ANNUAL ANALYSIS OF THE STATUS OF WADERS IN THE PORT OF BRISBANE BETWEEN JULY 2017 & JUNE 2018

Includes an analysis of historical trends in counts and a comparison with Moreton Bay populations.

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Queensland Wader Study Group

April 2019

Dedicated to the memory of David Milton

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EXECUTIVE SUMMARY

Update for 2017_18

As in previous reports, the species that are most important at the site are identified and their numbers on Port lands is compared with their numbers across the whole of Moreton Bay. Counts for each subsection of the site for August 2017 to September 2018 are tabulated and comparisons are made with previous years.

The twelve important species at the site are the Ruddy Turnstone, four plover species (Lesser and Greater Sand Plovers, Pacific Golden Plover and Grey Plover), three large sandpipers (Eastern Curlew, Bar-tailed Godwit and Great Knot) and four smaller species (Grey-tailed Tattler, Sharp-tailed Sandpiper, Curlew Sandpiper and Red-necked Stint).

Where practical, data are presented for each time of sampling. Alternatively, mean or maximum values are given for each of four periods of the year but with a focus on the main period of occupancy during the non-breeding season by the birds from mid-November to mid-March. Grouped data for all migratory wader species and all resident wader species are also presented.

As expected, numbers of migratory waders are highest during the summer months and as many as 14 species are regularly recorded at any one time. Numbers of resident waders are marginally higher during the winter months. Over the last decade migratory wader numbers have remained at about the same level and the site generally remains the most important single roosting area for waders in the whole of Moreton Bay. Data collected from throughout Moreton Bay continue to imply that the POB lands are becoming even more important for local shorebird populations as other shoreline habitat is impacted through disturbance or physical changes.

Subsections of the Port lands have been used to document changes in the distribution of waders across the site over time. There is a clear indication of the way in which birds alter their choice of roosting area as reclamation proceeds. They move to where fresh dredge spoil is being deposited and then move on as deposition stops and the spoil is allowed to dry and form a crust. For the areas that are currently in use by waders, more detailed spatial records are presented. For individual species it should be possible to relate the choice of habitat to the nature and condition of the substrate but this is beyond the scope of this report.

For the site as a whole since 2003, the pattern of yearly changes in numbers varies between species but without any significant change. These patterns are described and continued sampling will help to establish whether there are cyclical patterns or distinct increasing or decreasing trends in numbers.

There has been a slight hiatus in the production of this report, mainly due the tragic loss of David Milton. However, this report will now get the program back on track and another report will be produced in a timely manner to cover the 2018_19 count result. The counts have continued to be undertaken every month.

It is with great sadness that I have taken over the role that David Milton had in producing this report. David passed away early in 2018 after a tragic home accident. He has left a huge legacy within QWSG and initiated many programmes and activities. He will be sorely missed by a great many people across the many aspects of his life. One of those roles was formulating and writing the yearly POB report. which he assiduously and expertly performed for many years. I dedicate this particular POB report to David Milton, a tireless advocate for waders and as steadfast a person you could imagine.

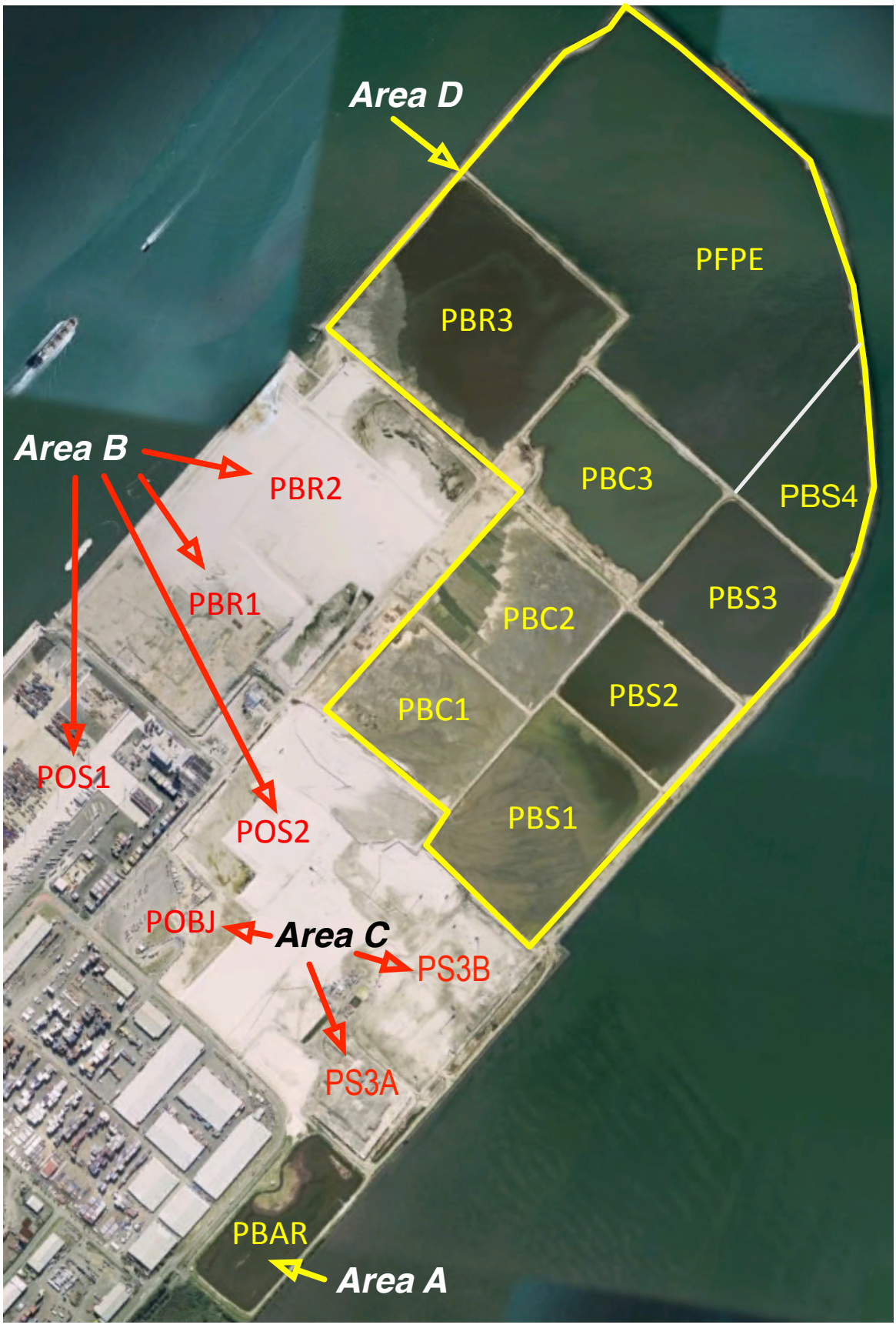

Figure 1. Wader count sites and site groupings (Areas) within the Port of Brisbane land reclamation zone. The sites are labelled with the same alphanumeric codes that are used throughout this report and in the QWSG database. The claypan roost (FICP) is in the south east of Fisherman Is. It is not shown but is used in the compilation of results.

