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Supplementary material

Appendix 1

Table A1. Sampling locations, regional groups, and sample sizes for all winter, migration and breeding sites. "*n* adult or unknown age by plumage" are individuals aged as adult by plumage in the field or individuals which we were unable to age. "*n* adult by isotope data" are individuals classified in the adult group in *Age class identification*.

Season	Region	Site	Latitude (degrees)	Longitude (degrees)	*n* adult or unknown age by plumage	*n* adults by isotope data	Year sampled
winter	Caribbean	Cuba, Rio Maximo	21.73	-77.52	3	2	2008-09
		Cuba, Tunas de Zaza	21.64	-79.54	3	0	2008-09
		Puerto Rico	17.97	-67.20	6	5	2008-09
		Yucatán	21.60	-87.98	10	10	2008-09
	Central Baja	Guerrero Negro	27.58	-114.10	10	9	2008-09
	Eastern North	Florida	30.10	-84.15	2	1	2008-09
	America	South Carolina	33.18	-79.22	4	4	2008-09
		Texas	26.32	-97.35	5	3	2008-09
	Gulf of California	Alto Golfo	32.00	-114.83	10	10	2008-09
		Bahía Santa María	24.94	-107.91	10	9	2008-09
		Caimanero	22.99	-106.04	10	10	2008-09

		Ensenada Pabellones	24.45	-107.47	7	7	2008-09
	South America	Ecuador	-2.20	-80.73	3	3	2008-09
		Panamá	9.00	-79.45	10	10	2008-09
	Southern Baja	La Paz	24.10	-110.37	10	10	2008-09
	Western North	Humboldt	40.83	-124.08	6	6	2008-09
	America	Punta Banda	31.75	-116.63	1	1	2008-09
		San Francisco	38.10	-122.40	10	9	2008-09
southward		Fraser Delta	49.05	-123.15	57	51	2008, 2009
migration		Kansas	38.19	-98.52	35	30	2007
northward		Fraser Delta	49.05	-123.15	58	56	2008, 2009
migration							
breeding	North Seward	Barrow	71.25	-156.47	21	14	2009, 2010
		Cape Krusenstern	67.10	-163.50	10	9	2010
		Espenberg	66.57	-163.96	16	16	2008
		Kotzebue	66.80	-162.57	14	9	2009
	Wales	Wales	65.61	-168.10	27	26	2008, 2009
	Nome	Nome	64.45	-164.94	95	89	2008, 2009, 2010
	Russia	Chukotka	67.04	-174.30	41	38	2009
	Y-K Delta	Yukon-Kuskokwim Delta	61.36	-165.13	42	42	2009

Table A2. Adult mean and standard deviation of each stable isotope for winter sampling sites grouped regionally, individual winter sampling sites, and for the second year of sampling from three sites in Mexico. Numbers in parentheses represent sample sizes in the first and (if applicable) second sampling year.

		Region mean ± sd (‰)			Site mean ± sd (‰)			Second year site mean ± sd (‰)		
Region	Site	δD	$\delta^{13}C$	$\delta^{15}N$	δD	$\delta^{13}C$	$\delta^{15}N$	δD	$\delta^{13}C$	$\delta^{15}N$
Caribbean (17)	Cuba (2)	-30 ± 16	-14.1 ± 3.4	10.9 ± 2.0	-42 ± 31	-17.0 ± 4.2	11.4 ± 2.7	-	-	-
	Puerto Rico (5)				-21 ± 14	-12.2 ± 3.6	10.6 ± 1.8	-	-	-
	Yucatán (10)				-32 ± 13	-14.5 ± 3.0	10.9 ± 2.2	-	-	-
Central Baja (9)	Guerrero Negro (9,10)	-25 ± 10	-10.5 ± 1.9	8.9 ± 0.9	-25 ± 10	-10.5 ± 1.9	8.9 ± 0.9	-10 ± 22	-11.6 ± 0.8	10.6 ± 1.5
Eastern North America (8)	Florida (1)	-46 ± 11	-12.5 ± 3.1	11.3 ± 1.5	-49	-18.1	9.6	-	-	-
	South Carolina (4)				-48 ± 7	-12.2 ± 2.6	10.9 ± 1.2	-	-	-
	Texas (3)				-42 ± 16	-10.9 ± 2.0	12.4 ± 1.5	-	-	-
Gulf of California (36)	Alto Golfo (10)	-46 ± 18	-11.2 ± 2.3	11.3 ± 2.8	-50 ± 17	-11.5 ± 2.1	11.8 ± 2.8	-	-	-
	Bahia Santa Maria (9,10)				-37 ± 18	-10.7 ± 2.6	10.6 ± 2.6	-24 ± 18	-9.9 ± 2.8	10.5 ± 3.1
	Caimanero (10)				-46 ± 14	-11.8 ± 2.7	11.2 ± 2.5	-	-	-
	Ensenada Pabellones (7,10)				-50 ± 23	-10.3 ± 1.9	11.6 ± 4.0	-32 ± 14	-10.3 ± 2.9	10.1 ± 2.9
Southern America (13)	Ecuador (3)	-39 ± 16	-13.2 ± 3.4	12.7 ± 1.3	-45 ± 3	-11.5 ± 4.3	13.6 ± 1.1	-	-	-

	Panamá (10)				-37 ± 18	-13.7 ± 3.2	12.5 ± 1.4	-	-	-
Southern Baja (10)	La Paz (10)	-52 ± 13	-10.7 ± 0.6	13.8 ± 2.3	-52 ± 13	-10.7 ± 0.6	13.8 ± 2.3	-	-	-
Western North America (16)	Humboldt (6)	-57 ± 7	-12.6 ± 1.8	16.5 ± 2.6	-51 ± 7	-11.0 ± 0.9	14.9 ± 0.2	-	-	-
	Punta Banda (1)				-61	-12.0	15.5	-	-	-
	San Francisco (9)				-61 ± 3	-13.8 ± 1.3	17.7 ± 2.9	-	-	-

Table A3. The parameter likelihood, parameter estimate, and 95% confidence interval of variables included in the candidate general linear model sets for the evaluation of the relationship between each stable isotope (δD, $\delta^{13}C$ and $\delta^{15}N$) and latitude and longitude of wintering adult western sandpiper feathers. Parameter likelihoods are the summed Akaike weights of the models in which a given parameter occurs (Table 1). Parameter estimates represent a weighted average. Confidence intervals of weighted parameter estimates account for model selection uncertainty.

