Penguin Taxon Advisory Group

Penguin Conservation

The Penguin TAG Newsletter

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In This Issue

From the Editors

This issue has been published as a printed version (as well as electronically) to be included in the IPC8 conference packets. We are pleased to provide information on the status and demographics of penguins in North American zoos and aquariums, the reproductive technologies used to conceive the first penguins via artificial insemination, and an account of continued institutional support for SANCCOB's Christmas Chick Bolstering Project.

The new, electronic publication of *Penguin Conservation Newsletter* debuted at IPC7 in 2010. We thank all those who have supported *PCN* over the last three years by contributing content and through readership. Our sincere thanks to the Penguin TAG Steering Committee for funding our IPC8 registration and the printing cost for this issue, and to Peter Barham and the IPC Steering Committee for facilitating the printing and inclusion of this issue in the conference packets. It is our goal to continue to support the mission of the Penguin TAG by promoting conservation concern and action for penguins.

As always, we wish to thank all of our contributors: Sharon Jarvis (SeaWorld Orlando), Tom Schneider (AZA Penguin TAG Chair), Dr. Justine O'Brien (SeaWorld and Busch Gardens Reproductive Research Center) and Colleen Lynch (Riverbanks Zoo and Garden & AZA Population Management Center).

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Archived issues are available on the Penguin TAG website: www.zoopenguins.org

ASSOCIATION OF ZOOS & AQUARIUMS

A Christmas Chick Experience: SANCCOB's Chick Bolstering Project

Sharon Jarvis, *Senior 1 Aviculturist, SeaWorld Florida, Gentoo Studbook Keeper and SSP Coordinator*

Last December I was given the opportunity of a lifetime. I had the honor of being chosen by the SeaWorld and Busch Gardens Conservation Fund Ambassador Program to travel to South Africa to work with SANCCOB's African Penguin Chick Bolstering Project. Having taken advantage of several penguin fieldwork opportunities during almost 20 years with SeaWorld Orlando's Aviculture Department, I was extremely excited over this new penguin adventure!

Sharon Jarvis feeding a Christmas chick. (Photo: Sharon Jarvis).

On my first day at SANCCOB, I was warmly welcomed by the staff at a brief morning meeting which was immediately followed by a whirlwind of activity that must be seen to be believed. Although I had been told that the chick season had started a little later than usual, the 18-25 chicks they already had were more than enough to keep me and one of their interns running until late that evening. I worked with the Intensive Care Unit (ICU) chicks, who received up to 7 feedings a day. In addition to feedings and cleaning, the chicks were moved outside after the first feeding and then back inside before the last feeding. Some of these chicks were receiving medications and nebulization treatments up to three times a day as well.

The SANCCOB team of staff and volunteers tackle a tremendous amount of work daily between the direct care given to the birds and all the preparation and clean up that goes into rehabilitating hundreds of birds a day. During my stay I also helped with copious amounts of laundry, making Darrow's solution (an electrolyte replacement therapy), cleaning and disinfecting thousands of tubes and syringes, straining gallons of penguin chick formula, pressure washing mats and crates, cleaning enclosures and pools, weighing chicks, veterinarian checks, administering medications, etc.

SANCCOB Christmas chicks. (Photo: Sharon Jarvis).

During the two weeks I was there the chicks just kept coming in, such that, by the time I left, they had close to 175 chicks. I thought my first day was busy!! The days were a different kind of hot than Florida and very dry. In addition, most work days were at the very least 10 hours in duration.
Although I must say that my time at SANCCOB was by far my most challenging, and to be honest, my most exhausting fieldwork experience to date, I also have to say that it was in many ways my most rewarding experience as well. SANCCOB is highly dependent on volunteers, and I met so many great and extremely dedicated people from all over the world: Australia, Germany, England, South Africa, and even the U.S.A. My trip to SANCCOB was an awesome opportunity to learn and exchange penguin knowledge and expertise between SeaWorld and SANCCOB. But I think the most incredible part of my time in South Africa was working directly with an endangered species and knowing in some small way I have contributed to the next generation of African penguins. Truly, for someone like myself who has an absolute passion for penguins, I couldn't ask for anything more.

