

Supplemental Material  
to  
**Assessing the Movements, Habitat Use, and Site Fidelity of the Giant Freshwater Stingray (*Urogymnus polylepis*) with Acoustic Telemetry in the MaeKlong River, Thailand**

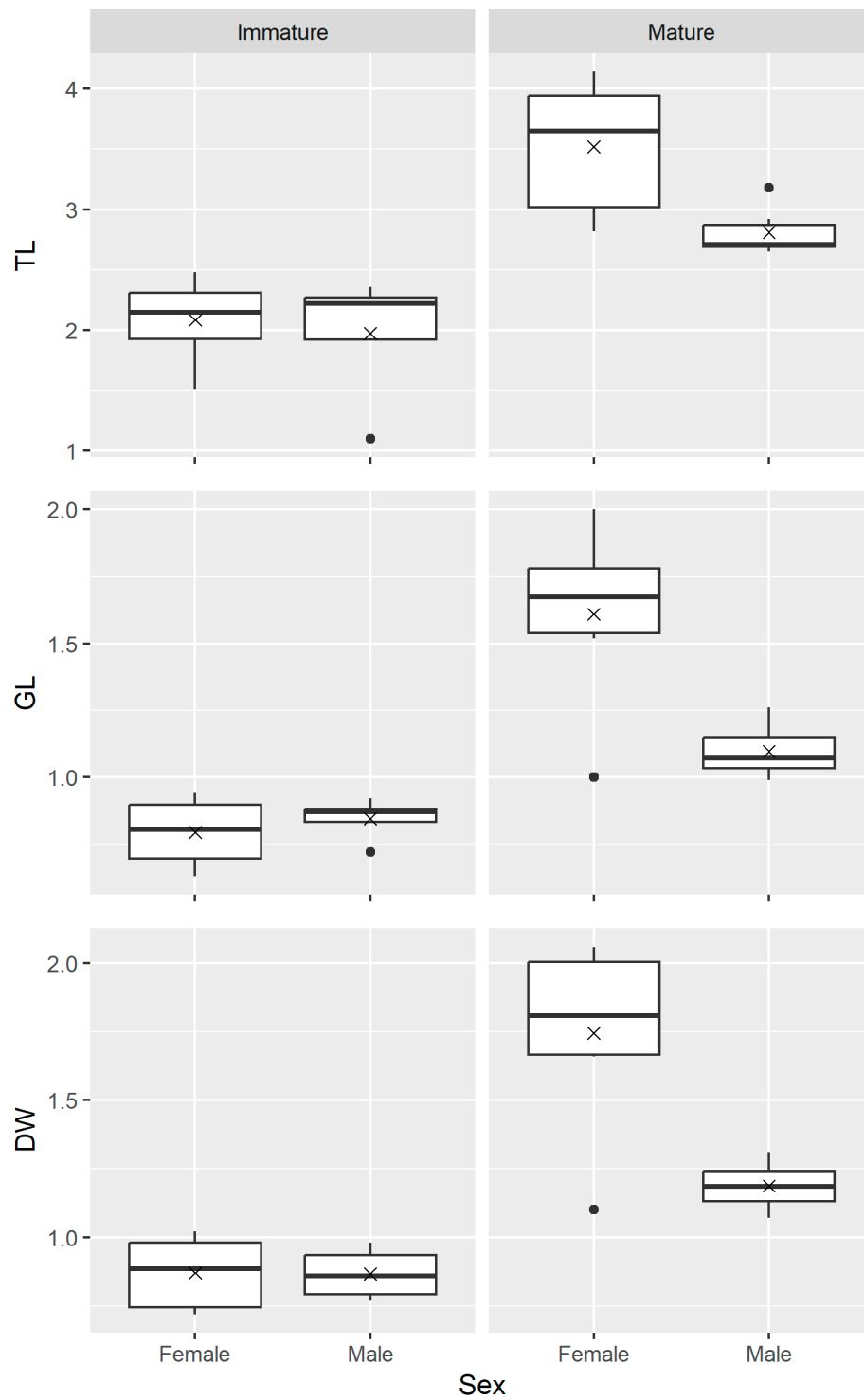
Thanida Haetrakul, Teresa Campbell, Chayanis Daochai, Nitiwadee Keschumras, Tanatchaporn Tantiveerakul, Zeb Hogan, and Nantarika Chansue

**Table S1.** Results of Student's T-test analyses of whipray body size as a function of sex and maturity. Means are reported in meters. Measurement: TL = total length, GL = girdle length, DW = disc width. Sample sizes: f = female, m = male. Asterisks indicate significance at the  $\alpha < 0.05$  level.