Response variable	**Explanatory variable**	**Parameter likelihood**	**Parameter estimate**	**95% CI**
δD	Intercept	1.000	-41.722	4.221
	Latitude	0.850	-0.562	1.047
	$Latitude^2$	0.568	-0.017	0.153
$\delta^{13}C$	Intercept	1.000	-12.174	1.260
	Latitude	0.330	0.006	0.142
	$Latitude^2$	0.082	0.000	0.009
$\delta^{15}N$	Intercept	1.000	11.438	1.454
	Latitude	0.927	0.122	0.416
	$Latitude^2$	0.886	0.008	0.093
δD	Intercept	1.000	-43.759	3.201
	Longitude	0.855	0.287	0.721
	$Longitude^2$	0.214	0.000	0.041

$\delta^{13}C$	Intercept	1.000	-12.041	1.269
	Longitude	0.818	-0.036	0.252
	$Longitude^2$	0.230	0.000	0.018
$\delta^{15}N$	Intercept	1.000	11.299	1.461
	Longitude	0.053	-0.004	0.027
	$Longitude^2$	0.034	0.000	0.003
	$e^{-longitude}$	0.023	0.000	0.000
	$e^{-longitude/10}$	0.303	0.160	0.541
	$e^{-longitude/5}$	0.610	0.039	0.189

Table A4. The relative abundance of western sandpipers across wintering regions as a proportion of the total population. Population estimate data was gathered from local survey data, published atlases, and the literature and generated an estimated world population of 1,292,550.

Region	Overall Abundance	Male Abundance*	Female Abundance*	Source
Caribbean	0.0065	0.0029	0.0108	Sociedad Ornitológica Puertorriqueña (pers. comm.)
Central Baja	0.1389	0.1627	0.1103	Morrison and Ross (2009)
Eastern North America	0.1590	0.1448	0.1760	Morrison et al. (2001)
Gulf of California	0.3787	0.3863	0.3695	Morrison and Ross (2009)
Southern America	0.1700	0.0858	0.2708	Spaans (1979), Morrison and Ross (1989), Morrison et al. (1998)
Southern Baja	0.0043	0.0057	0.0027	Fernández et al. (1998)
Western North America	0.1427	0.2118	0.0599	Page et al. (1999)

* Sex ratio data used to determine male and female abundance was obtained from this study and Nebel et al. (2002)

Appendix 2

Age class identification

In order to identify "true" adults and remove "cryptic", young birds from all datasets, we first assigned all individuals in the winter dataset to two possible regions of origin, Arctic or non-Arctic. The parameters (mean, variance-covariance) of the Arctic multivariate (δD, $\delta^{13}C$, $\delta^{15}N$) probability density function were defined by known young individuals: local juveniles from Arctic breeding areas, southward migrants in juvenile plumage (δD only), and wintering birds in juvenile plumage. The parameters of the non-Arctic probability density function were defined by all winter birds. For each individual in the winter dataset, we determined its probability of originating from either the Arctic or non-Arctic region using a probability density function with an exclusion criterion—that is, the individual being tested did not contribute to determining the parameters of the density function. If an individual had a probability greater than 0.50 of originating from the Arctic region, we classified it as a young bird, and if it had a probability of less than 0.50, we classified the individual as an adult. It proved difficult to determine probable age using probability assignment when one isotope provided information that was incongruent with the others (e.g. a more negative δD value coupled with more positive $\delta^{13}C$ and $\delta^{15}N$ values). We therefore also considered where an individual's isotope values fell in relation to the 95% confidence intervals of the adult age group, since we were interested in classifying the winter origins of adult sandpipers. An observation falling outside of the 95% confidence ellipse around the adult group for any bivariate isotope relationship (δD vs $\delta^{13}C$, δD vs $\delta^{15}N$, $\delta^{15}N$ vs $\delta^{13}C$) was considered to be an outlier and was removed from the dataset.

To distinguish adult from young birds in the migration and breeding datasets, we defined the parameters of the Arctic region using both young birds identified by plumage as well as birds

from the winter dataset identified as young; we defined the parameters of the non-Arctic region using birds classified as adult in the winter dataset.

Out of 120 birds in the winter dataset, 111 were classified as adult while 9 were classified as young. All 9 birds classified as young had probabilities greater than 75% of originating from the Arctic region. 110 birds classified as adult had probabilities greater than 95% of originating from the non-Arctic region. One bird classified as adult with a probability of 59% of originating from the non-Arctic region had δD (-85 ‰) and $\delta^{13}C$ (-25 ‰) values more similar to young birds, while another bird classified as adult had a δD value of -107 ‰ (more similar to young birds). These were both outliers of the adult group, so they were removed. Out of 266 birds in the breeding dataset, 243 were classified with 100% probability as belonging to the non-Arctic (adult) region. The remaining 23 were classified as young with probabilities greater than 99% of originating from the Arctic region. Out of 150 birds in the migrant dataset, 139 were classified with 100% probability as belonging to the non-Arctic (adult) region, while 11 were classified with 100% probability as belonging to the Arctic (young) region. Two individuals classified as adult had δD values of -103 ‰ and 12 ‰. These were both outliers of the adult group so we removed them. Overall, young birds had more negative δD, $\delta^{13}C$ and $\delta^{15}N$ values compared to adults with δD values ranging from -110 to -54 ‰, $\delta^{13}C$ values ranging from -29 to -20 ‰, and $\delta^{15}N$ values ranging from 3 to 11 ‰. These values were consistent with having grown feathers on terrestrial Arctic breeding grounds. In contrast, birds identified as adult had more positive stable isotope values consistent with having grown feathers at more southern latitudes.