BACKGROUND

For over 27 years, high numbers of migratory waders have been documented using Port of Brisbane (POB) lands as high tide roosting habitat (Figure 1). The habitat is primarily being created by pumping of dredge material as infill for ongoing reclamation and the birds respond to varying configurations of suitable habitat as the landscape changes at the Port.

Since 2003, members of the Queensland Wader Study Group (QWSG), have undertaken regular monthly counts of birds within the reclamation area, on a nearby clay pan, and at a purpose-built wader roost site. At the same time, QWSG members have also counted between 50 and 65 other high tide roosts monthly in Moreton Bay, which is used here as background information in assessing wader numbers at the Port.

In November 2012, the Port of Brisbane Pty Ltd approached the Queensland Wader Study Group to undertake an annual report of the status of migratory waders within their lands. This is the sixth annual report since 2013 and, as usual, includes:

1. Bird numbers by species and site (individually and overall) at the Port for the last year (2017-18) presented as a table of raw numbers and suitable graph/s.
2. Comparisons of wader numbers by species at the Port with Moreton Bay sites generally, noting any species showing any particular variation between datasets.
3. Presentation of annual changes in wader numbers by species for each subgroup of Port sites, and within the most recently preferred sites (subgroup D).
4. Graphical presentation of long-term trends for wader numbers at the Port by species.

A summary of the recoveries of waders caught and banded on the Port of Brisbane reclamation site is usually presented. However, these data will be held over until the next year's report. For items 1 to 4 above, POB only want a report on the most important species at the Port (i.e. high numbers, or highly threatened with relatively significant numbers at the Port).

IMPORTANT MIGRATORY WADER SPECIES AT THE PORT OF BRISBANE

In keeping with previous annual reports, twelve migratory species of wader are the main focus of this report. They have all been recorded, at some time or another, in numbers exceeding 0.1 % of their flyway populations, and mostly in numbers exceeding 1% of flyway numbers (Table 1). In this instance, Table 1 only includes data since 2003, unlike earlier presentations of this table that used data going back to 1991. Of particular note is the Great Knot. Here it is shown with a maximum count of 708, whereas numbers in the early 1990s were higher with a maximum count of 2600 birds. In contrast, three species (Grey-tailed Tattler, Ruddy Turnstone and Bar-tailed Godwit) have marginally had their highest recorded numbers in the 2017-18 period.

RECENT COUNTS OF MIGRATORY WADER SPECIES AT THE PORT OF BRISBANE.

The numbers of wader species and total birds recorded in each of the sites (see Figure 1) including the claypan (FICP, not shown in Figure 1) on each sampling occasion between July 2017 and June 2018 are given in Table 2. The tabulations are given for migratory and resident species separately. The same breakdown of counts for each of the important species (Table 1) is tabulated in Table 3.

Tables 2 and 3 are for twelve months of sampling, as was the case in previous reports. Furthermore, the sampling has been divided into four time periods as follows: "Winter" (June to August – the northern hemisphere breeding season); "South Migration" (September to mid-November); "Summer" (mid-November to mid-March – the middle of the yearly non breeding period) and "North Migration" (mid-March to May). This is because these time periods generally represent a breakdown of the activity of a migratory wader throughout the year. Such an approach is consistent with techniques of aging waders and allows a better understanding their population dynamics. Hence, the tables to follow sometimes use "wader" years not calendar years and are labelled accordingly. Hence, the "2017" label represents the period from mid 2017 to mid 2018.

Table 1. Important species: the maximum count of migratory species of wader present in internationally and nationally-significant numbers (> 0.5% flyway population) within the POB reclamation area (including the claypan), during the non-breeding season (15 November – 15 March). Grey Plover has been included as the POB is the most important site for this species in the region. There have been 172 Port wide counts since 2003 (all seasons) and N is the number of times each species was recorded. With the exception of Great Knot, Greater Sand Plover and Grey Plover, all species have been recorded on every Port wide summer count since 2003. The asterisk indicates the highest yearly maximum occurred in 2017_18 breeding year.

Species	Maximum count (% flyway popn)	N (out of 172)
Grey-tailed Tattler	1296 * (1.9)	162
Red-necked Stint	6803 (1.4)	172
Lesser Sand Plover	2433 (1.4) -	157
Curlew Sandpiper	2607 (2.9) -	171
Sharp-tailed Sandpiper	2078 (2.4) -	150
Eastern Curlew	670 (1.2) -	161
Pacific Golden Plover	1090 (0.9)	148
Great Knot	708 (0.2) -	127
Greater Sand Plover	441 (0.2) -	127
Ruddy Turnstone	213 * (0.7)	155
Bar-tailed Godwit	1529 * (0.5)	167
Grey Plover	145 (0.2)	114

Based upon Tables 2 & 3, counts of total migratory and total resident waders and the number of species for each group are consistent with data from past years. There is a wide variation in the numbers recorded at different sites, which is a reflection of both chance occurrence of the birds and the suitability of sites as roosting habitat. The latter will vary depending upon the species. More is given on differential use of sites in the next section.

As expected, numbers of migratory birds was lowest in winter when numbers of resident birds was highest. Numbers of migratory birds peak through the summer months and can be high also during the period of southward migration. The maximum number of 14 migratory species that was recorded on any single count is of itself significant. Few other sites in Moreton Bay hold as many species and none on a regular basis. The Port lands remain the most important area in the Bay for migratory waders (Section 2). During the 2017_18 shorebird year there were significant counts within the Port area of greater than 1% of the flyway population of six species (Table 1). There has been a similar pattern in past years, whereas some other species were recorded in lower numbers than they have in past years. Total wader numbers have been a little lower in the 2017_18 shorebird-year compared with 2016_17, as illustrated in Figure 2.

The concentration of waders is also now clearly on the more recently created ponds (area D), which started to happen over a decade ago. No birds were recorded outside of area D (Figure 1) last year, other than on the claypan (FICP), or at the artificial roost site (PBAR). That is, Areas A, B and C, now appear to have of no habitat value for waders. Figure 3 illustrates this change, by tracking numbers from different areas, over the years since 2003.

The prospect of progressive future loss of Area D as wader habitat, without suitable replacement, is raised in the recommendations section of this report.

