

APPENDIX D

SIMULATION RESULTS

TABLE D1a. Mortality rates (proportion of total golden eagles dying due to ingesting lead from gut piles in one month of big game hunting season) for 139 hunting units in the **State of Wyoming**, by mitigation rate or proportion **non-lead ammunition** adoption in 10% increments (columns) and percentile (%) of 5000 simulations (rows). The median simulation outcome (gray shading) is the expected eagle mortality due to lead ingestion for each level of mitigation.

% sims	Mortality rate by % of ammunition non-lead										
	0	10	20	30	40	50	60	70	80	90	100
0%	0.005	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0
10%	0.013	0.011	0.010	0.009	0.008	0.006	0.005	0.004	0.003	0.001	0
20%	0.017	0.015	0.013	0.012	0.010	0.008	0.007	0.005	0.003	0.002	0
30%	0.021	0.019	0.017	0.015	0.013	0.011	0.008	0.006	0.004	0.002	0
40%	0.026	0.023	0.021	0.018	0.016	0.013	0.010	0.008	0.005	0.003	0
50%	0.032	0.029	0.025	0.022	0.019	0.016	0.013	0.010	0.006	0.003	0
60%	0.039	0.035	0.031	0.027	0.023	0.019	0.015	0.012	0.008	0.004	0
70%	0.048	0.043	0.039	0.034	0.029	0.024	0.019	0.014	0.010	0.005	0
80%	0.065	0.058	0.052	0.045	0.039	0.032	0.026	0.019	0.013	0.006	0
90%	0.092	0.083	0.074	0.064	0.055	0.046	0.037	0.028	0.018	0.009	0
100%	0.287	0.258	0.23	0.201	0.172	0.144	0.115	0.086	0.057	0.029	0
mean	0.043	0.039	0.035	0.03	0.026	0.022	0.017	0.013	0.009	0.004	0

TABLE D1b. Mortality rates (proportion of total golden eagles dying due to ingesting lead from gut piles in one month of big game hunting season) for 139 hunting units in the **State of Wyoming**, by mitigation rate or proportion of **gut piles removed** in 10% increments (columns) and percentile (%) of 5000 simulations (rows). The median simulation outcome (gray shading) is the expected eagle mortality due to lead ingestion for each level of mitigation.

% sims	Mortality rate by % of gut piles removed										
	0	10	20	30	40	50	60	70	80	90	100
0%	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0
10%	0.013	0.012	0.012	0.011	0.010	0.010	0.009	0.008	0.007	0.006	0
20%	0.017	0.016	0.015	0.014	0.013	0.012	0.011	0.010	0.009	0.007	0
30%	0.021	0.020	0.019	0.018	0.017	0.015	0.014	0.012	0.011	0.009	0
40%	0.026	0.025	0.023	0.022	0.020	0.018	0.017	0.015	0.013	0.011	0
50%	0.032	0.030	0.028	0.027	0.025	0.023	0.020	0.018	0.015	0.013	0
60%	0.039	0.037	0.035	0.032	0.030	0.027	0.025	0.022	0.019	0.016	0
70%	0.048	0.046	0.043	0.041	0.038	0.035	0.031	0.028	0.024	0.021	0
80%	0.065	0.061	0.058	0.055	0.050	0.046	0.042	0.037	0.032	0.027	0
90%	0.092	0.087	0.083	0.077	0.072	0.066	0.060	0.053	0.046	0.040	0
100%	0.287	0.273	0.257	0.239	0.221	0.200	0.179	0.156	0.131	0.107	0
mean	0.043	0.041	0.039	0.037	0.034	0.031	0.028	0.025	0.022	0.018	0

TABLE D2a. Sensitivity analysis of mortality rates to gut pile densities and eagle densities typical of Wyoming, by mitigation rate or proportion of **non-lead ammunition** adoption in 10% increments (columns) and average availability of gut piles per eagle (rows). No mitigation column highlighted in gray.

Density (per 100km ²)		Average gut piles / eagle	Mortality rate by % of ammunition non-lead										
Gut piles	Eagles		0	10	20	30	40	50	60	70	80	90	100
5	0.5	10	0.039	0.035	0.031	0.027	0.023	0.019	0.015	0.012	0.008	0.004	0
45	0.5	90	0.064	0.058	0.051	0.045	0.038	0.032	0.026	0.019	0.013	0.006	0
85	0.5	170	0.065	0.059	0.052	0.046	0.039	0.033	0.026	0.020	0.013	0.007	0
5	2	2.5	0.015	0.013	0.012	0.010	0.009	0.007	0.006	0.004	0.003	0.001	0
45	2	22.5	0.054	0.048	0.043	0.038	0.032	0.027	0.022	0.016	0.011	0.005	0
85	2	42.5	0.061	0.055	0.048	0.042	0.036	0.030	0.024	0.018	0.012	0.006	0
5	3.5	1.4	0.013	0.011	0.010	0.009	0.008	0.006	0.005	0.004	0.003	0.001	0
45	3.5	12.9	0.044	0.040	0.035	0.031	0.027	0.022	0.018	0.013	0.009	0.004	0
85	3.5	24.3	0.055	0.049	0.044	0.038	0.033	0.027	0.022	0.016	0.011	0.005	0

TABLE D2b. Sensitivity analysis of mortality rates to gut pile densities and eagle densities typical of Wyoming, by mitigation rate or proportion of **gut piles removed** in 10% increments (columns) and average availability of gut piles per eagle (rows). No mitigation column highlighted in gray.

