

Spatial ecology of tagged feral cats on Schiermonnikoog

Public defence M.Sc. Dissertation

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All pictures from author, unless otherwise mentioned



university of
groningen

Introduction

- Feral Cat?

- House cat reverted to feral (verwilderd) state. It is independent of human help
- Many behavioural-, but no exterior differences



S: *Felis silvestris*
E: European Wildcat
D: Wilde kat



S: *Felis catus*
E: Domestic/house cat
D: Huiskat



S: *Felis catus*
E: Feral cat?
D: Verwilderde kat?

Introduction

- Highly discussed in Dutch society

"Katten afschieten moet verboden worden"

Door de nieuwsredactie · geplaatst: vrijdag 9 oktober 2015, 14:41 uur | update: 17:42 uur

PROVINCIE UTRECHT - De Partij voor de Dieren (PvdD) wil dat het verboden wordt om wilde katten dood te schieten. Dat is nu nog toegestaan in de provincies Utrecht, Friesland en Overijssel.

NOS REGIO

Doodsbedreiging jagers na oproep katten af te schieten

© WO 28 OKTOBER, 16:19 REGIO

De Koninklijke Jagersvereniging in Amersfoort heeft de afgelopen week ongeveer dertig doodsbetredingen gekregen. De club vindt dat verwilderde katten doodgeschoten moeten worden.



vrijdag 23 oktober in Stand.nl

Verwilderde huiskatten moeten worden afgeschoten

Verwilderde huiskatten horen niet thuis in de Nederlandse natuur. Ze richten een slachting aan onder beschermde diersoorten en verspreiden vaak ziekten. Daarom zouden ze moeten worden afgeschoten, als ze niet weggevangen kunnen worden. Dat zegt de Koninklijke Jagersvereniging. » [Lees meer](#)

2177 stemmen



197 reacties

Reageer

Introduction; problem description

- Problem?
 - Hybridisation / competition with *F. silvestris* (Wildcat)
 - Invasive alien species
 - Not a natural predator
 - Annually kill 1.7 billion birds and 10.9 billion mammals (USA + Europe)
 - Contributed to 14% of bird, mammal and reptile extinctions
 - Prey have no evolutionary adaptation
 - Especially birds on islands



Introduction; aim

- Gain knowledge on spatial ecological behaviour
- Aim to get insights...
 1. ...in which areas are used by feral cats;
 2. ...in how they use these areas;
 3. ...in reasons why they use these areas.

Introduction

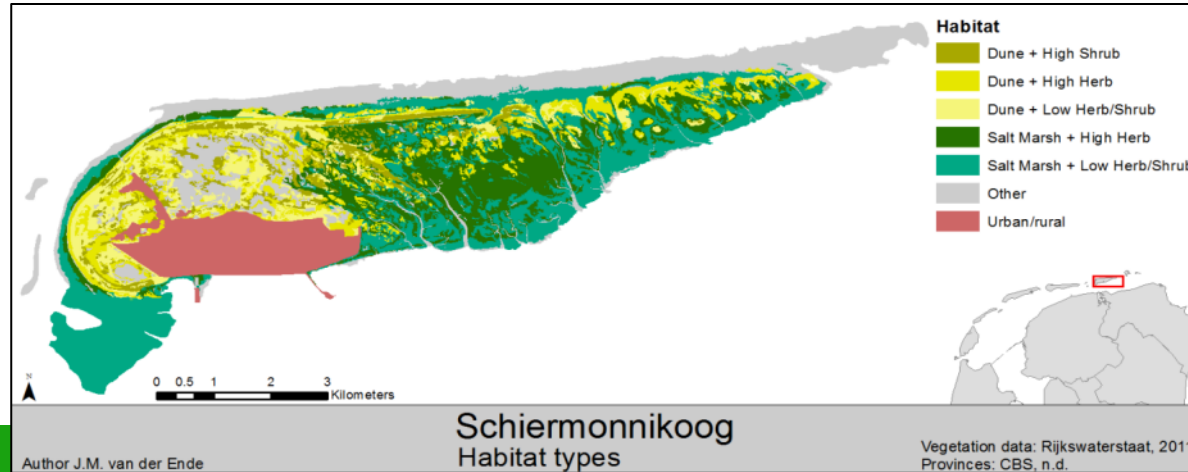
- Tag cats on an island
 - Use high resolution GPS
 - Movements during breeding season



Method; Study Area

- Schiermonnikoog

- Dutch Waddensea island
- 7 km offshore
- 3500 ha of unique natural area with different habitats



Method; Study Material

- 28 live traps
- 10 GPS tags (e-obs, Germany) + Telemetry equipment
- 10 feral cats
- Software Python 2.7.5, ArcGIS 10.2.1 & Geospatial Modelling Environment 0.7.3



(28)

