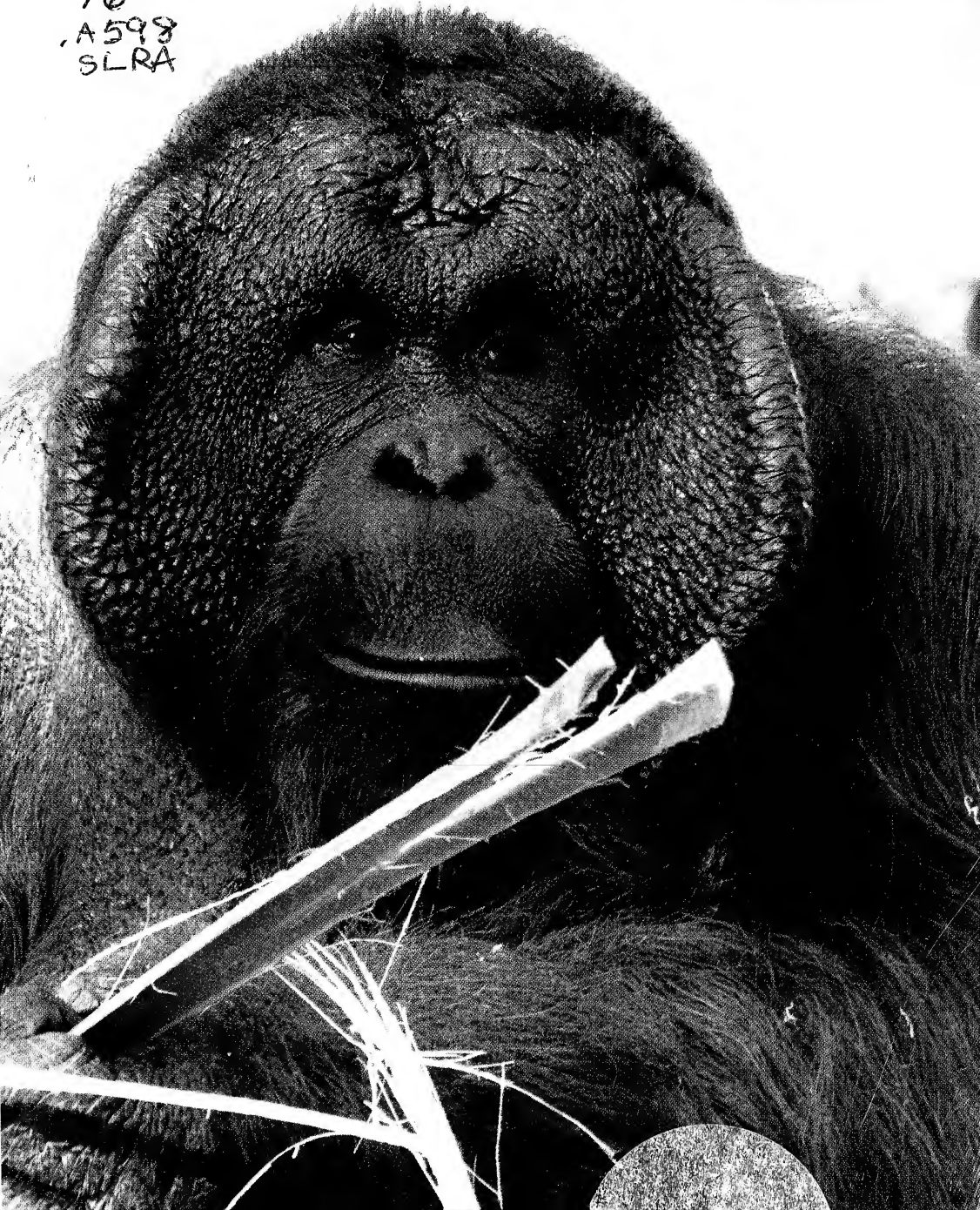


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MISSION STATEMENT

(Revised April, 2009)

American Association of Zoo Keepers, Inc.

The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover features Michael, a Bornean orangutan (*Pongo pygmaeus*) submitted by Denise Wagner of the Phoenix Zoo. Michael has resided in Phoenix since the year 2000 and has so far sired one offspring while there. Orangutans are the largest arboreal mammal on earth today. Bornean orangutans are endemic to the states of Sarawak and Sabah in Malaysia and three of the four Indonesian provinces of Kalimantan. Their numbers have declined well over 50% in the last 60 years. The population estimates now put their numbers at approximately 50,000 left in the wild. The IUCN lists them as an endangered species and they are listed in Appendix I of CITES. Their counterparts in Sumatra, Sumatran orangutans (*Pongo abelii*), are a critically endangered species with numbers at around 7,000.

Primary threats to orangutans today include habitat loss due to forest conversion to agriculture, primarily oil palm plantations. The rapid expansion of oil palm plantations in Borneo due to an increased demand internationally for use of the oil in cosmetics, foods, and as a source of bio-diesel fuel has accelerated the habitat loss for these animals. It is estimated that 60% of lowland forest (prime orangutan habitat) has been lost in Borneo since 1985. Illegal logging, fires due to drought, habitat fragmentation, and the illegal pet trade are also contributing factors to the decline of the orangutan. For more information on orangutans managed in North America please go to the Orangutan SSP® website at orangutanssp.org.

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for AKF. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. **Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org.** If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month.

Dedicated issues may have separate deadline dates and will be noted by the Editor.

Articles printed do not necessarily reflect the opinions of the AKF staff or the American Association of Zoo Keepers, Inc. Publication does not indicate endorsement by the Association.

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FROM THE PRESIDENT

Prologue

As an Association, everything that we do makes a positive impact on animal care. We believe in challenging our current knowledge-base and we strive to communicate effectively with others in our field in order to perfect our skills. What we learn, what we share, and how we engage is powered by the passion that we have for the animals we care for. We also believe that the passion we have for animals exceeds all borders. This passion enables us to make a profound impact on conservation; it drives the collective effort that enables us to send hundreds of thousands of dollars to support worthy conservation efforts each year. We do this because we care for animals.

Syracuse 2012

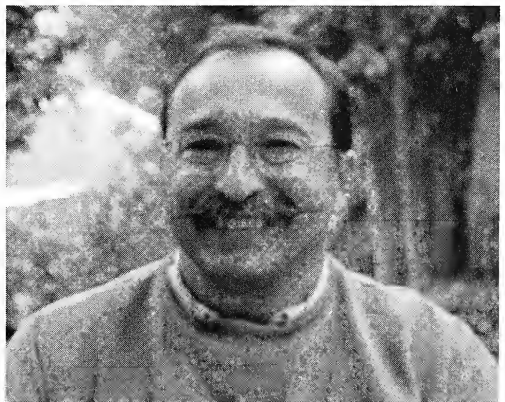
The final preparations for the 2012 AAZK Conference at Syracuse, NY are underway. Rosemund Gifford Zoo AAZK has worked steadily to bring you yet another exciting conference! Keynote speaker Deborah Olsen, Executive Director of the International Elephant Foundation, and guest speakers, Dennis Schmitt, DVM, PhD, Diplomat ACT, Ringling Bros. Chair of Veterinary Care and Director of Research and Conservation, and Emily McCormack, Curator of Turpentine Creek Wildlife Refuge promise to deliver enlightening and informative talks.

The combined efforts of RGZ AAZK and AAZK's Professional Development Committee assure another plethora of skills-based workshops as seen last year in San Diego. This new direction in workshops is aimed at providing more learning opportunities at our annual conferences. Needless to say, we still value the paper sessions and will continue to provide informative presentations during our annual conferences. Our conference structure will continue with morning paper presentations followed by afternoon workshops.

In all that we do, we strive to reach the goals of our mission. The Professional Development Committee and our annual conferences work together to help fulfill part of our mission. However, we realize that less than ten percent of our membership attends conferences. In order to advance excellence in the animal keeping profession, and reach all of our membership, we are developing online content; webinars that will make it possible for all AAZK members to have access to professional development. Partnering with well-established organizations will enable us to provide this content to the membership at very reasonable prices. Our conferences will continue to provide rich content in paper presentations and advanced skills-based workshops and we will provide learning opportunities for those who cannot make it to conferences. In short, we will be fulfilling our mission by providing learning opportunities for all of our members.

It's an exciting period for us as we solidify our conference structure and look ahead at stepping into the 21st Century of distance learning.

Bob Cisneros



— AAZK ANNOUNCES NEW MEMBERS —

NEW COMMERCIAL MEMBERS

CLR Design, Philadelphia (PA)

NEW INSTITUTIONAL MEMBERS

Tampa's Lowry Park Zoo, Tampa (FL)

NEW PROFESSIONAL MEMBERS

Caleb Bruss, The W.I.L.D., Rochester (NH)

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Laura Acevedo, Turtle Back Zoo, West Orange (NJ)

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Saasha Caldera, Binghamton Zoo at Ross Park, Binghamton (NY)

Linda Velasquez, Seneca Park Zoo, Rochester (NY)

Laura Shipp, Seneca Park Zoo, Rochester (NY)

James Locke, Disney's Animal Kingdom, Lake Buena Vista (FL)

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Marianne Cange, Brookfield Zoo, Brookfield (IL)

Janice L. Sansone, St. Louis Zoo, St. Louis (MO)

Carolyn Mueller, St. Louis Zoo, St. Louis (MO)

Thaddeus Kulczycki, Kansas City Zoo, Kansas City (MO)

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new ideas

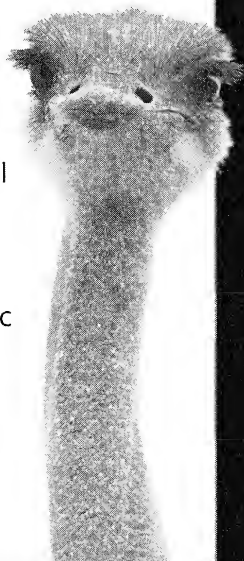


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COMING EVENTS

Post Your Upcoming Events here — e-mail shane.good@aazk.org

September 23-27, 2012

AAZK National Conference

Hosted by the Rosamond Gifford Zoo and the Rosamond Gifford Zoo AAZK Chapter in Syracuse, NY. For more information see rgzaazk.org.

October 6, 2012

AZH Zoo Horticulturist Certification Program

Three courses will be offered in conjunction with the 2012 AZH Annual Conference in Orlando: Browse and Toxic Plants and two elective courses: Design II and Responsible Water Use. Those who successfully complete the all-day Browse and Toxic Plants course will earn two credits toward the 10 credits required for AZH Certification. Those who successfully complete one of the four-hour elective courses will earn one credit. Electives courses will be offered sequentially, so that participants may choose to register for both of these courses. For more information visit azh.org.

October 6, 2012

Ohio Valley United Malacologists Meeting

Hosted by University of Saint Francis, Fort Wayne, IN. Forum for information sharing on mollusks. Papers and posters welcome. For more information go to: <http://ohiovalleyunifiedmalacologists6.blogspot.com/2012/07/6-oct-2012.html>

October 12-15, 2012

From Good Care to Great Welfare: A Workshop Designed for Animal Care Professionals

For information contact: Elizabeth Arbaugh, Animal Welfare Manager, Detroit Zoological Society, Tel: 248-398-0903 x3643, E-mail: Elizabeth@dzs.org or visit czaw.org.

November 2-4, 2012

New World Primate Husbandry Workshop

For more information including registration forms, please contact Dr. Stephanie Allard at sdampier@palmbeachzoo.org or Michelle Farmerie at mrfarmerie@aol.com.

November 5-8: The 2012

Elephant Managers Association Conference

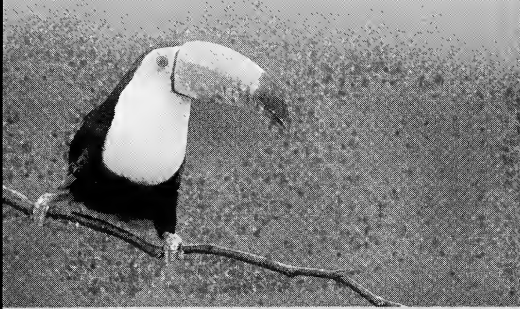
"Trunks and Palms" will be hosted by the Santa Barbara Zoological Gardens in Santa Barbara, CA. The Pre-conference trip will be hosted by the Los Angeles Zoo in Los Angeles, CA on Monday, November 5th followed by a cocktail party at the contemporary waterfront Cabrillo Art Center that evening. The conference will include two and half days of presentations followed by a Zoo Day at the Santa Barbara Zoo. The conference will conclude with a California cuisine banquet and auction. Beachfront accommodations and presentations will be held at the Hyatt of Santa Barbara: santabarbara.hyatt.com. To register or submit abstracts please visit: sbzoo.org under events-EMA. For additional information please e-mail lwilson@sbzoo.org.

December 3-7, 2012

Training and Enrichment Workshop for Zoo and Aquarium Animals

Hosted by Moody Gardens in Galveston, TX, Active Environments and Shape of Enrichment are proud to present the Sixth Training and Enrichment Workshop for Zoo and Aquarium Animals. This unique five-day workshop is designed for keepers, aquarists, managers, supervisors, curators, and veterinarians working with all species of animals held in zoos, aquariums, rescue centers, and sanctuaries. The workshop will present an array of topics relating to the behavioral management approach to caring for captive animals, with a focus on environmental enrichment, positive reinforcement training techniques, and the problem-solving process. For more information e-mail dolsen@moodygardens.com or go to enrichment.org.

National Conferences



AZA

2012 - Phoenix, AZ - September 8-13
2013 - Kansas City, MO - September 7-12
2014 - Orlando, FL - September 12-17

aza.org

AAZK

2012 - Syracuse, NY - September 23-27
2013 - Asheboro, NC - September 22-26
2014 - Orlando, FL - September 8-12

aazk.org

Last month featured updates on the AAZK and ICZ Conferences, National Zoo Keeper Week, and Chapter news. Stay Connected.

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Updates from the Membership Resources Committee (MRC)

The Annual Conference in Syracuse is right around the corner. As usual, the MRC will have a host of products for sale from the Association. We are doing a little 'fall' cleaning. There will be deep discounts on several products and a few on clearance so we can make room for new items in the future. A full listing of products and prices will be posted on the 'Shop' section of the AAZK website in September. Can't make it to the conference? Send your list of items to purchase with a co-worker. You might want to bring an extra bag; the sales will be that good!

