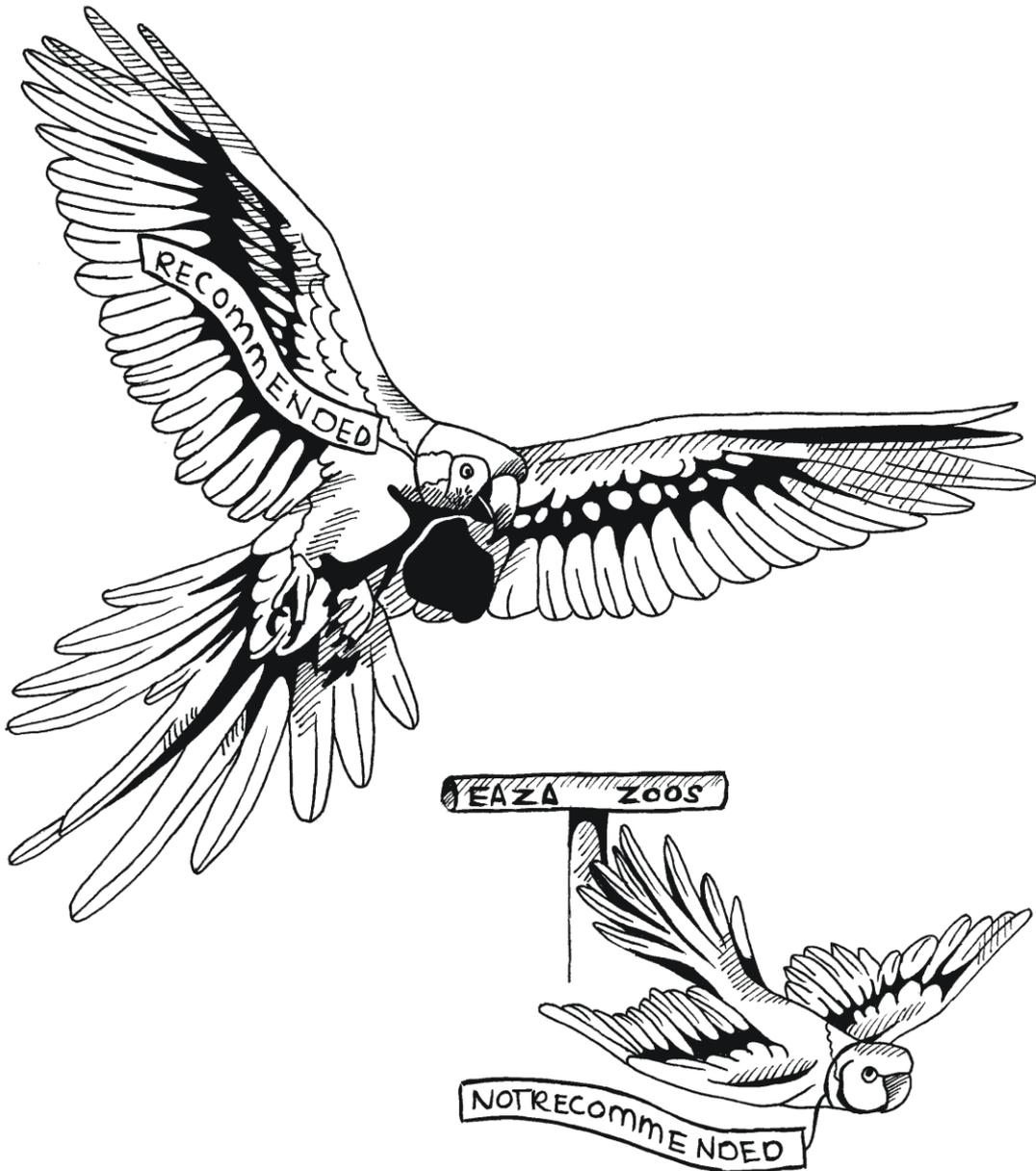


# The impact of Regional Collection Plans

An evaluation on the implementation of the recommendation given  
by Taxon Advisory Groups



By Anne van den Broek and Philip Jansen

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June, 2013

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# Foreword

In the last months we have been working on the thesis research 'The effect of Regional Collection Plans' for EAZA Executive Office. We saw this thesis as a very educational and informative experience to finish our studies at the University of Applied Sciences Van Hall Larenstein. We would like express our gratitude towards the persons who helped us during this research.

Firstly, we would like to thank Christina Henke, Executive Coordinator of EAZA Executive Office. We are grateful that she offered us this topic for our thesis research. During the research she has been a very helpful and also gave us the opportunity to gain insight into the activities of EAZA in general.

Our tutors of the University of Applied Sciences Van Hall Larenstein, Mrs. Griede and Mr. Bezuijen, have helped us with their critical view to improve this thesis research in a positive way. We are grateful for this and the way they helped us through the learning process of this thesis.

Last but not least, we would like to thank the whole EAZA Executive Office for their comments on our thesis during the process.

Anne van den Broek and Philip Jansen, June 2013

University of Applied Sciences Van Hall Larenstein  
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# Summary

To be able to keep sustainable populations which are independent from wild populations zoos need to cooperate in collection planning. To aid this cooperation the Taxon Advisory Groups (TAGS) of the European Association of Zoos and Aquaria (EAZA) design Regional Collection Plans (RCPs). These RCPs contain recommendations for EAZA member zoos about which species should be kept and which not. EAZA member zoos are encouraged to use these RCP recommendations as a framework but they can still make their own decisions for their collection planning. In order to be effective it is however important that member zoos follow the recommendations so sustainable populations can be formed.

This objective of this study is to evaluate the implementation of the RCP recommendations into their collection planning and which factors may have influence on this implementation.

To evaluate the implementations of the RCP recommendations, the change in RCP species kept, the change in number of member zoos keeping RCP species and the change in number of exhibits used for RCP species since publication, is examined for six different RCPs. These changes are examined for the RCP categories; Recommended, Not recommended and Pending. Furthermore, the movement of the population sizes of RCP species towards their recommended target population size is examined. An implementation score of each RCP is determined showing the implementation of the RCP recommendation by member zoos. Factors which are examined that might have influence on this implementation score are; the time zoos have to implement the RCP recommendations and the involvement of member zoos into collection planning tasks.

The information needed for this evaluation is obtained from the Zoological Information Management System (ZIMS), European Endangered species Programme (EEP) annual reports and the EAZA yearbook. Information is gathered from the collections of all full EAZA member zoos whom are also ISIS member and from the species mentioned in the following RCPs: Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid.

The results show that the number Recommended species kept increased for the Callitrichid (+1) and Parrot RCP (+3) and decreased for the Antelope RCP (-2). The number of Not recommended species kept increased for the Callitrichid RCP (+1) and Parrot RCP (+2), but decreased for the Prosimian (-1) and Antelope RCP (-2). The number of EAZA member zoos keeping Recommended species (X) increased since RCP publication ( $+1 \leq X \leq +24$ ). An increase in number of member zoos is also shown for the Not recommended Callitrichid (+2), Antelope (+7) and Prosimian species (+3). The number of member zoos keeping Not recommended Parrot (-2) and Prosimian species (-4) decreased. The number of exhibits (X) has increased for all the Recommended RCP species ( $+3 \leq X \leq +79$ ), except for the Penguin RCP. The number of exhibits used for Not recommended species increased for the Antelope (+1), Callitrichid (+2) and Prosimian RCP (+2) but decreased for the Parrot (-22) and Canid RCP (-2). The results show that the population sizes of ten of the sixteen species moved closer towards their target population size. The implementation score differs between every RCP, the Parrot RCP has the highest implementation score (0,019) and the Callitrichid the lowest implementation score (-0,003). The differences between these scores cannot be explained by the implementation time and the involvement categories.

Most results are in line with the RCP recommendations. It can however not be concluded that these results are caused by the RCPs. Furthermore, targets need to be set to make it possible to measure how the RCP recommendations are followed.

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# Chapter 1. Introduction

## 1.1 Problem description

Zoos need sustainable populations to be independent from wild populations. Sustainable populations are populations that are genetically and demographically healthy, and ranges from 50 to 500 individuals (Frankham, R. et al, 2007). Individual zoos cannot keep and create sustainable populations on their own, because every member zoo has limited resources and space. Thus, zoos need to cooperate to create and maintain sustainable populations by using their limited resource and space to keep large enough populations. Even if all zoos cooperate, they do not have enough resources to maintain sustainable populations for all possible species that could benefit from ex-situ breeding. Due to this, member zoos should only keep a limited number of species within their collections. A selection of species, displayed in a collection plan, should be made that applies for all zoos in a selected region.