Density (per 100km ²)		Average gut piles / eagle	Mortality rate by % of gut piles removed										
Gut piles	Eagles		0	10	20	30	40	50	60	70	80	90	100
5	0.5	10	0.039	0.036	0.033	0.030	0.027	0.024	0.020	0.016	0.014	0.012	0
45	0.5	90	0.064	0.064	0.063	0.063	0.062	0.061	0.059	0.056	0.050	0.036	0
85	0.5	170	0.065	0.065	0.065	0.065	0.064	0.064	0.063	0.062	0.059	0.049	0
5	2	2.5	0.015	0.014	0.014	0.013	0.013	0.012	0.012	0.012	0.011	0.011	0
45	2	22.5	0.054	0.052	0.050	0.048	0.045	0.041	0.036	0.030	0.022	0.014	0
85	2	42.5	0.061	0.060	0.059	0.057	0.056	0.053	0.049	0.044	0.035	0.021	0
5	3.5	1.4	0.013	0.012	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0
45	3.5	12.9	0.044	0.042	0.039	0.036	0.033	0.029	0.024	0.019	0.015	0.012	0
85	3.5	24.3	0.055	0.053	0.052	0.049	0.047	0.043	0.038	0.031	0.023	0.015	0

TABLE D3a. Mortality rates (proportion of total golden eagles dying due to ingesting lead from gut piles in one month of big game hunting season) for the six hunting units in the **Casper decision example**, by mitigation rate or proportion **non-lead ammunition** adoption in 10% increments (columns) and percentile (%) of 5000 simulations (rows). The median simulation outcome (gray shading) is the expected eagle mortality due to lead ingestion for each level of mitigation.

% sims	Mortality rate by % of ammunition non-lead										
	0	10	20	30	40	50	60	70	80	90	100
0%	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0
10%	0.010	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001	0
20%	0.013	0.012	0.011	0.009	0.008	0.007	0.005	0.004	0.003	0.001	0
30%	0.016	0.015	0.013	0.011	0.010	0.008	0.007	0.005	0.003	0.002	0
40%	0.020	0.018	0.016	0.014	0.012	0.010	0.008	0.006	0.004	0.002	0
50%	0.024	0.022	0.019	0.017	0.014	0.012	0.010	0.007	0.005	0.002	0
60%	0.029	0.026	0.023	0.020	0.018	0.015	0.012	0.009	0.006	0.003	0
70%	0.037	0.033	0.030	0.026	0.022	0.019	0.015	0.011	0.007	0.004	0
80%	0.049	0.045	0.040	0.035	0.030	0.025	0.020	0.015	0.010	0.005	0
90%	0.071	0.064	0.057	0.050	0.042	0.035	0.028	0.021	0.014	0.007	0
100%	0.218	0.196	0.174	0.152	0.131	0.109	0.087	0.065	0.044	0.022	0
mean	0.033	0.030	0.027	0.023	0.020	0.017	0.013	0.010	0.007	0.003	0

TABLE D3b. Mortality rates (proportion of total golden eagles dying due to ingesting lead from gut piles in one month of big game hunting season) for the six hunting units in the **Casper decision example**, by mitigation rate or proportion of **gut piles removed** in 10% increments (columns) and percentile (%) of 5000 simulations (rows). The median simulation outcome (gray shading) is the expected eagle mortality due to lead ingestion for each level of mitigation.

% sims	Mortality rate by % of gut piles removed										
	0	10	20	30	40	50	60	70	80	90	100
0%	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0
10%	0.010	0.010	0.009	0.009	0.008	0.008	0.007	0.007	0.006	0.006	0
20%	0.013	0.012	0.012	0.011	0.010	0.009	0.009	0.008	0.007	0.007	0
30%	0.016	0.015	0.014	0.013	0.012	0.011	0.010	0.010	0.009	0.008	0
40%	0.020	0.018	0.017	0.016	0.015	0.013	0.012	0.011	0.011	0.010	0
50%	0.024	0.022	0.021	0.019	0.018	0.016	0.015	0.014	0.013	0.012	0
60%	0.029	0.027	0.025	0.023	0.022	0.020	0.019	0.017	0.016	0.015	0
70%	0.037	0.035	0.032	0.030	0.028	0.025	0.024	0.022	0.020	0.019	0
80%	0.049	0.046	0.043	0.040	0.037	0.034	0.031	0.029	0.027	0.025	0
90%	0.071	0.067	0.062	0.058	0.053	0.049	0.046	0.042	0.040	0.037	0
100%	0.218	0.203	0.188	0.173	0.158	0.144	0.130	0.118	0.106	0.095	0
mean	0.0333	0.0311	0.029	0.0269	0.0249	0.023	0.021	0.02	0.0184	0.0171	0