Recently, many of you received brochures and presentations to participate in our AAZK Membership Drive. We hope that you have found the materials helpful and were able to gain members for the Association and local Chapters. If you have not received materials and would like to, please contact Jacque Blessington at the e-mail listed below. We would like to thank everyone who has taken the time to utilize the materials and would appreciate any feedback on how your presentations were received.

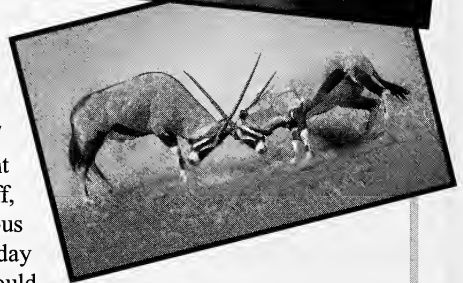
The MRC is also looking for additional committee members. If you would like to participate on the MRC please send a letter of interest and resume to: Jacque.Blessington@aazk.org. Or, if you have any questions, comments or suggestions for the committee, just drop me a line or come find me at the AAZK Exhibitor table at the conference in Syracuse.

ATTENTION ALL PHOTOGRAPHERS!

***AKF* Needs Your Photos**

Attention all photographers, the *AKF* needs your photos as potential cover photos and special feature photos throughout the issue. All photos need to be high resolution, 1875 x 2250 pixels or greater, 300 dpi or greater in resolution, 1MB or greater. All photographers will need to submit a photo release form that can be found at aazk.org/animal-keepers-forum/aazk-photo-model-release-form/. Photos that clearly depict facility logos and behind-the-scenes shots will need permission of the facility to be used.

Subjects for the photos should revolve around animal husbandry, conservation, education/interpretation, professional development, significant achievements in the industry (births, exhibits, staff, etc.), and can also include some of the more humorous or unique situations that we all come across each day in our occupations. Captions for each photo should also be submitted.



Behavioral Husbandry Committee Seeks New Members

Do you have a strong background in training or enrichment?

Are you a motivated AAZK member who wants to give more to the organization? Do you have the drive and enthusiasm to do more with your knowledge and expertise? The Behavioral Husbandry Committee (BHC) is looking to recruit new members!

For the first time since the Animal Training Committee and the Enrichment Committee merged to become the BHC, we have openings for new committee members. To apply, please submit a letter of interest along with your resumé and a writing sample to Christina Dembiec, BHC Chair, at dembiecc@jacksonvillezoo.org.

Want more information? E-mail Christina, or visit with any of the current BHC members at the annual conference. See you in Syracuse!

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INTERNATIONAL RED PANDA DAY

September 15, 2012

redpandanetwork.org

CALL FOR PAPERS

For Dedicated Issue of *Animal Keepers' Forum* – Multi-species Bird/Ungulate Habitats

The challenges we face in building sustainable zoo populations while creating dynamic habitats require innovative solutions. Ungulate and bird curators, managers and keepers have much to gain by collaborating together to explore ways to maximize our limited exhibit space. Increased space for our program species, more dynamic and more naturalistic exhibits to benefit our animals and our visitors, and diversification of keeper skills are just some of the benefits of multi-species bird/ungulate habitats.

We encourage those interested to submit manuscripts for consideration to be included in this dedicated issue. Possible topics could include, but are not limited to:

Reproduction/neonatal care

Feeding/nutrition

Veterinary care

Exhibit design

Pest control

Introductions of new animals

Staff communication

Benefits of Hoofstock/Bird multi-taxa habitats

Birds 101 for Hoofstock Keepers/Managers

Species selection

Training/enrichment

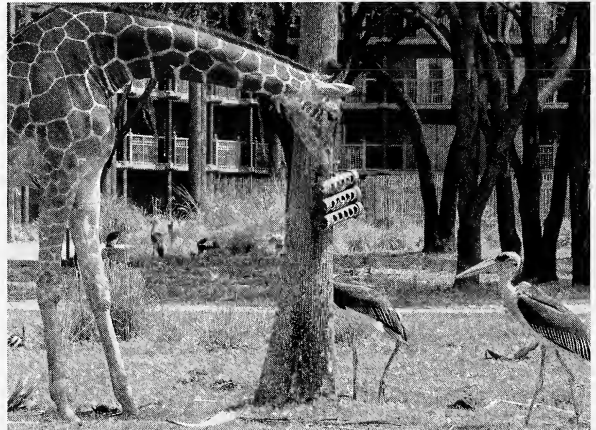
Hoofstock 101 for Bird Keepers/Managers

Papers should be submitted electronically, in MS Word only, to shane.good@aazk.org. Please use Times New Roman font (10 pt. text body). Please put "Bird Ungulate Issue" in the subject line of your e-mail. Papers should be no more than 10 pages in length. Any charts and/or graphs should be submitted in their native program (i.e. Microsoft Excel, Word, etc.). Photos submitted electronically should be high-resolution (minimum 300 dpi, 1 MB, 900 x 600 pixels) jpg or tiff files. Photos, charts, and graphs should be submitted as separate files and not be embedded in the manuscript. Be sure to include proper photo credit and a suggested caption for each photo. Please reference the complete set of *AKF* submission guidelines at aazk.org/akf-submission-guidelines/.


Be sure to also include your complete contact information including name, address, e-mail and a daytime phone where you may be reached if we have questions concerning your submission. Also be sure to include your facility and your job title at that facility.

Deadline for submission of articles for this special issue is

February 1, 2013.



Sunset Savanna at Disney's Animal Kingdom Lodge. *Photo by Kim Szawan, Animal Keeper, Disney's Animal Kingdom Lodge.*



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Dietary Practices for Hand-Rearing of an Infant Chimpanzee

(Pan Troglodytes) at the North Carolina Zoological Park

By Jennifer Ireland, Animal Management Supervisor
and Terry Webb, Former Curator of Mammals*

North Carolina Zoological Park, Asheboro, NC

*currently Collections Manager at WCS/Prospect Park Zoo

Abstract:

On 2 August 2010 a primiparous chimpanzee at the North Carolina Zoo gave birth to a healthy infant. Maternal competence was questionable as improper positioning of the infant prevented nursing. On Days 1 and 2 of the infant's life, the mother was anesthetized and the infant was allowed to nurse. On Days 3 through 5 zoo keepers were able to periodically bottle feed through caging without the mother interfering. On Day 6 the decision was made to remove the infant for hand-rearing as bottle feeding through the cage front became unreliable and required considerable cooperation from the mother.

The infant chimpanzee was put on a scheduled feeding regime consisting of human infant formula. Consumption, fecal output, and daily weights were recorded. Adjustments to the amount and type of formula offered were made based on consumption, fecal output, weight, behavior, and social and behavioral milestones.

Traditionally, hand-reared chimpanzee infants are introduced to adults between six and 18 months of age. With the permission of the Chimpanzee Species Survival Plan (SSP®) of the American Association of Zoos and Aquariums (AZA), plans were made for introduction at approximately four months. Physical development and mobility of the infant were the two factors that determined if the infant was ready. Traditional methods for food introduction and feeding schedules were accelerated.

Introduction

Chimpanzees have frequently been hand-reared (i.e. reared by humans) in research facilities and/or zoological institutions, though the frequency of hand-rearing has greatly reduced over the past 50 years due to improved husbandry practices (Porton and Niebruegge, 2006). Historically, hand-rearing has occurred for various reasons including: maternal incompetence, medical concerns, aggression towards the infant by the mother or conspecifics, death of the mother, rearing so that the animal was tractable for shows, educational presentations, or research, and the popularity of nursery exhibits with the public.

In AZA, accredited zoos' female chimpanzees are given every opportunity to raise their offspring. Only in the cases of maternal incompetence, aggression, or significant health issues are infants pulled for hand-rearing. If total neglect or abuse are not present, institutions are encouraged to allow the mother and infant to stay together for 72 hours prior to making the decision to hand-rear (AZA Ape TAG, 2010). Infants can survive these 72 hours without nursing (Rogers and Davenport, 1970). Maternal care is learned and can improve with practice, so this time allows the mother and infant time to develop proficiencies.

Research has shown that even chimpanzees hand-reared in socially and environmentally complex nursery settings show higher levels of abnormal behaviors (Maki, Fritz, and England, 1993; Bloomsmith and Haberstroh, 1995) and a greater chance of developing non-breeding behaviors or maternal incompetence as adults (King and Mellen, 1994). In order to encourage the development of

a normal behavioral repertoire, chimpanzees that cannot be mother-reared should be peer-reared and/or integrated with conspecifics at an early age. The SSP® Care Manual for Chimpanzees suggests that socialization back to the mother should occur within six months or to a surrogate by 18 months (AZA Ape TAG, 2010).

In developing a hand-rearing plan for chimpanzee infants it is therefore necessary to take both behavioral and nutritional factors into account. When the North Carolina Zoo was recently faced with the task of hand-rearing a chimpanzee infant we carefully considered the need to socialize the infant with conspecifics. The high degree of similarity between humans and chimpanzees allows for the relatively straight forward adaptation of human infant diets to the raising of chimpanzees. However, given the need to integrate the infant with adult chimpanzees at an early age, we accelerated some of the traditional timelines for diet presentation in order to prepare the young chimp for reintroductions to the troop.

Hand-rearing Nutrition Overview

Chimpanzees are humans' closest, living relative, with similarities in physiology as well as growth and development. As a result nutritional and feeding recommendations for humans can be adapted to chimpanzees with relative ease. In fact, prior to 2003 it was recommended that the human recommended daily allowance (RDA) tables be consulted when approximating chimpanzee nutritional requirements (Fulk, Loomis, and Garland, 1992). Currently, the specific nutrient requirements for chimpanzees are defined and are available in the book *Nutrient Requirements of Nonhuman Primates* (National Research Council, 2003)

In 1985, Fritz, Ebert, and Garland outlined the nutritional management of hand-reared chimpanzees at the Primate Foundation of Arizona in Tempe, AZ. This information is used as the basis for current recommendations for the feeding of infant chimpanzees that are being hand-reared (Porton, 1992). These recommendations provide suggestions on the frequency of feeding, volume, supplements, when to introduce solids, and weaning, which closely match dietary recommendations for human infants.

Hand-rearing and Dietary Practices at the North Carolina Zoological Park

On 2 August 2010 a primiparous chimpanzee at the North Carolina Zoo gave birth to a full-term, healthy infant (242 days after conception). Maternal competence was questionable as improper positioning of the infant prevented nursing (Photo I). On Days 1 and 2 of the infant's life no bouts of nursing were observed and the infant appeared weak. The mother was anesthetized on both days and the infant was allowed to nurse. Through cooperation with the mother, on Days 3 through 5 zoo keepers were able to periodically bottle feed the infant through the mesh caging. During these



Photo I: Female chimpanzee displaying improper positioning of infant, preventing the infant from nursing. Photo by Kat Ahern.

feeding sessions the mother brought the infant to the cage front and zoo keepers used a nipple extension to offer it Pedialyte® and/or a human infant formula. Unfortunately, cooperation with the mother declined during Days 4 through 5 preventing reliable feeding. The mother also began leaving the infant on the floor and unattended for prolonged periods of time. As a result of the inappropriate maternal behaviors, on Day 6 the decision was made to remove the infant for hand-rearing.

Once the decision to hand-rear was made, a team of trained neonatal volunteers was assembled to assist zoo staff in caring for the infant chimpanzee. It is the practice of AZA zoos to mimic natural mother-infant behavior as closely as possible during hand-rearing. Hand-rearing therefore involves almost 24-hour body-to-body contact between the infant and the caretaker, species-specific handling of the infant (including feeding the infant in a ventro-ventral position (Photo II), and exposure to conspecifics (AZA Ape TAG, 2010).



Photo II: Ventro-ventral feeding of infant. *Photo by Tom Gillespi.*

The hand-rearing team recorded food offered and consumed, daily weights and temperatures, urination frequencies, fecal output and its consistency, and any behavioral or developmental data. Dietary changes, including frequencies and amounts, were approved by the area supervisor, the Curator of Mammals, and the attending veterinarian. Factors for diet changes were: total diet consumption, consumption at certain periods of the day, fecal output, weight, behavior, and social and developmental needs.

Scheduled feeding was instituted, rather than on-demand feeding, due to the large number of individuals caring for the infant. We chose a fixed schedule to avoid reliance on different individuals' subjective judgment of hunger cues from the infant and the desire not to over or under feed.

For the first six weeks the infant was fed using a preemie bottle and nipple from Enfamil®. At six weeks we changed to Evenflo® Classic™ bottles and silicone nipples (3-6 month, medium flow) due to issues with the preemie nipples flowing too fast. We were concerned with aspiration and bloating due to rapid consumption.

Initially the infant was provided the human infant formula Similac® Advance® Early Shield® with iron (see Table I for dietary offerings). At just over two weeks of age the formula was changed to a soy formula (Enfamil® Prosobee® Infant Formula for Sensitive Tummy Soy formula with iron) due to several days of diarrhea and possible lactose intolerance. The infant remains on this formula to date. When bouts of diarrhea occurred, the infant was taken off formula and offered Pedialyte® solution at 100% for 1-5 feeds (depending on length and frequency of diarrhea), then switched back to 100% formula over the course of three feeds.

Rice cereal was offered at eight weeks. Novel fruits and vegetables in the form of baby food were introduced at 13 weeks. Each item was offered for four consecutive days before offering a new item. This was done to monitor for food allergies or adverse effects of each new food. At each feeding cereal and/or fruits/vegetables were supplemental foods. Formula was and continues to be the primary source of nutrition.

