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**Supplementary material**

APPENDIX 1.

Table A1. Site (sex)-specific estimates of apparent survival and recapture rates for adult tree swallows. Estimates were obtained using Markov chain Monte Carlo simulations (n = 80,000 simulations). Also shown are 95% lower (LCI) and upper (UCI) credible intervals. Estimates for Wisconsin were obtained via model-averaging, and include unconditional standard errors.

***Nova Scotia***

<b>Year</b>	<b>Parameter</b>	<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
2001	Phi - sexes combined	0.609	0.397	0.810
2002	Phi - sexes combined	0.427	0.312	0.547
2003	Phi - sexes combined	0.394	0.268	0.523
2004	Phi - sexes combined	0.494	0.344	0.663
2005	Phi - sexes combined	0.437	0.291	0.587
2006	Phi - sexes combined	0.320	0.184	0.455
2007	Phi - sexes combined	0.300	0.162	0.440
2008	Phi - sexes combined	0.327	0.178	0.480
2009	Phi - sexes combined	0.283	0.122	0.448
2010	Phi - sexes combined	0.460	0.249	0.699
2011	Phi - sexes combined	0.449	0.274	0.640
2001	p - females	0.856	0.709	1.000
2002	p - females	0.817	0.668	0.962
2003	p - females	0.753	0.575	0.913
2004	p - females	0.697	0.478	0.888
2005	p - females	0.778	0.600	0.939
2006	p - females	0.774	0.571	0.962
2007	p - females	0.788	0.591	0.993
2008	p - females	0.740	0.485	0.940
2009	p - females	0.680	0.326	0.928
2010	p - females	0.772	0.561	0.966
2011	p - females	0.810	0.637	1.000
2001	p - males	0.732	0.522	0.986
2002	p - males	0.668	0.478	0.890
2003	p - males	0.578	0.362	0.780
2004	p - males	0.510	0.279	0.719
2005	p - males	0.612	0.392	0.845
2006	p - males	0.612	0.361	0.867
2007	p - males	0.632	0.370	0.942
2008	p - males	0.567	0.276	0.831

2009	p - males	0.503	0.151	0.758
2010	p - males	0.608	0.352	0.885
2011	p - males	0.666	0.439	0.958

### *New York*

<b>Year</b>	<b>Parameter</b>	<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
1996	Phi - sexes combined	0.569	0.463	0.679
1997	Phi - sexes combined	0.477	0.396	0.558
1998	Phi - sexes combined	0.568	0.487	0.648
1999	Phi - sexes combined	0.509	0.426	0.594
2000	Phi - sexes combined	0.451	0.369	0.536
2001	Phi - sexes combined	0.516	0.428	0.601
2002	Phi - sexes combined	0.479	0.408	0.549
2003	Phi - sexes combined	0.441	0.366	0.519
2004	Phi - sexes combined	0.449	0.369	0.533
2005	Phi - sexes combined	0.472	0.401	0.544
2006	Phi - sexes combined	0.522	0.447	0.602
2007	Phi - sexes combined	0.344	0.271	0.420
2008	Phi - sexes combined	0.387	0.312	0.464
2009	Phi - sexes combined	0.466	0.386	0.550
2010	Phi - sexes combined	0.457	0.381	0.535
2011	Phi - sexes combined	0.441	0.330	0.566

1996	<i>p</i> - females	0.840	0.700	0.963
1997	<i>p</i> - females	0.844	0.727	0.942
1998	<i>p</i> - females	0.867	0.762	0.960
1999	<i>p</i> - females	0.786	0.645	0.917
2000	<i>p</i> - females	0.813	0.672	0.944
2001	<i>p</i> - females	0.908	0.813	0.988
2002	<i>p</i> - females	0.938	0.861	0.996
2003	<i>p</i> - females	0.935	0.854	0.997
2004	<i>p</i> - females	0.903	0.782	0.995
2005	<i>p</i> - females	0.925	0.847	0.990
2006	<i>p</i> - females	0.942	0.871	0.997
2007	<i>p</i> - females	0.860	0.722	0.979
2008	<i>p</i> - females	0.913	0.805	0.996
2009	<i>p</i> - females	0.898	0.793	0.986
2010	<i>p</i> - females	0.958	0.888	1.000
2011	<i>p</i> - females	0.830	0.623	0.999

