MIGRATORY SHOREBIRDS IN DARWIN HARBOUR, NORTHERN TERRITORY

FIRST REPORT

REPORT TO THE NORTHERN TERRITORY GOVERNMENT

31 OCTOBER 2013

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Lilleyman, A., Lawes, M.J. and Garnett, S.T. 2013. Migratory shorebirds in Darwin Harbour, Northern Territory. Report to the Department of Business, Northern Territory Government

31 October 2013

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SUMMARY

This project assesses the importance of Darwin Harbour for migratory shorebirds protected under the Environmental Protection and Biodiversity Conservation Act 1999. This first report identifies the hardware to be purchased, provides a complete record of all shorebirds recorded roosting at East Arm Wharf and identifies the known and potential roost sites that will be investigated during the duration of the project. It provides a baseline for the remainder of the project.

BACKGROUND

This project examines migratory shorebird ecology in Darwin Harbour. The research has practical implications for the long-term planning of development in Darwin Harbour. The distribution and abundance of shorebirds in Darwin Harbour is unknown, as is the importance of the mudflats in the harbour to maintaining these migratory shorebird populations, which are protected under the Environmental Protection and Biodiversity Conservation Act 1999. Development of Darwin Port is expected to increase and most projects will need to anticipate their impact on shorebirds if they are to get permits under the EPBC Act. A study of the shorebirds in Darwin Harbour will place any local developments in context and ensure the approval process is linked to empirical data. The research will also fulfil the shorebird monitoring required as part of the Northern Territory's environmental management of East Arm Wharf.

In order to meet the aims of this project, migratory shorebirds will be trapped and tagged to track movements within Darwin Harbour. To do this an array of tracking equipment (listed in Table 1) will be attached to shorebirds. At the time of this report these items are yet to be purchased.

Table 1. List of items to be purchased to undertake migratory shorebird project in Darwin Harbour.

Description	Per item cost	Number of items
Geolocators	204.50	20
GPS tags	80.75	10
VHF transmitters glue-on	213.00	50
VHF transmitters lite	158.00	70
Telemetry software	2000.00	1
Automatic receivers	8000.00	2
Yagi Aerials and housing	1485.00	4
VHF receiver	2200.00	4
Automatic receivers	8000.00	2
Fuel costs: 5000 kms @ $0.50 c/l	0.50	5000

Selected individual shorebirds will have tracking devices applied to them. Tracking of shorebirds is widely used in biological and ecological surveys, mostly to understand movement at a local-scale and migration at a global-scale. In the first season (January to April 2014) shorebirds will be applied with VHF tracking devices. These birds will then be tracked for local-scale movement in the Harbour using hand-held radio tracking receivers and antennae. Tracking of shorebirds will be complemented with intensive observational work to resighting individually-marked shorebirds. Additionally, in the second fieldwork season GPS bird tags will be applied to selected individual birds. These devices can be used to track shorebirds at a global scale; they are also advanced enough to track small-scale movements, such as those within a harbour. Moreover, geolocators will be attached the leg of the shorebird and can be used for one to five years, depending on the battery size. Geolocators measure the ambient light level with reference to time, so the location of the bird can be known.

The fieldwork component of the study will include intense observational surveys, in addition to the tracking using telemetry devices. Surveys performed at high tide roost-sites have been performed at East Arm Wharf since late-2009. These surveys will continue throughout the duration of the project.

SURVEY METHODS

SHOREBIRD SURVEYS

Migratory shorebirds were surveyed weekly at Pond D at East Arm Wharf from 2009 to 2013. All 36 listed migratory shorebirds were surveyed for during counts at Pond D. Surveys were conducted two hours either side of the high tide, within daylight hours. All birds were identified and counted using binoculars and a spotting scope.

HABITAT MAPPING

Potential roost sites for shorebirds were mapped using Google Earth. Roost habitat was selected for optimum conditions of a site, including large, open area, distance to nearest tall vegetation, distance to coastal water, connectedness and distance to other known roosting and feeding sites. The distance from East Arm Wharf to other known roost sites has been calculated.

