

PELECANIFORMES TAXON ADVISORY GROUP

REGIONAL COLLECTION PLAN 2011 – 2014 First Edition

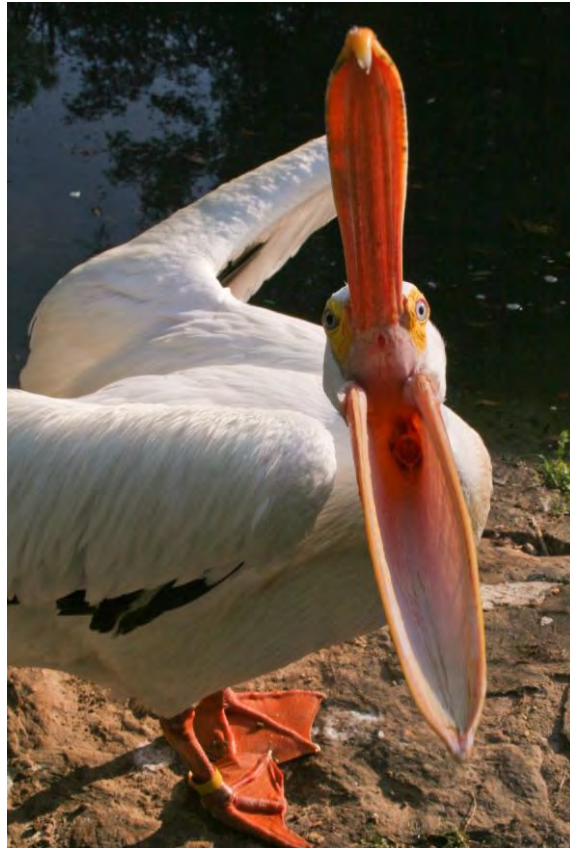


Photo: Cindy Pinger

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INTRODUCTION

Pelicans are one of the most recognizable and charismatic groups of birds exhibited in North American zoos and aquariums. As such they serve as ambassadors for increasing awareness of birds to our guests while playing an important role in education. They are long lived birds that do well in a zoo or aquarium environment and can be used in mixed species habitats. The brown pelican is an example of a remarkable conservation success story that led to the recovery of their wild populations. All of these attributes make them excellent collection animals for zoos and aquariums.



Photo – Ed Ferrin

TAG MISSION

The mission of the AZA Pelecaniformes TAG is to help provide excellent zoological management for pelicans and their relatives, to support education programs and to support conservation programs to aid wild populations.

Pelecaniformes Steering Committee

OFFICERS

Chair – Diane Olsen
Aquarium and Rainforest at Moody Gardens
1 Hope Blvd
Galveston, TX 77554
409-682-4102
dolsen@moodygardens.com

Vice Chair – Jay Christie
Racine Zoo
200 Gold St
Racine, WI 53402
262-636-9291
jchristie@racinezoo.org

Secretary – Steve Sarro
National Aviary
Allegheny Commons West
Pittsburgh, PA 15212
412-323-7235 x211
steve.sarro@aviary.org



Photo: Mike Macek

COMMITTEE MEMBERS

Scott Barton – Fresno Chaffee Zoo SBarton@fresnochaffeezoo.com 559-498-5915
Chris Brown – Dallas Zoo Chris.Brown@dallaszoo.com 469-554-7240
Jim Dunster – Miami Metro Zoo jdun@miamidade.gov 305-251-0400x84965
Sara Hallager – National Zoo hallagers@si.edu 202-633-3088
Michael Mace – San Diego Zoo's Wild Animal Park mmace@sandiegozoo.org 760-738-5077
Jay Therien – Disney's Animal Kingdom - jay.therien@disney.com 407-938-2317

ADVISORS

SPMAG Advisor

Jamie Ivy – San Diego Zoo Safari Park - Jivy@sandiegozoo.org 619-557-3905

Nutrition Advisor

Shannon Livingston - Disney's Animal Kingdom - Shannon.E.Livingston@disney.com 407-938-3276

Veterinary Advisor and Education Advisor – vacant

WCMC Liaison – Joe Barkowski, Sedgwick County Zoo, jcbksi@aol.com 316-266-8235

EAZA Pelecaniformes TAG Chair

Bjarne Klausen - Odense Zoo Denmark - bk@odensezoo.dk

TAG DEFINITION

The Association of Zoos and Aquariums (AZA) Pelecaniformes Taxon Advisory Group (TAG) encompasses all species in the Order Pelecaniformes, including pelicans, cormorants, anhingas, gannets, and frigate birds (see Appendix III for a complete species list). A goal of **AZA's** Avian Scientific Advisory Group (ASAG) is that all bird species be represented by a TAG so the Pelecaniformes TAG also includes members of Procellariiformes (Petrels and shearwaters) (see Appendix IV). Members of this order are extremely rare in zoological collections, but their conservation and husbandry issues are similar to many of those species in Pelecaniformes. All recommended species in this TAG can serve a vital educational function in serving as flagship species for their wild counterparts to generate interest, understanding and awe in these amazing birds.

TAG STRUCTURE

The Pelecaniformes TAG follows AZA's WCMC recommendations regarding TAG institutional representatives as well as appointment of steering committee members and advisors, election of officers, votes of confidence, etc.

- **The TAG chair will be elected by AZA's WCMC committee.**
- The TAG Steering Committee will consist of no more than 12 voting members. A Vice-Chair, Secretary and Treasurer will be elected from these members.
- If fewer than 12 members are available to serve on the steering committee, participation will be automatic as interest is expressed. At the start of each calendar year the committee should poll the IRs to encourage increased participation in the management of the TAG. Also, all existing committee members must be contacted to ensure their participation for the upcoming year. If there are not enough open positions for interested IRs an election must be held using the above mentioned WCMC guidelines.
- Members will either be up for re-election or rotate off the committee after serving a three-year term if all 12 positions remain filled. Terms will be staggered to promote continuity.
- Appointed advisors to the TAG will report to the Vice-Chair. The Vice-Chair will be responsible for soliciting new advisors when positions become vacant.

TAG THREE YEAR GOALS

1. Complete Animal Care Manual(s).
2. Promote pelicans as excellent exhibit and education animals.
3. Strengthen connections with rehab facilities, state and federal agencies to assist with placement of non-releasable birds.
4. Investigate possibility of importations from EAZA institutions to bolster AZA collections.
5. Increase and facilitate communication between institutions holding Pelecaniformes while recruiting potential new holders.
6. Continue to look for effective conservation programs the TAG can contribute to and support.
7. Continue to work with EAZA Pelecaniformes TAG to determine possibility of re-introduction of Dalmatian pelicans in central Europe

Working towards these goals the Pelecaniformes TAG has:

- Worked with ASAG to develop a comprehensive list of state and local rehab facilities.
- Supported research into the winter migration of Cape Gannets from Namibia through the Southern African Foundation for the Conservation of Coastal Birds (through a donation made from Moody Gardens on behalf of the Pelecaniformes TAG).
- Assisted with the Deepwater Horizon Oil Spill Response to place non-releasable American White and Brown pelicans in AZA institutions.

Taxonomy

The taxonomy utilized is from the Handbook of Birds of the World – Vol. 1. The following families **are included in this TAG's** purview:

Pelecaniformes;

- Pelicans – Pelecanidae
- Gannets and Boobies – Sulidae
- Cormorants – Phalacrocoracidae
- Frigate birds – Fregatidae
- Anhinga and Darters – Anhingidae
- Tropicbirds – Phaethontidae

Procellariiformes;

- Albatrosses – Diomedidae
- Fulmars, prions, shearwaters, gadfly and other petrels – Procellariidae
- Diving petrels – Pelecanoididae
- Storm petrels - Hydrobatidae

Conservation Status

CITES and IUCN status for all species comes from Birds to Watch 2, the electronic version – www.birdlife.org/datazone/species/index.html and the 2008 IUCN Red List of Threatened Species – www.iucnredlist.org. United States Fish and Wildlife status was determined from their website – www.fws.gov. Specific species status can be found on individual species pages or in Appendix III and IV.



Photo: Ed Ferrin

RCP Planning Process

History

In 2007 an RCP was submitted to WCMC and was not approved. No further work was done until 2009. Studbook petitions were put on hold until the completion of the RCP. In May 2011 a request was granted for an extension to allow the RCP to be formatted with the new WCMC guidelines. On November 29, 2011 the **RCP was sent out to the steering committee, the WCMC advisor and the IR's** for approval. The RCP was sent to the WCMC committee on December 30, 2011 for approval.

Space Analysis

A space survey was sent to all AZA institutions in November 2009 and was completed in April 2010. The Accountability Table can be found in Appendix V. This space analysis was sent to the SPMAG advisor in August of 2010 with analysis done in October 2010. Numbers from the space survey were compared to ISIS, and with a few minor changes, the survey is consistent with what is reported to ISIS. Target population sizes were determined either by analysis by the SPMAG advisor (three species) or by the results of the space survey. A copy of the space survey is included in Appendix II

Species Selection

The Pelecaniformes TAG followed the AZA recommended criteria in determining appropriate species. The levels at which species are managed are described in each species individual sheets. The following program definitions are found in the AZA Regional Collection Plan Handbook http://www.aza.org/uploadedFiles/Animal_Care_and_Management/Animal_Programs/Conservation_Programs_Database/PLH_RCPs.pdf

Species Selection Criteria

A species that qualified for a program was put through a subjective evaluation to determine the program type. The different criteria and definitions are below in order of importance to the decision making process. Each one has a an assigned weight of 1, 2 or 3.

