



Penguin Conservation

The Penguin TAG Newsletter

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OF ZOOS &
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From the Editors

The 9th International Penguin Congress was held in Cape Town, South Africa on September 5-9, 2016 with over 225 delegates attending. Steve Sarro and Gayle Sirpenski were among several delegates from the AZA zoo and aquarium community. They represented the African Penguin Species Survival Plan (SSP) and presented a poster on the African Penguin SSP initiatives under the AZA "Saving Animals from Extinction" (SAFE) plan. AZA's SAFE focuses on endangered SSP species to identify challenges and develop action plans. The full IPC9 program is available for download at <http://ipc9.adu.org.za/Programme.htm> and contains links to the presentation abstracts. Poster abstracts are available by link at http://ipc9.adu.org.za/ipc9_posters.php. The next Penguin Congress, IPC10, is slated for Dunedin, New Zealand in 2019 with tentative dates of 26-30 August.

Also during the IPC9, the IUCN Penguin Specialist Group (PSG) Steering Committee, along with a representative from BirdLife, and several penguin biologists, met for a two-day workshop to review and compile scientific data for 18 penguin species. The status of the 12 species of the ex situ penguin population living in accredited zoos and aquariums around the world was also reviewed. The PSG was originally established in 2015 with the goal of informing conservation policies and actions. The results of this meeting, which will be used to update the IUCN Red List, are presented for the first time in this issue.

Over 14,000 penguins of 12 species live in accredited zoos and aquariums around the world. These facilities are able to provide informal science education and conservation messaging to millions of visitors annually. In addition, this provides scientists and field researchers the opportunity to reach an audience that they normally would not have access to. Tom Schneider, Penguin TAG Chair, provides a history of penguins in AZA accredited zoos and aquariums, and describes the science behind maintaining genetic diversity and population sustainability. The status of penguins in the various regional zoo and aquarium associations is also provided.

Robert Webster, zoo and aquarium avian population analyst extraordinaire, provides a comparison of penguin populations from one to ten years in AZA accredited facilities and for penguin populations in European facilities at the end of the 2016 calendar year. We in the avian community look forward to these thorough annual reports.

Also in this issue, Lauren DuBois describes her experience with Homeward Bound, a year-long leadership development program focusing on women in science, technology, engineering and mathematics, that culminates in an expedition to Antarctica. The program vision is to support a global collaboration of 1,000 women leaders who can contribute to a more sustainable world. Lauren was one of 76 women with varying backgrounds from around the world selected for the inaugural voyage in November 2016. Lauren describes the journey to the Antarctic Peninsula where the group participated in a Symposium at Sea, experienced the amazing wildlife and landscape, and visited three research stations. Congratulations Lauren!

And finally, Judy St. Leger provides a memorial tribute to Frank Todd, renowned penguin and waterfowl biologist, author and wildlife photographer. Frank spent over 40 seasons studying penguins and other bird life in the Antarctic, subantarctic and Arctic regions. At the request of the National Science Foundation, he established an *ex-situ* population of Adélie and emperor penguins to facilitate year-round research. He pioneered the techniques required to transport penguin eggs *ex-situ* and achieved the first emperor penguin breeding outside the Antarctic. The penguins hatched from these collected eggs are the founders for the majority of penguins living in U.S. zoos and aquariums today. Frank's vision when developing the world-famous Penguin Encounters at SeaWorld parks was to provide a life-changing experience for visitors. As Frank Todd reminded us many times, "This is the power of penguins". With the conservation threats facing penguins and other organisms worldwide, we should remember Frank's other constant advice, "Keep the faith".

We thank Dee Boersma, *University of Washington* and the *Global Penguin Society*, Steve Sarro, *Smithsonian's National Zoo*, Gayle Sirpenski, *Mystic Aquarium*, Tom Schneider, *Detroit Zoological Institute*, Colleen Lynch, *Riverbanks Zoological Gardens*, Lauren DuBois, *Project Wildlife*, *San Diego Humane Society*, Robert Webster, *Avian Scientific Advisory Group (AZA)*, and Judy St. Leger, *SeaWorld San Diego* for their contributions.

Penguin TAG Steering Committee

Chair: Tom Schneider (Detroit Zoological Institute)

Vice Chair: Heather Urquhart (New England Aquarium)

Secretary: Gayle Sirpenski (Mystic Aquarium)

Members: Stephanie Costelow (SeaWorld San Diego), Colleen Lynch (Riverbanks Zoo and Garden), Steve Sarro (Smithsonian's National Zoo), Ric Urban (Newport Aquarium), Susan Cardillo (Central Park Zoo), Mary Jo Willis (Denver Zoo), Stephanie Huettner (Omaha's Henry Doorly Zoo), Diane Olsen (Aquarium at Moody Gardens), Geneve Darnell (Jacksonville Zoo), Alex Waier (Milwaukee County Zoo), Jen Kottyan (Maryland Zoo in Baltimore), Rachel Richason (Santa Barbara Zoo)

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.

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9th International Penguin Congress: Cape Town, South Africa, 5-9 September 2016

Steve Sarro, *Smithsonian's National Zoo* and Gayle Sirpenski, *Mystic Aquarium*

For the ninth time since 1988 penguin researchers, conservationists, advocates, managing authorities and members of the zoo and aquarium community (including 17 delegates from AZA organizations) convened to share their life's work, ideas and stories at the *International Penguin Congress* (IPC). A change from the term "conference" to "congress" was adopted by the International Scientific Committee at the IPC meeting in Bristol, UK in 2013 in order to better describe this large meeting with a small gathering of people. Just over 225 delegates attended but the list read like a "Who's Who" in the world of penguin conservation. Lewis Pugh, maritime lawyer and pioneer swimmer gave an inspiring keynote speech on the first day. As the UN Patron of the Oceans, he swims in near frozen lakes and seas, including all seven seas, to draw attention to the threats facing the animals and the vulnerable ecosystems.

The International Scientific Committee, including Penguin TAG Vice Chair Heather Urquhart (New England Aquarium), put together an amazing program. Penguin TAG Chair, Tom Schneider (Detroit Zoo) gave a great presentation on the sustainable management of AZA penguin populations. The oral presentations ranged from dietary preference of free-range penguins to predator study and associated mortality to the effects of global warming on prey distribution to extinct prehistoric penguin species and their ranges. In addition to the enlightening talks, there were over 90 poster presentations.

Both Tom and Heather were invited to attend the Penguin Specialist Group (PSG) meeting prior to the IPC. The PSG is one of 140 specialist groups that work under IUCN's Species Survival Commission. Their mission is to "provide scientific advice that informs policy and engages people in effective conservation action". PSG Co-Chair Dr. Popi Garcia Borboroglu and Dr. Susie Ellis spoke about the recent changes to the IUCN Red List. Adelie and Gentoo penguins were downlisted to Least Concern (LC) from Near Threatened (NT) and Royal penguins were uplisted to Near Threatened from Vulnerable (V). Fifty-five percent of penguin species are now considered threatened with extinction (Endangered or Vulnerable).

Representing the AZA "Saving Animals From Extinction" (SAFE) program and the African Penguin Species Survival Plan (SSP), we presented a poster that highlighted AZA's SAFE African penguin initiative. SAFE is a multi-goal program that focuses efforts on an endangered SSP species such as the African Penguin and identifies the challenges to that specie's future survival. The African penguin SAFE SSP Sustainability Goal focuses on the genetic and demographic health of the North American population. There are eight other goals in the Conservation Work Plan including the artificial nest box development plan, individual identification plan and the health monitoring and rehabilitation project. A number of the researchers were interested in the plans to contribute to the conservation of African Penguins in both *ex-situ* and *in-situ* projects.

Among the many presentations on African penguins, Dr. Richard Sherley spoke about his research using satellite transmitters (PTTs) to track the postnatal dispersal of fledgling African penguins. He found that these

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fledglings from Namibia and western South Africa are not responding to the rapidly changing environment like the adults do by seeking higher densities of fish. Instead, the juveniles forage in the historic areas of higher productivity which are now degraded habitats with inadequate food resources. His work can help highlight the importance of conservation management planning that reduces pressure in areas where forage fish are scarce.

