

Preferences for prioritizing species conservation

Case Study Details

Barred versus spotted owls. Northern spotted owls (*Strix occidentalis*) are a federally endangered species threatened by loss of old growth forest throughout the Pacific Northwest of the U.S. (Wiens, 2012). In more recent years, barred owls (*S. varia*), a congeneric species ranging across North America, have expanded into spotted owl range and begun displacing spotted owls (Dugger, Anthony, & Andrews, 2011; Kelly, Forsman, & Anthony, 2003). Protection of old growth forest is a critical factor for spotted owl conservation, but scientists and managers have argued that barred owls should also be lethally removed to ensure survival of spotted owls (USFWS, 2008; Kelly et al., 2003). Experimental control programs have been carried out by the U.S. Fish and Wildlife Service (USFWS) to measure the extent to which broader lethal control of barred owls could increase spotted owl survival (USFWS, 2008). These efforts have been met with mixed public reaction, which the USFWS has tried to proactively manage, even hiring an ethicist to review the decision-making process (Shogren, 2014). Some groups support lethal control to protect a rare species over a more common one and argue that nonlethal removal is unpractical (Shogren, 2014). Spotted owls may contribute to local economies by encouraging birding-related tourism (but also famously conflict with logging interests). Others do not support valuing and prioritizing one owl species over another; reasons may include the intrinsic value of barred owls or a worldview that humans should avoid intervening in nature (Lute & Gore, 2014; Vucetich et al., 2015).

Brown-headed cowbirds versus Kirtland's warblers. Brown-headed cowbirds (*Molothrus ater*), once restricted to prairies due to their association with bison, have benefited from agricultural expansion as livestock replaced bison and are now found throughout North America (Decapita, 2000). Contrastingly, endangered Kirtland's warblers (*Setophaga kirtlandii*) have not fared as well in human-dominated landscapes as their fire-dependent habitat has disappeared with human suppression of wildfires (Probst, 1985). They can now only be found in several counties in the northern lower peninsula of Michigan, USA. Because cowbirds are nest parasites, they may also contribute to Kirtland's warbler precarious situation (Decapita, 2000). To protect warblers, cowbirds have been lethally removed in warbler habitat since 1972; since inception of lethal control, nest parasitism markedly declined but the warbler population remained stable (Decapita, 2000). This has led some scientists to conclude cowbird removal is not justified, unpractical to continue in perpetuity and distracts resources from more effective conservation efforts (i.e., habitat restoration; Rothstein, 2004). Another consideration is the likelihood that Kirtland's warblers will forever remain dependent on active protection from people and whether such efforts are feasible (Scott, Goble,

Haines, Wiens, & Neel, 2010). Still others argue it is important to protect endangered and aesthetically pleasing species such as Kirtland's warbler; their popularity among birders is such that until recently Mio, Michigan held an annual warbler festival in celebration of the bird.

Caribou versus gray wolves. Boreal woodland caribou (*Rangifer tarandus*) are declining across their ranges in Canada. Factors attributed to the decline include cascading ecosystem changes stemming from development; habitat alteration and fragmentation from roads, pipelines and logging has occurred to the detriment of caribou but is a boon for moose and deer, which in turn benefited gray wolf and black bear populations (*Canis lupus*; Faille et al., 2010; Marris, 2015). Wolves and bears also predate on caribou and thus add to the factors contributing to caribou endangerment. In one study, annual wolf culls totaling 980 wolves since 2005 were found to stabilize but not increase a caribou herd numbering about 100 individuals (Hervieux, Hebblewhite, Stepnisky, Bacon, & Boutin, 2014). Because habitat restoration and protection would take decades before caribou could benefit, wolf culling is ongoing in British Columbia and Alberta as a stop-gap measure. These lethal control measures have been highly controversial; environmental groups and tribes have spoken out against the culls as unethical, especially in the face of continued logging and drilling permits (Marris, 2015). Others argue that alternative methods, such as maternity pens to safeguard female caribou and their newborn calves, are less effective and ceasing development unlikely.

