteristics prior to use in SCNT, such as chromosomal abnormalities and DNA damage, but the necessity for a standardized characterization method for somatic cell lines has become increasingly evident. We aim to elucidate the differences among bovine fibroblast cells grown in culture and determine the possible effects on reprogramming potential, an essential process for successful SCNT.

Chromosomes from a domestic cow fibroblast cell.



Fibroblast cells grown in-vitro (left) and stained to show DNA damage (right).

Determining the effect of epigenetic modulators on the reprogramming potential of bovine fibroblast cells

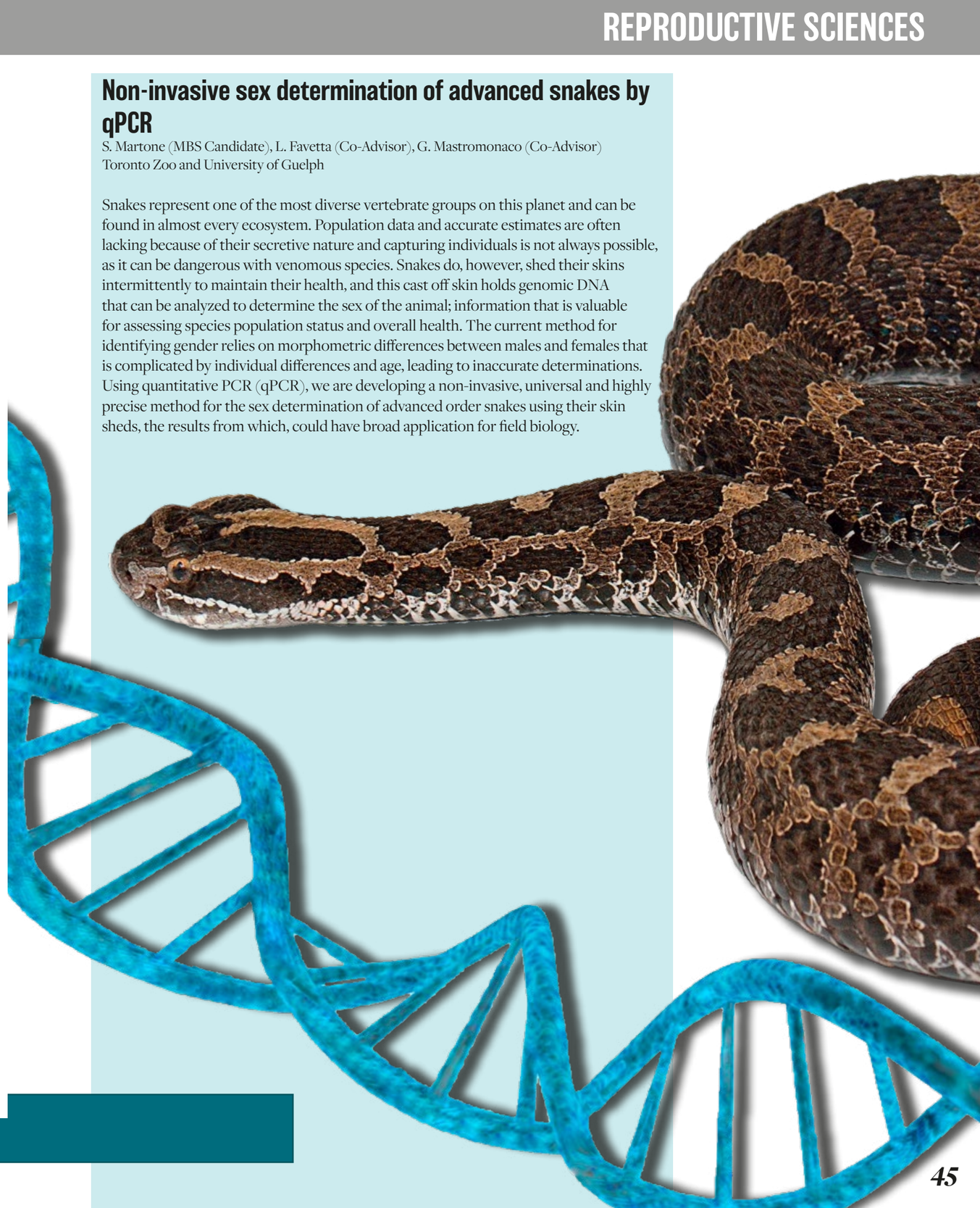
B. Chan(MSc Candidate), L Favetta (Co-Advisor), G. Mastromonaco (Co-Advisor)
Toronto Zoo and University of Guelph

Despite the successful cloning of "Dolly" the sheep and several other mammalian species, somatic cell nuclear transfer (SCNT) is still an inefficient technique with low offspring production. Successful SCNT requires epigenetic reprogramming or resetting of the donor cell nucleus. However, donor cells used for SCNT may vary in reprogramming potential despite coming from the same individual, making it a tedious process. To investigate these issues, we will examine the effect of exogenous epigenetic modulators on bovine fibroblast cells and evaluate the reprogramming potential between different cell lines grown in-vitro. The results of this study will help us further understand the underlying mechanisms that lead to successful SCNT.

Non-invasive sex determination of advanced snakes by qPCR

S. Martone (MBS Candidate), L. Favetta (Co-Advisor), G. Mastromonaco (Co-Advisor)
Toronto Zoo and University of Guelph

Snakes represent one of the most diverse vertebrate groups on this planet and can be found in almost every ecosystem. Population data and accurate estimates are often lacking because of their secretive nature and capturing individuals is not always possible, as it can be dangerous with venomous species. Snakes do, however, shed their skins intermittently to maintain their health, and this cast off skin holds genomic DNA that can be analyzed to determine the sex of the animal; information that is valuable for assessing species population status and overall health. The current method for identifying gender relies on morphometric differences between males and females that is complicated by individual differences and age, leading to inaccurate determinations. Using quantitative PCR (qPCR), we are developing a non-invasive, universal and highly precise method for the sex determination of advanced order snakes using their skin sheds, the results from which, could have broad application for field biology.



Evaluating the thermodynamics of stress in bird species

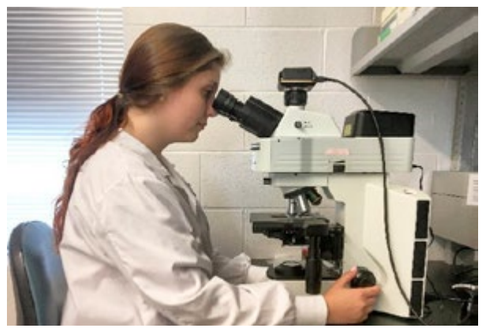
J. Robertson (PhD Candidate), G. Burness (Co-Advisor), G. Mastromonaco (Co-Advisor)
Toronto Zoo and Trent University

Changes in body temperature following a stressful experience have been documented for nearly two thousand years. Although stress-induced changes in body temperature have now been reported across many species (from fish to lizards, rodents, and birds), the physiological drivers and ultimate value of this "stress-induced fever" remain a target of hot debate. Using wild-caught black-capped chickadees, we tested a new hypothesis that stress-induced changes in body temperature, at the level of the skin, reflect adaptive changes in blood-flow to conserve or dissipate heat that is generated during the stress response (Thermoprotective Hypothesis). Our results supported the Thermoprotective Hypothesis, and showed that chickadees at low temperatures (4 – 14°C) conserved more heat and had colder skin temperatures (as measured around the eye) when stressed than rested, while those at high temperatures (30 – 40°C) dissipated more heat and had higher skin temperatures when stressed than rested. While these findings help resolve arguments regarding the value of stress-induced changes in body temperature, they also raise questions about how organisms may cope with the combined effects of stressful environments and increasing global climate.

Effects of parasites on captive breeding success in the Eastern Loggerhead Shrike (*Lanius ludovicianus migrans*)

I. Zimmerman (MSc Candidate), A Schulte-Hostedde (Co-Advisor), G. Mastromonaco (Co-Advisor)
Toronto Zoo and Laurentian University

Parasites are defined by an energetically demanding relationship with their host, which can have detrimental consequences, including lower breeding success rates. We are evaluating the relationship between parasitofauna and reproduction of captive and wild populations of the eastern loggerhead shrike (*Lanius ludovicianus spp.*), an endangered species of passerine bird with raptor-like habits. We will review historical records from the different breeding centres and carry out parasitological exams on fecal samples collected from captive shrikes to evaluate parasite load and diversity, and study their effect on reproductive success. This study may provide further information to support the long term success of this species.



Feature: Collaboration Outside of the Zoo

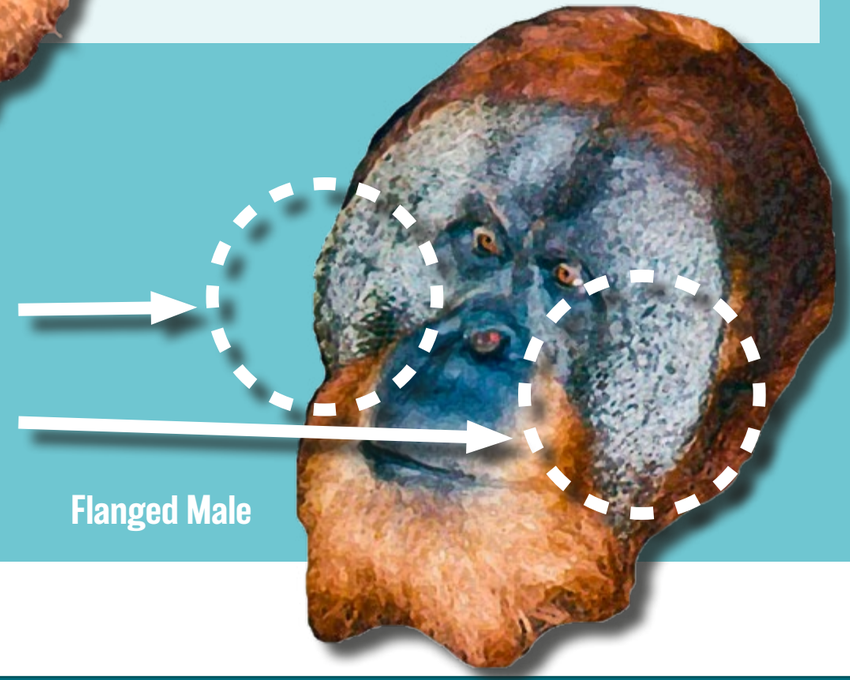
Flange development of male orangutans in relation to skeletal growth

C. Knott, F. Harwell
Boston University

Male orangutans exhibit a rare phenomenon called male bimaturism where there are two sexually mature forms: unflanged and flanged. All males are born without flanges (prominent cheek pads) as well as other secondary sexual characteristics. Some males flange early in development, while others do not flange until later in adulthood. Likewise, there are males that go their entire lives without flanging. The cause of flanging is still unknown, despite the importance of these secondary characteristics for reproductive behavior and mating success in the wild. Testosterone levels are monitored in two unflanged male Sumatran orangutans by collecting urine samples, since flanged males are known to have higher testosterone levels. Photographs are taken and arm length measured to monitor skeletal growth, as flanged males are notably larger in body size compared to unflanged males. These data are valuable for testing hypotheses related to the cause of flanging and development of these secondary sexual characteristics.

Unflanged Male

Male orangutans can actually exhibit facial differences. This difference is called a flange, so males can either be flanged or unflanged. These flanges are prominent cheek pads that are made of fatty tissue, and play a role in their reproductive behaviour.



Flanged Male

NUTRITION SCIENCE

Nutrition Science Centre

Toronto Zoo has been a leader in wildlife nutrition since the early days of zoo history, being the first North American zoo to hire a professional full-time staff nutritionist. Currently, Toronto Zoo has two qualified staff Zoo nutritionists that help to develop and implement nutritionally balanced and stimulating nutritional programs to all of the animals that call Toronto Zoo home. These specialized programs are designed to meet each animals' specific needs with an emphasis placed on optimizing health and ensuring the highest level of welfare. Each animal's diet is carefully evaluated and adjusted, when required, to suit an animal's individual life stage, health status, and behavioural requirements.

Jaap Wensvoort, full-time Nutritionist.

A small team of nutrition assistants prepare, package and deliver an array of high quality diets to 500+ species and approximately 5,000 individual animals across Zoo site daily. As you can imagine this takes passionate, team-oriented staff to accomplish such a feat! The Nutrition Assistants are on site starting at 6:00am daily, delivering baskets full of prepared diets to the various pavilions and paddocks. Our staff are the first line of quality control for all diet items, carefully inspecting fruits and vegetables, frozen fish, and dry feeds for signs of damage, deterioration or pests, ensuring that only the best items are integrated into diets.

Ultimately, the Nutrition Science Centre hopes to inspire the public to think outside the box and consider the effect food has on the diversity of life on our planet. Animals have evolved spectacular morphological, physiological, and behavioural adaptations to extract nutrients from their habitats that allow them, however small or large, to survive and thrive.

Green Initiatives

Throughout all activities of the Nutrition Science Centre, there is a strong green initiative to re-use items, separate and reduce waste, and to use energy and water resources responsibly. As everyone knows, your kitchen at home produces a large amount of household waste, imagine that times 500! Our staff have worked hard to find ways to reduce the amount of waste and re-direct items from landfill.

In an effort to reduce our reliance on single-use plastics, we have moved to packing all dry feeds (cubes, pellets, seeds, nuts, etc.) in brown paper bags instead of plastics. This switch from plastic to paper has saved approximately 63,000 individual plastic bags from entering the waste or recycling system. To ensure that items are not ending up in the wrong disposal bins, our Green Team representative, Elvira Di Nuzzo, has created Nutrition Science Centre specific garbage, recycling and compost signs. In addition, in an effort to reuse everything we can, Ben Martin, saved our earth worm castings for the Horticulture department to use as compost! We also save large plastic baskets that some of our fresh produce arrive in weekly to pack and organize feeds throughout the year. Furthermore, whenever possible, the Nutrition Science Centre will purchase in bulk to reduce on packaging and plastics. Most notably, this past year, 400 kg of marine oil was purchased in one large container and decanted in-house, into recycled ten gallon buckets. This marine oil is a staple food for polar bear training! Finally, although our staff of six permanent and three non-permanent staff may be relatively small, we still produce a ton of waste. That is why Nutrition staff participate in the Terra-cycle Program, where close to 10,000 pairs of nitrile gloves are diverted from the land-fill to a recycling program every year.

Browse

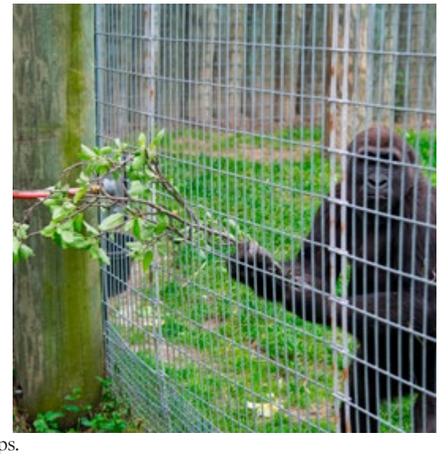
Browse is a collective term used to describe the edible leaves, twigs, bark, buds, and flowers collected from trees and shrubs. It is considered an essential requirement for the nutrition and welfare of various animals. The variability found in the morphology, volume, and nutrients of browse materials is a vital component of a holistic nutrition program that optimizes health and provides environmental stimulation that encourages natural behaviours.

All Browse Collection Totals

	2015	2016	2017	2018	2019
Fresh (kg)	7400	7200	8700	7500	9800
Silage (kg)	4500	6556	4455	2004	7143
Total (kg)	**11 900**	**13 756**	**13 155**	**9 504**	**16 943**

Nutrition staff started off the 2019 browse season by engaging several community partners which has led to our most successful season yet! With a massive donation from a local company, Acorn Development Corporation, of almost 100 apple trees the Nutrition Science Centre has been working like beavers to harvest material for the Zoo's herbivores. Toronto Zoo is fortunate to have engaged and supportive community partners such as PricewaterhouseCoopers (PWC) and Acorn Development Corporation. PWC and Acorn Development Corporation volunteered to work with Zoo staff and were able to harvest, pack and ensile almost 2,600 kg of apple and pear silage. This is a two year supply of the most favored food item for our Western Lowland gorilla family to munch on over the winter! Not only was silage and fresh apple browse obtained from the donation, there were also numerous truckloads of large branches, trunks, and root stumps used for perching and enrichment, basically natural "furniture" for animal's habitats.

PricewaterhouseCoopers group helping with the apple tree donation.



PricewaterhouseCoopers group feeding their collected browse to one of our gorilla troops.

Over the years the Nutrition Science Centre has learned that bark is a favored diet item by many species. This prompted us to ensure that nothing goes to waste. Branches left over from silage production or un-stripped branches from the Masai giraffe have a second life as feed for species that are equipped to strip and nibble bark from branches. To supplement the leafy browse provision, browse sticks are stored outside, in coolers and freezers and used for a variety of species including Vancouver Island marmots, two-toed sloth, West Caucasian tur and many more. Once branches are stripped they can be used as perching material or "furniture" for our animal's habitat or used as mulch used our gardens.

The Nutrition Science Centre continues to be leaders in the supply of fresh and ensiled browse material in North America. Toronto Zoo has shared the schematics of the hydraulic browse press and provided technical expertise to assist other zoos, including Denver Zoological Gardens, Cheyenne Mountain Zoo, Omaha Zoo, Woodland Park Zoo, and Oregon Zoo in building their own sustainable browse program and browse plantation designs.

In many other zoological institutions browse is still seen as an occasional enrichment item, and the amounts given are normally not weighed. Toronto Zoo puts a tremendous amount of effort into quantifying the amount of browse provided across site. Fresh material is weighed out into 5kg, 10kg, or 20kg bundles and delivered to the appropriate areas on site. Browse silage barrels are also weighed to provide an up-to-date inventory to allow for rationing to the highest priority browsing animals. The amounts collected and paired with seasonal nutritional analysis (i.e. protein, fat, fiber, and minerals) allows the Zoo's nutritionists to more accurately assess the nutritional impact of this essential forage item on an animal's diet, health, and well-being.

Nutritional Enrichment and Training

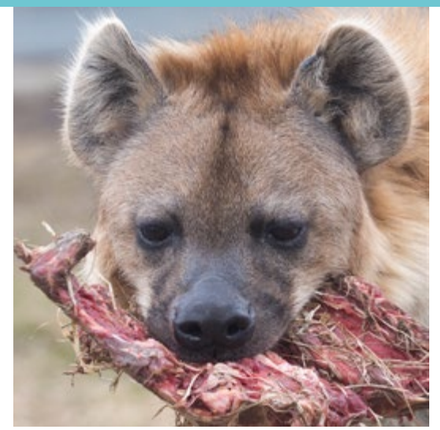
Training animals is essential to maintaining their health and well-being. From something as simple as a tiger opening it's mouth to inspect it's teeth, to asking a pygmy hippo to step onto a scale, or asking a polar bear for a blood sample, critical information regarding an animal's health can be obtained through these behaviours and more often than not food is used as a positive motivating factor. Careful consideration needs to be made to ensure the appropriate items and amounts are provided to individuals so that diets remain healthy and balanced. That is why this year we have rolled-out our first point based system for our orangutans to ensure that calories, sugar, and fats are in check as great ape species, similar to humans, are prone to cardiovascular issues.