All in all, the IPC was an interesting and educational, yet sobering, account of the state of penguins around the world. Case in point, it was mentioned that if changes do not occur to address the decline of the African penguin, it will be the next species to go extinct in the wild.

The next IPC will be hosted in New Zealand in 2019.

For more information on the 9th IPC and to view the presentation and poster abstracts, go to <http://ipc9.adu.org.za/Programme.htm>.



Steve Sarro and Gayle Sirpenski (third and fourth from the left) and other delegates at IPC9 in Cape Town, South Africa. Photo provided by Gayle Sirpenski.

Evaluating the Status and Trends of Penguin Populations

Boersma¹, P. D., Garcia-Borboroglu², P., Ellis³ S., Crawford⁴, R.J.M., Cárdenas-Alayza⁵, S., Chiaradia⁶, A., Mattern⁷, T., Moreno⁸, R., Pütz⁹, K., Schneider¹⁰, T., Seddon¹¹, P.J., Simeone¹², A., Steinfurth¹³, A., Trathan¹⁴, P.N., Waller¹⁵, L.J., and B. Wienecke¹⁶.

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14. British Antarctic Survey, High Cross, Madingley Road, Cambridge CB30ET, United Kingdom
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In 2015 the International Union for the Conservation of Nature (IUCN) approved the formation of a Penguin Specialist Group (PSG) co-chaired by Popi Garcia-Borboroglu and Dee Boersma. The PSG Steering Committee met for the first time in March 2016 in Florida where the group agreed that an update of the threat status of penguins needed to be conducted prior to the 9th International Penguin Congress (IPC9). The Global Penguin Society funded the meeting. A two-day workshop was held on September 4 and 5 in Cape Town, South Africa. A BirdLife representative participated in the workshop as BirdLife is responsible for the 2016 IUCN Red List re-assessment of all bird species. Many other interested penguin biologists also attended and participated. The group reviewed all 18 species of penguins compiling detailed up-to-date scientific information for the purposes of the IUCN Red List through BirdLife. The group also reviewed the status of captive populations of penguins. The workshop was funded by the Global Penguin Society and the results for each species and captive penguins are provided below.

The **Emperor Penguin** (*Aptenodytes forsteri*) has a circumpolar range and when breeding is restricted to the coast and shore fast ice of Antarctica. Breeding colonies occur right around the continent (Fretwell et al. 2012) with at least three-quarters of the breeding colonies vulnerable to predicted future changes in sea ice conditions; one-fifth of the colonies may be near-extinct by 2100 (Jenouvrier et al. 2014). There are regional variations in population declines but colonies located north of 70°S have a 46% probability of decreasing of up to >90% by the end of this century (Jenouvrier et al. 2014). This species was considered Near Threatened in 2012 because of the uncertainty and potential negative impact of climate change. A survey of satellite images from 2009 located 46 colonies containing c.238,000 breeding pairs, suggesting a total of c.595,000 individuals (Fretwell et al. 2012). Since then, a further seven colonies have been discovered bringing the total number to 53 colonies (Fretwell, pers. com.); however, a revised estimate of individuals has not yet been done. The species is still considered **Near Threatened**.

The **King Penguin** (*Aptenodytes patagonicus*) has a range of more than 20,000 km² and several large colonies appear to have stabilized at lower than pre-exploitation levels. The global population appears to be stable and is estimated to be 1.6 million breeding pairs (Bost et al. 2013). King Penguins have a prolonged

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breeding season (14-15 months) with an asynchronous laying period. The annual molt occurs from October until January with arrival at breeding colonies between September and November. King Penguins spend much of their time near breeding areas. Because of its range and abundance the species is considered **Least Concern**.

The **Adélie Penguin** (*Pygoscelis adeliae*) is found along the entire Antarctic coast and at nearby islands. Individuals are dispersive, moving towards areas of persistent sea ice to molt after breeding (Ainley et al. 2010). Numbers are increasing in Victoria Land in the Ross Sea and in other areas of East Antarctica. It is also increasing in the southern Antarctic Peninsula regions (Lyver et al. 2014, Southwell et al. 2015, Saillely et al. 2013), but is decreasing or stable in the northern Peninsula region (Lynch et al. 2012, Fountain et al. in press). Lynch and La Rue (2014) estimated the global population to be 3.79 million pairs (range 3.52-4.10 million pairs), equating to 7.58 million animals, based on satellite imagery obtained between 2006 and 2011. The global population has increased making the status for this species **Least Concern**.

The **Chinstrap Penguin** (*Pygoscelis antarctica*) has a circumpolar distribution with a previous estimated world population of ~4 million breeding pairs (Convey et al 1999). However, population information for many sites is unknown or out of date. Population trends for chinstrap penguins, although complex and somewhat regional in extent and timing, suggest that the species experienced a dramatic increase in numbers following the harvesting of fur seals and whales from the early 1800s to mid-1900s and the development and expansion of sub-Antarctic finfish fisheries that began in the 1960s. Chinstrap populations probably reached their peak in the late 1970s but have since experienced significant declines at some, but not all, breeding sites (Trivelpiece et al. 2011; Lynch et al. 2016). A recent analysis of published data on chinstraps in the Antarctic Peninsula region reports an estimated population decline of $1.1 \pm 0.8\%$ per annum since 1980 (Lynch et al. 2012). Recent volcanic activity near the Zavodovski breeding colony in the South Sandwich Islands may harm local populations but its distribution and large population make its status **Least Concern**.

The **Gentoo Penguin** (*Pygoscelis papua*) has a circumpolar breeding distribution estimated to be 387,000 pairs. The population is increasing, particularly in the south of its range (Lynch 2013). Population trends are difficult to establish because of large year-to-year fluctuations in the size of the breeding population. The increase in numbers of this species and expansion of breeding range to Chile, Argentina, and the Falklands/Malvinas warrants a down-listing of the species to **Least Concern**. However, the South African population at the Prince Edward Islands in the south-wet Indian Ocean has decreased rapidly and is considered **locally Endangered** (Crawford et al. 2014).

The **Yellow-Eyed Penguin** (*Megadyptes antipodes*) is endemic to New Zealand where it breeds mainly along the south-eastern coastlines of the South Island, Stewart Island and outlying islands, and the sub-Antarctic Auckland and Campbell Islands. The breeding range is fragmented with the subpopulations living on the mainland and the two sub-Antarctic islands are considered distinct management units (Boessenkool et al. 2009). While historically loss of breeding habitat was considered a main threat to the mainland population, changes in the marine environment, introduced predators and disease outbreaks pose significant threats (Seddon et al. 2013). Little is known about population trends or threats on the sub-Antarctic islands, but climate change could be impacting the species. Adults forage within about 50km of their breeding colony (Mattern et al. 2007). The species is considered **Endangered** because of its small, fragmented breeding range, small population size, and the apparent decline of the South Island Population.

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The **Southern Rockhopper Penguin** (*Eudyptes chrysocome*) breeds on islands located in the South Atlantic, Indian and Pacific Oceans. Other than the population in Chile, which may have increased (Oehler et al. 2008), almost all other subpopulations have undergone severe and often rapid declines (Ellis et al. 1998, Dyer and Crawford 2015). In New Zealand declines have paused in recent years (Morrison et al. 2015). The population in the Falkland Islands has shown a recent increase, but it is not yet clear whether this trend will continue. The classification of the population as **Vulnerable** appears warranted.

The **Northern Rockhopper Penguin** (*Eudyptes moseleyi*) is found in the temperate South Atlantic and Indian Oceans (Cuthbert 2013). The confined distribution, few breeding locations and rapid decline over the last 30 years is why this species is classified as **Endangered**. Approximately 2 million pairs (98%) were lost from Gough Island between 1955 and 2006 and Tristan da Cunha is thought to have held hundreds of thousands of pairs in the 1870s, which were reduced to around 5,000 pairs by 1955 (Cuthbert et al. 2009). Cuthbert 2013 estimated the population size as between 190,000 to 230,000 pairs. The growing fur seal population (*Arctocephalus tropicalis*), changes in sea surface temperature/marine productivity, human-induced activities like oil pollution, and introduced predators all play a role in the decline of this species and its classification as Endangered status.

