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Professional Experience

2005-present: Professor of Mathematical Sciences, Michigan Technological University.
9/91-2005: Assoc. Professor of Mathematical Sciences, Michigan Technological University.
9/97-12/97 Visiting Scholar, Yellowstone National Park
11/96-6/97: Interim Chair, Dept. of Math. Sci., Michigan Technological University
9/85-8/91 Assistant Professor, Michigan Technological Univ.

Education

Ph.D. Statistics, 1985, University of Wyoming
M.S. Applied Statistics, 1979, Bowling Green State Univ.

Professional Associations

American Statistical Association, Biometrics Society, Wildlife Society

Editorial Positions

Associate Editor Journals of Agricultural, Biological and Environmental Statistics 1999-2005.

Research Interests

Ecological statistics, sampling biological populations, applied statistics, joint research.

Current Research Projects

1. Lake trout were illegally introduced to Yellowstone Lake in Yellowstone National Park . As the lake trout population grew, the cutthroat trout population appeared to decline. Eagles and osprey both use cutthroat as a prey base, but osprey rely almost exclusively on cutthroat. The aim of the study is to determine how the change in the cutthroat population has affected eagle and osprey reproductive success, and to determine if netting efforts to reduce lake trout population levels have been successful.
2. Re-introduction of wolves into Yellowstone National Park in 1995 was highly controversial for a variety of reasons. One of the reasons cited for re-introducing wolves was to control the size of the resident elk population, which some biologists

believed had grown to unsustainable levels. The question remains as to what effect the wolf population has had on the size of the elk population. In this research the aim is to estimate how many elk are killed by wolves.

3. Funded by Michigan DNR. Sightability models are used to adjust counts from aerial survey data to account for detectability < 1.0 . Sightability is often assumed to depend on covariates such as group size, ground cover, and group activity. I examine the performance of these abundance estimators with regard to bias and confidence interval coverage, and examine the effects of covariate measurement error and misclassification.
4. Conducted jointly with researchers in Humanities and Cognitive Science. Funded by NSF. Universities and funding agencies are increasingly emphasizing awareness of the ethical conduct of research among faculty and graduate students. Individuals must first be aware that an ethical situation exists before an ethical decision can be made. We have developed one instrument for assessing ethical sensitivity and another instrument for assessing recognition of five professional attributes. The aim is to check for a correlation between the two sets of variables, and to compare domestic and international graduate students.
5. Conducted jointly with faculty in Dept. of Kinesiology and Integrated Physiology. Funded by NIH. The aim is to determine the effect of 24 hour sleep deprivation on resting muscle sympathetic nerve activity (MSNA) and blood pressure in men and women. A recent study reported that associations between short sleep duration and hypertension are more prevalent in women compared to men. To date, only two studies have examined resting MSNA and blood pressure after sleep deprivation, and neither study probed for sex differences. The study consisted of measuring resting blood pressure and MSNA in both men and women after normal sleep and 24 hours sleep deprivation using a crossover design.

Bibliography

Refereed Journal Publications

1. Drummer, T.D. and L.L. McDonald (1987). Size-bias in line transect sampling. *Biometrics* 43(1):13-22.
2. Drummer, T.D., A.R. Degange, L.L. Pank and L.L. McDonald (1990). Adjusting for group size influence in line transect sampling. *Journ. Wild. Man.* 54(3):511-514.
3. Drummer, T.D. (1990) Estimation of proportions and ratios from line transect data. *Comm. in Stat. (Theory and Methods)* 19(8):3069-3091.
4. Drummer, T.D. (1991). SIZETRAN: Analysis of size-biased line transect sampling. *Wildlife Society Bull.* 19:117-118.
5. Thurber, J.M., R.O. Peterson and T.D. Drummer (1991). The effects of regulated lake levels on muskrat, *Ondatra zibethicus*, in Voyageurs National Park, Minnesota. *The Canadian Field Naturalist* 105(1):34-40.
6. Thomasma, L.E., T.D. Drummer and R.O. Peterson (1991). A test of the habitat