Table I. Dietary Offerings to Infant Chimpanzee at the North Carolina Zoo

Age	Diet offered and frequency
2 days	Offer 60 ml Pedialyte ^{®1} when mother presents infant Offer 60 ml 75% Pedialyte [®] , 25% Similac [®] Advance [®] Early Shield ^{®2} (infant formula) when presented Offer 60 ml 50% Pedialyte [®] , 50% formula when presented Attempt feeds: 7am, 9am, 11am, 1pm, 3pm, 5:30 pm, 10 pm, 2am
3 days	Offer 60ml 25% Pedialyte [®] , 75 % formula when presented Offer 20 ml formula when infant presented
5 days	Infant pulled for hand-rearing Offer 25 ml formula at following times: 7am, 9am, 11am, 1 pm, 3pm, 5pm, 8 pm, 11pm, 2am, 5am
1 week 1 day	Increase formula amount to 60 ml on above schedule
2 weeks	Increase formula to 70 ml at 8pm, 11pm, 2am, 5am feeds only
2 weeks 2 days	Changed formula to Enfamil [®] Prosobee [®] Sensitive Tummy Soy formula with iron ³ due to diarrhea
3 weeks 3 days	Increase each feed by 10 ml (70 ml during the day, 80 ml overnight)
6 weeks 4 days	Offer 80 ml formula at 7am, 9:30am, 12pm, 2:30pm, 5pm, 8pm, 11pm, 2am, 5am
7 weeks 3 days	Offer 90 ml formula every three hours: 7am, 10am, 1pm, 4pm, 7pm, 10pm, 1am, 4am
8 weeks 2 days	Offer 1 tsp rice cereal ⁴ mixed with 1 Tbsp formula each feed
10 weeks 3 days	Offer 1 Tbsp rice cereal mixed with 2 Tbsp formula at each feed
12 weeks 4 days	Offer 110 ml formula every four hours: 7am, 11am, 3pm, 7am, 11pm, 3am. Continue cereal at all feeds but 3am feed.
13 weeks	Offer 1 Tbsp Stage 1 baby food ⁵ at each feed. Continue for 4 days. Every 4 days introduce novel fruit, vegetable or cereal grain.
14 weeks 2 days	Increase formula to 140 ml at following feeds: 7:30am, 11:30 am, 3:30 pm, 7:30pm, 11:45pm. Continue cereal and baby food.
15 weeks 5 days	Increase formula to 160 ml at each feed. Continue cereal and baby food.
18 weeks 6 days	Increase cereal to 2 Tbsp with 3 Tbsp formula. Baby food is now Stage 2, no more novel food introductions.
19 weeks 4 days	Increase formula to 180 ml at each feed (5x/day). Continue cereal and baby food.
25 weeks 5 day	Offer 180 ml formula 4x/day (7:30am, 12:30pm, 5pm, 10:30pm). Add small bites of adult food to each feed. Continue cereal and baby food.
36 weeks 3 days	Increase formula to 200 ml each feed (4x/day). Continue cereal and baby food but focus on adult food presentation.

¹Pedialyte[®] Unflavored by Abbott

²Similac[®] Advance[®] Early Shield[®] infant formula (with iron) by Abbott-24 cal/oz

³Enfamil[®] Prosobee[®] Infant Formula for Sensitive Tummy Soy formula (with iron) by Mead Johnson-22cal/oz

⁴Rice, oatmeal and wheat single grain cereals by Gerber[®]

⁵All baby food offered was Beech Nut[®] Stage 1[®] and Stage 2[®] fruits and vegetables

At 13 weeks of age the infant became ambulatory and at 14 weeks overnight feedings (midnight to 7am) were eliminated. This coincided with frequent refusal of the first meal of the day, suggesting that the infant was able to go up to eight hours without eating. Both of these milestones needed to be reached in order to consider the introduction of the infant to adult chimpanzees.

Discussion

There is no strict plan to follow for socializing an infant chimpanzee with an adult surrogate. In order to maximize the chances of producing a socially and behaviorally competent adult chimpanzee, it is in the chimpanzee's and institution's best interests to integrate the infant with an adult surrogate as soon as possible. If possible, the infant should also be raised with a peer. Certain physical developmental milestones must be met prior to introduction: the infant must be ambulatory (Photo III), able to go four to eight hours without a feeding, able to climb on and eat through mesh caging (Photo IV), be desensitized to the substrates the adult chimpanzees live on, and be developing a certain amount of independence from its caretakers.

The North Carolina Zoo accelerated the recommended feeding schedule by introducing solid foods at two months of age. Fritz, *et al.* (1985) caution against the introduction of solid foods prior to four to six months. Primary concerns addressed were the addition of supplemental calories (obesity) and excessive protein in the diet. It is noted however, that most infants "will not be outwardly harmed by early introduction of solid foods." All institutions hand-rearing chimpanzee infants should carefully review and consider information presented by Fritz, *et al.* (1985) and in the *Nutritional Requirements of Nonhuman Primates* (National Research Council, 2003) before introducing solid foods prior to four months of age.

Solids were introduced early because it was the institution's goal to introduce the infant to adults when it became ambulatory. This occurs around three to five months of age. The infant had to be ambulatory so that it could move off the surrogate's body and approach the mesh caging so zoo keepers could provide supplemental feeding. In order to accomplish this it was also necessary to have the infant proficient at eating off a spoon prior to introduction. It was also necessary that the infant had consumed each item from the adult chimpanzee diet with no adverse effects.

If introduction of solid foods had been delayed until four months, zoo keepers would be attempting to introduce new foods when the infant was already integrated with an adult(s). This is more difficult to do as zoo keepers need the cooperation of not only the infant, but also the adult(s) it is with. Although the adult could be trained to work with the zoo keeper to allow feeding, any interference from the adult may hinder the infant learning to eat from a spoon, or the adult may attempt to prevent feeding or steal the food.

Weight and food consumption graphs (Graph I, Graph II), and monthly body measurements (Graph III) indicate an overall healthy food consumption and growth rate for the infant. A veterinary assessment of the infant at 17 weeks found the infant in ideal body condition (R. DeVoe, personal communication, 3 December 2010). Physical developmental milestones for the infant, particularly

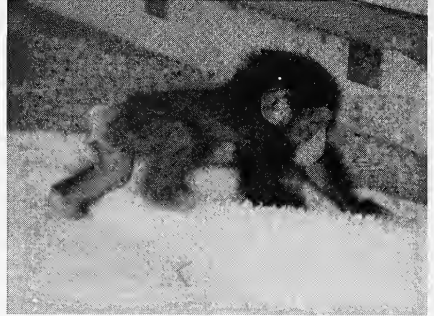
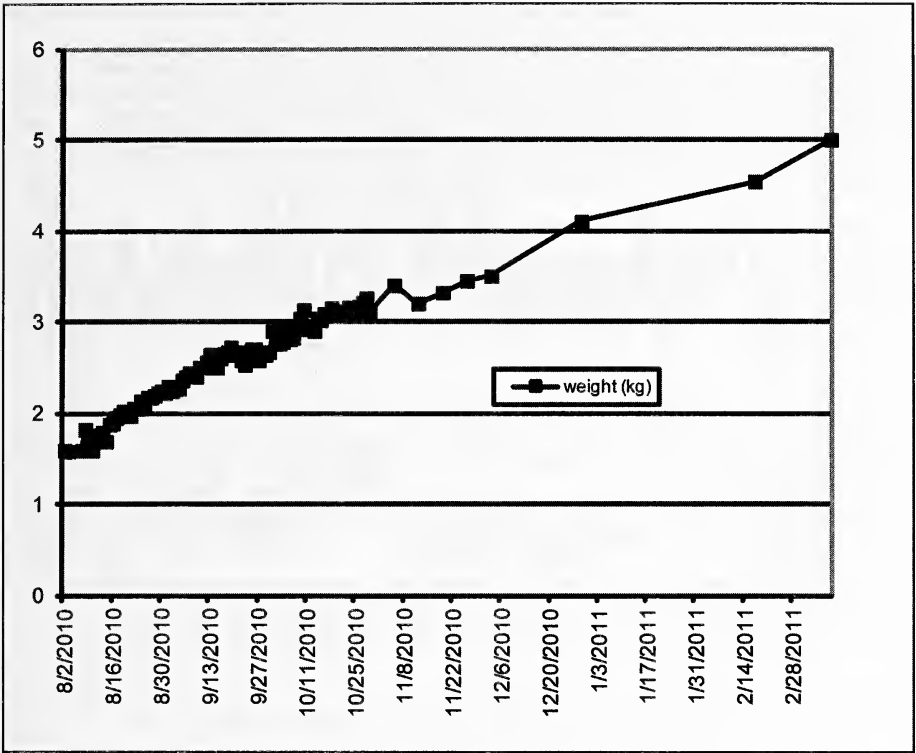


Photo III: Quadrupedal locomotion by infant. Photo by Jennifer Ireland.



Photo IV: Infant feeding through mesh caging. Photo by Jonita Lyle.



Graph I: Weights (in kg) of infant chimpanzee

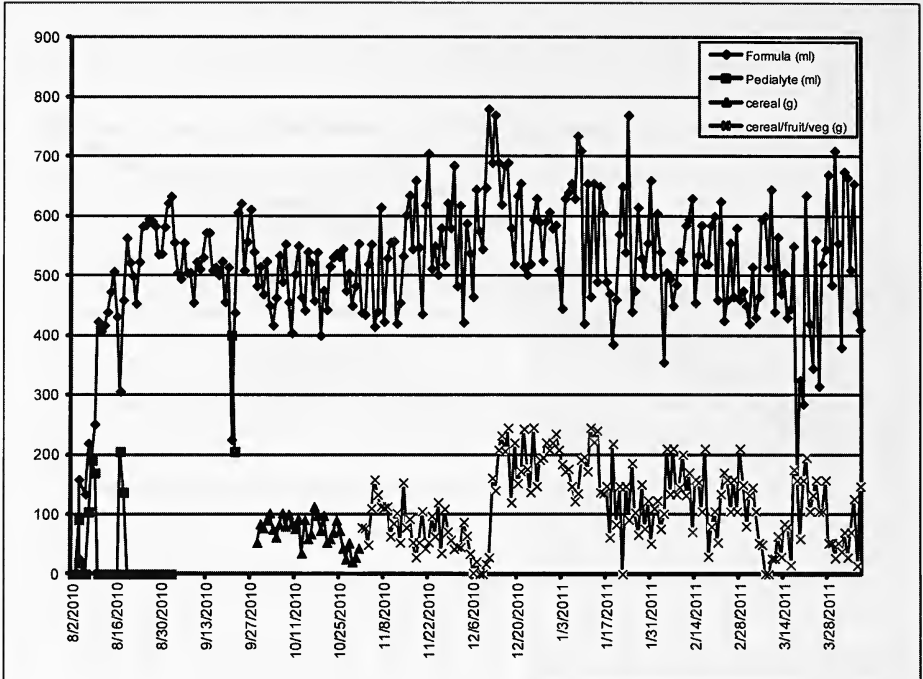
locomotion, were reached at the same time or before they would be in the wild (Plooi, 1984; van Lawick-Goodall, 1971) and considerably before infants hand-reared with little human contact (McClure, et al., 1973) (Table II).

While there does not appear to be any significant negative effects of the dietary regime instituted at the North Carolina Zoo, we did learn throughout the process. The infant has a strong tendency to suck its thumb. This may be attributed to the set feeding schedule rather than allowing feeding on demand. There also did not appear to be any gain by introducing rice cereal at eight weeks. While the infant readily accepted it within the first few days, there was not an increase in acceptance of solid foods over the course of time. In fact, acceptance of the formula and solid food was quite variable from day to day (Graph II).

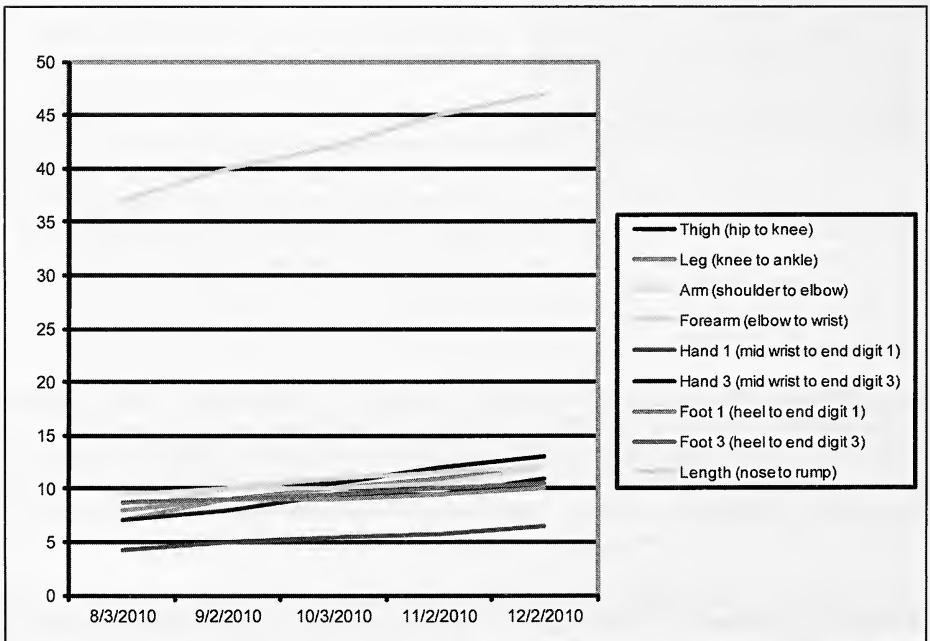
Conclusion

Ideally, all infant chimpanzees born in captivity would be mother-reared. When hand-rearing becomes necessary, a number of different factors need to be considered when developing a hand-rearing plan. These include staff resources and other occupational obligations, the social and behavioral development of the infant, a nursery setting which optimizes this development, exposure to conspecifics (including peer-rearing), and of course, dietary practices. Each one of these factors impacts the others making clear cut rules and guidelines difficult to define and follow.

When developing a dietary regime for an infant chimpanzee, it is feasible to follow recommendations and guidelines instituted for human infants. However, these guidelines should be balanced with the goals for introduction of the infant to conspecifics at the earliest possible age. An introduction prior to six months may be facilitated by the acceleration of presentation of new food items.



Graph II. Diet consumption of infant chimpanzee



Graph III: Body Measurements (in cm) of Infant Chimpanzee

Update

In December 2010, when the infant was four months old, it was introduced to adult members of the chimpanzee troop. Once this occurred, staff was no longer in direct contact with the infant. All food presentation was done through the mesh caging and in the presence of the adult troop members. At six months of age the infant was observed picking up and eating portions of the adult diet. It is planned, however, that she will be supplemented with human infant formula until she is at minimum one year old.

Over the course of four months the infant was successfully integrated into a chimpanzee troop consisting of two adult males, two adolescent males, and six adult females. The troop members rarely interfered with infant feeding and the process was deemed successful.

Table II. Comparative Developmental Milestones

Behaviors	NC Zoo infant	Wild infants ⁶⁷	Hand reared infants (little contact) ⁸
Pulling up	2 weeks 4 days	3 weeks	
Moves over mother/ caretaker body	4 weeks 1 day	5 weeks	15-41 weeks
Pulls to bipedal standing	4 weeks 6 days	4-8 weeks	19-33 weeks
Begins quadrupedal standing with support	5 weeks 3 days	7 weeks	19-33 weeks
Obtains some of what it reached for	5 weeks 5 days	7 weeks	
Stands quadrupedally with head upright	6 weeks 1 day	9 weeks	
Begins walking quadrupedally	13 weeks	14-17 weeks	37-56 weeks
Climbing on trees/mesh caging	13 weeks 6 days	18-20 weeks	

⁶ Plooj, 1984

⁷ van Lawick-Goodall, 1971

⁸ McClure, et al., 1973

Acknowledgments

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References

AZA Ape TAG. 2010. Chimpanzee (*Pan troglodytes*) Care Manual. Association of Zoos and Aquariums, Silver Spring, MD.