The **Erect-Crested Penguin** (*Eudyptes sclateri*) breeds on the Antipodes and Bounty Islands (20 km² and 1 km² respectively) to the south of New Zealand. Nest counts suggested perhaps 60,000 pairs remain (Hiscock and Chilvers 2014, Miskelly 2013). The population declined rapidly over the last three generations, resulting in the status of **Endangered** (Davis 2013). There is an urgent need for consistent census data and a better understanding of this species.

The **Fiordland Penguins** (*Eudyptes pachyrhynchus*) breeds in New Zealand on the west to south-west coast of the South Island, on Stewart Island, Solander Island, and several New Zealand offshore islands. Based on a terrestrial survey in the 1990's and data compiled from unpublished reports (Mattern 2013) and a series of comprehensive surveys in parts of the species range (Long 2014), the breeding population is estimated to be between 4,400 and 5,600 birds (Mattern 2013; Long 2014). The small population size, restricted range, an apparent decline in some sites and ongoing threats from introduced predators warrants a classification of this species as **Vulnerable**.

The **Snares Penguin** (*Eudyptes robustus*) breeds on the Snares Islands (3 km²), 200 km south of New Zealand. In 2013, surveys found more than 25,000 pairs (Hiscock and Chilvers 2016). Snares penguins travel up to 200 km east of the islands during incubation and stay within an 80 km when they have chicks (Mattern 2013). During the winter migration, the birds venture up to 3,500 km westwards into the Indian Ocean, principally staying in subtropical waters north of 45°S (Thompson 2016). The population appears to be stable. The isolated location and its small population indicate that stochastic events and human activities could impact the population, thus its classification as **Vulnerable**.

The **Macaroni Penguin** (*Eudyptes chrysolophus*) breeds in at least 258 colonies at 55 breeding sites with a population of 6.3 million breeding pairs (Crossin et al. 2013). The global population appears to have declined rapidly over the last three generations (36 years), leading to a listing as **Vulnerable**. The primary drivers of declines are uncertain but include climatic variation and competition for food from recovering populations of marine mammals (Trathan et al. 2012). During the winter, individuals from South Georgia spend most of their time widely distributed across the Scotia Sea (Ratcliffe et al. 2015). In contrast, macaroni penguins from the Kerguelen Is. showed strong inter-annual fidelity to their wintering sites spending most of their time in a narrow latitudinal band (47-49 degrees S) within the central Indian Ocean (70-110 degrees E), corresponding oceanographically to the Polar Frontal Zone (Thiebot et al. 2011).

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The **Royal Penguin** (*Eudyptes schlegeli*) is restricted to a breeding areas smaller than 100km² on Macquarie Island, Australia and nearby islands. The population is considered stable. The species was heavily exploited in the 19th century, but recovered. By 1984-1985, an estimated 850,000 pairs nested on Macquarie Island (Garnett and Crowley 2000). Feral cats were eradicated from Macquarie in 2001, and rodents and rabbits were eradicated in 2014 (Parks and Wildlife Service 2014). Removal of introduced species will benefit the species. The restricted breeding range, past degradation of breeding habitat and introduced predators, now recently removed, indicate a classification of the species as **Near Threatened**.

The **African Penguin** (*Spheniscus demersus*) is endemic to southern Africa where it breeds at 28 localities in Namibia and South Africa (Crawford et al. 2013, Kemper 2015). It is estimated that there may have been more than 1 million adult birds on just Dassen Island in the 1920's (Crawford et al. 2007). The global population has declined to such an extent that in 2015 the population was estimated to be only about 25,000 pairs (Crawford et al. 2013, Department of Environmental Affairs unpubl. data, MFMR, unpubl. data). The adults of this species are largely resident but there is some movement in response to prey (Hockey et al. 2005). This species is classified as **Endangered** because it has undergone a population decline of > 50% in the three most recent generations. While the species faces numerous threats the current likely drivers of the decline are food scarcity resulting from shifts in prey populations, which are likely driven by environmental change (Crawford et al. 2015), and competition with fisheries for prey (Crawford et al. 2011). Reversing the trend without expanded conservation actions that include securing sufficient prey appears unlikely.

The **Magellanic Penguin** (*Spheniscus magellanicus*) breeds on the Atlantic and Pacific coasts of South America, and the Falkland/ Malvinas Islands (Boersma et al. 2013). In the Atlantic, most individuals migrate north in the winter to northern Argentina, Uruguay, or southern Brazil and more rarely to northern Brazil (García-Borboroglu et al. 2010, Stokes et al. 2014). Magellanic penguins in the Pacific are less migratory, but some travel as much as 1000 km north (Skewgar et al. 2014, Pütz et al. 2016). The world population is estimated at between 1.1 and 1.6 million pairs with population trends varying among colonies and regions. The breeding population in Argentina has expanded north since the 1960s, with new colonies established and growing rapidly (Pozzi et al. 2015). The population is considered **Near Threatened** as oil pollution, fisheries interactions, and climate change (Boersma and Rebstock 2014) are ongoing sources of mortality (Boersma et al. 2013).

The **Humboldt Penguin** (*Spheniscus humboldti*) occurs along west coast of South America from Isla Foca (5° 12'S) in Peru down to Isla Guafo (43° 32'S) in southern Chile. The population is estimated at nearly 32,000 mature individuals. Historically, the population declined starting in the mid-1800s because extensive guano harvesting removed preferred nesting habitat. The population of this penguin fluctuates because of El Niño Southern Oscillation (ENSO) event which can be close to one order of magnitude at major colonies (de la Puente et al. 2013). A current analysis of population trends reveal high uncertainty in the quality of population numbers taken in the past three generations, with important deficiencies in the coverage of breeding sites and in the methodology employed to count penguins within and between the two countries (Simeone and Cárdenas unpublished). Interpreting the current trend of the population is problematic and further research is needed but due to this uncertainty in climate variation and fisheries management, the species qualifies as **Vulnerable**.

The **Galápagos Penguin** (*Spheniscus mendiculus*) is endemic to the Galápagos archipelago, Ecuador breeding on four islands, and several offshore islets. It is the most northerly species of penguin with approximately 95% of the population found on Isabela and Fernandina Islands. Its distribution is highly linked to the cool and

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nutrient-rich oceanic waters in the western Galápagos archipelago that allows for a high density of prey when upwelling is present (Boersma 1977, 1978, Karnauskas et al. 2015). Galápagos penguins undergo severe population fluctuations, primarily as a result of marine perturbations that reduce upwelling during ENSO events and these may become more frequent or extreme through climate change (Boersma et al. 2013). The population is small and has not recovered to what it was in the early 1970s because of several severe ENSOs. The restricted range and confined breeding to a few locations qualifies the Galápagos penguin as **Endangered**.

The **Little Penguin** (*Eudyptula minor*) is endemic; found along the southern coast of Australia and around northern and southern islands of New Zealand. The population size of this species is estimated at just under 500,000 breeding adults. Over all, the population trend appears to be stable with localized decreases at some sites. Where data were available, 51% of sites were stable, 29% deteriorating and 20% improving. These are the only truly nocturnal penguin species arriving on land after dusk and departing land before dawn (Rodríguez et al. 2016). Many populations of little penguins are severely threatened by human disturbance such as introduced predators, domestic dogs, road kill, coastal development, watercraft injuries, oil spills and gillnet fishing in both Australia and New Zealand (Dann 2013). Currently under consideration to be classified as two taxa (*Eudyptula minor* and *Eudyptula novaehollandiae*) (Banks et al. 2002, Grosser et al. 2016). Increasing ocean temperature is already having a negative impact on adult foraging and chick survival (Cannell et al. 2016, Carrol et al. 2016) as well as strong winds (Saraux et al. 2016). The extensive range and large population size make this species classification as **Least Concern**.

