

***History, fauna and flora of Lake Linlithgow
(Jenawarra) and associated wetlands in
south-west Victoria***



Rod Bird, Steve Clark and Murray Gunn

December 2019

Cover picture:

Cape Barren Geese flying over Lake Kennedy in February 1967. Some of the birds were wearing yellow collars, indicating that they had been banded on the Neptune group of islands off South Australia.

As many as 112 Cape Barren Geese were seen in 1967, but mostly in 10s or 20s at Lake Kennedy or *Jenawarra*. The birds have not been seen by HFNC at *Jenawarra* since 1977 but one bird was seen in February 2008 at Krause Swamp and in February 2018 at Lake Kennedy.

Picture by Graeme Pizzey (provided by John & Cicely Fenton).

Other photographs:

The images presented in this report are included as a pictorial record of the nature and changing environment of *Jenawarra* and associated wetlands over time.

Images in Figures 22-30 were scanned from the late Lionel Elmore's photographic slide collection that is now held by the Hamilton Field Naturalists Club.

Diane Luhrs provided digital images of scenes presented in Figures 49-54.

David Munro provided the digital images for scenes presented in Figures 55 & 56.

Steve Clark provided images for Freckled Duck and Cape Barren Goose, taken in February 2018 (Figures 65 & 66).

All other images were provided by Rod Bird, scanned from photographic slides or prints, except for Figures 38(b) & 61-64 that are digital images.

New Edition December 2019

This edition replaces the publication of August 2008, with the following changes:

- Inclusion of Murray Gunn's recollections of birdwatching in the 1960s and 1970s at *Jenawarra*
- The section 'Birds of *Jenawarra* and wetlands nearby' has been added to account for sightings from 2008-2019
- The list of birds in Table 2 has been updated to February 2019.
- Table 3 has been supplemented by Table 3b, to include the annual February surveys from 2007-2019
- A new table (now Table 4) highlights peaks in species numbers from the February surveys
- Table 5 (formerly Table 4) and Figures 15 & 16 have been revised to include data for Oct. 1990 inadvertently omitted from the 2008 edition.
- The section concerning Duck Hunting has been updated to account for actions taken from 2008-2019
- Two additional Appendices have been added, comprising 10 tables of summer waterbird/raptor survey data for *Jenawarra* and 5 adjacent wetlands for years 2010-19, and 2 tables for winter surveys in 2018-19.

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Rod Bird, Steve Clark and Murray Gunn

Introduction

The first edition of this report was produced for the 50th Anniversary of the Hamilton Field Naturalists Club (HFNC) in October 2008. The current edition extends the period of observations to 2019.

HFNC had been active in observing waterbirds on Lake Linlithgow (*Jenawarra*) since 1958. Annual surveys in February of numbers of birds of each species present on *Jenawarra* were made from 1983 to 2018 (Tables 3a & 3b), whilst the seasonal abundance of waterbirds was surveyed in a 5-year period from 1987 to 1992 (Table 5), a span of years in which the lake did not dry out over summer.

From 2006-08, HFNC members (with assistance from 3 members of the Portland FNC), also actively surveyed waterbirds on adjacent lakes and swamps, including Lake Bulrush, Krause Swamp, Lake Kennedy, Harnath Swamp, Soldiers Swamp and Tabor Swamp. The data from those surveys, plus incidental records, are presented in Appendix 1 of this report.

Sixty-three species of waterbirds have been recorded at *Jenawarra* (Table 2). Uncommon species such as Marsh Sandpiper, Pectoral Sandpiper, Glossy Ibis, Common Greenshank, Royal Spoonbill, Brolga, Cape Barren Goose, Freckled Duck, Blue-billed Duck and Great Crested Grebe are sometimes seen and, at times, many thousands of birds of other species were recorded (Tables 3-5).

HFNC has also been active from time-to-time since 1975 in revegetating the fringes of the lake, including a period from 2002-05 in a project with Parks Victoria's John Harris, whose work has been truly monumental in transforming the fringes of lakes Kennedy and *Jenawarra*. HFNC conducted a preliminary survey of the native flora after grazing livestock were removed from the fringes in 2002. The tree-planting activities and flora survey data are presented in this report.

A further objective of this report was to outline the history of the area since settlement, the geology and landscape features, historic water levels, salinity regimes, and future management issues.

Lake Linlithgow (*Jenawarra*)

Jenawarra is situated 15 km east of Hamilton, towards Penshurst. The lake is a major resource for water birds, which also use four nearby State Wildlife Reserves (the very saline Lake Kennedy (210 ha) 1 km to the SW of *Jenawarra*, the fresher Lake Bulrush (155 ha) 400 m to the east and Krause Swamp (27 ha) further to the east (on Mibus La), with Harnath Swamp (~12 ha) 400 m to the south of *Jenawarra* (on Lake Rd). Three wetlands further away are also significant: the remnant of the drained Soldiers Swamp (on West Boundary Rd, off Hamilton Highway), Tabor Swamp (on McIntyres Ck, Tabor), and the drained 3,000 ha Buckley Swamp.

Jenawarra lies on the volcanic plains and is 1,015 ha, or 1,477 ha with its foreshore and the Boonawah Ck flats (DCNR 1993). It is classified as a Lake Reserve/Public Park/fauna sanctuary. The southern half of the area (and the whole of the water area) is administered by the Shire of Southern Grampians, while Parks Victoria controls the banks of the northern half. The position and relative size of the wetlands is indicated in Fig. 1.

Jenawarra is a terminal lake with a catchment of about 140 km², fed mainly by Boonawah Ck. It is quite shallow in most years, usually less than 1.5 m, and not more than 4.9 m on the rare occasion when it overflows across Chatsworth Rd into the catchment of Muddy Ck and eventually the Grange Burn and Wannon River (SR&WSC 1977). Data from Thiess (Fig. 11) show that the depth of water in the lake for much of the period 1964-2004 was 0.5-2.5 m, with a seasonal variation of ~0.5-1 m.

On the volcanic plains, over 75% of the shallow freshwater wetlands have been lost or severely modified by drainage works (DNRE 1997). *Jenawarra* and nearby wetlands are very important – although degraded – remnants of the extensive former wetlands of SW Victoria that included the 3,000-ha Great Swamp, now the drained Buckley Swamp at Yatchaw, described by Bruni (1903) as ‘the most remarkable feature in the district around Hamilton...the home of myriads of waterfowl’

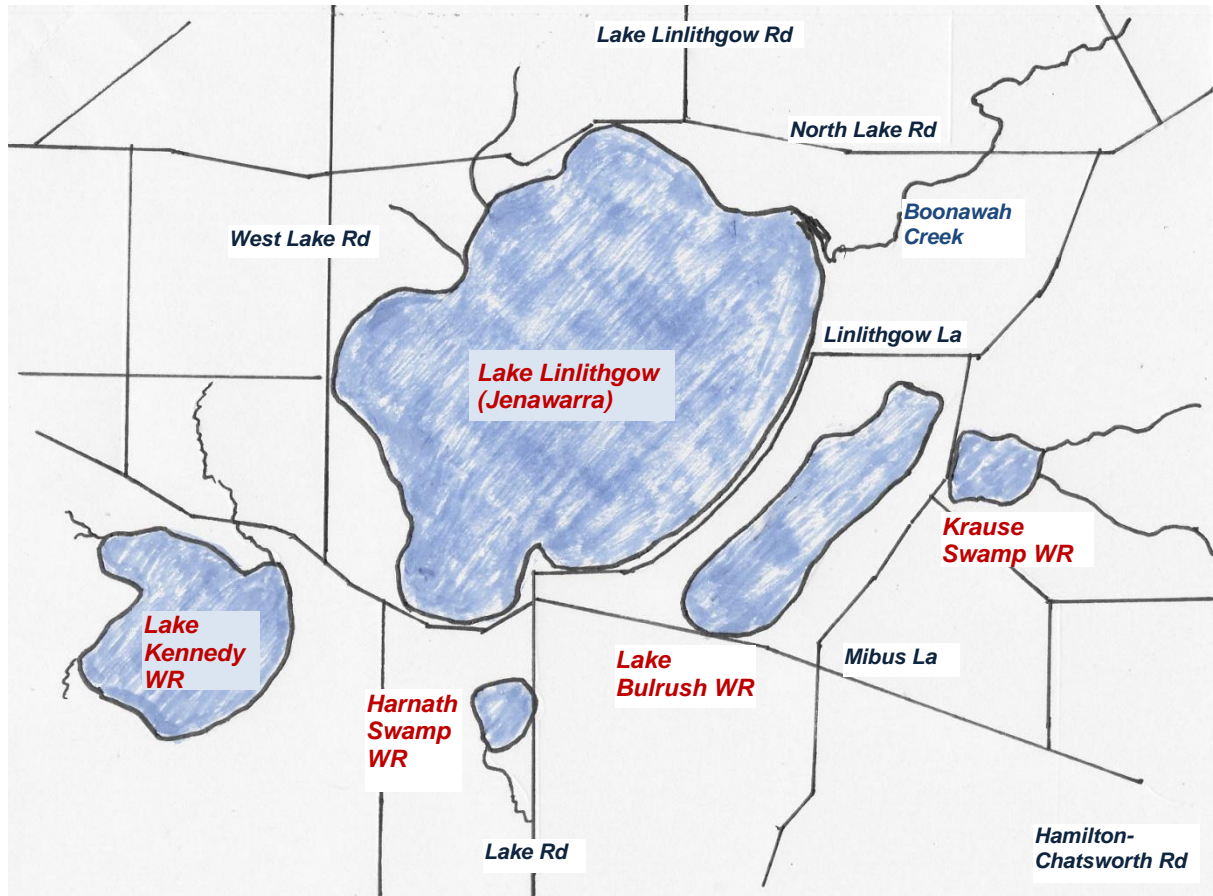


Figure 1. Location of *Jenawarra* and the adjacent lakes and swamps.



Figure 2.
Jenawarra in December 2000, from Chatsworth Rd, at the southern edge of the lake.

Pine & Cypress on The Point, the ridge that juts into the lake, were planted by Wilhelm Habel in the 1870s.

Mt. Sturgeon (*Wurgarri*) & Mt. Abrupt (*Mud-dadjug*) of *Gariwerd* (Grampians) are seen to the north.



Figures 3 & 4. Boonawah Ck in Dec. 2000 (left picture), turning (top, left) to flow into *Jenawarra*. This is the only creek flowing into the lake. It drains a large catchment to the east. Boonawah Ck usually ceases to flow during summer and may dry up in some years, as in Feb. 2000 (above, right).

Jenawarra and nearby wetlands fell within the *Chap Wurrung* tribal language group (see Clark 1987 for the clan groups). James Dawson, one time of the Eumeralla district, wrote of the Aborigines of SW Victoria (see Arkely 2000, Dawson 1880) and said that as many as 2,500 Aborigines could have attended the many great meetings of the tribes, as at a large marsh called *Mirraewuae*, near the border between *Tjapwurong* and *Gunditjmara* territory. That may have been Buckley Swamp but more likely Condah Swamp since Robinson recorded the name *Ko.nung.i.yoke* for the NW part of the “Great Swamp” at Yatchaw (Presland 1977).

Since 1838 the lakes have been severely degraded, the foreshores and banks used for grazing and the water for boating and/or duck shooting. The HFNC, with assistance from the former Mount Rouse Shire, planted 1,000 trees in a 500-m block on the east bank from 1975-1991. Parks Victoria, with some assistance from HFNC, Green Corps and other organizations, implemented a new plan for the lake and its Crown land surrounds. Grazing licences were cancelled in March 2002 and a program of tree planting started. A similar program was implemented on Lake Kennedy in 2001, where neighbors were consulted, grazing licences cancelled, fences repaired and some 9,000 indigenous trees and shrubs planted through the initiative of Greening Australia, Parks Victoria and Glenelg-Hopkins Catchment Management Authority (GHCMA).

The cessation of grazing in 2002 on the critical foreshore, bank, cliff, stream and saltmarsh areas has protected plants such as the rare Salt Tussock Grass (*Poa sallacustris*) and wildlife habitat in the Boonawah Ck. Removal of stock from these lakeside and creek fringes has also reduced nutrient pollution of the lake, a factor in algal blooms of past years. It will also allow the development of rush and reed habitat on the shoreline, and the protection and enhancement of important remnant native vegetation that exists on/near some of the cliff areas.

The banning of duck hunting and motor boats on *Jenawarra* and the adjacent wetlands would further bolster the purpose and image of this area as a prime wildlife habitat in a region deficient in that nature conservation resource.

Early history

Major Thomas Mitchell

Mitchell only saw the lake from the summit of Mt Napier on 8-9 Sept. 1836, on his homeward journey through “*Australia Felix*” from Portland Bay. It was a very wet spring and the lake was full. The Great Swamp (Buckley Swamp), Soldiers Swamp, Tabor Swamp, Lake Kennedy and other wetlands (now drained) were also brimming and he had to divert his course west of the mount to the Grange.

Mitchell named Lake Linlithgow after an associate from the Spanish Peninsula War (1808-14). His party passed to the west of the Mt Napier stones country, near present North Byaduk, and thence to The Grange. Stapylton’s diary (see Douglas & O’Brien 1971) also makes mention of this lake:

“Mount Napier is a commanding hill and I see a beautiful forest land bare of timber eastward of the morass [Buckley Swamp]...A vast plain with a great lake in the centre was to be seen to the north east of Mount Napier...Were it only dry weather and seen in summer it must appear the most interesting grassy country that can be imagined”.

The first pastoralists

The Wedge brothers established a pastoral run at the Grange Station in 1838, occupying over 30,000 acres (Bride 1897, Garden 1984). Mt Sturgeon Plains station was occupied by Cameron and Mt Rouse Station by John Cox soon after (Garden 1984).

The entire district was occupied by 1840 and by 1851 there were 21 pastoral runs in place of the first 3 loosely held runs. These later runs included Croxton and Linlithgow Plains. There was violent frontier conflict during this period of Aborigine dispossession (see later discussion).

Surveyor CJ Tyers

Travelling from Mt. Rouse to the Grange on 7 Nov. 1839:

'Resumed our journey in hopes of finding a passage between The Great Swamp (mentioned by Sir Thomas Mitchell) and Mt. Napier...having discovered we were hemmed in on all sides by swamps and stony ranges we reluctantly returned to our old encampment...the only opening appeared to be between N and NE...we skirted lake Linlithgow and avoided the swamps...'

'Between Mounts Rouse and Napier is some fine country but the greater portion consists of swamps...an open forest of stunted banksia extends 6 miles to the northward of Mt Rouse. Open downs, for 2 or 3 miles in width, divide this from an open forest (chiefly of eucalypti) extending some distance east and west of Mount Sturgeon...'

George Augustus Robinson

Robinson was Chief Protector of Aborigines from 1839-1849. He described a trip on 7 May 1841 (Presland 1977) to the Grange (at Strathkellar) from Mt Rouse (named by Mitchell in 1836), otherwise recorded phonetically by Robinson in at least 8 forms: *Calorer*, *Calorrer*, *Carlorrer*, *Collorrer*, *Colloruc*, *Cullor.rer*, *Colour* or *Colorer* (Presland 1977, Presland 1980, Clark 1988):

'Took a route over the beautiful undulating downs to Forlonge's station, formerly Wedge's... through a beautiful undulating country covered with dwarf banksias, gums, cherry tree and well grassed...but without one drop of water...the absence rendering it useless for grazing purposes'

'A short distance before reaching the lake, barbarously named Lake Linlithgow [by Mitchell in 1836], we passed over an elevation from which we had a magnificent view: Abrupt and Sturgeon 10 miles distant...the vast downs to the NW and NE, thinly studded with dwarf trees, was truly grand'

'The dry hollow, called by Mitchell a very extensive lake...we found without the least drop of water...the bed white marl...slightly moist and the imprint of white man's shoes and black men's naked feet and dogs feet were numerous...To the south of this lake, separated by elevated land 3 or 400 yards across, and along which were old camping places of the natives where they baked roots, etc., there was a reedy swamp' [Lake Kennedy to the SW? Or was it Lake Bulrush to the SE? There are now no reeds in Lake Bulrush or Lake Kennedy. Given that Lake Bulrush must have originally had reeds, to have merited that name, it seems probable that Robinson was referring to the elevated bank that separates *Jenawarra* and Lake Bulrush.]

On 30 June 1841, Robinson travelled from the Grange to Mt. Abrupt, via *Jenawarra* (Presland 1980). The land between Forlonge's outstation (near Strathkellar) and the lake was described as follows:

'...open downs, thinly studded with lightwood [Blackwood], banksia, cherry tree and well grassed...a park-like appearance. Mitchell's lakes [Jenawarra & Bulrush]...covered with thick and fine grass and I saw upwards of 100 turkeys [Bustards] feeding on it'

Robinson recorded the name of Lake Linlithgow as *Tar.re.are.re* (or *Ar.re.yar.rer*). However, he expressed some doubt since his guide was from an eastern clan and not native to the area (Presland 1977). Brough Smyth (1878) listed Linlithgow as *Tunneyare* (and Mt Napier as *Tapook*, Mt Eccles as *Poythim* and Mt Rouse as *Coloro*). Since the first Lutheran settlers in 1850s knew Lake Linlithgow as *Jenawarra*, and that was also the name given to the Parish by the surveyor Clarke at that time, *Jenawarra* seems to be the appropriate local Aborigine name for the lake.

Wilhelm Habel

Wilhelm Habel took up land at *Jenawarra* in 1861, in common with a number of German settlers who had moved across from South Australia to farm the rich black earth as early as 1853. By 1862, all the land in the Tabor and *Jenawarra* districts had been taken up (Janetzki 1976).

Habel's house stood near the intersection of Huf's Lane and Chatsworth Rd, between *Jenawarra* and Lake Kennedy. There are several large River Red Gum (*E. camaldulensis*) and a Drooping Sheoak (*Allocasuarina verticillata*) at that site. Since the nearest River Red Gum occurs a few km to the north of the lake, and there are no others in the vicinity of the lake or further south, it is probable that Habel planted those at Huf's Lane.

Habel's homestead garden between the lakes contained many fruit trees. He loved trees and his dream was to plant the shores of *Jenawarra* and Lake Kennedy, and to make *Jenawarra* a sanctuary, preventing swans from being shot for their down or broilgas for sport. Irrate neighbors pulled out the trees that he planted along the shores of the lake, for they used portions of the lake surrounds as their own common (Habel 1979). Wilhelm died in 1898 but his advocacy from 1875-1881, as a Shire Councillor of Mount Rouse, and that of his son Edward resulted in the lake being declared a Sanctuary for Wildlife in 1911. The Point was declared a Public Park and by the 1920s the area was further extended and a popular place for gymkhanas (Habel 1979).

According to the memorial sign in the trees near Chatsworth Rd on the southern bank of *Jenawarra*, just west of the overflow, Habel planted Sugar Gum (*E. cladocalyx*) there in 1875-81. A few trees are still present, including some regeneration. Cypress (*Cupressus macrocarpa*) and Monterey Pine (*Pinus radiata*) were planted there and to the west in 1925, as a memorial to Wilhelm. These remain today. Habel may have planted the pines, cypress and a few Sugar Gums on The Point and east bank in the 1880s but the cypress extending along the boundary to the east was planted later, possibly in the 1940s.

Aborigines of the area

Jenawarra was in the *Djab wurung* (*Tjapwurung*) clan territory, an area that included most of the Grampians and the land south to a line roughly between Mt Rouse and Mt Napier (see Clark and Harradine 1990). By 1861, only a few Aborigines remained in the area, most apparently having been murdered or chased away by the squatters who occupied the land from 1838. The history of violent dispossession has been well documented, notably in the journals of Robinson (Clark 1988, Presland 1977, Presland 1980) and books by Bonwick (1858), Bride (1897), Cannon (1973), Critchett (1992), Garden (1984) and Moodie (Palmer 1970). There were violent clashes between the Wedge brothers, their overseer Codd and the Aborigines (Arkely 2000, Garden 1984). Charles Wedge hinted at reprisals (Bride 1897) – '*...these depredations did not cease until many lives had been sacrificed*'. A swivel gun mounted near the station hut testified to intentions. John Wedge wrote in 1840 (see Garden 1984) that the squatters were '*... determined to exterminate the hostile tribe*'. Aborigine guerilla tactics caused Wedge to sell to Forlonge in 1841, but Robinson saw no natives at the Grange in 1841 (Presland 1977).

These, and other, accounts persuaded Governor Latrobe to set up a police station at the Grange to keep the peace between settlers and Aborigines. Its effect was to protect the settlers and see the demise of the Aborigines, for they had no recourse to justice (Arkely 2000, Presland 1977 & 1980). Their evidence was inadmissible and even perpetrators of massacres, such as the Whyte brothers of Koonongwotong, were not taken to court and punished. Retribution following deaths of shepherds (many who had interfered with the native women or insulted the men), or theft of sheep, was disproportionate and indiscriminate. In this colonial invasion there could only be one outcome.

Robinson wrote (Presland 1980) '*...the settlers encouraged their men to shoot the natives because thereby they would sooner get rid of them...they did not kill them when there were many together, lest they should be known, but singly*'. Some settlers, or their workers, provoked the natives in order to justify murdering them. Others fired first and pretended that they had been attacked, while some distributed poisoned food. Robinson remarked in 1841 that the labouring men were mostly ex-convicts and that '*I have never met with a more lawless and infamous a set. They acknowledge no authority...it may be guessed what the fate of the poor Aborigines will be that fall into their hands*' (Presland 1977).

The Aborigine population fell from an estimated 6-7,000 in 1836 to a few hundred in 1858 (Arkely 2000). The impact of disease and murder was compounded by the squatters' prohibition of hunting or digging for yams on the pastoral runs, lest they frighten the sheep or deprive them of grass by burning the ground to reveal the tubers (Presland 1980). The squatters also occupied the waterholes and excluded the Aborigines from them (Clark 1988, Presland 1977). Robinson lamented in 1841, sickened by what he saw, "*Where are they to procure food? Or are they to live?*" (Presland 1980).

In 1861, only a few Aborigines remained in the *Jenawarra* area (Habel 1979). Habel makes reference to a grisly tale of '*early squatters herding Aborigines along the lake bank, slaughtering them and cutting off enough ears to fill a sugar bag*'. If there was such a massacre it must have occurred before 1841, 10 or more years before Wilhelm Habel and other Lutheran farmers arrived to establish small farms around the lake and Pastor Schurmann arrived to minister to his Lutheran flock.

An Aborigine Protectorate was established at Kolor (Cox's Mt Rouse Station) in 1842 and lasted until 1850. Charles Sievwright was appointed Protector in 1839 and served briefly at Kolor in 1842. The settlers were hostile when he tried to perform his duties. Eventually they, Robinson and officials in Government forced him to resign (Arkley 2000). Meanwhile, Foster Fyans and his native police from the Geelong area, led by Dana, were brought to the district to curb the freedom fighters among the Aborigine tribesmen (Brown 1986). This they accomplished by 1845, after a short and bloody war centred around the Eumeralla-Lake Condah stones area. To that end, Dana also commented in 1844 (Garden 1984) that disease had stricken the natives '*...to such a frightful extent all over the country and they are dying very fast...a few seasons as fatal to them as this has been and they will cease to exist in the country*'.

The Tabor history (Janetzki 1976) states that there were two clans in the district – the Kolor clan around Penshurst and the *Jenawarra* clan. Clark (1987) lists *Kolorer Conedeet* (Mt. Rouse), *Toorac Conedeet* (Mt. Pierrepont), *Tappoc Conedeet* (Mt. Napier), *Uelgal Conedeet* (Grange) and *Tillac Conedeet* (NW of Mt Rouse). The natives were said to be generally friendly, although after receiving gifts of food or tobacco there were instances when the men were away working when some natives returned to the camps and stole the contents. Janetzki (1976) states that '*Each clan contained some 150-200 people and they were said to congregate in main camps during the winter and disperse in small groups during the warmer months, camping near swamps and creeks. All had either died or left the district by 1870*'.

Janetzki stated further that '*there appeared to be no evidence of religion amongst these natives*'. That conclusion is understandable because the settlers had no means of comprehending the complex and vastly different spiritual life and religious beliefs of the Aborigine.

Geology and landscape

The local landscape consists of volcanic plains, rolling hills, "little mountains" and waterfalls (*see* Grimes 2000; Bennetts *et al.* 2003). The older landscape (1st Phase basalts) has a crust of basic lava 4-40 m thick, resulting from lava flows ~4 Ma ago, overlying Tertiary or Late Miocene sediments (limestone, sandstone and shales). Volcanic hills (e.g. Mt Pierrepont – *Al.low.ween*) occur sporadically, with some (e.g. Gazette Hill) surrounded by second phase basalt. The second phase of volcanic activity occurred around ~2 Ma. Young soils have formed on the stony rises and scoria cones arising from third phase eruptions 32,000 years ago (Mt. Napier – *Tappoc*) to perhaps 500,000 years ago (Mt Rouse – *Collorer*). Lava from these eruptions flowed many km, that from Mt. Rouse extending past Port Fairy and that from Mt Eccles (*Budj.bim*) flowing past Narrawong to near the island of Lady Julia Percy.

While many have thought that the lakes on the basaltic plains were formed by local slumping of the lava crust, Bennetts *et al.* (2003a) consider that *Jenawarra* sits on 1st Phase basalts and is surrounded by 2nd Phase basalt flows. Lake Kennedy lies between the 1st Phase flows from Mt Pierrepont to the west and 2nd Phase flows to the east.

The weathered second phase basalt flow on the north end of *Jenawarra* displays impressive spherical weathering of boulders at the base of the cliff (Figs. 5 & 6). The whitish splotches seen in the less-weathered basaltic rocks are felspar. The occurrence of quartz pegmatite in some rocks, and free quartz lying on the lake bed, may indicate relics of the deep bedrock that were ejected during the eruptive phase, since quartz does not occur naturally in basaltic rock.

The pieces of quartz on the lake bed may, alternatively, have been imported from the Grampians (*Gariwerd*) or Glenhompson area by Aborigines, for the manufacture of scrapers and spear points. Flints and broken tools have been found from time-to-time on the edges of the lake.



Figures 5 & 6. – Northern bank of *Jenawarra* in 2000, showing spherical weathering of basalt boulders and remnant native vegetation clinging to the cliff, beyond the reach of livestock. The fascinating pattern of weathering is shown in the smaller picture. Among the species that occur on these small cliffs are Sweet Bursaria, Scented Groundsel, Austral Pelagonium, Tree Violet, Australian Hollyhock, Blue Devils, Pink Bindweed and Bluebells.

Lunettes on the eastern margin of the lake rise ~ 4 m above the overflow level (Fig. 7) and comprise zones of clay nodules, ferruginous pisoliths and fine sands (Bennett and Webb 2004). In earlier dry epochs, fine particles of clay and sand were blown from the lake bed, perhaps covering weathered basaltic rocks of a similar form as the NW and western cliff areas. There is, or was, a lunette of sand in the Boonawah creek area. Much of this material was removed long ago for building construction purposes locally and, more recently (1970), by the Yacht Club to place on the beach near the boat ramp. Aborigines had a burial ground near Boonawah Creek.



Figure 7.

Jenawarra east bank lunette in 1982, showing *Billawyn* (Victoria Range) and *Wurgarri* (Mt Sturgeon) of *Gariwerd* (Grampians) in the background.

The HFNC tree blocks, planted from 1975 (back) to 1991 (front) are seen on the distant curve of the east bank.

Boonawah Ck lies beyond .

The lake level remained fairly high in that decade.

Except for the fenced tree blocks, the lake foreshore and banks were grazed until 2003.

Along the northern and western shores much buckshot gravel has also been removed for construction purposes by farmers and others who used it in earlier times as an ingredient in concrete. The presence of this seam is still obvious. The gravel was formed as a result of precipitation of iron salts from the weathered surface rock and deposition on the underlying clay during a former very wet epoch.

The lake may be on a presumed line of the original course of the Wannon River, from Dunkeld under Mt Napier and down Harman's Valley. Bores on the Lehmann's property on the western edge of the lake show three aquifer layers; the first in a seam of 'scoria' at around 3.4 m, the second in another layer of 'scoria' below a band of harder rock at 11.6 m and a 4.6 m thickness of coal; and the third at 27 m, below a 6 m thickness of quartz and other solid rock (Allen Lehmann, pers. comm.).

Historic water levels at *Jenawarra*

Dry periods

The Protector of Aborigines, George Augustus Robinson, found that *Jenawarra* was dry in 1841 (Presland 1977). Robinson also recorded that a part, at least, of Buckley Swamp was dry enough to walk on in 1841, but that may have been an exception since Bruni (1903) doubted whether anyone had ever crossed the morass before it was drained.

The "1877 drought" was widespread in Australia, with the worst affected areas being in SW Victoria and SW WA, where swamps dried up and even native trees died (Wallace 2003). Anon. (1882) recorded that in February 1882 *'Lake Linlithgow...is said to be drier now than has been for 15 or 16 years. In one little corner alone is clear water to be seen and even this is very shallow, probably not more than two feet at the deepest part'*. The rainfall recorded at Hamilton in the years 1877-1881 was 391, 677, 500, 671 and 681 mm (mean 584 mm), compared with the long-term mean (1869-2001) of 692 mm (Spectator 2001), and that accounts for the drying up of the lake.

Further information on the water history of the lake has been provided by Mr Allen Lehmann of 'Montrose West', Chatsworth Road. Allen's great grandfather settled at the Lake in 1861, and his father was born in the area in 1892. The lake collected water in 1887 and filled to a high level in 1890 and retained water for the next 15 years, drying up in the summers of 1902 and 1903 (Lehmann 1976). The "1902 drought", part of the dry period from 1885-1903, was regarded by some as the worst drought in Australia, however the Hamilton region was relatively little affected (Garden 1984), the annual rainfall being 637, 525, 589, 764, 742, 643 and 682 mm (mean 655 mm) for the years 1896-1902. The mean for the previous 5-year period (1891-95) was 781 mm, and 704 mm for the preceding 9-year period (1882-90). By comparison with recent history, that would not suggest that the lake should have dried out in 1902. Did Hamilton rainfall adequately reflect the rainfall in the catchment of Boonawah creek?