Special Treats

Enrichment feeding is something the Nutrition Science Centre always tries to help out with. Often on birthdays or holidays special treats are created in coordination with our Behavioural Husbandry Supervisor. This year we helped to celebrate our Western Lowland gorilla baby Charlie's first birthday with a specially made frozen juice and gel layered cake and cupcakes iced with applesauce. Petal, our 33-year-old river hippo, received a special watermelon filled pool. In addition, we helped to create special Easter treats by dyeing quail and chicken eggs, as well as coconuts for a myriad of species. Just after Halloween we receive donations for pumpkins, and after the holidays we receive Christmas trees that are stored and distributed for festive treats.

Carcass Feeding

The Carcass Feeding Program involves providing large carcass pieces to stimulate animals basal instincts and behaviours such as stalking, tearing, jumping, pulling, purring, and even caching for later. Allowing animals to use their jaw muscles and bones improves their dental health and skull morphology. Carcass pieces also provide "animal fibre" in the form of hair, fur and cartilage. This animal fibre is essential for the proper gastrointestinal health of carnivore. Having extremely high product standards, the Zoo only uses Milliken meats, made with horse meat inspected by the Canadian Food Inspection Agency (CFIA).



Nutrition Advice

The nutritionists in the Nutrition Science Centre provide nutrition resources, guidance, and recommendations to various institutions internationally. They are involved with supporting several breeding and releases programs such as the Vancouver Island Marmot Recovery Team, Loggerhead Shrike Recovery Team, and Black-footed Ferret Species Survival Plan.

Training & Instructing:

The Smithsonian's National Zoo holds a Wildlife and Zoo Nutrition Management course each spring at their Front Royale Campus in conjunction with the George Mason School of Environmental Sciences. This past session, the Nutrition Science Supervisor, Sarra Gourlie was invited to be a course instructor and helped to teach students about the practical aspects of nutritional management of wildlife. Topics included carcass feeding programs, browse and forage procurement, conscientious integration of training and enrichment feeds, as well as specialized feeding programs for canid and ursid species. Throughout the week students were coached through a feed intake study and diet evaluation.

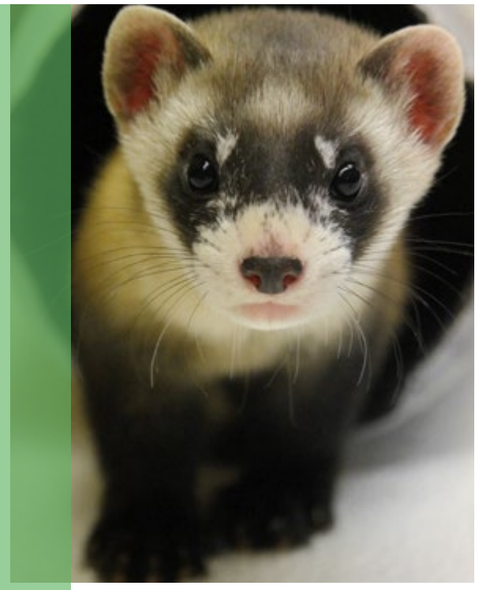
Nutrition Resident:

The Sue Crissey Animal Residency Fund (SCARF) grant funded postgraduate position was granted to Toronto Zoo's Nutrition Science Centre by the Zoo and Wildlife Nutrition Foundation (ZWNF). The Nutrition Resident will train at Toronto Zoo to become a zoo Nutritionist, qualified for employment in an AZA and CAZA accredited facility.

ZWNF

Nutrition & Physiology Research

The scientific research and development projects initiated and executed by the Nutrition Science Centre help to increase our collective knowledge of nutrition and physiology of non-domesticated species and support welfare of the animals under our care and conservation of species in the wild.



Assessing the nutritional status of free-ranging and human managed populations of black-footed ferrets (*Mustela nigripes*)

S. Gourlie, J. Wensvoort, M. Franke, B. McGregor, G. Mintha, P. Delnatte

The black-footed ferret is one of North America's most endangered mammals. This species became part of the breeding and re-introduction program in 1987 when the last known remaining wild individuals were found at a farm in Wyoming. Currently there are only 200 individuals remaining in the wild. In 2000, Toronto Zoo spearheaded an initiative to create a balanced diet that could be fed to all individuals in the breeding program. This diet remains the only commercially available diet endorsed by the Black-footed Ferret Species Survival Plan. In recent years, the breeding population has been affected with reproductive issues with no clear reason as to why. The wild populations appear to have greater reproductive stability, potentially because they have access to a natural diet of various prey species. Although, the managed populations are offered a nutritionally balanced diet composed of whole animals, like rats and mice, as well as the Toronto Zoo Small Carnivore Diet, there still may be something missing. Very little data exists regarding the nutritional composition of wild prey species, such as prairie dogs, grasshopper mice, and cottontail rabbits. There is even less information known regarding the feeding ecology of this seldom seen, fossorial predator. Toronto Zoo will assess the nutritional status of both wild and human-managed populations of black footed ferrets through blood, fur, and nail samples, in the hopes that improved dietary recommendations can be established. This project is currently seeking funding, through grant proposals.

Effect of provision of partial carcasses on behaviour of Sumatran tigers

L. Steffler (University of Guelph)

The purpose of the study was to determine if feeding partial carcass pieces affected the scope and frequency of behavioural patterns as well as habitat use in Sumatran tigers cared for by Toronto Zoo. A species specific ethogram was developed for the tigers that included behaviour patterns such as feeding, natural behaviours, stereotypic behaviours, and active or inactive. Findings indicated that the provision of carcass pieces significantly influenced the occurrence of feeding behaviours compared to regular diet items and a reduction in pacing behaviours observed several days after carcass presentation. There were no effects on natural behaviour, enclosure use, or active/inactive behaviours observed in other studies. This may have partially been due to the low sample size (only 2 tigers were observed) or that the carcasses were only partial (no skin, fur, or organs). Overall these findings suggest that partial carcass pieces provide an enriching feeding experience that likely improves individual animal's welfare.

Captive studies to improve diet estimates and bioenergetics modeling of polar bears in the wild

J. Wensvoort, C. Dutton and J. Young (Toronto Zoo), G. Thiemann and M. Glennie (York University), P. Molnar and S. Penk (University of Toronto), I. Duncan (University of Guelph)
Other investigators: C. Robbins (Washington State University), K. Rode (US Fish and Wildlife Service). S. Cherry (Parks Canada)

Due to climate change, it is predicted that some subpopulations of polar bears will diminish in size and some will possibly relocate to other areas. Changes in the distribution and availability of preferred habitat and prey will likely have negative effects on the body condition of polar bears. A more robust understanding of body condition patterns and physiological responses of polar bears would improve the understanding of seasonal feed intake and body condition; essential information, required to better predict the ecological effects of food web changes of polar bears in the wild.

Validation of the Body Condition Assessment of Polar Bears

Mathematical models to determine body composition of polar bears are used at Toronto Zoo and only require measurement of bears straight body length and body weight. Because polar bears at the Zoo, in contrast to being in the wild, can be weighed and measured very accurately, a validation of body condition estimates has been attempted. This integrates the use of bioelectric impedance analysis (BIA) to confirm that the mathematical models are able to calculate the percentage of body fat, an important aspect of body composition for survival of polar bears during the ice-free period.

Studies on the Behaviour and Physiology of Polar Bears under Human Care

Individual polar bears, within a simulated seasonal feeding program, will undergo periods of varying food supply, to establish relationships between growth/loss and calorie supply. Intensively behavioural observations paired with determining internal body temperature has elucidated that polar bears have some behavioural adaptations to handling the seasonal decrease in energy supply during the summer ice-out period. Throughout the year regular measurements in body mass fluctuations and voluntary blood samples allow us to observe how the biochemical and hormonal markers change during the anabolic and catabolic periods that polar bears experience in the wild.

Feature: Collaboration within the Zoo

Development of a marmot research pellet for improved hibernation robustness

S.Gourlie, J. Wensvoort, J. Aymen, P. Delnatte

The Vancouver Island marmots (VIMs) are a critically endangered hibernating species that inhabit remote alpine meadows at high elevations on Vancouver Island. Their diminishing natural habitat has been a threat to their survival and in 1997 the Vancouver Island Marmot Recovery Team determined that a captive breeding and reintroduction program was essential to save the species from extinction. The breeding and release program has been highly successful, reintroducing hundreds of VIMs back into the wild. Through intensive monitoring efforts it has been determined that first year pups released from the breeding centres do not fare as well as the first year wild born during their first hibernation period. This interesting observation has led to a collaborative project between the Veterinary and Nutrition branches of Toronto Zoo. Successful hibernation is reliant on several factors including adequate body fat stores and the composition of these fats. Little is known regarding the seasonal composition of the plants that VIMs consume in the wild and how they may select plants and plant parts in order to obtain the fatty acids required for a robust hibernation. The Nutrition Science Centre has developed a research pellet with a ratio of omega 3s and 6s more similar to what might be found in early season alpine meadow plants that will be tested by Veterinary Resident, Dr. Jessica Aymen on a model species, the woodchuck at Toronto Zoo, to determine its effect on various markers of hibernation success.

What is Behavioural Husbandry?

Have you ever wandered by your favourite animal's exhibit and wondered what that giant ball, plastic jug or cardboard box is doing in there? Those items are in there to serve a very important purpose! Here at Toronto Zoo we use a variety of items, both recyclable and new, to enrich the lives of the animals we take care of. The Toronto Zoo Behavioural Husbandry Program strives to attain the highest level of animal care by developing species appropriate training and enrichment programs. Not only do we have to make sure they have adequate food, water and shelter, we also have to make sure that their psychological health is given top priority. This is referred to as their "behavioural husbandry". Essentially, this means providing animals with as much choice and control in their environment so that they can perform as many natural behaviours as their wild counterparts. We accomplish this by providing various forms of daily enrichment and developing training programs that allow the animals the choice to participate in their own care. Utilizing the natural history of our animals we can provide stimulating natural environments and then take their individual personalities into account to develop specialized enrichment and training programs. Giving animals the opportunity to display these natural behaviours helps to improve both their physical and mental well-being.

Voluntary Training

By using positive reinforcement techniques and scientifically tested methods to train various medical behaviours, our keepers and veterinary staff are able to obtain valuable information about the animals' health without the need for anaesthetic, which is huge! Giving our animals the choice, we have been able to get voluntary blood collection from the polar bears and voluntary foot x-rays from giraffe, Mstari. We are also now actively vaccinating the majority of our animals voluntarily.

Polar bear voluntarily withdrawing blood.

Enrichment Assessment

A key component in developing these behavioural programs, is to first observe our animals. As our keepers work with these animals continually, they are constantly observing them and taking notes on what behaviors they are displaying. We can then provide or develop enrichment items or events that would either increase or decrease desired or undesired behaviour. There are five main categories of enrichment: sensory (using their senses), environmental (ex. climbing, burrowing, etc.), forage/feeding, occupational (ex. grooming, chewing, etc.), and play (i.e. toys). As we learn more about the animals we care for daily we are able to develop more comprehensive programs for both their physical and mental well-being. This dynamic process of assessing the animals' behavioural husbandry ensures that they receive top quality care.

It is important to the Toronto Zoo that our valued guests experience our animals in their natural settings in order to inspire action to conserve their wild habitats. We also love to share how we care for our animals and have incorporated some of our training sessions into daily routines that can be seen on exhibit by our guests. For example, you may be able to watch a training session with one of our polar bears while exploring the Tundra Trek.

Foraging

Many species spend the majority of their day in the wild foraging and essentially working for their food. In order for keepers to keep the animals active and involved throughout the day, we offer them food at various times and in different “toys” or enrichment devices, increasing the time spent searching and working for their food. This allows the animals to display their natural foraging behaviour. In addition to scattering their food, burying it under logs, placing it in enrichment toys, and even freezing it in popsicles, we also add various scents into our carnivore exhibits which encourages them to “hunt” and explore!

Carcass Feeding

Whether through foraging or hunting, finding, and procuring food is of vital importance for survival in the wild. The natural behavioural repertoire for carnivores includes: smelling, licking, clawing, chewing and consumption of all edible parts, and chewing on bones and tearing through skin. Therefore, it is very important that we provide our carnivores with food items large and complex enough to allow them to perform these natural behaviours. This type of enrichment feeding may allow for some animals to have social feeding and digesting experiences.

Stay tuned for our Carnivore Enrichment Feeding Calendar to catch a glimpse of these animals exhibiting their natural behaviours!

Enrichment Feature: Shintay's Den

This past winter, Shintay, our female North American grizzly bear was able to demonstrate her natural instinct to dig a den in preparation for her winter sleep. Although Samson does not partake in the digging, Shintay loves to dig and has a natural instinct to do so! Although she is given the opportunity to dig each year (she tends to dig in the same area as the ground is often softer at the back of her enclosure), our keepers do not want her to actually den up here, so her den is filled in each spring as it is safer for staff and Shintay to "hibernate" in her bear house. Both Samson and Shintay are provided with two indoor rooms (one of which is filled with the bedding material, wood wool) and an outdoor yard. During the winter, our keepers will check on both Shintay and Samson bi-monthly when they are in their houses to make sure they are doing well.

Enrichment Goals and Projects

After observing our animals over time and recording what behaviours they are exhibiting, whether desired or undesired, keepers will develop some enrichment goals. These goals are then turned into projects, where our keepers implement strategies to either reduce an undesired behaviour or increase a desired behaviour. For example, one of last year's projects for the Sumatran tigers included implementing an enrichment plan to reduce pacing. Strategies incorporated included providing a privacy area, the choice for preferred enclosure, switch-ups, and scattered feeds. These strategies were a success and resulted in the reduction of the female tigers pacing by 64.6% and the males by 53.3%. This is an example of how foraging and environmental enrichment can change an animal's behaviour.

Enrichment Giving Tree

In December of 2018, Toronto Zoo held its first ever Enrichment Giving Tree! As it was such a success, the Giving Tree continued in 2019. The tree was located in the Zootique Gift Shop and was filled with requests for enrichment items from the Zoo keepers. Requests included hair brushes, coffee, and perfume, as well as hoof stock balls, bubble machines and drones, to help care for the animals. Guests donated money that went towards providing our animals with special enrichment items at Christmas. Thanks to our wonderful guests, we managed to raise $5,519 for our animals.

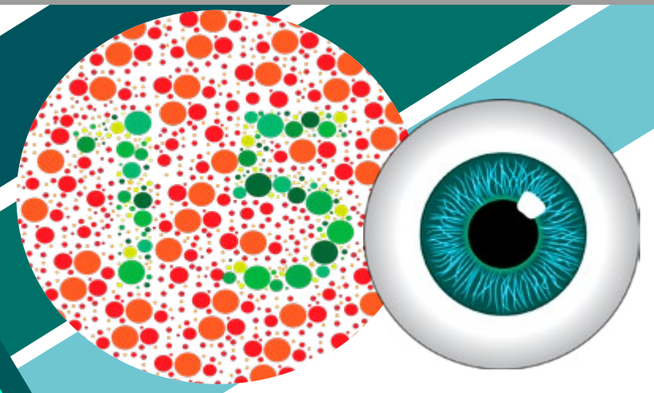
Behavioural Research

Do orangutans choose to choose?

S. MacDonald, S. Ritvo
York University

The purpose of this study is to gather baseline data on Sumatran orangutan choice behaviour, using a computer touch screen setup. The orangutans are familiar with the touchscreen, having used it for many years for enrichment. In this study, individual orangutans are presented with a computer 'game' that will let us determine whether—and to what extent—they prefer having control and choice over the outcomes of the game. The data will be used to help us design games and enrichment for the orangutans, which can be incorporated into their new outdoor exhibit.

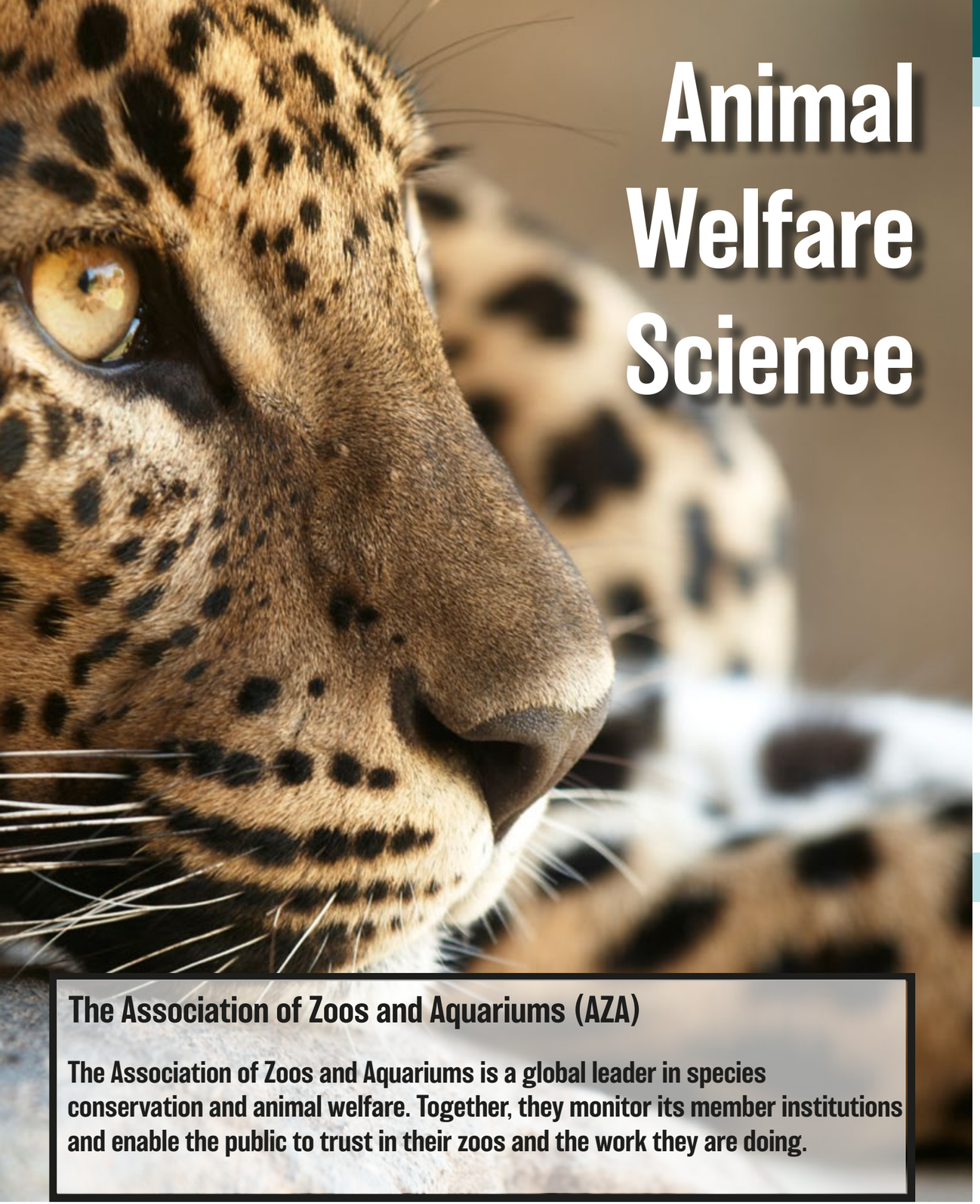
The objectives of this project are (a) to provide orangutan cognitive stimulation and enrichment, (b) to determine if orangutans share human and monkey preference for free- over forced-choice, and (c) to determine if orangutans choose to choose even when the alternative (i.e., not having a choice) is appealing in other ways.



