

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**The effect of predator presence on the  
behaviour of sheep in pain**

**A thesis presented in partial fulfilment of the requirements  
for the degree of**

**Masterate in Science**

**In**

**Zoology**

**at Massey University,  
Palmerston North, New Zealand.**

**Suzanne Karen Young**

**2006**

---

## Abstract

In the veterinary and ecology literature two claims regarding predator-prey interactions are frequently made. Firstly, that vertebrate predators typically capture disadvantaged individuals, including the young, weak, sick, aged and injured, from prey populations in higher than expected proportions. Secondly, as a consequence of this, prey animals when injured or diseased, are said to attempt to behave in a normal manner, similar to that of a healthy conspecific, so as not to draw the attention of a predator.

This thesis investigates whether the presence of a predator modifies the behaviour of sheep and lambs that are in pain.

There are two parts to this thesis. Part one examines the behaviour of lambs following castration. Part two examines the behaviour of adult sheep in response to a mechanical pressure device.

The aim of part one was to monitor the restlessness behaviour of lambs following castration in the presence of four stimuli (a goat, a dog, a cardboard box, and a tape recorder playing the sound of a dog barking), and the effect that the lambs' dam has on this behaviour. Three hundred and eighty four lambs were observed in this study, half of these lambs were castrated and the other half were left as controls.

Castrated lambs exhibited more restlessness behaviour than control lambs ( $p < 0.0001$ ). However, restlessness behaviour was not different between lambs exposed to one of the four stimuli. The presence of the lambs' dam significantly reduced the restlessness behaviours of both castrated ( $p < 0.0003$ ) and control lambs ( $p < 0.0019$ ).

The aim of part two was to determine the threshold response of 16 adult Romney ewes in response to a painful mechanical pressure device in the presence of four stimuli (a dog, a goat, a tape recording of a drum beat and a tape recording of a dog barking).

---

The response threshold was higher in sheep exposed to the dog than to the goat ( $p < 0.05$ ).

The significant difference between the behaviour of castrated and control lambs suggests that castration is a painful procedure. Moreover, lambs may rely on their mother to cue them on how to behave, as lambs significantly reduced the amount of restlessness behaviour they exhibited when their ewe was present (castrated lambs  $p < 0.0003$ ; control lambs  $p < 0.0019$ ). Adult sheep find dogs aversive, and their pain thresholds were higher in their presence than when a goat was present. This suggests that sheep are able to alter their behaviour in the presence of a potential threat.

These results justify further research into the behaviour of prey animals in the presence of a predator. Two key avenues for future research include; determining how prey animals view humans, and further investigating the mother-young relationship and the affect the presence of a predator has on this.

---

## Acknowledgements

This thesis would not have been possible without the help of staff and students at Massey University. I would like to thank: Amy Wake, Sabina Francois, Mark Sim, and Vikki Taylor for their assistance with the experimental component of this thesis.

I thank the staff at Massey University, especially the farm staff, Jono Brophy and Phil Brooks from Tuapaka, the technical staff in IVABS, Neil Ward and Bruce Cann for their patience and expertise and Alasdair Noble for his statistical expertise. I would also like to thank Anne, Wayne and Jamie Thomas, and Corey Laverty and many others, I am sincerely grateful for their contribution to this thesis.

Above all else, I am extremely grateful to Kevin Stafford and Ed Minot, for their supervision of this project. The time, patience and advice given over the course of this project have been invaluable.

This research would not have been possible had it not been for financial support provided by a Helen E. Akers Postgraduate Scholarship, an IVABS Postgraduate Research Fund, and most importantly the Thomas Family Trust. I am eternally grateful for this support.

I dedicate this thesis to my husband Bevan, and Jess, because with their unfailing optimism, understanding, companionship and support, I feel I can achieve everything and anything.

The use of all animals and procedures in the experiments described in this thesis were approved by the Massey University Animal Ethics Committee. Reference Numbers 03/122 and 03/11 (Appendix 7.3). In addition, it is intended that Chapters 3 and 4 of this thesis will be published as two papers in scientific journals. The authors of these papers will be Suzanne Young, Kevin Stafford and Ed Minot.

---

# Table of Contents

|  |            |
|--|------------|
| <b>ABSTRACT .....</b>  | <b>i</b>   |
| <b>ACKNOWLEDGEMENTS .....</b>  | <b>iii</b> |
| <b>TABLE OF CONTENTS .....</b>   | <b>iv</b>  |
| <b>1 GENERAL INTRODUCTION .....</b>  | <b>1</b>   |
| <b>2 LITERATURE REVIEW.....</b>  | <b>4</b>   |
| 2.1 ANIMALS AND PAIN   | 4          |
| 2.1.1 The function of pain.....  | 5          |
| 2.1.2 Assessing pain.....  | 6          |
| 2.1.3 Pain scales.....   | 8          |
| 2.1.4 Motivation.....  | 9          |
| 2.1.5 Behaviour following treatment.....   | 10         |
| 2.1.6 Individual and species specific responses to pain.....                     | 10         |
| 2.1.7 Analgesics and anaesthesia .....   | 12         |
| 2.2 EFFECTS OF PREDATORS ON THE BEHAVIOUR OF PREY SPECIES.....                   | 13         |
| 2.2.1 The selection of prey.....   | 14         |
| 2.2.1.1 <i>Hunting methods</i> .....   | 14         |
| 2.2.1.2 <i>Physical appearance</i> .....   | 16         |
| 2.2.1.3 <i>Predators may select prey based on their small size</i> .....         | 18         |
| 2.2.1.4 <i>Behaviour changes</i> .....   | 19         |
| 2.3 THE RESPONSE OF PREY ANIMALS TO THREATENING AND NON-THREATENING STIMULI..... | 19         |
| 2.3.1 Masking behaviour.....   | 20         |
| 2.4 SHEEP RESPONSES TO PREDATORS AND STIMULI.....                                | 22         |
| 2.4.1 Sheep and their predators.....   | 22         |
| 2.4.2 Sheep behaviour in response to predation.....                              | 23         |
| 2.4.3 Responses of sheep to fear-eliciting situations.....                       | 25         |
| 2.4.3.1 <i>Experience</i> .....  | 26         |
| 2.4.3.2 <i>Genotype</i> .....  | 27         |
| 2.4.3.3 <i>Sex and Age</i> .....   | 28         |