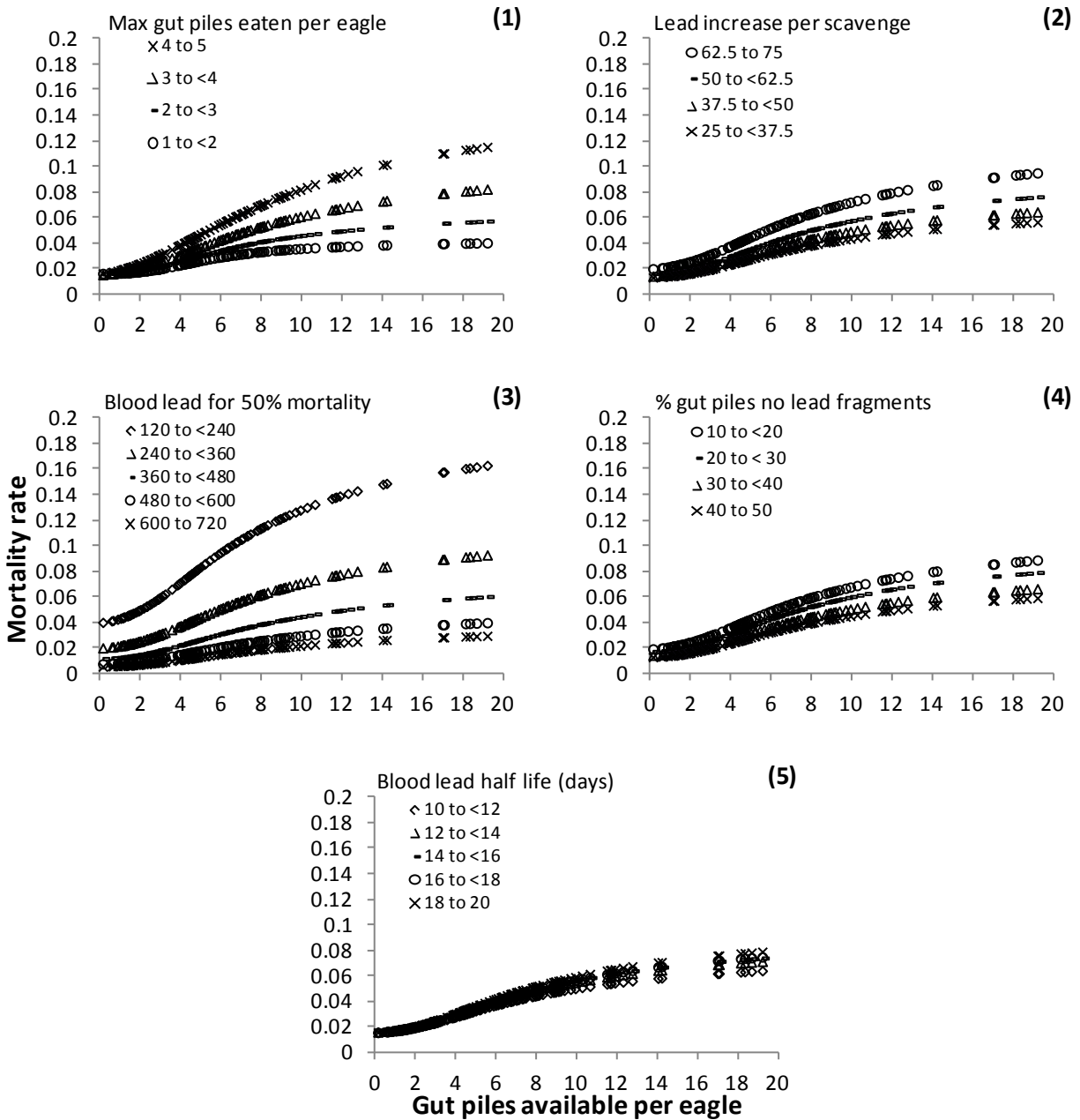


FIG. D1. Sensitivity analysis of mortality rate to five model parameters: (1) average maximum number of gut piles eaten per eagle, C^* , (2) mode of the blood lead concentration increase per gut pile consumed, E_{mode} , (3) the blood lead concentration that would lead to 50% mortality, k_m , (4) proportion of gut piles with no lead fragments, ϕ , and (5) half life of lead in blood, T_{half} . All parameters varied randomly for 5000 model iterations. Plot markers show the average eagle mortality calculated for the proportion of those simulations that fell into the indicated ‘bin’ or incremental levels of the parameter in each graph (all other parameters randomly varied), for 139 individual Wyoming big game hunting units under the status quo or no mitigation. These results are from simulations at 5.0 eagles/100km²; lower eagle densities produced identical mortality rates for any level of gut piles available per eagle.