Long-time residents in the area state that the lake remained dry for most summers from 1902 to 1946, although a picture of a carnival scene taken in summer of 1918 shows some water in the SE area of the lake (Lehmann 1976), following quite wet years in 1915, 1916 and 1917 (736, 760 and 826 mm, respectively). The "1914 drought" was a part of another dry spell from 1911-1916 in Australia. The rainfall for the 3 years 1912-1914 at Hamilton was 622, 627 and 499 mm, respectively, so it would not be surprising if the lake was dry by Jan. 1915. The average rainfall in the preceding 9 years (1903-1911) was 734 mm so there must have been some water in the lake during winter and spring of those years. That surmise is strengthened by the fact that, in 1908-09, the Hamilton progress Association began to develop facilities at the lake. *'An area of 83 acres was set aside, which huge working bees of residents of Croxton and Hochkirch ploughed, cleared and planted trees'* (Garden 1984). The area became the scene of a large annual gymkhana but Garden (1984) states that *'from 1920-1945 the lake was going through a dry period and no longer important a reserve as it had been'*.

From the early 1900s, cattle and sheep were grazed on the lake bed, where many fences were erected. Thus, in 1910, Lehmann erected a fence about two hundred metres out from the SW corner, adjacent to the frontage which they leased, in order to contain their stock. Linke did the same further to the north. These fences, and others, remained for many years, the last remnants on the SW bay being removed by the boating fraternity in the 1980s. The presence of those fences supports the claim that the lake was dry during summer and autumn for a very long period. Habel (1979) commented that there were *'...wild weekend fox hunts across the dry lake bed'*. Laurie Hermann (pers. comm. 2008) noted that *'In the 1940s drought big tussocks grew and a lot of spotlighting of foxes took place...'*

The Lake Linlithgow School was located just west of the present entrance off Chatsworth Road, marked by a palm tree. Children from the western side of the lake would take a short cut across the dry lake bed to school. Allen, who started at the school in 1941, recalls that succulent vegetation grew on the lake bed and, where the plants grew, blown sand would accumulate, causing miniature hillocks and a very rough lake bed. That effect was observed in May 2001, near the SW corner, where sand

and clay particles drifted as far as the Chatsworth road. The vegetation is mainly the almost prostrate, succulent, Glaucous Goosefoot (*Chenopodium glaucum*), which the cattle enjoyed, together with Salt Marsh-grass (*Puccinellia stricta*) and other species.

Over the 43 years from 1903 to 1946, the range in rainfall was 499-862 mm; the mean was 690 mm, almost the same as the long-term average when, for long periods, the lake did not dry out. How can that be? Allen believes that Hamilton rainfall is not particularly relevant, because the Boonawah catchment is derived from the area between the lake and Woodhouse to the east, which has perhaps a little less rainfall. It is also possible that the early rainfall records were inaccurate.

The lake almost dried up in the drought year of 1967 (rainfall 365 mm), following a run of 5 dry years in 6 (571, 569, 546, 858, 478 and 576 mm for the years 1961-66), but retained some water over summer.

The lake dried out completely in early 1983, following a run of four dry years (621, 587, 651 and 436 mm for the years 1979-82) but filled again during 1983 when 864 mm of rain fell.

The lake did not dry out again until Feb. 2000, following 5 dry years out of 7 (644, 512, 701, 696, 496, 629, and 568 mm for the years 1993-99). Some water was regained during the winter of 2000 but the rainfall for the year was only 592 mm and the lake was dry by January and remained dry until Jul. 2001. Some water was gained in 2001, for 824 mm was received in that year. That was sufficient to maintain a low level of water in the lake throughout 2002 (Table 1 or Fig. 10).



Figure 8.

Jenawarra in Feb. 2000, from near the Habel Memorial on the south bank.

Gariwerd (Grampians) Victoria Range and Mt Sturgeon appear in the background.

The previous recent drying of the lake was in 1983. The lake also dried out in the early months of 2003-05 and remained dry through 2006.

The lake dried out again in Jan. 2003, but a film was present on 22 February as a result of 50 mm of rain over the previous 2 days – members of HFNC saw a fox trotting through the water away from the north side. That water soon evaporated and the lake remained dry until July but a max. depth of only 0.5 m of water was gained in 2003 (see Table 1) and the lake dried out again by Mar. 2004.

This pattern was repeated in 2005, when the water gained in the winter of 2004 (max. depth 60 cm at The Point marker) was lost to evaporation by Feb. 2005. *Jenawarra* remained effectively dry throughout 2005 and 2006, when 541 mm of rain was recorded for 2005 and 493 mm for 2006. The lake gained a little water in 2007 (rainfall 685 mm), with the max. depth of 27 cm at the Point Marker on 16 Nov. following late spring rains, but it was dry by 9 Feb. 2008, and Lake Kennedy by 23 Feb.

Wet periods

During the 1870s the Hamilton Spectator urged the formation of a rowing and yacht club, but there was little interest. However, church picnic and community sports days were popular at the lake. A hotel operated at *Jenawarra* at this time (Habel bought it and closed it down in 1882, ostensibly to prevent the local Aborigines from becoming intoxicated and a nuisance to the community); rowing boats were provided for entertainment and shade trees were planted (Garden 1984).

There were some years in which the lake has overflowed across Chatsworth road to the south. The first time was in 1893 and 1894 (Lehmann 1976), when the rainfall recorded at Hamilton was 930 and 907 mm, respectively (Spectator 2001). Wilhelm Habel placed large stepping stones along the Chatsworth road to enable children to reach the Linlithgow School with dry feet (Habel 1979).

In 1946 the lake filled again when 1046 mm of rain fell, ending the 43-year period of almost annual drying out of the lake over summer. According to Lehmann (1976), more than 11 inches of rain was recorded at the lake in a few days in March 1946, putting a large volume of water into the lake via Boonawah Creek. The following 3 years were also wet (872, 704 & 677 mm), with farmers finding the land too wet for good crops.

The lake overflowed again in 1951, 1952 and 1956 (Lehmann 1976), when the rainfall was 851, 972 & 784 mm, respectively. Allen recalls picking up 3-4 pound Redfin left stranded in shallow water near the Chatsworth road. In 1960, when the rainfall was 875 mm, the lake almost overflowed. Perhaps the previous 3 drier years (640, 676 & 603 mm) had reduced the water level. Alternatively, the reconstruction of the Chatsworth Road in 1957 resulted in a slightly higher mound, thus preventing the water from overflowing. According to Habel (1979), floodwaters from *Jenawarra* were diverted into Lake Kennedy in the 1950s. While the natural course would take flood waters from *Jenawarra* into the then extensive swamps to the south of Lake Kennedy, thence into Muddy Ck, a drain was cut across the fields to prevent the flooding of a shearing shed.

A shallow sheet of water was evident on Lake Kennedy in early May 2001 when *Jenawarra* was still dry, indicating that Lake Kennedy, at least, is responsive to groundwater. Groundwater levels in a bore near the *Jenawarra* are given in Table 1.

Relationship between *Jenawarra* water level and recent rainfall

An intriguing question is the relationship between rainfall and the level of water in the lake. A good set of data for the years 1995-2005 enabled a preliminary analysis of factors that affected the change in water depth in the lake (Fig. 9). For these 10 years (94 data points), of the many variations (from 1 to 24 months) of monthly rainfall investigated, the current plus previous calendar month of rainfall (from PVI, Mt Napier Rd) gave far the best prediction of the change in water depth. Some 62% of the variation could be accounted for. The variation accounted for using rainfall in (i) the current calendar month, (ii) previous month, (iii) current plus previous month, (iv) current plus previous 2 months and (v) current plus 3 previous months was 40%, 44%, 62%, 54% and 40%, respectively. Less than 20% of the variation was accounted for when rainfall over longer periods was tested.

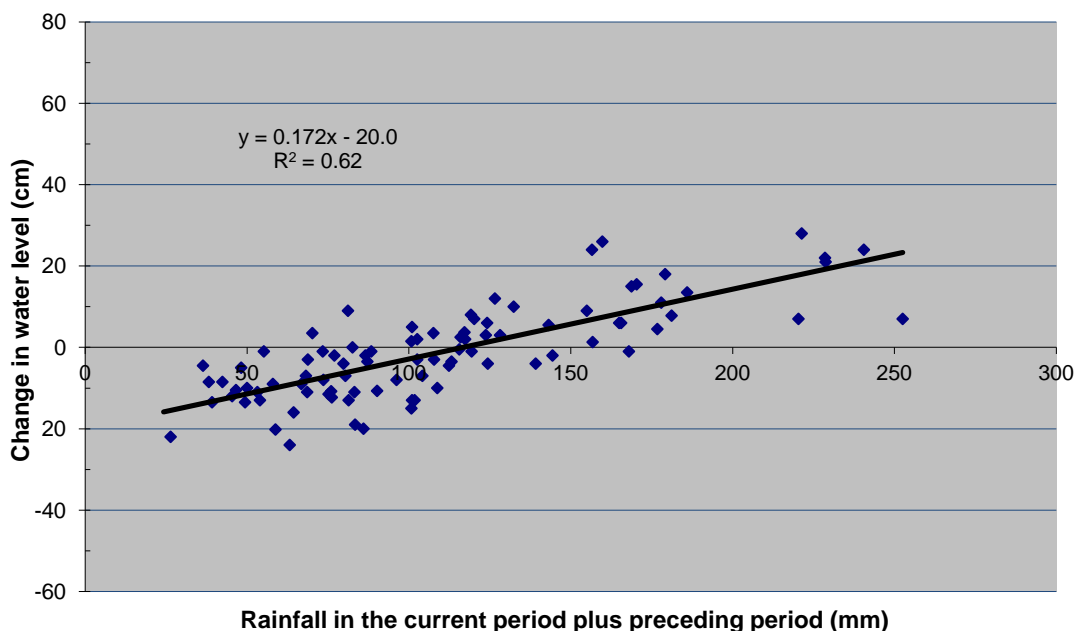


Figure 9.
Relationship between rainfall in the month plus preceding month, and change in lake level, 1995-2005.

On average, the water level rises when rainfall in the month in which depth is measured, plus the previous month, exceeds 115 mm. It drops 20 cm when little rain falls in that period. On average, the water level rises 4.5 cm for each 25 mm (1 inch) of rain that falls (or 1.8 cm per 10 mm rain).

Oddly, including summer/autumn & winter/spring rainfall as variables (approximate surrogates for temperature, evaporation & run-off potential) improved the prediction by only 2.5%.

A further analysis was made using the entire range of available data, from 1964-2005 (Fig. 10). The results were more variable but the same general conclusion was obtained – the slope and intercept of the regression line is virtually the same as in Fig. 9. The water level rises when more than 118 mm of rain is received in the current and previous month and it drops 20 cm when little rain is received. The water level rises, on average, 4.2 cm for every 25 mm of rain (or 1.7 cm for every 10 mm of rain).

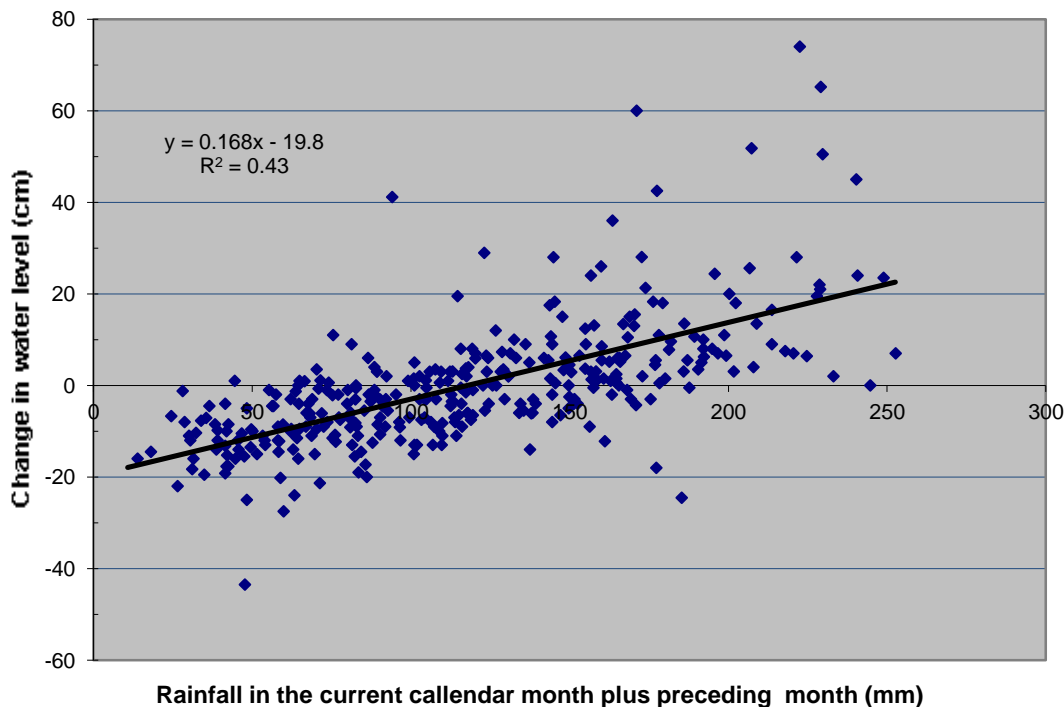


Figure 10.
Relationship between rainfall in the monthly period plus preceding month, and change in lake level, 1964-2005.

The water level data recorded for *Jenawarra* by SR&WSC (1964-95) were derived from gauges in the south bay near Chatsworth Rd. Thiess Services used a gauge in water off The Point (1995-). For the early records, one marker (no longer present) placed out in the bay indicated a near-dry lake when the water was at 1.35 m, the base of the gauge. One marker now reads 2.0 m at the ground. When the lake has water, that gauge gives the same surface water reading as the marker that was installed at The Point in 1995. However, the ground depression at The Point means that the base there is at 1.39 m, corresponding to a level at which the lake is almost dry. From observation and past records we assumed a gauge value of 1.30 m to represent the dry lake when calculating water depths (Fig. 12). Bennetts and Webb (2004) used a value of 1.15 m, giving 15 cm greater depths.

Salinity and water depth in *Jenawarra* & Lake Kennedy

Jenawarra was fresh and Lake Kennedy was salty in 1876, according to Habel (1979). The salinity of Lake Kennedy water was 150 dS/m in 1964 (State Rivers & Water Supply Commission 1977). Thiess Services (courtesy of Senior Hydrographer Barbara Dworakowski) kindly provided data from the former SR&WSC files for the period 1964-1995, and data from Thiess collected from 1995-2005 (Table 1). These data are presented in Figs. 9-12. Lake levels ranged from 0-3.0 m. Lake pH (8.3-9.9), temperature (7-31°C) and turbidity are also shown in Table 1 for the 10-year period.

The data shown in Fig. 11 for water salinity can be related to the data for water depth in Fig. 12. When there is at least a moderate depth of water (>0.5 m) the salinity level ranges from about 5-25 dS/m. When the lake dries below 0.5 m the salinity can exceed that in sea water (50-60 dS/m).

One mechanism for the removal of salt from *Jenawarra* or Lake Kennedy could be a massive outwash of salt on the rare occasions when the lake does overflow. Evidence that this happens is provided by historic accounts (Habel 1979) of regular salt harvesting on Lake Kennedy by farmers of the district, for home and stock use. Laurie Herrmann (pers. comm.) notes that '*My mother remembered salt being bagged in the 1914 drought on Lake Kennedy*'. Allen Lehmann (pers. comm.) also recalls local farmers bagging the salt in 1942 which, in parts, formed a crust several inches thick on the lake bed. Floods in 1946, 1951, 1952 and 1956 may be the reason there are no large deposits present now in that terminal lake.

Figure 11. Salinity (EC units, dS/m) of a spot-sample of water in *Jenawarra* (1964-2005).

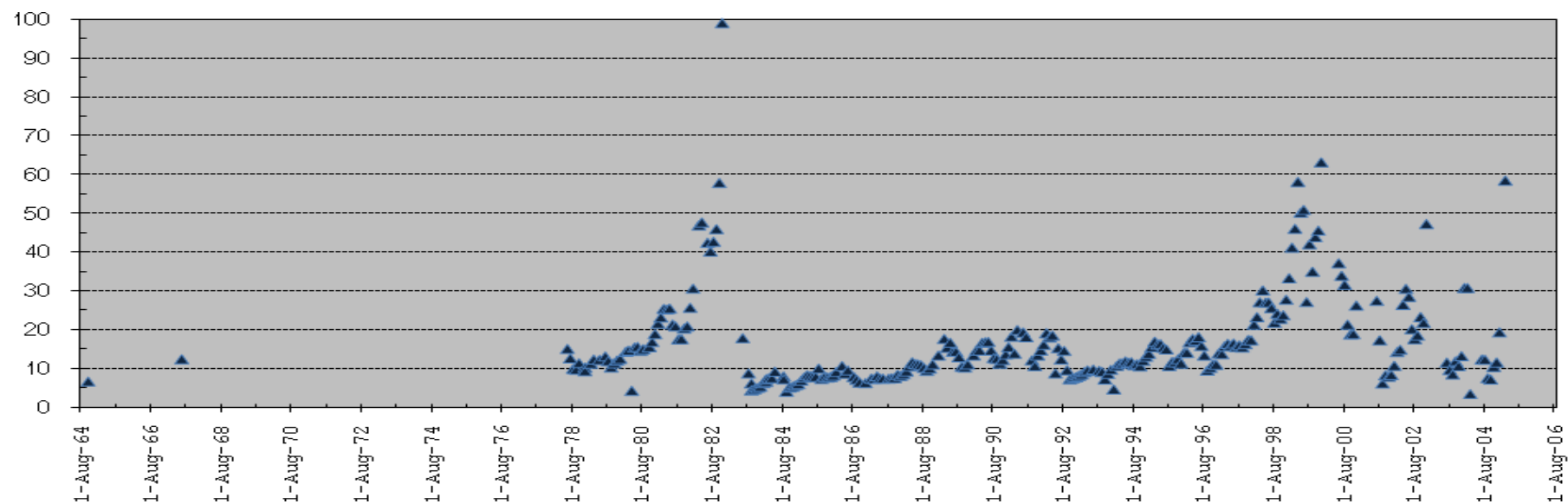


Figure 12. Depth of water (m) in *Jenawarra* (1964-2005).

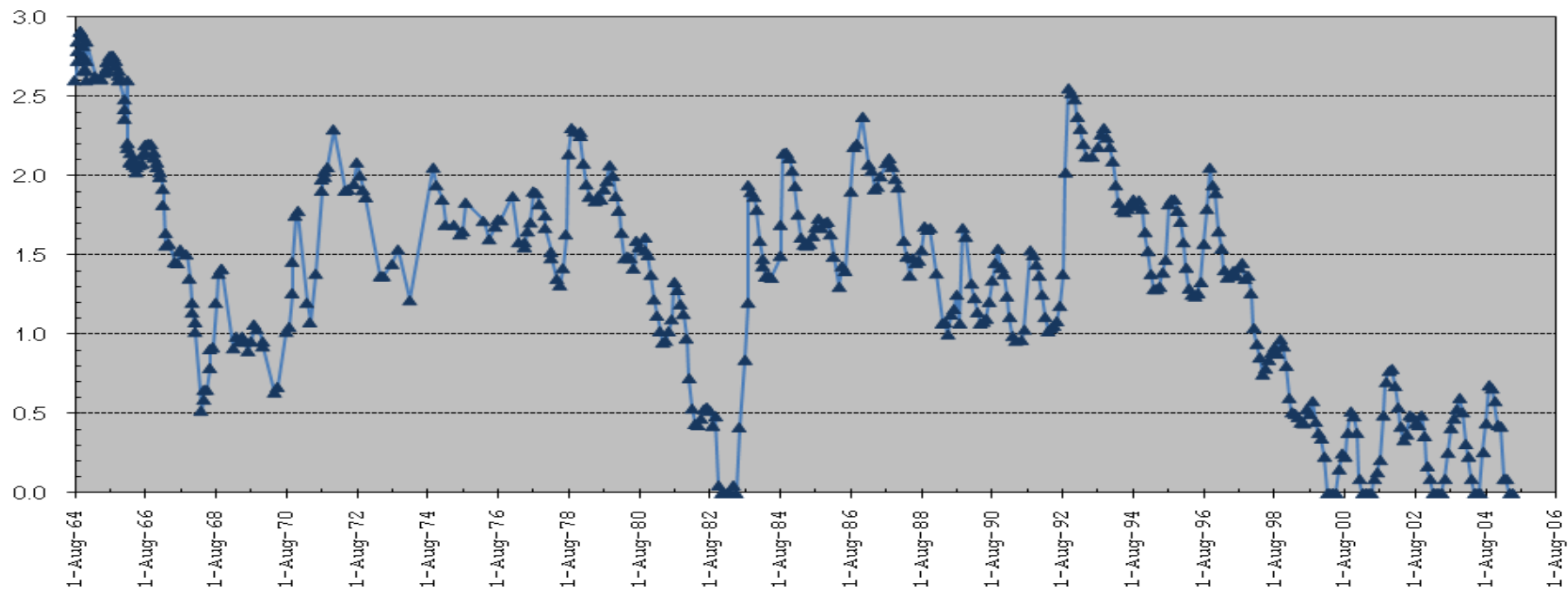


Table 1. Jenawarra water data for the years 1995-2005 (Thiess Services).

Date	Water depth (m)	EC (dS/m)	Turbidity	Temp (°C)	pH	DO (mg/L)	PVI Rain (mm)	Water depth in bore (m)
11-Jul-95	1.38	14.77	200	8.5	8.8	10.7	110.6	
9-Aug-95	1.73	10.47	45	7.5	8.9	11	67.4	
13-Sep-95	1.76	11.56	120	13	9.2	9.3	56.4	
10-Oct-95	1.76	11.49	66	13.5	9.2	9.6	26.2	
14-Nov-95	1.69	12.25	29	19.5	9.2	8.9	42	
11-Dec-95	1.62	11.16	16	16	9.2	10.1	38.4	
8-Jan-96	1.49	13.88	31	19.5	9	6.9	43	
12-Feb-96	1.33	13.92	65	13.5	9	9.4	21.4	
19-Mar-96	1.2	16.64	215	14.5	8.6	9.6	32.6	-6.17
16-Apr-96	1.16	17.50	27	13.7	8.9	9.7	47.2	
21-May-96	1.15	17.10	34	13	8.9	9.7	8	-6.4
19-Jun-96	1.17	17.95	140	11	8.6	9.9	94.6	
15-Jul-96	1.24	15.68	26	7	8.9	10.9	125.8	
21-Aug-96	1.48	13.23	42	8.4	9	11.8	114.8	-6.35
16-Sep-96	1.7	9.32	98	11	8.9	10.2	113.8	
15-Oct-96	1.96	10.06	125	18	8.4	8.7	46	
19-Nov-96	1.85	10.95	22	17.5	8.8	9.4	22.6	-5.87
10-Dec-96	1.8	10.84	17	17	8.9	9.4	25.6	
22-Jan-97	1.56	13.78	36	25.8	8.9	8.4	37.6	
18-Feb-97	1.45	13.53	110	30.5	8.9	7	15.6	-6.05
24-Mar-97	1.315	15.60	95	13.8	9	9.1	23.6	
17-Apr-97	1.27	16.24	31	16	9	9.4	12.8	
15-May-97	1.285	15.72	13	11.2	9	9.4	88	-6.3
18-Jun-97	1.31	16.32	21	12.5	9	12.4	28	
15-Jul-97	1.28	15.45	215	8.5	9	10.5	40.8	
20-Aug-97	1.33	15.84	8	10.1	8.9	10.4	60.2	-6.41
17-Sep-97	1.36	15.26	25	15.5	9.1	11.4	68	-6.48
21-Oct-97	1.26	16.13	17	19	8.9	9.7	40.8	-6.53
19-Nov-97	1.28	17.22	39	14.1	9	8.9	76.6	-6.48
9-Dec-97	1.17	17.16	14	21.8	9	8.6	6.6	-6.53
20-Jan-98	0.95	21.12	28	16.5	9.1	9.1	19.8	-6.6
16-Feb-98	0.85	23.12	15	15.5	9	8.4	30.2	-6.62
10-Mar-98	0.765	26.95	14	17	9.4	7.3	12.2	-6.72
17-Apr-98	0.658	29.99	10	12.5	9.1	9.1	78	-6.85
12-May-98	0.695	26.86	17	10	9.1	8.5	39.2	-6.84
15-Jun-98	0.75	26.90	83	7	9.1	9.8	104	-6.9
16-Jul-98	0.795	25.46	9.1	5.5	9.1	10.2	72.8	-6.92
17-Aug-98	0.83	21.65	17	12	8.5	11.2	34.8	-6.91
15-Sep-98	0.79	24.00	130	9.5	9.2	10.6	89.6	-6.86
21-Oct-98	0.88	22.63	24	17.3	9.6	9.9	65.4	-6.93
17-Nov-98	0.835	23.60	17	15.5	9	8.2	47	-6.9
16-Dec-98	0.712	27.60	41	15	8.9	10	29.2	-6.94
19-Jan-99	0.51	33.15	5.1	17.5	9.2	7.1	29.6	-7.01
15-Feb-99	0.42	41.04	14	19.5	9	6	28.4	-7.04
22-Mar-99	0.41	45.89	50	12	9.1	8.5	60	-7.13
20-Apr-99	0.39	57.96	49	14.4	9.1	10.3	17	-7.21
17-May-99	0.355	50.03	24	5	9.1	12.7	70.2	-7.24
8-Jun-99	0.35	50.74	100	10	9	8.6	45.4	-7.28
19-Jul-99	0.44	27.00	300	7.5	9.3	9.2	35.8	-7.23
16-Aug-99	0.41	41.88	56	9	9.1	8.6	66.8	-7.3
21-Sep-99	0.49	34.80	94	12	9.2	10.1	52.4	-7.15
20-Oct-99	0.36	43.72	175	14.5	9	8.4	48.6	-7.32
15-Nov-99	0.29	45.43	170	12.5	9.3	8.2	55.6	-7.34
13-Dec-99	0.255	63.00	110	17	8.8	8.8	57.6	-7.4
19-Jan-00	0.14						17.6	-7.41
16-Feb-00	0						12.6	-7.5
22-Mar-00	0						11.6	-7.61
26-Apr-00	0						69.6	-7.69
17-May-00	0						104.4	-7.68
19-Jun-00	0.06	37.00	4	9	9.1	11.8	51.8	-7.61
19-Jul-00	0.16	33.80	16	8	9.3	11.1	80.6	-7.6
16-Aug-00	0.14	31.44	13	14	9.4	11.5	63.8	-7.6
19-Sep-00	0.29	21.18	360	14.5	8.8	9.9	105	-7.49
17-Oct-00	0.425	18.61	130	10.5	9.2	9.4	81	-7.4
22-Nov-00	0.395	18.75	275	15.5	9.2	7.5	26.8	-7.33
11-Dec-00	0.29	26.09	120	19	9.5	8.7	19.8	-7.31

Date	Water depth (m)	EC (dS/m)	Turbidity	Temp (°C)	pH	DO (mg/L)	PVI Rain (mm)	Water depth in bore (m)
17-Jan-01	0						12.8	-7.42
19-Feb-01	0						26.2	-7.55
20-Mar-01	0						65.2	-7.61
12-Apr-01	0						68.2	-7.68
14-May-01	0						28.6	-7.66
18-Jun-01	0						56.4	-7.65
17-Jul-01	0.042	27.31	18	8	8.8	9.7	38.4	-7.61
21-Aug-01	0.12	17.13	11	5.5	9.1	11.5	142.8	-7.49
11-Sep-01	0.4	6.00	55	12.5	8.8	8.3	78.6	-7.38
17-Oct-01	0.61	8.09	145	13.5	9.3	10.1	150.2	-7.11
15-Nov-01	0.68	7.76	36	14	8.9	10.8	102.4	-6.98
4-Dec-01	0.693	8.17	115	19	8.9	11.8	54.4	-6.94
10-Jan-02	0.585	10.55	30	27	9.1	14.4	21.6	-6.9
13-Feb-02	0.45	14.10	220	25.5	9	10	27.8	-6.91
7-Mar-02	0.33	14.67	70	20.9	9.2	9	17.6	-6.97
8-Apr-02	0.245	26.27	90	12.5	8.7	8.8	20.6	-7.04
8-May-02	0.28	30.42	210	17.5	9.2	9.2	49.6	-7.1
6-Jun-02	0.4	28.35	245	9	9.3	8.5	77	-7.12
16-Jul-02	0.39	20.00	326	7	8.9	10.6	91	-7.02
13-Aug-02	0.35	17.45	170	6.5	8.3	10.9	48.2	-6.83
19-Sep-02	0.34	18.38	250	12	9	8.8	71.2	-6.83
22-Oct-02	0.4	23.13	150	15	9	7.6	53	-6.79
13-Nov-02	0.27	21.60	330	10	9.3	10.4	48.8	-6.87
18-Dec-02	0.08	47.13	170	31	8.8	7.3	34.6	-6.95
27-Jan-03	0						43.8	-7.12
10-Feb-03	0						56.2	-7.16
11-Mar-03	0						63.2	-7.24
9-Apr-03	0						29.2	-7.24
9-May-03	0						23.2	-7.35
5-Jun-03	0						110.2	-7.31
8-Jul-03	0.165	11.40	23.5	9.5	9	10.6	76.4	-7.31
27-Aug-03	0.32	9.48	220	13	8.7	10.6	94	-7.19
16-Sep-03	0.38	8.32	463	13.5	8.8	10	71.6	-7
23-Oct-03	0.44	11.75	607	12	8.5	10.1	93.4	-6.87
3-Nov-03	0.51	10.48	96	14.5	7.9	10.1	26.8	-6.87
2-Dec-03	0.42	13.07	148	14	7.7	9.3	40	-6.94
21-Jan-04	0.22	30.62	1855	25.5	9	8.9	46	-6.89
12-Feb-04	0.14	30.64	148	30.5	8.7	10	27.6	-6.9
9-Mar-04	0	3.27	368	16	9.9	8.6	64	-6.96
29-Apr-04	0						39.6	-7.14
4-May-04	0						46	-7.15
7-Jun-04	0						138.6	-7.18
15-Jul-04	0.17	12.18	103	6.5	9.1	11.2	75	-7.1
19-Aug-04	0.35	12.13	660	10	8.3	9	104.2	-7.01
20-Sep-04	0.59	7.37	55.5	12	8.4	9.2	52.4	-6.74
5-Oct-04	0.57	7.04	47	17	8.8	10.5	34.2	-6.8
10-Nov-04	0.49	10.29	233	15	8.4	8.8	62	-6.65
1-Dec-04	0.34	11.42	345	18.5	8.4	8.5	38.8	-6.67
11-Jan-05	0.33	19.19	105	20	9.1	8.4	34.6	-6.78
3-Feb-05	0						68	-6.74
2-Mar-05	0	58.32	2133	22	9	6.3	15	-6.71
14-Apr-05	0	14.77					24.8	-6.89
12-May-05	0	10.47					25.2	-7.13

Bennetts and Webb (2004) describe *Jenawarra* as moderately saline (median 12.7 dS/m) and alkaline. They conclude, from modelling studies, that there is limited removal of salt via leakage into groundwater in the Phase 1 basalt and that the most likely mechanism preventing an increasing accumulation of salt in the lake is the removal of dry salt from the surface by wind when the lake dries out.