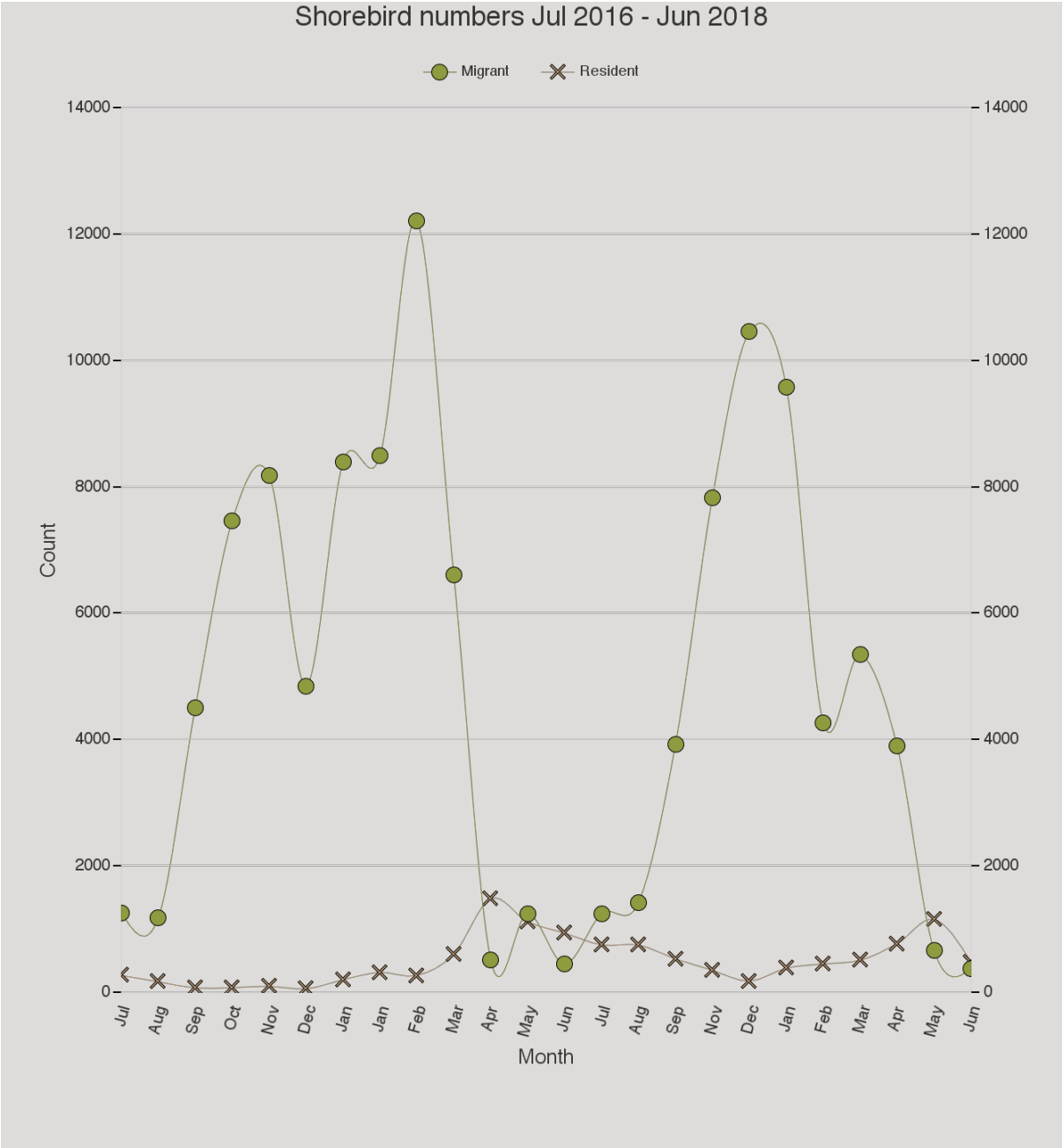

Figure 2. Total wader numbers by month between July 2016 and June 2018 for the combined monthly Port counts.

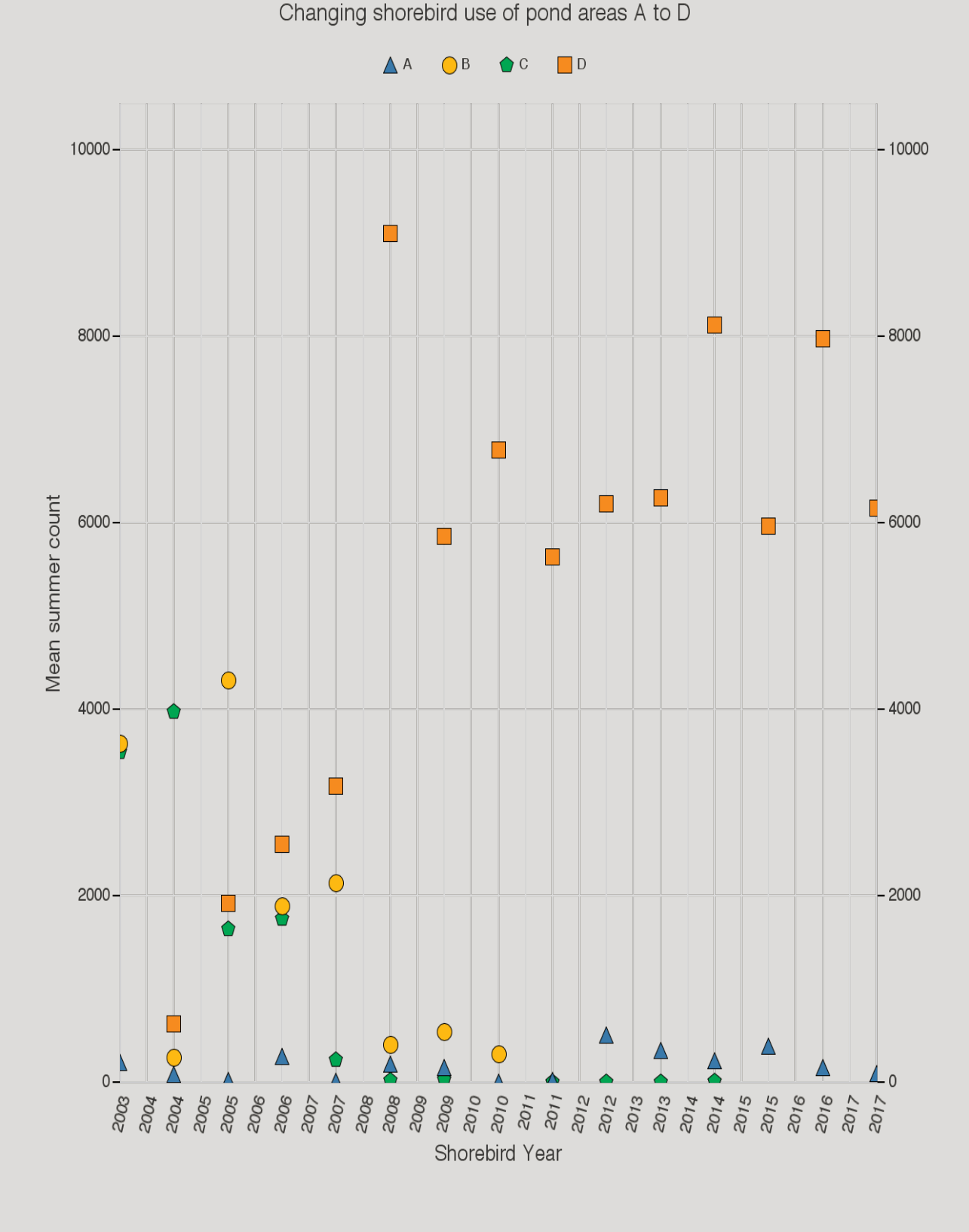

Figure 3. Changes in distribution on POB lands over time with changing habitat conditions on major pond areas A to D. The counts are mean values for summer (wader non-breeding season) counts on the different areas since 2003.