To coordinate and facilitate the focus of resources and other processes, European zoos have created a zoo association in 1992, called the European Association of Zoos and Aquaria (EAZA) (EAZA, 2013)<sup>3</sup>. EAZA has currently 345 members within 41 countries. Their mission is to facilitate cooperation within the European zoo and aquarium community, towards the goals of education, research and conservation (EAZA, 2013)<sup>1</sup>. One of the activities EAZA has set up is collection planning. To help coordinate the collection planning the EAZA has formed Taxonomic Advisory Groups (TAGs) (EAZA, 2013)<sup>2</sup>. Several TAG groups consist within EAZA, each group has a species group which they coordinate, e.g. the penguin TAG, parrot TAG and the amphibian TAG. The Regional Collection Plans (RCP) they design are plans with a selection of species to keep in European zoos. A RCP contains recommendation for EAZA member zoos which tell what species should be obtained and which species should not be obtained. Each TAG does this for its own species group. The RCPs are reviewed by the TAGs and are newly published after each review (EAZA, 2011). The TAGs do not review the RCPs on a regular basis and interval, therefore each RCP has a different year of publishing. The goal of these RCPs is to give recommendations to Institutional Collection Planners which species should be kept to ensure EAZA co-operation in species breeding and conservation programmes (EAZA, 2005). The goal of the RCP ensures that enough members hold recommended species so that sustainable populations can be formed that are independent from supplies out of the wild. The recommendations that are formed within the RCPs are scaled into three categories for the species, i.e. Recommended, Not recommended and Pending. To help the TAGs design their RCPs and form their recommendations, EAZA designed a manual for making these RCPs. In this manual EAZA recommends for example that target populations sizes should be set. Thereby, the EAZA designed manual lists criteria for recommended species based on the mission of EAZA in which conservation and education play a major role (EAZA, 2005).

The member zoos are encouraged by EAZA to use these recommendations as a framework to make their institutional collection plan. They can still make their own decisions whether they follow the recommendations or not and to what extent. However, it is important that the member zoos follow the recommendations of the RCPs, in order to make them effective (EAZA, 2013<sup>3</sup> & EAZA, 2005). If not, this will result in less sustainable populations within member zoos and a waist of limited resources and space.

So, it is important to know if member zoos indeed follow the recommendations in the RCPs. A research done by Willem van Doorn describes the implementation of the recommendations of TAGs in RCPs in Australia. It is important for the Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA) to know if their RCPs are followed, because one of their goals is also to form sustainable populations that are independent from other regions (Doorn, 2006), as it is for EAZA.

Besides the evaluation of the goal of the RCPs it is desirable to know what might cause why recommendations are followed positively or negatively among EAZA member zoos. There are several factors that may have influence on the implementation of the recommendations of the RCPs.

Firstly, the year of publishing of the RCPs might be a relevant factor for the implementation of the RCPs. RCPs that were published more recently might be implemented less than RCPs that were published at an earlier stage. Since member zoos had less time to implement recommendations within their institutional collection plan.

Secondly, the involvement level of member zoos might be a relevant factor for the implementation of the RCPs. A research was done on the involvement in the regional collection planning tasks by de Jong & Plattje in 2008. Results of this research show that there is a strong positive correlation between the involvement of member zoos and their number of executed collection planning tasks and other joint EAZA tasks (de Jong & Plattje, 2008). Therefore, the involvement of EAZA member zoos might be associated with the accuracy of following RCP recommendations.

## 1.2 Objective

The objective of this study is evaluating the implementation of the Regional Collection Plans into the collection of the EAZA member zoos. For this purpose it is of importance to gain insight in different factors which might influence the implementation of the recommendations; the implementation time of the RCPs and the involvement of zoos. Thereby, it is of importance to gain insight in movement of the populations sizes of the RCP species towards their recommended population sizes.

## 1.3 Research questions

1. How have EAZA member zoos responded to the recommendations written in the Regional Collection Plans for the Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid?
  - a. How has the number of species, for each Regional Collection Plan and for all member zoos together, changed per category since publication?
  - b. How has the number of member zoos keeping species per category for each Regional Collection Plan changed since publication?
  - d. How has the number of exhibits used for RCP species per category for each Regional Collection Plan changed since publication?
  - d. What is the implementation score of each Regional Collection Plan?
  
2. How have the Regional Collection Plans for the Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid with different publication years been implemented by EAZA member zoos?
  - a. What is the implementation time of each Regional Collection Plan?
  - b. Is there a relation between the implementation time and the implementation score of each Regional Collection Plan?
  
3. How have the Regional Collection Plans for the Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid been implemented by zoos with different involvement categories?
  - a. Which zoos are classified within which involvement category?
  - b. Is there a relation between the different involvement categories and the implementation score of each Regional Collection Plan?
  
4. How have the population sizes of the species described in Regional Collection Plans for the Callitrichid and Prosimian been moving towards their recommended target population sizes?
  - a. What is the target population size for each species described in each Regional Collection Plan?
  - b. How has the difference between the population size and the target population size of each species in each Regional Collection Plan changed since publication?

## Chapter 2. Methods

### 2.1 Operationalization

#### 1. Change in number of RCP species kept by all EAZA member zoos per category

The change in number of RCP species is expressed as a negative or positive number which can be calculated by the following formula:  $CS = N_{2012} - N_{\text{publish year RCP}}$

CS = Change in number of RCP species

N = Number of different RCP species kept by all EAZA member zoos together

This change in numbers is calculated separately for the RCP species per category, which are Recommended, not recommended or Pending. Thereby, this is calculated for each RCP separately.

#### 2. Change in number of member zoos keeping RCP species per category

The change in number of member zoos is expressed as a negative or positive number which can be calculated by the following formula:  $CZ = N_{2012} - N_{\text{publish year RCP}}$

CZ = Change in number of member zoos

N = Number of member zoos keeping RCP species

This change in number is calculated separately for zoos keeping RCP species from each category, which are Recommended, Not recommended and Pending. Thereby, this is calculated for each RCP separately.

#### 3. Change in number of exhibits used for RCP species per category

The change in number of exhibits used for RCP species is expressed as a negative or positive number which can be calculated by the following formula:  $CE = N_{2012} - N_{\text{publish year RCP}}$

CE = Change in number of exhibits

N = Number of exhibits

This change is also calculated separately for the exhibits per category, which are Recommended, Not recommended and Pending. Thereby, this is calculated for each RCP separately.

#### 4. Implementation score

The implementation score is expressed as a negative or positive number which tells how the recommendations of each RCP have been implemented by all EAZA member zoos together. This can be calculated by the following formula:  $I = D_{2012} - D_{\text{publish year RCP}}$

I = Change in division of exhibits used for Recommended /Not recommended species

D = Division of exhibits used for Recommended /Not recommended species

These implementation score is calculated for each RCP separately.

#### 5. Implementation time

The implementation time is expressed as the time interval in years between the publication year of a RCP and the end of 2012. This can be calculated by the following formula:  $TY = 2012 - Y$

TY = Time interval in years between the publication year of a RCP and 2012

Y = Year of publication

This number is calculated for each RCP.

#### 6. Involvement category

The involvement of EAZA members with regional collection planning is defined as the comparison between the amount of work an EAZA member actually carries out and the amount of work an EAZA member should do on the basis of fair division. This involvement is expressed in the Performance Index (PI), and is calculated in 2008 for all the EAZA member zoos whom are capable of executing collection planning tasks by de Jong and Plattje (2008).

To include the Performance Index in this research, the scores are divided into three involvement categories: Low (PI = 0 – 0,99), Medium (PI = 1 – 1,99) and High (PI = >2).

### *7. Movement of the population size to their recommended target population size*

The movement of the population size is expressed as a negative or positive number which tells how the population size moves towards or away from the target population size. The movement can be calculated by the following formula:  $MP = (DT_{\text{publish year RCP}} - DT_{2013}) * -1$

MP = Movement of the population size to their recommended target population size

DT = Difference between the population size and target population size

This movement is calculated for every Callitrichid and Prosimian species for which target population size was set.

## **2.2 Research type**

This research consists of several research types. Firstly, this research is empirical using quantitative data. Secondly, the research has an evaluation component, giving an evaluation about the goal of the Regional Collection Plans. Thirdly, this research has also an exploratory component. An answer is given if the implementation time is a reason why some Regional Collection Plans are better implemented than others, and if the involvement of member zoos plays a role. These questions were never answered or explored in a previous research. Thereby, this is a practical research. The research is made in order of EAZA and can be helpful in the future in the way Regional Collection Plans are managed.

## **2.3 Research population**

### *1. Regional Collection Plans*

The research population of RCPs consists of a total of six Regional Collection Plans, which are written for the following animal groups: Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid.

This research population is a sample from a total of 35 RCP published on the EAZA member site. From these 35 RCPs only 21 were possible to use in this research (Appendix I). From these 21 RCPs, the RCPs for the Callitrichid, Parrots and the Prosimian were suggested by the EAZA Executive Office to use into this research because of their high quality and year of publication. The RCPs for the Antelope, Penguin and Canid were randomly chosen from the remaining 19 RCPs by Microsoft Excel. The total sample size of six RCPs is based on the maximum time possible to spend on this research, supposed that the data collection of each RCP and the species collection takes around one and a half week.