Assessing the potential for visual and behavioural cues of reproductive ability in Golden Lion Tamarins (*Leontopithecus rosalia*)

A. D. Melin, L. A.A. Moreira Pacheco
University of Calgary

This study will investigate whether colour changes occur with age and puberty and across ovarian phase/estrous in the bare skin of tamarin monkeys (*L. rosalia*). The evolution of concealed versus advertised ovulation in mammals is of enduring interest to biologists because it plays a key role in governing mechanisms of sexual selection. Facial colouration varies across the menstrual cycle in many Old World monkeys (OWM), but this phenomenon has not yet been studied in New World monkeys (NWM). However, recent research has revealed subtle yet perceptible changes in female skin colouration during pregnancy, which may trigger males to prepare for care giving in species with high paternal care. The role of skin colour signals in socio-sexual communication in NWM is an under-explored area with great potential for discovery. In addition, colour vision is highly variable within NWM. Individuals can be either dichromats (red-green colour blind, all males and some females) or trichromats (colour normal relative to humans, some females). Many studies have highlighted the role that social and sexual selection plays in the evolution of colour vision in OWM, but in NWM this is a relatively new area of inquiry. The study will shed new light on these topics by 1) investigating the potential role of facial skin colour as an indicator of age and sexual maturity in a New World Monkey species, the golden lion tamarin (*Leontopithecus rosalia*), 2) investigating the potential role of facial colour as cues of estrous in female golden lion tamarins, and 3) modeling whether variation in facial color is perceptible to group members possessing different colour vision phenotypes.



Animal Welfare Science

The Association of Zoos and Aquariums (AZA)

The Association of Zoos and Aquariums is a global leader in species conservation and animal welfare. Together, they monitor its member institutions and enable the public to trust in their zoos and the work they are doing.

Animal Welfare Science Program at Toronto Zoo

Animal welfare encompasses many different definitions and subjects. It is the protection of the health and well-being of animals but also how an animal is coping with the conditions in which it lives. AZA defines animal welfare as an animals collective physical and mental state over a period of time and is measured on a continuum of good to poor. It is also important to note that there is a difference between animal welfare and animal rights, as animal welfare is measurable whereas animal rights are a personal belief. At the root of all the definitions, if an animal experiences good welfare if it is free from pain, stress or discomfort, is well nourished, comfortable, safe, and can perform natural behaviours.

The welfare of animals within AZA and CAZA has grown accordingly in recent years. In 2017 AZA introduced a number of new accreditation standards making animal welfare a condition of the accreditation process - AZA Accreditation Standard 1.5.0 Animal Welfare, Care, and Well-Being. The institution must have a process for assessing animal welfare and wellness and animal welfare considerations will impact every component of accreditation. This means all areas of Zoo operations, from Facilities to Education, Public Relations, etc. must all consider animal welfare.

Animal welfare has always been a top priority for the Toronto Zoo. As we move forward, we will be taking a more scientific approach to evaluate the well-being of animals in our care. As we learn more about the importance of individual animal's experiences, physical health, behavioural health, and overall environment, we are challenged to find ways to assess the comprehensive welfare of animals on a consistent basis and ensure that animals residing in our care are given ample opportunities to thrive.

Animal Welfare Assessment

Using the **5 Welfare Domains and 5 Opportunities to thrive**, as our framework, which include **Nutrition** (a species suitable diet provided in a way that ensures physical and mental health), **Environment** (opportunities to self maintain and promote comfort), **Health** (access to a wellness program, rapid diagnosis and treatment), **Behaviour** (social opportunities and provision for species appropriate and diverse behaviours) and **Mental Domains/Choice and Control**, we implemented an Animal Welfare Assessment process with various inputs and outputs to assess animals, across all taxa, at Toronto Zoo. This includes having a team of various staff conduct formal evaluations to get a better understanding of an animal's overall welfare. This includes looking at natural and individual history, all facilities, resources, programs and procedures that go into keeping our animals. In addition, we will be conducting science based animal welfare research on selected animals (species) that have been highlighted for various reasons (poor welfare, event impacts, etc.). Mechanisms to identify and evaluate the welfare/wellness impacts of significant life events or changes in the animal's environment could include construction events, unusual weather events, noise intrusion, changes in housing, or changes in animals exhibited with or nearby, etc. We will also conduct evaluation assessments for animals undergoing quarantine and for our ambassador outreach animals.

Geriatric Animals

We are also working on formulating a Quality of Life Checklist for geriatric animals. This will be an aged animal assessment to monitor animals over time and will be performed every 6-12 months (or more depending on the individual animal) to document a decline in health and welfare. As with humans, older animals require special care and adjustments to their environment to ensure their overall well-being.

Training

Education is a key part of understanding animal welfare and we will have numerous training sessions for all departments in the Zoo. This will include mandatory welfare modules to ensure that everyone understands the importance and complexity of animal welfare and their role in ensuring the best welfare for all of our animals.

By implementing this Animal Welfare Program, we are well ahead of the game and Toronto Zoo demonstrates its commitment to the animals we care so much about. Animals that demonstrate positive effective states can instill respect and wonder in guests. By telling the stories of these animals, we can connect with people in a personal way and can change how they think about the natural world by emphasizing the importance of conservation and what we all need to do to save species!

Maria Franke, Manager of Welfare Science, has worked at the Toronto Zoo for over 30 years!

FACILITIES & INFRASTRUCTURE

General Maintenance

Consists of the work force and materials to maintain the Zoo and ensure compliance with AZA requirements, the Ontario Building Code, O.H.S. A, and other regulatory agencies in the areas of carpentry, painting, locksmithing, and welding. This includes glazing, small roof repairs, and custom designing and construction of items particular to a Zoo such as shipping crates, plexiglass aquarium tops, special animal shift doors, and maintenance and repair of animal exhibits, and emergency repairs.

The team works hard to follow a preventative maintenance schedule for the entire Zoo for projects both big and small! This includes installation and maintenance of doors, hardware, painting of pathways, picnic tables, public benches, handrails and other surfaces, animal holdings, paddock holdings, concrete sites, palisade posts, offices; as well as the repair, installation, and construction of fences, signs, asphalt roadways, roof and eaves troughs, animal and bird cages, sun shades for exhibits, Bush Camp tent set up, and special requirements for group picnics and other Zoo functions.

General maintenance must maintain 107 buildings, totaling 402,257 sq. ft; 300+ picnic tables and shipping crates; 8,000 locks, 20 km of road, 31 km of fence, and 1800 signs!

In 2019, the Maintenance team worked closely with other departments on the Terra Lumina Night Walk project and Conservation Campus (front entrance) project.

Electrical & Plumbing

From lighting to electrical units, plumbing and even sound systems, our electrical and plumbing team works hard to fulfill work orders all across the Zoo site. One major project our team was responsible for over this past year, was replacing the lighting in the main parking lot, administrative building parking lot, Zoo vehicle parking lot, transit building, and bus loop and drop off loop. It is now all LED lighting and runs on less than half the amount of power than before! Another major project our team was responsible for was installing dozens of VFD units all over site to step down the run demand of our larger pump and fan units. This has cut down our power usage immensely!

Throughout the year our team is responsible for pump maintenance to keep all the pools operational for our animals and fish. In peak season, Splash Island keeps the team busy every day with the cleaning and startup procedure and constant return trips for back washing filters, as well as performing regular filter, pump and filter back washes daily throughout the Zoo site. The team installs new water lines that are required, makes repairs to the old, and fixes the odd major watermain break!

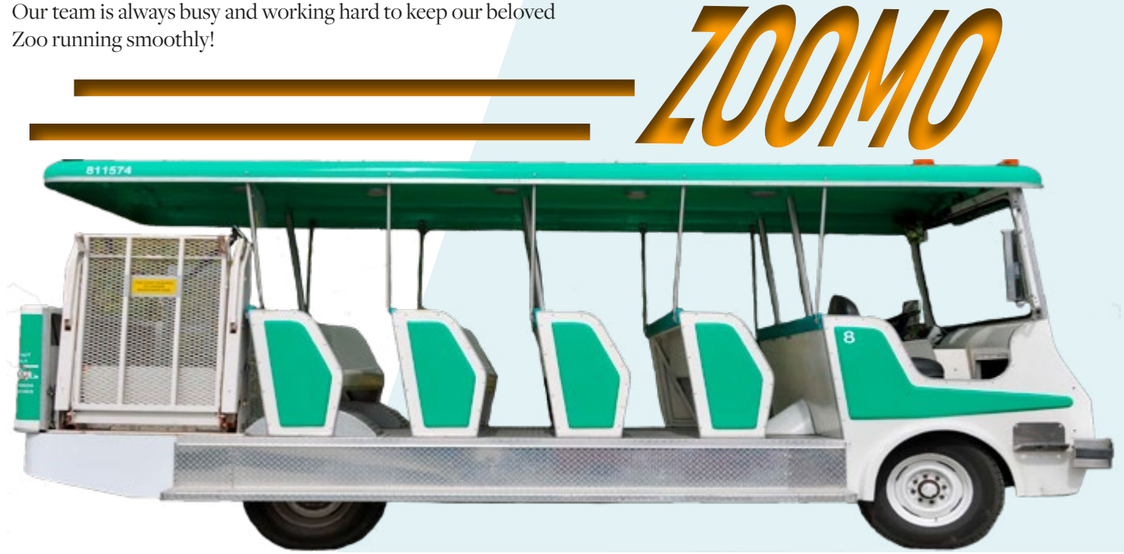
During peak season, the electrical and plumbing team are responsible for setting up for events occurring on site almost everyday. They are responsible for sound system set up or providing temporary lighting for guest access and exit.

Some of the large projects that our team will assist with in the future include a new African Rainforest Pavilion generator installation and a new Indo-Malaya Pavilion generator. This year, the team worked closely on the new exciting Terra Lumina Night Walk project!

Our team is always busy and working hard to keep our beloved Zoo running smoothly!

Transit

The Zoo's existing fleet of Zoomobiles has been operating at the Zoo since the 1980's. The existing Zoomobiles provide guided tour and transportation services to over 150,000 guests during the summer months. Each Zoomobile consists of an open air drive unit and 3 tow behind open air coaches & carries approximately 100 – 120 guests at a time. The current Zoomobiles are operating from approximately May 1st – October 15th. It is the Zoo's intention to further enhance the guest experience at the Zoo by offering them a warm and comfortable tour/transportation of the Zoo during the colder months by way of an enclosed and heated Zoomobile. The intention is that the new Zoomobile will be dual duty, preferably enclosed in the winter with operable doors and windows. In the warmer months the doors will be removable in order to return to the open air type vehicle. The winter route will slightly differ from the summer route as it will be a little shorter but take the guests to Zoomobile stations that are closer to the Zoo's indoor pavilions.



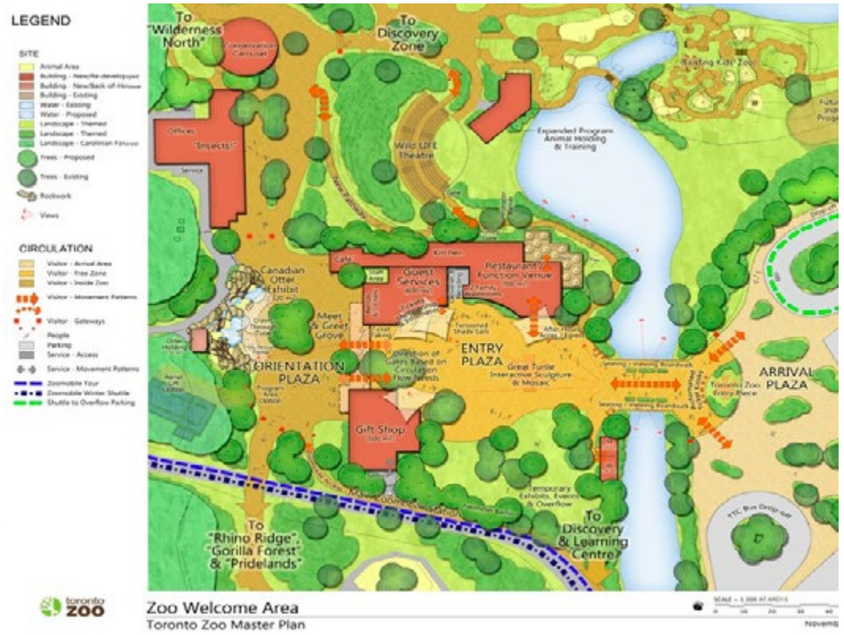
COMING SOON...

New Outdoor Orangutan Exhibit

An important part of Toronto Zoo's renewal plan is a brand new outdoor exhibit for our critically endangered species, the Sumatran orangutan. Mimicking natural rainforest environments, the new space will enhance the physical and mental health of these intelligent and playful apes, improve the viewing experience for guests, and enhance global captive breeding efforts.

The new outdoor exhibit will be located south of the Indo-Malaya Pavilion at the location of the former Gaur holding and outdoor exhibit. This exhibit will viewable along the main Zoomobile route and will provide immersive and interactive experiences for the orangutans and Zoo guests. The new outdoor area will more than double the living space for the orangutans and will greatly enhance the animal's overall health and well-being as it will allow them to live a more arboreal lifestyle. The new exhibit will consist of enrichment elements such as cables and platforms, a tunnel, and an orangutan O-line in parallel with a guest boardwalk. In addition, the exhibit will provide an improved guest experience through better lines of sight, more interesting natural structures. Interactive features will engage guests and connect them with the difficult situation these endangered red apes face, while empowering people to help save them in the wild.

Conservation Campus - New Front Entrance

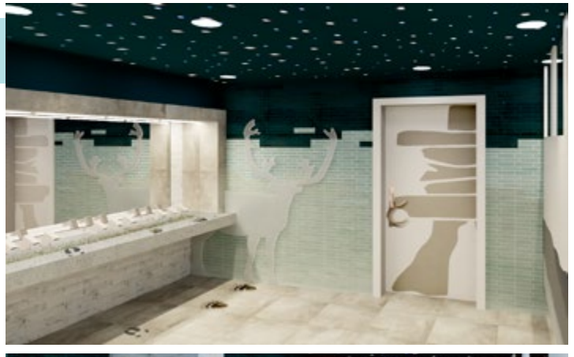


The existing Front Entrance of the Zoo was designed and built as part of the original construction in 1974. Minor modifications have been made subsequently with the addition of the Greenhouse Gift Shop, the expansion of admission booths, as well as landscape upgrades. The Front Entrance and Welcome Area Project is identified for completion as part of the 2016 Capital Master Plan. The front entrance of Toronto Zoo will become a state of the art community gathering point and show Toronto Zoo as a world-class institution in the zoo community. A major revitalization is pivotal to the guests' arrival point to the largest zoo in Canada and is essential in providing a compelling guest experience. This area of the Zoo has a major impact on the guest perception as it is the first and last point that a guest sees during their visit. The new front entrance will be welcoming, functional in terms of services and amenities for guests and staff, and leave a lasting impression on all. It will also have the potential to serve as a community centre, active year round and in the evenings. The design for the new front entrance and welcome area will include construction of a new facility that will contain guest admissions, retail, rental services, restaurant and food preparation space, an animal exhibit, event/community spaces, office space, space for educational opportunities and a theatre.

Public Washroom Improvements

Since Toronto Zoo opened in 1974, the operational requirements have increased, and significant updates or modernizations have not been made to the public washroom facilities. Therefore, Toronto Zoo acquired a qualified and experienced consultant team to facilitate and develop a sustainable and state-of-the-art design of public washrooms. Discussions with appropriate Toronto Zoo staff and a complete review of the site, facilities, exhibits, equipment and infrastructure occurred to confirm the design concept and prepare the required design documents. As well, the direction of the Zoo and its mission, vision, goals and objectives as set out in the 2015-2020 Strategic Plan were considered in preparing the proposed design with respect to animal care, existing structures, site conditions, financial sustainability, conservation, education and guest experiences.

Construction for the Caribou Café washroom began in Fall 2019.



Concept Design Images

HORTICULTURE

The Palm Oil Crisis

The picture on the left may look like just another palm tree, but it plays a pretty big role in your day to day life. That is an African Oil Palm (*Elaeis guineensis*). This palm is the reason thousands of hectares of old growth rainforest are being cleared everyday to plant oil palms as a crop. To date it already covers an estimated 27 million hectares, mainly in Indonesia and Malaysia. This widespread deforestation is pushing many species of plants and animals, such as the rare Sumatran orangutan, to the brink of extinction.

The oil from its fruit can be found in over half of processed grocery store products. This includes frozen goods, soaps, cosmetics, confectionary products and it is now increasingly being used as a biofuel as well. Some confusion arises when people try to identify products which contain palm oil and its derivatives. This is because it goes by dozens of names such as palmitic acid, sodium lauryl/laurenth sulphate and sodium palm kernelate. You may not even realize that you are purchasing a product that contains it!

Toronto Zoo Horticulture branch helped to illustrate this problem to guests by adding an African Oil Palm on display in the Indo-Malaya Pavilion last year. We decided to include an African plant outside of its native habitat in a different bioregion, to illustrate the profound impact that this crop has on the southeast Asian ecosystem. Despite being cultivated by the millions in tropical plantations, the African oil palm is virtually impossible to find in the nursery industry. After two years and several attempts to procure a specimen, it took the work of ten people, a backhoe and a 5,000 pound pump cart to get it into the pavilion as it weighed approximately 1,000 pounds! This was the largest and most costly tropical specimen that has been planted at the Zoo in the past 25 years.

