

The birds of Deep Pond – Kooragang Island 1993 - 2007

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Waterfowl and shorebirds are the main subjects for discussion in this article. The population of birds at Deep Pond was surveyed monthly over seven years from 2000 to 2007 as part of the Hunter Estuary Wader Surveys by members of the Hunter Bird Observers Club (HBOC). The surveys were conducted as close to high tide as possible by a varying number of observers. Fifteen species of waterfowl and seventeen species of waders have used the wetland during the seven years, many of which are listed under Commonwealth and State conservation legislation. There is an exchange of species between Deep Pond and Area E depending on weather and water level conditions. Deep Pond forms an integral part of the chain of wetlands in the Hunter Estuary. The total list of 104 species for Deep Pond includes observations from 1993 to 2007.

INTRODUCTION

Deep Pond is a freshwater wetland on Kooragang Island formed over a number of years through the infilling of surrounding estuarine wetlands with industrial waste, mainly slag from BHP Steelworks which commenced production in 1915. Deep Pond, 32° 51' 54" S 151° 43' 40" E, is situated on land earmarked for industrial development. The wetland is irregular in shape, measuring approximately 700 by 500 metres with an area of about 26 hectares (**Figure 1**). The western and northern sides are bounded by the industrial railway embankment which was built between the years 1966 and 1969. The railway is in constant use with slow moving trains transporting coal to the Port Waratah Coal Services export terminal day and night. The embankment is steep and has exposed rocks at the waterline. The bank on the southern side rises gently with edges vegetated with *Phragmites australis* and various grasses. During dry periods, when the wetland gradually dries out, mudflats are formed on this southern side. The bank on the eastern side is about five metres high and very steep but, at its base, is a narrow “beach” made from weathered slag material. This “beach” is favoured as a roost site for shorebirds and ducks. Waders roost on a row of rocks running for a short distance east-west out into the wetland. The land surrounding Deep Pond is flat and covered in grasses and weeds with few trees. This wetland is not affected by tidal movement and water levels appear to be dependent on rainfall.

Deep Pond will undergo considerable changes to its hydrology in future years as it lies in the path of the Newcastle Coal Infrastructure Group’s Coal

Export Terminal approved by the NSW State government in 2007. As part of Stage 2 of the Project, not expected to be implemented until 2020, a railway line will be built on a high embankment in an east-west direction across this wetland effectively cutting it in two. The ensuing fragmentation will remove wader and waterfowl habitat on the eastern “beach” and rocks. It will also degrade wader habitat on the southern side.

It is noteworthy that on the western side of the industrial railway embankment and Deep Pond is a large saline wetland known as Area E (**Figure 1**). It receives tidal flow from the South Arm of the Hunter River through Wader and Fish Fry Creeks. The vegetation on Area E is a complex of saltmarsh and mangroves. There is an exchange of birdlife between Deep Pond and Area E depending on the state of the wetlands in terms of water level and the availability of muddy edges, as exemplified by the Marsh Sandpiper results discussed in a later section.

METHODS

Members of the Hunter Bird Observers Club (HBOC) carried out 81 monthly surveys out of a possible 85 from September 2000 to September 2007 as part of the regular high tide wader survey of the Lower Hunter Estuary. The surveys of Deep Pond took place as close to high tide as possible. The time taken for each survey was between 20 and 120 minutes. The number of observers fluctuated with a minimum of one and a maximum of eight. Due to inclement weather, the months missed were October 2000, November 2003, May 2005 and June 2007. The data included in the graphs and discussions relate to HBOC surveys. I have

not included graphs for species which have occurred fewer than three times during these surveys. However, species reported in the Hunter Region of NSW Annual Bird Reports (Stuart 1994-2008) and observed outside the HBOC survey dates have been discussed in the text where appropriate. For the first four years surveys were undertaken from the western side of the wetland with an incomplete view across the industrial railway line and

this resulted in accurate counts of only the larger species. Since June 2005 the site has been surveyed from the eastern and southern sides which afford an unimpeded view of the wetland. The total of 104 species listed in **Appendix 1** was recorded from 1993 to 2007 and includes those seen outside the survey dates. The rainfall figures were supplied by the Kooragang Wetland Rehabilitation Project.

