Early Hunter Region avian records

Part 3. A review of historical data about shorebirds in the Hunter Estuary

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A review of records for shorebirds in the Hunter Estuary of New South Wales has shown that 12,000-15,000 shorebirds utilised the estuary, either as resident, non-breeding visitors or passage birds most years during the period 1970-1999, with 17,000-19,000 birds present some years. The limited data available for earlier years suggests this was a long-standing situation. 33 migratory species were recorded in the estuary (20 species regularly) and nine Australian resident species (one as a vagrant).

The most abundant of the migratory species were Bar-tailed Godwits *Limosa lapponica* and Curlew Sandpipers *Calidris ferruginea*, both in many thousands each year. Red Knots *Calidris canutus* and Sharp-tailed Sandpipers *Calidris acuminata* were sometimes present in similar counts. 500-1,000 each of Pacific Golden Plovers *Pluvialis fulva*, Black-tailed Godwits *Limosa limosa* and Eastern Curlews *Numenius madagascariensis* visited. Seven other migratory species were typically present in counts of hundreds of birds. Of the non-migratory species, most were present in modest numbers (less than 100 birds). However, about 1,000 Black-winged Stilts *Himantopus leucocephalus* were often in the estuary, and many thousands of Red-necked Avocets *Recurvirostra novaehollandiae* from the 1980s onwards.

Over the 30-year main review period, the numbers of migratory shorebirds visiting in the austral summer declined by around 20%. This was matched by an increase in the numbers of non-migratory shorebirds. The numbers of visiting Curlew Sandpipers decreased by 25-30% (1,000-1,500 birds), with the most change occurring in the 1990s. Lesser Sand Plover *Charadrius mongolus* numbers plummeted, decreasing by about 90% from their initial counts of around 500 birds. The decline was even more marked for Broad-billed Sandpipers *Limicola falcinellus*, with their numbers by the mid 1970s less than 5% of their peak. The numbers of Black-tailed Godwits, Common Greenshanks *Tringa nebularia* and Marsh Sandpipers *Tringa stagnatilis* also decreased, by 30-50% in each case.

During the austral winter, immature Bar-tailed Godwits, Eastern Curlews and Curlew Sandpipers were present in high numbers. Their numbers began to decline in the 1980s. For Double-banded Plovers *Charadrius bicinctus* and some other small to medium shorebirds, the decline was already underway in 1982 if not earlier.

INTRODUCTION

The Hunter Estuary near Newcastle in New South Wales (**Figure 1**) has long been known for its importance for shorebirds (Holmes 1970, van Gessel & Kendall 1972a, Gosper 1981, Lane 1987, Smith 1991, Herbert 2007, Stuart *et al.* 2013). Most accounts have focussed on shorebird numbers but both Lane and Smith also placed the Estuary into its national/state context. In his book *Shorebirds of Australia*, Lane (1987) summarised the status Australia-wide of every shorebird species. He also prioritised sites, based on the average numbers of birds present during 1981-86. From this analysis, he named the Hunter Estuary as a top 20 site Australia-wide for 14 species (**Table 1**). The estuary narrowly missed inclusion into Lane's overall top 20 sites list which was based on average total shorebird numbers. Smith (1991) nominated the Hunter Estuary (including Kooragang Island, Fullerton Cove and Hexham Swamp) as by far the most important shorebird site in New South Wales. Smith based his nomination on maximum counts recorded at the main NSW shorebird sites.

Shorebirds utilising the Hunter Estuary include residents, non-breeding visitors, passage birds and the occasional vagrant. The majority of species (and by far the majority of birds) are non-breeding visitors, these being birds which spend a substantial part of their annual cycle in the Hunter Estuary. The estuary therefore is very important to them. This category includes northern hemisphere

breeders present for the austral summer, resident Australian shorebirds congregating near the coast under drought conditions and the Double-banded Plover which breeds in New Zealand.

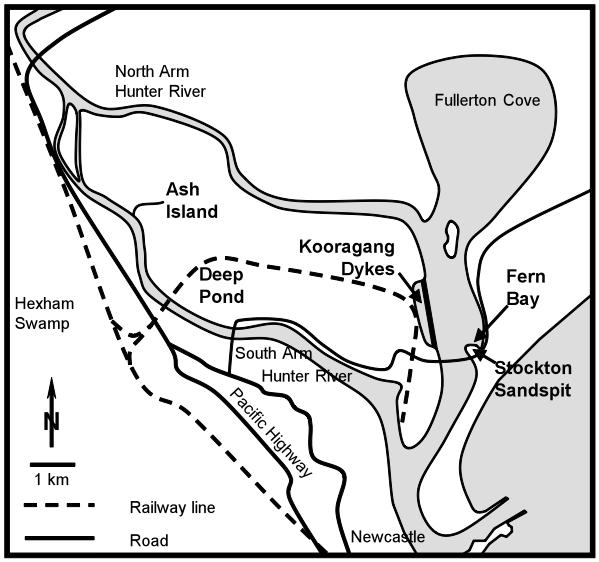

Figure 1. The Hunter Estuary (reproduced from Stuart *et al*. 2013)

Table 1. Shorebird species for which the Hunter Estuary was a 'Top 20 Site' in the 1980s (from Lane 1987)

Species	Average count 1981-85
Black-winged Stilt	550
Pacific Golden Plover	410
Double-banded Plover	90
Lesser Sand Plover	130
Red-kneed Dotterel	20
Black-tailed Godwit	470
Bar-tailed Godwit	1,300
Whimbrel	30
Eastern Curlew	490
Terek Sandpiper	30
Grey-tailed Tattler	100
Common Greenshank	560
Marsh Sandpiper	280
Curlew Sandpiper	1,570