It is for that reason; I owe a HUGE debt of gratitude to so many people for this amazing experience. Thank you so much to SANCCOB www.sanccob.co.za and their terrific staff and volunteers for giving me the opportunity to work beside them with the common goal of saving their national treasure, the African penguin; to the SeaWorld and Busch Gardens Conservation Fund www.swbg-conservationfund.org for their sponsorship of this project, which is SO very deserving of conservation and for choosing me for the Ambassador Program; and to the Aviculture staff and management at SeaWorld Orlando for their expertise in training me and supporting me in my all penguin adventures!!

Penguin TAG Mission: To provide leadership for the management of penguins *ex situ* in order to maintain healthy, sustainable populations for the purpose of:

- Engendering appreciation for these charismatic species that are indicators of the health of marine and coastal environments.
- Promoting conservation concern and conservation action through education programs and internet resources.
- Furthering *in situ* conservation and research in support of *ex situ* management.

Penguin TAG Website: www.zoopenguins.org

Status of Penguins in North American Zoos and Aquariums

Tom Schneider, *Association of Zoos and Aquariums (AZA) Penguin TAG (Taxon Advisory Group) Chair*

Animal populations in zoos and aquariums are managed to maintain genetic variability and demographic stability. The goal is to maintain long-term sustainable populations able to meet institutional needs without acquiring additional wild caught individuals. AZA Taxon Advisory Groups analyze space availability and the health of captive populations and make recommendations to member institutions on which species they should consider for their exhibits.

Once a species is selected to be managed, its studbook data is analyzed by population biologists at the AZA's Population Management Center. It will then fall into one of three categories: Green or Yellow Species Survival Plan (SSP) or be designated as a Red Program. SSPs are populations that have more than 50 individuals, with Green populations able to retain > 90.0% genetic diversity with a positive growth rate for 100 years and Yellow populations unable to meet these criteria. Red Programs are currently unsustainable and effort is needed to improve their health. A fourth category, Monitored, identifies programs that are not formally supported under AZA programs but may be tracked through registries for possible future management.

Ten of the twelve species of penguins in North America have viable populations and produce adequate offspring to supply the needs of North American facilities, as well as occasional exports to institutions in other regions of the world. While the majority of penguins in North America are temperate species, more zoos and aquariums are building exhibits for sub-Antarctic species which will increase the space available for these colder weather varieties. A list of species that are kept in North American facilities, their current status, and program leader contact information is provided below. Learn more at www.aza.org/animal-programs.

Common Name (Genus species)	Current Population Size	Current Number of Participating Institutions	Animal Program Designation	Target Population Size	Recent 5 Year Population Trend
African Penguin *(Spheniscus demersus)*	819	53	Green SSP	1030	Increasing
Magellanic Penguin *(Spheniscus magellanicus)*	240	15	Green SSP	170	Increasing
Humboldt Penguin *(Spheniscus humboldti)*	356	18	Green SSP	375	Increasing
Little (blue) Penguin *(Eudyptula minor)*	64	4	Yellow SSP	90	Increasing
Gentoo Penguin *(Pygoscelis papua)*	533	15	Green SSP	390	Increasing
Chinstrap Penguin *(Pygoscelis antarctica)*	142	4	Yellow SSP	150	Increasing
Adelie Penguin *(Pygoscelis adeliae)*	156	2	Green SSP	160	Increasing
King Penguin *(Aptenodytes patagonicus)*	270	16	Green SSP	290	Increasing
Emperor Penguin *(Aptenodytes forsteri)*	34	1	Monitored	NA	Increasing
Long-crested Rockhopper Penguin (*Eudyptes moseleyi)*	38	5	Red Program	50	Increasing
Short-crested Rockhopper Penguin (*Eudyptes c. chrysocome)*	317	17	Green SSP	340	Increasing
Macaroni Penguin *(Eudyptes chrysolophus)*	166	7	Green SSP	230	Increasing

Common Name	Program Leader	Contact Information
African Penguin	Steve Sarro	sarros@si.edu
Magellanic Penguin	Nancy Gonzalez	ngonzalez@wcs.org
Humboldt Penguin	Alex Waier	alex.waier@milwcnty.com
Little (Blue) Penguin	Heather Urquhart	hurquhart@neaq.org
Gentoo Penguin	Sharon Jarvis	Sharon.Jarvis@SeaWorld.com
Chinstrap Penguin	Robert Flores	Robert.Flores@SeaWorld.com
Adelie Penguin	Lauren DuBois	Lauren.Dubois@SeaWorld.com
King Penguin	Tom Schneider (interim)	tschneider@detroitzoo.org
Emperor Penguin	Linda Henry	Linda.Henry@SeaWorld.com
Long-crested Rockhopper Penguin	Amanda Ista	amanda.ista@milwcnty.com
Short-crested Rockhopper Penguin	Amanda Ista	amanda.ista@milwcnty.com
Macaroni Penguin	Jessica Jozwiak	jjozwiak@detroitzoo.org

