A comparison of canid depredation research published in journal and gray literature

Kyle Plotsky, Shelley M. Alexander, Dianne Draper & Marco Musiani

Published online: 02 Mar 2022.

Submit your article to this journal

Article views: 599

View related articles

View Crossmark data

Routledge
Taylor & Francis Group

RESEARCH NOTE

🔓 OPEN ACCESS   Check for updates

A comparison of canid depredation research published in journal and gray literature

Kyle Plotsky [a], Shelley M. Alexander[a], Dianne Draper[a], and Marco Musiani [b]

[a]Geography Department, University of Calgary, Calgary, Alberta, Canada; [b]Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada

ABSTRACT

We evaluated whether coyote and wolf depredation management research in peer-reviewed journals differed from research in gray literature (e.g., conference proceedings, research reports). Regression analysis showed that journal published research was more likely to have used statistical analyses and have authors with academic affiliations. These results show that reliance on one literature type may lead to management and research decisions based on partial information. Focusing on journal literature may reduce the likelihood of encountering descriptive (i.e., non-statistical) analyses that could inform management and illuminate future avenues of research. For instance, half of the 76 descriptive experimental research findings we located, including 10 controlled experiments, were found only in gray literature documents. Our results highlight that canid depredation managers and researchers should utilize both journal and gray literature.

Introduction

Wildlife management in North America is expected to be based on scientific evidence (Organ et al., 2012). The ability of decision-makers to use evidence depends on multiple factors, including their awareness of and ability to access past research (Song et al., 2000). We hypothesized that the perceptions of researchers, editors, and reviewers may bias some management research toward publication in journal or gray literature (e.g., conference proceedings, research reports, theses, periodicals). We collected research evaluating ways to mitigate livestock depredation by wolves (*Canis lupus*) and coyotes (*Canis latrans*) in the United States (US) and Canada; locations with similar environmental, social, policy, and economic contexts. The characteristics (Table 1) of management research published in peer reviewed journals and gray literature were then compared. A regression analysis evaluated which research characteristics best predicted publication in journal literature.

We expected that publication selection effects (i.e., bias in how research is reported) could arise from perceptions of certain research outcomes, methodologies, types of analyses, and author affiliations (Rosenberger & Johnston, 2009). Based on work focused on unpublished research (e.g., Rosenthal, 1979), we expected strong research outcomes, such as more significant or larger effects, to be biased toward publication in

Table 1. Descriptions of characteristics, categories, examples of each category, and the number of research findings within each of those categories for our evaluation of wolf and coyote depredation research findings published between 1970 and 2018.

Characteristic	Description	Categories	Example (where applicable)	n =[a]
Predator Species	Results were stated to be applicable to which canid species	Coyotes		119
		Wolves		28
		Both	Results applicable to both canids	4
		Unknown	Results are not canid species-specific	1
PI/Author Affiliation	Affiliation of Principal Investigator, the author of contact, or the first author	Academic	University of Colorado	70
		Government	Wildlife Services	67
		Not for profit	Project Coyote	3
		Corporation	Av-Alarm Corporation	1
		Combination	USDA, Utah State University	8
Experimental Design	Type of experimental or non-experimental methods.	Correlational	Survey, simultaneous comparison of locations	61
		Quasi-experiment	Before-after intervention comparisons	60
		Controlled experiment	Intervention vs. control comparisons	27
Analysis Type	Results included statistical H_0 testing	Statistical	Analysis of Variance, chi-square	51
		Descriptive	Producer perceptions, description of livestock deaths	97
Outcome Rating	Effectiveness of mitigation strategy based on reported results	Positive	>75% change in desired direction	44
		Mixed	25–75% change in desired direction	75
		Negative	<25%, undesirable, no change	29

[a]Sample size for all research findings; categories do not always total 152.

journal literature than gray literature. Some methodologies, particularly controlled experiments, also are perceived as higher quality than other methodologies (Treves et al., 2016). These perceptions may lead to a higher proportion of controlled experiments than other methodologies being published in journal literature. Similarly, researchers may be discouraged from publishing descriptive (i.e., non-statistical) results in journal literature due to perceptions of statistical analyses as superior (Murphy & Noon, 1991) and some journals requiring statistical results or having strict space limitations. Both academic and non-academic researchers with similar education backgrounds are assumed to apply the same standards regarding research design and analysis. However, non-academic researchers may not have the same resources (e.g., time, research assistants) to publish in journal literature nor a publish or perish mentality arising from their employment requirements as academic researchers (Mahoney, 1979). These employment and motivational differences may bias academic researchers toward publishing in journal literature compared to other non-academic researchers.