In 1999, members of Hunter Bird Observers Club (HBOC) commenced regular monthly counts of shorebirds at the known roosting sites within the Hunter Estuary. The data from those surveys are published in the Hunter Region Annual Bird Report series (Stuart 2000-2014). The results from the 1999-2007 surveys have been discussed (Herbert 2007) and the 1999-2010 summer and winter counts were recently reported (Stuart *et al.* 2013). In time, more publications involving in-depth analysis of the results may be expected. One important limitation to carrying out such analyses is the ability to compare with pre-1999 shorebird numbers. The available data are scattered (and incomplete). The purpose of this paper is to present a holistic picture of what is known about shorebird numbers in the Hunter Estuary prior to commencement of modern surveys. For space reasons, only summary information is presented here. Full details are available in a Special Report prepared for HBOC (Stuart in preparation). An early draft of that report was made available for three other reviews (Herbert 2007, Spencer 2010, Cooper *et al.* 2014).

METHODS

Many sources of information were consulted while conducting the review. They are summarised below:

- *The Emu* (journal of BirdLife Australia, published since 1901; until the mid-1970s a good source of local and regional information);
- *Stilt* (journal of Australasian Wader Studies Group (AWSG), published since 1981; until 1998 most summer and winter wader count summaries were published);
- NSW Bird Reports (produced by Birding NSW, published since 1971; source of opportunistic records about wader numbers);
- Hunter Region Annual Bird Reports (produced by HBOC, published annually since 1993; source of opportunistic records about wader numbers in 1993-1999);
- *Hunter Natural History* (journal of the now defunct Newcastle Flora and Fauna Society; published in the 1970s);
- Miscellaneous articles, reports and books (see References for details);
- Reports to participants in the national wader counts in summer and winter 1983 and summer 1985;
- HBOC archives (which contain copies of record sheets from some of the 1982-1984 AWSG summer and winter counts);
- Personal archives of the late Wilma Barden;
- Personal recollections of various 1970s/1980s Hunter Estuary wader surveyors (Wilma Barden, Sue Hamonet, Fred van Gessel, Dick Cooper, Ann Lindsey, Tom Kendall, Phil Straw).

When reviewing these information sources, every record about shorebird numbers was noted – these are presented in a supporting detailed report (Stuart in preparation). Analysis of those individual records allowed development of a perspective of shorebird numbers in the Hunter Estuary during various time periods. The preliminary perspectives were reviewed by several of the key surveyors from the 1970s/1980s and their comments taken into account.

LITERATURE AND DATA REVIEW

Very few data were found about shorebirds in the Hunter Estuary prior to the 1960s. On the occasions that shorebirds were mentioned in the early literature, there were no firm numbers cited (and few indicative numbers) Gwynne (1932) reported that both Lesser Sand Plover *Charadrius mongolus* and Red-capped Plover *Charadrius ruficapillus* were present "in large numbers", as were "godwits, stints and sandpipers". D'Ombrain (1945) referred to the presence of large flocks of godwits in the Hunter Estuary but did not indicate which species or how many birds.

Keast (1949) reported up to 34 Grey-tailed Tattlers *Tringa brevipes* roosting in Throsby Creek during the 1943-44 seasons. He had been advised of their presence by a local birdwatcher, A.J. Gwynne, who reported that he had found them "on certain Hunter River mudflats … over a number of years" (Keast 1949).

Over 1967-1970, Holmes surveyed in the Hunter Estuary frequently (Holmes 1970). He reported 21 migratory shorebirds as occurring regularly, giving typical counts for them. Holmes also generalised about *some* of the non-migratory shorebirds which with present-day experience we might have expected to be present, and he briefly mentioned four vagrant migratory birds (Holmes 1970).

From the late 1960s, van Gessel and Kendall were monitoring shorebird numbers in the Hunter Estuary. They presented summaries in a series of *Hunter Natural History* articles (Kendall & van Gessel 1972, van Gessel & Kendall 1972a, 1972b, 1974). At the peak, their surveys were comprehensive and conducted on a weekly basis – fortunately much of the raw data were recently relocated (T. Kendall pers. comm.).

Gosper (1981) also provided data for the period 1970-73 based on monthly surveys. There was then a six-year hiatus, until AWSG commenced national summer and winter wader counts. Some members of the Newcastle Flora and Fauna Society (from which HBOC later fledged) participated in those surveys. Hunter Estuary data do not appear in the national database until 1984, but some of the earlier data were in Wilma Barden's archives.

Although the AWSG-coordinated summer and winter surveys continued into the 1990s (and beyond), results were not reported in *Stilt* after 1997. Also, in several years prior to 1997, surveys of the Hunter Estuary either were not done or not reported (for example, there were no summer survey data reports for 1990-91 and 1993-95). Fortunately over 1994-1997 Kingsford and colleagues were conducting regular surveys (Kingsford *et al.* 1998).

There are many opportunistic records of shorebird numbers in the Hunter Estuary in the 1971-1999 NSW Bird Reports and the 1993-1999 Hunter Region Annual Bird Reports. It would be only rarely that such records reflected the total numbers of shorebirds present in the estuary at the time. Rather, they reflect the numbers present at the locations which the observer visited. It would be even less likely that such records reflected the peak numbers present in any given season. Nevertheless, the records give useful insights especially for times when there is a paucity of other data available.