- suitability index model for fisher. *Wildlife Society Bull.* 19(3):291-297.
7. Smith, S.W., R.O. Peterson and D.S. Sheputis (1991). Over winter activity and body temperature patterns in beavers. *Canadian Journ. of Zoology* 69(8): 2178-2182.
 8. Li, Yenhung, J. Glime and T.D. Drummer (1993). Effects of phosphorous on the growth of Sphagnum Magitecanicum Brid. and S. Papillosum Linob. *Lindbergia* 18:25-30.
 9. Peterson, R.O., J.M. Thurber, T.D. Drummer and S.L. Thomasma (1994). Gray wolf response to refuge boundaries and roads in Alaska. *Wildlife Society Bull.* (22):61-68.
 10. Smith, D., T. Drummer and R. Peterson (1994). Reply- Studies of beaver activity and body temperature:a historical perspective. *Canadian.Journ. of Zoology* (72):567-569.
 11. Drummer, T.D. and R. W. Aho.(1998) A sightability model for moose in Michigan's Upper Peninsula. *Alces* Vol. 34(1):15-19.
 12. Zhou, M., T.L. Sharik, M.F. Jurgensen, D.L. Richter, M.R. Gale and T.D. Drummer. 1998. Regeneration of northern red oak in relation to ectomycorrhizae in oak and pine stands after overstory and understory manipulations. *Northern Journal of Applied Forestry* 15(4): 182-90.
 13. Saunders, S. C., J. Chen, T. D. Drummer and T. R. Crow. 1999. Modeling temperature gradients across edges over time in a managed landscape. *Forest Ecology and Management* (117):17-31.
 14. Budd, J.W., T.D. Drummer, T.F. Nalepa and G.L. Gahnsteil (2001). Remote sensing of biotic effects: Zebra mussels (*Dreissena polymorpha*) influence on water clarity in Saginaw Bay, Lake Huron. *Limnology and Oceanography* 46(2): 213-223.
 15. V. C. Lessard, T.D. Drummer and D.D. Reed (2002). A comparison of the precision of fixed-radius plot, variable-radius point, and N-tree distance sampling estimators. *Forest Science* 48(1):1-6.
 16. Saunders, S.C., J. Chen, T.D. Drummer, T.R. Crow, K.D. Brosofske and E.J. Gustafson (2002). The patch mosaic and ecological decomposition across spatial scales in a managed landscape of northern Wisconsin, USA. *Basic and Applied Ecology* (3): 49-64.
 17. R. O. Peterson, A. K. Jacobs, T. D. Drummer, L. D. Mech and D. W. Smith. (2002). Leadership behavior in relation to dominance and reproductive status in gray wolves, *Canis lupus*. *Can. J. Zoology* (80): 1405-1412.
 18. D. W. Smith, T. D. Drummer, K. M. Murphy, D. S. Guernsey, and S. B. Evans. (2004). Winter prey selection and estimation of wolf kill rates in Yellowstone National Park, 1995-2000. *Journal of Wildlife Management* 68(1): 153-166.
 19. T.D. DeBruyn, T.S. Smith, K. Proffitt, S. Partridge, T.D. Drummer. 2004. Brown bear response to elevated viewing structures at Brooks River, Alaska. *Wildlife Society Bulletin* 32(4):1132-1140.
 20. S.C. Saunders, J. Chen, T.D. Drummer, E.J. Gustafson, K.D. Brosofske. 2005. Identifying scales of pattern in ecological data: a comparison of lacunarity, spectral and wavelet analysis. *Ecological Complexity* 2(1): 87-105.
 21. K.B. Harvey, T.D. Drummer and S.W. Donahue. 2005. The tensile strength of black

