

## An artificial site provides valuable additional habitat to migratory shorebirds in a tropical harbour

Amanda Lilleyman<sup>A,E</sup>, Danny I. Rogers<sup>A,B</sup>, Micha V. Jackson<sup>C</sup>, Richard A. Fuller<sup>C</sup>, Gavin O'Brien<sup>D</sup> and Stephen T. Garnett<sup>A</sup>

<sup>A</sup>Threatened Species Recovery Hub, National Environmental Science Program, Research Institute for the Environment and Livelihoods, Charles Darwin University, Ellengowan Drive, Casuarina, NT 0909, Australia.

<sup>B</sup>Arthur Rylah Institute for Environmental Research, Heidelberg, Vic. 3084, Australia.

<sup>C</sup>School of Biological Sciences, University of Queensland, St Lucia, Qld 4067, Australia.

<sup>D</sup>BirdLife Top End, Charles Darwin University, Ellengowan Drive, Casuarina, NT 0909, Australia.

<sup>E</sup>Corresponding author. Email: amanda.lilleyman@cdu.edu.au

### Supplementary material

**Table S1.** Number of times the EPBC Act 0.1% (national) and 1% (international) threshold has been met for migratory shorebirds at natural and artificial sites in Darwin, Northern Territory.

Threshold	0.1%	0.1%	1%	1%
Site class	Natural	Artificial	Natural	Artificial
Bar-tailed Godwit	<b>3</b>	0	0	0
Black-tailed Godwit	<b>28</b>	0	<b>1</b>	0
Common Greenshank	0	<b>6</b>	0	0
Common Sandpiper	0	0	0	0
Curlew Sandpiper	0	0	0	0
Eastern Curlew	<b>4</b>	<b>57</b>	0	0
Great Knot	<b>254</b>	0	<b>33</b>	0
Greater Sand Plover	<b>208</b>	<b>17</b>	<b>1</b>	0
Grey Plover	<b>1</b>	0	0	0
Grey-tailed Tattler	<b>4</b>	<b>17</b>	0	0
Lesser Sand Plover	<b>4</b>	<b>2</b>	0	0
Marsh Sandpiper	0	0	0	0
Oriental Plover	0	0	0	0
Pacific Golden Plover	0	<b>2</b>	0	0
Red Knot	<b>144</b>	<b>2</b>	0	0
Red-necked Stint	<b>1</b>	0	0	0
Ruddy Turnstone	<b>77</b>	0	0	0

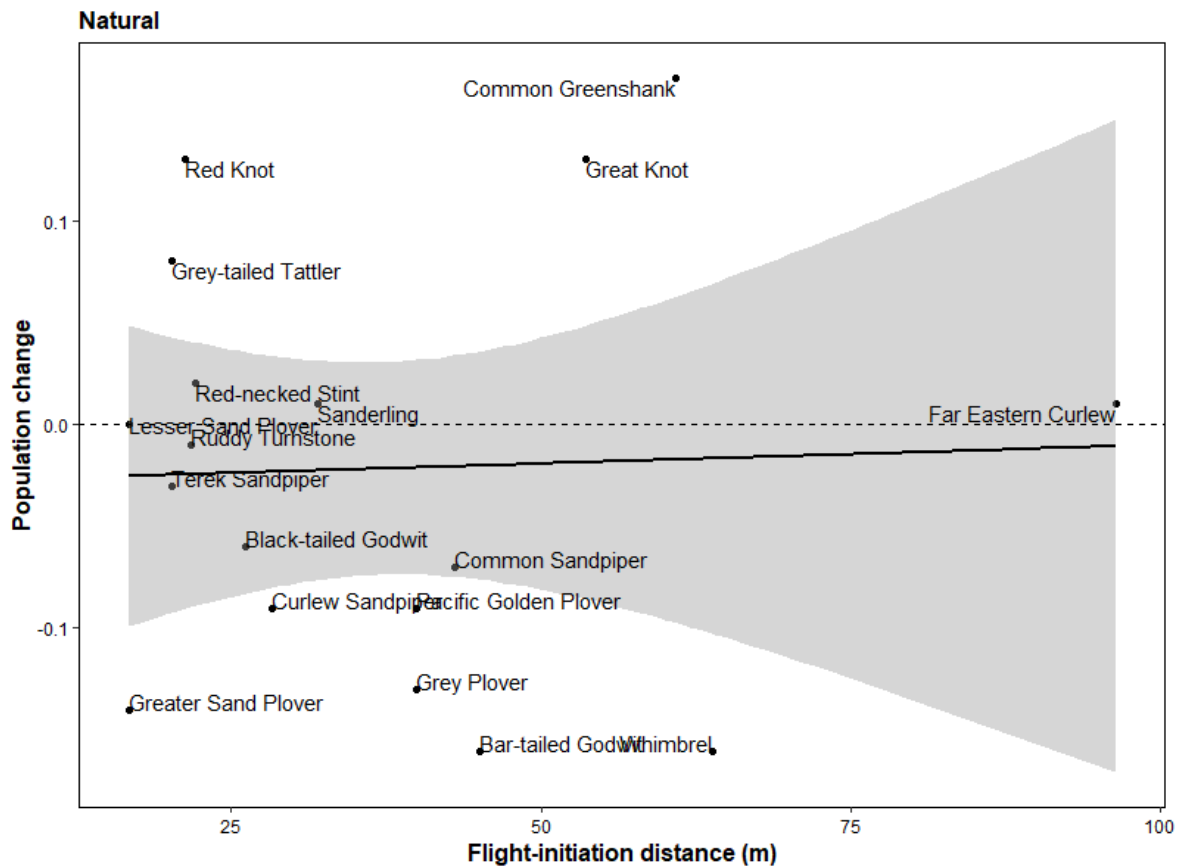
Sanderling	<b>154</b>	0	0	0
Sharp-tailed Sandpiper	<b>1</b>	<b>12</b>	0	0
Terek Sandpiper	<b>6</b>	<b>28</b>	0	0
Whimbrel	<b>48</b>	<b>28</b>	0	0

**Table S2.** Site characteristics of the natural and artificial sites in Darwin Harbour for migratory shorebirds. Area is the available suitable roosting area for shorebirds at tides >6m.