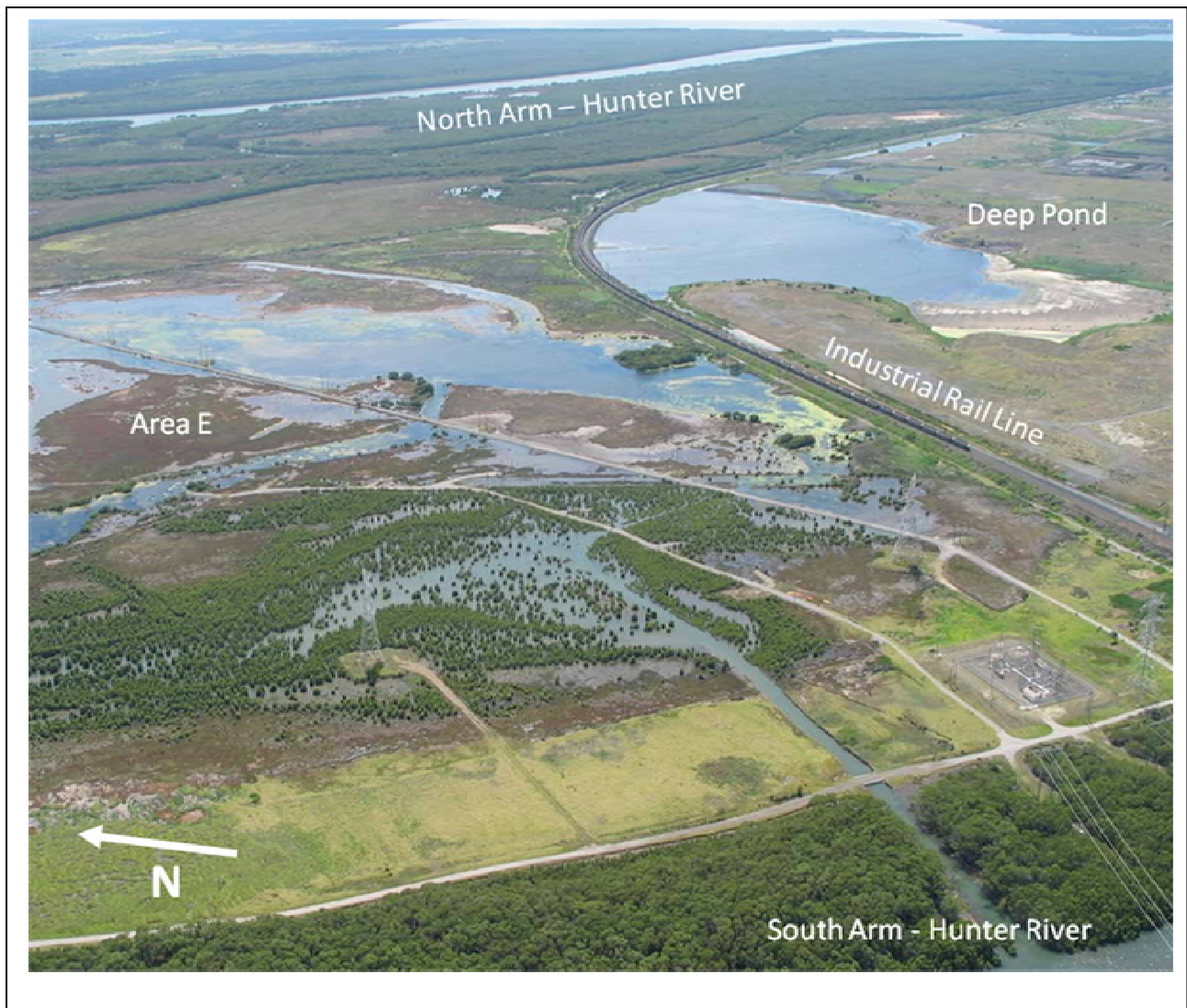


Figure 1. Oblique aerial photo of Deep Pond, which is separated from Area E by the industrial rail line (photo courtesy of Kooragang Wetland Rehabilitation Project).

RESULTS AND DISCUSSION

Waterfowl

The survey results of fifteen species of waterfowl recorded in this study are discussed below, drawing comparisons with their accepted status in the Hunter Region (Stuart 1994-2008).

Magpie Goose *Anseranas semipalmata*

The once abundant Magpie Goose vanished from NSW in the 1920s and was not seen again in NSW until 1984 at the Macquarie Marshes. In 1985 four appeared at Seaham Swamp, Seaham and in February 1986, probably the same four birds and a gosling appeared at the Hunter Wetlands Centre at Shortland. From 1987 a program of reintroduction commenced at the Centre (van der Sijs 1993).

Since that time the species has not spread but continues to survive and breed in small numbers mainly around Shortland and Hexham Swamp (M. Newman pers. comm.). It is therefore interesting to note that seven and nine birds appeared on Deep Pond in February and March 2007 respectively in the very late afternoon (F. van Gessel pers. comm.). This species is listed as Vulnerable under the NSW Threatened Species Conservation Act 1995 (TSC Act).

Wandering Whistling-Duck *Dendrocygna arcuata*

The Wandering Whistling-Duck is a common bird in the wetlands of northern Australia. It occurs in small numbers in the Hunter Region where it is a breeding resident. It was present on Deep Pond on two occasions. Two adults and two ducklings were seen in February 2005 and two adults and three ducklings in March 2005.

Musk Duck *Biziura lobata*

The Musk Duck is found in the southern half of Australia both inland and on the coast and is a breeding resident in the Hunter Region. It occurs in small numbers when the water levels are sufficiently deep to sustain feeding requirements (**Figure 2**). On Grahamstown Dam this species occurs in numbers of 20 or more but as elsewhere this species usually occurs only in ones and twos on smaller wetlands; the peak counts of 12 in March 2005 and 8 in December 2006 (Stuart 2007) are noteworthy.

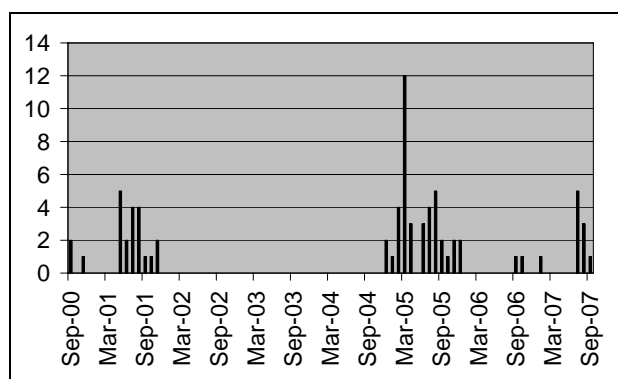


Figure 2. Musk Duck.

Freckled Duck *Stictonetta naevosa*

The Freckled Duck is a bird of inland wetlands and seldom comes to eastern NSW and is rare in the Hunter Region. It has occurred four times on Deep Pond: three birds in February 1999 (Stuart 2000), five in February and March 2000 (Stuart 2001),

three in January 2006, and six birds in December 2006. This species is known to disperse during times of drought and its presence in the Hunter Region reflects the severe drought conditions in NSW in 2005 and 2006. This species is listed as Vulnerable under the TSC Act.

Black Swan *Cygnus atratus*

The Black Swan is a common breeding resident in the Hunter Region and has been present in most months on Deep Pond with peak counts of 330 and 338 in September and October 2002 respectively. Counts of over a hundred are not uncommon. It bred successfully in 2005 with a maximum of three cygnets, twice in 2006 with three and five cygnets observed, and in September 2007 when five cygnets were present. There is no consistent seasonal trend in the variation of Black Swan numbers (**Figure 3**).

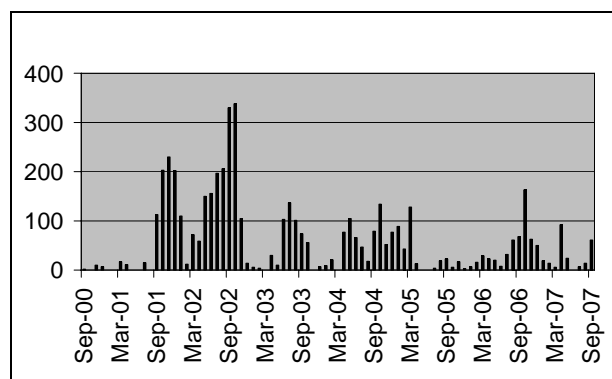


Figure 3. Black Swan.