While wind will remove some salt from the dry surface of the lake, a major mechanism not considered by Bennetts and Webb is the outwash of dissolved, accumulated salt when *Jenawarra* and Lake Kennedy overflowed, as in 1946, 1951, 1952 and 1956. Since those floods there has not been an accumulation of surface salt to the extent seen in the early days (e.g. reports from 1914 and 1942) when farmers bagged up salt from deposits in Lake Kennedy.

Rainfall and water levels in *Jenawarra* in February, from 1983 to 2019

Year	Depth in Feb. (cm)	Annual Rain(mm)
1983	0	864
1984	158	704
1985	176	711
1986	164	689
1987	220	598
1988	174	595
1989	122	622
1990	138	634
1991	126	660
1992	126	870
1993	245	644
1994	209	512
1995	153	701
1996	133	696
1997	145	496
1998	85	629
1999	42	568
2000	0	592
2001	0	727
2002	45	532
2003	0	719
2004	14	687
2005	0	428
2006	0	434
2007	0	685
2008	0	540
2009	0	564
2010	0	737
2011	80	713
2012	46	553
2013	30	562
2014	16	488
2015	0	471
2016	0	838
2017	114	672
2018	110	565
2019	107	
Long term average rain (mm)		680

The table lists the annual rainfall data (mm) and maximum lake water depth in February from the year we began our annual surveys here.

Note that the annual rainfall is read at the end of December whereas the entry for lake water depth is in February nearly two months later. One should, therefore, check the current year water depth with the previous year's rainfall (e.g. Feb. 2019 water depth and 2018 rainfall).

The annual rainfall in 16 years from 1983 to 1998 inclusive was 664 mm (range 496-864 mm) and the lake was never dry in February. The max. depth of water in mid-Feb. 1984-99 was 126-245 cm (ave. 152 cm).

The annual rainfall in 20 years from 1999 to 2018 inclusive was 603 mm (range 428-838 mm) and the lake was dry in 11 years. The maximum depth of water in mid-Feb. 2000-2019 was 0-114 cm (ave. 28 cm).

These data show the episodic nature of our climate. *Jenawarra* is a sink for water falling on the catchment and the increases in water level reflect changes in rainfall. Evaporation and internal drainage to aquifers result in water levels dropping. Except in rare circumstances (such as occurred in the 1946 and the 1960s) there is no overflow from the lake, or pumping for agricultural or industrial purposes. Note that Wannon Water currently permits water to be pumped from Lake Bulrush, e.g. by contractors engaged in road making. That has a significant adverse environmental impact when water levels are low and a large volume of water is extracted, as in 2015.

A fairly small change in average rainfall (61 mm) between these periods has a large impact on the average summer water level (a difference of 124 cm). Thus, a difference of 1 mm in annual rainfall results, on average, in a change of 2 cm in the level of the lake in February. Factors such as the incidence of the rainfall and summer temperatures will modify this general relationship between annual rainfall and February water level and there will be substantial differences among years.

Water sports on Jenawarra

The lake has been used by motor boats and yachts. An early record was the 'Lady of Linlithgow', a sailing boat capable of carrying 20 passengers that was brought to the lake in 1890 and stayed there for about 7 years before it was wrecked in a storm and sank near Boonawah Ck (Lehmann 1976).

By the 1920s the lake was a venue for many gymkhanas. The sports included the Lake Linlithgow Cup for draught horses, catching the greasy pig, football in the lake waters, and diving for a wild duck whose wings had been clipped (Habel 1979). Laurie Herrmann recalls that race meetings were held under the auspices of the Hamilton Race Club and that one year his uncle won the draught horse cup.

After the flood of 1946, water sports returned to the lake. Laurie Herrmann noted (pers. comm.) *'When the flood came a sailing club was formed and big speed boat carnivals took place. Two boys were drowned when an aeroplane belly-tank was swamped in the wake of a speed boat'*.

Sheds were erected near The Point. In about 1958, weed developed in the lake and eventually caused the cessation of all boating. Attempts to remove the weed failed. However, in 1973 the weed disappeared and the speedboats and yachts returned to the lake (Lehmann 1976). During those wet years speedboats also used the shallow Lake Bulrush, for a time called Lake Swallow by the boating fraternity when Swallow & Ariell (a biscuit manufacturer) sponsored a carnival.

In 1976 a boat ramp was constructed on the south shore, beside The Point, and the stone for the ramp came from Allen Lehmann's farm to the west of the lake. In June 1977, members of the Yacht Club carted sand from 2 pits on the bank near Boonawah Creek to put on the beach near the ramp. This work was suspended when an Aborigine burial site was found. The boat ramp on the north shore was built a few years later, after a conflict between users of power boats and yachts in the southern area.

Birds of Jenawarra and wetlands nearby

Anon. (1882a) describes *Jenawarra* in Feb. 1882, then almost dry after a drought:

'...as for game, there are myriads of ducks, hundreds of swan, geese, plover, pelicans and during the morning and evening, native companions in great number. Unfortunately no shooter can get near enough to them to shoot'.

Anon (1882b) describes the scene 2 months later:

'During the last few weeks farmers in the Lake Linlithgow district have been busily engaged in burning stubble, and the burnt fields are now the haunt of native companions and plover. These can be counted by the thousand and can easily be brought in range by the sportsman creeping up to the bank of the lake. As the much talked of turkeys [Bustard] are conspicuous by their absence, and native companions, if properly bled, buried etc. are not bad eating, a profitable hour's sport can be obtained by those who would follow the directions given. In one flock of native companions seen on Thursday week, there could not have been fewer than a thousand birds'.

Anon (1882c) describes the scene after rain fell in April and May:

'...there are now several patches of water instead of one. These are covered with thousands of wildfowl, swans, geese, duck, teal etc who swim about in the greatest of safety, as owing to the slime and mud they cannot be approached either by boat or foot'.

The lakes are frequented by 12 species listed by either the **Japan Migratory Bird Agreement** (JAMBA) or **China Migratory Bird Agreement** (CAMBA): Red-necked Stint, Latham's Snipe, Eastern Cattle Egret, Great Egret, Common Greenshank, Marsh Sandpiper, Sharp-tailed Sandpiper, Common Sandpiper, Curlew Sandpiper, Bar-tailed Godwit, Pectoral Sandpiper and Glossy Ibis (DCNR 1993).

The HFNC has visited the lake in most years since 1962, usually in February, to view or to count the water birds and birds of prey. In the 1960s Murray Gunn provided the first systematic observation of birds on these wetlands. His records constitute a large part of Table 2 and the early club reports.

Murray Gunn's recollections of birdwatching at Lake Linlithgow, Lake Kennedy and other nearby wetlands in the 1960s, 1970s and later

The first time I recorded the birds I observed at Lake Linlithgow was in February 1962. From that date until Oct. 1995 I recorded the species at the lake and the other nearby water bodies on 296 visits. The visits were much more frequent in the earlier years of this period and there were a number of highlights among my observations then which are listed in the following table.

Wetland	Date	First sighting
Harnath Swamp	Nov. 14 th 1963	Common Sandpiper
Lake Linlithgow	Feb. 8 th 1967	Bar-tailed Godwit
Lake Linlithgow	Feb. 8 th 1967	Gull-billed Tern
Lake Linlithgow	Nov. 14 th 1967	Common Greenshank
Lake Linlithgow	Nov. 19 th 1967	Marsh Sandpiper
Lake Linlithgow	Nov. 17 th 1972	Pacific Golden Plover
Lake Linlithgow	Jan. 24 th 1973	Pectoral Sandpiper

Another item of interest from my visits is that between Aug. 1999 & Nov. 2011 I forwarded 43 record sheets for the various Birds Australia Atlas projects.

At various times large numbers of Freckled Ducks, Blue-billed Ducks, Glossy Ibis, Brolgas, Red-necked Avocets, Banded Stilts, Double-banded Plovers & Curlew Sandpipers were seen. I did not record the number of birds with the accuracy of surveys carried out after 1984 by Rod and Steve and later by Jane Hayes.

In Feb. 1970 the Hamilton Field Naturalists Club invited Roy Wheeler, the long-standing secretary of the Bird Observers Club of Australia, to speak and because of his standing we hired a large hall for what turned out to be a very well attended and successful presentation.

Roy and his wife stayed with us and on the following Saturday the Hamilton Field Naturalists Club had an excursion to Lake Linlithgow. Roy was most impressed that he was able to record 50 species of birds for the morning at the lake and its environs and suggested that there would be few areas that could match this. I am fairly sure that these days there are a number of other sites that would be equally or more productive, but we were very impressed to hear such a respected figure in the birding world offer such an opinion of a particular place within our local area.

While I have mentioned the various rare sightings that have appeared from time-to-time I think the period from February 1962 to April 1977 when Cape Barren Geese were often seen was a particularly interesting time.

In 1965 Graham Pizzey, well known naturalist, and author wrote an article in the Herald or The Age newspaper stating that Dr Doug Dorward from Monash University had instigated a research project that involved fitting red plastic neck bands on about 600 Cape Barren Geese captured mainly on Flinders Island in Bass Strait. It was hoped that when the geese made their annual journey to Victoria in their non-breeding season some would be seen by local birders and other interested people. Their reports would provide information on the movements of the birds within Victoria.

Although Cape Barren Geese were seen in their normal numbers in 1965, none with red neck bands were observed. Graham Pizzey noted this in his article but wrote that the project would be tried again in 1966, and would anyone sighting geese with neck bands let him or Dr Dorward know.

I had often seen Cape Barren Geese on previous occasions, usually on or near Lake Kennedy. The last occasion before November 1966 was on Mar. 2nd of that year. On Nov. 5th I had two birding friends from Melbourne visiting; Anne Raymond and Roger Cowley, a respected birder, and we went to Lake Kennedy in the hope of finding the geese. I was able to locate several birds on a far shore but they, fortunately for us, took off and flew across the lake giving us a closer view. Anne said 'look, they have got collars on' and indeed they did. The most interesting thing was that the collars were not red but white.

I dropped a note to Graham Pizzey who came down within a week or two to verify the sighting and I was able to find the collared geese again. Graham of course was most impressed and wrote the about this episode in another article.

Red-collared birds had been expected as it was assumed that our birds came from the Bass Strait islands. The white-collared birds, which also had black bands on their left legs, were from a group of 75 birds banded on islands in the Sir Joseph Banks group off South Australia. This was an undoubted case where bird-banding, or collaring in this example, had enabled bird enthusiasts to learn more of the seasonal movements of birds. Here the results had also overturned a previous assumption about the source of the visiting Cape Barren Geese.

The photo below by Graham Pizzey shows the white collars of Cape Barren Geese from the Neptune group of islands seen flying over Lake Kennedy in 1966.



This photo below shows Cape Barren Geese grazing a pasture near a beach on Churchill Island in Nov. 2011.



A summary of sightings made and reported by HFNC members is presented below for the years 1960-1984. For the years following 1984 more systematic data is available and is presented in Tables 4-6.

Notable bird sightings from 1960 to 1984 from the Minutes Book of HFNC

- Nov. 1960 – a flock of Australian Pelicans flying between Lakes Kennedy & Jenawarra.
- Summer 1961 – 50-70,000 Black Swan, and a great number of Grey Teal, were seen on Lake Kennedy. The birds were feeding on Fennel Pondweed (*Stuckenia pectinata*), whereas Sea Tassel (*Ruppffia maritima*), which infested Jenawarra, was not so popular.
- Apr. 1961 – 10 Cape Barren Geese at Lake Kennedy. By June, Black Swan numbers shrunk to 25-30,000, together with ~20,000 Grey Teal, when there was green grass available elsewhere.
- Mar. 1962 – Cape Barren Geese were reported from Lake Kennedy.
- Apr. 1964 – Linlithgow still heavily stocked with waterfowl but Kennedy so low that Black Swans unable to use it.
- Dec. 1965 – a few Cape Barren Geese at Lake Kennedy.
- Feb. 1966 – 16 Cape Barren Geese at Lake Kennedy; 25 on 3 Mar. and 112 on 13 Mar. Some remained until July, with Sharp-tailed Sandpipers, Red-necked Stints and Red-capped Plover.
- Nov. 1966 – 12 Cape Barren Geese at Jenawarra, 4 with yellow collars from banding on the Neptune group of islands off South Australia [Laurie Herrmann (pers. comm.) saw 15 Cape Barren Geese near Boonawah Creek in about 1952, so the birds had been around for some time].
- Feb. 1967 – 12 Cape Barren Geese at Kennedy. 17 waterbird species were seen at Jenawarra; 12 White-faced Heron, 3 Whiskered Tern, 3 Red-capped Plover, 6 Straw-necked Ibis, 20 Black-fronted Dotterel, 20 Pied Stilts, ~50 Pink-eared Duck & ~20 Pacific Black Duck. Silver Gulls, Masked Lapwing, Hoary-headed Grebes and Australian Shelduck 'very common'. Eurasian Coots, Black Swan, Australasian Shoveler and Grey Teal all 'common'. Raptors seen were Brown Goshawk, Whistling Kite, Brown Falcon and Nankeen Kestrel.
- Jan.-Feb. 1968 – '*Lake Linlithgow drier than ever seen*'. Birds seen included 1 Red-necked Avocet, 1 Curlew Sandpiper, 1 Double-banded Plover, 3 Cape Barren Geese, ~20 Brolga, 100s of Red-capped Plovers, 100s or 1000s of Sharp-tailed Sandpipers, large flocks of Australian Shelduck but few other ducks and none of the Whiskered Terns or Pied Stilts seen in Dec. 1967.
- Dec. 1968 – 1 Eastern Cattle Egret seen at Jenawarra.
- Feb. 1969 – 2 Royal Spoonbill and 1 Yellow-billed Spoonbill at Jenawarra. At Lake Kennedy, 3-7 Cape Barren Geese were seen.
- Mar. 1969 – 20 species of waterbird at Jenawarra, with 12 Brolga and 2 Cape Barren Geese. Other species were Double-banded Plover, Red-capped Plover, Black-fronted Dotterel, Red-necked Stint, Chestnut Teal, Australasian Shoveler, Masked Lapwing, Australian Shelduck, Black Swan, Grey Teal, Hoary-headed Grebe, White-faced Heron, Eurasian Coot, Pied Stilt, Whiskered Tern, Maned Duck, Pink-eared Duck, Pacific Black Duck. Raptors seen were Brown Goshawk, Whistling Kite, Swamp Harrier, Brown Falcon and Black-shouldered Kite.
- Apr. 1969 – 50 Double-banded Plover at Jenawarra.
- Mar. 1969 – 12 Brolga, 2 Cape Barren Geese and 18 other waterbird species seen.
- Mar. 1970 – 38 and 43 Brolga seen at Jenawarra on separate occasions
- Apr. 1970 – 1000s of Pink-eared Duck at Jenawarra; Australasian Shoveler, Hardhead and Blue-billed Duck also seen.
- Feb. 1971 – Cape Barren Geese, Double-banded Plover, Banded Stilt, Red-necked Stint and Blue-billed Duck at Jenawarra, with 2 Sharp-tailed Sandpiper at Kennedy.
- Feb. 1972 – waterbird numbers down on last year. Pied Stilts seen.
- Dec. 1972 – 40 Glossy Ibis at Jenawarra.
- Feb. 1973 – Pectoral Sandpiper at Jenawarra, with Australian Pelicans, Double-banded Plover & Masked Lapwings; 4 Cape Barren Geese at Lake Kennedy.
- Feb./Mar. 1974 – 14 waterbird species present at Jenawarra – '*poorest year for species, with a low variety of duck*' – ~100 Pacific Black Duck, a few score Australasian Shoveler, 100 Australian Shelduck, many Grey Teal, 1 Musk Duck and several Blue-billed Duck present. Hoary-headed Grebe and Eurasian Coot usually in 1000s but now only a few of each. Few waders there but 100s at Lake Kennedy, mostly Red-necked Stint. There were ~700 Black Swan, several hundred Silver Gull, 20-30 White-faced Heron, several Hoary-headed Grebe, ~20 Red-capped Plover and a few Double-banded Plover.
- Mar. 1975 – 16 waterbird species seen at Jenawarra – 50 White-faced Heron, 2 Yellow-billed Spoonbill, 2 Great Crested Grebe, 2 Hoary-headed Grebe, 800 Black Swan, 200 Pacific Black Duck, 200 Australian Shelduck, 3-400 Maned Duck, 500 Grey Teal, 2 Chestnut Teal, 100 Pink-eared Duck, 100 Australasian Shoveler, 300 Musk Duck, 100 Silver Gull, 40-50 Red-capped Plover, 2 Double-banded Plover.

- Sept. 1975 – Australian Pelicans over *Jenawarra*.
- Oct. 1975 – 6 Red-necked Avocets and ibis at *Jenawarra*
- Feb. 1976 – 6 Cape Barren Geese on west side of *Jenawarra*, 10 Red-capped Plover (and a nest).
- Nov. 1976 – Red-necked Stint and Curlew Sandpipers at *Jenawarra*.
- Feb. 1977 – not many birds seen at *Jenawarra*. These included 26 Australian Pelican, Pink-eared Duck, Black Swan, Double-banded Plover, Australasian Grebe, Cape Barren Geese, Musk Duck, Grey Teal, Australian Shelduck, White-faced Heron & Silver Gull.
- Apr. 1977 – 2 Cape Barren Geese at *Jenawarra* and 2 Brolga at Kennedy.
- Feb. 1978 – 17 waterbird species seen at *Jenawarra*: Australian Shelduck, Musk Duck, Blue-billed Duck, Pink-eared Duck, Plumed Whistling Duck, Grey Teal, Black Swan, Australasian Grebe, Hoary-headed Grebe, Red-capped Plover, Eurasian Coot, Red-necked Stint, Masked Lapwing, Straw-necked Ibis, Silver Gull, Australian Pelican & White-faced Heron.
- Feb. 1979 – 2 Common Sandpipers seen at *Jenawarra*.
- Feb. 1980 – 200 Great Crested Grebe milling together at *Jenawarra* & 2 Brolga near Lake Bulrush.
- Mar. 1980 – thousands of waterbirds at *Jenawarra* (the most members could recall), including Pink-eared Duck (1000), Hoary-headed Grebe, Eurasian Coot, Red-necked Stint, Freckled Duck, Australian Shelduck (huge flocks), Pied Stilt, Double-banded and Red-capped Plovers. A Spotted Harrier, Swamp Harrier and Black Falcon were seen nearby. Also, 11 Brolga on Lake Bulrush, along with 1000 Red-necked Avocet, and Yellow-billed Spoonbills on Krause Swamp.
- Feb. 1981 – 16 waterbird species seen at *Jenawarra* (*‘the masses of birds from last year were missing but some notable birds were seen’*). These included 1 Common Sandpiper, 3 Curlew Sandpiper, 77 Australian Pelican, Red-necked Stint, Double-banded Plover, Red-capped Plover, Australasian Grebe, Hoary-headed Grebe, Australasian Shoveler, Musk Duck, Black Swan, Masked Lapwing, White-faced Heron, Straw-necked Ibis and very large flocks of Australian Shelduck. Notable raptors seen were Black Falcon, Spotted Harrier & Black-shouldered Kite.
- Nov. 1981 – Great Crested Grebe, Australian Pelican and Red-necked Avocets at *Jenawarra*.
- Feb. 1982 – very low water level at *Jenawarra* and very few birds present, including a complete absence of Eurasian Coots. Birds seen were Australian Pelican, Red-necked Avocet, Pink-eared Duck, and Chestnut Teal. A significant raptor sighted was an Australian Hobby.
- Feb. 1984 – *“a Black Kite was the most interesting bird seen at Lake Linlithgow”*.

Figure 13.

Royal and Yellow-billed Spoonbills on the lake and Australian Shelduck and Black Swans flying in Feb. 2005.

View north from near the old windmill on the SE corner. The water level was very low.



Notable bird sightings from 1985-2008 (excluding any noted in Tables 4 & 5)

- * Feb. 1985 – White-fronted Chat, Brown Thornbill, Yellow-rumped Thornbill, Grey Fantail, Willie Wagtail, Red Wattlebird, Little Raven, Australian Pipit, Magpie-lark, Australian Magpie and Welcome Swallow at *Jenawarra*.
- * Feb. 1986 – 1 Restless Flycatcher & 2 Yellow-tailed Black-Cockatoo in Cypress at *Jenawarra*.
- * Jan. 1987 – 2 Stubble Quail, 2 Restless Flycatchers and a flock of Tree Martins at *Jenawarra*
- * Feb. 1988 – Little Raven, Welcome Swallow, Tree Martin, Australian Pipit at *Jenawarra*.
- * Mar. 1988 – 1 Southern Boobook in a Cypress at The Point picnic area at *Jenawarra*.
- * Apr. 1988 – 1 Flame Robin at The Point picnic area at *Jenawarra*.
- * Feb. 1989 – dozens of Fairy Martins in paddocks at *Jenawarra*; Brolga and Yellow-billed Spoonbills on Krause Swamp; Banded Stilt on Lake Bulrush.

- * Oct. 1989 – thousands of Tree Martins and a few dozen Fairy Martins around *Jenawarra*.
- * Feb. 1990 – 2 Stubble Quail seen & others heard at *Jenawarra*. A Southern Boobook dead by road. 1 Golden-headed Cisticola in thistles on east bank of *Jenawarra*.
- * Apr. 1992 – several female and 1 male Flame Robin on West Lakes Rd area.
- * Feb. 1996 – at Krause Swamp 1 Musk Duck, 200 Australian Shelduck, 200 Grey Teal, 2 Pink-eared Duck, 3 Australasian Shoveler, 12 White-faced Heron, 1 Australian White Ibis, 1 Yellow-tailed Black-Cockatoo and dozens of Welcome Swallow.
- * 22 June 1997 – 1 Australian Pied Cormorant seen at Boonawah creek
- * Sept. 1997 – 1 Laughing Kookaburra on south edge of *Jenawarra*. Several Long-billed Corella, 2 Sulphur-crested Cockatoo, 1 White-fronted Chat and several Willie Wagtail, Australian Pipit, Magpie-lark, Tree Martin, Welcome Swallow, Little Raven and Australian Magpies seen.
- * Jan. 1999 – 1 Brown Goshawk at *Jenawarra*.
- * Feb. 1999 – Kennedy was dry but *Jenawarra* & Krause Swamp had water. A few Grey Teal, Australian Shelduck & White-faced Heron there.
- * Nov. 1999 – 100s of Red-necked Avocet, a small group of Banded Stilt and large numbers of Whiskered Tern on *Jenawarra*.
- * Jan. 2000 – 1 Australian Hobby on North Lakes Rd.
- * Feb. 2000 – Musk Lorikeet, Purple-crowned Lorikeet, White-faced Chat and Magpie-larks in HFNC tree block. *Jenawarra*, Boonawah Ck, Krause and Bulrush dry, the latter grass-covered.
- * Nov. 2000 – several hundred Banded Stilt on western side of *Jenawarra* and small numbers of Red-necked Avocet on south side. White-plumed Honeyeaters in the HFNC's 1975 tree block.
- * Dec. 2000 – Little Grassbirds seen on eastern bank and at Boonawah Ck and 600 Banded Stilt (most without chest band), 2 Pied Stilt, 16 Red-necked Avocet, 160 Black Swan, 80 Eurasian Coot, 97 Silver Gull, 44 Masked Lapwing, 1 White-faced Heron, 630 Australian Shelduck, 40 Pink-eared Duck, 105 Grey Teal, 6 Australasian Shoveler, 8 Sharp-tailed Sandpiper, 26 Red-capped Plover, Horsfield's Bronze Cuckoo, Little Raven, Brown Songlark, Australian Pipit, Whistling Kite, 2 Wedge-tailed Eagles, Yellow-rumped Thornbill and Magpie-lark at *Jenawarra*.
- * Feb. 2001 – at *Jenawarra*, Red-rumped Parrot, Long-billed Corella, Yellow-rumped Thornbill, Forest Raven, White-fronted Chat, Yellow-tailed Black-cockatoo, European Greenfinch, Australian Magpie. At Krause Swamp 2 Australian Pelican, 30 Straw-necked Ibis, 200 Masked Lapwing, 6 White-faced Heron, 100 Pink-eared Duck, 2 Pacific Black Duck & 8 Silver Gull.
- * Sept. 2001 – Pacific Black Duck (nest with 11 eggs), 2 Black-fronted Dotterel, several Red-capped Plover, 11 Red-necked Avocet, 1 Yellow-billed Spoonbill, Willie Wagtail, Magpie, Brown Falcon, Nankeen Kestrel, 2 Chestnut Teal, several Australasian Shoveler, several flocks of Grey Teal, Hoary-headed Grebe and a few Maned Duck on *Jenawarra*.
- * Dec. 2001 – 1 Glossy Ibis, 1 Blue-billed Duck, 1 Royal Spoonbill & 2 Yellow-billed Spoonbill on Krause Swamp; 100s of Hardhead (most common), 100s of Pink-eared Duck, much fewer Blue-billed Duck, Maned Duck, Grey Teal & Australian Shelduck, a few Australasian Swamphehen, Pied Stilt, Whiskered Tern, Red-rumped Parrot, Stubble Quail, Brown Songlark, Black-faced Cuckoo-shrike, Long-billed Corella, Galah, Yellow-tailed Black-Cockatoo, Masked Lapwing, Silver Gull, Red-capped Plover and Black Swan (some with cygnets) on *Jenawarra*; several Freckled Duck on Harnath Swp, 1 Striated Fieldwren and some Banded Stilt at Kennedy.
- * Jan. 2002 – several Black-tailed Nativehen and Pied Stilt on Harnath Swamp; Australasian Swamp Hen on Krause Swamp.
- * Feb. 2002 – several Black-tailed Nativehen on western shore and small groups of Red-necked Avocet on east shore of *Jenawarra*. Bulrush had >3,000 Australian Shelduck, >200 Eurasian Coot, >200 Black Swan, 10 Pied Stilt and a few Pink-eared Duck & Australasian Shoveler.
- * Mar. 2002 – Lake Bulrush was particularly well frequented with waterbirds. 6,000 Grey Teal, 500 Pink-eared Duck, 500 Pacific Black Duck, 20 Australasian Shoveler, 8 Maned Duck, 2,000 Eurasian Coot, 250 Sharp-tailed Sandpiper, 50 Pied Stilt, 100 Silver Gull, 100 Masked Lapwing, 22 Yellow-billed Spoonbill, 3 White-necked Heron, 8 Australian White Ibis, 20 White-faced Heron, 3 Red-kneed Dotterel.
- * Sept. 2002 – 1 immature White-bellied Sea Eagle & 1 Pacific Golden Plover seen at *Jenawarra*, at The Point boat ramp.
- * Aug. 2003 – many Stubble Quail and Golden-headed Cisticola in grassland at *Jenawarra*.
- * Jan. 2004 – ~200 Sharp-tailed Sandpipers at *Jenawarra*, 100s of Whiskered Terns over Lake Bulrush and 2 Blue-billed Duck seen at Krause Swamp (the first for years).
- * 30 Jul. 2004 – 1 Far Eastern Curlew on Harnath Swamp south of *Jenawarra*; it then flew to *Jenawarra*.
- * Sep. 2004 – 74 Black Swan nests on Lake Bulrush.