Bloomsmith, MA and M.D. Haberstroh. 1995. Effect of early social experiences on the expression of abnormal behavior among juvenile chimpanzees. *Am. J. Primatol.* 36:110

- Fritz, J, Ebert, J.W., and J. Carland. 1985. Nutritional Management of Infant Apes. In: Graham and Bowen, eds. *Clinical management of Infant Great Apes*. New York, NY: Alan R. Liss, Inc: 141-156.
- Fulk, R, Loomis, M, and C. Garland. 1992. Nutrition of Captive Chimpanzees. In: Fulk, R. and C. Garland, eds. *The care and management of chimpanzees in captive environments. Chimpanzee Species Survival Plan – Husbandry Manual*. American Association of Zoos and Aquariums.
- King N. E. and J. D. Mellen. 1994. The effects of early experience on adult copulatory behavior in zoo-born chimpanzees (*Pan troglodytes*). *Zoo Biol.* 13:51–59
- Maki, S, Fritz, J, and N. England. 1993. An assessment of early differential rearing conditions on later behavioral development in captive chimpanzees. *Infant Behav. Dev.* 16:373-381
- McClure, H. M., Pieper, W. A., Keeling, W. E., Jacobson, C. B. and R. C. Schlant. 1973. Down's-like syndrome in a chimpanzee. In Bourne, ed: *The Chimpanzee*, Vol. 6. Basel: Karger, 182-214.
- National Resource Council. 2003. *Nutrient Requirements of Non-human Primates*. 2nd revised edition. Washington, DC: National Academies Press. 191-194.
- Plooij, F. X. 1984. *The Behavioral Development of Free-Living Chimpanzee Babies and Infants*. Norwood, NJ: Ablex Publishing Corp.
- Porton, I. 1992. Hand Rearing of Captive Chimpanzees. In: Fulk, R and Garland, C, eds. *The care and management of chimpanzees in captive environments. Chimpanzee Species Survival Plan – Husbandry Manual*. American Association of Zoos and Aquariums.
- Porton, I, and K. Niebruegge. 2006. The Changing Role of Hand Rearing in Zoo-Based Primate Breeding Programs. In: Sackett, GP, Ruppenthal, G, Elias, K, eds. *Nursery Rearing of Nonhuman Primates in the 21st Century*. New York, NY: Springer, pp.21-31.
- Rogers, C. M. and R. K. Davenport. 1970. Chimpanzee Maternal Behavior. In: L. H. Bourne ed. *The Chimpanzee* (Vol. 3) Basel: Karger.
- van-Lawick-Goodall, J. 1971. In the Shadow of Man, Boston, MA: Houghton Mifflin Co.; 270-271

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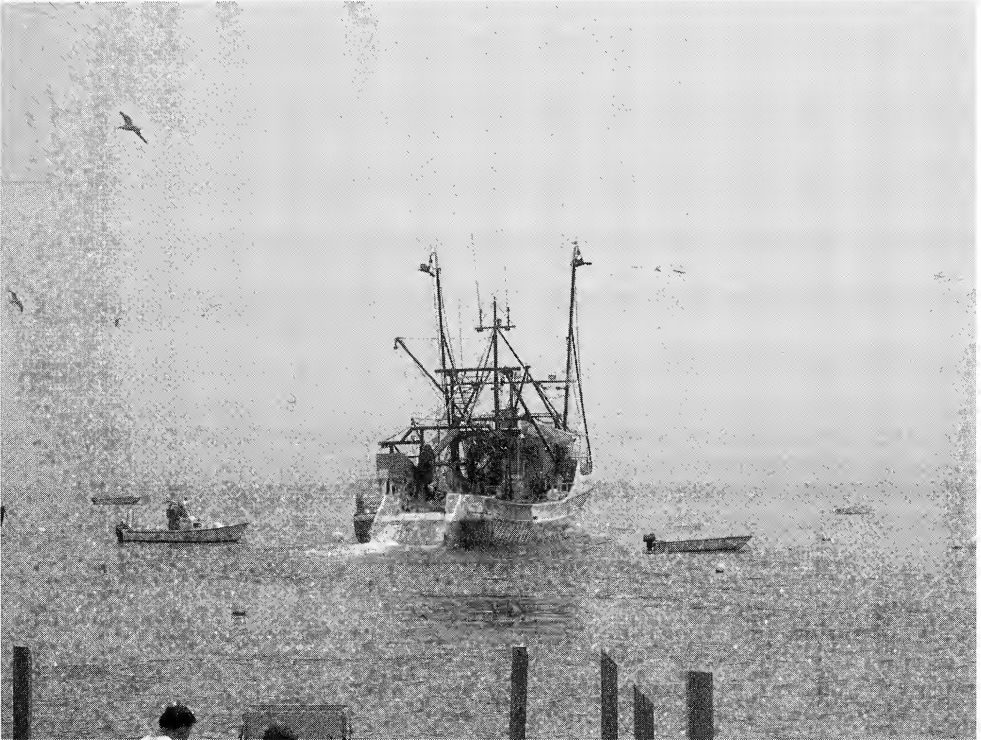
Footnotes

- 1 Pedialyte® Unflavored by Abbott
- 2 Similac® Advanc^e Early Shield® infant formula (with iron) by Abbott-24 cal/oz
- 3 Enfamil® Prosobe^e Infant Formula for Sensitive Tummy Soy formula (with iron) by Mead Johnson-22cal/oz
- 4 Rice, oatmeal and wheat single grain cereals by Gerber®
- 5 All baby food offered was Beech Nut® Stage 1® and Stage 2® fruits and vegetables
- 6 Plooij, 1984
- 7 van Lawick-Goodall, 1971
- 8 McClure, et al., 1973

“Good Catch”

Monitoring fish consumption/waste in order to reduce food fish waste at the Penguin and Puffin Coast

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Herring trawler in Stonington, Maine. *Photo by Rick Smith.*

With zoos and aquariums being at the forefront of educating the public about consuming sustainable seafood, it is our hope that these practices will help the conservation of many species of fish. Some of the fish species we are trying to conserve are caught in the North Atlantic by commercial fisheries. These species are not only consumed by humans but are also fed to a variety of zoo animals. In 2010 the staff at the Saint Louis Zoo's Penguin and Puffin Coast (PPC) monitored food fish consumption and waste for our collection of penguins and puffins. A six-month survey determined how much fish was actually used from the daily breakout. Fish breakouts were monitored as penguin and puffin appetites changed [i.e. molting, nesting, etc.]. Our eventual goal was to reduce fish waste in the daily diets. During the initial period of the survey (six months) it was determined that the total average daily fish waste was 5.6 kg (7.46 lbs.). This is equivalent to an annual waste of 1134 kg (2500 lbs) at an approximate cost of \$1200. We felt that from a conservation standpoint this was not acceptable. The survey was continued for six more months so that we could analyze the entire year's fish use. From the data collected, the PPC staff will be able to adjust future fish amounts to a more optimal

level. It is hoped that this practice can serve as a model for other zoos and aquariums to monitor fish consumption and, in turn, adjust their diets to reduce fish waste

Introduction

Zoological Parks and aquariums feed a variety of food fishes to their animal collections. They make every effort to offer a balanced diet and in doing so there is always food fish waste (uneaten fish). But, how much do they throw away? In 2010, a survey was created to find out how much fish waste actually is disposed of at the Saint Louis Zoo's Penguin Puffin Coast (PPC). In spring 2010, the PPC keepers began to monitor the amount of fish usage and waste at PPC. A series of meetings were held with the zoo's Animal Nutritionist. It was determined that a sample goal of recording monthly, four days-worth of fish used, could provide a better understanding of how much fish was actually being used and what portion of the daily breakout was not being used. Initially seven monthly samples, April-October, were taken and then reviewed. These results indicated that there was a significant wasting of food fish in our daily use. For a more extensive view of this waste, it was decided the sampling should continue for five more months (November-March). The first task of the analysis was to create an extensive record of all the food fishes we use. The breakout; daily diet, any uneaten fish, and by-catch; unusual fish, are all included. The survey focuses on four primary species of fish that make up the majority of our PPC diets; capelin, Atlantic herring, Atlantic mackerel, and lake smelt. Using the results from the survey, PPC is in its initial stages of more conservative fish use. With zoos and aquariums being at the forefront of educating the public about consuming sustainable seafood, it is our hope that these practices will help the conservation of many species of fish. The author has included a summary of the primary food fishes and their fisheries.

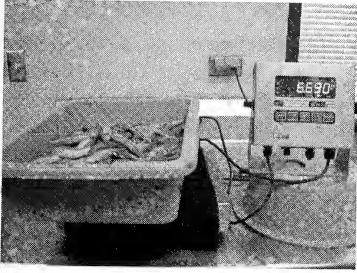
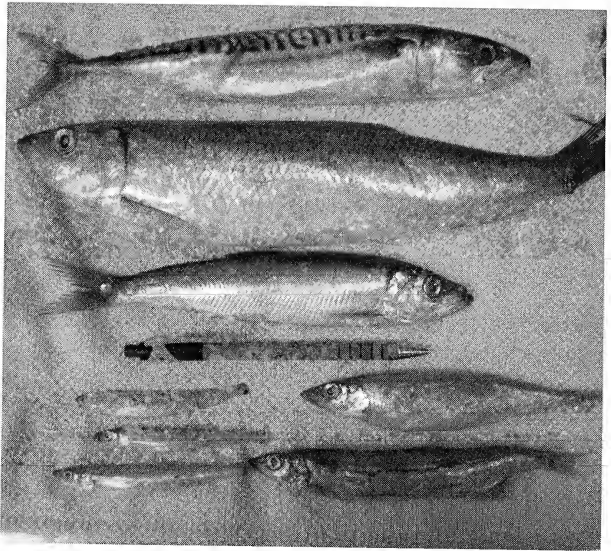
Species Biology and fisheries history

Capelin (*Mallotus villosus*), Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scromber scrombus*), and lake (rainbow) smelt (*Osmerus mordax*), are caught by fisheries in Canada and the USA. Government agency assessments have shown that all of these species have had some population declines. Regulations in season, net size and total allowable catch (TAC) have had some positive management results, however these regulations include population growth that forecast decline.

Capelin - Capelin are smelt-like, cold-water pelagic, schooling fish habiting Arctic and sub-Arctic seas in the Atlantic and Pacific. They are the most important forage species in the North Atlantic and are consumed by larger fish, seabirds, whales, osprey (*Pandion haliaetus*) and eagles (NFCS, 2011). The capelin eats small crustaceans (*Euphosid* species) that are loaded with keratin. This

With zoos and aquariums being at the forefront of educating the public about consuming sustainable seafood, it is our hope that these practices will help the conservation of many species of fish.

makes them an excellent food fish choice for most seabirds on exhibit. Historically, capelin has been eaten locally and used as a fertilizer product. The female capelin became a sought-after species by the Japanese fisheries for its roe. Large female capelin are sorted from the males and smaller females; both of which are discarded. Their own capelin fishery collapsed from these practices. The



Clockwise from top left: (Top Left) Grinding food fish waste; (Right) Fish species top to bottom: Atlantic mackerel, large Atlantic herring, medium Atlantic herring, female capelin, male capelin, lake smelt; (Bottom Left) Leftover waste fish being weighed. *Photos by Rick Smith.*

Japanese fisheries have continued using these same practices in the North Atlantic's international waters. (NFCS, 2011) The Canadian fishery off the west coast of Newfoundland also targets the mature females. Since the 1970s there has been a sharp increase in landings of several hundred tons per year with highs for bumper years reaching 10,000 tons. Capelin is also a shrimp fishery by-catch. The Capelin fishery at this point appears to be somewhat stable in the west coast of Newfoundland, however surveys on the east coast of Newfoundland and the northern portion of the Gulf of St Lawrence have shown declines since the 1990s. (CSAS, 2010)

Atlantic herring - Atlantic herring are supplied to zoos and aquariums from the USA and Canada. Atlantic Herring are fished from New Jersey north to Newfoundland. Atlantic herring inhabit the continental shelf and inshore waters where they are a primary forage fish for larger fish and many marine animals. Robin et al. (1986) consider them to be "One of the world's most valuable fishes" and have been a commercial fishery staple for decades. They are used fresh, salted, canned and for bait. The most common uses include fish oils, canned "sardines", and salted as bait for the New England lobster industry. In zoos they are commonly fed to the larger sea birds and marine mammals. TAC proposals for 2010-2012 include and predict a 7.5% population decline. Without these regulations the population would decline nearly 35%. Atlantic Herring, as long as it is regulated, will not decline into an over-fished condition (NEFMC, 2010).

Atlantic Mackerel - The Atlantic mackerel is an attractive, dark striped (mackerel striping), large, pelagic, schooling predator that is found from North Carolina to Labrador. Zoos and aquariums feed mackerel mostly to larger marine animals. Mackerel are sold at seafood markets but are not a popular fish for the average consumer. Overholtz (2006) reported that "their biomass has increased and mortality statistics were low. They therefore were not overfished and overfishing is not occurring". In contrast The Transboundary Resources Assessment Committee report (TRAC, 2010) had uncertain results and recommended a strategy to maintain low or neutral risks of exceeding mortality limits to prevent any overfishing. This decision was made because there were declines in older fish populations and lower numbers in egg surveys indicated in a reduced population (TRAC, 2010).

Lake Smelt – The lake smelt is a slender, dark-backed, silver fish with blue and pink stripes. It was originally distributed along the Atlantic coastal drainage but has since been introduced throughout the Great Lakes. Lake smelt are major prey species for game fish. Smelt containing low levels of DDT, mercury, and PCBs have been documented in government surveys. These contaminants are below guidelines established to protect wildlife consumers (McGoldrick, personal conversation, 2011). In zoos and aquaria, lake smelt is fed mostly to smaller seabirds and fish. Lake smelt is commercially fished mainly in eastern Canada. The smelt fishery is stable and at present under-harvesting their quotas (OMNR, 2011).