Table 2. Latest year site totals: total migratory and resident wader numbers and the number of species for each group recorded at each count site during each Port count between July 2017 and June 2018. The percentage contribution to the total numbers made by each site is included.

	23/07/2017	27/08/2017	24/09/2017	19/11/2017	17/12/2017	14/01/2018	18/02/2018	18/03/2018	15/04/2018	13/05/2018	17/06/2018		
Migratory shorebird totals						Season						Total	
Season	Breeding	Breeding	Sth Migr.	Sth Migr.	Non Br.	Non Br.	Non Br.	Nth Migr.	Nth Migr.	Nth Migr.	Breeding		% of total
FICP	54	1	22	2334	3105	1429	236	2203	50	149	10	**9593**	19.6%
PBAR			17	29	193	78	116	37	4			**474**	1.0%
PBC2	126	30		109		69	144	24				**502**	1.0%
PBC3	473	338	433	219	2493	5221	11	934	114	438	327	**11001**	22.4%
PBR3		99	3071	3433	1986	254	1913	811	24	13	2	**11606**	23.7%
PBS1	14			97		48	21	8			15	**203**	0.4%
PBS2	4		256	151	482	246	1091	457	64	3	23	**2777**	5.7%
PBS3	210	746	29	1048	1055	633		37		9		**3767**	7.7%
PBS4	287	177	43	188	640	1412	726	26	18	28	1	**3546**	7.2%
PFPE	81	36	57	228	506	193	16	811	3623	28	3	**5582**	11.4%
Total	**1249**	**1427**	**3928**	**7836**	**10460**	**9583**	**4274**	**5348**	**3897**	**668**	**381**	**49051**	
Migratory shorebird number of species													
FICP	2	1	5	7	6	9	5	9	5	3	1		
PBAR			6	9	8	8	7	6	1				
PBC2	2	2		2		2	2	2					
PBC3	5	2	3	3	7	9	2	6	4	3	3		
PBR3		2	6	9	14	7	9	11	1	2	1		
PBS1	2			3		2	3	3			1		
PBS2	1		6	2	5	5	8	6	3	2	1		
PBS3	3	5	2	4	7	5		4		1			
PBS4	3	3	1	4	6	10	8	3	3	2	1		
PFPE	2	1	2	8	7	5	3	8	8	2	1		
Resident shorebird totals													% of total
FICP	9	7	42	130	40	20	68	206	65	28	87	**702**	11.1%
PBAR	143	196	114	67	82	73	56	12	39	110	115	**1007**	15.9%
PBC2	28	8	10	9		22	68	22	1	35		**203**	3.2%
PBC3	39	25	74	31	6	216	213	2	130	844	165	**1745**	27.6%
PBR3	19	449	236	11	18	11	6	6	290	10	18	**1074**	17.0%
PBS1	9	24	12	32	4	24	22	46	1	28	34	**236**	3.7%
PBS2	3		12	11		2	10	17	83	36	26	**200**	3.2%
PBS3	471	15	3	45	3	12		27	7	7	3	**593**	9.4%
PBS4	27	17	13	5	7	2	9	168	157	57	32	**494**	7.8%
PFPE	6	11	15	10	21	4	1	5		2	3	**78**	1.2%
Total	**754**	**752**	**531**	**351**	**181**	**386**	**453**	**511**	**773**	**1157**	**483**	**6332**	
Resident shorebird number of species													
FICP	1	2	3	4	2	2	2	3	4	2	2		
PBAR	4	2	5	4	5	3	5	5	4	4	4		
PBC2	1	1	1	1		1	1	1	1	1			
PBC3	1	1	1	2	1	2	1	1	1	2	1		
PBR3	1	4	3	2	1	1	1	1	3	3	1		
PBS1	1	1	1	1	1	1	1	1	1	1	1		
PBS2	1		1	1		1	1	1	1	1	1		
PBS3	1	2	1	2	1	1		2	1	1	1		
PBS4	2	3	2	2	2	1	3	3	3	2	1		
PFPE	2	2	1	2	2	2	1	1		1	2		

Table 3a. Counts of Grey-tailed Tattler, Red-necked Stint and Sharp-tailed Sandpiper recorded in each subsection of the Port during the 2017-18 "shorebird year". Seasons are winter (breeding), summer (non-breeding) and migration (south and north migrations).

Grey-Tailed Tattler				**Season**								**Total**
Season	*Breeding*	*Breeding*	*Sth Migr.*	*Sth Migr.*	*Non Br.*	*Non Br.*	*Non Br.*	*Nth Migr.*	*Nth Migr.*	*Nth Migr.*	*Breeding*	
FICP												
PBAR			1		1							**2**
PBC2												
PBC3												
PBR3					1		8	12				**21**
PBS1												
PBS2												
PBS3												
PBS4					536	1259	545			4		**2344**
PFPE				21	240			40	300		3	**604**
Total			**1**	**21**	**778**	**1259**	**553**	**52**	**300**	**4**	**3**	**2971**
Red-necked Stint												
FICP	6	1	3	613	2473	196	113	570		139	10	**4124**
PBAR				6		2	12	11				**31**
PBC2	112	29		100		67	141	23				**472**
PBC3	119	310	178	176	992	1313	9	347	84	409	232	**4169**
PBR3		39	738	860	23	52	22	304		12	2	**2052**
PBS1	4			92		5	6	4			15	**126**
PBS2			51		128	66	379	23	52	2	23	**724**
PBS3	17	85	21	698	245	413				9		**1488**
PBS4	25	94	43	159	41	45	14	9				**430**
PFPE			28	15		1		493	1430			**1967**
Total	**283**	**558**	**1062**	**2719**	**3902**	**2160**	**696**	**1784**	**1566**	**571**	**282**	**15583**
Sharp-tailed Sandpiper												
FICP				68	346	44		205	5			**668**
PBAR			8	13	4	56	23	19	4			**127**
PBC2		1										**1**
PBC3	1			9	9	10	2	1	2			**34**
PBR3				39	42	27	61	14	24			**207**
PBS1				1		43	6	3				**53**
PBS2			1	6	2	1	5		2			**17**
PBS3				15	10	17		2				**44**
PBS4				3	20	17	8	4	7	24		**83**
PFPE				3	1		1		460			**465**
Total	**1**	**1**	**9**	**157**	**434**	**215**	**106**	**248**	**504**	**24**		**1699**

Table 3b. Counts of Curlew Sandpiper, Great Knot and Bar-tailed Godwit recorded in each subsection of the Port during the 2017-18 "shorebird year". Seasons are winter (breeding), summer (non-breeding) and migration (south and north migrations).

