

APPENDIX 1

Table A1.1) Comparison of models with variables hypothesized to affect Lesser Scaup (*Aythya affinis*) clutch size between 2006 to 2018 (excluding 2016) at the Lower Red Rock Lake study area in southwestern Montana, USA. Shown are the modeled variables (Model), conditional log likelihood (CLL), degrees of freedom (df), and conditional Akaike Information Criterion (cAIC). INIT = nest-specific initiation date within a year, PRELVL = pre-breeding season water level, LVL = breeding season water level, PHENIND = phenological index (date of maximum water level minus the mean nest initiation date for that year), PRETEMP = pre-breeding season water temperature. All models included a random effect for nest year (YEAR_{RAN}).

Model	CLL	df	cAIC
INIT + YEAR _{RAN}	-1474.30	8.57	2965.75
PRELVL + INIT + YEAR _{RAN}	-1474.34	8.54	2965.75
LVL + INIT + YEAR _{RAN}	-1475.40	7.59	2965.97
PHENIND + INIT + YEAR _{RAN}	-1474.30	9.03	2966.67
PRETEMP + INIT + YEAR _{RAN}	-1474.30	9.09	2966.79
PRELVL * INIT + YEAR _{RAN}	-1473.95	9.52	2966.94
PHENIND * INIT + YEAR _{RAN}	-1473.82	10.04	2967.72
LVL * INIT + YEAR _{RAN}	-1475.37	8.55	2967.84
PRETEMP * INIT + YEAR _{RAN}	-1473.88	10.09	2967.94
INTERCEPT + YEAR _{RAN}	-1508.70	7.58	3032.56
PRELVL + YEAR _{RAN}	-1508.74	7.54	3032.56
LVL + YEAR _{RAN}	-1509.80	6.58	3032.75
PHENIND + YEAR _{RAN}	-1508.71	8.03	3033.47
PRETEMP + YEAR _{RAN}	-1508.70	8.10	3033.60

Table A1.2) Comparison of models for first step in model selection for nest daily survival rates with inter-annual covariates for Lesser Scaup (*Aythya affinis*) at the Lower Red Rock Lake study site in Montana, USA between 2006 to 2018 (excluding 2016). Shown are the modeled variables (Model), deviance, number of parameters (K), Akaike Information Criterion adjusted for sample size (AIC_c), difference in AIC_c relative to the top model (ΔAIC_c), and model weight (w_i). PRELVL = pre-breeding season water level, LVL = breeding season water level, PHENIND = phenological index (date of maximum water level minus the mean nest initiation date for that year), PRETEMP = pre-breeding season water temperature, CONSTANT = a null model with constant DSR.

Model	Deviance	K	AIC_c	ΔAIC_c	w_i
PHENIND	1423.62	2	1427.62	0.00	0.51
PRELVL + PHENIND	1423.59	3	1429.59	1.97	0.19

LVL + PHENIND	1423.62	3	1429.62	2.00	0.19
CONSTANT	1430.90	1	1432.90	5.28	0.04
PRELVL	1429.78	2	1433.78	6.16	0.02
PRETEMP	1430.42	2	1434.42	6.80	0.02
LVL	1430.47	2	1434.48	6.85	0.02
PRELVL + PRETEMP	1429.71	3	1435.71	8.09	0.01
LVL + PRETEMP	1429.97	3	1435.928	8.36	0.01

Table A1.3) Comparison of models for second step of model selection for Lesser Scaup (*Aythya affinis*) nest daily survival rates (DSR) at the Lower Red Rock Lake study site, Montana, USA between 2006 to 2018 (excluding 2016), where intra-annual covariates were added to the inter-annual covariate(s) supported in the first step of model selection. Shown are the modeled variables (Model), deviance, number of parameters (K), Akaike Information Criterion adjusted for sample size (AIC_c), the difference in AIC_c relative to the top model (ΔAIC_c), and model weight (w_i). PHENIND = phenological index (date of maximum water level minus the mean nest initiation date for that year), TIME = linear time trend in DSRs across the breeding season, TIME² = additional term for a quadratic time trend, and NAGE = nest developmental age.