### *2. The species collection of Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid of EAZA member zoos from whom the species collection is published in the Zoological Information Management System (ZIMS)*

The second research population for which data will be collected is from the species collection of Callitrichid, Parrots, Antelope, Penguin, Prosimian, and Canid of the EAZA members from who the species collection is published in ZIMS. ZIMS is one of the species holding programmes created by the International Species Information System (ISIS). The EAZA member zoos from whom the species collection is published in ZIMS are typically members which pass information about their species collection on to ISIS. From March 2013 in total 247 EAZA member zoos do this, which are 87% of the total 285 EAZA full member zoos (Appendix II). There is specifically chosen for this research population because of the ability of ZIMS to give information about the animals and species in these zoos, which will be needed to answer the research questions.

### *3. The EAZA member zoos from who the involvement is determined and from whom the species collection is published in ZIMS*

The third research population consists of the EAZA member zoos from who the involvement is determined and from who the species collection is published in ZIMS. This research population is almost the same as research population 2 except the fact that from these EAZA member zoos the involvement is determined by de Jong & Plattje. From these specific zoos from which also the species collection is also published in ZIMS (Appendix II) information can be collected which will give answer

to the third research question. In total this research population consists of 204 EAZA member zoos, which is 72% of the total EAZA full member zoos.

## 2.5 Data collection

### *1. Data collection using the ISIS programme ZIMS*

The ZIMS programme is used to get information about which species are kept in which zoos in which years. This information is gathered for each species described RCPs for the Callitrichid, Parrots, Antelope, Penguin, Prosimian and Canid. This information is inserted in a primary data sheet within Excel. For each RCP a separate datasheet is filled in twice, once for the year the RCP was published and once for the year 2012. When both primary datasheets for each RCP are filled in the following information was known: which different RCP species are kept per category at year of publication and the end of 2012, and which member zoos are keeping which RCP species per category at the year of publication and the end of 2012.

### *2. Determination of the year of publication of each RCP.*

Information about the years of publication is collected from the RCP itself.

### *3. Determine the involvement categories*

The determination of the involvement categories is done with the data from the research done by de Jong & Plattje. The involvement categories are determined like mentioned in the operationalization and written in the primary datasheet. Afterwards, it was possible to know which member zoos in the different involvement categories keep which RCP species per category at the year of publication and the end of 2012.

### *4. Determine the target population sizes and to collect data about population sizes*

Information about the target population sizes of the Callitrichid and Prosimian species are collected from the RCPs themselves. The population sizes from the year of publication are collected from the EEP annual reports and the EAZA yearbook. Data about the population sizes from the year 2013 is collected from ZIMS. This information is inserted in a datasheet, making it possible to know what the target population sizes of which species is and what the population sizes are for each species for which target population size was set at the year of publication and in 2013.

## Chapter 3. Results

### 3.1 Response to recommendations written in RCPs

Six RCPs were under research to access the response to the recommendations (table 1). The publication years of these RCPs vary between 2003 and 2011. The Canid RCP is the most recently published RCP and the Antelope RCP is the least recently published RCP. The Parrot RCP describes the largest number of species and the Penguin RCP the smallest number of species.

Table 1. Number of species described in the RCPs and the publication year of the RCPs

RCP	Number of species described in the RCP				Publication year
	REC	NOT REC	PEN	TOTAL	
Canid	18	47	4	69	2011
Prosimian	21	8	5	34	2010
Penguin	9	10	1	20	2009
Parrot	109	318	4	431	2008
Callitrichid	34	31	0	65	2006
Antelope	60	11	0	71	2003

#### 3.1.1 Change in number of RCP species since publication

Only a small number of these possible species described in the RCPs can be kept by EAZA member zoos. Since publication, the number of Callitrichid and Parrot species kept increased, while the number of Antelope and Prosimian RCP species kept decreased.

Table 2. Number of RCP species kept in the year of publication and 2012

RCP	Number of RCP species kept at publication	Number of RCP species kept in 2012	Increase (+), decrease (-) or stable (0)
Parrot (n=431)	278	283	+ 5
Callitrichid (n=65)	23	25	+ 2
Canid (n=69)	39	39	0
Penguin (n=20)	11	11	0
Prosimian (n=34)	32	31	- 1
Antelope (n=71)	56	52	- 4

In the case of the Callitrichid and Parrot species, the increase in number of species is a result of an increase in both Recommended and Not recommended species (table 3). The decrease in number of Prosimian species is the result of a decrease in number of Not recommended species kept and of the Antelope species a decrease in Recommended and Not recommended species kept.

Table 3. Change in number of RCP species kept since publication per category

RCP	Change in number of RCP species together per category		
	REC	NOT REC	PEN
Parrot (n=431)	+ 3	+ 2	0
Callitrichid (n=65)	+ 1	+ 1	0
Canid (n=69)	0	0	0
Penguin (n=20)	0	0	0
Prosimian (n=34)	0	-1	0
Antelope (n=71)	-2	-2	0

### 3.1.2 Change in number of member zoos keeping RCP species since publication

Changes in number of RCP species kept can be caused by a change in the collection of zoos that already keep RCP species or by more zoos getting involved in keeping RCP species. The number of member zoos keeping RCP species has increased for all the six RCPs (table 4).

Table 4. Number of EAZA member zoos keeping RCP species in the year of publication and 2012

RCP	Number of member zoos keeping RCP species at year of publication	Number of member zoos keeping RCP species at year in 2012	Increase (+), decrease (-) or stable (0)
Callitrichid	166	190	+ 24
Antelope	162	172	+ 10
Prosimian	179	184	+ 5
Penguin	110	114	+ 4
Parrot	204	206	+ 2
Canid	177	178	+ 1

These changes are the results of more member zoos starting to keep Recommended species, with the highest increase for the Callitrichid RCP (table 5). However, for the Callitrichid, Antelope and Prosimian RCPs, more member zoos start to keep Not recommended species as well. Only for the Parrot and Canid RCPs, the data show a decrease in member zoos keeping Not recommended species. A decrease in member zoos is recorded with regard to Pending species for the Parrot and Prosimian RCP.

Table 5. Change in number of member zoos keeping RCP species since publication per category

RCP	Change in total number of zoos keeping species in each category		
	REC	NOT REC	PEN
Callitrichid	+ 24	+ 2	0
Antelope	+ 9	+ 7	0
Prosimian	+ 3	+ 3	- 4
Penguin	+ 4	0	0
Parrot	+ 2	- 3	- 2
Canid	+ 1	- 2	0

Differences in numbers between the increase in table 4 and the sum of all changes in table 5 can be seen. These differences are caused by zoos whom already keep a RCP species in the year of publication and added a RCP species of another category.

### 3.1.3 Change in number of exhibits used for RCP species since publication

The number of exhibits is limited in every zoo. The number of available exhibits designated to RCP species is depending on the policy of the individual zoos. RCP recommendations do influence the division of exhibits if the zoo incorporates the RCP recommendations in their collection planning policy.

Since publication of each RCP, the total number of exhibits among all EAZA member zoos has increased for all the RCP species, except the Penguin RCP. This number of exhibits is calculated assuming that one species uses one exhibit (table 6).

Table 6. Change in number of exhibits used for RCP species since publication

RCP	Number of exhibits used for RCP species at the year of publication	Number of exhibits used for RCP species per zoo in 2012	Increase (+), decrease (-) or stable (0)
Antelope (n=71)	835	914	+ 79
Callitrichid (n=65)	633	711	+ 78
Parrot (n=431)	2390	2429	+ 39
Prosimian (n=34)	655	679	+ 24
Canid (n=69)	470	473	+ 3
Penguin (n=20)	156	156	0

This new space, in case of the Parrot and Canid RCP, is 100% used for Recommended species (table 7). For the Callitrichid, Parrot and Prosimian RCP this is less, but still above 90%.

Table 7. Percentage of new exhibits used for Recommended species

RCP	Percentage of number of new exhibits used for Recommended species
Parrot (n=431)	100%
Canid (n=69)	100%
Antelope (n=71)	99%
Callitrichid (n=65)	97%
Prosimian (n=34)	93%
Penguin (n=20)	-

However, much more new exhibits are provided to Recommended Parrot species than to Recommended Canid species (table 8). Less exhibits have been provided to Not recommended species of these RCPs. Much less new space is used for Recommended Prosimian species compared to Callitrichid and Antelope species.

