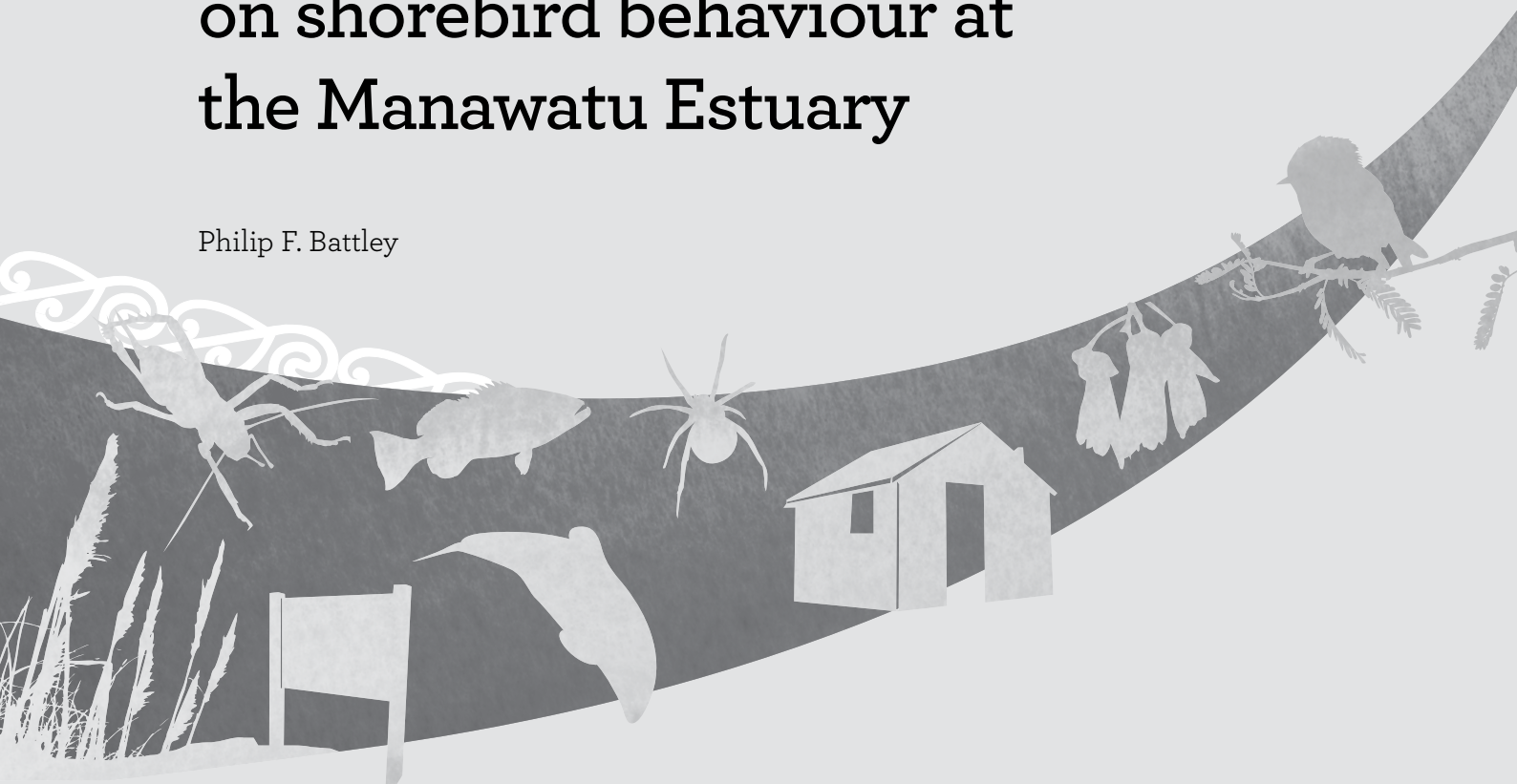




An evaluation of the impact of a national kite boarding championship on shorebird behaviour at the Manawatu Estuary

Philip F. Battley



DOC RESEARCH AND DEVELOPMENT SERIES 351

DOC Research & Development Series is a published record of scientific research carried out, or advice given, by Department of Conservation staff or external contractors funded by DOC. It comprises reports and short communications that are peer-reviewed.

This report is available from the departmental website in pdf form. Titles are listed in our catalogue on the website, refer www.doc.govt.nz under *Publications*, then *Series*.

© Copyright February 2018, New Zealand Department of Conservation

ISSN 1177-9306 (web PDF)

ISBN 978-1-98-851453-6 (web PDF)

This report was prepared for publication by the Publishing Team; editing and layout by Lynette Clelland. Publication was approved by the Director, Terrestrial Ecosystems Unit, Department of Conservation, Wellington, New Zealand.

Published by Publishing Team, Department of Conservation, PO Box 10420, The Terrace, Wellington 6143, New Zealand.

In the interest of forest conservation, we support paperless electronic publishing.

CONTENTS

Abstract	1
1. Introduction	2
2. Methods and survey effort	2
3. Overview of shorebird behaviour before the event	4
4. Background rates of disturbance	5
5. Overview of the kite boarding event and conditions	6
6. Shorebird disturbance during the kite boarding event	7
7. Impacts on birds	8
8. Conclusions	9
9. Acknowledgments	9
Appendix 1	
Counts made at shorebird roosts, Manawatu Estuary, over the monitoring period in August–November 2015.	10
Appendix 2	
List of events recorded during shorebird monitoring at Manawatu Estuary, August–November 2015. These include activities that did not result in bird disturbance, as well as those that did.	11

An evaluation of the impact of a national kite boarding championship on shorebird behaviour at the Manawatu Estuary

Philip F. Battley

Wildlife and Ecology Group, Massey University, Private Bag 11-222, Palmerston North 4442
p.battley@massey.ac.nz

Abstract

A national kite boarding competition was held at the Manawatu Estuary on 12-15 November 2015. Monitoring was undertaken prior to and during the kite boarding event to document sources and rates of disturbance to roosting shorebirds. The background rate of disturbance was 0.63/hr, much of which was due to other birds; 0.21/hr of this was due to people. During the first three days of the competition there was insufficient wind for much kite boarding and by the time boarding got fully underway on those days, birds had finished roosting over the high tide and were starting to feed again. On the fourth day there were strong winds suitable for kite boarding throughout the high tide period and the disturbance rate by people increased substantially, from 0.47/hr on the first three days to 1.28/hr on the fourth, including some disturbances from kite boarders being blown hundreds of metres upriver. Overall, birds tolerated the event well and no substantial disturbance resulted from the event, though this may have been in part due to the lack of kite-boarding during the first three days, particularly over the high tide roosting periods. The monitoring showed that impacts on wildlife from kite boarding are certainly possible and risks are likely to be site-specific. Ensuring a substantial distance is maintained between kite boarding activity and birds is an important factor in minimising risks of disturbance.