We consider the similar histories and behaviors of wolves and coyotes (Crabtree & Sheldon, 1999; Wang et al., 2004) reason to include both in our analysis. However, publication selection effects (Rosenberger & Johnston, 2009) may arise from the contrasting attitudes toward these species. The status of wolves as endangered charismatic mega-fauna may increase the need for peer-reviewed research (Houston et al., 2010; Smith et al., 2003) and afford publication in additional journals. These characteristics may increase the likelihood that wolf research will be reported in journals compared to research on coyotes, which are often viewed as a pest or vermin (Fox & Papouchis, 2005).

Methods

Documents containing canid livestock depredation management research published between 1970 and 2018 were collected through Google Scholar and Science Direct. Search terms combined words describing livestock depredation/conflict with general methods (e.g., lethal, non-lethal), specific strategies (e.g., scare device, taste aversion, trapping, shooting), and species (wolf, coyote). Initially, title and abstract were used to determine relevance of the document to our analysis. Documents had to include methods, results, and a statement of applicability to mitigating livestock depredation by wolves or coyotes in the US or Canada.

Gray literature was located through conference proceedings and search engines. We focused on well-known conferences, particularly the Vertebrate Pest Conference, the Eastern Wildlife Damage Control Conference, and the Wildlife Damage Management Conference. References in the collected documents were used to identify additional literature. We did not contact authors to identify additional research as our focus was on publicly available research and our wide range of publication dates. Documents not locatable online were requested through the authors' university library.

Data Preparation

We use the term "research finding" to refer to individual experiments, studies, or results reported in the documents. We collected 152 documents and 42 of those documents reported multiple research findings. For instance, implementations of a management strategy using different experimental designs or samples in the same document were recorded as separate research findings. One research finding was selected at random in each of the 42 documents that reported multiple research findings (Nelson & Kennedy, 2009). These randomly selected 42 research findings were then included in our analysis for a sample size of 152. Thus, all documents were included as single research findings to minimize multiple observation biases. Identical research findings identified in multiple documents were recorded once. We expected journal literature to be more accessible than gray literature so identical research in both literature types was recorded as a journal research finding.

Beyond being categorized as journal or gray literature, we assigned each research finding a category for five characteristics: (1) predator species; (2) author/Principal Investigator (PI) affiliation; (3) experimental design; (4) analysis type; and (5) outcome rating (Table 1). Research findings were recorded as incomplete entries when a characteristic was unidentifiable leading to variable sample sizes (Table 1).

Statistical Analysis

Chi-square tests compared the frequency of the five characteristics (Table 1) between journal and gray literature (Tabachnick & Fidell, 2013). Each chi-square test was considered independent and we interpreted a significant result ($p < .05$) as indicating that a characteristic occurred at an unexpected rate between journal and gray literature. To fulfill the expected frequency assumption of the chi-square test (McHugh, 2013), categories with insufficient research findings were removed from analyses.

Characteristics occurring at significantly different frequencies between literature types were independent variables in a forward stepwise logistic regression analysis to predict which characteristics predicted journal publication (Tabachnick & Fidell, 2013). Wald statistics ($p < .05$) determined entry of the independent variables in the logistic regression model. After listwise deletion of cases, the regression analysis included 128 research findings (74 journal, 54 gray). Cases were not weighted as the goal was overall classification accuracy.

To focus on experimental canid management research, we conducted the same chi-square and logistic regression analyses using only quasi and controlled experimental research findings. For this analysis, we ensured that one random experimental research finding from each document that reported multiple experimental research findings was included in the analysis. The experimental research findings regression included 53 journal and 38 gray literature research findings with no weighting of cases. All analyses were conducted in SPSS (Statistical Package for the Social Sciences; IBM Corp, 2017).