Penguins in captivity include 12 species with more than 14,000 penguins in hundreds of accredited zoos and aquariums across the world, including 110 North American institutions in the Association of Zoos and Aquariums (AZA). Zoos and aquariums that are members of one of the regional zoo associations filled out a survey before the PSG workshop, in particular, by The World Association of Zoo and Aquariums (WAZA), the Association of Zoos and Aquariums (AZA), the European Association of Zoos and Aquariums (EAZA), the Zoo and Aquarium Association (ZAA), the Japanese Zoo Association (JAZA), the Pan African Association of Zoos and Aquariums (PAAZA), and the Latin American Zoo and Aquarium Association (ALPZA). Although penguins have been kept in captivity for over 100 years, there was little captive breeding or scientific management until the 1970s, when captive raised individuals began to replace wild-caught individuals in collections. In the 1980s, SeaWorld brought in eggs from the wild and raised the hatchlings of Antarctic species of penguins. AZA now intensively manages penguins using studbooks and specialized analytical software to maintain genetic diversity and demographic stability and determine which animals should breed. The AZA Penguin Taxon Advisory Group (TAG) does not support importation of wild-caught individuals to augment existing AZA penguin populations.

Each regional zoo association manages its own populations and there is limited migration between the regional populations. For more than 30 years, AZA institutions have scientifically managed their penguin populations and are overseen by the Penguin TAG, an AZA committee consisting of representatives from all 110 zoos and aquariums that have penguins at their institutions. The TAG has an elected Steering Committee and a number of advisors with specialized expertise. One of the main responsibilities of the TAG is to develop a Regional Collection Plan (RCP) that reviews all species within the taxa and recommends management for each species. Based on criteria such as husbandry expertise, availability, and institutional commitment, species are recommended to be established, maintain for long-term management, monitored, or phased out so the species is no longer in accredited institutions. Once a species has a long term management plan, the goal of the TAG and the Program Manager is to develop a strategy for sustaining the species in zoos for 100 years or longer.

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The main tool that AZA institutions use to manage animals is the Species Survival Plan® (SSP). Each SSP population is classified as Red, Yellow, or Green depending on the size of the population and projected genetic diversity. Green SSPs are considered to be the most sustainable of managed populations meeting established criteria for population size, genetic health, and extinction risk. Nine of AZA's Penguin SSPs programs are classified as Green meaning they meet the established criteria for population size, genetic health and extinction risk. Of the 12 species with an SSP, the 5-year population trend in captivity is: increasing for 7 (Adélie, African, Chinstrap, Gentoo, Humboldt, Little Blue, Magellanic) stable for 3 (King, Macaroni, and Southern Rockhopper) declining for two (Northern Rockhopper and Emperor) penguins.

SPECIES	AZA	EAZA	PAAZA	JAZA	ALPZA	ZAA	Total
Adelie Penguin <i>Pygoscelis adeliae</i>	167	4	0	164	11	0	346
African Penguin <i>Spheniscus demersus</i>	943	1861	416	622	0	0	3842
Little Blue Penguin <i>Eudyptula minor</i>	100	0	0	30	0	261	391
Chinstrap Penguin <i>Pygoscelis antarctica</i>	158	26	0	91	0	0	275
Emperor Penguin <i>Aptenodytes forsteri</i>	31	0	0	22	0	0	53
Gentoo Penguin <i>Pygoscelis papua</i>	535	534	0	430	5	77	1581
Humboldt Penguin <i>Spheniscus humboldti</i>	405	2500	0	1872	57	0	4834
King Penguin <i>Aptenodytes patagonicus</i>	264	281	0	300	0	76	921
Macaroni Penguin <i>Eudyptes chrysolophus</i>	174	0	0	15	0	0	189
Magellanic Penguin <i>Spheniscus magellanicus</i>	263	120	0	400	63	0	846
Southern Rockhopper Penguin <i>Eudyptes chrysocome</i>	320	60	0	124	0	0	504
Northern Rockhopper Penguin <i>Eudyptes moseleyi</i>	31	95	9	106	0	0	241

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Homeward Bound Launches Women Leaders Into Antarctica

Lauren DuBois, *Director, Project Wildlife, San Diego Humane Society (formerly Assistant Curator of Birds, SeaWorld San Diego), San Diego, CA*

Homeward Bound is an ambitious leadership program for women in Science, Technology, Engineering and Mathematics (STEM) designed to elevate their leadership abilities in scenarios involving a variety of stakeholders. The program is the dream and design of Fabian Dattner, an Australian leadership expert, and Antarctic researcher Jess Melbourne-Thomas, who saw Antarctica as the perfect backdrop to challenge women in STEM fields to better promote climate science. I was fortunate to be chosen as one of the participants for this ground-breaking experience.



The author, Lauren DuBois, among the penguins.



Homeward Bound participants get ready to explore Paulet Island.

November 2016 marked the inaugural launch of the program with participants from all over the world and with varied backgrounds including academics, educational outreach, non-profits and government agencies. I found that the diversity of experiences among participants brought a necessary variety of perspectives to the program.

Prior to the expedition all participants were required to complete diagnostic tests to help recognize leadership styles and preferences. While on board the ship, *Ushuaia*, the leadership and strategic training exercises helped us to evaluate the leadership styles that we prefer and to understand how all styles function. With a better understanding of how to interact with diverse stakeholders, it allowed us to be more successful in discussing climate issues or policies with fellow academics, government officials, and school and community groups. Each participant completed a Strategy Map (professional and personal) as a tool to help us to develop a critical understanding of what we value as we move forward in our careers and personal endeavors.

To share the groups' diverse experiences a Symposium at Sea (S@S) was held to highlight the programs, experiences and work of each participant. These short elevator-type presentations of no more than three minutes demonstrated the skills, research and backgrounds of each participant. The S@S presentations helped us to see the many similarities and challenges we share as we promote science and navigate the struggles of women in the STEM fields.

Antarctica was the perfect backdrop for this expedition, not only for the issues of climate change Antarctica represents, but for the remoteness and peaceful respite it offered for the twenty days on board ship. Our expedition leader was Greg Mortimer, an experienced mountain climber and



Adélie penguin colony on Paulet Island.

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Antarctic expert. We went on numerous trips via zodiac to see penguin colonies, historic areas and research stations.

Highlights among the landings included Paulette Island. The *Ushuaia* had been able to visit Paulette Island only two to three times in the last six years due to ice blocking the landing area. This year, the landing was ice free and we were treated to a colony of 200,000 pairs of Adélie penguins. As we landed on the beach we were greeted by penguins marching along the beach some heading out to sea others back to the nest after foraging. A unique feature of the beach is the how there is a short pebble area to land and walk on. Then within a few feet there are penguin



Adélie penguin on Paulette Island.

nests at eye level. Breathtaking to see these birds sitting tight on nests smack dab in front of you. It was early in the breeding season so no chicks were yet hatched in the nests and the birds were sitting tight on eggs as snow fell. While watching the birds, it was interesting to see the interactions between pairs, neighbors, and interlopers; I have seen these same interactions among the penguins at SeaWorld. The island is also home to a colony of king shags with an impressive number of nests, some already with chicks.

A visit to Baily Head-Deception Island, with a sizeable chinstrap penguin colony, was another amazing landing. The difference in activity between the two colonies was an interesting contrast. The chinstrap penguins were very busy with lots of squawking among the birds (the name "stone cracker" penguin fits) as they greeted one another at the nest. The birds not on the nest, either heading out or returning from the sea, created a highway-view of black backs heading out to sea and white penguin chests returning after a long foraging trip. Many of the birds had their eyes closed, as if on autopilot after a long day. But they all seemed to know where they were going.



Chinstrap penguins at Baily Head-Deception Island.

We also visited three-research stations: Port Lockroy, Carlini Base and Palmer Station.

Port Lockroy is an Antarctic Heritage site. It is staffed for four months of the year, during the tourist season with three to four employees. Their responsibilities include greeting the tour ships, running the gift shop, maintaining the buildings as well as monitoring the gentoo penguin colony.

Carlini Base is an Argentine Base that is staffed year-round. Our tour of the facility was a fascinating insight to life in this remote area. Most science is focused within the bay where the base is located. Some the work

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March of the Gentoo penguins (or the Orange Krill Road) at Deco Island.

includes samples of mollusks from the bay, sediment testing and monitoring of the local glacier. The glacier is retreating at a high rate. This glacier fills a lake which is the main source of fresh water for the station. It will be interesting to see how this glacial retreat will affect the future of Carlini base.