Table 8. Change in number of exhibits used for RCP species since publication per category

RCP	Change in number of exhibits used for RCP species since publication		
	REC	NOT REC	PEN
Antelope (n=71)	+ 78	+ 1	0
Callitrichid (n=65)	+ 76	+ 2	0
Parrot (n=431)	+ 61	- 22	0
Prosimian (n=34)	+ 27	+ 2	- 5
Canid (n=69)	+ 5	- 2	0
Penguin (n=20)	0	0	0

### 3.1.4 Implementation score of each RCP

If EAZA member zoos decide to change the number of exhibits of RCP species or the occupancy of the exhibits in accordance with the recommendations, new exhibits should be occupied by Recommended RCP species. If a zoo decreases the number of exhibits, implementation of the recommendations would lead to a decrease of Not recommended species rather than of Recommended species. This implementation of the recommendations is expressed by an implementation score for each RCP ( $I = D_{2012} - D_{\text{publish year RCP}}$ )(Appendix III).

The Parrot is the best implemented, having the highest implementation score (figure 1). The scores for the Prosimian, Canid and Antelope RCP are positive but much lower than the Parrot RCP. The RCP implemented least are the Penguin and Callitrichid RCP.

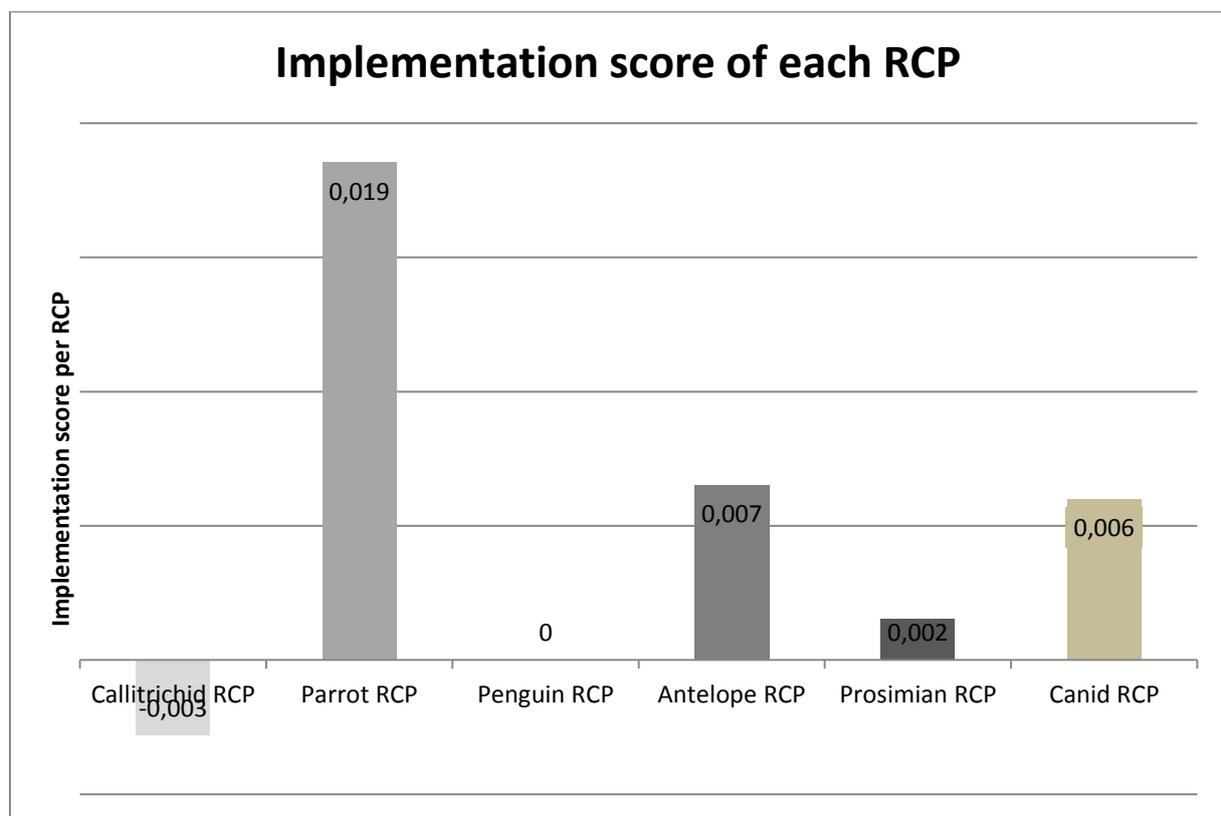


Figure 1. Implementation score of each RCP

The implementation score of the Callitrichid RCP is negative because in the year of publication all exhibits were used for Recommended species and in 2012 two new exhibits were used for Not recommended species. It should be taken into account that new exhibits were used for Recommended species as well.

### 3.2 Differences in implementation by different publication years

Each RCP is published in a different year. If EAZA member zoos have more time to implement the RCP recommendations, these recommendations might be better implemented.

The differences in implementation scores are however not related to the time EAZA member zoos had to implement the recommendations ( $R^2 = 6,826 \text{ E-}5$ )(figure 2).

Implementation of the recommendation of RCPs with different publication years

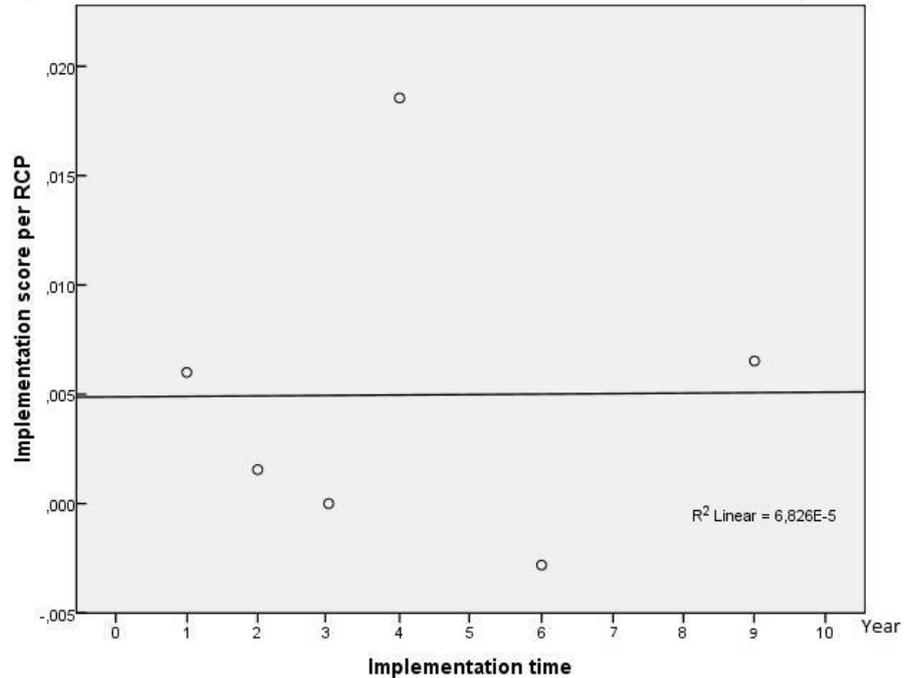


Figure 2. Implementation of the recommendation for RCPs with different publication years

### 3.3 Differences in implementation by different involvement categories

The involvement level of EAZA member zoos, which was researched by de Jong & Plattje, 2008, is divided into three categories. Member zoos in category 1 have a low involvement in regional collection planning and member zoos in category 3 have the highest involvement. This involvement of EAZA member zoos might be associated with the accuracy of following RCP recommendations.

However, no difference in implementation scores between these categories was found (figure 3).

Implementation of the recommendations per involvement category

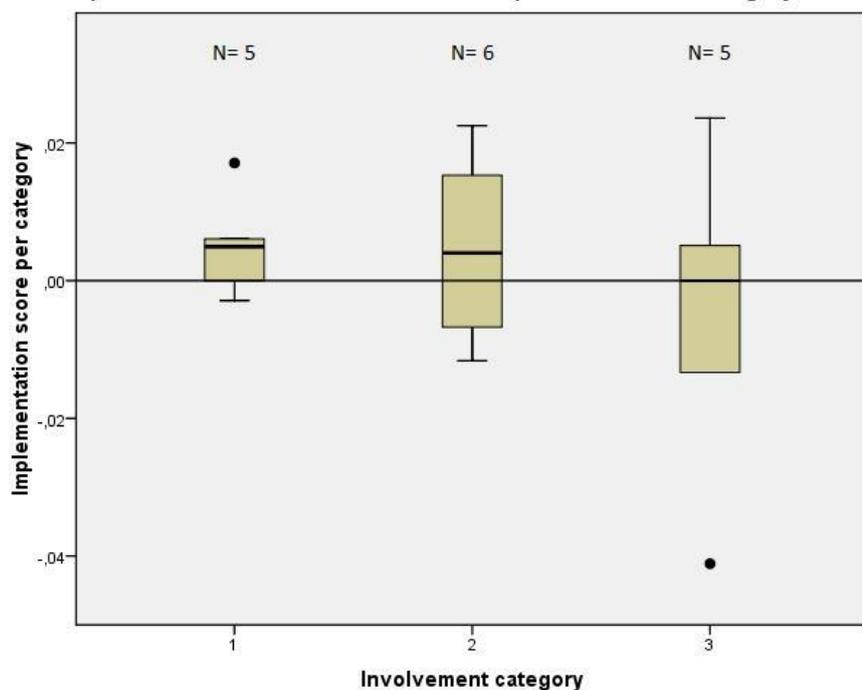


Figure 3. Implementation of the recommendations per involvement category

### 3.4 Movement of the populations to their recommended target populations

The implementation of the RCPs can also be seen in the movement of the population size of the described species towards their recommended target population size. This is only researched for the Recommended Callitrichid and Prosimian species for which these targets are set.