Results

The 152 research findings (86 journal literature, 66 gray literature) were variably distributed across the research characteristic categories (Table 1). We hypothesized that more positive outcome ratings and stronger experimental designs (e.g., controlled experiments) would be more common in journal literature than gray literature. However, the distribution of outcome ratings ($x^2(2$, n = 148) = 0.411; $p = .814$) and experimental designs ($x^2(2$, n = 148) = 0.944; $p = .624$) across the two literature types was not different than would be expected under the null hypothesis. These characteristics remained not significant when only experimental research findings were included (outcome rating: $x^2(2$, n = 91) = 0.597; $p = .742$; experimental design: $x^2(2$, n = 91) = 0.607; $p = .436$).

We hypothesized that coyote research findings would be more common in gray literature and wolf research findings would be more common in journal literature. Our findings supported this hypothesis as wolf research findings were predominantly in journal literature while coyote research findings were more evenly distributed between journal and gray literature (Figure 1a; $x^2(1$, n = 147) = 9.744; $p = .002$). These differences were not significant when only experimental research findings were included ($x^2(1$, n = 90) = 2.498; $p = .114$).

We hypothesized that research findings with academic PIs would be more common in journal literature while non-academic PIs would be more common in gray literature. Research findings with academic PIs were more often in journal literature compared to gray literature than would be expected under the null hypothesis (Figure 1b; $x^2(1$, n = 137) = 6.102; $p = .014$). This relationship was nearly significant in the experimental research findings ($x^2(1$, n = 84) = 3.246; $p = .072$).

We hypothesized that statistical analyses would be more common in journal literature than gray literature and vice-versa for descriptive analyses. Research findings that reported the results of a statistical analysis were significantly more often in journal literature while descriptive analyses were more often in gray literature than expected under the null hypothesis (Figure 1c; $x^2(1$, n = 148) = 24.076; $p < .001$). This pattern remained statistically significant in the experimental research findings (Figure 1d; $x^2(1$, n = 91) = 11.071; $p = .001$).
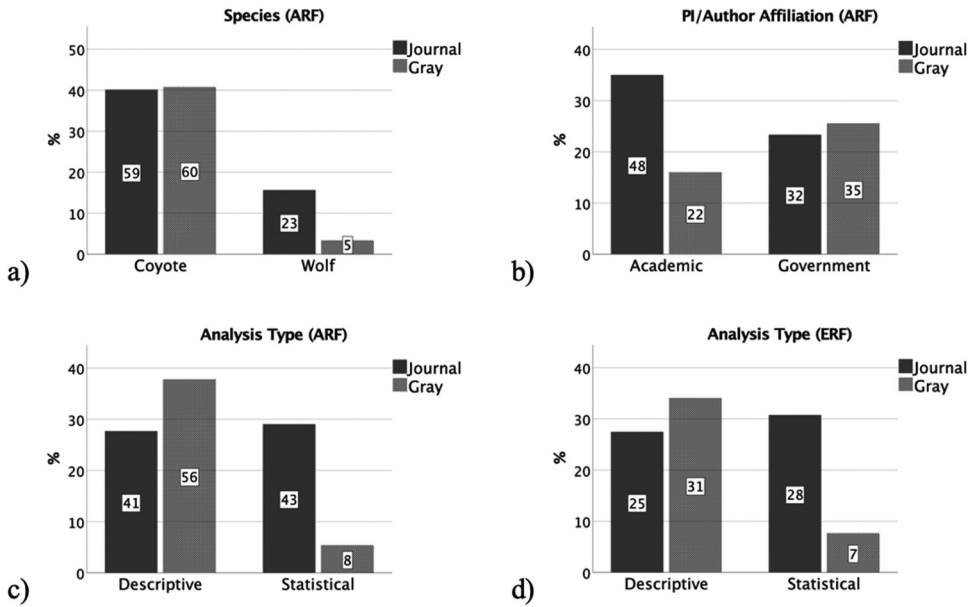
Figure 1. Analyses of differences between canid livestock depredation management research findings published in journal and gray literature (p ≤ .014; ARF = All research findings analysis; ERF = Experimental research findings only analysis). Research findings were conducted in Canada or the US and published 1970–2018. Percent (y-axis) of research findings in journal and gray literature as well as the number of research findings (bar labels) in each x-axis literature category are reported.