Methods and Results

In March 2010, the first meeting with the zoo's ANS was held as a planning meeting. In April 2010, one month's data was reviewed and the focus of the project was developed. It was determined that we would need at least six months data before we could create any major plans to reduce the fish waste. A sample of four days-worth of fish use would be recorded monthly. The data for the 2010/2011 survey included all of the fish species (capelin, herring, mackerel, lake smelt, etc.) we fed at PPC. The monthly data collected was calculated to percentages of fish thrown away from the diet. Results of seven months (April-October) showed an average fish waste of 5.9% or 3534 grams [7.8lbs.]

Table 1 PPC 2010/2011 Fish Waste		
Survey A	Average	Average
Month	Waste %	Sum grams
April	5.576677	3213.75
May	6.560276	3743.333
June	4.731082	2726.337
July	6.839357	3860.25
August		
September	5.817435	3628.75
October	5.984869	4035
Average % A	5.91828267	
Sum average A		3534.57
Survey B		
November	15.77067	7531.5
December	3.866007	2191.667
January	7.26943	3766.67
February	6.413918	5030
March	4.285008	2720
Average %B	7.5210066	
Sum average B		4247.9674
Year A+B		
Average %	6.71964463	
Sum average		3831.81892

(Table 1, Survey A). There was a need for food fish conservation. The survey continued for five more additional months (November- March) so that we had a full year's perspective on our fish use (Table 1, Survey B). During both surveys a few gaps (indicated by blank spaces) occurred. This was due to keeper error and the food fish waste being ground up before it could be weighed. During the month of August only one day's data could be collected.

After review, the focus was on the four primary fish species we feed to our birds. The lake smelt is a favorite among the birds and most of the time it is consumed. For this reason it was omitted from the percent waste calculations and from further review. The larger herring and mackerel are handled. The capelin, smaller sized (medium) herring, and, and lake smelt are offered in an iced tray. The capelin and medium herring made up the majority of what was leftover in the food trays. These “uneaten fish” are what the survey considers **waste**. Fish over 24 hours-old cannot be used because they are spoiled. Any fish that are mutilated, broken belly, freezer burned, or fish that “just don’t look good” were thrown away. These fish are considered “non-consumable”. The by-catch are fish that are not a target species. By-catch is separated as a “treat” for specific birds that “like” them. Some by-catch such as sticklebacks (*Spinachia spinachia*) are discarded because they are non-palatable.

Note: The average daily breakout amounts that are fed: capelin 44946g (99.09lbs.), Atlantic herring 11350g (25.02lbs.), Atlantic mackerel 1335g (2.943lbs.), lake smelt 4994 (11.01lbs.), and rainbow trout (*Onchorhynchus mykiss*) 800-1000g (1.764-2.205lbs.). In addition we mix silversides (*Menidia menidia*), squid, and krill (*Euphausiacea*) into our puffin diets.

Survey **A** originally determined that the total average daily fish waste of 5.6% (3402g/ 7.46lbs.) of our capelin and herring are wasted. This is equivalent to an annual waste of about 1134kg (2500 lbs.). The survey was continued for five more months so that we could determine if our prediction was accurate. The results from Survey **B** were higher than **A** and showed the total average daily percent was 7.5% (4248g/ 9.3lbs.). Survey **B** occurred over penguin nesting and molting seasons and this may be a factor because during these times the keepers have the most difficulty predicting how much food is needed. Penguins in zoos eat very little or fast during their molt. This was greatly exaggerated in November during king penguin (*Aptenodytes patagonicus*) end of molting and beginning of nesting seasons. The results from Survey **A** (and reflected from Survey **B**) confirmed that in over a year’s time we may be throwing out just over one pallet (1134kg/2500lbs) of fish. The financial cost of this waste is not too much (approximately \$1200) but, if we are to practice wise consumption of this resource, we must also recognize a significant biological loss like this one.

One unexpected, favorable result was that the communication between co-workers increased. It appeared that after the first few months of collecting data there was a better conscience to change the diets as needed to reduce waste. This was accomplished by observing what was being consumed the previous day. Daily breakout amounts were recorded on a calendar and a dry-erase board was used to address any daily diet changes. The communication between our staff and the animal nutrition department appears to have reduced our overstocking and overfeeding. Fish delivery changes are made after the keepers discuss how the birds are eating and how much leftovers we are throwing out. From these conversations we adjust the delivery to the birds’ present appetites. The results confirmed our belief that these efforts were worthwhile because we no longer unconsciously grind fish down the drain. Unfortunately, predicting these trends and turning them into a concrete schedule has proved to be difficult with only one year’s data.

Over seven species of by-catch were found. Of those, alewife (*Alosa pseudoharengus*), a relative of the Atlantic herring, were most common and found in the Atlantic herring boxes. In the Gulf of Maine there have been several controversies over regulation changes concerning the alewife harvest. Immature Atlantic cod (*Gadus morhua*) were also found frequently in with the capelin.



Since the 1990s the cod industry has been shut down from overharvesting and may never recover (Kurlinsky, 1998).

Conclusion

There are very few records of food fish waste (at PPC) prior to the 2010/2011 survey. From the 2010/2011 Fish Consumption/Waste survey we now have a better view of how much fish is being thrown away every year. This quantity of waste is under 10% of what we feed to the birds. But there was a large mass of wasted fish life. It is important to note that on 25 November 2010, data was very high (15kg/ 34 lbs.). This was not the only day during the survey that a larger than normal amount of fish were thrown away. The survey was created to address this kind of peak in our fish waste and hopefully minimize any future mass wasting. We had hoped that the survey would have shown some sort of trend in our bird's appetites and we could better predict what amount of fish we should offer them. But, PPC is a multi-species exhibit with a variety of life stages (i.e. nesting, molting etc.) simultaneously occurring throughout our year. These factors complicate any forecasting of fish use. It appears that we will need more data collected from future surveys to complete the task. We may need to treat each exhibit separately instead of as a whole. However, from the 2010/2011 survey we have become more conservative in our fish use. At present we are using smaller amounts of fish than we have fed in the past. There is a greater consciousness over appetite changes and altering the diets to better suit the birds' consumption rates.

As demand for fish increases, the economics will have an impact on what type of fish we will feed at zoos and aquaria. The 2010-2012 NEFMC herring fishery predictions are already including a percent in population decline in their "neutral harvest". Pollution and climate change are going to have negative effects on fisheries. Disease, contaminants, and drugs like antibiotics from aquaculture are also going to affect our food fish we give to animals. There is a need for wise conservation of these resources. If we ignore the historical waste of fish we feed at the zoo, no matter how small, we will contribute to the decline of certain fisheries. If the fish waste results recorded during the 2010/2011 survey are similar for all zoological parks that feed fish, then this trend becomes a greater concern. If one of the North Atlantic fisheries crashes, zoos and aquariums will certainly look for alternatives resources. But these fish may not be the same quality. If zoos and aquariums promote the sustainable use of seafood by the public, shouldn't they also strive towards more conservative food fish-use at their parks? In returning to the question "how much fish is wasted at PPC?" The answer is *less*. We now have a better focus on our fish usage and we are better at communicating it to one another and that is "a good catch".

Acknowledgements

The author expresses his gratitude to: the keepers at the Penguin Puffin Coast for their assistance during the survey, Zoo Nutritionist Deb Schmitt and the Bird Department management for their guidance during the project.

Literature Cited

- CSAS. 2010. CSAS Science Advisory Report 2011/008. Assessment of the Estuary and Gulf of St. Lawrence Capelin Stock. Canadian Science Advisory Specialist
- Kurlinsky, M. 1998. *Cod "A biography of the Fish That Changed the World"*. Penguin Group Inc. Boston, MA.
- Daryl, 2011. Personal conversation. Environmental Scientist, Water Quality Monitoring and Surveillance Division, Water Science and Technology Directorate, Environment Canada. Canada Center for Inland Waters, 867 Lakeshore Road, P.O. Box 5050, Burlington, ON L7R4A6.

NEFMC. 2010. Final 2010-2012 Herring Specifications 02/16/10. New England Fisheries Management Council 2010

NFCS. 2011. Newfoundland Capelin, Newfoundland Coastal Safari caostalsafari.com

McGoldrick, D. 2011. Personal conversation. Environmental Scientist, Water Quality Monitoring and Surveillance Division, Water Science and Technology Directorate, Environment Canada. Canada Center for Inland Waters, 867 Lakeshore Road, P.O. Box 5050, Burlington, ON, L7R4A6.

OMNR. 2011. Ontario Ministry of Natural Resources, *2010 Status of Major Stocks*. Lake Erie Management Unit, ISSN 1718-4924 (Print), ISBN 978-1-4435-6432-8 (Print, 2010 ed.), ISSN 1925-5454 (Online), ISBN 978-1-4435-6433-5 (PDF, 2010 ed.). 69 pp.

Overholtz, W. 2006. Status of Fishery Resources off the North Eastern US. <http://www.nefsc.noaa.gov/sos/spsyn/pp/mackerel/index.html>

TRAC. 2010. Atlantic Mackerel in the Northwestern Atlantic. TRAC Status Report 2010/01

Neptune's Newsreel

H3N8 Bird Flu Mutation Jumps to Seals — Researchers from Columbia University report in the journal *mBio* that 162 harbor seals (*Phoca vitulina*) died along the New England coast after being infected with a new strain of avian influenza. To read more go to: cnn.com/2012/07/31/health/baby-seals-avian-flu/index.html

Tropical Plankton Found Living in Arctic Ocean for First Time — Record warmth in the Arctic, excessive ice melt, and strong Gulf Stream currents are believed to have contributed to the establishment of tropical plankton northwest of the Norwegian archipelago of Svalbard. To read more go to: earthweek.com/2012/ew120803/ew120803a.html

Seahorses (*Hippocampus spp.*) Facing Extinction? — An undercover report by a marine biologist claims that 150 million seahorses are killed annually for Traditional Chinese Medicine, up to seven times the official estimate. To read more go to: earthweek.com/2012/ew120810/ew120810b.html

Australia's Oceans are Changing — A 2012 scientific report states that warming sea temperatures are influencing the distribution of marine plants and animals, while ocean winds and dynamics are influencing seabird foraging. To read more go to: sciencedaily.com/releases/2012/08/120816201631.htm

Planning and Implementing a Herp Survey

Lisa Duke, Zookeeper II
Chris Gertiser, Zookeeper
Binder Park Zoo, Battle Creek, MI

In 2010, Binder Park Zoo had its very first Herp Survey. We had over 30 volunteers and employees scouring our 433 acres of varied woodlands and wetlands searching for reptiles and amphibians. Reptiles and amphibians are declining worldwide and we wanted to bring awareness to their plight. This hands-on day of searching for herps helps to get the local community involved in protecting and appreciating the wildlife in their own backyards, all the while gathering valuable information. Data gathered from this day of surveying was submitted to the Michigan Herp Atlas (www.miherpatlas.org), resulting in the first official Blanding's Turtle (*Emydoidea blandingii*) reported for Calhoun County, MI. By the final count, we had found 21 species and 468 total animals. This Herp Survey was planned, organized and implemented by zoo keepers at Binder Park Zoo and this is our method so that you can plan your own survey.

Of the 433 acres of land at Binder Park Zoo, only approximately 120 acres are actually developed. Most of the land is undisturbed, allowing natural populations of herps to thrive. We wanted to know what species we had on grounds for our own knowledge and also to monitor any declines in populations that could be an environmental indicator. Previous employees had recorded observations of some species on grounds, but no formal survey had been performed. Our survey would get the public involved, while generating data for Michigan's Herp Atlas. This program was implemented in 2005 to better promote the conservation of declining species by recording what reptile and amphibian species are in Michigan, and where they are found.

We planned our survey for the last weekend of May before Memorial Day. Our thought process for this was that fewer people would be on vacation allowing for a larger volunteer pool. It was warm enough that most reptiles and amphibians had emerged, frogs were still calling on ponds and



A young herper with a large Eastern Garter Snake (*Thamnophis s. sirtalis*).

salamanders were returning from their migration to vernal pools. Also, it wasn't far enough into the season that the weeds and brambles were impassable.

Our group of interested volunteers and employees met at the zoo office in the morning to be briefed on the day's events, safety, zoo rules and safe animal handling protocol. We made sure to discuss the threat of Chytrid Fungus (*Batrachochytrium dendrobatidis*) to amphibians and all footwear and nets were bleached at the door. We had an informational slideshow of herps that we expected to encounter that day, along with pictures and brief descriptions.

To survey the large amount of area in a single day, we divided the park into five areas of relatively equal size. Some were more complex and difficult to survey (thick wetlands and water bodies) while others were more navigable (open hardwoods). This allowed us to break up our volunteers both by physical ability and individual interests. We had some idea of what species should be found in the various areas and discussed that when breaking up into groups. Each group had at least one employee with a radio that knew the grounds and led the group. There was also at least one individual in each group that could identify Michigan herps by sight, in order to accurately record what animals were found. The rest of the group would be comprised of individuals with varying experience. These were the "eyes" of the group; they would find, and if possible, catch the animals for identification by the group's expert. Someone in the group recorded what species were found and how many individuals were in each area. To survey the area, we would make a line and walk forward, trying to find as many specimens as we could in the shortest amount of time.

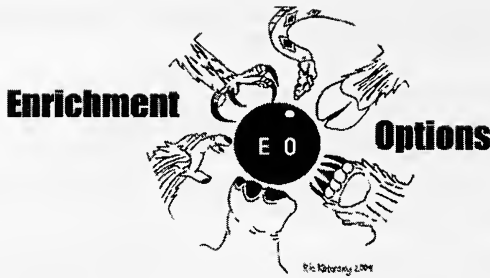
The volunteers and employees surveyed the grounds from 0900 until noon at which point they took a break for lunch. We try to keep our volunteers on grounds for lunch, because if they leave they tend to not come back for the afternoon session. We encouraged this by offering discounts at our zoo restaurant, getting lunch sponsors, or recommending bringing bag lunches. We reconvened at 1245 and rearranged the groups to cover what land hadn't been surveyed yet. During the afternoon session, many of our zoo keepers were able to help after they had finished cleaning their areas. We surveyed until around 1700 at which point we gathered at the office for a final tally of species and numbers found, as well as an ice cream social as a reward! Baked goods were provided by our local Battle Creek AAZK Chapter.