- * Feb. 2005 – Little Grassbird & Golden-headed Cisticola on east bank of *Jenawarra*.
- * Mar. 2005 – 1 Blue-winged Parrot seen near Boonawah Ck.
- * Sep. 2005 – Black-faced Cuckoo-shrike, Golden-headed Cisticola, Red-rumped Parrot, Restless Flycatcher and Eurasian Skylarks seen near North Lakes Rd, *Jenawarra*.
- * Oct. 2005 – 1 Peregrine Falcon, 1 Collared Sparrow-hawk & 1 White-winged Triller, N Lake Rd; 1 Cape Barren Goose at Krause Swamp (the last sighting in the area, at *Jenawarra*, was 1977).
- * Feb. 2006 – Striated Fieldwrens at Boonawah Ck, among clumps of *Gahnia trifida*.
- * Nov. 2006 – 2 Satin Flycatchers at The Point, Rufous Songlarks on east bank of *Jenawarra*; 16 Brolga at Lake Bulrush which was dry.
- * Jan. 2007 – Rufous Songlark calling at HFNC tree block on 30 Jan. A Spotted Harrier and 2 Wedge-tailed Eagles over the grassy lake bed. Kennedy had water on SE part, after recent 75 mm of rain, with 82 Australian Shelduck and 60 Red-capped Plover. Krause Swamp was dry.
- * Feb. 2007 – 20 Red-capped Plover on Kennedy; 5 Blue-winged Parrots at *Jenawarra*, E bank.
- * 23 Oct. 2007 – *Jenawarra* marker 1.50 m (20 cm water), lake green except parts of centre; ~ 150 swan nests, ~11,000 Grey Teal and a few Pacific Black Duck, Australasian Shoveler, Chestnut Teal, Hardhead, Straw-necked Ibis and Australian White Ibis, ~1,400 Sharp-tailed Sandpiper, ~1,100 Whiskered Tern, ~2,000 Pied Stilt; 17 Black-tailed Nativehen at The Point & 4 Red-kneed Dotterel on swamp off N Lakes Rd. Bulrush & Harnath dry, Kennedy ~ full.
- * 24 Oct. 2007 – 1 Marsh Sandpiper and 20 Red-necked Avocet on *Jenawarra*.
- * 16 Nov. 2007 – *Jenawarra* marker 1.66 m (after 120 mm rain); stilts, teal & Whiskered Tern.
- * 11 Dec. 2007 – *Jenawarra* marker 1.52 m – thousands of birds – >2,000 Whiskered Tern., > 1000 Pied Stilt, ~400 Sharp-tailed Sandpiper, 250 Banded Stilt, 400 Eurasian Coot.
- * 7 Jan. 2008 – *Jenawarra* marker 1.43 m – ~2,000 Pied Stilt, 600 Banded Stilt.
- * 23 Jan. 2008 – 1 Black Falcon, 700 Black Swan, 16 Banded Stilt, 150 Whiskered Tern, 300 Straw-necked Ibis at *Jenawarra*; 6 Glossy Ibis, 2 Yellow-billed Spoonbill at Krause Swamp; ~3,000 Australian Shelduck, 40 Grey Teal & 3 Blue-winged Parrots at Lake Kennedy.
- * 25 Jan. 2008 – ~5,000 Sharp-tailed Sandpipers (and a few Pectorals) arose from Bulrush and settled on *Jenawarra* (Figs. 38 & 61-64). Also many Australian Shelduck, swans and gulls.
- * 29 Jan. 2008 – 22 Red-capped Plover, ~100 Black Swan & ~3,000 Sharp-tailed Sandpiper.
- * 9 Feb. 2008 – *Jenawarra* dry; 8 Wedge-tailed Eagle & 1 imm. White-bellied Sea Eagle. Krause Swamp had ~700 Australian Shelduck, 2 Brolga, a few grebes, ibis, lapwing and swan.



Figure 14.
Pelicans on
Jenawarra,
Boonawah Ck
area, in Feb.1992
– part of a flock
of over 600 birds,
the largest seen at
the lake.

Murray Gunn, Rod Bird & Steve Clark listed 137 species for *Jenawarra* for the period 1960-2018 (Table 2). This list includes 63 species of water birds. Since the flowering of the HFNC plantings of trees, the bird list increased to year 2000 with White-plumed Honeyeater, Little Lorikeet and Purple-crowned Lorikeet. Rufous Songlarks were seen in 2006, Pallid Cuckoo, Superb Fairy-wren, Crested Pigeon, Horsfield's Bush Lark and Banded Lapwing after 2008, and Singing Honeyeater in 2018.

This list also gives an estimate of the relative rarity and the relative abundance of each species, to better indicate what one might expect to see. To take the extremes, species seen only once are rated 'extremely rare', while species for which there are >50 records on different dates are considered 'very common'. However, that is only part of the story for it is possible to have very few records of a particular species on different dates, but when the species is present it may be in great numbers. We have indicated this, for example, by marking (#) those species that may sometimes be seen in tens ('moderately abundant'), hundreds ('very abundant') or thousands ('extremely abundant').

Table 2. Bird list for Jenawarra, 1960-2018

Compiled from records of Murray Gunn, Steve Clark, Rod Bird and HFNC records

Water birds	Relative abundance								Other birds	Relative abundance							
	xr	vr	r	c	vc	ma	va	xa		xr	vr	r	c	vc	ma	va	xa
Great Crested Grebe			*			#			Black-shouldered Kite				*			#	
Hoary-headed Grebe					*			#	Black Falcon		*						
Australasian Grebe		*				#			Black Kite	*							
Australian Pelican				*		#			Square-tailed Kite	*							
Australasian Darter									Whistling Kite				*			#	
Australian Pied Cormorant	*								Brown Goshawk		*						
Little Pied Cormorant			*						Collared Sparrow-hawk		*						
Great Cormorant			*						White-bellied Sea Eagle		*						
Little Black Cormorant			*						Wedge-tailed Eagle				*			#	
White-necked Heron		*							Little Eagle	*							
White-faced Heron				*					Swamp Harrier					*			
Intermediate Egret		*							Spotted Harrier		*						
Little Egret	*								Australian Hobby			*					
Eastern Cattle Egret		*							Peregrine Falcon			*					
Great Egret		*							Brown Falcon					*		#	
Australasian Bittern	*								Nankeen Kestrel				*			#	
Australian White Ibis				*		#			Stubble Quail			*					#
Straw-necked Ibis				*		#			Southern Boobook	*							
Glossy Ibis		*							Laughing Kookaburra				*				
Royal Spoonbill		*							Welcome Swallow				*				#
Yellow-billed Spoonbill		*							Tree Martin			*					
Black Swan					*			#	Fairy Martin			*					
Plumed Whistling Duck	*								Australian Pipit				*			#	
Freckled Duck				*					Black-faced Cuckoo-shrike		*						
Cape Barren Goose			*						White-winged Triller	*							
Australian Shelduck					*			#	Flame Robin		*						
Pacific Black Duck				*				#	Grey Shrike-thrush			*					
Grey Teal					*			#	Restless Flycatcher			*					
Chestnut Teal				*					Satin Flycatcher	*							
Australasian Shoveler				*				#	Grey Fantail			*					
Pink-eared Duck					*	*		#	Willie Wagtail			*					
Hardhead				*		#			Golden-headed Cisticola			*					
Maned Duck				*		#			Brown Songlark				*				
Blue-billed Duck				*				#	Rufous Songlark		*						
Musk Duck					*	#			Horsfield's Bush Lark			*					
Black-tailed Nativehen		*							Brown Thornbill				*				
Australasian Swampphen		*							Yellow-rumped Thornbill				*				
Dusky Moorhen	*								Red Wattlebird				*				
Eurasian Coot					*			#	Yellow-faced Honeyeater	*							
Brolga				*		#			Singing Honeyeater	*							
Banded Lapwing	*								White-plumed Honeyeater			*					
Masked Lapwing					*	#			White-fronted Chat				*				
Pacific Golden Plover		*							Masked Woodswallow		*						
Red-kneed Dotterel			*			#			White-browed Woodswallow		*						
Double-banded Plover			*						Magpie-lark				*				
Red-capped Plover					*	#			Australian Magpie					*			
Black-fronted Dotterel			*						Australian Raven		*						
Pied Stilt				*				#	Forest Raven	*							
Banded Stilt				*				#	Little Raven					*		#	
Red-necked Avocet				*		#			Yellow-tailed Black-cockatoo				*				
Ruddy Turnstone	*								Sulphur-crested Cockatoo				*			#	
Eastern Curlew	*								Long-billed Corella					*			#
Marsh Sandpiper		*							Galah			*					
Common Greenshank	*								Crimson Rosella	*							
Common Sandpiper		*							Red-rumped Parrot			*					
Latham's Snipe	*								Blue-winged Parrot			*					
Bar-tailed Godwit		*							Musk Lorikeet			*					
Sharp-tailed Sandpiper				*				#	Little Lorikeet	*							
Pectoral Sandpiper		*							Purple-crowned Lorikeet			*					
Red-necked Stint				*		#			Horsfield's Bronze Cuckoo	*							
Curlew Sandpiper		*							Shining Bronze Cuckoo	*							
Silver Gull					*	#			Pallid Cuckoo	*							
Whiskered Tern				*				#	Australian Reed-warbler	*							
Gull-billed Tern		*							Little Grassbird				*				
Introduced Species									Superb Fairy-wren	*							
Eurasian Skylark				*		#			Striated Fieldwren			*					
House Sparrow			*						Silvereye	*							
European Goldfinch				*		#			Crested Pigeon			*					
European Greenfinch			*														
Common Blackbird	*																
Common Starling			*					#									

* xr, extremely rare (1 record); vr, very rare (<5 recs); r, rare (<10 rec); c, common (>10 recs); vc, very common (>50 recs)

at times: ma, mod. abundant (often 10s); va, very large flocks (often 100s); xa, extremely large flocks (perhaps 1000s)

Surveys of waterbird/shorebird and raptor species and numbers at *Jenawarra*

A detailed count in February of water birds and birds of prey has been kept over the last 32 years (from 1985 to 2019), from visits made to the same points on the lake each year (Tables 3a & 3b).

Table 3a. Water birds & raptors seen in February on HFNC excursions to *Jenawarra*.

Count total: (1) Cypress, SW cnr, (2) The Point, (3) SE bank, (4) HFNC trees, (5) Boonawah, (6) N Lakes Rd, (7) W Lake Rd.

SPECIES	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Great crested Grebe	-			12	16	26			1	12		-				5								
Hoary-headed Grebe	-		h	h	770	1320	825	2480	2260	160	3	-	30	240	1	24	20			140				
Australasian Grebe	-		f									-												
Australian Pelican	-				4		6			610	2	-	1	1	1	25								
Little pied Cormorant	-		f	f	f				1	1		-	-											
Great Cormorant	-			1	f					2	10	-	10	1	6									
Little black Cormorant	-		f	f					1			-				4								
White-necked Heron	-			1								-												
White-faced Heron	-		f	1	f		13	37	2	4	34	-	30	26	24	39	10							1
Great Egret	-											-		1										
Australian White Ibis	-		f		f	10						-												
Straw-necked Ibis	-		f			2				2		-										185		
Royal Spoonbill																							8	
Yellow-billed Spoonbill	-		1							6		-											8	
Black Swan	-		h	th	910	1240	2130	2020	350	140	90	-	50	32	20	100	10			600		2700	70	
Freckled Duck	-		10	1				8				-												
Australian Shelduck	-		h	10s	36	530	1240	530	930	890	431	-	600	470	245	680	350	0	0	350	20	425	270	
Pacific Black Duck	-		f		5		3	114		12	17	-	40	2	9	6						6	1	
Grey Teal	-		th	10s	16	90	2240	410	1380	250	180	-	50	50	57	13	250	0	0	5500		1550	60	
Chestnut Teal	-		f			5	4	5	3	2		-								2	2	5		
Australasian Shoveler	-		f	h	12	40	14	970	600	6		-	6	2		10				100			5	
Pink-eared Duck	-		f	h				330	450	355	6	-	350	8	70		5			750		250		
Hardhead	-		f	2				18		1		-												
Maned Duck	-		f		10							-			10									
Blue-billed Duck	-							13	98	135		-				2								
Musk Duck	-		f	1	10	12	10	27	43	18	2	-	10	19	13	18								
Australasian Swamphen	-										5	-												
Eurasian Coot	-		th	th	130	810	965	1520	660	487	11	-	300	300	138	43				40		3000		
Brolga	-											-	20											
Masked Lapwing	-		10s	h	h	200	148	172	217	134	67	-	100	75	96	250	160	50	0	60	25	60	165	14
Red-kneed Dotterel	-					2	2	2				-												
Double-banded Plover	-		2									-												
Red-capped Plover	-		3	1		3	1		3	11		-	2	6		7	36	6	23	45	20	25	20	
Black-fronted Dotterel	-				3	5	4	4	6	1		-		3										
Pied Stilt	-		10s		50		53	72				-				1							65	
Banded Stilt	-											-	-	5			19							
Red-necked Avocet	-								1			-								13			20	
Common Sandpiper	-										1	-												
Sharp-tailed Sandpiper	-					14						-											2	
Pectoral Sandpiper	-											-												
Red-necked Stint	-						1					-	5									250	450	
Curlew Sandpiper	-											-												
Silver Gull	-		10s	10s	210	100	560	291	117	76	447	-	100	200	125	117	450			15	1	60	135	
Whiskered Tern	-			20	100		10	40				-									100			
WATER BIRDS				2600	4380	8230	9060	7120	3320	1310	-	1700	1440	810	1340	1310	56	23	7620	168	8516	1279	15	
Black-shouldered Kite	-		f	2								-		1		1	5	1	1	6		5		
Black Kite	-	1										-												
Square-tailed Kite	-											-												
Whistling Kite	-		f	1	3		2	1	2	1		-	2		2	4		1		5	3		2	
Brown Goshawk	-											-						1		1				
Wedge-tailed Eagle	-		f									-				2			1	2		2	2	
Little Eagle	-											-			1									
Swamp Harrier	-			3			1		1	1		-		3	1			1		1			2	
Spotted Harrier	-											-									2			
Peregrine Falcon	-								1			-											2	
Brown Falcon	-		f			20		19				-	5	6	10	3	11	11	14	5	6	5	6	2
Black Falcon	-											-												
Australian Hobby	-											-												
Nankeen Kestrel	-		f						1			-						4			4			2
RAPTORs			5+	6	3	20	2	20	5	2	-	-	7	10	14	9	12	23	16	15	21	5	19	
Previous year rain mm	431	848	759	775	774	610	608	742	701	664	868	673	582	701	695	499	622	567	645	824	561	728	728	541
water depth (m) in Feb.	0	1.58	1.76	1.64	2.20	1.74	1.22	1.38	1.26	1.26	2.45	2.09	1.53	1.33	1.45	0.85	0.42	0	0	0.45	0	0.14	0	0
fine, showers, rain	-	f	f	f	f	sh	f	f	f	f	f	-	f	f	f	f	f	f	f	f	f	f	sl	f
cloud cover: oc, s	-	s	s	oc	oc	oc	oc	oc	s	oc	oc	-	oc	s	s	oc	oc	s	oc	oc	oc	s	oc	s
windyness: c, b, w	-	w	w	b	w	c	w	w	e	b	w	-	b	w	w	b	b	c	b	c	c	c	c	c
temp: c, m, h	-	m	c	m	c	c	m	c	c	m	c	-	m	m	h	m	h	m-h	m	m	m	m	m	m

Bird numbers: f (few, e.g. <5), 10s (tens, 10-100), h (hundreds, 100-1000), th (thousands)

Temp: c (<15 degrees), m (15-30 degrees C), h (>30 degrees C)

Cloud cover: oc (>50%), s (<50%)

Windyness: c (calm), b (breeze); w (windy, >10 knot)

Table 3b. Water birds & raptors seen in February on HFNC excursions to Jenawarra.

Count total: (1) Cypress, SW cnr, (2) The Point, (3) SE bank, (4) HFNC trees, (5) Boonawah, (6) N Lakes Rd, (7) W Lake Rd.

SPECIES	2007 18 th	2008 23 ^d	2009 21 st	2010 06 th	2011 20 th	2012 12 th	2013 24 th	2014 10 th	2015 22 nd	2016 04 th	2017 19 th	2018 18 th	2019 24 th	2020	2021	202	2023	2024	2025	2026	2027	2028
Great-crested Grebe																						
Hoary-headed Grebe					150	476	550				75	295	6									
Australasian Grebe							2															
Australian Pelican												7										
Little pied Cormorant						33						2										
Great Cormorant																						
Little black Cormorant						2																
White-necked Heron							3				1											
White-faced Heron	1				7		3				1	3	9									
Great Egret						4																
Australian White Ibis					5							1										
Straw-necked Ibis						6	19				8	56	200									
Royal Spoonbill						1																
Yellow-billed Spoonbill						1							2									
Black Swan					730	295	1000	220			67	52	4									
Freckled Duck											11	135	23									
Australian Shelduck					2690	60	30	100			15	37	600									
Pacific Black Duck					230	1					120	300										
Grey Teal					220	1860	150	13000			215	2000	3000									
Chestnut Teal					50	155	400	900					4									
Australasian Shoveler					70	465	40				6	250	100									
Pink-eared Duck						620	400				28	5000	5000									
Hardhead											20	200										
Maned Duck					2						2	3										
Blue-billed Duck											36	780	1200									
Musk Duck											8	3										
Australasian Swamphen																						
Eurasian Coot						7400	13000				53	10	2									
Black-tailed Nativehen							11															
Brolga																						
Masked Lapwing					95	67	340	60		2	22	37	70									
Red-kneed Dotterel					55																	
Double-banded Plover							20						4									
Pacific Golden Plover													3									
Red-capped Plover							520	400				15	30									
Black-fronted Dotterel																						
Black-winged Stilt					165	825	700	450					1									
Banded Stilt							140															
Red-necked Avocet							6	400					200									
Common Sandpiper																						
Sharp-tailed Sandpiper							240	110					35									
Pectoral Sandpiper								1														
Red-necked Stint							2500	770					90									
Curlew Sandpiper																						
Silver Gull					550	30	60	60			29	72	82									
Whiskered Tern						1		70					1									
WATER BIRDS	1	0	0	0	5020	1265	20135	16140	0	2	715	9260	13672									
Black-shouldered Kite		3						2	2				2									
Black Kite																						
Square-tailed Kite																						
Whistling Kite							49					1	3									
Brown Goshawk																						
Wedge-tailed Eagle			1			2		1			1	1										
Little Eagle																						
Swamp Harrier							2					1	1									
Spotted Harrier																						
Peregrine Falcon																						
Collared Sparrowhawk									1													
Brown Falcon				5	3	4	15	1			1	7	1									
Black Falcon		1											1									
Australian Hobby								1				1										
Nankeen Kestrel							1	1				1										
RAPTORS	4	1	5	3	6	69	6	1	0	2	12	8										
Previous year rain mm	493	685	540	564	737	713	553	562	488	471	838	672	565									
water depth (cm) in Feb.	0	0	0	0	80	46	30	22	0	0	114	110	107									
Approx. water cover %	0	0	0	0	80	70	33	50	0	0	90	85	80									
fine, showers, rain	f	f	f	f	sh	f	f	f	f	f	sh	f	F									
cloud cover: oc, s	S	s	m	s	oc	s	s	s	s	s	oc	oc	Oc									
windyness: c, b, w	B	c	b	c	w	c	c	b	c	b	b	b	B									
temp: c, m, h	h	m	m	m	m	m	m	m	h	m	m	m	m									

Temp: c (<15 degrees C), m (15-30 degrees C), h (>30 degrees C)

Cloud cover: oc (>50%), s (<50%)

Windyness: c (calm), b (breeze); w (windy, >10 knot)

Counts were made of birds on the lake from seven points around the lake, commencing at The Cypress corner (Chatsworth Rd) at 7 am and proceeding then to The Point and on, anti-clockwise around the lake to the SE bank (near the old windmill), HFNC tree block established from 1975-91, Boonawah Ck, NW corner on North Lakes Road and mid-west on West Lakes Rd (at the unfenced road reserve). The survey generally finished by 11 am. Some highlights from those surveys are presented below, showing the highest number of various species seen and also indicating how scarce some species are.

The survey period of 1984-2018 included drought years, after which the lake dried up during summer for one or more years, including 2005-10 inclusive and 2015 & 2016.

Table 4. Greatest waterbird numbers at Jenawarra from February surveys for 1984-2019

Species	1989	1990	1991	1992	1993	1995	1998	2002	2004	2005	2011	2012	2013	2014	2018	2019
Australasian Grebe													2			
Australian Pelican				610			25									
Australian Shelduck	1240										2690					
Australasian Shoveler		970	600									465				
Maned Duck															3	
Banded Stilt													140			
Black-fronted Dotterel	4		6													
Black-tailed Nativehen													11			
Black-winged Stilt												825	700	450		
Black Swan									2700				1000			
Blue-billed Duck				135											780*	1200
Brolga						20										
Chestnut Teal													400	900		
Common Sandpiper					1											
Double-banded Plover													20			4
Eurasian Coot									3000			7400*	13000			
Freckled Duck															135*	
Great Cormorant					10	10										
Great Egret												4				
Grey Teal								5500						13000		
Hardhead		18													200	
Hoary-headed Grebe		2480										476	550			
Little Black Cormorant							4									
Little Pied Cormorant												33			2	
Masked Lapwing							250						340			
Musk Duck			43													
Pacific Black Duck											230				300	
Pectoral Sandpiper														1		
Pink-eared Duck								750				620			5000	
Australasian Swamphen					5											
Pacific Golden Plover																3
Red-capped Plover													520	400		
Red-necked Avocet										20				400		200
Red-necked Stint													2500	770		
Red-kneed Dotterel	2										33					
Royal Spoonbill				1						8						
Sharp-tailed Sandpiper													240	110		
Silver Gull					447						550					
Straw-necked Ibis													19		56	
Whiskered Tern														70		
White-faced Heron		37					39									
White-necked Heron													3			
Yellow-billed Spoonbill				6						8						

* 25,000 Eurasian Coots were seen on 9 Dec. 2012; on 30 Mar. 2018, 1050 Blue-billed Duck & 850 Freckled Duck

Numbers vary quite substantially from week-to-week (and, with some species, also during the day), so the above data does not necessarily show the highest numbers of a given species that may frequent the lake in January, February or March. For example, on 25 Feb. 2018, Steve Clark and Rob Drummond reported seeing 4-500 Freckled Duck on *Jenawarra* near Boonawah Creek, whereas only 135 birds were seen on 18 February 2018. On 23 March 2017, Rod and Jane Hayes counted 530 Blue-billed Ducks on the lake, whereas a month earlier only 36 birds were seen.

Two members (Steve Clark and Rod Bird) also conducted a detailed seasonal survey over six years, from 1988-93, in order to show the variations in populations of various species during the year (Table 5 and Figs. 13 & 14). That period did not include any years in which the lake dried out but neither did it include any period when the lake was very high. It may give a reasonable representation of species diversity and abundance in average runs of years when the lake has water. Graphs showing the seasonal abundance of various species are given in Figures 3-6.

When comparing numbers in February (Table 3, 3b) with those at other times (Table 5) it is apparent that peak numbers of some species are much lower in summer – e.g. Great Crested Grebe and perhaps the Musk Duck – but not for Australian Shelduck, Chestnut Teal, Grey Teal, Pacific Black Duck, Pink-eared Duck or Freckled Duck. The sandpipers, stints, plovers and dotterels favour very shallow waters, with exposed mud or sand flats and those conditions may occur at any time from October through to May, depending upon the climatic conditions. Some, like the Blue-billed Duck, appear to be equally at home at any time of the year, provided there is an ample depth of water.

Notable records for *Jenawarra* for periods other than February in the years 1987-1993:

- 10 Little Black Cormorant, Oct. 1987
- 100 Pied Stilt, Oct. 1987
- 10 Red-capped Plover, Oct. 1987
- 11 Sharp-tailed Sandpiper, Oct. 1987
- 1200 Australian Shelduck, Apr. 1988
- 4 Australian White Ibis, Apr. 1988
- 10 White-necked Heron, Apr. 1988
- 2190 Eurasian Coot, Apr. 1988
- 60 Straw-necked Ibis, Apr. 1988
- 10 Black-fronted Dotterel, Apr. 1988
- 2 Australasian Grebe, Apr. 1988
- 28 Little Pied Cormorant, June 1988
- 30 Double-banded Plover, June 1988
- 500 Whiskered Tern, Oct. 1988
- 50 Red-necked Stint, June 1998
- 95 Pacific Black Duck, June 1989
- 3 Eastern Cattle Egret, Apr. 1989
- 50 Chestnut Teal, June 1989
- 2190 Eurasian Coot, Apr. 1989
- 9 Freckled Duck, Apr. 1989
- 2350 Black Swan, Apr. 1989
- 330 Silver Gull, Oct. 1989
- 285 Masked Lapwing, Apr. 1989
- 500 Whiskered Terns, Oct. 1989
- 1200 Grey Teal, Apr. 1990
- 40 Hardhead, Oct. 1990
- 1785 Hoary-headed Grebe, June 1990
- 2300 Australasian Shoveler, Apr. 1990
- 112 Musk Duck, June 1990
- 37 Great Cormorant, Oct. 1991
- 1 Great Egret, June 1991
- 1 Australasian Darter, June 1991
- 3 Curlew Sandpiper, Oct. 1991
- 75 Red-necked Avocet, Apr. 1991
- 1 Ruddy Turnstone, Oct. 1991
- 440 Great Crested Grebe, Oct. 1991
- 1 Royal Spoonbill, June 1992
- 16 Yellow-billed Spoonbill, Apr. 1992
- 135 Australian Pelican, Apr. 1992
- 1 Pectoral Sandpiper, Apr. 1992
- 965 Blue-billed Duck, June 1992
- 2360 Pink-eared Duck, June 1992.

A disadvantage of only surveying the lake at one date, and only in summer, is that some species will not be recorded. Water levels may be low or the lake may be dry, so that birds may congregate elsewhere. Also, on a particular day some species may be found primarily at Lake Kennedy, Krause Swamp or Lake Bulrush. There can be a marked movement of Australian Shelduck or Grey Teal between any of these – or other wetlands – that can happen when the birds are disturbed or for other reasons, such as windy weather. Counts of birds are thus rendered very approximate. A count on a different day and/or time could result in some species being present at *Jenawarra* whereas they were not on the previous day. An extraordinary example is the sighting of some 5,000 Sharp-tailed Sandpipers at 3 pm on the 25 Jan. 2008, rising from Lake Bulrush in 3 flocks and settling on *Jenawarra* adjacent to a few pools of water (see Figs. 61-63); none were seen there on the morning of 23 Jan. The birds were seen again on the afternoon of 29 Jan. but were gone by 9 Feb. 2008.

The more saline environment of Lake Kennedy produces clearer water and, in theory, greater plant growth. That presumably would encourage more diving species to frequent that lake.

Until recently our club had not made a comprehensive survey of all of these wetlands on a regular basis, surveyed on the same day. In 2006, GHCA contracted Birds Australia to examine a suite of wetlands in the CMA region, with a view to determining impacts of the wetlands on waterbird species and numbers. Members of HFNC were associated with that project, as volunteers who did the quarterly surveys. *Jenawarra* and the associated adjacent lakes and swamps, including the private Soldiers Swamp off West Boundary Rd (south of the Hamilton Highway), form one group of wetlands. The survey started in late spring 2007, following the drought in 2005-06 that resulted in these wetlands drying up. Results for 8 periods (Nov. 2007-July 2008) are presented in **Appendix 1**.

From 2009, HFNC has been involved with the Birdlife Australia Shorebirds 2020 summer surveys and part of that has included a survey of waterbirds/shorebirds at the 6 wetlands in the *Jenawarra* area. Results of those surveys of numbers of waders, raptors and other species are shown in **Appendix 2**. Winter surveys began in 2018 for most of these wetlands and these are shown in **Appendix 3**.

Table 5. Seasonal waterbird & raptor survey for *Jenawarra*, Oct. 1987 to Feb. 1993

Steve Clark & Rod Bird

Birds seen	Date of Survey																					
	1987	1988				1989				1990				1991				1992				1993
	11 Oct	7 Feb	10 Apr	26 Jun	22 Oct	5 Feb	8 Apr	11 Jun	8 Oct	11 Feb	8 Apr	17 June	14 Oct	23 Feb	13 Apr	2 Jun	12 Oct	22 Feb	12 Apr	8 Jun	24 Oct	20 Feb
Great Crested Grebe	6	26	3		7	1								1		4	440	12	12	65	105	
Hoary-headed Grebe	1000	1320	1410	45	220	825	765	39	60	2480	1200	1785	160	2260	190	205	230	160	135	405	8	3
Australasian Grebe			2																			
Australian Pelican	3			3	1	6										15		610	135	53		2
Australasian Darter																1						
Little pied Cormorant	8	5	4	28								1		1			2	1	1			
Great Cormorant	5											15	3			2	37	2		3	27	10
Little black Cormorant	10			1	1												4	1	3	9		
White-necked Heron			10																	1		
White-faced Heron	1	2	43			13	1			37	44			2	24			4	25	14		34
Eastern Cattle Egret							3								1							
Great Egret																1				1		
Australian White Ibis		5	4		1																	
Straw-necked Ibis	40	10	60				2	8										2				
Royal Spoonbill																				1		
Yellow-billed Spoonbill			3										4			3		6	16	9		
Black Swan	1500	1240	1495	360	900	2135	2350	1260	680	2020	1950	1600	695	350	640	350	49	140	85	15	27	90
Freckled Duck						9				8						3						
Australian Shelduck	50	530	1200	65	315	1245	265	200	205	530	200	160	170	930	560	30	25	890	325	30	85	480
Pacific Black Duck	10		29	13	4	3	55	95		115	50	60			5			12		7		17
Grey Teal	400	95	400		29	2240	55	16	700	410	1200	95	100	1380	550	585	5	255	145	31		180
Chestnut Teal		5	1			4	1	50	8	5	15			3	1	7				2		
Australasian Shoveler	200	40	165			14	355		105	970	2300	12	10	600	230	395		6	10			
Pink-eared Duck	2						4			330	600	495	2	450	510	730	1040	355	1140	2360	610	6
Hardhead	10								2	18		5	40	11				1				
Blue-billed Duck										13	100	464	50	100	45	3	295	135	415	965	5	
Musk Duck	10	12	9	53	24	10	19	39	14	27	26	112	58	43	24	18	5	18	8	14	2	
Australasian Swamphen																						1
Eurasian Coot	200	810	2190	400		965	1275	505		1520	1350	1990	320	660	205	95	235	485	95	8	1	11
Brolga		2																				
Masked Lapwing	10	200	205	4	23	150	285	25	24	170	250	30	80	215	170	34	12	135	24	6	5	65
Red-kneed Dotterel										2												
Double-banded Plover				(30)								2				2			1	6		
Red-capped Plover	10	3		2		1		4				8		3		4		11	7	8		
Black-fronted Dotterel		5	10			4	4	2		4	10	9	2	6	2	1		1	2			
Pied Stilt	100				15	53				72	2		2									
Red-necked Avocet	12													(30)	75							
Ruddy Turnstone																	1					
Common Sandpiper																						1
Sharp-tailed Sandpiper	11	14											2									
Pectoral Sandpiper																			1			
Red-necked Stint				4(50)		1		1	5			10							10			
Curlew Sandpiper	1								2								3					
Silver Gull	60	100	135	16	280	560	120	85	330	290	100	8	185	115	90	24	195	75	190	60	38	445
Whiskered Tern	100				500	10			15	40			5				250			3	18	
Whistling Kite			10	3		2	15			1	3	3	1	2	6	1			2	2		1
Collared Sparrow-hawk				1																		
Swamp Harrier													1	1				3				1
Peregrine Falcon												1		1								
Brown Falcon		20	10	3			20			19		3				12						
Nankeen Kestrel				5			1	3														
Rainfall prev. 2 mth*	85	49	39	151	113	62	74	155	171	92	99	92	144	107	62	126	105	46	131	150	207	103
Lake water depth (m) ≠	2.22	1.74	1.52	1.60	1.81	1.22	1.23	1.28	1.82	1.38	1.22	1.25	1.45	1.26	1.11	1.11	1.65	1.26	1.19	1.23	2.70	2.45
Lake fill #	7/10	5/10	4/10	4/10	5/10	3/10	3/10	3/10	5/10	3/10	3/10	3/10	4/10	3/10	3/10	3/10	4/10	3/10	3/10	3/10	8/10	8/10

* Rainfall total (mm) at the Pastoral & Veterinary Institute, 12 km SW of the lake, in the current plus previous calendar month of the count (this indicates the likely change in the level of water in the lake – see Fig. 9).