Anomalous Records

In a later section, some exceptional counts are discussed i.e. instances where shorebirds were present in much larger numbers than normal. However, some anomalous records were identified, where the reported numbers could be shown to be incorrect. Those records were disregarded when preparing the **Appendix**, which summarises the status of shorebirds in the Hunter Estuary from the 1960s to 1990s, and in the discussion which follows in this article. For completeness, the discounted records are:

- Reports of 4,000 Black-tailed Godwits *Limosa limosa* in 1985 and several other reports of 2,000-3,000 birds over 1984-85 (in the NSW Bird Reports). The reported high counts of 2,000-3,000 birds in January-February 1984 do not match with the AWSG count of 520 birds in February 1984. Bar-tailed Godwits *Limosa lapponica* were present in large numbers in the estuary at the time and some data entry errors (or mis-identification errors) seem likely to have occurred.
- A report in *Stilt* of 520 Ruddy Turnstones *Arenaria interpres* in February 1986. This is about an order of magnitude more than most other records. The next row in the table in *Stilt* reports just 40 Eastern Curlews *Numenius madagascariensis* in the same survey – an unusually low count for this species. Lane (1987) clearly did not use the record of 520 birds in his analysis of the Ruddy Turnstone. There seems no doubt that the two records were accidentally transposed in the *Stilt* table

(and that the error then propagated into Smith's 1991 review).

- A report of 401 Ruddy Turnstones in 1996 (Kingsford *et al.* 1998). This was a typographical error; only 40 birds were present (D. Geering pers. comm.)
- A report of 678 Marsh Sandpiper *Tringa stagnatilis* in 1996 (Kingsford *et al.* 1998). This was a typographical error; only 68 birds were present (D. Geering pers. comm.)
- A report of 633 Terek Sandpiper *Xenus cinereus* in 1997 (Kingsford *et al.* 1998). This was a typographical error; only 63 birds were present (D. Geering pers. comm.)
- Reports of 31 Greater Sand Plover *Charadrius leschenaultia* in 1976 and 23 birds in 1997 (in the NSW Bird Reports). These are very high counts for what then (as now) was considered a rare visitor to the estuary. There are no other records of >5 birds. It seems probable that some mis-identifications occurred.
- Records of Cox's Sandpiper in 1988 and Little Stint *Calidris minuta* in 1991. The former is now considered a hybrid i.e. not a full species. The latter does not appear in the current Hunter Region checklist (Stuart 2014); i.e. its presence in the Hunter Region has not been confirmed.

Summary

42 shorebird species have been reported from the Hunter Estuary (**Table 2**, **Appendix**), comprising 28 species either resident or visiting in most years and 14 rare or vagrant species.

Table 2. Shorebird species recorded in the Hunter Estuary 1960-1999

	Migratory birds	Australian resident birds	Total species
Regular visitors	20	8	28
Vagrant/accidental	13	1	14
Total shorebirds	33	9	42

The inferred status of all 42 species for each of the four decades from the 1960s to the 1990s is described in the **Appendix** (with supporting material available in Stuart in preparation). The summaries take into account all of the data available in the sources described earlier, with interpolations made for cases where gaps in data exist. It was not feasible to develop perspectives for decades earlier than the 1960s because of the very large gaps in available data.

DISCUSSION

Much of the discussion that follows in this section is based around the maximum counts for individual species. Some shorebird species are only present in their maximum numbers for a relatively short period, for example during migration passage or if conditions elsewhere have become unfavourable. That is, the maximum count does not necessarily reflect the typical situation. Examples for the Hunter Estuary are Red Knots *Calidris canutus*, which are mostly only present in September-November during their migration passage, and Sharp-tailed Sandpipers *Calidris acuminata,* which often move to/from inland wetlands in response to local rainfall patterns.

For all species, however, the maximum count at any particular wetland site indicates the relative importance of that site for survival of the species. For at least some time in their life cycle, those birds have relied on that site for food and shelter. Hence it is valid to analyse the Hunter Estuary based on maximum counts of shorebirds.

A great many of the available records have been from occasional and usually short duration visits to the estuary by observers. In most cases therefore, it is not possible to know with certainty how long a particular species remained present in its maximum numbers. Indeed, it cannot even be concluded for sure that the maximum numbers were counted. However, the fact that many species often were counted in similar numbers in repeat visits during a season, and over different seasons, does suggest that they frequently remained in their maximum numbers for extended times.

Typical Ranges for Maximum Shorebird Numbers

Table 3 summarises typical maximum numbers expected for each of the main shorebird species that occurred in the Hunter Estuary (rare and vagrant species have not been included). For each of the three decades for which sufficient data were available, a range is given. The ranges represent interpolated estimates of the maximum counts that could be expected for the species in any given season from that decade. The estimates are based upon actual count data for individual species, whenever available, with the underlying assumption that the numbers for that species will have been similar in the adjoining years for which data were not available.

Table 3. Typical shorebird maximum counts for the Hunter Estuary

	Typical maximum counts*		
Species	**1970s**	**1980s**	**1990s**
Aust. Pied Oystercatcher	5-20	5-20	5-20
Sooty Oystercatcher	1-10	1-10	1-10
Black-winged Stilt	500-1,500	500-1,500	500-1,500
Red-necked Avocet	0-100	1,000-2,000	2,000-4,000
Pacific Golden Plover	500-800	500-800	100-200
Red-capped Plover	50-100	50-100	50-100
Double-banded Plover	200-300	10-50	10-50
Lesser Sand Plover	100-500	100-200	50-100
Black-fronted Dotterel	20-50	20-50	20-50
Red-kneed Dotterel	10-50	10-50	10-50
Banded Lapwing	0-20	0-20	0-20
Masked Lapwing	50-80	50-80	50-80
Black-tailed Godwit	700-800	400-600	300-400
Bar-tailed Godwit	1,000-3,000	3,000-4,000	2,000-3,000
Whimbrel	100-200	100-200	100-200
Eastern Curlew	600-1,000	600-800	600-1,000
Terek Sandpiper	100-150	100-150	50-100
Common Sandpiper	1-5	1-5	1-5
Grey-tailed Tattler	40-50	40-50	20-40
Common Greenshank	200-300	100-200	100-200
Marsh Sandpiper	200-400	200-300	100-300
Ruddy Turnstone	30-50	20-50	20-50
Great Knot	0-10	0-8	10-50
Red Knot	1,000-2,000	1,000-2,000	1,000-2,000
Red-necked Stint	100-200	100-200	100-200
Pectoral Sandpiper	1-5	1-5	1-5
Sharp-tailed Sandpiper	1,000-1,500	1,000-1,500	1,000-1,500
Curlew Sandpiper	1,000-3,500	1,000-4,000	1,000-2,500