Keywords: shorebird, wader, disturbance, kite boarding, roost

© Copyright February 2018, Department of Conservation. This paper may be cited as:

Battley, P.F. 2018: An evaluation of the impact of a national kite boarding championship on shorebird behaviour at the Manawatu Estuary. *DOC Research and Development Series 351*. Department of Conservation, Wellington. 14 p.

1. Introduction

A national kite boarding competition was held at the Manawatu Estuary (2698743E; 6079908N) on 12–15 November 2015. Shorebirds at the estuary are vulnerable to disturbance as they generally have only two roosting sites available (the spit and the bollards; Fig. 1), both of which are accessible to people. A lot of driftwood had settled on the spit, reducing its suitability as a roost site as shorebirds require clear sites with good visibility. A combination of habitat and disturbance issues caused bar-tailed godwits (*Limosa lapponica*) in particular over the 2014/15 summer to frequently abandon the estuary at high tide to roost at the Ohau Estuary, 20 km to the south. In response to concerns about possible disturbance to birds from kite boarding, the Department of Conservation (DOC) commissioned bird monitoring during the event. The aim was to document any impacts on birds that arose from the running of the kite boarding event. To do this, observations were made before the event to establish baseline patterns of movements and roost site choice within the estuary, and to document the nature and frequency of disturbance from various sources. Monitoring continued during the kite boarding event, and this report summarises the findings of this work.

2. Methods and survey effort

As part of ongoing research into shorebird biology, regular visits to the Manawatu Estuary were made from late August to November 2015, mostly by Phil Battley (Table 1; other observers were Massey University students with experience in ornithology and bird monitoring). Efforts were made to monitor birds during spring tides series, as these were what would be encountered during the kite boarding event. Spring high tides at the Manawatu Estuary are generally morning high tides and >3.0 m high (using the Port Taranaki datum and times, which give a reasonable approximation of the Manawatu Estuary tides, sourced from <http://www.linz.govt.nz/>). On these days the locations of roosting birds were recorded, along with their numbers, and their behaviour on the rising tide. Because of the time of year, most New Zealand-breeding shorebirds were away on breeding grounds, so the main species present on the estuary were northern hemisphere breeders, along with South Island pied oystercatchers (*Haematopus finschi*) and gulls and terns (see Appendix 1 for all counts). As the focus of the monitoring was on the migratory shorebirds and other birds that used the bollards for roosting, some pied stilts (*Himantopus himantopus*) and spur-winged plovers (*Vanellus miles*) may have been using the spit at times when the main flock was at the bollards and therefore been undercounted.

Any instances of disturbances (sudden or unexpected flights) were recorded and any cause, if evident, noted. During the kite boarding event, observers sat or stood unobtrusively amongst driftwood near the bollards and monitored the flocking behaviour of the birds and made notes on disturbances, periodically the numbers and locations of kites up in the air, and any times when kites came close to birds or went past the marker buoy that marked the no-go area for kite boarding.

The main areas referred to in this report are shown in Figure 1. Birds typically have two options for roosting in the estuary – the spit or the bollards. The spit is about 800 m from the main kite boarding ‘camp’ but had a lot of woody debris on it and was often not used by shorebirds, in particular, godwits and red knots (*Calidris canutus*). The bollards area is largely open sand adjacent to the bollards opposite the access track through the dunes. Birds often roost just below the bollards on small tides and just west of them on larger tides. A temporary fence had been set up before the kite boarding event to restrict people’s access near the bollards. In the river, a large black buoy had been set out approximately on line with the temporary fence to signify the point beyond which kite boarders should not go (i.e. a bail-out point). On the rising tide birds generally congregate on the



Figure 1. Map of the Manawatu Estuary, showing main reference points used during monitoring.

Table 1. Dates and times of shorebird monitoring, Manawatu Estuary, August–November 2015. Days of the kite boarding competition are shaded.

DATE	START	END	DURATION		HIGH TIDE TIME	HIGH TIDE HEIGHT (m)	OBSERVER(S)	WEATHER
			hr	min				
31/08/2015	9:30	9:45		15	10:30	3.8	Phil Battley	Overcast, light east
14/09/2015	9:20	10:00		40	10:15	3.4	Phil Battley	Sunny, coolish, light SE
18/09/2015	13:10	13:50		40	12:25	3.2	Phil Battley	
28/09/2015	9:30	10:40	1	10	10:30	3.8	Phil Battley	Fine, calm
29/09/2015	10:06	11:30	1	24	11:15	3.9	Phil Battley, Charmaine Stanley	Fine, calm, mild
05/10/2015	15:00	16:30	1	30	16:30	2.9	Phil Battley	Fine but wind quite cool.
15/10/2015	9:30	12:15	2	45	11:50	3.4	Phil Battley	Overcast
16/10/2015	10:15	12:20	2	05	12:25	3.3	Phil Battley	Overcast, strong westerly
27/10/2015	9:45	11:00	1	15	10:55	3.8	Phil Battley	
28/10/2015	9:05	11:30	2	25	11:00	3.8	Phil Battley	Overcast, calm
30/10/2015	9:30	11:50	2	20	12:30	3.7	Phil Battley	Light cloud, cool
31/10/2015	10:45	12:00	1	15	13:15	3.7	Phil Battley	Sun, cloud, light westerly
01/11/2015	11:10	13:30	2	20	14:05	3.3	Rachel Withington	
10/11/2015	9:30	10:45	1	15	9:45	3.2	Phil Battley, Toby Ross	Overcast, calm
11/11/2015	9:20	11:30	2	10	10:20	3.3	Phil Battley, Katie Gibb	Overcast, light westerly
12/11/2015	8:20	13:10	4	50	10:55	3.4	Phil Battley, Katie Gibb, Toby Ross	Overcast, calm, cool
13/11/2015	9:20	12:33	3	13	11:30	3.4	Phil Battley, Katie Gibb, Toby Ross	Light SW, cool, cloud/sun
14/11/2015	9:45	14:30	4	45	12:05	3.4	Katie Gibb, Toby Ross	High clouds, ~14–16°C, low winds for most of the day
15/11/2015	9:50	14:30	4	40	12:40	3.4	Katie Gibb, Toby Ross	Overcast with infrequent showers, gusty NE winds, ~15–17°C

