

## Supplementary material

Axelle Moreau, Clément Rousseau, Pierrick Bocher, Christine Dupuy & Sébastien Farau 2024: Home range sizes and nycthemeral habitat uses by the Northern Shoveler (*Spatula clypeata*) on prenuptial stopovers in Vendée marshes, western France. — *Ornis Fennica* 101: 62–75.

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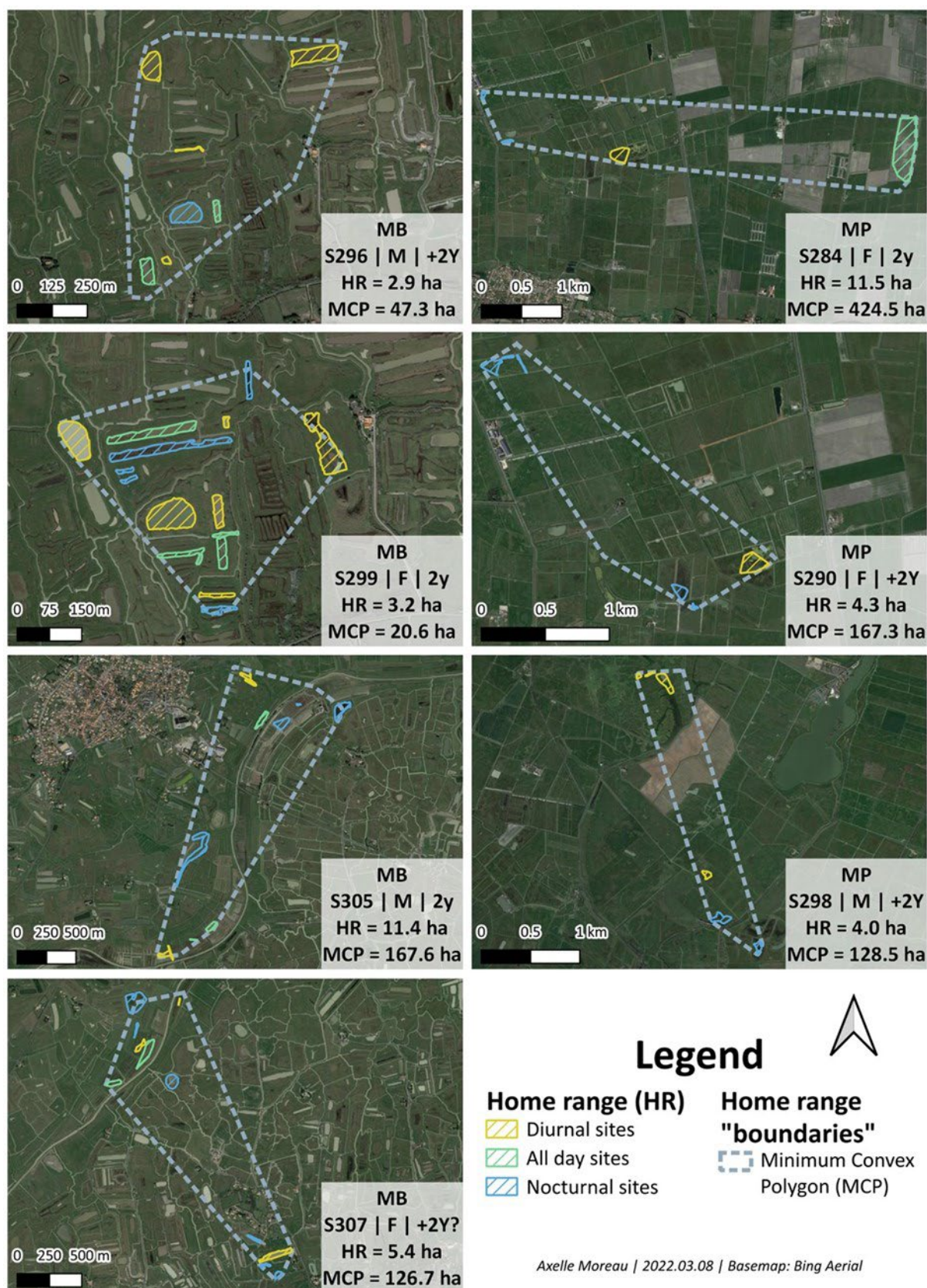
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**Supplementary figures (Fig. S1–S4) and tables (Table S1–S3)**

