The Influence of Novel Feeding Systems on the Behaviour of Captive Female Common Marmosets, *Callithrix jacchus*

By

Samantha Bjone
Bachelors of Science
Millersville University, U.S.A.

A thesis submitted for the degree of Master of Arts with Honours of the Faculty of Arts, University of New England.

August 2004

Certificate

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis and all sources used have been acknowledged in this thesis.

Samantha Bjone

Date: 27 August 2004

Acknowledgements

I will be forever grateful to my supervisors, Dr. Ian Price and Dr. Paul McGreevy. Both supervisors were always available to discuss and answer questions. They created a stable environment in which to learn, and because of their guidance and support, I was able to write this thesis.

This thesis would not have been possible without the upstanding and honourable Professor Bill Noble.

Thank you to Professor Gisela Kaplan, Professor Lesley Rogers, and the School of Biological, Biomedical and Molecular Sciences for the learning experience with the marmosets. Thank you to the Brain and Behaviour group at the University of New England.

I would like to thank Jane Davies and Thea Harris for their moral support, Dr. Stuart Cairns for his statistical assistance, and Craig Lawlor for his swift and endless technical support. Many thanks to Al Rummery and the staff at the Science Workshop at University of New England for constructing the experimental apparatus. Grahame Chaffey, the UNE Animal House Complex Manager, also deserves great praise for his patience and assistance at any time.

My appreciation goes to Jacqueline Thompson and Eugene Frazer who encouraged and supported my writing from the dark days of 9th grade English to the present. Special thanks goes to Mary Ellen Thompson and the Thompson family who supported me through this entire degree.

Finally, I would like to thank Angus McKenzie for his continual support and unfailing encouragement.

Abstract

The influence of novel feeding systems on the behaviour of eight female captive common marmosets, *Callithrix jacchus*, was determined through a series of experiments. Captive environments are often impoverished when compared to the richness of natural habitats and so can usually be found lacking in terms of choice, complexity, and change. Therefore, the welfare of animals kept in captive environments may be compromised. Environmental enrichment is used to improve welfare by emulating natural environments within captive environments so captive animals are provided with the surroundings and stimulation considered likely to promote species-typical behavioural repertoires.

The University of New England marmosets have rotating free access, via a runway system, to another room that is four times larger than their home cages. This room is furnished similarly to the home cage with a proportionally larger number of furnishings, such as perches, platforms, nest boxes, tubes, tunnels, tyres, and hanging objects. The female marmoset subjects do voluntarily enter the room and utilize the different areas, but they choose to spend significantly more time in the home cages. Therefore, the added room space may not be as useable as the home cages.

Since foraging enrichment is relatively inexpensive, easily implemented, and addresses some of the marked differences between captive and wild marmoset foraging strategies, foraging feeders were used in the present study. The current project examines the effects of four food distributions on the welfare of captive common marmosets: food centrally located in a stationary bowl, food in a bowl that changes location each day, hidden food in a clustered food source (cluster feeder), and hidden food in dispersed food sources (dispersed feeders). These four distributions were examined in four conditions with three intermediate conditions during which no additions were made to the typical room contents. These 'empty room' conditions were used to check possible order effects. The current study determined the behavioural effects of the four food distributions on activity, food apparatus use, eating, and self-directed and affiliative behaviours. The current study also determined whether food distribution altered the space use of the subjects in the short- and long-term.

Eight female common marmosets in four cage mate pairs were given free access from their respective home cages to the Exercise Rooms (ERs) in which the four experimental conditions were presented. The ER was divided into vertical and horizontal divisions, resulting in nine room sections. These sections were used to denote the feeder and bowl locations and to determine the subjects' use of space. Subjects had *ad libitum* access to the food bowls and water. The feeders were presented at the beginning of a testing session and withdrawn at the end. The cluster feeder was placed in one room section, while the dispersed feeders were placed throughout the nine ER sections.