SURVEY RESULTS

SHOREBIRD SURVEYS

Results from regular shorebird surveys at Pond D are shown in Table 2. Maximum counts and threshold values for migratory shorebirds at East Arm Wharf are shown in Table 3.

Table 2. Migratory shorebird count data from November 2009 to October 2013, continued from page 6 - 15.

Date	30/11/2009	9/01/2010	6/02/2010	27/03/2010	17/04/2010	10/07/2010	28/10/2010	12/11/2010	16/11/2010	18/11/2010	22/11/2010	24/11/2010
Time of count	14:00:00	10:50:00	10:50:00	15:00:00	8:00:00	15:00:00	9:00:00	7:35:00	15:02:00	10:35:00	18:30:00	9:32:00
Time of nearest high tide	17:39:00	12:59:00	11:07:00	16:34:00	8:04:00	9:11:00	8:06:00	8:57:00	14:52:00	16:38:00	19:03:00	18:47:00
Hight tide (m)	7	5.3	5.9	6.4	7.4	6.7	6.2	5.06	4.9	5.9	7.3	6.5
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	3:39:00	2:09:00	0:17:00	1:34:00	0:04:00	5:49:00	0:54:00	1:22:00	0:10:00	6:03:00	0:33:00	9:15:00
Latham's snipe												
Pin-tailed snipe												
Swinhoe's snipe												
Black-tailed godwit					7							
Bar-tailed godwit												
Little curlew												
Whimbrel								2	2			
Eastern curlew		1	5	101	1			1	95		27	
Common redshank												
Marsh sandpiper		1	1								250	63
Common greenshank		6	8	11	3			20	15		10	2
Wood sandpiper												
Terek sandpiper												
Common sandpiper					1							
Grey-tailed tattler												
Wandering tattler												
Ruddy turnstone												
Asian dowitcher												
Great knot									20			
Red knot		1			150							
Sanderling			1									
Red-necked stint		6		4	4			30	25			55
Long-toed stint												
Pectoral sandpiper												

Date	30/11/2009	9/01/2010	6/02/2010	27/03/2010	17/04/2010	10/07/2010	28/10/2010	12/11/2010	16/11/2010	18/11/2010	22/11/2010	24/11/2010
Time of count	14:00:00	10:50:00	10:50:00	15:00:00	8:00:00	15:00:00	9:00:00	7:35:00	15:02:00	10:35:00	18:30:00	9:32:00
Time of nearest high tide	17:39:00	12:59:00	11:07:00	16:34:00	8:04:00	9:11:00	8:06:00	8:57:00	14:52:00	16:38:00	19:03:00	18:47:00
Hight tide (m)	7	5.3	5.9	6.4	7.4	6.7	6.2	5.06	4.9	5.9	7.3	6.5
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	3:39:00	2:09:00	0:17:00	1:34:00	0:04:00	5:49:00	0:54:00	1:22:00	0:10:00	6:03:00	0:33:00	9:15:00
Sharp-tailed sandpiper			9	1	5			10			200	32
Curlew sandpiper								14	2		12	18
Broad-billed sandpiper												
Ruff												
Red-necked phalarope												
Golden plover												
Grey plover							1					6
Double-banded plover												
Lesser sand plover											300	20
Greater sand plover			1						45		210	21
Oriental plover												
Oriental pratincole												
Unidentified												
TOTAL	0	15	25	117	171	0	1	77	204	0	1009	217

