Sources and dynamics of international funding for waterfowl conservation in the Prairie Pothole Region of North America

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Table S1. Examples of state duck stamp programs that annually deliver funding for waterfowl habitat conservation in the Canadian portion of the Prairie Pothole Region of North America.

State	Policy on payments to Canada	Source
California	"Two dollars and twenty-five cents ($2.25) of the amount collected by the department for each state duck stamp sold shall be allocated by the Fish and Game Commission for the purposes of the North American Waterfowl Management Plan in those areas of Canada from which come substantial numbers of waterfowl migrating to, or through, California.… this program requires a maximum of 6 percent overhead charged by grantees or contractors…. The [California State Duck Stamp Program] has up to $1,135,000 allocated for projects on a Fiscal Year basis.... An additional $5 million raised from the sale of State Duck Stamps has been expended to improve waterfowl habitat in the production areas in Canada that contribute waterfowl to the wintering populations in California."	https://www.wildlife.ca.gov/Grants/Duck-Stamp
Illinois	"[50%] of funds derived from the sale of State migratory waterfowl stamps shall be turned over by the Department of Natural Resources to appropriate non-profit organizations to be used for the implementation of the North American Waterfowl Management Plan. These funds shall be used for the development of waterfowl areas within the Dominion of Canada or the United States that specifically provide waterfowl for the Mississippi Flyway."	http://www.ilga.gov/legislation/ilcs/fulltext.asp?DocName=052000050K1.29
Wisconsin	"67% of the moneys received under s. 29.191(1), Waterfowl Hunting Stamp, shall be applied to 'developing, managing, preserving, restoring, and maintaining wetland habitat and for producing waterfowl and ecologically related species of wildlife.' The remaining 33% is applied to "the development of waterfowl propagation areas within Canada which will provide waterfowl for this state and the Mississippi flyway."	https://dnr.wi.gov/topic/WildlifeHabitat/documents/wguide.pdf

Table S2. Parameter estimates for best-performing models of millions of hunters and funds (millions 2016 USD) for conserving waterfowl habitat in the Canadian portion of the Prairie Pothole Region. Response variables included years 2007-2016 unless otherwise noted. Parameters: β_0 = intercept; β_1 = year effect; β_2 = province (p) effect; β_2 = year (t) × province interaction. Abbreviations: AB = Alberta; CA = California; df = degrees of freedom; ; hunters = hunters in states sending payments to focal province; IL = Illinois; NAWCA = North American Wetland Conservation Act; SE = standard error; SK = Saskatchewan; pays = state payments to PPR provinces

Response variable	Parameter	Estimate	SE	t value	Pr(>|t|)
CN_NAWCA_t					
	β_0	216.460	213.421	1.01	0.340
	β_1	-0.100	0.106	-0.94	0.373
$pays_{t,p}$					
	β_0	-103.612	17.963	-5.77	<0.001
	β_1	0.052	0.009	5.86	<0.001
	$\beta_{2,p=Manitoba}$	116.191	25.404	4.57	<0.001
	$\beta_{2,p=Alberta}$	168.595	25.404	6.64	<0.001
	$\beta_{3,p=Manitoba}$	-0.058	0.013	-4.62	<0.001
	$\beta_{3,p=Alberta}$	-0.085	0.013	-6.69	<0.001
$ILhunters_t$					
	β_0	3.246	0.596	5.45	0.001
	β_1	-0.002	0.000	-5.39	0.001
$CAhunters_t$					
	β_0	2.402	0.673	3.57	0.007
