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Supplementary material

Assessment of river otter abundance following reintroduction

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Supplementary material – A

Summary of river otter reintroduction to ohio, usa from 1986-1993

River otters (*Lontra canadensis*) were reintroduced to Ohio, USA, in two separate efforts. The first effort occurred in 1986 in the Grand River watershed (Fig. A1) and reintroduced river otters suffered high mortality rates. This effort is thought to have failed. The second reintroduction effort began in 1988 with river otters again reintroduced to the Grand River watershed over the course of three years (Table A1, Fig. A1). Then from 1991-1993, river otters were reintroduced into three different watersheds: Killbuck Creek (1991), Stillwater Creek (1992), and Little Muskingum River (1993) (Table A1, Fig. A1). River otters have since been reported throughout the state (Fig. A1) and the reintroduction effort has been considered a success.

Table A1. Number of male and female river otters (*Lontra canadensis*) reintroduced to Ohio, USA from 1988-1993.

Year	Watershed	Male	Female
1988	Grand River	3	5
1989			
1990	Grand River	11	15
1991	Killbuck Creek	8	15
1992	Stillwater Creek	11	15
1993	Little Muskingum River	10	15
Total		43	65

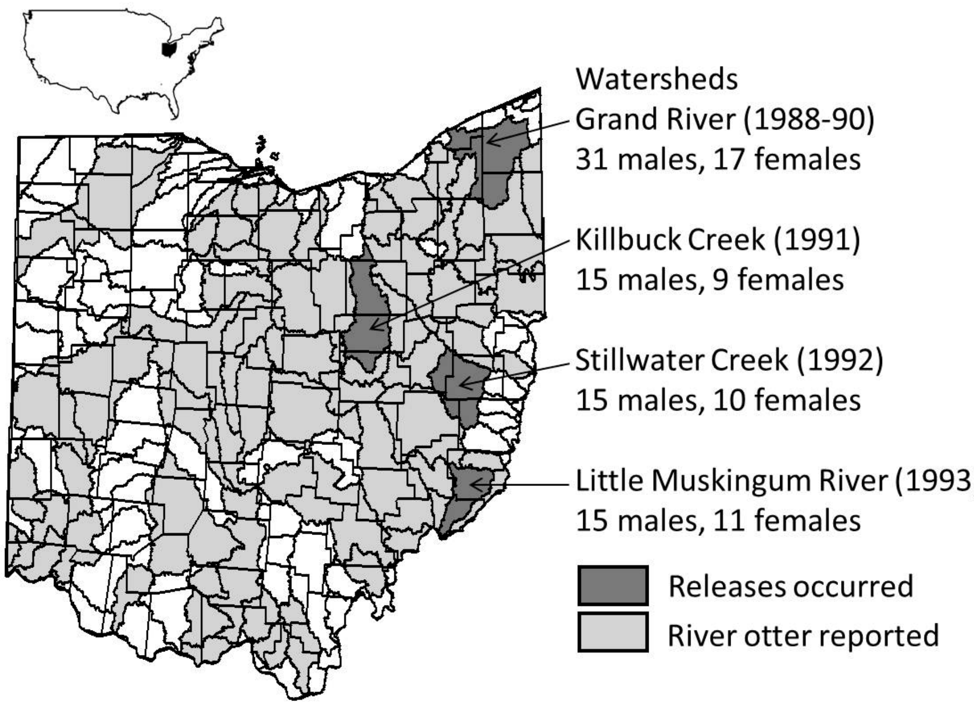

Fig. A1. Watersheds in Ohio, USA, where river otters (*Lontra canadensis*) were successfully reintroduced (reintroductions occurred from 1988 to 1993). The current distribution of river otters in Ohio is unknown, but river otter occurrences have been reported across the state. Inset map shows Ohio's location within the USA.

Supplementary material – B

Summary of river otter harvest data in ohio, usa from 2006-2008

Following the successful reintroduction of river otters (*Lontra canadensis*) to Ohio, USA, the Ohio Department of Natural Resources (ODNR) implemented a limited harvest beginning in the 2005-2006 fur harvest season (Figure B1). Over the next three years, the ODNR collected river otter carcasses when trappers checked their fur harvest at various check stations around the state. Various demographic parameters were collected from the harvested river otter carcasses. Sex was confirmed from visually inspecting the carcass and age was determined using cementum analysis by Matson's Lab (Milltown, MT, Table B1). The reproductive tracts of harvested females were also inspected for presence of corpora lutea, placental scars, and embryos (Table B2).

Table B1. Number of river otters (*Lontra canadensis*) harvested by sex and age class in Ohio, USA, from 2006-2008.

Sex	Age class	2006	2007	2008
Male	Juvenile	40	27	17
	Yearling	20	17	14
	Adult	45	20	14
	Unknown age	20	1	5
	Total	125	65	50
Female	Juvenile	35	24	16
	Yearling	15	13	8
	Adult	30	30	26
	Unknown age	21	5	8
	Total	101	72	58

Table B2. Reproductive rates and litter sizes of river otters (*Lontra canadensis*) in Ohio, USA, derived from harvest data collected in Ohio from 2006-2008.

