

Article

Predicting Dynamics of the Potential Breeding Habitat of *Larus saundersi* by MaxEnt Model under Changing Land-Use Conditions in Wetland Nature Reserve of Liaohe Estuary, China

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Table S1. Change rate (%) of different habitat suitability classes of *Larus saundersi* during various change periods.

Period	US	LS	S	MS
1988-2000	4.38	-14.54	-12.22	-33.13
1988-2009	3.48	-6.47	-25.15	-34.89
1988-2017	3.26	-8.69	-20.18	-25.03
2000-2009	-0.87	9.45	-14.73	-2.64
2000-2017	-1.08	6.85	-9.07	12.10
2009-2017	-0.22	-2.37	6.63	15.14

Notes: US-Unsuitable, LS-Less Suitable, S-Suitable and MS-Most Suitable.

Table S2. Change rate (%) of different land-use types during various change periods.

Period	NIF	PD	RD	SW	AF	WB	MF	SCP	SS
1988-2000	50.68	604.42	-5.08	-83.34	78.24	27.44	-10.86	285.54	5.29
1988-2009	102.79	559.22	-7.27	-76.31	115.45	40.94	31.23	583.84	-28.25
1988-2017	304.93	563.52	-13.19	1.70	84.24	60.65	-23.36	685.90	-9.64
2000-2009	34.58	-6.42	-2.31	42.25	20.88	10.60	47.22	77.37	-31.85
2000-2017	168.73	-5.81	-8.54	510.59	3.37	26.07	-14.03	103.85	-14.18
2009-2017	99.68	0.65	-6.38	329.23	-14.49	13.98	-41.60	14.92	25.94

Notes: NIF- Non-Irrigated Farmland, PD-Paddy field, RD-Reed marsh, SW- Seepweed marsh, AF- Artificial Facility, WB-Water Body, MF-Muddy Flat, SCP- Shrimp and Crab Pond, and SS-Shallow Sea.

Table S3. Area and percentage of every land-use type out of each habitat suitability class of *Larus saundersi* in different years.