Palmer Station is the United States base. We were fortunate in our landing as they limit the number of ships that visit; ships must enter into a lottery months prior to any intended visit. With our great luck, expedition leader and unique group we were allowed access to the station and its wonderful staff. The tour we were given was a great overview of the research at the station and Antarctica's role as a research platform.

Palmer Long Term Ecological Research ((LTER) is looking at some of the local changes including how warm, moist maritime conditions are migrating south along the peninsula, and changes in the glacier, which has been monitored since 1975 and is receding. There is also work on fish physiology looking at Antarctic Evolution and Medical Research, polar entomology (Antarctica's largest land animal is *Belgic Antarctica*, a species of wingless fly!), chemical ecology, subglacial lakes and monitoring penguins via satellite.

Learning about life on the base was fascinating. The team at the time was a group of 38 individuals with a variety of backgrounds, skills and ages but all exhibiting a sense of camaraderie to ensure that the base remains functional. I felt a great admiration for this team and a sense of pride that this was the US base and they are doing some great work.

As a participant of Homeward Bound I developed a better understanding of leadership styles and perspectives. The adventure in Antarctica was a once-in-a-life-time experience. After experiencing, firsthand, the spectacular, breathtaking and magical environment of Antarctica, I am determined to continue the quest to conserve the penguins, the wingless fly, all the wildlife, this magnificent continent, and what it means for the entire planet.



The author, Lauren DuBois, at Palmer Station.

For more about Homeward Bound: <https://homewardboundprojects.com.au/>

The next trip is planned for February 2018.

All photos provided by Lauren DuBois.

Worldwide Status of Penguins in Zoos and Aquariums

Tom Schneider, *AZA Penguin TAG Chair, Detroit Zoological Society* and Colleen Lynch, *Riverbanks Zoological Gardens*
Contributions: Nick Boyle, *Taronga Conservation Society, Australia*, Martin Zordan, *Asociación Latinoamericana de Parques Zoológicos y Acuarios (ALPZA)*, Jo Elliott, *The Royal Zoological Society of Scotland*, John Werth, *Pan-African Association of Zoos and Aquaria* and Masanori Kurita, *Port of Nagoya Public Aquarium*

Introduction

There are over 14,000 penguins in hundreds of accredited zoos and aquariums across the world, including in 110 AZA institutions. These facilities have the opportunity to reach visitors about their wild counterparts' conservation challenges. In addition, millions of children visit zoos as part of their school curriculum and thousands of teachers receive informal science training at zoos across the world. Zoo penguins provide an opportunity for field researchers to reach an audience to which they would otherwise not have access.

Penguins have been kept in zoos for more than 100 years, but until the 1970s there was little management or reproductive success and recruitment was mostly accomplished by acquisition of additional wild-caught individuals. Beginning in the late 1960s, specialized facilities were built to house temperate penguins, concentrating on African, Humboldt, and Magellanic penguins. These zoo populations were better managed with a priority placed on welfare and reproduction. By the early 1970s, zoo-hatched individuals were replacing wild-caught individuals as the main source of recruitment into zoo populations.

In the late 1960s, there was interest in maintaining the more cold weather species in North America, and facilities designed to meet their specialized environmental requirements began opening in the late 1960s. Zoo populations were small and consisted mostly of wild-caught animals with little cooperative management. When Sea World opened facilities for sub-Antarctic and Antarctic penguins in the early 1980s and needed to acquire large numbers of individuals for their four facilities, they used techniques developed by waterfowl avicultural enthusiasts to collect eggs from nesting birds at several locations. This eliminated the mortality risk of capturing, transporting, and acclimating adult penguins.

Penguin eggs were transported to Sea World in California and their incubation and hand-rearing were overseen by Frank Todd, Corporate Curator of Birds and a renowned waterfowl aviculturist. This collection had little impact on the wild populations, as only one of two eggs were collected from the smaller species and king penguin eggs were collected late in the season when they otherwise would not have survived. These techniques also reduced the logistics of transporting live penguins from remote locations, eliminated transport and acclimation mortality that occurs when collecting adult birds, and produced birds better adapted to a zoo environment. This was very successful, with over 70% of the eggs hatching and 83% of hatched chicks fledged. These birds have formed the founding stock for the existing AZA sub-Antarctic and Antarctic penguin populations. Based on AZA penguin studbook data, there have been only a couple instances that wild-caught individuals have been imported into AZA populations in the last 25 years, and the AZA Penguin TAG does not support importation of wild-caught individuals to augment existing AZA penguin populations.

Zoos from other regional zoo associations have also built both temperate and sub-Antarctic penguin facilities and have used both egg collection and acquisition of wild-caught individuals to found their zoo populations. While there are still some non-releasable rehabilitated penguins that come into zoos, the majority of zoo populations are managed by the reproductive success of existing zoo populations.

Population Management

Each regional zoo association manages their own populations and there is limited migration between the regional populations. For over 30 years AZA institutions have scientifically managed their penguin populations.

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Other regional associations employ similar techniques, but often not across the same spectrum of species.

To scientifically maintain sustainable zoo populations, the AZA analyzes population data and makes population management recommendations. In 2000 the AZA founded the Population Management Center (PMC). Hosted by the Lincoln Park Zoo, the PMC employs a team of population biologists who work with program managers for each species, to analyze and evaluate zoo populations, to develop specialized software and management strategies, and to trouble shoot animal management challenges.

Penguins in AZA institutions are overseen by the Penguin Taxon Advisory Group (TAG), an AZA committee consisting of representatives of all 110 zoos and aquariums that have penguins at their institutions. The TAG has an elected Steering Committee and a number of advisors with specialized expertise. One of the main responsibilities of the TAG is to develop a Regional Collection Plan (RCP) that reviews all species within the taxa and recommends the appropriate level of zoo management for each species. Based on criteria such as husbandry expertise, availability, and institutional commitment, species will be recommended to establish or maintain long-term management plans, to monitor existing populations, to phase out existing populations, to establish new zoo populations, or to not have that species in zoos.

Once a species is recommended for a long term management plan, the goal of the TAG and the Program Manager is to develop a strategy for sustaining the species in zoos for 100 years or longer. The main tool that AZA institutions use to manage animals is the Species Survival Plan® (SSP). Each SSP population is classified as Red, Yellow, or Green depending on the size of the population and projected genetic diversity. Green SSPs are considered to be the most sustainable of managed populations meeting established criteria for population size, genetic health, and extinction risk. Nine of AZA's twelve programs are classified as Green SSPs. Every SSP is analyzed every one to three years to determine the success of the program. SSP population information is listed below.

For an SSP species, population data are recorded using specially designed database softwares by a Program Manager into a Studbook (SB). Databases track individual animals through their lives and include unique identifiers, life history events, and pedigrees.

Using additional population management softwares and methodologies (see Ballou and Lacy 1995, Lacy 1995, Ballou et al 2010), studbooks are analyzed every 1-3 years by the PMC and management recommendations are formulated and documented in a Breeding and Transfer Plan (BTP). Breeding and Transfer Plans include genetic and demographic analyses that illustrate population history, describe population structure, and predict population futures based upon historic data and potential management actions. Demographic data illustrate the age and sex structure of populations and historic census data. Life tables are generated from historic hatch and death events. Pedigrees are analyzed to calculate kinship matrices and quantify gene diversity. From these analyses, breeding efforts are planned to maintain populations within carrying capacities and pairwise scores describing the genetic benefit of all potential matings are created. Studbook data also inform Population Viability Analyses (PVA) to examine long-term extinction risk for each population under varying management scenarios.

The Breeding and Transfer Plan is distributed to all SSP-participating facilities and, after review and consensus, the Plan is implemented. Individual zoos and aquariums function as demes in a meta-population as individual animals transferred between zoos and breeding opportunities are managed to optimize the retention of gene diversity and demographic stability of the population.