Age class	Reproductive rate				Litter size estimates (SD)		
	Average	2006	2007	2008	Corpora lutea[a]	Blastocysts[b]	Embryos[c]
Juvenile	0.03	0.06	0.00	0.00	N/A	N/A	3.00
Yearling	0.39	0.53	0.15	0.50	3.38 (0.96)	3.25 (0.50)	3.29 (0.49)
Adult	0.67	0.80	0.67	0.54	3.61 (0.82)	3.40 (0.89)	3.30 (0.95)

[a] Sample size was 0, 13, and 56 for juveniles, yearlings, and adults, respectively

[b] Sample size was 0, 4, and 5 for juveniles, yearlings, and adults, respectively

[c] Sample size was 2, 7, and 27 for juveniles, yearlings, and adults, respectively

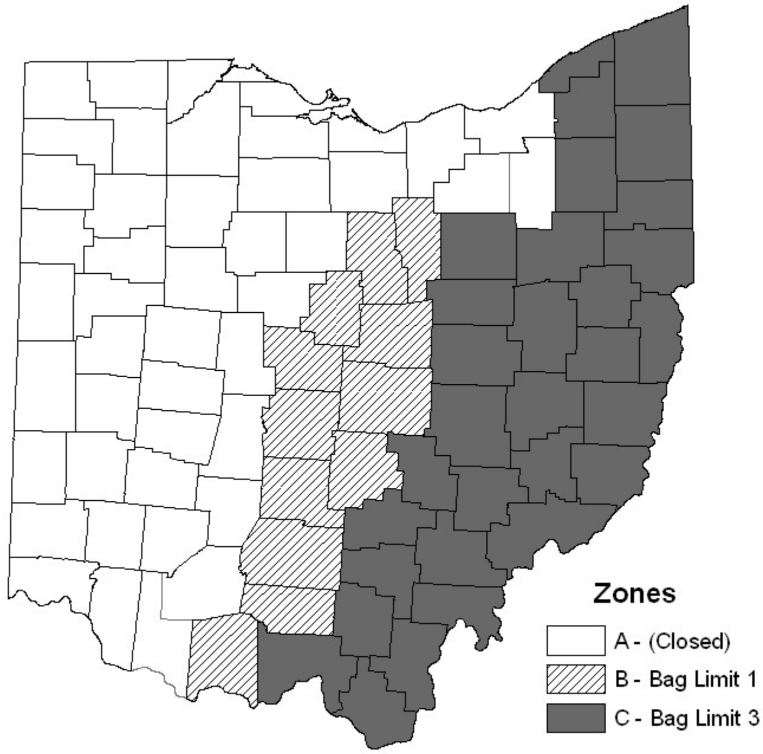

Fig. B1. Trapping zones and bag limits for river otter (*Lontra canadensis*) in Ohio, USA by county for the 2005-06 trapping season until present (2015-16).

Supplementary material – C

Estimating river otter survival in ohio, USA

We used estimates of river otter (*Lontra canadensis*) survival in Ohio, USA that were reported in an unpublished study (Dwyer 2005). Dwyer (2005) captured and radio-marked 34 river otters (16M:18F) from 2001-2004 in Wayne, Holmes, and Muskingum counties in Ohio, USA. They surgically implanted radio-transmitters (105g, ATS), equipped with mortality sensors, in the intraperitoneal cavity of river otters (Serfass et al. 1993) and released animals within 5-7 hours. They included river otters in the study following a 1-week adjustment period to account for any capture or release-related mortality and monitored animals bi-weekly using standard ground and aerial techniques until the transmitter battery failed or the animal was found dead. Dwyer (2005) used the Kaplan-Meier staggered entry procedure (Kaplan and Meier 1958, Pollock et al. 1989) and the known fate model of program MARK (White and Burnham 1999) to generate estimates of annual survival for each year class (September-August). River otters surviving to the end of each year class were re-entered as new animals in the subsequent year class. Results suggest that annual survival rates ($\hat{S}$) of radio-marked river otters in Ohio were similar for 2001-2002 ($\hat{S}$ = 0.83; CI 0.58-1.09, n = 8), 2002-2003 ($\hat{S}$ = 0.84; CI 0.62-1.06, n = 13), and 2003-2004 ($\hat{S}$ = 0.93; CI 0.76-1.11, n = 20). In our analysis, we used the most conservative estimate of survival from 2001-2002, $\hat{S}$ = 0.83; CI 0.58-1.09.

References

Dwyer, C. 2005. Status and management of river otters (*Lontra canadensis*) in Ohio. Ohio Department of Natural Resources, Division of Wildlife, unpublished report.

Kaplan, E. L. and P. Meier. 1958. Nonparametric estimation from incomplete observations. Journal of the American Statistical Association 53:457-481.