- bear (*Ursus americanus*) cortical bone is not compromised with aging despite annual periods of hibernation. *Journal of Biomechanics* 38:2143-2150.
22. M.J. Potvin, T.D. Drummer, J.A. Vucetich, D.E. Beyer, R.O. Peterson and J.H. Hammill. 2005. Monitoring and Habitat Analysis for Wolves in Upper Michigan. *Journal of Wildlife Management* 69(4): 1660-1669.
 23. S. A. Sorby, T. Drummer and R. Molzon. 2006. Experiences in using spatial skills testing instruments with younger audiences. *Journal for Geometry and Graphics* 10(2):227-235.
 24. Hungwe, K., S. Sorby, T. Drummer and R. Molzon. 2007. Preparing K-12 students for engineering studies by improving 3-D spatial skills. *Journal of Learning*:14(2):127-134.
 25. McGee-Lawrence, M. E., S. J. Wojda, L. N. Barlow, T. D. Drummer, K. Brunnell, J. Auger, H. L. Black, S. W. Donahue. Six months of disuse during hibernation does not increase intracortical porosity or decrease cortical bone geometry, strength, or mineralization in black bear (*Ursus americanus*) femurs. 2009. *Journal of Biomechanics* 42: 1378-1383.
 26. McGee-Lawrence, M. E., S. J. Wojda, L. N. Barlow, T. D. Drummer, A. B. Castillo, O. Kennedy, K. W. Condon, J. Auger, H. L. Black, O. L. Nelson, C. T. Robbins, S. W. Donahue. 2009. Grizzly bears (*Ursus arctos horribilis*) and black bears (*Ursus americanus*) prevent trabecular bone loss during disuse (hibernation). *Bone* 45(6):1186-1191.
 27. R. O. Peterson, J. A. Vucetich, G. Fenton, and T. D. Drummer. 2010. The ecology of arthritis. *Ecology Letters* 13:1124-1128.
 28. Drummer, T.D., R.G. Corace, and S. Sjogren. 2011. Sharp-tailed grouse lek attendance and fidelity in Upper Michigan. *Journal of Wildlife management* 75(2):311-318.

Book Chapters

1. Thomasma, L.E., T.D. Drummer and R.O. Peterson. 1994. Winter habitat selection by fishers. Pages 316-325 in *Martens, Sables and Fishers: Biology and Conservation*. Cornell University Press, Ithaca, NY.
2. Drummer, T. D. 1999. Planning abundance estimation surveys when detectability is < 1.0. Pages 67-74 in *Marine mammal survey and assessment methods*. Garner, G.W., S.C. Amstrup, J.L. Laake, B.F.J. Manly, L.L. McDonald and D.G. Robertson (eds.). 1999. A. A. Balkema, Rotterdam, Netherlands.

Proceedings

1. Lessard, V.C., D.D. Reed and T. Drummer (1995). N-tree distance sampling compared to fixed radius plot and variable radius point sampling in forest inventory estimation of basal area per acre. Pages 81-90 in *Proceedings of The Monte Verita Conference on Forest Survey Designs*, MonteVerita, Switzerland, Swiss Federal Institute for Forest,