Measurement	Female Mean	Male Mean	t value	df	p value	Sample Sizes
<b>Immature</b>						
TL	2.085	1.975	0.3365	4.4530	0.7517	f = 6, m = 4
GL	0.795	0.845	-0.7288	7.9814	0.4870	f = 6, m = 4
DW	0.870	0.868	0.0338	7.8222	0.9739	f = 6, m = 4
<b>Mature</b>						
TL	3.518	2.810	2.8660	6.2677	0.0272*	f = 6, m = 6
GL	1.610	1.097	3.5308	5.8449	0.0129*	f = 6, m = 6
DW	1.745	1.187	3.7099	5.599	0.0113*	f = 6, m = 6

**Table S2.** Summary statistics of whipray body size grouped by maturity and sex. All measurements are reported in meters. Measurement: TL = total length, GL = girdle length, DW = disc width. Sex: F = female, M = male. Sample sizes are reported in Table S1.

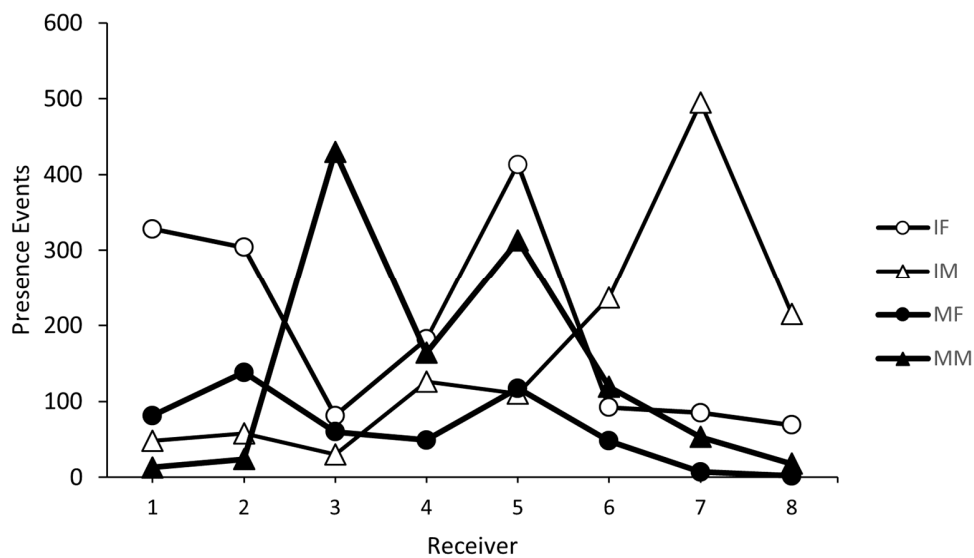
Measurement	Sex	Min	Mean (SD)	Max
<b>Immature</b>				
TL	F	1.51	2.08 (0.35)	2.48
	M	1.10	1.98 (0.59)	2.36
GL	F	0.63	0.80 (0.13)	0.94
	M	0.72	0.85 (0.09)	0.92
DW	F	0.72	0.87 (0.14)	1.02
	M	0.77	0.87 (0.10)	0.98
<b>Mature</b>				
TL	F	2.82	3.52 (0.57)	4.14
	M	2.65	2.81 (0.21)	3.18
GL	F	1.00	1.61 (0.34)	2.0
	M	0.99	1.10 (0.10)	1.26
DW	F	1.10	1.74 (0.36)	2.06
	M	1.07	1.19 (0.09)	1.31



**Figure S1.** Box plots of whipray body size as a function of sex and maturity. Note different y-axis scales for TL (total length), GL (girdle length), and DW (disc width). All measurements are in meters. Sample sizes are reported in Table S1. X's represent the mean of the data and dark horizontal bars represent the median. White shaded areas show the middle 50% of the data, while vertical bars show the lower and upper 25%. Black dots represent outliers.

**Table S3.** Summary of receiver detection results. Receiver days are the number of days between deployment and the study end date, 13 February 2019. Receiver detection days is the number of days the receiver detected tags. Total events and cumulative and average event duration refer to presence events (see methods). Detection index = fish detection days / fish days  $\times$  100. Detection index and average event duration are independent of the amount of time the receiver was deployed.