Pollock, K. H., S. R. Winterstein, C. M. Bunck, and P. D. Curtis. 1989. Survival analysis in telemetry studies: the staggered entry design. Journal of Wildlife Management 53:7-15.

Serfass, T. L., R. L. Peper, M. T. Whary, and R. P. Brooks. 1993. River otter (*Lutra canadensis*) reintroduction in Pennsylvania: Prerelease care and clinical evaluation. Journal of Zoo and Wildlife Medicine 24:28-40.

White, G. C. and K. P. Burnham. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46S:120-138.

Supplementary material – D

LITERATURE REVIEW OF RIVER OTTER DEMOGRAPHIC DATA

Approach

We compiled demographic rates (survival, reproductive rate, litter size, and the sex ratio of the litter) of river otters (*Lontra canadensis*) from 29 different published studies that took place in USA and Canada. We excluded studies which were from identical datasets or subsets of larger datasets. We included data presented in this study for comparison purposes.

Survival

We found 10 studies that reported annual survival of river otters. Of these, none reported age-specific survival rates and only three reported sex-specific survival rates (Table D1). We excluded studies that monitored river otter survival for less than 9 months. All studies reporting annual survival estimates occurred after 1980, consistent with the advent of implantable telemetry devices. The lowest estimate of annual survival was 0.57 in West Virginia in 1987 (Tango et al. 1991) and the highest survival estimate was 1.00 for 18 river otters in Nebraska 2006-2009; Wilson 2012).

Reproductive rate

We found 17 studies that reported river otter reproductive rates: three reported reproductive rate for all ages combined and seven reported age-specific reproductive rates (Table D1). We excluded studies that estimated reproductive rate from small samples (< 3) or that were based on methods that had limited ability to detect active reproduction (e.g., visual observation). Across all age categories, reproductive rates appeared to be higher in studies conducted more recently. This, however, could be an artefact of methodology. Some earlier studies might have grouped harvested juveniles with adults in their sample; reproduction in juvenile river otters is extremely rare and including this age class from the reported reproductive rate would lead to underestimates. The highest reported reproductive rate of yearling river otters (0.59) was recorded in Missouri from 1996-1999 (Gallagher 1999), whereas the reproductive rate of yearlings was estimated to be 0.00 in North Carolina from 1978-1980 (Lancia et al. 1983). The highest reproductive rate of adults (0.92) was observed in Missouri from 1996-1999 (Gallagher 1999). Relatively high reproductive rates of adults (> 0.80) were also observed in Oregon in 1970-1972 (Tabor and Wight 1977), British Columbia in 1975-1981 (Stenson 1985), and Indiana in 1998-2006 (Johnson et al. 2007). Conversely, the lowest reproductive rates reported for adults (0.50) were observed in Alabama and Georgia in 1972-1977 (Lauhachinda 1978).

Litter Size

We found 17 reports of river otter litter size (including one from captive animals) in the literature: three studies reported yearling litter sizes only and seven studies reported adult litter sizes only (Table D1). Reported litter size estimates were based on embryos, corpora lutea, or placental scars. If a study reported litter size using multiple methods, we used the estimate based on embryos. The study on captive animals reported litter size as the number of kits born. The largest average litter size (3.52, pooled over all age classes) was from Arkansas in 1978-1985 (Polecha 1987); this estimate was reported using embryos, which tends to be a more conservative estimate than corpora lutea or placental scars. The smallest average litter size (2.11, pooled over all age classes) was from New York in 1953-1962, estimated using embryos (Hamilton and Eadie 1964). The range in litter size of yearlings was large, ranging from 1.70 in Wisconsin from 1979-2013 (Rolley et al. 2015) to 3.67 in Arkansas in 1978-1985 (Polecha 1987). The range in litter size of adults was also large, ranging from 1.79 in Maine in 1982-1983 (Docktor et al.

1987) to 3.42 in Arkansas (Polecha 1987) in 1978-1985. The largest litter reported, including all known captive litters, was 5 (Reed-Smith 2001).

Sex Ratio

We found six reports of the sex ratio of river otter litters in the literature (Table D1). We did not find any studies that reported that the sex ratio of the litter was 50:50. Six studies reported that the proportion of females in wild litters ranged from 0.29 to 0.46, and one study of a captive population reported that the proportion of females in the litter was 0.48 (Reed-Smith 2001). The average proportion of females in the litter across all studies was 0.41 (n = 6, SD = 0.07).

Table D1. Demographic rates of river otters (*Lontra canadensis*) as reported in the published literature.