The population sizes from six of the nine Recommended Callitrichid species moved towards their recommended target population sizes (table 9). The population size of the *Saguinus imperator subgrisescens* moved most towards its target population size, and even reached this target since publication of the RCP.

Table 9. Difference population size from the target population size Callitrichid species

Callitrichid species		Difference population size from target population size		Movement towards (+) or away (-) from target population size
Latin name	Target pop	Year of publication	Apr 2013	
<i>Saguinus imperator subgrisescens</i>	400	-180	+7	+187
<i>Saguinus oedipus</i>	500	-102	-48	+54
<i>Callimico goeldii</i>	250	-32	-1	+31
<i>Leontopithecus rosalia</i>	180	-41	-12	+29
<i>Leontopithecus chrysomelas</i>	200	-37	-22	+15
<i>Saguinus bicolor</i>	300	-226	-215	+11
<i>Saguinus midas</i>	400 - 500	-217	-229	-12
<i>Leontopithecus chrysopygus</i>	100	-59	-87	-28
<i>Callitrix geoffroyi</i>	400 -500	-85	-134	-49

The population size of four of the seven Recommended Prosimian species moved towards their recommended target population size (table 10). The *Eulemur macaco macaco* moved with the highest numbers towards its target and the *Varecia rubra* with the highest numbers away from its target.

Table 10. Difference population size from the target population size Prosimian species

Prosimian species		Difference population size from target population size		Movement towards (+) or away (-) from target population size
Latin name	Target pop	Year of publication	May 2013	
<i>Eulemur macaco macaco</i>	200	-113	-69	+44
<i>Nycticebus pygmaeus</i>	130	-48	-19	+29
<i>Eulemur coronatus</i>	100	-57	-42	+15
<i>Hapalemur griseus alaotrensis</i>	150	-61	-51	+10
<i>Varecia variegata subcincta</i>	50	-9	+20	-29
<i>Varecia variegata</i>	600	-209	-247	-38
<i>Varecia rubra</i>	400	-18	-107	-89

## Chapter 4. Discussion

The results of this study give insight in the implementation of recommendations from six RCPs, factors which could have influence on this implementation and how the population sizes of the Callitrichid and Prosimian species moved towards their recommended target populations.

Most results are in line with the RCP recommendations but also vary a lot between the six RCPs. The results of the Parrot and Canid RCP are mostly in line with the recommendations and the results of the Penguin and Prosimian RCP the least. This difference can however not be explained by the implementation time and the involvement categories. It would be expected that the implementation is better with a long implementation time and by member zoos with a high involvement in collection planning (category 3), but the results show otherwise.

As mentioned in the introduction, a previous research to examine the effect of regional collection planning for ARAZPA zoos was done by Willem van Doorn in 2006. The conclusion of this research shows that the desired effect of collection planning of member institutions has been achieved. This conclusion was based on the fact that the number of prioritized animals has moved towards their target and that institutions replaced Not recommended species for Recommended species. Even if the results are presented in a different way, in this research similar results are shown.

It cannot be concluded are caused by the RCPs or by other factors. These factors are; legislation, transport issues, species availability, intensity of management by TAG, husbandry issues and the time to gain new number of exhibits for the species in a zoo. To implement these factors in this study was in excess of the time and scope of this research. These factors can be included in future research to find this out.

In the RCPs no targets were set on how high the implementation score should be for a good implementation of the RCP recommendations. Comparison to a target can therefore not be made so it is difficult to say if the RCP recommendations have been sufficiently implemented. Targets need to be set in the RCPs, so future comparison can be made on the implementation of the RCP recommendations.

It should be kept in mind that for the calculation of the number of exhibits the assumption is made that one species in a zoo is equal to one exhibit in that zoo (1 species per zoo = 1 exhibit). With this assumption it should be taken into account that the number of exhibits presented in table 6 and 8 could be higher. The difference between the number of exhibits used for Recommended species and the number of exhibits used for Not recommended species can therefore be bigger or smaller. This can result in a different implementation score.

The implementation score does not represent the implementation of the RCP recommendations in a few situations. A negative score is seen when no exhibits were used for Not recommended species at the year of publication and in a later year exhibits are used for Not recommended species, even if new exhibits are used for Recommended species as well. The implementation score will be zero when exhibits were only used for Recommended species at the year of publication, even if an increase in number of exhibits for Recommended species in a later year is shown. The implementation score will be high when the total number of exhibits used for RCP species at the year of publication is small ( $\pm 200$ ), even if only small increases or decreases are shown. When the total number of exhibits used for RCP species is high ( $\pm 2000$ ) at the year of publication, the score will be small, even if high increases or decreases are shown. Furthermore, the score is sensitive for mistakes due to the subtraction of two fractions.

The interpretation of the results of each RCP is as followed:

#### *Antelope RCP*

The decrease in Recommended species kept (-2) is not in line with the RCP recommendations. The *Tetracerus quadricornis* and the *Gazella rufifrons* are both not kept anymore since publication of the RCP. The population size of the *Tetracerus quadricornis* decreased since 1993 and was kept in only a few zoos since that year. The *Gazella rufifrons* was also kept in only a few zoos (EAZA Antelope and Giraffe TAG, 2003). The fact that these species are not kept anymore could be explained by this, rather than not following the RCP recommendations. Factors like transport difficulty or bad breeding results may have been a reason for the disappearance of these species in EAZA member zoos.

The increase in member zoos keeping Not recommended species (+7), can be seen as negative RCP implementation but since publication only one more exhibit is used for Not recommended species. The number of exhibits used for Not recommended species mainly changed among zoos instead of increasing, thus the increase in member zoos keeping Not recommended species can be neglected.

The percentage of 99% (78/79) of new exhibits that are used for Recommended species is in line with the RCP recommendations. An increase of 78 exhibits can be interpreted as high, when the husbandry issues of Antelope species and the fact that they are normally kept with more specimen is taken into account. The implementation score of the Antelope RCP shows that the percentage of exhibits used for RCP species changed positively towards Recommended species with 0,7% since publication. This change seems to be small, especially when considering that the implementation time of the RCP is nine years. If it takes nine years to create such a small effect on the Antelope species collection, it is questionable what the impact of the RCP is. An effect, so a change in division of exhibits, is however difficult to notice in the first place because only a small number of Not recommended species is kept among member zoos compared to Recommended species.

#### *Callitrichid RCP*

The increase of Recommended species kept (+1) is in line with the RCP recommendations. This a small increase and not sure to be caused by RCP publication. The *Saguinus labiatus thomasi*, which was obtained by EAZA member zoos, was already kept in Europe, but never before by an EAZA member zoo (EAZA Callitrichid Taxon Advisory Group, 2006). The increase of Not recommended species (+1) is not in line with the recommendations. The Not recommended species which was obtained is the *Saguinus imperator hybrid*. One member zoo whom start to keep this species already kept the *Saguinus imperator subgriseus* at the year of publication, thus the hybrid was possible added to the collected because of unwanted breeding. The reasons why the other zoo added this Not recommended species is unknown, but it is unlikely that the zoo took effort to obtain a hybrid species into their collection. The increase of Not recommended species and the zoos which start to keep them can thus be seen as only a minor discard of the RCP recommendations. The increase in member zoos keeping Recommended species (+24) can be considered a high increase and positive implementation of the RCP recommendations. The species availability can be a reason for this increase too, instead of the RCP publication. The percentage of new exhibits used for Recommended species (97%)(76/78) is in line with the RCP recommendations. These new exhibits were mostly used for the *Saguinus imperator subgriseus*, *Mico argentatus* and *Cebuella pygmaea*. For the *Saguinus imperator subgriseus* a large increase of population size was shown, which could have had effect on the species availability. This large increase resulted in a movement towards the recommended target population. For the two other species also an increase in their population sizes and movement towards their target population size was shown, but smaller than of the *Saguinus imperator subgriseus*. These movement towards their target populations can be interpreted to be in line with the RCP recommendations. However, small movements in population sizes are normal among populations (Kirsten Leus, Population management EAZA Executive Office, personal communication). Thus only big movements towards or away from a target population size can really be interpreted as implementation of the recommendations. Beside this, it has to be taken into account that the population sizes presented in the results only the population sizes from the member zoos whom are

ISIS member. Even though a negative implementation score of the Callitrichid RCP (-0,003) is shown, it does not mean the results are not in line with the RCP recommendations. In the method used for calculating the implementation score ( $I = D_{2012} - D_{\text{publish year RCP}}$ ) a decrease was shown, due to the increase in exhibits used for Not recommended species. The increase in number of exhibits used for Recommended species (+76) compared to the increase in number of exhibits used for Not recommended species (+2) show properly that the results are in line with the RCP recommendations.