≠ Actual depth of water at The Point marker – data of State Rivers & Water Supply Commission (supplied by Thiess Services).

Lake fill – an approximate 11-point indicator – 0/10 is dry, 5/10 is half full, 10/10 is the overflow level, etc.

() observation in adjacent Lake Kennedy

Figure 15 – seasonal abundance of various waterbirds at *Jenawarra*, Oct. 1987 to Feb. 1992

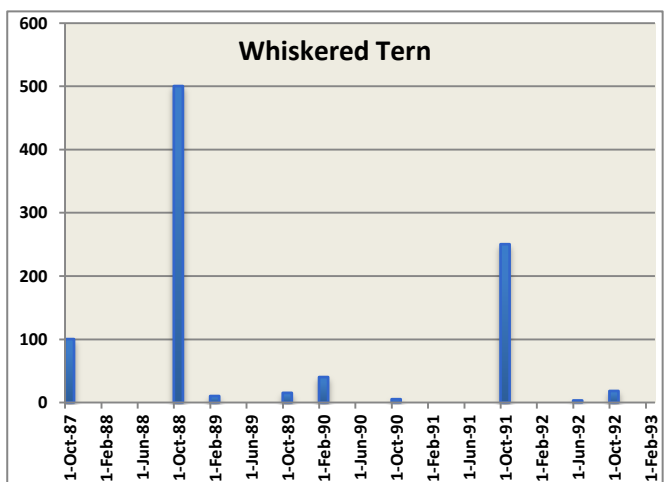
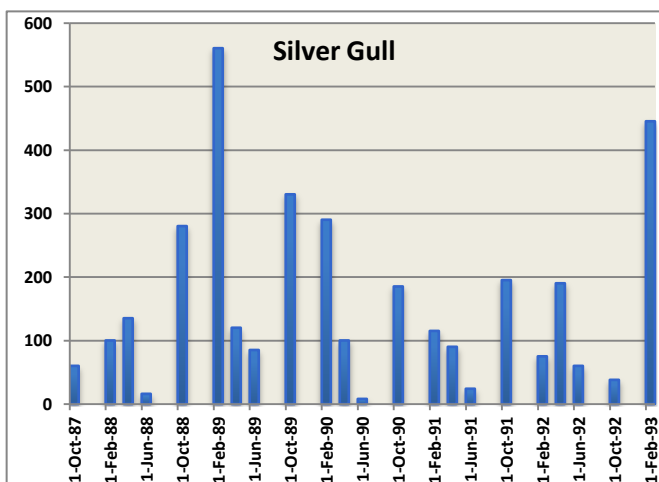
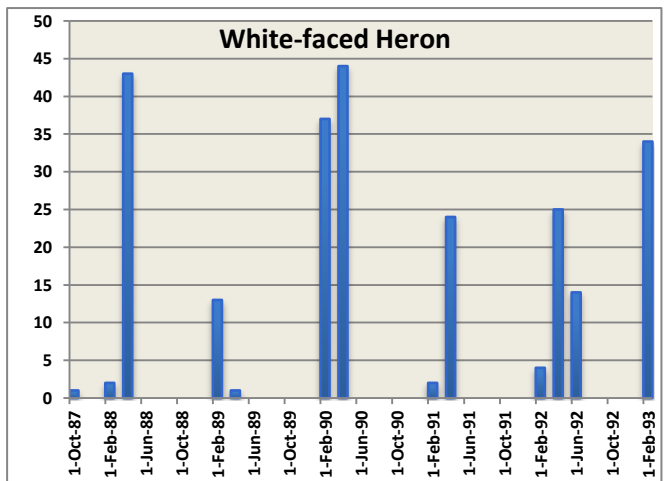
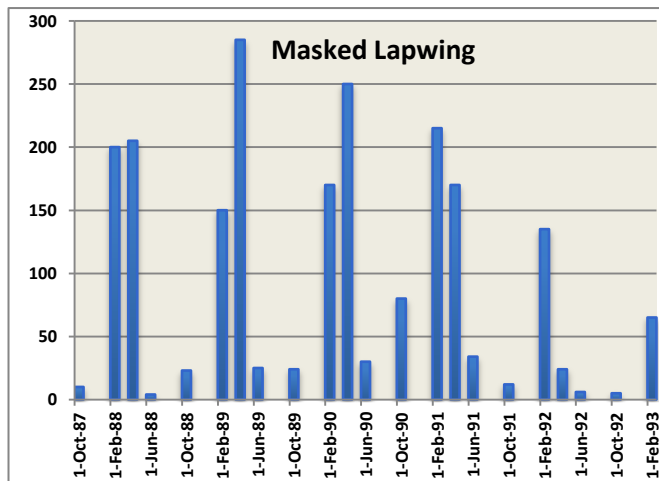
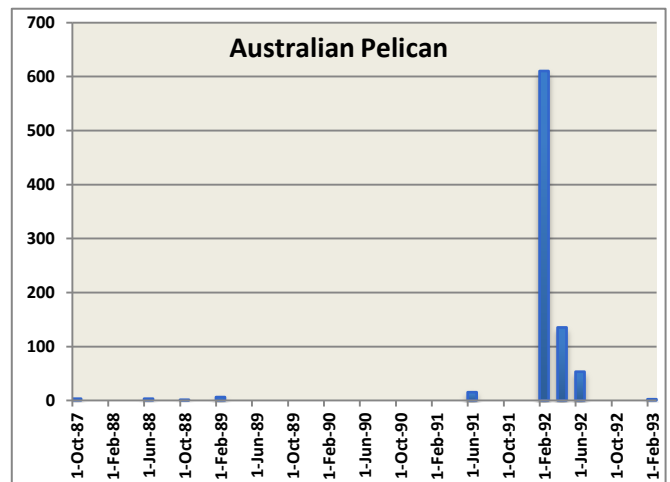
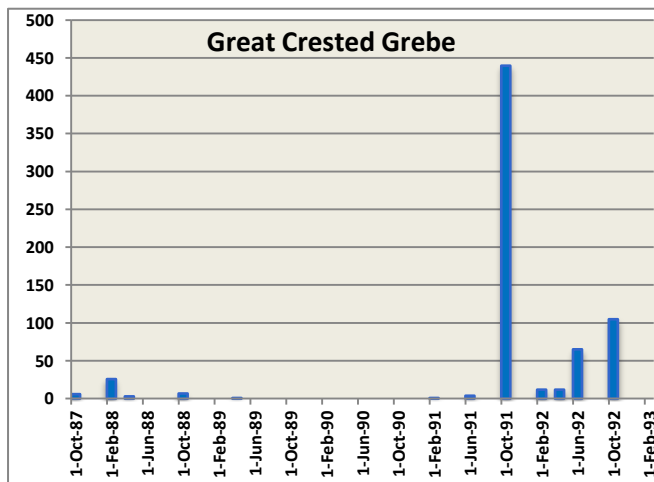
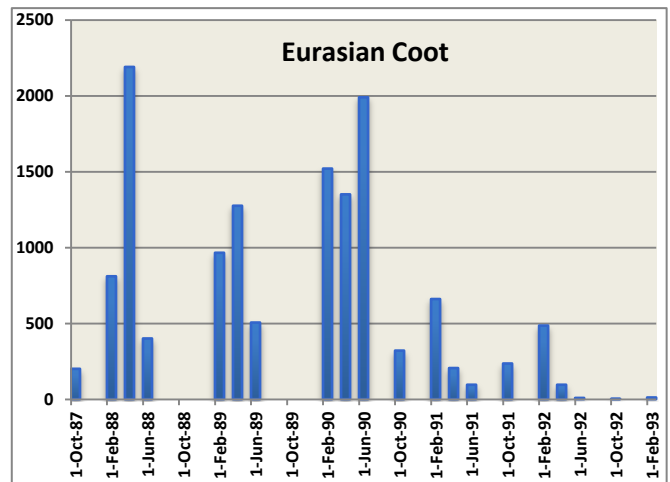
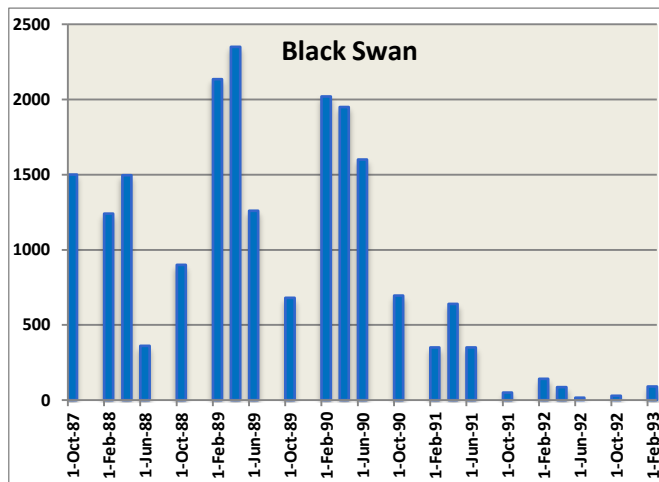
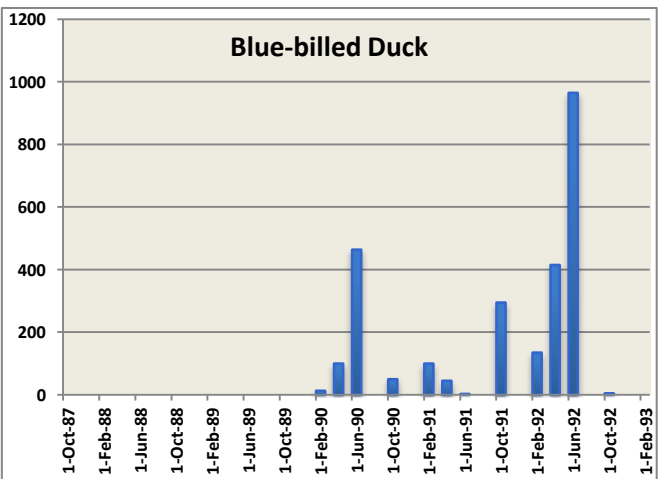
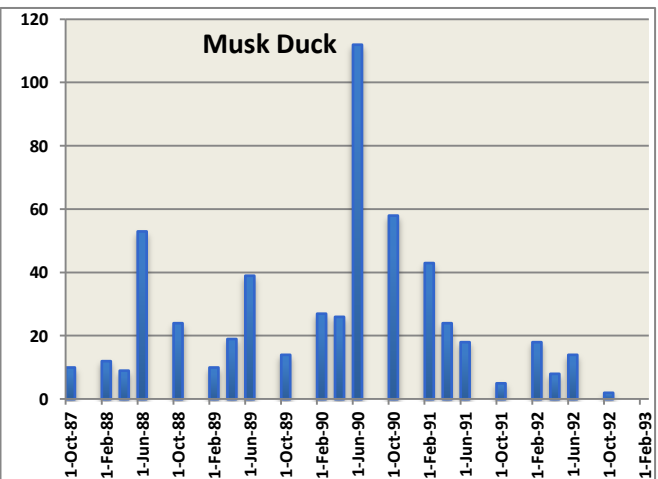
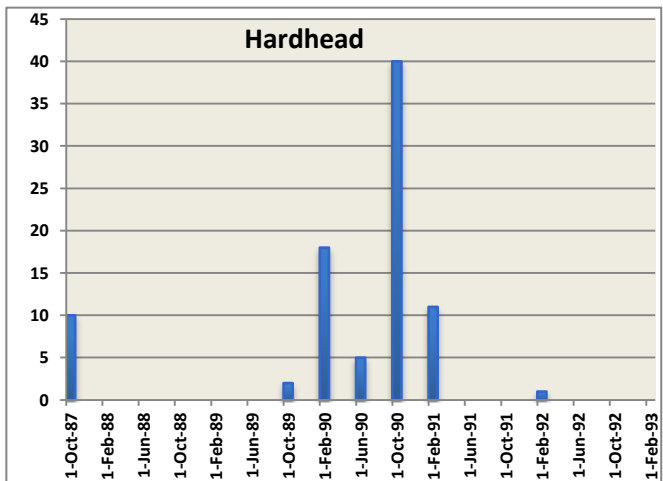
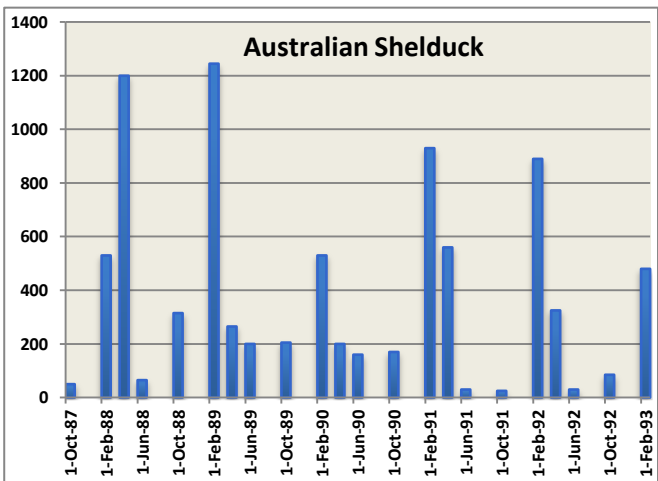
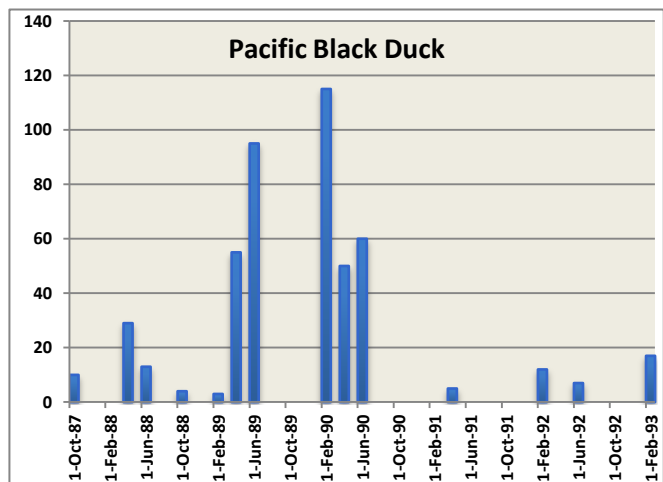
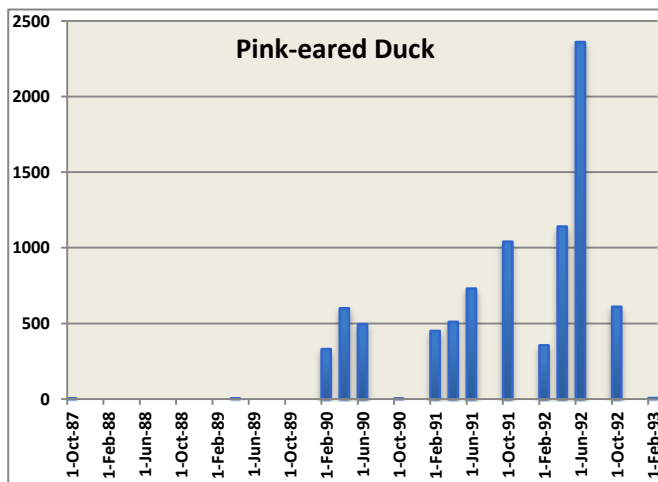
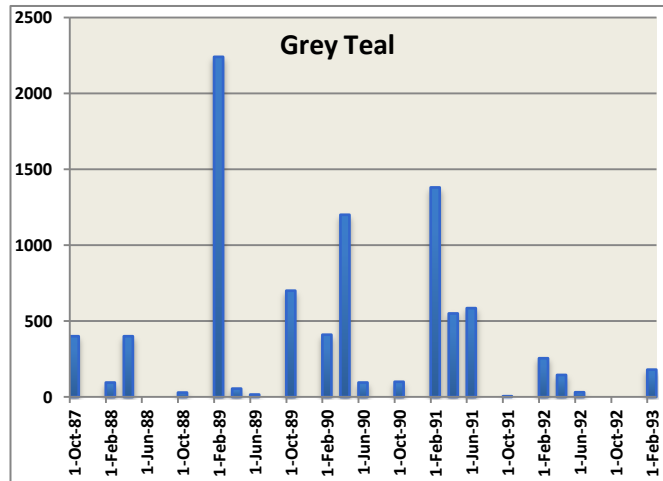
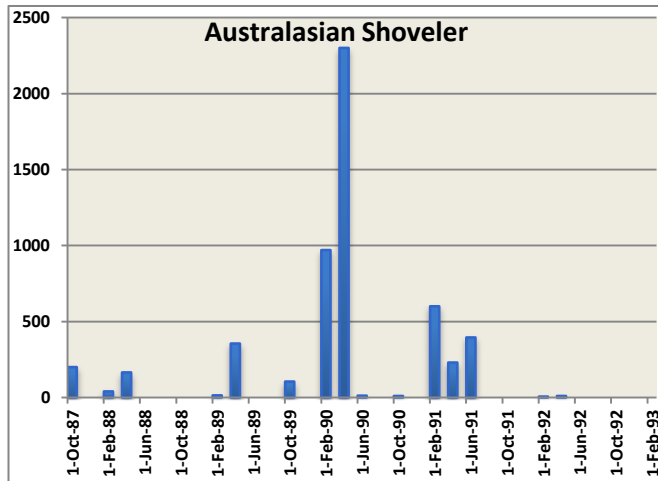


Figure 16 – seasonal abundance of various species of duck at *Jenawarra*, Oct. 1987 to Feb. 1992



Notable bird sightings 2008-2019, not including February excursions reported in Table 3b

- Feb. 2008 – Australasian Bittern close to the road at Soldiers Swamp
- Mar. 2008 – 2 Brolga at Soldiers Swamp
- May 2008 – 4 Brolga at Krause Swamp
- Jul. 2008 – 2 Brolga at Krause Swamp and 3,500 ducks (mostly Grey Teal) at *Jenawarra*
- Nov 2008 – 30 Red-necked Avocets at Krause and 10 Glossy Ibis, 9 Red-kneed Dotterel and 2 Brolga at Tabor Swamp
- Oct. 2008 – 1 Gull-billed Tern seen on Tabor Siding Rd, Tabor Swamp, and Brolga nesting there
- Dec. 2008 – 300 Sharp-tailed Sandpipers, >100 Red-kneed Dotterels, 100 Pied Stilt, >200 Grey Teal at Tabor Swamp
- Feb. 2009 – 16 waterbird species recorded at Tabor Swamp and 1 Black Falcon, 4 Brown Falcon, 1 Swamp Harrier, 1 Black-shouldered Kite,, 3 Whistling Kites and 2 Wedge-tailed Eagles
- Jul. 2009 – 5 Banded Stilt at Lake Kennedy
- Sep. 2009 – 152 Pied Stilt on Harnath, 12 Pink-eared Duck on Krause Swamp and a Brolga nesting on Tabor Swamp
- Sep. 2009 – 40 Black-tailed Nativehen and 310 Hardhead on Soldiers Swamp
- Oct. 2009 – 122 Black-tailed Nativehen & Red-kneed Dotterel at Soldiers Swamp
- Oct. 2009 – 2000 Pied Stilt plus Whiskered Tern, Sharp-tailed Sandpiper and Grey Teal at *Jenawarra*, which had 25% water cover
- 30 Dec. 2009 – 1 immature White-bellied Sea Eagle at picnic area *Jenawarra*
- Jan. 2010 – 15 Brolga, 1 Common Greenshank and Glossy Ibis on Harnath Swamp & 8,000 ducks (mainly Shelduck) on Lake Kennedy
- Jan. 2010 – 4000 Sharp-tailed Sandpipers on *Jenawarra*
- Jun. 2010 – 80-100 Double-banded Plovers at Lake Kennedy (some in breeding plumage), 1 Banded Lapwing at Krause Swamp & 3 Brolga at Soldiers Swamp
- Aug. 2010 – 2 Brolga at Yatmerone Swamp (‘seeing off’ a fox) & 2 Brolga at Tabor Swamp
- 6 Aug. 2011 – 4 Intermediate Egrets with Eastern Cattle Egrets
- 11 Dec. 2011 – several Intermediate Egrets seen at *Jenawarra*
- Nov. 2011 – 55 Glossy Ibis on Krause Swamp & 2 Great Crested Grebe on *Jenawarra*
- Apr. 2012 – 4,000 Black Swan at *Jenawarra*
- Nov. 2012 – 20 Black-tailed Nativehen at The Point, *Jenawarra*
- Nov. 2014 – 600 Sharp-tailed Sandpipers at *Jenawarra* & 2 Spotted Harriers at Harnath Swamp
- 13 Jan. 2015 – 30 Sharp-tailed Sandpipers & 70 Pied Stilts at Soldiers Swamp
- Mar. 2015 – 49 Brolga roosting at night at Lake Bulrush
- 19 Mar. 2015– 300 Red-necked Stint, 100 Red-capped Plover, 30 Double-banded Plover, 38 Red-necked Avocet, 8 Brolga, 5 Pied Stilt and 1 Spotted Harrier on Lake Bulrush
- Jul. 2016 – 2 Banded Lapwings near *Jenawarra*
- 13 Mar. 2017 – 466 Blue-billed Duck on *Jenawarra*
- 22 Mar. 2017 – 530 Blue-billed Duck, 31 Freckled Duck, 1 Banded Stilt on *Jenawarra*; 2 Brolga on Lake Bulrush; 14 Red-necked Avocet & 2 Yellow-billed Spoonbill on Krause Swamp
- 25 Jan. 2018 – 1 immature White-bellied Sea Eagle seen over the southern fringe of *Jenawarra*
- 22-25 Feb. 2018 – 1 Cape Barren Goose on the SW corner of Lake Kennedy (see Figure 64).
- 22 Feb. 2018 – 580 Freckled Duck and more than 900 Blue-billed Duck counted by DELWP on *Jenawarra*, following a HFNC report of 135 Freckled Duck and 780 Blue-billed Duck on 18 Feb.
- 25 Feb. 2018 – 1 immature White-bellied Sea Eagle seen over Lake Kennedy
- 2 Mar. 2018 – 103 Red-capped Plover, 30 Red-necked Stint, 1 Sharp-tailed Sandpiper, 10 Pied Stilts, 280 Hoary-headed Grebes and 3,200 Pink-eared Duck counted on Lake Kennedy
- 30 Mar. 2018 – 1050 Blue-billed Duck, 850 Freckled Duck, 640 Aust. Shoveler on *Jenawarra*
- 2 April 2018 – Singing Honeyeaters in flowering Silver Banksia on north shore bank (first record)

After 2006 HFNC members began to monitor Soldiers Swamp on South Boundary Rd, near that intersection with Hamilton Highway. This is a shallow, drained swamp of about 12 ha on private land. It was once part of a much larger swamp that extended around a hill to the west. It rarely holds water beyond March and is heavily grazed by sheep but it does accommodate a host of birds when there is water there. There is a dam on the SW corner. A summer count is made of waterbirds and raptors.

Another wetland that was monitored by HFNC for some time was Tabor Swamp. This is a wetland that lies on the creek that runs into Buckley Swamp. A drain was put down the centre to deepen the

channel in years past. John Harris from Parks Victoria engaged in a project to restore some of the wetland attributes by putting 8 mounds across the site to create pools. That effectively flooded 30 of the 48 ha of the longitudinal valley site. However, in Jan. 2011 a local landholder who once ran cattle and sheep over the entire site complained to the local MP about supposed flooding upstream. Graeme Parkes from PV then approved the breaching of the mounds, without establishing any need to do so, and thus ruined the work done by John Harris. The channel opened again and cattle were once again allowed over the entire site – this time because of a spurious fire danger. It was pointed out that re-establishment of the wetland would remove any alleged fire danger.

In 2014 the PV ranger at Mt Eccles (Gary Bellisini) was to work with GHCMa to re-establish the levees but he was transferred before that could happen. Nothing has been done subsequently. A comprehensive monthly bird survey had been conducted from Oct. 2008 to Oct. 2009. Notable species seen in December 2008 included 2 Wood Sandpiper, 1 Pectoral Sandpiper, 330 Sharp-tailed Sandpipers, 100 Red-kneed Dotterel and 2 Brolga. Latham's Snipe was seen in November and Common Greenshank in January. In all, 39 waterbirds were seen and 9 raptors, including a Black Falcon in Jan-March of 2009. Due to the lack of restoration of levees we no longer monitor the site.

Duck Hunting on *Jenawarra*, Lake Bulrush and adjacent wetlands

The HFNC has agitated for all of the 5 wetlands in this Linlithgow complex to be excluded from duck hunting. Our objective has been to remove duck shooting from this complex of wetlands, so that the birds on one area would not be disturbed by action at another area. For example, shooters would wait at a point between lakes Kennedy and *Jenawarra* to shoot birds disturbed on one lake and flying to the other. Shooting on any one lake in the area also makes all birds wary, difficult to observe and easy to disturb. These wetlands are too important for waterbird conservation to allow this to continue.

We began a campaign in 1975, with a submission to the LCC, re. Corangamite Study Area. Our recommendations appeared to have been ignored.

The Wildlife Act was amended in 1976, and a technicality left *Jenawarra* vulnerable to duck hunting, despite its status as a sanctuary since being proclaimed as such under the Games Act of 1928. The duck shooters were informed in 1985 that, due to a technicality, they could not be prosecuted for shooting on *Jenawarra* and this they proceeded to do. Unsympathetic shooters shot on this lake, together with Lake Bulrush, Krause Swamp and Lake Kennedy. A photograph in the local paper (Drew 1985) shows happy shooters with 40 ducks. Shooters were back at *Jenawarra* on duck open day in Feb. 1986, coinciding with our annual excursion to the lake. Ducks were scarce and the shooters did not fare well on that day, at least.

HFNC wrote to the Minister for Conservation, Forests and Lands (Joan Kirner) in May and in June 1985, protesting about this situation. The Minister responded saying that the LCC recommendations for the Corangamite Study Area were that Lake Linlithgow, Lake Bulrush, Lake Kennedy and Krause Swamp become Lake Reserves and that shooting of game species would be permitted in the proclaimed season. She wrote '*When these areas [on *Jenawarra*] are consolidated as a Lake Reserve, together with Lake Bulrush, it will be possible to gazette regulations over the reserve. A regulation prohibiting hunting in the reserve will be considered at this time*'. There was a change of government and the duck hunters in the Department of Conservation Forests & Land (DCFL) blocked any change.

In Aug. 1990, HFNC submitted a proposal to DCFL to cancel grazing licenses in the Boonawah creek area and around to the 1975 tree block on *Jenawarra*. Nothing eventuated.

In Oct. 1992, HFNC wrote to Dept. Conservation & Natural Resources (DCNR) regarding the *Review of Wildlife Reserves 1992*, concerning *Jenawarra* and Lake Kennedy. There was no response.

In Sept. 2003, HFNC wrote to the Minister for Environment (John Thwaites), providing background information on the lake-swamp complex, outlining the problem of duck hunting on what was once a sanctuary, and requesting that duck hunting be banned on all of the wetlands in this complex. No response was received and HFNC wrote again in 2004, again with no response.

In 2005, HFNC wrote to the Victorian Environment Assessment Council (VEAC), the successor to the LCC, renewing the case. After a further note in 2006 we were informed by the Department of Sustainability & Environment (DSE) that our case was too small for VEAC to consider and that we should proceed through the regional office of DSE. That proved also to be fruitless.

Several long and detailed submissions to government to restore the sanctuary status of Lake Bulrush and *Jenawarra* were made in 2014-2017 – all were ignored.

A deputation to the Southern Grampians Shire Council in 2016 for support in having VEAC examine the case, was equally fruitless. The response from the Shire was that they wished to hand their management of the lake surrounds to PV (they inherited that responsibility from the former Shire of Mount Rouse but had not acted on it). There was no indication of support for our request, which we assume would have created a requirement for the Shire to actually look after the reserve.

Our attempt to ban hunting on Lake Bulrush in 2015, when a flock of 50 Brolga were roosting there and feeding on adjacent stubble paddocks was disregarded by the Game Management Authority (GMA), a body created in 2014. Their response was that the Brolga could go to Krause Swamp, 200 m distant! Since that swamp was dry before the duck season opened that was never going to work. The Brolga moved away on the Friday afternoon as shooters arrived and spread around the lake which was dry in parts. Almost all of the other main wetlands in the region were dry and where the birds went is unknown. The Brolga did not return to Lake Bulrush that year and rarely thereafter.

In autumn 2017, despite the presence of a flock of 600 Blue-billed Ducks and 35 Freckled Duck on *Jenawarra*, the GMA refused to prohibit hunting on the lake. Instead they banned motor boats, claiming that the ducks would be safe in the middle of the lake (and presumably would not fly off to waters where they could be shot). Since all the other hunting areas were available, the cynical refusal to close the lake was seen as a message to those who opposed duck hunting on these waters.

On 18 February 2018 HFNC wetland surveys revealed 780 Blue-billed Duck, 250 Australasian Shoveler and 135 Freckled Duck on *Jenawarra*. Counting by DELWP officers a week later found 580 Freckled Duck and more than 900 Blue-billed Duck. The GMA refused to close the lake to hunting in 2017, allowing shooting from the banks. A report (ABC, 1 March 2018) of an enquiry into the GMA has been very critical of its management of duck hunting in Victoria and that may have influenced its decision. A survey by HFNC on 30 March 2018 found 1050 Blue-billed Ducks, 850 Freckled Duck and 640 Australian Shoveler on *Jenawarra*, the latter two species mainly near Boonawah Creek. The presence of 1200 Blue-billed Ducks in Feb. 2019 was also deemed insufficient to prevent hunting.