1996	<i>p</i> - males	0.805	0.584	0.985
1997	<i>p</i> - males	0.505	0.283	0.737
1998	<i>p</i> - males	0.788	0.638	0.926
1999	<i>p</i> - males	0.446	0.294	0.602
2000	<i>p</i> - males	0.506	0.314	0.699
2001	<i>p</i> - males	0.481	0.255	0.709
2002	<i>p</i> - males	0.822	0.630	0.989
2003	<i>p</i> - males	0.447	0.213	0.699
2004	<i>p</i> - males	0.289	0.113	0.474
2005	<i>p</i> - males	0.859	0.659	0.999
2006	<i>p</i> - males	0.236	0.096	0.390
2007	<i>p</i> - males	0.282	0.106	0.483
2008	<i>p</i> - males	0.528	0.282	0.788
2009	<i>p</i> - males	0.371	0.177	0.584
2010	<i>p</i> - males	0.276	0.081	0.505
2011	<i>p</i> - males	0.613	0.335	0.957

### ***Long Point, Ontario***

Sexes combined

<b>Year</b>	<b>Parameter</b>	<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
1976	Phi - females	0.465	0.360	0.574
1977	Phi - females	0.545	0.459	0.631
1978	Phi - females	0.549	0.465	0.634
1979	Phi - females	0.475	0.394	0.554
1980	Phi - females	0.499	0.416	0.581
1981	Phi - females	0.472	0.383	0.560
1982	Phi - females	0.565	0.464	0.661
1983	Phi - females	0.533	0.433	0.631
1984	Phi - females	0.526	0.436	0.616
1985	Phi - females	0.596	0.508	0.687
1986	Phi - females	0.417	0.332	0.499
1987	Phi - females	0.533	0.444	0.623
1988	Phi - females	0.478	0.397	0.559
1989	Phi - females	0.485	0.401	0.570
1990	Phi - females	0.518	0.437	0.600
1991	Phi - females	0.613	0.531	0.699
1992	Phi - females	0.590	0.506	0.672
1993	Phi - females	0.553	0.470	0.634
1994	Phi - females	0.488	0.411	0.569
1995	Phi - females	0.592	0.509	0.674

1996	Phi - females	0.552	0.472	0.635
1997	Phi - females	0.459	0.375	0.544
1998	Phi - females	0.458	0.367	0.547
1999	Phi - females	0.593	0.502	0.679
2000	Phi - females	0.580	0.495	0.661
2001	Phi - females	0.578	0.494	0.663
2002	Phi - females	0.496	0.416	0.577
2003	Phi - females	0.490	0.409	0.569
2004	Phi - females	0.573	0.493	0.656
2005	Phi - females	0.551	0.469	0.630
2006	Phi - females	0.611	0.525	0.697
2007	Phi - females	0.463	0.373	0.550
1976	Phi-males	0.519	0.408	0.629
1977	Phi-males	0.598	0.513	0.681
1978	Phi-males	0.602	0.520	0.685
1979	Phi-males	0.529	0.447	0.608
1980	Phi-males	0.554	0.471	0.634
1981	Phi-males	0.527	0.435	0.614
1982	Phi-males	0.617	0.524	0.714
1983	Phi-males	0.586	0.490	0.683
1984	Phi-males	0.580	0.492	0.670
1985	Phi-males	0.647	0.559	0.730
1986	Phi-males	0.471	0.385	0.558
1987	Phi-males	0.587	0.498	0.675
1988	Phi-males	0.532	0.451	0.614
1989	Phi-males	0.539	0.452	0.621
1990	Phi-males	0.572	0.490	0.650
1991	Phi-males	0.664	0.585	0.743
1992	Phi-males	0.641	0.565	0.723
1993	Phi-males	0.606	0.529	0.686
1994	Phi-males	0.543	0.462	0.619
1995	Phi-males	0.643	0.564	0.721
1996	Phi-males	0.605	0.526	0.684
1997	Phi-males	0.514	0.427	0.598
1998	Phi-males	0.513	0.423	0.604
1999	Phi-males	0.644	0.560	0.729
2000	Phi-males	0.632	0.553	0.711
2001	Phi-males	0.631	0.552	0.715
2002	Phi-males	0.550	0.468	0.628
2003	Phi-males	0.544	0.462	0.621