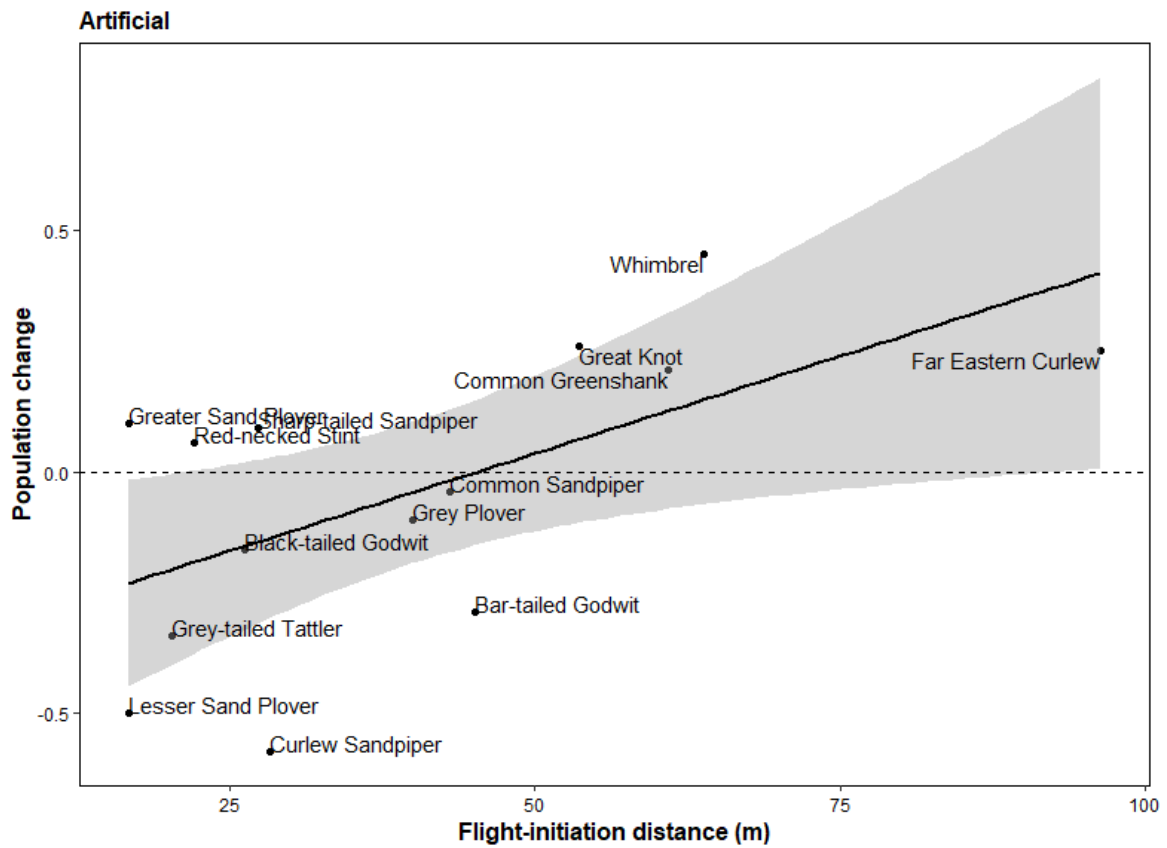
<b>Site class</b>	<b>Site</b>	<b>Habitat type</b>	<b>Area (km<sup>2</sup>)</b>
Artificial	East Arm Wharf	dredge ponds	0.117
Natural	Lee Point	sandy beach	0.047
Natural	Spot on Marine	saltpan	0.021
Natural	Nightcliff Rocks	rocky shore	0.013
Natural	East Point	rocky shore	0.018
Natural	Sandy Creek	sandy beach	0.051

**Table S3.** Count of responses of migratory shorebirds to various disturbance stimuli at four sites from 2014 – 2016 austral summer months. BOP = bird of prey.

<b>Response type =&gt;</b>	<b>Flight</b>						<b>Non-flight</b>	<b>No response</b>		<b>Total</b>
	<b>Aircr aft</b>	<b>B OP</b>	<b>D og</b>	<b>Hum an</b>	<b>Human + dog</b>	<b>Unkno wn</b>	<b>Huma n</b>	<b>Hum an</b>	<b>Human + dog</b>	
<b>Site</b>										
<b>Lee Point</b>		3		8	9		1	4	17	<b>42</b>
<b>Nightcliff Rocks</b>		3		3	1					<b>7</b>
<b>Sandy Creek</b>	2	3	3	6	3	1	4		2	<b>24</b>
<b>Spot on Marine</b>					1		1			<b>2</b>
<b>East Arm Wharf</b>		4				2				<b>6</b>
<b>Total</b>	<b>2</b>	<b>13</b>	<b>3</b>	<b>17</b>	<b>14</b>	<b>3</b>	<b>6</b>	<b>4</b>	<b>19</b>	<b>81</b>



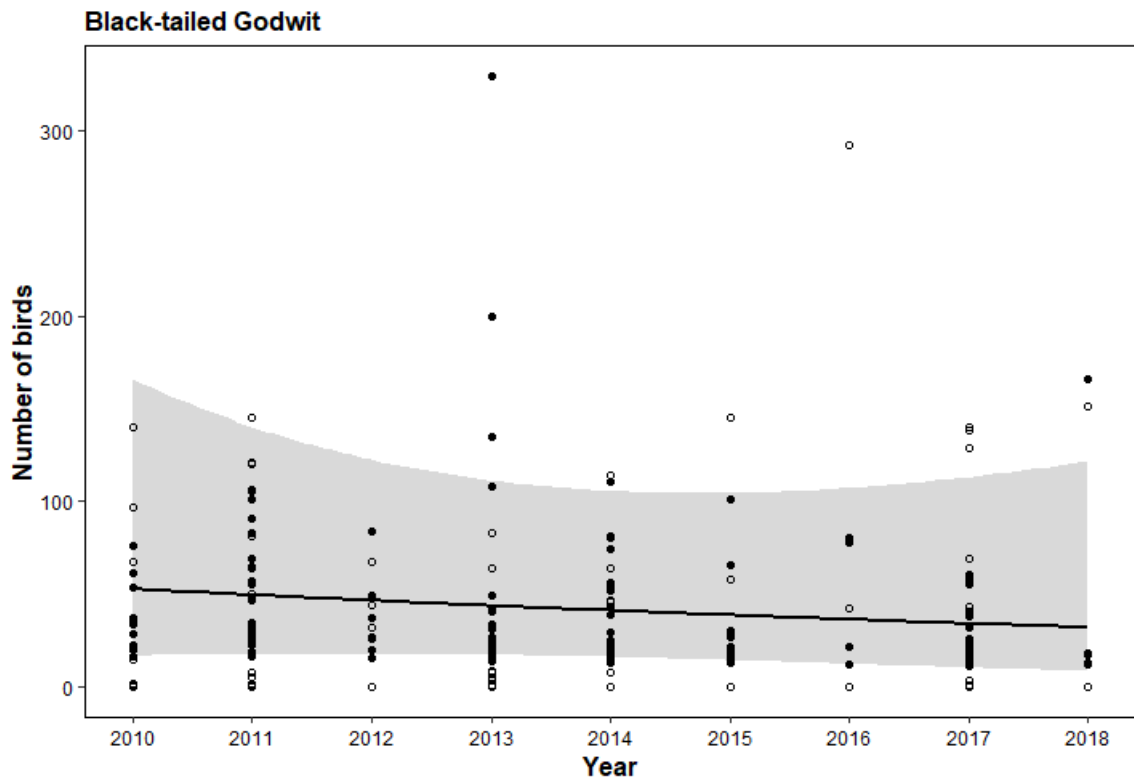
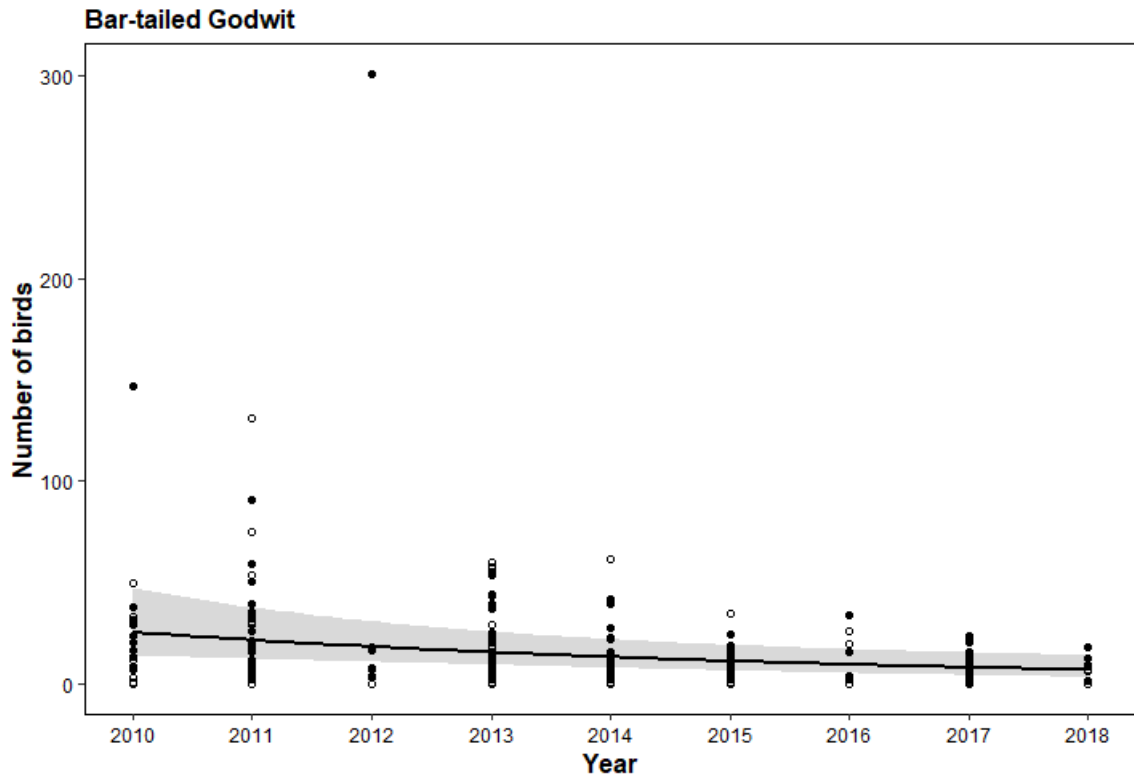
**Figure S1.** Relationship between population change of each species and flight-initiation distance at natural sites in Darwin Harbour. Dashed line shows a stable population change rate, values above or below indicate the species population increase or decrease, respectively.