Penguins Conceived for the First Time Using Artificial Insemination

Justine K. O'Brien, PhD. *Scientific Director, SeaWorld Parks and Entertainment Inc., SeaWorld and Busch Gardens Reproductive Research Center, San Diego, CA 92109.*

The sustainability of penguin populations in the wild is an ongoing concern, with 11 of the 18 penguin species classified as threatened with extinction[1]. Zoological penguin populations are educational ambassadors for conservation issues in the wild and represent an important biological resource that can enhance our understanding of each species' biology. This knowledge is a prerequisite for developing *in situ* population management plans designed to mitigate detrimental impacts of anthropogenic stressors. *Ex situ* penguin populations also have potential for use in the revival of wild populations in response to catastrophic losses providing that appropriate habitats exist. Our long-term goal is to develop assisted reproductive technologies including artificial insemination (AI) and semen preservation for use in conjunction with natural breeding efforts to maintain genetically diverse and sustainable penguin populations in cooperation with other zoos. This report focuses on our research in the Magellanic penguin (*Spheniscus magellanicus*).

Fig. 1. A Magellanic penguin in an isolated nesting site (the paired male is present to the right, outside of the fencing material). (Photo: Lauren R. DuBois, SeaWorld San Diego).

Magellanic penguin semen was first collected and characterized from a male at the Cincinnati Zoo and Botanical Garden. In that work, methods for the short-term and long-term (cryopreservation) storage of semen were developed[2]. The next phase of this research occurred at SeaWorld San Diego and the SeaWorld and Busch Gardens Reproductive Research Center. An AI study was conducted for the first time during the 2013 breeding season by SeaWorld reproductive scientists, aviculturists and veterinary staff. Four females were separated from their paired male at least one week before the estimated date of egg lay. Females were fed and maintained in their nest site until egg lay was completed (Fig. 1). Female bodyweight and general health/body condition was monitored during the separation period, and weekly bloods were collected for retrospective hormone and biochemical analyses. Cloacal inseminations were performed once weekly under anesthesia (15 to 20 min total procedural time) with semen chilled at 5°C for up to 20 h prior to insemination. The semen donor was different for each week of insemination to allow determination of the AI sire.

Females were separated from their paired males for 11-24 days without any health complications. This separation approach was considered acceptable since wild female Magellanic penguins typically fast for up to a month during the time taken for courtship, egg lay and the first half of egg incubation before being relieved at the nest by the male after his foraging trip[3]. A total of seven eggs were laid and all were fertile based on standard candling observations and genetic analysis. Conceptions occurred between 5-11 days after AI with semen that was chilled between 3-20 h prior to AI. Four eggs hatched from three females and genetic analyses confirmed that all four chicks were sired by AI males. It is to our understanding that the chicks are the first offspring of any penguin species to be produced using AI. The chicks represent an important step toward

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Fig. 2. Magellanic penguin chicks produced during the 2013 breeding season using artificial insemination. From left to right: MG0182 (Sire MG0127: no living offspring/Dam MG7517: 4 living offspring), MG0177 (Sire MG0138: no living offspring/Dam MG0103: 1 living offspring), MG0183 (Sire MG0138: no living offspring/Dam MG0097: no living offspring); MG0181 (Sire MG0127: no living offspring/Dam MG7517: 4 living offspring). (Photo: Mike Aguilera, SeaWorld San Diego).

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maintaining the genetic diversity of the Magellanic penguin population with respect to the genetic representation of their sire and dam (Fig. 2.).

Summary: The fertility of Magellanic penguin semen chilled for up to 20 h was high and fertile eggs were obtained up to 11 days after AI. These results are encouraging as they indicate that it is possible for zoos within the USA to share Magellanic penguin genetics without having to transport an animal, and instead transport chilled semen for use in AI. The results of this research phase have immediate application to the management of SeaWorld's Magellanic penguin population; any genetically under-represented female Magellanic penguins will be inseminated in the 2014 breeding season with chilled semen from males of an appropriate genetic match. Our ongoing research will focus on: (i) characterization of weekly profiles of peripheral plasma hormones and biochemical parameters of AI females to improve our understanding of ovulation timing, and (ii) conducting AI trials to determine the fertility of cryopreserved semen.