Conservation status of the taxon:

- Status of species in the wild
- Extinction risk of species in the wild
- 1=endangered 2= threatened/vulnerable 3= not listed or least concern

Availability:

- Within AZA member institutions
- Outside AZA member institutions
- Potential non-AZA partnerships
- On-going programs for intensively building sustainability of the species
- 1= rare or difficult to obtain, 2=moderately available, 3= readily available

Availability of potential founders:

- Availability of potential founders in conjunction with the viability of the North American population
- Expense, legal, ethical and logistical issues
- Interest among AZA member institutions to import founders from regions or the wild

- 1= rare or difficult to obtain, 2=moderately available, 3= readily available

Demand within AZA:

- Demand for the species within AZA member institutions
- Space availability
- 1=high demand, 2=moderate demand, 3=little or no demand

Institutional commitment:

- Commitment to the species within AZA member institutions
- Space and resource availability (currently or in development)
- 1=high level of commitment, 2=moderate level, 3= little or no commitment

Husbandry expertise:

- Level of expertise available to the management program to meet the species basic biological needs (i.e., nutritional, medical, social, etc) as related to maintaining and propagating them in AZA member institutions.
- 1=high level of expertise available, 2=moderate level, 3= little or none

Education value:

- Potential to increase visitor awareness of the species, its habitat, and conservation issues surrounding the species
- Program animal use/potential
- 1=great potential, 2=good potential, 3=little or no potential

Exhibit value:

- Visitor appeal of the species
- 1=high appeal, 2=moderate appeal, 3=little or no appeal

Taxonomic uniqueness:

- Level at which the taxon is unique – used in conjunction with exhibit value and conservation potential
- 1=high level of uniqueness, 2= moderate. 3=not unique

Acquisition costs:

- Cost of obtaining the species from sources outside AZA member institutions
- 1=high cost, 2=moderate cost, 3=low cost

Risk of losing the *Ex-situ* population

- Risk of loss within AZA member collections if the population is not managed (i.e., increase or decrease)
- Risk of loss within AZA member collections if the population is managed (i.e., increase or decrease)
- 1=high risk, 2=moderate risk, 3=little or no risk

Link to *In situ* conservation

- Potential for a managed population to affect *in situ* conservation
- Potential to engage visitors in conservation action for the species and its habitat
- 1=high potential, 2=moderate potential, 3=little or no potential

Two decision trees were utilized – one for managed and one for non- managed programs. The decision trees are on the following pages. For each category a score is given. Species that obtain a score under 21 will be considered for a managed program. From there the species will again be evaluated to determine at what level – red, yellow or green – of management that it will be given. This evaluation will be based on the criteria that has been set forth by AZA as well as determinations that are made by population advisors (PMC or SPMAG).

Species Currently Held in North American Collections but not a managed program



Selection Criteria

- Conservation status
- Availability
- Availability/Feasibility of potential founders
- Demand within AZA
- Institutional Commitment
- Husbandry Expertise
- Educational value
- Exhibit value
- Taxonomic uniqueness
- Acquisition costs
- Risk of losing the *Ex situ* population
- Link to *In Situ* conservation

See above for rankings



Score of 21
or below

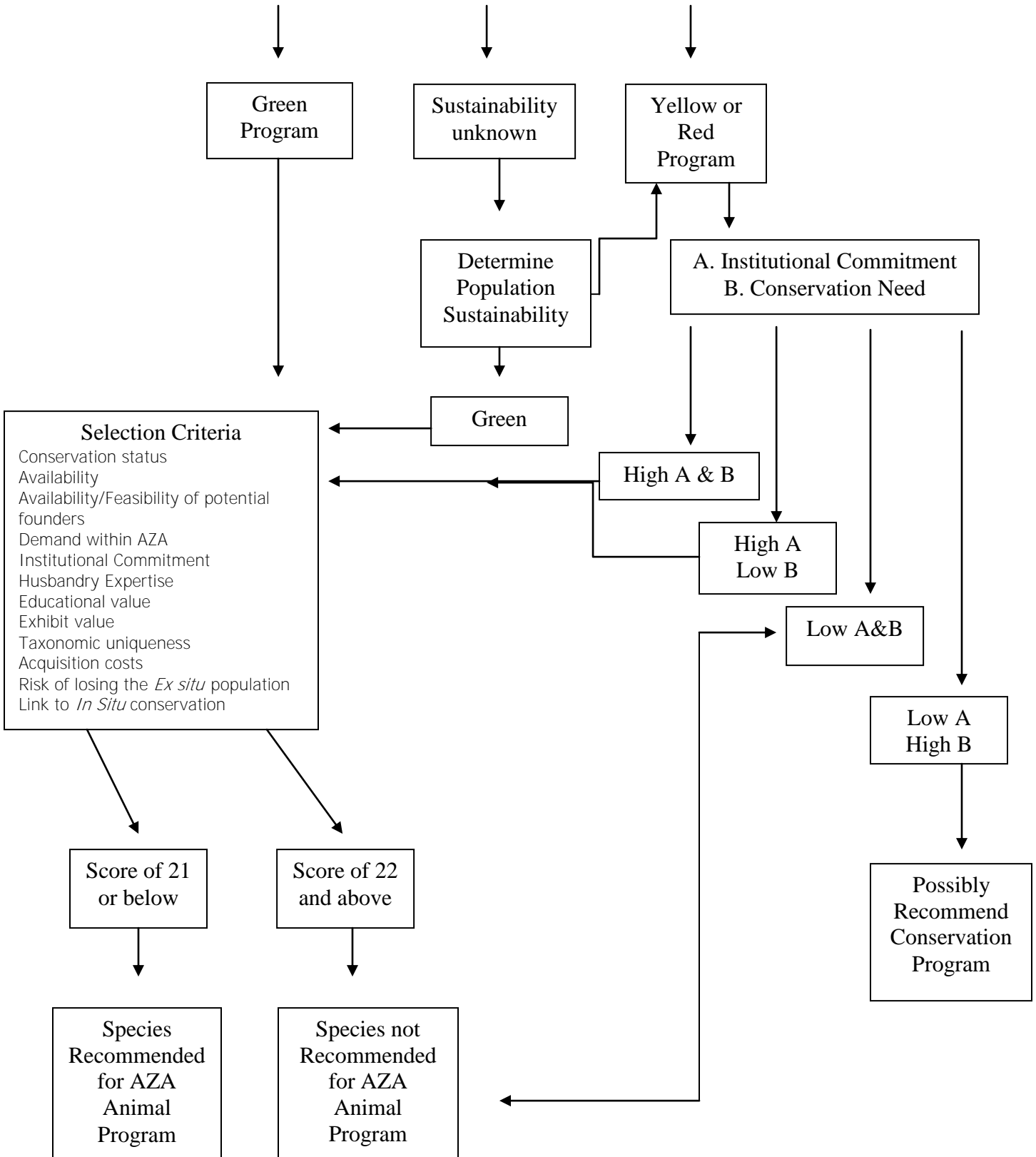
Score of 22
or above



Species
Recommended for
Pelecaniformes
Animal programs

Species not
Recommended for
Pelecaniformes
Animal Programs

Species Currently in an Existing AZA Animal Management Program



Selection Results

In the Pelecaniformes taxonomic group there are a limited number of species that are held in institutions and even fewer that are held in numbers greater than 5. Of these American white pelicans *Pelecanus erythrorhynchos* and brown pelicans *Pelecanus onocrotalus* are in collections primarily as non-releasable rehab birds as are double crested cormorants *Phalacrocorax auritus*. When these species were run through the decision tree they ranked the following score:

- American white pelican = 25
- Brown pelican = 25
- Double crested cormorant = 26

The Pelecaniformes TAG recommends that these species not be formally managed as there are sufficient opportunities to obtain these animals from rehab facilities and there does not appear that there would be any sustainability issues with these species.

The four species that the Pelecaniformes TAG recommends for management are the eastern white pelican, the pink backed pelican, the Dalmatian pelican and the white breasted cormorant. When run through the decision tree the scores were as follows:

- Eastern white pelican = 20
- Pink backed pelican = 20
- Dalmatian pelican = 20
- White breasted cormorant = 21

Based on these scores and the population analysis that was conducted in 2010 these species require management within AZA institutions to maintain and work to obtain Green SSP status.



Photo: Michael Mace

Pelecaniformes Program Management

Pelecaniformes Programs were determined using the following criteria:

Criteria	Green SSP	Red studbook	Red studbook
TAG Recommended for cooperative management	YES	YES	YES
Population Size (Total N)	50 and above	50 and above	49 or less
Projected % GD at 100 years or 10 generation	90.0% or above	Less than 90.0%	Less the 90.0%

Green SSP Programs

- Green SSP Programs have a population size (total N at the time of population planning) equal to or greater than 50 individuals.
- This population is able to retain >90.0% GD over 100+ years or 10+ generations.
- The population is presently sustainable demographically with a sufficiently large population size and a positive growth rate to reach 100 years or 10 generations.

Red studbook Programs

- Red studbook Programs have a population size (total N at the time of population planning) equal to or greater than 50 individuals.
- The population is not able to retain at least 90.0% GD over 100+ years or 10 generations.
- The population may have never been formally planned, or was planned more than 5 years ago so that the population sustainability score cannot be properly assessed.

Red studbook Programs

- Red Programs have a population size of fewer than 50 individuals unless accepted models can demonstrate long-term sustainability.
- The population is not incorporated into an AZA Regional Studbook, and thus the population size cannot be properly assessed.