This undertaking would not have been possible without the help of many volunteers. Several months prior to our survey date we began sending out recruiting emails to various nature-minded organizations, herpetological societies and clubs, schools and of course our own docents, volunteers and Zoo Teens. We also reached out to neighboring zoos and their keeper staff. Due to staffing constraints, we were selective on where we advertised, in order to attract only the most enthusiastic volunteers. This was a whole-day event through rough terrain, so dedication was a must. Volunteers were encouraged to bring a lunch, rubber boots, bug spray, sunscreen, protective clothing, field guides and anything else you could think of for a fun day of herping.

This method is adaptable to your zoo's characteristics. If your zoo is in a city, you could survey a local park or wildlife sanctuary. Even a small pond surrounded by city buildings could have breeding populations of frogs that could be surveyed and reported. If you have a longer warm season, you could survey twice in one year.

We found the herp survey to be quite an enjoyable and rewarding experience for the zoo and the community. We had our second survey in 2011, and found 567 animals, representing 18 species, to report to the Michigan Herp Atlas. We hope to continue this tradition in the future to monitor Binder Park Zoo's changing population of herps.

If you are interested in more information or ideas, please contact Chris Gertiser (cgertiser@binderparkzoo.org) or Lisa Duke (lduke@binderparkzoo.org), 7400 Division Dr., Battle Creek, MI 49014.



Safer Enrichment — It's as Easy as 1,2,3

Heidi Hellmuth, Smithsonian's National Zoo & The Shape of Enrichment
 Valerie Hare, The Shape of Enrichment

(This paper was originally presented at the 2007 International Conference on Environmental Enrichment.)

By definition, an enriched environment offers more potential for harm than a sterile one. Yet the behavioral, physical, and welfare benefits of enriched environments are generally considered to outweigh the risks. To make enrichment safer, caretakers should make every reasonable effort to anticipate problems and to reduce the potential dangers associated with enrichment. By using a simple, three-step process, animal caregivers can help improve the safety of their enrichment efforts. 1) Evaluate – utilizing an enrichment approval system that includes a detailed safety checklist can help to more critically evaluate potential safety risks; 2) Read – The Shape of Enrichment's new safety database is an anonymous, living catalog of known safety incidents involving enrichment, which can help others to learn from these unfortunate experiences and help to avoid problems before they occur; and 3) Share – in addition to sharing enrichment successes, submitting enrichment safety incidents to The Shape of Enrichment's website will allow others to benefit from these experiences, and provide safer enrichment to the animals in their care.

The catalyst for this paper, and for the presentation at the ABMA conference, was a talk given at the 2007 International Conference on Environmental Enrichment (ICEE), held in Vienna, Austria, titled *Enrichment Gone Wrong!* (Hare, Rich, & Worley, 2007). It featured a variety of examples of enrichment safety hazards, along with tips for how to minimize and mitigate some of the most common risks. After the talk, during the question and answer period, there was a suggestion of

Please evaluate item for potential safety risks (a box must be checked for each item below):			
	Low	Moderate	High
Body part entrapment – holes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Body part entanglement – hanging materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item lodged in mouth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ingestion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other potential risks?			
Additional comments:			
RESTRICTIONS on USE			
Note any restrictions on the use of this item (ex. supervised only, on or off exhibit only, etc.):			

putting all of these safety incidents in a common location as a resource for people to learn about enrichment risks, so that they could make their own enrichment efforts safer. That discussion led directly to the development of the new enrichment safety database on The Shape of Enrichment's website, and to this presentation at the ABMA 2010 conference.

Step One

The first step to safer enrichment is EVALUATE. The most important part of this step is to encourage critical thinking about enrichment safety. For example, an earlier version of the Smithsonian's National Zoological Park (NZIP) enrichment approval form had a single, open-ended query in the safety section:

SAFETY

Note any potential safety concerns and restrictions on use.

The vast majority of responses in this section involved some version of "none". It appeared obvious that people were not putting much thought into potential safety risks that their enrichment strategy might pose, and were making assumptions that they would be safe. As a result of learning more about enrichment safety at ICEE, the safety section for NZIP's approval form was completely revised, to encourage more critical thinking:

Including the checklist for the most common hazards helped encourage people to really think about their enrichment idea, how it might be used by the animals, and to better assess possible dangers.

Enrichment safety hazards can be organized into three main categories – animal safety, human safety, and other risks. For animal safety, main categories to consider include body part entrapment, entanglement or strangulation in hanging materials, items or components becoming lodged or stuck in an animal's mouth, and ingestion concerns.

When evaluating enrichment for body part entrapment, it's important to consider the size of holes or gaps in the device, and to evaluate the entrapment risk for all body parts: head, snout, teeth, paws, limbs, antlers/horns, neck, full body, etc. Examples of incidents involving entrapment:

- Maned wolf and feeder ball – a maned wolf was given a soft plastic feed ball unsupervised overnight. In the morning keepers found the wolf with the ball wedged over its lower jaw. The wolf had to be sedated to remove the ball, and received minor lacerations, but recovered fully.
- Fishing cat and PVC pipe – a fishing cat pool had a PVC pipe in it, used as a hiding area for live fish which are given as enrichment. The PVC pipe was large enough for the fishing cat's paws to easily fit in to try and get the fish, but a cat stuck its head in to pursue the fish and got stuck in the pipe. The cat was sedated and the tube removed. Although the fishing cat recovered, it sustained severe injuries to its claws, and drowning was a definite risk during this incident.

To reduce the risk of body part entrapment, here are some tips to consider:

- Make sure all holes and openings are either too large or too small for any body part to become entrapped, and establish minimum/maximum hole sizes as part of your enrichment protocols
- Soft, flexible items can change shape during use, which may pose additional risks for entrapment as hole size can vary
- Make sure that enrichment items are evaluated for safety with each individual animal that will have access to it, not just generally for the species
- Check enrichment items daily for wear and damage

Another common enrichment hazard involves entanglement or strangulation in hanging materials. Several animals have died over the past few years due to this, in some cases gaining access to items that staff thought were safely out of reach. Some examples:

- Gorilla and braided rope – a gorilla pulled apart a braided rope in its enclosure, and got the rope caught around its neck. Staff tried to revive the gorilla, but it died due to strangulation.
- Saki monkey and wire – a young saki monkey accessed a piece of wire which was used in bamboo screening in its enclosure. The wire got wrapped around the monkey's waist. Luckily the wire was able to be removed by a keeper and the monkey was uninjured.
- Cockatoo and rope – a pair of cockatoos had rope in their enclosure for perching and enrichment. The rope became frayed, and this was not noticed by staff. One morning the male cockatoo was found dead in the enclosure, hanging upside down from the frayed rope in which it had become entangled.
- Maned wolf and bungee – a ball was hung on a bungee cord, at head height, for a maned wolf. The wolf pounced on the ball, stretching the cord, which then wrapped around its leg. Luckily the wolf remained calm and was able to extricate itself without injury.

A few suggestions to reduce the most common entanglement/strangulation risks:

- Check all items daily for wear and damage
- Be aware of the length, diameter, and flexibility of hanging materials to make sure they cannot loop around an animal
- Cover flexible hanging materials with a more rigid material like a garden hose, fire hose, PVC pipe, metal conduit, or other material
- Never hang an item with a looped attachment, no matter what the material, as this loop poses a significant entrapment hazard

Evaluating enrichment items should also include whether or not the item, or any part of it, could get stuck in the animal's mouth; or in some cases even cause an animal's mouth to become stuck shut:

- Giraffe and rubber ball – a giraffe target was made from a rubber ball glued on top of a piece of bamboo. The ball fell off, and was stuck back on the bamboo but not re-glued. The giraffe used its tongue to dislodge the ball, which became stuck between the animal's cheek and molars. It took several days, but staff was able to massage the ball free eventually.
- Polar bear/otters and cardboard – there are several instances where animals' mouths were glued shut due to cardboard. In all cases the cardboard was given in areas with water features, and the adhesive used in the cardboard was moistened and caused this adhesive to activate, literally gluing the animals' mouths. In all cases the animals were sedated and recovered fully.
- Lion/tiger and balls – In multiple cases, large cats got balls stuck in their teeth, or lodged in their mouths. The tiger got her teeth stuck in a large ball but was able to free herself. The lion had a ball lodged in its mouth and passed out, but revived once the ball was removed.

Risks can be identified and reduced by thinking carefully about the item, how the animal might use it, and if the whole item or any parts might become stuck in an animals' mouth. It is also important to consider how easy/difficult it would be to intervene and assist if an item did become stuck.

Along with the other risks already discussed, accidental ingestion of enrichment items needs to be considered when evaluating their suitability and safety. It's important to think not only about the entire item, but all materials and parts, in case it becomes damaged or comes apart:

- Fishing cat and cloth bag – a fishing cat was given a rabbit in a cotton bag. While eating the rabbit, it also ingested part of the bag, and went off food. The cat required surgery to remove the obstruction, but recovered.

- Giant anteater and shoes – an anteater was given tennis shoes for enrichment, and tore up the shoes with its claws and ingested small pieces. The anteater had to be sedated for treatment, but recovered.
- Macaque and sisal rope – a macaque became lethargic and uninterested in food. After not responding to treatment, exploratory surgery was performed. The macaque was found to have a large ball of rope strands (from exhibit features) in the stomach, as well as rope in the intestines. The rope caused damage to the intestines, including perforations allowing leakage into the abdomen. Due to the severe damage, euthanasia was required.

To reduce the risk of ingestion, materials used for food-based enrichment should be considered carefully. When using feeder devices made of materials that are potentially ingestible, like cardboard/paper/cloth, use only food that doesn't stick or absorb such as kibble, dried fruit, insects, seeds, nuts, etc. If using foods like meat, fruit, honey, peanut butter, etc., feeder devices should be made of strong, non-absorbing materials like hard plastic or metal (Hare, Rich, & Worley, 2007).

Animal safety may be the most obvious enrichment risk, but there are other potential dangers including escape, human safety, and other hazards. Here are a few examples:

- Orangutans and PVC feeders – after removing food from PVC feeders, the animals used the pipe to break the light fixtures above their exhibit. Luckily keepers were able to move the animals before they were injured by the broken glass.
- Fur seal and gorilla with ice blocks – in both cases animals threw the ice blocks out of the exhibits. The gorilla would apparently intentionally throw the ice blocks at visitors when agitated; while the fur seal used the toy sticking out of the ice as a handle and flung the block, striking a child in the head.
- Bonobos and branch – bonobos pulled a branch off of an old climbing structure, propped it on the wall, and escaped the enclosure. Luckily for all involved the animals returned to the exhibit on their own.
- Tiger and PVC rattle – when the normal 6-inch PVC was unavailable, a tiger rattle (PVC with rocks inside) was made from 4-inch pipe instead. The tiger managed to crack the PVC, and the sharp edges cut the animal's tongue. Luckily it was not injured seriously.

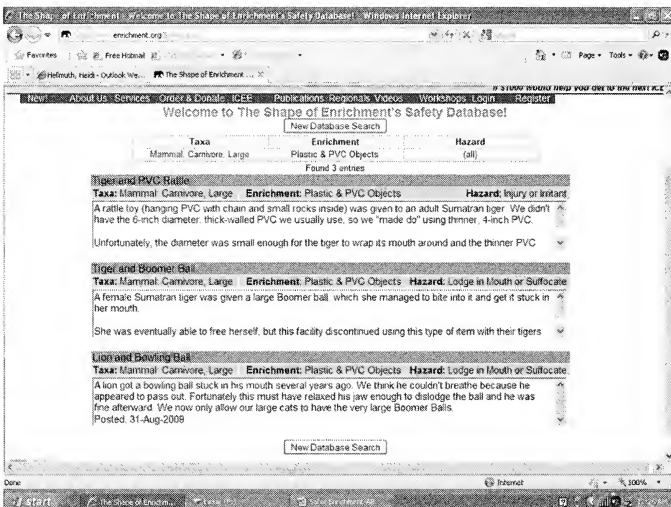
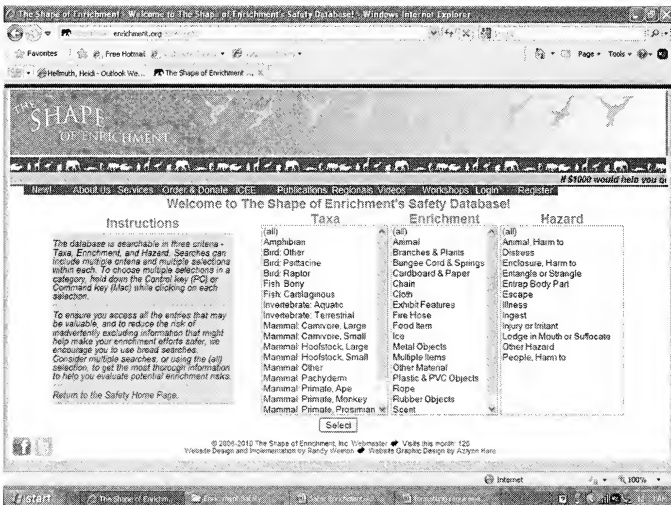
Step Two

In addition to careful evaluation of potential enrichment risks, a safer enrichment program also involves step two, READ. In 2009, an enrichment safety database was added to The Shape of Enrichment's website, to catalogue actual safety incidents that have occurred at zoos and other animal facilities. The database entries are completely anonymous, to encourage facilities to be willing to share their experiences so that others might benefit from their unfortunate incidents.

The database is searchable by Taxa, Enrichment Type, and Hazard; and multiple options can be selected in each category. (Figure 1)

For example, searching under the taxa - Mammal, Carnivore, Large; enrichment type – PVC and plastic objects; and all hazards currently yields three entries. (Figure 2)

This database can be an important resource for everyone who works with animals. There are many papers written and presentations given touting and sharing enrichment success stories. These are great because they inspire and encourage us to continue and expand our enrichment efforts with the animals in our care. Just as important, however, is learning about enrichment risks and hazards, so that we can benefit from the experiences of others to offer our animals with safer enrichment strategies.

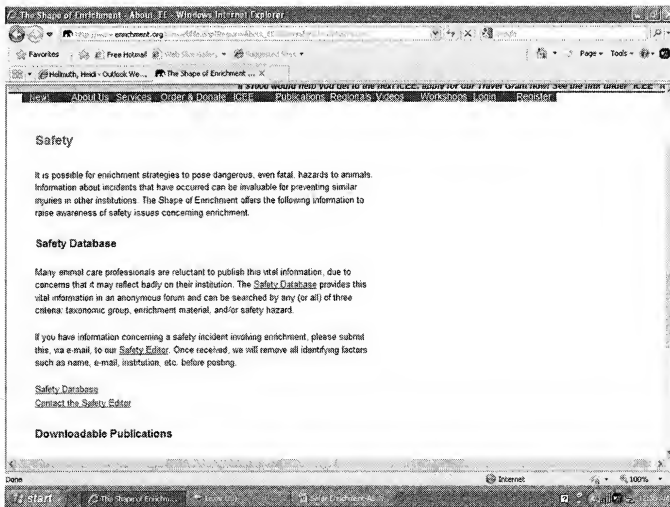


Step Three

This database is only as good as its entries, which brings us to step three – SHARE. The Shape of Enrichment’s safety database is the most visited page (except for the home page) on the website, which means people are interested in this resource. Several enrichment coordinators require their volunteers and interns to read the database prior to submitting any new enrichment ideas.

