Figure S1. Estimated annual pelican population counts per survey site by Christmas Bird Counts (CBC) from 1974 to 2017 in the Northern and Southern Gulf of Mexico (GOM) (left panels). The calculation of the estimated CBC was conducted separately using generalized additive models (See the methods of the text; 4243 vs. 126 observations at Northern and Southern GOMs, respectively). Right panel indicates the location of CBC survey. A horizontal line in the right panel separates the survey sites between Northern and Southern GOMs.

Figure S2. Capture sites of American White Pelicans at breeding and non-breeding grounds.

Figure S3. Relationships between year and estimated Christmas bird counts per survey site.

Figure S4. Hourly movement distances of American White Pelicans from 2002 to 2012. Blue and red colors represent wintering populations at the Northern and Southern Gulf of Mexico, respectively. Panels show a) breeding, b) wintering, c) spring migration, and d) autumn migration. Polygons represent 95% confidence intervals of the lines.

Figure S5. Maximum hourly movement distances of American White Pelicans from 2002 to 2012. Blue and red colors represent wintering populations at the Northern and Southern Gulf of Mexico, respectively. Panels show a) breeding, b) wintering, c) spring migration, and d) autumn migration. Polygons represent 95% confidence intervals of the lines.

Table S1. Generalized linear mixed models of average hourly movement distances of American white pelicans. Symbol ΔAIC is difference in Akaike information criterion between a model and the most parsimonious model. AIC weight indicates proportional weight of Akaike information criterion at each model. Models include year as a covariate instead of Christmas Bird Count.

Model	df	ΔAIC	AIC weight
(sin + cos) * ssn * g + ssn * g * yr + hfp	51	0.00	0.62
(sin + cos) * ssn * g + ssn * g * yr + ssn * hfp	54	1.08	0.36
(sin + cos) * ssn * g + ssn * g * yr	50	8.87	0.01
(sin + cos) * ssn * g + ssn * yr + hfp	47	10.67	0.00
(sin + cos) * ssn * g + g * yr + ssn * yr + hfp	48	12.70	0.00
(sin + cos) * ssn * g + yr + hfp	44	28.22	0.00
(sin + cos) * ssn * g + g * yr + hfp	45	29.82	0.00
(sin + cos) * ssn * g + hfp	43	36.54	0.00
(sin + cos) * (g + ssn) + ssn * g * yr + hfp	39	55.21	0.00
(sin + cos) * ssn + ssn * g * yr + hfp	35	71.52	0.00
(sin + cos) * g + ssn * g * yr + hfp	27	792.61	0.00
(sin + cos) + ssn * g * yr + hfp	23	800.14	0.00

(sin + cos): Circadian hours with Fourier transformation of sine and cosine function

ssn: Season (i.e., breeding and wintering seasons and spring and autumn migration)

g: Wintering population group (the Northern or Southern Gulf of Mexico)

yr: Year from 2002 to 2012

hfp: Human footprint index within seasonal home ranges of pelicans

All the models with interactions include main effects.

Table S2. Generalized linear mixed models of maximum hourly movement distances of American white pelicans. Symbol ΔAIC is the difference in Akaike information criterion between a model and the most parsimonious model. AIC weight indicates proportional weight of Akaike information criterion at each model. Models include year as a covariate instead of Christmas Bird Count. Models include year as a covariate instead of Christmas Bird Count.

Model	df	ΔAIC	AIC weight
(sin + cos) * ssn * g + ssn * g * yr	50	0.00	0.52
(sin + cos) * ssn * g + ssn * g * yr + hfp	51	1.40	0.26
(sin + cos) * ssn * g + ssn * g * yr + ssn * hfp	54	1.75	0.22
(sin + cos) * ssn * g + g * yr	44	13.41	0.00
(sin + cos) * ssn * g + g * yr + ssn * yr	47	13.42	0.00
(sin + cos) * ssn * g + ssn * yr	46	13.94	0.00
(sin + cos) * ssn * g + yr	43	14.80	0.00
(sin + cos) * (g + ssn) + ssn * g * yr	38	18.95	0.00
(sin + cos) * ssn + ssn * g * yr	34	33.82	0.00
(sin + cos) * ssn * g	42	66.50	0.00
(sin + cos) * g + ssn * g * yr	26	328.67	0.00
(sin + cos) + ssn * g * yr	22	336.18	0.00

(sin + cos): Circadian hours with Fourier transformation of sine and cosine function

ssn: Season (i.e., breeding and wintering seasons and spring and autumn migration)

g: Wintering population group (the Northern or Southern Gulf of Mexico)

yr: Year from 2002 to 2012

hfp: Human footprint index within seasonal home ranges of pelicans

All the models with interactions include main effects.

Table S3. Linear mixed models of seasonal home ranges of American white pelicans.

Symbol ΔAIC is difference in Akaike information criterion between a model and the most parsimonious model. AIC weight indicates proportional weight of Akaike information criterion at each model. Models include year as a covariate instead of Christmas Bird Count. Models include year as a covariate instead of Christmas Bird Count.

Model	df	ΔAIC	AIC weight
ssn * g + g * yr + hfp	13	0.00	0.54
ssn * g + yr + hfp	12	1.71	0.23
ssn * g + g * yr + ssn * yr + hfp	16	2.51	0.15
ssn * g + ssn * yr + hfp	15	4.88	0.05
ssn * g * yr + ssn * hfp	22	7.36	0.01
ssn * g * yr + hfp	19	7.95	0.01
ssn * g + hfp	11	9.05	0.01
ssn * g	10	32.82	0.00
ssn * g * yr	18	37.16	0.00
ssn + g * yr + hfp	10	46.04	0.00
g * yr + ssn * yr + hfp	13	48.81	0.00
ssn + g	7	74.26	0.00

ssn: Season (i.e., breeding and wintering seasons and spring and autumn migration)

g: Wintering population group (the Northern or Southern Gulf of Mexico)

yr: Year from 2002 to 2012

hfp: Human footprint index within seasonal home ranges of pelicans

All the models with interactions include main effects.