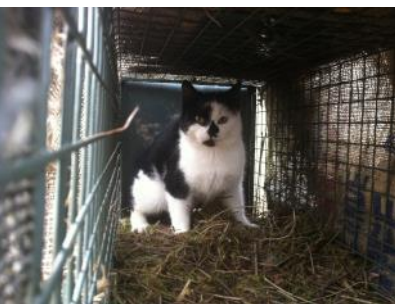
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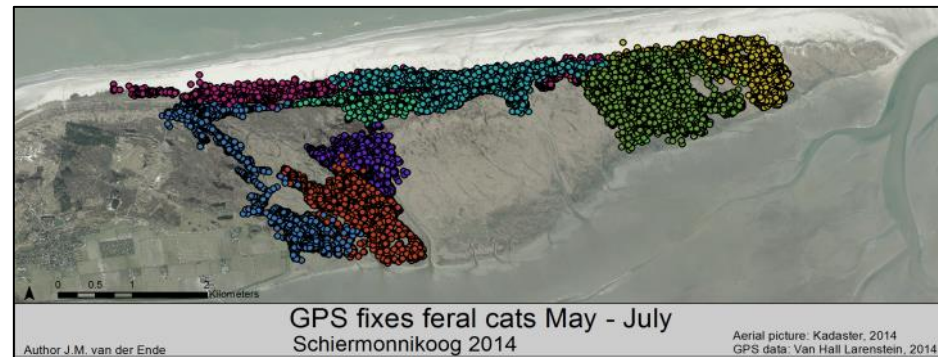
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1 fix per 15
+ minutes during =
3 months



Result; trapping

Cat	Sex	Age	Weight kg		GPS started	GPS stopped	# Total fixes	Remark
			1st catch	2nd catch				
0	M	Ad	4.6	6.2	4-05-14 22:13	-	-	Tag damaged
1	F	Ad	3.3	3.3	4-05-14 0:00	24-08-14 23:45	10848	Presumably pregnant
2	M	Sub	2.6	-	4-05-14 0:00	16-09-14 23:45	13056	
3	M	Sub	2.6	-	4-05-14 0:00	16-09-14 23:45	13056	
4	F	Sub	2.6	2.7	4-05-14 0:00	16-09-14 23:45	13056	
5	F	Sub	2.4	-	4-05-14 0:00	16-09-14 23:45	13056	
6	M	Sub	3.0	-	4-05-14 0:00	31-07-14 23:45	8544	
7	F	Ad	3.6	3.9	4-05-14 0:00	16-09-14 23:45	13056	Mating observed with cat 9
8	F	Ad	2.8	3.4	4-05-14 0:00	16-09-14 23:45	13056	Pregnant / Kittens found
9	M	Ad	4.1	-	4-05-14 0:00	16-09-14 23:45	13056	
Total							110784	

- After data preparation ~77,000 suitable fixes were used (May - July)



Method; which area is used

- Home ranges

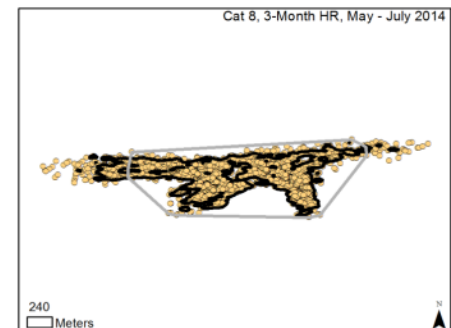
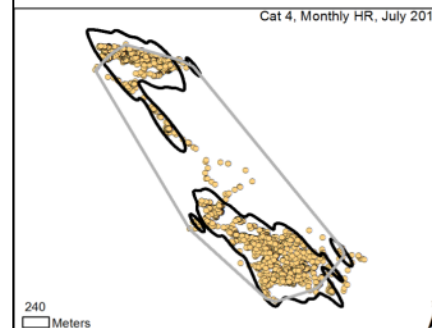
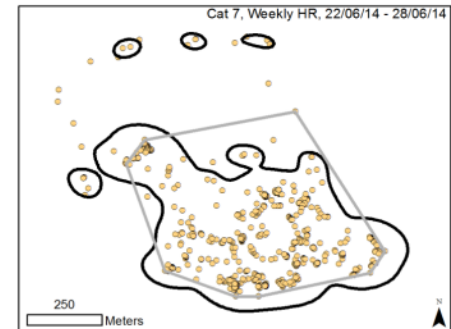
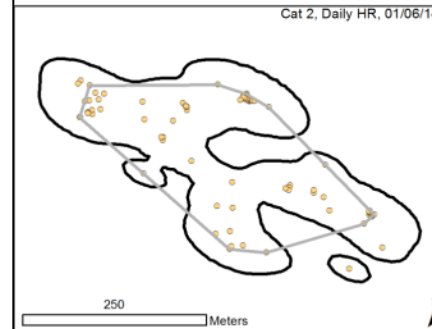
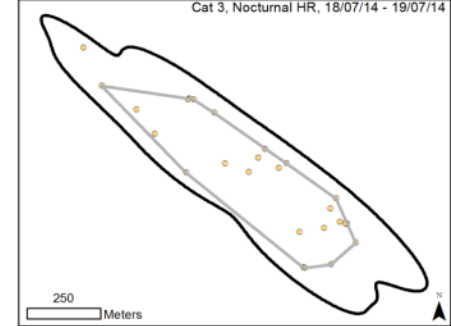
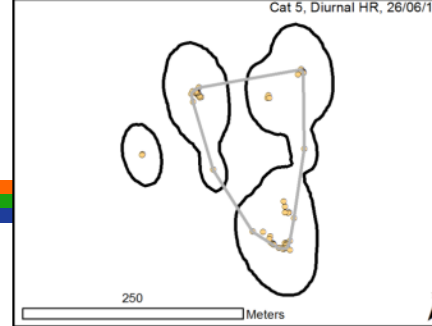
- HR = “that area traversed by an individual in its normal activities of food gathering, mating, and caring for young.” (Burt 1943)

- Minimum Convex Polygon (MCP 95%)

- The smallest possible polygon enclosing all data points by connecting the peripheral points where the interior angles are always smaller than, or equal to 180°