2004	Phi-males	0.625	0.547	0.704
2005	Phi-males	0.604	0.524	0.681
2006	Phi-males	0.661	0.582	0.744
2007	Phi-males	0.518	0.428	0.608
Years combined	<i>p</i> - both sexes	0.765	0.741	0.790

### *Mud Creek, Ontario*

<b>Year</b>	<b>Parameter</b>	<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
1988	Phi - sexes combined	0.468	0.362	0.578
1989	Phi - sexes combined	0.535	0.432	0.639
1990	Phi - sexes combined	0.520	0.421	0.617
1991	Phi - sexes combined	0.552	0.456	0.652
1992	Phi - sexes combined	0.612	0.512	0.710
1993	Phi - sexes combined	0.512	0.411	0.609
1994	Phi - sexes combined	0.609	0.500	0.717
1995	Phi - sexes combined	0.627	0.524	0.732
1996	Phi - sexes combined	0.451	0.352	0.554
1997	Phi - sexes combined	0.491	0.398	0.584
1998	Phi - sexes combined	0.489	0.400	0.578
1999	Phi - sexes combined	0.581	0.491	0.672
2000	Phi - sexes combined	0.629	0.538	0.721
2001	Phi - sexes combined	0.554	0.469	0.641
2002	Phi - sexes combined	0.297	0.218	0.380
2003	Phi - sexes combined	0.579	0.476	0.681
2004	Phi - sexes combined	0.633	0.532	0.734
2005	Phi - sexes combined	0.583	0.488	0.679
2006	Phi - sexes combined	0.537	0.445	0.628
2007	Phi - sexes combined	0.384	0.288	0.477
Years combined	<i>p</i> - both sexes	0.830	0.797	0.861

### *Michigan*

<b>Year</b>	<b>Parameter</b>	<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
1997	Phi - sexes combined	0.470	0.366	0.575
1998	Phi - sexes combined	0.474	0.385	0.566
1999	Phi - sexes combined	0.424	0.340	0.509
2000	Phi - sexes combined	0.553	0.468	0.642
2001	Phi - sexes combined	0.403	0.327	0.477

2002	Phi - sexes combined	0.406	0.321	0.489
2003	Phi - sexes combined	0.331	0.257	0.406
2004	Phi - sexes combined	0.425	0.342	0.511
2005	Phi - sexes combined	0.496	0.415	0.573
2006	Phi - sexes combined	0.612	0.525	0.706
Years combined	$\rho$ - both sexes	0.827	0.779	0.873

### ***Saskatchewan***

<b>Year</b>	<b>Parameter</b>	<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
1992	Phi - females	0.406	0.305	0.504
1993	Phi - females	0.456	0.345	0.567
1994	Phi - females	0.478	0.365	0.589
1995	Phi - females	0.601	0.501	0.701
1996	Phi - females	0.475	0.411	0.541
1997	Phi - females	0.513	0.449	0.580
1998	Phi - females	0.598	0.520	0.678
1999	Phi - females	0.393	0.320	0.466
2000	Phi - females	0.568	0.499	0.637
2001	Phi - females	0.544	0.472	0.618
2002	Phi - females	0.462	0.396	0.527
2003	Phi - females	0.486	0.423	0.552
2004	Phi - females	0.501	0.443	0.564
2005	Phi - females	0.524	0.463	0.585
2006	Phi - females	0.607	0.541	0.673
2007	Phi - females	0.495	0.437	0.555
2008	Phi - females	0.568	0.513	0.626
2009	Phi - females	0.571	0.520	0.624
2010	Phi - females	0.571	0.519	0.622
2011	Phi - females	0.484	0.394	0.586
1992	Phi - males	0.441	0.341	0.544
1993	Phi - males	0.492	0.381	0.605
1994	Phi - males	0.513	0.398	0.623
1995	Phi - males	0.635	0.539	0.736
1996	Phi - males	0.511	0.445	0.577
1997	Phi - males	0.548	0.482	0.613
1998	Phi - males	0.632	0.558	0.711
1999	Phi - males	0.427	0.353	0.505
2000	Phi - males	0.603	0.534	0.669

