

# CURRICULUM VITAE

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## MICHAEL STEPHEN MOORING

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### Education

<b>Institution &amp; Location</b>	<b>Degree</b>	<b>Year</b>	<b>Field of Study</b>
University of Colorado, Boulder	B.A.	1987	Environmental, Population & Organismic Biology
University of California, Davis	M.Sc.	1990	Animal Behavior
University of California, Davis	Ph.D.	1993	Animal Behavior

### Academic Honors

<b>Dates</b>	<b>Honors</b>
1987	Graduated summa cum laude, CU Boulder
1988, 1989, 1990	Recipient UC Davis Research Awards
1988, 1989	Recipient of Sigma Xi Grants
1989	Regents Fellow in Animal Behavior
1990	Storer Fellowship
1990	Society of Mammalogists Research Grant
1990	Robert Emrie Smith Fellowship
1991	University of California Fellowship
1994-1995	Visiting Scientist, University of Pretoria
1995-1996	NATO Postdoctoral Fellowship, University of Alberta
1999, 2002, 2004-2008	PLNU Research & Special Projects Grant
1999	PLNU Teaching Development Award
2000, 2004, 2005	PLNU Alumni Grant
2000, 2004, 2005	PLNU Wesleyan Center Scholar
2000	New Mexico Dept. Game & Fish Grant
2001	PLNU Wesleyan Center Fellow
2003	PLNU Provost's Grant
2004-2006	Visiting Associate Professor, UC Davis
2005-2008	NSF-RUI Award IOB-0517771

## **Employment & Experience**

- 2006-Present** Full Professor (tenured)  
Department of Biology  
Point Loma Nazarene University  
3900 Lomaland Drive  
San Diego, CA 92106-2899
- 2002 - 2006:** Associate Professor  
Department of Biology  
Point Loma Nazarene University
- 1997-2002:** Assistant Professor  
Department of Biology  
Point Loma Nazarene University
- 1996-1997:** Postdoctoral Research Associate  
Department of Anatomy, Physiology & Cell Biology  
School of Veterinary Medicine  
University of California, Davis, CA 95616 USA  
(Supervisor: Dr. Benjamin L. Hart)
- 1995-1996:** NATO Postdoctoral Fellow  
Department of Biological Sciences  
University of Alberta  
Edmonton, Alberta T6G 2E9 Canada  
(Sponsor: Dr. William M. Samuel)
- 1994-1995:** Visiting Scientist  
Department of Zoology & Entomology  
University of Pretoria  
Pretoria 0002, South Africa  
(Collaborator: Dr. Andrew A. McKenzie)
- 1990-1993** Research Associate  
Department of National Parks & Wild Life Management  
P.O. Box 8365, Causeway  
Harare, Zimbabwe  
(Chief Ecologist: Dr. A. Conybeare)

**Current Research Interests:** Behavioral adaptations against parasites and disease  
Sexual segregation and sexual selection  
Predation risk and anti-predator strategies  
Bison behavioral ecology and conservation  
Behavioral endocrinology  
Sexual selection  
Acoustical communication

**Professional Societies:** Animal Behavior Society  
International Society for Behavioral Ecology  
American Society of Mammalogists  
The Wildlife Society

**Courses taught:** Ecology  
Animal Behavior  
Vertebrate Biology  
Animal Biology  
Environmental & People  
Human Biology and Bioethics  
Anatomy and Physiology lab