- Kernel 95%

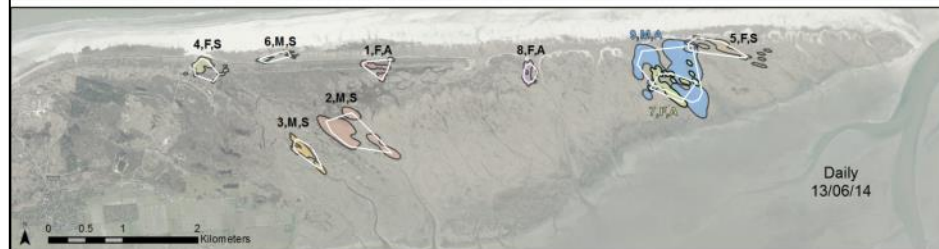
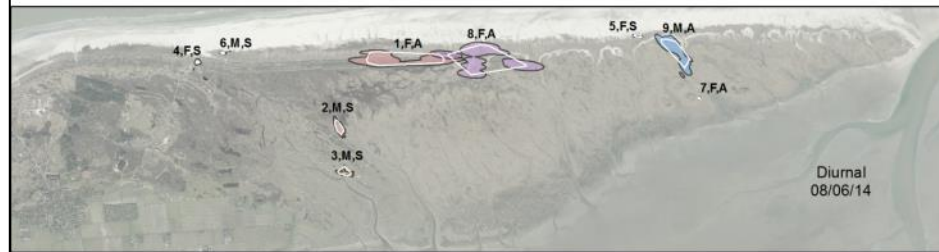
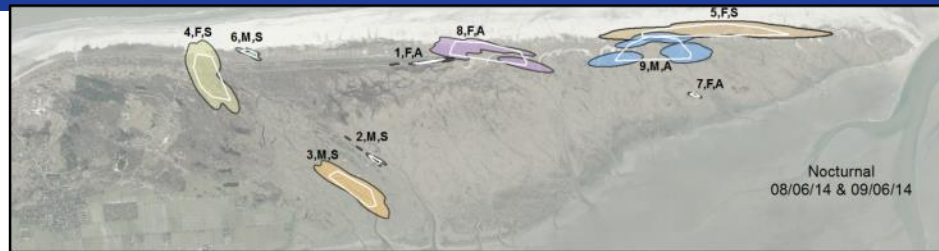
- Fixed kernel with Plug-in bandwidth selection



Method; which area is used

- Home ranges
 - Nocturnal, Diurnal, Daily, Weekly, Monthly & 3-Months
 - Total of 2505 HR calculated

Result; which area is used

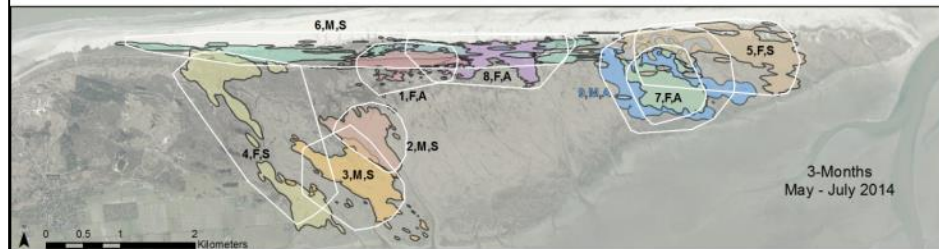
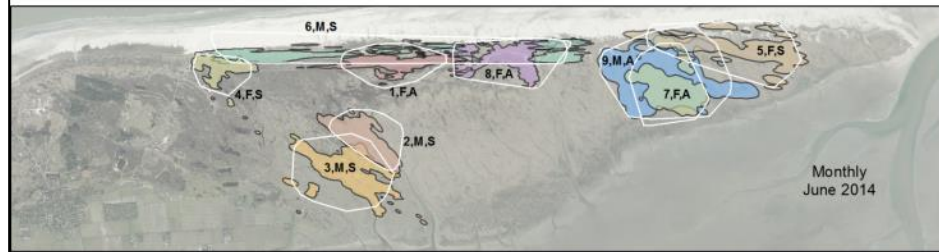
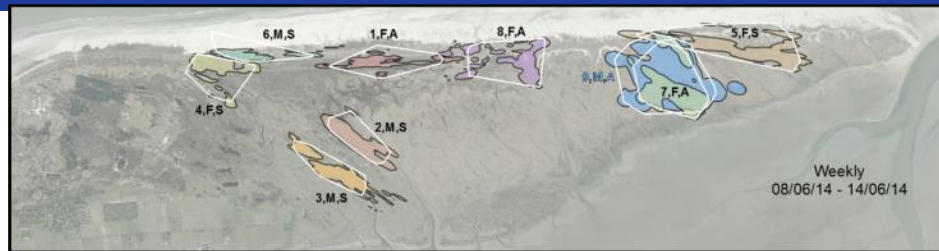


1-9: CatID
M/F: Male/Female
A/S: Adult/Subadult

□ MCP 95%
□ Kernel 95%

**Home ranges feral cats
Schiermonnikoog 2014**

Author: J.M. van der Ende
Aerial picture: Kadaster, 2014
GPS data: Van Hall Larenstein, 2014