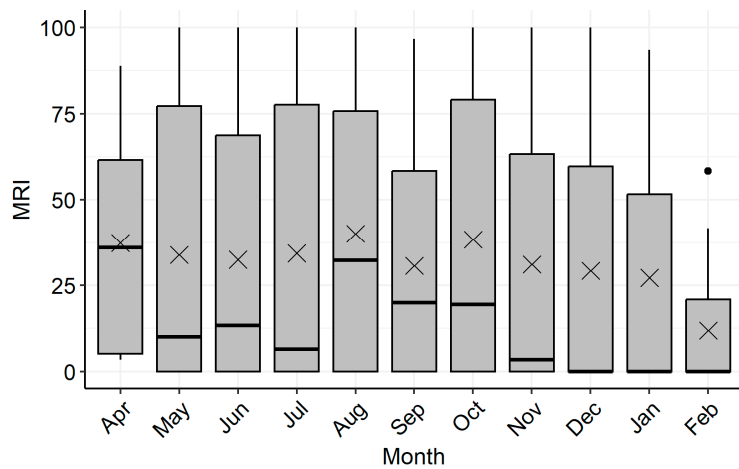
Receiver	Receiver Days	Receiver Detection Days	Total Detections	Total Events	Cumulative Event Duration (h:mm:ss)	Fish Days	Fish Detection Days	Detection Index	Avg Event Duration (h:mm:ss)
1. Estuary	332	142	4093	470	385:22:36	6026	290	4.81	0:49:12
2. Mussel Pier	332	160	4490	524	326:33:00	6026	321	5.33	0:37:23
3. Marine Department	332	199	3911	601	328:48:32	6026	338	5.61	0:32:50
4. Baan Tai Had resort	332	183	4499	521	402:49:50	6026	341	5.66	0:46:23
5. Wat Tai Had	332	228	8316	953	642:35:30	6026	495	8.21	0:40:27
6. Chaosamran restaurant	332	194	13731	496	606:30:29	6026	312	5.18	1:13:22
7. Wat Bang Khae Noi	316	219	18639	640	915:22:52	5969	295	4.94	1:25:49
8. Wat Bang Kung	205	116	9258	304	532:49:31	4510	168	3.73	1:45:10



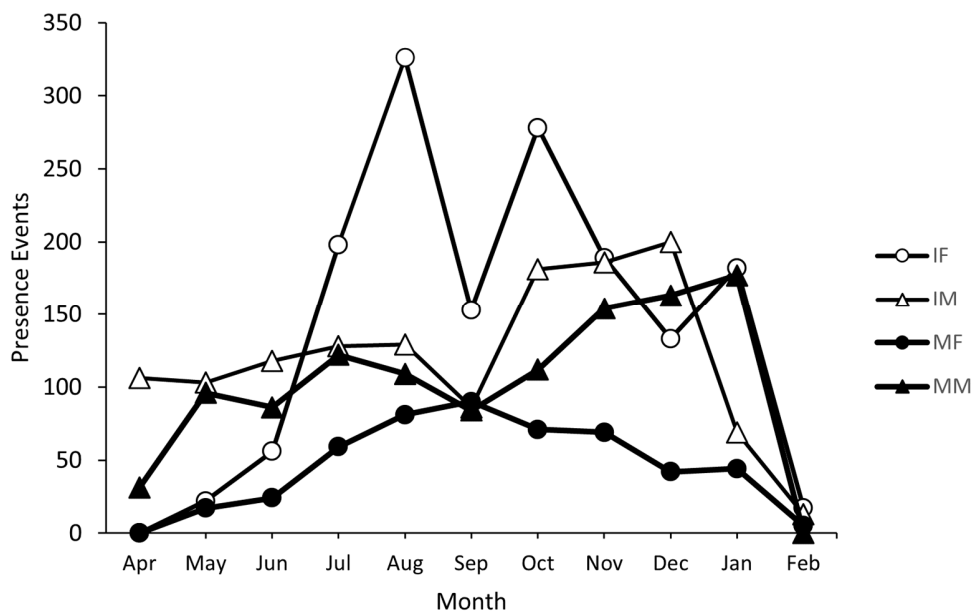
**Figure S2.** Total presence events by receiver for each life-history group. IF = immature female, IM = immature male, MF = mature female, MM = mature male.