Photo: Julie Tomita

Recommended Species

Animal Program Summary Table

	Eastern White Pelican	Pink-Backed Pelican	Dalmatian Pelican	American White Pelican	Brown Pelican	White-breasted Cormorant	Double-crested Cormorant
	<i>Pelecanus onocrotalus</i>	<i>Pelecanus rufescens</i>	<i>Pelecanus crispus</i>	<i>Pelecanus erythrorhynchos</i>	<i>Pelecanus occidentalis</i>	<i>Phalacrocorax lucidus</i>	<i>Phalacrocorax auritus</i>
Animal Program Designation	Red studbook	Red studbook	Red studbook	Not recommended for program	Not recommended for program	RED – needs program leader	Not recommended for program
Date of Last Breeding and Transfer plan	Not planned	Not planned	Not planned	Not planned	Not planned	Not planned	Not planned
Current Population size	41	72	21	148	78	44	16
Current Number of participating Institutions	8	8	1	39	26	10	11
Sustainability score (retained %GD at 100 years or 10 generations)	84.4%	92.3%	78.1%	Unknown	Unknown	Unknown	Unknown
Target population size	110	167	100	251	112	Not determined	64
Target sustainability score	90.0% at 100 yrs	95.0% at 100 yrs	90.0% at 100 yrs	Unknown	Unknown	Unknown	Unknown
Space needed (target population – current space)	10	18	88	59	21	unknown	23
Recent 5 year population trend	Increasing	Increasing	Stable	Increasing	Increasing	Stable	Decreasing
USFWS ICUN CITES	Not listed Least concern Not listed	Not listed Least concern Not listed	Not listed Vulnerable Not listed	Not listed Least concern Not listed	Not listed Least concern Not listed	Not listed Least concern Not listed	Not listed Least concern Not listed
Goal #1	Import founders	Increase breeding	Increase space	Increase space for rehab birds	Increase space for rehab birds	Find population manager	Increase space for rehab birds
Goal #2	Increase space	Increase space	Increase breeding	Develop husbandry standards	Develop husbandry standards	Produce sustainability plan	Develop husbandry standards
Goal #3	Develop husbandry standards	Develop husbandry standards	Develop husbandry standards	Develop relationships with rehab facilities	Develop relationships with rehab facilities	Increase space	Develop relationships with rehab facilities

Management Update Table

Common Name	Scientific Name	Previous Recommendation	Current Designation	Program Leader Change	Program Leader/Species Contact
Eastern White Pelican	<i>Pelecanus onocrotalus</i>	PMP	Red studbook	No	Kristi Florence San Diego Zoo Safari Park kflorance@sandiegozoo.org 619-718-3544
Pink Backed Pelican	<i>Pelecanus rufescens</i>	PMP	Red studbook	No	Jay Therien Disney's Animal Kingdom Jay.Therien@disney.com 407-938-2317
Dalmatian Pelican	<i>Pelecanus crispus</i>	PMP	Red studbook	No	Kristi Florence San Diego Zoo Safari Park kflorance@sandiegozoo.org 619-718-3544
White Breasted Cormorant	<i>Phalacrocorax lucidus</i>	None	Red studbook	N/A	N/A

The eastern white and pink-backed pelicans should be able to obtain Green SSP status with additional breeding and studbook analysis. The Dalmatian pelican will require a larger population and moving specimens to additional facilities. Work is underway to accomplish that goal. White breasted cormorants should become a managed program and the TAG will begin looking for a studbook keeper.

Animal Program Status Table

Animal Program	Scientific Name	Current Program Leader	Current Designation	Start of Program Monitoring	Date Program Initiated	Date of last Studbook	Date of last Plan Publication
Eastern White Pelican – Red studbook	<i>Pelecanus onocrotalus</i>	Kristi Florence San Diego Zoo Safari Park kflorance@sandiegozoo.org 619-718-3544	Red studbook	January 2008	January 2008	N/A	N/A
Pink Backed Pelican – Red studbook	<i>Pelecanus rufescens</i>	Jay Therien Disney's Animal Kingdom Jay.Therien@disney.com 407-938-2317	Red studbook	August 2006	2004	August 2004	N/A
Dalmatian Pelican – Red Studbook	<i>Pelecanus crispus</i>	Kristi Florence San Diego Zoo Safari Park kflorance@sandiegozoo.org 619-718-3544	Red Studbook	January 2008	January 2008	N/A	N/A
White Breasted Cormorant – Red studbook	<i>Phalacrocorax lucidus</i>	None	Red studbook	N/A	N/A	N/A	N/A

Pelecaniformes TAG Recommended Species

Though there are a number of Pelecaniformes species held in AZA institutions, most are few in numbers and are rare enough to not warrant management. This could change with potential imports, but as of the writing of this RCP, the following species are the only ones that are recommended. Currently the Pelecaniformes TAG recommends 7 species for AZA collections with the focus being on the educational value of these species to represent their wild counterparts.

Eastern White Pelican (Great White Pelican) *Pelecanus onocrotalus*



Photo: Michael Mace

IUCN status: Least Concern
CITES: Not listed

AZA Population: 60
Number of U.S. institutions: 8
Target population: 110

Status: Red studbook
Studbook status: in process
Kristi Florence

San Diego Zoo Safari Park
Kflorence@sandiegozoo.org 619-718-3544

Eastern white pelicans are impressive birds with pure white plumage, black flight feathers, yellow gular pouches and bills that are blue and red. Males are slightly larger than females. These are flock birds that are best displayed in groups of 10 or more.

Distribution: This pelican species ranges over much of Africa, Europe and western Asia. They are found in shallow lakes, marshes and broad rivers and deltas into brackish or saline lagoons. Fish eaters, they are found where there are large concentrations of medium sized fishes. Northern populations are tending to be migrants while the Africa populations are often residents.

Species notes: These pelicans are appropriate for African exhibits. They are colonial ground nesters so when housed with other animals it is best to provide space where they can nest, utilizing flat surfaces. These birds are readily bred in European zoos and there is interest in AZA facilities to increase population numbers so international cooperation is suggested.

Pink-backed Pelican *Pelecanus rufescens*



Photo: Shelia Murphy

IUCN status: Least Concern
CITES: Not listed

AZA Population: 79
Number of U.S. institutions: 10
Target population: 167
Status: Red studbook
Studbook status: in process
Jay Therien - **Disney's Animal Kingdom**
Jay.Therien@disney.com 407-938-2317

This African pelican is smaller than the Eastern White and does well in smaller colonies, EAZA recommendations are colonies of 6 or more individuals. Plumage is grey and white, duller than the Eastern White, with a pink back. Breeding adults have long feathers on the top of their heads. They are known to make large nests and can roost in trees or snags. Females are slightly smaller than males.

Distribution: They are resident breeders in Africa and southern Arabia and are found in lakes and swamps. They fish in groups, often forming lines to surround the fish and plunging their heads in at the same time. They eat fish and amphibians.

Species notes: These birds do well in African themed exhibits and need sufficient nesting materials. Successful breeding at San Diego Zoo Safari Park **and Disney's Animal Kingdom along with imports** have contributed, and will continue to contribute, to the population sustainability.

Dalmatian Pelican *Pelecanus crispus*



Photo: Shelia Murphy

IUCN status: Vulnerable
CITES: Appendix 1

AZA Population: 12
Number of U.S. institutions: 1
Target population: 100
Status: Red Studbook
Studbook status: in process
Kristi Florence at SDWAP

kflorence@sandiegozoo.org 619-718-3544

The largest of the pelicans with a wing span of approximately ten feet, it is one of the world's heaviest flying birds. It has gray plumage that turns silver during breeding season. The nape feathers are curly with gray legs and feet.

Distribution – This species breeds both in Eastern Europe and in Russia and China. It migrates short distances to winter in the Middle East and around the eastern Mediterranean. It is found in swamps, freshwater wetlands and along river deltas. Nests are made of vegetation.

Species notes –One of two species of pelicans with a conservation concern. Loss of habitat and persecution from fisherman are the main threats. San Diego is currently the only institution working with these birds. However, efforts are underway to work with EAZA institutions to import birds to increase AZA holdings which will allow an increase in the number of institutions that can house this species.

American White Pelican

Pelecanus erythrorhynchos



Photo: Ed Ferrin

IUCN status: Least Concern
CITES: Not listed

AZA Population: 118
Number of U.S. institutions: 32
Target population: 201 ** from space survey
**Driven by willingness to take rehab animals
Status Recommendation: DERP
Studbook status: none

The American white pelican is one of the largest North American birds. It has white plumage with black wing tips and yellow coloration on chest during breeding season. Breeding coloration includes the gular sac, the skin around the eyes, and the feet. A large bump on the bill also occurs. Nests are scraped depressions with sticks and brush as nesting materials.

Distribution – Breeds along lakes and brackish bodies of water in the Midwest, northern states and Canadian provinces. They winter along the Gulf and Pacific coasts and along the Mississippi river as far north as St. Louis.

Species notes - American white pelicans are very common in zoos and in the wild. They are migrants – breeding in the northern U.S. and Canada then wintering in the south. They are often available through rehab facilities with wing injuries the most common reason for them being non-releasable. They can be exhibited in many types of exhibits, most often in large waterfowl ponds.

Brown Pelican

Pelecanus occidentalis



Photo: Ed Ferrin

IUCN status: Least Concern
CITES: Not listed

AZA Population: 69
Number of U.S. institutions: 26
Target population: 91 ** from space survey
Driven by willingness to take rehab animals**
Status Recommendation: DERP
Studbook status: none

The brown pelican is unique among the pelican species. Its plumage is dark in color; it plunges into the water to catch its food and is found primarily in coastal salt water habitats, not freshwater lakes. Brown pelicans are one of the smallest of the pelican species. They have a brown body with a white head tinged with yellow. In the breeding season the back of the neck turns black and the yellow extends to the neck. It has a large bill and pouch.