Estimating winter relative abundance

Previous studies incorporating relative abundance in probability assignment tests (Royle and Rubenstein 2004, Norris et al. 2006) used standardized datasets on avian distribution patterns such as the North American Breeding Bird Survey (Sauer et al. 2011). When such data are unavailable, the number of individuals sampled from each potential region of origin can be used (Wunder et al. 2005). Using the sample size approach must ensure that capture effort across regions is even. As it was difficult to ensure equal capture effort across regions in our study, we gathered data on western sandpiper abundance from local survey data, published atlases, and the literature for use in estimating relative abundance (Spaans 1979, Morrison and Ross 1989, 2009, Fernández et al. 1998, Morrison et al. 1998, 2001, Page et al. 1999, Sociedad Ornitológica Puertorriqueña pers. comm., Supplementary material Appendix 1, Table A3). Because males and females exhibit latitudinal segregation on the wintering grounds, we estimated the relative abundance of males and females in each winter region separately using the proportion of each sex captured in this study and in a study conducted by Nebel et al. (2002). Nebel et al.'s (2002) study compiled up to 25 years of sex ratio capture data from 12 wintering areas and represents a comprehensive view of sex segregation across the wintering range of the western sandpiper. Because the same sites were not necessarily sampled in both studies, we adopted the following approach to best represent the regional distribution of the sexes for our analysis: we calculated the proportion of females and males captured in each winter region in our study and averaged that with the proportion of females and males reported for the same regions in Nebel et al. (2002). If no sex ratio was reported in Nebel et al. (2002) for a region sampled in our study, we used only the sex ratio from our study. We then multiplied the proportion of each sex in a region by the total number of birds in that

region based on population estimates to obtain a relative abundance estimate for females and males.

Appendix 3

Table A5. The distribution of assignments for winter adults to each region of winter origin out of 10,000 simulations.

Region assigned								
WNA	SB	CB	GC	SA	ENA	CARIB	Site of origin	Region of origin
0	0	261	0	0	0	9739	Cuba	CARIB
0	0	0	0	9650	0	350	Cuba	CARIB
0	0	0	6	1353	0	8641	Puerto Rico	CARIB
0	0	7388	26	157	0	2429	Puerto Rico	CARIB
0	0	8956	1036	3	0	5	Puerto Rico	CARIB
0	183	0	331	561	8925	0	Puerto Rico	CARIB
0	0	0	0	0	0	10000	Puerto Rico	CARIB
0	0	0	0	0	337	9663	Yucatan	CARIB
0	0	0	0	0	354	9646	Yucatan	CARIB
0	0	0	0	9833	62	105	Yucatan	CARIB
0	0	0	3	1587	0	8410	Yucatan	CARIB
5	0	64	9208	0	723	0	Yucatan	CARIB
0	467	0	43	354	9136	0	Yucatan	CARIB
0	0	0	0	0	5941	4059	Yucatan	CARIB
0	0	0	6	8951	0	1043	Yucatan	CARIB
0	0	0	1	534	0	9465	Yucatan	CARIB
0	0	0	0	0	85	9915	Yucatan	CARIB
0	0	8984	1016	0	0	0	Guerrero Negro	CB
0	0	9929	65	0	0	6	Guerrero Negro	CB
0	0	8638	6	0	0	1356	Guerrero Negro	CB

0	1	8840	1139	0	20	0	Guerrero Negro	CB
0	0	9234	748	0	17	1	Guerrero Negro	CB
0	0	9736	12	0	1	251	Guerrero Negro	CB
0	0	7035	679	0	0	2286	Guerrero Negro	CB
0	0	9306	7	8	0	679	Guerrero Negro	CB
0	0	9463	536	0	0	1	Guerrero Negro	CB
0	0	0	0	0	8820	1180	Florida	ENA
0	0	0	0	6766	3234	0	South Carolina	ENA
627	0	0	4048	0	5325	0	South Carolina	ENA
0	0	0	5	7	9962	26	South Carolina	ENA
0	0	2975	8	0	6945	72	South Carolina	ENA
0	0	0	2	132	9742	124	Texas	ENA
1141	8859	0	0	0	0	0	Texas	ENA
0	0	0	11	9803	183	3	Texas	ENA
9932	0	0	68	0	0	0	Alto Golfo	GC
0	127	3124	1928	81	4710	30	Alto Golfo	GC
180	1972	0	3823	0	4025	0	Alto Golfo	GC
0	0	4081	4095	0	1821	3	Alto Golfo	GC
0	0	97	673	9159	0	71	Alto Golfo	GC
0	230	847	767	0	8156	0	Alto Golfo	GC
5513	0	0	4486	1	0	0	Alto Golfo	GC
0	189	533	220	131	8876	51	Alto Golfo	GC
731	86	0	613	8131	439	0	Alto Golfo	GC
0	0	1	6356	0	3643	0	Alto Golfo	GC
0	0	4306	758	2634	0	2302	Bahia Santa Maria	GC
0	105	1143	8747	0	5	0	Bahia Santa Maria	GC
3	1	0	1248	232	8516	0	Bahia Santa Maria	GC
0	0	2	0	843	8731	424	Bahia Santa Maria	GC

0	0	0	49	6184	3767	0	Bahia Santa Maria	GC
0	0	0	402	9598	0	0	Bahia Santa Maria	GC
188	7956	0	940	898	0	18	Bahia Santa Maria	GC
0	0	488	9512	0	0	0	Bahia Santa Maria	GC
0	0	9	9991	0	0	0	Bahia Santa Maria	GC
0	0	10	7283	0	2707	0	Caimanero	GC
0	0	0	6894	396	2556	154	Caimanero	GC
2249	451	0	7172	115	0	13	Caimanero	GC
55	9428	0	83	426	1	7	Caimanero	GC
0	0	307	9693	0	0	0	Caimanero	GC
0	0	198	9802	0	0	0	Caimanero	GC
0	0	0	1	55	9650	294	Caimanero	GC
0	52	3175	1548	1171	3529	525	Caimanero	GC
0	0	5317	4683	0	0	0	Caimanero	GC
88	0	0	514	9329	69	0	Caimanero	GC
1256	2563	0	6180	0	0	1	Ensenada Pabellones	GC
0	570	1611	7778	0	41	0	Ensenada Pabellones	GC
0	38	251	32	6	9635	38	Ensenada Pabellones	GC
0	0	0	10000	0	0	0	Ensenada Pabellones	GC
0	0	6754	40	507	0	2699	Ensenada Pabellones	GC
9982	12	0	6	0	0	0	Ensenada Pabellones	GC
189	0	0	5669	0	4142	0	Ensenada Pabellones	GC
3418	3342	0	101	1271	1868	0	Ecuador	SA
0	0	0	0	9220	190	590	Ecuador	SA
591	68	0	792	1029	7516	4	Ecuador	SA
0	0	0	0	5533	0	4467	Panama	SA
0	0	6475	353	3031	0	141	Panama	SA
0	0	0	5	9921	73	1	Panama	SA