What You Can Do To Help

- SHOP RESPONSIBLY: Buy products from companies that have joined the Roundtable on Sustainable Palm Oil (RSPO). You can print the shopping guide at cmzoo.org/Conservation/PalmOilCrisis
- USE YOUR POWER AS A CONSUMER: Write to your favourite restaurants, companies and supermarkets. Educate them on the importance of using Certified Sustainable Palm Oil.

ORANGUTAN FRIENDLY PALM OIL

Projects Completed by Horticulture:

Began planting Spring blossom trees to begin development of a Spring Blossom festival. With 20 trees planted in 2019, there is a plan to plant over 100 trees.

Transferring pollen for our Corpse Flower 'Pablo', into the McMaster Corpse Flower on July 4th, 2019. This marked the first time, we believe, in the world pollen was stored using cryopreservation and then used for pollination.

Donated two corms of the first Corpse to bloom in the GTA, to the Royal Botanical Gardens in Burlington.

Completed landscaping in the new Hippo exhibit and Aldabra tortoise exhibit, enhancing the area for animal enrichment and mimicking their native areas of the world.

- Prepared multiple sites across the Zoo for the many Wild Encounters taking place behind the scenes.
- Assisted with the setup of the Washed Ashore exhibits.
- Planted and maintained the garden beds during the 2019 season.
- Helped complete the Public Relations stage at our front entrance.
- Created a picnic area for guests over our geothermal bed.
- Protected the Core Woods on the Toronto Zoo property as Native Trillium plants continue to thrive there.
- Completed all seasonal decorating.
- Hosted the Orchid Oasis festival, showcasing a variety of hand-picked orchid species for our guests to enjoy!

Participated in the Symcor planting Acres for the Atmosphere and pollinating plant gardens on site. This is a yearly event with nearly 100 volunteers participating.

Created a Canadian themed courtyard at our front entrance.

Completed the new Greenhouse entrance, and surrounding gardens.

Created a new natural play area in Eurasia for children to become connected with nature (used recycled material from the Panda Exhibit).

Maintain the Americas Mayan Temple area, one of the most photographed areas on site.

- Created many planters across the Zoo site (no two are the same) as well as butterfly pavilion entrance planters with Hibiscus and other flowering plants to attract hummingbirds and butterflies.
- Maintained the core woods as well as hire an arborist to inspect the site twice a year to ensure that the area is maintained (all hazardous trees removed).
- Completed planting 1,000 apple and crabapple trees on site for browse production (will not be ready to be harvested for 5 to 8 years). Red Mulberry and Willow continuing to be planted on site.
- Hosted Greenhouse tours for guests to enjoy our extensive collection of plants. Here in the greenhouses, our staff are able to explain the plants we have specifically grown for browse or medicinal value for some of our animals here on site.

GREEN INITIATIVES

Toronto Zoo has a strong record of environmental protection and of energy efficient operations management. We have motivated staff and volunteers that understand the importance of living sustainably in balance with nature. We understand and accept that climate change is a real threat to Earth's biodiversity and we encourage people to lessen their ecological footprint on the Earth. By setting a positive example and promoting public awareness of environmental issues, the Toronto Zoo will be viewed as an important source of information and inspiration for individual and group action against climate change.

In 2007, Toronto Zoo published its Green Plan renewing its commitment to demonstrate environmental leadership in all aspects of our operations, including sustainable growth and maintenance. To date, Toronto Zoo has achieved 25 of the 27 action steps identified in the Green Plan and has made significant movement toward achieving its 2027 targets for energy, water and waste management on-site.

In 2019, Toronto Zoo continued to implement an ISO14001 compliant environmental management system providing a framework to actively reduce our negative environmental impacts and ensure we are able to achieve certain environmental targets while providing a balance with other operational needs and services.

Staff Involvement

Green Eco-Zoo Team (GEZT)

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

GEZT provides an annual report to the CEO for presentation to the Board of Management on environmental projects, programs, and initiatives in progress or completed over the past year. In 2019, GEZT concentrated on 5 main areas to focus Toronto Zoo's environmental sustainability platform. This included implementation of an ISO14001 - compatible Environmental Management System (EMS), palm oil awareness, energy consumption reductions, water consumption reductions, and waste management.

Fox's Den: Design a Product to Reduce Plastic Waste

On August 14th, 2019, Toronto Zoo held its first ever Fox's Den challenge for staff and volunteers. The challenge was focused on bringing awareness to issues with plastic waste and our ecological impact. So, the task at hand was to design an innovative product or project that would reduce plastic waste within individual branches here at the Zoo or to come up with an idea that reduces your ecological impact on energy consumption, water consumption or waste. After developing a product or coming up with an idea, staff and volunteers then created a 5 minute presentation and pitched their ideas to the Fox's Den panel of experts. This panel featured a special guest, Dolf DeJong, our very own CEO.

With special first place and second place prizes for winning participants, we had plenty of innovative and interesting ideas!

Plastic Free July Ecochallenge

This year, staff at Toronto Zoo joined the Plastic Free July EcoChallange, where participants reduced their single-use plastics for one month. For the entire month of July, staff accepted daily challenges such as picking up three pieces of litter a day, replacing their plastic toothbrush with a bamboo alternative or even pledging to watch a documentary film about waste with their friends and family. All of this effort culminated to an enormous impact! As a team of 181 members, we kept a large amount of waste from reaching landfills. This includes 144 disposable cups, 833 plastic containers, 1,027 pieces of plastic cutlery, 1,019 plastic bottles and 518 plastic straws. On top of this we picked up 904 pieces of litter, consumed 209 zero waste meals, conducted 11 waste audits, signed 100 petitions, and dedicated 46 volunteer hours.

The Plastic Free EcoChallenge mission is to raise awareness of the dangers of single-use plastic on our environment, and challenges individuals, organizations and communities to do something about it!

"IT TAKES THREE WEEKS TO CHANGE A HABIT. IF YOU CAN STICK WITH A NEW BEHAVIOUR FOR 21 DAYS IN A ROW, YOU'RE A LOT MORE LIKELY TO KEEP IT UP FOREVER." - PLASTIC FREE JULY

Highlights: Environmental Initiatives

Toronto Zoo staff have taken a giant leap towards a zero waste facility, by implementing a zero waste employee program. This encourages all staff and volunteers to consciously produce less waste and divert what waste they produce from the landfill.

The Wildlife Nutrition Centre came up with the idea to use glycerine bags to eliminate 50 percent of plastic bags used in the preparation of animal diets. Glycerine bags are biodegradable and are diverted to the Zoo's compost facility.

Healthy ecosystems start with healthy water. The installation of three new windmills which use the renewable power of wind to aerate the Zoo's stormwater management ponds in conjunction with the new floating wetlands, will create healthy habitat for fish, frogs, birds and more!

Toronto Zoo has installed 6 water bottle filling stations to help reduce the amount of single use plastic waste generated each year. In the first 3 months, Zoo staff alone saved 964 single use bottles!

Environmental Management System (EMS)

Chemical Management

Here at the Zoo, we restrict the use of pesticides on site, opting for the use of ecological control methods for landscaping and bio-controls to help keep pests under control in the pavilions and greenhouses.

In addition, we maintain an electronic database linked to a Globally Harmonized System for chemical management.

We also source where possible, Ecologo certified or plant-based products and are continuously evaluating new alternatives.

Energy Management

We are currently investing in the renewal of our facilities, specifically upgrading existing energy services with more efficient systems. In addition, we are actively researching energy production on site, electric vehicle charging stations and engagement opportunities to reduce our resource consumption for the future.

We have a total of 12,673 square feet of green roof; 50 solar thermal panels to supply hot water to the Administrative Support Complex; cool our Caribou Café with our ICE Bear system, 12% of our transit fleet is made up of electric vehicles; we have many on-demand water heaters to help our annual energy savings by $ 3,168; and since 2016, we have Variable Frequency Drives (VFD's) installed in our larger buildings to help reduce our energy consumption per month, per building, by 30%.

Stewardship of the Land

The Zoo occupies 287 hectares of valley, river, forest, field and meadow ecosystems at the edge of the Rouge National Urban Park. We provide beautifully wild and ecologically sustainable spaces for staff, guests, our animal ambassadors, and the diverse wildlife of the Rouge River Watershed. Progressive development of the Zoo property to support wildlife conservation programs and work of the Toronto Zoo involves commitment to management and rehabilitation of the site and of critical habitats for local species at risk, as well as help to mitigate climate change.

Programs & Awareness

Toronto Zoo leads with practical examples of how we can reduce the impact of our operations on the environment, by increasing communication and transparency on how we are actively reducing our impact. Such examples include Party for the Planet event and Waste Free Wednesdays.

Water Management

Here at Toronto Zoo, we surpassed our 2027 water reduction target of a 40% reduction below 1990 levels. We have maintained this reduction since 2011.

In addition, in 2018 we installed a Rainwater Harvesting System that filters, stores, and distributes collected rainwater to our horticultural greenhouse.

Sustainability & Purchasing

At the Toronto Zoo we give preference to products and services that are deemed to be environmentally superior.

Waste Management

Toronto Zoo staff and Volunteers participate in the Terracycle Waste Stream Program. This diversion program finds alternatives for products that are not yet blue-box recyclable.

Another way we divert waste is by collecting feminine hygiene products here at the Zoo and send them to the Durham York Energy Centre (DYEC).

Toronto Zoo also developed a Phone Apes cell phone recycling program which increases awareness about the environmental impacts of consumable products on wildlife.

In addition, we compost organics on site which is used in indoor and outdoor garden beds.

Green Initiative Exhibit

Washed Ashore

On Thursday May 16, 2019, Toronto Zoo officially opened a new temporary exhibit, Washed Ashore - Art to Save the Sea. The exhibit displayed ten larger than life sculptures, created by Washed Ashore, a non-profit organization whose mission is to use the arts to educate a global audience about plastic pollution in oceans and waterways and to spark positive changes in consumer habits.

The exhibit educated guests about the negative and devastating effects of plastic pollution, with each sculpture built completely from plastics found in oceans and waterways around the world. Each year, 300 million pounds of plastic are produced globally and less than 10% of it is recycled!

Toronto Zoo also created its own sculpture named 'Poly' the Polar Bear, built with plastic from local shoreline cleanups, from the Zoo's site, and local supporting organizations.

EVERY PIECE OF PLASTIC WAS ONCE PURCHASED BY SOMEONE, DISCARDED, BECAME WATERBORNE, AND LANDED ON A BEACH WHERE SOMEONE ELSE PICKED IT UP TO MAKE A DIFFERENCE.

This exhibit was supported by 10,000 Changes, a multi-platform plastics engagement program launched in June 2019 that will help Canada move toward zero plastic waste.

'Poly' the Polar Bear

LEARNING & ENGAGEMENT

Conservation Education Mission: Toronto Zoo will engage communities by providing the tools and knowledge to connect to nature and protect our natural world.

Toronto Zoo Volunteers

Volunteers assist in the delivery of the Zoo's educational experiences, using their knowledge and interpretive expertise to help connect guests with nature, bring conservation messages to life, and to enhance the experience of each guest with whom they come in contact with.

Here at Toronto Zoo, we have four categories of volunteering opportunities. We have Year Round Volunteers, Summer Information Volunteers, short-term volunteer opportunities (Wildlife Health Centre Interpretive Volunteers or Volunteer host) and Zoo Ambassador Student Volunteers.

To learn more about becoming a volunteer, visit www.torontozoo.com/BecomeAVolunteer/

In 2019, our roster of 431 volunteers donated 39,088 hours of their time, making contact with 1,033,138 people!

Educational Programs

The Toronto Zoo provides a perfect setting for individuals of all ages to explore the natural world first hand, providing opportunities to observe and interact with plants and animals from around the world which they may not otherwise get an opportunity to experience in the wild. Such opportunities help to connect people with nature, establishing a bond which creates an unparalleled opportunity to foster conservation through education.

The Learning & Engagement Branch develops and delivers a wide range of educational experiences specifically designed for a variety of audiences/ages. These include the more formal school program offerings and educator resources, as well as a roster of themed public programs, overnight experiences, and summer day camps. In addition to these, the Learning & Engagement Branch is also involved in creating and reviewing content for interpretive graphics/displays, providing interpretive training and support to staff/volunteers (both internally and externally), plus creating and operating interpretive displays to support special events at the Zoo and in the community.

Formal Education Experiences

- Curricum-linked programs for a variety of grades
- Professional development sessions for educators
- Internship programs
- Operation Conservation (grant-funded program for Grade 6 students of undeserved communities).
- Educational resources for educators

Non-Formal Education Experiences

- Themed family and children's programming (weekends & evenings throughout the year)
- Adult only programming (e.g. Love at the Zoo Valentine's Program)
- Overnight programs for Guides, Brownies, Scouts, and Cubs (Sept. - May)
- Zoo Camps (summer day camp for ages 4 -16) & Serengeti Bush Camp (overnight experience for families, adults, youth/school groups; May long weekend to Labour Day)

Informal Education Experiences

- Interaction with a Volunteer at an interpretive station
- Interactive exhibits/displays
- Animal Shows, keeper talks and close encounters
- Free play in the Kids Zoo or Nature Playground areas

Zoo School

The Toronto Zoo has received credit granting authority from the Ministry of Education for the Grade 11 Biology, University Preparation (SB13U) course. This intensive four-week summer program is delivered in both July and August. This unique learning experience engages students through interactive learning opportunities, behind-the-scenes tours, career discussions with Zoo staff, and formal classroom lessons. Curriculum content includes Scientific Investigation Skills and Career Exploration, Diversity of Living Things, Evolution, Genetic Processes, Animals: Structure and Function, and Plants: Anatomy, Growth, and Function.

TORONTO ZOO SCHOOL
where education comes alive

DID YOU KNOW?

This program has been running for the past 10 years, with two sessions a summer. With 18 students participating in each session, we have taught over 396 students in our "Zoo School"!

"I know I have said it before but I shall say it again, it was the best decision of my life to come to this course - it was simply the best course I have ever taken. What made it amazing were the teachers, the creativity, the animals, the people - basically everything and everyone involved... Thank you to all the teachers for inspiring me to do more and giving me hope and courage." - Former Student, Jax

Orangutan Palm Oil Hot Spot Activity Zone

Supporting the theme “orangutans need rainforests, and so do we”, an interactive activity zone was created and is operated by Volunteers to help guests understand the importance of the rainforest to orangutans and raise awareness about the issue of sustainability surrounding palm oil. An orangutan- friendly shopping guide was created as part of this, and is available for guests to take home to help them make sustainable shopping choices.

Connecting with Nature through Play

An expanding body of scientific evidence suggests that nature-deficit disorder contributes to a diminished use of the senses, attention difficulties, conditions of obesity, and higher rates of emotional and physical illnesses. Research also suggests that the nature-deficit weakens ecological literacy and stewardship of the natural world. These problems are linked more broadly to what health care experts call the ″epidemic of inactivity″, and to a devaluing of independent play. Nonetheless, we believe that society′s nature-deficit disorder can be reversed.″ (Children & Nature Network, 2015).

Today′s children are often bombarded with electronic media, full schedules, and highly structured lives. Outdoor natural play spaces provide a place to take a break, for children to use their imagination/creativity to have fun, get dirty, and experience just being kids. Toronto Zoo has been working to create a variety of play spaces in natural areas throughout the Zoo encouraging interaction with the natural world. These play spaces provide opportunities for young children to develop essential cognitive and motor skills and allow them to freely express themselves all while immersing them in the natural world.

Visit one of our play spaces today, located outside the Africa restaurant (next to Gorilla Climb) or near the entrance to Eurasia Wilds (opposite the kangaroo walkthrough at Australasia).

Toronto Zoo's Conservation Education Committee

To further help guide educational experiences and conservation messaging here at the Zoo, we have a cross-section of staff who are part of a Conservation Education Committee (CEC). This is an internal Advisory Committee that helps direct effective educational opportunities for guests in line with the Zoo′s strategic plan. The purpose of the Committee is to assist in developing tools and methodology to evaluate educational experiences, make recommendations to improve educational experiences to ensure they fit with the broader message, and to work collaboratively with all Zoo branches to ensure consistent messaging.

Bison and Caribou and Polar Bears, Oh My!

Parks Canada Parcs Canada

As long-time partners, both the Toronto Zoo and Parks Canada continue to work together to inform Canadians and foster public understanding about the importance of protected areas for conserving biodiversity and species at risk. This past summer, Zoo guests had the opportunity to explore three Parks Canada stations featuring interactive and educational activities surrounding Canadian wilderness and biodiversity and highlighting the Canadian species the Zoo and Parks Canada are working together to save and protect.

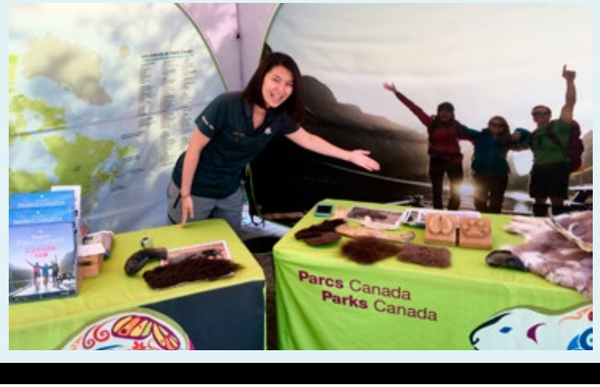
The stations included:

• **Saving Species at Risk** - hear about our many conservation stories surrounding species at risk, the collaborative work Parks Canada is doing with Toronto Zoo, and simple things guests can do at home to help wildlife.

• **Wildlife Monitoring and Observing** - learn how to explore nature by looking and listening for signs of wildlife in their natural habitat, and test your knowledge of Canada′s biodiversity with species identification challenges.

• **Tundra Trek** - experience sites in Nunavut and the Western Arctic, and learn about the work being done to conserve our northern habitats.

• **Plus NEW for 2019, Learn-to Camp Pop Ups!** - On select dates throughout the summer, Parks Canada staff also set up a Learn-to Camp demonstration site (at the Front Courtyard Kiosk). Here guests could discover more about camping, camp cooking, national parks, hiking, wildlife safety and the outdoors! Through these demonstrations guests are able to develop the knowledge and skills to feel confident planning and carrying out their own camping adventure.



University/College Partnerships & Other Collaborations and Training

Toronto Zoo makes contributions in the areas of wildlife care, and reproductive, veterinary, behavioural and nutritional sciences, as well as species preservation with many partners, including conservation groups, governmental organizations, and environmental organizations, other wildlife care facilities, and universities and colleges.

These partnerships allow the Zoo to share resources such as personnel, expertise, equipment and training which assist us in advancing towards our common goals.

Adjunct University Positions

Toronto Zoo staff have adjunct university appointments and provide lectures, advice, and assistance to student programs. Graduate studies are available through Zoo collaborations and include M.Sc., Ph.D., D.V.Sc., and Post-Doctoral programs.