**Marital status:** Married to Emma Mooring  
Two children: Rebekah and Timothy

## Research Publications

1. 1989 Mooring, M.S. Ontogeny of allogrooming in mule deer (*Odocoileus hemionus*). *Journal of Mammalogy* 70: 434-437.
2. 1990 Hart, B.L., Hart, L.A., & Mooring, M.S. Differential foraging of oxpeckers on impala in comparison with sympatric antelope species. *African Journal of Ecology* 28: 240-249.
3. 1991 [Mooring, M.S. & Rubin, E.S. Nursing behavior and early development of Kenyan impala at the San Diego Wild Animal Park. \*Zoo Biology\* 9: 329-339.](#)
4. 1992 Mooring, M.S. & Hart, B.L. Reciprocal allogrooming in dam-reared and hand-reared impala fawns. *Ethology* 90: 37-51.
5. 1992 Hart, B.L., Hart, L.A., Mooring, M.S. & Olubayo, R. Biological basis of grooming behaviour in antelope: The body size, vigilance and habitat principles. *Animal Behaviour* 44: 615-631.
6. 1992 [Mooring, M.S. & Hart, B.L. Animal grouping for protection from parasites: Selfish herd and encounter-dilution effects. \*Behaviour\* 123: 173-193.](#)
7. 1993 Mooring, M.S. & Hart, B.L. Effects of relatedness, dominance, age, and association on reciprocal allogrooming by captive impala. *Ethology* 94: 207-220.
8. 1993 Mooring, M.S. Predation on a newborn impala by a martial eagle. *Ostrich* 64: 185-186.
9. 1994 Mooring, M.S. Allogrooming, an essential activity in impala behaviour. *Zimbabwe Wildlife*, January 1994: 19-22.
10. 1994 [Mooring, M.S., Mazhowu, W. & Scott, C.A. The effect of rainfall on tick challenge at Kyle Recreational Park, Zimbabwe. \*Experimental & Applied Acarology\* 18: 507-520.](#)
11. 1995 Mooring, M.S. & Hart, B.L. Differential grooming rate and tick load of territorial male and female impala, *Aepyceros melampus*. *Behavioral Ecology* 6: 94-101.
12. 1995 [Mooring, M.S. The effect of tick challenge on grooming rate by impala. \*Animal Behaviour\* 50: 377-392.](#)
13. 1995 [Mooring, M.S. & Hart, B.L. Costs of allogrooming in impala: Distraction from vigilance. \*Animal Behaviour\* 49: 1414-1416.](#)
14. 1995 [Mooring, M.S. & McKenzie, A.A. The efficiency of patch sampling for determination of relative tick burdens in comparison with total tick counts. \*Experimental & Applied Acarology\* 19: 533-547.](#)
15. 1995 Mooring, M.S. & Mazhowu, W. Geographic distribution of ticks and comparison of tick load on male and female impala from three sites in Zimbabwe. *Zimbabwe Veterinary Journal* 26: 76-85.

16. 1996 Mooring, M.S. & Mundy, P.J. Interactions between impala and oxpeckers at Matobo National Park, Zimbabwe. *African Journal of Ecology* 34: 54-65.
17. 1996 [Mooring, M.S., McKenzie, A.A. & Hart, B.L. Grooming in impala: Role of oral grooming in removal of ticks and effects of ticks in increasing grooming rate. \*Physiology and Behavior\* 59: 965-971.](#)
18. 1996 [Mooring, M.S. & Mundy, P.J. Factors influencing host selection by yellow-billed oxpeckers at Matobo National Park, Zimbabwe. \*African Journal of Ecology\* 34: 177-188.](#)
19. 1996 [Mooring, M.S., McKenzie, A.A. & Hart, B.L. Role of sex and breeding status in grooming and total tick load of impala. \*Behavioral Ecology and Sociobiology\* 39: 259-266.](#)
20. 1997 [Mooring, M.S. & Hart, B.L. Self grooming in impala mothers and lambs: Testing the body size and tick challenge principles. \*Animal Behaviour\* 53: 925-934.](#)
21. 1997 Mooring, M.S. & Hart, B.L. Reciprocal allogrooming in impala lambs. *Ethology* 103: 665-680.
22. 1998 [Mooring, M.S. & Samuel, W.M. Tick-removal grooming by elk \(\*Cervus elaphus\*\): testing principles from the programmed-grooming hypothesis. \*Canadian Journal of Zoology\* 76: 740-750.](#)
23. 1998 Mooring, M.S. & Samuel, W.M. Tick defense strategies in bison: the role of grooming and hair coat. *Behaviour* 135: 693-718.
24. 1998 [Mooring, M.S., Gavazzi, A.J., & Hart, B.L. Effects of castration on grooming in goats. \*Physiology and Behavior\* 64: 707-713.](#)
25. 1998 [Mooring, M.S. & Samuel, W.M. The biological basis of grooming in moose \(\*Alces alces\*\): programmed versus stimulus-driven grooming. \*Animal Behaviour\* 56: 1561-1570.](#)
26. 1999 [Mooring, M.S. & Samuel, W.M. Premature loss of winter hair in free-ranging moose \(\*Alces alces\*\) infested with winter ticks \(\*Dermacentor albipictus\*\) is correlated with grooming rate. \*Canadian Journal of Zoology\* 77: 148-156](#)
27. 1999 Mooring, M.S. & Dennis, N.J. Impala, the living fossil. *Africa Environment & Wildlife* 7: 52-61.
28. 2000 Samuel, W.M., Mooring, M.S., Aalangdong, O.I. Adaptations of winter ticks (*Dermacentor albipictus*) to invade moose and moose to evade ticks. *Alces* 36: 183-195.
29. 2000 [Mooring, M.S., Benjamin, J.E., Harte, C.R., & Herzog, N.B. Testing the interspecific body size principle in ungulates: the smaller they come, the harder they groom. \*Animal Behaviour\* 60: 35-45.](#)