#### *Canid RCP*

The stable number of Canid species kept can be ignored when concluding if the RCP recommendations are followed. It is unlikely that a total new species is obtained by EAZA member zoos in only one year. The decrease of member zoos keeping Not recommended species (-2) is in line with the RCP recommendations. This decrease can be interpreted as high when the life span of Canid species is considered. The increase of member zoos keeping Recommended species (+1) is not small but might be related to the low implementation time. Other reasons why this increase might be low could be the species availability, husbandry issues or the time need to create a Canid enclosure.

The percentage of 100% (5/5) of new exhibits that are used for Recommended species is in line with the RCP recommendations. Taken into account the time needed to create an exhibit and transport difficulty, an increase of five exhibits can be interpreted as high. The decrease in number of exhibits for Not recommended species (-2) is caused by two member zoos which discard these species. The implementation score resulting from these changes (0,006) is small. However, much effort is taken to get this effect in only one year. Also need to be taken into account that the number of exhibits used for Canid species at the year of publication was not very high. Changes in the division can therefore be easily noticed.

#### *Parrot RCP*

The increase of Recommended species kept (+3) is in line with the RCP recommendation but the increase of Not recommended species kept (+2) is not. Both increases can be interpreted as small. Almost all Recommended species were already kept at the year of publication, so not much choice was left anymore obtaining new Recommended species. The five species which were obtained after RCP publication by EAZA member zoos had small population number in Europe (EAZA Parrot Taxon Advisory Group 2008). Because their availability was probably low, member zoos should have taken effort to obtain these species. The increase in member zoos keeping Parrot species (+4) is in line with the RCP recommendations. At the year of publication already 204 member zoos kept Parrot species, therefore a high increase is unlikely to occur. However, an increase of only four member zoos can be interpreted as low considering the implementation time of six years. According to the EAZA Parrot TAG, the interest of keeping Parrot species decreased over the past 20 years (EAZA, 2011). Still the number of exhibits for Recommended Parrot species increased with 61, while the number of exhibits for Not recommended species only decreased with 22. This total increase of 39 exhibits can therefore be considered as a high. The percentage of 100% (61/61) of new exhibits used for Recommended species is in line with the RCP recommendations. Other reasons rather than the RCP recommendations might have caused the increase in number of exhibits for Recommended species. The species availability might be high due to breeding results. The decrease of 22 exhibits used for Not recommended species is rather high when member zoos decide to remove Parrot species from their collection passively. Even though these changes can be interpreted as high, on the total number of exhibits used for Parrot species only a small effect can be seen. At the year of publication already 2390 exhibits were used for Parrot species. The implementation score of the Parrot RCP (0,019) might therefore not be as high as expected. However, this score is the highest in the research and the results are in line with the RCP recommendations.

#### *Penguin RCP*

The four member zoos whom start to keep Recommended species are in line with the RCP recommendations. An increase of four member zoos is small, but still a positive result considering

that no other changes have been shown for this RCP. The number of exhibits used for Recommended species only changed among member zoos but did not increase. This means that total Penguin groups have moved from other member zoos to this four new member zoos whom start to keep Recommended species. The zoos where the Penguin groups came from however still kept another Recommended Penguin species, else the number of zoos would stay stable. These zoos, whom discard a Recommended species, did not follow the RCP recommendations. The four zoos whom start to keep Recommended species obtained the *Spheniscus humboldti* and *Spheniscus demersus*. It is interesting to mention that these two species are classified with the lowest husbandry issues for Penguin species (EAZA Penguin TAG 2009). At and since the year of publication, only one member zoo keeps Not recommended species (2) but also keeps Recommended species (5). This zoo has a Penguin theme as part of their collection plan and probably does not want to remove the Not recommended species from their collection (Faunia, 2013). Because this zoo has more Recommended species than Not recommended species, it could be concluded that this zoo is still in line with the RCP recommendations. The implementation score of the Penguin RCP is very low (0) because the number of exhibits did not change for any of the categories since publication. It is not in line with the recommendations that even after three years of implementation time no new exhibits were used for Recommended species. However, reasons for this stable situation might be husbandry issues, availability and the time needed to create a Penguin enclosure. Furthermore, it should be kept in mind that at the year of publication almost all exhibits were already used for Recommended species.

#### *Prosimian RCP*

The decrease of Not recommended species kept (-1) can be interpreted to be in line with the RCP recommendations. The implementation time has only been two years thus effort must have been taken to get this result. The species which is not kept anymore, the *Hapalemur griseus*, was however kept by only one member zoo. Therefore it is unlikely that the disappearance of this species in EAZA member zoos is because of the RCP recommendations. The increase in number of member zoos keeping Recommended species (+3) is in line with the RCP recommendations, but the increase in number of member zoos keeping Not recommended species (+3) is not. Both increases can be interpreted as small. The effort of these zoos was however high, considering the husbandry issues of Prosimian species (EAZA Prosimian TAG,2010). The high percentage of new exhibits used for Recommended species (93%)(27/29) shows that the RCP recommendations did influence the choice made by member zoos which species should be incorporated in their collection planning. The number of new exhibits used for Recommended species (+27) can be interpreted as high, especially because the short implementation time. Most of these new exhibits were used for the *Lemur catta* and *Eulemur cornatus*. The increase of new exhibits used for the *Lemur catta* could be a result of the intensive management and promotion from the Prosimian TAG and the EPMAG (EAZA Prosimian TAG,2010). The increase of exhibits for the species *Eulemur cornatus* could result from the increase in the population size(+15) which in turn could have influenced the species availability. The implementation score of the Prosimian RCP (0,002) can be interpreted as small. The results are partly in line with the RCP recommendations and partly not, which is possible to see back in this score.

## Chapter 5. Conclusion

Since publication, the number of Callitrichid and Parrot species kept increased for both Recommended (+1, +3) and Not recommended species (+1, +2). For the Prosimian RCP, the number of Not recommended species kept (-1) decreased and for the Antelope RCP species, the number of Recommended (-2) and Not recommended species kept (-2) decreased.

The number EAZA member zoos that keep Recommended species (X) increased since the publication of the RCPs ( $+1 \leq X \leq +24$ ). For the Callitrichid, Antelope and Prosimian RCPs, more member zoos start to keep Not recommended species (+2,+7,+3) as well. A decrease in member zoos keeping Not recommended species is shown for the Parrot (-3) and Canid RCP (-2). A decrease in zoos is recorded with regard to Pending species for the Parrot (-2) and Prosimian RCP (-4).

The total number of exhibits (X) has increased for all the Recommended RCP species ( $+3 \leq X \leq +79$ ), except for the Penguin RCP species since publication of the RCPs. The number of exhibits used for Not recommended Antelope (+1), Callitrichid (+2) and Prosimian species (+2) increased as well. For the Parrot and Canid RCP, the number of exhibits decreased for the Not recommended species (-22, -2). A decrease is also seen for the Pending species of the Prosimian RCP (-5).

The implementation score of the Parrot RCP is the highest (0,019). The scores for the Prosimian (0,002), Canid (0,006) and Antelope RCP (0,007) also are positive. The RCP implemented least are the Penguin (0) and Callitrichid RCP (-0,003).

No relation was shown between these implementations scores and the time member zoos had to implement the RCP recommendations. The implementation scores are also not related to the involvement member zoos show in regional collection planning.

The population sizes from six of the nine Callitrichid species and four out of seven Prosimian species moved since the publication of the RCPs towards their recommended target populations.

Most of these results are in line with the RCP recommendations. The results for the Parrot and Canid RCP are mostly in line with the RCP recommendations and the results for the Penguin and Prosimian the least. It can however not be concluded that these results are caused by the RCPs. Other factors, like legislation, transport issues, species availability, intensity of management by TAG, husbandry issues and the time to gain new number of exhibits for the species in a zoo can be included in future research to find this out. Furthermore, targets need to be set to make it possible to measure how the RCP recommendations are followed.