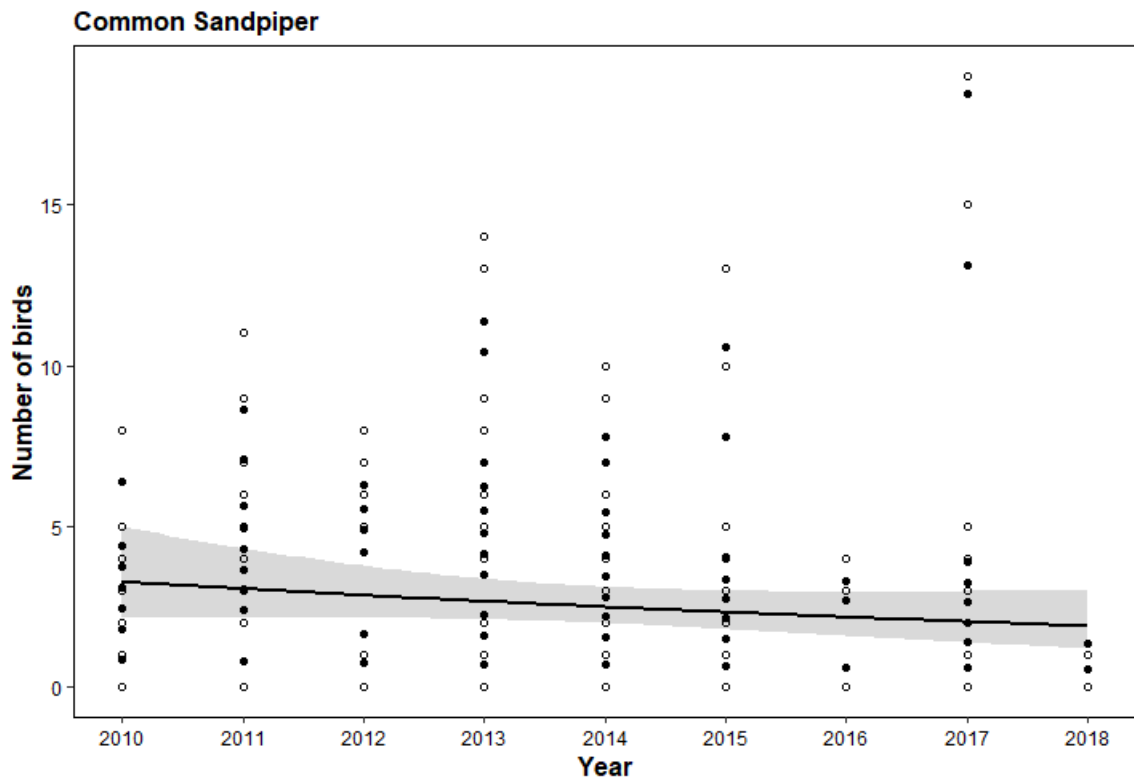
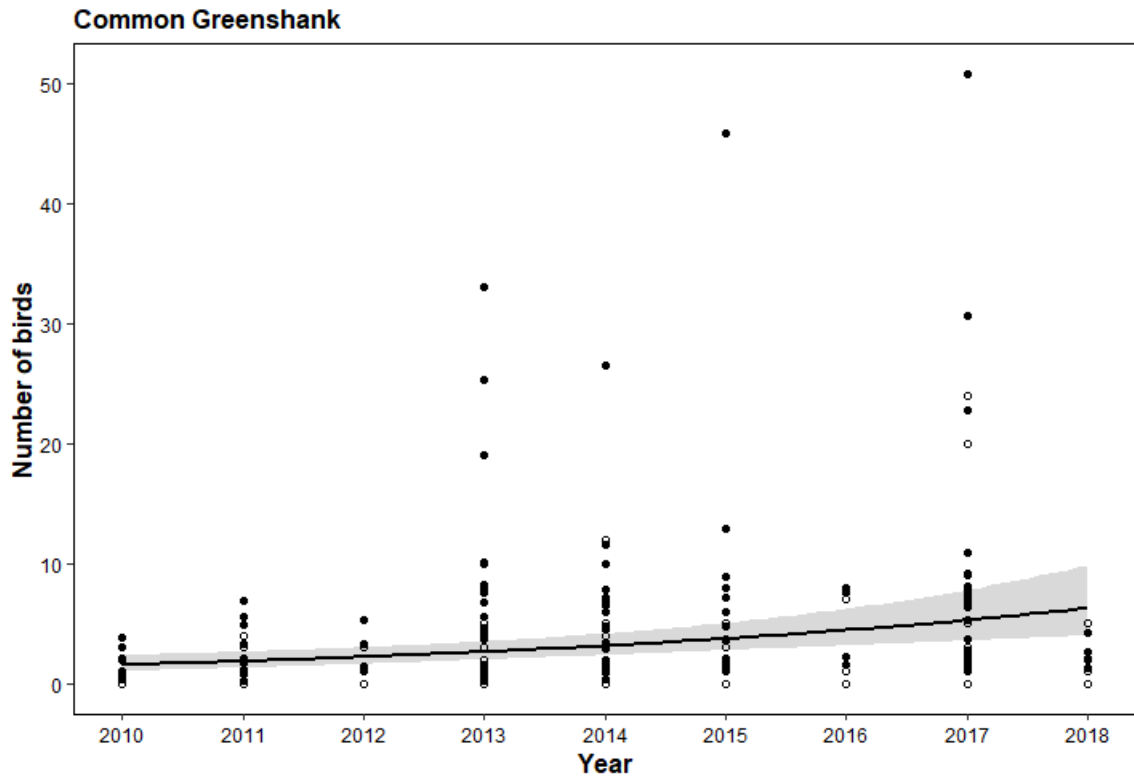