Source	State	Year	Survival	Male survival	Female survival	Reproductive rate	Yearling reproductive rate	Adult reproductive rate	Litter size	Yearling litter size	Adult litter size	Proportion of females in the litter
[1]	NC	1948-59				0.24			2.88[g]			
[2]	NY	1953-62				0.64			2.11[g]			
[3]	FL	1962										0.44
[4]	OR	1970-72				0.36		0.98	2.75[g]			
[5]	AL, GA	1972-77				0.41		0.50	2.60[g]			0.37
[6]	ZOO[b]	1972-00							2.33			0.48
[7]	MD	1974-77				0.35	0.07	0.65	2.73[g]			
[8]	BC	1975-81						0.91			2.50[g]	
[9]	NC	1978-80				0.30	0.00	0.79			2.46[g]	0.40
[10]	LA	1978-81						0.68[f]				
[11]	AR	1978-85						0.51[f]	3.52[g]	3.67[g]	3.42[g]	0.46
[12]	VA	1979-81				0.45	0.27	0.55	2.78[g]			
[13]	WI	1979-13				0.57	0.32	0.73		1.70[i]	2.10[i]	
[14]	CO	1980-84	0.72									
[15]	ME	1982-83						0.77			1.79i	
[16]	MO	1982-84	0.81									
[17]	NY[d]	1983							2.20[j]			
[18]	MN[d]	1983-84						0.61	2.20[j]			
[19]	WV	1987	0.57									
[20]	OH	1987-89	0.62[e]									

[21]	IN	1995	0.71									
[22]	KY[a]	1995	0.73									
[23]	AK[c]	1996-97	0.80									
[24]	MO	1996-99				0.73	0.59	0.92	2.85[g]	2.50[g]	3.00[g]	
[25]	NY	1997-99	0.89	0.92	0.86							
[26]	IN	1998-06				0.72	0.50	0.88	3.06[g]	4.00[g,k]	2.93[g]	0.29
[27]	MN	2002-04	0.80	0.95	0.68		0.32	0.77				
This study	**OH**	**2003-05**	**0.83**									
	OH	**2005-08**					**0.53, 0.15, 0.50**	**0.80, 0.67, 0.54**		**3.29[g]**	**3.30[g]**	
[28]	KY	2006-09					0.36	0.72	3.14[h]			
[29]	NE	2006-09	1.00	1.00	1.00							

[a] Reported in Barding and Lacki (2014)

[b] Summary data from captive populations in American Zoological Association zoos; data from known litters at birth

[c] Reported in Gorman et al. (2008)

[d] Reported in Melquist and Dronkert (1987)

[e] Reported as a midpoint of the range; influenced by animals with an unknown fate

[f] Estimated from a range of reproductive values using corpora lutea and embryos together, and using embryos alone

[g] Litter size estimated from embryos

[h] Litter size estimated from embryos and placental scars

[i] Litter size estimated from corpora lutea

[j] Method used to estimate litter size was not reported

[k] Sample size of two: litter sizes were 3 and 5

[1] - Wilson, K. A. 1959. The otter in North Carolina. Proceedings of the Annual Conference of the Southeast Association of Game and Fish Commissioners 13:267-277.

[2] - Hamilton, W. J. and W. R. Eadie. 1964. Reproduction in the otter, *Lutra canadensis*. Journal of Mammalogy 45:242-252.

[3] - McDaniel, J. C. 1963. Otter population study. Proceedings of the Southeastern Association of Game and Fish Commissioners 17:163-168.

[4] - Tabor, J. E. and H. M. Wight. 1977. Population status of river otter in western Oregon. The Journal of Wildlife Management 41:692-699.

[5] - Lauhachinda, V. 1978. Life history of the river otter in Alabama with emphasis on food habits. Ph.D. dissertation, Auburn University, Auburn, Alabama

[6] - Reed-Smith, J. 2001. North American river otter: *Lontra canadensis*: husbandry notebook. John Ball Zoological Garden, Grand Rapids, Michigan.

[7] - Mowbray, E. E. 1979. The status, population characteristics and harvest of the river otter in Maryland. Publication Wildlife Ecology 2, Maryland Wildlife Administration, Maryland.

[8] - Stenson, G. B. 1985. The reproductive cycle of the river otter, *Lutra canadensis*, in the marine environment of southwestern British Columbia. Ph.D. dissertation, University of British Columbia, Vancouver, British Columbia, Canada.

[9] - Lancia, R. A., J. D. Hair, and S. D. Miller. 1983. Population status of bobcat (*Felis rufus*) and river otter *(Lutra canadensis*) in North Carolina. Project Report E-1, North Carolina State University, Raleigh, North Carolina.

[10] - Fleming, W. J., C. M. Bunck, G. Linscombe, N. Kinler, and C. J. Stafford. 1985. PCBs, organochlorine pesticides, and reproduction in river otters from Louisiana. Proceedings

of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 39:337-343.

[11] - Polechla, P. J. 1987. Status of the river otter (*Lutra canadensis*) population in Arkansas with special reference to reproductive biology. Ph.D. dissertation, University of Arkansas, Fayetteville, Arkansas.