**Table S4.** Receiver presence events by month for each life-history group.

<b>Immature</b>	<b>April</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Total</b>
<b>Female</b>												
1. Estuary			3	8	99	79	78	28	16	12	5	<b>328</b>
2. Mussel Pier			2	24	83	35	103	36	12	8	1	<b>304</b>
3. Marine Department			8	10	33	9	14	4		2	1	<b>81</b>
4. Baan Tai Had Resort		1	23	71	19	2	12	20	24	10		<b>182</b>
5. Wat Tai Had		13	20	58	39	18	59	78	57	61	10	<b>413</b>
6. Chaosamran restaurant		4		7	14	2	6	7	16	36		<b>92</b>
7. Wat Bang Khae Noi		4		12	19	4	2	9	4	31		<b>85</b>
8. Wat Bang Kung				8	20	4	4	7	4	22		<b>69</b>
<b>Female total events</b>		22	56	198	326	153	278	189	133	182	17	<b>1554</b>
<b>Male</b>												
1. Estuary					18	27		1	1	1		<b>48</b>
2. Mussel Pier	2			2	32	17	3	1	1			<b>58</b>
3. Marine Department				2	20	8						<b>30</b>
4. Baan Tai Had Resort	1		17	30	9	13	47	4	3	2		<b>126</b>
5. Wat Tai Had	33	1	6	23	10	6	11	8	2	9	1	<b>110</b>
6. Chaosamran restaurant	28	16	12	19	22	11	54	25	38	10	2	<b>237</b>
7. Wat Bang Khae Noi	42	86	83	50	17	4	39	72	73	21	8	<b>495</b>
8. Wat Bang Kung				2	1		27	75	82	26	2	<b>215</b>
<b>Male total events</b>	106	103	118	128	129	86	181	186	200	69	13	<b>1319</b>
<b>Immature total events</b>	<b>106</b>	<b>125</b>	<b>174</b>	<b>326</b>	<b>455</b>	<b>239</b>	<b>459</b>	<b>375</b>	<b>333</b>	<b>251</b>	<b>30</b>	<b>2873</b>
<b>Mature</b>	<b>April</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Total</b>
<b>Female</b>												
1. Estuary				1	33	31	15	1				<b>81</b>
2. Mussel Pier		3	2	6	34	57	24	3	4	4	1	<b>138</b>
3. Marine Department		7	8	4	13	2	18	3	1		4	<b>60</b>
4. Baan Tai Had Resort		7	3	12	1		3	18	3	2		<b>49</b>
5. Wat Tai Had			8	20			9	37	26	17		<b>117</b>
6. Chaosamran restaurant			3	12			2	7	8	16		<b>48</b>
7. Wat Bang Khae Noi				4						3		<b>7</b>
8. Wat Bang Kung										2		<b>2</b>
<b>Female total events</b>		17	24	59	81	90	71	69	42	44	5	<b>502</b>
<b>Male</b>												
1. Estuary	1	3			3	5		1				<b>13</b>
2. Mussel Pier	1	10		1	1	3	2	6				<b>24</b>
3. Marine Department	19	74	25	38	88	75	73	21	15	2		<b>430</b>
4. Baan Tai Had Resort	8	6	10	32	13	1	14	36	27	17		<b>164</b>
5. Wat Tai Had		3	29	38	4		13	69	91	66		<b>313</b>
6. Chaosamran restaurant			11	13			6	16	24	49		<b>119</b>
7. Wat Bang Khae Noi	2		11				2	3	5	30		<b>53</b>
8. Wat Bang Kung							2	2	1	13		<b>18</b>
1. Estuary	31	96	86	122	109	84	112	154	163	177		<b>1134</b>
<b>Mature total events</b>	<b>31</b>	<b>113</b>	<b>110</b>	<b>181</b>	<b>190</b>	<b>174</b>	<b>183</b>	<b>223</b>	<b>205</b>	<b>221</b>	<b>5</b>	<b>1636</b>



**Figure S3.** Boxplots showing the distribution of monthly residency index (MRI) data for tagged whiprays. X's represent the mean of the data and dark horizontal bars represent the median. Gray shaded areas show the middle 50% of the data, while vertical bars show the lower and upper 25%. Black dots represent outliers. Whiprays never detected by the array ( $n=3$ ) were not included. Sample size for July through February was  $n = 19$ . April, May, and June had reduced sample sizes ( $n = 7, 12$ , and  $18$ , respectively) because not all whiprays were tagged. March 2018 is not shown because three out of four tagged fish were never detected again, and the fourth had an MRI = 0.