Code for Suitable Classes	Code for Land use types	1988		2000		2009		2017	
		Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent(%)	Area (ha)	Percent (%)
1	1	98.82	0.12	148.59	0.18	199.17	0.24	396.99	0.48
1	2	954.09	1.18	5111.55	6.34	5542.47	6.69	5174.55	6.25
1	3	39209	48.64	35219.2	43.69	35625.9	42.98	33593.3	40.57
1	4	14.58	0.02	199.35	0.25	287.01	0.35	145.8	0.18
1	5	1245.87	1.55	1767.24	2.19	2421.9	2.92	1601.91	1.93
1	6	8211.24	10.19	7472.88	9.27	14022.7	16.92	8172.81	9.87
1	7	225.99	0.28	1582.92	1.96	4538.25	5.47	5369.04	6.48
1	8	28410.3	35.25	28883.2	35.83	19844	23.94	25607.7	30.93
1	9	2234.79	2.77	219.87	0.27	409.14	0.49	2734.29	3.30
subtotal		80604.68	100.00	80604.8	100.00	82890.54	100.00	82796.39	100.00
2	1	0	0.00	0	0.00	1.17	0.01	1.71	0.01
2	2	7.56	0.05	1335.51	9.49	722.25	5.44	1119.78	8.65
2	3	3544.65	25.18	4257.45	30.24	4401.18	33.14	4138.65	31.97
2	4	89.46	0.64	104.4	0.74	74.7	0.56	137.07	1.06
2	5	686.61	4.88	705.15	5.01	443.97	3.34	1155.33	8.92
2	6	5840.82	41.49	4720.41	33.53	5691.33	42.85	3363.39	25.98
2	7	425.16	3.02	1230.39	8.74	627.12	4.72	575.37	4.44
2	8	233.28	1.66	1253.79	8.91	648.54	4.88	264.24	2.04
2	9	3250.35	23.09	470.79	3.34	670.5	5.05	2190.33	16.92
subtotal		14077.89	100.00	14077.89	100.00	13280.76	100.00	12945.87	100.00
3	1	0	0.00	0	0.00	0	0.00	0	0.00
3	2	0	0.00	184.32	6.40	61.65	2.95	70.92	3.00
3	3	700.2	24.32	705.96	24.52	487.17	23.33	261.09	11.03
3	4	69.75	2.42	38.79	1.35	29.25	1.40	25.92	1.09
3	5	69.48	2.41	96.57	3.35	28.89	1.38	355.05	14.99
3	6	1383.66	48.06	1569.33	54.51	1116.81	53.48	724.68	30.61
3	7	73.08	2.54	105.12	3.65	62.91	3.01	84.33	3.56
3	8	47.43	1.65	58.05	2.02	58.14	2.78	6.57	0.28
3	9	535.59	18.60	121.05	4.20	243.54	11.66	839.25	35.44
subtotal		2879.19	100.00	2879.19	100.00	2088.36	100.00	2367.81	100.00
4	1	0	0.00	0	0.00	0	0.00	0	0.00
4	2	0	0.00	125.73	5.68	32.04	2.04	30.06	1.75
4	3	455.85	20.59	640.89	28.94	241.47	15.39	111.24	6.47
4	4	31.86	1.44	6.57	0.30	30.6	1.95	42.93	2.50
4	5	66.51	3.00	67.14	3.03	20.07	1.28	210.69	12.26
4	6	1145.7	51.74	1014.57	45.82	918.72	58.56	439.56	25.58
4	7	47.61	2.15	57.06	2.58	60.12	3.83	51.66	3.01
4	8	15.84	0.72	33.84	1.53	50.85	3.24	1.71	0.10
4	9	451.08	20.37	268.65	12.13	215.01	13.70	830.61	48.33
subtotal		2214.45	100.00	2214.45	100.00	1568.88	100.00	1718.46	100.00

Notes: 1-unsuitable, 2-less suitable, 3-suitable, and 4-most suitable for code of suitable classes. 1-Non-irrigated farmland, 2-Paddy field, 3-Reed marsh, 4- Artificial facility, 5-Water body, 6-Muddy flat, 7- Shrimp and crab pond, 8-Shallow sea, and 9-Seepweed marsh for code of land-use types.

Table S4. Relative contributions of environmental variables to the *Larus saundersi* distribution predicted by the Maxent model. Lu: Land-use types, D_cl: Distance to coastlines, D_af: Distance to artificial facilities, D_rl: Distance to linear rivers, NDVI: Normalized Difference Vegetation Index, D_road: Distance to roads, and Dem30m: Digital Elevation Model with 30 m spatial resolution.

Variables	Percent contribution (%)			
	1988	2000	2009	2017
Lu	40.3	32.4	16.4	35.8
D_cl	34.7	35.1	48.0	34.5
D_af	8.8	11.1	5.9	7.2
D_rl	11.0	11.0	9.7	5.5
NDVI	0.3	6.3	4.8	5.2
D_road	4.3	3.9	12.5	10.6
DEM30m	0.7	0.2	2.6	1.2