easternmost piece of mudflat (referred to here as the P-flat), then fly across the flooding channel either to the flats just off the spit or to the flats below the bollards. Birds near the spit generally flew to the bollards to roost. In October and November 2015 large numbers of juvenile godwits were on the estuary, and regularly fed on the back flat as the tide flooded it, catching mud crabs emerging from their burrows. This meant that birds would often trickle out from a roosting flock and fly to the northern side of the spit. Such movements were not treated as disturbances.

3. Overview of shorebird behaviour before the event

Birds were very settled and consistent in their roosting behaviour, with most birds roosting at the bollards (Table 2; see Fig. 2). The Arctic-breeding shorebirds would congregate either off the spit or directly at the bollards, and move up with the rising tide. Gulls and terns would generally roost between the bollards and the fence, and South Island pied and variable oystercatchers (*Haematopus unicolor*) would also often roost near either the other shorebirds or the gulls. Up to 450 birds used the bollards roost from September to November (see Appendix 1).

A single instance of birds leaving the estuary was noted. On 29 September a vehicle and the rising tide caused the godwits at the bollards to take flight, and 60 birds (of 135 present) flew out the river mouth and headed south (as they did the previous summer when they used the Ohau Estuary on a regular basis). This was not seen again in October or November.

Table 2. Locations of the principal shorebird roosts at Manawatu Estuary during monitoring carried out in August–November 2015. Days of the kite boarding competition are shaded. See Appendix 1 for the full bird counts.

DATE	SITE	WHERE ROOSTING
31/08/2015	Bollards	All at the bollards*.
14/09/2015	Bollards	All at the bollards.
18/09/2015	Bollards	All at the bollards.
28/09/2015	Bollards	All at the bollards.
29/09/2015	Bollards	All at the bollards.
05/10/2015	Bollards+spit	Half the godwits were at the spit, as were spur-winged plovers; rest were at bollards.
05/10/2015	Bollards	All at the bollards.
15/10/2015	Bollards	All at the bollards.
16/10/2015	Bollards	All at the bollards.
27/10/2015	Bollards	All at the bollards.
28/10/2015	Bollards	All at the bollards.
30/10/2015	Bollards+spit	Stilts and spur-winged plovers on spit; rest at bollards.
31/10/2015	Bollards	All at the bollards.
01/11/2015	Bollards+spit	210 godwits used the spit; everything else used the bollards.
10/11/2015	Bollards	All at the bollards.
11/11/2015	Bollards	Oystercatchers, stilts and a spur-winged plover on the spit (total 38 birds); 12 godwits and 1 knot trying to roost on the flooded back flat; most birds (346) at bollards.
12/11/2015	Bollards	All at the bollards.
13/11/2015	Bollards	All at the bollards.
13/11/2015	Spit	Started at the bollards; harrier disturbance caused 70 godwits/knots to move to spit.
14/11/2015	Spit	Birds congregated on P-flat and off spit then moved to bollards. Kite boarder caused all bollards birds to move to spit.

* 'All' in this context refers to the main flock of godwits, knots, small shorebirds, gulls and terns.



Figure 2. The shorebird flock roosting between the bollards and the temporary fence on 11 November 2015. The kite boarding event site is visible behind the small vegetated dunes in the foreground.

4. Background rates of disturbance

Between 31 August and 11 November no disturbances were recorded in 8 hr 15 min of monitoring across 8 days, while 12 disturbance events (above and beyond the tide rising) were recorded over 10 hr 50 min of monitoring on 5 days. Disturbances were mostly due to other birds and were of short duration (Table 3). Harriers (*Circus approximans*) caused five disturbances that lasted from 20 s to 1 min 15 s. Black-backed gulls (*Larus dominicanus*) caused one small disturbance, while an unexplained flight of all birds could possibly have been due to an overflying black shag (*Phalacrocorax carbo*). Human activity was implicated in four disturbances. Two involved a car (including the one that caused birds to leave the estuary), one a kite boarder (minor disturbance only) and one was possibly due to observers 80 m away. An additional disturbance of the shorebird flock by a child with a dog was reported an hour after monitoring finished on 10 November.

Table 3. Disturbances recorded during monitoring of shorebirds at Manawatu Estuary before the kite boarding event in November 2015.

