

Supplemental Material for:

Dundas, S. J., R. H. von Haefen, and C. Mansfield. 2018. "Recreation Costs of Endangered Species Protection: Evidence from Cape Hatteras National Seashore." *Marine Resource Economics* 33(1).

ONLINE-ONLY APPENDIX

Table A.1. Off-Road Vehicle Restriction Policy Scenarios: Alternative D

Fishing Site	Island	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Oregon Inlet (North)	Bodie	X	A	A	A	A	X
Rodanthe Fishing Pier	Hatteras	XP	XP	O	O	XP	XP
Beach Access Ramp 20	Hatteras	XP	XP	O	O	XP	XP
Beach Access Ramp 23	Hatteras	O	O	O	O	O	O
Beach Access Ramp 27	Hatteras	XP	XP	XP	XP	XP	XP
Beach Access Ramp 30	Hatteras	A	A	A	A	A	A
Beach Access Ramp 34	Hatteras	XP	XP	XP	XP	XP	XP
Avon Fishing Pier	Hatteras	XP	XP	O	O	XP	XP
Beach Access Ramp 38	Hatteras	O	O	O	O	O	O
Buxton Beach	Hatteras	XP	XP	O	O	XP	XP
Cape Point	Hatteras	X	A	A	A	A	X
Beach Access Ramp 49	Hatteras	O	O	O	O	O	O
Frisco Pier	Hatteras	XP	XP	O	O	XP	XP
Hatteras Inlet	Hatteras	X	A	A	A	A	X
Hatteras Inlet Beach	Ocracoke	X	A	A	A	A	X
Ocracoke Inlet & Beach	Ocracoke	X	A	A	A	A	X

Note: O = Open, no impact. X = Closed: ORV restrictions and need ORV for access. XP = ORV restrictions but pedestrian access. A = Adaptive management with closures – could be O or X.

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Table A.2. Welfare Costs Associated with Policy Scenarios 2009–2010

(Thousands of 2010\$)	Upper Bound				Lower Bound			
<i>Alternative F</i>	Estimate	95% Confidence Interval		t-Stat	Estimate	95% Confidence Interval		t-Stat
Aggregate	-\$1,911	-\$1,607	-\$2,282	-10.2	-\$350	-\$289	-\$424	-8.96
Year-Specific								
2009	-\$2,044	-\$1,840	-\$2,327	-16.8	-\$380	-\$344	-\$432	-17.0
2010	-\$1,778	-\$1,569	-\$2,068	-14.0	-\$319	-\$282	-\$372	-14.1
<i>Alternative D</i>								
Aggregate	-\$2,457	-\$2,056	-\$2,948	-9.85	-\$619	-\$505	-\$759	-8.22
Year-Specific								
2009	-\$2,639	-\$2,378	-\$3,002	-16.8	-\$681	-\$615	-\$773	-17.0
2010	-\$2,274	-\$2,008	-\$2,645	-14.0	-\$558	-\$493	-\$649	-14.1
<i>Close all CAHA Sites</i>								
Aggregate	-\$3,291	-\$2,772	-\$3,930	-10.3				
Year-Specific								
2009	-\$3,516	-\$3,165	-\$4,004	-16.7				
2010	-\$3,066	-\$2,703	-\$3,571	-13.9				

Note: All numbers are in thousands of 2010 US dollars. Models are calibrated to impose a dissimilarity coefficient (0.46) and an imputed value of a trip (\$30) supported by recent meta-analyses (Johnston and Moeltner 2014; Moeltner and Rosenberger 2014). Simulation estimates are WTP of residents of coastal counties covered by the MRIP survey. The upper bound of welfare is estimated given the most restrictive possibilities on ORV rules. The lower bound of welfare is estimated given the most relaxed possibilities on ORV rules. *Alternative F* was implemented by NPS and two stricter scenarios, *Alternative D* and *Close all CAHA Sites*, are shown for comparison purposes. Confidence intervals are estimated using a parametric bootstrap (Krinsky and Robb 1986) with 500 draws.

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Table A.3. Demand Responses for Policy Scenarios 2009–2010

(Thousands of Trips)	<i>Upper Bound</i>				<i>Lower Bound</i>			
	Estimate	95% Confidence Interval		t-Stat	Estimate	95% Confidence Interval		t-Stat
<i>Alternative F</i>								
Affected Trips	137	110	164	8.65	137	110	164	8.65
Lost	-67	-54	-80	-8.75	-12	-9.8	-15	-7.75
Substitute	69	56	84	8.56	12	9.3	14	7.63
Diminished	-	-	-	-	113	91	135	8.88
<i>Alternative D</i>								
Affected Trips	173	138	108	8.41	173	138	108	8.41
Lost	-86	-69	-104	-8.47	-22	-17	-27	-7.18
Substitute	87	69	105	8.34	20	16	25	7.10
Diminished	-	-	-	-	131	106	157	8.88
<i>Close all CAHA Sites</i>								
Affected Trips	225	181	270	8.74				
Lost	-119	-94	-139	9.08				
Substitute	110	89	132	8.69				
Diminished	-	-	-	-				