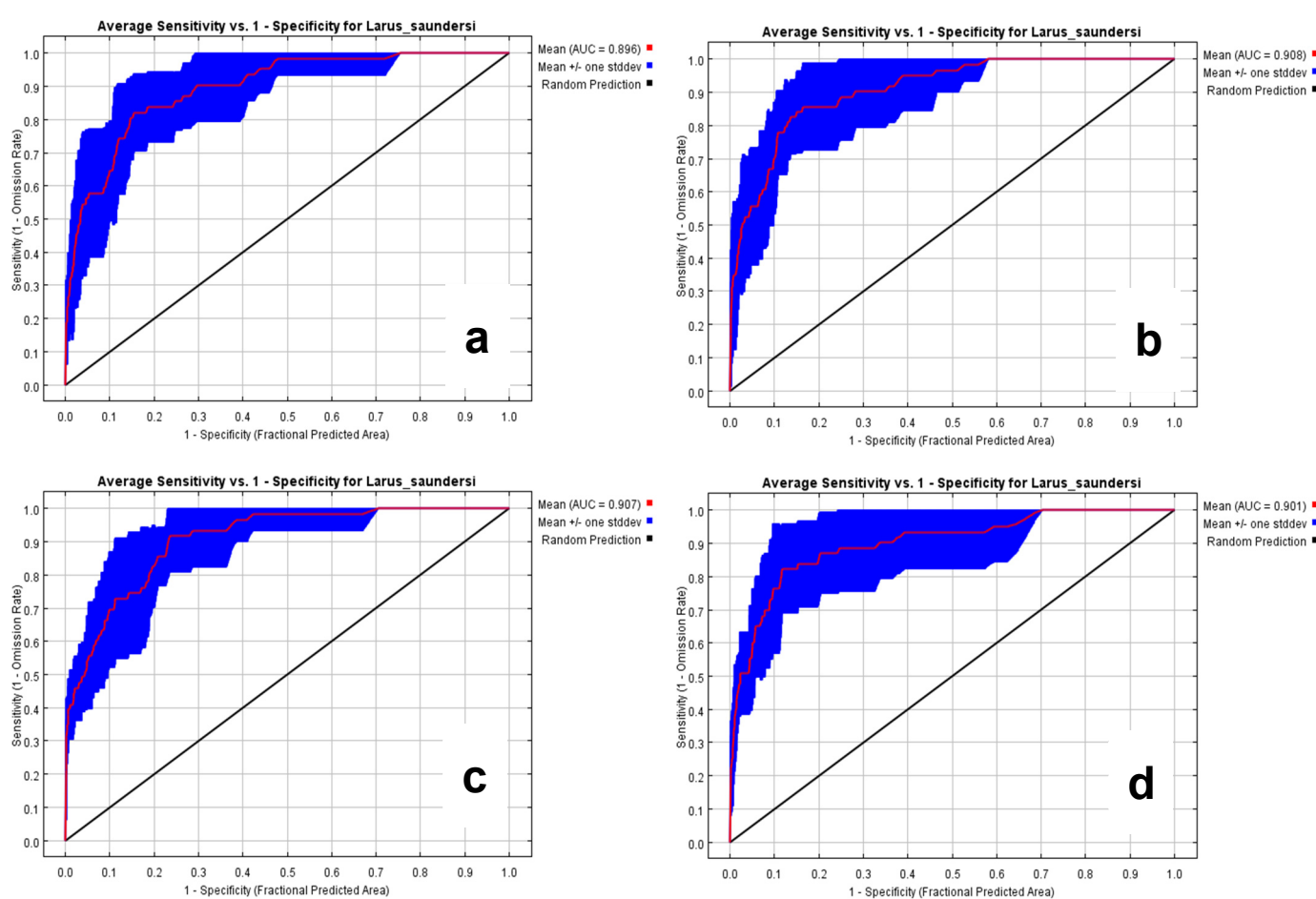


Figure S1. ROC curves for evaluating the performance of the MaxEnt model. a-1988, b-2000, c-2009, and d-2017. The red line represents the mean of 10 replicates, and the blue color represents the error bar with one standard deviation. The black line represents random predictions.