DATE	TIME	EVENT	CAUSE
28/09/2015	10:20	Car drove within 50 m of birds before turning away. Birds spooked and ran to water's edge but did not fly.	Car
28/09/2015	10:14	Godwits flew. 60 out river mouth; 44 returned to bollards.	Rising tide + car
15/10/2015	9:58	Harrier overhead put up 40 godwits, oystercatchers and terns. Returned calmly east of bollards (where they flew from) within 30 s.	Harrier
15/10/2015	10:02	Different harrier put godwits up from east of bollards. 48 settled at bollards 20 s later.	Harrier
15/10/2015	10:32	Harrier put birds up. Wrybills (<i>Anarhynchus frontalis</i>) and red-necked stints (<i>Caladris ruficollis</i>) stayed put. Godwits took 30 s to return to bollards, South Island pied oystercatchers took 1 min to return.	Harrier
28/10/2015	10:22	Harrier 100 m to east, high, flying to south side. Half of the godwits plus the oystercatcher flock took off and landed 20 s later at west end of flock.	Harrier
30/10/2015	10:42	Harrier flew high, crossing to south side. All birds flew but returned to same place after 1 min 15 s.	Harrier

Continued on next page

Table 3 continued

DATE	TIME	EVENT	CAUSE
10/11/2015	1:15	Sharon Wright (Ecology and Ecology Group secretary, Massey University) reported birds in the same place at the bollards at 1 pm as they had been when monitoring finished at 12:00. Birds disturbed by a child and a dog but returned to the same area.	Child + dog
11/11/2015	9:22	Two juvenile black-backed gulls put up godwits from east side of bollards. Landed on west side halfway to fence.	Gulls
11/11/2015	9:33	Kite setting down opposite small dunes caused c. 50 godwits to run several metres.	Kite
11/11/2015	10:37	All birds up. No obvious cause, though it could have been a black shag flying in from the north. White-fronted terns (<i>Sterna striata</i>) took longer to re-land than the waders – 2 min 15 s.	Shag?
11/11/2015	11:05	Birds flew as we approached from west side, still 80 m away. Caspian terns (<i>Hydroprogne caspia</i>) in flight. Unsure if it was us or something else. Godwits went back to the same spot.	People?

5. Overview of the kite boarding event and conditions

The times of high tides during the 4 days of the kite boarding competition (10:55–12:40) meant that there was considerable potential for disturbance by competitors and spectators, given that birds were roosting at the bollards (with 220–668 birds counted daily at the roost over the competition). However, wind conditions on the first 2 days of the competition were too light to enable kite boarding to operate much over the main high tide period.

12 November (high tide 10:55)

The first kite was not up on the water until 11:00 and it was only when a southerly change came through at 12:15 that any serious kite boarding activity occurred, by which stage a harrier had disturbed some of the shorebird flock away from the bollards. Birds were fairly settled despite moderate numbers (5–8) of kites up. By 12:50 birds had started feeding on the falling tide, so by the time that 19 kites were up at 12:52 and all birds flew suddenly (possibly due to a kite ‘dump’), the shorebirds could just settle along the exposing tideline east of the bollards.

13 November (high tide 11:30)

Again, wind conditions were light in the morning, and from 10:00 to 11:00 only one or two kites were ever up. By 11:30 it was calm and sunny and no kite flying was possible. At 11:53 and 12:07 two kites were recorded as being up (with boards hydrofoiling in the main channel). At 12:32 a harrier flew over the flock and some birds moved to the spit.

14 November (high tide 12:05)

With the wind starting as a light southwesterly there was little kite activity in the morning. The first kite was not up until 11:38 and only around 12:50 were there two or three kites up. One of these boarders crashed near the bollards and the flock was disturbed and flew to the spit.

15 November (high tide 12:40)

This was the first day with the expected brisk winds. There was considerable kite board activity from 10:00, with ten kites up at 10:34, seven at 12:03 and two or three around 14:00. Kite boarders had considerable trouble with the conditions and frequently ended up heading upriver past the no-go buoy.

Appendix 2 lists all events recorded during monitoring, including those that did not cause disturbances. This list includes two kite boarders on 14 November that ended up past the no-go buoy (at 13:01–13:10) and six on 15 November, including three that ended up at the easternmost end of the estuary (10:34, rescued by the boat ramp; 11:44, bailed at the sandspit; 12:13, on the flat adjacent to Hartley St).

6. Shorebird disturbance during the kite boarding event

There were 24 disturbances recorded over 17 hr 28 min of monitoring carried out during the kite boarding competition (Table 4). Twelve were by other birds (five from harriers; four from black-backed gulls; one each from South Island pied oystercatchers, a black shag and a rock dove (*Columba livia*)). Shorebirds resettled quickly and nearby after the black-backed gull, black shag, South Island pied oystercatcher and rock dove disturbances. Overflying harriers caused more major disturbances and in three of the five harrier events, shorebirds shifted location (e.g. from bollards to inside spit, from bay to spit).

Table 4. Shorebird disturbances recorded during the kite boarding event at Manawatu Estuary, November 2015.