** Estimated total numbers of birds visiting the Hunter Estuary annually. Maximum counts for species often occurred on different days. Rarer species are not included in the Table.*

For example, for Bar-tailed Godwit in the 1970s, the maximum counts in any season would always have been of at least 1,000 birds and maximum counts of up to 3,000 birds would not have been unexpected. Taking another example, for the Curlew Sandpiper *Calidris ferruginea* in the 1970s maximum counts of 3,500 birds could be expected at times but by the 1990s any counts of more than 2,500 birds would have been considered exceptional.

For some species, there would occasionally have been greater maximum counts than indicated by the ranges given in **Table 3**. Those exceptional counts will be considered in a later section. In this section, the focus is on the typical utilisation of the estuary by shorebirds.

Table 3 provides an interpolation for all species in all years from the limited Hunter Estuary data that are available. It should not be interpreted that birds were present *all the time* in the numbers indicated. The ranges indicate the *maximum* numbers that would have been expected each year if there were regular systematic surveys.

It should be noted that analysing on the basis of the maximum numbers present is different to analysing on the basis of the numbers of birds utilising the estuary for a substantial part of the year. The latter counts (which exclude the birds that were on passage migration through the estuary) potentially relate more closely to the long-term holding capacity of the estuary for the species than do the maximum counts. However the relationship is indirect as the numbers are also affected by many external influences – these may occur at the breeding grounds or within the East Asian-Australasian Flyway. Also, in periods of no systematic surveying, it is often difficult to discern what the typical counts were for some species whereas the maximum counts are more likely to be available.

Importance of the Hunter Estuary to Shorebirds Collectively

Extending the theme that the maximum numbers of a shorebird species present at a wetland site indicate the importance of the site for the survival of that particular species, it is instructive to consider the total of all of the maximum counts. This total, being the number of different individual birds, is a useful indicator of the importance of the Hunter Estuary to shorebirds generally. Not all the birds are necessarily present simultaneously, but all have relied on the site for some part of their life cycle.

It must be noted that this analysis will under-estimate the number of individual birds that relied on the Hunter Estuary in any season, as it neglects the estuary's importance to birds that are in transit. For example, Red Knots regularly spend some time in the estuary during September-November, before continuing their migration passage. For some 4-8 weeks, the numbers present on any given day can be many hundreds and potentially in excess of 1,000 birds. Are these the same birds all the time? Most probably not – the post-breeding migration is relatively fast for most species compared with the movement north to the breeding grounds (where birds stage at several sites to feed and regain weight, thus ensuring that they arrive in prime condition for breeding). Recent studies based on flagged Red Knots show that most birds stay in the estuary for only a few days, although occasionally longer, before continuing their migration (L. Crawford pers. comm.). Thus, many thousands of Red Knots probably rely temporarily on the Hunter Estuary. For all the other migratory birds a similar situation potentially applies; birds recorded at the beginning of the migration period are not

necessarily the same as those that are present later in the season. A recent study of Bar-tailed Godwits in the Hunter Estuary confirms this (Crawford & Herbert 2013).

Despite this difficulty, by using the ranges for individual species from **Table 3** the total numbers of shorebirds utilising the estuary in each decade can be estimated. The results are presented in **Table 4**. In the 1970s at least 7,000 individual migratory shorebirds visited the Hunter Estuary each year and perhaps as many as 15,000 birds (i.e. 11,000 ± 4,000 birds). The total numbers held up fairly well in the 1980s (range 8,000-14,000 birds) but by the 1990s the total number of migrant species had declined to 9,200 ± 2,700 birds (i.e. ranging from 6,500 birds to around 12,000 birds).

Table 4. Typical numbers of shorebirds utilising the Hunter Estuary each year

	Typical numbers present*		
	1970s	**1980s**	**1990s**
Migratory shorebirds	11,000 ± 4,000	11,500 ± 3,500	9,200 ± 2,700
Australian resident birds	1,200 ± 650	2,700 ± 1,100	4,200 ± 1,600
Total shorebirds	12,000 ± 4,500	14,500 ± 4,500	13,500 ± 4,300

** Estimated total numbers of birds visiting the Estuary each year. Usually, not all species were present simultaneously in their maximum count numbers.*

Over the three decades, the numbers of Australian resident birds utilising the estuary progressively increased. This change largely reflects the growing numbers of Red-necked Avocet *Recurvirostra novaehollandiae*. These were an infrequent visitor in the 1960s and 1970s (first recorded as five birds in December 1965) but by the 1990s they often were present in counts of many thousands of birds.

Table 4 indicates the great importance of the Hunter Estuary to shorebirds. In some years during the 1980s around 19,000 individual birds potentially relied at least some of the time on the estuary for their food and shelter. This number agrees well with Smith's estimate of around 24,000 birds visiting regularly over the 20-year period 1970-1990 (Smith 1991).