30. 2002 [Mooring, M.S., Reisig, D.D., Niemeyer, J.M., and Osborne, E.R. Sexually and developmentally dimorphic grooming: a comparative survey of the Ungulata. \*Ethology\* 108: 911-934.](#)
31. 2003 [Mooring, M.S., Fitzpatrick, T.A, Fraser, I.C., Benjamin, J.E., Reisig, D.D. & Nishihira, T.T. Insect-defense behavior by desert bighorn sheep. \*Southwestern Naturalist\* 48: 635-643.](#)
32. 2003 [Mooring, M.S., Fitzpatrick, T.A, Benjamin, J.E., Fraser, I.C., Nishihira, T.T., Reisig, D.D. & Rominger, E.M. Sexual segregation in desert bighorn sheep \(\*Ovis canadensis mexicana\*\). \*Behaviour\* 140: 183-207.](#)
33. 2004 [Mooring, M.S., Blumstein, D.T. & Stoner, C.J. The evolution of parasite-defence grooming in ungulates. \*Biological Journal of the Linnean Society\* 81: 17-37.](#)
34. 2004 [Mooring, M.S. & Rominger, E.M. 2004. Reply – Is the activity budget the holy grail of sexual segregation? \*Behaviour\* 141: 521-530.](#)
35. 2004 [Mooring, M.S., Fitzpatrick, T.A, Nishihira, T.T., & Reisig, D.D. Vigilance, predation risk, and the Allee effect in desert bighorn sheep. \*Journal of Wildlife Management\* 68: 519-532.](#)
36. 2004 [Mooring, M.S., Patton, M.L., Lance, V.A., Hall., B.M., Schaad, E.W., Fortin, S.S., Jella, J.E., & McPeak, K.M. 2004. Fecal androgens of bison bulls during the rut. \*Hormones & Behavior\* 46: 392-398.](#)
37. 2005 [Mooring, M.S., Reisig, D.D., Osborne, E.R., Kanallakan, A.L, Wiseman, D.S., Huber, R.R. Sexual segregation in bison \(\*Bison bison\*\): a test of multiple hypotheses. \*Behaviour\* 142: 897-927.](#)
38. 2006 [Mooring, M.S., Patton, M.L., Lance, V.A., Hall., B.M., Schaad, E.W., Fetter, G.A., Fortin, S.S., & McPeak, K.M. Glucocorticoids of bison bulls in relation to social status. \*Hormones & Behavior\* 49: 369-375.](#)
39. 2006 [Mooring, M.S., Hart, B.L., Fitzpatrick, T.A, Benjamin, J.E., Fraser, I.C., Nishihira, T.T., and Reisig, D.D. Grooming in desert bighorn sheep and the ghost of parasites past. \*Behavioral Ecology\* 17: 364-371.](#)
40. 2006 [Mooring, M.S., Patton, M.L., Reisig, D.D., Osborne, E.R., Kanallakan, A.L., and Aubery, S.M. Sexually dimorphic grooming in bison: influence of body size and testosterone. \*Animal Behaviour\* 72: 737-745.](#)
41. 2007 [Mooring, M.S., Blumstein, D.T., Reisig, D.D., Niemeyer, J.M., and Osborne, E.R. Insect-repelling behaviour in bovids: role of mass, tail length, and group size. \*Biological Journal of the Linnean Society\* 91: 383-392.](#)
42. 2007 Wyman, M.T., Mooring, M.S., McCowan B., Penedo, M.C.T., and Hart, L.A. Bellow amplitude of bison reflects male quality, seasonal condition, and motivation. *Animal Behaviour* (in press).



## Student Presentations

Jill Benjamin, Cynthia Harte, Nathan Herzog, and Michael S. Mooring. "Testing the body size principle at the San Diego Wild Animal Park," presented by Jill Benjamin at the 24<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at University of California-Irvine in Irvine, California, May 1, 1999.