0	0	0	19	4314	5664	3	Panama	SA
0	0	0	0	9986	14	0	Panama	SA
0	0	0	0	9719	0	281	Panama	SA
0	0	0	0	9736	264	0	Panama	SA
92	0	0	2799	4841	2268	0	Panama	SA
0	0	0	0	7788	0	2212	Panama	SA
0	0	0	0	9906	0	94	Panama	SA
98	9901	0	1	0	0	0	La Paz	SB
20	9861	0	55	64	0	0	La Paz	SB
0	3648	46	6305	0	1	0	La Paz	SB
902	6370	0	2610	0	118	0	La Paz	SB
1919	8080	0	1	0	0	0	La Paz	SB
1	9303	0	664	3	0	29	La Paz	SB
175	9776	0	0	0	49	0	La Paz	SB
103	9897	0	0	0	0	0	La Paz	SB
1468	5994	0	40	0	2498	0	La Paz	SB
34	9842	0	104	18	2	0	La Paz	SB
9286	56	0	383	275	0	0	Humboldt	WNA
109	9891	0	0	0	0	0	Humboldt	WNA
71	9929	0	0	0	0	0	Humboldt	WNA
107	9893	0	0	0	0	0	Humboldt	WNA
112	9861	0	6	17	4	0	Humboldt	WNA
6240	3496	0	51	213	0	0	Humboldt	WNA
9893	67	0	40	0	0	0	Punta Banda	WNA
9983	0	0	17	0	0	0	San Francisco	WNA
9997	0	0	3	0	0	0	San Francisco	WNA
9701	0	0	293	6	0	0	San Francisco	WNA
9999	0	0	1	0	0	0	San Francisco	WNA

9991	0	0	9	0	0	0	San Francisco	WNA
9974	0	0	26	0	0	0	San Francisco	WNA
9981	0	0	19	0	0	0	San Francisco	WNA
8847	0	0	1144	9	0	0	San Francisco	WNA
2	9931	0	9	0	58	0	San Francisco	WNA

Table A6. The distribution of assignments for breeding adults to each region of winter origin out of 10,000 simulations.

			Region assigned							
WNA	SB	CB	GC	SA	ENA	CARIB	Breeding site	Breeding region	Year	Sex
0	0	0	0	6598	323	3079	Barrow	Barrow	2009	F
0	0	0	9923	0	77	0	Barrow	Barrow	2009	M
0	0	6933	3063	4	0	0	Barrow	Barrow	2009	M
0	0	3981	6018	1	0	0	Barrow	Barrow	2009	M
0	0	0	264	0	9736	0	Barrow	Barrow	2010	F
9413	0	0	587	0	0	0	Barrow	Barrow	2010	F
0	0	0	2950	7050	0	0	Barrow	Barrow	2010	F
0	0	7614	2386	0	0	0	Barrow	Barrow	2010	F
0	0	25	9975	0	0	0	Barrow	Barrow	2010	F
173	215	0	9612	0	0	0	Barrow	Barrow	2010	M
0	0	3638	6362	0	0	0	Barrow	Barrow	2010	M
376	0	0	9624	0	0	0	Barrow	Barrow	2010	M
7	0	0	9993	0	0	0	Barrow	Barrow	2010	M
0	0	8198	1802	0	0	0	Barrow	Barrow	2010	M
0	0	1087	1014	7626	273	0	Cape Krusenstern	North Seward	2010	F

9865	0	0	135	0	0	0	Cape Krusenstern	North Seward	2010	F
0	0	4958	4302	158	5	577	Cape Krusenstern	North Seward	2010	F
0	0	1067	8933	0	0	0	Cape Krusenstern	North Seward	2010	M
0	0	58	9942	0	0	0	Cape Krusenstern	North Seward	2010	M
0	0	0	9529	470	1	0	Cape Krusenstern	North Seward	2010	M
0	0	4726	4696	578	0	0	Cape Krusenstern	North Seward	2010	M
0	0	44	8922	1034	0	0	Cape Krusenstern	North Seward	2010	M
0	0	0	10000	0	0	0	Cape Krusenstern	North Seward	2010	M
0	0	0	1581	1370	7049	0	Espenberg	North Seward	2008	F
0	0	0	10000	0	0	0	Espenberg	North Seward	2008	F
0	0	0	9581	419	0	0	Espenberg	North Seward	2008	F
549	0	0	9451	0	0	0	Espenberg	North Seward	2008	F
0	0	0	10000	0	0	0	Espenberg	North Seward	2008	F
0	0	0	9896	104	0	0	Espenberg	North Seward	2008	F
0	0	0	113	0	9887	0	Espenberg	North Seward	2008	F
0	0	5120	4880	0	0	0	Espenberg	North Seward	2008	M
9893	0	0	107	0	0	0	Espenberg	North Seward	2008	M
0	0	549	156	0	9295	0	Espenberg	North Seward	2008	M
2915	0	0	7085	0	0	0	Espenberg	North Seward	2008	M
9114	0	0	886	0	0	0	Espenberg	North Seward	2008	M

0	0	5685	4315	0	0	0	Espenberg	North Seward	2008	M
0	0	8364	1636	0	0	0	Espenberg	North Seward	2008	M
0	0	0	9986	0	14	0	Espenberg	North Seward	2008	M
6710	0	0	3290	0	0	0	Espenberg	North Seward	2008	M
0	0	615	9310	0	75	0	Kotzebue	North Seward	2009	F
0	0	1525	8475	0	0	0	Kotzebue	North Seward	2009	F
0	0	3401	6599	0	0	0	Kotzebue	North Seward	2009	F
0	0	0	3999	142	5859	0	Kotzebue	North Seward	2009	F
0	0	0	2729	5851	1420	0	Kotzebue	North Seward	2009	M
0	0	393	9607	0	0	0	Kotzebue	North Seward	2009	M
0	0	9503	497	0	0	0	Kotzebue	North Seward	2009	M
0	0	500	9500	0	0	0	Kotzebue	North Seward	2009	M
0	0	8005	1863	132	0	0	Kotzebue	North Seward	2009	M
9729	0	0	271	0	0	0	Nome	Nome	2008	F
0	0	0	797	9179	24	0	Nome	Nome	2008	F
0	0	0	0	2112	7888	0	Nome	Nome	2008	F
0	0	61	9939	0	0	0	Nome	Nome	2008	F
0	0	0	30	8906	1064	0	Nome	Nome	2008	F
0	0	6706	3087	207	0	0	Nome	Nome	2008	M
569	5038	0	4393	0	0	0	Nome	Nome	2008	M