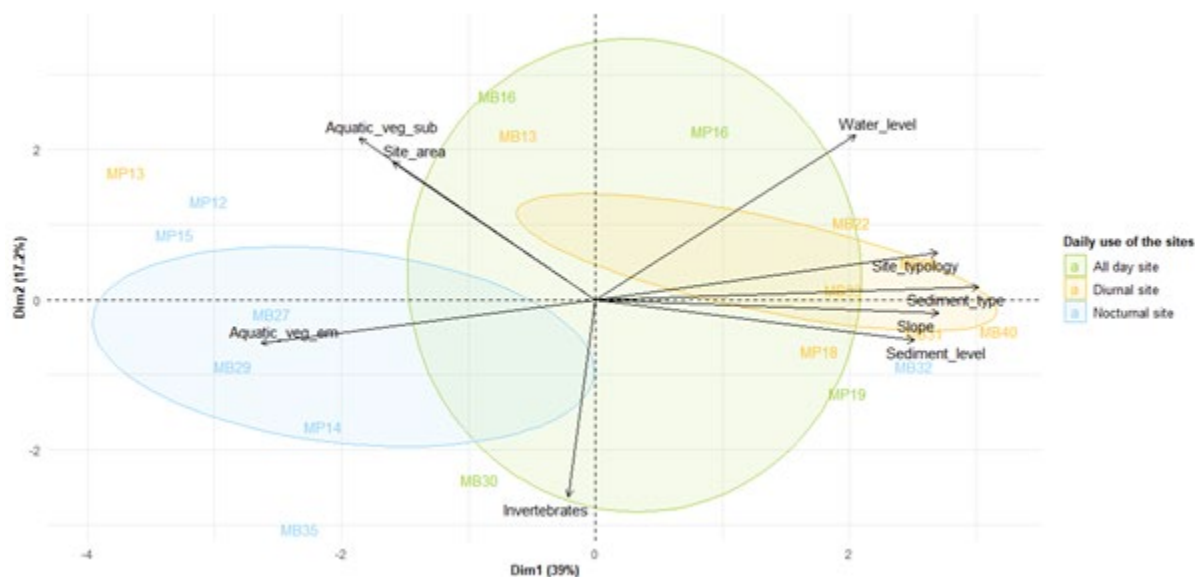


**Fig S1.** Illustrations of the 3 studied habitat types: (A) Wet meadow, (B) pond, (C) channel.

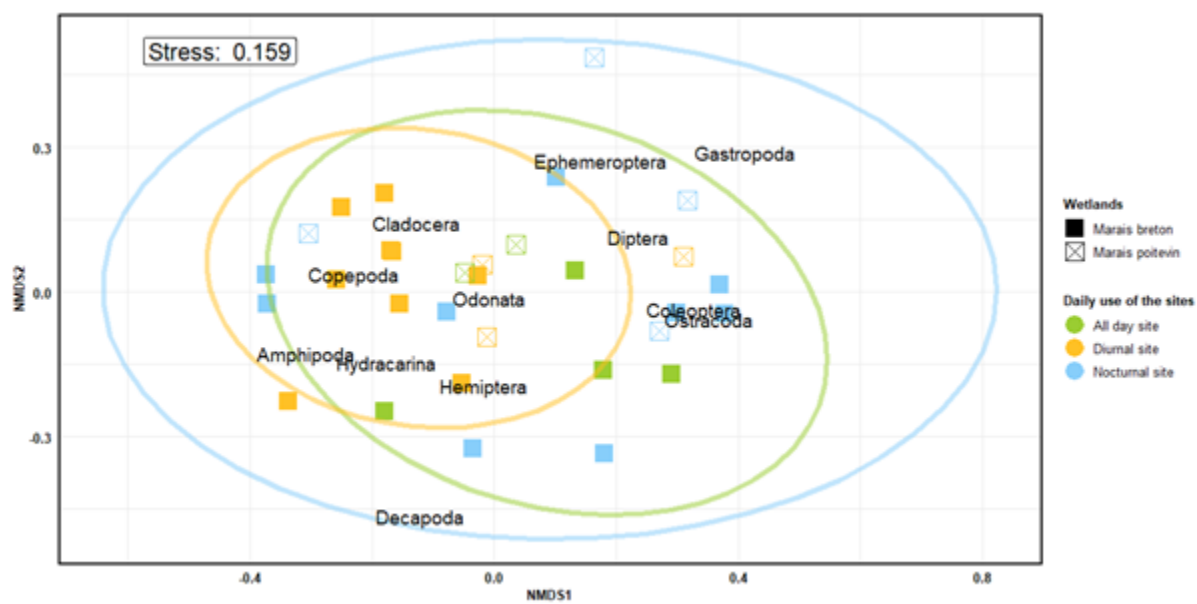




**Fig S2.** Illustration of the Minimum Convex Polygons (MCP) and Home Ranges (HR) for seven individuals: three from the Marais poitevin (MP) and four from the Marais breton (MB).



**Fig. S3.** Principal Component Analysis (PCA) of the environmental variables of the pre-nuptial stopover sites used by tagged Shovelers. Dimensions 1 and 2 account for 56.2% of the total variance. Poorly represented sites and variables ( $\cos^2 < 0.2$  on each axis) are not represented. Sites frequented by individuals during the day are coloured in yellow, during all day in green, and during nighttime in blue. Confidence ellipses at 95 % were drawn around each sites according to their daily use. “Invertebrates” = invertebrate density, “Slope” = slope, “Site\_area” = water surface area, “Helophyte” = percentage cover of riparian helophytes, “Aquatic\_veg\_em” = emerged aquatic vegetation, “Aquatic\_veg\_sub” = submerged aquatic vegetation, “Water\_level” = water level, “Sediment\_level” = sediment depth, “Site\_typology” = habitat type, “Sediment\_type” = sediment type.



**Fig. S4.** Nonmetric Multidimensional Scaling Plots (NMDS) of the proportional taxonomic density with coloured ellipses show the standard deviation of group centroids based on the daily use of the sites and the dot shapes show the wetlands. Each points represent samples and text represents taxa (stress = 0.159).

**Table S1.** Summary of the information collected per tagged individual, Home Range (HR) size, Minimum Convex Polygon (MCP) size, and number of habitats used by the 15 Shovelers in the Marais breton (MB) and the Marais poitevin (MP) during 2020 and 2021 (M = male, F = female, juv = juvenile, ad = adult).