Date	29/11/2010	11/12/2010	10/01/2011	16/01/2011	23/03/2011	11/04/2011	20/06/2011	14/07/2011	18/08/2011	16/09/2011	15/10/2011	28/11/2011
Time of count	9:25:00	8:35:00	9:20:00	16:45:00	9:30:00	11:30:00	10:00:00	8:30:00	10:00:00	9:00:00	10:00:00	8:20:00
Time of nearest high tide	10:59:00	8:50:00	9:18:00	16:26:00	8:39:00	10:56:00	9:17:00	5:50:00	8:28:00	7:47:00	7:11:00	7:11:00
Hight tide (m)	5.03	5.9	6.06	5.67	7.77	5.95	6.93	6.59	6.86	6.83	6.68	6.8
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	1:34:00	0:15:00	0:02:00	0:19:00	0:51:00	0:34:00	0:43:00	2:40:00	1:32:00	1:13:00	2:49:00	1:09:00
Latham's snipe												
Pin-tailed snipe												
Swinhoe's snipe												
Black-tailed godwit												
Bar-tailed godwit												
Little curlew												
Whimbrel	8		1		15							
Eastern curlew	9				72							
Common redshank												
Marsh sandpiper				2	1	2	2					3
Common greenshank	2	15		4	8				12		16	28
Wood sandpiper												
Terek sandpiper							12	20				
Common sandpiper			2	1	2				1			
Grey-tailed tattler	2						3	1				
Wandering tattler												
Ruddy turnstone												
Asian dowitcher												
Great knot							50	20				
Red knot										53		
Sanderling												
Red-necked stint				2			12	20	12	6		
Long-toed stint												
Pectoral sandpiper												

Date	29/11/2010	11/12/2010	10/01/2011	16/01/2011	23/03/2011	11/04/2011	20/06/2011	14/07/2011	18/08/2011	16/09/2011	15/10/2011	28/11/2011
Time of count	9:25:00	8:35:00	9:20:00	16:45:00	9:30:00	11:30:00	10:00:00	8:30:00	10:00:00	9:00:00	10:00:00	8:20:00
Time of nearest high tide	10:59:00	8:50:00	9:18:00	16:26:00	8:39:00	10:56:00	9:17:00	5:50:00	8:28:00	7:47:00	7:11:00	7:11:00
Hight tide (m)	5.03	5.9	6.06	5.67	7.77	5.95	6.93	6.59	6.86	6.83	6.68	6.8
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	1:34:00	0:15:00	0:02:00	0:19:00	0:51:00	0:34:00	0:43:00	2:40:00	1:32:00	1:13:00	2:49:00	1:09:00
Sharp-tailed sandpiper	10		3	7	6		4			6	2	
Curlew sandpiper										6	1	6
Broad-billed sandpiper												
Ruff												
Red-necked phalarope												
Golden plover					16							
Grey plover	2							3				
Double-banded plover												
Lesser sand plover	3	20										
Greater sand plover	50	50										
Oriental plover												
Oriental pratincole												
Unidentified												
TOTAL	86	85	6	16	120	2	83	64	25	71	19	37

Date	15/12/2011	12/01/2012	21/02/2012	23/03/2012	23/04/2012	20/07/2012	17/08/2012	14/09/2012	15/11/2102	15/11/2012	12/02/2013	13/02/2013
Time of count	9:45:00	7:30:00	9:27:00	8:35:00	8:40:00	8:30:00	8:32:00	9:00:00	7:22:00	6:30:00	7:17:00	7:25:00
Time of nearest high tide	8:16:00	7:35:00	5:46:00	6:56:00	7:39:00	7:21:00	6:19:00	5:06:00	6:05:00	6:05:00	7:23:00	8:04:00
Hight tide (m)	6.26	6.71	6.36	7.09	7.18	6.96	6.76	6.3 m	7.1	7.1	7.26	7.3
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	1:29:00	0:05:00	3:41:00	1:39:00	1:01:00	1:09:00	2:13:00	3:54:00	1:17:00	0:25:00	0:06:00	0:39:00
Latham's snipe												
Pin-tailed snipe												
Swinhoe's snipe												
Black-tailed godwit												
Bar-tailed godwit										36		
Little curlew												
Whimbrel						37				2		
Eastern curlew									1	1	1	
Common redshank												
Marsh sandpiper	18		1						1	4	1	2
Common greenshank		6	9	24	3	47		5	54	32	30	22
Wood sandpiper												
Terek sandpiper												5
Common sandpiper	1			2								3
Grey-tailed tattler												
Wandering tattler												
Ruddy turnstone												
Asian dowitcher												
Great knot					20					1	100	21
Red knot												
Sanderling									1			
Red-necked stint	35							4	3	57	23	17
Long-toed stint												
Pectoral sandpiper												