Model	Deviance	K	AIC_c	ΔAIC_c	w_i
PHENIND + TIME + TIME ²	1360.21	4	1368.21	0.00	1
PHENIND + TIME	1374.31	3	1380.31	12.10	0
PHENIND + NAGE	1377.46	3	1383.46	15.25	0
PHENIND	1423.62	2	1427.62	59.41	0

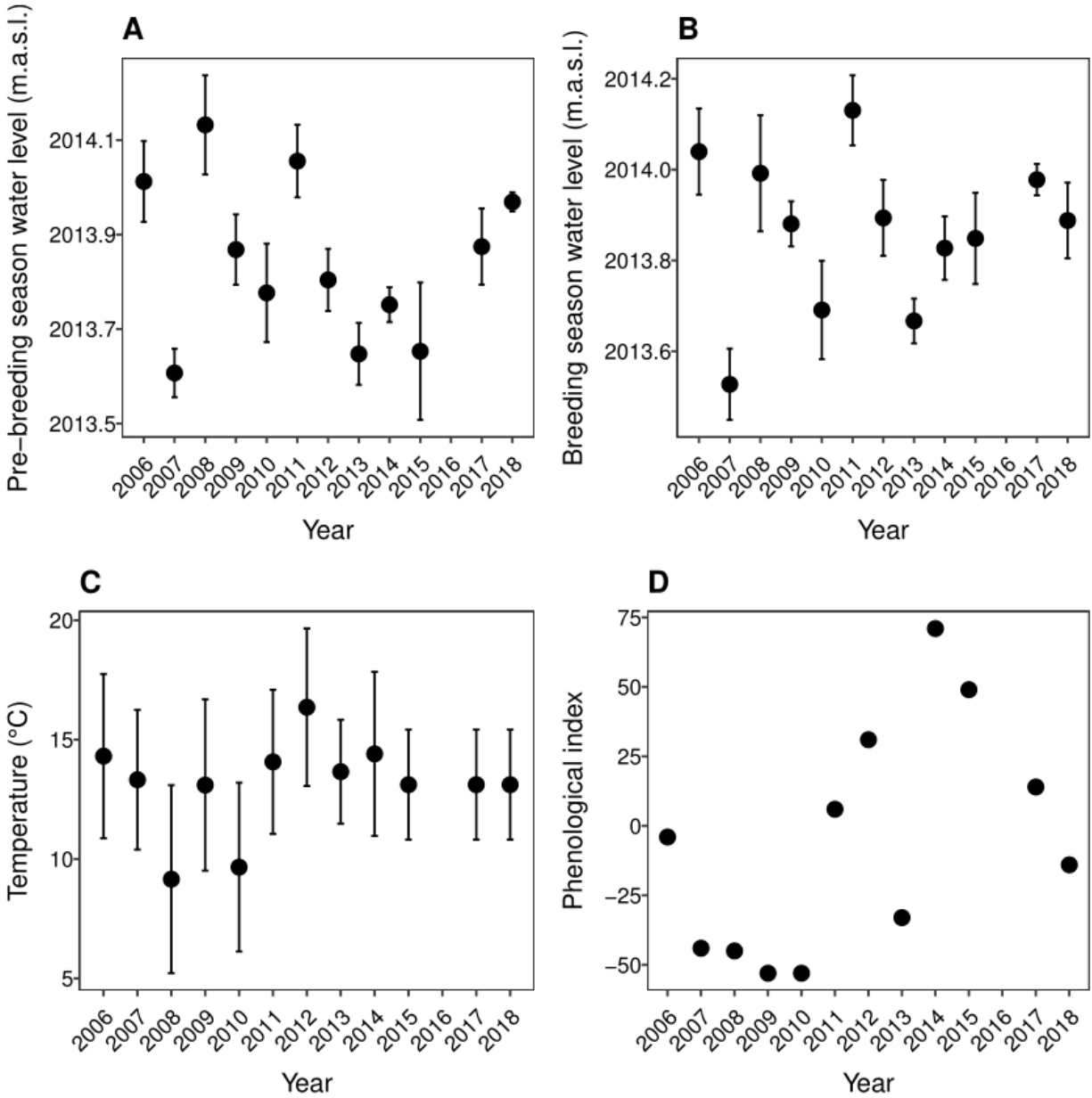


Figure A1.1) Environmental conditions at the Lower Red Rock Lake in southwestern Montana, USA from 2006 to 2018 (excluding 2016 due to funding constraints) for (A) mean pre-breeding season (May 1st – June 15th) water levels measured in meters above sea level (m.a.s.l.) and associated 95% confidence intervals (error bars), (B) breeding season water levels (May 1st – August 31st) measured in m.a.s.l. and associated 95% confidence intervals (error bars), (C) pre-breeding season (May 1st – June 15th) water temperature measured in degrees Celsius, and (D) phenological index (date of maximum water level minus the mean nest initiation date for that year).