Doctor of Veterinary Science (D.V.Sc.) Degree Programs

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 (D.V.Sc.) 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 Training

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 25 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.

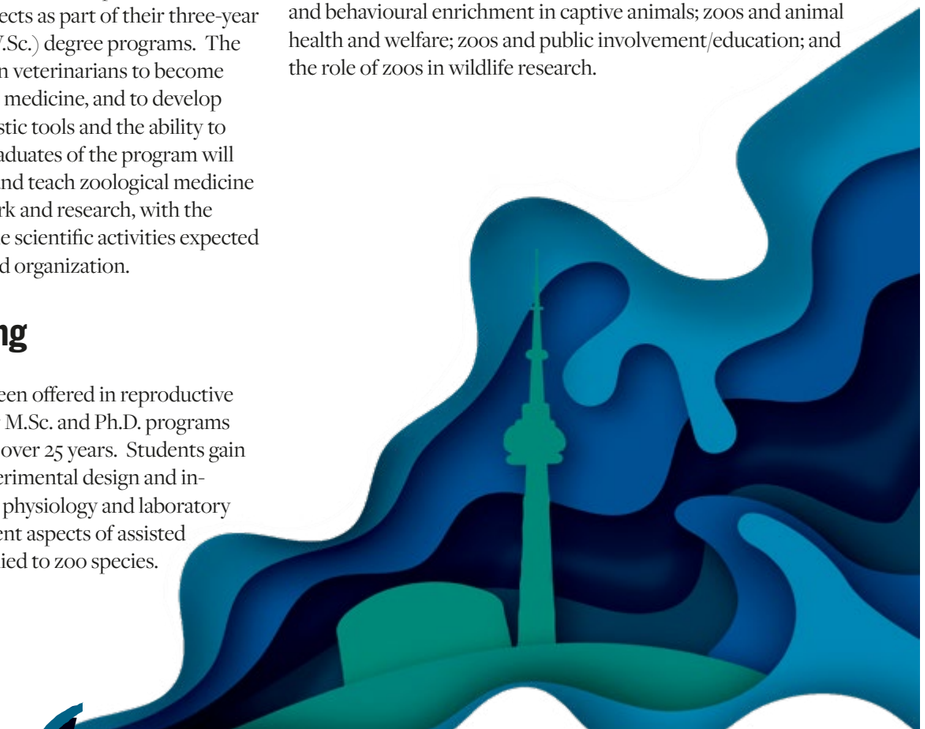
Student Externships / Summer Students

The Wildlife Health Centre accommodates senior veterinary students on externships throughout the year from veterinary colleges around the world.

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.

The Role of Zoos in Conservation – University of Toronto Scarborough Course: BIOC62H3

Toronto Zoo staff are guest lecturers for the Role of Zoos in Conservation course taught at the University of Toronto, Scarborough Campus. The course is a lecture and discussion course that examines the role of zoos in conservation, with an emphasis on the following contemporary topics: involvement of zoos in situ and ex situ conservation; captive breeding and reintroduction of species; new technologies to assist in reproduction in wild populations; the importance of nutrition and behavioural enrichment in captive animals; zoos and animal health and welfare; zoos and public involvement/education; and the role of zoos in wildlife research.



Toronto Zoo Staff Venomous Animal Training Course

The purpose of this course is to train Toronto Zoo staff how to safely work with venomous/poisonous reptiles and amphibians. Staff learn Toronto Zoo accepted policies, procedures and techniques for dealing with potentially dangerous animals. At the end of the course, staff continue with training on site until a checklist is completed, and they are approved to work with each species housed at Toronto Zoo.

Toronto Zoo staff are required to work with potentially dangerous venomous/poisonous reptile and amphibian species while servicing for general care and maintenance, and assisting in veterinary procedures and occasionally when assisting outside organizations. To ensure that staff are properly informed and trained on working with these animals, Toronto Zoo has developed and regularly offers this course. Staff are trained on venomous/poisonous reptile and amphibian biology, and behaviour and management using approved techniques and following approved protocols and procedures.

All training of staff is documented and staff are required to sign off on the Venomous Reptile Care Expectations before being approved to receive venomous reptile keys. Training to work with venomous species is an ongoing process, with handling procedures being used as opportunities for staff to enhance their skills.

Canadian Armed Forces Preventive Medicine Course & Toronto Animal Services Training

The purpose of these courses is to train staff from the Canadian Armed Forces (CAF) and Toronto Animal Services (TAS) to recognize and safely deal with potentially dangerous animals that they may encounter during the performance of their duties. The courses teach basic identification and handling techniques that involve some manipulation of animals.

CAF personnel are often required to serve in foreign countries where they might encounter species of reptiles, amphibians, and invertebrates that could pose a threat to human safety. In order to keep personnel and wildlife safe, this workshop teaches CAF medical personnel to recognize and safely deal with potentially dangerous species they may encounter. Species identification, safe handling techniques, and first aid treatment is the focus of the workshop. Participants should leave the course with a better understanding of how to deal with potentially dangerous animals and the injuries they may inflict on humans. Presentations are given on reptiles, amphibians, and invertebrates, followed by a practical demonstration using both live animals and inanimate systems. Participants have the opportunity work directly with live animals to better prepare them for encounters they may experience in the field.

Toronto Animal Services personnel are sometimes called upon to identify and handle potentially dangerous animals as part of their daily job. This course is designed to teach TAS staff basic identification and handling techniques to assist them in the safe performance of their duties. TAS staff may also be required to care for confiscated/rescued animals for extended periods so the course also provides basic husbandry information and potential health concerns for both animals and staff. Participants receive hands on training with live animals. They learn techniques for handling and containing animals that they may be called upon to collect, transport, and temporarily house.

Eastern Massasauga Rattlesnake Public Workshop

Each year Toronto Zoo hosts rattlesnake workshops for individuals who share habitat with rattlesnakes near their homes and cottages, where they work and play. These popular workshops provide an opportunity for participants to learn about the biology and life history of this snake and how to safely share habitat. Discussions about the natural history of rattlesnakes are followed by ample opportunity to ask questions. Participants learn to identify Eastern massasaugas and other native snakes and about the vital role they play in Ontario's wilderness and meet a live rattlesnake! A portion of the proceeds gathered for this program are directed towards funding massasauga rattlesnake conservation at Toronto Zoo.

Community Outreach

Here at Toronto Zoo, our mission is to educate guests about wildlife and our animals but also to spark a passion to protect these animals in the wild and the habitats they live in. That is why it is so important for us to participate in outreach activities, whether it is interacting with our guests on site through casual encounters, keeper talks, or by participating in offsite visits where we can introduce our animals to the community!

Public Involvement & Curriculum Links

35,013
Animal Show Visits

The Wonders of Wildlife Show is an interactive opportunity for guests 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 guests of all ages as captivating birds fly overhead and incredible creatures show off their wild behaviours through activities on stage. With the shows newly added backdrop, you never know where the next animal will appear from!

Our new animal show wall at the Waterside Theatre.

One of our keepers speaking at our Giraffe Keeper Talks

177,189
Keeper Talk Visits

Toronto Zoo keepers provide engaging and educational talks to guests at scheduled times and locations throughout the day. During meet-the-keeper talks, keepers discuss individual species as well as their feeding habits and threats to survival in the wild.

Outreach Ambassadors

In many ways, education and conservation are inseparable and go hand-in-hand. 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.

Ambassador animals provide compelling experiences for guests and allow them to gain and maintain personal connections with nature. They inspire guests to protect the environment and discover the animals within it.

Animal ambassador, Captain Sunshine, our Blanding's turtle

1,381
Casual Encounters

The Casual Encounters program offers unexpected opportunities to meet animals and keepers in public areas across the Zoo site.

4
Offsite Visits

Toronto Zoo's animal outreach program introduces some of the Zoo's amazing animals to the community.

One of our staff hosting a casual encounter with Micheal, our pied imperial pigeon

WILD ENCOUNTERS

On Thursday, May 16, 2019, Toronto Zoo officially opened the new Wild Encounters tours, where guests have the chance to go behind-the-scenes with staff to experience some of our amazing animals and habitats up close! At the beginning of these behind-the-scenes experiences, our Wild Encounter Tour Guide leads up to 8 guests on an interpretive tour, where they learn about the work Toronto Zoo does for the conservation of our animals, about their biology, and how our keepers take care of them. At the end of the tour, guests receive a meet and greet with a Wildlife Care Keeper and experience an up-close encounter. Here, participants learn about the personality of these animals and in some cases interact with them!

The Wild Encounters take place with the kangaroos, capybaras, Aldabra tortoises, flamingos, Indian rhinos, giraffes, Amur tigers, Sumatran tigers, African penguins, polar bears, gorillas, caribou, and our outreach birds. In addition, tours of our Wild Spaces are offered as well, such as the African Rainforest Pavilion, African Savanna Hoofstock building, and invertebrate house, as well as "Hidden Zoo" tour, which takes guests behind the scenes at our Wildlife Health Centre, Nutrition Centre, and Horticulture Greenhouse.

We are extremely proud of how we care for our animals and it is our hope that by allowing our guests to experience this up close, they will be inspired to create meaningful action in their everyday lives and make a positive impact on our natural world and environment. With each encounter we highlight our conservation efforts and passion and give examples of ways that they can make a difference. Our hope is that by sharing our passion, we will inspire more people to take action to effect real change! Animal welfare is our top priority and our animals have the choice to participate in these encounters or choose to leave at any time.

In the first month that Wild Encounters was launched, over 950 spots were sold!

With the great success of the summer pilot program sales were extended until Thanksgiving and then continued again after Halloween.

By the end of 2019, the revenue for Wild Encounters was $132,000 and the program saw over 2,983 encounters.

A full 2020 schedule will be launched in March 2020!

Saving Species Days 2019

Toronto Zoo hosts Species Awareness/Saving Species Days and Weekends throughout the year to celebrate different species of animals from all over the world. These awareness events allow guests to visit our animals on site and to participate in the meet-the-keeper talks, enrichment presentations, and family activities. The events highlight how human activity is affecting wild animal populations and how we can help protect these species.

FEBRUARY 16-18
National Hippo Awareness Weekend

APRIL 27/28
Gorilla Awareness Weekend

MAY 4
Annual Spring Toad Festival

MAY12
Migratory Bird Day

MAY 25
World Turtle Festival

JUNE 15/16
Hippo Awareness Weekend

JUNE 21
World Giraffe Day

JUNE 28- JULY 1
Saving Canadian Species Weekend

JULY 20/21
White Rhino Open House

JULY 27/28
Tiger Awareness Weekend

AUGUST 3-5
Penguin Awareness Weekend

AUGUST 10/11
World Lion Weekend
Open House

AUGUST 17/18
Bat Awareness Weekend

AUGUST 24/25
Orangutan Awareness Weekend

SEPTEMBER 1/2
Vulture Awareness Weekend

SEPTEMBER 13
Great Canadian Shoreline Cleanup

OCTOBER 19/20
International Snow Leopard Weekend

OCTOBER 26/27
Lemur Awareness Weekend

DECEMBER 4
International Cheetah Day

PASSIONS TO ACTIONS

KEEPER FEATURE

MEET SUE EBERTH

Sue is a Grade III Keeper in the African Rainforest Pavilion, who works with many different animals, from ring-tailed lemurs and slender-tailed meerkats, to pygmy hippopotamus' and Western lowland gorillas. She is responsible for not only providing daily care such as food and water but also daily enrichment, whether it be an approved enrichment device, a training session (e.g. for a physical exam), a keeper interaction of some kind, or a Wild Encounter activity for the gorillas, Aldabra tortoises, and meerkats specifically.

"IT IS LIVING A DREAM... I COULD NOT WORK HERE AND IN GOOD CONSCIENCE DO NOTHING TO HELP THEM."

For over 30 years Sue has been supporting various conservation efforts with a focus on gorillas and their habitats, so when she was hired here at the Zoo in 2008, it was a dream come true. Sue began working in the Indo-Malaya Pavilion first, moved over to become a keeper for our elephants for 3 years, then ultimately moved to the African Rainforest Pavilion in 2014. In the African Rainforest Pavilion, gorillas are one of the animals she works with most, working with them on a daily basis. Sue describes it as a living dream and focuses heavily on conservation issues gorillas are facing. In order to help gorillas, Sue and her gorilla team have been organizing an awareness day each year to benefit Ape Action Africa, and this year the Zoo team raised just over $5800 dollars! In addition, Sue and the team celebrate World Gorilla Day as well, where extra educational time is spent discussing the plight of gorillas and sharing information about our Phone Apes Program. This program, which has been in operation since 2006, is a 100% landfill free cell phone recycling service. It has been awarded top honours among North American zoos, aquaria and wildlife organizations in 2007 and 2009, and has made Toronto Zoo the most trusted cell phone recycler in the Greater Toronto Area & throughout Ontario. The recycling of cell phones and other small electronic devices helps reclaim valuable metals and reduces the demand to mine Coltan (a metallic ore used to produce tantalum capacitors in almost all cell phones, laptops and pagers) in the rainforests of the former Republic of the Congo, where, unfortunately, the endangered Lowland gorilla resides. In addition, Sue continues the fight for gorilla conservation and awareness and seeks support each year from the Zoo's Endangered Species Reserve Fund to obtain more help for gorillas.

In her spare time, Sue is very passionate about raising awareness about the conservation issues gorillas are facing. Since 2005, she has been volunteering with Ape Action Africa (AAA), a non-governmental organization (NGO) in Cameroon Africa, where she helps care for orphaned gorillas and chimpanzees that have been negatively affected by the bush meat trade. In addition, she has travelled to the African Rainforest on her own time (from 3 weeks to 3 months) to hand rear orphans, reintroduce them into conspecific groups, transport them across Cameroon to sister NGO's, develop enrichment devices, and enhance enclosure spaces. In addition, Sue is involved with Rotary International which has sponsored the education program for Ape Action Africa over the last three years. This year, Sue and her Rotary team have been able to provide over $6,000 in support and are building an education centre right in the rainforest compound where they can reach the most rural of populations. Here, they can teach the local people the value of Cameroon wildlife and wild spaces while also educating the children of today about the plight of gorillas. Furthermore, Sue is also a part of the Rotary Action Group for Endangered Species, where she has been able to get the organization to list Ape Action Africa as one of their projects of choice!

2016 Toronto Zoo

2006 Cameroon

"TO HAVE BEEN IN THE PAVILION THROUGH THE LAST TWO GORILLA BIRTHS AND WATCHING THOSE CHILDREN GROW HAS BEEN VERY SPECIAL."

In 2019 for World Gorilla Day, Sue and her team set up an education table with information for guests on our PhoneApes program, the status of the Western lowland gorilla which is listed as critically endangered (we are still losing approx. 3% of them annually to poaching), habitat loss, disease and how climate change plays a role. Social media posts helped push out the importance of gorilla conservation and spread awareness on how people can help.

2017 Cameroon

2012 Cameroon

"...TO HAVE THE CHANCE TO WORK SO CLOSELY WITH CHARLES AND JOSEPHINE IS AN ABSOLUTE HONOUR."

One of the highlights of Sue's career is being a part of the team which formed the Zoo's first gorilla bachelor group. Being in the pavilion through the last two gorilla births and watching those children grow has been very special for her. This past year alone, Sue's area has seen several births between Charlie the baby gorilla, Ginger and Hazel, our baby red river hogs, and Penelope the baby pygmy hippo. But most importantly for Sue, having the chance to work so closely with Charles and Josephine has been an absolute honour. Sue says, "Both individuals are wild caught, first generation gorillas from Gabon. At 47 and 48 years old, they are well past their life expectancy and going strong. Out of the North American population of approximately 350 gorillas, 11 are left from the first generation, five males and six females. For them alone, we must raise as much awareness and support as we can for the animals that remain in the wild to this day."

PRIDE

On Saturday, June 15, 2019, Toronto Zoo hosted its first ever PRIDE event! The Zoo welcomed guests who had the chance to partake in PRIDE themed enrichments at six different locations across the site. These tours were led by Toronto Zoo staff along with guest presenters and PRIDE drag queen entertainers.

The event was all about celebrating Toronto PRIDE with fun, colour, and, of course DIVERSITY!

toronto
ZOO

TERRA LUMINA
AN ENCHANTED NIGHT WALK

Photo by Moment Factory Terra Lumina

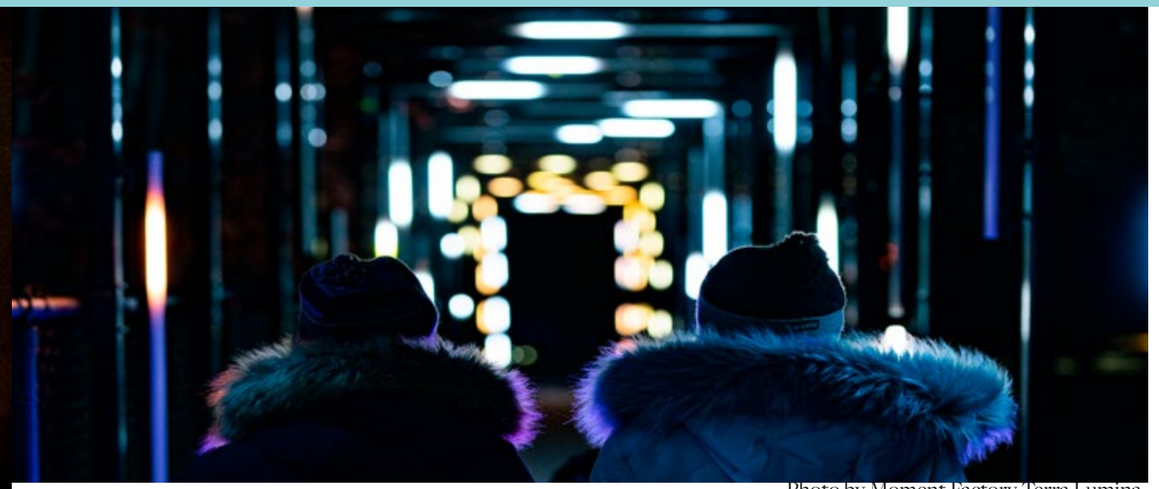


Photo by Moment Factory Terra Lumina

On Friday, December 13, 2019, Toronto Zoo celebrated the opening of Terra Lumina: An Enchanted Night Walk Into A Bright Future. Terra Lumina is the eleventh unique experience created in Moment Factory's Lumina night walk series.

After nightfall guests are invited to pursue an immersive experience along a 1.5 km walking path that travels into the future and back. The journey begins when a portal carries guests into the luminescent wonders of the year 2099, a time when humans and nature learn to live in harmony.

Guests are transported by vibrant lighting, multimedia effects, breathtaking video projections to an enchanted world filled with possibility and explore this bright and hopeful future to reveal the powerful secrets of tomorrow.