Date	15/12/2011	12/01/2012	21/02/2012	23/03/2012	23/04/2012	20/07/2012	17/08/2012	14/09/2012	15/11/2102	15/11/2012	12/02/2013	13/02/2013
Time of count	9:45:00	7:30:00	9:27:00	8:35:00	8:40:00	8:30:00	8:32:00	9:00:00	7:22:00	6:30:00	7:17:00	7:25:00
Time of nearest high tide	8:16:00	7:35:00	5:46:00	6:56:00	7:39:00	7:21:00	6:19:00	5:06:00	6:05:00	6:05:00	7:23:00	8:04:00
Hight tide (m)	6.26	6.71	6.36	7.09	7.18	6.96	6.76	6.3 m	7.1	7.1	7.26	7.3
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	1:29:00	0:05:00	3:41:00	1:39:00	1:01:00	1:09:00	2:13:00	3:54:00	1:17:00	0:25:00	0:06:00	0:39:00
Sharp-tailed sandpiper	14								8	30	13	5
Curlew sandpiper	1								14	5		
Broad-billed sandpiper												3
Ruff												
Red-necked phalarope												
Golden plover												
Grey plover												
Double-banded plover												
Lesser sand plover										5		
Greater sand plover										4		
Oriental plover												
Oriental pratincole												
Unidentified												
TOTAL	69	6	10	26	23	84	0	9	82	177	168	78

Date	14/02/2013	18/04/2013	3/05/2013	16/05/2013	22/05/2013	29/05/2013	21/06/2013	27/06/2013	5/07/2013	11/07/2013	16/07/2013	25/07/2013
Time of count	7:45:00	10:00:00	11:12:00	8:55:00	15:20:00	8:15:00	14:43:00	8:03:00	14:50:00	8:21:00	11:00:00	8:24:00
Time of nearest high tide	8:42:00	10:56:00	11:58:00	9:52:00	15:33:00	9:15:00	15:43:00	9:03:00	16:04:00	8:15:00	10:36:00	8:07:00
Hight tide (m)	7.16	5.79	6	6.38	5.92	7.36	5.84	7.47	5.22	6.9	6.1	7.7
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	0:57:00	0:56:00	0:46:00	0:57:00	0:13:00	1:00:00	1:00:00	1:00:00	1:14:00	0:06:00	0:24:00	0:17:00
Latham's snipe												
Pin-tailed snipe												
Swinhoe's snipe												
Black-tailed godwit												
Bar-tailed godwit			9									
Little curlew												
Whimbrel		10	8	2	11	7	6	8				4
Eastern curlew			48	11								2
Common redshank						35						
Marsh sandpiper	10	1	1									
Common greenshank	27	18	25	9			19	34	14	43	9	73
Wood sandpiper	2											
Terek sandpiper		5										1
Common sandpiper	1											
Grey-tailed tattler												
Wandering tattler												
Ruddy turnstone												
Asian dowitcher												
Great knot	66	21	34	8	16							
Red knot												
Sanderling												
Red-necked stint	20	3	10	5	7	4	8	11	11	23		
Long-toed stint												
Pectoral sandpiper												