Environmental Conditions

Pre-breeding water levels at LRRL averaged 2013.87 (± 0.17 s.d.) msl with the highest mean pre-breeding water levels in 2008 (2014.13 ± 0.10 msl) and the lowest in 2007 (2013.61 ± 0.05

msl). During the years of 2015, 2017, and 2018 the capacitance probe malfunctioned, and we were unable to obtain average water temperature readings. For the purposes of modeling, we included the average water temperature over the entirety of the project during pre-breeding for these years with missing data (which should lead to conservative estimated effects, if any). Pre-breeding water temps averaged $13.12 (\pm 2.30) ^\circ\text{C}$ and ranged from $0.43 - 28.49 ^\circ\text{C}$. Water temperatures were lowest in April of 2008 and highest in July of 2016. Breeding season water levels averaged $2013.87 (\pm 0.19)$ m.a.s.l. and ranged between $2013.14 - 2014.33$ msl. The highest mean water levels occurred in 2011 (2014.13 ± 0.08 msl) and the lowest mean water levels occurred in 2013 (2013.67 ± 0.05 msl). The ordinal date of the maximum water level throughout the breeding season averaged day $169 (\pm 41)$ days with the earliest date being 121 (2009 and 2010) and the latest being 243 (2015). Our phenology index demonstrated that maximum water levels rarely ‘matched’ with mean initiation dates ranging from an index of -53 (ordinal date of maximum water level was earlier than mean nest initiation for that year) to 71 (ordinal date of maximum water level was later than mean nest initiation date for that year) with a median of -9.