Coqui frogs versus happy-face spiders. Coqui frogs (*Eleutherodactylus coqui*) have become established on the island of Hawaii (and are largely controlled on Oahu and Kauai) while they have declined in their native Puerto Rico (Choi & Beard, 2012). Concerns over this invasion center on the potential threat to endemic invertebrate species; research suggests coqui frog predation may decrease certain classes of insects (i.e., ticks and mites) and increase others (i.e., flies; Choi & Beard, 2012). They may also alter nutrient cycling that confer advantages for non-native plants (Sin, Beard, & Pitt, 2008). Eradication is considered a losing battle in part because frogs are often found in high densities in residential areas, making control efforts difficult (Kalnicky, Brunson, & Beard, 2014). In fact, one study reported a positive relationship between frog density and property owners' tolerance of coqui frogs (Kalnicky et al., 2014). But not all residents are fond of the frog and have formed groups to organize lethal control efforts, citing concerns that frogs might threaten charismatic and endemic species, such as the happy-face spider (*Theridion grallator*; e.g., <http://coquifreewaimea.org/>).

Salmon versus California sea lions. California sea lions (*Zalophus californianus*) were once harvested by people and have now rebounded as a result of protection under the Marine Mammal Protection Act. Sea lions can damage fishing gear and compete with

fisherfolk along the west coast of North America for salmonids (*Oncorhynchus* spp.) either by direct removal of fish from hooks or predation that decrease stocks (Weise & Harvey, 2005). Research has found that relatively few individual sea lions contribute to most fish removed from hooks and recommend nonlethal deterrents because lethal control would need to target the offending individuals to be effective (Weise & Harvey, 2005). Pacific salmon species have been declining in recent years, which are predominately attributed to overharvesting and change and degradation in both ocean and upstream habitats (Bradford & Irvine, 2000; Miller et al., 2014). The extent to which sea lion predation contributes to salmon declines is not entirely clear, but evidence suggests that sea lions may have local impacts, especially where salmon congregate in front of dams (Naughton et al., 2011). The National Oceanic and Atmospheric Administration has carried out various nonlethal and lethal control programs in the Columbia River. Controversy over lethal control programs as well as interactions between fisherfolk and sea lions highlight the value tradeoffs between animal welfare, endangered species protection, economies and livelihoods (Weise & Harvey, 2005).

Pretesting

Pre-testing consisted of recruiting volunteers matching the target population (i.e., ≥18 years old, no formal training in environmental science) to take the survey. We asked them to explain their understanding for each question and if they needed any clarifications. Based on feedback, we revised the survey instrument before pre-testing again, to ensure vignettes and phrasing were believable, clear, and covered appropriate information for lay audiences. Pre-testing continued until no further changes were needed (N = 15).

Statistical Analyses

As stated in the main document, we used the user generated command `—gologit2—` (Williams, 2006) in Stata 13.1 to conduct generalized ordered logistic regression (Statacorp, TX). Constrained (i.e., forced variables to meet parallel lines assumptions) and unconstrained models were run and compared with a global test. Final models used the `autofit` option to estimate partial proportional odds that best fit the data (i.e., constrained the variables that met parallel lines assumptions). If interested in seeing all constrained and unconstrained model results or Stata code to explore the data, please contact the first author.

Case Study Responses and Considerations

Generally participants showed low support for lethal control and high support for habitat protection with the frog-spider case study as a notable exception (SI Tables 1 and 2). Participants also rated ecosystems and moral principles as the most important considerations in determining their chosen response to each case study.

SI Table 1. Descriptive statistics of case study responses and species characteristics (alpha refers to Cronbach's alpha, further denoted as alpha).