Mammals of *Jenawarra*

Habel (1979) noted that ‘*native spotted cats*’, wallabies and bandicoots were once found near the shores of the lake, in the years before the settlers drastically altered the landscape through clearing of the understory shrubs and cultivation. The ‘spotted cat’ was either the Spot-tailed Quoll (*Dasyurus maculatus*) or the Eastern Native Quoll (*Dasyurus viviparus*). The first is now rare in Victoria; the latter was once very common but is now extinct on the Australian mainland but present in Tasmania.

The skeleton of a Fat-tailed Dunnart (*Sminthopsis crassicaudatus*) was found by HFNC on the northern bank in Feb. 2001, while Swamp Rats (*Rattus lutreolus*) are common in the areas planted with trees where there is long grass. Since about 2000, Black Wallabies (*Wallabia bicolor*) now live in the trees areas and clumps of *Gahnia trifida* along the Boonawah Creek, and occasionally an Eastern Grey Kangaroo (*Macropus giganteus*) is seen. Lionel Elmore recorded in 1981 that in 1971 a Mr E. Wiese of Hamilton ‘*had a barred bandicoot run up his sleeve while rabbiting near Boonawah Creek*’ (HFNC notes). The species is no longer there. The Red Fox (*Vulpes vulpes*) is present.

Fish of *Jenawarra*

The lake has contained English Redfin from time to time. It has also contained eels. A commercial eel farmer (Skipton Eels) was licensed to stock the lake with eels during the wet years of the 1970s and 80s. HFNC reported 140 dead eels on the eastern shore in Aug. 1978 after the herbicide 2,4-D had been used to kill thistles nearby. The land adjacent to the lake and Boonawah Ck is intensively cropped and, since both the lake and creek also dry up periodically, it is a wonder that any small native fish survive the combined effects of pesticide and herbicide drift, plus desiccation. Yet such must be the case if the presence at certain times of large flocks of Australian Pelican (e.g. Figure 14) and Whiskered Tern is any indication.

Laurie Herrmann recalls ‘*In 1952 I saw a flock of about 50 pelicans beating in a line in the bay near the Boonawah mouth, driving the fish*’. Local fishermen also have been seen at times using drag nets in the shallows to capture minnows for use as bait elsewhere (Ian Holdsworth, pers. communication).

Flora of Jenawarra

The question as to what original tree vegetation was around the lake is interesting. We have not been able to obtain much information. Habel (1979) indicates that “*that across the plain there were no large gums, only scattered small Blackwood*”. However, that evidence is not entirely consistent with the reports of Robinson or of Tyers who saw the country in 1839 and 1841 before any clearing was undertaken. By 1861, when Wilhelm Habel arrived, the first German settlers had 8 years to clear away most of the vegetation to allow cultivation. According to Habel (1979), in 1861 the fringes of the lake were almost devoid of trees and therefore he began planting to beautify the surrounds.

The description of the country provided by Tyers in 1839 and Robinson in 1841, before any clearing had occurred, indicate that the plains around the lakes certainly contained Silver Banksia (*Banksia marginata*) and probably scattered Swamp Gum (*E. ovata*). There are still a few ancient Swamp Gum within a few km of the lake, and also a few Drooping Sheoak (*Allocasuarina verticillata*) which were widespread but sporadic in the early days. One specimen occurs near the Chatsworth Rd-Huffs lane, between Jenawarra and Lake Kennedy, as do 6 specimens of River Red Gum (*E. camaldulensis*), although these appear to have been planted by Habel more than 100 years ago.

Blackwood (*A. melanoxylon*) occurs on the NW corner of the lake – there is a fine stand on North Lakes Rd – and presumably was fairly common in the early days. Mr A. Krause’s parents were the first settlers on the gilgai flats to the east and NE of Jenawarra and the late Lionel Elmore recorded Mr Krause as saying ‘*there were only occasional Blackwoods around the bases of the lunettes in that area*’. There were certainly Blackwoods of considerable size in the Croxton East and Tabor area, evidenced by beams from the Hernhutt Church that was demolished in 1897 and used in a woolshed near Jenawarra (Fig. 17). The Hernhutt Church was 8 or 9 km SSE of Jenawarra, and the trees taken by members of Krummow’s commune probably grew on the property.

Figure 17.

Blackwood beams, posts and boards seen in April 2005 at “Silvan Grove”, in the interior part of the woolshed off Mibus Lane, near Linlithgow. The structure is still solid. There has been an extension at the back of the shed, visible in this photograph.

The property was owned by Jill Sinclair and the late Rob Sinclair (pictured).



Trees in the vicinity of the lake – and for a considerable distance around – would have been prized as a source of firewood and for construction of buildings and fences. Apart from the timber demands of the settlers, the rich, black soil around the lakes produced fine crops of potatoes and this attracted town dwellers from Hamilton, who leased quarter-acre plots from the farmers. They built small huts around the lake to accommodate themselves when they came to dig the potatoes, and no doubt they exploited the reserves for any available wood. Little wonder that the lakeside vegetation became sparse!

Other trees/shrubs that would be expected to occur in the area are Tree Violet (*Melicytus dentatus*), Sweet Bursaria (*Bursaria spinosa*), Black Wattle (*Acacia. mearnsii*), Hedge Wattle (*A. paradoxa*), Woolly Tea-tree (*Leptospermum lanigerum*), Cherry Ballart (*Exocarpos cupressiformis*) and Tree Everlasting (*Ozothamnus ferrugineus*). Of these, 30 Tree Violet still occur on the cliff tops at the NW corner of the lake, together with 3 remnant Sweet Bursaria clinging to the cliff. Also finding refuge on the cliffs, away from grazing sheep, are fine examples of Nodding Saltbush (*Einadia nutans*), Austral Stork’s-bill (*Pelargonium australe*), Australian Hollyhock (*Malva preissiana*) and Scented Groundsel (*Senecio odoratus*). The occurrence of these species at the lake is of great interest and the population must be protected by excluding livestock from the banks and the plants thereby encouraged to regenerate along the bank.

Several old Tree Everlasting occur along the high-water line of the western edge of Lake Bulrush.



Figure 18 – an ancient Tree Violet (*Melicytus dentatus*) in Sept. 2005 on the north bank of Linlithgow, adjacent to North Lake Rd.



Figure 19 – Australian Hollyhock (*Malva preissiana*) is pictured right, seen in Feb. 2003. This species occurs along Boonawah Ck and the north bank.

The absence of Black Wattle is surprising but that of Hedge Wattle not unexpected – this shrub was at one time declared a noxious weed, on account of its thorns. Clumps exist along the West Lakes Rd and on Chatsworth Rd. The rarity of Sweet Bursaria here is probably also due, in part, to the presence of thorns. However, the shrubs seen on the NW bank were free of thorns, as is sometimes the case with this species, and its scarcity may relate more to destruction by grazing livestock. There may have been Woolly Tea-tree and Prickly Tea-tree growing along the drainage lines, as still occur in some parts of the district. Woolly Tea-tree can tolerate quite severe salinity and waterlogged conditions, but does not enjoy harsh, dry conditions in summer where groundwater seepage is not available.

The complete absence now of Black Wattle, Drooping Sheoak and Silver Banksia is probably due to their use for firewood (banksia wood was also favoured for smoking eels), cultivation and the effect of rabbits and livestock in preventing regeneration. These species would certainly have grown along the well-drained parts of the lake, and particularly near the rocky banks on southern, western and northern sides. The parasitic Cherry Ballart was also once widespread but its absence now is not surprising, given the grazing pressure that it would have encountered in this area.

The predominant grasses in the better-drained parts of the Grange catchment would have been Kangaroo Grass (*Themeda triandra*), Spear Grass (*Austrostipa* spp.), Wallaby Grass (*Austrodanthonia* spp.), Red-leg Grass (*Bothriochloa macra*), Common Wheatgrass (*Elymus scaber*) and Weeping Grass (*Microlena stipoides*). In the wetter parts, White Tussock (*Poa labillardiera*) and Blown Grass (*Lachnagrostis avenaceae*) were dominant. These species, excepting perhaps Red-leg Grass, but adding the Five-awned Spear Grass (*Pentapogon* sp.), are present at *Jenawarra*.

The uncultivated surrounds to *Jenawarra* contain some surprisingly fine examples of native grass communities. The best occur in and above the Boonawah creek wetlands and on the high NW parts of the lake surrounds. Subterranean Clover and other pasture species, including Phalaris, Sweet Vernal and Soft Brome, occur freely in paddocks such as that near the boat ramp on the north shore.

Severe summer grazing of the foreshore before 2002 temporarily obliterated most of the sedges and forbs, including the rare Salt Tussock-grass (*Poa sallacustris*). A luxuriant growth of Spear Thistle (*Cirsium vulgare*) and other weeds, such as Horehound (*Marrubium vulgare*), occur in drier areas that were heavily grazed. Thistles were noted growing vigorously on the bank near the school in 1876 (Lehmann 1976). Sharp Club-rush (*Shoenoplectus pungens*), Water Buttons (*Cotula coronopifolia*), Creeping Monkey-face (*Thyridia repens*), Lemon Beauty-heads (*Calocephalus citreus*), Salt Pratia (*Lobelia irrigua*) and Round-leaf Wilsonia (*Wilsonia rotundifolia*) survive on the foreshore and Boonawah flats. *Carex* aff. *bichenoviana* grows luxuriantly on the Boonawah sand dune. Shiny Swamp-mat (*Selliera radicans*), Creeping Brookweed (*Samolus repens*), Milky Beauty-heads (*Calocephalus lacteus*), Glaucous Goosefoot (*Chenopodium glaucum*) and Salt Marsh-grass (*Puccinellia stricta*) occur in masses on the flats. Except for small areas after 1975, cattle and sheep grazed the banks of the reserve until 2002. Cattle were photographed in the 1960s (Fig. 23) foraging in the lake for Fennel Pond Weed (*Potamogeton pectinata*) or Sea Tassel (*Ruffia maritima*).

Common Reed (*Phragmites australis*) occurs on Boonawah Creek downstream from the crossing on North Lakes Rd. Heavy grazing and increasing salinity may have removed it from the lower section of the creek. Sharp Club-rush is also heavily grazed by sheep. An additional serious threat there, and to the entire lake foreshore, is the presence of Tall Wheatgrass (*Thinopyron ponticum*) that has escaped down the Boonawah Ck from a planted area near the North Lakes stream crossing.

A significant species at Boonawah Ck is *Gahnia trifida* (Cutting Sedge) – a tall sedge that grows in a mass to 1.5 m. There are various patches of this plant on the expanse of flat adjacent to the creek. Field Wrens, Golden-headed Cisticola, Superb Fairy-wren, White-fronted Chat and Little Grassbird are particularly attracted to the *Gahnia* habitat. Associated with *Gahnia trifida* are clumps of White Tussock (*Poa labillardiera*) (Figs. 20 & 21). *Gahnia trifida* is not common in the region but is a good replacement for the nasty environmental weed Spiny Rush (*Juncus acutus*) which is a serious problem in SW Victoria. That species has appeared around *Jenawarra* and is established at Lake Kennedy.



Figure 20 – Cutting Sedge (*Gahnia trifida*) and White Tussock (*Poa labillardiera*) in the foreground at the winter-wet Boonawah Ck flats in Sep. 2003.



Figure 21 – White Tussock (*Poa labillardiera*) at Boonawah Ck flats in Sept. 2003.

A stand of *Gahnia trifida* can be seen in the right background, while other sedges occur in the middle ground.

Wurgarri (Mt Sturgeon) is seen to the north.

A comprehensive survey and listing of flora has not yet been made. An outcome of this project is to establish a list of plant species for the lake and surrounds. A preliminary list is given in Table 5. This includes “new” species found since grazing was terminated in autumn 2002 – Common Eutaxia (*Eutaxia microphylla*) and Austral Trefoil (*Lotus australis*) – both unusual occurrences in this region. Neither species were noticed when the foreshore was grazed.

The spikey, close-cropped Eutaxia plants must have persisted against the odds – their recovery and notable presence now on the shore from The Point to Boonawah Ck (see Figs. 52 & 53) has been the most significant result of removing grazing stock from the lake frontage. *Poa sallacustris* (Salt Tussock-grass) has also re-appeared and is now flourishing around the lake shore, especially the zone immediately above the high watermark. Tall Wheatgrass, Phalaris and Spiny Rush are the tangible threats to this rare species, for they dominate the same littoral zone.

Some idea of the condition of the lake and its surrounds (including Boonawah Ck) in the 1960s may be gleaned from a set of photographic slides taken by Lionel Elmore and reproduced below (Figs. 22-30). These also show the water levels that prevailed then and in the early 1970s. These pictures can be compared with those presented elsewhere in this report for later years.



Figure 22 – *Jenawarra* from the boat ramp area near the Point in the 1960s.



Figure 23 – Cattle in the SE corner of *Jenawarra* in June 1967 – thistles and dead swans on the shore.



Figure 24 – members of HFNC on the grazed east bank of *Jenawarra* in March 1966.



Figure 25 – Boonawah Creek in flood in March 1966.



Figure 26 – Flock of at least 35 Brolga on the Boonawah Ck flat, March 1968. Sheep grazed the flats.



Figure 27 – NE side of *Jenawarra* , view from edge of HFNC tree block to Boonawah Ck, Mar. 1968.



Figure 28 – SE corner of *Jenawarra* in Jan. 1967, start of the drought year.
Note the thistles, grazing sheep on the shoreline and a flock of Silver Gulls.



Figure 29 – Shelduck and swans in the SE corner of *Jenawarra*, from the Cypress bank in April 1969.



Figure 30 – SE corner of *Jenawarra* on Lake Reserve Rd in Feb. 1971, before HFNC planting in 1975.

Table 7. Native flora of Jenawarra
Nov. 2000-Feb. 2008.

60 species

<i>Acacia melanoxylon</i>	– Blackwood (NW bank, North Lakes Rd and S end of West Lakes Rd)
<i>Acacia paradoxa</i>	– Hedge Wattle (on W bank road reserve)
<i>Asperula conferta</i>	– Common woodruff - N shoreline
<i>Austrodanthonia caespitosa</i>	– Wallaby Grass (NW and Boonawah Ck)
<i>Austrodanthonia duttoniana</i>	– Wallaby Grass (NW and Boonawah Ck)
<i>Austrodanthonia geniculata</i>	– Kneed Wallaby Grass (S peninsula)
<i>Austrodanthonia setacea</i>	– Bristly Wallaby Grass (NW and Boonawah Ck)
<i>Austrodanthonia pilosa</i>	– Velvet Wallaby Grass (NW and Boonawah Ck)
<i>Austrostipa bigeniculata</i>	– Kneed Spear-grass (coll. DF & DT)
<i>Bolboschoenus</i> sp.	– Sedge (coll. DF & DT)
<i>Bursaria spinosa</i>	– Sweet Bursaria (NW bank – 2 trees)
<i>Calocephalus citrinus</i>	– Lemon Beauty-heads (uncommon, Boonawah Ck flats)
<i>Calocephalus lacteus</i>	– Milky Beauty-heads (common, NW bank, shoreline and Boonawah Ck flat)
<i>Carex</i> aff. <i>bichenoviana</i>	– Sedge (abundant on the sand bank near Boonawah Creek)
<i>Chenopodium glaucum</i>	– Glaucous Goosefoot (dry lake bed and shore)
<i>Convovulus erubescens</i>	– Pink Bindweed (Boonawah area and NW bank)
<i>Convovulus remotus</i>	– Grassy Bindweed (Boonawah area and NW bank)
<i>Cotula coronopifolia</i>	– Water Buttons (Boonawah Ck)
<i>Crassula helmsii</i>	– Swamp Crassula (Boonawah Ck)
<i>Dichondra repens</i>	– Kidney-weed (Boonawah Ck area and NW Bank)
<i>Distichlis distichophylla</i>	– Australian Salt-grass (Boonawah Ck)
<i>Dysphania glomulifera</i> ssp. <i>glomulifera</i> .	– Globular Pigweed (coll. DF & DT)
<i>Einadia nutans</i>	– Nodding Saltbush (NW bank and The Point)
<i>Elymus scaber</i>	– Common Wheatgrass (NW and grassland at Boonawah Ck flats)
<i>Epilobium billardierianum</i>	– Variable Willow-herb (coll. DF & DT)
<i>Eragrostis infecunda</i>	– Southern Cane-grass (Boonawah Ck flats)
<i>Eryngium ovinum</i>	– Blue Devil (NW bank)
<i>Eutaxia microphylla</i>	– Common Eutaxia (eastern shoreline and Chatsworth Rd shoreline)
<i>Gahnia trifida</i>	– Cutting Sedge (many large clumps on Boonawah Ck flats)
<i>Geranium solanderi</i>	– Austral Cranesbill (N shore bank area)
<i>Hypoxis</i> sp.	– Yellow Star (NW bank)
<i>Isolepis</i> sp.	– Club-rush (coll. DF & DT)
<i>Lachnograstis avenaceae</i>	– Blown Grass (fringing the lake)
<i>Lilaeopsis polyantha</i>	– Australian Lilaeopsis (coll. DF & DT)
<i>Lobelia irrigua</i>	– Salt Pratia (shoreline Chatsworth Rd and elsewhere)
<i>Lotus australis</i>	– Austral Trefoil (2 plants on shoreline, 400 m S of Boonawah Ck)
<i>Malva preissiana</i>	– Australian Hollyhock (NW bank, NE shoreline and Boonawah Ck)
<i>Melicytus dentatus</i>	– Tree Violet (NW bank – 20 original trees but 380 seedlings from there planted 2002-3)
<i>Microlaena stipoides</i>	– Weeping Grass (NW and paddock on N bank of lake at Aquatic area)
<i>Pelagonium australe</i>	– Austral Stork's-bill (NW bank and shoreline S of Boonawah Ck)
<i>Pentapogon quadrifida</i>	– Five-awned Speargrass (NW)
<i>Phragmites australis</i>	– Common Reed (Boonawah Ck below North Lakes Rd)
<i>Poa labillardiera</i>	– White Tussock (NW and Boonawah Ck flats)
<i>Poa sallowacustris</i>	– Salt Tussock-grass (around the shoreline, particularly the S shore bay near Chatsworth Rd)
<i>Puccinellia perlaxa</i>	– Saltmarsh-grass (on the flats)
<i>Ranunculus (inundates?)</i>	– Small River Buttercup (Boonawah Ck)
<i>Ruffia maritima</i>	– Water Weed (growing in the water at Jenawarra)
<i>Samolus repens</i>	– Creeping Brookweed (Boonawah Ck flats and N shore)
<i>Sarcocornia quinqueflora</i>	– Beaded Glasswort (S shore, N shore and Boonawah Ck)
<i>Schoenoplectus pungens</i>	– Sharp Club-rush (fringing the lake and on Boonawah Ck)
<i>Schoenus nitens</i>	– Shiny Bog-sedge (coll. DF & DT)
<i>Sebaea albidiflora</i>	– White Sebaea (coll. DF & DT)
<i>Selliera radicans</i>	– Shiny Swamp-mat (fringing the lake and at Boonawah Ck)
<i>Senecio odoratus</i>	– Scented Groundsel (NW bank)
<i>Stuckinia pectinatas</i>	– Fennel Pond Weed (growing in the water at Jenawarra and Lake Kennedy)
<i>Themeda trianda</i>	– Kangaroo Grass (Boonawah Ck area)
<i>Thyridia repens</i>	– Creeping Monkey-face (Boonawah Ck and N shore boat ramp area)
<i>Triglochin striata</i>	– Streaked Arrow-grass (Boonawah Ck)
<i>Wahlenbergia multicaulis</i>	– Bluebells (NW bank)
<i>Wilsonia backhousei</i>	– Narrow-leaf Wilsonia (coll. DF & DT)

Species that may have been expected to occur in the area:

- Acacia mearnsii* – Black Wattle (found almost everywhere else in district)
- Allocasuarina verticillata* – Drooping Sheoak (Chatsworth Rd, near Huf's lane -planted there?)
- Banksia marginata* – Silver Banksia (once common on the plains, still present at Yatchaw railway line)
- Exocarpos cupressiformis* – Wild Cherry (found elsewhere in the district)
- Eucalyptus camaldulensis* – River Red Gum (Chatsworth Rd, near Huf's lane – planted?)
- Eucalyptus ovata* – Swamp Gum (found away from the lake, on farms and roadsides in the district)
- Leptospermum lanigerum* – Woolly Tea-tree (may have been present on Boonawah Ck)
- Leptospermum continentale* – Prickly Tea-tree (may have been present on Boonawah Ck)
- Ozothamnus ferrugineus* – Tree Everlasting (found at Lake Bulrush and elsewhere in district)

Hamilton Field Naturalists Club (HFNC) revegetation projects

The HFNC has been actively interested in *Jenawarra* and its nearby wetlands Lake Kennedy, Lake Bulrush and Krause Swamp since about 1958, when the club was formed.

Committee of Management

In 1971 the Rev. Baulch, from Penshurst, represented HFNC on the Lake Linlithgow Committee of Management (then part of the Shire of Mount Rouse). In 1975, Rod Bird (President), Lionel Elmore and Max Greiner were elected. The Committee reviewed the remuneration from the grazing licences that were current and gave permission for the HFNC to plant trees on part of the eastern bank. The committee lapsed when Mt Rouse Shire was amalgamated with Dundas Shire several years later.

Revegetation activities 1975-77

In September of 1975, HFNC planted 180 trees on a 150 m section of the mid north-eastern bank of the lake. Mount Rouse Shire assisted this project by supplying and erecting the fencing on the bank, while HFNC erected fences into the water.



Figure 31. East bank of *Jenawarra* – preparing to plant trees in Sept. 1975. The view is south, towards Mt. Napier. HFNC member, John Cayley, is pictured with Rod's dog 'Licky', and children are playing at the waterside. The area was fenced to exclude sheep (note fence that extends into the lake).

The following species were purchased from the Forests Commission Nursery at Wail:

- *E. camaldulensis* (River Red Gum) – 10 planted (a few survive in 2000)
- *E. ovata* (Swamp Gum) – 20 (most survive)
- *E. viminalis* (Manna Gum) – 20 (most survive)
- *Allocasuarina verticillata* (Drooping Sheoak) – 20 (some survive)
- *B. marginata* (Silver Banksia) – 20 (a few survive)
- *A. melanoxylon* (Blackwood) – 20 (a few survive)
- *Leptospermum lanigerum* (Woolly Tea-tree) – 50 planted on the flat at each end of the block, near the highest water mark (some survive but have not established seedlings)
- *Leptospermum obovatum*, *L. scoparium*, *Melaleuca lanceolata*, *M. squarrosa* – total of 20 shrubs, planted near or above high water mark (not strictly local species). Luckily most of these species did not survive – we planted local provenance material thereafter.

In April and August of 1977, another 89 trees, grown from local seed by Peter Francis of Coleraine and Peter Milne (HFNC), were planted. HFNC had just begun a policy of only planting trees and shrub species that were known to occur naturally in the area. That policy was now strengthened, to ensure that the local provenance was perpetuated, by insisting that our plants came from seed collected locally:

- *Banksia marginata* (Silver Banksia) – 13 on the slope
- *Allocasuarina verticillata* (Drooping Sheoak) – 13 on the slope
- *Eucalyptus viminalis* (Manna Gum) – 6 on the top
- *Leptospermum lanigerum* (Woolly Tea-tree) – 42 on the shoreline.



Figure 32.

A view in Feb. 1982 from within the tree block planted by HFNC on the east bank of Jenawarra in 1975.

Silver Banksia & Drooping Sheoak grew well on the slope, as did Swamp Gum & Manna Gum planted on the top of the bank, despite the adverse effects of exposure to wind, the sticky clay soil and early competition from thistles.

Revegetation activities 1989-91

Planting in 1989

In 1989, trees were planted by the Penshurst Primary School in a 350 m adjacent area along the bank to the south. This area had been fenced by Mt Rouse Shire and trees planted in the in two or three rows ripped along the top and similarly on the flat below the high-water mark. However, of the trees planted (species and origin unknown), most perished due to poor follow-up weed control. Only 70-80 trees survived, mostly on the foreshore flat. HFNC weeded around the remaining trees in Aug. 1990, to give them a better chance of surviving.

Planting in 1990

In Aug. 1990, HFNC planted another 490 trees at this site. Strips were sprayed along previous years rip-lines with Glyphosate and Simazine, and spots were sprayed on the previously unplanted sloping bank. All trees planted were grown by HFNC from seed collected locally from species that occur naturally in the district. Eucalypts and Blackwood were planted mostly along the first and third row on the top of the bank; Drooping Sheoak and Sweet Bursaria in two rows on the sloping bank (planting spots there were cleared with a mattock) and also along the first and second ripped row at the top of the shoreline nearest the base of the bank. We did not plant any trees in the other rows closer to the water. In September we direct-seeded some trees (including Sheoak) in spots along the slope, but this was not successful. Cracking, north or west-facing clay slopes are difficult places to grow trees.

The list of trees planted in 1990 was:

- *Acacia melanoxylon* (Blackwood) – 64
- *A. mearnsii* (Black Wattle) – 52
- *A. verticillata* (Prickly Moses) – 6
- *Allocasuarina verticillata* (Drooping Sheoak) – 100
- *Bursaria spinosa* (Sweet Bursaria) – 190 from seed collected near Hamilton
- *Eucalyptus camaldulensis* (River Red Gum) – 24 planted
- *E. ovata* (Swamp Gum) – 26
- *E. viminalis* (Manna Gum) – 24
- *Leptospermum lanigerum* (Woolly Tea-tree) – 4 planted on the flat

Despite the ideal wet conditions at planting, and good weed control, many of the trees HFNC planted in 1990 did not fare much better than those planted by the school. Unfortunately, in late spring of 1990, plant growth in the lake covered part of the fence in the southern end and allowed sheep access.

Someone had then pushed the fence down to let the stock out (the frontage to the south was leased for grazing) but had left it in that condition. Consequently, the sheep re-entered the block at will, pulled out some trees and defoliated others, killing perhaps two thirds of the trees we had planted, and many of those remaining from 1989. However, many of the Sweet Bursaria that we had planted on the steeper section of bank survived, as did some eucalypts. The tall thistles that initially colonised the area afforded the trees some protection against the sheep!

Figure 33.

HFNC members in Sep. 1990, planting trees in the “new” block adjacent to & south of the 1975 block of trees.

Rod Bird cleared thistles from spots to be planted on the bank, whilst Keith Cumming and others worked on the shoreline.

The thistles grew profusely for 2-3 years but largely disappeared once grass cover was re-established on the slope.



Planting in 1991

A further 100 trees was planted by HFNC in Sept. 1991.

- *Banksia marginata* – 80 grown from seed collected at Yatchaw
- *E. camaldulensis* – 20 from Hensley Park.

The Shire of Mount Rouse subsequently fenced the plantation along the foreshore, preventing stock from entering the block when the lake dried out in summer. This experience with the sheep on the leased area was an important lesson – where trees are concerned, stock cannot be adequately controlled with fences that project into the lake.

The Sweet Bursaria and eucalypts planted on the high water mark have grown very well, although the longer-term prospects may be uncertain, due to future salinity and waterlogging events.



Figure 34. HFNC tree block planted in 1990-91, as seen in Dec. 2000.

The trees in the contiguous 1975 block are at the back of the 1990 block. Note the growth of thistles outside the block, in the grazed area, whereas there were very few inside the fenced area

These plantings have provided good evidence of species and methods that work on this difficult, windy, clay site. The success of the planting confounded some of the local landholder critics.

Of interest in these plantings was the initial dominance of thistles prior to planting and their tremendous head-high growth in the early years thereafter. Thistles were suppressed by grass in later years, after stock were excluded, because little bare ground was available for them to re-establish.

Revegetation activities at Lakes Kennedy & Jenawarra, 2001-05

HFNC and GHCMA has assisted Parks Victoria (PV) to revegetate other parts of the surrounds of *Jenawarra*. John Harris (PV) responded to a letter from HFNC in 1999, and he proposed HFNC apply for funding under PV's Volunteer Group Grants Program, with agreement from the Committee of Management (Southern Grampians Shire). HFNC was granted funding in 2000/01 (\$10,750) and 2003/04 (\$10,750), with PV managing the projects (fencing, purchase of trees, site preparation and planting). HFNC grew selected local provenance trees and accepted payment for those but passed the major portion of its allocation to PV to service the project. HFNC planted two areas in 2003-2005.

Planting in 2001

PV & GHCMA managed a Living Links project that saw the planting of about 9,000 trees at Lake Kennedy in Aug. 2001 (Anon. 2001). Preparation for this planting required PV to negotiate cancelling of grazing licences, realignment of some boundaries and secure fencing of the frontage. Similar work began later at *Jenawarra*, particularly in the Boonawah Creek area.

Planting in 2002

PV organized a similar re-fencing, boundary re-alignment and cancellation of grazing licences on the northern half of *Jenawarra*. PV's team (Conservation Volunteers Australia) had a major planting effort on the NW foreshore, extending from midway on West Lake Rd around to North Lakes Rd to the Aquatic Club entrance. The middle, headland section, just east of the sharp bend in North Lake Road, was left for the HFNC. HFNC planted 10 *Bursaria spinosa* and 3 *Banksia marginata* (Yatchaw provenance) in that area in Sept. 2002 and grew seedlings in 2002 to plant there in 2003.

Planting in 2003

PV planted the NE section of the *Jenawarra* around to Boonawah Ck. That planting included Yatchaw provenance of Silver Banksia; 400-500 plants from Wail Nursery and 350 from Liz Fenton.

HFNC planted and guarded 600 trees and shrubs on the North Lake Rd section on 13 Sept. These plants were grown by HFNC from seeds they collected locally. The species were:

- *Banksia marginata* (Silver Banksia) – Yatchaw source – 150
- *Bursaria spinosa* (Sweet Bursaria) – *Jenawarra* source – 370
- *Melicytus dentatus* (Tree Violet) – *Jenawarra* source – 20
- *Malva preissiana* (Australian Hollyhock) – *Jenawarra* source – 60

Phalaris and other introduced weeds were spot-sprayed on this area and along the road. The planted area had been grazed by sheep and cattle for many decades and so most of the native species had vanished. The flora was dominated by pasture and weed species that flourished in the absence of further grazing. The only prospect for this area is dense planting or subsequent regeneration of trees.