Date	14/02/2013	18/04/2013	3/05/2013	16/05/2013	22/05/2013	29/05/2013	21/06/2013	27/06/2013	5/07/2013	11/07/2013	16/07/2013	25/07/2013
Time of count	7:45:00	10:00:00	11:12:00	8:55:00	15:20:00	8:15:00	14:43:00	8:03:00	14:50:00	8:21:00	11:00:00	8:24:00
Time of nearest high tide	8:42:00	10:56:00	11:58:00	9:52:00	15:33:00	9:15:00	15:43:00	9:03:00	16:04:00	8:15:00	10:36:00	8:07:00
Hight tide (m)	7.16	5.79	6	6.38	5.92	7.36	5.84	7.47	5.22	6.9	6.1	7.7
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	0:57:00	0:56:00	0:46:00	0:57:00	0:13:00	1:00:00	1:00:00	1:00:00	1:14:00	0:06:00	0:24:00	0:17:00
Sharp-tailed sandpiper												
Curlew sandpiper		2										
Broad-billed sandpiper												
Ruff												
Red-necked phalarope												
Golden plover						5	2					
Grey plover		2		4								
Double-banded plover												
Lesser sand plover			5			3						
Greater sand plover	9	4				2						
Oriental plover												
Oriental pratincole												
Unidentified												
TOTAL	135	66	140	39	34	56	35	53	25	66	9	80

Date	1/08/2013	8/08/2013	12/08/2013	23/08/2013	27/08/2013	6/09/2013	11/09/2013	20/09/2013	23/09/2013	2/10/2013	8/10/2013	17/10/2013	21/10/2013
Time of count	12:25:00	8:36:00	8:47:00	8:47:00	9:34:00	8:15:00	6:56:00	7:35:00	6:30:00	15:20:00	6:20:00	16:28:00	6:25:00
Time of nearest high tide	12:21:00	7:23:00	9:00:00	7:39:00	9:22:00	6:48:00	8:56:00	6:31:00	7:54:00	16:53:00	7:30:00	17:16:00	6:50:00
Hight tide (m)	4.8	7	6.84	7.61	6.39	7.04	6.62	7.33	7.08	5.76	7.15	6.71	6.95
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	0:04:00	1:13:00	0:13:00	1:08:00	0:12:00	1:27:00	2:00:00	1:04:00	1:24:00	1:33:00	1:10:00	0:48:00	0:25:00
Latham's snipe													
Pin-tailed snipe													
Swinhoe's snipe													
Black-tailed godwit							1	2	3		1		
Bar-tailed godwit		1					18	53	55	34	48	40	41
Little curlew													
Whimbrel		22				8	1		1	69	1	58	
Eastern curlew		1				1						83	
Common redshank													
Marsh sandpiper								2		1	6		4
Common greenshank	20	38		58	71	97	104	112		111	86	30	76
Wood sandpiper													
Terek sandpiper								1	1				
Common sandpiper									1	1			
Grey-tailed tattler						3	2	10	9				
Wandering tattler													
Ruddy turnstone													
Asian dowitcher							2	3	3	3	3	2	1
Great knot		1					3	4	5	13	58	8	10
Red knot						6			2		2		
Sanderling													
Red-necked stint		11				6	25	3	13		66		68
Long-toed stint													
Pectoral sandpiper													