**Figure S4.** Total presence events by month for each life-history group. IF = immature female, IM = immature male, MF = mature female, MM = mature male. March 2018 is not shown because three out of four tagged fish were never detected again, and the fourth had an MRI = 0.

**Table S5.** Number of presence events during the day and night for all life-history groups. Day:Night is the ratio of the number of day events to the number of night events.

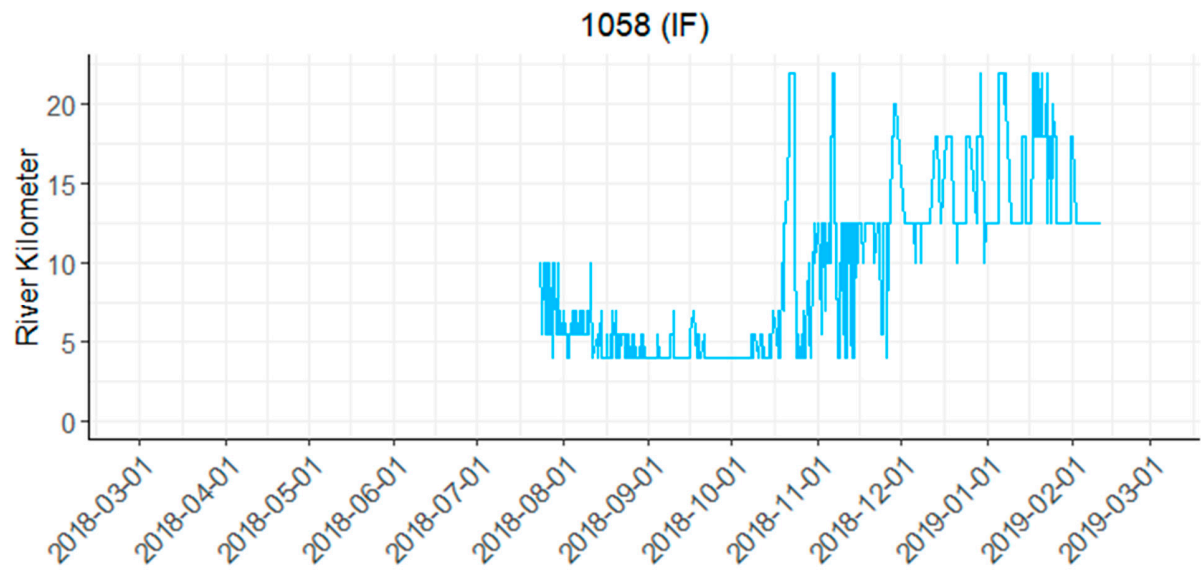
Sex	Total Events		Day:Night		
	Day	Night	Min	Mean (SD)	Max
<b>Immature</b>					
Female	740	814	0.50	0.75 (0.15)	0.88
Male	622	697	0.00	0.63 (0.57)	1.26
<i>Subtotal</i>	<i>1,362</i>	<i>1,511</i>	<i>0.00</i>	<i>0.70 (0.37)</i>	<i>1.26</i>
<b>Mature</b>					
Female	260	242	0.54	0.93 (0.28)	1.26
Male	642	492	0.88	1.18 (0.31)	0.56
<i>Subtotal</i>	<i>902</i>	<i>734</i>	<i>0.54</i>	<i>1.04 (0.30)</i>	<i>1.56</i>
<b>Sex Subtotal</b>					
<i>Female</i>	<i>1,000</i>	<i>1,056</i>	<i>0.50</i>	<i>0.84 (0.23)</i>	<i>1.26</i>
<i>Male</i>	<i>1,264</i>	<i>1,189</i>	<i>0.00</i>	<i>0.91 (0.52)</i>	<i>1.56</i>
<b>Grand Total</b>	<b>2,264</b>	<b>2,245</b>	<b>0</b>	<b>0.87 (0.37)</b>	<b>1.56</b>

**Table S6.** Results of Pearson's correlation tests for environmental correlates of residency index (RI). Tests analyzed the relationship between mean monthly environmental factors (temperature, salinity, and tide), and mean monthly residency indices (MRI).