Note: All numbers are in thousands of trips. Models are calibrated to impose a dissimilarity coefficient (0.46) and an imputed value of a trip (\$30) supported by recent meta-analyses (Johnston and Moeltner 2014; Moeltner and Rosenberger 2014). The upper bound is estimated given the most restrictive possibilities on ORV rules. The lower bound is estimated given the most relaxed possibilities on ORV rules. *Alternative F* was implemented by NPS and two stricter scenarios, *Alternative D* and *Close all CAHA Sites*, are shown for comparison purposes. Confidence intervals are estimated using a parametric bootstrap (Krinsky and Robb 1986) with 500 draws.

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Table A.4. Welfare Costs Associated with Policy Scenarios (2005–2007 Uncalibrated)

(Thousands of 2010\$)	<i>Upper Bound</i>				<i>Lower Bound</i>			
	Estimate	95% Confidence Interval	t-Stat		Estimate	95% Confidence Interval	t-Stat	
<i>Alternative F</i>								
Aggregate	-\$2,163	-\$1,398	-\$3,087	-3.95	-\$406	-\$239	-\$594	-3.38
Year-Specific								
2005	-\$1,501	-\$1,354	-\$1,756	-15.0	-\$255	-\$230	-\$298	-15.4
2006	-\$2,768	-\$2,522	-\$3,186	-16.6	-\$535	-\$490	-\$614	-17.5
2007	-\$2,219	-\$2,004	-\$2,546	-15.6	-\$426	-\$385	-\$489	-15.7
<i>Alternative D</i>								
Aggregate	-\$2,920	-\$1,860	-\$4,173	-3.86	-\$706	-\$426	-\$1,012	-3.56
Year-Specific								
2005	-\$1,995	-\$1,801	-\$2,336	-15.0	-\$454	-\$409	-\$530	-15.4
2006	-\$3,742	-\$3,416	-\$4,312	-16.6	-\$911	-\$836	-\$1,046	-17.5
2007	-\$3,007	-\$2,713	-\$3,456	-15.6	-\$750	-\$678	-\$861	-15.6
<i>Close all CAHA Sites</i>								
Aggregate	-\$3,927	-\$2,450	-\$5,680	-3.70				
Year-Specific								
2005	-\$2,629	-\$2,371	-\$3,083	-14.9				
2006	-\$5,089	-\$4,644	-\$5,861	-16.5				
2007	-\$4,063	-\$3,663	-\$4,680	-15.4				

Note: All numbers are in thousands of 2010 US dollars. Models allow an uncalibrated dissimilarity coefficient (0.04) and an imputed value of a trip (\$342). Simulation estimates are for WTP for residents of coastal counties covered by the MRIP survey. The upper bound of welfare is estimated given the most restrictive possibilities on ORV rules. The lower bound of welfare is estimated given the most relaxed possibilities on ORV rules. *Alternative F* was implemented by NPS and two stricter scenarios, *Alternative D* and *Close all CAHA Sites*, are shown for comparison purposes. Confidence intervals are estimated using a parametric bootstrap (Krinsky and Robb 1986) with 500 draws.

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Table A.5. Demand Responses for Policy Scenarios (2005–2007 Uncalibrated)

(Thousands of Trips)	<i>Upper Bound</i>				<i>Lower Bound</i>			
	Estimate	95% Confidence Interval	t-Stat	Estimate	95% Confidence Interval	t-Stat		
<i>Alternative F</i>								
Affected Trips	143	92	195	4.26	143	92	195	4.26
Lost	-5.7	0.5	-15	-1.44	-1.1	0.09	-2.9	-1.39
Substitute	138	87	188	4.25	24	14	34	3.66
Diminished	-	-	-	-	118	77	160	4.41
<i>Alternative D</i>								
Affected Trips	187	119	255	4.21	187	119	255	4.21
Lost	-7.6	0.7	-20	-1.44	-1.8	0.2	-5.0	-1.41
Substitute	179	113	244	4.21	40	24	54	3.95
Diminished	-	-	-	-	145	94	197	4.29
<i>Close all CAHA Sites</i>								
Affected Trips	239	151	327	4.12				
Lost	-10	0.9	-27	-1.39				
Substitute	229	143	313	4.12				
Diminished	-	-	-	-				

Note: All numbers are in thousands of trips. Models allow an uncalibrated dissimilarity coefficient (0.04) and an imputed value of a trip (\$342). The upper bound is estimated given the most restrictive possibilities on ORV rules. The lower bound is estimated given the most relaxed possibilities on ORV rules. *Alternative F* was implemented by NPS and two stricter scenarios, *Alternative D* and *Close all CAHA Sites*, are shown for comparison purposes. Confidence intervals are estimated using a parametric bootstrap (Krinsky and Robb 1986) with 500 draws.