Distribution - Brown pelicans are found along all three North American coasts, down to South American and along the Caribbean Islands. It is the state bird of Louisiana and the Turks and Caicos Islands

Species notes – Brown pelicans are colonial nesters and do better in groups. They are excellent exhibit birds. The recovery of the species from the brink of extinction makes the species a good conservation story. There are 5 subspecies of brown pelicans: California Brown, Eastern Brown, Caribbean Brown, Pacific Brown and Galapagos Brown.

White Breasted Cormorant

Phalacrocorax lucidus

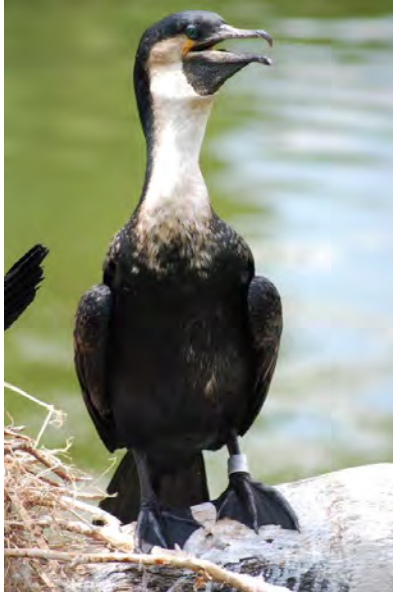


Photo: Julie Tomita

IUCN status: Least Concern
CITES: Not listed

AZA Population: 46
Number of U.S. institutions: 10
Target population: not yet determined
Status: not currently managed
Studbook status: none

This large cormorant species resembles the great cormorant but has a white neck and chest.

Distribution – they are found along the southern coasts of Africa as well as along waterways and wetlands of the interior of southern Africa. They inhabit reefs or inland waterways that have adequate fish supplies. During the dry season, they will move to follow available water sources.

Species notes – There is debate as to whether this is a species or a sub-species of the great cormorant (*P. carbo*). Though there are not many in AZA institutions, they are one of the few cormorant species to be kept and bred.

Double Crested Cormorant

Phalacrocorax auritus



IUCN status: Least Concern
CITES: Not listed

AZA Population: 16
Number of U.S. institutions: 10
Target population: 41 – from space survey **
**Driven by willingness to take rehab animals
Status Recommendation: DERP
Studbook status: none

The double crested cormorant is a large bird with a stocky body and a hooked bill. The “double crest” refers to a small amount of black and white feathers that are on the head only during breeding season – the rest of the year the body is all black. The skin around the face and the gular sac are colored either yellow or orange. Males and females are not sexually dimorphic.

Distribution – Very common and widespread they are found as far north as southern Alaska and eastern Canada and as far south as Mexico and the Bahamas. They will winter anywhere where there is no ice. It will take up residence around any body of water with fish.

Species notes - Cormorants are gregarious nesters, often found with other water birds. They swim low in the water column and hunt by diving and swimming to catch their prey. Double crested cormorants a steep population **decline in the 1960’s** due to DDT thus making them a species with a good conservation story. They are often available from wildlife rehabilitators. In some regions, they conflict with human activities and are culled (i.e. fish farms or hatcheries).

Appendix I

Eastern White Pelican

Pelecanus onocrotalus

Proposed Program Status: Red studbook

Projections for this population were based on ISIS data retrieved from the most recent Specimen Reference CD (published 30 June 2009). A studbook is not yet available. Projections should be considered rough approximations and used only as a guide for initial program planning, as ISIS data of this type is often of poor quality and there is a paucity of demographic data for accurately estimating mortality and fecundity rates. Genetic data exports were based on the AZA population. A total of 37 animals with unknown ancestry were excluded from genetic analyses and projections. Demographic exports were based on North American data from 1 January 1970 – 30 June 2009.

Demography & Genetics

	Number of holding institutions	N	N after exclusions	Estimated 1-5/5-10 yr holding capacity	T	Projected λ	GD (%)	Ne/N	% known before assumptions	% known after assumptions
AZA	8	62 (22.30.10)	25 (14.11)	100/110	19	0.91	84.4	0.24	11.0	100
Variables used in projections						1.05 1.10	97.6	0.40		

N – Current population size

Estimated capacity was based on the Pelecaniformes TAG's space survey

T – Generation time (years)

λ - Potential population growth rate ($\lambda = 1.0$, 0% growth)

GD – Estimated current gene diversity of AZA population

Ne/N – Ratio of effective population size to actual population size

% Known – proportion of descendant population with known pedigree

Projection Strategy	% GD at 100 years	Years to 90% GD	Years to 10% GD loss	Target population size	Minimum population size needed to meet genetic goals
A. Baseline ($\lambda = 0.91$; Ne/N = 0.24; Kt = current 1-5 yr capacity of 100)	3	currently <90%	12	100	not possible
B. Increase λ and target size to 5-10 yr capacity ($\lambda = 1.05$; Ne/N = 0.24; Kt = 5-10 yr capacity of 110)	73	currently <90%	87	110	not possible
C. B + maximize potential GD ($\lambda = 1.05$; Ne/N = 0.24; Kt = 110; current GD = 97.6)	84	37	59	110	not possible

D. C + increase λ and Ne/N ($\lambda = 1.10$; Ne/N = 0.40; Kt = 110; current GD = 97.6)	90	100	>100	110	97
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Eastern White Pelican

Pelecanus onocrotalus

(Continued)

Demographic Summary: Studbook records indicate that Eastern White pelicans have been exhibited in North America since the 1800s, but the population remained at less than 10 animals until the 1970s (Figure 1).

Population growth rates have varied over the past 40 years (λ varied from 0.75 to 1.92), but an overall trend of positive growth has been observed with an average λ of 1.05 (5% growth per year). Growth has been primarily due to importations rather than successful captive reproduction; only 9 hatches have ever been recorded in North America.

The age structure of the population in AZA zoos is difficult to evaluate, since 44 of the 62 birds are of unknown age (Figure 2). The sex ratio in the population is approximately even, with slightly more females than males.

- Given the uncertainty surrounding the age structure of the population and the paucity of biological data with which to estimate hatchling mortality rates, it is impossible to accurately estimate the number of hatches that would be necessary to maintain or grow towards a particular target size.

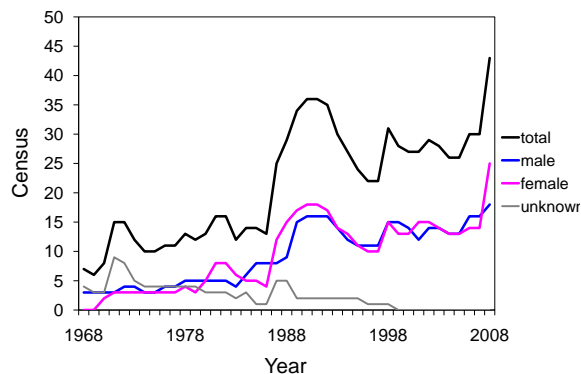


Figure 1. Population census of the Eastern White pelican population in North America from 1968 to

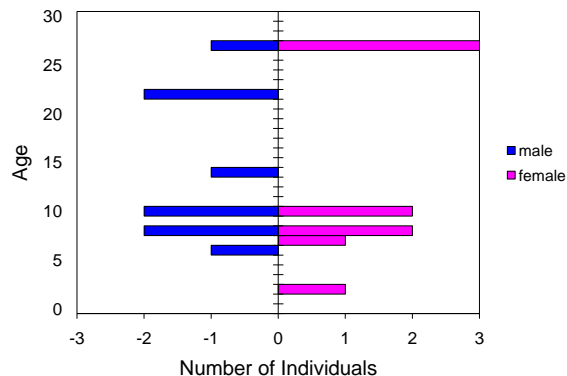


Figure 2. Age structure of the Eastern White pelican population in AZA zoos (18 birds total). An additional 44 birds of unknown age are not shown.

Genetic Summary: The portion of the population with known ancestry has a gene diversity of 84% derived from 6 founders, with 15 potential founders still remaining. Projections indicate that under current population parameters, this population will not meet standard genetic goals of 90% GD for 100 years (Scenario A). The most important factor currently driving projections is lack of reproduction. Projections suggest that 90% GD could be retained for 100 years if reproduction could be improved such that 1) the population could grow by ~10% annually with a N_e/N of 0.40 and 2) all 15 potential founders could be maximally recruited into the population.

The following strategies will help this population to retain gene diversity over the long term:

- Improve breeding husbandry to increase reproduction.
- Attempt to resolve the large amount of unknown ancestry in the population so additional birds can be included in the breeding program.

Pink-Backed Pelican

Pelecanus rufescens

Proposed Program Status: Red studbook

Projections for this population were based on ISIS data retrieved from the most recent Specimen Reference CD (published 30 June 2009). A studbook is not yet available. Projections should be considered rough approximations and used only as a guide for initial program planning, as ISIS data of this type is often of poor quality and there is a paucity of demographic data for accurately estimating mortality and fecundity rates. Genetic data exports were based on the AZA population. A total of 5 animals with unknown ancestry were excluded from genetic analyses and projections. Demographic exports were based on North American data from 1 January 1985 – 30 June 2009.