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# Appendixes

## Appendix I. Published RCPs

Species group	Possible to use in research	Reason
Terrestrial invertebrate	Yes	
Amphibian	Yes	
Reptile	No	Missing recommendations
Ratite	Yes	
Penguin	Yes	
Pelecaniformes	Yes	
Ciconiiformes and phoenicopteriformes	Yes	
Waterfowl	No	Missing recommendations
Falconiformes	No	Missing recommendations
Cracid	Yes	
Galliformes	Yes	
Gruiformes	Yes	
Charadiiformes	No	Missing recommendations
Pigeon and dove	No	Considered not representative for the species group anymore, written before 2001
Parrot	Yes	
Toucan and Turaco	Yes	
Hornbill	Yes	
Passeriformes	No	Missing recommendations
Monotreme and Marsupial	Yes	
Prosimian	Yes	
Callitrichid	Yes	
Old World Monkeys	No	Published too recently (2012)
Great Ape	No	Missing recommendations
Small mammal	No	RCP only for specific period (2000-2005)
Canid and Hyaenid	Yes	
Small Carnivore	Yes	
Equid	Yes	
Rhinoceros	No	Missing recommendations
Tapir and Hippo	Yes	
Pig and Peccary	No	Considered not representative for the species group anymore, written before 2001
Deer	No	Missing recommendations
Cattle and Camelid	No	Published too recently (2012)
Antelope and Giraffe	Yes	
Sheep and Goat	No	Missing recommendations

## Appendix II. Full EAZA members whom are ISIS member institution

\* = EAZA member zoos from whom the involvement in determined by de Jong & Plattje

ISIS member name	Full name	Country
AALBORG*	Aalborg Zoo	DK
AGRATE*	Parco Faunistico La Torbiera	IT
AHTARI*	Zoo Ahtari	FI
ALFRISTON*	Drusillas Zoo Park	GB
ALPHEN*	Vogelpark Avifauna	NL
AMERSFOOR*	Dierenpark Amersfoort	NL
AMIENS*	Parc Zoologique d'Amiens	FR
AMSTERDAM*	Artis Zoo	NL
ANTIBES	Marineland Côte d'Azur	FR
ANTWERP*	Zoo of Antwerp	BE
APELDOORN*	Apenheul	NL
ARNHEM*	Burgers' Zoo	NL
ATTICAZOO*	Attica Zoological Park S.A.	GR
AUGSBURG*	Zoologischer Garten Augsburg GmbH	DE
AYWAILLE*	Monde Sauvage Safari SPRL	BE
BALLAUGH*	Curraghs Wildlife Park	GB
BANDHOLM*	Knuthenborg Safaripark	DK
BANHAM*	Banham Zoo Ltd	GB
BARCELONA*	Parc Zoologic de Barcelona	ES
BASEL*	Zoologischer Garten Base	SW
BAYRAMOGL	Faruk Yalcin Zoo	TR
BEKESBRNE*	Howletts Wild Animal Park	GB
BELFAST*	City of Belfast Zoo	GB
BERGEN AQ*	Akvariet i Bergen	NO
BERLIN TP*	Tierpark Berlin-Friedrichsfelde GmbH	DE
BERLINZOO*	Zoologischer Garten Berlin AG	DE
BERN*	Tierpark Dählhölzli	SW
BESANCON*	Museum de Besancon	FR
BEWDLEY	West Midland Safari & Leisure Park Ltd	GB
BIOPARCVA	Bioparc Valencia	ES
BIRMINGHAM	Birmingham Nature Centre	GB
BLACKPOOL*	Blackpool Zoo	GB
BLAIRDRUM	Blairdrummond Safari Park	GB
BOISSIERE	Espace Zoologique la Boissiere du Dore	FR
BOJNICE*	Zoologicka zahrada Bojnice	SK
BORAS*	Boras Djurpark Zoo	SE
BOURTON*	Birdland Park & Gardens	GB
BRANTON	Yorkshire Wildlife Park	GB
BREMERHVN*	Zoo am Meer Bremerhaven GmbH	DE
BRISTOL*	Bristol, Clifton, West of England Zool	GB
BRNO*	Zoologicka Zahrada Mesta Brna	CZ
BROXBOURN*	Paradise Wildlife Park	GB
BUDAPEST*	Budapest Zool.& Botanical Garden	HU
BURFORD*	Cotswold Wildlife Park and Gardens	GB

BURSA ZOO	Bursa Zoo	TR
BUSSOLENG*	Parco Natura Viva	IT
CABARCENO*	Parque de la Naturaleza de Cabarceno	ES
CALVIAC	Reserve Zoologique de Calviac	FR
CAMBRON*	Parc Paradisio S.A.	BE
CHESINGTN*	Chessington World of Adventures, Ltd	GB
CHESTER*	North of England Zoological Society	GB
CHOMUTOV*	Podkrušnohorský Zoopark Chomutov	CZ
CLERES*	Parc Zoologique de Cleres	FR
COLCHESTR*	Colchester Zoo	GB
COLWYNBAY*	Welsh Mountain Zoo	GB
COPEN AKV*	Danmarks Akvarium	DK
COPENHAGE*	Copenhagen Zoo	DK
COULANGE*	Parc Zoologique d'Amneville	FR
DEBRECEN*	Nagyerdei Kultúrpark KHT.	HU
DECIN*	Zoo Decin - Pastyrská Stena	CZ
DOMBES	Parc des Oiseaux	FR
DORTMUND*	Zoo Dortmund	DE
DRESDEN Z*	Zoo Dresden GmbH	DE
DUBLIN*	Zoological Society of Ireland-Dublin	IE
DUDLEY*	Dudley Zoological Gardens	GB
DUISBURG*	Zoo Duisburg AG	DE
DUSSELDOR*	Aquazoo Düsseldorf	DE
EBELTOFT	Ree Park - Ebeltoft Safari	DK
EDINBURGH*	Edinburgh Zoo-Scottish National Zoo	GB
EMMEN*	Dierenpark Emmen	NL
EPE*	Dierenpark Wissel	NL
ERFURT*	Thuringer Zoopark Erfurt	DE
ESKILSTUN*	Parken Zoo i Eskilstuna AB	SE
EUROPA	Dierenrijk	NL
FALCONARA*	Parco Zoo di Falconara	IT
FARJESTAD*	Olands Djurpark	SE
FAUNIA	Faunia	ES
FOLLYFARM	Folly Farm Leisure Ltd	GB
FONTAINE*	BioParc de Doué	FR
FORT MARD	Parc Zoologique communautaire Fort Mardycq	FR
FOTA*	Fota Wildlife Park	IE
FRANKFURT*	Zoologischer Garten Frankfurt	DE
FUENGIROL	Bioparc Fuengirola	ES
FURUVIK	AB Furuviksparken	SE
GDANSK*	Miejski Ogród Zoologiczny Wybrzeza	PL
GELSNKRKN*	ZOOM Erlebniswelt Gelsenkirchen	DE
GENOVA AQ*	Acquario di Genova	IT
GIVSKUD*	DSI Givskud Zoo	DK
GOTEBORGS	Universeum Science Center	SE
HALLE*	Zoologischer Garten Halle GmbH	DE
HAMBURG*	Tierpark Hagenbeck GmbH	DE
HANNOVER*	Zoo Hannover GmbH	DE
HANSURLES*	Reserve d'Animaux Sauvage	BE
HAYLE*	Paradise Park Wildlife Sanctuary	GB
HEIDELBRG*	Tiergarten Heidelberg	DE
HELSINKI*	Helsinki Zoo	FI

HERBERSTN*	Tierwelt Herberstein	AT
HILVARENB*	Safaripark Beekse Bergen	NL
HLUBOKA*	Zoologicka zahrada Ohrada	CZ
HUNBSTRND*	Nordens Ark	SE
IEPER	Bellewaerde Park	BE
INNSBRUCK*	Alpenzoo Innsbruck	AT
ISL AM AD*	Amazon World	GB
IZMIR ZOO	Izmir Zoo	TR
JASZBEREN	Jászberény Zool.& Botanical Garden	HU
JERSEY*	Durrell Wildlife Conservation Trust	FR
JERUSALEM*	The Tisch Family Zoological Gardens	IL
JIHLAVA*	Zoologicka Zahrada Jihlava	CZ
JURQUES*	Parc Zoologique de Jurques	FR
KATOWICE*	Silesian Zoological Garden	PL
KAUNAS*	Lietuvos Zoologijos Sodas	LT
KAZAN*	Kazan Zoological & Botanical Garden	RU
KERKRADE*	Gaia Zoo	NL
KERZERS*	Papiliorama Swiss Tropical Gardens	SW
KESSINGLA*	Africa Alive!	GB
KINGUSSIE*	Highland Wildlife Park	GB
KNOWSLEY*	Knowsley Safari Park	GB
KOLMARDEN*	Kolmardens Djurpark AB	SE
KOLN*	Cologne Zoo	DE
KRAKOW*	Park i Ogród Zoologiczny w Krakowie	PL
KREFELD*	Zoo Krefeld GmbH	DE
KRISTIANS*	Kristiansand Dyrepark ASA	NO
KRONBERG*	Opel-Zoo von Opel Hessische Zoostiftung	DE
LA FLECHE*	Parc Zoologique de La Fleche	FR
LA FRONTI*	Zoobotanico de Jerez	ES
LA PALMYR*	Parc Zoologique de La Palmyre	FR
LA PLAINE*	Espace Zoolog de St-Martin-la-Plaine	FR
LANDAU*	Zoo Landau in der Pfalz	DE
LE PAL*	Le Pal	FR
LEEUWARDE*	Aqua Zoo Friesland	NL
LEIPZIG*	Zoo Leipzig	DE
LES EPESS*	Grand Parc Du Puy Du Fou	FR
LESNA-GOT	Zoologicka Garden & Chateau Zlin-Lesna	CZ
LIBEREC*	Zoologicka zahrada Liberec	CZ
LILLE ZO*	Parc Zoologique de Lille	FR
LINTON*	Linton Zoological Gardens	GB
LISBOA AQ*	Oceanario de Lisboa	PT
LISBON*	Jardim Zoologico	PT
LISIEUX Z*	CERZA Centre d'Etude et de Recherche Zoologique Augeron	FR
LJUBLJANA*	Zivalski vrt Ljubljana	SI
LONDON RP*	London Zoo	GB
LONGLEAT*	Longleat Safari & Adventure Park	GB
LOUROSA Z	Parque Ornitológico de Lourosa	PT
LUND*	Stiftelsen Skanes Djurpark	SE
LYMPNE*	Port Lympne Wild Animal Park	GB
LYON	Jardin Zoologique de la Ville de Lyon	FR
MADRID Z*	Zoo Aquarium de Madrid	ES