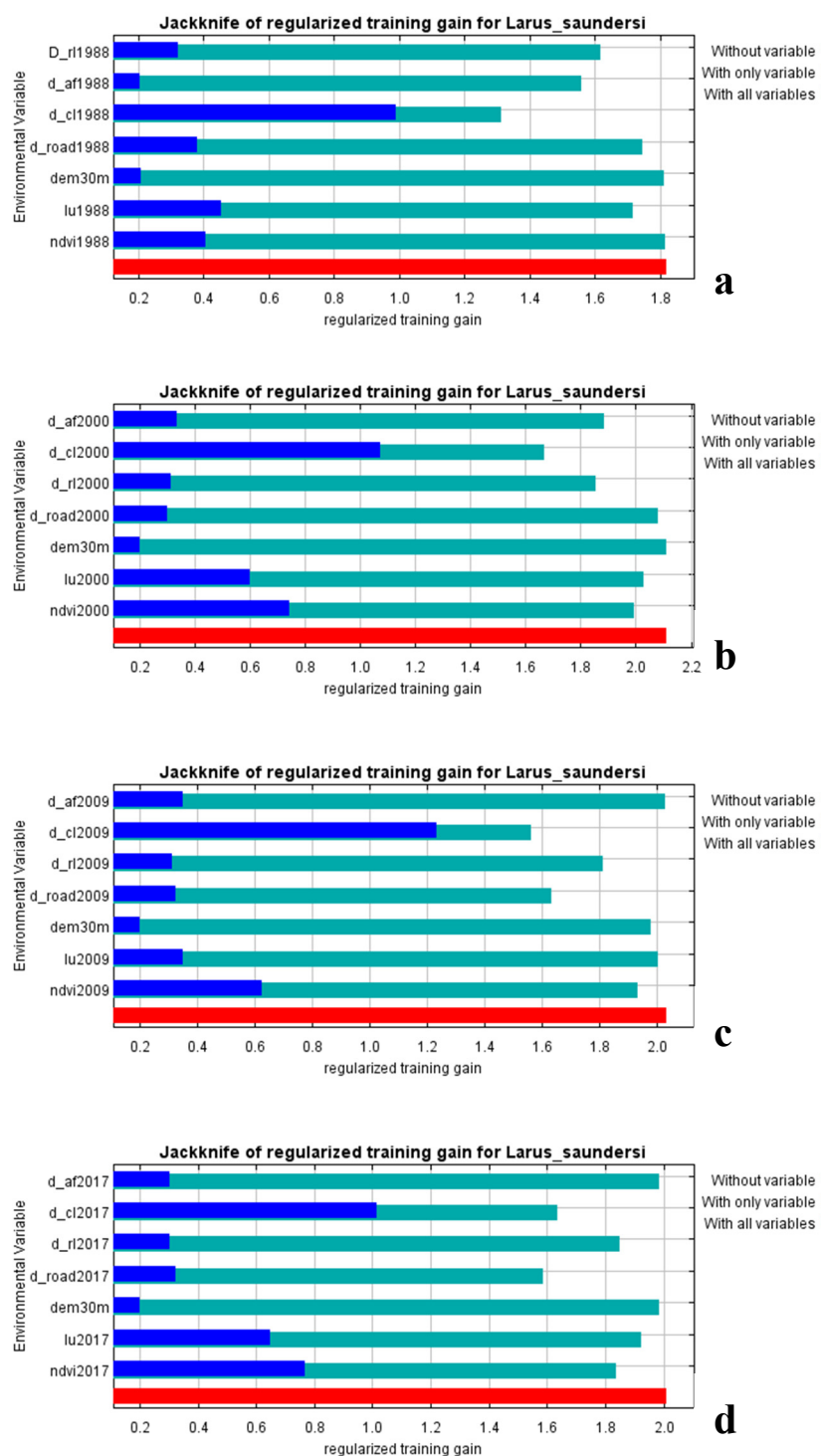


Figure S2. Importance of environmental variables to *Larus saundersi* distribution by using jackknife analysis. a-1988, b-2000, c-2009, and d-2017.