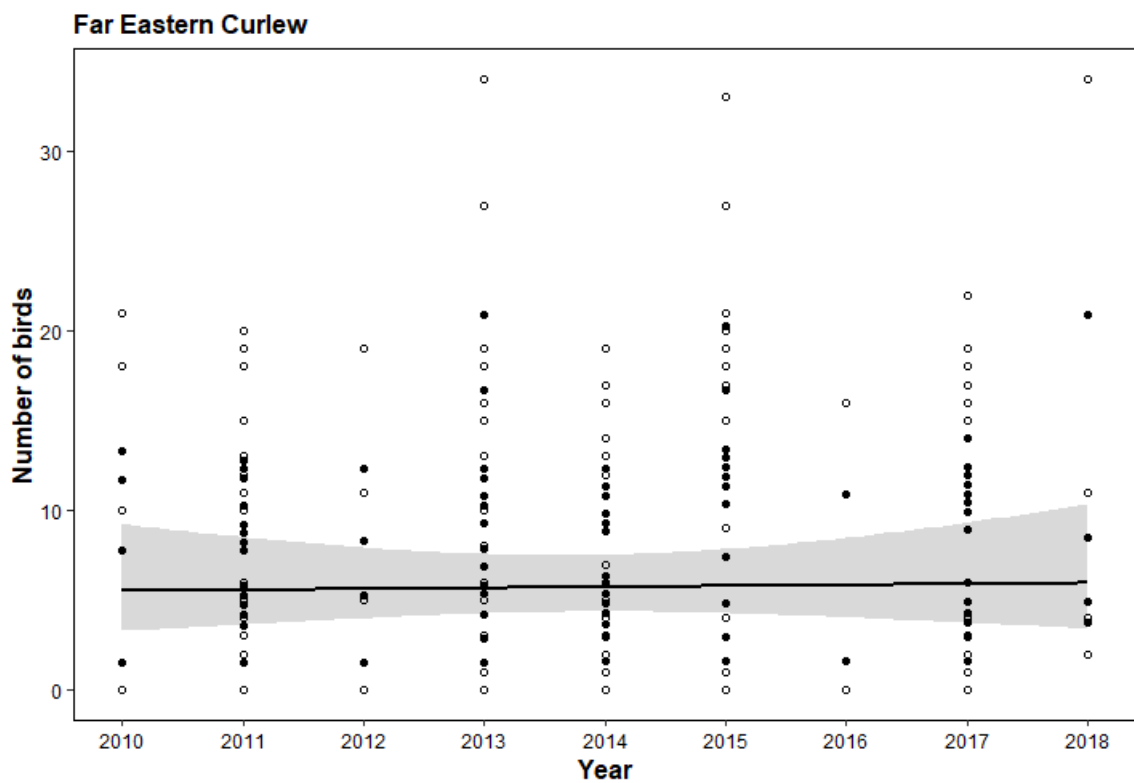
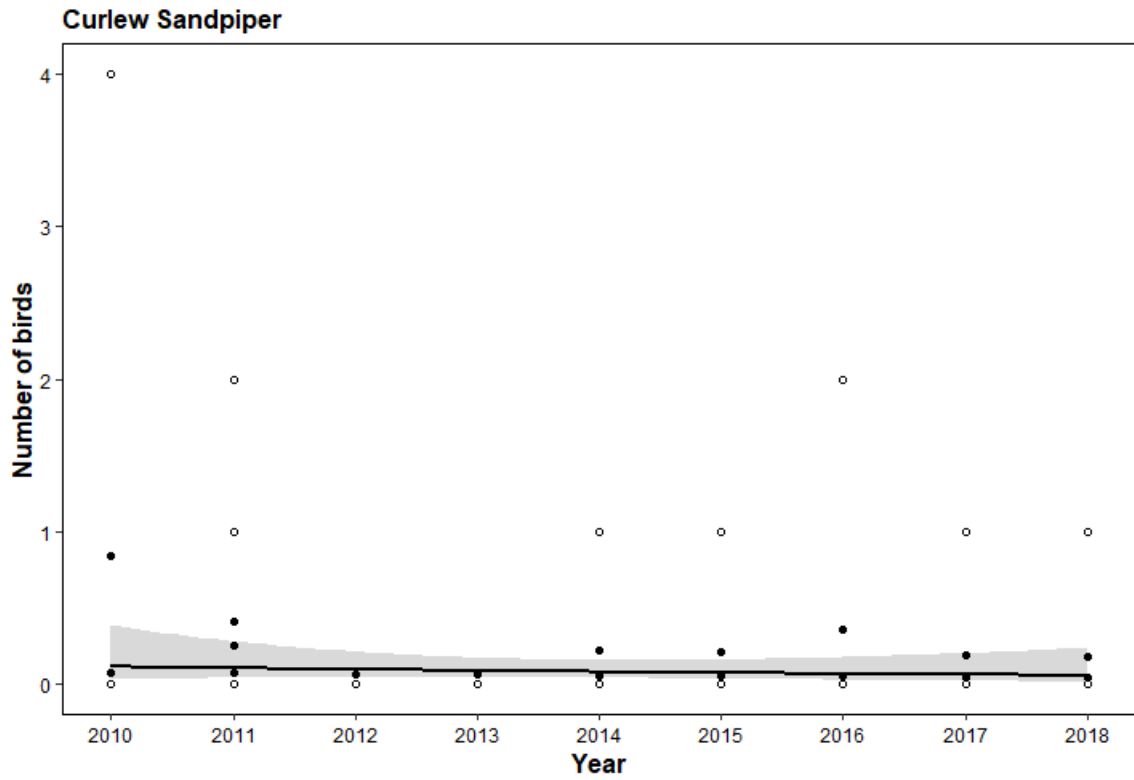
**Figure S2.** Relationship between population change of each species and flight-initiation distance at the artificial site in Darwin Harbour. Dashed line shows a stable population change rate, values above or below indicate the species population increase or decrease, respectively.