	M	SD	Alpha
Case Study Responses (0-1)			
Lethal Control	0.04	0.10	0.37
Owls	0.01	0.11	
Sea Lion-Salmon	0.01	0.11	
Wolf-Caribou	0.03	0.17	
Cowbird-Warbler	0.04	0.19	
Frog-Spider	0.10	0.30	
Habitat Protection	0.63	0.34	0.79
Owls	0.68	0.47	
Sea Lion-Salmon	0.74	0.44	
Wolf-Caribou	0.74	0.44	
Cowbird-Warbler	0.65	0.48	
Frog-Spider	0.36	0.48	
Both Lethal Control and Habitat Protection	0.08	0.17	0.60
Owls	0.07	0.25	
Sea Lion-Salmon	0.05	0.21	
Wolf-Caribou	0.09	0.28	
Cowbird-Warbler	0.09	0.28	
Frog-Spider	0.14	0.35	
No Action	0.24	0.31	0.80
Owls	0.24	0.43	
Sea Lion-Salmon	0.20	0.40	
Wolf-Caribou	0.14	0.35	
Cowbird-Warbler	0.23	0.42	
Frog-Spider	0.40	0.49	
Species Characteristics (1-5)			
Important to Ecosystem	4.01	0.64	0.90
Attractive	3.67	0.59	0.80
Endangered	2.91	0.60	0.76
Familiar	2.79	0.69	0.84
Important to Economy	2.77	0.73	0.90
Nuisance	2.39	0.58	0.79
Dangerous	2.31	0.58	0.82

SI Table 2. Descriptive statistics of case study considerations and intrinsic value.

Decision Considerations (1-5)			
Ecosystem	4.29	0.67	0.89
Owls	4.26	0.81	
Sea Lion-Salmon	4.34	0.76	
Wolf-Caribou	4.34	0.75	
Cowbird-Warbler	4.27	0.80	
Frog-Spider	4.20	0.86	
Moral	4.07	0.84	0.95
Owls	4.11	0.92	
Sea Lion-Salmon	4.15	0.91	
Wolf-Caribou	4.13	0.88	
Cowbird-Warbler	4.03	0.93	
Frog-Spider	3.91	0.99	
Practical	3.81	0.80	0.91
Owls	3.75	0.95	
Sea Lion-Salmon	3.80	0.94	
Wolf-Caribou	3.76	0.93	
Cowbird-Warbler	3.85	0.90	
Frog-Spider	3.84	0.92	
Cost/Benefit	3.40	1.00	0.94
Owls	3.35	1.15	
Sea Lion-Salmon	3.41	1.13	
Wolf-Caribou	3.37	1.10	
Cowbird-Warbler	3.42	1.11	
Frog-Spider	3.42	1.10	
Economy	2.99	1.01	0.91
Owls	2.90	1.19	
Sea Lion-Salmon	3.17	1.17	
Wolf-Caribou	2.94	1.15	
Cowbird-Warbler	2.96	1.16	
Frog-Spider	2.94	1.16	
Intrinsic Value (1-5)	4.24	0.60	0.79
Humans	4.11	0.93	
Some Animals	4.41	0.71	
All Animals	4.20	0.80	
All Life	4.30	0.74	
Ecosystems	4.20	0.86	

Response choices (e.g., lethal control) were highly correlated among case studies (SI Table 3). The large majority of participants (n=900) did not support lethal control in any case study; no participant chose lethal control for all cases. Participants were also consistent in not choosing the option of “both lethal control and habitat protection” (n=801). Participants were relatively less consistent in choosing habitat protection (chosen for all cases, n=311; chosen for no cases, n=149) and no action (chosen for all cases, n=99; chosen for no cases, n=512).

SI Table 3. Correlation of response choices among case studies.