Predicting Literature Type

The stepwise logistic regression analysis of all research findings used species, affiliation, and analysis type as predictors. The final model predicting publication in journal literature contained a constant, affiliation, and analysis type (Table 2); species was not included as it was only nearly significant (p = .060). Journal published research findings were two times more likely to have academic PIs/authors and five times more likely to have used statistical analyses. The two-predictors model was significantly different than a constant only model (x^2(2, n = 128) = 21.908; p < .001), showed good fit (Hosmer–Lemeshow Test, p = .891), and accounted for a modest amount of variance (Nagelkerke R Squared = 0.211). Prediction success was 67.2% overall (journal: 78.4%; gray: 51.9%).

Table 2. Characteristics found to predict publication in journal literature (compared to gray literature) and the associated logistic regression coefficients and statistics for a model using all research findings and a separate model using only experimental research findings.

Characteristic	Categories	Regression Coefficients (B)[a]	Wald Statistics[a]	Odds Ratios[a]
PI/Author Affiliation	Government, Academic	0.866/ –	4.914*/ –	2.377/ –
Analysis Type	Descriptive, Statistical	1.641/-1.601	12.984***/10.224*	5.163/0.202
Constant		−1.895/0.215	18.135***/0.640	0.150/1.240

*p < .05, ***p < .001
[a]#/#: all research findings model/experimental research findings only model

The only predictor in the experimental research findings logistic regression was analysis type. Experimental research findings that used a statistical analysis were nearly five times more likely to be published in journal than gray literature. The model was significantly different than a constant only model (x^2(2, n = 91) = 11.652; p = .001), reported a Nagelkerke R Square of 0.162, and a prediction success rate of 64.8% (journal: 52.8%; gray: 81.6%).

Discussion

We investigated potential publication selection effects (Rosenberger & Johnston, 2009) in published canid livestock depredation management research. Three of the five research characteristics we investigated showed significantly different frequencies between journal and gray literature: species of interest, PI/author affiliation, and analysis type. Affiliation and analysis type were significant in the regression that included all research findings. However, analysis type was the only significant predictor in both the full analysis and the analysis of only experimental research findings. Our results highlight the potential for researcher context and perceptions to lead to bias in how canid management research is published.

Counter to our expectations, stronger experimental designs (Treves et al., 2016) were not associated with a particular literature type. A preference for disseminating research with certain experimental designs in journal literature could be detrimental to wildlife management. For instance, informative research utilizing a non-controlled experimental design may be less well known and underutilized if biased to gray literature. Thus, we believe our experimental design result is a positive for canid management.

It was surprising that research outcomes were not related to literature type as weaker results are likely more difficult to publish in journals than highly significant results (Hedges, 1992). Importantly, we used uneven categories to summarize research outcomes as has been done previously (Khorozyan & Waltert, 2019). The mixed outcome rating category had broader criteria than the positive and negative outcome categories. The grouping of research findings with weak positive results and somewhat strong positive results in a single broad outcome rating category may have obscured publication selection.

Although coyotes seem to be well researched, wolf research was more likely to be published in journal literature. Species-based publication selection may have arisen from the perceptions and status of wolves (Houston et al., 2010; Smith et al., 2003). Analysis type and affiliation had stronger influences on literature type than species based on the regression that included all research findings; notably, species was nearly significant in this regression indicating there may be an effect that we were unable to parse out. Species differences in the distribution of research findings did not remain significant in the analysis of only experimental research findings, likely due to coyote research often using a correlational design.

Author affiliation showed publication selection (Rosenberger & Johnston, 2009) and supported the notion that the expectations and demands associated with particular author affiliations (e.g., Mahoney, 1979) can influence how canid management research is published. Government researchers may focus on less labor-intensive dissemination routes, such as conferences, or direct communication with researchers and managers. Importantly, research conducted by non-academic authors may not reach as wide of an audience by being less likely to be published in journal literature.