Demography & Genetics

	Number of holding institutions	N	N after exclusions	Estimated 1-5/5-10 yr holding capacity	T	Projected λ	GD (%)	Ne/N	% known before assumptions	% known after assumptions/exclusions
AZA	5	60 (36.24)	55 (34.21)	149/167	17	1.02	92.3	0.19	93.3	100
Variables used in projections						1.05	96.9	0.25		

N – Current population size
 Estimated capacity was based on the Pelecaniformes TAG's space survey
 T – Generation time (years)
 λ - Potential population growth rate ($\lambda = 1.0$, 0% growth)
 GD – Estimated current gene diversity of AZA population
 N_e/N – Ratio of effective population size to actual population size
 % Known – proportion of descendant population with known pedigree

Projection Strategy	% GD at 100 years	Years to 90% GD	Years to 10% GD loss	Target population size	Minimum population size needed to meet genetic goals
A. Baseline ($\lambda = 1.02$; $N_e/N = 0.19$; Kt = current 1-5 yr capacity of 149)	80	8	74	149	not possible
B. Increase target size to 5-10 yr capacity ($\lambda = 1.02$; $N_e/N = 0.19$; Kt = 5-10 yr capacity of 167)	80	8	77	167	not possible
C. B + increase N_e/N ($\lambda = 1.02$; $N_e/N = 0.25$; Kt = 167)	83	12	>100	167	not possible
D. C + increase λ ($\lambda = 1.05$; $N_e/N = 0.25$; Kt = 167)	85	15	>100	167	not possible
E. B + maximize potential GD ($\lambda = 1.02$; $N_e/N = 0.19$; Kt = 167; current GD = 96.9)	84	34	65	167	not possible

F. Maximize potential GD, increase λ and N_e/N (λ = 1.05; N_e/N = 0.25; K_t = 167; current GD = 96.9)	90	100	>100	167	167
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Pink-Backed Pelican

Pelecanus rufescens

(Continued)

Demographic Summary: Studbook records indicate that pink-backed pelicans have been consistently exhibited in North America since 1970 (Figure 1), with the first captive hatches occurring in 1991. Population growth rates have varied since that time (yearly $\lambda_{1991-2008}$ varied from 0.84 to 1.36), but an overall trend of positive growth has been observed with an average λ of 1.05 (5% growth per year). Growth has been due to a combination of successful captive breeding and importations. During 2008, the captive-hatched portion of the population grew by ~21%.

The age structure of the population in AZA zoos demonstrates that successful reproduction has only recently been occurring, with the majority of birds in the population being less than 5 years old (Figure 2). The sex ratio in the population is slightly skewed towards males, which may limit the population's future growth rate.

- Approximately 40 hatches are needed over the next 5 years to maintain the population at its current size ($\lambda = 1.00$). Approximately 189 hatches are needed over the next 5 years to grow the population to the estimated holding capacity of 149 birds ($\lambda = 1.20$).
- Approximately 68 hatches are needed over the next 5 years to grow the population by an average of 5% per year (Scenario F); this growth rate would meet genetic goals with a total population size of ~77 animals at the end of 5 years.

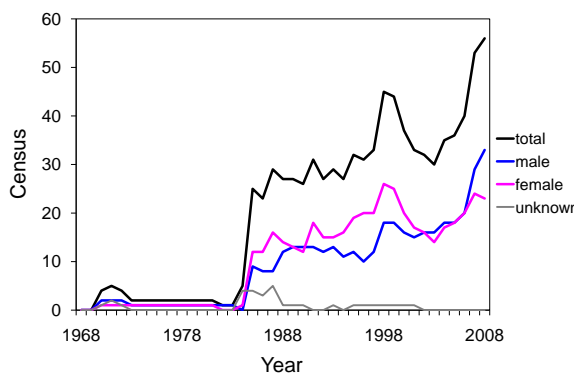


Figure 1. Population census of the pink-backed pelican population in North America from 1968 to 2008.

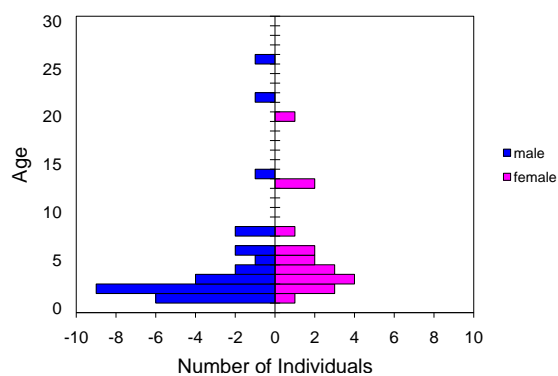


Figure 2. Age structure of the pinked-backed pelican population in AZA zoos (48 birds total). An additional 12 birds of unknown age are not shown.

Genetic Summary: The portion of the population with known ancestry has a gene diversity of 92% derived from 11 founders, with 5 potential founders still remaining. Projections indicate that under current population parameters, this population will not meet standard genetic goals of 90% GD for 100 years (Scenario A). Projections suggest that 90% GD could be retained for 100 years if potential founders could be successfully incorporated into the breeding population and small improvements could be made to both the growth rate and the N_e/N ratio (the number of breeding birds).

The following strategies will help this population to retain gene diversity over the long term:

- Place potential founders at the most successful breeding institutions to increase the chances of capturing their gene diversity.
- Increase λ and N_e/N by encouraging breeding at as many institutions as possible.
- Do not breed birds with unknown ancestry; this will facilitate future genetic management.

Dalmatian Pelican

Pelecanus crispus

Proposed Program Status: Red studbook

Projections for this population were based on ISIS data retrieved from the most recent Specimen Reference CD (published 30 June 2009), which was updated with recent births and deaths to a currentness date of 20 October 2010. A studbook is not yet available. Projections should be considered rough approximations and used only as a guide for initial program planning, as ISIS data of this type is often of poor quality and there is a paucity of demographic data for accurately estimating mortality and fecundity rates. Genetic data exports were based on the AZA population. Demographic exports were based on North American data from 1 January 1960 – 30 June 2009. The generation time used for projections was 18 years (a value consistent with other pelican species), because demographic data was not sufficient for estimating this parameter.

Demography & Genetics

	Number of holding institutions	N	N after exclusions	Estimated 1-5/5-10 yr holding capacity		Projected λ	GD (%)	Ne/N	% known before assumptions	% known after assumptions/exclusions
				T	λ					
AZA	1	21 (10.20)	21 (10.20)	20/20	6	0.94	78.1	0.29	0	100
Variables used in projections				100	18	1.05 1.10	95.0			

N – Current population size

Estimated capacity was based on the Pelecaniformes TAG's space survey

T – Generation time (years)

λ - Potential population growth rate ($\lambda = 1.0$, 0% growth)

GD – Estimated current gene diversity of AZA population

Ne/N – Ratio of effective population size to actual population size

% Known – proportion of descendant population with known pedigree

Projection Strategy	% GD at 100 years	Years to 90% GD	Years to 10% GD loss	Target population size	Minimum population size needed to meet genetic goals
A. Baseline (T = 18; $\lambda = 0.94$; Ne/N = 0.29; Kt = current capacity of 20)	3	currently <90%	15	20	not possible
B. Increase λ and target size (T = 18; $\lambda = 1.05$; Ne/N = 0.29; Kt = 100)	68	currently <90%	93	100	not possible
C. B + maximize potential GD (T = 18; $\lambda = 1.05$; Ne/N = 0.29; Kt = 100; current GD = 95.0)	82	15	65	100	not possible
D. Further increase λ and target size (T = 18; $\lambda = 1.10$; Ne/N = 0.29; Kt = 100)	69	currently <90%	68	100	not possible
E. D + maximize potential GD (T = 18; $\lambda = 1.10$; Ne/N = 0.29; Kt = 100; current GD = 95.0)	84	29	88	100	not possible
F. E + import 2 founders every 10 years (T = 18; $\lambda = 1.10$; Ne/N = 0.29; Kt = 100; current GD)	90	100	>100	100	100

= 95.0)					
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Dalmatian Pelican

Pelecanus crispus

(Continued)

Demographic Summary: Studbook records indicate that Dalmatian pelicans have been consistently exhibited in North America since the early 1950s, but the population remained at less than 10 animals until 2006 (Figure 1). The San Diego Zoo Safari Park is the only North American institution currently holding birds; 10 of their birds were captive-hatched imports from other regions, while 11 birds were captive-hatched at the Safari Park. Given the paucity of demographic data available, it is difficult to predict the rate at which this population will grow in the future. This is a species that is just being established in AZA zoos.

The age structure of the population at the Safari Park demonstrates that this is a newly established population with many empty age classes (Figure 2). The sex ratio in the population is approximately even.

- Given the paucity of biological data with which to estimate mortality and fecundity rates, it is impossible to accurately estimate the number of hatches that would be necessary to maintain or grow towards a particular target size.

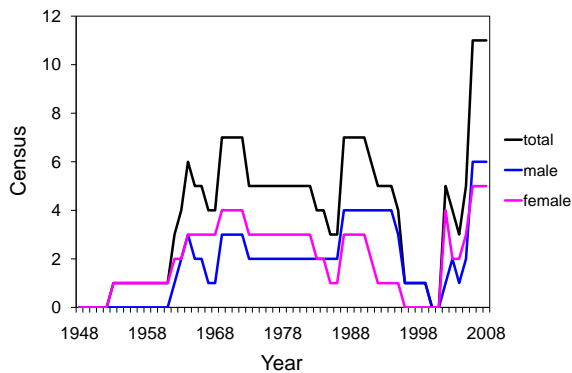


Figure 1. Population census of the dalmatian pelican population in North America from 1948 to 2008.

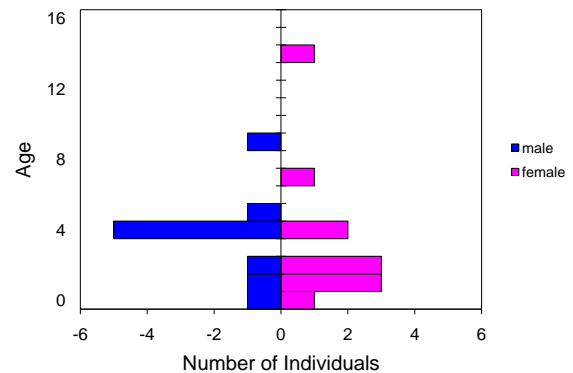


Figure 2. Age structure of the dalmatian pelican population in AZA zoos (21 birds total).