	β_1	-0.001	0.000	-3.49	0.008
$IL\_pays\_SK_t$					
	β_0	-32.641	8.802	-3.71	0.006
	β_1	0.016	0.004	3.76	0.006
$CA\_pays\_AB_t$					
	β_0	49.753	11.298	4.40	0.002
	β_1	-0.025	0.006	-4.38	0.002
$CA\_pays\_AB\_2010\_2016_t$					
	β_0	8.552	3.263	2.62	0.047
	β_1	-0.004	0.002	-2.57	0.050

Table S3. Annual average payments (2016 USD in millions) from states in the US to provinces for waterfowl habitat conservation in the Canadian portion of the Prairie Pothole Region from 2007-2016

Paying state	Payment[a]	Proportion
To Alberta		
California	2.13	0.79
Arizona	0.27	0.10
Colorado	0.13	0.05
Nevada	0.10	0.04
Montana	0.05	0.02
Wyoming	0.03	0.01
Subtotal	*2.70*	*1.00*
To Manitoba		
Missouri	2.90	0.45
Wisconsin	1.82	0.28
Minnesota	0.84	0.13
Kentucky	0.53	0.08
Florida	0.32	0.05
Subtotal	*6.41*	*1.00*
To Saskatchewan		
Illinois	4.83	0.28
Arkansas	3.39	0.20
Louisiana	2.87	0.17
Texas	1.91	0.11
Mississippi	1.01	0.06
Tennessee	0.85	0.05
Oklahoma	0.80	0.05
Nebraska	0.66	0.04
Kansas	0.34	0.02
North Dakota	0.24	0.01
South Dakota	0.18	0.01
Iowa	0.18	0.01
Subtotal	*17.26*	*1.00*

[a] Contributions toward match for funds awarded annually for projects requesting funding through the North American Wetlands Conservation Act.

Table S4. Parameter estimates for best-performing models of funds (2016 USD) for conserving waterfowl habitat in the U.S. portion of the Prairie Pothole Region 2007-2016. Funds were in millions unless otherwise noted. Abbreviations: FDS = federal duck stamp; LWCF = Land and Water Conservation Fund; license = license-based; MBCF = Migratory Bird Conservation Fund; NAWCA = North American Wetland Conservation Act.

Model	Estimate	SE	t value	Pr(>|t|)
$USPPRfunds_{t,s}^{1/3}$ [a]				
β_0	-27.094	6.838	-3.96	<0.001
β_1	0.014	0.003	4.01	<0.001
$\beta_{2,s=LWCF}$	-3.457	9.671	-0.36	0.723
$\beta_{2,s=NAWCA}$	18.218	9.671	1.88	0.069
$\beta_{2,s=NAWCAsurplus\_match}$	17.911	9.671	1.85	0.073
$\beta_{3,s=LWCF}$	0.002	0.005	0.34	0.735
$\beta_{3,s=NAWCA}$	-0.009	0.005	-1.89	0.068
$\beta_{3,s=NAWCAsurplus\_match}$	-0.009	0.005	-1.87	0.071
$MBCF_{t,s}^{1/2}$ [a]				
β_0	-218.649	62.522	-3.50	0.001
β_1	0.110	0.031	3.55	0.001
$\beta_{2,s=Non\_license\_FDS\_sales}$	-52.050	88.420	-0.59	0.560
$\beta_{2,s=Arms}$	-395.515	88.420	-4.47	<0.001
$\beta_{2,s=Right\_of\_way}$	38.710	88.420	0.44	0.664
$\beta_{3,s=Non\_license\_FDS\_sales}$	0.025	0.044	0.58	0.568
$\beta_{3,s=Arms}$	0.197	0.044	4.49	0.000
$\beta_{3,s=Right\_of\_way}$	-0.021	0.044	-0.47	0.644
$USPPRfunds_{t,s}/USPPRfunds_{t,\bullet}$				
β_0	-82.375	63.163	-1.30	0.192
β_1	0.041	0.031	1.31	0.192
$\beta_{2,s=LWCF}$	-226.441	128.779	-1.76	0.079
$\beta_{2,s=NAWCA}$	250.506	93.716	2.67	0.008
$\beta_{2,s=NAWCAsurplus\_match}$	158.956	120.744	1.32	0.188
$\beta_{3,s=LWCF}$	0.111	0.064	1.74	0.082
$\beta_{3,s=NAWCA}$	-0.125	0.047	-2.68	0.007
$\beta_{3,s=NAWCAsurplus\_match}$	-0.080	0.060	-1.34	0.182
$MBCF_{t,s}/MBCF_{t,\bullet}$				
β_0	161.485	32.025	5.04	<0.001
β_1	-0.081	0.016	-5.07	<0.001
$\beta_{2,s=Non\_license\_FDS\_sales}$	-163.880	53.005	-3.09	0.002
$\beta_{2,s=Arms}$	-234.113	43.120	-5.43	<0.001
$\beta_{2,s=Right\_of\_way}$	-506.621	138.117	-3.67	<0.001
$\beta_{3,s=Non\_license\_FDS\_sales}$	0.081	0.026	3.07	0.002
$\beta_{3,s=Arms}$	0.117	0.021	5.46	<0.001
$\beta_{3,s=Right\_of\_way}$	0.250	0.069	3.64	<0.001
$Backcast\_MBCF_{t,\bullet}$				
β_0	-8816.398	1302.224	-6.77	<0.001
β_1	4.394	0.647	6.79	<0.001

Table S4. Continued.