Tables 3 and **4** are based upon estimates that have been developed for population ranges. Any errors in the initial estimates will distort the conclusions. It is therefore important to compare the suggested numbers with the counts for some years for which there was more intensive survey effort and more comprehensive coverage of the Hunter Estuary. The periods 1985-86 and 1994-96 offer opportunities for such comparisons, as there are data available for many species. Data for 1985-86 are mainly from Australasian Wader Study Group surveys. Data for 1994-96 are from the study by Kingsford *et al*. (1998). The shorebird counts for those five years are presented in **Table 5**. For species where no count data were available the maximum number of birds has been estimated.

Table 5. Shorebird maximum counts for some particular years

	Maximum counts*				
Species	**1985**	**1986**	**1994**	**1995**	**1996**
Aust. Pied Oystercatcher	***10***	***10***	***10***	***10***	5
Sooty Oystercatcher	***5***	***5***	***5***	***5***	8
Black-winged Stilt	1,205	943	100	500	1,659
Red-necked Avocet	1,200	1,600	2,000	3,000	4,500
Pacific Golden Plover	220	630	100	145	60
Red-capped Plover	6	106	34	50	50
Double-banded Plover	6	***20***	***20***	3	2
Lesser Sand Plover	25	83	40	35	35
Black-fronted Dotterel	***30***	***30***	20	***30***	***30***
Red-kneed Dotterel	63	***20***	20	***20***	22
Masked Lapwing	***60***	***60***	***60***	***60***	***60***
Black-tailed Godwit	***500***	550	400	300	379
Bar-tailed Godwit	4,000	1,440	5,000	2,000	3,100
Whimbrel	60	***100***	250	500	75
Eastern Curlew	650	220	303	1,000	917
Terek Sandpiper	40	5	55	154	94
Common Sandpiper	***2***	***2***	***2***	***2***	***2***
Grey-tailed Tattler	***40***	55	20	38	10
Common Greenshank	561	150	100	208	350
Marsh Sandpiper	277	12	300	433	131
Ruddy Turnstone	***20***	***20***[1]	50	6	50
Great Knot	***5***	***5***	1	20	50
Red Knot	400	50	***1,000***	305	2,000
Red-necked Stint	***100***	145	20	400	100
Pectoral Sandpiper	***1***	***1***	***1***	***1***	***1***
Sharp-tailed Sandpiper	***1,000***	940	1,000	600	228
Curlew Sandpiper	4,000	2,200	800	1,520	2,737
Total of migratory birds	11,907	6,628	9,462	7,670	10,321
Total of Aust. resident birds	2,579	2,774	2,249	3,675	6,334
TOTAL	14,486	9,402	11,711	11,345	16,655

Numbers in **Bold Italics are estimated. All others are counts.*
[1]Reported in Stilt as 520 birds

The numbers in **Table 5** agree well with the predictions of **Table 4**. In 1985 there were 14,486 total shorebirds including 11,907 migratory birds – both figures lie very near the mid-point of predicted ranges for the 1980s. Similarly for 1994-96, the actual numbers generally lie comfortably within the predicted ranges; the exception being the 1996 total of 6,314 individuals for Australian breeding resident birds. This reflects the exceptionally high count of Red-necked Avocet in that year (4,500 birds). The 1986 counts for migratory shorebirds (**Table 5**) are below the predicted maximums. This is mainly associated with very low counts for Bar-tailed Godwit,

Eastern Curlew *Numenius madagascariensis*, Marsh Sandpiper *Tringa stagnatilis* and Red Knot. Perhaps exceptionally low numbers of each of these species visited that year, but the more probable explanation is that the peak numbers were not recorded.

Over-wintering Migratory Shorebirds

Immature migratory shorebirds do not return to their breeding grounds, choosing instead to over-winter in Australia although some birds undertake a partial migration towards northern Australia (Geering *et al.* 2007). The number of birds in the Hunter Estuary in winter therefore provides another opportunity for trend analysis (however, short-term fluctuations can occur due to differences in breeding success each year: Minton *et al.* 2003). Unfortunately, there are far less winter records available as these tended not to be reported as highlights in the NSW and Hunter Region annual bird reports. The main sources of winter count data are from the 1971-77 surveys by Kendall & van Gessel (in preparation), AWSG surveys in two periods of the 1980s (records from other times are incomplete) and the work by Kingsford and colleagues in 1994-97 (Kingsford *et al.* 1998).

The maximum winter counts of the main shorebird species during 3-4 year time frames within the above periods are in **Table 6** (rare and vagrant species have not been included). Only June-July records were used, to eliminate late-departing or early-returning birds. For many species, the counts year-on-year had considerable variation. This perhaps in part reflects the natural variation. However, it is sometimes unclear whether the entire estuary was surveyed i.e. some birds that were present may have been overlooked.

From **Table 6**, some trends are apparent. In the 1970s and 1980s, Bar-tailed Godwits, Eastern Curlews and Curlew Sandpipers were present in high numbers. By the 1990s a clear decline was underway for them and for smaller shorebirds such as Red-capped Plover *Charadrius ruficapillus* and Black-fronted Dotterel *Elseyornis melanops*. The counts for Double-banded Plovers *Charadrius bicinctus* were already decreasing by the 1980s, with Red Knot also declining as an over-wintering species around that time. Conversely, Red-necked Avocets were only in low numbers until the late 1980s after which it became common for several thousand to be present in winter (and in summer).

Appearances by most other shorebirds in winter were less common events and trends are less easily discerned. Black-winged Stilt *Himantopus leucocephalus* numbers generally were stable; the peak counts for them in 1982-84 are presumed to be associated with the severe drought Australia was then experiencing (Botterill & Fisher 2003).