Figure 35.

Members of HFNC on a wet day in Sep. 2003, just finished planting trees in the headland area adjacent to North Lake Rd.

Those pictured are: Roger Thompson, Ken Grimes, Lyn Munro, David Munro, Glenys Cayley, Janeen Samuel & Diane Luhrs.

Planting in 2004

PV removed grazing licences from the southern half of the lake. Planting continued on the eastern shore from Boonawah creek to The Point, and west from The Point to the midway point on West Lake Rd. Conservation Volunteers Australia worked with PV staff on this project. Major funding was provided through the 'Revive Our Wetlands' initiative, a 3-year project funded by BHP Billiton. As in previous years, the trees came from local seed sources (Liz Fenton supplied 450 Yatchaw banksia).

HFNC continued to spot-spray Phalaris clumps on the planted areas (175 L of spray was applied), and planted and guarded 210 trees, focusing on the North Lake Rd site (sheoaks) and West Lake Rd (banksia:)

- *Allocasuarina verticillata* (Drooping Sheoak) – seed from sites west of Jenawarra – 160
- *Banksia marginata* (Silver Banksia) – Yatchaw source – 50



Figure 36.

The area of tree planting adjacent to North Lake Rd in Sept. 2004.

Some members of HFNC shown here are Yvonne Ingeme, Reto Zollinger, Janeen Samuel (in background), Diane Luhrs & Ken Grimes.

Planting in 2005

The 'Revive Our Wetlands' project continued, with Conservation Volunteers Australia providing assistance to PV. As in 2004, the volunteers were mainly young people from overseas. Areas targeted this year were Boonawah Ck frontage near the lake and foreshore areas along the SE bank. Again, the trees came from local seed sources (Liz Fenton supplied 490 Yatchaw Silver Banksia).

HFNC continued to spot-spray Phalaris clumps on the planted areas (95 L of spray was applied). Also, clumps of Tall Wheatgrass were sprayed at Boonawah Ck near the lake. HFNC planted and guarded 130 trees, focusing on the North Lake Rd site (Sheoaks) and West Lake Rd: (Banksia & Sheoak):

- *Allocasuarina verticillata* (Drooping Sheoak) – seed from sites west of Jenawarra – 25 trees on West Lake area and 80 trees on the North lakes area
- *Banksia marginata* (Silver Banksia) – Yatchaw source – 25 trees on the West Lake Rd area.



Figure 37.

The area of tree-planting adjacent to West Lake Rd in Sep. 2004, when there was some water in the lake.

Ken Grimes, Janeen Samuel, Reto Zollinger & Yvonne Ingeme were part of the HFNC team who planted more trees here in Sep. 2005.

These works have substantially completed the tree planting project for *Jenawarra* and Lake Kennedy and could not have been achieved without the persistence and enthusiasm of the late John Harris from PV, and the massive injection of funds and volunteer labour he organized to accomplish the task.

Future management of *Jenawarra* and adjacent wetlands

Victoria's Biodiversity Strategy (NRE 1997) has several Statewide key directions for the Volcanic Plains, including the following:

- Finalising management plans for significant wetlands (HFNC has argued for *Jenawarra*).
- Identifying sites of biological significance in the rural landscape and encouraging appropriate use of this information in local planning schemes.
- Focus revegetation and rehabilitation efforts on the riparian environments.
- Maintain appropriate water regimes for freshwater wetlands.

As early as 1960, HFNC recognized that the foremost of the wetlands requiring action on the basaltic plains was that of *Jenawarra*, Lake Bulrush, Krause Swamp & Lake Kennedy. These were once major Eastern Barred Bandicoot, Cape Barren Geese & Brolga habitat areas and are important for a number of migratory and local species of birds. The entire reserve banks, flats and fringes of the lakes had been grazed for 150 years. Rarely have the needs for biodiversity been seriously considered and promoted in past planning of activities associated with usage of lakes – the lakes have been considered basically for recreational water sports and grazing, with duck hunting an optional extra.

HFNC had proposed several schemes to Mount Rouse Shire (Aug. 1990, Apr. 1991, Nov. 1991) who were responsible for the lake prior to council amalgamations, and DNRE & PV (Aug. 1990, Oct. 1992, Feb. 1999), to improve the amenity, conservation and management of the lakes surrounds. To date, only the tree planting has attracted a positive response, with PV resolving in 2000/01 to work with Southern Grampians Shire, GHCA, DNRE, HFNC and other organizations to develop a management plan that would see parts of the foreshore fenced from grazing stock and regenerated (Anon. 2000). However, we regard tree planting as the least important of the efforts that need to be made to improve the biodiversity value of the lake and its appearance. The grassland and shoreline sedges and other plants were neglected in years past. The critical issues for PV in 2000 were the appraisal of grazing leases and revegetation. Ultimately a decision was taken to end the licences and to slash firebreaks along the boundaries of the reserve. Some re-alignment of boundary fences was made at Lake Kennedy and Boonawah Ck. and removal of old fencing along North Lake Rd.

Fencing and grazing

Livestock no longer have access to the lake and that policy must continue. The unsightly fences that project into the lake should be removed. Old fencing wire and garden refuse (including weeds) has been dumped over the cliffs on the NW corner and must be removed, together with other fencing that remains on the lake. The lake surrounds should be allowed to regenerate, either naturally (particularly in the case of the littoral fringe and grassland) or through some assistance (direct-seeding or planting). An exception is the picnic area at The Point where the exotic grasses & thistles need to be slashed.

At the Boonawah Ck, the property owner has, commendably, re-fenced part of the boundary opposite the mouth of the creek, to take the fence back from the saline, boggy fringe. Negotiations are required to continue that policy, with an extension further east, along the northern boundary of Boonawah Ck. Control of nutrient pollution of the lake depends on stock being denied access to these sites.

Some Crown land on the Boonawah frontage has been absorbed into crop land to the south. That area could have been planted with trees to provide a solid woodlot area for birds, without disturbing the important native grassland that it abuts. The adjacent grassland contains several species of wallaby grass (*Austrodanthonia*), including *Austrodanthonia setacea*, *pilosa*, *caespitosa* and *duttoniana*, and a number of other species. However, an arrangement has been made with the present landholder to exchange that land for an area of saline land to the east, adjacent to the important area of *Gahnia trifida* (Cutting Sedge), *Eragrostis infecunda* (Southern Cane-grass) and White Tussock (*Poa labillardierei*).

Drainage

Glenelg-Hopkins CMA (2004) lists Lake Bulrush as part of a drainage scheme, on a catchment area of 1648 ha, and draining into Soldiers Swamp (another drainage area). That policy needs to be altered.

Revegetation policy

Excessive tree planting would not be in character with the original status of the lake, as determined from historical accounts, and therefore care must be taken not to disturb that balance. Some local residents, among them Rob Sinclair, have expressed concern about tree-planting where there were relatively few trees in the past. Continuous strips should not be employed.

HFNC recommended the following actions for re-vegetation when the 2001-05 project began:

- A limited planting of species that grew in the area, from strictly local seed or cuttings;
- The major species used on the banks should be Drooping Sheoak, Plains Silver Banksia, Sweet Bursaria, Blackwood and Tree Violet; parts of the Boonawah Ck could be planted with Woolly Tea-tree and perhaps Prickly Tea-tree (*Leptospermum continentale*).
- Trees and shrubs to be planted in targeted areas, particularly in weed-infested former stock camp sites, where such planting can reduce present and future problems with Horehound and thistle, or adjacent to remnant populations of the same species, but not in areas of good native grassland or saline wetland;
- Scenic vistas (Mt. Rouse, Mt. Napier and Grampians) should not be obscured – Pine, Cypress and Sugar Gum belts on adjacent farms define current view lines and visual gaps should be left open.

Recreational vehicles

Motor vehicles, particularly motor bikes, need to be prohibited from the foreshore, creek and bank areas of the lake. These areas are nesting grounds for birds such as the Red-capped Plover, which we observed recently nesting, whilst a four-wheel motor bike travelled repeatedly across the area. The noise and motion of these vehicles along the shoreline also disrupts the feeding and resting activities of a multitude of waterbirds either on the shoreline or in the water within 200 m of the shore.

Driving on the dried out lake bed, a popular recreational activity in periods of drought, perhaps does little damage. However, such activities must be restricted to periods when the lake is dry, and to areas other than the foreshore and banks of the lake, or the Boonawah Ck area. Undesirable vehicle activity has been noted on the Boonawah Ck flats in the dry times of recent years.

If/when water returns to the lake, power boating must be banned in these high-conservation waters.

Weed management issues

The greatest problem is the proliferation of Tall Wheat-grass, Spiny-rush and Phalaris. These species invade the littoral fringe. Phalaris, in particular, also spreads to higher ground. Tall Wheat-grass drifts from private property adjacent to Boonawah Ck. In summer 2008, ParksVic sprayed most of the clumps on the reserve but the problem remains. Lake Kennedy also has Spiny Rush emerging.

On 23 Jan. 2008, herbicide was applied by aircraft to Lake Bulrush. This was apparently scheduled by the DSE (Portland Region) & ParksVic (Horsham) to reduce a landholder's perceived problem of "Fairy Grass" (Blown Grass). HFNC protested to the Minister for Environment because there may be long-term adverse consequences of aerial spraying of herbicides on wetlands.

Our objections and observations were as follows:

- The failure to mention herbicide application in the Fire Operations Plan for 2007 in the community consultation process is a serious omission, since we were not able to point out the obvious biodiversity negatives that flow from such treatment of Wildlife Reserves.
- Other much less expensive but more environmentally-friendly alternatives for managing "Fairy Grass" were apparently not considered, such as employing casual labour periodically to manually remove any bank of Blown Grass from sheds or house fences of the one or two landholders who could possibly have been affected.
- We observed in Feb. 2008 that a band of 10-20 m of herbicide spray had been applied near the western margin of Lake Bulrush in 2006 or early 2007, apparently in preparation for burning the swamp. The effect of that was to remove the native vegetation and promote exotic plants, thistles in particular, on that sprayed area. It has severely damaged the flora on the site.
- A frog expert, Ray Draper, has stated at a public meeting run by GHCA on 22 Feb 2008 that herbicide should never be applied to a wetland because it will kill frogs as well as the plants and organisms that they and other wildlife depend upon. The "bioactive" form of Glyphosate is also a danger, particularly when there is surface water present; there was 5 cm or more of water over almost the entire swamp surface, concealed by the grass.

- While frogs may survive fire by hiding in cracks, there are also good reasons why wetlands should NOT even be burned. When wetlands recharge again after a 'dry' spell there is a prolific growth of organisms, and a resurgence in the population of waterbirds. Burning of the vegetation and litter will simply reduce the fertility of the site through loss of nutrients in the fire and the destruction of biota in the surface layers. The long-term biological consequences of continued burning of swamps has not been assessed anywhere, yet it is widely used by ParksVic. We know of no systematic survey of non-avian fauna, or of flora, on this swamp or adjacent wetlands – what species may we be compromising by this indiscriminate, broadscale use of herbicide or fire. For example, what frogs occur there?
- *Poa salacustris* (Salt Tussock-grass) – a threatened species known from only a few lakes in Victoria – has also been found on the margins of Bulrush. On 9 Feb. 2008 we found this species along a 1.5 km section on the western shore and it probably occurs all around the swamp. Clearly, any drift of herbicide from spraying would affect this species. No environmental assessment was made to see if any rare/endangered species were present.
- During the Feb. 2008 Birds Australia survey of shorebirds a mass of ~5,000 Sharp-tailed Sandpipers were seen flying from Bulrush to *Jenawarra* (see Figs. 61-64). From time-to-time these wetlands support a remarkable population of birds. The possibility of long-term ill-effects of repeated herbicide application to Lake Bulrush on the flora, and microfauna upon which the birds feed, has not been investigated.



Figure 38(a) & 38(b).

A few Pectoral Sandpipers have been seen at times at *Jenawarra* and Lake Bulrush. Their bills have a pale base and their legs are more yellow. They are also a little larger, with longer necks, than Sharp-tailed Sandpipers and the markings on the breast are sharply cut off (Fig. 38a). Sharp-tailed Sandpipers are more common, sometimes in flocks of thousands on the shores of the wetlands (Figs. 38b & 61-64).

The birds migrate in March/April to breed in Siberia; adults have a stopover in China and presumably on the margins of the Yellow Sea then and on return to Australia. However, the juveniles hatched in Siberia fly to the shores of SW Alaska to fatten up and then take a trans-Pacific route to Australia in September.

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**Bird Atlassing in Regions
2006-2008
Glenelg Hopkins Region
Western Wetlands of National Significance**

Birds can be considered as indicators of health of the environment, and changes over time indicate that the environment is changing. The Glenelg Hopkins CMA supported this project and their focus was on the influence of wetland condition on bird communities, and the value of wetland restoration.

Birds Australia managed this project (November 2006 to early January 2008). HFNC contributed to the seasonal surveys, concentrating on the wetlands in the area of *Jenawarra*. HFNC made further surveys in April and July of 2008, to provide a more complete record but those data (and our January records) were not recorded in the final report for one year by Chris Sanderson, John Peter and Meghan Cullen (2008). We present the full Hamilton area results in the tables below.

The main target was waterbirds: Waterfowl (ducks, Black Swan, geese), herons, ibis and spoonbills, Australian Pelican, cormorants, and darter, gallinules (Eurasian Coot, Dusky Moorhen, Australasian Swamphen, crakes and rails), shorebirds (resident waders such as Red-kneed Dotterels and Red-capped Plovers, and migratory waders such as Red-necked Stints, Sharp-tailed Sandpipers and Latham's Snipe) and gulls and terns.

A summary of Sanderson *et al.* Final Report for the overall project in the GHCMR Region follows:

- 121 species recorded from 70 surveys over 11 sites (5 'main' sites and 6 'satellite' sites).
- That total included 50 waterbird species, with a mean count of 16 species per survey.
- The wetlands with the most species of waterbirds were the coastal wetlands, Belfast Lough and Rutledges Cutting Swamps (33 species each).
- The inland wetland with the most waterbird species (26) was Lake Condah (note that this wetland will be restored in 2009 when a weir is placed on the Condah Drain).
- The 'main' wetlands were significantly richer in species than 'satellite' wetlands.
- The highest tally for a 'satellite' wetland was 16 species at both Soldiers and Krause Swamps.
- The lowest tally (2) was at Harnath Swamp, which was dry throughout the survey.
- The most frequently seen birds were Australian Magpie, Eurasian Skylark, Little Raven and Masked Lapwing.
- Threatened birds recorded were Orange-bellied Parrot (on the coastal swamps), Magpie Goose, Great Egret, Little Egret, Brolga, Caspian Tern and Hooded Plover.

We have presented the seasonal data for the Linlithgow-area wetlands in the following pages, 2 sites per page, grouping the birds in 4 broad categories: waterbirds (34 species), raptors (10 species), other native birds (36 species) and introduced species (6 species). In total, we recorded 86 species from November 2006 until July 2008. Observations between seasonal surveys are not shown in the tables.

The wetlands we surveyed were dry for much of this time and that had an impact on bird numbers and species. For example, we recorded large numbers of Sharp-tailed Sandpipers, Whiskered Tern and Pied Stilts on *Jenawarra* as the waters dried up in December 2007 and January 2008. Conversely, there were generally fewer diving birds, including no record of Blue-billed Duck, Great Crested Grebe, Australasian Grebe or Musk Duck. *Jenawarra* had 24 species of waterbirds.

Significant waterbird or raptor sightings from our sites included the following:

- * Brolga (2-4) at *Jenawarra*, Lake Bulrush, Krause Swamp and Soldiers Swamp.
- * Magpie Goose (10) at Soldiers Swamp
- * Sharp-tailed Sandpipers in great numbers (5,000) at *Jenawarra* and Lake Bulrush.
- * Whiskered Terns in great numbers (2,000 for a mid-period count on 11 Dec 2007) at *Jenawarra*
- * Pied Stilt in very large numbers (2,000) at *Jenawarra*
- * Banded Stilt in large numbers (250 for a mid-period count on 11 Dec 2007) at *Jenawarra*.
- * Grey Teal (as many as 11,000 birds) at *Jenawarra*
- * Black Falcon at *Jenawarra*
- * Spotted Harrier over *Jenawarra*
- * White-bellied Sea Eagle over Lake Bulrush and *Jenawarra*.

Seasonal occurrence of birds at 6 wetlands in the *Jenawarra* area, November 2006 to July 2008
(Surveyed by Jane Hayes and Mollie Herrmann, with occasional input from Rod Bird, Steve Clark, A-M Burgoine, Max & Lois Phillips)

SPECIES	Jenawarra (Chatsworth Rd)								Lake Kennedy (Chatsworth Rd)							
	19 Nov 2006	30 Jan 2007	13 Apr 2007	22 Jul 2007	23 Oct 2007	23 Jan 2008	23 Apr 2008	15 Jul 2008	19 Nov 2006	30 Jan 2007	11 Apr 2007	22 Jul 2007	23 Oct 2007	23 Jan 2008	23 Apr 2008	15 Jul 2008
Hoary-headed Grebe																
Australian Pelican						13										
Little pied Cormorant																
White-necked Heron	1			1												
White-faced Heron					2	2										
Great Egret																
Australian White Ibis																
Straw-necked Ibis					25	65		2		1						
Royal Spoonbill																
Yellow-billed Spoonbill																
Black Swan				420	650	600		420					450			2
Australian Shelduck					100	580		100		81		8	16	3100		
Pacific Black Duck				300				350				2				
Grey Teal				300	11000			2450						500	50	700
Chestnut Teal					10								12			180
Australasian Shoveler					3								80			5
Pink-eared Duck					2											
Hardhead																
Maned Duck				6												
Australasian Swamphen																
Eurasian Coot													4			
Brolga				2												
Black-tailed Nativehen					17											
Masked Lapwing		2		7	6	30		2	1	3		6	12	30		6
Red-kneed Dotterel					3											
Red-capped Plover						22				39		4	1	2		
Black-fronted Dotterel																
Pied Stilt					2000			12								
Banded Stilt						16						7				
Red-necked Avocet					30											
Marsh Sandpiper					2											
Sharp-tailed Sandpiper					1400	5000										
Silver Gull				15	1	380		35		1			37	65		3
Whiskered Tern					1100	150										
Black-shouldered Kite	*	2		*		1		7	*							
Black Falcon						1										
Whistling Kite	*				1	3										
Brown Goshawk				1												1
White-bellied Sea Eagle																
Wedge-tailed Eagle	*	2	*			1	1									
Swamp Harrier					2	1			1					1		
Spotted Harrier		1														
Brown Falcon		4	*	*	1		2	3		*						
Nankeen Kestrel		6	*	*	1			2								
Stubble Quail						*										
Yellow-tailed Black Cockatoo		*														
Galah						*						*				
Long-billed Corella				*									*			
Purple-crowned Lorikeet		*														
Crimson Rosella				*												
Red-rumped Parrot			*			*										
Blue-winged Parrot		*	*	*				3				*		3		
Horsfield's Bronze Cuckoo									*							
Shining Bronze Cuckoo					*											
Striated Pardalote																
Striated Fieldwren																
Brown Thornbill		*	*	*	*		*					*				
Yellow-rumped Thornbill	*	*	*	*	*	*	*	2				*			*	
Red Wattlebird		*	*			*										
White-plumed Honeyeater		*	*			*	*	6								
New Holland Honeyeater			*										*		*	
White-fronted Chat	*	*		*										*		
Grey shrike-Thrush			*	*		*	*	1								
Satin Flycatcher	*															
Restless Flycatcher						*										
Maggie-lark		*	*	*	*	*	*	1				*	*			
Willie Wagtail	*	*	*	*	*	*	*	2					*	*		2
Australian Magpie	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Forest Raven								*								
Little Raven	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Australian Pipit	*	*	*	*	*	*	*	2	*	*	*	*	*	*	*	*
Welcome Swallow		*	*	*	*	*	*	*	*	*				*	*	
Tree Martin	*	*				*			*							
Fairy Martin	*															
Little Grassbird																
Rufous Songlark	*	*														
Brown Songlark	*				*			*								
Australian Reed-warbler																
Golden-headed Cisticola		*	*			*		1								
Silvereye							*									
Eurasian Skylark	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
House Sparrow	*	*	*	*	*	*	*	20+						*		
European Greenfinch	*				*											
European Goldfinch	*	*	*	*	*	*		200	*	*	*	*	*	*		
Common Blackbird				*												
Common Starling	*	*	*	*	*	*	*	*				*	*			
Water level (0=dry, 10=full)	0/10	0/10	0/10	2/10	3/10	<1/10	0/10	2/10	0/10	1/10	0/10	5/10	7/10	1/10	0/10	1/10

Seasonal occurrence of birds at 6 wetlands in the Jenawarra area, November 2006 to July 2008
(Surveyed by Jane Hayes and Mollie Herrmann, with occasional input from Rod Bird, Steve Clark, A-M Burgoine, Max & Lois Phillips)

SPECIES	Lake Bulrush (Chatsworth Rd)								Krause Swamp (Mibus Rd)							
	16 Nov 2006	25 Jan 2007	11 Apr 2007	25 Jul 2007	24 Oct 2007	24 Jan 2008	23 Apr 2008	16 Jul 2008	16 Nov 2006	25 Jan. 2007	11 Apr 2007	22 Jul. 2007	23 Oct. 2007	23 Jan. 2008	23 Apr 2008	15 Jul. 2008
Hoary-headed Grebe												9	11	25		
Australian Pelican						7										
Little pied Cormorant																
White-necked Heron				1	4								12			
White-faced Heron					1	70							1	2		1
Great Egret															1	
Glossy Ibis														6		
Australian White Ibis					1								12	33		
Straw-necked Ibis					250	140							2	8		
Royal Spoonbill																
Yellow-billed Spoonbill						2										
Black Swan												5				5
Australian Shelduck					2	250							12	20	63	2
Pacific Black Duck												5	80			
Grey Teal												800	400	45	65	220
Chestnut Teal												2			4	
Australasian Shoveler												4	5	20		1
Pink-eared Duck												4	500			
Hardhead												600	20		1	4
Maned Duck																2
Australasian Swamphen													20	5		
Eurasian Coot												40	90	2		
Brolga						2									(4)	2
Masked Lapwing															116	7
Red-kneed Dotterel																
Red-capped Plover																
Black-fronted Dotterel																
Pied Stilt												7				
Banded Stilt																
Red-necked Avocet															1	4
Marsh Sandpiper																
Sharp-tailed Sandpiper						20										
Silver Gull					2									4	156	3
Whiskered Tern						100										
Black-shouldered Kite			*												1	
Black Falcon																
Whistling Kite							1									1
Brown Goshawk																
White-bellied Sea Eagle						1										
Wedge-tailed Eagle		*				2										
Swamp Harrier					1	1										
Spotted Harrier																
Brown Falcon			*				1			*				1		
Nankeen Kestrel					1				2						1	
Stubble Quail	*															
Yellow-tailed Black Cockatoo									*							
Galah				*											2	2
Long-billed Corella				*					*							
Purple-crowned Lorikeet																
Crimson Rosella																
Red-rumped Parrot																
Blue-winged Parrot																
Horsfield's Bronze Cuckoo																
Shining Bronze Cuckoo																
Striated Pardalote																
Striated Fieldwren																
Brown Thornbill																
Yellow-rumped Thornbill						*			*						*	
Red Wattlebird									*							2
White-plumed Honeyeater			*													
New Holland Honeyeater																
White-fronted Chat			*		*			12				*				
Grey Shrike-thrush																
Satin Flycatcher																
Restless Flycatcher																
Magpie-lark					*	*		2						*	*	1
Willie Wagtail					*	*			*			*			*	
Australian Magpie	*	*	*	*	*	*	*	5	*		*	*	*	*	*	*
Forest Raven																
Little Raven	*		*	*	*		*	24	*		*		*		*	*
Australian Pipit	*		*				*	1	*	*	*					
Welcome Swallow				*	*	*	*					*		*		*
Tree Martin						*								*		
Fairy Martin																
Little Grassbird																
Rufous Songlark																
Brown Songlark					*											
Australian Reed-warbler													*			
Golden-headed Cisticola							*								*	
Silvereye				*												
Eurasian Skylark	*		*	*	*	*	*	80+	*	*	*	*			*	*
House Sparrow					*				*	*				*	*	*
European Greenfinch																
European Goldfinch					*	*		90+	*	*				*		
Common Blackbird																
Common Starling									*				*		*	*
Water level (0=dry, 10=full)	0/10	0/10	0/10	0/10	2/10	<1/10	0/10	0/10	0/10	0/10	0/10	6/10	8/10	6/10	4/10	4/10

Seasonal occurrence of birds at 6 wetlands in the *Jenawarra* area, November 2006 to July 2008
(Surveyed by Jane Hayes and Mollie Herrmann, with occasional input from Rod Bird, Steve Clark, A-M Burgoine, Max & Lois Phillips)

SPECIES	Harnath Swamp (on Lake Rd)								Soldiers Swamp (West Boundary Rd)							
	16 Nov 2006	25 Jan 2007	13 Apr 2007	25 Jul 2007	24 Oct 2007	24 Jan 2008	24 Apr 2008	15 Jul 2008	16 Nov 2006	25 Jan 2007	11 Apr 2007	22 Jul 2007	24 Oct 2007	24 Jan 2008	24 Apr 2008	16 Jul 2008
Hoary-headed Grebe												6		1		
Australian Pelican																
Little pied Cormorant														1		
White-necked Heron													6	2		
White-faced Heron										1			2	4	5	1
Great Egret																
Australian White Ibis													2	2		
Straw-necked Ibis					1					22			4	60	40	
Royal Spoonbill																
Yellow-billed Spoonbill														17		
Magpie goose														10		
Black Swan												69	17	10	9	30
Australian Shelduck					1							2	1	400	38	33
Pacific Black Duck												1		70		10
Grey Teal												50		160	74	150
Chestnut Teal																
Australasian Shoveler												24				6
Pink-eared Duck												20				
Hardhead												2				
Maned Duck														6		
Australasian Swamphen												3	40	150		4
Eurasian Coot												43	2	3		
Brolga														2		
Masked Lapwing									2	8		3	6	44	128	39
Red-kneed Dotterel																
Red-capped Plover																
Black-fronted Dotterel																6
Pied Stilt														2		
Banded Stilt																
Red-necked Avocet																
Marsh Sandpiper																
Sharp-tailed Sandpiper																
Silver Gull												9	1			
Whiskered Tern																
Black-shouldered Kite																
Black Falcon																
Whistling Kite									*							
Brown Goshawk																
White-bellied Sea Eagle																
Wedge-tailed Eagle									*	*						
Swamp Harrier									*				2	2		
Spotted Harrier																
Brown Falcon															1	
Nankeen Kestrel																1
Stubble Quail					*											
Yellow-tailed Black Cockatoo																
Galah									*							
Long-billed Corella																
Purple-crowned Lorikeet																
Crimson Rosella																
Red-rumped Parrot																
Blue-winged Parrot																
Horsfield's Bronze Cuckoo																
Shining Bronze Cuckoo																
Striated Pardalote																1
Striated Fieldwren												*				
Brown Thornbill																
Yellow-rumped Thornbill																
Red Wattlebird																2
White-plumed Honeyeater												*				
New Holland Honeyeater																
White-fronted Chat									*	*		*			7	
Grey Shrike-thrush																
Satin Flycatcher																
Restless Flycatcher																
Magpie-lark												*		*	24	1
Willie Wagtail												*		*	4	2
Australian Magpie	*	*		*	*	*	3		*	*	*	*	*	*	6	11
Forest Raven																
Little Raven	*	*		*		*	1	*	*	*	*	*	*	*	*	22
Australian Pipit												*	*		4	4
Welcome Swallow	*		*			*						*	*		20	20
Tree Martin																
Fairy Martin																
Little Grassbird																
Rufous Songlark																
Brown Songlark									*							
Australian Reed-warbler																
Golden-headed Cisticola																
Silvereye															3	
Eurasian Skylark	*				*	*	*	*	*		*	*	*		*	2
House Sparrow																
European Greenfinch																
European Goldfinch				*		*					*	*		*	*	1
Common Blackbird																
Common Starling	*			*	*				*				*		20	
Water level (0 = dry, 10 = full)	0/10	0/10	0/10	0/10	0/10	0/10	0/10	<1/10	0/10	1/10	0/10	3/10	3/10	1/10	<1/10	1/10

APPENDIX 2.