Australian Shelduck *Tadorna tadornoides*

This species is rare in the Lower Hunter Estuary and has been seen only once on Deep Pond when two were recorded in December 2001 (Stuart 2002).

Pink-eared Duck *Malacorhynchus membranaceus*

The Pink-eared Duck, which inhabits the wetlands of inland Australia, is highly responsive to weather conditions and moves onto and away from wetlands according to rainfall (Marchant & Higgins 1990, p. 1249). Since 2003 drought conditions have persisted throughout inland Australia and this species has been seen intermittently at Deep Pond in small numbers. However, in April 2005, 143 birds were recorded after several weeks of heavy rain on the coast (**Figure 4**). In February and March of that year 135mm and 185mm respectively of rain were

recorded on Kooragang Island. Numbers peaked again at 214 in May 2007 after rainfalls of 120.5mm, 191.5mm and 153mm in February, March and April respectively.

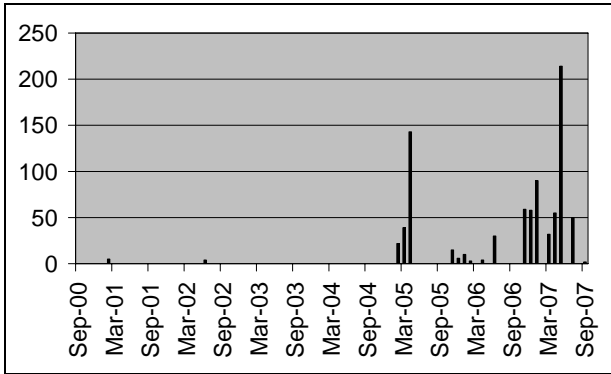


Figure 4. Pink-eared Duck.

Australasian Shoveler *Anas rhynchos*

Numbers of Australasian Shoveler have increased in the Hunter Region in recent years and it is currently considered to be a breeding resident though breeding records remain scarce. Numbers on Deep Pond build up in autumn and winter with smaller numbers present in the summer months (Figure 5).

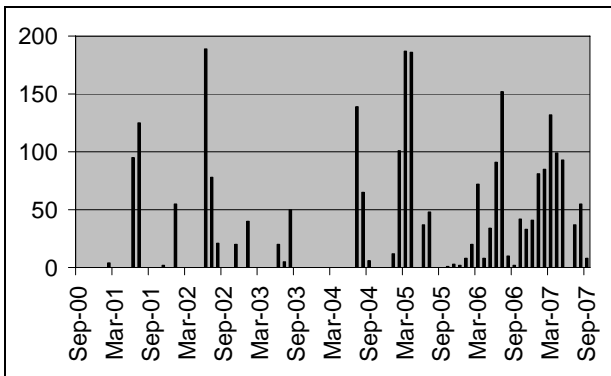


Figure 5. Australasian Shoveler.

The highest number of 189 was recorded in June 2002. In 2005 large numbers occurred in February (101), March (187) and April (186) after heavy rain over several weeks. Smaller than expected numbers in winter 2005 may have been due to the majority of the population being at the nearby Hunter Wetlands Centre (HWC), 207 in June and 100+ in July. This apparent relocation reflects the importance of a choice of wetlands being available. The numbers at HWC in the winter of 2005 are comparable to the peak numbers seen at Deep Pond in most years.

Northern Shoveler *Anas clypeata*

This species occurs in the northern hemisphere and is vagrant to Australia. It occurred once on Deep Pond in July 2002 (Stuart 2003). It is listed under the intergovernmental treaty with China for the protection of migratory birds and their habitat (CAMBA).

Grey Teal *Anas gracilis*

The wide-spread Grey Teal responds rapidly to rainfall and in times of drought it leaves drying wetlands, often coming to coastal areas (Marchant & Higgins 1990, p. 1269). It is a breeding resident in the Hunter Region and appears on Deep Pond in large numbers after good rain (Figure 6). The highest number recorded was 997 in April 2007 after heavy rain in March (191.5mm) and in April (153mm). A steadily increasing trend is evident since summer 2003/2004.

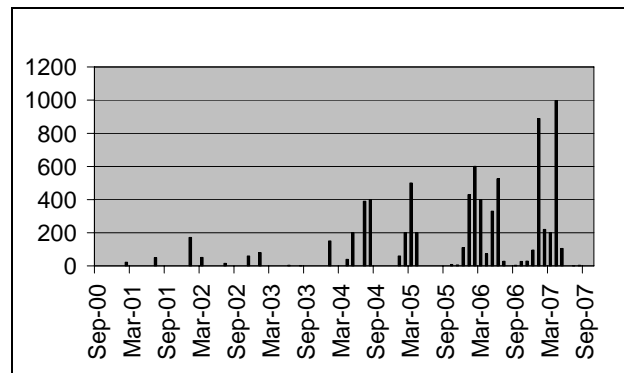


Figure 6. Grey Teal.

Chestnut Teal *Anas castanea*

The Chestnut Teal is most common on the coastal wetlands of southern and eastern Australia. It tolerates saline conditions better than other duck species. The Chestnut Teal is a breeding resident in the Hunter Region and on Deep Pond it outnumbers other species of ducks. In general numbers increase over the summer months when other wetlands become unsuitable (Figure 7). Numbers peaked in February 2004 at 1010 birds. This is 1% of the estimated South Eastern Australian population of 100,000 birds (Wetlands International 2006, p. 89). Deep Pond is clearly an important site for both Chestnut Teal and the previously discussed Grey Teal.

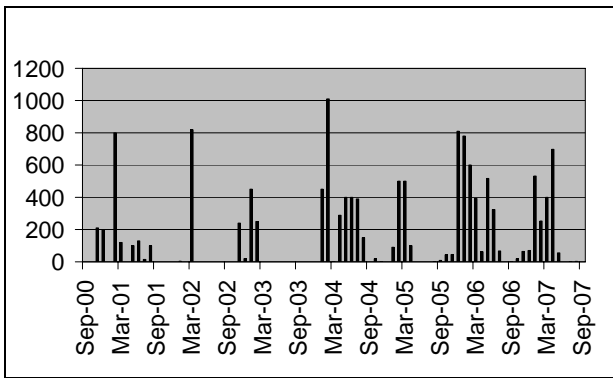


Figure 7. Chestnut Teal.