Environmental Correlate	MRI	t	df	R	p
Temperature	MRI	0.35	9	0.12	0.73
	Female MRI	0.24	8	0.08	0.82
	Male MRI	0.80	9	0.26	0.45
	Immature MRI	-0.91	9	-0.29	0.39
	Mature MRI	0.46	9	0.15	0.66
Salinity	MRI	-0.20	9	-0.07	0.84
	Female MRI	-0.87	8	-0.29	0.41
	Male MRI	0.71	9	0.23	0.49
	Immature MRI	0.34	9	0.11	0.74
	Mature MRI	-0.40	9	-0.13	0.70
Tide	MRI	-1.52	9	-0.45	0.16
	Female MRI	-2.30	8	-0.63	0.05
	Male MRI	-0.50	9	-0.16	0.63
	Immature MRI	-0.10	9	-0.03	0.92
	Mature MRI	-2.2	9	-0.59	0.06

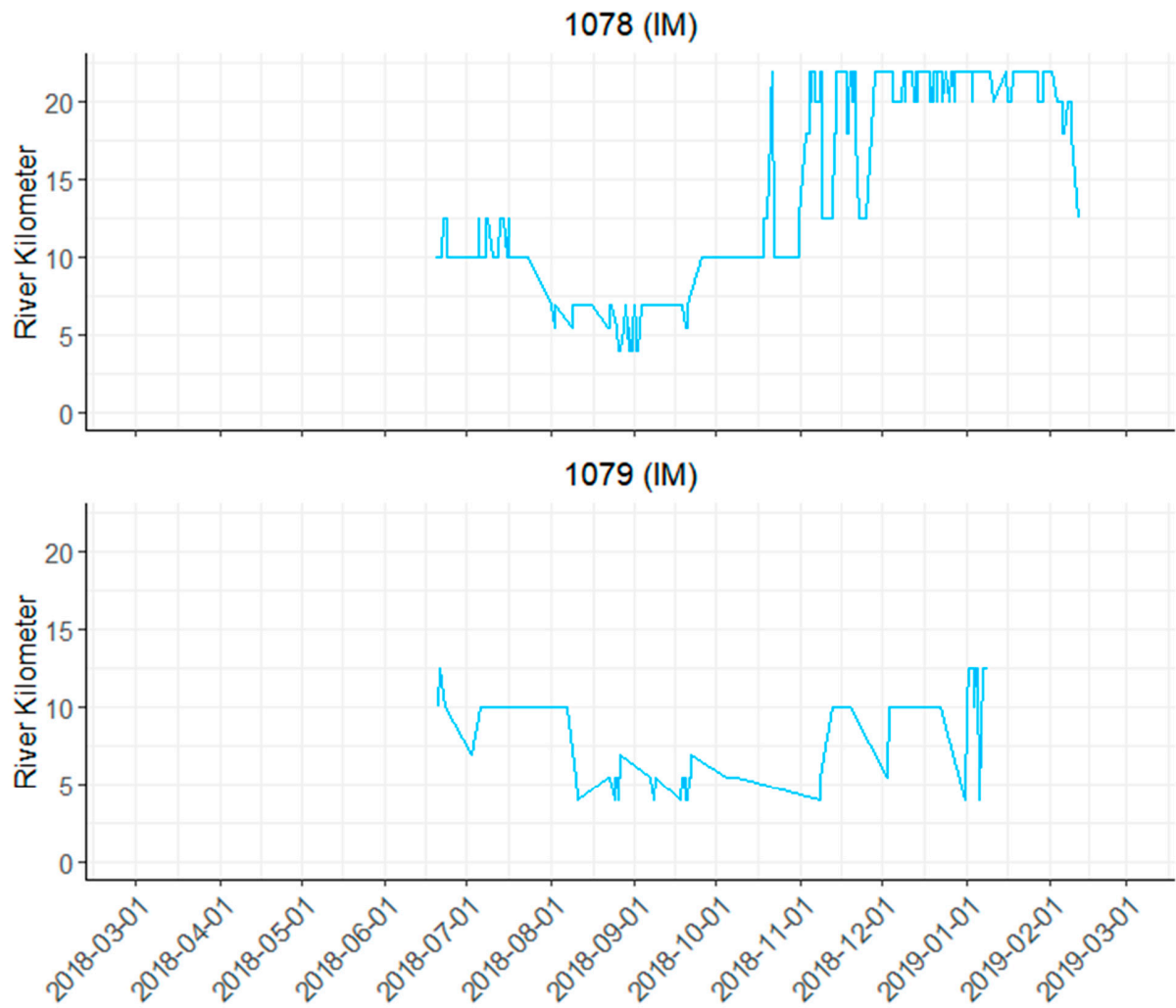
## Movement Plots of High-Use Whiprays

Immature Females



## Movement Plots of High-Use Whiprays

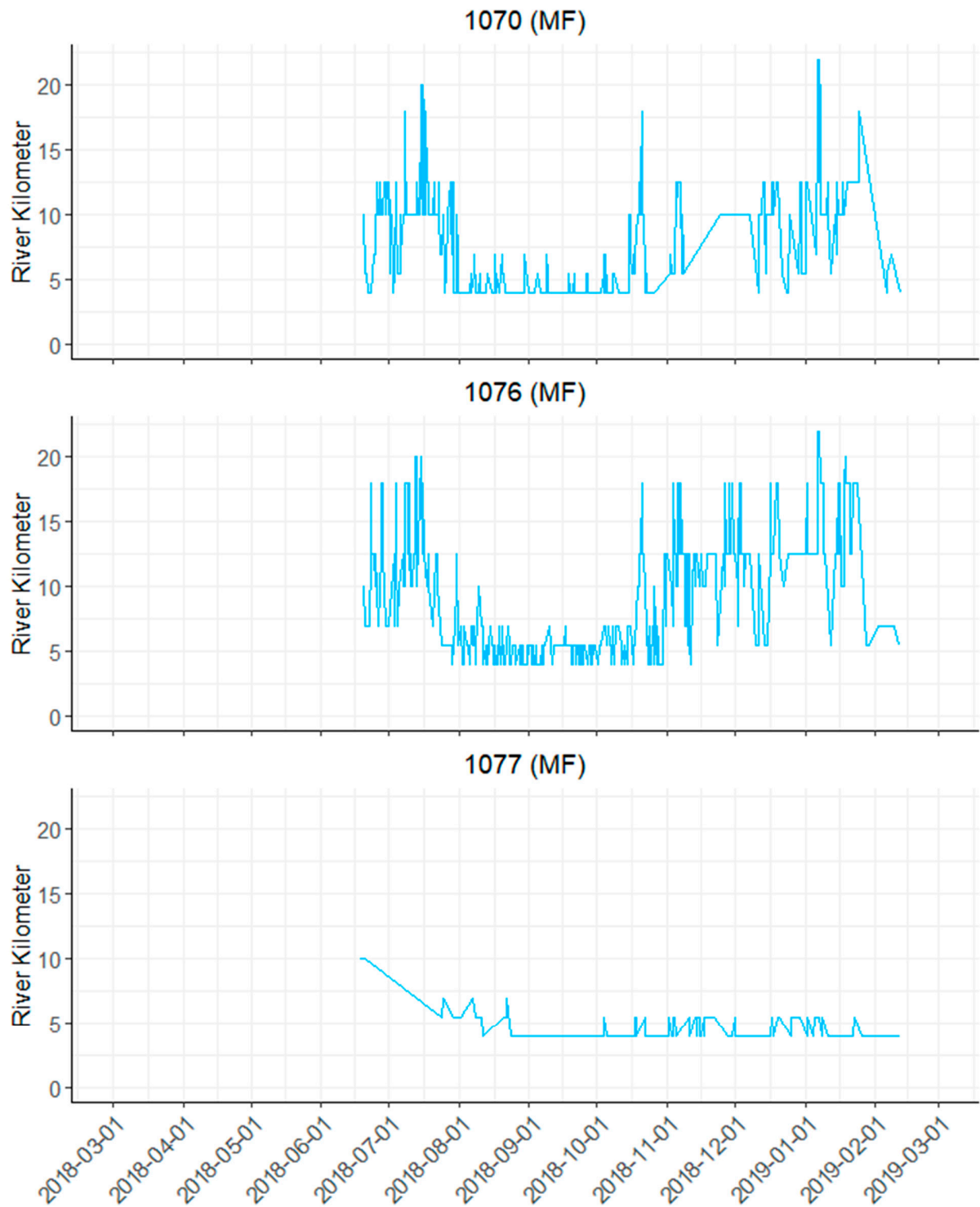
Immature Males





## Movement Plots of High-Use Whiprays

Mature Females



## Movement Plots of High-Use Whiprays

Mature Males