1-9: CatID
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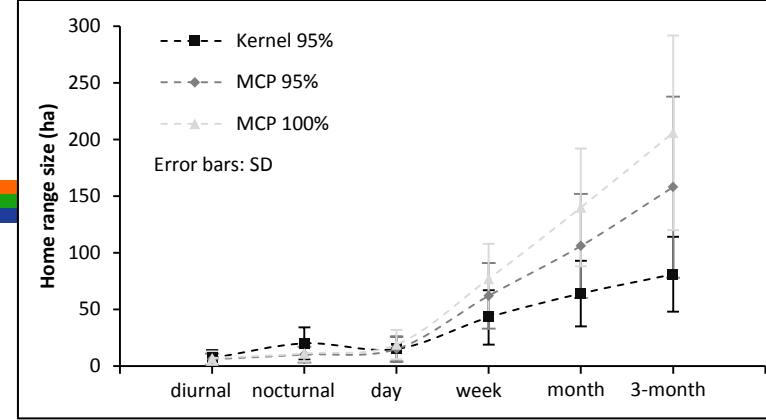
□ MCP 95%
□ Kernel 95%

**Home ranges feral cats
Schiermonnikoog 2014**

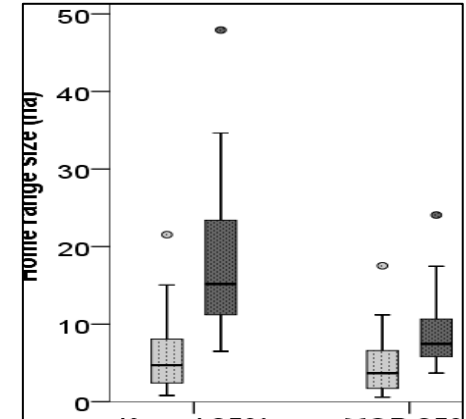
Author: J.M. van der Ende
Aerial picture: Kadaster, 2014
GPS data: Van Hall Larenstein, 2014

Result; which area is used

- Home ranges
 - No difference between sexes or age classes
 - Nocturnal > Diurnal HR
 - ($Z=-1.955, p=0.051$)

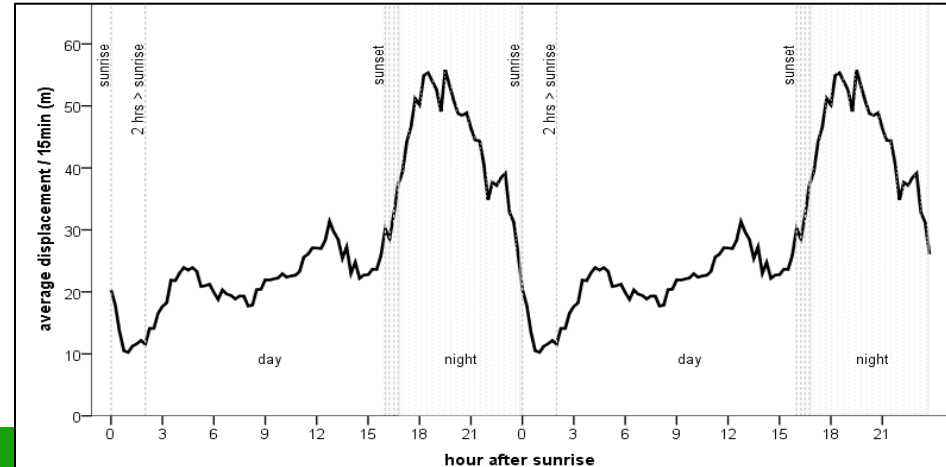


Method	Max	Min
Kernel 95%	140 ha (adult male)	37 ha (adult female)
MCP 95%	289 ha (subadult female)	62 ha (subadult male)



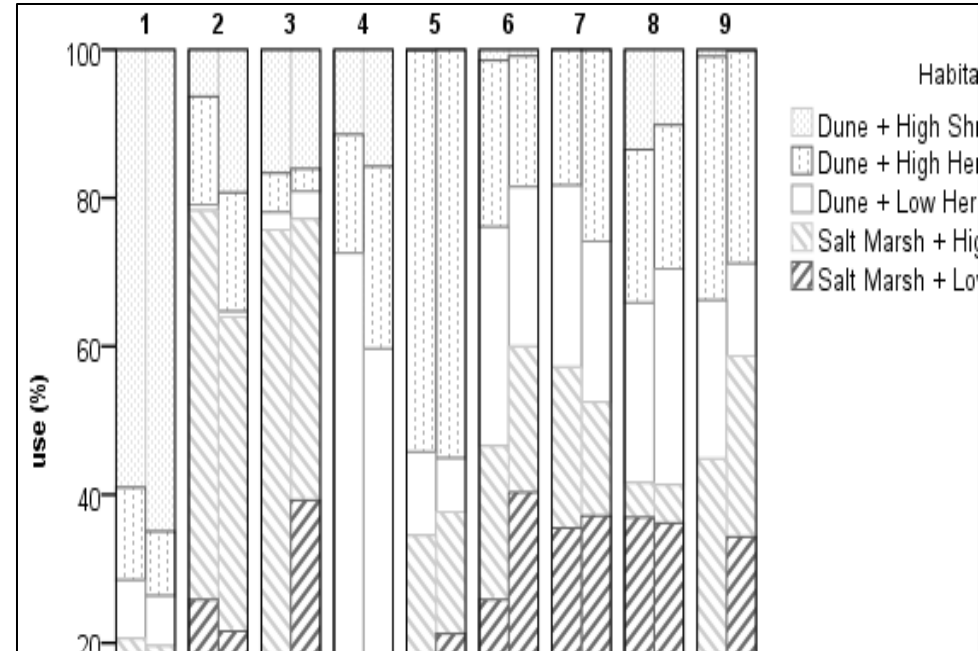
Method & Result; how the area is used

- Circadian activity pattern
 - Distance between 2 fixes
 - Nocturnal > Diurnal displacement
 - (LMM; $M=\pm 24.71$, $SE=4.45$, 10 , $p<0.001$)