DATE	TIME	EVENT	CAUSE
12/11/2015	8:47	Harrier mobbed by magpies (<i>Gymnorhina tibicen</i>), high over kite 'camp'. South Island pied oystercatchers (SIPOs; 2) and c. 6 godwits moved 50 m along tideline in response, and carried on feeding.	Harrier
12/11/2015	11:46	Juvenile black-backed gull put 50 godwits up. Re-landed 10 m away.	Black-backed gull
12/11/2015	11:54	All birds up. Probably due to a single harrier very high. Godwits (12), SIPOs + variable oystercatchers moved to inside the sandspit. Rest of waders landed between bollards and spit. SIPOs (5), gulls and terns went back to bollards.	Harrier
12/11/2015	12:53	Flock all flew up but landed along tideline east of bollards. 19 kite boarders operating at the time and one had just dumped into the water.	Kite dumping?
13/11/2015	9:27	Terns, gulls and godwits that were present near bollards went up. Resettled nearby. Black shag flying over was probably the cause.	Black shag
13/11/2015	10:05	Godwits off spit all took off but resettled immediately. A fast-moving black-backed gull had just flown over.	Black-backed gull
13/11/2015	10:57	SIPOs piped then flew towards the sandspit. Their doing so caused the terns to get up and move 30 m to the west.	Oystercatchers
13/11/2015	11:10	Terns up, possibly in response to a nearby kite. 80-odd headed out towards the beach. The rest resettled.	Possibly due to kite?
13/11/2015	11:29	Large helicopter over forest to Foxton Beach. No disturbance. Black-backed gulls put white-fronted terns up at same time. Most moved between bollards and fence.	Black-backed gull
13/11/2015	11:53	2 kites up. One kite being walked along towards fence (maybe halfway between dune and fence?) with yappy dog. Nearby terns moved to within fence.	Kite+dog
13/11/2015	12:32	Harrier flew directly over flock. Godwits went up then back down, but some moved to the spit.	Harrier
14/11/2015	11:44	Sailboat (sunburst size) within 20 m of bollards fence flock. All birds spooked but only 47 returned.	Sailboat
14/11/2015	13:08	2nd kite crashed just short of the main bollards. c. 21 birds spooked to the spit immediately.	Kite boarder
14/11/2015	13:10	Remainder of flock disturbed by a kite-boarder moving to shore with the kite, and flew to the spit.	Kite boarder
14/11/2015	13:18	Harrier pair circling around salt marsh put flock on spit up. The waders circled around and resettled on the spit.	Harrier
14/11/2015	13:37	Harrier spooked 11 godwits from bay to spit.	Harrier
14/11/2015	14:03	Black-backed gulls returning to spit put 10 waders up.	Black-backed gull
15/11/2015	10:11	1 kite lost board, drifting well past black buoy on the far (south) side of estuary. Second kite just in front of black buoy but very close to north bank – spooked 5 knots just east of first fence.	Kite boarder
15/11/2015	10:17	Kite 'slap' on water surface well within black buoy, spooked 14 white-fronted terns from base of second fence.	Kite boarder
15/11/2015	10:18	First kite close to south bank – about 400 m up from buoy, 5 godwits spooked to tidal flat at east end of estuary.	Kite boarder
15/11/2015	11:40	2 kite boarders past buoy; 3 godwits disturbed from tidal flats in 'bay'.	Kite boarder
15/11/2015	11:44	Kite boarder bailed out on sandspit by houses. Disturbed the godwits there; 15 went to the back flat, the remainder to the 'bay' between the spit and bollards.	Kite boarder
15/11/2015	13:17	White-fronted terns spooked by rock dove.	Rock dove
15/11/2015	14:08	Kite close to shore spooked c. 15 godwits that landed about 10 m east of where they had been.	Kite boarder

Human activity resulted in 12 disturbances: one was from a sailboat and 11 involved (or likely involved) kite boards. These included kites being walked over land (with a dog), kites dumping loudly on the water surface, kite boarders walking out of the water, and kite boarders being blown upriver and landing on the sandspit where birds were roosting.

Rates of disturbance were higher during the event than beforehand (Table 5). In 19 hours of monitoring over 13 days beforehand, 12 disturbances were recorded, only four of which involved people. During the 17.5 hours of monitoring over the 4 days of the kite boarding competition there were 24 disturbances recorded, 12 of which were by people; 11 of those were associated with kite boarding. Eight of those were on 14–15 November when winds were high enough to make kite boarding feasible. The numbers of disturbances by birds were comparable before and during the event (equating to rates of 0.42/hr beforehand and 0.69/hr during the event: Chi-square test, $\chi^2 = 0.8$, not significant) whereas they were significantly higher for human disturbances during the event (rates of 0.21/hr beforehand and 0.69/hr during the event: Chi-square test, $\chi^2 = 4$, $P = 0.0455$).

Table 5. Rates of shorebird disturbance before and during the kite boarding event at Manawatu Estuary, November 2015.

	NUMBER OF DAYS	DURATION OF OBSERVATIONS (hr)	DISTURBANCES		BY BIRDS		BY PEOPLE	
			Total number	Rate (No./hr)	Number	Rate (No./hr)	Number	Rate (No./hr)
Before event	13	19.1	12	0.63	8	0.42	4.0	0.21
During event (first 3 days)	3	12.8	17	1.33	11	0.86	6.0	0.47
During event (Sunday 15/11/2015)	1	4.7	7	1.50	1	0.21	6.0	1.28
During event (total)	4	17.5	24	1.37	12	0.69	12.0	0.69

7. Impacts on birds

Impacts on shorebirds during the kite boarding competition in November 2015 were limited. Because of the timing of the high tides and the lack of suitable kite boarding wind conditions, roosting birds were generally very settled and had been pre-roosting or roosting for some time before there was much kite activity. However, birds were disturbed by kite boarders, and disturbance from kite boarders caused birds to leave the bollards to roost on the spit, and kite disturbance also forced birds off the spit. The disturbances experienced did not cause wading birds to leave the estuary. Subsequent observations showed that the shorebirds were using both roosts in the estuary later that year. On 30 November the shorebirds were split between the bollards and the sandspit, and on 12 December birds were initially inside the sandspit before they moved to the bollards. In March 2016, birds continued to use both roosts (J.R. Conklin, pers. comm.).

The wind conditions during the event were not those hoped for by the organisers, and little kite boarding was actually possible on the first 3 days of the event. On the day that did have brisk winds, the bird disturbance rate rose almost three-fold (the rate for the previous 3 days was 0.47/hr compared with 1.28/hr on 15 November, well above the background rate of 0.21/hr). Kite boarders were unable to stay west of the marker buoy on a number of occasions, and three kite boarders were unable to stop being blown entirely across the estuary. Had the event had similar winds on all days the cumulative impact of disturbances may have been quite different.

The observations made during the event did, however, show that in general birds tolerated kite boarders that stayed downriver well. Kites operating directly out from the event camp would have been 300–400 m from the roosting flock at the bollards, and as birds were able to start roosting

without much human activity around, they became very settled and were not disturbed by distant kites. The disturbance issues at the bollards arose mostly when kite boarders came much closer to the roosting flock, and when kites slapped noisily and dramatically into the water.

It needs to be noted that the potential for conflict between kite boarders and birds will vary between sites, depending on where kite boarders operate and where birds roost and feed. Fortunately, at the Manawatu Estuary kite boarding is generally attempted downriver of the tidal flat area where birds congregate, and as long as boarders are able to keep to that area, direct conflicts can be avoided. This may not be true for other sites favoured by kite boarders, and the lack of negative impacts on birds during this event at the Manawatu Estuary cannot be taken as evidence that there will never be impacts of kite boarding on shorebirds. The conditions experienced during the event did not facilitate much kite boarding activity (an outcome favourable to the birds roosting nearby), and on the day that activity was high, the disturbance rate increased. Four days of extensive disturbance may well have negatively affected bird behaviour; equally so, the fact that birds were not disturbed extensively during this event shows that, at this site at least, a kite boarding event will not necessarily result in long-lasting disturbance to birds.