- Snow and Landscape Research, Zurich, 316 pp.
2. Cumming, W.A., E.A. Jones, D.D. Reed and T.D. Drummer. 2001. Frontier function analysis to estimate the maximum relative growth rate of red pine (*Pinus resinosa*, Ait.) in northern Michigan. Proceedings of IUFR04.11 Conference: "Forest Biometry, Modelling and Information Science"; K. Rennolls, ed.. University of Greenwich, June 25-29. 8 pp. <http://cms1.gre.ac.uk/conferences/iuj>.
 3. S. A. Sorby, L.J. Bohmann, T.D. Drummer, J.O. Fren dewy, K.G. Mattila, and J.W. Sutherland. 2005. Development of a service systems engineering curriculum using a Delphi technique. Proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition (CD-Rom).
 4. Sorby, S.A., T.D. Drummer, K. Hungwe and P. Charlesworth. 2005. Developing 3-D spatial visualization skills for non-engineering students. Proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition (CD-Rom).
 5. Sorby, S.A., T. D. Drummer and R. L. Molzon. 2006. Experiences in using spatial skills testing instruments with younger audiences. Twelfth international conference on geometry and graphics. August 6-10, Salvador, Brazil. (CD-ROM).
 6. Sorby, S.A., T.D. Drummer, K. Hungwe, L. Parolini and R.E. Molzon. 2006. Preparing for engineering studies: Improving the 3-D spatial skills of K-12 students. Ninth international conference on engineering education, July 23-28, San Juan, Puerto Rico. (CD-ROM).
 7. Sorby, S.A., P. Charlesworth and T.D. Drummer. 2006. Spatial skills and their relationship to performance in chemistry courses. 12th international conference on geometry and graphics, August 6-10, Salvador, Brazil. CD-Rom.
 8. Sorby, S., T. Drummer, R. Molzon and K. Hungwe. 2007. Effective strategies in developing 3-D spatial skills among K-12 students. In Jon N. Duff (ed.) Proceedings of the 61st Midyear Design Graphics Division. San Diego, CA..
 9. Bowler, M.J., S.L. Amato-Henderson, T.D. Drummer, J.H. Holles, J.M. Schrieber, T.W. Lockhart, D.D. Charlesworth, and J. Ren. (2010). Testing for ethical sensitivity to responsible conduct of research among among multi-national STEM researchers . American Society for Engineering Education, Louisville, KY, June 2010.
 10. Bowler, M.J., S.L. Amato-Henderson, T.D. Drummer, J.H. Holles, J.M. Schrieber, T.W. Lockhart, D.D. Charlesworth, and J. Ren. (2010). Assessing role orientation among STEM researchers: the development of a research role orientation inventory. American Society for Engineering Education, Louisville, KY; June, 2010.

Book Reviews

1. (2000). Review of Sampling and Statistical Methods for Behavioral Ecologists by J. Bart, W. Notz, and M. Fligner. Appeared in Forest Ecology and Management 132 (2000): 281-284.

2. (2011). Review of Mixed Effects Models and Extensions in Ecology With R by A. F. Zuur, E. N. Ieno, N. J. Walker, and G. M. Smith. Appeared in *The American Statistician* 65(1): 64.

Abstracts

1. S.W. Donahue, S. A. Galley, M.R. Vaughn, P. Buckendahl, L.M. Demers, J.L. Vance, T.D. Drummer, and M.E. McGee. 2006. PTH may maintain bone formation in hibernating black bears (*Ursus americanus*) to prevent disuse osteoporosis. 52nd Annual Meeting of the Orthopaedic Research Society (CD).
2. Lucas, A, J. Carter, T.D. Drummer. 2009. Effects of pediatric adiposity on heart rate variability (Abstract). *Federation of American Societies for Experimental Biology* 23: 612.

Technical/Consulting Reports

1. T.D. Drummer. (1986). The feasibility of using line transect sampling to monitor caribou usage. USFWS, Anchorage, AK. 19 pp.
2. T.D. Drummer. (1986). An evaluation of the line transect method for estimating sea otter abundance. USFWS, Anchorage, AK. 19 pp.
3. T.D. Drummer. (1987). Estimation of brown bear abundance and age/sex ratios on Kodiak Island, Alaska. USFWS, Kodiak, AK. 6 pp.
4. T.D. Drummer. (1987). Estimation of pronghorn antelope abundance and age/sex ratios via line transect sampling. Colorado Dept. of Natural Resources, Fort Collins, CO. 20 pp.
5. T.D. Drummer. (1990). User's manual for SIZETRAN. 63 pp.
6. R.J. Esher, C. Levenson and T.D. Drummer. (1992). Aerial surveys endangered and protected species in the Empress II ship trial operating area in the Gulf of Mexico. Naval Research Laboratory, NRL/MR/7174-92-7002. 53 pp.
7. T.D. Drummer. (1999). Evaluation of measurement error and sampling intensity in a site classification measurement system. For U.S. Forest Service, 63pp..
8. T.D. Drummer. (2001). Influence of human use of restricted use shoreline areas in Voyageurs National Park, MN. 15pp..
9. T. D. Drummer, T. McNinch, and T. Colling. 2006. Analysis of PASER Rating Quality Control Agreement & Development of a Quality Control Data Sampling Plan. Michigan Transportation Asset management Council. 37 pp.