- **Habitat use**

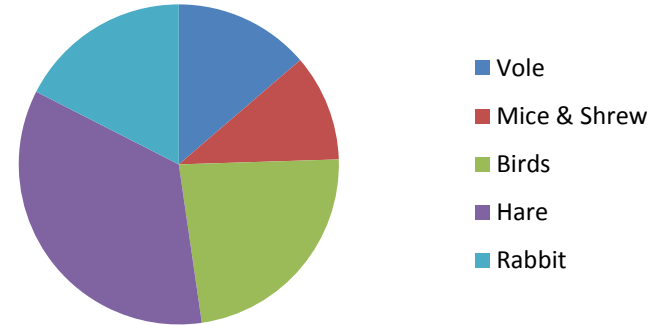
- Randomly selected 600 fixes per period (day/night)
- Nocturnal vs. Diurnal habitat use differed significantly for 8 cats
 - (χ^2 ; 4.68 – 111.29, 4-5, $p < 0.001 - 0.322$)
- Dune and Salt Marsh dwellers
- Salt Marsh + Low Herb/Shrub used more during night
- No clear pattern



- Prey

- Faeces analysis
- Calculate volume of prey
 - Small mammals ~ 25%
 - Birds ~ 25%
 - Hare/rabbit ~50%

Volume of prey ingested 2014



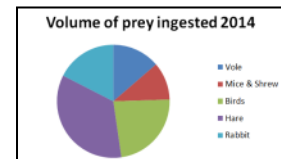
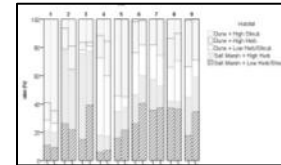
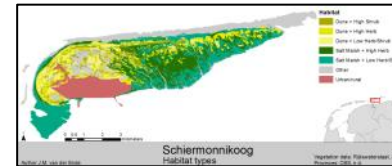
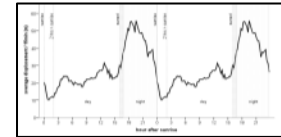
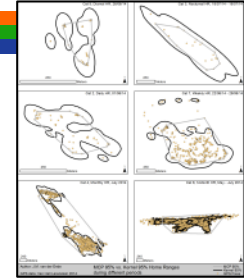
Summarize / conclusion

Which

How

Why

- Home ranges
 - Shapes of HR differ
 - No difference between ♀ & ♂
 - Bigger nocturnal HR than Diurnal
- Displacement
 - More active during night
- Habitat use
 - More use of short Salt Marsh vegetation during night
- Prey
 - Hare and Rabbit big part of diet



Summarize / conclusion

- Each cat is unique, so hard to find patterns with a small sample
- The nocturnal cats seem to search for their favourite prey in short vegetation

Questions



Open data

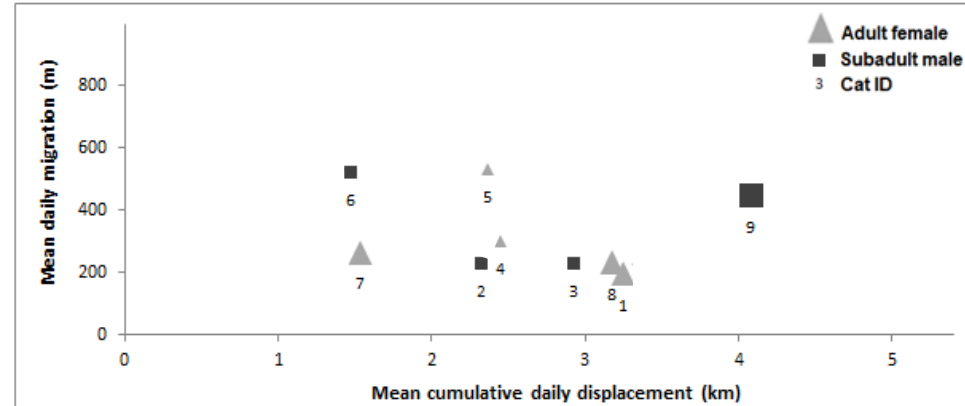
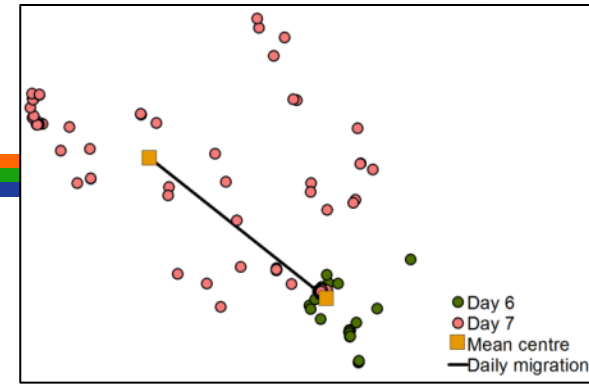
- GPS data: May – September (for most cats) interval of 15 min
- Acceleration data: May –September interval of 3 min, 8.85 sec sample, 18.74 Hz per axis (XYZ)
- Hogeschool VHL should be acknowledged

Acknowledgement

- Finances & material; VHL
- Supervision; Eduardo Dias (UNIGIS) & Chris Smit (RUG)
- Accommodation & DEC; RUG
- Permissions & Logistics; Natuurmonumenten Schiermonnikoog
- Fieldwork; Arjen Strijkstra, Corine Oomkes, Ilse Hendriksen, Rick Heeres & Stephan Warnaar
- Sharon Boekhout
- Colleagues
- External advisors
- Volunteers & students