Summer shorebird/waterbird/raptor surveys in the *Jenawarra* area wetlands 2009-2018

2009/2010 Shorebird 2020 surveys of *Jenawarra* (JENA), Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Jane Hayes (JH), Rod Bird (RB) & HFNC club excursion

Wetland	JENA		LKEN			KRAU			BULR		HARN			SOLD		
Observer	JH	hfnc	JH	RB	hfnc	JH	RB	hfnc	JH	hfnc	JH	RB	JH	RB	JH	hfnc
Survey date	28Dec	6Feb	28Dec	8Jan	6Feb	28Dec	8 Jan	6Feb	20Dec	6Feb	28Dec	8 Jan	14Jan	9 Jan	19Jan	6Feb
Water depth	vlow	nil	vlow	vlow	~nil		mod	mod	<3cm	~nil	low	vlow	vlow	<5cm	low	~nil
Water % cover	<15	0	75	70	<5	80	80	75	30	0	90	75	50	50		5
Australasian Grebe						72									1	
Hoary-headed Grebe														12	6	3
Little Pied Cormorant						2								27	13	9
White-necked Heron									10			12		12	27	49
White-faced Heron	2											1				
Great Egret								1								
Glossy Ibis													1			
Australian White Ibis	1					2		1						4	10	12
Straw-necked Ibis	800+				70				32		1			3	2	270
Yellow-billed Spoonbill								2						1	2	1
Black Swan	32B		48		8	8	5				2+4j		1	6+8j	30 B	17
Australian Shelduck	50		1650	8000	130	48	10	20	21		151	270	110	20	3	80
Pacific Black Duck	4					6					8			50	280^	10
Grey Teal	27		490	25		88	230	10	11		900	700	350	1450	300^	1350
Chestnut Teal											2		2		12	
Australasian Shoveler							5	23	1		6	15	12		10	
Pink-eared Duck						8	5					17				
Hardhead						3	2	5				10				
Australasian Swamphen														25+	52 B	120
Eurasian Coot						1	40									
Brolga					4				5		2	15	11	2	2	2
Masked Lapwing	127		16	120	2		45		68		28	20	11	85	98	160
Red-capped Plover	45															
Red-kneed Dotterel	1										3				15	
Pied Stilt	670		88								373	230	170	20	20	
Red-necked Avocet								5								
Common Greenshank													1			
Wood Sandpiper	1										1					
Sharp-tailed Sandpiper	4000+								250			40		50	1	
Red-necked Stint	150												12			
Silver Gull	220		50	25				3				14	17			2
Whiskered Tern	230													40		4
Black-shouldered Kite								3								
Whistling Kite	1								1				1			
Wedge-tailed Eagle								1								
White-bellied Sea Eagle	1								1							
Swamp Harrier																
Brown Falcon		5					1									
Nankeen Kestrel								2								
Golden-headed Cisticola					2			1	3						1	
White-fronted Chat																

^ There were also more than 500 ducks (Grey Teal and Pacific Black Duck) on stubble adjacent to Soldiers Swamp

2010/2011 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Jane Hayes (JH) & Rod Bird (RB)

Wetland	JENA		LKEN		KRAU		BULR		HARN		SOLD	
Observer	RB	RB	JH	RB	JH	RB	JH	RB	RB	JH	RB	JH
Survey date	2Feb	20Feb	28Dec	20Feb	28Dec	20Feb	28Dec	20Feb	25Feb	28Dec	25Feb	25Feb
Water depth	0.8m	0.8m		mod		high		mod	mod		mod	
Water % cover	90	80	80	90	90	100	90	90	90	90	70	65
Australasian Grebe												3
Hoary-headed Grebe		150			1				4			
Little Pied Cormorant											10	11
Little Black Cormorant											1	
Great Cormorant			2									1
White-necked Heron						1						
White-faced Heron		7		2		1		1	2		2	3
Australian White Ibis		5										
Yellow-billed Spoonbill								1				
Black Swan	20	730	140	175	12B	13	P	1500			30	32B
Australian Shelduck	20	2690	19	275	1			50			13	5
Maned Duck		2										
Musk Duck						3		3	2			
Pacific Black Duck	10	230			6	10	11		34B	2	32	25
Grey Teal		220		10								11
Chestnut Teal		50									4	
Australasian Shoveler		70									4	
Hardhead					9		8		1			
Australasian Swamphen						3					17	14
Eurasian Coot											2	
Brolga						3						
Masked Lapwing	4	95	3	12				2	2		6	12
Red-kneed Dotterel		55										
Pied Stilt		165										
Silver Gull	50	550	6				20	10				
Whiskered Tern	20											
Swamp Harrier					1	1					1	1
Brown Falcon		3										
Little Grassbird									P			

2012 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Jane Hayes (JH) & HFNC club excursion

Wetland	JENA		LKEN		KRAU		BULR	HARN		SOLD	
Observer	hfnc	JH	hfnc	JH	hfnc	JH	hfnc	hfnc	JH	hfnc	JH
Survey date	12Feb	7 Dec	12Feb	28Dec	12Feb	28Dec	12Feb	12Feb	7 Dec	12Feb	26Dec
Water depth	0.46m		mod		mod	high	high	high	high	v low	low
Water % cover	80	90	80	90	80	100	90	90	95	40	60
Australasian Grebe						1					
Hoary-headed Grebe	476	1600		50	41	33	7	16	71	3	
Little Pied Cormorant	33			1		7			1	5	
Little Black Cormorant	2										
White-necked Heron					4	1				4	1
White-faced Heron			12	2	10					45	1
Great Egret	4	1								2	1
Australian White Ibis						6				12	
Straw-necked Ibis	6									21	
Glossy Ibis				20		19*					
Yellow-billed Spoonbill	1					2#				17	
Royal Spoonbill	1	3			1					4	
Black Swan	595	1296	25	760	8		40	8	10	4	8
Australian Shelduck	60	210	20	20		10	140	4	1	2	
Maned Duck											4
Blue-billed Duck						2	1				
Musk Duck		1					1				
Pacific Black Duck	1	8				2	7		21	1	14
Grey Teal	1860	776	30	2000	76	66	12	10	34	475	122
Chestnut Teal	155	34		10	4					25	
Australasian Shoveler	465	28		14	40						
Hardhead		110		2		14			2		
Pink-eared Duck	620	240							2		
Australasian Swamphen					2	2				35	27
Black-tailed Nativehen		32									2
Eurasian Coot	7400†	25000+		42		11	1400	113	61		
Brolga			2							2	2
Pied Stilt	825	320	150	29	11				2	55	15
Banded Stilt	310	1		6							
Red-capped Plover	67			10							
Masked Lapwing	67	20	50	16	40	2			6	65	12
Red-necked Stint	103										
Whiskered Tern	1	105									
Silver Gull	30	35	55	40	2					1	
Wedge-tailed Eagle	2										
Swamp Harrier							1				
Whistling Kite							1				
Black-shouldered Kite	1									2	
Brown Falcon	4	1			1		1				1
Black Falcon							1				
Golden-headed Cisticola	P				6						
Striated Fieldwren					1						
White-fronted Chat	P				1				2		

* the Glossy Ibis may have been the same birds seen lifting off LKEN earlier that morning.

2 roosting Spoonbills at Krause Swamp – could not see bills or legs (presumed to be YB).

† a decline on the 25,000 Eurasian Coot counted in December (a record number for this lake).

2013 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

HFNC club excursion

Wetland	JENA	LKEN	KRAU	BULR	HARN	SOLD
Observer	hfnc	hfnc	hfnc	hfnc	hfnc	hfnc
Survey date	24Feb	24Feb	24Feb	24Feb	24Feb	24Feb
Water depth (max.)	0.3 m	dry	mod	mod	mod	dry
Water % cover	50	0	50	90	90	in dam
Musk Duck				1		
Freckled Duck				50	4	
Black Swan	1,000		4	2,900	15	
Australian Shelduck	30		33			50
Pink-eared Duck	400			440		
Australasian Shoveler	40			110		
Grey Teal	150		23	400	580	10
Chestnut Teal	400			40		
Pacific Black Duck				12		
Hardhead				50	120	
Australasian Grebe	2					
Hoary-headed Grebe	550			100	160	
Little Pied Cormorant				1		
White-necked Heron	3					
White-faced Heron	3		1	6	20	16
Straw-necked Ibis	19			43		
Black-tailed Nativehen	11					
Eurasian Coot	13,000			18,000	220	
Silver Gull	60		26			
Pied Stilt	700			6		
Banded Stilt	140					
Red-necked Avocet	6				14	
Red-capped Plover	520					
Double-banded Plover	20					
Red-kneed Dotterel			9			
Masked Lapwing	340		70	5	3	28
Common Greenshank			3			
Red-necked Stint	2,500		10			
Sharp-tailed Sandpiper	240					
Black-shouldered Kite	2					
Whistling Kite	49					
Swamp Harrier	2					
Nankeen Kestrel	1					
Brown Falcon	15					
Golden-headed Cisticola	*					
Little Grassbird	*					
Striated Fieldwren	*					
White-fronted Chat	*					

2014 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Rod Bird (RB)

WETLAND	JENA	LKEN	KRAU	BULR	HARN	SOLD
Observer	RB	RB	RB	RB	RB	RB
Survey date	10Feb	10Feb	10Feb	10Feb	7Feb	24Feb
Water depth (max.)	0.22 m	dry	mod	high	mod	v low
Water % cover of area	50	0	70	90	70	<10
Australasian Shoveler				20		
Australian Shelduck	100		20	50	320	
Black Swan	220		12	280		44
Brolga			2			
Blue-billed Duck				4		
Chestnut Teal	900			500		
Eurasian Coot				3000		
Freckled Duck				2		
Grey Teal	13000		60	3000	18	700
Hoary-headed Grebe				500		
Pacific Black Duck				10		100
Pink-eared Duck	5000			1500	9	
Australasian Swampphen			6			20
Little Pied Cormorant						1
Australian White Ibis			1			5
Royal Spoonbill			2			1
Straw-necked Ibis						10
White-faced Heron			2	3		54
White-necked Heron						28
Yellow-billed Spoonbill			8		4	16
Silver Gull	60			3		1
Whiskered Tern	70					13
Pied Stilt	450			23		12
Masked Lapwing	60		2	4		70
Pectoral Sandpiper	1					
Red-capped Plover	400					
Red-kneed Dotterel						5
Red-necked Avocet	400					
Red-necked Stint	770					
Sharp-tailed Sandpiper	110					
Australian Hobby	1					
Brown Falcon	1					
Black-shouldered Kite	2					
Nankeen Kestrel	1					
Swamp Harrier						1
Wedge-tailed Eagle	1					
Whistling Kite			1			
Golden-headed Cisticola	6					
White-fronted Chat	2					

2014-2015 Shorebird 2020 surveys of *Jenawarra* (JENA), Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Jane Hayes (JH), Rod Bird (RB) & HFNC club excursion

WETLAND	LKEN	JENA				BULR					KRAU				HARN		SOLD	
Observer	RB	JH	JH	RB	JH	JH	RB	hfnc	RB,JH	JH	JH	RB	hfnc	JH	JH	JH	RB	
Survey date	22Feb	22Oct	21Dec	26Dec	22Oct	21Dec	26Dec	22Feb	17Mar	22Oct	21Dec	26Dec	22Feb	22Oct	10Dec	22Oct	13Jan	
Water depth (max.)	dry	30cm	vl	dry	mod	low	low	0-25	0-20	high	mod	mod	low	mod	vl	mod	vl	
Water % cover on bed	0	70	<2	0	100	90	90	75	50	100	90	80	75	95	50	90	70	
Banded Stilt											3							
Pied Stilt		<100				65	20	16	5	16				18		30	70	
Common Greenshank						2*												
Double-banded Plover								2	30									
Masked Lapwing					6	10	2	195	270		2	6	34	2	2	12	12	
Red-capped Plover		38	153				1	110	100									
Red-necked Avocet		400†				84	17		38		9							
Red-necked Stint		22	257					215	300									
Sharp-tailed Sandpiper		620	224			8*	7	17							39	8	30	
Australasian Grebe											2							
Australasian Shoveler		300†			1	4	10	20	80	2	21	65				20		
Australian Shelduck		p			288			350	58	17	12	12				22		
Black Swan		p			830	730	475	600	300	7	2	1	4			12	1	
Brolga							7	45#	27				3		2			
Chestnut Teal		p				10	50	20	10	2	2	20					50	
Freckled Duck					2													
Grey Teal		3000†			38	>1000	2500	6000	6000	48	5	60		94		180	350	
Hardhead																26		
Hoary-headed Grebe					55	<100				4		9				7		
Pacific Black Duck								15	12					2		32		
Pink-eared Duck		10000†				>1000	400	35		1	540	150		11				
Australian White Ibis							3			3	3	3				2		
Dusky Moorhen										1								
Great Egret										1						1		
Eurasian Coot					>1000	>2000	5200	1100		47		1				>200		
Australasian Swamphen										4	4					18		
Royal Spoonbill								1										
White-faced Heron						3		22	27	3	1					1		
White-necked Heron				2					2	1						3		
Yellow-billed Spoonbill						1	3	14	4	6	4	3	2			9	2	
Silver Gull		p	24			12	10	165	205		1		34					
Whiskered Tern		150†			44	86	50	2		2		6		29		11		
Australian Hobby									1								1	
Brown Falcon		1						1				2				1		
Black-shouldered Kite								1	1					1				
Swamp Harrier						1	2	1		1								
Spotted Harrier									1					2				
Golden-headed Cisticola									1									
Little Grassbird									1									
White-fronted Chat								2										

* seen on 24 Dec 14

† seen 2 Oct 14 by KH

¶ seen on 19 Mar 14 by RB

97 Brolga also seen on 22 Feb am at Blackwood Swp.

2015-2016 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Jane Hayes (JH) & Rod Bird (RB)

WETLAND	LKEN		JENA			BULR			KRAU			HARN		SOLD	
Observer	RB	RB	JH	RB	RB	JH	RB	RB	JH	JH	RB	JH	RB	JH	RB
Survey date	16Oct	8Feb	7Oct	16Oct	4Feb	4Nov	16Oct	4Feb	4Nov	11Nov	4Dec	4Nov	4Feb	11Nov	4Feb
Water depth (max.)	low	dry	vlow	dry	dry	~dry	low	dry	low	<5cm	dry	dry	dry	~dry	dry
Water % cover on bed	80	0	<40	0	0	0	20	0	90	60	0	0	0	Y	0
Water only drains/dams?														Y	Y
Banded Stilt	440								1						
Masked Lapwing	5	2				4			18	3				2	45
Red-capped Plover						20				13					
Red-necked Stint						5	300		1						
Sharp-tailed Sandpiper						280	700		57	127					
Australian Shelduck	400														1
Black Swan									3						
Brolga			3							2					
Grey Teal	300						2000								
White-faced Heron														1	
Silver Gull	20								13						
Whiskered Tern						40			50	74					
Brown Falcon			1					6							
Black Falcon			1												
Nankeen Kestrel								2							
Swamp Harrier					1	1									
Wedge-tailed Eagle						1									
Whistling Kite						2			1						

2017 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Rod Bird (RB) & HFNC club excursion

WETLAND	LKEN		JENA		BULR		KRAU		HARN		SOLD
Observer	RB	hfnc	RB	hfnc	RB	hfnc	RB	hfnc	RB	hfnc	RB
Survey date	22Jan	18Feb	22Jan	18Feb	22Jan	18Feb	22Jan	18Feb	22Jan	18Feb	20Feb
Water depth (max. cm)	mod	mod	mod	114	mod	mod	mod	mod	mod	mod	v low
Water % cover on bed	100	90	90	90	100	100	100	100	100	100	80
Pied Stilt		2									
Masked Lapwing	10	30	18	22			4	6	2	2	110
Red-kneed Dotterel											2
Australasian Shoveler	60	8	15	6		2		22			50
Australian Shelduck	380		340	15	30					13	57
Maned Duck				2					14		
Black Swan	1050	835	205	67	5			3			1
Brolga					2						3(1i)
Blue-billed Duck	2		83	36(466 [#])							
Chestnut Teal		10									10
Freckled Duck				11							
Grey Teal	30	1670	115	215	80	175	10	3	4		520
Hardhead			90	20							
Hoary-headed Grebe	65	35	85	75		44	5		26	24	
Musk Duck				8							
Pacific Black Duck	30	100	35	120		55		48	16 (7j)	19	10
Pink-eared Duck			8	28							
Australian White Ibis			5				7				
Eurasian Coot	105	180	270	53	20	64				27	
Australasian Swamphen			1				1				
Straw-necked Ibis				8				3		1	
White-faced Heron				1			1	3		6	4
White-necked Heron				1							
Silver Gull	190	95		29				1			51
Brown Falcon			1	1							2
Wedge-tailed Eagle				1							
Whistling Kite						2	1				
Little Grassbird									1		

j Breeding record – number of juveniles (included in count);

i = immature bird (included in count)

survey on 14/03/2017 to check Blue-billed Ducks – 466 seen

* indicates a new record for the Hamilton Area Summer Survey

2018 Shorebird 2020 surveys of *Jenawarra* (JENA) , Lake Kennedy (LKEN), Krause Swamp (KRAU), Harnath Swamp (HARN), Lake Bulrush (BULR) & Soldiers Swamp (SOLD)

Jane Hayes (JH), Rod Bird (RB) & HFNC club excursion

WETLAND	LKEN			JENA			BULR		KRAU			HARN		SOLD
Observer	JH	hfnc	RB	JH,RB	hfnc	JH,RB	JH,RB	hfnc	JH,RB	hfnc	JH,RB	JH	hfnc	RB
Survey date	21Jan	18Feb	3Mar	31Jan	18Feb	30Mar	31Jan	18Feb	31Jan	18Feb	30Mar	21Jan	18Feb	07Feb
Water depth (max. cm)	mod	mod	mod	117	110		high	high	high	mod	mod	mod	mod	0-10
Water % cover on bed	90	80	75	90	85	80	90	90	90	85	80	90	85	60
						*					*			
Banded Stilt											3			3
Pied Stilt	11	15	10											
Masked Lapwing	22	40	55	17	37	p				2	88	4	4	125
Red-kneed Dotterel					15						3			
Red-capped Plover			103								140			
Red-necked Avocet				3										
Red-necked Stint			30											
Sharp-tailed Sandpiper			1											
Australasian Grebe							1							
Australasian Shoveler	30	60	100	1	250	640			19	30	11			
Australian Shelduck	8	250		48	37	10	600		19	5		340	425	4
Maned Duck				13	3								10	
Black Swan	1231	600	1200	6	52	10	97	35		10		2	2	3
Blue-billed Duck				335	780	1050				1				
Cape Barren Goose		1#												
Chestnut Teal			10			50								40
Freckled Duck	56	5	5		135	850								
Grey Teal	690	2600	2000	20	2000	>1000	2		22	350		182	140	120
Hardhead	1	200		180	200							4		
Hoary-headed Grebe	10	12	280	65	295	p	2		70	7		57	26	
Musk Duck	1			2	3	2	1							
Pacific Black Duck		300			300		90		11			120		4
Pink-eared Duck	2450	1600	3200	565	5000	>5000			45	40		3	2	
Australian Pelican					7									
Great Cormorant			1											
Little Pied Cormorant			1		2		2							
Australian White Ibis					1				4	18				
Black-tailed Nativehen	6													
Great Egret										1				
Eurasian Coot	1826		150				700	1450	2			142	40	
Australasian Swamphen							2		2	13			1	34
Royal Spoonbill										5				
Straw-necked Ibis	35				56					3	160			2
White-faced Heron	1	8	12	1	3	2			1	1				57
White-necked Heron										2				13
Yellow-billed Spoonbill										9				6
Silver Gull	4		20	76	72	p								
Australian Hobby					1									
Brown Falcon				1	7	3				1			2	
Collared Sparrowhawk				1										
Nankeen Kestrel					1					1				
Swamp Harrier	1				1					2			1	
Spotted Harrier						1			1					
Wedge-tailed Eagle					1			1					3	
Whistling Kite		3	2	1	1	1								
White-bellied Sea Eagle				1#										
Golden-headed Cisticola										3				
White-fronted Chat				20										

p present but not counted

* not all species counted or presence noted

D Tonkinson 25 Jan. 18

≠ Y Ingeme 22 Feb. 18

2019 Shorebird 2020 summer surveys of Lake Kennedy, Jenawarra (Lake Linlithgow), Lake Bulrush, Krause Swamp, Harnath Swamp & Soldiers Swamp

Rod Bird, Diane Luhrs & HFNC club excursion

WETLAND	Kennedy	Jenawarra		Bulrush	Krause	Harnath	Soldiers
Observer	RB,DL	RB	HFNC	RB	RB	RB,DL	RB,DL
Survey date	17Feb	19Feb	24Feb	21Feb	19Feb	17Feb	17Feb
Water depth (max. cm)	low	107		mod	mod	mod	~dry
Water % cover on bed	60	80	80	95	90	90	<1
Shorebirds & Waders							
Pied Stilt	50		1				
Double-banded Plover			4				
Masked Lapwing	93	70	70	2	88		2
Pacific Golden Plover *			3#				
Red-capped Plover	220	26	30				
Red-necked Avocet		182	~200		1		
Red-necked Stint		35	90				
Sharp-tailed Sandpiper		85	35				
Cranes, Crakes, Ducks, Grebes, Geese, Swans							
Australasian Grebe							
Australasian Shoveler		170	~100	45		38	
Australian Shelduck	350	535	~600	440		2	
Black Swan	14	6	4	12		2	
Blue-billed Duck		905	~1200				
Chestnut Teal			4	4		30	
Freckled Duck			23	2			
Grey Teal	200	2810	~3000	135			2
Hardhead		20					
Hoary-headed Grebe		60	6	45		35	
Musk Duck		5					
Pacific Black Duck				20		10	
Pink-eared Duck		6530	~5000	1335		28	
Gannets, Pelicans & Cormorants							
Great Cormorant							1
Hérons, Egrets, Ibis, Spoonbills							
Australian White Ibis				2			
Eurasian Coot			2	6		33	
Straw-necked Ibis	31		~200			30	
White-faced Heron		3	9	14			33
White-necked Heron		3					
Yellow-billed Spoonbill		20	2				
Gulls & Terns							
Silver Gull	149	54	82				
Whiskered Tern			1				
Raptors							
Brown Falcon			1				
Black Falcon			1				
Black-shouldered Kite			2				
Swamp Harrier			1				
Wedge-tailed Eagle		2					
Whistling Kite			3				

Second record for Pacific Golden Plover at this lake (a single bird was seen in September 2002)

APPENDIX 3.

Winter shorebird/waterbird/raptor surveys in the Jenawarra area wetlands

2018 Shorebird 2020 winter surveys of Lake Kennedy, Jenawarra (Lake Linlithgow), Krause Swamp, Harnath Swamp & Soldiers Swamp

Rod Bird

Wetland	Kennedy	Jenawarra	Krause	Harnath	Soldiers
Observer	RB	RB	RB	RB	RB
Survey date	29Jun	29Jun	29Jun	29Jun	29Jun
Time	0915-1045	1100-1300	1315-1345	1400-1420	1430-1515
Water depth (cm, max.)	high	100	high	high	low
Water % cover	95	95	100	100	60
SHOREBIRDS & WADERS					
Pied Stilt	2				
Double-banded Plover					40
Masked Lapwing	44	22	12	2	36
Red-necked Avocet		47	18		
Red-capped Plover	31	8			
GANNETS, PELICAN & CORMORANTS					
CRANES, CRAKES, DUCKS, GREBES, GEESE, SWANS					
Australasian Shoveler	6	5		2	
Australian Shelduck		6			82
Australian Wood Duck			3		
Black Swan	200		8	2	90
Blue-billed Duck		920			
Chestnut Teal	60	6		10	
Eurasian Coot	25	36	20	80	
Freckled Duck		650			
Grey Teal	450	100	920	90	740
Hardhead		1			
Hoary-headed Grebe	15	4		8	
Musk Duck	2	1		1	
Pacific Black Duck		32	15	10	20
Pink-eared Duck	1980	1200			30
HERONS, EGRETS, IBIS, SPOONBILLS					
White-faced Heron	1		1		
Yellow-billed Spoonbill		5			
GULLS & TERNS					
Silver Gull		7			
RAPTORS					
Black-shouldered Kite		2			
Brown Falcon	1		1		
Nankeen Kestrel		1			
Spotted harrier			1		
Whistling Kite	5	1			
OTHER SPECIES ASSOCIATED WITH WETLANDS					
White-fronted Chat					P

**2019 Shorebird 2020 winter surveys of Lake Kennedy, Jenawarra (Lake Linlithgow),
Krause Swamp, Harnath Swamp & Soldiers Swamp**

Rod Bird

Wetland	LKEN	LLIN	KRAUSE	HARNATH	SOLDIERS
Observer	RB	RB	RB	RB	RB
Survey date	19/07	19/07	19/07	25/07	19/07
Time	1015-1100	1115-1500	1300-1315	1515-1530	0930-1000
Water depth (max.)		0.65m			
Water % cover	80	70	80	95	75
SHOREBIRDS & WADERS					
Black-fronted Plover					2
Double-banded Plover		155*			
Masked Lapwing	8	4	2		8
Red-capped Plover	1	47			
Red-necked Stint		15			
GANNETS, PELICAN & CORMORANTS					
Great Cormorant		1			
CRANES, CRAKES, DUCKS, GREBES, GEESE, SWANS					
Australasian Shoveler					32
Australian Shelduck				2	2
Australian Wood Duck					1
Black Swan	8	80			12
Blue-billed Duck		2200#			
Grey Teal		540			172
Hoary-headed Grebe				4	
Pacific Black Duck				2	
Pink-eared Duck		2160			25
HERONS, EGRETS, IBIS, SPOONBILLS					
White-faced Heron		2	1		1
Yellow-billed Spoonbill		8			
GULLS & TERNS					
Silver Gull		10			
RAPTORS					
Nankeen Kestrel			1		
Wedge-tailed Eagle		2			
Whistling Kite					1
OTHER SPECIES ASSOCIATED WITH WETLANDS					

APPENDIX 4 Photograph gallery for the wetlands 1997-2008



Figure 39.

Sunrise from the south bank, looking east towards The Point from near Habel's memorial off Chatsworth Rd.

Photo taken in 1997, on HFNC's annual February excursion.

The lake at this time had a good depth of water.



Figure 40.

Roger Thompson is walking on the dry lake bed on another HFNC excursion

Scene from south bank near Habel's memorial in Feb. 2000.



Figure 41.

Lake Linlithgow from the west side of The Point on a HFNC excursion in Feb. 2002.

The lake held some water that summer (0.45 m at The Point in Feb.), the most observed over 8 years (2000-08). In Feb. 2004 the depth was 0.14 m but the lake was dry in Feb. of the other 6 years.



Figure 42.

Lake Bulrush in Feb. 2002, from the SW corner off Chatsworth Rd.

The swamp at this time had a good depth of water and a host of waterbirds, among them at least 250 Sharp-tailed Sandpipers, 6,000 Grey Teal and 2,000 Eurasian Coots.



Figure 43.

Lake Bulrush in Feb. 2002, also looking north, from the drain on Chatsworth Rd.

In 2004 there were 74 Black Swan nests on this swamp.



Figure 44.

Lake Bulrush in Feb. 2002, looking SW from Mibus Lane, just north of Krause Swamp.

Mt. Napier can be seen in the left background.



Figure 45.

A flight of Brolga over Lake Bulrush in 2002.



Figure 46. Lake Kennedy, with *Tappoc* (Mt. Napier) beyond, taken from Chatsworth Rd in Feb. 1982. The lake was dry.



Figure 47. Eastern half of Lake Kennedy where the flats were once grazed by Cape Barren Geese in the summer and autumn. Scene from Chatsworth Rd in March 2001 when the lake was dry.



Figure 48. Eastern half of Lake Kennedy from just west of the entrance area off Chatsworth Rd., looking to *Kolor* (Mt. Rouse). Scene in March 2001 when the lake was dry and before tree planting began on the banks in Sep. 2001.



Figure 49. Lake Kennedy, west side in Feb. 2007. Note the growth of trees planted on the banks in 2001.



Figure 50. Lake Kennedy, dry in Feb. 2007. Note the trees planted from 2001-05 around the lake.



Figure 49. Lake Kennedy, eastern side, dry in Feb. 2007. Note the relatively poor survival of trees in saline areas. That was expected and will keep open the flight paths for swans and other waterbirds flying across to *Jenawarra*. This saline area was once a prime site for Cape Barren Geese.



Figure 52. *Eutaxia microphylla* on the SE foreshore in Feb. 2007. The HFNC 1975-91 500-m tree block is top left.



Figure 53. *Eutaxia microphylla* on the SE foreshore in Feb. 2007. The plants were not seen when sheep grazed here.



Figure 54. Members of HFNC in Feb. 2007, in the shade of trees the club planted on the east bank in 1975. Pictured: Jane Hayes, John Cayley, Glenys Cayley, Rod Bird, Lyn Munro, Dave Munro. Diane Luhrs took the photo.



Figure 55. The southern foreshore in Nov. 2005, at the overflow point. The rare *Poa salacustris* grows here.



Figure 56. Looking to the southern foreshore in Nov. 2005. Note the broad mound of wind and water borne silt.

Figure 57.

Looking past an old Cypress on Habel's Memorial bank in March 2007. The old Cypress are beginning to break down.

Tree-planting has been done along the SW bank, in this corner of Lake Linlithgow.

The lake was still dry, its bed in most parts a sea of grass, mostly *Puccinellia stricta* var. *perlaxa*. – Salt Marsh-grass.





Figure 58.

North bank adjacent to North Lake Rd, looking west through trees planted in 2002 by Parks Victoria. The HFNC's planted area (2004-2005) lies to the east of this stand, on the headland (see Fig. 36).

The trees include Blackwood, Swamp Gum, Black Wattle, Silver Banksia and Drooping Sheoak. The trees were grown from local seed.

Photo in March 2007.



Figure 59.

SW bank, from the edge of West Lake Rd, looking SE through trees planted in 2004 by Parks Victoria's groups of volunteers. The trees extend around to Habel's memorial stand, completing a remarkable planting effort.

The trees include Silver Banksia, Blackwood, Swamp Gum, Black Wattle, Sweet Bursaria and Drooping Sheoak. The trees were grown from local seed.

Photo in March 2007.



Figure 60.

West bank, adjacent to West Lake Rd, looking south through trees planted in 2003 by Parks Victoria's volunteers.

The trees include Blackwood, Swamp Gum, Black Wattle and Drooping Sheoak. The trees were grown from local seed.

Photo in March 2007.



Figure 61.

Three of 4 flocks of Sharp-tailed Sandpipers above the southern edge of Lake Linlithgow. A small flock of similar size to that on the left is not visible to the right. There is an overlap of 2 flocks in the centre.

These birds had risen from Lake Bulrush at about 3 pm and probably numbered 5,000 or more.

Photo 25 Jan. 2008, taken from the centre of the lake and looking at the cypress to the south.



Figure 62.

A flock of Sharp-tailed Sandpipers about to land by the water pools on Lake Linlithgow.

As a result of a run of dry years, and a dry winter in 2007 before the late spring rains, there was a good cover of grass on the lake bed

Photo on 29 Jan. 2008, taken from the centre of the lake and looking at the pines and cypress to the south, again at about 3 pm.



Figure 63.

Part of a flock of Sharp-tailed Sandpipers high above the lake. Photo 29 Jan. 2008.

Figure 64.

Sharp-tailed Sandpipers landed in or near shallow pools on Lake Linlithgow. Photo 29 Jan. 2008.



Figure 65.

Cape Barren Goose, Black Swan and Masked Lapwing at Lake Kennedy.

Photo 22 February 2018.



Figure 66.

Part of a flock of at least 400 Freckled Duck on *Jenawarra*, near Boonawah Creek.

Photo 22 February 2018.