Northern Mallard *Anas platyrhynchos*

This introduced species has occurred only once on Deep Pond where one bird was present in August 2007.

Pacific Black Duck *Anas superciliosa*

The Pacific Black Duck prefers permanent wetlands with low salinity (Marchant & Higgins 1990, p. 1321) and is a common, breeding resident in the Hunter Region. The exceptionally high peak number of 350 in April 2005 was more than six times higher than the maximum number in any other year (**Figure 8**). This occurred after rains in February (135mm) and March (185mm) filled Deep Pond. Three ducklings were present in December 2005.

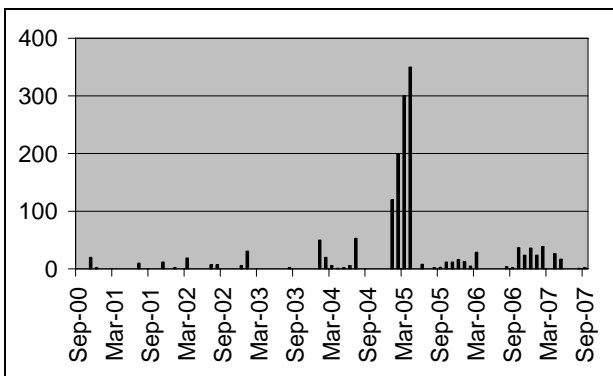


Figure 8. Pacific Black Duck.

Hardhead *Aythya australis*

The Hardhead prefers deep, freshwater wetlands which it leaves before they become shallow. It is known to disperse over long distances in search of suitable wetlands (Blakers *et al.* 1984). This species is resident in the Hunter Region and visits Deep Pond only during or after heavy rain. It was present in every month of 2005 with the peak count of 600 in April (**Figure 9**). Numbers rose again to 550 in

October 2006 after storms filled the wetland. Heavy autumnal rains in 2007 kept Deep Pond full and the highest number ever recorded was 823 in May of that year.

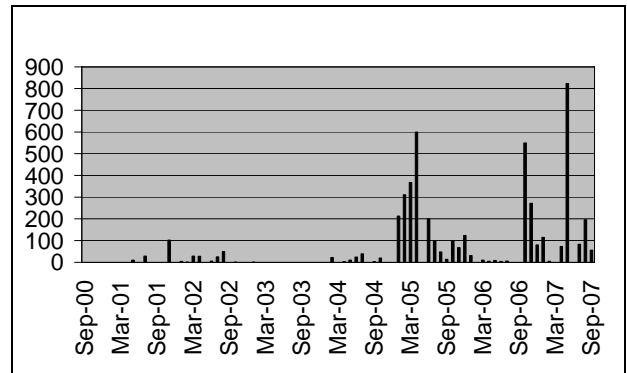


Figure 9. Hardhead.

Blue-billed Duck *Oxyura australis*

In NSW this species is usually found west of the Great Dividing Range where it prefers deep, permanent wetlands and is regarded as rare in the Hunter Estuary. It appeared on Deep Pond in July, August and September 2005 with two, four and three birds respectively and in July and August 2007 with three and two birds respectively. On both occasions heavy rains had filled the wetland. This species is listed as Vulnerable under the TSC Act.

Grebes

The grebes are widespread in Australia and three species are common in the Hunter Region. All are known to breed in the area (Stuart 2008). The low numbers until mid 2005 may be partly due to the distance from the western survey point used until that time. The absence of both species in 2003 may be attributed to the exceptionally dry conditions of that year.

Australasian Grebe *Tachybaptus novaehollandiae*

This species occurred on 49 surveys. Good rainfall maintained a high level of water in Deep Pond during the earlier months of 2005 and the highest number recorded was 76 in July 2005 (**Figure 10**).

Hoary-headed Grebe *Poliiocephalus poliocephalus*

Grahamstown Dam, a deep water reservoir, is the most important site for this species in the Hunter

Region where counts of over 300 occur regularly (Stuart 1994-2008). On Deep Pond the highest number of 146 occurred in May 2007 (Figure 11).

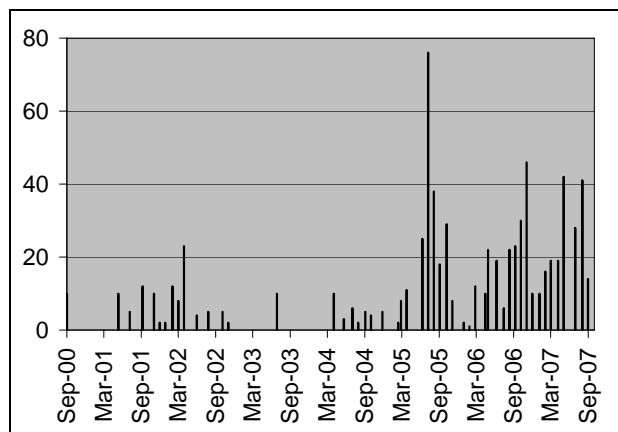


Figure 10. Australasian Grebe.

Migratory Shorebirds

With one exception, migratory shorebirds occurring on Deep Pond breed in the Northern Hemisphere and are usual summer migrants to the Hunter Estuary. The exception is the Double-banded Plover *Charadrius bicinctus* which breeds in New Zealand and flies to Australia for the winter months. Some species of shorebirds make long distance flights of up to 29,000 kilometres a year and return to the same areas year after year. This migratory habit and their site faithfulness make them vulnerable to habitat variability. Migratory shorebird numbers in the Hunter Estuary have been in a serious state of decline over the past thirty years due to many factors but in part, at least, due to loss of suitable habitat in the area (Herbert 2007). Remaining habitat, however small, is therefore extremely valuable. Deep Pond supported an increasing number of shorebirds as drought conditions spread across NSW and eleven species

Great Crested Grebe *Podiceps cristatus*

This species occurred only once in September 2007 when two birds were present.