	Barred - Spotted Owl	Sea Lion - Salmon	Caribou - Wolf	Cowbird - Warbler	Frog - Spider
Lethal Control					
Barred - Spotted Owl					
Sea Lion - Salmon	-0.01 ^a				
Caribou - Wolf	0.08	0.13			
Cowbird - Warbler	0.12	0.07**	0.18		
Frog - Spider	0.22	0.11	0.09	0.16	
Habitat Protection					
Barred - Spotted Owl					
Sea Lion - Salmon	0.49				
Caribou - Wolf	0.50	0.47			
Cowbird - Warbler	0.51	0.48	0.45		
Frog - Spider	0.37	0.32	0.31	0.36	
Both Lethal Control and Habitat Protection					
Barred - Spotted Owl					
Sea Lion - Salmon	0.32				
Caribou - Wolf	0.32	0.29			
Cowbird - Warbler	0.36	0.33	0.20		
Frog - Spider	0.15	0.19	0.13	0.21	
No Action					
Barred - Spotted Owl					
Sea Lion - Salmon	0.50				
Caribou - Wolf	0.51	0.49			
Cowbird - Warbler	0.55	0.52	0.50		
Frog - Spider	0.37	0.40	0.30	0.38	

all $p < 0.01$ except ^a = not significant and ** = $p < 0.05$

Species Characteristics

Participants were consistent in how they rated species characteristics, regardless of whether the species was the target of protection or lethal control in each case study (SI Table 4). Uncertainty about species characteristics (indicating “I don’t know”) correlated with a number of other factors. Greater uncertainty positively related to choosing no action ($r=0.09$; $p<0.01$), dangerous ($r=0.13$; $p<0.01$), nuisance ($r=0.10$; $p<0.01$) and economic species characteristics ($r=0.09$; $p<0.01$). Uncertainty negatively related to the habitat protection policy choice ($r=-0.08$; $p<0.01$), attribution of intrinsic value ($r=-0.07$; $p<0.05$), attractive ($r=-0.08$; $p<0.01$) and familiar species characteristics ($r=-0.17$; $p<0.01$), considerations of economics ($r=-0.08$; $p<0.05$) and ecosystems ($r=-0.12$; $p<0.01$) and respondents with higher incomes ($r=-0.07$; $p<0.05$).

SI Table 4. Descriptive statistics of species characteristics.

	M	SD	I don't know %	Alpha*		M	SD	I don't know %	Alpha*
Barred Owls				0.44	Spotted Owls				0.49
Attractive	4.04	0.82	0.3		Attractive	4.09	0.83	0.2	
Dangerous	2.23	0.91	7		Dangerous	2.03	0.85	8	
Endangered	2.56	1.04	9		Endangered	3.62	0.97	8	
Nuisance	2.32	0.94	6		Nuisance	2.02	0.82	7	
Familiar	2.57	1.12	1		Familiar	2.68	1.15	1	
Important to Economy	2.48	1	10		Important to Economy	2.61	1.04	11	
Important to Ecosystem	4.02	0.84	7		Important to Ecosystem	4.16	0.8	7	
Sea Lions				0.49	Salmon				0.53
Attractive	3.73	0.98	0.3		Attractive	3.14	1.15	0.6	
Dangerous	2.43	1.03	4		Dangerous	1.56	0.71	1	
Endangered	2.58	1	7		Endangered	3.11	1.07	4	
Nuisance	2.34	1	4		Nuisance	1.7	0.74	2	
Familiar	3.59	1.07	0.6		Familiar	3.91	1.02	0.3	
Important to Economy	2.81	1.01	7		Important to Economy	4.15	0.79	2	
Important to Ecosystem	4.22	0.76	4		Important to Ecosystem	4.36	0.67	3	

* Negative characteristics (i.e., dangerous, nuisance) reversed coded.

SI Table 4 continued. Descriptive statistics of species characteristics.