Model	Estimate	SE	t value	Pr(>|t|)
$Backcast\_MBCF_{t,s}^{1/2}$ [a]				
β_0	19.012	46.140	0.41	0.683
β_1	-0.008	0.023	-0.35	0.728
$\beta_{2,s=Non\_license\_FDS\_sales}$	-113.116	65.252	-1.73	0.093
$\beta_{2,s=Arms}$	-267.582	65.252	-4.10	<0.001
$\beta_{2,s=Right\_of\_way}$	-198.950	65.252	-3.05	0.005
$\beta_{3,s=Non\_license\_FDS\_sales}$	0.056	0.032	1.72	0.095
$\beta_{3,s=Arms}$	0.134	0.032	4.12	<0.001
$\beta_{3,s=Right\_of\_way}$	0.098	0.032	3.01	0.005
$License\_FDS\_sales_t$				
β_0	-9317.019	1677.111	-5.56	0.001
β_1	4.647	0.834	5.57	0.001
$Non\_License\_FDS\_sales_t$ [a]				
β_0	-270.699	44.137	-6.13	<0.001
β_1	0.136	0.022	6.18	<0.001

[a] Thousands of USD.

Fig. S1. Conceptual model showing flows from major funding sources to waterfowl habitat conservation in the US and Canada, with special emphasis on the Prairie Pothole Region (PPR; thick bordered boxes). Gray-filled boxes indicate focal funding sources for the analysis. Dotted lines and borders represent external or minor/nested stocks and flows of funding that were not modeled in the present study. Asterisk (*) indicates payments to Canada that are relevant for a subset of states. For simplicity, funding from US federal programs to states outside of PPR are not shown. Abbreviations: approp. = appropriation, CN = Canada; contrib. = contribution, fed. = federal, govt. = government, LWCF = Land and Water Conservation Fund, MBCF = Migratory Bird Conservation fund, MBTA = migratory bird treaty act, NAWCA = North American Wetland Conservation Act, NGO = non-government organization, P-R = Pittman-Robertson.