Curlew Sandpiper				**Season**								**Total**
Season	*Breeding*	*Breeding*	*Sth Migr.*	*Sth Migr.*	*Non Br.*	*Non Br.*	*Non Br.*	*Nth Migr.*	*Nth Migr.*	*Nth Migr.*	*Breeding*	
FICP				30	241	90	20	311	2			**694**
PBAR				1		2						**3**
PBC2	14											**14**
PBC3	328				865	2097		60	25	1	59	**3435**
PBR3		60	1655	1955	805	19	209	6		1		**4710**
PBS1	10							1				**11**
PBS2			13		1		110	10				**134**
PBS3	190	607	8	266	672	122		5				**1870**
PBS4	54	81		24	16	24	70				1	**270**
PFPE	42	36	29	9	7				720			**843**
Total	**638**	**784**	**1705**	**2285**	**2607**	**2354**	**409**	**393**	**747**	**2**	**60**	**11984**
Great Knot												
FICP						4		154				**158**
PBAR												
PBC2												
PBC3						566						**566**
PBR3			92	70	280		103	13				**558**
PBS1												
PBS2												
PBS3					98							**98**
PBS4						10						**10**
PFPE								37				**37**
Total			**92**	**70**	**378**	**580**	**103**	**204**				**1427**
Bar-tailed Godwit												
FICP			1	1453		969	1	649	11	3		**3087**
PBAR			1	2	173	7	66					**249**
PBC2												
PBC3					15	426						**441**
PBR3			535	74	431		580	406				**2026**
PBS1												
PBS2												
PBS3		43			1							**44**
PBS4	208						70					**278**
PFPE	39							94				**133**
Total	**247**	**43**	**537**	**1529**	**620**	**1402**	**717**	**1149**	**11**	**3**		**6258**

Table 3c. Counts of Eastern Curlew, Pacific Golden Plover and Ruddy Turnstone recorded in each subsection of the Port during the 2017-18 "shorebird year". Seasons are winter (breeding), summer (non-breeding) and migration (south and north migrations).

Eastern Curlew				**Season**								**Total**
Season	*Breeding*	*Breeding*	*Sth Migr.*	*Sth Migr.*	*Non Br.*	*Non Br.*	*Non Br.*	*Nth Migr.*	*Nth Migr.*	*Nth Migr.*	*Breeding*	
FICP	48			115	8	72	88	32	13	7		**383**
PBAR			2	2	4	2	2	1				**13**
PBC2								1				**1**
PBC3						1						**1**
PBR3					1			3				**4**
PBS1												
PBS2												
PBS3								6				**6**
PBS4									1			**1**
PFPE												
Total	**48**		**2**	**117**	**13**	**75**	**90**	**43**	**14**	**7**		**409**
Pacific Golden Plover												
FICP			2	17	24	25		10				**78**
PBAR				1	2	4	6	4				**17**
PBC2				9			3					**12**
PBC3					10	90						**100**
PBR3					4	4						**8**
PBS1				4			9					**13**
PBS2	4		178	145	350	64	366	224		1		**1332**
PBS3								24				**24**
PBS4				2	3	2	2		10			**19**
PFPE					6	2		14				**22**
Total	**4**		**180**	**178**	**399**	**191**	**386**	**276**	**10**	**1**		**1625**
Ruddy Turnstone												
FICP												
PBAR												
PBC2												
PBC3								6				**6**
PBR3					2	1	1	13				**17**
PBS1												
PBS2							2	5				**7**
PBS3												
PBS4					24	28	16					**68**
PFPE				26	11	2	12	7	10	1		**69**
Total				**26**	**37**	**31**	**31**	**31**	**10**	**1**		**167**

Table 3d. Counts of Lesser Sandplover, Greater Sandplover and Grey Plover recorded in each subsection of the Port during the 2017-18 "shorebird year". Seasons are winter (breeding), summer (non-breeding) and migration (south and north migrations).

Lesser Sandplover				**Season**								**Total**
Season	*Breeding*	*Breeding*	*Sth Migr.*	*Sth Migr.*	*Non Br.*	*Non Br.*	*Non Br.*	*Nth Migr.*	*Nth Migr.*	*Nth Migr.*	*Breeding*	
FICP												
PBAR												
PBC2												
PBC3		28	210	34	523	646		460				**1901**
PBR3				380	361	150	926	9				**1826**
PBS1												
PBS2			2		1	107	209	193				**512**
PBS3		6			3	2						**11**
PBS4		2				24						**26**
PFPE				152	235	186	3	125	660			**1361**
Total		**36**	**212**	**566**	**1123**	**1115**	**1138**	**787**	**660**			**5637**
Greater Sandplover												
FICP												
PBAR												
PBC2						2						**2**
PBC3			45		79	72		60				**256**
PBR3				18	18							**36**
PBS1												
PBS2						8	16					**24**
PBS3												
PBS4						1						**1**
PFPE				1	6	2			40			**49**
Total			**45**	**19**	**103**	**85**	**16**	**60**	**40**			**368**
Grey Plover												
FICP												
PBAR												
PBC2												
PBC3												
PBR3			7	33	14			12				**66**
PBS1												
PBS2												
PBS3	3	5										**8**
PBS4							1	13				**14**
PFPE												
Total	**3**	**5**	**7**	**33**	**14**		**1**	**25**				**88**

COMPARISON OF WADER NUMBERS BETWEEN THE POB AND MORETON BAY AS A WHOLE

This section presents a comparison of migratory wader numbers between the POB reclamation area (including the claypan) and Moreton Bay as a whole. In order to make temporal comparisons, an index of the relative importance (IRI) of the POB is needed for each important species (Table 1) for each month of sampling. Previous reports have looked at trends in the IRI over several years. In this report, a simple comparison between the last two years is made. Future reports will again include analyses of longer-term trends.

The IRI is calculated for each month (Eq. 1) as the ratio of average counts at the POB compared with summed average counts across the whole of Moreton Bay, including the POB. Usually there is only a single count each month at a site (no average), but this can vary. Temporal changes in the IRI would be expected to reflect local changes in the relative importance for the species of the POB reclamation area compared with Moreton Bay as a whole.

$$IRI = \frac{Port\ of\ Brisbane\ count}{Moreton\ Bay\ count} \qquad (1)$$

These monthly indices for each of the two shorebird-years, 2016-17 and 2017-18, have been averaged over months and are given in Table 4. The IRI can vary between zero and one, with a value of 1 meaning all birds of that species that month were counted within the POB reclamation area.

The IRI is less for 2017_18 than the previous year for nine of the twelve species listed in Table 4. For the Curlew Sandpiper and the Lesser Sandplover it is up slightly and for the Red-necked Stint it remains the same. There is a suggestion from the total counts of waders (Figure 1) that over the last year numbers at POB have dropped but it is too early to say whether there is a sustained trend for waders as a whole or for individual species. Further analysis will be made in next year's report using data for another year in combination with past records.