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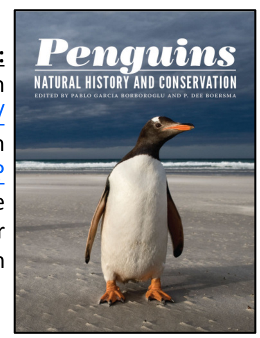
2. O'Brien JK, Oehler DA, Malowski SP. and Roth TL. 1999. Semen collection, characterization and cryopreservation in a Magellanic penguin (*Spheniscus magellanicus*). Zoo Biology 18:199-214.
3. Yorio P, Boersma PD. 1994. Causes of nest desertion during incubation in the Magellanic Penguin (*Spheniscus magellanicus*). Condor 96:1076-1083.

Acknowledgments: Curatorial, keeper and veterinary staff at SeaWorld San Diego are thanked for their support and assistance with semen collection and artificial insemination procedures. Staff at the SeaWorld and Busch Gardens Reproductive Research Center are also thanked for technical assistance. Dr Jean Dubach of the Loyola University Medical Center (Chicago) is gratefully acknowledged for conducting genetic analyses.

Two Much-Awaited Penguin Books Now Available

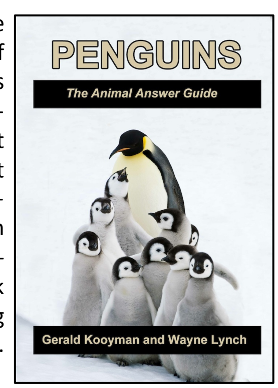
Penguins: Natural History and Conservation



The book that was discussed and anticipated at IPC7 (International Penguin Conference, 2010), **Penguins: Natural History and Conservation**, is now available! It was published by the University of Washington Press and can be purchased through their website (http://www.washington.edu/uwpress/search/books/BORPEN.html), the University of Washington Bookstore, other local book stores, and online. You can watch a video preview about the book at http://www.youtube.com/watch?feature=player_detailpage&v=Ka9gIw1VrsM. It is recommended as an engaging and comprehensive review of penguins, their natural history and conservation status. Zoos and aquariums should consider offering this book in their gift shops to help visitors learn more about penguins and perhaps inspire them to take action for conservation.

Penguins: The Animal Answer Guide

Dr. Gerald Kooyman, professor emeritus at the Scripps Institution of Oceanography, has teamed up with Dr. Wayne Lynch, Canada's most published wildlife photographer, to author a book on penguins. This book is written in such a way as to make the information widely accessible. As the September publication date nears, **PCN** asked Dr. Kooyman to share his thoughts about his new book:



"Writing "**Penguins: the Animal Answer Guide**" was a special challenge. Most of the questions were already provided by Johns Hopkins University Press in a general format established for the series. Of course there were modifications to suit the subject. There is not much interest in how deep squirrels dive, but there is for penguins. The series of questions that I was supposed to answer was like an open-book exam, which I have not experienced since I was a student. Taking the "exam" revealed to me that I did not know much about penguins other than kings and emperor penguins, which are my specialty. It was hard work, but enjoyable, as I searched the literature for answers to some of the most basic questions. My answers are not technical. They are written with the young as well as the old students in mind, who are not necessarily aspiring scientists. Indeed, in my view everyone is a student. The outcome of the writing, for me, was a journey through literature and reports, which in my daily work would not have been pursued. I am glad for the trip. I hope the reader feels the same after reading various sections of the book. Skipping around is a useful approach since there is no beginning or end. Let curiosity be the guide."

The Demography is in the Details: A Review of Life Tables From Ten Species of Zoo Penguins

Colleen Lynch, M.S., *Curator of Birds, Riverbanks Zoo and Garden & Consulting Population Biologist, AZA PMC*

Introduction: Zoos present a unique opportunity, not always available to field researchers, for detailed monitoring and documentation of life history events (births/hatches and deaths) of known-aged individuals throughout their entire lifetimes. Each individual is tracked through birth/hatch, reproduction, and death in a national or international database known as a studbook. Collecting this scope of detailed data in the field can be especially difficult for long-lived species such as penguins as individual animals outlive individual studies. This became clear at IPC7, where the most common questions field researchers posed to zoological managers pertained to the life and reproductive spans of animals in zoological facilities.