Id	Sex	Age	Wetland	Year	Period	Number of locations recorded per individual	Period	HR (ha)	MCP (ha)	Total number of habitats used	Channels	Ponds	Wet meadows
S292	M	juv	MB	2020	03–17 Apr	1176	03–17 Apr	6.0	9.0	4	1	3	0
S296	M	ad	MB	2020	10 Mar to 23 Apr	7477	12–26 Mar	2.9	47.3	8	1	5	2
S298	M	ad	MP	2021	30 Mar to 30 Apr	6662	01–15 Apr	4.0	128.5	6	0	2	4
S299	F	juv	MB	2021	18 Mar - 30 Apr	9471	20 Mar to 03 Apr	3.2	20.6	15	1	7	7
S302	M	juv	MB	2021	01 Mar to 30 Apr	9406	03–17 Mar	5.1	71.9	11	0	10	1
S304	M	ad	MB	2021	01–30 Apr	4925	01–15 Apr	9.1	110.0	11	0	11	0
S305	M	juv	MB	2020	05 Mar to 03 Apr	3678	7–21 Mar	11.4	167.6	11	0	7	4
S307	F	ad	MB	2020	01 Mar to 01 Apr	5278	2–16 Mar	5.4	126.7	11	0	3	8
S310	M	ad	MB	2020	01 Mar to 12 Apr	4895	03–17 Mar	6.1	76.2	18	1	10	7
S281	M	ad	MP	2021	06–23 Apr	3417	08–22 Apr	25.4	2846.4	6	1	4	1
S284	F	juv	MP	2020	11 Mar to 11 Apr	4770	13–27 Mar	11.5	424.5	6	0	0	6
S285	M	juv	MP	2020	16–31 Mar	2195	17–31 Mar	16.2	417.8	4	0	0	4
S289	M	juv	MP	2021	05 Mar to 28 Apr	9910	7–21 Mar	7.2	17.9	2	0	0	2
S290	F	ad	MP	2021	05 Mar to 07 Apr	5558	7–21 Mar	4.3	167.3	6	1	0	5
S291	M	juv	MP	2021	31 Mar to 20 Apr	4853	02–16 Apr	9.6	1161.2	5	0	4	1

**Table S2.** Mean value and standard deviation of the environmental variables depending on the daily use of the sites (diurnal, all day, nocturnal) and the wetlands (MB, MP and both wetlands combined).

Environmental variables	Diurnal site			All day site			Nocturnal site		
	MB (n=9)	MP (n=3)	All sites (n=12)	MB (n=4)	MP (n=2)	All sites (n=6)	MB (n=9)	MP (n=4)	All sites (n=13)
Emerged aquatic vegetation (% cover)	10.5 ± 26.2	10 ± 17.3	10.4 ± 23.5	28.7 ± 38.3	0 ± 0	19.2 ± 33.2	35.5 ± 44.1	46.2 ± 48.1	38.8 ± 43.6
Submerged aquatic vegetation (% cover)	14.1 ± 25.8	26.6 ± 37.8	17.2 ± 27.8	44.7 ± 46.6	45 ± 63.6	44.8 ± 46.0	17.7 ± 31.5	31.2 ± 39.6	21.9 ± 33.1
Invertebrate density (ind/m <sup>3</sup> )	16,105 ± 13,241	31,898 ± 13,148	20,053 ± 14,490	40,592 ± 39,904	19,585 ± 16,419	33,590 ± 33,571	37,697 ± 31,316	23,794 ± 15,468	33,420 ± 27,535
Sediment level (cm)	12.0 ± 11.9	6.66 ± 5.45	10.7 ± 10.7	4.74 ± 2.11	11.1 ± 9.19	6.9 ± 5.5	7.27 ± 7.60	4.25 ± 1.95	6.34 ± 6.45
Site area (ha)	0.46 ± 0.27	1.80 ± 1.33	0.80 ± 0.86	0.69 ± 0.71	0.70 ± 0.48	0.7 ± 0.6	0.49 ± 0.25	1.54 ± 1.25	0.81 ± 0.82
Water level (cm)	42.2 ± 8.23	36.8 ± 19.5	40.9 ± 11.1	21.8 ± 11.6	33.6 ± 8.48	25.8 ± 11.6	30.3 ± 25.2	23.5 ± 11.9	28.2 ± 21.7

**Table S3.** Mean value, standard deviation, and mean comparison (Wilcoxon test) of freshwater invertebrate density (ind/m<sup>3</sup>) and diversity per site. Mean comparison (Wilcoxon test) was only made for the total density and diversity of the three habitat types according to the daily use (diurnal, all day, nocturnal) in the MB and MP. Means followed by the same letter are not different ( $p > 0.05$ ).