8. Conclusions

The kite boarding event held at the Manawatu Estuary in November 2015 increased the disturbance to roosting shorebirds above what would have been expected without the event. However, impacts were seemingly small, in part because there was actually little kite boarding possible on the estuary for much of the time. When winds were brisk, disturbance rates increased substantially and kite boarders had trouble staying within the designated zone for boarding. Had winds been consistently strong, the number of disturbances would be expected to be higher. The key to minimising disturbance to shorebirds would be to ensure that kite boarders do not pass a no-go point that is adequately distanced from any roosting birds near the bollards. This may be difficult to ensure, if involvement in the event is by registration rather than by qualification and meeting a certain proficiency level (presuming that it was the less-proficient boarders who got into trouble in those conditions). Disturbance would also be minimised if birds were already roosting on the sand spit rather than at the bollards. Active management of the spit to remove driftwood and weeds that reduce visibility would improve the chance of shorebirds roosting there.

9. Acknowledgments

Thanks to Allannah Irvine from the Department of Conservation for enabling this monitoring to take place, and to Katie Gibb, Toby Ross, Rachel Withington and Charmaine Stanley for assistance during monitoring.

Appendix 1

Counts made at shorebird roosts, Manawatu Estuary, over the monitoring period in August–November 2015.

DATE	TIME	SITE	TOTAL	BAR- TAILED GODWITS	RED KNOTS	RED- NECKED STINTS	FAR- EASTERN CURLEWS*	WRY- BILLS	SIPOs**	VOCs**	PIED STILTS	SPUR- WINGED PLOVERS	WHITE- FRONTED TERNS	CASPIAN TERNS	RED- BILLED GULLS*	BLACK- BILLED GULLS*	BLACK- BACKED GULL
31/08/2015	09:30–09:45	Spit	0														
31/08/2015	09:30–09:45	Bollards	145					8	25			2		1	1	2	106
31/08/2015	09:30–09:45	South side	21						1								20
14/09/2015	09:20–10:00	Bollards	69	12	0		1	6	21	0		2			6	1	20
18/09/2015	13:10–13:50	Bollards	84	45			1	17	18					3			
28/09/2015	09:30–10:30	Bollards	140	114				5	20					1			
29/09/2015	10:06–11:30	Bollards	176	135	1				22	1				4			13
5/10/2015	16:15	Spit	83	58								25					
5/10/2015	16:15	Bollards	119	74	1			3	23	2				2			14
15/10/2015	09:30–12:15	Bollards	233	180	4	2		16	28								3
16/10/2015	10:15–12:20	Bollards	248	183	2			16	24	4				3	1	7	8
27/10/2015	09:45–11:00	Bollards	307	260	15			1	29	2							
28/10/2015	9:05–11:30	Bollards	354	271	23			2	35	2				12	3	6	
30/10/2015	9:30–11:00	Bollards	379	273	30			10	39	1	1		1	12	1	7	4
30/10/2015	12:10	Spit	19								13	6					
31/10/2015	10:45–12:00	Bollards	376	284	26			3	35	1			15	4	7	7	1
1/11/2015	12:36	Bollards	103	57	22				20					4			
1/11/2015	12:36	Spit	210	210													
1/11/2015	11:10–13:30	Bollards	35					3	32								
10/11/2015	9:30–10:45	Bollards	453	263	36	1		2	39				95	1	16	present	
11/11/2015	9:20–11:30	Bollards	346	251	38			1	2				40	4	8	2	
11/11/2015	11:18–11:19	Back flat	13	12	1												
11/11/2015	11:28–11:30	Spit	38						33		4	1					
12/11/2015	8:20–13:10	Bollards	355	273	36	1		7	16	1				9	2	10	
13/11/2015	9:20–12:33	Bollards	668	235	34			2	5		4		380			12	9
13/11/2015	12:50	Spit	70	70					25								
14/11/2015	10:41–11:31	Bollards	220	149	36	1			21			4	9				
14/11/2015	13:48	Spit	279	217	30				26	2							4
15/11/2015	09:50–14:30	Bollards†	248	248									179				

* Far-eastern curlews (*Numenius madagascariensis*), red-billed gulls (*Larus novaehollandiae*), black-billed gull (*Larus bulleri*). ** Abbreviations: SIPOs = South Island pied oystercatchers; VOCs = variable oystercatchers; † Incomplete count.

Appendix 2

List of events recorded during shorebird monitoring at Manawatu Estuary, August–November 2015. These include activities that did not result in bird disturbance, as well as those that did.