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Once a species is determined to have a long term management plan, the goal is to develop a strategy for sustaining the species in zoos for 100 years or longer. The main tool that AZA institutions use to manage animals is the Species Survival Plan® (SSP). Software program Population data are recorded using specially designed software. These plans track all individuals in the population to determine the genetic and demographic viability of the zoo population.

AZA Penguin Population Analysis

Common Name (Genus species)	Date of Last SB/ BTP/ PVA	Current Population Size Total (M.F.U)	Current Number of AZA Institutions	Current % Gene Diversity	SSP Status	Carrying Capacity	Five-Year Population Trend
Adelie Penguin <i>Pygoscelis adeliae</i>	SB - 6/2014 BTP - 11/2015 PVA – 5/2014	167 (82.84.1)	2	98.2	Green	171	Increasing
African Penguin <i>Spheniscus demersus</i>	SB - 3/2016 BTP - 11/2013 PVA – 7/2014	943 (502.425.16)	49	98.7	Green	1100	Increasing
Chinstrap Penguin <i>Pygoscelis antarctica</i>	SB - 7/2015 BTP - 10/2015 PVA – 5/2014	158 (80.78)	5	97.7	Green	170	Increasing
Gentoo Penguin <i>Pygoscelis papua</i>	SB - 1/2015 BTP - 12/2014 PVA – 7/2014	535 (231.269.35)	18	98.8	Green	480	Increasing
Humboldt Pen- guin <i>Spheniscus humboldti</i>	SB - 6/2013 BTP - 10/2015 PVA – 8/2014	405 (198.190.4)	19	98.3	Green	460	Increasing
King Penguin <i>Aptenodytes patagonicus</i>	SB - 6/2016 BTP - 7/2016 PVA – 5/2014	264 (153.111)	16	98.9	Green	290	Stable
Little Blue Penguin <i>Eudyptula minor</i>	SB - 1/2014 BTP - 3/2015 PVA – 5/2014	100 (52.48.1)	6	96.2	Yellow	150	Increasing
Macaroni Penguin <i>Eudyptes chrysolophus</i>	SB - 12/2015 BTP - 8/2016 PVA – 5/2014	174 (74.93.7)	6	98.2	Green	190	Stable

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Common Name (Genus species)	Date of Last SB/BTP/ PVA	Current Population Size Total (M.F.U)	Current Number of AZA Institutions	Current % Gene Diversity	SSP Status	Carrying Capacity	Five- Year Population Trend
Magellanic Penguin <i>Spheniscus magellanicus</i>	SB - 10/2013 BTP - 2/2014 PVA - 6/2014	263 (141.122)	15	98.3	Green	310	Increasing
N. Rockhopper Penguin <i>Eudyptes moseleyi</i>	SB - 1/2014 BTP - 6/2016 PVA - 7/2014	31 (18.13)	3	88.4	Red	60	Decreasing
S. Rockhopper Penguin <i>Eudyptes chrysocome</i>	SB - 5/2016 BTP - 1/2016 PVA - 6/2016	320 (150.170)	19	99.0	Green	460	Stable
Emperor Penguin <i>Aptenodytes forsteri</i>	NA	31 (13.18)	1		Candidate	NA	Decreasing

Zoo Penguin Population Status

Zoo penguins occur in zoos and aquariums across the world, but this document reports only on zoos and aquariums that are members of one of the regional zoo associations that cooperated with the surveys. The regional associations that are represented in this report are listed below:

AZA - Association of Zoos and Aquariums represents more than 230 institutions in North America and overseas, which collectively draw more than 180 million visitors every year. <http://www.aza.org/>

EAZA - The European Association of Zoos and Aquariums consists of 356 European zoos and aquariums and have over 140 million visitors a year. <http://www.eaza.net/>

ZAA - The Zoo and Aquarium Association is the peak body representing the zoo and aquarium community throughout Australasia. ZAA members engage over 17 million visitors and provide education to over 600,000 students each year. <http://www.zooaquarium.org.au/>

JAZA – The Japanese Zoo Association is a gathering of 151 Japanese zoos and aquariums for the purpose of conserving nature and precious animals from an international perspective. <http://www.jaza.jp/english.html>

PAAZA – The Pan African Association of Zoos and Aquariums has 28 members in four countries, with the majority located in South Africa. <http://www.zoosafrika.com/>

ALPZA - Latin American Zoo & Aquarium Association consist of 47 zoos and aquariums from thirteen Latin American countries. <http://www.alpza.com/>

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2016 Population Status of Penguins in Regional Zoo Associations

SPECIES	AZA	EAZA	PAAZA	JAZA	ALPZA	ZAA	Total
Adelie Penguin <i>Pygoscelis adeliae</i>	167	4	0	164	11	0	346
African Penguin <i>Spheniscus demersus</i>	943	1861	416	622	0	0	3842
Little Blue Penguin <i>Eudyptula minor</i>	100	0	0	30	0	261	391
Chinstrap Penguin <i>Pygoscelis antarctica</i>	158	26	0	91	0	0	275
Emperor Penguin <i>Aptenodytes forsteri</i>	31	0	0	22	0	0	53
Gentoo Penguin <i>Pygoscelis papua</i>	535	534	0	430	5	77	1581
Humboldt Penguin <i>Spheniscus humboldti</i>	405	2500	0	1872	57	0	4834
King Penguin <i>Aptenodytes patagonicus</i>	264	281	0	300	0	76	921
Macaroni Penguin <i>Eudyptes chrysolophus</i>	174	0	0	15	0	0	189
Magellanic Penguin <i>Spheniscus magellanicus</i>	263	120	0	400	63	0	846
Southern Rockhopper Penguin <i>Eudyptes chrysocome</i>	320	60	0	124	0	0	504
Northern Rockhopper Penguin <i>Eudyptes moseleyi</i>	31	95	9	106	0	0	241
Fiordland Penguin <i>Eudyptes pachyrhynchus</i>	0	0	0	0	0	0	0
Snares-Penguin <i>Eudyptes sclateri</i>	0	0	0	0	0	0	0
Erect-crested penguin <i>Eudyptes sclateri</i>	0	0	0	0	0	0	0
Royal Penguin <i>Eudyptes schlegeli</i>	0	0	0	0	0	0	0
Yellow-eyed Penguin <i>Megadyptes antipodes</i>	0	0	0	0	0	0	0
Galapagos Penguin <i>Spheniscus mendiculus</i>	0	0	0	0	0	0	0

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List of Penguins in European Zoological Institutions—December 31, 2016

Robert Webster – *Avian Scientific Advisory Group (ASAG) Population Monitor, AZA*

Species * - indicates species is represented by more than one taxa	Population / sex ratio (M.F.Unk)	# of institutions	# hatched last 12 months	December 2016 Population
Humboldt Penguin	1048.1043.290	92	504	2381
Jackass Penguin (African Penguin)	812.745.198	52	235	1752
*Gentoo Penguin	199.205.30	18	64	434
*King Penguin	142.98.33	16	16	273
Magellanic Penguin	52.48.10	7	11	110
Northern Rockhopper Penguin	47.46.3	7	7	96
Macaroni Penguin	27.27.8	4	1	62
Southern Rockhopper Penguin	29.28.0	5	-	57
Chinstrap Penguin	8.17.0	2	-	25
Adelie Penguin	1.3.0	1	-	4

Data compiled from the ZIMS website, December 31, 2016

Frank Todd, Committed Penguin and Waterfowl Biologist

Judy St. Leger, *Corporate V.P., Research and Science, SeaWorld Parks and Entertainment*



Frank Todd with an Emperor penguin chick at SeaWorld San Diego. Photo provided by Joan Embery.

San Diego, CA — Frank S. Todd, 74, died December 8, 2016 at home following a brief illness. Frank leaves behind his daughter, Suzy Todd-Johnson and son-in-law, Chris Johnson; a brother, John and his wife Judy Todd of North Carolina; sister, Joan Rasor of Idaho; nieces and nephews, Sturdy and Kathy Rasor and Eric and John Todd; and many close friends and colleagues around the globe.