9425	0	0	575	0	0	0	Nome	Nome	2008	M
0	0	0	9965	35	0	0	Nome	Nome	2008	M
0	0	8427	1563	10	0	0	Nome	Nome	2008	M
0	0	77	3	0	9920	0	Nome	Nome	2008	M
0	0	0	6377	3432	181	10	Nome	Nome	2008	M
0	0	9439	561	0	0	0	Nome	Nome	2008	M
7269	0	0	2731	0	0	0	Nome	Nome	2008	U
0	0	3431	5575	994	0	0	Nome	Nome	2008	U
0	0	7811	978	1211	0	0	Nome	Nome	2009	F
0	0	5	5	0	9990	0	Nome	Nome	2009	F
0	0	0	60	9939	1	0	Nome	Nome	2009	F
0	0	0	9691	307	2	0	Nome	Nome	2009	F
0	0	101	0	3768	6131	0	Nome	Nome	2009	F
0	0	0	0	8281	1719	0	Nome	Nome	2009	F
0	0	0	3464	6536	0	0	Nome	Nome	2009	F
0	0	7130	2870	0	0	0	Nome	Nome	2009	F
3514	0	0	6486	0	0	0	Nome	Nome	2009	F
0	0	0	98	2313	7589	0	Nome	Nome	2009	F
0	0	0	661	9337	2	0	Nome	Nome	2009	F
0	0	0	21	9963	6	10	Nome	Nome	2009	F

0	0	0	8	9992	0	0	Nome	Nome	2009	F
0	0	353	9640	0	7	0	Nome	Nome	2009	F
0	0	0	0	0	6046	3954	Nome	Nome	2009	F
0	0	426	140	0	792	8642	Nome	Nome	2009	F
0	0	0	6195	0	3805	0	Nome	Nome	2009	F
0	0	0	1863	0	8137	0	Nome	Nome	2009	F
0	0	9489	507	4	0	0	Nome	Nome	2009	M
0	0	5948	4052	0	0	0	Nome	Nome	2009	M
0	0	8	0	3858	6057	77	Nome	Nome	2009	M
0	0	2757	16	3	7224	0	Nome	Nome	2009	M
760	2	0	9238	0	0	0	Nome	Nome	2009	M
0	0	7368	2632	0	0	0	Nome	Nome	2009	M
0	0	362	9638	0	0	0	Nome	Nome	2009	M
0	0	9712	288	0	0	0	Nome	Nome	2009	M
1	0	0	9999	0	0	0	Nome	Nome	2009	M
0	0	0	0	1483	0	8517	Nome	Nome	2009	M
0	0	9007	993	0	0	0	Nome	Nome	2009	M
77	0	0	9904	19	0	0	Nome	Nome	2009	M
18	0	0	9944	38	0	0	Nome	Nome	2009	M
0	0	256	6640	3037	67	0	Nome	Nome	2009	M

0	0	3019	5422	1559	0	0	Nome	Nome	2009	M
0	0	1089	2279	0	1948	4684	Nome	Nome	2009	M
0	0	0	4	0	7707	2289	Nome	Nome	2009	M
0	0	187	9813	0	0	0	Nome	Nome	2009	M
0	0	0	701	0	7910	1389	Nome	Nome	2009	M
0	0	924	218	0	8858	0	Nome	Nome	2009	M
0	0	509	1201	0	8290	0	Nome	Nome	2009	M
0	0	0	10000	0	0	0	Nome	Nome	2010	F
0	0	0	0	9028	972	0	Nome	Nome	2010	F
1431	0	0	8409	156	4	0	Nome	Nome	2010	F
9642	0	0	358	0	0	0	Nome	Nome	2010	F
0	0	0	10000	0	0	0	Nome	Nome	2010	F
0	0	0	16	9984	0	0	Nome	Nome	2010	F
0	0	96	9904	0	0	0	Nome	Nome	2010	F
0	0	5019	1088	151	3250	492	Nome	Nome	2010	F
0	0	0	9938	0	62	0	Nome	Nome	2010	F
0	0	0	10000	0	0	0	Nome	Nome	2010	F
0	0	1300	8699	1	0	0	Nome	Nome	2010	F
0	0	0	10000	0	0	0	Nome	Nome	2010	F
7077	0	0	2923	0	0	0	Nome	Nome	2010	F

4092	23	0	5885	0	0	0	Nome	Nome	2010	F
1843	0	0	8157	0	0	0	Nome	Nome	2010	F
0	0	671	9329	0	0	0	Nome	Nome	2010	F
0	0	0	0	0	7009	2991	Nome	Nome	2010	F
0	0	465	9535	0	0	0	Nome	Nome	2010	M
0	0	5498	4502	0	0	0	Nome	Nome	2010	M
0	0	69	9931	0	0	0	Nome	Nome	2010	M
0	0	0	9997	0	3	0	Nome	Nome	2010	M
0	0	0	10000	0	0	0	Nome	Nome	2010	M
0	0	0	10000	0	0	0	Nome	Nome	2010	M
0	0	0	10000	0	0	0	Nome	Nome	2010	M
0	0	6250	3750	0	0	0	Nome	Nome	2010	M
0	0	9853	147	0	0	0	Nome	Nome	2010	M
0	0	9821	179	0	0	0	Nome	Nome	2010	M
0	0	87	7201	2712	0	0	Nome	Nome	2010	M
7378	0	0	2622	0	0	0	Nome	Nome	2010	M
0	0	9817	183	0	0	0	Nome	Nome	2010	M
0	0	0	10000	0	0	0	Nome	Nome	2010	M
0	0	0	8371	1629	0	0	Nome	Nome	2010	M
6456	0	0	3544	0	0	0	Nome	Nome	2010	M