DATE	TIME	EVENT	NUMBER OF KITES UP	DISTURBANCE?	CAUSE
31/08/2015		None.			
14/09/2015		None.			
18/09/2015		None.			
28/09/2015	10:20	Car drove with within 50 m of birds before turning away. Birds were spooked and ran to the water's edge but did not fly.		yes	Car
28/09/2015	10:14	Godwits flew; 60 went out river mouth, 44 returned to bollards.		yes	Rising tide + car
29/09/2015		None.			
5/10/2015		None.			
15/10/2015	9:58	Harrier overhead put up 40 godwits, South Island pied oystercatchers (SIPOs) and terns. Birds returned calmly to the east of the bollards (where they flew from) within <30 s.		yes	Harrier
15/10/2015	10:02	Different harrier put godwits up from east of the bollards; 48 settled at bollards 20 s later.		yes	Harrier
15/10/2015	10:32	Harrier put birds up. Wrybills and stints stayed put. Godwits took 30 s, SIPOs 1 min to return to bollards.		yes	Harrier
15/10/2015	10:35	Harrier chased by magpies 100 m away. No disturbance to shorebirds.			
15/10/2015	11:20	Tide pushed up towards vegetation and tree trunks, and birds were disturbed. Re-landed 50 m west of bollards and roosted there.			
16/10/2015	11:06	Red car drove almost to the end of the bollards and parked. No disturbance.			
16/10/2015	12:20	No disturbance apart from the rising tide. Nobody on estuary at 12:20.			
27/10/2015		None other than tide. 5–6 vehicles and 1 dog with owner used the areas west of bollards.			
28/10/2015	10:08	1 walker 1/3 way up bollards coincided with birds shifting from east side of bollards to join the half already on the west side. Tide was moving then, but birds probably moved due to the walker c. 30 m away. Landed quickly.			
28/10/2015	10:22	Harrier 100 m to east, high, flying to south side. Half godwit+SIPO flock took off and landed 20 s later at west end of flock.		yes	Harrier
30/10/2015	10:42	Harrier flew high, crossing to south side. All birds flew but returned to same place after 1 hr 15 min.		yes	Harrier
31/10/2015	10:59	Lots of vehicles (>10) towards river mouth. 4–5 car movements in 7 min, but no disturbances. Birds were still along tideline (P-flat only joined main flat birds after 10:45).			
31/10/2015		No disturbances while I was there.			
31/10/2015	11:06	Airforce plane crossed estuary over boat ramp. No disturbance.			
31/10/2015	11:09	Vehicle drove to within 40 m of bollards before turning off.			
31/10/2015	11:24	Second airforce plane flew over dunes. No disturbance.			
31/10/2015	11:53	Third airforce plane flew over beach. No disturbance.			
31/10/2015	11:53	3 cars near beach, 1 back of dunes (parked), 2 horse floats + cars past entrance. Nothing near bollards.			
31/10/2015	11:57	Tide pushed up and 11 godwits flew to back flat (as juveniles were doing to feed on crabs).			

Continued on next page

Appendix 2 continued

DATE	TIME	EVENT	NUMBER OF KITES UP	DISTURBANCE?	CAUSE
31/10/2015	11:59	Harrier flying low along spit above vegetation. No disturbance.			
31/10/2015		Sharon Wright (Wildlife and Ecology Group secretary, Massey University) reported birds in same place at 13:00. Birds were disturbed by a child and a dog but returned to the same area.		yes	
10/11/2015		None. Birds were on the east side of the bollards, possibly due to workmen putting in the temporary fence out from the track, designed to keep people away from the bollards.			
11/11/2015	9:22	2 juvenile black-backed gulls put up godwits from east side of bollards. Landed on west side halfway to fence.		yes	Gulls
11/11/2015	9:33	Kite setting down opposite small dunes caused c. 50 godwits to run several metres.		yes	Kite
11/11/2015	10:37	All birds up. No obvious cause, although a black shag flew in from the north. White-fronted terns took longer to re-land than the waders – 2 min 15 s.		yes	Shag?
11/11/2015	11:05	Birds flew as we approached from west side, still 80 m away. Caspian terns in flight. Unsure if it was us or something else. Godwits went back to same spot.		yes	People?
12/11/2015	8:47	Harrier mobbed by magpies, high over kite boarders' 'camp'. 2 SIPOs and c. 6 godwits moved 50 m along tideline in response, and carried on feeding.		yes	Harrier
12/11/2015	10:55	First kite up behind little dune.	1		
12/11/2015	11:00	First kite boarder out on water.	1		
12/11/2015	11:02	First kite boarder back on land.	0		
12/11/2015	11:28	Man on quad bike drove along fenceline. No disturbance.			
12/11/2015	11:46	Juvenile black-backed gull put 50 godwits up. Re-landed 10 m away.		yes	Gulls
12/11/2015	11:54	All birds up. Probably due to a single harrier very high. 12 godwits, and SIPOs + VOCs moved to inside the sandspit. Rest of waders landed between bollards and spit. 5 SIPOs, gulls and terns went back to bollards.		yes	Harrier
12/11/2015	12:01	Small car drove halfway along fence then turned back. No disturbance.			
12/11/2015	12:14	1 kite up again over land.	1		
12/11/2015	12:16	1 kite up over water.	1		
12/11/2015	12:17	Southerly change – brisk and cold. 18 godwits flew to back flat.			
12/11/2015	12:20	4 godwits to back flat.			
12/11/2015	12:22	10 godwits to back flat.			
12/11/2015	12:23	1 godwit to back flat	4		
12/11/2015	12:24	More godwits to back flat; 4 SIPOs moved to tideline. Godwits generally still settled despite three kite boarders on water. Wind may be causing some to move.	3		
12/11/2015	12:39	Birds fine despite 5 kite boarders on water.	5		
12/11/2015	12:41	2 godwits to back flat.			
12/11/2015	12:43	5 kites over water plus 3 over land.	8		
12/11/2015	12:50	12 knots feeding off bollards. Wrybills, stints and some godwits feeding 50 m to east	10		
12/11/2015	12:52	19 kites up!	19		
12/11/2015	12:53	Flock all flew up but landed along tideline east of bollards. 19 kites up at the time and one had just dumped into the water.	19	possibly	Kite dumping?
13/11/2015	9:27	Terns, gulls and godwits that were present near bollards went up. Resettled nearby. Black shag flying over was probably the cause.		yes	Black shag
13/11/2015	10:05	Godwits off spit all took off but resettled immediately. A fast-flying black-backed gull had just flown over.		yes	Black-backed gull