	M	SD	I don't know %	Alpha*		M	SD	I don't know %	Alpha*
Woodland Caribou				0.40	Gray Wolves				0.52
Attractive	3.97	0.84	0.6		Attractive	4.21	0.79	0.4	
Dangerous	2.13	0.96	4		Dangerous	3.83	0.9	2	
Endangered	3.44	0.96	5		Endangered	2.78	1.03	8	
Nuisance	1.97	0.83	5		Nuisance	2.76	1.07	4	
Familiar	3.21	1.12	0.6		Familiar	3.58	1.1	0.5	
Important to Economy	2.95	1	9		Important to Economy	2.6	1	9	
Important to Ecosystem	4.24	0.73	5		Important to Ecosystem	4.17	0.82	5	
Brown-Headed Cowbirds				0.56	Kirtland's Warblers				0.45
								1	
Dangerous	2.24	1.01	4		Dangerous	1.73	0.75	4	
Endangered	2.32	1	8		Endangered	3.63	0.97	7	
Nuisance	2.82	1.1	7		Nuisance	1.92	0.81	6	
Familiar	2.21	1.06	2		Familiar	2.23	1.02	1	
Important to Economy	2.35	0.97	9		Important to Economy	2.89	1.11	8	
Important to Ecosystem	3.78	0.96	8		Important to Ecosystem	4.13	0.78	7	
Coqui Frogs				0.11	Happy-Face Spiders				0.53
Attractive	2.94	1.14	0.5		Attractive	2.64	1.34	0.5	
Dangerous	2.2	0.94	6		Dangerous	2.67	1.03	17	
Endangered	2.02	0.94	6		Endangered	3	1.01	5	
Nuisance	3.36	1.08	3		Nuisance	2.58	1.08	8	
Familiar	2.06	1.02	2		Familiar	1.92	0.92	1	
Important to Economy	2.2	0.97	7		Important to Economy	2.26	1	10	
Important to Ecosystem	3.3	1.21	7		Important to Ecosystem	3.92	0.96	8	

* Negative characteristics (i.e., dangerous, nuisance) reversed coded.

Socio-demographic differences

Significant differences were consistently found between sexes (SI Tables 5 and 6).

Women significantly indicated higher ratings for the following measures: habitat protection responses; intrinsic value of all entities; attractive, endangered, important to

the economy and ecosystem species characteristics; conservation of individuals and species; conservation everywhere; conserving at the global level; and considering moral principles, economies and ecosystems in conservation policy. Men significantly indicated higher ratings for the following measures: lethal control for cowbird-warbler and frog-spider case studies and no action responses; dangerous and nuisance species characteristics; conservation in protected areas only; people as beneficiaries of conservation; and practical considerations.

Significant differences were also consistently found across political orientation (collapsed into liberals versus conservatives for simplicity; SI Tables 5 and 6). Conservatives indicated higher ratings for the following measures: lethal control responses for sea lion-salmon, caribou-wolf and frog-spider case studies and no action responses; conservation in protected areas only; people and both people/nature as beneficiaries of conservation; and considering economies, practicality and cost-benefits analyses in conservation policy. Liberals indicated higher ratings for the following measures: habitat protection responses; intrinsic value of all entities; endangered and important to the ecosystem species characteristics; conservation everywhere; nature as beneficiaries of conservation; conservation of populations, species and ecosystems; conserving at the local, intermediate, and global levels; and considering ecosystems in conservation policy.

SI Table 5. Sex and political differences in case studies policy choices (only significant t-tests reported).

	Men (n=582)	Women (n=455)			Liberal (n=565)	Conservative (n=216)		
	M	M	t	p	M	M	t	p
Lethal Control								
Barred - Spotted Owl	0.02	0.01			0.01	0.02		
Sea Lion - Salmon	0.02	0.01			0.00	0.02	-2.15	*
Caribou - Wolf	0.03	0.02			0.02	0.07	-3.70	**
Cowbird - Warbler	0.05	0.02	-2.79	**	0.04	0.06		
Frog - Spider	0.13	0.07	-3.01	**	0.08	0.17	-3.58	**
Habitat Protection	0.59	0.69	4.85	**	0.70	0.51	7.37	**
Both	0.09	0.08			0.09	0.07		
No Action	0.27	0.20	-3.62	**	0.18	0.36	-7.36	**

* = $p < 0.05$

** = $p < 0.01$

SI Table 6. Sex and political differences in case study considerations, species considerations and general conservation beliefs (only significant t-tests reported).