300	0	0	9700	0	0	0	Nome	Nome	2010	U
0	0	0	4	0	2643	7353	Nome	Nome	2010	U
6485	0	0	3515	0	0	0	Russia	Russia	2009	F
0	14	0	9986	0	0	0	Russia	Russia	2009	F
0	0	0	0	26	9972	2	Russia	Russia	2009	F
0	0	7227	2761	12	0	0	Russia	Russia	2009	F
0	0	236	9764	0	0	0	Russia	Russia	2009	F
0	0	1384	3499	5117	0	0	Russia	Russia	2009	F
0	0	0	22	9957	21	0	Russia	Russia	2009	F
0	0	0	0	3533	6467	0	Russia	Russia	2009	F
0	0	0	97	3730	6173	0	Russia	Russia	2009	F
0	0	0	48	9792	94	66	Russia	Russia	2009	F
0	0	0	1	9959	40	0	Russia	Russia	2009	F
0	0	2237	7763	0	0	0	Russia	Russia	2009	F
0	0	0	469	9518	13	0	Russia	Russia	2009	F
0	0	0	17	113	9870	0	Russia	Russia	2009	F
0	0	2564	3721	0	3715	0	Russia	Russia	2009	F
8255	0	0	1745	0	0	0	Russia	Russia	2009	F
3704	0	0	6296	0	0	0	Russia	Russia	2009	F
0	0	6109	477	422	2992	0	Russia	Russia	2009	F

5681	0	0	4319	0	0	0	Russia	Russia	2009	M
0	0	6227	3515	258	0	0	Russia	Russia	2009	M
0	0	16	9984	0	0	0	Russia	Russia	2009	M
0	0	1287	8713	0	0	0	Russia	Russia	2009	M
0	0	0	7842	672	1486	0	Russia	Russia	2009	M
8091	0	0	1909	0	0	0	Russia	Russia	2009	M
9371	0	0	629	0	0	0	Russia	Russia	2009	M
9800	0	0	200	0	0	0	Russia	Russia	2009	M
0	0	4586	5408	1	5	0	Russia	Russia	2009	M
0	0	7711	101	0	2188	0	Russia	Russia	2009	M
155	0	0	9845	0	0	0	Russia	Russia	2009	M
0	0	9243	730	27	0	0	Russia	Russia	2009	M
0	0	29	9971	0	0	0	Russia	Russia	2009	M
2175	0	0	7825	0	0	0	Russia	Russia	2009	M
0	0	0	10000	0	0	0	Russia	Russia	2009	M
0	0	2706	7290	0	4	0	Russia	Russia	2009	M
0	0	8010	1990	0	0	0	Russia	Russia	2009	M
0	0	2548	7452	0	0	0	Russia	Russia	2009	U
0	0	3418	6582	0	0	0	Russia	Russia	2009	U
0	0	440	189	4295	5076	0	Russia	Russia	2009	U

6867	0	0	3089	44	0	0	Wales	Wales	2008	F
0	0	0	210	8688	1102	0	Wales	Wales	2008	F
0	0	0	4100	1218	4682	0	Wales	Wales	2008	F
0	0	4854	5146	0	0	0	Wales	Wales	2008	F
0	0	0	6845	0	3155	0	Wales	Wales	2008	F
0	0	5	9995	0	0	0	Wales	Wales	2008	M
0	0	4013	211	10	5766	0	Wales	Wales	2008	M
0	0	130	4209	0	5661	0	Wales	Wales	2008	M
0	0	0	9940	60	0	0	Wales	Wales	2008	M
0	0	0	10000	0	0	0	Wales	Wales	2008	M
0	0	0	891	0	7716	1393	Wales	Wales	2008	M
0	0	0	10000	0	0	0	Wales	Wales	2008	M
1109	0	0	8891	0	0	0	Wales	Wales	2008	M
9993	0	0	7	0	0	0	Wales	Wales	2008	M
0	0	274	9726	0	0	0	Wales	Wales	2008	M
0	0	0	10000	0	0	0	Wales	Wales	2008	M
2540	2886	0	4574	0	0	0	Wales	Wales	2008	M
0	0	1282	6971	1465	282	0	Wales	Wales	2008	U
322	0	0	9635	43	0	0	Wales	Wales	2009	F
4	0	0	2178	7818	0	0	Wales	Wales	2009	F

8975	0	0	1025	0	0	0	Wales	Wales	2009	F
0	0	441	9559	0	0	0	Wales	Wales	2009	F
0	0	8877	994	0	65	64	Wales	Wales	2009	F
0	0	7364	2636	0	0	0	Wales	Wales	2009	M
0	0	0	88	0	9912	0	Wales	Wales	2009	M
8580	0	0	1420	0	0	0	Wales	Wales	2009	M
0	0	0	3399	95	6506	0	YKD	YKD	2009	F
0	0	0	651	0	9347	2	YKD	YKD	2009	F
0	0	0	4449	0	5551	0	YKD	YKD	2009	F
0	0	22	36	9038	904	0	YKD	YKD	2009	F
0	0	0	0	0	9988	12	YKD	YKD	2009	F
0	0	1787	8099	0	114	0	YKD	YKD	2009	F
0	0	0	431	9569	0	0	YKD	YKD	2009	F
0	0	7	9883	104	6	0	YKD	YKD	2009	F
0	0	0	686	1759	7555	0	YKD	YKD	2009	F
0	0	0	0	9946	54	0	YKD	YKD	2009	F
0	0	0	12	9988	0	0	YKD	YKD	2009	F
9689	0	0	311	0	0	0	YKD	YKD	2009	F
0	0	24	21	5767	4188	0	YKD	YKD	2009	F
0	0	0	0	0	9999	1	YKD	YKD	2009	F