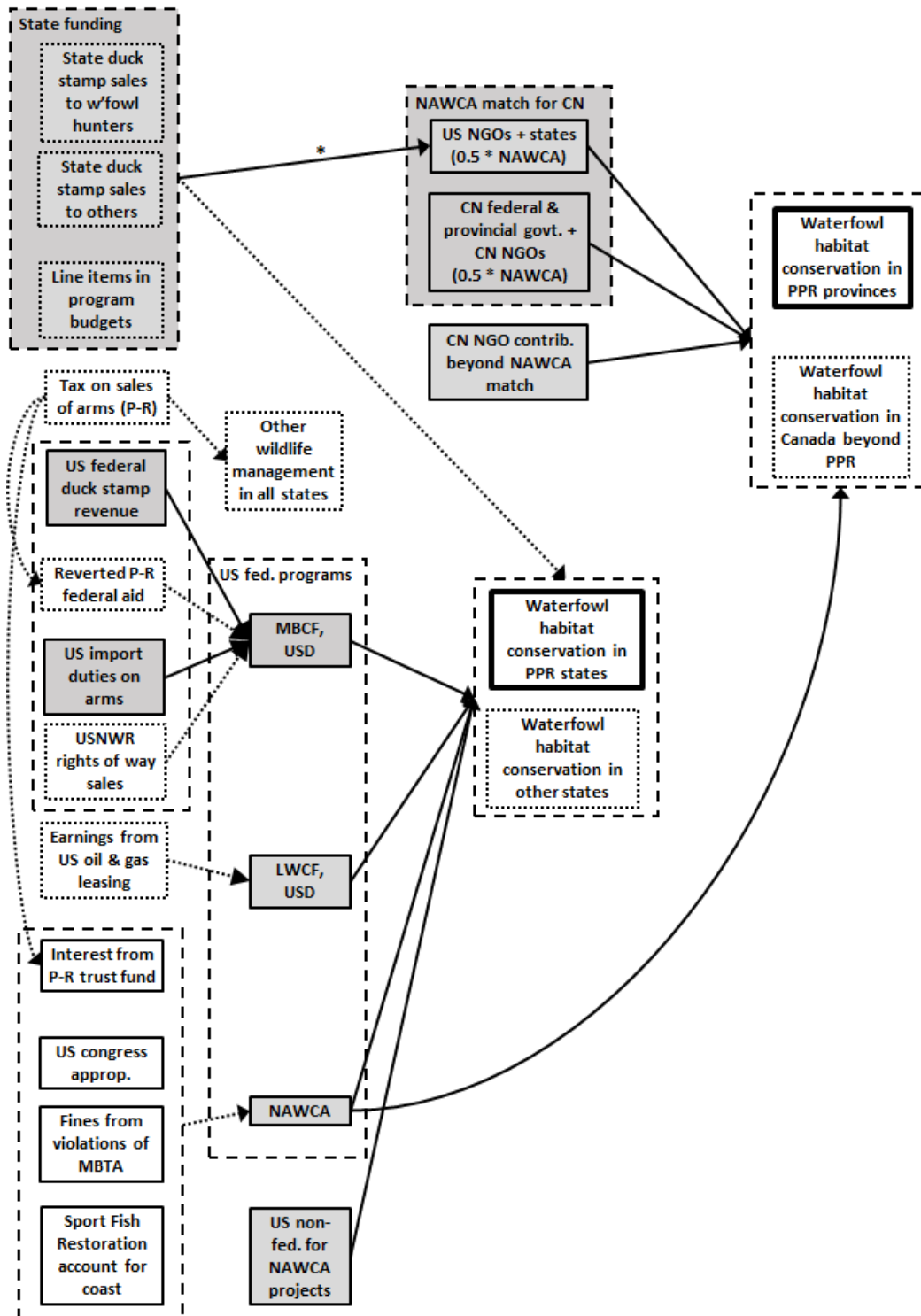
Fig. S2. Trend in annual payments from California to Alberta for waterfowl habitat conservation in the Prairie Pothole Region from 2010-2016.