Table 4. Index of relative importance (IRI) for the POB, average for each of the last two shorebird years for each of the twelve "important" species (Table 1).

Species	Mean proportion of the Moreton Bay populaiton (IRI) in 2016-17	IRI for 2017-18
Bar-tailed Godwit	0.21	0.16
Curlew Sandpiper	0.68	0.84
Far Eastern Curlew	0.16	0.07
Great Knot	0.36	0.35
Greater Sand Plover	0.72	0.63
Grey Plover	0.85	0.70
Grey-tailed Tattler	0.43	0.31
Lesser Sand Plover	0.71	0.76
Pacific Golden Plover	0.57	0.44
Red-necked Stint	0.51	0.51
Ruddy Turnstone	0.66	0.36
Sharp-tailed Sandpiper	0.40	0.25

ANNUAL CHANGES IN WADER NUMBERS BETWEEN SITES WITHIN THE POB

This section firstly examines annual changes in total migratory wader numbers over time between the various areas being used by waders on the POB lands. As noted earlier, only Area D is now being used together with the claypan (FICP) and the artificial roost (PBAR). Area D has 8 subareas (C2, C3, R3, BS1, BS2, BS3, BS4 & FPE). That is, there is a total of ten sites at present being counted on a regular basis on POB lands.

Rather than plot the temporal series of data over several years across these ten sites, another approach is taken here to look specifically at the latest year's data. That is, the data in Tables 2 & 3 are used to rank the ten sites on a combination of the total number of migration waders recorded for the year, the total number of resident waders recorded for the year and the number of species that favour each of the sites. The result is a weighted ranking that lies between 1 and 10 assigned to each site, which is indicative of the preference waders have for each site. The lower the ranking the higher the preference. The results are given in in Table 5.

Table 5. Derived rank of relative importance of the ten sampling sites currently in use at the POB based upon data from Tables 3 & 4 (wader counts at these sites for the 2017_18 sampling period).

Site	Site code	Rank
Area D - R3	PBR3	2.3
Area D - C3	PBC3	2.4
Claypan	FICP	3.4
Area D - BS3	PBS3	4.6
Area D - FPE	PFPE	5.2
Area D - BS4	PBS4	6.4
Area D - BS2	PBS2	6.9
Artificial roost	PBAR	7.5
Area D - C2	PBC2	7.5
Area D - BS1	PBS1	8.7

Three (R3, C3 & BS3) of the four sites of lowest rank (highest value) are the three that lie across the prong of reclamation works from northwest to southeast but do not include those at the very front of the reclamation zone. The fourth of these four sites is the claypan roost, well away from the reclamation area. The next highest ranked (FPE & BS4) at the front of the reclamation zone. Area D – C2, BS2 & BS1 sites are of higher rank (less value) again and this trailing group also includes the artificial roost site (PBAR).

Birds appear to be concentrating their roosting activities in the zone between full reclamation and early stage reclamation, which perhaps equates to a zone of moderate inundation of newly established low level land form.

It is of note that the artificial roost is not necessarily a favoured site, yet the existing claypan (FICP) consistently serves as a good habitat for roosting waders. This technique of ranking sites using the latest twelve months of data may be a better way of tracking the changing value to waders of various internal roosting areas. Past reports have relied upon graphical presentation of changing spatial patterns of use by waders of different areas with the POB.

The progressive replacement of suitable roosting habitat as reclamation continues has long been a feature of the Port lands. Earlier than 2008, area C was being supplanted by area B, which are both now superseded by area D and more specifically by the central zone of area D.

LONG TERM TRENDS IN WADER NUMBERS

Data are available since 1991 but consistency in sampling procedures has been best since 2003. The data presented here in Figure 4 are mean counts for all migratory waders for different seasons across the POB lands, including the claypan (FICP) from 2003 until mid 2018. Again, seasons are defined as in Section 1 and the "shorebird" or "wader" year is the relevant unit of comparison up until 2017_18. As well as mean values, the maximum values for the summer season is graphed as are mean values for winter and the combined migration season (north and south).