Funding

1. 1989-1992: An ecological study of fisher and marten in the Western Upper Peninsula of Michigan. \$35,000 from Michigan Dept. of Natural Resources and US Forest Service. CO-PI with R.O Peterson (FWRS).

2. 1992-1995: Developing a censusing method for the Michigan moose population. \$60,000 from the Michigan Dept. of Natural Resources.
3. 1994-1995. A model computer laboratory for the teaching and learning of undergraduate mathematics for preservice secondary school teachers. Co-PI with Bev Gimmestad Baartmans and Sid Graham; \$60,000 from NSF.
4. 1996. Climate effects as determinants of interannual variation in the forage base of Great Lakes salmonid Fisheries. Co-PI with Steve Bowen and Ann MacLean; \$62,000 from Michigan Sea Grant.
5. 1999-2002. Gray wolf management in the Lake Superior Region: Pictured Rocks National Lakeshore. \$102,00 for 3 years funded by National Park Service. Co-PI Rolf Peterson, School of Forestry and Wood Products.
6. 2000-2001. Wolf ecology in Voyagers National Park. \$106,000 for 2 years funding provided by National Park Service. Co-PI Rolf Peterson, School of Forestry and Wood Products.
7. 2000-2003. The gray wolf in Michigan. \$134,636 for 3 years, funded by Michigan DNR. Co-PI Rolf Peterson, School of Forestry and Wood Products.
8. 2001-2003. Monitoring of wolves in Michigan's upper peninsula. MDNR, \$91,000 for 2 years. CO- PI Rolf Peterson
9. 2001-2004. Gray Wolf population modeling and estimation techniques. MDNR \$283,500. Co_PI Rolf Peterson (Forestry).
10. 2004-2007. Removing Barriers to Success: Reducing Gender Differences in Spatial Skills. NSF, 3 years, \$499,534. PI Sheryl Sorby (College of Engineering), CO-PI's: Tom Drummer(Math), Kedmon Hungwe (Education), Paul Charlesworth(Chemistry).
11. 2004. Development of a Service Sector Engineering Curriculum. NSF, 2 years, \$99,976. PI Sheryl Sorby; PI's Len Bowman (EE), John Sutherland(ME), Tom Drummer(Math), Jim Frenndwey(Business) Kris Mattila(Civil Eng.)
12. 2005-2007. Developing a sharptailed grouse monitoring program in the eastern Upper Peninsula. MDNR \$51,000 for 3 years.
13. 2005-2006. Construction and evaluation of a sightability model for the Michigan moose census. \$17,900 by MDNR, 1 year. Asked for 1-year no-cost extension.
14. 2005-2006. Developing a reliable survey technique to monitor a harvested moose population in Lake Clark national Park and Preserve, Alaska. National Park Service; \$18,000 for 2 years.
15. 2005-2007. Winter use by white-tailed deer of remnant hemlock stands in the western Upper Peninsula. PI Chris Webster (SFWP); CO-PI's: J. Vucetich and R. Peterson (SFWP); T. Drummer (Math. Sci.); 3 years, \$149,418.
16. 2010. Sleep deprivation and neurovascular control in humans. PI Jason Carter. Consultant T. Drummer. 1 year, \$232,499, US. Dept. Health and Human Services.
17. 2008-2011. Responsible Conduct of Research in Science and Engineering Education: Moral Motivation and Ethical Sensitivity in Multi-National Graduate Students. T Three years, \$299,614, Michael Bowler (MTU Humanities) PI, T. D. Drummer – Consultant.