Continued on next page

Appendix 2 continued

DATE	TIME	EVENT	NUMBER OF KITES UP	DISTURBANCE?	CAUSE
13/11/2015	10:05	1 kite up over land.	1		
13/11/2015	10:14	1 kite up over water.	1		
13/11/2015	10:31	2 kites up over water.	2		
13/11/2015	10:43	1 godwit called and flew upriver.			
13/11/2015	10:49	Car with canoe drove halfway along fence, stopped, then left 1 minute later. Tide moving waders up. 2 kite boarders on water.	2		
13/11/2015	10:52	Kite boarder between spikey trunk and end buoy walked out not far from fence. No disturbance.			
13/11/2015	10:57	SIPOs piped then flew towards the sandspit. Their doing so caused the terns to get up and move 30 m to the west.		yes	Oystercatchers
13/11/2015	11:10	Terns up, possibly in response to a nearby kite. 80-odd headed out towards the beach. The rest resettled.		yes	Kite?
13/11/2015	11:19	Small helicopter over estuary from river mouth over kite-boarding 'camp'. No disturbance.			
13/11/2015	11:29	Larger army (?) helicopter over forest to Foxtan Beach. No disturbance. Black-backed gulls put white-fronted terns up at same time. Most moved between bollards and fence.		yes	Gulls
13/11/2015	11:34	Very calm and sunny now. No kites.	0		
13/11/2015	11:48	Terns all up; most back down again. Big feeding workup off beach on north side.			
13/11/2015	11:53	2 kites up. One kite being walked along towards fence (maybe halfway dune to fence) with yappy dog. Nearby terns moved to within fence.	2	yes	Kite+dog
13/11/2015	12:01	7 godwits to back flat.			
13/11/2015	12:07	2 kites up, hydrofoiling. 3 godwits to back flat.	2		
13/11/2015	12:09	2 godwits to back flat.			
13/11/2015	12:15	1 godwit to back flat.			
13/11/2015	12:18	1 godwit to back flat.			
13/11/2015	12:32	Harrier flew directly over flock. Godwits went up then back down, but some moved to the spit.		yes	Harrier
14/11/2015	10:15	2 jet skis on water out from tents heading up estuary.			
14/11/2015	11:03	Harrier over top (north to south). C. 40 birds flew to bollards.			
14/11/2015	11:38	First kite up.	1		
14/11/2015	11:44	Sailboat (sunburst size) within 20 m of bollards fence flock. All spooked but only 47 returned.		yes	Sailboat
14/11/2015	12:18	Kite up and plane overhead.	1		
14/11/2015	12:41	Kite up and on water.	1		
14/11/2015	12:42	7 speedboats up estuary.			
14/11/2015	12:48	2nd kite up.	2		
14/11/2015	12:51	3rd kite up.	3		
14/11/2015	13:01	Kite past black buoy (no-go marker). No disturbance.			
14/11/2015	13:07	2nd kite past buoy.			
14/11/2015	13:08	2nd kite crashed just short of the main bollards. C. 21 birds spooked to the spit immediately.		yes	Kite boarder
14/11/2015	13:10	Remainder of flock disturbed by the kite-boarder moving to shore with their kite, and flew to the spit.		yes	Kite boarder
14/11/2015	13:18	Harrier pair circling around salt marsh put flock on spit up. The waders circled around and resettled on the spit.		yes	Harriers
14/11/2015	13:37	Harrier spooked 11 godwits from salt flat to spit.		yes	Harrier
14/11/2015	13:48	Count at spit of 279 birds and 38 on tidal flats in bay from spit to bollards. No kites up.	0		
14/11/2015	14:03	Black-backed gulls returning to spit put 10 waders up.		yes	Gulls

Continued on next page

Appendix 2 continued

DATE	TIME	EVENT	NUMBER OF KITES UP	DISTURBANCE?	CAUSE
14/11/2015	14:10	Most of tidal flats open and birds starting to feed. No kites up.	0		
14/11/2015	14:23	Black-backed gulls spooked 13 waders from spit to salt marsh.			
15/11/2015	10:11	1 kite lost board, drifting well past black buoy on the far (south) side of estuary. Second kite just in front of black buoy but very close to north bank – spooked 5 knots just east of first fence		yes	Kite boarder
15/11/2015	10:17	Kite 'slap' on water surface well within black buoy, spooked 14 white-fronted terns from base of second fence.		yes	Kite boarder
15/11/2015	10:18	First kite close to south bank – about 400 m up from buoy, 5 godwits spooked to tidal flat at east end of estuary.		yes	Kite boarder
15/11/2015	10:34	Kite rescued by boat in front of launching ramp.			
15/11/2015	10:40	10 kites up.	10		
15/11/2015	10:45	Heavy rain.			
15/11/2015	11:33	2 godwits from back flat to estuary.			
15/11/2015	11:38	18 godwits on back flat by road, plus 80+ on north side of spit with 26 SIPOs.			
15/11/2015	11:40	2 kite boarders past buoy; 3 godwits disturbed from tidal flats in 'bay'.		yes	Kite boarder
15/11/2015	11:44	Kite boarder bailed out on sandspit by houses. Disturbed the godwits there; 15 went to the back flat, the remainder to the 'bay' between the spit and bollards.		yes	Kite boarder
15/11/2015	12:03		7		
15/11/2015	12:06	Kite past buoy, middle of channel.			
15/11/2015	12:06	Kite blown 200 m up river.			
15/11/2015	12:13	Kite now on flat opposite Hartley Street (P-flat).			
15/11/2015	12:26	c. 36 godwits from estuary to back flat.			
15/11/2015	12:27	All kites off water.			
15/11/2015	13:05	Kites back up – 2 over water, 1 over land.	3		
15/11/2015	13:17	White-fronted terns spooked by rock dove.		yes	Rock dove
15/11/2015	13:35	2 godwits from back flat to estuary.			
15/11/2015	13:44	16 godwits from estuary to back flat.			
15/11/2015	13:45	10 godwits from back flat to estuary.			
15/11/2015	13:48	1 kite up on water + 1 on land.	2		
15/11/2015	13:51	2 kites up on water.	2		
15/11/2015	13:57	3 godwits from estuary to back flat.			
15/11/2015	14:01	Black-backed gulls disturbed all terns plus 18 godwits. All but one godwit returned to the estuary (the other went to the back flat).	3		
15/11/2015	14:02	9 godwits from back flat to estuary.			
15/11/2015	14:05	1 kite past buoy.			
15/11/2015	14:08	Kite close to shore spooked c. 15 godwits that landed about 10 m east of where they had been.		yes	Kite boarder
15/11/2015	14:08	5 godwits from estuary to back flat.			
15/11/2015	14:11	2 godwits from estuary to back flat.			
15/11/2015	14:30	Kites down.			