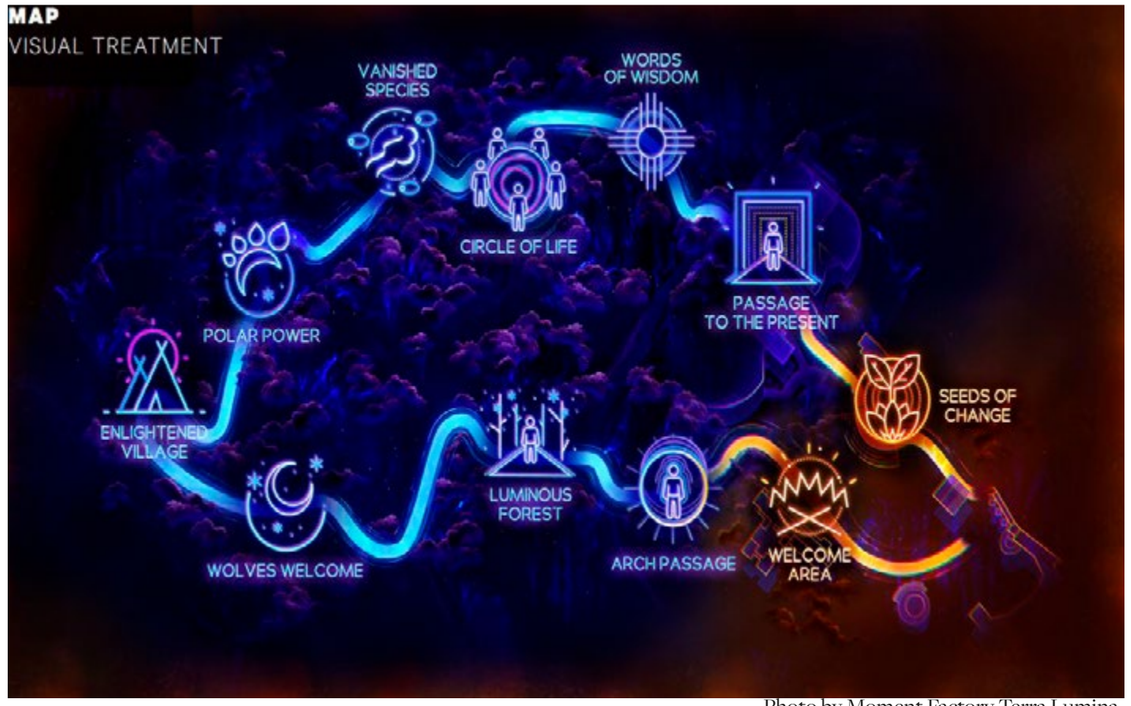


Photo by Moment Factory Terra Lumina

The Journey with Moment Factory

Moment Factory is a multimedia studio with a full range of production expertise under one roof. The team combines specializations in video, lighting, architecture, sound and special effects to create remarkable experiences. With its headquarters based in Montreal, the studio also has offices in Los Angeles, Tokyo, London, New York City and Paris. Since its inception in 2001, Moment Factory has created more than 400 unique shows and destinations. Productions span the globe.

"At Moment Factory, we bring people together. Our shows and destinations pioneer forms of entertainment that offer the world new experiences. Whether at a concert, a flagship store or across an urban square, we aim to inspire a sense of collective wonder and connection." Moment Factory

Photos by Moment Factory Terra Lumina

Photo by Moment Factory Terra Lumina

Animal Welfare Assessment: Keeping our Animals Happy

A crucial part of our journey to Terra Lumina was ensuring the continued well-being of our animals. As an AZA-accredited zoo, we are committed to operate based on three core principles: animal welfare, safety, and guest engagement. Excellence in animal welfare is the underlying foundation on which all accreditation standards and practices are based. An animal's welfare state at any given time is dependent on a combination of factors that encompass physical, behavioral and emotional well-being. Some of these factors contribute to the animal's welfare state, others are the measurable effects of these contributing factors. Most events in our lives and the lives of the animals we care for have the potential to affect well-being either in a positive or negative way. These factors can include things like social relationships and interactions, weather events, renovations and construction to the places we live, or things like our Terra Lumina which is a new and innovative guest engagement event that will change the regular routines for our staff and animals. Although Terra Lumina does not focus on the animals, some of our animals will be in nearby habitats during this time and may see and hear parts of the Lumina experience. To prevent adverse effects on our animals and mitigate any welfare concerns, we had our dedicated Keepers and other Wildlife & Science staff carefully monitor our animals throughout the process to maintain positive animal welfare as we provide a powerful and inspiring experience for our guests.

In the months leading up to the launch of Terra Lumina we conducted simulation trials using speakers and lights that were situated at key locations along the event route over a course of four weeks. Our Zoo's Animal Welfare Science team collected baseline behavioural data on animals day and night throughout this period. Throughout this trial period our Reproductive Sciences team performed stress hormone analysis and these results were compared to the behavioural observations. Data collected also helped us gauge the effect that changes in light, sound, and human presence outside of our normal operating hours may have on the animals and assists us in making any needed adjustments to the experience. While the initial test did not reveal any significant issues, we are continuing to closely monitor our animals to ensure they too are happy with the Terra Lumina experience.

Gabe Magnus collecting data.

SickKids® Dream Day

"They expressed how grateful they were for the opportunity to show their son all the animals he loves so much."

On Saturday, June 1, 2019 Toronto Zoo hosted its first ever "Dream" event in support of Toronto's Hospital for Sick Children. The Zoo was thrilled to host this event as a way to give back to the community and to offer children and their families a rare opportunity to enjoy a special day out as a family.

At the private event, over 300 families, who are currently in active care at SickKids, were greeted at the main entrance and were given complimentary admission, parking, rentals and carousel as part of their special day. Over 600 people were in attendance and enjoyed early and exclusive admission to the Zoo from 8am to 10am to allow them to enjoy access to exhibits and pavilions, special animal encounters, a Dream Day only Animal Show at 9:30 am in the Waterside Amphitheatre, Splash Island, Carousel and Zoomobile.

The Zoo was proud to be part of this special day for the children and their families while they built fond and happy memories of a beautiful day surrounded by animals and nature.

New Engagement Platform in Toronto's downtown core

Staff also participated in a new shared engagement opportunity at a key activation site adjacent to Bremner Blvd, across from the CN Tower and Rogers Centre.

This exciting opportunity allowed us to increase our Zoo presence in the downtown core and to develop a greater community impact.

Doors Open Toronto

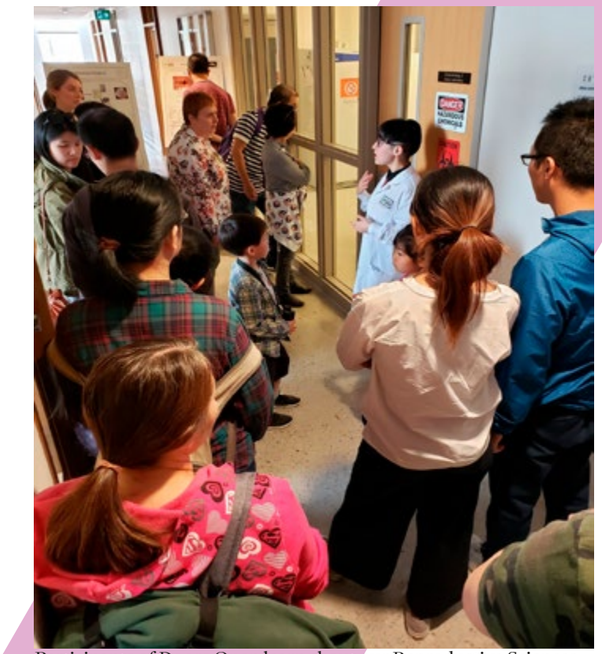
On Saturday, May 25 and Sunday, May 26, 2019, Toronto Zoo hosted its first ever Doors Open. The 20th annual Doors Open Toronto presented by Great Gulf, provided an opportunity to see inside some of Toronto's most architecturally, historically, culturally and socially significant buildings across the city.

This year, for the very first time the Zoo opened the Administrative Complex for this program and provided over 1,100 guests with the opportunity to go behind the scenes at the new Wildlife Health Centre, Reproductive Physiology Unit, Project and Exhibit Design shop and the Wildlife Nutrition Centre, to get an up-close and personal look at how the Zoo cares for over 5,000 animals daily.

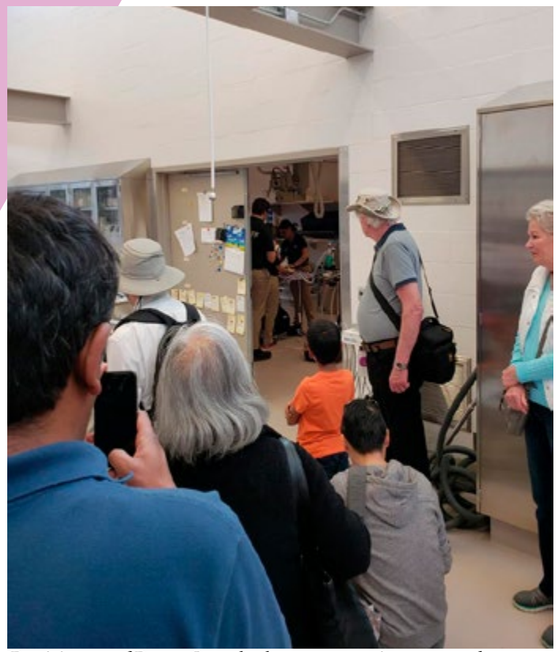
Many guests had no idea that the Zoo's behind the scenes were so interesting or that it even existed!

Participants of Doors Open learn about our unique nutritional program.

"THE BENEFIT FOR THOSE THAT ATTEND IS INCREDIBLY VALUABLE"



Participants of Doors Open learn about our Reproductive Sciences Program.



Participants of Doors Open look on as a veterinary procedure takes place.

BREW at the Zoo

toronto zoo

On Saturday August 31, 2019, Toronto Zoo hosted its first ever Brew at the Zoo! Taking place in the private and unique setting of the Toronto Zoo's scenic African Savanna, the event featured some of the GTA's best and most popular craft breweries, as well as African inspired food, musical performances, and, of course, some of Africa's most majestic species. Aside from the craft beer, wine and delicious foods, guests also enjoyed Meet-the-Keeper experiences, wild animal encounters and a silent auction!

OASIS zoorun

10k Run &
5k Run/Walk

On Saturday, September 21, 2019 Toronto Zoo held its annual fundraiser run/walk for the Zoo. Open to all runners, walkers and fitness folks of all ages and abilities, the Zoo run brought the whole family together for a day of fitness, fun and fundraising. All proceeds went towards conservation and endangered species projects.

Toronto Zoo Polar Dip

On Saturday March 2, 2019, Toronto Zoo hosted its first ever Polar Dip, where participants had the chance to "dip" into icy-cold waters to raise awareness for polar species conservation. The dip took place outside the Zoo's Wildlife Health Centre Viewing Gallery in a dip tank generously provided by GFL Environmental Inc. A registration fee of $100 was required to participate, but the fundraising did not stop there! Participants continued to fundraise by collecting pledges from friends and family! The event also featured a silent auction and one-of-a-kind prizing, including exclusive special viewing of a polar bear behavioural training session with the keepers. Awards were given to the participants for "Top Individual Fundraiser", "Top Fundraising Team", "Best Dressed" and "Most Spirited". The event raised $14,192 in funds!

Following the dip, there was a 'Post-Splash Bash' in the warm climate-controlled Special Events Centre, where participants and guests had the chance to meet our polar bear keepers and find out about what the Zoo is doing to help these iconic animals.

The proceeds raised in the Toronto Zoo Polar Dip supported conservation in the wild, as well as Toronto Zoo's role in scientific research, education and saving and protecting the polar bear for future generations.

Toronto Zoo is a champion for Canada's majestic polar bears, listed as vulnerable by the International Union for Conservation of Nature (IUCN), as they are at risk of becoming endangered due to climate change. The primary conservation concern is habitat loss and reduced access to their seal prey. Scientists predict that as the Arctic continues to warm, two thirds of the world's polar bears could disappear within this century. However, research shows that hope remains if action is taken now to reduce the impacts of climate change.

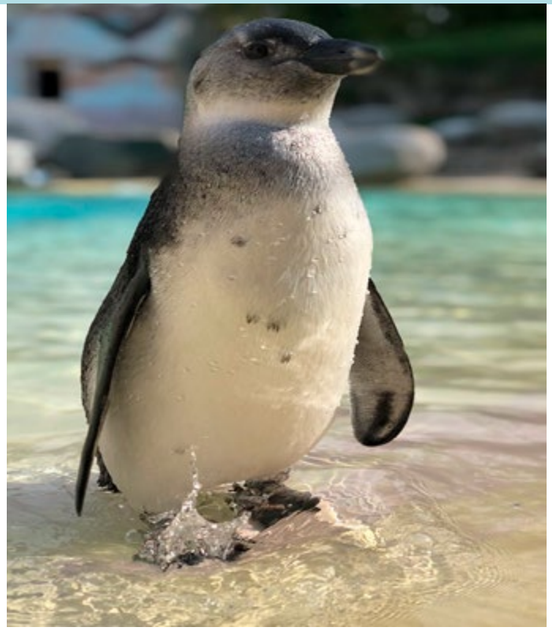
The Annual Move Your Paws for the Polar Bear Cause 1K & 5K Run/Walk

On Saturday, Febraury 23, 2019, in collaboration with the Canada Running Series, the Toronto Zoo held its 6th annual Move Your Paws for the Polar Bear Cause 1K & 5K walk/run, where participants had the chance to run/walk through the Zoo in support of a great cause. The annual Move Your Paws event proceeds went towards the Toronto Zoo's polar bears, as well as polar bears in the wild. The event brought outdoor fun, fitness, and fundraising to friends, family, and colleagues all over the Zoo!

THE POLAR DIP AND MOVE YOUR PAWS EVENTS RAISED OVER $35,000 TO SUPPORT POLAR SPECIES!

ACHIEVEMENTS 2019:

BABIES OF 2019!



African Penguins

On March 1, 2019, African penguin parents Ellie and Chupa (who were recommended to breed by the Species Survival Plan) welcomed their third chick, Matilda. This signifies a great achievement for these penguin parents and the African Savanna Wildlife Care Staff as Toronto Zoo was able to reach 100% of our Species Survival Plan pairing and breeding goals in this breeding season. Of the 18 penguin species around the world, the African penguin is one of the most endangered, with the wild population size dropping by more than 97% in the past century. Recent estimates suggest, there could be as few as 25,000 breeding pairs left in the wild.

Red River Hogs

On February 17, 2019, Red River hog parents Tisa and Sir Phillip Pigglesworth III, welcomed their first litter of hoglets, Hazel and Ginger!

This makes the third litter of Red River hoglets born in Toronto Zoo's history, coincidentally during the year of the pig!

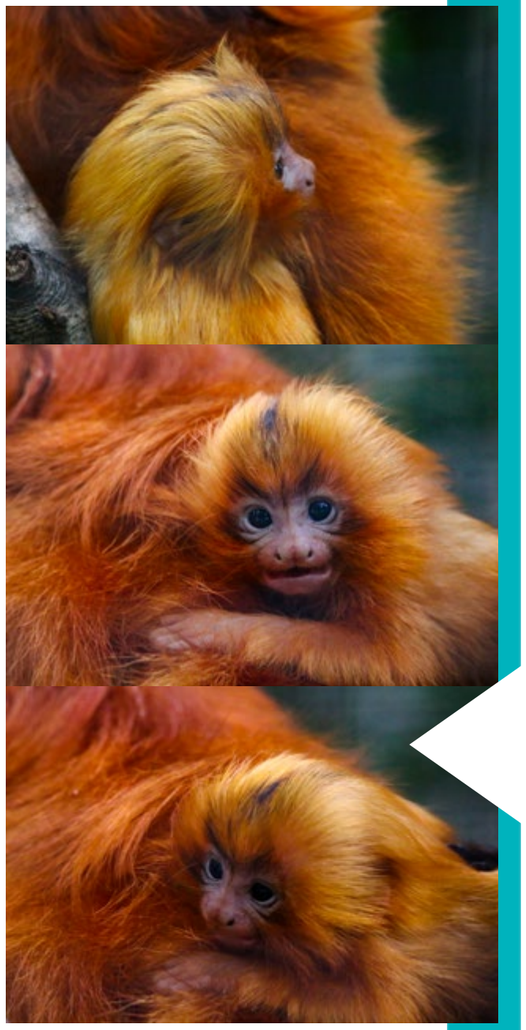
Although these hoglets are born with yellow stripes along their back, they will grow out of these stripes into a rufous brown colour as the grow up.

On November 4, 2019, Tisa and Sir Phillip Pigglesworth III celebrated the arrival of their second litter.

Tisa is a great second-time mom, very trusting and comfortable with Keepers.

Arctic Wolves

On Wednesday, April 24, 2019, Keepers observed Vera go into a den and two days later Dora proceeded to follow. Having observed both females breed with Imiq in mid-February, this indicated that one or both of our females had given birth. On Thursday, May 2, 2019, Arctic wolf parents Vera, Dora and Imiq welcomed four new pups to Toronto Zoo!



Grevy's Zebra

On February 13, 2019, Grevy's zebra parents Tori and Jake welcomed their third foal, Obi. This birth is an excellent achievement as this species is currently listed as Endangered on the IUCN (International Union for Conservation of Nature) Red List of Threatened Species, with the current global population of 2800.

Golden-lion Tamarins

On Sunday, July 14, 2019, Claire and Dolce our golden lion tamarin welcomed a new baby! Golden lion tamarins participate in "co-operative rearing", which means the whole family will contribute and help raise the baby. Currently, the family consists of mom Claire, dad Dolce, older siblings Kat and Dave (born in March 2015), and the former baby of the family Carrie (born January 23, 2019).

We are proud to welcome this little one, especially since the golden lion tamarin is a part of our Species Survival Program here at the Zoo.

Masai Giraffe

On June 21, 2019, we announced that Mstari, our 2-year old female, and Kiko, our 7-year old male, are expecting their first calf! Based on her conception date of January 18, 2019, the calf is expected to arrive mid-April 2020. Giraffe pregnancies can range from 400-488 days in length, and so there is considerable difficulty in pinpointing a due date.

Toronto Zoo is part of the AZA Masai Giraffe Species Survival Plan (SSP), and with Mstari currently being the most genetically valuable female in the North American Masai Giraffe SSP, this expectant calf is very important! Toronto Zoo has had 19 giraffes born since 1974, with this upcoming birth being the first third-generation Toronto-born giraffe.

Walruses

In November 2019, Toronto Zoo announced it will be the temporary home to two walruses in 2020 to expand our capacity to help polar species and walruses.