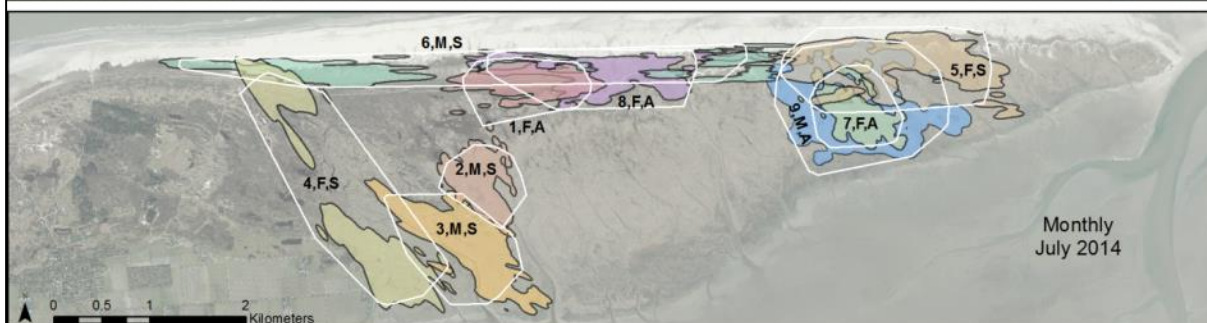
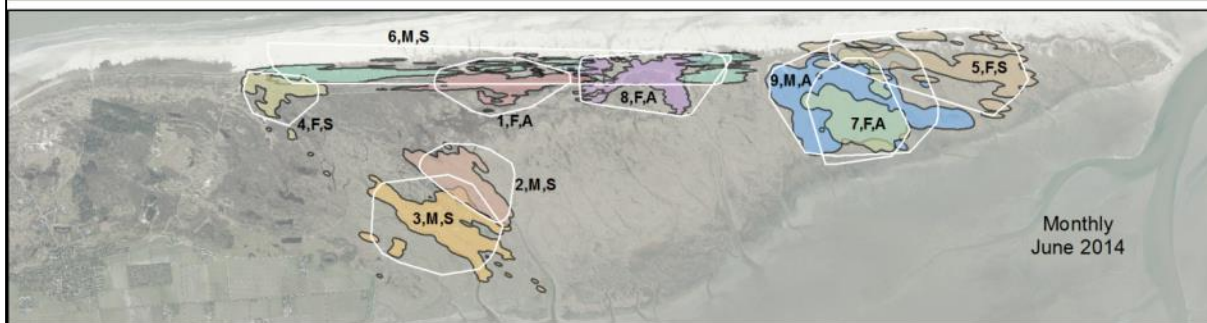
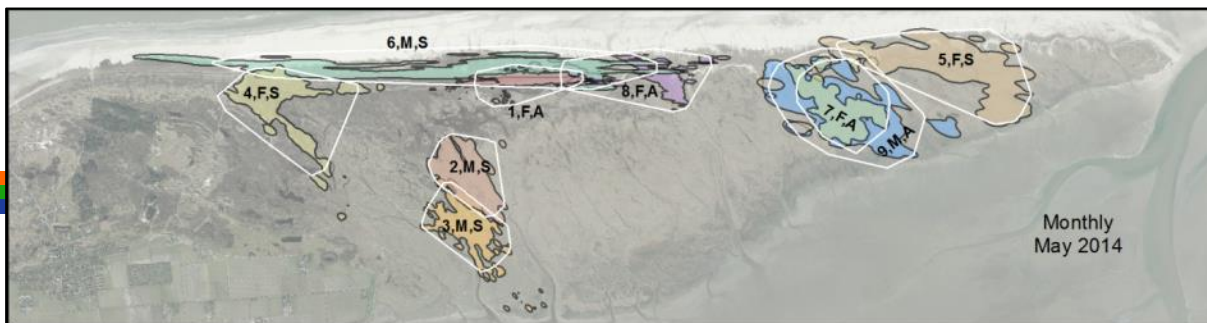
How the area is used