0	0	1756	7287	957	0	0	YKD	YKD	2009	F
0	0	706	9288	0	6	0	YKD	YKD	2009	F
0	0	1840	8153	7	0	0	YKD	YKD	2009	F
0	0	0	3	61	9936	0	YKD	YKD	2009	F
0	0	0	6288	0	3712	0	YKD	YKD	2009	F
0	0	641	9359	0	0	0	YKD	YKD	2009	M
0	0	92	9908	0	0	0	YKD	YKD	2009	M
7043	0	0	2957	0	0	0	YKD	YKD	2009	M
3564	922	0	5514	0	0	0	YKD	YKD	2009	M
0	0	4	9996	0	0	0	YKD	YKD	2009	M
0	0	9458	542	0	0	0	YKD	YKD	2009	M
0	0	2705	7295	0	0	0	YKD	YKD	2009	M
4504	0	0	5496	0	0	0	YKD	YKD	2009	M
0	0	0	10000	0	0	0	YKD	YKD	2009	M
0	0	0	9968	0	0	32	YKD	YKD	2009	M
14	0	0	9970	16	0	0	YKD	YKD	2009	M
0	0	1371	6441	2188	0	0	YKD	YKD	2009	M
0	0	4	9996	0	0	0	YKD	YKD	2009	M
0	0	2825	6276	0	899	0	YKD	YKD	2009	M
0	0	5467	4533	0	0	0	YKD	YKD	2009	M

0	0	0	10000	0	0	0	YKD	YKD	2009	M
0	0	0	10000	0	0	0	YKD	YKD	2009	M
0	0	117	11	188	9635	49	YKD	YKD	2009	M
0	0	0	10000	0	0	0	YKD	YKD	2009	M
0	0	240	5575	0	4185	0	YKD	YKD	2009	M
0	0	4258	5565	0	177	0	YKD	YKD	2009	M
0	0	8	961	4471	4560	0	YKD	YKD	2009	M
0	0	0	10000	0	0	0	YKD	YKD	2009	M

Table A7. The distribution of assignments for migrant adults to each region of winter origin out of 10,000 simulations.

Region assigned										
WNA	SB	CB	GC	SA	ENA	CARIB	Migration site	Year	Season	Sex
0	0	0	9818	182	0	0	Kansas	2007	southward	M
0	0	0	3323	0	6677	0	Kansas	2007	southward	M
0	0	0	3838	18	6144	0	Kansas	2007	southward	F
0	0	0	9705	147	148	0	Kansas	2007	southward	F
0	0	2564	6549	0	887	0	Kansas	2007	southward	M
0	0	0	88	1558	8354	0	Kansas	2007	southward	F
0	0	0	2476	0	7524	0	Kansas	2007	southward	M
0	0	0	0	0	10000	0	Kansas	2007	southward	F
0	0	7126	2525	0	349	0	Kansas	2007	southward	M
0	0	0	2011	2883	5106	0	Kansas	2007	southward	F
0	0	0	0	0	10000	0	Kansas	2007	southward	M
0	0	0	98	9902	0	0	Kansas	2007	southward	F
0	0	118	9882	0	0	0	Kansas	2007	southward	U
0	0	5289	44	0	4667	0	Kansas	2007	southward	U
0	0	704	9296	0	0	0	Kansas	2007	southward	M

0	0	0	19	9950	31	0	Kansas	2007	southward	F
0	0	0	969	6138	2893	0	Kansas	2007	southward	M
0	0	0	3333	6667	0	0	Kansas	2007	southward	F
0	0	3	0	0	8703	1294	Kansas	2007	southward	F
0	0	0	59	9852	89	0	Kansas	2007	southward	F
0	0	8135	1865	0	0	0	Kansas	2007	southward	M
0	0	8018	1982	0	0	0	Kansas	2007	southward	M
0	0	0	0	9494	506	0	Kansas	2007	southward	F
0	0	7499	953	1023	525	0	Kansas	2007	southward	F
0	0	7313	2687	0	0	0	Kansas	2007	southward	M
0	0	69	9931	0	0	0	Kansas	2007	southward	M
0	0	0	1406	8593	1	0	Kansas	2007	southward	F
0	0	9587	413	0	0	0	Kansas	2007	southward	M
0	0	0	1653	8346	1	0	Kansas	2007	southward	F
0	0	7379	2451	170	0	0	Kansas	2007	southward	M
0	0	8884	1116	0	0	0	Fraser Delta	2008	northward	M
0	0	0	10000	0	0	0	Fraser Delta	2008	northward	M
7379	0	0	2621	0	0	0	Fraser Delta	2008	northward	F
9220	0	0	780	0	0	0	Fraser Delta	2008	northward	M
0	0	1	7067	2173	759	0	Fraser Delta	2008	northward	F

0	0	445	9555	0	0	0	Fraser Delta	2008	northward	M
0	0	2331	7669	0	0	0	Fraser Delta	2008	northward	M
0	0	0	8735	1162	103	0	Fraser Delta	2008	northward	M
0	0	1633	1529	6794	44	0	Fraser Delta	2008	northward	U
0	0	354	9646	0	0	0	Fraser Delta	2008	northward	M
6559	0	0	3441	0	0	0	Fraser Delta	2008	northward	M
0	0	0	2437	0	7563	0	Fraser Delta	2008	northward	F
0	0	0	10000	0	0	0	Fraser Delta	2008	northward	F
0	4840	0	5160	0	0	0	Fraser Delta	2008	northward	M
0	0	5917	4083	0	0	0	Fraser Delta	2008	northward	M
0	0	0	8	9992	0	0	Fraser Delta	2008	northward	F
0	0	0	7278	2722	0	0	Fraser Delta	2008	northward	M
0	0	0	0	0	9980	20	Fraser Delta	2008	northward	F
8837	0	0	1163	0	0	0	Fraser Delta	2008	northward	M
0	0	107	9075	0	818	0	Fraser Delta	2008	northward	M
7441	0	0	2559	0	0	0	Fraser Delta	2008	northward	M
0	0	0	0	266	9734	0	Fraser Delta	2008	northward	F
0	0	4	2438	2179	5379	0	Fraser Delta	2008	northward	F
5	1585	0	8410	0	0	0	Fraser Delta	2008	northward	M
99	0	0	9493	3	405	0	Fraser Delta	2008	northward	M