Date	1/08/2013	8/08/2013	12/08/2013	23/08/2013	27/08/2013	6/09/2013	11/09/2013	20/09/2013	23/09/2013	2/10/2013	8/10/2013	17/10/2013	21/10/2013
Time of count	12:25:00	8:36:00	8:47:00	8:47:00	9:34:00	8:15:00	6:56:00	7:35:00	6:30:00	15:20:00	6:20:00	16:28:00	6:25:00
Time of nearest high tide	12:21:00	7:23:00	9:00:00	7:39:00	9:22:00	6:48:00	8:56:00	6:31:00	7:54:00	16:53:00	7:30:00	17:16:00	6:50:00
Hight tide (m)	4.8	7	6.84	7.61	6.39	7.04	6.62	7.33	7.08	5.76	7.15	6.71	6.95
Count site	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D	Pond D
Time difference with high tide	0:04:00	1:13:00	0:13:00	1:08:00	0:12:00	1:27:00	2:00:00	1:04:00	1:24:00	1:33:00	1:10:00	0:48:00	0:25:00
Sharp-tailed sandpiper						16	19	20	4	50	24	37	2
Curlew sandpiper						2	4	1	5	4	8	6	5
Broad-billed sandpiper							6	2	4	1	4		3
Ruff													
Red-necked phalarope													
Golden plover										32			
Grey plover								2	1			8	
Double-banded plover													
Lesser sand plover								1			1		
Greater sand plover							1				1		
Oriental plover													
Oriental pratincole													
Unidentified													
TOTAL	20	74	0	58	71	139	186	216	107	319	309	272	210

Table 3. The 36 migratory shorebirds surveyed at East Arm Wharf, Darwin. Shorebird abundances are represented as present in the counts, as a per cent, maximum numbers counted, and times the counts exceeded the threshold for national significance, as outlined by Department of the Environment Water Heritage and the Arts (2009).

Shorebird	Counts	% present in counts	Maximum count	No. counts > EPBC threshold	Threshold (DEHWA 2009)
Latham's snipe	0	0	0	0	34
Pin-tailed snipe	0	0	0	0	25 -1000
Swinhoe's snipe	0	0	0	0	25 - 100
Black-tailed godwit	5	9	7	0	160
Bar-tailed godwit	10	18	55	0	325
Little curlew	0	0	0	0	180
Whimbrel	22	39	69	2	55
Eastern curlew	18	32	101	5	38
Common redshank	1	2	35	0	75
Marsh sandpiper	22	39	250	0	1000
Common greenshank	46	82	112	3	100
Wood sandpiper	1	2	2	0	100
Terek sandpiper	7	13	20	0	50
Common sandpiper	11	20	3	0	50
Grey-tailed tattler	7	13	10	0	40
Wandering tattler	0	0	0	0	n/a
Ruddy turnstone	0	0	0	0	35
Asian dowitcher	7	13	3	0	24
Great knot	20	36	100	0	380
Red knot	6	11	150	0	220
Sanderling	2	4	1	0	320
Red-necked stint	34	61	68	0	160
Long-toed stint	0	0	0	0	25
Pectoral sandpiper	0	0	0	0	n/a
Sharp-tailed sandpiper	26	46	200	1	180
Curlew sandpiper	19	34	18	0	180
Broad-billed sandpiper	7	13	6	0	25
Ruff	0	0	0	0	n/a
Red-necked phalarope	0	0	0	0	100 - 1000
Golden plover	4	7	32	0	100
Grey plover	9	16	8	0	125
Double-banded plover	0	0	0	0	50
Lesser sand plover	9	16	300	1	40
Greater sand plover	12	21	210	1	100
Oriental plover	0	0	0	0	700
Oriental pratincole	0	0	0	0	2880
Unidentified	0	0	0	0	-

HABITAT MAPPING

There are several known habitat sites used by migratory shorebirds in the Darwin Harbour region (Figure 1). In addition, satellite image were used to investigate potential habitat areas. The minimum distances from the East Arm Wharf roost site to other known roost sites are shown in Table 3. Using satellite imagery, additional potential roost sites for migratory shorebirds have been identified based on habitat environmental attributes that have been correlated with shorebird presence, abundance and species composition (Figure 3). Most of these sites will be investigated for ground-truthing of habitat characteristics and surveyed during the Austral summer season for roosting shorebird presence.