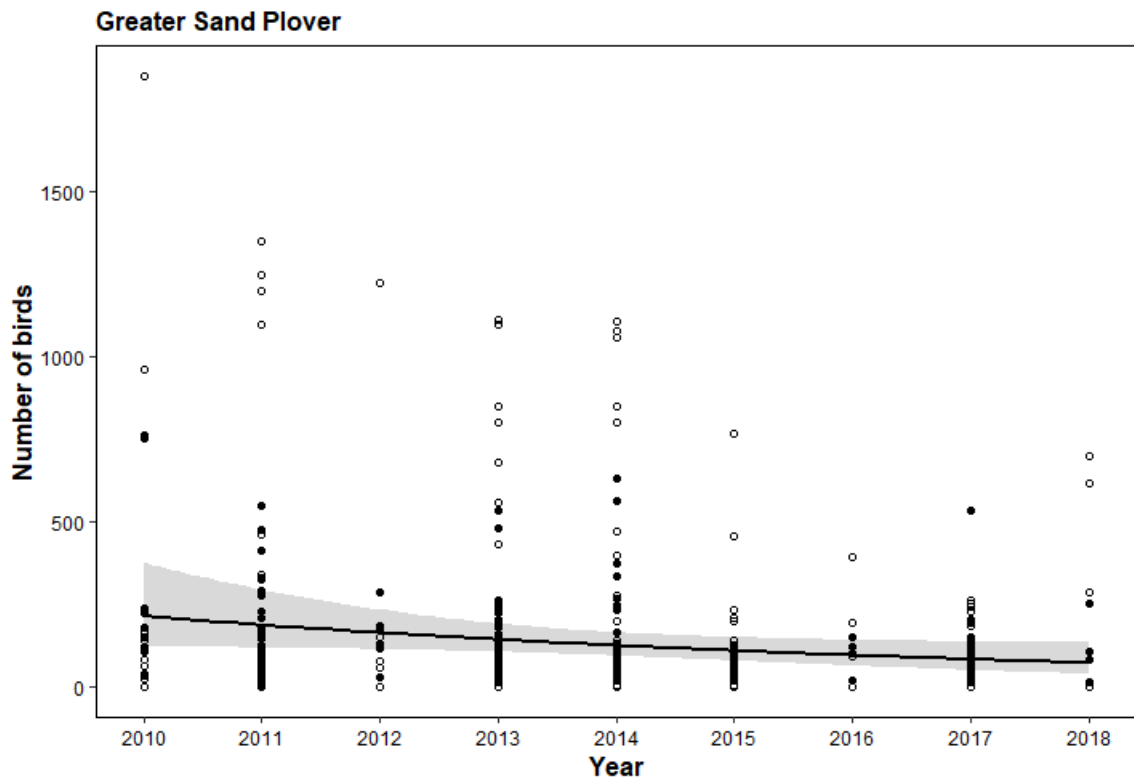
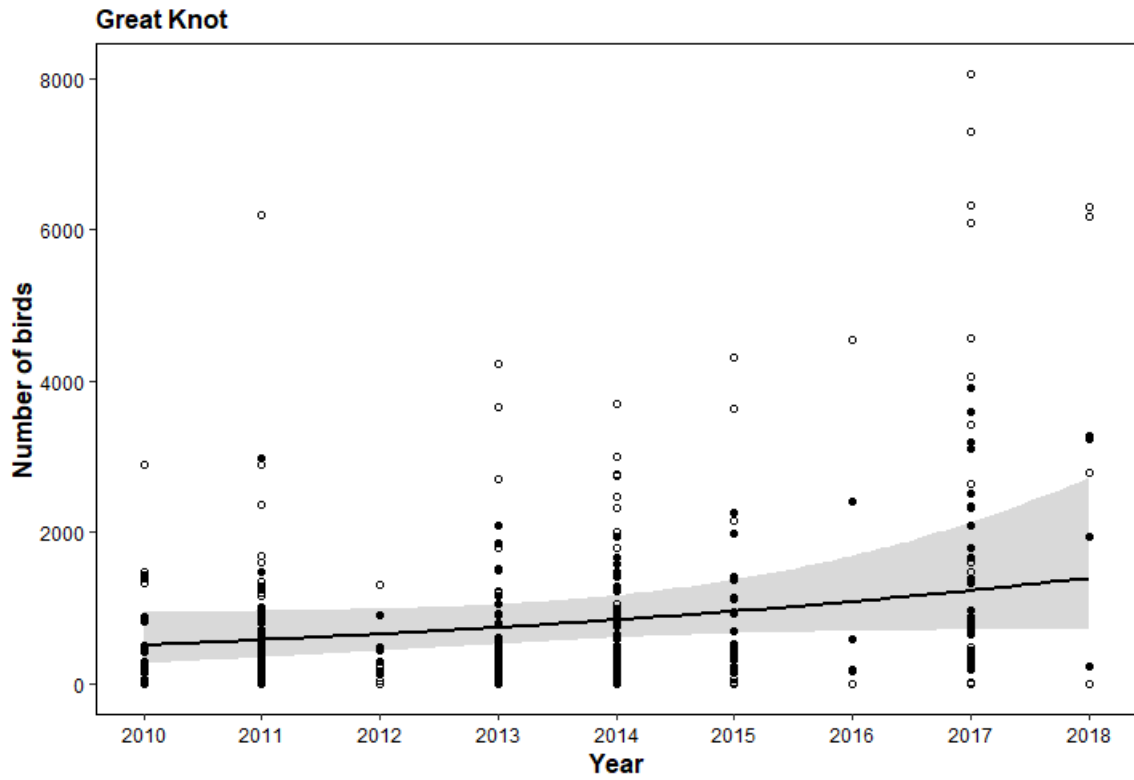
**Figures S3 – 31.** Shorebird species trends graphs (presented by site class and then by alphabetical order).

Natural sites:

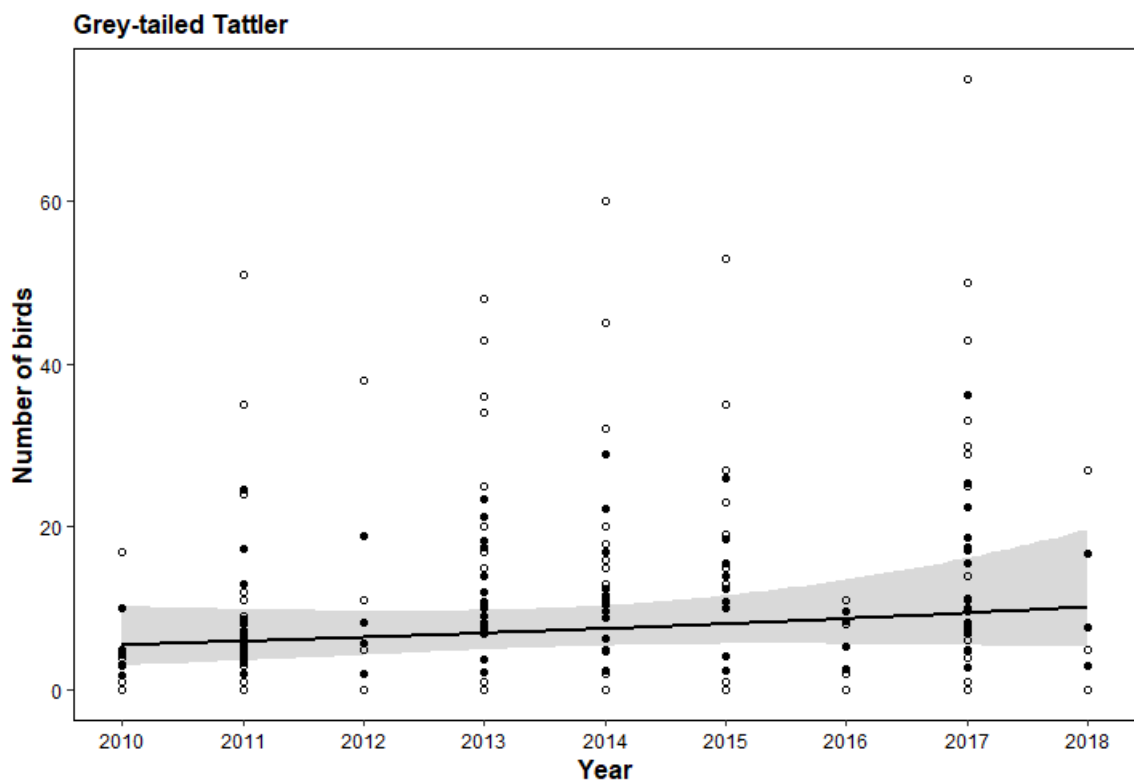
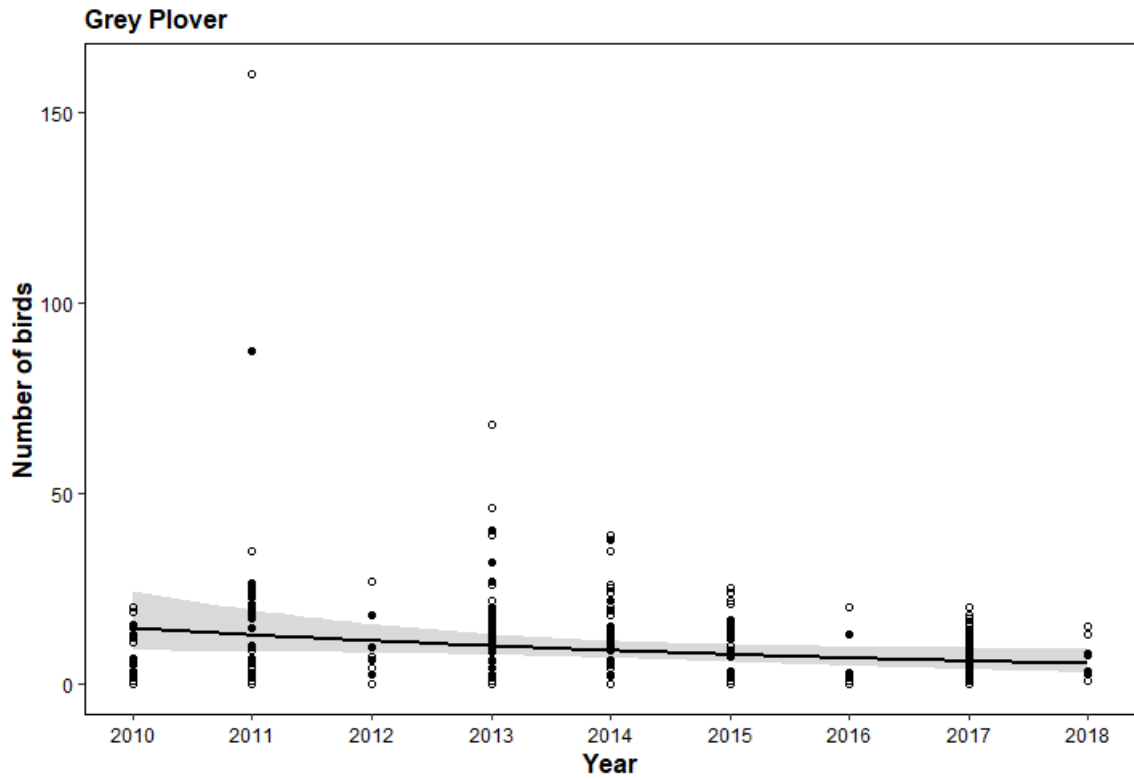