Table 6. Maximum shorebird winter counts for the Hunter Estuary in five survey periods

	Survey Periods				
Species	**1971-1973**	**1974-1977**	**1982-1984**	**1987-1990**	**1994-1997**
Aust. Pied Oystercatcher	11		8	1	4
Black-winged Stilt	220+	600+	1,053	302	377
Red-necked Avocet	1	11	85	2,000	3,000
Pacific Golden Plover*	13	9		4	
Red-capped Plover	80	20+	55	55	1
Double-banded Plover#	255	400+	60		3
Lesser Sand Plover*	20	3			
Black-fronted Dotterel	50+	13	4	7	
Red-kneed Dotterel	25+	2	29		
Masked Lapwing	21		34	10	12
Black-tailed Godwit*	50	30	53	110	30
Bar-tailed Godwit*	450	800+	411	620	363
Whimbrel*	22	25	30	10	8
Eastern Curlew*	160	226	290	162	85
Terek Sandpiper*	1	12			1
Common Sandpiper*					3
Grey-tailed Tattler*	17	13	15	4	
Common Greenshank*	35	6	51	9	39
Marsh Sandpiper*		1	6		1
Ruddy Turnstone*	2	5	5	7	
Great Knot*	3				13
Red Knot*	60	55	8	2	30
Red-necked Stint*	100	40+	190	4	4
Sharp-tailed Sandpiper*		1			
Curlew Sandpiper*	350	500+	580	84	91

*Birds which breed in the Northern Hemisphere.
#Non-breeding population from NZ, includes adult birds

Breeding Records of Shorebirds in the Hunter Estuary

An early record was from Gwynne (1932) who reported that dredging operations in the Hunter River had created many sandflats which had become favoured nesting sites for Red-capped Plovers.

Kendall & van Gessel (unpublished) summarised the birds found breeding on Kooragang Island during 1969-1976. They reported the numbers of breeding pairs recorded each year; **Table 7** shows their data for shorebirds. Black-winged Stilt, Red-capped Plover, Black-fronted Dotterel and Masked Lapwing *Vanellus miles* bred regularly in the estuary. Red-kneed Dotterels *Erythrogonys cinctus* also bred, but not in every year.

Table 7 Shorebird breeding records 1969-1976 (from Kendall & van Gessel unpublished)

	Number of breeding pairs						
	1969/70	**1970/71**	**1971/72**	**1972/73**	**1973/74**	**1974/75**	**1975/76**
Black-winged Stilt	6	0	1	10	9	5	2
Red-capped Plover	6	1	4	15	7	9	5
Black-fronted Dotterel	1	2	0	3	0	0	0
Red-kneed Dotterel	2	0	0	5	0	2	0
Masked Lapwing	?	1	1	2	1	3	2

Gosper (1981) confirmed the breeding status of those five species; however he reported a higher count of 25 Black-winged Stilt nests present in October-December 1972.

Neither Kendall & van Gessel (unpublished) nor Gosper (1981) described Australian Pied Oystercatchers *Haematopus longirostris* as breeding in the Hunter Estuary. However, Holmes (1970) reported that they bred behind the foredunes along Newcastle Bight.

There were occasional breeding records reported for Black-winged Stilts in the 1980s and 1990s and Red-capped Plovers in the 1990s (Stuart in preparation). The general absence of breeding records probably reflects that they were not considered to be "highlights" for inclusion in an annual bird report, rather than an absence *per se*.

Banding Studies

Banding studies do not directly indicate how many birds of a given species are present. However, it is appropriate to note that there was an extensive banding program for migratory shorebirds in the Hunter Estuary in the 1970s (van Gessel & Kendall unpublished) with the program continuing (at varying levels of activity) until 2005 – for example, see Richardson (2004) and Foate (2005).

Between July 1972 and April 1973, 728 migratory shorebirds were banded in the Newcastle and Sydney districts (Lane 1973). Between May 1973 and July 1974, an additional 845 migratory shorebirds were banded on Kooragang Island and Stockton Sandspit (van Gessel & Kendall unpublished). These numbers are indirect indicators of the types of shorebirds that were present in large numbers in the estuary in the 1970s.

Key Sites for Shorebirds

In general the sites where shorebirds roosted and foraged are not well described in the available literature. Stockton Sandspit and Fullerton Cove are specifically mentioned as important areas, but many other records are simply described as being from "Kooragang Island". The main ponds of Ash Island often hosted many birds (T. Kendall pers. comm.) and the former sewage treatment works at Stockton was an important roost for shorebirds such as Curlew Sandpiper (S. Hamonet pers. comm.).

Exceptional Counts

In the discussion below, some counts which were very much higher than the norm have been identified. The counts are considered likely to be correct but as they appear to be exceptional records compared to the norm they were not taken into account when preparing summary statements for the **Appendix**.

Most of the maximum counts of Terek Sandpiper *Tringa cinereus* in the 1970s were 100-200 birds (Kendall & van Gessel 1972) with occasional reports of 300 or so birds. However, a flock of 600 birds was at Stockton in January 1970 (Holmes 1970, van Gessel & Kendall 1972a, 1972b) and 500 birds were reported present in March 1972 (Stuart in preparation).

Most maximum counts of Common Greenshanks *Tringa nebularia* and Marsh Sandpiper *Tringa stagnatilis* were usually of 100-300 birds. In 1985, 561 Common Greenshanks were reported in the "Hunter Wetlands"; perhaps this related to an area larger than just the Hunter Estuary. Gosper (1981) reported Marsh Sandpiper to be a rare visitor and Holmes (1970) did not even list it as present in 1967-70. Conversely 433 birds were present in 1995 (Stuart in preparation) and Smith (1991) reported a maximum count of 500 birds over 1970-1990 – he noted the Hunter Estuary as one of the most important sites for the species in NSW. It seems there was considerable variation in the numbers of visiting Marsh Sandpipers.