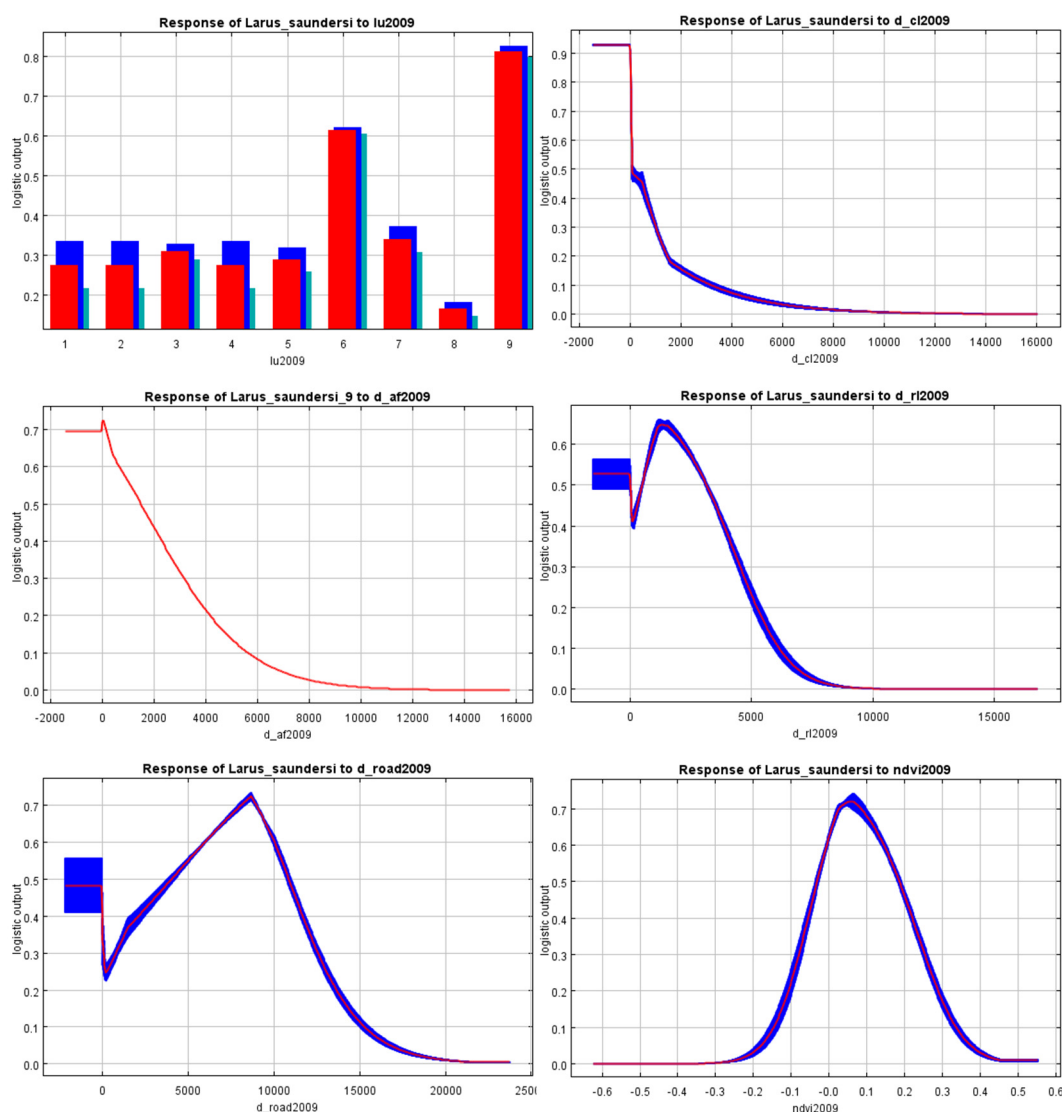


Figure S3. Response curves of selected environmental variables to predicted probability contributions using 2009 as an example. The red color represents the mean of 10 replicates, and the blue color represents the standard deviation. The numbers under the horizontal axis of the upper-left chart represent different land-use types, with 1 for non-irrigated farmland, 2 paddy fields, 3 reed marshes, 4 artificial facilities, 5 water bodies, 6 mudflats, 7 shrimp and crab ponds, 8 shallow water and 9 seepweed marshes.