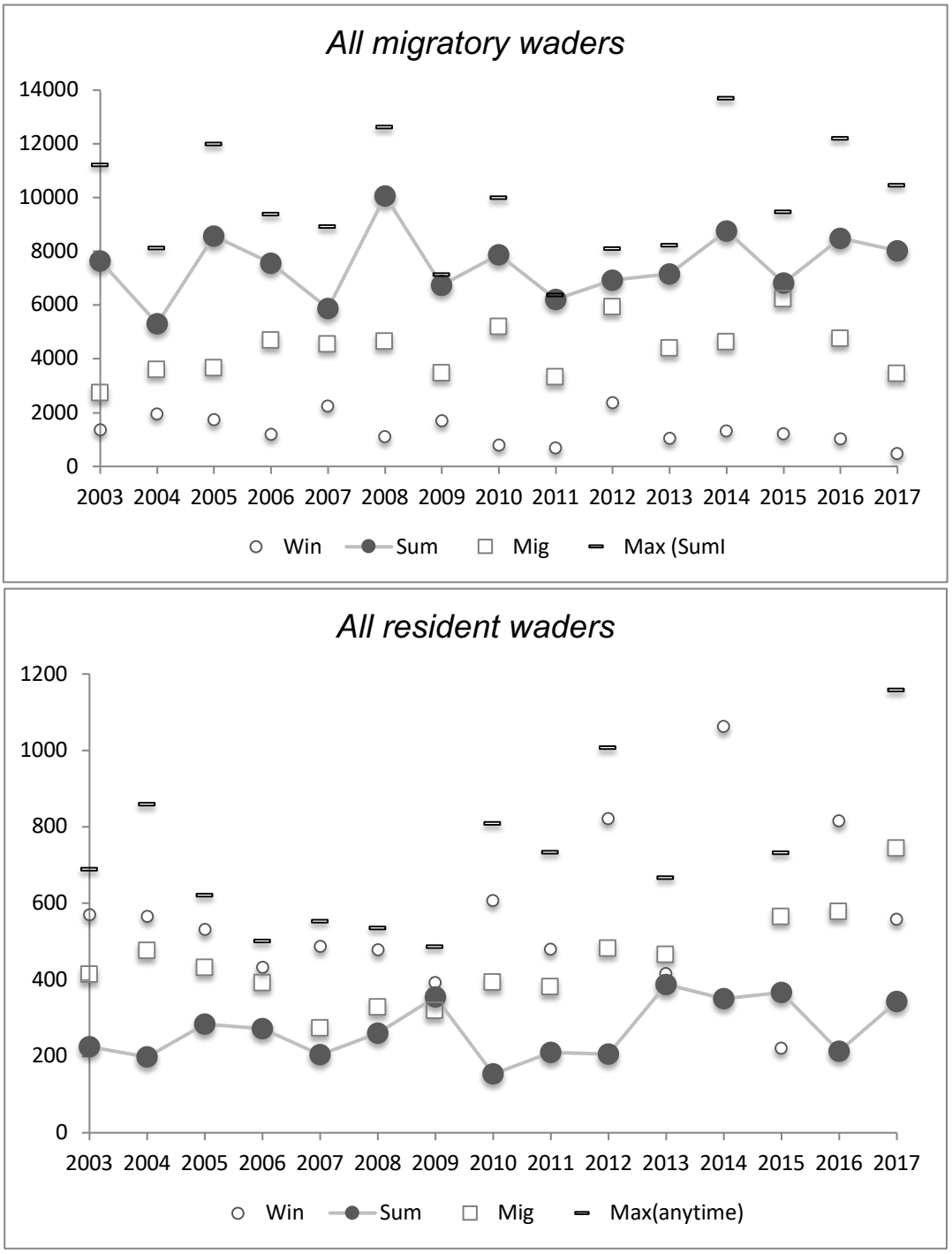

Figure 4. Average counts for each season and "wader" year since 2013 for all migratory and all resident waders throughout the Port lands, including the claypan (FICP). Win: winter (Jun to Aug); Sum: summer (mid Nov to mid March); Mig: migration periods (south – Sep to mid Nov and north – mid March to end of May. The "wader: year runs from the southward migration through to winter.

Mean values for all resident waders are also presented for each season and year but the maximums given are for the winter season (June to August), when resident waders tend to be at their peak abundances.

Average counts of total migratory waders do not appear to have changed appreciably over the last ten years (Figure 4). However, the two highest counts of total birds occurred prior to 2009. Similarly, there is no distinct downward trend in total resident wader numbers on the Port Lands.

Normally in this section of the report, each species has its own graph but there is little to be gained in adding just a single data point each year (refer to the 2017 report). Therefore, although the data for individual species is

tabulated in Appendix B, they are not presently graphically as in previous years. Individual species trends will be examined in more detail in the next report.

CRITICAL COUNT VALUES OF EACH IMPORTANT SPECIES

The critical low summer count value for any single species on Port lands (including the claypan), will not be presented in this particular report. The technique will be reviewed in time for the next report and some changes made in the analysis. There is value in having a "critical count value" for each species, whereby a threshold, low count is established that, if not reached, signals the possible need for management action and further investigation into possible local threats or changed habitat conditions on site. It is anticipated the same or similar method of analysis will be reintroduced in the next report.

RECOMMENDATIONS

The analysis does not identify any clear trends in changes in the count of each wader species on POB lands since 2003. However, these data and the experience of QWSG members during the 15 years of intensive monitoring of the site do suggest some recommendations that maybe helpful in maintaining the wader populations within the POB lands.

- The monitoring of waders and waterbirds within the POB lands should continue with the same intensity and recording detail. These data should be sufficient to inform the POB of substantial changes in counts of the most abundant species.
- The POB consider an analysis of patterns of habitat type use by waders based on more specific habitat parameters. Such an analysis would help indicate the appropriate proportion and extent of each habitat that is required to support the existing wader populations as reclamation continues. It would help identify those species with less flexibility in habitat choice. It would also potentially identify habitat construction/maintenance priorities and options. This type of approach is already being undertaken using anecdotal evidence through consultations between QWSG and POB, especially in the context of management of the artificial roost site (PBAR). It would be useful to extend this approach to other count areas and to start to consider the longer-term outcome for waders on POB lands once the extensive reclamation project draws to a close when much of the current habitat will inevitably disappear.
- There be ongoing maintenance of sufficient coverage of each general habitat type used for roosting by each of the 12 "important" species. These habitats include wet margins of ponds, dry rubble/broken ground and shallow pools up to 5 cm deep and bund wall. Natural and induced wetting and drying occurs throughout the year and as works proceed. This continually alters the extent of suitable roosting habitat.
- It is a challenge, but the POB could attempt to ensure all wader habitat types remain available in sufficient quantity over the long term. This will be particularly relevant as reclamation works wind down and the large extent and variety of substrate starts to decrease. The existing artificial roost is likely to be insufficient to cater for the large numbers of waders that currently occur on the POB lands.
- The POB currently provides the majority of roosting habitat in Moreton Bay for four species of migratory wader that occur in internationally or nationally-significant numbers within the POB lands. The POB needs to better understand the use of the site by these species (Curlew Sandpiper, Greater and Lesser Sand-Plovers, and Ruddy Turnstone) in order to plan for the future when the redevelopment of the site is complete.

Appendix A: Important species average and maximum summer counts, and average winter and migration period counts (north and south) - July 2016 to June 2018

Species	ShBdYear-->	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Bar-tailed Godwit	Sum	198	391	623	968	615	764	718	500	272	768	1084	1042	1047	766	1067
	Max (Sum)	461	401	874	1235	657	913	942	577	344	1283	1481	1185	1356	1066	1529
	Mig	518	260	464	669	547	597	384	511	130	499	742	594	801	581	425
	Win	435	397	557	395	342	326	573	88	37	53	292	146	28	132	32
Curlew Sandpiper	Sum	1062	865	1612	1037	899	1387	667	1784	1218	691	956	1078	553	1599	1914
	Max (Sum)	1418	2298	2289	1813	1855	2007	768	2086	1746	697	2040	1671	849	2443	2607
	Mig	184	676	530	481	527	620	324	1043	660	880	462	477	937	806	712
	Win	50	160	58	28	244	63	185	96	62	50	101	188	70	477	32
Far Eastern Curlew	Sum	163	111	133	355	80	173	155	114	87	156	102	97	90	51	74
	Max (Sum)	244	186	280	670	164	212	227	128	105	259	119	165	122	133	117
	Mig	38	88	83	63	69	105	83	74	100	153	140	106	91	62	17
	Win	134	32	34	67	43	56	59	41	67	107	29	49	34	35	14
Great Knot	Sum	71	95	117	117	133	84	74	89	166	277	439	246	363	177	283
	Max (Sum)	123	221	210	185	183	111	112	160	180	515	708	534	596	379	580
	Mig	304	104	99	115	87	53	103	98	358	203	261	449	156	175	148
	Win	1		1		20	10	5	1	3	2	33	86			1
Greater Sand Plover	Sum	99	240	71	215	28	121	102	74	207	173	31	109	82	120	56
	Max (Sum)	404	415	158	441	42	185	216	146	432	336	80	226	133	287	103
	Mig	1	40	37	19	83	129	26	27	82	129	5	64	61	43	48
	Win	1	61	1		1		6	50	23	4		1			
Grey Plover	Sum	43	30	51	30	52	29	37	40	14	20	32	34	16	21	16
	Max (Sum)	55	51	59	45	145	32	45	45	23	33	40	38	52	38	33
	Mig	21	17	11	13	35	27	23	19	30	10	19	21	12	11	16
	Win	5	1	7		9		5					3		4	
Grey-tailed Tattler	Sum	368	572	649	696	786	356	599	560	428	349	740	824	841	692	653
	Max (Sum)	496	890	801	960	1288	584	1105	568	478	413	803	1230	1175	1296	1259
	Mig	288	476	415	488	509	527	491	455	271	441	532	577	550	250	89
	Win	232	419	360	149	197	362	22	15	33	254	375	357	265	55	11
Lesser Sand Plover	Sum	1164	1216	549	493	353	989	461	625	1438	1173	1036	1303	1013	1275	986
	Max (Sum)	2433	1664	823	605	954	1256	643	833	1458	1856	1424	1929	1409	1804	1138
	Mig	294	277	212	345	390	479	276	485	550	640	462	543	322	577	553
	Win	101	65	37	49	85	12	46	123	19	15	21	41	28	36	3
Pacific Golden Plover	Sum	363	367	711	682	242	327	381	175	223	233	233	419	379	384	289
	Max (Sum)	455	755	902	1090	303	372	546	201	298	418	301	664	575	464	399
	Mig	118	183	276	265	167	117	113	137	148	112	159	175	208	157	117
	Win	18	46	20	11	18	9	15	3	6	2	22			4	
Red-necked Stint	Sum	3841	1294	3153	2043	1882	4525	2914	3451	1602	2463	2151	3145	2033	3040	2369
	Max (Sum)	6803	2383	5239	2978	2623	5586	3547	4791	2015	3323	3143	6669	4111	4666	3902
	Mig	1072	1292	1236	1964	1366	1513	1401	1887	1112	2381	1270	1183	2207	2022	1246
	Win	525	735	591	460	1176	527	709	349	441	1933	153	432	817	332	393
Ruddy Turnstone	Sum	23	10	80	68	84	70	118	118	69	56	100	49	91	128	31
	Max (Sum)	46	22	207	134	113	104	166	136	104	91	131	75	127	213	37
	Mig	5	12	63	47	80	112	55	76	80	28	55	33	56	27	14
	Win		31	75	31	108	15	55	28	27	6	11	2	4	19	6
Sharp-tailed Sandpiper	Sum	193	97	658	622	641	1208	485	286	421	469	211	367	235	209	228
	Max (Sum)	454	226	2078	1082	1201	1680	774	446	610	476	258	832	504	304	434
	Mig	90	227	175	217	868	283	279	218	167	388	129	606	465	184	196
	Win	4		1	4	14	64	3	1	8	3	7	78	5	1	1