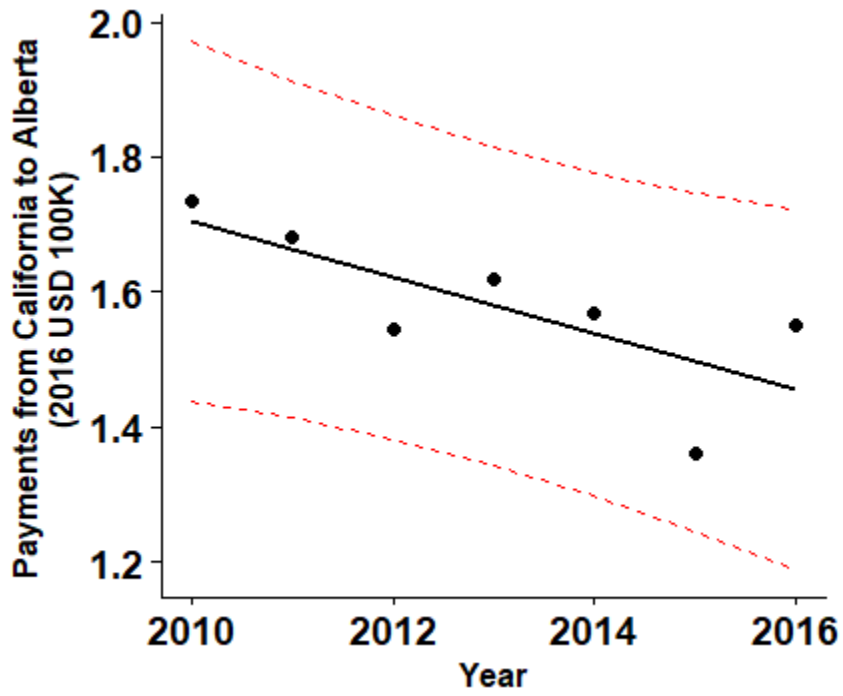
Fig. S3. Trends in proportional contributions of main funding sources for waterfowl habitat conservation in the U.S. portion of the Prairie Pothole Region from 2007 to 2016: a) North American Wetland Conservation Act (NAWCA) funds including 1:1 match; b) Matching funds for NAWCA exceeding 1:1; c) Migratory Bird Conservation Fund (MBCF); and d) Land and Water Conservation Fund (LWCF). Note the differing y-axes. Solid line is the best fit, and the dashed lines are the upper and lower 95% confidence limits.
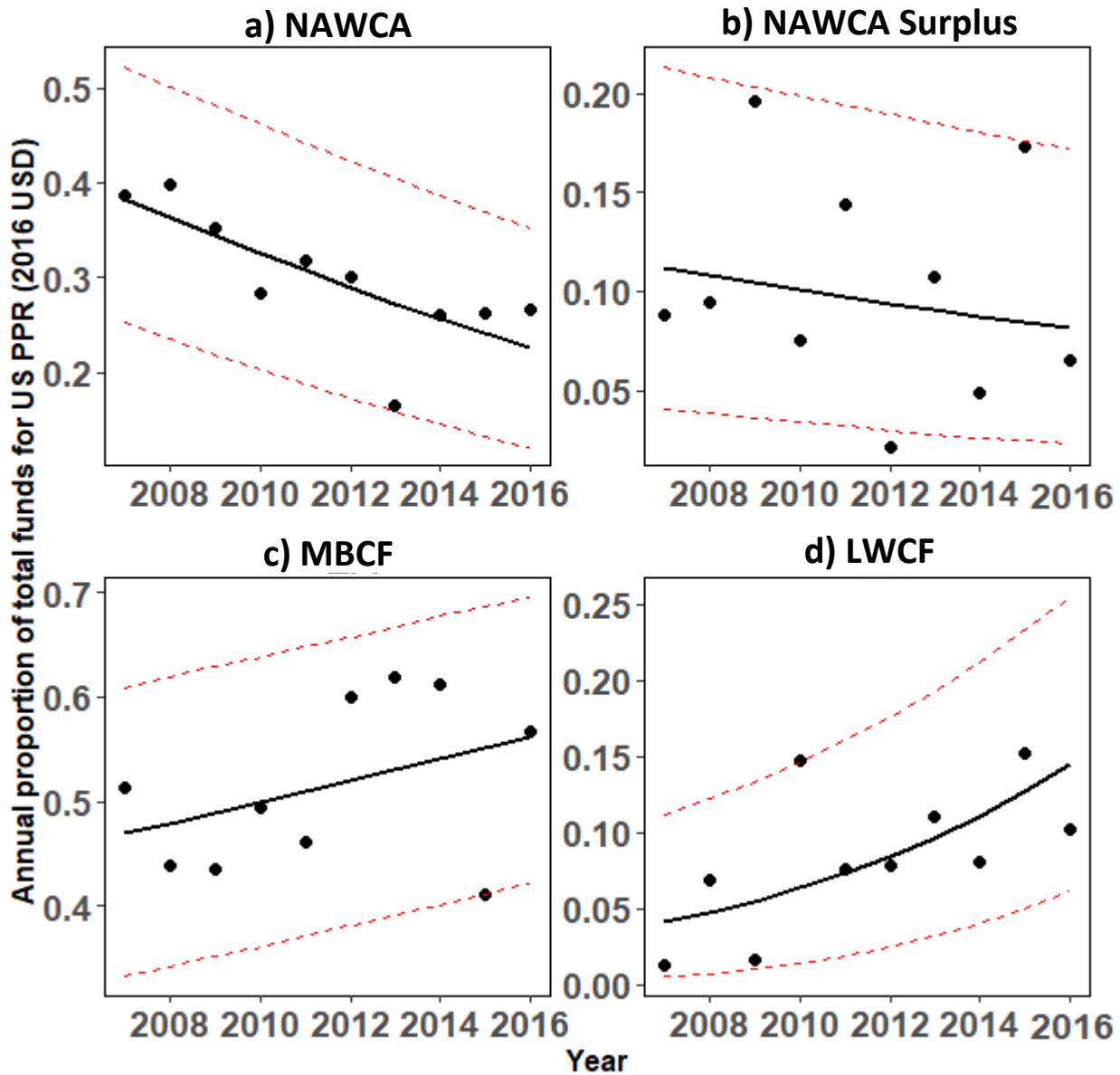