[12] – Anderson, K. L. 1981. Population and reproduction characteristics of the river otter in Virginia and tissue concentrations of environmental contaminants. M.S. thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

[13] – Rolley, R. E., N. M. Roberts, T. R. Pearson. 2015. Otter population analyses. Wisconsin Department of Natural Resources. http://dnr.wi.gov/topic/WildlifeHabitat/documents/reports/otterpop2.pdf

[14] – Mack, C. M. 1985. River otter restoration in Grand County, Colorado. M.S. thesis, Colorado State University, Fort Collins, Colorado.

[15] - Docktor, C. M., R. T. Bowyer and A. G. Clark. 1987. Number of corpora lutea as related to age and distribution of river otter in Maine. Journal of Mammalogy 68:182-185.

[16] - Erickson, D. W. and C. R. McCullough. 1987. Fates of translocated river otters in Missouri. Wildlife Society Bulletin 15:511-517.

[17] – Brown, M. K. and G. R. Parson. 1983. Otter management in northern New York: preliminary results. Transactions of the Northeast Section of the Wildlife Society 40:96.

[18] - Berg, W. E. 1984. Otter status report, 1983–1984. Minnesota Department of Natural Resources, Grand Rapids, Minnesota.

[19] – Tango, P. J., E. D. Michael, and J. I. Cromer. 1991. Survival and seasonal movements during river otter restoration efforts in West Virginia. Proceedings of the Annual. Conference of Southeast Association of Fish and Wildlife Agencies 45:64-72.

[20] - McDonald, K. P. 1989. Survival, home range, movements, habitat use, and feeding habits of reintroduced river otters in Ohio. M.Sc. thesis, Ohio State University, Columbus, Ohio.

[21] - Johnson, S. A. and K. A. Berkley. 1999. Restoring river otters in Indiana. Wildlife Society Bulletin 27:419-427.

[22] - Cramer, M. S. 1995. River otter (*Lontra canadensis*) restoration in Kentucky. Final Report, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.

[23] - Ben-David, M., L. K. Duffy, G. M. Blundell, and R. T. Bowyer. 2001. Natural exposure of coastal river otters to mercury: relation to age, diet, and survival. Environmental Toxicology and Chemistry 20:1986-1992.

[24] - Gallagher, E. L. 1999. Monitoring trends in reintroduced river otter populations. M.Sc. thesis, University of Missouri-Columbia, Columbia, Missouri.

[25] - Spinola, R. M., T. L. Serfass, and R. P. Brooks. 2008. Survival and post-release movements of river otters translocated to western New York. Northeastern Naturalist 15:13-24.

[26] - Johnson, S. A., H. D. Walker, C. M. Hudson, T. R. Hewitt, and J. S. Thompson. 2007. Prospects for restoring river otters in Indiana. Proceedings of the Indiana Academy of Science 116:71-83.

[27] - Gorman, T. A., B. R. McMillan, J. D. Erb, C. S. Deperno, and D. J. Martin. 2008. Survival and cause-specific mortality of a protected population of river otters in Minnesota. The American Midland Naturalist 159: 98-109.

[28] - Barding, E. E. and M. J. Lacki. 2014. Demographic and reproductive characteristics of reintroduced northern river otters in Kentucky: implications for population growth. The American Midland Naturalist 172:338-347.

[29] - Wilson, S. P. 2012. River otter (*Lontra canadensis*) home range, habitat use, overnight movement, and survival in the Platte River of Nebraska. Ph.D. dissertation, University of Nebraska, Lincoln, Nebraska.

Supplementary material – E

INDICES OF RIVER OTTER TRAPPER EFFORT IN OHIO, USA

We sought to determine the influence of harvest effort on our estimates of river otter population abundance. Otter harvest effort has only recently been recorded in Ohio (2013-2014). At otter check stations, trappers were asked to report the number of days that they set traps for otters and the average number of traps set per day. Unfortunately, these data are not sufficient to estimate trapper effort from 2006-08. Thus, we generated multiple models of harvest effort based on:

1) Generic trends: linear increase, linear decrease, and constant
2) Existing data on river otter harvest effort from states surrounding Ohio (Kentucky and Michigan):
   a. As indices of otter harvest effort in Ohio.
   b. Using the relationship between otter pelt price and otter trap effort in these states to model the relationship between otter pelt price and otter trapper effort in Ohio.
3) River otter pelt price