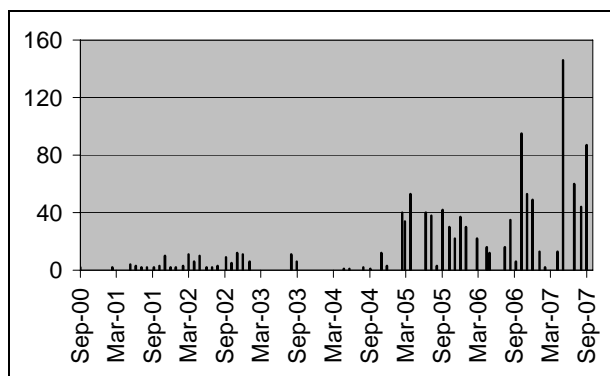


Figure 11. Hoary-headed Grebe.

of migratory shorebirds have occurred on this wetland to date. All migratory shorebirds and their habitats are protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and respective international conservation agreements with Japan, China and South Korea (JAMBA, CAMBA, ROKAMBA).

Some species such as Double-banded Plover, Latham’s Snipe *Gallinago hardwickii*, Black-tailed Godwit *Limosa limosa*, Bar-tailed Godwit *Limosa lapponica*, Pectoral Sandpiper *Calidris melanotos* and Ruff *Philomachus pugnax* occurred irregularly in small numbers. Significant numbers of the remaining five migratory shorebirds have been recorded.

Table 1 summarises the survey results for the most numerous species of migratory shorebirds occurring on Deep Pond.

Table 1. Summary of migratory shorebird data for Deep Pond.

Species	Reporting Rate (%)*	Average Number Per Survey	Maximum Number	Minimum Number	Total Surveys Seen
Marsh Sandpiper	29	70	150	4	14
Common Greenshank	15	7	21	1	7
Red-necked Stint	6	3	4	2	3
Sharp-tailed Sandpiper	31	96	496	1	15
Curlew Sandpiper	15	84	450	1	7

*The reporting rate was calculated based on the frequency of presence between September and March involving 48 surveys.

Double-banded Plover *Charadrius bicinctus*

Two birds were seen in July 2004 and two in March 2007.

Latham's Snipe *Gallinago hardwickii*

A single bird was seen in February 2006.

Black-tailed Godwit *Limosa limosa*

A single bird was seen in September 2000. This species is listed as Vulnerable under the TSC Act.

Bar-tailed Godwit *Limosa lapponica*

A single bird was seen in February 2007.

Ruff *Philomachus pugnax*

A single bird was seen in March 2007.

Common Greenshank *Tringa nebularia*

This extremely wary shorebird prefers estuarine and inland wetlands in its non-breeding range and in the Hunter Estuary is seen most often on the Kooragang Dykes where up to 315 birds have been observed. Since the beginning of monthly wader surveys by HBOC in April 1999 this species has shown an overall decline in the estuary of 50% (Herbert 2007, p. 115). It occurred in small numbers on Deep Pond during five seasons, the highest number being 21 in March 2001 (**Figure 12**).

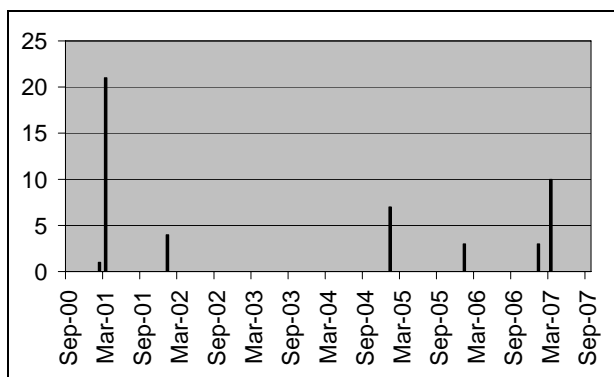


Figure 12. Common Greenshank.

Marsh Sandpiper *Tringa stagnatilis*

In its non-breeding range the Marsh Sandpiper prefers fresh or brackish wetlands. In the Hunter Estuary it occurred commonly on Fullerton Cove Beach until 2003 but is seldom seen there now because of the severe beach erosion. It is most

commonly seen on Area E and Deep Pond. This species exemplifies the use of different wetlands by birds. The water in Area E is mostly saline and in Deep Pond the water is fresh. **Figure 13** shows that the majority of the birds are often on one or the other area. The Marsh Sandpiper has been present on Deep Pond every summer except 2000/2001. The highest number recorded on HBOC survey days was 150 in January 2002. However, I recorded the peak number of 270 in February 2007 outside the survey date.

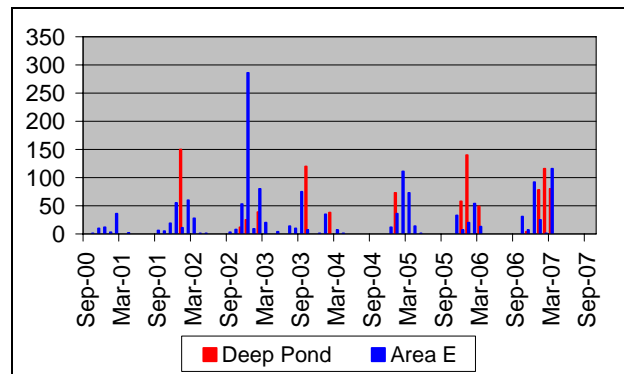


Figure 13. Marsh Sandpipers use both saline (Area E) and freshwater (Deep Pond) wetlands and the majority of birds in the Hunter Estuary are on either one or the other.

Red-necked Stint *Calidris ruficollis*

Red-necked Stints, one of the smaller species considered to be in decline in the Hunter Estuary (Herbert 2007, p. 134), have been recorded only occasionally and usually in small numbers, four or fewer. Prior to the change in survey points in 2005 there were no records. This was possibly due to the difficulty in identifying this very small species at long distance. The only record of a substantial number of 120 was seen outside the survey date in February 2007 when the birds were roosting on the row of rocks running east-west.

Pectoral Sandpiper *Calidris melanotos*

Unless good viewing conditions prevail, this species is difficult to separate from the Sharp-tailed Sandpiper and therefore may often go unidentified. One was observed in February and again in March 2007 (Stuart 2008).

Sharp-tailed Sandpiper *Calidris acuminata*

As other wetlands dry out this species is seen sporadically on Deep Pond where muddy margins are still present (**Figure 14**). It often roosts on the rocks on the eastern side. In the summer of

2006/2007 large numbers occurred; the highest HBOC count was 496 birds in January and in February 600 birds were present (F. van Gessel pers. comm.).