Genetic Summary: The San Diego Zoo Safari Park has imported 10 captive-hatched birds from other regions; 3 birds came from the Jurong Bird Park in Singapore and 7 birds came from the Tierpark Zoo in Germany. All imported birds were assumed to be unrelated for the purposes of these analyses. The birds from Jurong have successfully reproduced, resulting in a population with a gene diversity of 78% derived from 3 founders.

Projections indicate that under current population parameters, this population will not meet standard genetic goals of 90% GD for 100 years (Scenario A). The most important factors currently driving projections are number of founders, rate of reproduction, and space. Projections suggest that 90% GD could be retained for 100 years if 1) the population could grow by ~10% annually with a N_e/N of 0.29, 2) the 7 Munich imports could be maximally recruited into the population, 3) the holding capacity could be increased to 100 spaces, and 4) two new founders could be imported every 10 years.

The following strategies will help this population to retain gene diversity over the long term:

- Improve breeding husbandry** to increase reproduction. As reproduction increases, establish colonies at additional institutions.
- Successfully breed the Munich imports, thereby adding additional founders to the population.**
- Reassess projections after the population has become better established** to refine future management.

Appendix II

Pelecaniformes Space Survey November 2009 – April 2010

Italic numbers have been corrected to match most current ISIS data – 10/11

Eastern White Pelican <i>Pelecanus onocrotalus</i>	CURRENT SPACE				CURRENT MAXIMUM SPACE			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
Audubon Zoo	O	2.1	Yes	No	4.4	No	0	4.4
Baltimore Zoo	B	0	No	Yes	4	Maybe		4
Dallas Zoo & Aquarium	O	0	No	No	6.6	No		6.6
Disney's Animal Kingdom	O	0	Yes	No	0	No		0
Fort Wayne Children's Zoo	B	1.1	No	No	1.1	No		5.5
Fort Worth Zoo					4			4
Fundación Temaikèn	O	4.5.10	No		16			16
Henry Vilas Zoo	B	<i>0</i>	No	No	3	No		3
Honolulu Zoo	O	1	No	No	3	Yes	0.1.	3
Lowry Park Zoo**	O	2.7	No	No	2.0.12	No		3.3**
Maryland Zoo		0			5.5			5.5
San Diego Zoo Safari Park	O	<i>6.6</i>	No	No	5.5	No		5.5
Sedgwick County Zoo	B	<i>5.8</i>	No	No	15	No		15
The Toledo Zoo		0	Yes					6
Eastern White Pelican Species Total Capacity:		Current Holdings = 59			Current Capacity = 101			Future Capacity = 107

ISIS reports that the following institutions have birds but there is no space survey data:
Toronto Zoo – 1.0.0

Pink-backed Pelican <i>Pelecanus rufescens</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
Audubon Zoo	O	7.7	Yes	No	4.4	No		4.4
Baltimore Zoo	B	6	No	Yes	10	Maybe		10
Busch Gardens	O	0	Yes	No	4.4	Yes		4.4
Cincinnati Zoo		2.1	No	No	6	No		6
Dallas Zoo & Aquarium	O	0	No	No	6.6	No		6.6
Denver Zoo		0			0	No		2
Disney's Animal Kingdom	O	14.10	No	No	40	No		40
Fort Worth Zoo								4
Maryland Zoo		0			4.4			4.4
Pittsburgh Zoo & Aquarium		1				Yes	1	2
Phoenix Zoo	O	0	No	No	20	No		20
San Diego Zoo Safari Park	O	8.10	No	Yes	9.9	No		9.9
San Francisco Zoo	O	0	No	No	4	Yes		8
Sedgwick County Zoo	O	3.5	No	No	15	No		15
The Toledo Zoo		0	Yes					6
Pink-backed Pelican Species Total Capacity:	Current Holdings = 62				Current Capacity = 149			Future Capacity = 167

ISIS reports that the following institutions have birds but there is no space survey data:

Jacksonville – 3.3.0

Phoenix – 3.4.0

Toronto – 4.0.0

American White Pelican <i>Pelecanus erythrorhynchos</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
Alexandria Zoo	O	2.0	No	No	2	No		2
Baton Rouge Zoo	O	0.0.2	Yes	Yes	6	No		6
Birmingham Zoo	O	5.0.0	No	No	8	Yes	2	0.0.8
Brevard Zoo		0						2
Bronx Zoo	B	0	Yes	Yes	10.10	No		20
Brookfield Zoo		1.2			5			12 (future)
Busch Gardens		0	No	No		No		1
Caldwell Zoo	O	4.0	No	No	3	Yes	4	7
Calgary Zoo		0.0			2			2
Cameron Park	O	0.0.2	Yes	No	2	No		2
Dallas Zoo and Aquarium	O	6.3	No	No	6.6	No		6.6
Denver Zoo	O	2.0.1	Yes	Yes	2	No		6
Dickerson Park Zoo		1	No	No	1	No		0
Fort Worth Zoo	O	3.2	No	No	2	No		2
Franklin Park Zoo								4-6 pairs
Gladys Porter Zoo	O	3.1	No	No				3.1
Hutchinson Zoo	O	0.1.1	No	No	2	No		2
Jackson Zoo	O	4	No	Yes	3	No		3
John Ball Zoo	O	0.4	No	No	4	Yes	3	7
Little Rock Zoo	O	1.0	No	No	5	No		7
Memphis Zoo**	O	3.0	Yes	Yes	3.3	Maybe	Unknown	Unknown
Miami MetroZoo	O	3.0	No	No	6.6	No		6.6
Northeastern Wisconsin Zoo	O	1.0	Yes	No	2	No		2
Omaha's Henry Doorly Zoo		1.0.4	No		10	Yes		10
Phoenix Zoo	O	0.0.4			10			10
Potter Park Zoo	B	0.0.1			1	Yes	1	10
Pueblo Zoo	B	1.1	Yes	Yes	2.2	Yes	0	2.2
Racine Zoo	B	0.0	Yes	Yes	4.4.0	No		4.4.4
Salisbury Zoological Park	O	2.1	No	No	3.3	No		3.3
San Antonio Zoo	O	6.2	Yes	Yes	15	Yes		20
San Diego Zoo Safari Park	O	1	No	No	3.3	Yes	2.3	3.3
San Francisco Zoo	O	0.0.1	No	No	10	No		10
Scovill Zoo	O	2.0			2			2
St. Augustine Zoo	O	0.0.2			2			2
St. Louis Zoo	O	7.3.2	No	No	12	No		12
Sunset Zoo	B	1.0	No	No	2	No		2
Tautphaus Park Zoo	O	3.0	No		6	No		6
Zoo Montana		0			8	No		4.4
American White Pelican Species Total Capacity		Current Holdings = 103			Current Capacity = 201			Future Capacity = 251

ISIS reports that the following institutions have birds but there is no space survey data:

Waco – 0.0.2 Tracy Aviary – 7.6.0

Dalmatian Pelican <i>Pelecanus crispus</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
San Diego Zoo Safari Park	0	6.6	No	No	6.6	No		6.6
Dalmatian Pelican Species total capacity	Current Holdings = 12				Current Capacity = 12			Future Capacity = 12

Brown Pelican <i>Pelecanus</i> <i>occidentalis</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
Alexandria Zoo	O	0	No	No	4	No		4
Arizona – Sonora Desert Museum		1			1	No		0
Brevard Zoo		0						2
Bronx Zoo **	B	1.2.1	Yes	Yes	0	No		0
Cameron Park	O	0.0.6	Yes	No	5	No		5
Dallas Zoo & Aquarium	O	1.0	No	No	3.3	No		3.3
Fresno Chaffee		0			1.1	Yes (2 yrs)	2.2	3.3
Fort Worth Zoo	O	0.1.1	No	No	1.1	No		2
Gladys Porter Zoo		0.0.1				Yes	2.2	4.4
Houston Zoo	O	3.1	No	Yes	2	No		2
Jackson Zoo	O	0.1.2	No	Yes	3	No		3
Miami Metro Zoo	O	7.5.1	No	No	8.8	No		8.8
Milwaukee	B	0			6			6 (?)
National Aviary	I	0.0.2	Yes	Yes	4	No		4
National Zoological Park	B	0.2	No	No	4	No		10
North Carolina Aq. at Pine Knolls	O	0	No	No	2 (coming)	No		2
Palm Beach Zoo	O	2.0.2	Yes	Yes	0.0.8	No		8
Philadelphia Zoo	B	1.1	Yes	Yes	4	No		4
San Francisco Zoo	O	0	No	No	2	No		2
Santa Barbara Zoo	O	2.0	No	No		No		2
Scovill Zoo	O	2	No	No	2	No		2
Sea World Orlando	B	0.0.1	No	No	3	No		3
South Carolina Aquarium	O	2			2	No		2
St. Augustine Alligator Farm	O	0.0.2	No	No	2 Same sex	No		2
St. Louis Zoo	B	0.0.0	No	No	2	No		2
Virginia Aq. and MSC	B	1.1	No	No	4	No		4
Virginia Zoo	O	1	No	No	5	No		5
Brown Pelican Species Total Capacity		Current Holdings = 57			Current Capacity =91			Future Capacity = 112

ISIS reports that the following institutions have birds but there is no space survey data:

Baton Rouge - 0.0.4
 Los Angeles – 0.0.1
 Brownsville – 0.0.1

Virginia Museum – 0.0.2
 Tulsa – 1.1
 Audubon – 0.0.2

Brandt's Cormorant <i>Phalacrocorax penicillatus</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Year Capacity
Sea World San Diego	O	2	Yes	Yes	4	No		4
Brandt's Cormorant Species Total Capacity:	Current Holdings = 0				Current Capacity = 0			Future Capacity = 3

White-breasted Cormorant <i>Phalacrocorax lucidus</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
Audubon Zoo	O	2.2.1	Yes	No	4.4	No		4.4
Dallas Zoo & Aquarium	O	2.0	Yes	Yes	12	Yes		12
Disney's Animal Kingdom	O	2.1	Yes	No	0	No		0
Lowry Park Zoo	O	4.5	No	No	3.8	No		11
Maryland Zoo**	O	3.2	Yes	NO	6.6	Yes - future		10.10
Memphis Zoo	O	3	No	No	0	Yes	3	3
Racine Zoo	B	2.0	Yes	No	2.2	Yes	0.0.2	2.2
Roger Williams Park Zoo	B	1	No	No	2	No		0
San Diego Zoo Safari Park	O	5.3	No	No	3.3	No		3.3
San Diego Zoo	O	2.4	No	No	2.4	Yes	2	2.4
White-breasted Cormorant Species Total Capacity:	Current Holdings = 44				Current Capacity = 61			Future capacity = 70

ISIS reports that the following institutions have birds but there is no space survey data:
Toronto – 2.0.0

Gannets

Northern Gannet <i>Morus bassanus</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	
Virginia Aq. and MSC		0			4	N		4
Northern Gannet Species Total Capacity:	Current Holdings = 0				Current Capacity = 4			Future Capacity = 4

Anhingas

Anhinga <i>Anhinga anhinga</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 year Capacity
Bronx Zoo	I	1	Yes	No	2.2	No		2.2
Caldwell Zoo		0			2			2
Dallas Zoo & Aquarium	O	0	Yes	Yes	6	Yes		6
Miami MetroZoo		0						2.2
National Zoological Park		0						6
Omaha's Henry Doorly Zoo								6
Virginia Aq. and MSC					2	No		2
Anhinga Species Total Capacity	Current Holdings = 1				Current Capacity = 14			Future Capacity = 30

African Darter <i>Anhinga rufa</i>	CURRENT SPACE				CURRENT MAXIMUM CAPACITY			FUTURE CAPACITY
	Inside, Outside or Both	Current total of individuals	Flexibility between taxa	Flexibility geographically	Current maximum # of individuals	Could more space be allocated?	How Many More?	5-10 Years Capacity
Houston Zoo		0						1.1
San Diego Zoo Safari Park	O	2.2	No	Yes	3.3	Yes	1.1	3.3
San Diego Zoo	O	2.1	No	No	2.1	yes	1.2	2.1
African Darter Species Total Capacity:	Current Holdings = 7				Current Capacity = 9			Future Capacity = 11

Appendix III

Status of Pelecaniformes species
IUCN Red List of Endangered Species 2010

Common Name	Scientific Name	Red List
African Darter	<i>Anhinga rufa</i>	LC
Christmas Island Frigate bird	<i>Fregata andrewsi</i>	CR
Ascension Frigate bird	<i>Fregata aquila</i>	VU
Lesser Frigate bird	<i>Fregata ariel</i>	LC
Magnificent Frigate bird	<i>Fregata magnificens</i>	LC
Greater Frigate bird	<i>Fregata minor</i>	LC
Northern Gannet	<i>Morus bassarnus</i>	LC
Cape Gannet	<i>Morus capensis</i>	VU
Australasian Gannet	<i>Morus serrator</i>	LC
Abbott's Booby	<i>Papasula abbotti</i>	EN
Australian Pelican	<i>Pelecanus conspicillatus</i>	LC
Dalmatian Pelican	<i>Pelecanus crispus</i>	VU
American White Pelican	<i>Pelecanus erythrorhynchos</i>	LC
Brown Pelican	<i>Pelecanus occidentalis</i>	LC
Eastern White Pelican	<i>Pelecanus onocrotalus</i>	LC
Spot-billed Pelican	<i>Pelecanus philippensis</i>	NT
Pink-backed Pelican	<i>Pelecanus rufescens</i>	NT
Peruvian Pelican	<i>Pelecanus thagus</i>	NT
Red-billed Tropicbird	<i>Phaethon aethereus</i>	LC
White-billed Tropicbird	<i>Phaethon lepturus</i>	LC
Red-tailed Tropicbird	<i>Phaethon rubicauda</i>	LC
Reed Cormorant	<i>Phalacrocorax africanus</i>	LC
European Shag	<i>Phalacrocorax aristotelis</i>	LC
Imperial Shag	<i>Phalacrocorax atriceps</i>	LC
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	LC
Guanay Cormorant	<i>Phalacrocorax bougainvillii</i>	NT
Neotropic Cormorant	<i>Phalacrocorax brasillanus</i>	LC
Campbell Island Shag	<i>Phalacrocorax campbelli</i>	VU
Cape Cormorant	<i>Phalacrocorax capensis</i>	NT
Japanese Cormorant	<i>Phalacrocorax capillatus</i>	LC
Great Cormorant	<i>Phalacrocorax carbo</i>	LC

New Zealand King Shag	<i>Phalacrocorax carunculatus</i>	VU
Stewart Island Shag	<i>Phalacrocorax chalconotus</i>	VU
Auckland Island Shag	<i>Phalacrocorax colensoi</i>	VU
Crowned Cormorant	<i>Phalacrocorax coronatus</i>	NT
Pitt Island Shag	<i>Phalacrocorax featherstoni</i>	EN
Red-legged Cormorant	<i>Phalacrocorax gaimardi</i>	NT
Galapagos Cormorant	<i>Phalacrocorax harrisi</i>	EN
Bank Cormorant	<i>Phalacrocorax neglectus</i>	VU
Socotra Cormorant	<i>Phalacrocorax nigrogularis</i>	VU
Chatham Island Shag	<i>Phalacrocorax onslowi</i>	CR
Pallas' Cormorant	<i>Phalacrocorax perspicillatus</i>	EX
Bounty Island Shag	<i>Phalacrocorax ranfurlyi</i>	VU
Tasman Booby	<i>Sula tasmani</i>	EX

Conservation status:

E = endangered

VU = vulnerable

NT = near threatened

NL = not listed

I = Appendix I (CITES)

Appendix IV
Endangered and Threatened Procelleriformes
IUCN Red List of Endangered Species 2010

Small St Helena Petrel	<i>Bulweria bifax</i>	EX
Jouanin's Petrel	<i>Bulweria fallax</i>	NT
Cape Verde Shearwater	<i>Calonectris edwardsii</i>	NT
Amsterdam Albatross	<i>Diomedea amsterdamensis</i>	CR
Antipodean Albatross	<i>Diomedea antipodensis</i>	VU
Tristan Albatross	<i>Diomedea dabbenena</i>	CR
Southern Royal Albatross	<i>Diomedea epomophora</i>	VU
Wandering Albatross	<i>Diomedea exulans</i>	VU
Northern Royal Albatross	<i>Diomedea sanfordi</i>	EN
Polynesian Storm-Petrel	<i>Nesofregetta fuliginosa</i>	EN
White-vented storm-Petrel	<i>Oceanites gracilis</i>	DD
New Zealand Storm-Petrel	<i>Oceanites maorianus</i>	CR
Ashy Storm Petrel	<i>Oceanodroma homochroa</i>	EN
Ringed Storm-Petrel	<i>Oceanodroma hornbyi</i>	DD
Guadalupe Storm-Petrel	<i>Oceanodroma macrodactyla</i>	CR
Markham's Storm Petrel	<i>Oceanodroma markhami</i>	DD
Matsudaira's Storm-Petrel	<i>Oceanodroma matsudairae</i>	DD
Tristram's Storm-Petrel	<i>Oceanodroma tristrami</i>	NT
Peruvian Diving-Petrel	<i>Pelecanoides garnotii</i>	EN
Short-tailed Albatross	<i>Phoebastria albatrus</i>	VU
Laysan Albatross	<i>Phoebastria immutabilis</i>	NT
Waved Albatross	<i>Phoebastria irrorata</i>	NT
Black-footed Albatross	<i>Phoebastria nigripes</i>	EN
Sooty Albatross	<i>Phoebetria fusca</i>	EN
Light-mantled Albatross	<i>Phoebetria palpebrata</i>	NT
White-chinned Petrel	<i>Procellaria aequinoctialis</i>	VU
Grey Petrel	<i>Procellaria cinerea</i>	NT
Spectacled Petrel	<i>Procellaria conspicillata</i>	VU
Black Petrel	<i>Procellaria parkinsoni</i>	VU
Westland Petrel	<i>Procellaria westlandica</i>	VU
Mascarene Black Petrel	<i>Pseudobulweria aterrima</i>	CR
Beck's Petrel	<i>Pseudobulweria becki</i>	CR
Fiji Petrel	<i>Pseudobulweria macgillivrayi</i>	CR
Tahiti Petrel	<i>Pseudobulweria rostrata</i>	NT
Phoenix Petrel	<i>Pterodroma alba</i>	EN
Trindade Petrel	<i>Pterodroma arminjoniana</i>	VU
Henderson Petrel	<i>Pterodroma atrata</i>	EN
Chatham Petrel	<i>Pterodroma axillaris</i>	EN
Barau's Petrel	<i>Pterodroma barau</i>	EN

Appendix IV
Endangered and Threatened Procelleriformes
IUCN Red List of Endangered Species 2006
Continued