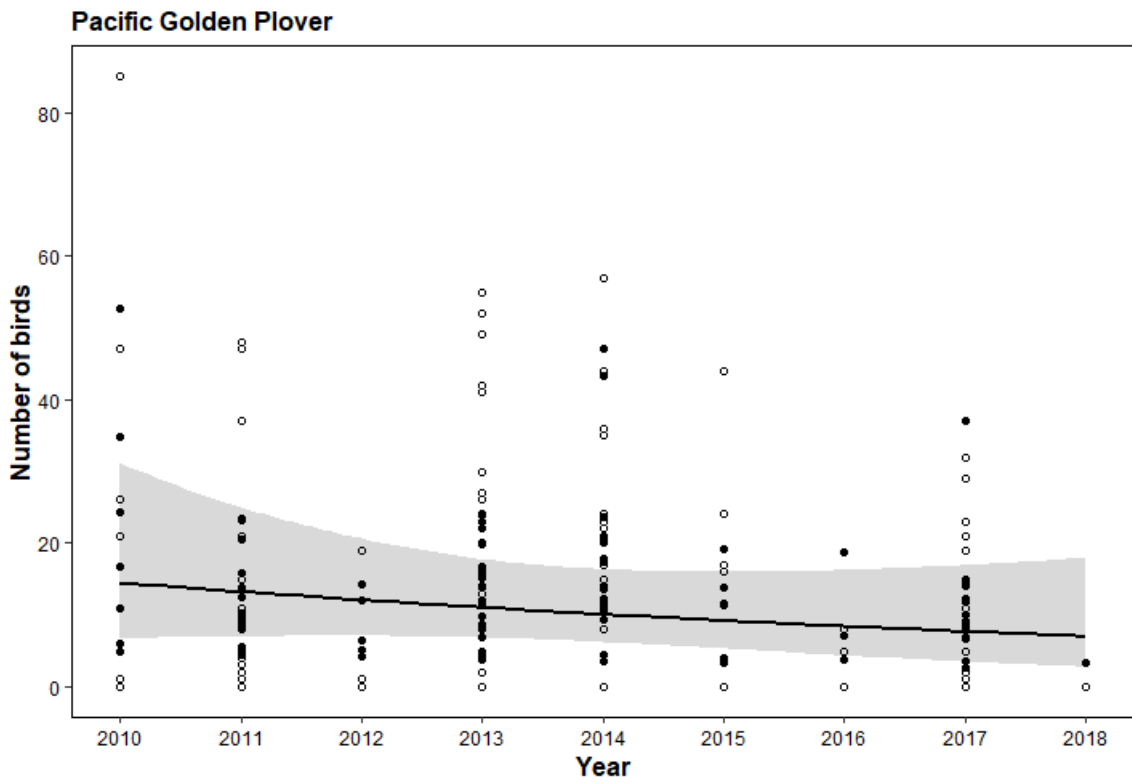
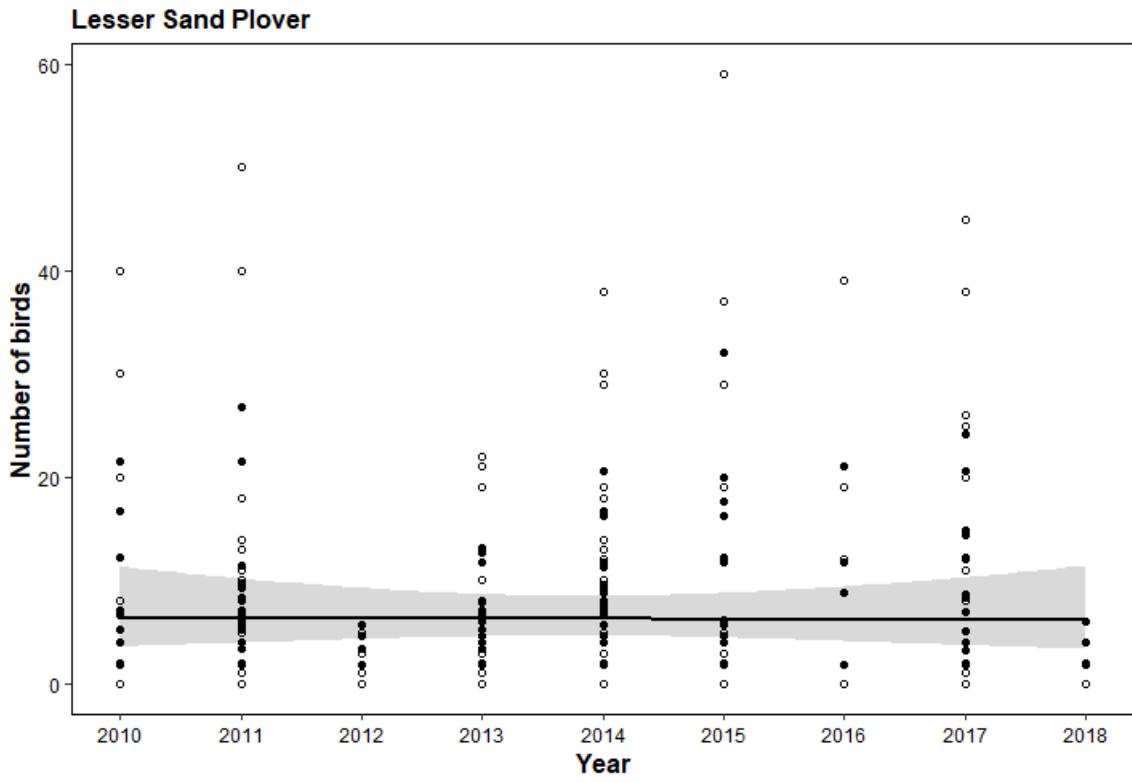