Animal management may be a confounding variable; constant food availability, predation release, veterinary care, managed breeding programs, and other factors certainly influence vital rates. The observed rates still, however, represent biological possibilities and limits that may otherwise be unknown to field researchers. Detailed life history data for penguin species exhibited in AZA (Association of Zoos and Aquariums) accredited facilities represent more than 9000 individuals from ten species over several decades. Age-specific mortality and fecundity rates including first and last reproduction, median survivorship (including Q_x0), maximum life expectancy, and other demographic parameters were derived from these data and presented at IPC8. Additionally, factors influencing the applications of these data from zoo populations to field studies were discussed.

Methods: Data were collected from the North American Regional Studbooks for ten penguin species having significant holdings in the region. Birth, death, and reproductive events from known individuals were exported from studbooks maintained in software databases SPARKS V 1.5 or PopLink V 2.4. These data were compiled into Leslie matrix life tables using PM2000 V 1.213. Calculations include age-specific vital rates for mortality (Q_x), fecundity (M_x), survival (P_x), survivorship (l_x), and life expectancy (E_x). Unlike life tables typically compiled for wild populations, zoo life tables are also sex-specific as both male and female reproductive data are readily available.

Results: Male and female life tables were calculated for the following species and are available from the author: Adelie, African, Chinstrap, Gentoo, Humboldt, King, Little Blue, Macaroni, Magellanic, and Short-crested Rockhopper penguins *[Editors' note: The author has agreed to publish these life tables in a forthcoming issue of the PCN].* Sample size per species ranged from N = 311 (Little Blue) to 2971(African). The Humboldt penguin female life table is included as an example. Additional data derived from the studbooks include clutch size (median and range), generation time (average age at reproduction) and expected Lambda (proportional change in population size from one time step to the next).

	Adelie	African	Chinstrap	Gentoo	Humboldt	King	L.Blue	Macaroni	Magellanic	Rockhopper
Maximum Longevity	31	39	24	31	37	40	31	30	31	40
Median Survivorship	14	7	19	23	7	24	4	24	6	11
Age at First Reproduction	2	3	3	1	1	2	1	2	3	2
Age at Last Reproduction	29	30	18	26	31	34	16	29	30	26
Clutch Size Range	1 to 3	1 to 3	1 to 2	1 to 3	1 to 2	1 to 2	1 to 3	1 to 2	1 to 3	1 to 2
Median Clutch Size	1.36	1.25	1.30	1.30	1.32	1.00	1.23	1.12	1.32	1.17
1st Year Mortality	0.08	0.32	0.22	0.19	0.33	0.12	0.83	0.16	0.22	0.22

Life table for female Humboldt penguins housed in AZA facilities from 1988-2011.
Lambda = 1.0312; generation time (T) = 11.52.

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Age (x)	Q_x	P_x	l_x	M_x	E_x	Risk (Q_x)	Risk (M_x)
0	0.33	0.67	1	0	14.09	286.9	199.3
1	0.04	0.96	0.67	0.01	16.647	185	179.4
2	0.03	0.97	0.643	0.08	16.216	174.1	172.6
3	0.05	0.95	0.624	0.11	15.847	171.3	166.2
4	0.07	0.93	0.593	0.1	15.791	160.5	153
5	0.06	0.94	0.551	0.14	15.822	147.3	143
6	0.03	0.97	0.518	0.18	15.528	143.2	139.9
7	0.04	0.96	0.503	0.17	15.054	139.6	134.8
8	0.03	0.97	0.482	0.14	14.565	129.6	126.4
9	0.06	0.94	0.468	0.13	14.201	125.4	119.5
10	0.02	0.98	0.44	0.16	13.76	116.9	115.2
11	0.07	0.93	0.431	0.14	13.357	109	105.4
12	0.03	0.97	0.401	0.22	13.018	99.3	98
13	0.04	0.96	0.389	0.14	12.453	94.6	93.4
14	0.06	0.94	0.373	0.12	12.053	84.6	81.5
15	0.04	0.96	0.351	0.14	11.638	69.7	67.4
16	0.1	0.9	0.337	0.18	11.432	68.7	65.6
17	0.05	0.95	0.303	0.18	11.294	60.8	59
18	0.03	0.97	0.288	0.26	10.725	63.6	63.1
19	0.06	0.94	0.279	0.23	10.181	57	55
20	0.04	0.96	0.263	0.17	9.667	45	43.5
21	0.03	0.97	0.252	0.12	8.983	37.2	37
22	0.06	0.94	0.245	0.05	8.357	32.7	31.9
23	0.04	0.96	0.23	0	7.747	28.2	27.7
24	0.04	0.96	0.221	0	7.028	25.1	24.3
25	0.21	0.79	0.212	0.12	6.875	23.5	20.8
26	0.05	0.95	0.167	0.08	6.827	18.7	18.2
27	0.06	0.94	0.159	0	6.165	18.1	18
28	0	1	0.149	0.03	5.33	15.1	15.1
29	0.2	0.8	0.149	0	4.811	12.3	11.5
30	0.11	0.89	0.12	0	4.537	9	8.3
31	0.12	0.88	0.106	0.07	3.995	8	7.1
32	0.29	0.71	0.094	0	3.742	7	5.9
33	0	1	0.067	0	3.302	5	5
34	0.2	0.8	0.067	0	2.558	5	4.9
35	0.25	0.75	0.053	0	2.003	4	3.4
36	0.33	0.67	0.04	0	1.401	3	2.8
37	1	0	0.027	0	1	2	1
38	1	0	0	0	0	0	0