- Migration vs. Displacement



Home Ranges

values in ha													
Cat,sex,age	Diurnal		Nocturnal		Day		Week		Month		3-Month		
	M	n SD	M	n SD	M	n SD	M	n SD	M	n SD	M	n SD	
1,F,A	8	88 7	7	88 8	11	89 8	23	13 11	31	3 16	37	1	
2,M,S	8	88 7	7	88 11	12	89 9	29	13 8	41	3 3	48	1	
3,M,S	5	88 4	23	88 24	17	89 13	41	13 20	62	3 25	72	1	
4,F,S	5	88 5	16	88 25	12	89 13	36	13 21	55	3 40	92	1	
5,F,S	2	88 3	35	88 33	10	89 9	58	13 29	90	3 18	111	1	
6,M,S	1	88 1	11	88 14	5	89 6	35	13 32	73	3 17	99	1	
7,F,A	2	78 3	15	79 19	8	78 7	31	10 13	48	3 7	59	1	
8,F,A	15	88 18	14	88 18	18	89 21	35	13 21	51	3 27	69	1	
9,M,A	22	88 20	48	88 48	43	89 29	102	13 28	125	3 23	140	1	
Male	9	4 9	22	4 19	19	4 17	52	4 34	75	4 36	90	4 39	
Female	6	5 5	17	5 10	12	5 4	36	5 13	55	5 21	74	5 29	
Adult	12	4 8	21	4 18	20	4 16	48	4 37	64	4 42	76	4 42	
Subadult	4	5 3	18	5 11	11	5 5	40	5 11	64	5 18	85	5 25	
Overall	7	9 7	20	9 14	15	9 11	43	9 24	64	9 29	81	9 33	
MCP 95%	1,F,A	7	88 5	4	88 4	10	89 7	35	13 9	55	3 19	74	1
	2,M,S	5	88 4	4	88 5	10	89 7	34	13 8	50	3 3	62	1
	3,M,S	4	88 3	11	88 10	17	89 14	48	13 28	91	3 35	134	1
	4,F,S	4	88 4	8	88 13	13	89 15	62	13 39	120	3 100	289	1
	5,F,S	2	88 2	17	88 16	13	89 12	96	13 46	138	3 27	194	1
	6,M,S	1	88 1	6	88 7	5	89 8	58	13 49	171	3 20	246	1
	7,F,A	2	78 2	7	79 9	8	78 6	44	10 14	73	3 12	83	1
	8,F,A	11	88 13	7	88 9	17	89 17	56	13 26	91	3 23	134	1
	9,M,A	18	88 15	24	88 22	42	89 24	123	13 29	168	3 30	203	1
	Male	7	4 7	11	4 9	19	4 16	66	4 40	120	4 60	161	4 81
	Female	5	5 4	9	5 5	12	5 3	59	5 23	95	5 34	155	5 89
	Adult	9	4 7	11	4 9	19	4 16	65	4 40	96	4 50	124	4 60
	Subadult	3	5 2	9	5 5	11	5 4	60	5 23	114	5 46	185	5 90
	Overall	6	9 5	10	9 7	15	9 11	62	9 29	106	9 46	158	9 80
MCP 100%	1,F,A	8	88 6	5	88 5	12	89 7	44	13 12	71	3 19	103	1
	2,M,S	6	88 4	4	88 6	12	89 8	43	13 12	77	3 7	107	1
	3,M,S	4	88 3	12	88 11	21	89 15	70	13 28	134	3 30	198	1
	4,F,S	5	88 5	10	88 15	17	89 19	87	13 39	173	3 66	345	1
	5,F,S	2	88 2	19	88 16	19	89 16	111	13 45	202	3 53	284	1
	6,M,S	1	88 1	6	88 7	8	89 10	70	13 50	199	3 14	280	1
	7,F,A	2	78 2	8	79 9	10	78 8	58	10 17	96	3 9	126	1
	8,F,A	12	88 13	8	88 10	20	89 19	73	13 33	123	3 32	182	1
	9,M,A	20	88 15	26	88 23	50	89 25	139	13 28	186	3 26	228	1
	Male	8	4 9	12	4 10	23	4 19	80	4 41	149	4 56	203	4 73
	Female	6	5 4	10	5 5	16	5 4	74	5 26	133	5 54	208	5 104
	Adult	11	4 8	12	4 10	23	4 18	78	4 42	119	4 49	160	4 56
	Subadult	3	5 2	10	5 6	15	5 5	76	5 25	157	5 52	243	5 92
	Overall	7	9 6	11	9 7	19	9 13	77	9 31	140	9 52	206	9 86



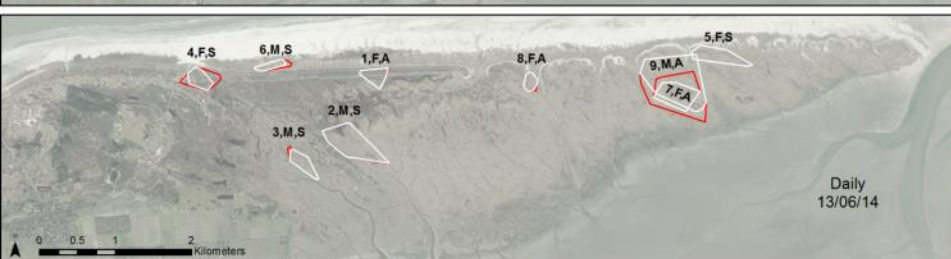
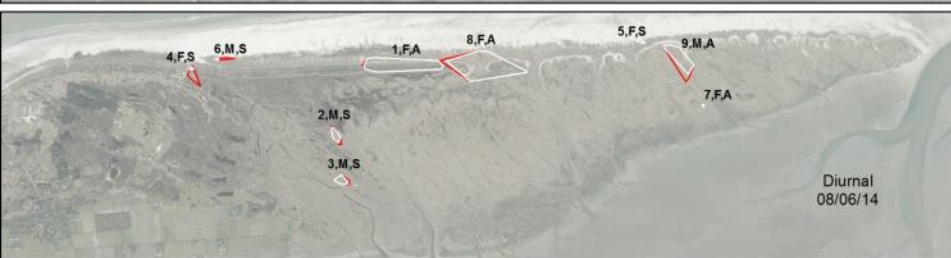
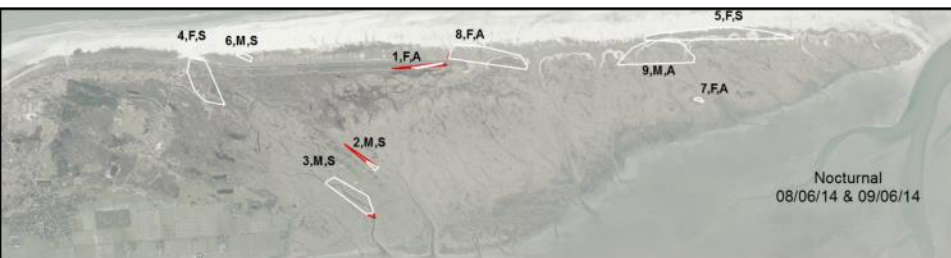
0 0.5 1 2
Kilometers