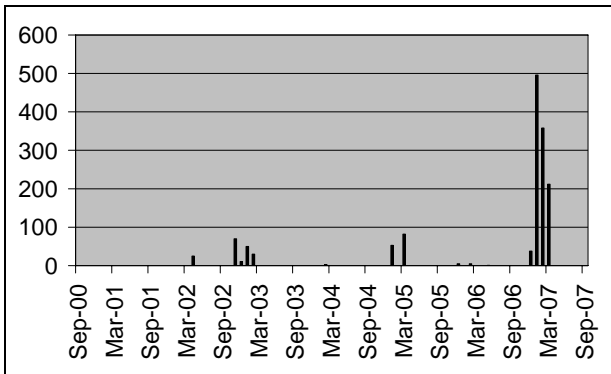


Figure 14. Sharp-tailed Sandpiper.

Curlw Sandpiper *Calidris ferruginea*

In its non-breeding areas the Curlw Sandpiper prefers the muddy edges of both coastal and inland wetlands (Higgins & Davies 1996, p. 315). In the Hunter Estuary loss of suitable habitat, such as the sewage ponds at Stockton and Big Pond on Kooragang Island, has contributed to a serious decline in numbers. When conditions are suitable, Deep Pond compensates to some extent for the loss of those sites. The species was seen on 50% of the summer surveys. The highest number on Deep Pond of 450 was recorded in January 2003 at the

height of the drought and small numbers occurred in 2005, 2006 and 2007 (Figure 15).

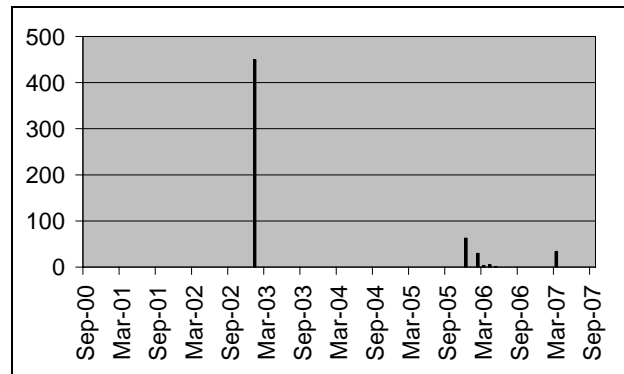


Figure 15. Curlw Sandpiper.

Australian Resident Shorebirds

Australian resident shorebirds occurring at Deep Pond are protected only under the most general legislation which applies to all fauna in Australia.

In general these species are not well studied. Survey results for the six species of resident shorebirds recorded on Deep Pond, all of which occur frequently in the Hunter Estuary, are summarised in Table 2.

Table 2. Summary of survey results for resident shorebirds at Deep Pond

Species	Reporting Rate (%) *	Average per Survey	Maximum Number	Minimum Number	Total Surveys Seen
Black-winged Stilt	47	97	525	1	38
Red-necked Avocet	28	296	2000	2	23
Red-capped Plover	4	20	53	1	3
Black-fronted Dotterel	22	8	48	1	18
Red-kneed Dotterel	4	3	4	2	3
Masked Lapwing	31	5	33	1	25

* The reporting rate was calculated based on the frequency of presence throughout the year involving 81 surveys.

Black-winged Stilt *Himantopus himantopus*

This species lives on shallow fresh or saline water and was seen at Deep Pond on 38 surveys. Over 200 birds commonly occur in February with a maximum of 525 in 2001(**Figure 16**).

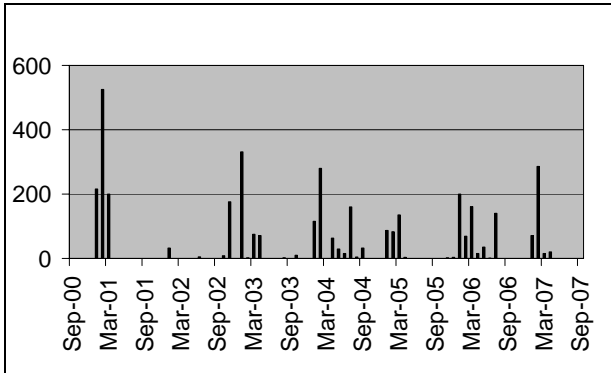


Figure 16. Black-winged Stilt.

Red-necked Avocet *Recurvirostra novaehollandiae*

Since the 1980s this inland species has taken up residence in the Hunter Estuary, probably as a result of drought conditions at that time. In some years up to 7,000 birds are present over the winter months. In response to rain in the central and western regions of Australia, they leave the Hunter Estuary to breed on the newly formed ephemeral wetlands. On Deep Pond the highest numbers regularly occur in January (**Figure 17**), and Deep Pond becomes important for any birds remaining over the summer months. The maximum number of 2000 was seen in January 2006, an exceptionally dry period throughout NSW. This count is more than 1% of the estimated Australian population of 107,000 birds (Wetlands International 2006, p. 150).

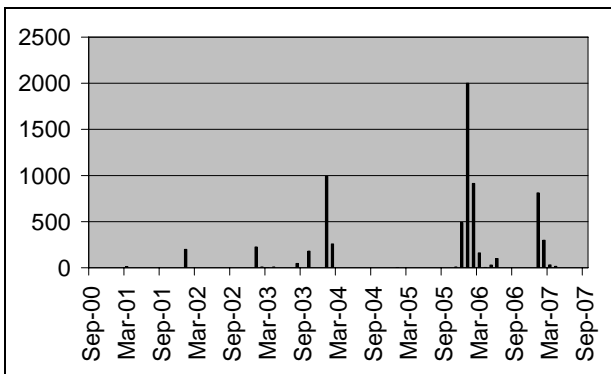


Figure 17. Red-necked Avocet

Red-capped Plover *Charadrius ruficapillus*

This species has been seen only on three surveys at Deep Pond. The maximum number of 53 was seen in June 2003. Interestingly, this species has taken advantage of changes in habitat and moved into areas fairly near Deep Pond where the habitat has been improved through the removal of weeds, e.g. Stockton Sandspit at Stockton, and where saltmarsh has been created, e.g. Phoenix Flats on Ash Island.