Born and raised in Panama, before attending college Frank helped to found the Summit Zoo near Panama City within the Panama Botanical Garden. This small zoo is today home to about 300 animals. One of the attractions of the zoo is the harpy eagle; the national bird of Panama. After moving to the Continental US, Frank Todd received a B.A. from the University of Montana. His original goal was to become a forest ranger, but life had other plans for Frank. In the late 1960s, while working at the LA County Museum of Natural History preparing specimens, he met Dr. Nathan B. Gale from the LA Zoo. Frank wanted a zoo position working with reptiles but the zoo only had an opening with birds. On the advice of Dr. Gale, Frank took the position in

the avian department and with Dr. Gale's mentorship he became the curator of birds for the Los Angeles Zoo. While in the position, Frank worked with Nate Gale and Art Risser on establishing the California Condor Conservation program. This program is now the key to the success of this species in the wild.

In 1972, Frank moved from Los Angeles to San Diego when he was hired to work at SeaWorld by George Millay. At SeaWorld he built and curated one of the largest collections of exotic waterfowl in the world. He was committed to cutting edge zoology; in collaboration with the National Science Foundation he oversaw the development of The SeaWorld Penguin Encounter which opened in May of 1983. This facility serves as the model for zoological penguin holding facilities worldwide. It created a population of penguins where biologists could view the full life cycle of these species without needing to weather cold and dark months in Antarctica. Frank's interest in penguin biology and Antarctic research took him to the Southern Continent every year to study penguins. As the summer research season in Antarctica is during winter in the northern hemisphere, Frank spent many Christmases in the world of the penguin. For him this environment populated by millions of penguins was the only place to be. "A biologist has to be where the action is. We can't forget that animals are unconcerned with the human calendar".

Following his time at SeaWorld, Frank founded EcoCepts International, an environmental and zoological consulting firm. In this capacity he influenced zoos and aquariums internationally in their design and management of birds. He also became a Senior Research Fellow at the Hubbs-Sea World Research Institute in San Diego. Later in life he continued to visit both Arctic and Antarctic waters as resident scientist on research cruises, educating and entertaining in formal lectures and in bars with his vast knowledge and endless collection of pictures. At the time of his death he was serving on the board of the International Wild Waterfowl Association (IWWA) and inspiring conservation and ornithology on a global scale. His catch phrase "Penguin Power" is known to many.

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Frank Todd's achievements were many and he was rewarded with high honors. His singleness of purpose and dedication to his goals were paralleled by few. In recognition of his work in Antarctica, He received the National Science Foundation Polar Medal. His conservation efforts and breeding successes include numerous penguin species as well as work with harpy eagles, red lorikeets, whispering ibis, and giant tinamou. These accomplishments were recognized with the San Diego Zoological Society Conservation Medal, three separate Edward H. Bean awards for penguin breeding accomplishments from the Association of Zoos and Aquariums, and election to the American Game Breeders' Avicultural Hall of Fame and the IWWA Hall of Fame in 2000.

Frank is the author of numerous articles and scientific papers in addition to his books: *Antarctic Splendor; Penguins; Waterfowl: Ducks, Geese and Swans of the World;* and *10,001 Titillating Tidbits of Avian Trivia*. In addition to detailed writing, Frank was an avid and accomplished wildlife photographer. He was committed to sharing the beauty of the animal kingdom and his images were part of many lectures and the foundation of his most adored books. At the time of his death, he was working furiously on his final book, *Waterfowl of North America*. His last adventure was in August of this year to the Island of Kauai in Hawaii seeking out Hawaiian ducks to get just the right images for the text. The chase was hard and the ducks were elusive. In the end, the best images came from some of the biologists he met while on the trip. Always one for details, Frank left specific instruction on how the work was to be completed. Publication is expected in mid-2017.

Frank married Sherlyn Todd in 1966 and they had two children, Jody and Suzy. Sherlyn accompanied Frank on many expeditions. On one memorable adventure, she injured a knee prior to a trip to Antarctica. Sherlyn explained back in 1986 how Frank was so committed to showing her the extensive penguin colonies that, "he took my crutches and leg brace and threw them overboard. From that point on, he became my physical therapist, patiently working with me for hours on end. I was able to climb the mountains of Antarctica, viewing thousands of penguins as he had always wanted me to."

Friends and colleges can make a donation to the Frank Todd Memorial Fund to the IWWA (IWWA c/o Sylvan Heights Bird Park 500 Sylvan Heights Park Way • PO Box 11 Scotland Neck, NC 27874 info@shwpark.com) . Memories can be shared and viewed on the Frank Todd Memorial Facebook page at: <https://www.facebook.com/Frank-S-Todd-Memorial-Tributes-1760246757633522/>.

Websites We Like

Learn more about the Association of Zoos and Aquariums (AZA) Saving Animals From Extinction (SAFE) featuring the African Penguin <https://www.aza.org/SAFE-african-penguin>.

Take action to help protect Chile's Humboldt penguins by visiting this website: <https://www.rainforest-rescue.org/petitions/1085/speak-out-for-chile-s-humboldt-penguins>.

Don't forget to check the latest edition of the PSG-supported journal *Marine Ornithology*; <http://www.marineornithology.org/>.

Be a citizen scientist for penguins: <http://www.penguinmap.com/>

All Penguin Species in North American Zoological Institutions and a Comparison of Populations From One and Ten Years Past - December 31, 2016

Robert Webster – Avian Scientific Advisory Group (ASAG) Population Monitor, AZA

Current rank	Total Aves rank	Species * - indicates species is represented by more than one taxa	Population / sex ratio	# hatched last 12 months	# holding institutions	12/16 population	12/15 population	12/06 population
1	7	African "Jackass" Penguin	470.382.17	61	49	869	846	568
2	15	*Gentoo Penguin	237.299.6	38	18	542	542	291
3	20	Humboldt Penguin	212.198.14	48	22	424	409	255
4	36	*Southern Rockhopper Penguin	147.162.4	10	16	313	299	265
5	44	Magellanic Penguin	143.111.8	27	15	262	231	172
6	48	*King Penguin	147.101.6	13	15	254	248	223
7	70	Adelie Penguin	81.77.20	7	3	183	177	126
8	73	Macaroni Penguin	67.89.18	12	6	174	166	122
9	78	Chinstrap Penguin	76.75.8	20	4	159	147	110
10		*Blue Penguin	55.47.0	21	5	102	84	65
11		Northern Rockhopper Penguin	16.12.3	3	3	31	28	29
12		Emperor Penguin	13.17.0	-	1	30	31	?

** : Data compiled from the ZIMS website plus the following institutions provided their collection information: Denver Zoo, Fort Worth Zoo, Houston Zoo, Lincoln Park Zoo, Memphis Zoo, Monterey Bay Aquarium, National Aquarium, SeaWorld Orlando, SeaWorld San Antonio, SeaWorld San Diego, Shedd Aquarium, Texas State Aquarium, Zoo Atlanta

- Rehabilitation facilities in ZIMS were excluded from these tables
- Data covers entire "North American" region of ZIMS only since 2014
- Only populations of 10 or more individuals were recorded prior to 2007

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News and Updates

It is important for Penguin Advocates to stay current with the breaking news affecting penguins and their conservation status, and to share this information with Zoo and Aquarium visitors, colleagues, family and friends. “Awareness without action is worthless.” Phil McGraw.

May: Anyone can *Invest in the Nest: Saving Penguins from Extinction*, a featured 30-day Kickstarter campaign that opened on May 17. Hoping to raise US\$150,000, the goal of the campaign is to make and place up to 1,500 artificial African penguin nests in South Africa. The fragile conservation status of African penguins is well known and AZA has selected the African penguin as one of ten highlighted species for focused attention and action in the AZA SAFE Program <https://www.aza.org/SAFE-african-penguin>. This Kickstarter campaign, to which US\$30,000 has already been committed by AZA SAFE Partner *Stonyfield Yogurt*, is designed to raise both funds and awareness for the plight of the African penguin with the ultimate goal of in-the-field conservation outcomes. Watch Gayle Sirpenski, Mystic Aquarium, describe the objectives of this campaign at <https://www.kickstarter.com/projects/aza/invest-in-the-nest-save-penguins-from-extinction> and see photos of the nest design and engineering process.