Appendix B: Wader counts for each month - July 2016 to June 2018

Date	24-Jul-16	21-Aug-16	18-Sep-16	16-Oct-16	13-Nov-16	04-Dec-16	01-Jan-17	29-Jan-17	26-Feb-17	26-Mar-17	30-Apr-17	28-May-17	25-Jun-17	23-Jul-17	27-Aug-17	24-Sep-17	19-Nov-17	17-Dec-17	14-Jan-18	18-Feb-18	18-Mar-18	15-Apr-18	13-May-18	17-Jun-18	
Migratory wader count (#spp)	1261 (10)	1186 (10)	4509 (13)	7467 (15)	8187 (15)	4852 (14)	8396 (14)	8494 (13)	12209 (16)	6604 (17)	515 (9)	1252 (9)	451 (9)	1249 (9)	1427 (6)	3928 (14)	7836 (18)	10460 (17)	9583 (16)	4274 (15)	5348 (17)	3897 (13)	668 (9)	381 (4)	
Resident wader count (#spp)	271 (5)	170 (6)	72 (3)	77 (4)	100 (3)	59 (4)	204 (5)	319 (4)	270 (4)	607 (7)	1485 (6)	1121 (6)	941 (7)	754 (6)	752 (5)	531 (6)	351 (6)	181 (6)	386 (4)	453 (7)	511 (6)	773 (6)	1157 (6)	483 (4)	
Total waders	1532	1356	4581	7544	8286	4911	8600	8813	12479	7211	2000	2373	1392	2003	2179	4459	8187	10641	9969	4727	5859	4670	1825	864	Total
Pied Oystercatcher	13	23	8	9	24	8	129	145	138	90	52	54	17	5	14	21	14	19	209	217	166	109	48	3	1535
Sooty Oystercatcher										2										1					3
Masked Lapwing	3	4	5	10	7	5	3	8	5	4	8	7	10	1	2	7	2	6	3	2	6	9	3	3	123
Grey Plover			10	1	31	23	38		3	2			4	3	5	7	33	14		1	25				200
Pacific Golden Plover			71	348	227	342	411	464	319	125		14		4		180	178	399	191	386	276	10	1		3946
Red-kneed Dotterel													1												1
Lesser Sand Plover		28	165	1145	1002	858	996	1442	1804	567	6				36	212	566	1123	1115	1138	787	660			13650
Double-banded Plover	3	1										78	82	24							2	13	55	36	294
Greater Sand Plover			1		85	51	74	69	287	86	1					45	19	103	85	16	60	40			1022
Red-capped Plover	76	35	59	57	69	43	64	160	90	148	98	50	87	110	94	151	134	78	107	122	112	230	210	277	2661
Black-fronted Dotterel	2	1		1			3			3	2	4	2	2		1	2	1		1	2	1	1		29
Pied Stilt	177	100				3	5	6	37	175	226	161	189	165	218	166	149	76	67	107	219	147	140	200	2733
Red-necked Avocet		7								185	1099	845	635	471	424	185	50	1		3	6	277	755		4943
Ruddy Turnstone		4	1	22	47	47	213	95	157	49		18	19				26	37	31	31	31	10	1		839
Asian Dowitcher																			1						1
Far Eastern Curlew	4	63	14	148	143	5	3	133	61	2	33	34	22	48		2	117	13	75	90	43	14	7		1074
Whimbrel	1	1	1	42	99	21	16	38	17	246	11	1				13	39	14	30	17	200	19			826
Grey-tailed Tattler	257	273	324	207	250	621	279	572	1296	603	45	68	55			1	21	778	1259	553	52	300	4	3	7821
Wandering Tattler																	1								1
Common Greenshank	1			1		1	2	1	2	1						6	2	5	3	4	1				30
Marsh Sandpiper	1									1															2
Terek Sandpiper				7	4														2						13
Black-tailed Godwit	2	2															1	3			20				28
Bar-tailed Godwit	28		650	633	1101	1066	906	608	485	892	107	100	106	247	43	537	1529	620	1402	717	1149	11	3		12940
Red Knot				20	18				1	1						57	4	3			73				177
Great Knot			130	153	340	19	200	111	379	77						92	70	378	580	103	204				2836
Sharp-tailed Sandpiper		5	38	74	542	108	171	254	304	262	6		1	1	1	9	157	434	215	106	248	504	24		3464
Red-necked Stint	944	690	1840	3045	3377	868	2644	3980	4666	3235	230	405	154	283	558	1062	2719	3902	2160	696	1784	1566	571	282	41661
Curlew Sandpiper	20	119	1264	1621	920	822	2443	727	2404	420	76	534	8	638	784	1705	2285	2607	2354	409	393	747	2	60	23362
Broad-billed Sandpiper									24	35				1			69	27	80	7		3			246