We expected statistical research to be more likely in journal literature given the limited space in journals and perceptions of statistical analyses as superior to descriptive analyses (Murphy & Noon, 1991). This relationship was identified in both analyses, even though descriptive research findings can inform future research and management. Individuals that rely on one type of literature over another may be less likely to know about research using either statistical or descriptive analyses. For instance, we identified more descriptive controlled experiments that evaluated changes in livestock losses in gray literature than journal literature. Of the three controlled experiments evaluating the efficacy of chemicals on livestock (e.g., scented sprays, collars) to deter depredation, two reported descriptive analyses and were found in gray literature. Similarly, the only controlled experiment of carrion removal and three controlled experiments of taste aversion used descriptive analyses and were in gray literature.

Our affiliation and analysis type results may be artifacts of one another. Academics may be more likely to publish in journals and to use statistical methods due to their education and backgrounds emphasizing statistical approaches. However, analysis type seems to be more important than author affiliation as only analysis type was significant in both analyses. The consistent effect of analysis type can be interpreted as showing that the effects we observed are more likely due to journal requirements and differences in motivations and perceptions than educational differences between researchers.

Managers are known to prefer experience-based sources of information, such as their personal experiences and conversations with colleagues (Fabian et al., 2019; Muter et al., 2011). Combining these past findings with our affiliation findings reinforces the idea that government researchers may be less likely to engage with journal literature. If true, the likelihood of government researchers interacting with some information (e.g., statistical results) may be reduced. Managers being more likely to use experience-based sources of information (Fabian et al., 2019; Muter et al., 2011) could create a situation where a person's knowledge of research is more related to who they know than the literature. It would be useful to understand whether academics and government researchers have similar views of canid management research and whether those views reflect the literature.

Addressing the biases we have identified in the authorship and analysis type of research in journal and gray literature would likely help canid management and all interested parties. For addressing authorship biases, ensuring non-academic researchers are involved in the journal publication process and have access to resources for publishing in journals would be a straightforward option. However, we do not presume that placing the onus on one party will address the issue given the importance of motivational and resource differences between academic and non-academic researchers. Extension programs in the US that help bring together academic and non-academic researchers and managers likely already play a positive role in the issue and will likely help address it in the future. Reducing analysis-type biases in canid management literature could be addressed by reducing the stigma attached to non-statistical analyses or by the creation of accessible repositories for descriptive research.

We are not able to provide insight into how much research has not been published or only been disseminated via word of mouth. Compiling this unpublished research or conducting other empirical analyses of publication bias (e.g., Stanley, 2008) is an important future avenue of research for evidence-based management. Our analysis used a random selection approach to account for documents containing multiple-research findings; future

analyses could benefit from using more advanced statistical methods, such as weighted meta-regression (Stanley, 2008). We also did not account for research methodology (e.g., sample size, statistical approach) and the associated influence on reliability. Researchers may have considered these additional method-related characteristics when deciding whether to submit research to peer-reviewed journals. We also do not know if gray literature was submitted to journals and not published.

Our results show that how a research finding has been published is related to certain characteristics of that research finding, especially the type of analysis used. We believe these selection effects arise from researcher, editor, and reviewer perceptions. Overall, not all research is equally accessible to researchers and managers in journal literature. Reliance on a particular literature type for information could lead to canid depredation management decisions that do not reflect all published past research. This potentiality can be minimized by considering all literature types and, in turn, more of the available research.

Disclosure statement

Funding

ORCID

Kyle Plotsky 🆔 http://orcid.org/0000-0003-3217-8105
Marco Musiani 🆔 http://orcid.org/0000-0002-6097-5841