Thomas Fitzpatrick and Michael S. Mooring. "Optimal predators and vulnerable prey: predator-prey relations of bighorn sheep and mountain lions," presented by Thomas Fitzpatrick at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Ian Fraser and Michael S. Mooring. "Grooming and the ghost of parasites past," presented by Ian Fraser at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Jill Benjamin and Michael S. Mooring. "Fly-defense behavior by desert bighorn sheep," presented by Jill Benjamin at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Danielle Garcia and Michael S. Mooring. "Exhibit preferences by visitors to the San Diego Zoo," presented by Danielle Garcia at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Mark Houseman and Michael S. Mooring. "Role of the dominant male in great ape societies," presented by Mark Houseman at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Daniel Miller and Michael S. Mooring. "Grouping against fly harassment in Calamian deer," presented by Daniel Miller at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Amy Sheridan and Michael S. Mooring. "Reproductive constraints on sentry behavior in meerkats," presented by Amy Sheridan at the 25<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2000.

Thomas Fitzpatrick, Tara Nishihira, Dominic Reisig, and Michael S. Mooring. "Risk of mountain lion predation in desert bighorn sheep," presented by Thomas Fitzpatrick at the 26<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Santa Clara University, in Santa Clara, California, April 28, 2001.

Tara Nishihira, Thomas Fitzpatrick, Dominic Reisig, and Michael S. Mooring. "Sexual segregation in desert bighorn sheep," presented by Tara Nishihira at the 26<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Santa Clara University, in Santa Clara, California, April 28, 2001.

Dominic Reisig, Tara Nishihira, Thomas Fitzpatrick, and Michael S. Mooring. "Grooming and fly repelling behavior in desert bighorn sheep," presented by Dominic Reisig at the 26<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Santa Clara University, in Santa Clara, California, April 28, 2001.

Eric R. Osborne, Jason M. Niemeyer, Dominic D. Reisig, and Michael S. Mooring. “Developmentally dimorphic grooming in ungulates,” presented by Eric Osborne at the 27<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Loyola Marymount University in Los Angeles, California, April 27, 2002.

Dominic D. Reisig, Eric R. Osborne, Jason M. Niemeyer, and Michael S. Mooring. “Effect of body size on fly-repelling behavior in ungulates,” presented by Dominic Reisig at the 27<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Loyola Marymount University in Los Angeles, California, April 27, 2002.

Jason M. Niemeyer, Eric R. Osborne, Dominic D. Reisig, and Michael S. Mooring. “Sexually dimorphic grooming in ungulates,” presented by Jason Niemeyer at the 27<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Loyola Marymount University in Los Angeles, California, April 27, 2002.

Adam L. Kanallakan, Dominic D. Reisig, Eric R. Osborne, and Michael S. Mooring. “Sexual segregation in bison: a test of multiple hypotheses,” presented by Adam Kanallakan at the 28<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Colorado College in Colorado Springs, Colorado, April 26, 2003.

Eric W. Schaad, Brent M. Hall, and Michael S. Mooring. “Effective population size and conservation of bison at Fort Niobrara National Wildlife Refuge” presented by Eric Schaad at the 29<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 24, 2004.

Brent M. Hall, Eric W. Schaad, Jacquelynn E. Jella, Shavonne S. Fortin, and Michael S. Mooring. “Fecal androgens of bison bulls during the rut” presented by Brent Hall at the 29<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 24, 2004.

Shavonne S. Fortin, Jacquelynn E. Jella, Brent M. Hall, Eric W. Schaad, and Michael S. Mooring. “Glucocorticoids of bison in relation to social status” presented by Shavonne Fortin and Jacquelynn Jella at the 29<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 24, 2004.

Michael Dillenbeck, Kevin Yarbrough, and Michael S. Mooring. “Glucocorticoids of bison bulls in relation to social status” presented by Michael Dillenbeck at the 30<sup>th</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Santa Clara University in Santa Clara, California, April 30, 2005.

Angela Merkens, Michael Dillenbeck, Timothy O’Brien, and Michael S. Mooring. “Effect of dominance on acoustical communication in bison bulls” presented by Angela Merkens at the 31<sup>st</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2006.

Timothy O’Brien, Angela Merkens, Michael Dillenbeck, and Michael S. Mooring. “Genetic parentage of bison compared with breeding behavior” presented by Timothy O’Brien at the 31<sup>st</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Point Loma Nazarene University in San Diego, California, April 29, 2006.

Daniel Sullivan and Michael S. Mooring. “Do bison females synchronize parturition by gestation adjustment?” presented by Daniel Sullivan at the 32<sup>nd</sup> Annual West Coast Biological Sciences Undergraduate Research Conference at Loyola Marymount University in Los Angeles, California, April 28, 2007.