CONCLUSIONS

Analysis of available data confirms the long-term importance of the Hunter Estuary for shorebirds. Throughout the 1970s, 1980s and 1990s, 12,000-15,000 shorebirds regularly visited the estuary, with peak counts of 17,000-19,000 birds.

Over the time period reviewed, the numbers of visiting migratory shorebirds declined by around 20-30% (2,000-3,000 fewer birds). This was approximately matched by an increase in numbers of non-migratory (Australian resident) shorebirds.

The most abundant of the migratory species were Bar-tailed Godwits and Curlew Sandpipers, both present in counts of many thousands of birds each year. Red Knots and Sharp-tailed Sandpipers were sometimes present in similar counts – the former during their migration passage and the latter when conditions were unfavourable inland. 500-1,000 each of Pacific Golden Plovers *Pluvialis fulva*, Black-tailed Godwits and Eastern Curlews visited and many hundreds each of Double-banded Plover, Lesser Sand Plover, Whimbrel *Numenius phaeopus*, Terek Sandpiper, Common Greenshank, Marsh Sandpiper and Red-necked Stint.

Of the non-migratory species, most were present in modest numbers (less than 100 birds). However, about 1,000 Black-winged Stilts were often in the estuary, and many thousands of Red-necked Avocets from the 1980s onwards.

Several of the migratory shorebirds declined notably in abundance during the review period. The numbers of visiting Curlew Sandpipers decreased by 25-30% (1,000-1,500 birds), with the most change occurring in the 1990s. Lesser Sand Plover numbers plummeted, decreasing by about 90% from their initial counts of around 500 birds. The decline was even more marked for Broad-billed Sandpipers, with their numbers by the mid 1970s less than 5% of their peak. The numbers of Black-tailed Godwits, Common Greenshanks and Marsh Sandpipers also decreased, by 30-50% in each case (~100 fewer birds of each species visiting).

Bar-tailed Godwit numbers appear to have increased in the 1980s then decreased in the 1990s but they were in greater numbers than in the 1970s. The counts of Red-necked Avocets rose dramatically from the mid 1980s, when 1,000 birds began to be recorded regularly and many thousands of birds were often present in the 1990s.

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Appendix. Status of shorebirds in the Hunter Estuary 1960s to 1990s

Species	Summary of status 1960s to 1999	Maximum counts			
		1960s	1970s	1980s	1990s
Australian Pied Oystercatcher *Haematopus longirostris*	Small numbers of birds were regularly present.	nd*	24	8	8
Sooty Oystercatcher *Haematopus fuliginosus*	Birds were rarely recorded to have utilised the Estuary.	nd	nd	nd	8
Black-winged Stilt *Himantopus leucocephalus*	Some birds were present every year and there were regular influxes of 500-1500+ birds when conditions were unfavourable inland.	nd	1,200	1,209	1,659
Red-necked Avocet *Recurvirostra novaehollandiae*	An irregular but frequent visitor. Fewer than 100 birds visited occasionally in the 1970s and early 1980s. There were two substantial influxes of many thousands of birds, over 1985-87 and 1992-97, with a trend of progressively more birds present.	5	19	1,600+	4,500
Banded Stilt *Cladorhynchus leucocephalus*	The Banded Stilt was an accidental visitor.	nd	1	1	2
Pacific Golden Plover *Pluvialis fulva*	500-800 birds regularly visited in the 1980s and the total numbers probably were similar in the 1970s. Numbers declined in the 1990s, with 100-200 birds typically being present and the peak count being of 300 birds. Birds usually did not over-winter.	100	350	800	219
Grey Plover *Pluvialis squatarola*	The Grey Plover was a rare summer visitor.	nd	1	2	1
Ringed Plover *Charadrius hiaticula*	The Ringed Plover was an accidental visitor in 1967, present over February-December.	1	0	0	0
Red-capped Plover *Charadrius ruficapillus*	100+ birds were present when conditions were favourable, and probably at least 50 birds were regularly present and some pairs breeding.	nd	90	55	50+
Double-banded Plover *Charadrius bicinctus*	Birds occasionally utilised the Estuary in winter. In the 1970s several hundred birds were sometimes present. There was subsequently a substantial decline in numbers.	50	400+	60	3
Lesser Sand Plover *Charadrius mongolus*	Many hundreds of birds came to the Estuary each year in the early 1970s. The numbers of birds visiting then declined steadily, down to just a few tens of birds by the late 1990s.	500	800	200	68
Greater Sand Plover *Charadrius leschenaultii*	The Greater Sand Plover was a rare visitor.	10	5	2	nd
Oriental Plover *Charadrius veredus*	The Oriental Plover was a rare visitor.	nd	nd	16	nd
Black-fronted Dotterel *Elseyornis melanops*	Between 20 and 50 birds were frequently present when conditions were favourable, and some birds were resident.	nd	18	24	50
Red-kneed Dotterel *Erythrogonys cinctus*	Up to 50-60 birds were sometimes present when the conditions inland were unfavourable.	nd	50	63	30
Banded Lapwing *Vanellus tricolor*	The Banded Lapwing was an infrequent visitor.	nd	1	16	9

*nd: No count data were found

Appendix Status of shorebirds in the Hunter Estuary 1960s to 1990s (cont.)