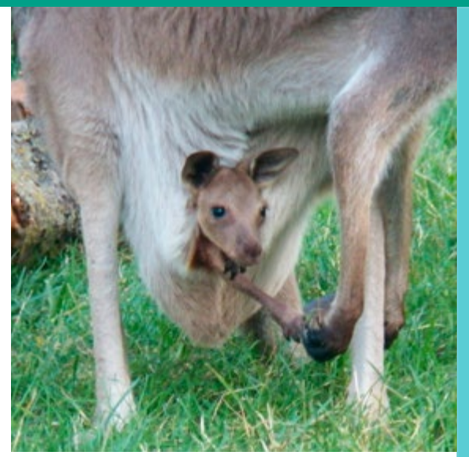
Three-year-old Lakina (female) and Balzak (male), returned to the Aquarium du Québec from their current home at the Vancouver Aquarium. Lakina along with her mother, 16-year-old Arnaliaq, will then prepare to take up residence at the Toronto Zoo in late Spring 2020 once modifications to our current polar bear habitat are complete. Balzak will remain in the walrus habitat at the Aquarium du Québec with his father, Boris. This change will ensure better reproductive management and allow for a study of the maternal bond that exists within the species..

This new addition will also result in changes to the current polar bears that live at the Toronto Zoo. Renovations are being completed on the Aquarium du Québec's polar bear habitat which will allow for greater capacity for polar bears. Hudson and Humphrey will be moving to join the 20-year-old polar bear Eddy in the Aquarium's new habitat once completed. Québec's female bear Taïga will then be joining our three other female polar bears here at our Zoo.

Western Grey Kangaroo

Our Kangaroo Walk-Thru was also reopened in 2019!

The walk-thru exhibit was temporarily closed to the public in 2013 for the opening of the Giant Panda Experience. The experience allows guests to step into the Australian Outback, adjacent to the Australasia Pavilion, and experience our kangaroo mob and wallabies from within their habitat.



On Thursday, July 4, 2019, Tori, our 8-year-old Western grey kangaroo, was observed with a joey in her pouch! This made Tori and father Simon first-time parents. Keepers first observed Tori with a joey on April 13th and the little joey popped its head out on June 29th. Once born joeys stay hidden for approximately 3 months and will not leave the pouch for 6 months, eventually venturing out for short periods of time and returning for rest and food. Joeys continue to nurse for up to 18 months.

A second joey was born in September 2019.

GREAT CANADIAN Shoreline Cleanup

OCEAN WISE & WWF

On Friday, September 6, 2019, Toronto Zoo participated in the annual Great Canadian Shoreline Clean-up, a national conservation initiative led by Vancouver Aquarium and World Wildlife Fund Canada. The clean-up removes shoreline debris and garbage, which is responsible for the death of millions of animals every year. This event gives Toronto Zoo staff and local community members or groups the opportunity to take local action to clean-up communities in their backyard and do something positive to protect local wildlife.

Townline Marsh Cleanup

On Wednesday, May 8, 2019, Toronto Zoo participated in a staff run cleanup at the Townline Marsh. The marshlands were in desperate need of a clean-up, and with 26 staff volunteering 62.25 hours of time, the area was left much more suitable for wildlife. Now that the marshlands are cleaned up they are ready for the eco-passage work that will be taking place in 2020-2021.

Love at the Zoo

From Thursday February 14 to Saturday February 16, 2019, the Toronto Zoo held its annual Love at the Zoo event.

Each evening included a romantically-inspired dinner with hors d'oeuvres, buffet dinner, dessert and a complimentary glass of sparkling wine, as well as a special animal encounter, an interactive group presentation, and a tour of our Reproductive Labs led by our Reproductive Specialist Team.

Keeper Week

On July 21 - 27, 2019, Toronto Zoo celebrated National Zoo Keeper week. The entire week was focused on highlighting and celebrating the hard work and dedication provided by the Zoo Keepers as they care for some of the worlds most endangered and vulnerable species. Zoo Keepers play a vital role in the ongoing fight for species survival and the presentation of the natural homelands inhabited by the animals they care for. National Zoo Keeper week provides the opportunity to recognize the efforts of our Zoo Keepers and increase awareness about the importance of animal conservation.

This past year we had 4 different events during the week. This included Zoo Diaries Live!: Indo-Malaya; Zoo Diaries Live!: Polar Bear; Zoo Diaries Live!: African Rainforest; and Zoo Diaries Live!: African Savanna. These events included a special presentation on the species of focus and guests were able to meet some of our very own Toronto Zoo Keepers who were able to share stories and information on how we take care of our animals.

A portion of the proceeds gathered were directed towards the Toronto Zoo chapter of American Association of Zoo Keepers.

Events

Save the Vaquita Day!

On July 6, 2019, Toronto Zoo hosted volunteer representatives from The Porpoise Conservation Society in celebration of International Save the Vaquita Day. A few volunteers were stationed at a booth outside the entrance to the Americas Pavilion from 10 am to 4 pm to engage Zoo guests in activities, raise awareness of the endangered vaquita and collect signatures for their petition to save the Vaquita (with around 100 signatures collected).

According to The Porpoise Conservation Society, the vaquita is the most endangered marine mammal in the world, with less than 20 individuals left. Listed as critically endangered, the population has declined by 90 percent between 2011 and 2016. Found only in the Sea of Cortez (Northern Gulf of California), the major threat these porpoises face are entanglement in gillnets due to fishing for endangered totoaba, however, they are also negatively affected by the shrimp fishery industry as they are caught as by-catch.

To learn more about these critically endangered species, visit the following link:
https://porpoise.org/save-the-vaquita/

National Indigenous People Day

On June 21, 2019, Toronto Zoo celebrated National Indigenous People Day and over 20 years of strong, vibrant cultures and traditions. For the entire weekend only the Zoo offered complimentary admission to Indigenous people with the presentation of their status card, Metis card or an Inuit Health Branch Client Identification Number. On the Friday, there was a First Nations Art Garden gathering to meet with our Turtle Island Conservation team and explore the Indigenous programming and resources available at Toronto Zoo. On the Saturday and Sunday, there was an event in the Wildlife Marquee where guests learned about local indigenous history and tradition with smudging throughout the day, teaching about the sacred medicines, the opportunity to create your very own medicine bag, and learning why these are such an important piece of indigenous culture. In addition, there was a very special bird show offered on the Saturday and Sunday as well, followed by an Indigenous storytelling and teaching of the Creation Story and the significance of our Turtle Island Conservation Program.

Taylor Tabobondung, our Turtle Island Conservation Steward, leading smudging ceremonies.

World Giraffe Day with Dr. Anne Innis Dagg

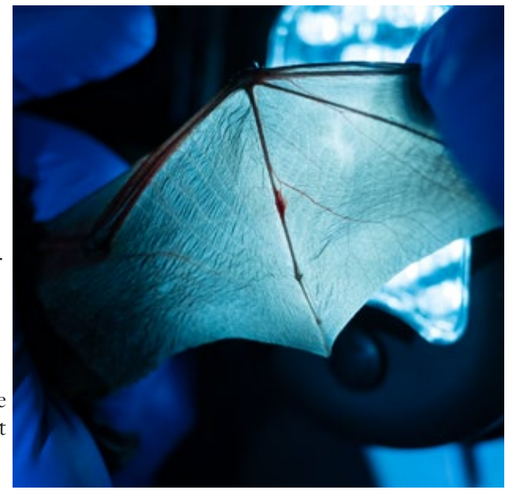
On June 21, 2019, Toronto Zoo welcomed Dr. Anne Innis Dagg for a reading of her children's book by the giraffe enclosure. Otherwise known as "The Woman Who Loves Giraffes" in her documentary, Dr. Anne Innis Dagg is a Canadian zoologist, feminist and author of numerous books. She is a pioneer in the study of animal behaviour and is credited with being the first to study giraffes in the wild in Africa. She has also researched and written extensively about the gender bias in academia, with some experience with the issue herself. Dr. Dagg read her book called "5 Giraffes" on World Giraffe Day to celebrate the species and raise awareness to all that came to the event!

Spring Toad Festival

On Saturday May 4, 2019, Toronto Zoo held its annual Spring Toad Festival at the Americas Wetlands, where guests celebrated the arrival of spring by experiencing the sights and sounds of amorous male toads in search of that special someone! Although the emergence and courtship of the toads was the main event, there were heaps of other fun activities for children and adults alike, including air-brush tattoos, Toady the Mascot, information on how to become a Frog Watcher or Turtle Detective, and froggy games like "Fish for a Prize." It was "toad-ally" fun for the whole family!

Bat Night

On Saturday August 17, 2019, Toronto Zoo held its annual Bat Night. The evening began with an informative presentation by two of Canada's leading bat experts, Dr. Brock Fenton and Dr. Paul Faure, as they shed some light on these mysterious and often misunderstood creatures. After the presentation, guests were able to experience the Zoo after dark for a short tour to and "listen to the night" and identify wild bats using special "bat detectors". Guests also had the chance to meet two big brown bats from Dr. Faure's research colony for an up close look at this common Ontario species while discovering more about the work being done at the Zoo and across the province to monitor and help protect these important creatures!



45 YEARS

On Thursday, August 15, 2019, Toronto Zoo celebrated 45 years! Hosting over 19,000 guests at the Zoo, it was the largest day of visitation since May 2013 and the biggest day in August since 2009.

Members enjoyed an additional 10% off in all of our gift shops (20% in total) and 2 for 1 Conservation Carousal Tickets, while guests enjoyed 45% off Zoo admission! Throughout the entire day, guests also celebrated with our animals by enjoying special enrichment sessions, including Puppe our orangutan, Vasili our male Amur tiger, and Tempete our Arctic fox.

The '74 Club

Among the thousands of animals that have lived at the Zoo since it opened, three of our animals have all been living at the Zoo for 45 years, some since opening day on August 15, 1974!

Puppe, our Sumatran orangutan, is the oldest living animal at our Zoo. She was born in 1967 in Sumatra and has lived here since 1973. Her sharp mind and powers of observation have made her a well recognized individual here at the Zoo - sailing across the moat in a bowl, twisting open a tube of lipstick, and even washing her side of the viewing glass with a bucket of water. She has six offspring, including Budi who still lives here today.

Josephine, our Western lowland gorilla, is now 48 years old (surpassing the average lifespan of gorillas). She frequently uses tools such as filling empty containers so she can drink from a cup, using old browse sticks to fish items out of her reach, and she even once removed the screws from the ductwork above the keeper hallway with a piece of browse!

Charles, our Western lowland gorilla and probably the most best recognized animal at the Zoo, just turned 47 in 2019. He is protective of his family and shows immense patience with the younger gorillas (even when they throw mulch over him). However, if a toad makes its way into the exhibit, you won't find Charles anywhere near it - he is petrified of them! Most recently, he has fathered Charlie (named after Charles), our newest addition to one of our troops.

NEWS WORTHY

Toronto Zoo Provides Anti-venom

As an accredited facility that is home to venomous snakes, Toronto Zoo maintains an inventory of anti-venom which is imported through Health Canada's Special Access Program for non-marketed drugs for the treatment of serious or life-threatening conditions. It is stocked here at Toronto Zoo primarily to ensure the health and safety of staff, however, when the need arises the Toronto Zoo will provide assistance to the public with venomous snake bite cases.

A venomous eyelash viper.

On Friday, June 7, 2019, Toronto Zoo was contacted by the Ontario Poison Centre, located at SickKids Hospital, for assistance with an Ontario patient requiring treatment for a venomous snake bite. The patient was experiencing re-emerging symptoms following a snake bite she received while vacationing in Thailand. Although the patient had been treated in Thailand, upon returning to Ontario the symptoms returned and she was subsequently admitted to the Grand River Hospital in Kitchener.

In consultation with Ontario Poison Control, the Toronto Zoo's Acting Manager of Safety and Security, Lead Keeper of Reptiles & Amphibians and the Acting Director of Wildlife Care and Welfare, determined the best course of action was to immediately send six vials of anti-venom from Toronto Zoo's inventory to the Grand River Hospital. This was to ensure that the patient received the quickest treatment possible, as timely access to the most appropriate anti-venom is essential for recovery. In addition, the Zoo's Lead Keeper of Reptiles & Amphibians continued searching for another location in North America that had anti-venom specific to a snake bite from a Malayan Pit Viper and another Ontario facility was identified and provided additional anti-venom.

Toronto Zoo Collaborates with TTC

This past year, Toronto Zoo and TTC came together to share an amazing partnership opportunity: an advertising campaign that promotes the Zoo as a TTC destination! The campaign ran from May until September and came at no cost to Toronto Zoo as it was TTC's internal campaign. The project was valued as over $1,000,000, with over 3,000 ads posted all around downtown Toronto on TTC posters, subway door cards, subway interiors, streetcar/bus interiors, and streetcar vinyls.

NEW FEATURES

WILD FOR LIFE
TORONTO ZOO PODCAST

Tune In On:

iTunes: https://podcasts.apple.com/us/podcast/wild-for-life/id1456395854?mt=2

Spotify: https://open.spotify.com/show/2rk1sfoAECFczk4SGeXLPS

Google: https://play.google.com/store/apps/details?id=com.google.android.apps.podcasts&hl=en_CA

On Wednesday March 27, 2019, Toronto Zoo launched its new podcast series titled "Wild for Life", which takes you behind-the-scenes and unveils the "hidden zoo". Each episode gives information on the critical conservation work that protects endangered species and works to preserve biodiversity. A new episode will become available every Wednesday where you will have the opportunity to hear from wildlife care, nutritionists, ecologists, veterinarians, social scientists, wildlife biologists, and more that are working hard to help protect wildlife from all over the world.

The making of episode 17 with Ashley Fell and Brendan Bonner, discussing "Outreach and Discovery" here at the Zoo.

The making of episode 12 with Erica Jacques and Alison Babin, discussing "Pygmy and River Hippos at The Toronto Zoo".

The making of episode 6 with Angie Snowie and Deserrai Buunk, discussing "Protecting Rhinos with Rhino Keepers".

COMMENDATIONS

Rudolf Ippen Young Scientist: Dr. Ellie Milnes

Dr. Ellie Milnes, the Zoo's recent DVSc Student/Resident in Zoological Medicine and Pathology, was presented with the Rudolf Ippen Young Scientist Award at the Zoo and Wildlife Health Conference in Sweden in June 2019.

Professor Dr. Rudolph Ippen was a pioneer of the scientific discipline of wildlife pathology and co-founder of the International Conference on Diseases of Zoo and Wild Animals (now known as the Zoo and Wildlife Health Conference). This award honours young scientists whose scientific output, particularly the papers published in the past 12 months, document the beginning of a promising career in wildlife veterinary science, conservation medicine, or zoo animal medicine. Currently, Dr. Ellie Milnes is a veterinary research fellow in wildlife and One Health with the Global Health Program based at Ol Jogi Wildlife Conservancy in Laikipia County, Kenya, working for the Smithsonian's National Zoo and Conservation Biology Institute.

Our very own Dr. Pauline Delnatte, staff veterinarian, also won this award in 2013, making Toronto Zoo the only institution whose residents have won this award twice! This is a testament to the incredible, world class training program that the Zoo and the Ontario Veterinary College offer jointly, and to the high caliber and commitment from our Residents.

Toronto Star Readers' Choice Awards

The Toronto Zoo won four awards with the Toronto Star Readers' Choice awards, including DIAMOND (top) AWARD for the Best Day Trip Destination!

READERS' CHOICE 2019 DIAMOND WINNER — Entertainment: Day Trip Destination
READERS' CHOICE 2019 GOLD WINNER — Entertainment: Children's Entertainment
READERS' CHOICE 2019 GOLD WINNER — Entertainment: Local Waterpark
READERS' CHOICE 2019 PLATINUM WINNER — Professional Services in Community/Charity Foundat

The Zoo's other wins included:

- Platinum (2nd place) Professional Services: Community Charity/Foundation
- Gold (3rd place) Entertainment: Children's Entertainment
- Gold (3rd place) Entertainment: Local Waterpark

Toronto Zoo Receives Marketing Award from the Association of Zoos and Aquariums

At the Association of Zoos and Aquariums (AZA) conference in September 2019 in New Orlean's the Toronto Zoo was recognized with the 2019 Excellence in Marketing Award for significant achievement for the zoo's "Come See All That We Do At The Toronto Zoo" campaign.

DONORS:

The Toronto Zoo would like to acknowledge donors who have contributed $500 or more in 2019.

Individuals

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- IBM Canada Ltd.
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- Ingredion Canada Inc.
- Kristine Chan Medicine Professional Corporation
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- Milliken Meat Products Ltd.
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- Toronto Zoo Hippo Zookeepers
- Toronto Zoo Lemur Zookeepers
- Toronto Zoo Lion Zookeepers
- Toronto Zoo Orangutan Zookeepers
- Toronto Zoo Penguin Zookeepers
- Toronto Zoo Rhino Zookeepers
- Toronto Zoo Snow Leopard Zookeepers
- Toronto Zoo Zookeepers
- Toronto Zoo Friday Volunteers
- University of Toronto - Scarborough Campus

Estates

The Estate of June Barringham
The Estate of Anne-Marie Carr
The Estate of Zelia Da Costa Garcia
The Estate of Dorothy Dilworth
The Estate of Wilma Hinchliffe
The Estate of Murray Neil Hobbs
The Estate of Donna May Lavers
The Estate of Joyce Thomson
The Estate of Pamela Walker

Government

Environment and Climate Change Canada
Fisheries and Oceans Canada
OntarioMinistry of Natural Resources
Ontario Ministry of the Environment
Rouge National Urban Park (Parks Canada)

PARTNERS, SUPPORTERS & AFFILIATES

ELSA Wild Animal Appreal of Canada. Vancouver Island Marmot Foundation. Marmot Recovery Team. Toronto Zoo Development Division. Turtle S.H.E.L.L Tortue. International Bear Management Association. Milliken Meats Limited. The Henry White Kinnear Foundation. Tippet Foundation. Geoffrey H. Wood Foundation. Conservation Council of Ontario. Georgian Bay Biosphere Reptile Awareness Program. Pond Life (Liverpool, UK). Ontario Vernal Pool Association. Royal Botanical Gardens. Greater Georgian Bay Reptile Awareness Program. K.M. Hunter Charitable Foundation. Ralph Kirk Endowment Fund. Government of Canada, Habitat and Stewardship Fund. Ontario Power Authority. National Heritage Information Centre. Ontario Streams/Habitat Stewardship Environment Canada. Sydenham Conservation Foundation. Recovery of Nationally Endangered Wildlife. Ontario Ministry of Natural Resources (OMNR) - Species at Risk. Nebraska Herpetology Society. Grasslands National Park - Saskatchewan. First Nation Partnerships. Endangered Species Recovery.

DONATIONS

THANK YOU!