Fig. S4. Trends in proportional contributions of sources for Migratory Bird Conservation Fund for waterfowl habitat conservation in the U.S. portion of the Prairie Pothole Region from 2007 to 2016: a) duties on arms imports into the U.S.; b) sales of products from rights-of-way across national wildlife refuges; c) license-based sales of federal duck stamps (FDSs); and d) non- license-based sales of FDSs. Note the differing y-axes. Solid line is the best fit, and the dashed lines are the upper and lower 95% confidence limits.
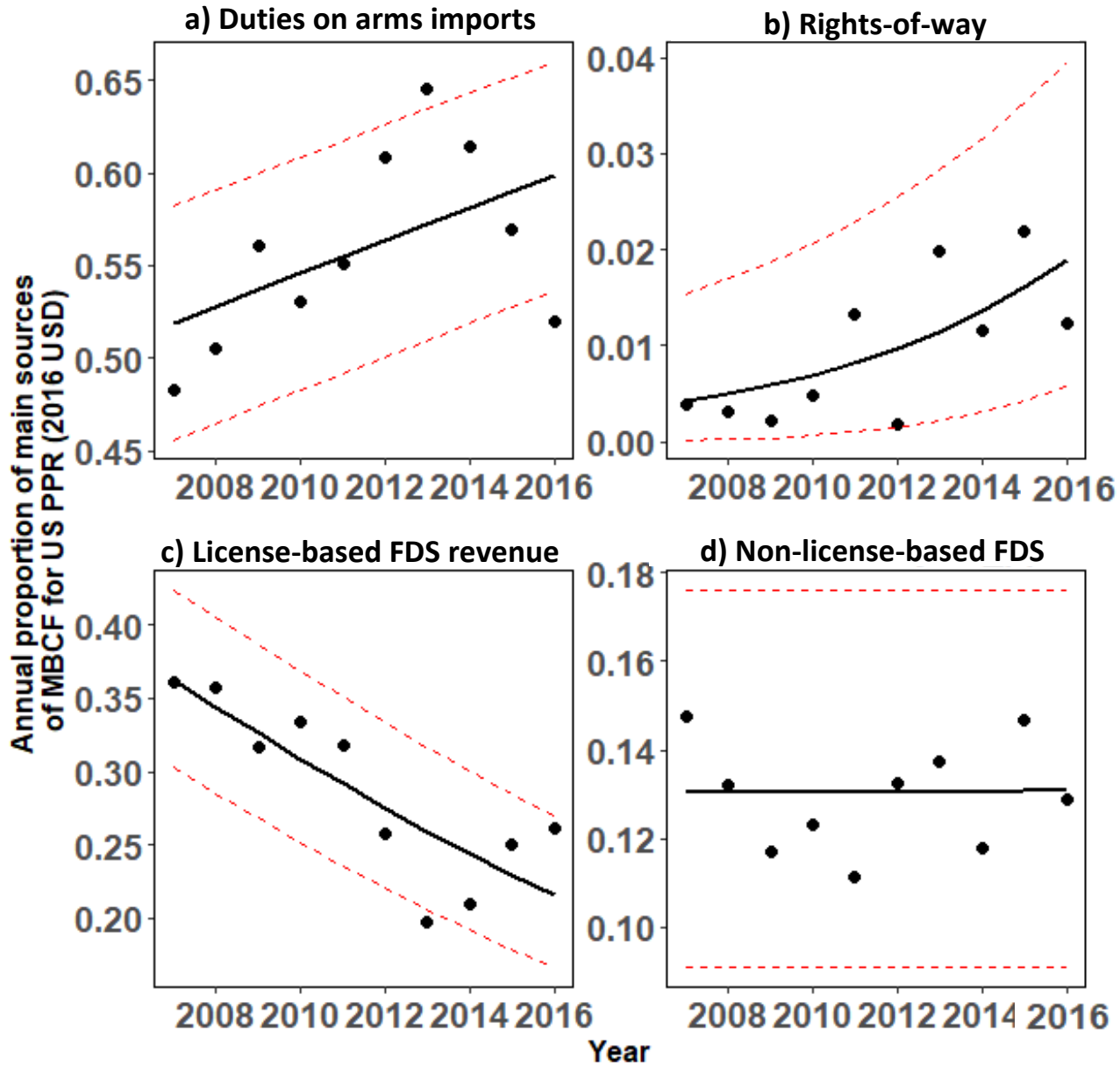
Fig. S5. Trend in the Migratory Bird Conservation Fund allocated to the U.S. portion of the Prairie Pothole Region under a backcasting scenario from 2007 to 2016. Solid line is the best fit, and the dashed lines are the upper and lower 95% confidence limits.