	Men (n=582) M	Women (n=455) M	t	p	Liberal (n=565) M	Conservative (n=216) M	t	p
Considerations								
Moral	3.99	4.16	3.29	**	4.11	4.05		
Economic	2.92	3.05	2.11	*	2.84	3.28	-5.56	**
Ecosystem	4.20	4.39	4.52	**	4.37	4.12	4.44	**
Practical	3.85	3.74	-2.23	*	3.73	3.98	-3.93	**
Cost/Benefit	3.40	3.39			3.33	3.62	-3.62	**
Characteristics								
Attractive	3.60	3.77	4.6	**	3.69	3.64		
Dangerous	2.36	2.25	-3.11	**	2.3	2.27		
Endangered	2.85	2.97	3.31	**	2.93	2.76	3.65	**
Nuisance	2.43	2.35	-2.12	*	2.39	2.38		
Familiar	2.78	2.82			2.81	2.77		
Important to Economy	2.68	2.88	4.27	**	2.73	2.79		
Important to Ecosystem	3.91	4.14	5.69	**	4.05	3.92	2.58	**
Conservation:								
Location								
Backyard	0.01	0.009			0.01	0.01		
Protected Areas	0.20	0.13	-2.95	**	0.13	0.28	-5.01	**
Everywhere	0.79	0.86	3.08	**	0.86	0.71	4.78	**
Beneficiaries								
People	0.06	0.03	-2.32	*	0.02	0.12	-5.70	**
Nature	0.34	0.39			0.45	0.24	5.40	**
Both	0.59	0.58			0.53	0.64	-2.77	**
Level								
Local	0.72	0.73			0.77	0.69	2.20	*
Intermediate	0.74	0.71			0.78	0.66	3.32	**
Global	0.78	0.84	2.66	**	0.86	0.65	6.77	**
Entities								
Individuals	0.53	0.63	3.15	**	0.57	0.55		
Populations	0.79	0.81			0.83	0.74	3.04	**
Species	0.87	0.91	2.25	*	0.91	0.83	3.14	**
Ecosystems	0.93	0.94			0.96	0.86	5.43	**
Intrinsic Value	4.17	4.34	4.53	**	4.28	4.12	3.40	**

* = p<0.05

**= p<0.01

Literature Cited

- Bradford, M. J., & Irvine, J. R. (2000). Land use, fishing, climate change, and the decline of Thompson River, British Columbia, coho salmon. *Canadian Journal of Fisheries and Aquatic Sciences*, 57(1), 13–16. doi:10.1139/f99-283
- Choi, R. T., & Beard, K. H. (2012). Coqui frog invasions change invertebrate communities in Hawaii. *Biological Invasions*, 14(5), 939–948. doi:10.1007/s10530-011-0127-3
- Decapita, M. (2000). Brown-headed Cowbird Control on Kirtland's Warbler Nesting Areas in Michigan, 1972-1995. In J. Smith, T. Cook, S. Rothstein, S. Robinson, & S. Sealy (Eds.), *Ecology and Management of Cowbirds and Their Hosts: Studies in the Conservation of North American Passerine Birds*. University of Texas Press.
- Dugger, K. M., Anthony, R. G., & Andrews, L. S. (2011). Transient dynamics of invasive competition: Barred Owls, Spotted Owls, habitat, and the demons of competition present. *Ecological Applications*, 21(7), 2459–2468. doi:10.1890/10-2142.1
- Faille, G., Dussault, C., Ouellet, J. P., Fortin, D., Courtois, R., St-Laurent, M. H., & Dussault, C. (2010). Range fidelity: The missing link between caribou decline and habitat alteration? *Biological Conservation*, 143(11), 2840–2850. doi:10.1016/j.biocon.2010.08.001
- Hervieux, D., Hebblewhite, M., Stepnisky, D., Bacon, M., & Boutin, S. (2014). Managing wolves (*Canis lupus*) to recover threatened woodland caribou (*Rangifer tarandus caribou*) in Alberta. *Canadian Journal of Zoology*, 92, 1029–1037.
- Kalnicky, E. A., Brunson, M. W., & Beard, K. H. (2014). A social–ecological systems approach to non-native species: Habituation and its effect on management of coqui frogs in Hawaii. *Biological Conservation*, 180, 187–195. doi:10.1016/j.biocon.2014.09.044
- Kelly, E. G., Forsman, E. D., & Anthony, R. G. (2003). Are Barred Owls Displacing Spotted Owls? *The Condor*, 105(1), 45–53. doi:10.1650/0010-5422(2003)105[45:ABODSO]2.0.CO;2
- Lute, M. L., & Gore, M. L. (2014). Stewardship as a path to cooperation? Exploring the role of identity in intergroup conflict among Michigan wolf stakeholders. *Human Dimensions of Wildlife*, 19(3), 267–279.
- Marris, E. (2015). Wolf cull will not save threatened Canadian caribou. *Nature News*. Retrieved from <http://www.nature.com/news/wolf-cull-will-not-save-threatened-canadian-caribou-1.16734#/ref-link-1>