Freshwater invertebrate taxa	Diurnal site			All day site			Nocturnal site		
	MB (n=9)	MP (n=3)	All sites (n=12)	MB (n=4)	MP (n=2)	All sites (n=6)	MB (n=9)	MP (n=4)	All sites (n=13)
Amphipoda	0.0 ± 0.0	1.0 ± 1.8	0.3 ± 0.9	1.6 ± 3.1	0.0 ± 0.0	1.0 ± 2.6	25.0 ± 58.4	0.0 ± 0.0	17.3 ± 49.2
Cladocera	1,581.0 ± 2,148.0	16,675.0 ± 15,775.0	5,354.0 ± 9,757.0	12,038.3 ± 17,988.5	3,653.0 ± 2,563.0	9,243.0 ± 14,636.0	18,427.0 ± 33,489.0	17,521.0 ± 17,250.0	18,148.0 ± 28,675.0
Coleoptera	0.3 ± 1.0	8.3 ± 14.5	2.3 ± 7.2	4.7 ± 9.4	0.0 ± 0.0	3.1 ± 7.7	15.3 ± 22.2	7.0 ± 8.2	12.8 ± 19.0
Copepoda	14,471.0 ± 13,349.0	14,272.0 ± 14,061.0	14,421.0 ± 12,866.0	22,484.0 ± 23,261.0	15,271.0 ± 19,675.0	20,079.0 ± 20,395.0	17,221.0 ± 13,498.0	3,998.0 ± 1,588.0	13,153.0 ± 12,745.0
Decapoda	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	40.7 ± 35.5	0.0 ± 0.0	27.1 ± 34.6	76.9 ± 194.0	6.3 ± 12.5	55.1 ± 162.1
Diptera	10.4 ± 14.7	94.9 ± 153.6	31.6 ± 76.9	108.0 ± 143.7	26.6 ± 15.5	80.9 ± 119.2	128.7 ± 245.5	918.6 ± 942.5	371.7 ± 637.4
Ephemeroptera	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	13.3 ± 26.6	0.0 ± 0.0	8.9 ± 21.7	52.5 ± 104.4	5.5 ± 11.0	38.0 ± 88.4
Gastropoda	0.3 ± 1.0	138.8 ± 237.6	35.0 ± 119.1	99.4 ± 169.9	0.0 ± 0.0	66.2 ± 141.2	19.1 ± 35.6	356.0 ± 666.5	122.8 ± 371.6
Hemiptera	29.9 ± 49.1	48.0 ± 42.7	34.4 ± 46.4	241.0 ± 363.9	6.3 ± 0.0	162.8 ± 306.9	141.2 ± 179.6	71.2 ± 140.3	119.7 ± 166.0
Hydracarina	1.7 ± 2.8	1.0 ± 1.8	1.6 ± 2.5	2.3 ± 3.0	0.0 ± 0.0	1.6 ± 2.6	1.4 ± 4.2	0.0 ± 0.0	1.0 ± 3.5
Odonata	0.3 ± 1.0	0.0 ± 0.0	0.3 ± 0.9	0.8 ± 1.6	0.0 ± 0.0	0.5 ± 1.3	3.1 ± 8.3	0.0 ± 0.0	2.2 ± 6.9
Ostracoda	7.0 ± 14.0	659.0 ± 796.0	170.0 ± 450.0	5,558.0 ± 7,643.0	629.0 ± 677.0	3,915.0 ± 6,451.0	1,583.0 ± 2,951.0	911.0 ± 106.0	1,376.0 ± 2,489.0
All taxa	16,106.0 ± 13,241.0 b	31,899.0 ± 13,149.0 abc	20,054.0 ± 14,490.0	40,592.0 ± 39,904.0 abc	19,585.0 ± 16,420.0 abc	33,590.0 ± 33,571.0	37,698.0 ± 31,316.0 c	23,795.0 ± 15,468.0 abc	33,420.0 ± 27,536.0
Diversity	4.3 ± 1.2 b	6.7 ± 0.6 a	4.9 ± 1.5	7.8 ± 2.6 a	5.0 ± 0.0 ab	6.8 ± 2.5	6.6 ± 1.7 a	5.5 ± 2.1 ab	6.2 ± 1.8