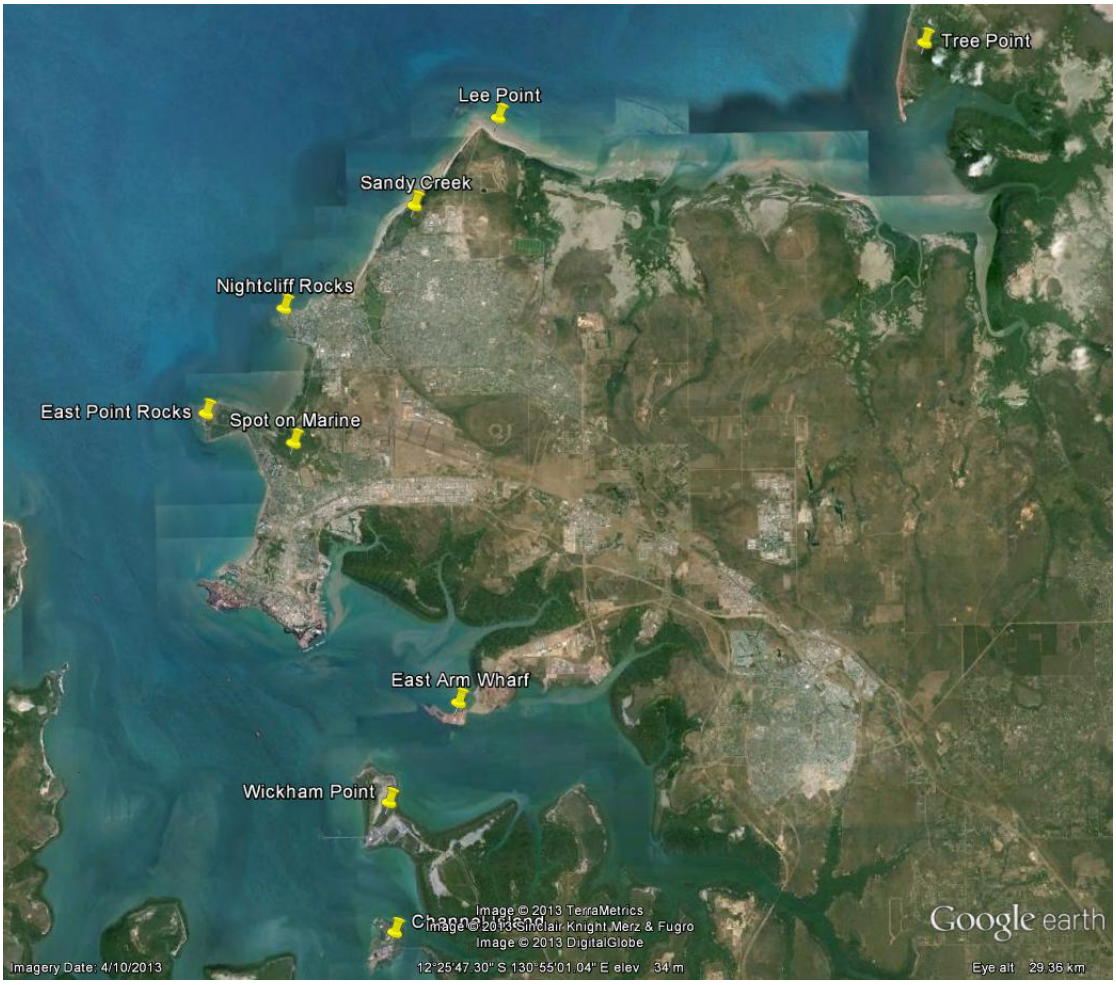

Figure 1. Known roost sites in the Darwin Harbour region. Image credit: Google Inc (2013)

Table 3. Minimum distances for travelling migratory shorebirds from the East Arm Wharf roost site to other known roost sites in the Darwin Harbour region.