Black-fronted Dotterel *Elseornis melanops*

The Black-fronted Dotterel occupies mainly freshwater shorelines and occurs in small numbers on Deep Pond when the wetland is drying out (**Figure 18**). Over 48 were present in July 2004. In October 2006 a nest with 3 eggs was found.

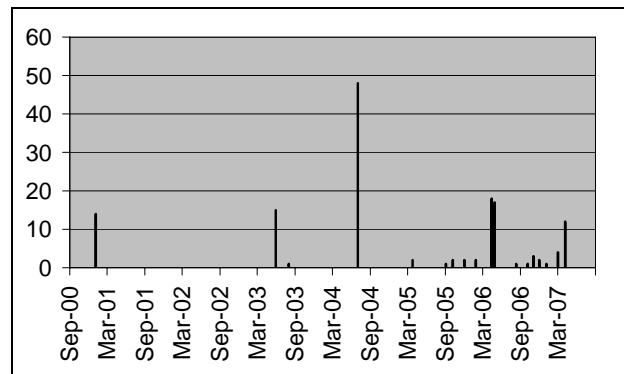


Figure 18. Black-fronted Dotterel.

Red-kneed Dotterel *Erythrogonys cinctus*

This species was observed on Deep Pond on only three surveys. The highest number was four in February 2006.

Masked Lapwing *Vanellus miles*

This common species occurs in small numbers around the muddy edges during any month of the year (**Figure 19**). The maximum number seen was 33 in March 2005.

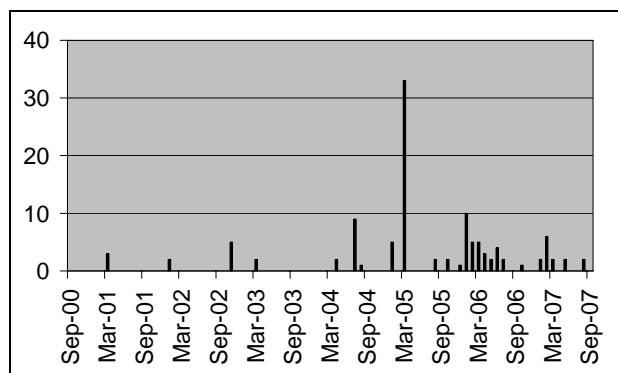


Figure 19. Masked Lapwing.

Other Species

Many other species of birds use the grasslands bordering Deep Pond. They include passerines such as the Golden-headed Cisticola *Cisticola exilis*, Australian Reed-Warbler *Acrocephalus australis*, Tawny Grassbird *Megalurus timoriensis*, Little Grassbird *Megalurus gramineus* and Australasian Pipit *Anthus novaeseelandiae*, all of which occur in large numbers. The uncommon Chestnut-breasted Mannikin *Lonchura castaneothorax* is often recorded. Stubble Quail *Coturnix pectoralis*, Brown Quail *Coturnix ypsilophora* and the rare Red-backed Button-quail *Turnix maculosus* are seen in the thick grass and weeds. Two Red-backed Button-quail were seen in February 2006 and three in February 2007 (Stuart 2007 & 2008). It is listed under the TSC Act as Vulnerable. Of particular interest is the large number of birds of prey or raptors (see **Appendix 1**), with White-bellied Sea-Eagles and Swamp Harriers being seen regularly. Twelve species, 50% of Australia's breeding raptors, have been recorded, including the Eastern Osprey *Pandion cristatus*, which is rare in the Hunter Estuary and is listed as Vulnerable under the TSC Act and the Spotted Harrier *Circus assimilis*, an uncommon bird near the NSW coast. The presence of so many raptors indicates a varied and abundant food supply as items in their diet include insects, fish, birds and small mammals. All raptors are protected under the EPBC Act.

CONCLUSIONS

The importance of Deep Pond lies in its large size and the varying water depths after heavy rainfall. It is a freshwater wetland rather than saline and its water levels fluctuate thus providing a variety of habitats suitable for different species at different times of the year. It seldom completely dries out. A rare advantage of the site is that it is secluded and

closed to the public thus free from major disturbance. Most disturbances are caused by the large number of raptors which visit the area. The shorebirds utilise it when water levels are low and muddy edges are exposed particularly in late summer when other wetlands may dry out completely. It supports a large variety of waterbirds both shallow water species, such as the dabbling ducks, and deep water species, including Hardhead, Musk and Freckled Ducks as well as the three species of grebes. The timing of the occurrence of peak numbers of waterfowl is complex and differs between species. The data suggest that Deep Pond provides a refuge for birds leaving drought-affected areas and that it is capable at times of supporting some of the highest numbers of birds recorded for the wetlands in the Lower Hunter Estuary.

Of the birds recorded on Deep Pond six species are listed under the TSC Act and eleven species of shorebirds are listed under the EPBC Act. Two species, the Chestnut Teal and the Red-necked Avocet, have occurred in numbers fulfilling one of the criteria required for listing in the Directory of Important Wetlands Australia and the intergovernmental treaty, The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (otherwise known as the Ramsar Convention). The criterion is that a wetland support 1% of the population of a species. The estimated total populations of the Chestnut Teal in South Eastern Australia and the Red-necked Avocet are 100,000 and 107,000 birds respectively (Wetlands International 2006, pp. 89 & 150). However, another dimension of this criterion is the question of regularity. Although it cannot be established at present that Deep Pond "regularly" supports 1% of the population of these species, continued monitoring will clarify this issue. In three of the seven years of HBOC surveys, 2001, 2002, and 2005, Chestnut Teal numbers have exceeded 800 and in 2004 reached the 1% threshold of 1000 birds. Red-necked Avocet numbers exceeded the threshold of 1100 in January 2006 with 2000 birds being present. Data show that Deep Pond clearly provides important habitat for waterfowl and shorebirds and requires some measure of protection, especially in view of its location on industrial land. It is an integral component in the network of wetlands in the Hunter Estuary.

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Appendix 1. Total list of species recorded at Deep Pond 1993 – 2007.