Thank you to Canada Blooms, who donated plants for our rose garden which allowed us to create beautiful landscaping near our Zootique Giftshop. Since 2018, they have donated materials with an estimated value of $10,000!

A brand new feature for 2019 was our Daylily garden by the Amur Tiger exhibit. Thanks to Canadian Hybridized Growers, who donated 97% of our daylily garden, we were able to showcase close to 300 species of Daylilies. This was the largest collection of Daylilies in Canada.

Another community partner that helped created our most successful browse season yet is PricewaterhouesCoopers. This group of individuals not only helped harvest, pack, and ensile the browse donated by Acorn Development Corporation, but were also given the opportunity to feed the browse they collected to our animals.

The Nutrition Science Centre received almost 100 apple trees for harvest from Acorn Development Corporation. Staff worked like beavers to harvest material for the Zoo's animals, alongside another community partner. After it was harvested, packed, and ensiled, we had a total of almost 2,600 kg of apple and pear silage - a two year supply for our Western Lowland gorilla troops.

Symcor continued their strong support of Toronto Zoo and the renaturalization of the site in 2019 through corporate volunteerism and generous donations. In 2019, 227 volunteers took part in tree planting for the Acres for the Atmosphere program and pollinator meadow habitat restoration for the Meadows for Monarchs program. The Meadows for Monarchs planting added 1,500 pollinator friendly plants (from 27 native species) and the Acres for Atmosphere plantings added 500 native trees and shrubs!

1.1 Publications 2018-2019

PEER-REVIEWED PAPERS

1. Dulude-de Broin F, Hamel S, Mastromonaco GF and Cote Steeve. Predation risk and mountain goat reproduction: evidence for stress-induced breeding suppression in a wild ungulate. Functional Ecology (2019); in press.
2. Stewart ND, Reilly A, Mastromonaco GF and Burness G. No island-effect on stress for a rodent from a near-shore archipelago. Peer J (2019); in press.
3. Imlay TL, Angelier F, Hobson KA, Mastromonaco GF, Saldanha S and Leonard ML. Intrinsic markers identify carry-over effects from non-breeding to breeding for three Nearctic-Neotropical migrant birds. The Auk: Ornithological Advances (2019) 136:1-15. doi:10.1093/auk/ukz053.
4. Dulude-de Broin F, Mastromonaco GF, Whiteside DP and Cote Steeve. Faecal metabolites and hair cortisol as biological markers of HPA-axis activity in the Rocky Mountain goat. General and Comparative Endocrinology (2019) doi.org/10.1016/j.ygcen.2019.04.22.
5. Stewart ND, Reilly A, Gilman C, Mastromonaco GF and Burness G. Evidence of degradation of hair corticosterone in museum specimens. General and Comparative Endocrinology (2018) 268: 128-133.
6. Acker M, Mastromonaco G and Schulte-Hostedde A. The effects of body region, season and external arsenic application on hair cortisol concentration. Conservation Physiology (2018) 6. doi:10.1093/conphys/coy037.
7. Hamilton MT, Finger Jr. JW, Elsey RM, Mastromonaco GF and Tuberville TD. Corticosterone in American alligator (Alligator mississippiensis) scutes: evaluating the feasibility of using keratinized tissues for investigating environmental stressors. General and Comparative Endocrinology (2018) 268:7-13.
8. Palomino JM, Jones L, Vanhanen T, Mastromonaco GF, Busato R and Adams GP. Alpaca embryo transfer on a private Canadian farm. Canadian Veterinary Journal (2018) 59:631-634.
9. Baqir S, Orabah AB, Al-Zeheimi N, Al-Shakaili Y, Al-Rasbi K, Gartley CJ and Mastromonaco G. Computer assisted semen analysis (CASA) in the captive Arabian leopard (*Panthera pardus nimr*): a multivariate clustering analysis. Journal of Veterinary Science and Technology (2018) 9. doi:10.4172/2157-7579.1000526.
10. Larouche CB, Mosley C, Beaufrère H, Dutton C. 2019. Effects of midazolam and nitrous oxide on the minimum anesthetic concentration of isoflurane in the ball python (*Python regius*). Vet Anaesth Analg. 46(6):807-814
11. Larouche CB, Johnson R, Beaudry F, Mosley C, Gu Y, Zaman KA, Beaufrère H, Dutton C.2019. Pharmacokinetics of midazolam and its major metabolite 1-hydroxymidazolam in the ball python (*Python regius*) after intracardiac and intramuscular administrations. J Vet Pharmacol Ther. 42(6):722-731
12. Larouche CB, Beaufrère H, Mosley C, Nemeth NM, Dutton C. 2019. Evaluation of the effects of midazolam and flumazenil in the ball python (*Python regius*). J. of Zoo and Wildlife Medicine, 50(3):579-588
13 .Larouche CB, Beeler- Marfisi J, Attard L, Nemeth N, Beaufrère H. 2019. Hemolymph cytology, hemocyte count, glucose, and electrolyte reference intervals in 93 Cameroon red tarantulas (*Hysterocrates gigas*). Vet Clin Pathol. 2019 Sep;48(3):461-468
14. Léveillé AN, Bland SK, Carlton K, Larouche CB, Kenney DG, Brouwer ER, Lillie BN, Barta JR. 2019. Klossiella equi Infecting Kidneys of Ontario Horses: Life Cycle Features and Multilocus Sequence-Based Genotyping Confirm the Genus Klossiella Belongs In the Adeleorina (Apicomplexa: Coccidia). J Parasitol. 2019 Feb;105(1):29-40.
15. Milnes EL, Delnatte P, Woodbury M, Hering A, Lee S, Smith DA, Nemeth NM, Gu Y, Gehring R, Johnson R. 2019. Pharmacokinetics of imidocarb dipropionate in white-tailed deer (*Odocoileus virginianus*) after single intramuscular administration. J Vet Pharmacol Ther 43(1):33-37
16. Milnes EL, Thornton G, Léveillé AN, Delnatte P, Barta JR, Smith DA, Nemeth N. 2019. Babesia odocoilei and zoonotic pathogens identified from Ixodes scapularis ticks in southern Ontario, Canada. Ticks Tick Borne Dis. 2019 Apr;10(3):670-676. 17.
17. Milnes EL, Thornton GL, Delnatte P, Léveillé AN, Barta JR, Smith DA, Nemeth NM. 2019. Molecular detection of Babesia odocoilei in wild, farmed, and zoo cervids in Ontario, Canada. J Wildl Dis. 2019 Apr;55(2):335-342.
18. Milnes E, Delnatte P, Dutton CJ, Brouwer E, Cai HY, Smith DA, Peregrine AS. 2018. Echinococcus equinus hydatid cyst in the liver of a Przewalski's horse (*Equus przewalskii*) in a Canadian zoo. J Zoo Wild Med. 49(4):1047-1050.
19. Milnes E, Delnatte P, Cai HY, Nemeth N. 2018. Systemic encephalitozoonosis due to Encephalitozoon cuniculi strain IV in a Vancouver island marmot. J Zoo Wildl Med. 2018 Jun;49(2):484-488.
20. Mathieu A, Pastor AR, Berkvens CN, Gara-Boivin C, Hébert M, Léveillé AN, Barta JR, Smith DA. 2018. Babesia odocoilei as a cause of mortality in captive cervids in Canada. Can Vet J. 2018 Jan; 59(1): 52–58.

1.1 Publications 2018-2019

CONFERENCE PROCEEDINGS

1. Fernandez Aguilar X, Leclerc L, Carlsson A, Hanke A, Di Francesco J, Mavrot F, Mastromonaco G, Kinniburgh DW and Kutz S. Understanding health challenges and drivers for the declining Dolphin and Union caribou. 68th Annual International Conference of the Wildlife Disease Association, Tahoe City, California, USA, August 4-9, 2019.
2. Di Francesco J, Mastromonaco G, Checkley S, Wynne-Edwards K, Rowell JE, Blake J and Kutz S. Validating the use of qiviut cortisol as a stress biomarker in muskoxen. 7th Annual Conference of the International Society for Wildlife Endocrinology, Pretoria, South Africa, October 13-16, 2019.
3. Robertson JK, Burness G and Mastromonaco G. Stress-induced peripheral hypothermia: role of the sympathetic nervous system in avian thermal modulation. Society for Integrative and Comparative Biology Annual Meeting, Tampa, Florida, USA, January 3-7, 2019.
4. Robertson JK, Burness G and Mastromonaco G. The heat is on: what thermal profiles reveal about stress in birds. Canadian Association of Zoos and Aquariums, Cambridge, Ontario, Canada, September 11-14, 2018.
5. Imlay T, Angelier F, Hobson K, Mann H, Mastromonaco G, Mills Flemming J and Leonard M. The role of food availability and wintering ground conditions on population declines for barn swallows in Maritime Canada. International Ornithological Congress, Vancouver, British Columbia, Canada, August 19-26, 2018.
6. Schoof VAM, Goldberg TL, Greenberg D, Mastromonaco G and Chapman CA. Role of age and sex in determining glucocorticoid response to parasite infection. American Association of Physical Anthropologists, Austin, Texas, USA, April 11 – 14, 2018.
7. Cervantes MP, Adams GP, Anzar M, Palomino JM and Mastromonaco G. In vitro embryo production from oocytes collected from non-superstimulated wood bison (*Bison bison athabascae*) following maturation in vitro using portable incubators. Annual Conference of the International Embryo Transfer Society, Bangkok, Thailand, January 14-16, 2018.
8. Milnes E, Dutton C, Larouche C, Delnatte P, Lentini A, Woodburn D, Nemeth N, and Smith D. An epizootic of mycotic shell disease associated with Nannizziopsiaceae fungal infection in juvenile wood turtles (*Glyptemys insculpta*) in a conservation head-starting program. 2018 Joint EAZWV/AAZV/Leibniz-IZW Conference Proceedings.
9. Milnes E, Delnatte P, Attard L, and Dutton C. Living syringes: a pilot study using hematophagous triatomine insects (*Triatoma dimidiata*) for blood collection from zoo reptiles. 2019 51st AAZV Annual Conference Proceedings.
10. Milnes E, Delnatte P, Woodbury M, Johnson R, Gehring R, Smith D, and Nemeth N. Towards an evidence-based treatment protocol for cervid babesiosis: pharmacokinetics of imidocarb in white-tailed deer (*Odocoileus virginianus*). 2019 51st AAZV Annual Conference Proceedings.

BOOK CHAPTER

1. A Pastor, E Milnes. 2019. Babesiosis in Cervidae. Fowler's Zoo and Wild Animal Medicine Current Therapy, Volume 9, 647-655.

DOCTORAL THESIS

1. Milnes E. 2018. Eco-Epidemiology and Treatment of Babesiosis in Cervids. DVSc thesis. University of Guelph.
2. Larouche CB. 2019. The Use of Midazolam, Isoflurane, and Nitrous Oxide for Sedation and Anesthesia of Ball Pythons (Python regius). DVSc thesis. University of Guelph.

REPORTS

1. Adams GP, Zwiefelhofer M, Palomino JM, Cervantes M, Yang S, Anzar M, McCorkell RB and Mastromonaco GF. Development and use of a genome biobank to restore the genetic diversity of North American bison. Report to Parks Canada, January 2019.

1.2 Active Research Proposals 2019

REF. NO	PROJECT AND RESEARCHER	STATUS
2017-01-02	Studies on the Behaviour and Physiology of Polar Bears Under Human Care J. Wensvoort Toronto Zoo Feb/March 2017 – Jan/Feb 2022	Renewal/Amendment approved on 2019-05-22
2017-03-01	Habitat Use and Nesting Patterns of Turtles in Rouge Park and along the Highway 400 Corridor Research R. Vos Toronto Zoo April 2017 – December 2019	Renewal approved 2019-01-23
2017-03-02	Physiological Correlates of Fitness in Wild and Captive Reared Eastern Loggerhead Shrike J. Robertson Toronto Zoo April 2017 – December 2019	Renewal /Amendment approved on 2019-11-20
2017-03-03	Toronto Zoo Native Bat Conservation Program M. Franke Toronto Zoo June 2017 – March 2020	Renewal approved 2019-01-23
2017-06-01	Assessing the Nutritional Status of Free-ranging and Human Managed Populations of Black-footed Ferrets (Mustela nigripes) S. Gourlie & J. Wensvoort Toronto Zoo August 1, 2017 – December 31, 2018	Renewal received 2020-01-07
2017-11-05	Assessing the Potential for Visual and Behavioural Cue of Reproductive Ability in Golden Lion Tamarins A. Melin University of Calgary April 2018 – April 2019	Renewal approved 2019-01-23
2018-03-01	Ontario Reptile and Amphibian Field Methods Workshop (Pedagogical Research) R. Vos Toronto Zoo 2018-04-27 – 2019-04-30	Renewal approved 2019-01-23
2018-03-02	Eastern Milksnake Monitoring R. Vos Toronto Zoo 2018-04-01 – 2021-03-21	Renewal approved 2019-01-23

1.2 Active Research Proposals 2019

REF. NO	PROJECT AND RESEARCHER	STATUS
2018-05-02	Gut Microbial Communities of the Vancouver Island Marmot in Captivity and in the Wild P. Van Leeuwen Laurentian University 2018-05-24 – 2018-09-01	COMPLETED – manuscript in progress
2018-05-03	Exploring the Impacts of Diet Change on Gut Microbial Communities in the Relocation Context of Captive-born Animals (Deer Mice) P. Van Leeuwen Laurentian University 2018-05-24 – 2018-09-01	COMPLETED – manuscript in progress
2018-05-04	Flange Development of Male Orangutans in Relation To Skeletal Growth C. Knott Boston University 2018-06-01 – ongoing	Renewal approved 2019-09-18
2018-06-01	Toronto Zoo Carnivore Diet Mammalian Feeding Trial: Base & Dynamic Diet Investigation S. Gourlie Toronto Zoo 2018-09-01 – 2020-09-01	Renewal approved 2019-09-18
2018-09-01	Assessment of Physiological Parameters During Anesthesia in Przewalski's Horses (Equus przewalskii) C. Larouche & E. Milnes Toronto Zoo 2018-09-01 – 2020-09-01	Renewal/amendment approved on 2019-11-20
2018-09-04	Venomous Training: Canadian Armed Forces & Toronto Animal Services (pedagogical) R. Vos Toronto Zoo 2018-11-06 – 2018-11-07	COMPLETED
2018-11-01	Imaging of Healthy Female Ball Pythons Using Ultrasonography, Computed Tomography, and Magnetic Resonance Imaging P. Delnatte/C. Larouche Toronto Zoo 2018-11-22 - 2019-01-31	COMPLETED
2019-01-01	Relationship Between Diet, Lipid Metabolism, Body Composition, and Hibernation in the Critically Endangered Vancouver Island Marmot (Marmota Vancouverensis) J. Aymen Toronto Zoo 2019-02-01 – 2020-07-01	Amendment approved 2019-05-22

1.2 Active Research Proposals 2019

REF. NO	PROJECT AND RESEARCHER	STATUS
2019-01-02	Eastern Massasauga Conservation Breeding Centres – Assurance Population/Head Start Project (Henvey Inlet Fist Nation and Ojibway Prairie Remnants Reptile Recovery Program) R. Vos Toronto Zoo Summer 2019 – Ongoing	Approved 2019-01-23
2019-05-01	Does Prey Consumption of an Invasive Fish Species Exceed Prey Consumption of Native Fishes at Increasing Water Temperature - Test Case Using the Invasive Round Goby and Native Fishes from the Credit River N. Mandrak & K. Greenham 2019-06-15 - 2019-12-31	Approved 2019-05-22
2019-06-01	Assisted Reproductive Technologies as a Method of Embryo Production in Wood Bison G. Mastromonaco Toronto Zoo Sept 2019 – Aug 31, 2022	Approved 2019-06-26
2019-06-02	Do Orangutans Choose to Choose S. MacDonald York University July 2019 – June 2020	Approved 2019-06-26
2019-06-03	Ultrasonic Calls in Mammalia J. Bowman Trent University 2019-07-15 – 2019-11-15	Amendment approved 2019-11-20

1.3 Operating Projects - 2019

Each year, the Toronto Zoo completes various operating projects that will make improvements to infrastruture and animal welfare. Projects are prioritized based on various criteria needs such as essential infrastructure/operating requirements, operational efficiency, public/staff safety, exhibit/holding repairs.

Projects completed in 2019 included the following:

- Indian Rhino House Soft Floor
- WHC Turtle Yard Roof Mesh Replacement
- Orangutan Climbing Structure Repairs
- Indian Rhino Manure Bin
- Outdoor holding Manure Bin
- Nutrition Centre Cold Room - design completed in 2019
- Archway Sign for Waterside Theatre
- New “Show Wall” for Waterside Theatre
- Enclosure – Peafowl Holding
- Quarantine Greenhouse Construction
- Sea Eagle Pool
- Demolish Existing Fish Carousel
- Symcor – Acres for the Atmosphere
- Symcor – Monarch Butterfly and Honey Bee Conservation
- Floating Wetlands

1.4 Endangered Species Reserve Fund (ESRF)

Toronto Zoo undertakes many conservation and research projects locally, nationally, and internationally for the benefit of threatened and endangered species, promoting species survival, reproduction, and habitat preservation. Most of this work is funded from the operating budget and is undertaken by Zoo staff directly or in collaboration with other external agencies.

The Zoo's Endangered Species Reserve Fund (ESRF) was established for the purpose of funding research and education projects that directly assist in the conservation of endangered species. Money collected from the wishing wells on site and coin boxes at points of sale are also a source of annual additions to the Fund. Projects supported by the Endangered Species Reserve Fund in 2019 included the following:

- Beaded Lizard Community Based Conservation
- Long-term Monitoring of the Demographic Status of Komodo Dragon Populations and Their Prey in Komodo National Park
- Snow Leopard - Combating Poaching
- The Pygmy Hippo in the Upper Guina forest
- Forest Restoration - Besitang, North Sumatra
- Blanding's Turtle and Wood Turtle Head-starting
- Toronto Zoo Bat Conservation Monitoring Program
- Aqua-Links
- Great Lakes Outreach Program
- The Influence of Seasonality on Assisted Reproductive Technologies in Wood Bison
- Ojibway Prairie Reptile Recovery Program
- Black-Footed Ferret Canadian Recovery Efforts
- Ape Action Africa Forest Education Office
- Toronto Zoo Conservation in Action: In situ Madagascar
- Tree Kangaroo & Biodiversity Conservation
- Action Indonesia: Conserving Anoa, Banteng and Babirusa
- Support the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB)
- Hutan Reforestation Efforts in Kinabatangan
- Support of the Mabula Ground Hornbill Project
- Poison Response Action - Another Continental Vulture Crisis
- Conservation of Great Green Macaw, Costa Rica
- Securing the Last Wild Siamese Crocodile Population in Indonesia


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