We collected otter harvest effort from the Kentucky Department of Fish and Wildlife and the Michigan Department of Natural Resources. River otter harvest effort in Kentucky was generated from trapper surveys from 2008-2013 (Table E1). River otter harvest effort in Michigan was generated from trapper surveys from 2007-2013 (Table E1). Both Michigan and Kentucky have different river otter harvest restrictions (i.e., bag limits and season length) from each other and from Ohio, such differences could influence trapper effort. We also collected river otter pelt price data from pelts sold during February and March from 2005 to 2014 (North American Fur Auction Toronto, Canada; Table E1). Using these data, we examined the relationship between river otter trapper effort in Kentucky and Michigan and pelt price using linear regression (Figure E1). Otter harvest effort in both Kentucky and Michigan was positively related to otter pelt price; this relationship was stronger in Michigan (β = 0.99 [per 1,000 trap nights], p = 0.04, adj. R^2 = 0.45, n = 8) than in Kentucky (β = 0.67 [per 1,000 trap nights], p = 0.13, adj. R^2 = 0.28, n=7). Using these relationships, we estimated harvest effort for river otters in Kentucky in 2006 and 2007 and in Michigan in 2006. This allowed us to use both the harvest effort in Kentucky and Michigan as indices for the harvest effort in Ohio (Table E2). We scaled pelt price to be on a similar scale as the Kentucky and Michigan trapper effort (Table E2). Finally, we generated generalized trapper effort models that were on a similar scale as the Kentucky and Michigan trapper effort indices (Table E2).

Table E1. River otter (*Lontra canadensis*) trapper effort in Kentucky (KY) and Michigan (MI), USA, and river otter pelt price from 2006-2014.

Year	KY trapper effort[a]	MI trapper effort[a]	Otter pelt price (100 USD)[b]
2006			1.07
2007		2.948	1.43
2008	0.586	1.664	0.48
2009	0.788	1.384	0.41
2010	0.479	1.341	0.31
2011	0.973	1.392	0.51
2012	1.350	2.077	0.58
2013	0.951	2.063	1.02
2014	1.314	1.430	1.13

[a] Trapper effort was scaled to hundred-thousand trap-nights

[b] Data obtained from North American Fur Auction Reports 2000-2009 (http://www.nafa.ca/)

Table E2. Generalized and indexed models of river otter (*Lontra canadensis*) trapper effort in Ohio (2006-2008).

Model[a]	Year		
	2006	2007	2008
Constant	1.43	1.43	1.43
Linear increase	1.43	3.26	5.09
Linear decrease	5.09	3.26	1.43
Kentucky	0.72	0.97	0.59
Michigan	1.06	2.95	1.66
Pelt price	1.07	1.43	0.48

[a] We generated generalized trapper effort models (constant, linear increase and decrease) on a similar scale to the indices of trapper effort (Kentucky, Michigan, and pelt price).