The results indicate that both the cluster and dispersed feeders improved the welfare of eight female common marmosets by increasing their space use, activity, and the time spent acquiring and eating food as compared to the bowl only conditions. Both feeder types increased the time spent in the ER and activity within the room as compared to both bowl conditions. The cluster feeder increased the time spent in the ER

more than the dispersed feeders and this effect was sustained throughout the day after the feeders had been removed. However, the dispersed feeders increased activity within the room more than the cluster feeder and bowl conditions. Throughout all four experimental conditions, the study subjects moved within the High room sections the most and the Low room sections the least. However, the use of the Low room sections increased if there were dispersed feeders located within these sections. The cluster feeder also increased room use, as compared to the bowl conditions, but its effect was more localised. In particular, the cluster feeder shifted space use to the particular section in which it was located. As indicated by time spent with feeders and food bowls, the subjects preferred to interact with feeders rather than with food bowls. Of the two feeder types, the marmosets spent more time with the cluster feeder.

In addition, both feeder types were effective in reducing self-directed behaviours, and the marmosets manipulated the feeders rather than huddle or allogroom. Self-directed behaviours, such as scratching and grooming, have been linked to stress and stereotypical behaviour. Huddling and allogrooming may be incompatible with optimal use of objects or devices that are intended improve an animal's welfare. Therefore, a decrease in these behaviours would indicate improved welfare. Sitting also decreased from bowl to feeder conditions and the type of sitting shifted from passive, unengaged sitting next to a light during the bowl conditions to active, engaged sitting while eating during the feeder conditions.

The implementation of species-appropriate foraging devices during the feeder conditions resulted in an overall increase in activity, space use, and foraging as compared to the bowl conditions. Thus, these species-appropriate behaviours encompassed more of the marmosets' time budgets. Therefore, since the feeders induced species-typical behaviours and activities, the welfare of the marmosets improved in that regard as well as through the secondary effect of limiting the amount of spare time that could potentially be filled with abnormal behaviours. For all these reasons, both feeder types, cluster and dispersed, positively affected the study subjects and were therefore, enriching.

The present study's foraging feeders made a quantitatively large space qualitatively viable for the study subjects. This same experimental concept could be implemented in zoos and research facilities to improve the useability of a larger space and thus encourage animals to take advantage of the space available to them. Similarly, conservation reintroduction programmes could utilize the feeders to increase time spent acquiring and eating food, a necessary step to survival after reintroduction.

Table of Contents

Chapter 1: Introduction

Chapter 2: Methods

Chapter 3: Results

Chapter 4: Discussion

List of Abbreviations

AEC	Animal Ethics Committee
APHIS	Animal and Plant Health Inspection Service
Bowl	Bowl condition
CBP	Changing Bowl Position condition
CCAC	Canadian Council on Animal Care
CF	Cluster Feeder condition
DF	Dispersed Feeders condition
ER	Exercise Room
FAWC	Farm Animal Welfare Council
G-G	Greenhouse-Geisser adjustment
GL	Grooming next to a Light
GLT	Golden Lion Tamarin
GLTCP	Golden Lion Tamarin Conservation Program
GO	Grooming Overall
H1	Room section in the High and 1st divisions
H2	Room section in the High and 2nd divisions
H3	Room section in the High and 3rd divisions
HC	Home Cage
HR	Home Room
HSC	Tukey's Honestly Significant Difference
IPS	International Primatology Society
L1	Room section in the Low and 1st divisions
L2	Room section in the Low and 2nd divisions
L3	Room section in the Low and 3rd divisions
M1	Room section in the Middle and 1st divisions
M2	Room section in the Middle and 2nd divisions
M3	Room section in the Middle and 3rd divisions
MANOVA	Multivariate ANOVA
MSP	Motion Sensor Photographs

NHMRC	National Health and Medical Research Council
RMA	Repeated Measures ANOVA
SE	Sitting and Eating
SEM	Standard Error of the Mean
SL	Sitting next to a Light
SLE	Sitting next to a Light and Eating
SO	Sitting Overall
TG	Testing Group
UK	United Kingdom
UNE	University of New England
US	United States
USDA	United States Department of Agriculture

List of Figures

Page

Chapter 2: Methods

Chapter 3: Results

List of Tables

Page

Chapter 1: Introduction

Chapter 2: Methods

Chapter 3: Results