As of 1 October 2010, there are 47 entries in the safety database, only one of which is non-mammalian. This is a great start, but there are certainly many more stories to share out there. The database needs everyone’s involvement to be a more comprehensive and complete resource for us all. To help achieve this goal, and to allow others to learn from your experiences, please contribute your enrichment safety experiences to the database.

Sharing is easy, and anonymous. How do you submit something to the safety database? First, go



to The Shape of Enrichment website – enrichment.org. Next, go to the Services tab, and click on Safety. On the Safety page there is a link to contact the Safety Editor. (Figure 3)

Your submission is e-mailed to the Safety Editor, who edits the entry and removes any references to the facility involved, so that all information is posted in an anonymous manner. The edited entry is e-mailed to the submitter for approval, and once approved the entry is added to the database as a resource for others.

The goal of this paper, and of the safety database, is to help all of us use the information available to offer the animals in our care with an enriched, and safer life. It is about looking at RISK ASSESSMENT, not RISK AVERSIVENESS. Sharing safety issues should not make us fearful to offer enrichment; instead it gives us powerful information to reduce and mitigate enrichment risks, and should give us more confidence in the safety of our efforts.

Please be a part of this effort, and use this three step process in your enrichment program:

1. **Evaluate** – critically evaluate safety risks prior to approving and implementing enrichment
2. **Read** – use The Shape of Enrichment’s safety database to learn about safety incidents at other facilities, in order to avoid some of the same issues at your facility
3. **Share** – submit any enrichment safety issues to the safety database so that others can learn from your experiences

Safer enrichment, it really is as easy as 1,2,3.

References

Enrichment Safety Database, The Shape of Enrichment Website, enrichment.org/Safety.php.

Hare, V., Rich, B., & Worley, K. (2007) *Enrichment Gone Wrong!* Paper presented at the 2007 International Conference on Environmental Enrichment.

The AAZK Behavioral Husbandry Committee Presents



Where you can share your training experiences!

Training Tales Editors – Jay Pratte, Henry Doorly Zoo;
Kim Kezer, Zoo New England; and Beth Stark-Posta; Toledo Zoo

You want to Stick What? Where?: Redirecting Focus to Facilitate Injection Training of Mongoose Lemurs

By: Cathy Flanagan, Animal Husbandry Intern
Lemur Conservation Foundation
Myakka City, FL

Introduction

The Lemur Conservation Foundation (LCF) is a small non-profit corporation dedicated to the preservation and conservation of the primates of Madagascar through captive breeding, scientific research, education, and reintroduction. The foundation works with several organizations and coordinators to ensure that the colony is maintained and utilized as a prime field site for studying lemur behavior, primate cognition, captive management, conservation, as well as functioning as a breeding resource. Currently the facility houses over 40 lemurs that live on the Myakka City Lemur Reserve in shelters or in one of our two free-ranging forests. Each forest is 10+ acres to allow the lemurs optimal room to roam and stimulates the behaviors they would exhibit within their natural habitat in Madagascar.

In Madagascar, mongoose lemurs (*Eulemur mongoz*) breed through May and June and give birth in October and November. In Florida, however, since the seasons are opposite from Madagascar, our lemurs breed between November and February, giving birth in April or May after a 125 day gestation period. The female usually gives birth to a single offspring and may have offspring for consecutive years (LCF, 2012).

Training Plan

The training goal was for our 0.1 mongoose lemur to voluntarily receive birth control injections during the breeding season. We began by reinforcing previously trained behaviors such as target and station (see Figure 1). From here, the ultimate goal was for the animal to target, hold their thigh against the mesh for three seconds, and tolerate injection without aggression or major reaction to the injection. We chose Emelia to be our priority. As a juvenile, Emelia was caught up twice a day for antibiotic injections to treat an illness. These interactions caused Emelia to become wary of her keepers. We felt she would benefit the most from this training.

Target Training

The steps were as follows via protected contact:

1. Introduce animal to target (Target was a pole with colored taped on the end).
2. Reward for approximations toward target end.
3. Reward animal for touching target end with nose.
4. Have animal follow target to different stations.
5. Touch nose to target end and hold for three seconds.



Figure 1. Target Training. *Photo credit: Alison Hunt*

Following target training, our next goal was to have Emelia shift her weight and present her thigh to the mesh. After several sessions with little to no success we revised our training plan. Previous training sessions were performed with protected contact and Emelia was asked to touch her nose to a target. This would minimize the option for the animal to grab food directly from the trainer's hand or break station. When reviewing our options, we ultimately decided to train in a free contact setting and bait the necessary behaviors to complete our goal. We incorporated a thin, green plastic cutting board into our training plan and used this as a cue to station her in the desired area. The cutting board was smeared with monkey crunch dust and fruit from her diet as a reward (see figure 2). Once we decided to go to free contact we followed these steps.

Modified Station Training

1. Have animal station at cutting board.
2. Reward animal for stationing at board and remaining calm.

For these steps, Emelia was stationed (asked to stay in front of the cutting board) on a branch in her outdoor cage. After she learned how to station, Emelia was asked to tolerate being touched with a syringe on her thigh. She did seem to prefer to be touched on her left side versus her right. This could be because of the position in which she prefers to station. To touch her right side meant the trainer would need to reach across her body. She was not comfortable with this and we decided to only touch her left side for the rest of the training plan (see Figure 3).



Figure 2. Cutting Board Station. *Photo Credit: Phil Sirois*

Syringe Introduction

1. Introduce syringe.
2. Touch animal with syringe.
3. Touch animal firmly with syringe.
4. Touch animal with syringe firmly for three seconds.
5. Introduce capped needle on syringe.
6. Touch animal with capped needle.
7. Touch animal with capped needle for three seconds.
8. Touch animal firmly with capped needle for three seconds.
9. Introduce blunted needle (Cut 18-gauge needle with tip cut off, sharp edges filed).
10. Touch animal with blunted needle.
11. Touch animal firmly with blunted needle for three seconds.
12. Touch animal with a regular needle, but do not break the skin.
13. Inject animal with medication.

Injecting Animal

When the trainer is ready to inject the animal it is important to consider factors such as the weather and the animal/trainer's stress levels. If it is raining outside or the trainer is nervous, the animal will be able to pick up on this. Also, it is important to remember when the trainer is actually injecting the animal that they are distracted by their reward. The day Emelia was injected, a bird of prey flew overhead and she started to alarm call. The trainer waited until the raptor flew by, she began eating again, and then Emelia was injected with her medication. If Emelia was injected too quickly after the distraction, she could have become startled, broken station, and it would have turned into a negative training session.



Figure 3. Touching hip with syringe. *Photo Credit: Phil Sirois*

Stationing Conspecifics

Since female mongoose lemurs are dominant over their male counterparts, Emelia would frequently break station and displace or exhibit aggressive behaviors toward her mate. We decided to solve this issue by incorporating this into her training plan. A second keeper would feed her mate and offspring while she was being trained (see Figure 4). She now allows her mate and offspring to be fed first, even if she is not being trained nor has food of her own.



Figure 4. Stationing Bimbini & Andres while Emelia is being trained. *Photo Credit: Phil Sirois*

Due to the fact that Emelia is an extremely active and eager participant in training we decided not to hand-feed her during sessions. She tends to grab the trainer's hand when she is not being fed fast enough. We also found that the plastic material of the cutting board we chose gave her the ability to hold onto the board during training sessions. Since Emelia was grasping the cutting board this dramatically reduced the tendency for her to grab food from the trainer's hand.

Conclusion

Overall the training took from 15 September 2011 to 19 January 2012. Sessions were performed on average three times per week. This training plan has been deemed a success and training will continue throughout the breeding season because our females are given birth control once every 45 days. Success in this training was accomplished by the trainer's ability to redirect Emilia's focus from her conspecifics while increasing the animal's level of comfort with the keepers.

Our goal of injection training was achieved by modifying our training plan to meet the animal's specific needs. Although our original goal of training her to shift her weight and accept an injection did not work, we did achieve the same goal by capturing the behavior in a way that worked best for Emelia and the staff.

Reference:

Lemur Conservation Foundation. 2009. Retrieved 25 January 2012, lemurreserve.org/mission.

Smith, Amy. 2012. Introducing 1.1 Andean Condors (*Vultur gryphus*) at the Knoxville Zoo, *Animal Keepers Forum*, Vol. 39, No.1, pg. 18-23, AAZK, Inc., Topeka, Kansas, U.S.A.

Comments by Jay Pratte

The author has provided a detailed outline of the benefits of flexibility in reaching training goals. Contraceptive injections need to be timed fairly closely to avoid reproductive mishaps, and so adapting new methods to reach a specific goal in a less forgiving time frame allows for greater training success. Many trainers will run into time crunches or potentially unrealistic deadlines with training goals, but they can be reached by paying attention to the animal's behavior and modifying methods appropriately.

By switching the lemur to a "baiting" approach, the animal is aware of the rewards ahead of time and more likely to station in the desired location. Obviously not all animals have the potential for a free contact situation, but initially luring an animal into a specific position can easily be shaped into a cue-behavior-reward situation. A suggested transition to this is to provide the station, and switch from the food waiting in the open to placing it visibly in hand, and holding it over the station. Next you can start turning the hand motion into a cue and differentially rewarding appropriate steps towards the animal choosing to station where it had previously been baited. Having used this technique to switch from baiting/luring to a true operant response in several species (from big cats to mongoose lemurs), training everything from side presentation to scale stationing, it is a viable method.

Remember also that providing a more continuous reward (such as the monkey crunch dust on the station) during an invasive procedure is also rewarding the animal for a desired behavior. In this case, remaining in position and accepting a potentially aversive injection. Remember that the more challenging or possibly invasive the behavior is, then the rewards should correspond in value. Good luck and thank you for sharing your Training Tales!

CONSERVATION STATION

Express Crisis Relief

*By Ashley Roth, Hoofed Stock Keeper
Houston Zoo, Inc., Houston, TX*



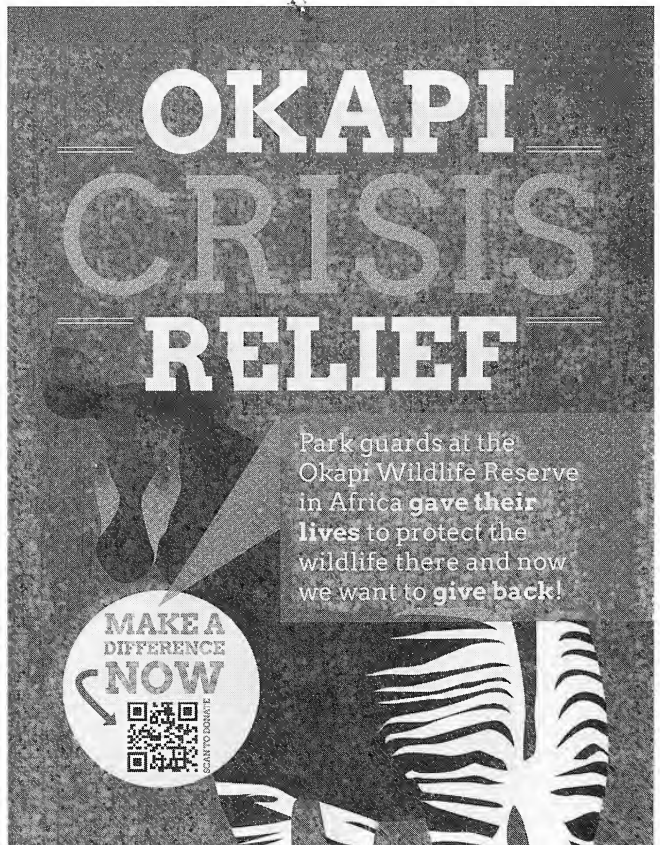
Okapi Crisis Relief is a joint project of the Greater Houston Chapter of the American Association of Zoo Keepers and Houston Zoo, Inc. *Photo ©Shutterstock*

On 24 June 2012, the Okapi Wildlife Reserve, located near the Epulu station in the Democratic Republic of Congo's Ituri Forest, was attacked by a group of poachers known as Simba rebels. They were seeking revenge on the Institute in the Congo for Conservation of Nature (ICCN), whose headquarters are based at the Okapi Wildlife Reserve, for recently shutting down their illegal poaching and mining activities. The outcome of this attack was tragic, leaving six people dead. Everything of value, from computers to vehicles were stolen or burned. All food and medical supplies were taken, leaving the village with nothing to eat. The fourteen Okapis stationed at the reserve, serving as ambassadors for the country's flagship species were killed. Over 30 villagers from Epulu were taken hostage to assist the poachers in transporting the stolen goods. Fortunately most of the Okapi Conservation Project's (OCP) staff and locals were able to escape into the forest unharmed. Also, the villagers taken hostage were released and are beginning to return to the village.

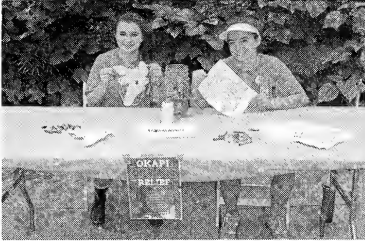
In response to the crisis at OCP, Houston Zoo, Inc. with assistance from the Greater Houston Chapter of the American Association of Zoo Keepers (GHCAAZK) wanted to plan an emergency fundraiser. The Houston Zoo committed to assisting the OCP by any means necessary. Due to the urgent nature and time sensitivity of this crisis, it was dire to act as quickly as possible. The decision was made to plan and implement an Okapi Crisis Relief fundraiser to raise money to be sent as emergency aid to the project.

The goal of the Okapi Crisis Relief was to raise monetary support to be sent to the OCP. Additionally, the Houston Zoo wanted to increase community awareness and knowledge, not only about okapis but the true wildlife heroes that risk their lives on a daily basis to protect species and their habitats.