Discussion: Animal management influences vital rates in several ways. Yet data generated in AZA may still be appropriate for use in the modelling and management of wild populations. However impacted by management, **observed vital rates may represent either biological limits or biological possibilities**.

- **Q_x:** Mortality is indirectly influenced in many ways. Modern veterinary care, reliable food supplies, and predation release may all decrease mortality across all age classes. Median survivorship (l_x = 0.5) and maximum life expectancy (l_x = 0) may be extended in zoos. **Q_x values likely represent biological limits for penguins rather than accurate representations of age-specific rates for wild populations.** (For some species, time in captivity may still limit observations of biological maximum longevity.)

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- **M_x:** Fecundity is directly influenced by animal management. Carrying capacity in zoological facilities is limited. As breeding efforts are often focused based on genetic considerations, many individuals may be actively prevented from breeding, reducing individual fecundity. On the other hand, management actions such as artificial incubation, multiple clutching, and cross-fostering may increase individual fecundity. Reproductive span has been found to be increased in zoo species from reptiles to primates as ample nutritional resources result in earlier reproduction and veterinary care and assisted reproductive technology assists breeding in older (or even deceased) animals. It is also important to note that studbooks record number of offspring hatched rather than number of eggs laid. **M_x values, therefore, are more likely to represent biological possibilities for wild penguins rather than biological limits.**

There are many instances in which wild population research and management can be informed using data from zoological settings. Life tables derived from zoo data have been used most commonly to parameterize population viability analyses. These data may also be used to inform basic experimental design and modelling for ecological, epidemiological, behavioural, and other studies. The key to successfully using these data is understanding how they are generated and are influenced by zoological care and management.

Acknowledgements: Thank you to all of the referenced studbook keepers, the AZA Penguin Taxon Advisory Group, and Riverbanks Zoo and Garden for supporting this analysis.

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Events and Announcements

- 1-6 September 2013: **8th International Penguin Conference**, Bristol, UK.
- 19 October 2013: **Mystic Aquarium's 7th Annual Penguin Run/Walk**. The 5k run or two-mile walk helps raise funds to benefit African penguins. http://www.mysticaquarium.org/visit/calendar/details/161-penguinrunwalk.
- 11-15 November 2013: **Training and Enrichment Workshop for Zoo and Aquarium Animals** presented by Active Environments and Shape of Enrichment. Hosted by Moody Gardens, Galveston, Texas, USA, the workshop cost is US$1,350 Single-US$975 Double. Go to www.activeenvironments.org to register.
- 18-22 November 2013: **Avian Incubation Workshop** hosted by San Diego Zoo Global and the Los Angeles Zoo. The workshop consists of hands-on lab instruction and site visits of incubation facilities at the San Diego Zoo's Avian Propagation Center, the San Diego Zoo Safari Park and SeaWorld San Diego. Registration fee US$300. For more information contact AIW@sandiegozoo.org.
- 20 January 2014: **Penguin Awareness Day**. Mark your calendar and use this day to promote penguins and take action for conservation.
- 25 April 2014: **World Penguin Day**. Another opportunity to bring penguins to the forefront.
- 12-16 October, 2015 *Proposed Dates*: **World Seabird Conference II**, Cape Town, South Africa www.seabirds.net.