From East Arm Wharf to:	Distance (km)
Wickham Point	3.15
Channel Island	7.14
Spot on Marine	10.22
East Point	11.69
Nightcliff	13.16
Sandy Creek	15.26
Lee Point	17.79
Tree Point	24.27

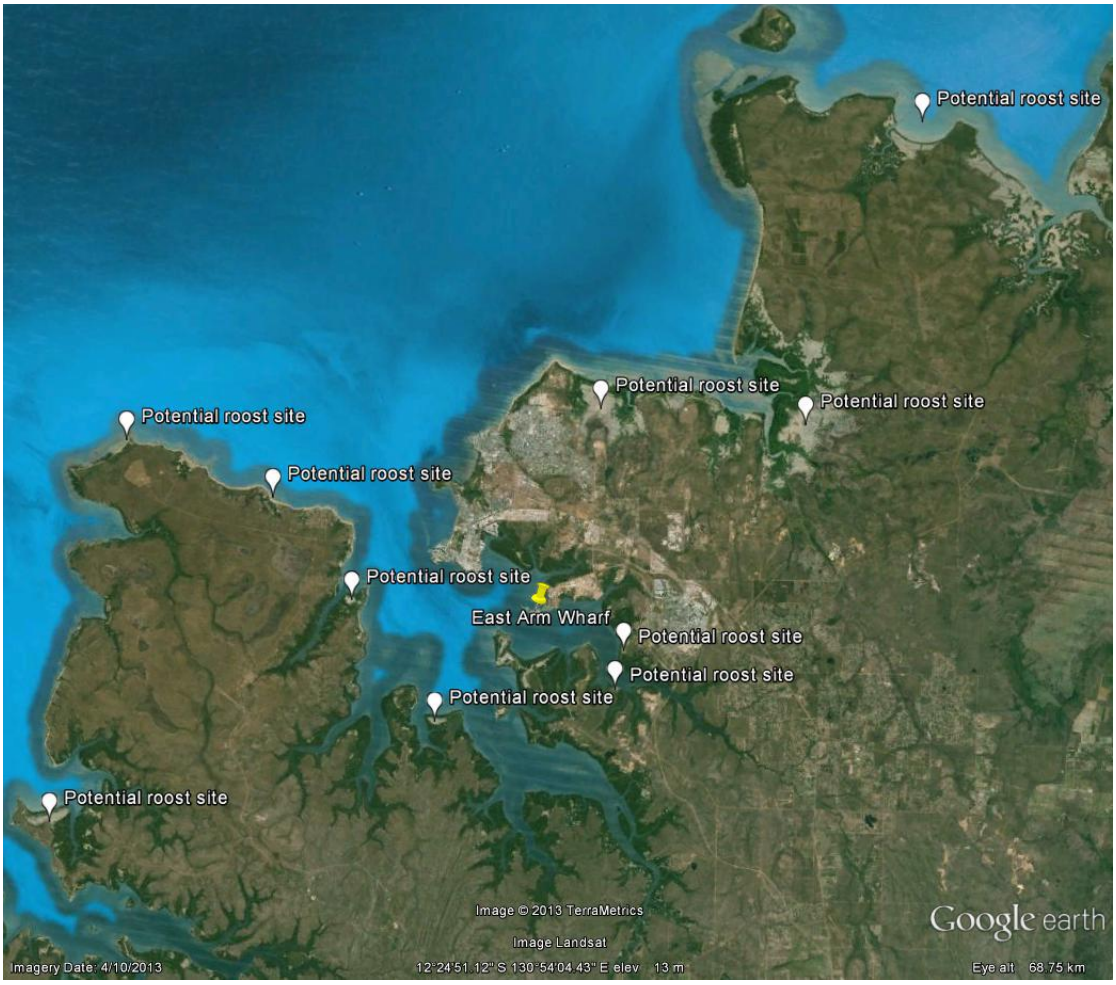

Figure 2. Potential roost sites for migratory shorebirds in the Darwin Harbour region based on habitat characteristics. Image credit: Google Inc (2013).

REFERENCES

Department of the Environment Water Heritage and the Arts (2009) Significant impact guidelines for 36 migratory shorebird species. Background paper to EPBC Act policy statement 3.21.

Google Inc (2013) Google Earth.