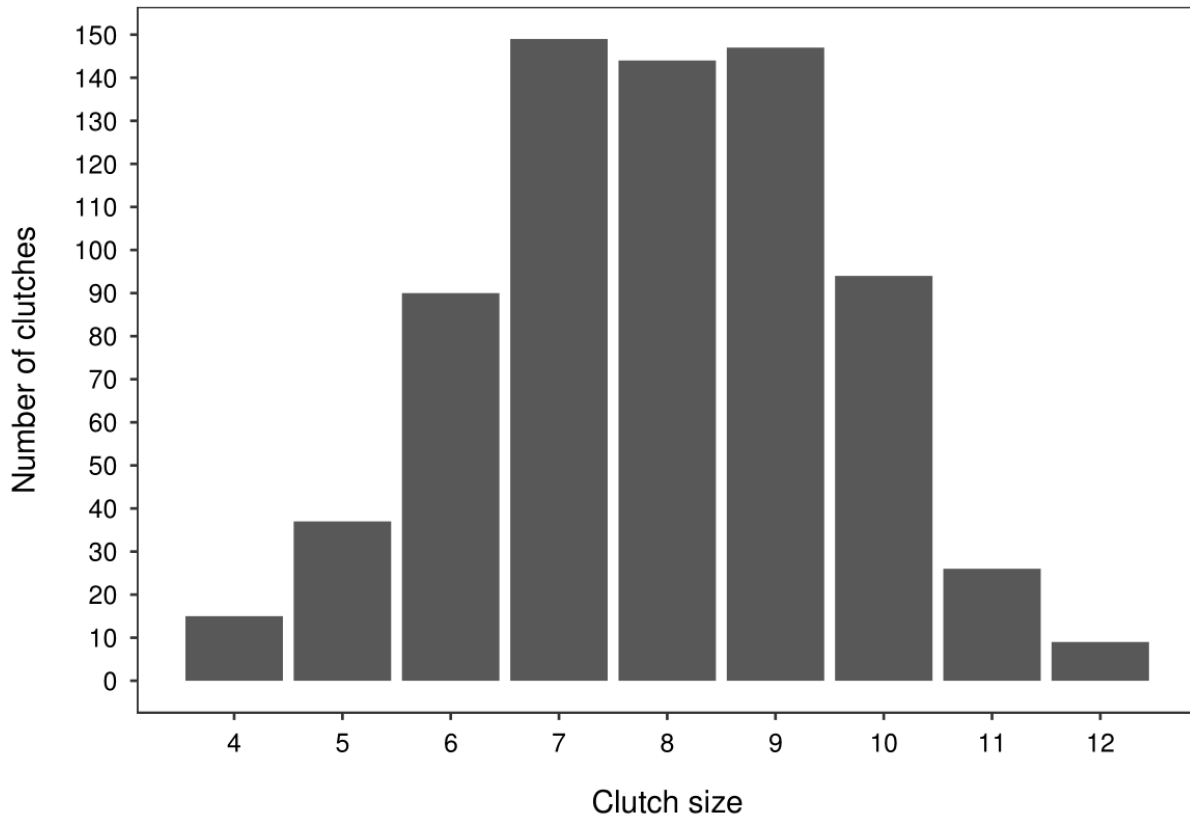


Figure A1.2) Distribution of Lesser Scaup (*Aythya affinis*) clutch sizes from 2006-2018 (excluding 2016) at the Lower Red Rock Lake study area in Montana, USA.

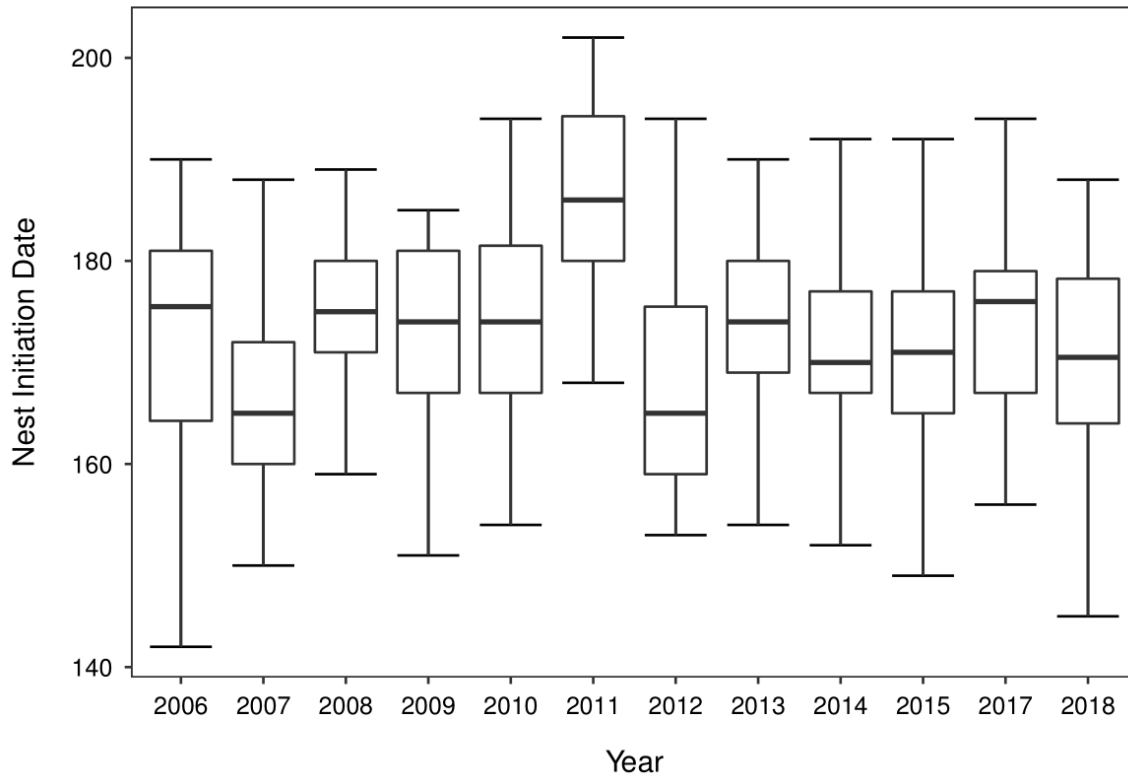


Figure A1.3) Boxplots of nest initiation dates each year for lesser scaup (*Aythya affinis*) at the Lower Red Rock Lake study area, Montana, USA. Shown are the estimated median (bold line), 1st and 3rd quartiles (box) and largest and smallest value within 1.5x interquartile range above 3rd quartile and below 1st quartile (whiskers).