References

Crabtree, R. L., & Sheldon, J. W. (1999). *The ecological role of coyotes on Yellowstone's northern range* (pp. 15–23). Yellowstone Science, Spring.
Fabian, Y., Bollmann, K., Brang, P., Heiri, C., Olschewski, R., Rigling, A., Stofer, S., & Holderegger, R. (2019). How to close the science-practice gap in nature conservation? Information sources used by practitioners. *Biological Conservation*, *235*(March), 93–101. https://doi.org/10.1016/j.biocon.2019.04.011
Fox, C. H., & Papouchis, C. M. (2005). *Coyotes in our midst: Coexisting with an adaptable and resilient carnivore* (Animal Protection Institute).
Hedges, L. V. (1992). Modeling publication selection effects in meta-analysis. *Statistical Science*, *7*(2), 246–255. https://doi.org/10.1214/ss/1177011364
Houston, M., Bruskotter, J., & Fan, D. (2010). Attitudes toward wolves in the United States and Canada: A content analysis of the print news media, 1999-2008. *Human Dimensions of Wildlife: An International Journal*, *15*(5), 389–403. https://doi.org/10.1080/10871209.2010.507563
IBM Corp. (2017). *IBM SPSS statistics for macintosh (Version 25.0)*. IBM Corp.
Khorozyan, I., & Waltert, M. (2019). A framework of most effective practices in protecting human assets from predators. *Human Dimensions of Wildlife*, *24*(4), 380–394. https://doi.org/10.1080/10871209.2019.1619883

Mahoney, M. J. (1979). Psychology of the scientist: An evaluative review. *Social Studies of Science*, *9*(3), 349–375. https://doi.org/10.1177/030631277900900304

McHugh, M. L. (2013). The Chi-square test of Independence. *Biochemia Medica*, *23*(2), 143–149. https://doi.org/10.11613/BM.2013.018

Murphy, D. D., & Noon, B. D. (1991). Coping with uncertainty in wildlife biology. *The Journal of Wildlife Management*, *55*(4), 773–782. https://doi.org/10.2307/3809531

Muter, B. A., Gore, M. L., & Riley, S. J. (2011). Toward exploring stakeholder and professional information sources about cormorant management in the Great Lakes. *Human Dimensions of Wildlife*, *16*(1), 63–66. https://doi.org/10.1080/10871209.2011.531517

Nelson, J. P., & Kennedy, P. E. (2009). The use (and abuse) of meta-analysis in environmental and natural resource economics: An assessment. *Environmental and Resource Economics*, *42*(3), 345–377. https://doi.org/10.1007/s10640-008-9253-5

Organ, J. F., Geist, V., Manohey, S. P., Williams, S., Krausman, P. R., Batcheller, G. R., Decker, T. A., Carmichael, R., Nanjappa, P., Regan, R., Medellin, R. A., Cantu, R., McCabe, R. E., Craven, S., Vecellio, G. M., & Decker, D. J. (2012). *The North American model of wildlife conservation* (The Wildlife Society).

Rosenberger, R. S., & Johnston, R. J. (2009). Selection effects in meta-analysis and benefit transfer: Avoiding unintended consequences. *Land Economics*, *85*(3), 410–428. https://doi.org/10.3368/le.85.3.410

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*(3), 638–641. https://doi.org/10.1037/0033-2909.86.3.638

Smith, D. W., Peterson, R. O., & Houston, D. B. (2003). Yellowstone after wolves. *BioScience*, *53*(4), 330–340. https://doi.org/10.1641/0006-3568 (2003)053[0330:YAW]2.0.CO;2

song, F., Eastwood, A. J., Gilbody, S., Duley, L., & Sutton, A. J. (2000). Publication and related biases. *Health Technology Assessment*, *4*(10), 1–115. https://doi.org/10.1089/omi.2011.0035

Stanley, T. D. (2008). Meta-regression methods for detecting and estimating empirical effects in the presence of publication selection. *Oxford Bulletin of Economics and Statistics*, *70*(1), 103–127. https://doi.org/10.1111/j.1468-0084.2007.00487.x

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Harper Collins College Publishers.

Treves, A., Krofel, M., & Mcmanus, J. (2016). Predator control should not be a shot in the dark. *Frontiers in Ecology and the Environment*, *14*(7), 380–388. https://doi.org/10.1002/fee.1312

Wang, X., Tedford, R. H., Van Valkenburgh, B., & Wayne, R. K. (2004). Ancestry. In D. W. Macdonald & C. Sillero-Zubiri (Eds.), *Biology and conservation of wild canids* (pp. 39–54). Oxford University Press.