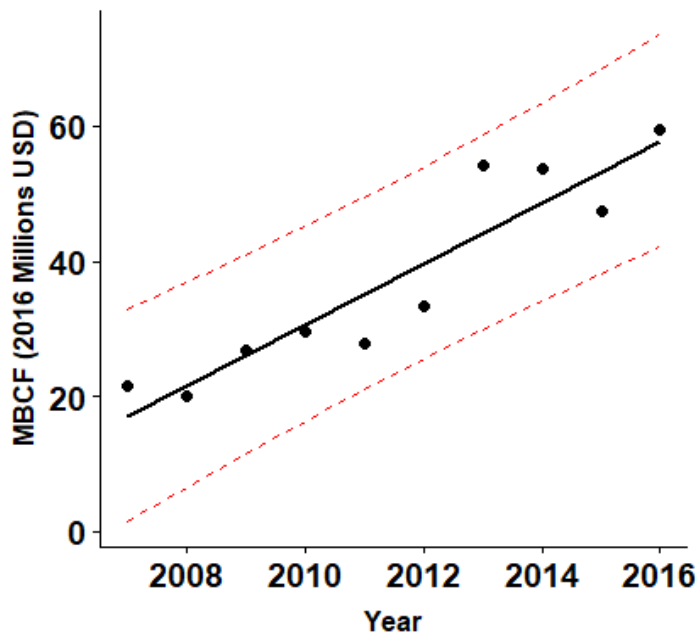
Fig. S6. Trends in sources for Migratory Bird Conservation Fund for waterfowl habitat conservation in the U.S. portion of the Prairie Pothole Region under a backcasting scenario from 2007 to 2016: a) duties on arms imports into the U.S.; b) sales of products from rights-of-way across national wildlife refuges; c) license-based sales of federal duck stamps (FDSs); and d) non- license-based sales of FDSs. Note the differing y-axes. Solid line is the best fit, and the dashed lines are the upper and lower 95% confidence limits.