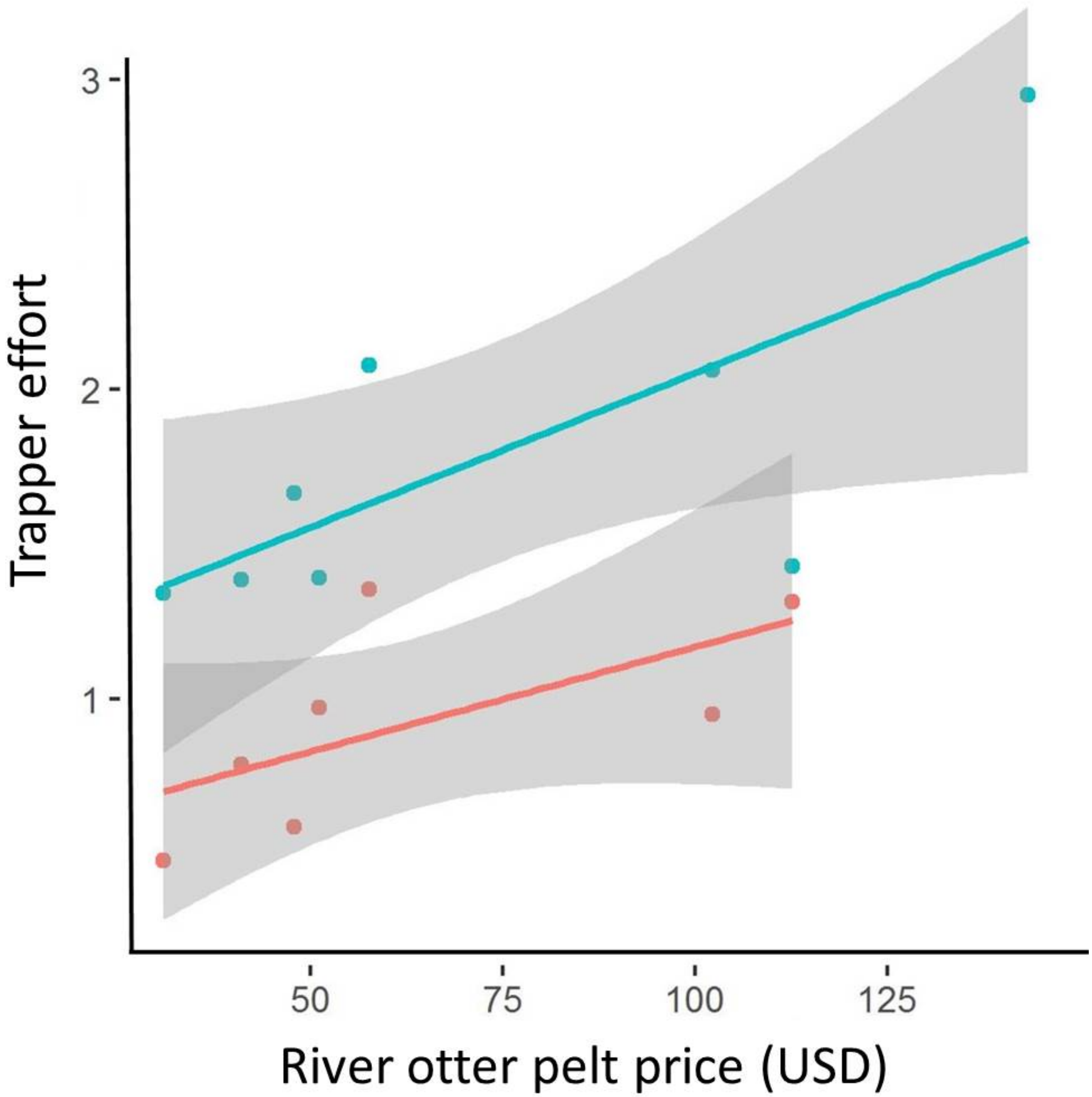

Figure E1. Relationship between river otter (*Lontra canadensis*) pelt price and river otter trapper effort in Michigan (blue) and Kentucky (red), USA, from 2006-2014. Shading represents the 95% confidence interval around the linear relationship.

Supplementary material – F

ADDITIONAL INFORMATION ON STATISTICAL POPULATION RECONSTRUCTION MODELS OF RIVER OTTER IN OHIO, USA FROM 2006-2008

We ran 48 statistical population reconstruction (SPR) models with different configurations of variability for harvest and survival probability among age classes and across years (random effects, Table F1). Across all SPR trapper effort and initial abundance scenarios the top model was S0_H3R (where survival probability was static and harvest probability varied among ages 0-3 and across years). In these different scenarios, survival probability varied from 0.71 (SD = 0.17) in the constant trapper effort model and 0.79 (SD = 0.12) in the initial abundance 1000 model (Table F2). Harvest probability was mostly static across the different trapper effort models, however harvest probability increased as the initial abundance decreased (Table F3).

Table F1. Generalized configuration of varying survival and harvest probabilities among different age classes of river otters (*Lontra canadensis*) used to estimate population abundance of river otters in Ohio, USA, from 2006-2008 using statistical population reconstruction methods.

Model	Unique probabilities		Vary among years	
	Survival	Harvest	Survival	Harvest
S0_H0	None	None	No	No
S0_H1	None	<1; >1	No	No
S0_H2	None	<1; 1-2; >2	No	No
S0_H3	None	<1; 1-2; 2-3; >3	No	No
S1_H0	<1; >1	None	No	No
S1_H1	<1; >1	<1; >1	No	No
S1_H2	<1; >1	<1; 1-2; >2	No	No
S1_H3	<1; >1	<1; 1-2; 2-3; >3	No	No
S2_H0	<1; 1-2; >2	None	No	No
S2_H1	<1; 1-2; >2	<1; >1	No	No
S2_H2	<1; 1-2; >2	<1; 1-2; >2	No	No
S2_H3	<1; 1-2; >2	<1; 1-2; 2-3; >3	No	No
S3_H0	<1; 1-2; 2-3; >3	None	No	No
S3_H1	<1; 1-2; 2-3; >3	<1; >1	No	No
S3_H2	<1; 1-2; 2-3; >3	<1; 1-2; >2	No	No
S3_H3	<1; 1-2; 2-3; >3	<1; 1-2; 2-3; >3	No	No
S0_H0R	None	None	No	Yes
S0_H1R	None	<1; >1	No	Yes
S0_H2R	None	<1; 1-2; >2	No	Yes
S0_H3R	None	<1; 1-2; 2-3; >3	No	Yes
S1_H0R	<1; >1	None	No	Yes
S1_H1R	<1; >1	<1; >1	No	Yes
S1_H2R	<1; >1	<1; 1-2; >2	No	Yes
S1_H3R	<1; >1	<1; 1-2; 2-3; >3	No	Yes
S2_H0R	<1; 1-2; >2	None	No	Yes
S2_H1R	<1; 1-2; >2	<1; >1	No	Yes
S2_H2R	<1; 1-2; >2	<1; 1-2; >2	No	Yes
S2_H3R	<1; 1-2; >2	<1; 1-2; 2-3; >3	No	Yes
S3_H0R	<1; 1-2; 2-3; >3	None	No	Yes
S3_H1R	<1; 1-2; 2-3; >3	<1; >1	No	Yes
S3_H2R	<1; 1-2; 2-3; >3	<1; 1-2; >2	No	Yes
S3_H3R	<1; 1-2; 2-3; >3	<1; 1-2; 2-3; >3	No	Yes
S0R_H0	None	None	Yes	No
S0R_H1	None	<1; >1	Yes	No
S0R_H2	None	<1; 1-2; >2	Yes	No