1-9: CatID
M/F: Male/Female
A/S: Adult/Subadult

□ MCP 95%
□ Kernel 95%

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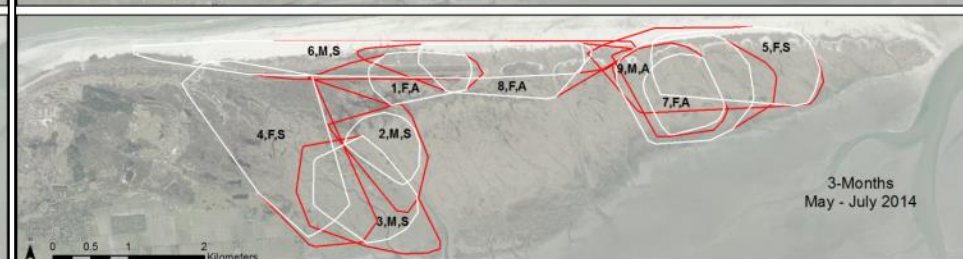
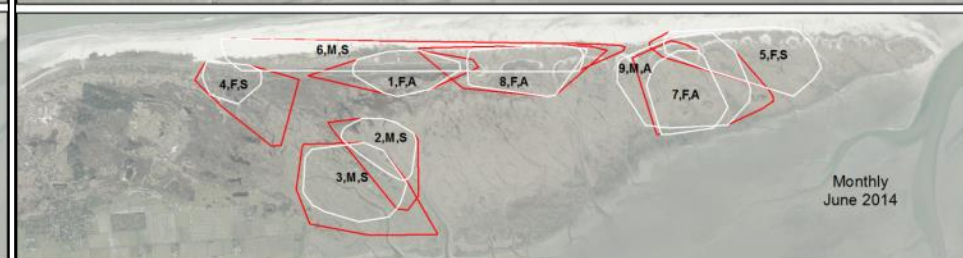
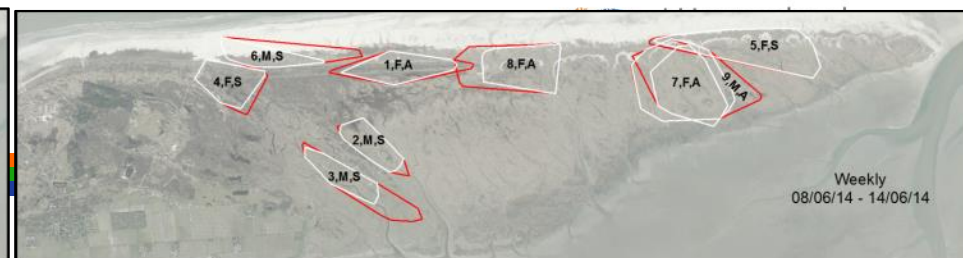


1-9: CatID
M/F: Male/Female
A/S: Adult/Subadult

□ MCP 95%
□ MCP 100%

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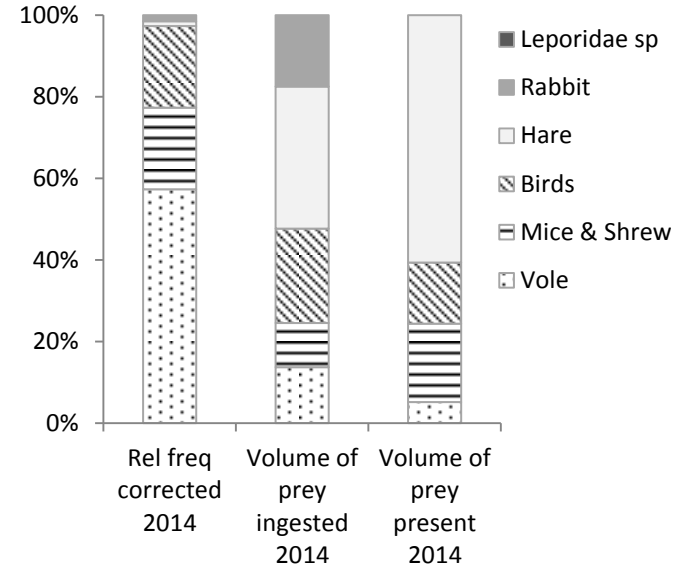
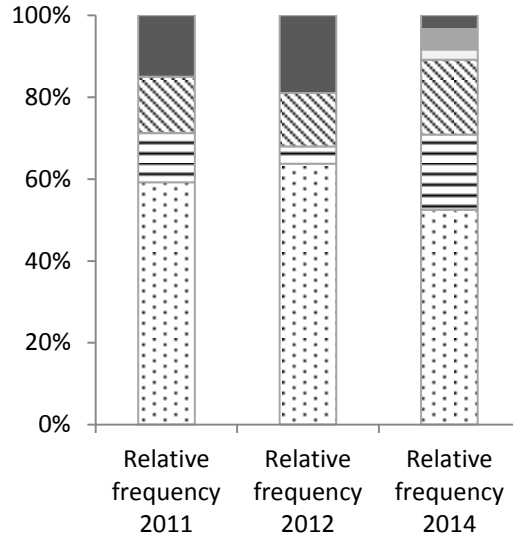
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□ MCP 100%

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Prey



Data Preparation