- Miller, K. M., Teffer, A., Tucker, S., Li, S., Schulze, A. D., Trudel, M., ... Hinch, S. G. (2014). Infectious disease, shifting climates, and opportunistic predators: cumulative factors potentially impacting wild salmon declines. *Evolutionary Applications*, 7(7), 812–855. doi:10.1111/eva.12164
- Naughton, G. P., Keefer, M. L., Clabough, T. S., Jepson, M. a., Lee, S. R., Peery, C. a., ... Bradford, M. (2011). Influence of pinniped-caused injuries on the survival of adult Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) in the Columbia River basin. *Canadian Journal of Fisheries and Aquatic Sciences*, 68(9), 1615–1624. doi:10.1139/f2011-064
- Probst, J. R. (1985). A Review of Factors Limiting the Kirtland' s Warbler on its Breeding Grounds. *The American Midland Naturalist*, 116(1), 87–100.
- Rothstein, S. I. (2004). Brown-headed Cowbirds: Villian or Scapegoat. *Birding*, (August), 374–284.
- Scott, J. M., Goble, D. D., Haines, A. M., Wiens, J. a., & Neel, M. C. (2010). Conservation-reliant species and the future of conservation. *Conservation Letters*, 3(2), 91–97. doi:10.1111/j.1755-263X.2010.00096.x
- Shogren, E. (2014, January 16). To Save Threatened Owl, Another Species Is Shot. *National Public Radio*. Retrieved from <http://www.npr.org/2014/01/15/262735123/to-save-threatened-owl-another-species-is-shot>
- Sin, H., Beard, K. H., & Pitt, W. C. (2008). An invasive frog, *Eleutherodactylus coqui*, increases new leaf production and leaf litter decomposition rates through nutrient cycling in Hawaii. *Biological Invasions*, 10(3), 335–345. doi:10.1007/s10530-007-9133-x
- U.S. Fish and Wildlife Service. (2011). *Revised recovery plan for the Northern Spotted Owl (Strix occidentalis caurina)*. Portland, Oregon.
- Vucetich, J. A., Bruskotter, J. T., & Nelson, M. P. (2015). Evaluating whether nature's intrinsic value is an axiom of or anathema to conservation. *Conservation Biology*, 29(2), 321–332. doi:10.1111/cobi.12464
- Weise, M. J., & Harvey, J. T. (2005). Impact of the California sea lion (*Zalophus californianus*) on salmon fisheries in Monterey Bay, California. *Fishery Bulletin*, 103(4), 685–696.
- Wiens, J. (2012). *Competitive Interactions and Resource Partitioning Between Northern Spotted Owls and Barred Owls in Western Oregon*. Dissertation, Oregon State University.

Williams, R. (2006). Generalized ordered logit/partial proportional odds models for ordinal dependent variables. *Stata Journal*, 6(1), 58–82.