S0R_H3	None	<1; 1-2; 2-3; >3	Yes	No
S1R_H0	<1; >1	None	Yes	No
S1R_H1	<1; >1	<1; >1	Yes	No
S1R_H2	<1; >1	<1; 1-2; >2	Yes	No
S1R_H3	<1; >1	<1; 1-2; 2-3; >3	Yes	No
S2R_H0	<1; 1-2; >2	None	Yes	No
S2R_H1	<1; 1-2; >2	<1; >1	Yes	No
S2R_H2	<1; 1-2; >2	<1; 1-2; >2	Yes	No
S2R_H3	<1; 1-2; >2	<1; 1-2; 2-3; >3	Yes	No
S3R_H0	<1; 1-2; 2-3; >3	None	Yes	No
S3R_H1	<1; 1-2; 2-3; >3	<1; >1	Yes	No
S3R_H2	<1; 1-2; 2-3; >3	<1; 1-2; >2	Yes	No
S3R_H3	<1; 1-2; 2-3; >3	<1; 1-2; 2-3; >3	Yes	No

Table F2. Estimated river otter (*Lontra canadensis*) survival (SD) in Ohio, USA, from 2006-2008 using a statistical population reconstruction model with static survival and variable harvest probability (among ages 0-3 and across years).

	Scenario	Survival probability
	Stagnant	0.71 (0.17)
Generalized trapper effort	Linear increase	0.78 (0.14)
	Linear decrease	0.78 (0.10)
	Kentucky	0.75 (0.14)
Indices of trapper effort	Michigan	0.78 (0.14)
	Pelt price	0.78 (0.13)
	1000	0.79 (0.12)
Initial abundance	2000	0.78 (0.12)
	3000	0.78 (0.13)

Table F3. Estimated river otter (*Lontra canadensis*) harvest probability (SD) across age classes in Ohio, USA from 2006-2008 using a statistical population reconstruction model with static survival and variable harvest probability (among ages 0-3 and across years).

	Scenario	Harvest vulnerability											
		2006				2007				2008			
		Juv	1yr	2yr	Adult	Juv	1yr	2yr	Adult	Juv	1yr	2yr	Adult
Generalized trapper effort	Constant	0.06 (0.02)	0.06 (0.02)	0.10 (0.04)	0.05 (0.02)	0.03 (0.02)	0.03 (0.02)	0.06 (0.03)	0.02 (0.01)	0.02 (0.02)	0.02 (0.02)	0.04 (0.03)	0.02 (0.01)
	Linear increase	0.05 (0.02)	0.06 (0.02)	0.10 (0.04)	0.05 (0.02)	0.03 (0.01)	0.03 (0.01)	0.05 (0.02)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.03 (0.02)	0.01 (0.01)
	Linear decrease	0.05 (0.02)	0.06 (0.02)	0.10 (0.03)	0.05 (0.02)	0.03 (0.01)	0.03 (0.01)	0.05 (0.02)	0.03 (0.01)	0.01 (0.01)	0.02 (0.01)	0.03 (0.01)	0.01 (0.01)
Indices of trapper effort	Kentucky	0.06 (0.02)	0.06 (0.02)	0.10 (0.04)	0.05 (0.02)	0.03 (0.02)	0.03 (0.01)	0.05 (0.02)	0.03 (0.01)	0.02 (0.01)	0.02 (0.01)	0.04 (0.02)	0.02 (0.01)
	Michigan	0.05 (0.02)	0.06 (0.02)	0.10 (0.04)	0.05 (0.02)	0.03 (0.01)	0.03 (0.01)	0.05 (0.02)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.03 (0.02)	0.02 (0.01)
	Pelt price	0.05 (0.02)	0.06 (0.02)	0.11 (0.04)	0.05 (0.02)	0.03 (0.01)	0.03 (0.01)	0.05 (0.02)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.03 (0.02)	0.01 (0.01)
Initial abundance	1000	0.22 (0.07)	0.23 (0.07)	0.41 (0.12)	0.24 (0.11)	0.13 (0.06)	0.14 (0.06)	0.25 (0.11)	0.14 (0.08)	0.08 (0.05)	0.09 (0.05)	0.16 (0.09)	0.09 (0.05)
	2000	0.11 (0.04)	0.12 (0.04)	0.21 (0.07)	0.11 (0.05)	0.06 (0.03)	0.06 (0.03)	0.11 (0.05)	0.06 (0.03)	0.03 (0.02)	0.04 (0.02)	0.07 (0.04)	0.03 (0.02)
	3000	0.07 (0.03)	0.08 (0.03)	0.14 (0.05)	0.07 (0.03)	0.04 (0.02)	0.04 (0.02)	0.07 (0.03)	0.04 (0.02)	0.02 (0.01)	0.02 (0.01)	0.04 (0.02)	0.02 (0.01)