Presentations at Conferences

1. Drummer, T.D. and L.L. McDonald. (1985). Size-bias in line transect sampling. Joint national meetings, Las Vegas, NV.
2. Drummer, T.D. (1986). Extensions of line transect sampling. Advanced Conference on Weighted Distribution, Penn State Univ.
3. Drummer, T.D. (1987). Estimation of proportions and ratios from line transect sampling. Biometrics Society spring meeting, Dallas, TX.
4. Thomasma, L.E., T.D. Drummer and R.O. Peterson. (1988). Winter habitat selection by fisher. Midwest chapter of the Wildlife Society, Columbus, OH.
5. Drummer, T.D. (1989). SIZETRAN-Analysis of size biased line transect data. Midwest chapter of the Wildlife Society, Milwaukee, WI.
6. Drummer, T.D. (1990). Properties of bivariate line transect detection functions. (Invited talk). Joint national meetings, Baltimore, MD.
7. Thomasma, L.E., T.D. Drummer and R.O. Peterson. (1991). An ecological study of fisher and marten. US Forest Servicer Confer. on Old Growth Ecosystems, Land O'Lakes, WI.
8. Lessard, V.C., D.D. Reed and T.D. Drummer. (1993). N-tree distance sampling basal area estimates in random and contagious patterned forests. Midwestern Forest Mensurationists and Association of Southern University Biometricians Joint Meeting. Williamsburg, VA.
9. Lessard, V.C., D.D. Reed and T.D. Drummer. (1994). N-tree distance sampling compared to fixed radius plot and variable radius point sampling in forest inventory estimation of basal area per acre. Processings of the Monte Verita Conference on Forest Survey Designs: 'Simplicity versus Efficiency' and the Assessment of Non-timber Resources, Monte Verita, Ascona, Switzerland.
10. Thomasma, L.E., T.D. Drummer and R.O. Peterson. (1996). Habitat requirements of fisher and marten. Midwest Furbearers Conference, Ironwood, MI.
11. Drummer, T. D. 1998. Planning abundance estimation surveys when detectability is < 1.0 . Symposium for Surveys, Status and Trends of Marine Mammals, March 10-12. Seattle, WA.
12. Drummer, T.D. 1999. Spatial and temporal patterns in age-1 lake herring year class strength. Lake Superior Technical Conference, January 6, 1999, Marquette, MI.
13. Drummer, T. D. 2000. Estimation of Yellowstone National Park wolf kill rates using the double counts method. International Wolf Conference, Duluth, MN.
14. Gunasekara, G.P. and T.D. Drummer. 2004. Measurement error in dual systems models. Biometrics Society ENAR Spring Meeting, Pittsburgh, PA.
15. Drummer, T.D. and D.L. Beyer. Evaluation of Minnesota wolf survey methods in Michigan. Midwest wolf stewardship conference, Watersmeet, MI, April 23, 2006.
16. Drummer, T.D. and D.L. Beyer. Evaluation of wolf population sampling plans. Midwest wolf stewardship conference, Watersmeet, MI, April 23, 2006.
17. Hungwe, K., S. Sorby, T. Drummer and R. Molzon. Preparing K-12 students for Engineering Studies by Improving 3-D Spatial Skills. 2007. Presented at the 14th

International Conference on Learning; University of Witwaterstand, Johannesburg, June 26-29, 2007.

18. Hungwe, K., S. Sorby, T. Drummer and R. Molzon. 2007. Effective strategies for developing 3-D spatial skills among K-12 students. Poster presented at the NSF Joint Annual Meeting, Washington, DC. August 25-26, 2007.
19. Drummer, T.D., R.G. Corace, and S. Sjogren. Monitoring sharp-tailed grouse in the eastern UP. Michigan Ornithological Conference, April 4, 2009, Petoskey, MI.
20. Bowler, M.J., T.W. Lockhart, S.L. Amato-Henderson, T.D. Drummer, D.D. Charlesworth, J. ren, J.H. Holles, J.M. Schreiber. (2009). Assessing moral motivation and ethical sensitivity among multi-national graduate students: implications for research and teaching. Ethics Education in Science and Engineering Conference, sponsored by national Science Foundation; Arlington, VA, January 2009.
21. Baril, L. M., T.D. Drummer, T. Koel, and T. McEneany. (2010). Bald eagle and osprey reproductive success in Yellowstone National Park: are declines in cutthroat trout since exotic lake trout introduction influencing rates of reproduction? Raptor Research Conference, Ft. Collins, CO; September 25, 2010.