Species	Summary of status 1960s to 1999	Maximum counts			
		1960s	1970s	1980s	1990s
Masked Lapwing *Vanellus miles*	At least 50 birds were regularly present.	nd*	60	34	20+
Black-tailed Godwit *Limosa limosa*	700-800 birds migrated each summer in the 1970s, declining to 400-600 birds in the 1980s and then further declining to 300-400 birds in the 1990s. 30-50 birds often over-wintered in the 1970s and 1980s.	100	700	800	400
Hudsonian Godwit *Limosa haemastica*	A single bird was present from late 1982 and recorded intermittently until 1988.	nd	0	1	0
Bar-tailed Godwit *Limosa lapponica*	Numbers rose steadily from less than 1,000 birds in the 1960s to around 4,000 birds in the mid-1980s. Subsequently the numbers declined again and by the late 1990s the typical counts were around 2,000 birds but with records in 2 years of ~5,000 birds. There was considerable variability in the numbers present each summer. Around 400 immature birds over-wintered in the 1980s, declining to ~250 birds in the 1990s.	nd	3,500	4,000	5,000
Little Curlew *Numenius minutus*	It was a rare visitor, present in small numbers at intervals typically of 5-10 years.	3	2	32	7
Whimbrel *Numenius phaeopus*	At least 200 birds were frequently present over 1993-95 and the peak count was of around 500 birds. In most other years, the maximum counts were of less than 100 birds. Whimbrel is a difficult species to count accurately and it seems quite possible that numbers were reasonably stable from the 1970s to the late 1990s or even that they increased somewhat.	nd	105	60+	220
Eastern Curlew *Numenius madagascariensis*	At least 600 birds regularly visited from at least the 1960s onwards and in many years some 800-1,000 birds were present. A minimum of 300-400 birds were present every summer. Typically, 150-250 birds over-wintered. In excess of 1% of the total world population were present almost every year and in some years the numbers were nearly 2.5% of the population (Delany & Scott 2002). The Estuary was consistently a very important site for Eastern Curlew over the review period.	600	1,000+	900+	917
Terek Sandpiper *Tringa cinereus*	100-150 birds regularly visited and at times it supported up to 600 birds. Over-wintering was uncommon.	400	600	100	350+
Common Sandpiper *Actitis hypoleucos*	Small numbers regularly visited.	10	11	2	2
Grey-tailed Tattler *Tringa brevipes*	40-50 birds regularly visited from the early 1980s, and probably prior to then also. Occasionally, 60-100 birds were present. 10-15 birds regularly over-wintered until around the mid-1980s with the winter numbers subsequently declining to around 5 birds.	100	13	96	80
Wandering Tattler *Tringa incana*	The Wandering Tattler was a rare visitor, with occasional records of single birds.	nd	1	1	nd
Common Greenshank *Tringa nebularia*	150-200 birds regularly visited and greater numbers were present occasionally. Most years 1-10 birds over-wintered.	50	300	561	250
Marsh Sandpiper *Tringa stagnatilis*	100-200 birds regularly visited and greater numbers were present in several years. The Estuary at times supported 400-500+ birds. Occasionally, a few birds over-wintered.	nd	500+	277	433

*nd: No count data were found

Appendix Status of shorebirds in the Hunter Estuary 1960s to 1990s (cont.)

Species	Summary of status 1960s to 1999	Maximum counts			
		1960s	1970s	1980s	1990s
Wood Sandpiper *Tringa glareola)*	It was an uncommon visitor in the early 1970s and became increasingly rare in the subsequent years. It was not recorded after 1992.	nd*	6	1	1
Ruddy Turnstone *Arenaria interpres*	30-50 birds regularly visited each summer and a few birds occasionally over-wintered.	10	30	50	50+
Asian Dowitcher *Limnodromus semipalmatus*	It was an accidental visitor, with records of single birds in two years only (1985 and 1988).	nd	0	1	0
Great Knot *Calidris tenuirostris*	Birds regularly migrated each year, initially in counts of up to 12 birds but with the numbers increasing in the 1990s to 20+ birds. Over-wintering was uncommon.	40	12	8	40
Red Knot *Calidris canutus*	The peak counts each spring during the migration passage were of 1,000-2,000 birds. Outside of this period, small numbers of birds were present – typically there were less than 20 birds but occasionally the numbers rose to above 50 birds. It was uncommon for birds to over-winter.	100	600+	~400	1,567
Sanderling *Calidris alba*	Single birds were recorded in 1973 and 1995.	nd	1	nd	1
Red-necked Stint *Calidris ruficollis*	100-200 birds were regularly present and at times the Estuary supported up to 500 birds. Over-wintering was uncommon but it was an important refuge for over-wintering birds when conditions were unfavourable elsewhere.	"numerous"	500	136	278
Pectoral Sandpiper *Calidris melanotos*	1-2 birds were often present during the migration period, and less frequently there were 5-10 birds present.	nd	25	10+	<10
Sharp-tailed Sandpiper *Calidris acuminata*	Birds visited most summers, sometimes only in small to moderate numbers, but when conditions were unfavourable elsewhere, the Estuary became an important refuge, with more than 1,000 birds present at such times. It is likely that numbers were under-recorded due to infrequent visits by observers to the more preferred habitats of this species.	400	400	1,065	1,200
Curlew Sandpiper *Calidris ferruginea*	1,500-2,500 birds regularly visited each summer and the numbers rose to >3,500 birds when conditions were unfavourable elsewhere. Up to 100 immature birds regularly over-wintered and occasionally the winter counts were substantially greater. The Estuary was an important site for Curlew Sandpiper.	"numerous"	3,500	4,000	2,600
Buff-breasted Sandpiper *Tryngites subruficollis*	A single bird was caught and banded in March 1979.	nd	1	0	0
Broad-billed Sandpiper *Limicola falcinellus*	Birds often visited in counts of 100 or more in the 1960s and early 1970s, but then there was a major decline, with birds only intermittently present and in counts of less than 10 birds.	100	180	9	3
Ruff *Philomachus pugnax*	The Ruff was a rare summer visitor.	1	2	nd	1

*nd: No count data were found