Collared Petrel	<i>Pterodroma brevipes</i>	NT
Bermuda Petrel	<i>Pterodroma cahow</i>	EN
Jamaica Petrel	<i>Pterodroma caribbaea</i>	CR
White-necked Petrel	<i>Pterodroma cervicalis</i>	VU
Cook's Petrel	<i>Pterodroma cookii</i>	VU
De Filippi's Petrel	<i>Pterodroma defilippiana</i>	VU
Juan Fernandez Petrel	<i>Pterodroma externa</i>	VU
Fea's Petrel	<i>Pterodroma feae</i>	NT
Black-capped Petrel	<i>Pterodroma hasitata</i>	EN
Atlantic Petrel	<i>Pterodroma incerta</i>	EN
Mottled Petrel	<i>Pterodroma inexpectata</i>	NT
Gould's Petrel	<i>Pterodroma leucoptera</i>	VU
Stejneger's Petrel	<i>Pterodroma longirostris</i>	VU
Zino's petrel	<i>Pterodroma madeira</i>	EN
Chatham Island Taiko	<i>Pterodroma magentae</i>	CR
Galapagos Petrel	<i>Pterodroma phaeopygia</i>	CR
Pycroft's Petrel	<i>Pterodroma pycrofti</i>	VU
Hawaiian Petrel	<i>Pterodroma sandwichensis</i>	VU
Providence Petrel	<i>Pterodroma solandri</i>	VU
Murphy's Petrel	<i>Pterodroma ultima</i>	NT
Townsend's Shearwater	<i>Puffinus auricularis</i>	CR
Buller's Shearwater	<i>Puffinus bulleri</i>	VU
Pink-footed Shearwater	<i>Puffinus creatopus</i>	VU
Sooty Shearwater	<i>Puffinus griseus</i>	NT
Heinroth's Shearwater	<i>Puffinus heinrothi</i>	VU
Hutton's Shearwater	<i>Puffinus huttoni</i>	EN
Balearic Shearwater	<i>Puffinus mauretanicus</i>	CR
Newell's Shearwater	<i>Puffinus newelli</i>	EN
Black-vent Shearwater	<i>Puffinus opisthomelas</i>	N
Yelkouan Shearwater	<i>Puffinus yelkouan</i>	NT
Buller's Albatross	<i>Thalassarche bulleri</i>	NT
Indian Yellow-nosed Albatross	<i>Thalassarche carteri</i>	EN
Shy Albatross	<i>Thalassarche cauta</i>	NT
Atlantic Yellow-nosed Albatross	<i>Thalassarche chlororhynchos</i>	EN
Grey-headed Albatross	<i>Thalassarche chrysostoma</i>	VU
Chatham Albatross	<i>Thalassarche eremita</i>	CR
Campbell Albatross	<i>Thalassarche impavida</i>	VU
Black-browed Albatross	<i>Thalassarche melanophrys</i>	EN
Salvin's Albatross	<i>Thalassarche salvini</i>	VU
White-capped Albatross	<i>Thalassarche steadi</i>	NT

ACCOUNTABILITY TABLE

Appendix V

Space Survey Responses		
<i>yellow indicates no response</i>		
Institutions with IR's		
Abilene Zoological Gardens	Hogle Zoo	Racine Zoological Gardens
African Safari Wildlife Park	Honolulu Zoo	Riverbanks Zoo & Garden
Akron Zoological Park	Houston Zoo, Inc.	Roger Williams Park Zoo
Aquarium & Rainforest at Moody Gardens, Inc.	Hutchinson Zoo	Roosevelt Park Zoo
Arizona-Sonora Desert Museum	Jackson Zoological Park	Sacramento Zoo
Assiniboine Zoo	Jacksonville Zoo and Gardens	Saint Louis Zoo
Audubon Zoo	John Ball Zoological Garden	Salisbury Zoological Park
Birmingham Zoo	Kansas City Zoo	San Antonio Zoological Gardens & Aquarium
Blank Park Zoo	Knoxville Zoological Gardens	San Diego Zoo
Bronx Zoo	Lee Richardson Zoo	San Diego Zoo Safari Park
Busch Gardens Tampa Bay	Lincoln Park Zoo	San Francisco Zoological Gardens
Calgary Zoo, Botanical Garden & Prehistoric Park	Little Rock Zoo	Santa Barbara Zoological Gardens
Cameron Park Zoo	Living Desert Zoo & Gardens State Park	Scovill Zoo
Cheyenne Mountain Zoo	Los Angeles Zoo and Botanical Gardens	SeaWorld San Diego
Chicago Zoological Society - Brookfield Zoo	Louisville Zoological Garden	Sedgwick County Zoo
Cincinnati Zoo & Botanical Garden	Maryland Zoo in Baltimore	Sequoia Park Zoo
Cleveland Metroparks Zoo	Memphis Zoo	Six Flags Discovery Kingdom
Columbus Zoo and Aquarium	Miami Metrozoo	Smithsonian National Zoological Park
Cosley Zoo	Miller Park Zoo	St. Augustine Alligator Farm
Dallas Zoo	Minnesota Zoological Garden	St. Louis Zoo
Denver Zoological Gardens	Montgomery Zoo	Tampa's Lowry Park Zoo
Detroit Zoological Society	Nashville Zoo, Inc.	Tautphaus Park Zoo
Dickerson Park Zoo	National Aviary	Texas State Aquarium
Disney's Animal Kingdom	Newport Aquarium	Toledo Zoological Gardens
El Paso Zoo	Northeastern Wisconsin (NEW) Zoo	Tulsa Zoo and Living Museum
Elmwood Park Zoo	Oklahoma City Zoological Park	Turtle Back Zoo
Erie Zoo	Omaha's Henry Doorly Zoo	Virginia Zoo
Florida Aquarium	Palm Beach Zoo	Woodland Park Zoo
Fort Wayne Children's Zoo	Philadelphia Zoo	Zoo de Granby
Fort Worth Zoo	Point Defiance Zoo & Aquarium	
Franklin Park Zoo	Potter Park Zoological Gardens	
Great Plains Zoo Delbridge Museum of Natl. Hist.	Pueblo Zoo	
Henry Vilas Zoo	Queens Zoo	

Space Survey Responses

yellow indicates no response

Institutions without IR's

Aquarium of the Pacific	DNREC	Peoria Zoo
Adventure Aq	Ellen Trout Zoo	Pittsburgh Zoo
Alameda Park Zoo	Fossil Rim	Potawatomi Zoo
Albuquerque Biological Park	Georgia Aquarium	Prospect Park Zoo
Alexandria Zoo	Gladys Porter Zoo	Red River Zoo
Atlantis Paradise Island	Greenville Zoo	Reid Park
Baton Rouge Zoo	Grizzly and Wolf Discovery Center	Ripley's Aq
Bergen County Zoo	Happy Hollow Zoo	Ripley's Aq of the Smokies
Bermuda Aq, Museum, Zoo	Henson Robinson Zoo	Riverside Zoo
Binder Park	Houston Aq	Rolling Hills
Biodome de Montreal	Indianapolis Zoo	Rosamond Gifford Zoo
Birch Aq	International Crane Foundation	Santa Ana Zoo
Boonshoft Museum	Jenkinsons Aq	Santa Fe Teaching College
Bramble Park Zoo	Lehigh Valley	Sea World San Antonio
Brandywine Zoo	Lincoln Children's Zoo	Seattle Aq
Brevard Zoo	Long Beach Aq	Senaca Park Zoo
Brookfield Zoo	Mesker Park Zoo	Shark Reef
Brookgreen Gardens	Mote Marine Aq	Shedd Aq
Buffalo Zoological Gardens	Museum of Science Boston	South Carolina Aquarium
Butterfly House	Mystic Aq	Squam Lakes Nat Sci Ctr
Buttonwood Park Zoo	Naples Zoo	Staten Island Zoo
Cabrillo Marine Aquarium	Nat Mississippi River Museum	Sunset Zoo
Caldwell Zoo	Nat Sci Ctr & Animal Discovery	Tennessee Aq
Cape May Cty Park Zoo	National Aquarium	The Butterfly House
Capron Park Zoo	NC Aq at Fort Fisher	The Living Seas
Central Florida Zoo	NC Aq at Pine Knolls	The Wilds
Central Park Zoo	NC Aq at Roanoke Island	Topeka Zoo
Charles Paddock Zoo	Niabi Zoo	Toronto Zoo
Chattanooga Zoo	New England Aq	Trevor Zoo
Chahinkapa Zoo	NY Aquarium	Vancouver Aq
Chehaw Wild Animal Park	North Carolina Zoo	Virginia Aq and Marine Sc Ctr
Clyde Peeling Reptile House	Northwest Trek	Virginia Living Museum
Como Park Zoo	Oakland Zoo	Walter Stone Memorial Zoo
Connecticut Beardsley Zoo	Ocean Park	W. North Carolina Nature Center
Coyote Point Museum	Oglebay's Good Zoo	Wildlife Safari
Dakota Zoo	Oregon Coast Aq	Zoo Atlanta
Dallas World Aq	Oregon Zoo	Zoo Boise
David Traylor Zoo	Patronato del Parque	Zoo Montana
Denver Downtown Aq		

The space survey results show that 85 out of 95 **institutions that currently have Pelecaniformes IR's** responded which is equivalent to a 90% response rate. For those institutions without an IR the response rate was 94 out of 115 which is equivalent to a 82% response rate.

Acknowledgements

Thanks to everyone who assisted with this RCP.

Special thanks to Sara Hallager, Joe Barkowski and Tom Schneider for all your mentoring!

PHOTO CREDIT

Many thanks to everyone who submitted pictures for this RCP!!