Also in May, the Southern population of the yellow-eyed penguin was in the news following the publication of a computer modeling study (See Mattern et al, 2017 in [Recommended References](#)) that estimated this population could disappear from the New Zealand mainland by 2060. As with so many species around the world, and including other penguin species, there are a variety of pressures contributing to the yellow-eyed penguin population decline including climate change and fisheries activities, but also emerging diseases and predator-prey relationships.

In March, African penguins were in the news after a study by Sherley et al (see [Recommended References](#)) was published that showed that juvenile birds may be fooled into dispersing into the wrong area. Termed an “ecological trap”, these young penguins are relying on environmental cues, like high phytoplankton levels, to guide them to fish abundance. Unfortunately, a combination of climate change and fisheries pressures has caused the fish to move and the once rich waters are essentially empty of their former fish stocks. By falling into this “trap”, the study estimates that the Western Cape African penguin population has dropped by 80%. To save penguins and other species in the Western Cape, the long-term solution will be to implement regulations to promote fisheries sustainability.

January: Proposed land-based, open mining operations, and an accompanying desalination plant and purpose-built industrial port, threaten the largest colony of Humboldt penguins in Northern Chile. This area, 360 miles north of Santiago, is home to roughly 80% of the world population of Humboldt penguins. A study, commissioned by Oceana, an advocacy group focused solely on ocean-based environmental concerns, found that the environmental impact estimated for these mining operations was vastly underestimated. Now NGOs including Rainforest Rescue, Sphenisco and Oceana are working to pressure the Chilean government to establish the La Higuera/Isla Chañaral marine region as a UNESCO World Heritage Site. Sign the petition at <https://www.rainforest-rescue.org/petitions/1085/speak-out-for-chile-s-humboldt-penguins> and learn more at <http://oceana.org/blog/mining-and-port-megaprojects-threaten-worlds-largest-colony-humboldt-penguins> and <http://www.sphenisco.org/index.php/en/projects-northern-chile/canpaigns/452-the-national-protection-area-of-the-humboldt-penguin-must-not-die>.

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Also in January Species360, AZA, EAZA and ZAA announced the beta release of the new **ZIMS for studbooks**, a web-based studbook database software with the goal of seamless connections between institutional and studbook records, ultimately reducing data errors and saving time. This software will replace Poplink and SPARKS. Roll out of the beta test is scheduled to begin in April and take several months to incorporate all studbooks. Species360 members will have access to the software as part of their membership. Visit <https://www.species360.org/products-services/zims-for-studbooks/> to learn more.

The Australian Antarctic Division provides links to the **Sounds of Antarctica**. This would be a great link for zoos and aquariums to offer through education and conservation programs so children can experience the sounds of nature. <http://www.antarctica.gov.au/about-antarctica/sounds-images/sounds>.

November 2016: Climate scientists have been closely monitoring glaciers in West Antarctica to assess vulnerability to collapse and the consequences for sea level rise. But recently additional concerns are being raised about East Antarctica, and a new area in West Antarctica where 40 years of NASA Landsat data show significant glacial retreat. <https://www.washingtonpost.com/news/energy-environment/wp/2016/06/01/scientists-have-found-yet-another-part-of-antarctica-that-may-be-in-trouble/>. A separate study released in July emphasized concerns over ice losses tied to warmer ocean temperatures in these areas of Antarctica. <https://ww2.kqed.org/science/2016/07/15/oceans-eating-away-at-yet-another-part-of-antarctica/>. (See **Recommended References**, Christie et al 2016 and Cook et al 2016).

Last fall, a paper by Hurt et al (in **Recommended References**) highlighted some results of ongoing disease surveillance on the Antarctic Peninsula. The study describes a novel H5N5 subtype **Avian Influenza virus found during 2015 in a chinstrap penguin**. Phylogenetic analysis of this subtype showed recent emergence on the continent with lineages from both North America and Eurasia. Most disturbing is that this finding underlines the vulnerability of the continent to emerging diseases.

Two AZA member collaborators from SeaWorld San Diego and The Maryland Zoo in Baltimore departed last July for a two-week working trip to Cape Town, South Africa to participate in the **SAFE African Penguin Individual Identification Project**. Their itinerary included working with local partners to insert PIT tags in adult and juvenile penguins in two breeding colonies. These tags allow birds to be individually identified without capture, which will inform much-needed conservation research. In addition to the tagging effort, the AZA community representatives assisted with checks of existing artificial nests, and gathering and preliminary assessment of education/outreach materials.

Last May a Japanese aquarium, the Shimonoseki Marine Science Museum, announced that they produced the first **Humboldt penguin chicks** to hatch as a result of **artificial insemination** (AI) technology. This success was followed closely by a Humboldt penguin AI chick hatched in the U.S. at SeaWorld San Diego. It is hoped that AI technologies will prove to be an important tool for managing genetic diversity and supporting population sustainability for penguins.

Penguins are iconic and charismatic animals that are popular with zoo and aquarium visitors. Now, the **Maryland Zoo** has developed a new program that maximizes the popularity of Penguin Ambassadors to **better engage audiences for conservation**. Through the "Penguin Partner" program, visitors or organizations requesting penguin appearances are encouraged to schedule the visit through the existing **ZOOmobile** program. For an additional fee, a penguin ambassador will join the program and includes a penguin footprint painting, a penguin photo and penguin-related conservation education materials. This helps balance the demand for penguin ambassadors with the availability of these "celebrity" animals and further emphasizes the conservation status of penguins.

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AZA Penguin TAG Advisor, [Dr. Elizabeth Mulkerrin \(Omaha's Henry Doorly Zoo\)](#), has been named as the project coordinator for the [African Penguin Public Engagement Project](#). This project is a part of AZA's Saving Animals From Extinction (SAFE) Conservation Action Plan designed to create effective messaging for, and engage the public in, opportunities for conservation action. <https://www.aza.org/safe-african-penguin-conservation-projects#>.

Several new penguin exhibits opened in 2016 including [Penguin Expedition](#) at Sea Life Sydney Aquarium (see the ride video at https://youtu.be/ZMUos_NJXx4). Also the [Polk Penguin Conservation Center](#) at the Detroit Zoo (https://youtu.be/B2P_aQ-dWRA and https://youtu.be/PNdr_27WyQ), and the [Penguin Cove](#) at The Zoo Louisville (<https://youtu.be/zxsC6BaFgfk>). The Lincoln Park Zoo opened [The Robert and Mayari Pritzker Penguin Cove](#) exhibit which features African penguins. In addition, the [Maryland Zoo](#) received the AZA 2016 award for Exhibit Design in September for their [Penguin Coast](#) exhibit also featuring African penguins.

Events and Announcements

June is Zoo and Aquarium Month

5 June is [World Environment Day](#). According to the United Nations Environment Programme (UNEP), we will need three planets by the year 2050 to sustain our ways of living if current consumption and production patterns remain the same. WED is about taking a step forward and learning to live sustainably with fewer resources. Raising awareness and educating others is also incredibly important.

<http://worldenvironmentday.global/>.

8 June is [World Oceans Day](#) <http://www.worldoceansday.org/>.

3 July is [International Plastic Bag Free Day](#) <http://www.plasticbagfreeday.org/>.

4-5 July is the [BIAZA](#) (British and Irish Association of Zoos and Aquariums) [Research Conference](#) hosted by the Edinburgh Zoo. Deadline for registration is 1 July. <https://biaza.org.uk/events/detail/biaza-research-conference>.

27-31 August is the [AAZK National Conference](#) to be hosted by National Capital AAZK Chapter, Washington, D.C., USA.

9-13 September is the [2017 AZA Annual Conference](#) hosted by the Indianapolis Zoo, Indianapolis, IN, USA.

13 October is [African Penguin Awareness Day](#) (Look for events at Mystic Aquarium and SANCCOB).

15-17 October is [The International Conference on Environmental Enrichment](#) to be held in Brazil and hosted by Parque Jaime Duque - Bioparque Wakatá. http://www.parquejaimeduque.com/enriquecimiento_en.html.