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Table A.6. Welfare Costs Associated with Policy Scenarios (2005–2007 Site Choice Only)

(Thousands of 2010\$)	<i>Upper Bound</i>				<i>Lower Bound</i>			
<i>Alternative F</i>	Estimate	95% Confidence Interval		t-Stat	Estimate	95% Confidence Interval		t-Stat
Aggregate	-\$2,071	-\$1,442	-\$2,781	-4.96	-\$440	-\$322	-\$587	-5.55
Year-Specific								
2005	-\$1,548	-\$1,399	-\$1,806	-15.1	-\$347	-\$311	-\$412	-13.8
2006	-\$2,488	-\$2,284	-\$2,848	-16.7	-\$524	-\$480	-\$602	-16.5
2007	-\$2,177	-\$2,012	-\$2,474	-17.5	-\$450	-\$408	-\$525	-15.0
<i>Alternative D</i>								
Aggregate	-\$2,820	-\$2,067	-\$3,726	-5.64	-\$730	-\$553	-\$983	-5.73
Year-Specific								
2005	-\$2,216	-\$1,998	-\$2,600	-14.8	-\$597	-\$534	-\$707	-13.7
2006	-\$3,334	-\$3,072	-\$3,811	-16.9	-\$874	-\$796	-\$1,012	-15.6
2007	-\$2,912	-\$2,670	-\$3,314	-17.4	-\$721	-\$638	-\$876	-11.9
<i>Close all CAHA Sites</i>								
Aggregate	-\$3,622	-\$2,561	-\$4,840	-5.12				
Year-Specific								
2005	-\$2,747	-\$2,476	-\$3,226	-14.8				
2006	-\$4,338	-\$4,001	-\$4,953	-16.8				
2007	-\$3,782	-\$3,471	-\$4,311	-17.5				

Note: This alternative model specification where each individual's choice set consists of sites as opposed to site/wave pair. All numbers are in thousands of 2010 US dollars. Models are calibrated to impose a dissimilarity coefficient (0.46) and an imputed value of a trip (\$30) supported by recent meta-analyses (Johnston and Moeltner 2014; Moeltner and Rosenberger 2014). Simulation estimates are for WTP for residents of coastal counties covered by the MRIP survey. The upper bound of welfare is estimated given the most restrictive possibilities on ORV rules. The lower bound of welfare is estimated given the most relaxed possibilities on ORV rules. *Alternative F* was implemented by NPS and two stricter scenarios, *Alternative D* and *Close all CAHA Sites*, are shown for comparison purposes. Confidence intervals are estimated using a parametric bootstrap (Krinsky and Robb 1986) with 500 draws.

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Table A.7. Demand Responses for Policy Scenarios (2005–2007 Site Choice Only)

(Thousands of Trips)	<i>Upper Bound</i>				<i>Lower Bound</i>			
	Estimate	95% Confidence Interval	t-Stat	Estimate	95% Confidence Interval	t-Stat		
<i>Alternative F</i>								
Affected Trips	146	96	189	4.76	146	96	189	4.76
Lost	-69	-46	-90	-4.66	-15	-10	-19	-5.23
Substitute	77	52	100	4.85	16	11	20	5.52
Diminished	-	-	-	-	116	75	150	4.59
<i>Alternative D</i>								
Affected Trips	195	135	249	5.38	195	135	249	5.38
Lost	-93	-65	-121	-5.27	-24	-17	-32	-5.50
Substitute	101	71	129	5.48	24	17	31	5.77
Diminished	-	-	-	-	147	100	187	5.20
<i>Close all CAHA Sites</i>								
Affected Trips	244	164	314	4.98				
Lost	-130	-81	-157	-5.21				
Substitute	124	84	158	5.16				
Diminished	-	-	-	-				

Note: This alternative model specification where each individual's choice set consists of sites as opposed to site/wave pair. All numbers are in thousands of trips. Models are calibrated to impose a dissimilarity coefficient (0.46) and an imputed value of a trip (\$30) supported by recent meta-analyses (Johnston and Moeltner 2014; Moeltner and Rosenberger 2014). The upper bound is estimated given the most restrictive possibilities on ORV rules. The lower bound is estimated given the most relaxed possibilities on ORV rules. *Alternative F* was implemented by NPS and two stricter scenarios, *Alternative D* and *Close all CAHA Sites*, are shown for comparison purposes. Confidence intervals are estimated using a parametric bootstrap (Krinsky and Robb 1986) with 500 draws.