---

|          |   |           |
|----------|---|-----------|
| 2.4.3.4  | <i>Physiological State</i> .....  | 29        |
| 2.5      | SHEEP RESPONSES TO PAINFUL STIMULI.....   | 30        |
| 2.5.1    | Sheep and their response to castration and tail docking.....                        | 30        |
| 2.5.1.1  | <i>Physiological measures</i> .....   | 31        |
| 2.5.1.2  | <i>Behavioural measures</i> .....   | 33        |
| 2.5.2    | Sheep and their response to mechanical thresholds.....                              | 36        |
| 2.6      | CONCLUSIONS.....  | 38        |
| 2.7      | HYPOTHESIS AND AIMS.....  | 42        |
| <b>3</b> | <b>THE EFFECT OF PREDATOR PRESENCE ON LAMB BEHAVIOUR FOLLOWING CASTRATION</b> ..... | <b>43</b> |
| 3.1      | INTRODUCTION.....   | 43        |
| 3.2      | METHODS AND MATERIALS.....  | 44        |
| 3.2.1    | Introduction .....  | 44        |
| 3.2.2    | Animals .....   | 45        |
| 3.2.3    | Observation Pen .....   | 49        |
| 3.2.4    | Treatments.....   | 52        |
| 3.2.4.1  | <i>Castration with rubber rings (C)</i> .....                                       | 52        |
| 3.2.4.2  | <i>Handled Control (NC)</i> .....   | 52        |
| 3.2.5    | Stimuli .....   | 53        |
| 3.2.5.1  | <i>Dog</i> .....  | 54        |
| 3.2.5.2  | <i>Barking Tape</i> .....   | 55        |
| 3.2.5.3  | <i>Cardboard box</i> .....  | 55        |
| 3.2.5.4  | <i>Goat</i> .....   | 57        |
| 3.2.6    | Video Reading .....   | 58        |
| 3.2.7    | Data Gathering.....   | 58        |
| 3.2.8    | Behaviours .....  | 58        |
| 3.2.8.1  | <i>Restlessness</i> .....   | 58        |
| 3.2.8.2  | <i>Average time spent sitting</i> .....   | 59        |
| 3.2.9    | Data Analysis .....   | 59        |
| 3.3      | RESULTS.....  | 60        |
| 3.3.1    | Restlessness.....   | 60        |
| 3.3.2    | Average time spent sitting.....   | 64        |
| 3.3.3    | Time first sat .....  | 65        |

|            |   |            |
|------------|---|------------|
| 3.4        | DISCUSSION.....   | 66         |
| <b>4</b>   | <b>THE EFFECT OF PREDATOR PRESENCE ON THE MECHANICAL PRESSURE THRESHOLDS OF EWES.....</b> | <b>70</b>  |
| 4.1        | INTRODUCTION.....   | 70         |
| 4.2        | METHODS AND MATERIALS.....  | 68         |
| 4.2.1      | Introduction .....  | 71         |
| 4.2.2      | Animals .....   | 71         |
| 4.2.3      | Observation pen.....  | 73         |
| 4.2.4      | Treatments.....   | 75         |
| 4.2.5      | Stimuli .....   | 76         |
| 4.2.5.1    | <i>Dog</i> .....  | 76         |
| 4.2.5.2    | <i>Barking Tape</i> .....   | 77         |
| 4.2.5.3    | <i>Drum Tape</i> .....  | 77         |
| 4.2.5.4    | <i>Goat</i> .....   | 77         |
| 4.2.6      | Data Gathering.....   | 77         |
| 4.2.7      | Data Analysis .....   | 78         |
| 4.3        | RESULTS.....  | 78         |
| 4.4        | DISCUSSION.....   | 81         |
| <b>5.0</b> | <b>GENERAL DISCUSSION.....</b>  | <b>84</b>  |
| <b>6.0</b> | <b>REFERENCES.....</b>  | <b>91</b>  |
| <b>7.0</b> | <b>APPENDICES.....</b>  | <b>107</b> |
| 7.1        | APPENDIX A – CASTRATION EXPERIMENT DATA.....  | 107        |
| 7.1.1      | Castrated Lamb Restlessness data .....  | 107        |
| 7.1.2      | Control Restlessness data .....   | 108        |
| 7.1.3      | Time First Sat data.....  | 108        |
| 7.1.4      | Average time spent sitting data.....  | 109        |
| 7.2        | APPENDIX B –THRESHOLD EXPERIMENT DATA.....  | 111        |
| 7.2.1      | Sheep threshold values for dog stimulus.....  | 110        |
| 7.2.2      | Sheep threshold values for noise stimulus.....  | 110        |
| 7.2.3      | Sheep threshold values for goat stimulus.....   | 111        |
| 7.2.4      | Sheep threshold values for bark stimulus.....   | 111        |
| 7.3        | APPENDIX C - ANIMAL ETHICS APPLICATIONS.....  | 113        |