2001	Phi - males	0.579	0.509	0.652
2002	Phi - males	0.498	0.428	0.561
2003	Phi - males	0.522	0.456	0.587
2004	Phi - males	0.537	0.474	0.594
2005	Phi - males	0.560	0.500	0.621
2006	Phi - males	0.640	0.575	0.704
2007	Phi - males	0.530	0.469	0.589
2008	Phi - males	0.603	0.549	0.660
2009	Phi - males	0.606	0.556	0.659
2010	Phi - males	0.606	0.555	0.657
2011	Phi - males	0.519	0.432	0.622
1992	<i>p</i> - females	0.889	0.747	0.997
1993	<i>p</i> - females	0.517	0.358	0.687
1994	<i>p</i> - females	0.332	0.187	0.480
1995	<i>p</i> - females	0.939	0.873	0.993
1996	<i>p</i> - females	0.915	0.850	0.975
1997	<i>p</i> - females	0.826	0.745	0.903
1998	<i>p</i> - females	0.815	0.727	0.897
1999	<i>p</i> - females	0.725	0.615	0.832
2000	<i>p</i> - females	0.848	0.775	0.917
2001	<i>p</i> - females	0.766	0.673	0.856
2002	<i>p</i> - females	0.808	0.720	0.894
2003	<i>p</i> - females	0.948	0.900	0.991
2004	<i>p</i> - females	0.923	0.867	0.974
2005	<i>p</i> - females	0.906	0.847	0.960
2006	<i>p</i> - females	0.830	0.756	0.898
2007	<i>p</i> - females	0.822	0.747	0.889
2008	<i>p</i> - females	0.821	0.757	0.882
2009	<i>p</i> - females	0.897	0.850	0.941
2010	<i>p</i> - females	0.898	0.847	0.946
2011	<i>p</i> - females	0.866	0.720	0.993
1992	<i>p</i> - males	0.871	0.708	0.996
1993	<i>p</i> - males	0.474	0.315	0.649
1994	<i>p</i> - males	0.295	0.157	0.436
1995	<i>p</i> - males	0.928	0.851	0.990
1996	<i>p</i> - males	0.901	0.826	0.969
1997	<i>p</i> - males	0.799	0.711	0.887
1998	<i>p</i> - males	0.787	0.685	0.880
1999	<i>p</i> - males	0.688	0.564	0.812



2000	<i>p</i> - males	0.824	0.742	0.902
2001	<i>p</i> - males	0.734	0.637	0.830
2002	<i>p</i> - males	0.780	0.682	0.870
2003	<i>p</i> - males	0.939	0.882	0.988
2004	<i>p</i> - males	0.910	0.844	0.968
2005	<i>p</i> - males	0.890	0.823	0.950
2006	<i>p</i> - males	0.803	0.727	0.879
2007	<i>p</i> - males	0.795	0.715	0.871
2008	<i>p</i> - males	0.794	0.723	0.862
2009	<i>p</i> - males	0.879	0.824	0.931
2010	<i>p</i> - males	0.881	0.824	0.935
2011	<i>p</i> - males	0.847	0.694	0.991