0	0	141	9859	0	0	0	Fraser Delta	2008	northward	M
0	0	7040	2960	0	0	0	Fraser Delta	2008	northward	M
0	0	0	9496	127	377	0	Fraser Delta	2008	northward	F
0	0	0	5362	0	4638	0	Fraser Delta	2008	northward	F
0	0	0	10000	0	0	0	Fraser Delta	2008	northward	M
0	0	0	10000	0	0	0	Fraser Delta	2008	northward	M
0	0	1245	8755	0	0	0	Fraser Delta	2008	southward	M
0	0	9775	225	0	0	0	Fraser Delta	2008	southward	M
0	0	6189	3345	449	17	0	Fraser Delta	2008	southward	M
0	0	8533	1467	0	0	0	Fraser Delta	2008	southward	M
0	0	9912	88	0	0	0	Fraser Delta	2008	southward	M
0	0	9662	338	0	0	0	Fraser Delta	2008	southward	M
0	0	0	1818	7875	307	0	Fraser Delta	2008	southward	M
0	0	0	2165	1103	6732	0	Fraser Delta	2008	southward	F
6656	1605	0	1739	0	0	0	Fraser Delta	2008	southward	M
0	0	0	0	8104	1896	0	Fraser Delta	2008	southward	F
0	0	2	7707	2290	1	0	Fraser Delta	2008	southward	M
0	0	9473	523	4	0	0	Fraser Delta	2008	southward	M
0	0	0	7061	0	2939	0	Fraser Delta	2008	southward	M
0	0	0	0	227	9773	0	Fraser Delta	2008	southward	M

0	0	0	92	9908	0	0	Fraser Delta	2008	southward	F
1118	0	0	8882	0	0	0	Fraser Delta	2008	southward	M
0	0	565	9430	5	0	0	Fraser Delta	2008	southward	M
0	0	1623	590	7761	26	0	Fraser Delta	2008	southward	F
0	0	0	1737	0	8263	0	Fraser Delta	2009	northward	M
0	0	8	249	0	9743	0	Fraser Delta	2009	northward	M
9755	0	0	245	0	0	0	Fraser Delta	2009	northward	M
0	0	5995	4005	0	0	0	Fraser Delta	2009	northward	M
0	0	0	1	9992	3	4	Fraser Delta	2009	northward	M
0	0	0	73	8161	1766	0	Fraser Delta	2009	northward	F
0	0	360	9640	0	0	0	Fraser Delta	2009	northward	M
0	0	1	9999	0	0	0	Fraser Delta	2009	northward	M
0	0	2547	7453	0	0	0	Fraser Delta	2009	northward	M
0	0	0	9978	22	0	0	Fraser Delta	2009	northward	M
0	0	8769	1229	2	0	0	Fraser Delta	2009	northward	M
0	0	2838	7162	0	0	0	Fraser Delta	2009	northward	F
0	0	5680	4320	0	0	0	Fraser Delta	2009	northward	F
0	0	0	144	8971	885	0	Fraser Delta	2009	northward	F
0	0	0	1028	8463	63	446	Fraser Delta	2009	northward	F
0	0	0	10000	0	0	0	Fraser Delta	2009	northward	M

0	0	87	9913	0	0	0	Fraser Delta	2009	northward	M
0	0	0	1760	8240	0	0	Fraser Delta	2009	northward	U
4	10	0	9986	0	0	0	Fraser Delta	2009	northward	M
180	162	0	9658	0	0	0	Fraser Delta	2009	northward	M
0	0	5114	4163	723	0	0	Fraser Delta	2009	northward	M
0	0	0	8341	1658	1	0	Fraser Delta	2009	northward	M
0	0	0	55	6748	3197	0	Fraser Delta	2009	northward	F
0	0	623	13	0	9364	0	Fraser Delta	2009	northward	F
0	0	4960	3153	0	1887	0	Fraser Delta	2009	northward	F
0	0	0	10	0	9990	0	Fraser Delta	2009	southward	F
0	0	6048	3875	0	77	0	Fraser Delta	2009	southward	M
0	0	0	2	9878	120	0	Fraser Delta	2009	southward	F
0	0	9610	341	49	0	0	Fraser Delta	2009	southward	F
0	0	5	9995	0	0	0	Fraser Delta	2009	southward	F
0	0	77	9923	0	0	0	Fraser Delta	2009	southward	M
0	0	4377	5623	0	0	0	Fraser Delta	2009	southward	M
0	0	139	9861	0	0	0	Fraser Delta	2009	southward	M
0	0	7935	2065	0	0	0	Fraser Delta	2009	southward	M
0	0	2179	7821	0	0	0	Fraser Delta	2009	southward	M
0	0	0	48	9945	7	0	Fraser Delta	2009	southward	F

0	0	8822	1177	1	0	0	Fraser Delta	2009	southward	M
0	0	324	9676	0	0	0	Fraser Delta	2009	southward	M
557	0	0	9443	0	0	0	Fraser Delta	2009	southward	F
0	0	0	3439	6552	9	0	Fraser Delta	2009	southward	F
0	0	0	474	0	9526	0	Fraser Delta	2009	southward	F
0	0	0	2	0	9998	0	Fraser Delta	2009	southward	F
0	0	2066	7912	0	22	0	Fraser Delta	2009	southward	M
0	0	0	31	9969	0	0	Fraser Delta	2009	southward	F
0	0	0	6505	2516	979	0	Fraser Delta	2009	southward	M
0	0	1187	3384	19	5410	0	Fraser Delta	2009	southward	M
0	0	0	333	5378	4289	0	Fraser Delta	2009	southward	F
0	0	216	9784	0	0	0	Fraser Delta	2009	southward	M
0	0	0	34	9292	674	0	Fraser Delta	2009	southward	F
0	0	0	74	0	9926	0	Fraser Delta	2009	southward	M
0	0	2197	5773	2030	0	0	Fraser Delta	2009	southward	M
26	0	0	7625	2349	0	0	Fraser Delta	2009	southward	F
0	0	356	9644	0	0	0	Fraser Delta	2009	southward	M
0	0	5059	4941	0	0	0	Fraser Delta	2009	southward	F
188	0	0	9708	104	0	0	Fraser Delta	2009	southward	M
0	0	19	9981	0	0	0	Fraser Delta	2009	southward	M

0	0	9846	154	0	0	0	Fraser Delta	2009	southward	M
0	0	10	0	0	9203	787	Fraser Delta	2009	southward	F