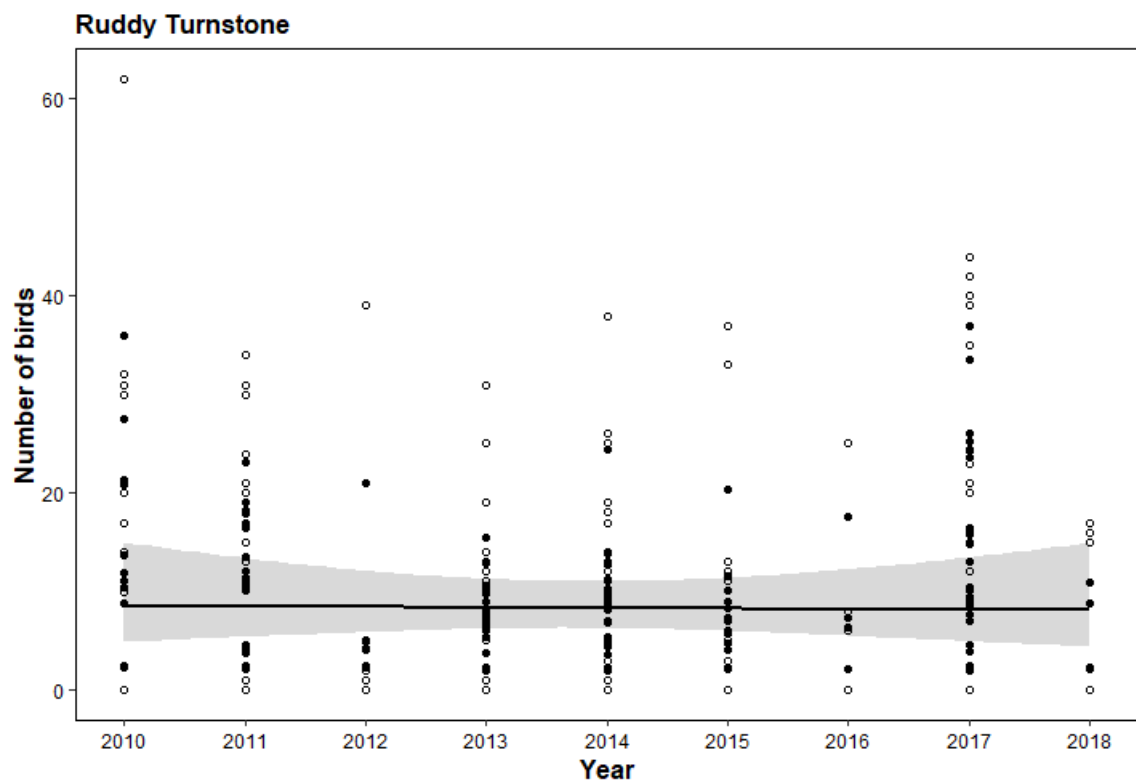
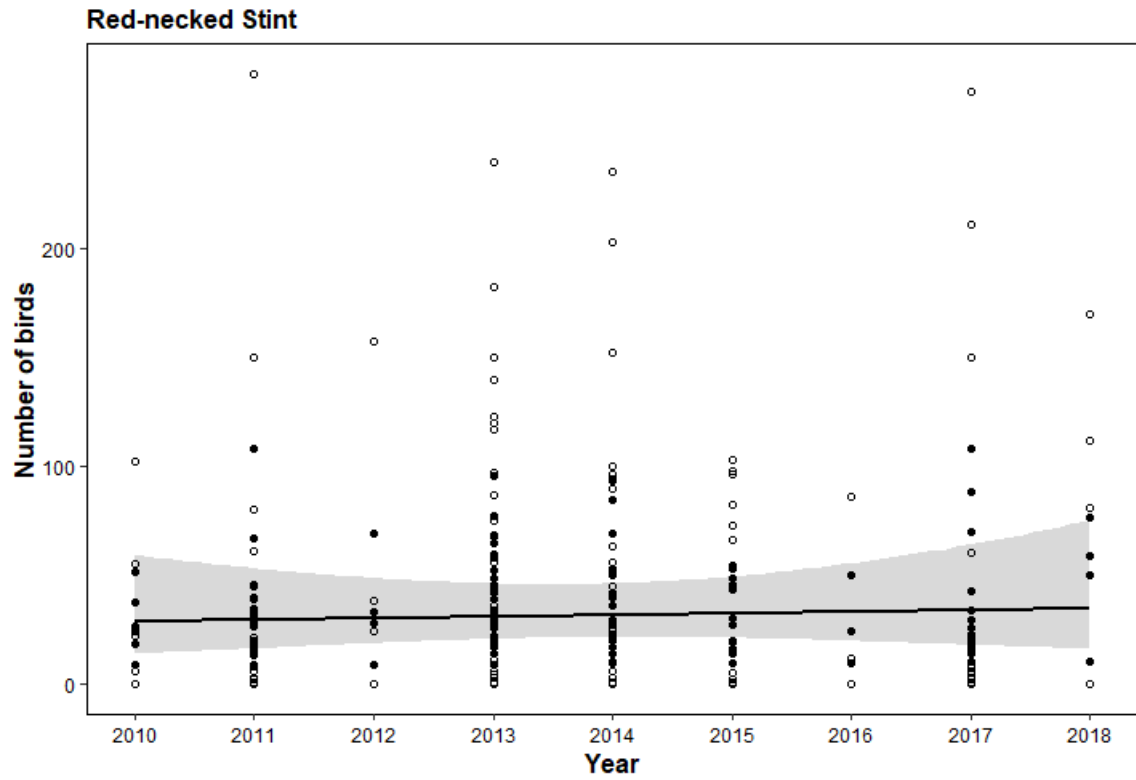