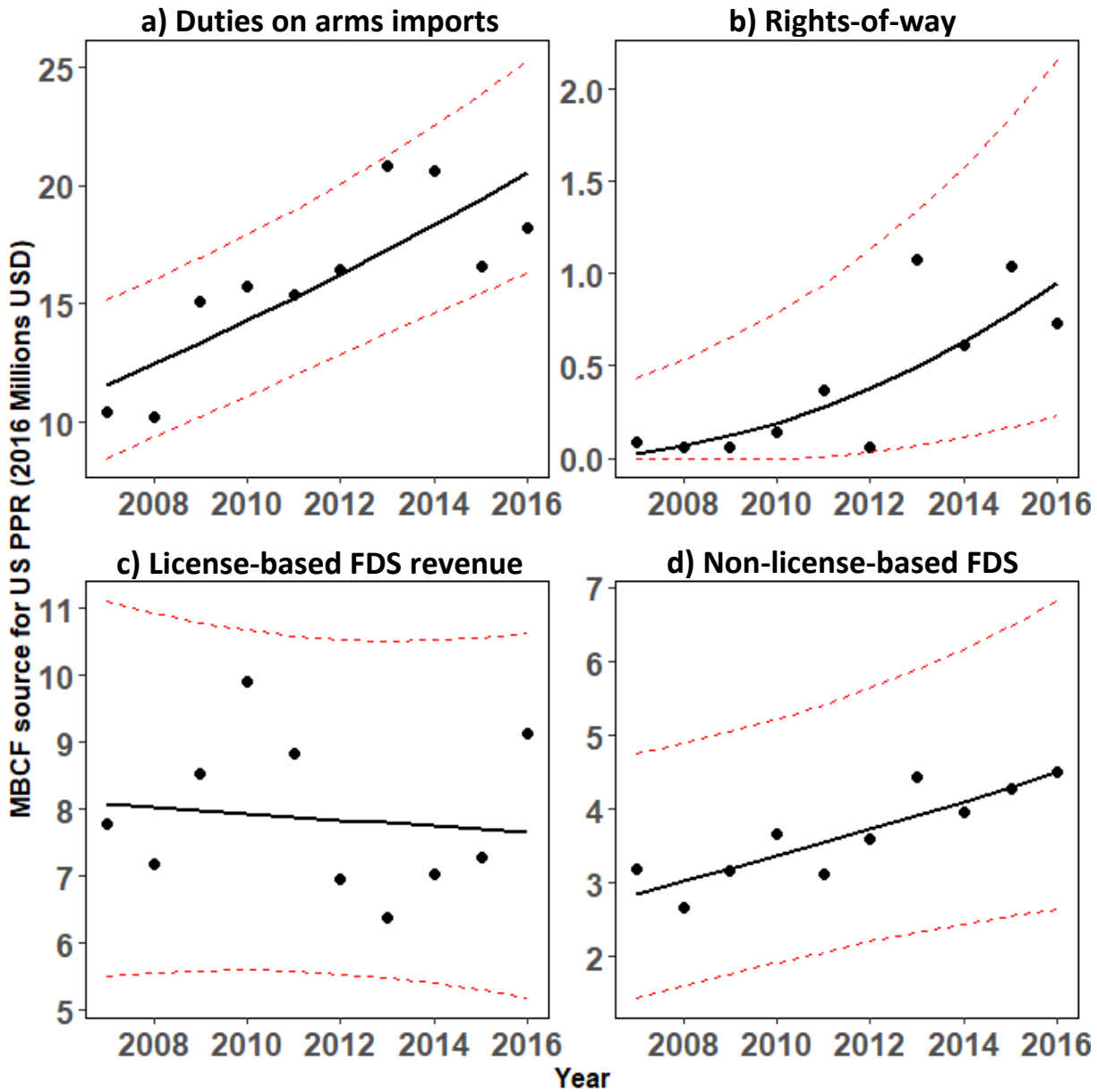
Fig. S7. Trends in estimated purchases of federal duck stamps (FDSs) in the U.S. from 1999-2016 associated with (A) hunting licenses and (B) stamp collecting and support for waterfowl conservation. License-based sales represent the estimated numbers of waterfowl hunters, and non-license-based sales represent the difference between total FDS sales and numbers of waterfowl hunters. Solid line is the best fit, and the dashed lines are the upper and lower 95% confidence limits. Note the differing scales between graphs.