### ***British Columbia***

<b>Year</b>		<b>Mean</b>	<b>95% LCI</b>	<b>95% UCI</b>
2003	Phi - females	0.366	0.286	0.448
2004	Phi - females	0.363	0.294	0.432
2005	Phi - females	0.450	0.388	0.515
2006	Phi - females	0.457	0.391	0.522
2007	Phi - females	0.433	0.374	0.496
2008	Phi - females	0.482	0.412	0.555
2009	Phi - females	0.429	0.368	0.489
2010	Phi - females	0.405	0.343	0.464
2011	Phi - females	0.373	0.265	0.489
2003	Phi - males	0.461	0.371	0.550
2004	Phi - males	0.457	0.382	0.537
2005	Phi - males	0.548	0.485	0.615
2006	Phi - males	0.555	0.492	0.624
2007	Phi - males	0.531	0.467	0.592
2008	Phi - males	0.580	0.509	0.650
2009	Phi - males	0.527	0.463	0.588
2010	Phi - males	0.502	0.437	0.568
2011	Phi - males	0.468	0.341	0.600
2003	<i>p</i> - females	0.925	0.854	0.989
2004	<i>p</i> - females	0.933	0.874	0.987
2005	<i>p</i> - females	0.919	0.863	0.968
2006	<i>p</i> - females	0.916	0.862	0.967
2007	<i>p</i> - females	0.929	0.878	0.976

2008	$p$ - females	0.874	0.795	0.942
2009	$p$ - females	0.916	0.860	0.969
2010	$p$ - females	0.943	0.890	0.993
2011	$p$ - females	0.815	0.627	0.963
2003	$p$ - males	0.867	0.755	0.971
2004	$p$ - males	0.879	0.794	0.969
2005	$p$ - males	0.855	0.777	0.933
2006	$p$ - males	0.850	0.764	0.929
2007	$p$ - males	0.873	0.800	0.943
2008	$p$ - males	0.782	0.678	0.881
2009	$p$ - males	0.849	0.765	0.929
2010	$p$ - males	0.897	0.817	0.981
2011	$p$ - males	0.700	0.445	0.916

***Wisconsin - model-averaged estimates***

<b>Year</b>	<b>Parameter</b>	<b>Model-averaged estimate</b>	<b>95% Lower confidence interval - unconditional</b>	<b>95% Upper confidence interval - unconditional</b>
1998	Phi - females	0.537	0.297	0.761
1999	Phi - females	0.650	0.448	0.810
2000	Phi - females	0.621	0.460	0.759
2001	Phi - females	0.675	0.428	0.852
2002	Phi - females	0.608	0.467	0.732
2003	Phi - females	0.602	0.448	0.738
1998	Phi - males	0.553	0.292	0.788
1999	Phi - males	0.667	0.472	0.817
2000	Phi - males	0.637	0.474	0.773
2001	Phi - males	0.691	0.458	0.855
2002	Phi - males	0.624	0.476	0.752
2003	Phi - males	0.618	0.455	0.759
Years combined	$p$ - females	0.912	0.730	0.976
Years combined	$p$ - males	0.873	0.694	0.954

Table A2. Estimates of site-specific mean apparent survival ( $SE[\beta]$ ), process variance ( $\sigma$ : square-root of process variance) and sampling variance estimated by variance components analysis in Program MARK (Appendix D in Cooch and White 2014). Estimates were derived from a global model incorporating time and sex-specific variation in apparent survival and recapture rates, and excluded inestimable parameters. Also shown are number of estimable parameters ( $k$ ) and proportion of temporal variance attributable to sampling error.

Site	Mean apparent survival	$SE(\beta)$	Process variance ( $\sigma$ )	Sampling variance	$k$	Proportion of variance due to sampling
Nova Scotia	0.411	0.049	0.035 (0.186)	0.013	20	0.277
New York	0.459	0.024	0.011 (0.107)	0.006	30	0.360
Long Point, ON	0.553	0.013	0.0059 (0.077)	0.005	62	0.437
Mud Creek, ON	0.535	0.019	0.008 (0.090)	0.006	38	0.410
Michigan	0.426	0.019	0.001 (0.033)	0.006	18	0.840
Saskatchewan	0.531	0.016	0.008 (0.088)	0.002	38	0.237
British Columbia	0.468	0.025	0.007 (0.086)	0.002	16	0.242