MAGDEBURG*	Zoologischer Garten Magdeburg	DE
MALTON	Flamingo Land LTD	GB
MANOR HS	Manor House Wildlife Park	GB
MARINELND*	Marineland Mallorca	ES
MARLOW BP*	Bird Park Marlow	DE
MARWELL*	Marwell Wildlife	GB
MONTPELLI*	Parc de Lunaret	FR
MOSCOW*	Moscow Zoological Park	RU
MOTZKIN*	Hai Park Kiriat Motzkin	IL
MULHOUSE*	Parc Zoologique Et Botanique Mulhouse	FR
MUNICH*	Münchener Tierpark Hellabrunn	DE
MUNSTER*	Westfälischer Zoologischer Gtn Munster	DE
NESLES	Le Parc des Felins	FR
NEUNKIRCH*	Neunkircher Zoologischer Garten GmbH	DE
NEWQUAYZO*	Newquay Zoo	GB
NIKOLAEV*	Nikolaev Zoo of Nikolaev-City Council	UA
NOVOSIBRK*	Novosibirsk Zoological Park	RU
NURNBERG*	Tiergarten der Stadt Nürnberg	DE
NYIREGYHA*	Nyíregyházi Állatpark Nonprofit KFT	HU
NYKOBING	Jesperhus Blomsterpark	DK
OCEAN VAL*	L'Océanografic	ES
ODENSE*	Odense Zoologiske Have	DK
OLOMOUC*	Zoologicka zahrada Olomouc	CZ
OPOLE*	Ogrod Zoologiczny Opole	PL
ORSA*	Orsa Grönklitt Bjornpark	SE
OSNABRUCK*	Zoo Osnabrück	DE
OSTRAVA*	Zoologicka zahrada Ostrava	CZ
OVERLOON*	Zoo Parc Overloon	NL
PAIGNTON*	Paignton Zoo Environmental Park	GB
PARC MERV	Parc Merveilleux	LU
PARIS JP*	Menagerie du Jardin des Plantes	FR
PARIS ZOO*	Parc Zoologique de Paris	FR
PEAUGRES*	Safari de Peaugres	FR
PELISSANE*	Parc Zoologique de la Barben	FR
PISTOIA	Societa Zoologica Di Pistoia S.R.L	IT
PLAISANCE*	African Safari	FR
PLANCKNDL	Wild Animal Park Mechelen Planckendael	BE
PLEUGUEN*	Château et Parc Zoologique de la Bourbansais	FR
PLOCK*	Miejski Ogrod Zoologiczny	PL
PLZEN*	Zoologická a botanická zahrada Plzen	CZ
PONTSCORF*	Zoo de Pont-Scorff	FR
POZNAN*	Ogrod Zoologiczny w Poznaniu	PL
PRAHA*	Zoological Garden Prague	CZ
PUNTAVERD*	Parco Punta Verde	IT
QUINTASI	Zoo de Gaia	PT
RAMAT GAN*	Zoological Center Tel Aviv - Ramat Gan	IL
RANDERS*	Randers Regnskov	DK
RANUA*	Ranua Wildlife Park	FI
RHEINE*	NaturZoo Rheine	DE
RHENEN*	Ouwehand Zoo	NL
RIGA*	Riga Zoo	LV
ROMA*	Rome Zoo-Fondazione Bioparco di Roma	IT

ROMAGNE*	La Vallée des Singes	FR
ROSTOCK*	Rostock Zoologischer Garten	DE
ROTTERDAM*	Rotterdam Zoo	NL
SAARBRUCK*	Zoologischer Garten Saarbruecken	DE
SALZBURG*	Salzburg Zoo Hellbrunn	AT
SANTILLAN*	Zoo de Santillana y Parque Cuaternario	ES
SCHMIDING*	Zoologischer Garten Schmiding	AT
SCHWERIN*	Zoologischer Garten Schwerin	DE
SELWO MAR	Selwo Marina	ES
SERVION*	Zoo De Servion	SW
SHALDON*	Shaldon Wildlife Trust	GB
SHARJAHBR*	Sharjah Breeding Centre For Endangered	UAE
SHEPHRETH	Shepreth Wildlife Park	GB
SIGEAN*	Reserve Africaine de Sigean	FR
SO LAKES*	South Lakes Wild Animal Park	GB
STE CROIX	Parc Animalier de Sainte Croix	FR
STOCKHOLM*	Skansen Foundation, Zool. Dept.	SE
STUTTGART*	Wilhelma Zoo	DE
SZEGED*	Szeged Zoo	HU
TABERNAS	Oasys Parque del Desierto de Tabernas	ES
TALLIN*	Tallin	ET
TENERIFE*	Loro Parque	ES
TERRA NAT*	Terra Natura	ES
THOIRY*	Thoiry Zoological Park	FR
TORQUAYLC*	Living Costs	GB
TORUN ZOO	Zoobotanical Garden in Torun	PL
TOURNAI*	Musee d'Histoire Naturelle de Tournai	BE
TOUROPARC*	Touroparc	FR
TREGOMZOO	Parc Zoologique de Tregomeur	FR
TWYCROSS*	Twycross Zoo	GB
USTI*	Usti nad Labem Zoo	CZ
VESZPREM*	Kittenberger Kálmán Nonprofit Kft.	HU
VIENNA*	Schönbrunner Tiergarten GmbH	AT
WADDES DON	Waddesdon Manor Aviary	GB
WALSRODE*	Weltvogelpark Walsrode	DE
WARSAW*	Miejski Ogród Zoologiczny Warsaw	PL
WEYHILL*	The Hawk Conservancy	GB
WHIPSNAD*	ZSL Whipsnade Zoo	GB
WOBURNLTD*	Woburn Safari Park	GB
WORLDOWLS	World Owl Trust	GB
WROCLAW*	Wroclaw Zoo	PL
WUPPERTAL*	Zoologischer Garten Wuppertal	DE
YARMOUTH*	Thrigby Hall Wildlife Gardens	GB
ZAGREB*	Zagreb Zoo	HR
ZAMOSCZSM	Ogród Zoologiczny im. Stefana Milera	PL
ZOOMARINE*	Mundo Aquatico	PT
ZOOMARITA	Zoomarine Italia S.p.A.	IT
ZURICH*	Zoo Zürich	SW

## Appendix III. Calculation of the implementation score

Table 11. Number of exhibits used for the calculation of the implementation score

RCP	Number of exhibits used for RCP species in 2012		Number of exhibits used for RCP species at the year of publication	
	REC	REC + NOT REC	REC	REC + NOT REC
Antelope	751	835	829	914
Callitrichid	635	635	709	711
Canid	339	468	344	471
Parrot	1000	2358	1061	2397
Penguin	154	156	154	156
Prosimian	560	625	587	67

The formula used to calculate the implementation score:  $I = D_{2012} - D_{\text{publish year RCP}}$

I = Change in division of exhibits used for Recommended /Not recommended species

D = Division of exhibits used for Recommended /Not recommended species

Table 12. The calculation of the implementation score

RCP	$D_{2012}$	$D_{\text{publish year RCP}}$	I
Antelope	0,900	0,907	0,007
Callitrichid	1	0,997	-0,003
Canid	0,724	0,730	0,006
Parrot	0,424	0,443	0,019
Penguin	0	0	0
Prosimian	0,896	0,898	0,002