Stubble Quail <i>Coturnix pectoralis</i>	Australian Spotted Crake <i>Porzana fluminea</i>
Brown Quail <i>Coturnix ypsilophora</i>	Eurasian Coot <i>Fulica atra</i>
Magpie Goose <i>Anseranas semipalmata</i>	Black-winged Stilt <i>Himantopus himantopus</i>
Wandering Whistling-Duck <i>Dendrocygna arcuata</i>	Red-necked Avocet <i>Recurvirostra novaehollandiae</i>
Musk Duck <i>Biziura lobata</i>	Red-capped Plover <i>Charadrius ruficapillus</i>
Freckled Duck <i>Stictonetta naevosa</i>	Double-banded Plover <i>Charadrius bicinctus</i>
Black Swan <i>Cygnus atratus</i>	Black-fronted Dotterel <i>Elseyornis melanops</i>
Australian Shelduck <i>Tadorna tadornoides</i>	Red-kneed Dotterel <i>Erythrogonyx cinctus</i>
Pink-eared Duck <i>Malacorhynchus membranaceus</i>	Masked Lapwing <i>Vanellus miles</i>
Australasian Shoveler <i>Anas rhynchotis</i>	Latham's Snipe <i>Gallinago hardwickii</i>
Northern Shoveler <i>Anas clypeata</i>	Black-tailed Godwit <i>Limosa limosa</i>
Grey Teal <i>Anas gracilis</i>	Bar-tailed Godwit <i>Limosa lapponica</i>
Chestnut Teal <i>Anas castanea</i>	Common Greenshank <i>Tringa nebularia</i>
Northern Mallard <i>Anas platyrhynchos</i>	Marsh Sandpiper <i>Tringa stagnatilis</i>
Pacific Black Duck <i>Anas superciliosa</i>	Red-necked Stint <i>Calidris ruficollis</i>
Hardhead <i>Aythya australis</i>	Pectoral Sandpiper <i>Calidris melanotos</i>
Blue-billed Duck <i>Oxyura australis</i>	Sharp-tailed Sandpiper <i>Calidris acuminata</i>
Australasian Grebe <i>Tachybaptus novaehollandiae</i>	Curlew Sandpiper <i>Calidris ferruginea</i>
Hoary-headed Grebe <i>Poliiocephalus poliocephalus</i>	Ruff <i>Philomachus pugnax</i>
Great Crested Grebe <i>Podiceps cristatus</i>	Red-backed Button-quail <i>Turnix maculosus</i>
Australasian Darter <i>Anhinga novaehollandiae</i>	Caspian Tern <i>Hydroprogne caspia</i>
Little Pied Cormorant <i>Microcarbo melanoleucos</i>	Whiskered Tern <i>Chlidonias hybrida</i>
Great Cormorant <i>Phalacrocorax carbo</i>	Crested Tern <i>Thalasseus bergii</i>
Little Black Cormorant <i>Phalacrocorax sulcirostris</i>	Silver Gull <i>Chroicocephalus novaehollandiae</i>
Pied Cormorant <i>Phalacrocorax varius</i>	Horsfield's Bronze-Cuckoo <i>Chalcites basalis</i>
Australian Pelican <i>Pelecanus conspicillatus</i>	Shining Bronze-Cuckoo <i>Chalcites lucidus</i>
Black-necked Stork <i>Ephippiorhynchus asiaticus</i> *	Eastern Barn Owl <i>Tyto javanica</i>
White-necked Heron <i>Ardea pacifica</i>	Superb Fairy-wren <i>Malurus cyaneus</i>
Eastern Great Egret <i>Ardea modesta</i>	Yellow Thornbill <i>Acanthiza nana</i>
Intermediate Egret <i>Ardea intermedia</i>	Yellow-faced Honeyeater <i>Lichonostomus chrysops</i>
Cattle Egret <i>Ardea ibis</i>	White-fronted Chat <i>Epthianura albifrons</i>
White-faced Heron <i>Egretta novaehollandiae</i>	White-breasted Woodswallow <i>Artamus leucorhynchus</i>
Little Egret <i>Egretta garzetta</i>	Grey Butcherbird <i>Cracticus torquatus</i>
Australian White Ibis <i>Threskiornis molucca</i>	Australian Magpie <i>Cracticus tibicen</i>
Straw-necked Ibis <i>Threskiornis spinicollis</i>	Willie Wagtail <i>Rhipidura leucophrys</i>
Royal Spoonbill <i>Platalea regia</i>	Australian Raven <i>Corvus coronoides</i>
Yellow-billed Spoonbill <i>Platalea flavipes</i>	Magpie-lark <i>Grallina cyanoleuca</i>
Eastern Osprey <i>Pandion cristatus</i>	Eurasian Skylark <i>Alauda arvensis</i>
Black-shouldered Kite <i>Elanus axillaris</i>	Golden-headed Cisticola <i>Cisticola exilis</i>
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	Australian Reed-Warbler <i>Acrocephalus australis</i>
Whistling Kite <i>Haliastur sphenurus</i>	Tawny Grassbird <i>Megalurus timoriensis</i>
Brown Goshawk <i>Accipter fasciatus</i>	Little Grassbird <i>Megalurus gramineus</i>
Spotted Harrier <i>Circus assimilis</i>	Brown Songlark <i>Cincloramphus cruralis</i>
Swamp Harrier <i>Circus approximans</i>	Silvereye <i>Zosterops lateralis</i>
Wedge-tailed Eagle <i>Aquila audax</i>	Welcome Swallow <i>Hirundo neoxena</i>
Nankeen Kestrel <i>Falco cenchroides</i>	Fairy Martin <i>Petrochelidon ariel</i>
Brown Falcon <i>Falco berigora</i>	Tree Martin <i>Petrochelidon nigricans</i>
Australian Hobby <i>Falco longipennis</i>	Common Starling <i>Sturnus vulgaris</i>
Peregrine Falcon <i>Falco peregrinus</i> **	Red-browed Finch <i>Neochmia temporalis</i>
Purple Swampphen <i>Porphyrio porphyrio</i>	Chestnut-breasted Mannikin <i>Lonchura castaneothorax</i>
Lewin's Rail <i>Lewinia pectoralis</i> ***	Australasian Pipit <i>Anthus novaeseelandiae</i>
Buff-banded Rail <i>Gallirallus philippensis</i>	European Goldfinch <i>Carduelis carduelis</i>

* 1 in August 2002 (Stuart 2003). Listed as Endangered under the TSC Act.

** 1 in February 2007 (F. van Gessel pers. comm.).

*** 1 in February 2007 (Stuart 2008).