The Houston Zoo regularly supports a wide range of conservation efforts and organizations, but has not been faced with such an immense crisis with a short timeframe for fundraising. Generally several months of planning would go into preparing for such events as the Okapi Crisis Relief, but due to the nature of this emergency, several months was not realistic to offer monetary aid. The Houston Zoo is lucky enough to have a devoted conservation department that worked diligently alongside with hoofed stock keepers and the marketing/graphics departments, with assistance from the rest of the zoo, and GHCAAZK to make this event happen. From the initial planning meeting to organizing supplies, education, and promotional materials, the Okapi Crisis Relief was put together in three days.



QR code banner placed throughout zoo.



(Top left) Keepers and volunteers at the okapi table.

(Bottom left) Volunteers working the crafts table.

(Right) I love Okapi button assembled by GHCAAZK members.

The conservation department's connections with the OCP initially sparked the idea to provide assistance to the project. A representative from the department organized a meeting with hoofed stock, special events, marketing, and graphics departments. The decision was made to host the conservation event on Sunday, 1 July 2012. A donation page was immediately set up on the zoo's website; including information about the project and crisis updates from the Congo. The crisis and fundraising event was promoted via the internet using Facebook, Twitter, and an e-mail campaign

The Houston Zoo wanted to increase community awareness and knowledge, not only about okapis but the true wildlife heroes that risk their lives on a daily basis to protect species and their habitats.

which included over 50,000 zoo members and donors. A painting done by one of our resident okapis was put on eBay to be auctioned off. Our marketing and graphics department quickly designed banners that were placed throughout the zoo with QR codes, bringing guests directly to the donation page. Local newspapers ran a story about the zoo's relief efforts and local news stations covered the event.

In preparation for the Okapi Crisis Relief event, the GHCAAZK donated time and supplies. The day before the event, members gathered to make okapi buttons to be sold. Okapi masks were cut out for kids to color and wear the day of the event.

To raise money, several different tables were stationed throughout the zoo, with the main table set-up in front of the zoo's okapi exhibits. Merchandise included: "I love okapis" and "Okapi Crisis

Relief” buttons, conservation bracelets, paintings done by some of the zoo’s animals, magnets, finger puppets, stuffed animals, Wildlife Heroes books, and conservation snare art, to name a few. Raffle tickets were sold for a chance to win a behind the scenes tour to meet one of the zoo’s resident okapis. The okapi table highlighted the conservation efforts of the OCP and the risks the staff and locals take every day to protect the Okapi Wildlife Reserve. Volunteers set-up a biological facts table to allow guests a hands-on learning opportunity. Included on the table were an okapi skull and an animal pelt. To involve some of the younger guests, a crafts table was set-up for children to make okapi masks and decorate an okapi coloring page. Face painting was also offered at the main entrance.

Many staff and volunteers donated their time to work at the tables to educate the public about the situation in the Congo as well as the effort the Houston Zoo was putting forth to provide emergency relief. Though the day of the event was overcast and rainy, many guests came out to the zoo to show their support and take part in the day’s events. The public displayed a willingness to help however financially possible, whether it was \$1 or \$500. One very young man brought in his savings to purchase an okapi painting.

Following the Okapi Crisis Relief event, donations continued to be given. Keepers were stopped by guests unable to attend the event, but who wanted to make a financial contribution. Online donations continued as well. The okapi painting placed on eBay raised a sizeable amount; more than was ever expected. In addition, the GHCAAZK held an all-staff bake sale with a percentage of the profits donated to support the okapi relief efforts.

To date \$21,840 has been raised for the Okapi Conservation Project (OCP). This relief fund could not have occurred without the help and teamwork from everyone at the zoo. Staff from animal keepers, grounds, administration, marketing, and conservation worked to make this event a success. All money raised will help the locals rebuild their lives, the reconstruction of the conservation station, and assist the ICCN to continue to protect the wildlife of the Ituri Forest. The OCP is a symbol for the livelihood of the local people. It provides long-term stability for the local communities for the future as an alternative to the fast money and unsustainable practice of poaching animals instead of protecting them. Rebuilding the project and getting the community back on its feet shows the strength that comes from the project, outshining the will of illegal activity groups wanting to be free to do as they wish. Houston Zoo staff is very proud to work for an institution that cares so greatly about conservation and allows its staff to take part in conservation efforts like the Okapi Crisis Relief. Events like the Okapi Relief Fund truly define the work of zoos as they continue to work diligently to conserve the world’s species.

To learn more about OCP, visit okapiconservationproject.org. To assist in the recovery go to houstonzoo.org/okapicrisis/ or wildlifeconservationnetwork.org/wildlife/okapi.html.

UPDATE

Okapi Wildlife Reserve Crisis

According to okapiconservation.org, the presence of Congolese troops near the Okapi Wildlife Reserve has improved security in the area. Food and medicine are being distributed every two weeks. Donations to the Reserve have been used for regular provisions of food and basic needs to the many displaced families, replacement of household needs, support of the families of the rangers killed in action, and re-equipping guards so they can continue patrol and restore security to the Okapi Wildlife Reserve.

To get further updates, go to: okapiconservation.org

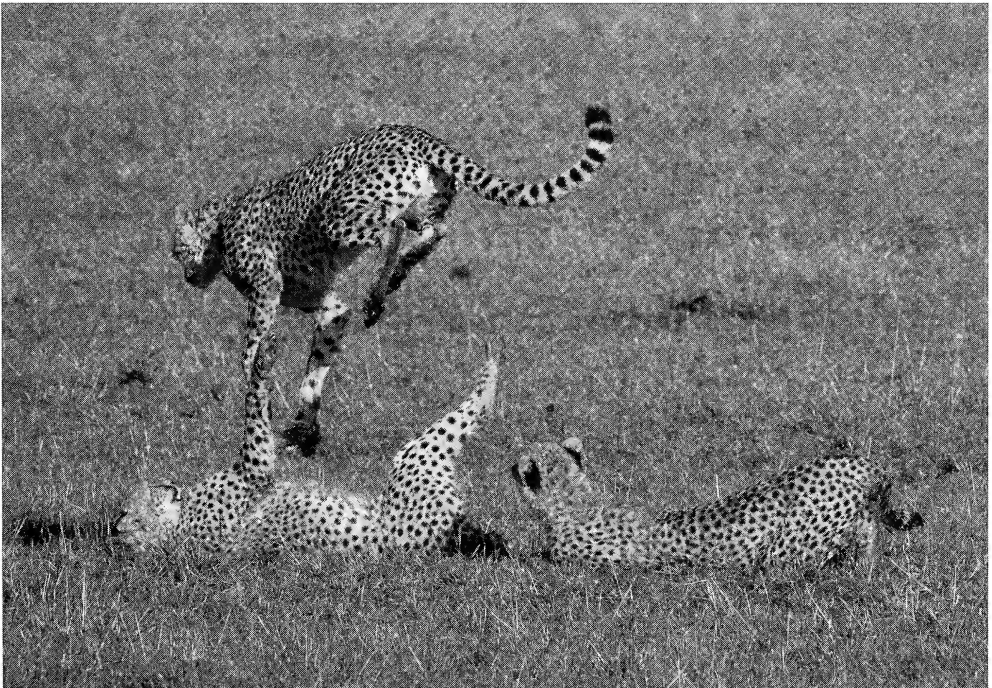
By Becky Richendollar, Senior Editor

Spending Time Evaluating Enrichment – How Much is Enough?

Any keeper will tell you that they never have enough time to do all the things they would like to do for their animals. You would also be hard pressed to find a keeper that doesn't think that enrichment is good for animals. But how effective is our enrichment if we don't have time to properly evaluate it? Evaluation is a key component to the enrichment process, so how can we spend less time on evaluation and still evaluate accurately?

A new study looks at varying degrees of sampling effort to determine how effective each method is in determining the efficacy of enrichment. The study was conducted at Fota Wildlife Park, Carrigtwohill, Co., Cork, Ireland, during March 2010. The research was conducted on eight cheetahs held in five enclosures within the park. The cheetahs were normally fed once a day, at the same time each day. Over the course of the 16-day research period, the authors picked eight random days to feed the cheetahs at their normal time, and eight random days in which the cheetahs were fed at a random time throughout the day.

During the sixteen days, two hours of data collection were carried out daily using instantaneous scan sampling with a 5-minute interval between each scan, giving them a total of 24 scans. The authors analyzed the data using all 24 scans, and then analyzed the data using only some of the scans, to



How much time does it take for busy cheetah keepers to get accurate data on the efficacy of their enrichment programs? You might be surprised. *Photo ©Shutterstock.*

mimic the evaluation methods employed by a typical zookeeper who certainly doesn't have two hours to watch an animal every day.

Not surprisingly, the data showed that the best way to get a completely thorough, accurate picture of how an animal responds to temporal feeding enrichment is to spend a large amount of time engaged in data collection (the two-hour, 24 scan method). However, the authors go on to say, "methods B, C, and D involving 1 hr 40 min, 45 min, and 30 min, respectively, of data collection daily also gave a useful insight into the effectiveness of the enrichment, and some would argue more than enough evidence to prove its efficacy and stimulate its future use as an enrichment strategy."

Unfortunately, Method E, which involved only 15 minutes of data collection, wrongly showed that the enrichment offered had no significant effect on cheetah behavior. Thus a keeper observing the cheetahs for 15 minutes would not know that the enrichment had actually had a significant impact on the cheetah's behavior.

Finally, the authors point out that there is some value to monitoring your animals for the fifteen minute time frame, especially when you are using interactive enrichment devices. Watching for fifteen minutes after the device is given will give a good picture of how a new device is initially received.

Practical Applications for Zoo Keepers:

Using a variable feeding schedule for cheetahs does impact their behavior.

When thoroughly and accurately trying to determine if an enrichment practice or device is affecting your animal's behavior, more data is better than less data. Perhaps the use of volunteers or interns would be helpful for evaluating new enrichment in this way.

Watching your animals for 15 minutes after they receive a new enrichment device and recording their behavior does have some value in that it gives you a good idea of how the animal initially reacts to the device. However, it won't give you an overall picture of how the animal reacts to the device all day.

Any time you do research on the effectiveness of enrichment devices, publish your results in *Animal Keepers' Forum* or another publication. If everyone shares their results, we'll all have a general idea of how enrichment affects our animals without all of us recreating the same experiments on our own. If we share information, we can save time!

To view the complete article:

Quirke, T., and O'Riordan, R.M. 2012. Evaluation and Interpretation of the Effects of Environmental Enrichment Utilizing Varying Degrees of Sampling Effort. Zoo Biology 00: 1-11.

Neotropical Primates in Mixed-Species Exhibits

A recent article in *International Zoo Yearbook* summarizes the existing literature about the benefits and possible problems of putting New World monkeys in mixed-species exhibits. Mixed-species exhibits can be beneficial for animals and visitors alike. Living in a more enriching environment can cause the animals to be more active, thus encouraging visitors to stand in front of their exhibits longer, becoming more engaged and learning more about the species. Mixed-species exhibits are a win-win situation for zoos.

After examining the literature, the author noted a few things that zoos should keep in mind when trying to house New World primates in mixed-species exhibits. The most successful pairings appear to be those in which the animals choose to interact in the wild. For example, wild capuchins (*Cebus and Sapajus spp.*) spend more than half their time in troops with common squirrel monkeys (*Saimiri*

spp.). Zoos also have had great success housing capuchins and squirrel monkeys.

New World primates have been successfully housed with non-primate species as well. These species include guinea pig (*Cavia porcellus*), chinchilla (*Chinchilla spp.*), degus (*Octodon degus*), coatimundi (*Nasua and Nasua spp.*), agouti (*Dasyprocta spp.*), acouchi (*Myoprocta spp.*), rock cavies (*Kerodon rupestris*), ground cuscus (*Phalanger gymnotis*), sloths *Megalomychidae* (two-toed sloth) and *Bradypodidae* (three-toed sloth), tree porcupines (*Sphiggurus spinosus*), armadillo (*Dasybus spp.*), tamandua (*Tamandua spp.*), giant anteater (*Myrmecophaga tridactyla*), tapirs (*Tapirus spp.*), and Mexican red brocket deer (*Mazama spp.*). Some New World primates will predate on lizards, toads, bird eggs, fledglings, and bats so it is important to keep that in mind as well.

Health concerns should also be taken in to consideration when preparing a mixed-species exhibit. The author states that “both spider monkeys (*Ateles spp.*) and squirrel monkeys (*Saimiri spp.*) are hosts to *Herpesvirus*. This disease is fatal for *Callitrichines* (i.e. marmosets and tamarins) and night monkeys.” In addition, it is important that all of the animals in a mixed-species exhibit have adequate food. Creating multiple feeding sites or a small area in which only the smaller of the species can go to eat can insure that all of the animals are receiving their food.

When preparing a mixed-species exhibit, it is important to consider both species and individual personalities. After examining the literature, this author reports that titi monkeys (*Callicebus spp.*) do not seem to be good candidates for mixed-species exhibits as they are often intimidated by the other animals in the enclosure. After reading this examination of the literature, the most important factor in determining the success of a mixed-species exhibit is to know your animal.



Neotropical primates can be included in exciting mixed-species exhibits, but many different factors influence the successful pairings of species. *Photo by Linda Oakleaf*

Practical Applications for Zoo Keepers:

Know the natural history of your species and have a good grasp on individual personality to help you decide if a mixed-species exhibit will be appropriate for your institution.

Create different levels in an exhibit, as well as multiple exits, feed stations, and sleeping options so that the animals won't be competing for resources.

Pay careful attention to mixed-species exhibits. Just because they have worked in the past, doesn't mean they won't stop working in the future. Look for signs of stress and aggression.

To view the complete article (including tables with successful vs. unsuccessful pairings):

Buchanan-Smith, H. M. 2012. Mixed-species Exhibition of Neotropical Primates: Analysis of Species Combination Success. International Zoo Yearbook 46: 150-163

THANK YOU!



The AAZK Board of Directors and Staff send their sincere appreciation to the **Omaha AAZK Chapter** for sponsoring this month's issue of the *Animal Keepers' Forum*.

The Chapter made a special contribution designated for the *AKF* with their re-charter materials. It is the special contributions of our Chapters that allow our Association to continue to grow, expand your professional development opportunities, and reaffirm our commitment to your flagship conservation programs. Our thanks goes out to the Omaha Chapter for sponsoring this month's *AKF*, and to all of the Chapters that support the Association throughout the year.

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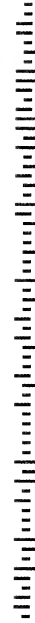


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