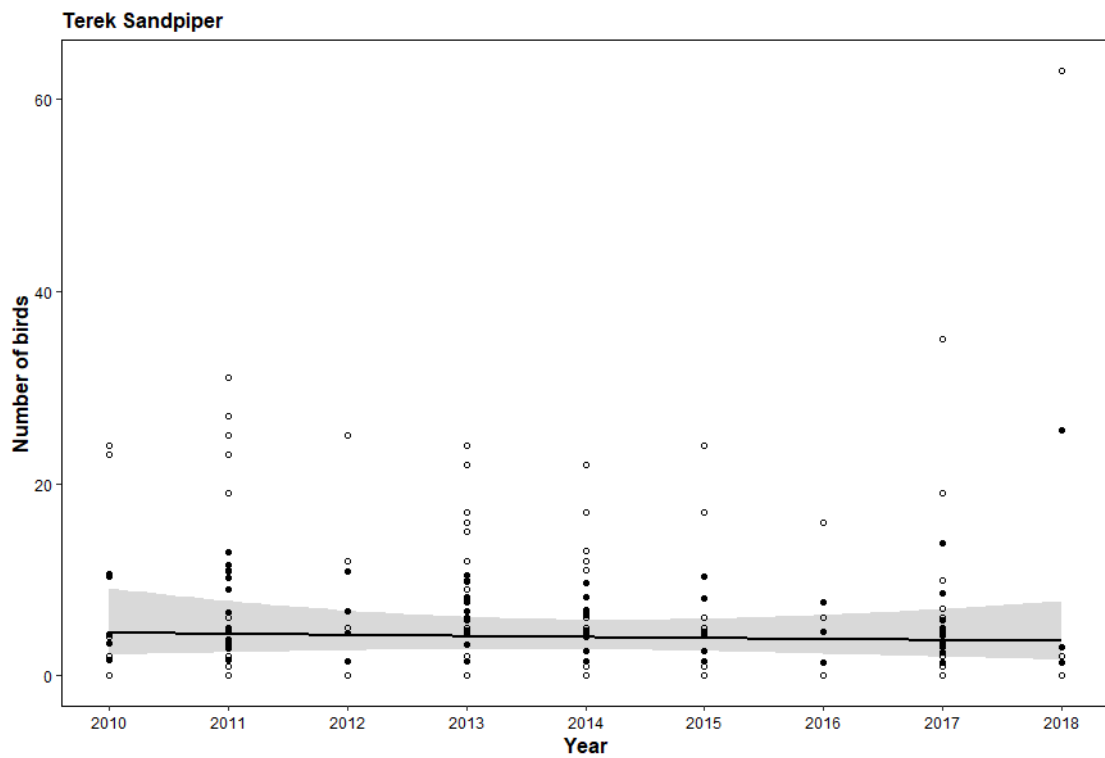
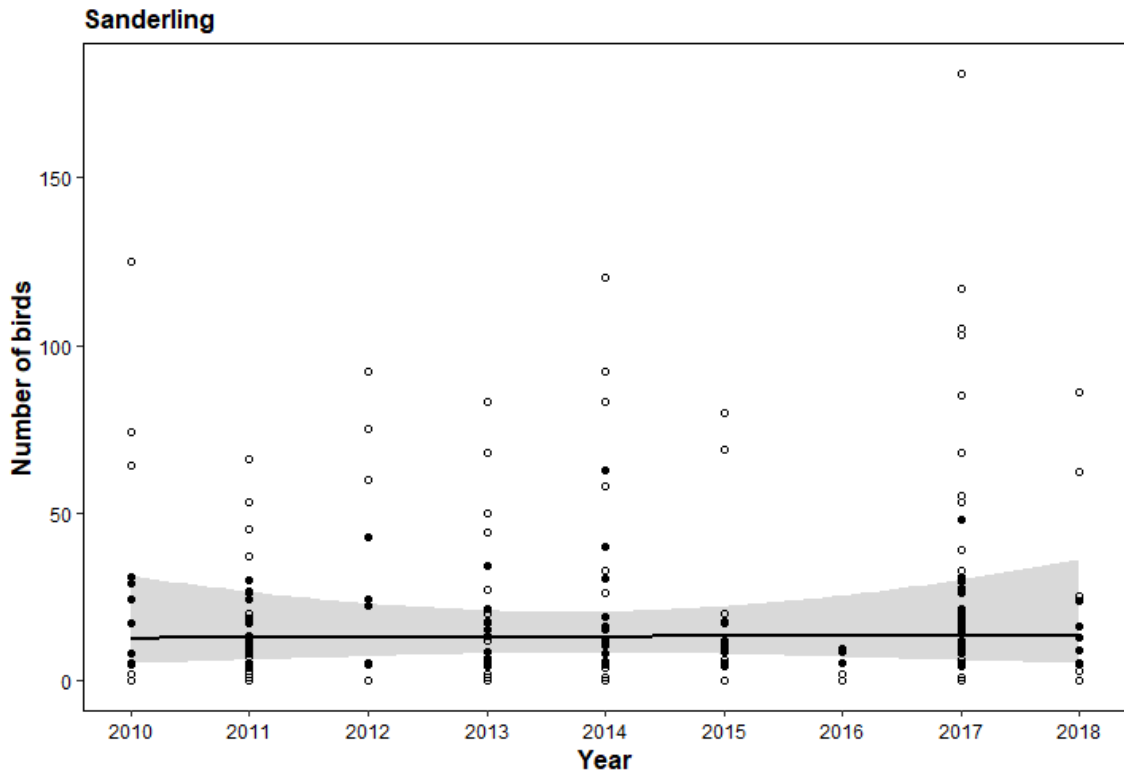


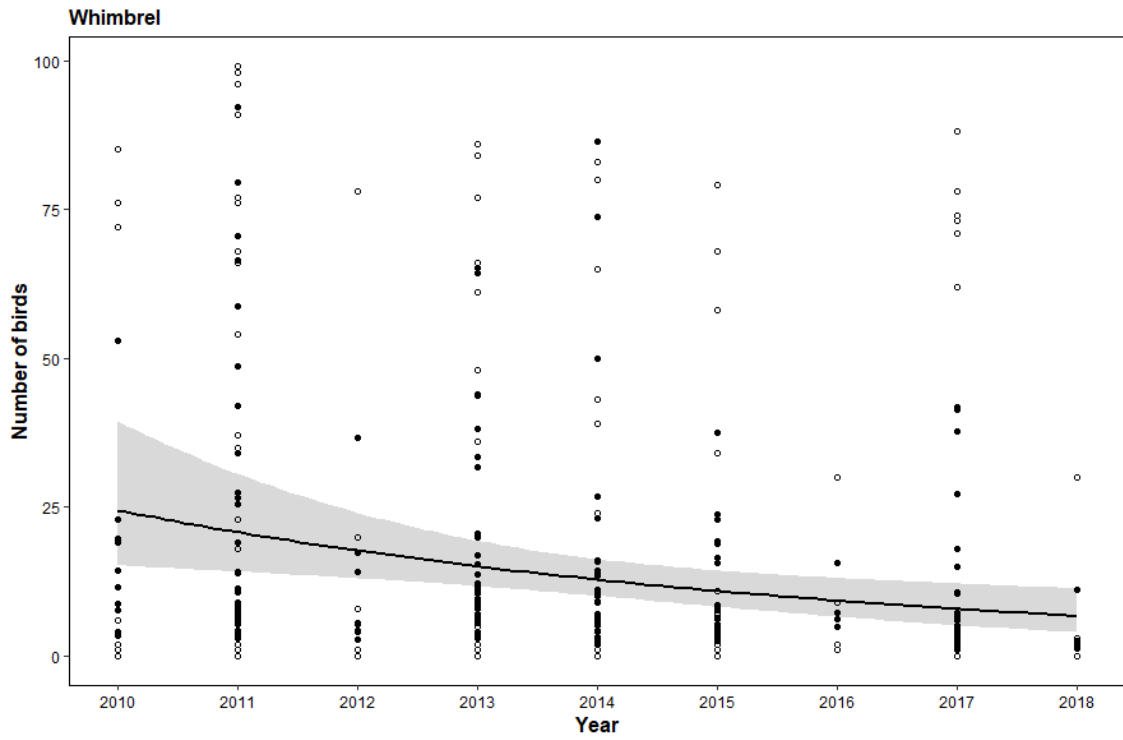












Artificial site:

