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Fauna Values of three Sub-Coastal Wetlands on the Bellarine Peninsula

Lake Victoria, Freshwater Lake and St Leonards Salt Lagoon

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Fauna Values of Three Sub-Coastal Wetlands on the Bellarine Peninsula:

Lake Victoria, Freshwater Lake and St Leonards Salt Lagoon

Marilyn J. Hewish

Arthur Rylah Institute for Environmental Research

November 2003

Executive Summary

- Lake Victoria, Freshwater Lake and St Leonards Salt Lagoon are shallow subcoastal lagoons which form part of the Swan Bay system of wetlands and marine environments on the eastern Bellarine Peninsula, Victoria.
- They are included in the Lonsdale Lakes and Salt Lagoon Nature Reserves administered by Parks Victoria. The three wetlands and associated remnant coastal woodlands are under pressure from development and recreational use, changes in hydrology, and exposure to introduced predators and pests. This study of the fauna of the three wetlands, with emphasis on waterbirds, has been commissioned by Parks Victoria as part of its management strategy.
- Annotated lists covering the period since 1980 have been compiled for all waterbirds and wetland-associated land birds known to use these wetlands. Information was sought on numbers, temporal patterns of occurrence, habitat use, historical changes, occurrence of significant populations and threatened species, and possible threats and management issues.
- Options for future study are suggested, with emphasis on monitoring the occurrence and status of Orange-bellied Parrots at the three wetlands.
- Mammals, reptiles and frogs recorded from the vicinity of the three lagoons and land birds using the wetland surrounds have also been listed. The list of mammals includes recent historical records for two threatened species, Brush-tailed Phascogale and Southern Brown Bandicoot.
- Lake Victoria is a stable wetland environment, the lagoon never drying out completely and maintaining its salinity even when full. It is surrounded by saltmarsh.
- 81 species of waterbirds have been recorded from Lake Victoria. The most numerous species are salt-tolerant waders and dabbling waterfowl, which sometimes occur in thousands. The highest total waterbird count recorded at the lake was 10,062. There are breeding records for five species.
- 37 species occur at Lake Victoria in numbers which are significant at global, national, state or regional levels, have special conservation status, or are listed in international treaties. The lake attracts significant populations of the globally endangered Orange-bellied Parrot, the nationally vulnerable Hooded Plover, and the Little Egret, which is

listed as critically endangered in Victoria. The lake is important for waders gaining weight before migration, and for over-wintering first-year waders.

- Waterbird numbers at the lake are highly variable, in response to changes in water level and salinity, seasonal movements of waterfowl and waders, irruptions of waterbirds to the coast from inland, and movements within the Swan Bay and other wetland systems. Waterfowl occur in the highest numbers when the lake is full in late summer-autumn. Waders are most numerous when the water is low and mudflats exposed in the same season.
- Freshwater Lake is subject to large changes in water level, salinity and vegetation. When full, it is weakly saline, the margins are flooded, and rushes are the dominant vegetation. When water levels are low, the lake is saline, mudflats are exposed, and it is surrounded by saltmarsh. It is often dry in summer.
- 60 species of waterbirds have been recorded from Freshwater Lake. Dabbling waterfowl and waders are most numerous when the water level is low and mudflats exposed; deep-diving waterfowl occur when water levels are high and the salinity low. The highest waterbird count recorded was 2823. There are breeding records for six species.
- 26 species occur at Freshwater Lake in numbers which are significant at global, national, state or regional levels, have special conservation status, or are listed in international treaties. The lake attracts significant populations of the globally endangered Orange-bellied Parrot in some years.
- Waterbird numbers vary in response to changes in water level and salinity, seasonal movements of waterfowl and waders, irruptions of waterbirds to the coast from inland, and movements within the Swan Bay and other wetland systems. Peak numbers often occur in winter, as the lake is often dry in summer, and the lake is sometimes important for over-wintering first-year waders.
- St Leonards Salt Lagoon is a very shallow, highly-saline lagoon, close to the sea, surrounded by saltmarsh vegetation, and with an associated salt meadow. It often dries out completely in summer.
- 41 species of waterbirds have been recorded from the lagoon, and the highest total count was 1402 on 7/2/02. Dabbling waterfowl and waders are the dominant waterbirds. Only one species has been recorded breeding. Species, numbers and breeding are probably restricted because of the high salinity and the ephemeral nature of the lagoon.

- The lagoon supports 16 species of waterbirds in numbers which are significant at national, state or regional levels, have special conservation status, or are listed in international treaties. It contains potential habitat for Orange-bellied Parrots, and is of national significance for Common Greenshanks.
- Waterbird numbers vary in response to changes in water level and salinity, seasonal movements of waterfowl and waders, irruptions of waterbirds to the coast from inland, and movements between the lagoon, the Swan Bay system and probably Portarlington Sewage Ponds. The highest waterbird numbers often occur in winter and early spring, when the lagoon is most likely to hold water. The lagoon is important for over-wintering first-year waders of several species.
- Changes in status have been noted for some species since 1980. Australian Shelducks have declined in numbers, probably because they have moved to the nearby Portarlington Sewage Ponds; Double-banded Plovers and Masked Lapwings have declined at Lake Victoria and Freshwater Lake for unknown reasons; and Little Egrets have moved into Lake Victoria since 1990, as part of a recent expansion in range into the region.

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SUMMARY

- Lake Victoria, Freshwater Lake and St Leonards Salt Lagoon are shallow subcoastal lagoons forming part of the Swan Bay system of wetlands on the eastern Bellarine Peninsula.
- They are part of the Lonsdale Lakes Nature Reserve (Lake Victoria, Freshwater Lake) and the Salt Lagoon Nature Reserve (St Leonards Salt Lagoon) administered by Parks Victoria.
- As part of its management strategy, Parks Victoria has commissioned this study of the waterbirds using the three wetlands.
- Lake Victoria is the largest wetland. Although it varies in water level, it provides a relatively stable environment for waterbirds, maintaining its high salinity even when full and never drying out in summer. Saltmarsh is the dominant vegetation around the lakeshore at all times.
- Freshwater Lake is smaller and slightly further from the coast. The habitats available to waterbirds change their character in response to changing water levels. The lake is often dry in summer. When it is full, the water is weakly saline, the margins are flooded, and, if high water persists, rushbeds become the dominant vegetation; when the water is low, it becomes highly saline, mudflats are exposed, and the lake is fringed by saltmarsh.
- The Salt Lagoon is an ephemeral lagoon with an associated salt meadow, abutting the coast at St Leonards. Both wetland areas are very shallow and highly saline even when at capacity, and saltmarsh is the dominant vegetation.
- The three wetlands and associated remnant coastal woodlands are under pressure from development and recreational use, changes in hydrology, and exposure to introduced predators and pests.

INTRODUCTION

Lake Victoria, Freshwater Lake and St Leonards Salt Lagoon are subcoastal lagoons on the eastern Bellarine Peninsula, south-east of Geelong. They are part of the Swan Bay complex of shallow marine waters and wetlands formed by subsidence on the eastern side of the Bellarine Fault and incursion of the waters of Port Phillip Bay (Gill 1948; Douglas and Ferguson 1976; Garnett et al. 1986). In this system, Swan Bay and its associated intertidal mudflats, saltmarshes, sand barriers, low islands and lagoons are important habitats for

waterfowl, waders and other wetland and marine birds (Barter et al. 1988). The environmental value of Swan Bay has been recognised for many years and its southern section has been declared a Wetland of International Importance under the RAMSAR Convention. The whole of Swan Bay is included on the Register of the National Estate. However, to date little attention has been directed towards Lake Victoria, Freshwater Lake and St Leonards Salt Lagoon, in defining their individual roles in this wetland system and their value for waterbirds.

Lake Victoria (38°16′S 144°36′E) at Point Lonsdale is separated from Bass Strait by a narrow strip of coastal dunes. It is a natural lake but has been modified by shell-grit mining, which has been in operation for more than 50 years and is at present under a 10-year licence to J. McMahon & Sons. Several smaller wetlands are associated with the lake, some formed by shell-grit extraction. There are two complexes of shallow ponds and low banks on the south-eastern and south-western shores of the lake. To the west of the lake, shallow ephemeral swamps surrounded by saltmarsh are on private land. Two small wetlands immediately north-east of the lake are marked on old maps (National Topographic Map 7821 1:100,000) but have been filled with mining spoil and no longer exist. Further to the north-east, there is an extensive system of shell-grit ponds, some of which have been connected and deepened as waterways for a canal estate. The country to the north of the lake has been largely cleared. The dune woodland to the south has been partly cleared for a golf course, and a housing estate was established close to the south-eastern border of the lake reserve in the 1990s. A wetland system known as the Emily Street wetland was constructed by the City of Greater Geelong to catch stormwater from this estate and eventually direct it into Lake Victoria. An open drain also delivers urban run-off from Ocean Grove. A relieving drain with a weir acts as an outlet from the lake. The level of the weir is set by the City of Greater Geelong as part of its stormwater management system, and excess water passes into the waterways of the canal estate and from there into Swan Bay.

Freshwater Lake (38°15′S 144°34′E), also known as Clow's Swamp and Cox's Lagoon, is a short distance north of Lake Victoria, and approximately 1.5 km from Bass Strait. The surrounds have been largely cleared for agricultural and pastoral use, but there is one small area of remnant coastal woodland which is included in the reserve. Low-density housing comes down to the lakeshore on the southern and south-western sides.

St Leonards Salt Lagoon (38°09′S 144°42′E) lies in a depression at St Leonards, behind the shoreline of Port Phillip Bay. It is approximately 100 metres from the beach and is backed by low dunes. Despite its proximity to the Bay and low elevation on the seaward side, there is no above-ground connection with the sea. There were probably regular incursions of sea-

water in the past, before construction of the St Leonards-Portarlington Road cut the connection. There is no culvert, and now the sea encroaches over the road only very occasionally when the highest tides and strong easterly winds coincide (D. King, pers. comm.). In the past, the western section was used for garbage disposal, and old fence lines around the lagoon perimeter suggest that grazing may once have occurred (King 1987). At least part of the lagoon was owned at one time by Cheetham Salt Pty Ltd but no salt was extracted (D. King, pers. comm.). A remnant of coastal woodland on the low dune to the south of the lagoon is included in the reserve. The land around the northern and western perimeter of the lake has been cleared. Housing along the St Leonards-Portarlington Road abuts the reserve in the north and south.

For all three wetlands, their proximity to housing and private land poses potential problems with stormwater and agricultural run-off, water management, dogs, cats and other introduced predators, exotic birds, weeds, rubbish dumping, horse-riding, trail-bikes, sports-cycling and visitor pressure. The garbage tip at the Salt Lagoon has been covered with landfill, and household rubbish and old car bodies removed from the northern part of the lagoon and its shores, but seepage and pollution from the site may be a problem. In the 1980s, a piggery operated on the north-western slope above Freshwater Lake, and produced offensive odours and perhaps some run-off into the lake (M. Cameron, G. Tribe, pers. comm.). Land values on the Bellarine Peninsula coast have increased markedly in the last few years, and pressure for development is high. These problems are perhaps most marked at Lake Victoria, where there are plans for development and extension of the golf course. With a housing estate and golf course nearby and formed tracks around the lakeshore, its recreational use is also higher than for the other wetlands.

The three wetlands and some associated remnant woodland areas are included in the Lonsdale Lakes State Nature Reserve (Lake Victoria and Freshwater Lake) and the Salt Lagoon State Nature Reserve (St Leonards Salt Lagoon), permanently set aside as wildlife reserves and administered by Parks Victoria since 1996. As part of its responsibility, Parks Victoria has begun a programme of replanting local indigenous vegetation, and control of pest plants and animals. The three wetlands are closed to duck-hunting.

This report has been commissioned by Parks Victoria through the Victorian Department of Natural Resources and Environment. The aim was to produce annotated bird lists covering the period since 1980 for all waterbirds using these wetlands, including waterfowl, waders, egrets, herons, ibis, spoonbills, crakes, rails, gallinules, cormorants, coastal birds, wetland-associated land birds and birds of prey. Information was sought on numbers, temporal patterns of occurrence, habitat use, historical changes, occurrence of significant populations

and threatened species, and possible threats and management issues. Some records of land birds were collected during this process, and appear in Appendices 2-4.

HABITATS

Lake Victoria

Lake Victoria is a natural shallow saline lake 139 ha in extent. The substrate consists of deposits of sand, clay, silt and black mud, with beds of fossil shells laid down in recent geological times when the Point Lonsdale area was part of a shoreline lagoon enclosed by a reef. The ancient shore is visible as a scarp north of the lake, between Ocean Grove and Point Lonsdale, and deposits of cemented limestone (aeolianite) mark the remains of the former dune-lines (Gill 1948; Douglas and Ferguson 1976). The lake lies below sea level. The southern part is shallow and features gently-sloping shores of sand and soft mud. Even when the lake is at high level, this shoreline retains some sandy margins, sandspits, banks and islands. At low water levels, extensive mudflats and limestone outcrops are exposed. The northern part of the lake is deeper, up to about two metres at capacity (G. Tribe, pers. comm.), and the shore is steeper and scattered with pebbles and rocks. Two complexes of ponds formed by shell-grit extraction on the southern shore of the lake are also shallow, with low banks and, at low water level, flats of sand and mud.

Water level and salinity are highly variable. However, the lake has not been known to dry out in the last 20 years, although there have been two serious local droughts during that period (M. Cameron, G. Tribe, pers. comm.). Water enters the lake through urban run-off, rainfall and slow seepage. Evaporation is high. A weir in a relieving drain controls the maximum water level in the lake. At or near capacity, the water is highly saline (51 ppt on 18 Jan. 2002; seawater 35 ppt), becoming hypersaline when the level is low, particularly in autumn. Because of its open aspect, the lake is exposed to westerly winds and wave-action can be quite strong, but there are sheltered areas in the ponds, in the lee of islands and outcrops, and in the crevices of limestone areas when they are exposed. In summer 2001-2002 (Dec.-Feb.), the conditions at Lake Victoria were apparently unusual, as it was at or near capacity throughout this period. The water level was also high in July 2001 (M. Cameron, pers. comm.), which suggests that the lake had been full for at least seven months.

A brief survey of the vegetation was carried out by Graeme Stockton on 18 Jan. 2002. At this time, the plant communities consisted of salt-tolerant species typical of coastal dune woodland and saltmarsh in the region. Woodland and tall shrubland along the southern lakeshore is mainly coastal Moonah woodland *Melaleuca lanceolata*, a vegetation association that is listed as threatened in Victoria under the Flora and Fauna Guarantee Act,

1988. Moonah occurs in single species' stands and intermingled with Boobialla *Myoporum insulare*, Coast Tea-tree *Leptospermum laevigatum*, Coast Beard-heath *Leucopogon parviflorus* and Wirilda Wattle *Acacia retinodes*. Parts of this woodland have been cleared for the golf course. The woodland along the northern shore has been largely cleared, leaving grassland with small scattered stands of Moonah, Wirilda Wattle and Coast Beard-heath, and some Coast Banksia *Banksia integrifolia*. Along the margins of the lake, particularly along the southern shore and in the ponds, there are extensive beds of sedge, spear-grass and rush, predominantly Chaffy Saw-sedge *Gahnia filum*, Prickly Spear-grass *Stipa stipoides* and Sea Rush *Juncus kraussii*. In low-lying areas, there is a low samphire shrubland and herbland of Black-seeded *Halosarcia pergranulata* and Grey Glasswort *H. halocnemoides,* Beaded Glasswort *Sarcocornia quinqueflora* (in extensive flats along the south-western shore, smaller areas elsewhere), Thick-head Glasswort *S. blackiana,* Trailing Jointweed *Hemichroa pentandra*, Rounded Moon-flower *Disphyma crassifolium*, Ross' Noonflower *Carpobrotus rossii*, and Creeping Brookweed *Samolus repens*. A taller shrubland of Shrubby Glasswort *Sclerostegia arbuscula* occurs mainly along the south-western shore. Austral Seablite *Suaeda australis* and Southern Sea Heath *Frankenia pauciflora* are scattered throughout the saltmarsh. Some areas of levelled mining spoil along the north-eastern shore support a sparse cover of Beaded and Thick-head Glasswort*.* Aquatic vegetation becomes established when shallow stagnant water persists in the lake and ponds. In February 2002, this consisted mainly of Sea Tassel *Ruppia* sp. in the area examined along the southern shoreline.

The vegetation at the lake has been depleted by clearing and mining and is subject to large changes in salinity and water level. The dominant vegetation associations have however persisted at the lake from at least 1978 (King and Conole 1978; Yugovic 1984; Garnett et al. 1986; McMahon et al. 1994; Starks 1996; Hubbard 1997, 2001), although they may be temporarily affected by changing conditions (McMahon et al. 1994).

Freshwater Lake

Freshwater Lake is a circular depression 30 ha in extent. In recent geological times, the site of Freshwater Lake was within the Point Lonsdale shoreline lagoon and protected by a reef, and the substrate now consists of cemented limestone overlain with lagoon deposits of sand, clay, silt and black mud. The ancient shore is visible as rising ground on the north-western shore of the lake (Gill 1948; Douglas and Ferguson 1976).

The lake is shallow and is surrounded by gently-sloping shores of soft mud except in the north-west section. There the shores slope more steeply and apparently abut the deepest part of the lake. The water level is highly variable. The lake is fed by rainfall, run-off and seepage. Seepage from springs can continue long after rainfall events, but ceases after

prolonged dry periods. Water is lost by evaporation and the lake usually dries rapidly after rainfall, but occasionally the water level is maintained for some months (G. Tribe, pers. comm.). Of the three wetlands under study, Freshwater Lake appears to vary most in salinity, ranging from weakly saline when the lake is at or near capacity (7 ppt on 18 Jan. 2002; seawater 35 ppt) to hypersaline when the water level is low. At capacity, water inundates the vegetation leaving no bare ground, and water intrudes into low-lying swampy backwaters on the southern and eastern shores. The first area to be exposed as the lake dries is the north-eastern shore, forming mudflats covered with a mat of compacted dead vegetation. As water recedes further, extensive mudflats occur around the lake margins, and it often dries completely, especially in summer-autumn and during drought. The lake is in a depression and there is therefore a little shelter close to the banks from strong winds. Between Dec. 2001 and Feb. 2002, the conditions at Freshwater Lake were apparently very unusual, as it was at or near capacity throughout this period. The water level was also high in July 2001 (M. Cameron, pers. comm.), which suggests that the lake had been full for at least seven months.

A brief survey of the vegetation was carried out by Graeme Stockton on 18 Jan. 2002. A degraded remnant of dune woodland occurs at the access from Clows Lane: mainly Blackwood *Acacia melanoxylon*, Golden Wattle *Acacia pycnantha,* Coast Tea-tree, Black Wattle *Acacia mearnsii* and Coast Beard-heath, with a dense ground layer of Austral Bracken *Pteridium esculentum*. On private property around the lakeshore, some residents have planted trees, particularly eucalypts and Drooping Sheoke *Allocasuarina verticillata* (which would formerly have occurred there naturally). In January 2002, dense beds of rush of several species occurred around much of the lakeshore, except in the north-west where the steeper shoreline was mostly bare. The rushbeds were in or just above the waterline and were predominantly Bare Twig-rush *Baumea juncea*, Sea Rush, Sea Club-rush *Bolboschoenus caldwellii* and Knobby Club-rush *Isolepis nodosa,* with a ground layer of low herbs and grasses, including Australian Salt-grass *Distichlis distichophylla,* Water-buttons *Cotula australis*, Creeping Brookweed, Creeping Monkey-flower *Mimulus repens* and Streaked Arrowgrass *Triglochin striata*. Glaucous Goosefoot *Chenopodium glaucum* occurred in patches, some of them large, along the southern and eastern shores, and was flowering on 20 Feb. 2002. During flooding of the lake, swampy backwaters of soft mud, shallow water and inundated rushbeds had formed in three areas but they were dry or drying rapidly by February 2002. Aquatic vegetation had become established in stagnant shallow water in the lake and by 20 Feb. 2002 had formed a mat on the surface up to 50 metres from shore on the eastern side; Sea Tassel and Water-milfoil *Myriophyllum* sp. were identified in

the area examined. There were no extensive areas of saltmarsh, but small patches of Beaded Glasswort were regenerating on mudflats where the water had recently retreated.

There are few published descriptions of the vegetation of Freshwater Lake, but there are indications that different communities dominate or decline depending on water level. In January 2002, when the exposed shore was limited in extent and the salinity low, rushes were dominant and there was little saltmarsh. However, the lakeshore has in the past been described as “saltmarsh” and has supported an extensive herbfield of Beaded Glasswort with Southern Sea Heath during periods of low water, high salinity and the occurrence of exposed mudflats (M. Cameron, pers. comm.; Brown and Wilson 1980, 1984; Garnett et al. 1986). The speed with which Beaded Glasswort regenerates after the water recedes was noted in January 2002. Glaucous Goosefoot was noted as long ago as 1980 (Brown and Wilson 1980, 1984). During prolonged droughts, the lake dries and loses much of its vegetation (Brown and Wilson 1984). Aquatic vegetation and the associated invertebrate fauna develop around the lake margins only when a high water level has been maintained for unusually long periods (G. Tribe, pers. comm.).

St Leonards Salt Lagoon

St Leonards Salt Lagoon is a very shallow saline lagoon 66 ha in extent (including the associated salt meadow). It is roughly circular with a narrow inlet off the northern shore. The substrate is sand with clay, silt and black mud. The water level depends on rainfall, run-off and seepage, but even at capacity the lagoon does not exceed 0.5 metre in depth (D. King, pers. comm.). At or near capacity, the lake is highly saline (67 ppt on 18 Jan. 2002; seawater 35 ppt), becoming hypersaline in summer when water levels are low, and often drying out completely during summer and autumn. At capacity, there is little exposed shoreline except for a narrow strip of cracked mud along the seaward (eastern) shore. Evaporation can be rapid, especially in warm windy weather, and the water recedes forming extensive mudflats. The northern inlet is the shallowest area and the first to dry out. It contains water only when the main body of the lagoon is full. Behind the southern shore of the lagoon, there is a salt meadow which contains water only occasionally, after heavy rainfall or when the lake floods and overflows. Even then, it is very shallow and dries rapidly if not replenished. Between Dec. 2001 and Feb. 2002, the conditions at the Salt Lagoon were apparently very unusual, as it was at or near capacity throughout this period and the salt meadow was flooded for much of the time. The water level was also high in July 2001 (M. Cameron, pers. comm.), which suggests that the lagoon had been full for at least seven months.

A brief survey of the vegetation was carried out by Graeme Stockton on 18 Jan. 2002. The vegetation at that time consisted of dune woodland and saltmarsh typical of coastal wetlands

on the Bellarine Peninsula. The mixed woodland on the low dune backing the lagoon is very dense, and consists mainly of Boobialla, Coast Tea-tree, Moonah, Coast Beard-heath, Golden Wattle and Coastal Wattle *Acacia sophorae*. In the south and west, flats around the lagoon margins and the salt meadow are covered with extensive beds of sedge, rush and spear-grass, predominantly Chaffy Saw-sedge; Sea Rush occurs in a narrow strip at the water's edge, and covers wider areas at some sites; Prickly Spear-grass is scattered through the sedge beds, especially on the south-eastern shore and in the salt meadow. In low-lying areas and in the salt meadow, there is a samphire herbfield and shrubland with a lush growth of Beaded Glasswort (beginning to flower at the time of the survey), Southern Sea Heath (flowering) and Grey and Black-seeded Glasswort, mixed with Australian Salt-grass, Streaked Arrowgrass, Rounded Moon-flower and Trailing Jointweed. Silky Wilsonia *Wilsonia humilis* and Thick-head Glasswort occur in patches in the salt meadow.

The few published descriptions of the vegetation of the Salt Lagoon suggest that saltmarsh and beds of sedge and rush have been present since at least 1979 (Carr and Kinhill Planners 1979). However, individual species may alter in abundance over time. J. Yugovic noted the presence of Grey Glasswort at the Salt Lagoon in 1984. In 1987, Grey Glasswort was described as scarce, although regeneration was observed (King 1987). The two species of Halosarcia are at present the dominant plants in the saltmarsh. Grey Glasswort is tolerant of extreme salinity (Yugovic 1984), a feature of the Salt Lagoon because of its high evaporation rate and the absence of flushing by seawater. The sedgebeds have become denser in the last 20 years (D. King, pers. comm.).

SOURCES OF INFORMATION AND METHODS

The three wetlands have been surveyed as part of several long-term studies, including:

- The RAOU Wader Studies Programme and the Population Monitoring Project of the Australasian Wader Studies Group (surveys in Jan./Feb. and June/July, 1981 onwards);
- NRE/RAOU Summer Waterfowl Counts (surveys in Feb. 1988-1992);
- RAOU VicGroup Wetland Surveys (4 times/year, 1987-1992);
- RAOU/Birds Australia Orange-bellied Parrot monitoring programme;
- RAOU Atlas of Australian Birds 1977-1981, and the Birds Australia Atlas of Australian Birds 1998-2002;
- Information collected for the Wetlands Database, Dept of Natural Resources and Environment, Victoria;

- Information collected for the Atlas of Victorian Wildlife, Dept of Natural Resources and Environment, Victoria;
- A study of Hooded Plovers in southern Victoria by Mike Weston, 1995-2001; and
- Regular excursions by the Bellarine branch of the Birds Observers Club of Australia.

These records have been supplemented by additional information recorded on original count sheets from these surveys. Estimates of water coverage at the time of the count (as a percentage of the total wetland area) were requested on count forms for the VicGroup Wetland Survey, the RAOU Waterfowl Count and the NRE Wetlands Database, and were often volunteered by wader counters. Wader counts were conducted simultaneously at all sites within the Swan Bay-Queenscliff-Mud Islands system, as birds are known to move between these areas. Counts were sometimes repeated at all sites if boat access to Mud Islands was prevented by rough weather on the designated day. Two or more counts in close succession sometimes gave valuable information on short-term variability of wader numbers at the lakes.

Other sources of information were a bird list for Lake Victoria compiled at some time before 1984 by the late Jack Wheeler, interviews with local observers, and information in *Geelong Bird Reports*, *Victorian Bird Reports* and other literature sources. Additional surveys were conducted as part of this study at:

Lake Victoria on 9 Dec. 2001, and 7 Jan., 13 Jan., 18 Jan., 3 Feb. and 10 Feb. 2002, with partial surveys on 3 May, 7 July, 24 July, 20 Sept. and 22 Oct. 2002;

Freshwater Lake on 9 Dec. 2001, and 7 Jan., 12 Jan., 18 Jan., 31 Jan., 10 Feb. and 20 Feb. 2002, with partial surveys on 17 Mar., 3 May, 14 June, 7 July, 28 July, 22 Oct. and 26 Oct. 2002;

and St Leonards Salt Lagoon on 27 Dec. 2001, and 8 Jan., 18 Jan., 7 Feb. and 20 Feb. 2002, with partial surveys on 3 May, 14 June, 7 July, 28 July, 20 Sept. and 22 Oct. 2002.

Lake Victoria appears to have a high profile among local bird observers, and there is much more information on the birds of this wetland than for Freshwater Lake and St Leonards Salt Lagoon. For Freshwater Lake and St Leonards Salt Lagoon, there are problems in the timing of the summer wader counts and the RAOU Waterfowl Counts. These wetlands are often dry in summer at the time of the counts. At St Leonards Salt Lagoon, wader numbers are often highest in early spring, outside the time of the main surveys (Peter Bright, pers. comm.). The occasional occurrence of unusual species or high numbers may be missed in widely-spaced surveys at fixed times of year. Information on land birds is extremely limited. While basic bird

lists can be compiled, there is not enough information to assess status and habitat needs for most species.

Although they revealed much new information, the intensive surveys in 2001-2002 could not wholly correct these deficiencies, as they covered only a limited period and one set of conditions, which in fact appeared to be unusual.

Salinity Determinations

For salinity determinations, water samples were collected from areas showing wave action at each wetland. Electrical conductivity (mS/cm) of the sample or a known dilution in distilled water was measured using a TSDTestr 4™ (Cole Parmer, Chicago, Illinois, USA), and the concentration of total dissolved salts (parts per thousand) calculated as described by Sainty and Jacobs (1994). Salinities were classified as: fresh, less than 1 ppt; brackish, 1.0-2.9 ppt; weakly saline, 3.0-9.9 ppt; moderately saline, 10.0-29.9 ppt; highly saline, 30.0-99.9 ppt; hypersaline, 100 ppt or more (Jaensch et al. 1988).

Tide Heights and Times

Tide heights and times for Port Phillip Heads were obtained using the Tidal Display Program, Mr. Tides version 1.2.6 (Freeware, GNU General License file).

CRITERIA FOR ASSESSING THE SIGNIFICANCE OF THE THREE WETLANDS AT INTERNATIONAL, NATIONAL, STATE AND REGIONAL LEVELS

Waders

The criteria of Garnett et al. (1986) have been used to assess the importance of the wetlands under study at international, national and state levels. Minimum population estimates for Australia and Victoria were obtained from Watkins (1993), with additional information from Garnett and Crowley (2000). At a regional level, maximum counts at the wetlands under study have been compared with Wader Count results elsewhere on the Bellarine Peninsula.

- Of international significance: for individual species or subspecies, any area which has carried 1% or more of the estimated minimum population in the East Asian-Australasian region (resident waders) or flyway (migratory waders).
- Of national significance: any area which has carried 10,000 or more waders, or, for individual species or subspecies, 1% or more of the estimated minimum population in Australia.

- Of state significance: for individual species or subspecies, any area which has carried 5% or more of the estimated minimum population in Victoria.
- Of regional significance: for individual species or subspecies, any area carrying the highest or second-highest numbers in any Wader Count on the Bellarine Peninsula (or comparable numbers obtained in other surveys), or any area carrying species which are regular but in low numbers or of restricted distribution on the Bellarine Peninsula. For migratory waders from the northern hemisphere, counts in summer (adults and first-year birds) and winter (predominantly first-year birds) are considered separately.

Waterfowl

No attempt has been made to assess the importance of the wetlands for waterfowl species at an international or national level, with the exception of the Blue-billed Duck, for which there is a national population estimate (Garnett and Crowley 2000). There have been no national waterfowl surveys attempting complete coverage, and there are no other known estimates of the Australian populations for other waterfowl species occurring at the wetlands under study. At state and regional levels, significance has been assessed by comparison with results obtained in RAOU Victorian Summer Waterfowl Counts, 1988-1992, in which wide state coverage was obtained (Hewish 1988a; Peter 1989, 1990, 1991, 1992).

- Of international significance (assessment attempted for the endemic Blue-billed Duck only): any area which has carried 1% or more of the estimated minimum population in Australia.
- Of state significance: for individual species, any area which was ranked in the top five wetlands in Victoria in any NRE/RAOU Summer Waterfowl Count (or with comparable counts obtained in other surveys), or any area carrying waterfowl species which are regular but in low numbers or of restricted distribution in Victoria.
- Of regional significance: for individual species, any area which was ranked in the top five wetlands in the Geelong region in any NRE/RAOU Summer Waterfowl Count (or with comparable counts obtained in other surveys), or any area carrying waterfowl species which are regular but in low numbers or of restricted distribution in the Geelong region.

Other species

Information on populations, distribution or breeding was available for a few other species, and enabled assessment of the significance of the wetlands: Little Egret (Pescott 1983; Emison et al. 1987; Geelong Bird Reports); Whiskered Tern (Pescott 1983; Emison et al. 1987); Little Tern (Pescott 1983; Emison et al. 1987; Higgins and Davies 1996); Fairy Tern

(Garnett and Crowley 2000); Blue-winged Parrot (RAOU and Birds Australia OBP Count Reports, summarised in Higgins 1999); and Orange-bellied Parrot (Garnett and Crowley 2000). Where population estimates were available, significance at the national level was set at 1% of the Australian population, and at the state level, 5% of the Victorian population (*cf* Garnett et al. 1986). For species restricted to Australia (endemic species), a count of 1% of the estimated national population becomes of international significance.

Criteria are considered to apply if they have been met in even one count. This is in recognition of the fact that many wetlands in Australia are ephemeral, and waterbirds need a network of wetlands to survive under different seasonal and climatic conditions (Watkins 1993). This reasoning is appropriate for the three wetlands under study, as numbers of waterbirds vary greatly with changes in habitat and movement within Swan Bay.

2. Lake Victoria

SUMMARY

- 81 species of waterbirds have been recorded from Lake Victoria. These include waterfowl, waders, pelicans, cormorants, herons, egrets, ibis, spoonbills, crakes and rails, gallinules, coastal birds, and wetland-associated birds of prey, parrots and land birds. There are breeding records for five species.
- The lake often supports thousands of waterbirds. The highest count ever recorded was 10,062 on 20/2/00. The most numerous waterbirds are dabbling waterfowl and waders tolerant of salinity.
- The lake is of international significance for Red-necked Stints, Banded Stilts and the globally endangered Orange-bellied Parrot, and of state significance for the nationally vulnerable Hooded Plover and for the Little Egret which is critically endangered in Victoria. In total, 37 species occur in numbers significant at international, national, state or regional levels, have special conservation status, or are listed in international treaties.
- There is interchange between the lake and the other wetlands of the Swan Bay system (waders and probably waterfowl); the local beaches and inshore waters of Bass Strait (Hooded Plovers, probably terns, gulls, oystercatchers); and probably Portarlington Sewage Ponds (waterfowl). At times, Lake Victoria holds most or all of the small waders in the Swan Bay system.
- Waterbird numbers vary seasonally, peak numbers generally occurring in summer-autumn. The lake is important for migratory waders gaining weight in autumn before migration, and sometimes supports large numbers of over-wintering first-year waders.
- Numbers of waterbirds can vary markedly at any time of year in response to changes in water level and salinity, movements within Swan Bay and other wetland systems, and irruptions of waterbirds to the coast from inland. Waterfowl occur in the highest numbers when the lake is at or near capacity in late summer-autumn; migratory waders when the water level is low and mudflats exposed in the same season.
- The important sites for waterbirds are mainly along the southern shore and include:
- The south-western ponds, of particular significance for Orange-bellied Parrots and Hooded Plovers.
- The north-eastern shore, for Orange-bellied Parrots.

- The islands, outcrops and mudflats of the central southern shore, for Hooded Plovers, other waders, waterfowl, Little Egrets and terns.
- The south-eastern ponds and lakeshore, for waders, waterfowl, Little Egrets and terns.
- Since 1980, Little Egrets have increased in numbers, and Australian Shelducks, Double-banded Plovers and Masked Lapwings declined. These changes appear to relate to regional changes and shifts in population rather than changes at the lake.
- Mammals, reptiles and frogs recorded from the vicinity of Lake Victoria have been listed. Few of the records include precise locations.

Figure 2.1 Vegetation around Lake Victoria

Figure 2.2 Ducks and swans on south-eastern ponds at Lake Victoria

Waterbird species and numbers

In this report, 81 species of waterbirds and birds associated with wetlands are listed for Lake Victoria. The RAOU VicGroup Wetland Survey (1987-1992) was the only regular monitoring programme in which all species of waterbirds were counted. Total counts varied greatly (range, 168-3,402 birds), with the highest numbers generally occurring in summer and autumn. These counts however understate the importance of the lake for waterbirds, as several counts since have been higher, some by a considerable margin. The highest count ever recorded was 10,062 on 20/2/00, including 9000 small waders (M. Cameron, M. Hewish, Geelong Field Naturalists Club, pers. comm.). On 7/2/99 there were 5,503 waders at the lake (AWSG Wader Count), and in surveys conducted for this study in 2001-2002, total waterbird counts regularly exceeded 4000.

The high number of species listed probably reflects the productivity of the lake, the habitats available to waterbirds, its high profile among bird observers and natural history clubs over many years, and its connection with the important wetlands and marine environments of the Swan Bay system (Anon 1982; King and Conole 1978; pre-1984 bird list by Jack Wheeler; Barter et al. 1988). Of the three wetlands under study, Lake Victoria provides the most stable environment for waterbirds. Unlike Freshwater Lake and the Salt Lagoon, Lake Victoria does not dry out completely, even during prolonged droughts; at least it has not done so in the last 20 years. There is little change in the character of the waterbird community with changes of depth and water coverage, as even at capacity the lake retains its salinity and saltmarsh is the dominant vegetation (unlike Freshwater Lake). Most of the waterbirds it supports are salt-tolerant. However, it is not consistently hypersaline like the Salt Lagoon, which would place restrictions on the number of species able to use the lake.

Breeding records and the importance of the lake for juveniles and immature birds

There are breeding records at the lake for five species. Red-capped Plovers, Masked Lapwings and White-fronted Chats often nest in saline environments, especially those with saltmarsh vegetation. A Black Swan nest discovered in 1995 was unusual. Swans' nests are usually built of soft emergent or aquatic vegetation (Marchant and Higgins 1990). Such vegetation is uncommon at the lake, and the nest was on a bare island with a few stones moved up to surround the site (R. Mackenzie, pers. comm.). The consistently high salinity presumably restricts breeding of other waterfowl; ducklings of many species require a source of fresh water.

The single breeding record for Hooded Plovers is noteworthy. In eastern Australia, Hooded Plovers are uncommon on terrestrial wetlands, and nesting in such situations is extremely rare (Marchant and Higgins 1993). There was a second possible Hooded Plover nest record at the lake (W. and I. Borrie, pers. comm.), and an adult nesting on a nearby ocean beach fed and roosted at the lake during its time off-duty (M. Weston, pers. comm.). Any breeding record for Hooded Plovers is important, as they are classified as Vulnerable nationally (Garnett and Crowley 2000). Nests on beaches suffer disturbance and crushing by people, dogs and off-road vehicles, and are subject to extremes of weather. By contrast, the lake is sheltered and relatively undisturbed.

Juveniles and immatures of several species of waterbirds feed and rest at the lake. Young Black-winged Stilts often visit the lake in February and March. In January and February, juvenile Fairy Terns, probably from breeding areas in Port Phillip Bay, solicit food from adults and rest on outcrops and sandbars isolated by water. Little Egrets are numerous in autumn and winter, the population probably including young from a breeding colony in Corio, Geelong (Greaves 1990). The lake is important for young birds of a number of resident and migratory wader species. Banded Stilts and Red-necked Avocets occur in large numbers when adults and young return to the coast from nesting inland; first-year birds of the migratory Red Knot, Red-necked Stint and Curlew Sandpiper sometimes occur at the lake in high numbers in winter; and flocks of Hooded Plovers at the lake contain a high proportion of juveniles.

Table 2.1. Waterbird species* at Lake Victoria with significant populations and/or special conservation status

Species	Significance (1)	Conservation status
Blue-billed Duck	State	Vulnerable in Vic. (4); threatened (5)
Black Swan	Regional	
Australian Shelduck	Regional	
Australasian Shoveler	Regional	Vulnerable in Vic (4)
Grey Teal	Regional	
Chestnut Teal	State	
Hardhead	State	Vulnerable in Vic (4)
Australasian Grebe	Regional	
Hoary-headed Grebe	State	
Great Crested Grebe	Regional	
Pied Cormorant		Lower risk, near threatened in Vic. (4)
Little Egret	State	Critically endangered in Vic. (4); threatened (5)
Great Egret		Endangered in Vic. (4); threatened (5); JAMBA; CAMBA

Species	Significance (1)	Conservation status
Royal Spoonbill		Vulnerable in Vic. (4)
Black-tailed Godwit	State	JAMBA; CAMBA
Common Greenshank	State	JAMBA; CAMBA
Ruddy Turnstone		JAMBA; CAMBA
Red Knot	State (winter)	JAMBA; CAMBA
Red-necked Stint	International	JAMBA; CAMBA
Sharp-tailed Sandpiper	State	JAMBA; CAMBA
Curlew Sandpiper	State	JAMBA; CAMBA
Black-winged Stilt	Regional	
Banded Stilt	International (endemic)	
Red-necked Avocet	Regional	
Grey Plover		JAMBA; CAMBA
Red-capped Plover	State	
Double-banded Plover	Regional	
Hooded Plover	State	Vulnerable nationally (3); endangered in Vic. (4); threatened (5)
Masked Lapwing	Regional	
Pacific Gull		Lower risk, near threatened in Vic. (4)
Caspian Tern		Vulnerable in Vic. (4); CAMBA
Crested Tern		Lower risk, near threatened in Vic. (4); JAMBA
Little Tern	Regional	Vulnerable in Vic. (4); threatened (5); JAMBA; CAMBA
Fairy Tern	National	Vulnerable in Vic. (4); threatened (5)
Whiskered Tern		Lower risk, near threatened in Vic. (4)
Blue-winged Parrot	State	
Orange-bellied Parrot	International (endemic)	Endangered nationally (2); critically endangered nationally and in Vic. (3, 4); threatened (5)

* Includes non-vagrant birds with 5 or more records; species with breeding record/s or any high count; critically endangered species.

(1) Criteria for significance in Chapter 1.

(2) Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia.

(3) The Action Plan for Australian Birds 2000. S.T. Garnett and G.M. Crowley. Environment Australia, Canberra.

(4) Threatened Vertebrate Fauna in Victoria 2000. A systematic list of vertebrate fauna considered extinct, at risk of extinction or in major decline in Victoria. Dept. of Natural Resources and Environment, East Melbourne.

(5) Flora and Fauna Guarantee Act, 1988 (Vic.).

JAMBA, CAMBA: species listed under the Japan-Australia Migratory Birds Agreement, China-Australia Migratory Birds Agreement.

Species with significant populations and/or conservation status

Table 2.1 lists 37 species which have occurred at the lake in numbers significant at an international, national, state or regional level, have special conservation status, or are listed in international treaties.

Lake Victoria is internationally significant for Red-necked Stints and Banded Stilts, having held at some time 1% or more of the estimated population in the East Asian-Australasian flyway or region. Orange-bellied Parrots which are critically endangered globally, also occur in numbers of international significance, the lake supporting up to 10% of the estimated population of this endemic species. Parrots apparently do not visit in every year, but when conditions are suitable may remain for extended periods.

The lake is significant at national, state or regional levels for a further 25 species of wetland birds from a range of families, including waterfowl, egrets, waders, terns and parrots. These include the Hooded Plover which is vulnerable nationally, and the Little Egret which is critically endangered in Victoria.

New information from surveys in 2001-2002

A series of intensive surveys in 2001-2002 produced much new information:

- First records for Blue-billed Ducks, Australian Spotted Crakes and Black-tailed Native-hens. A Buff-banded Rail was recorded for the first time on 5/12/01 (P. Bright, pers. comm.), and the observation confirmed during surveys for this study.
- The highest numbers ever recorded for Black Swans, Australasian Shovelers, Grey Teal, Chestnut Teal, Great Crested Grebes, Australian Pelicans, Red Knots and Whiskered Terns.
- Feeding observations for Little Terns.
- Counts covering influxes of Grey Teal, Chestnut Teal and Banded Stilts to the lake over summer and autumn.
- Observations of changes in habitat use by waterbirds as water levels fell from capacity in the ponds and the lake.

Species diversity at the lake

As Lake Victoria generally maintains its salinity, even at high water levels, salt-tolerant waterbird species are dominant at the lake in terms of numbers. These include dabbling waterfowl (Black Swans, Australian Shelduck, Grey Teal, Chestnut Teal) and many species

of waders attracted to the low saltmarsh, muddy shores and shallow water in the ponds and around the lake.

However waterfowl and waders which prefer freshwater or weakly saline wetlands occur on occasions, usually in low numbers and for limited periods. Hardhead were present for a few months in mid-2001, with one high count (300 birds); Australian Wood Ducks were noted on a bird list compiled by the late J. Wheeler; there were several records of Australasian Grebes in 1990-1991, their numbers sometimes reaching levels of regional significance; Eurasian Coot was recorded in April 1999; and Black-fronted Dotterel was recorded during a visit in June 2000.

It is unfortunate that there are no details on habitat use, water levels and salinity for most of these records, as some of the available information appears contradictory. On 18/4/91, 14 Australasian Grebes were present when water coverage on the lake was 25% and the salinity must have been very high; hardly typical habitat for this species. The large flock of Hardhead present in July 2001 were on the south-eastern ponds, not the lake, and it is possible that the other freshwater-specialist waterbirds also occurred in the ponds. As these ponds are relatively small, run-off from the golf course and housing estate could greatly lower the salinity, at least temporarily. Australasian Grebes are known to prefer small wetlands (Hewish 1988a). Even at capacity, the lake is probably usually too saline, and marginal habitat at best for these species.

Variability in waterbird numbers

Although Lake Victoria shows marked changes in waterbird numbers over both short and long time scales, it provides a more stable wetland environment than either Freshwater Lake or St Leonards Salt Lagoon. It does not dry out in summer, it retains its salinity even at high water levels, and waterbirds can find suitable habitat under most conditions by moving between the lake and the ponds.

Waterbird counts are highest in summer and autumn, when migratory waders from the northern hemisphere spend the non-breeding season in Australia in large numbers, and when many species of waterfowl move to the coast from drying wetlands inland. Lake Victoria always contains water in summer-autumn, and so can support large populations of waterbirds in this season. The regular waterfowl and wader counts in late summer have been well-timed to detect these peak numbers. Numbers of waterbirds decline in winter, after the adult migratory waders depart and waterfowl disperse. The lake differs in this respect from Freshwater Lake and St Leonards Salt Lagoon, which can dry out in summer and so often carry their highest numbers in winter.

In addition to regular seasonal variations, fluctuations in waterbird numbers can occur at any time of year in response to changes in water levels from rainfall, run-off and evaporation. Record numbers of Black Swans, Grey Teal and Chestnut Teal occurred when high water levels in 2001-2002 coincided with the usual summer-autumn concentration of waterfowl at the coast: 700 Grey Teal and 4000 Chestnut Teal moved into the lake in at least two waves between December and April.

Flooding in summer and autumn is however unusual. More usually the lake dries by evaporation, the water is at low-moderate levels and extensive mudflats are exposed. Thus feeding areas are often available for migratory waders during their peak season, and the lake regularly supports very large numbers of these birds. The highest count of migratory waders occurred in late summer (9000 birds on 20/2/00), and birds were feeding across wide areas of exposed mudflats on the south central shore of the lake (M. Cameron, M. Hewish, Geelong Field Naturalists Club).

The lakeshore is not the only habitat that can be used by waders. When the water level is high in the lake and covers the mudflats, many waders can continue to use shallow-water feeding areas in the adjacent ponds. When the lake was flooded in summer 2001-2002, more than 1000 small waders fed in the south-eastern ponds, and then moved onto the lakeshore as the water receded and the ponds dried out. Hence the ponds can help buffer the effects of water level changes in the lake itself.

Influxes of Banded Stilts sometimes boost counts of waterbirds. Most observations coincide with the return of large numbers of adults and young to the coast from breeding inland. In summer 2001-2002, 1500 birds arrived in at least two waves between January and February. Suitable habitat is usually available at the lake to accommodate returning birds. The salinity remains high even at high water levels, and if the water around the lake margins is too deep for wading, birds move into the south-eastern ponds (e.g. in Jan. 2002). Banded Stilts can also take food from the water surface while swimming, but only under calm conditions. This is in marked contrast to Freshwater Lake, which is avoided by Banded Stilts when it is at capacity, even if Stilt numbers are very high elsewhere in the region.

For some waterbirds, high numbers or first records at Lake Victoria relate to irruptions into the Geelong region. For instance, the first observations of Black-tailed Native-hens at the lake were part of a regional invasion beginning in late 2000 (Geelong Bird Report 2000; records submitted in 2001 and 2002 for Geelong Bird Reports), and high counts of Great Crested Grebes in summer 2001-2002 mirrored high counts elsewhere in the Geelong region since 1999 (Geelong Bird Reports, 1999, 2000). Blue-billed Ducks first appeared at the lake in summer 2002 during a regional influx, when Werribee Sewage Treatment Works,

Portarlington Sewage Ponds and Freshwater Lake supported record numbers (R. Swindley via R. Loyn; P. Bright; M. Hewish).

The role of Lake Victoria in regional wetland systems, particularly the Swan Bay system

There is a further source of variability at Lake Victoria. The lake is a component of the Swan Bay system of wetlands and marine environments, which includes Swan Bay, Queenscliff, Edwards Point, Mud Islands, Freshwater Lake and St Leonards Salt Lagoon. This system is of international importance for waterbirds. There is extensive movement within it, certainly of waders and probably also of waterfowl (Barter et al. 1988). All the component wetlands of the Swan Bay system are important, providing food and shelter for birds over a range of seasonal and weather conditions

The waterbirds which occur in high numbers at Lake Victoria are largely those which are common in the Swan Bay system (Barter et al. 1988; Barter 1992). These include many species which are tolerant of salinity and feed in shallow water or on intertidal mudflats e.g. Black Swans, Australian Shelducks, Grey Teal, Chestnut Teal, ibis, spoonbills, herons, egrets and many species of waders (Barter et al. 1988; NRE/RAOU Summer Waterfowl Counts; Geelong Bird Reports). Several species occurring at the lake are rare at other terrestrial wetlands in the region but are known from Swan Bay: for instance, White-bellied Sea-Eagle, Terek Sandpiper, Common Sandpiper, Ruddy Turnstone, Great Knot and Lesser Sand Plover. Fairy and Little Terns probably also visit from Swan Bay, and dependent juvenile Fairy Terns at the lake in January and February may originate from nesting sites in the Swan Bay system (Barter et al. 1988). During this study, Royal Spoonbills and Little Egrets moved to and from Lake Victoria, probably indicating interchange between the lake and Swan Bay where they are numerous (Barter et al. 1988).

There is more direct evidence of waterbird movements within the Swan Bay system. A flock of 10-11 Black-tailed Godwits, which are rare locally, visited Lake Victoria, Freshwater Lake, St Leonards Salt Lagoon, Duck Island in Swan Bay, and the Sand Island at Queenscliff, between late summer and early spring in 1998. The connection between Lake Victoria and Freshwater Lake only one kilometre away is particularly evident. In winter 1981, a flock of about 20 Grey Plovers appeared to move within the space of a week from Freshwater Lake to Lake Victoria (Robinson 1982; Wader Count results); the first record of Blue-billed Ducks occurred at Lake Victoria when there were large flocks at Freshwater Lake; and in summer 2001-2002, Swamp Harriers at Freshwater Lake often arrived from the direction of Swan Bay and flew off towards Lake Victoria.

There may also be some movements of waterfowl between Lake Victoria and Portarlington Sewage Ponds, which were constructed in 1982 and began to carry large numbers of waterfowl in the early 1990s (NRE/RAOU Summer Waterfowl Counts; King 1997; Geelong Bird Reports). The ponds are close to Swan Bay and about 15 km from the lake. Australian Shelducks may have shifted from the lake to the sewage ponds, which have recently become a major regional moulting-site (King 1997).

Hooded Plovers using Lake Victoria as a winter refuge originate from beaches and dune systems facing Bass Strait, as far afield as Breamlea and Black Rocks in the west and the Mornington Peninsula in the east. This conclusion is based on banding data (M. Weston, pers. comm.). Other species may also come from the beaches and inshore waters of Bass Strait, rather than from Swan Bay and Port Phillip Bay. These include locally common seabirds such as Pacific Gulls, Caspian Terns, Crested Terns and Common Terns, and perhaps also Pied Oystercatchers and Sanderlings. The lake provides resting sites which are more sheltered and less disturbed than the local beaches.

Some of the rapid changes in numbers at the lake are clearly related to short-term movements within these systems. The conditions which stimulate these movements are not fully understood. The need for sheltered roosts or feeding areas during rough weather or exceptionally high tides may play a role (Garnett et al. 1986; Barter et al. 1988), perhaps especially for waders and birds which use the lake primarily in winter (e.g. Little Egrets, Hooded Plovers). However, there is no direct evidence in the records collected for this study linking counts with wind strength or direction. High numbers of waterbirds are sometimes maintained over days or longer (e.g. Fairy Terns in Feb. 2000), and have occurred when the weather and tides were unexceptional (e.g. 9000 small waders on 20/2/00, when the tide was low and the wind light-moderate). Waders are generally more mobile in winter than in summer (Minton 1981; Fletcher et al. 1982; Paton et al. 1982), and that season occasionally produces records of unusual species, unusually high numbers and probable movements to and from the lake (see Black-tailed Godwit, Eastern Curlew, Red Knot, Red-necked Stint and Grey Plover, in Species List).

Important habitats and sites for waterbirds

Several areas which are important for birds have been identified from observations of habitat use in 2001-2002 and information from naturalists and local observers (M. Weston, M. Cameron, I. Borrie, W. Borrie, R. Mackenzie, P. Bright, T. Pescott). These areas are concentrated along the southern shore of the lake, which is shallow with gently-sloping shores and provides a variety of habitats.

Some of the most important areas around the lakeshore, including some which support species of international conservation significance, are on private land.

The South-Western Shore

The ponds on the south-western shore are sheltered, and are relatively undisturbed as they lie beyond the end of the main walking track along the southern lakeshore. The margins of the ponds and the strip of land between the ponds and the lake carry extensive areas of saltmarsh, including the largest stands of Shrubby Glasswort and Beaded Glasswort at the lake. Significant observations include:

- Two sightings, possibly three, of Orange-bellied Parrots; up to 10 birds, 5% of the known population, for this endangered species. The major food source for Parrots here is Shrubby Glasswort, seeding in Aug.-Oct. (Loyn et al. 1986).
- Blue-winged Parrots also recorded in this area.
- Hooded Plovers regularly occur in the ponds and levees on the south-western shore. The area is used for shelter during rough weather, and is a possible nest-site.
- Favoured area for Australian Shelducks; possibly a moulting-site in summer 2002.
- Feeding and resting area for waders and waterfowl.
- Nesting area for Red-capped Plovers.
- Resting site for Swamp Harriers.
- The saltmarsh, particularly the Shrubby Glasswort, supports large numbers of wetland-associated passerines: Striated Fieldwrens, White-fronted Chats and Little Grassbirds.

The Central Southern Shore

The central southern shore, and the associated shallow-water areas, mudflats, limestone outcrop and island are favoured feeding and roosting areas for waders, waterfowl, terns and other waterbirds. In early 2002, thousands of waterbirds, mainly Teal and Banded Stilts, gathered on the lee shores of the island, especially during high winds.

- Very large numbers and high diversity of waders feed on the mudflats, and roost on the island and in the crevices of the limestone outcrop (e.g. 9000 on 20/2/00).
- Protected and undisturbed area for Hooded Plovers, which often roost and shelter on the island and the limestone outcrop.

- Favoured feeding and resting area for large flocks of Banded Stilts (e.g. 2000 on 10/2/02).
- Feeding and resting area for very large numbers of Teal, especially during high winds (e.g. 2500 Chestnut Teal on 3/5/02).
- Favoured feeding and resting area for Fairy Terns, sometimes in exceptionally large numbers (e.g. 240 on 20/2/00), and sheltered and undisturbed area for dependent young.
- Favoured feeding and resting area for Little Terns, and resting area for Caspian Terns.
- Favoured feeding and resting area for Little Egrets (e.g. 14 on 3/2/02).
- The island is a roost-site for Australian Pelicans, spoonbills and cormorants.
- Flocks of waterfowl and waders disturbed by walkers and dogs at the eastern end of the lake flew to this area.

The South-Eastern Ponds

The south-eastern ponds. When the lake is at capacity, many waders, waterfowl, large wading birds and terns move onto the sandflats, low saltmarsh and shallow water of these ponds to feed and roost. All observations are from 2001-2002.

- Up to 500 Banded Stilts fed and roosted in the ponds.
- Up to 1400 waders fed and roosted on the shores and in saltmarsh.
- Up to 300 Grey and Chestnut Teal rested on sandbars and in shallow water in the ponds, with smaller numbers of Black Swans, Pacific Black Ducks, Australasian Shovelers and Hoary-headed Grebes on the water. Hardhead used the ponds in large numbers in mid-2001.
- A favoured hunting and resting area for Whiskered Terns, and resting area for Fairy Terns, including juveniles, Little Terns and Caspian Terns.
- Feeding area for White-faced Herons, Little Egrets, Royal and Yellow-billed Spoonbills.
- Black-tailed Native-hens fed along the shores and sheltered in the sedgebeds around the banks.
- Australian Spotted Crakes fed in shallow water and among aquatic vegetation, and sheltered in the sedgebeds on the banks.

The South-Eastern Lakeshore

The south-eastern lakeshore. The sandspits, bare shores and shallow water provide extensive feeding areas for waders and large wading birds. This area is close to the entrance from Emily Street, the main walking track, and the shell-grit works. However as the water is shallow, many species can move out from the shore, and even a slight fall in level exposes extensive sandflats and mudflats which act as a buffer to disturbance.

- Favoured area for Hooded Plovers.
- Favoured area for Banded Stilts (e.g. 1400 on 3/2/02), Red-necked Avocets and other waders (e.g. 700 Red-necked Stints on 3/2/02; 170 Red Knots on 7/7/02).
- Favoured area for flocks of Little Egrets (17 on 10/2/02) and spoonbills.
- Rest-site for flocks of Little Black Cormorants, Black Swans, Grey and Chestnut Teal, Australasian Shovelers and small terns.

The North-Eastern Shore

The north-eastern shore. Shoreline flats supporting regenerating Beaded and Thick-head Glasswort have been used as feeding habitat by Orange-bellied Parrots. The lakeshore is sheltered on the landward side by rising ground, and provides a protected roost-site for waterfowl. The land behind the lakeshore is under private ownership and access is restricted, providing some protection from disturbance. However, the effect of activity at the nearby shell-grit works on Parrots and waterfowl roosting patterns is not known. The works were not in operation during visits in 2001-2002.

- In winter 1994, up to 19 Orange-bellied Parrots (10% of the estimated population) fed on seeding Beaded and Thick-head Glasswort growing on mining spoil on the lakeshore. The birds remained in the area for at least two months.
- Large flocks of Chestnut Teal (up to 760 birds) roosted in a tight mass against the shoreline in summer 2002.
- 150 Blue-winged Parrots feeding in a field at the eastern end of the lake on 28/7/91 may have been in this area.

Western End

The far-western sandflats and low islands were favoured feeding areas for waders in summer 2001-2002. Access to this area and thus disturbance to birds is limited. There is no formed walking track and the mud around the shore can be very soft.

- More than 800 small waders (Red-necked Stints, Sharp-tailed Sandpipers, Curlew Sandpipers) fed around the islands in summer 2002.
- On 10/2/02, flocks of waders disturbed at the eastern end of the lake flew to this area; this included a flock of 2000 Banded Stilts.
- Royal and Yellow-billed Spoonbills rest on the shores.
- Australian Shelducks rest along the shores, and the area may be a summer moulting site.

The North-Western Shore

- Posts, wooden railings and fallen timber by the shore are favoured roost-sites for cormorants.

The Coastal Woodland

The coastal woodland, including the Moonah thicket on the south central lakeshore. Woodland remnants occur on the south-eastern shore and in the golf course, but the most extensive area on the south central shore adjoins the dune woodland on the Buckley Park Foreshore Reserve. Most of the woodland is on private land.

- The woodland supports a community of birds typical of coastal woodlands in the region.

Have any waterbirds declined or increased in numbers since 1980?

It is difficult to discern long-term trends in waterbird numbers at the lake because normal variations are so marked. The few noticeable long-term changes appear to relate to regional changes in numbers or shifts in population, rather than alterations at the lake itself.

Little Egrets have been recorded at the lake only since 1990. They are recent immigrants to the Geelong region (Pescott 1983). The first records at Lake Victoria corresponded approximately with the establishment of a breeding colony at Corio in Geelong (Greaves 1990), and the lake appears to be one of the principal winter refuges for adults and young from this breeding population.

Before 1993, counts of Australian Shelducks in summer were occasionally very high, more than 100 birds. Numbers have decreased since Shelducks began to use the nearby Portarlington Sewage Ponds in large numbers for moulting. At least some of the birds now at the sewage ponds may have moved there from the lake (King 1997).

Before 1992, Double-banded Plovers were regularly recorded at the lake in their usual winter season and counts were often high (up to 104 birds). There have been no winter records since that time, and counts have never exceeded 13 birds. A similar decline has been

observed at Freshwater Lake since 1990. Numbers in the Swan Bay system have remained high during this period, and the reason for the changes at the lakes is not known.

In early Wader Counts, Masked Lapwings were regularly recorded in high numbers (75-104 birds in 1982-1986). However there have been no counts of 50 or more since 1994. The reason for the decrease in numbers is not known, but similar declines have occurred at Freshwater Lake and at Lake Lorne in the central Bellarine Peninsula (King and Cameron 1997).

The occurrence at Lake Victoria of previously-unrecorded waterbirds and waterfowl in record numbers in 2001-2002 probably reflects the high numbers across the Geelong region in general and temporarily favourable conditions at the lake, rather than any long-term alteration in the lake itself.

Waterfowl

Fourteen species of waterfowl (swans, ducks, grebes, coots) have been recorded from Lake Victoria. Although the species list is extensive, only a limited number of species are common. All are salt-tolerant, and also occur in the marine environments of Swan Bay in large numbers (Barter et al. 1988): Black Swans, Australian Shelducks, Grey Teal, Chestnut Teal and Hoary-headed Grebes. Deep-diving waterfowl are rarely recorded, and probably occur mainly when the lake is at or near capacity (Blue-billed Ducks, Musk Ducks). Occasional records of freshwater-specialist waterfowl (Hardhead, Australian Wood Ducks, Australasian Grebes, Eurasian Coots) are difficult to reconcile with the consistently high salinity at the lake. However in July 2001 Hardhead were using the south-eastern ponds and not the lake; no information is available on habitat use for the other species, but they may also have used the ponds.

The NRE/RAOU Summer Waterfowl Counts, 1988-1992, are the major source of systematic counts of waterfowl at Lake Victoria (Table 2.2). The counts of 36-459 waterfowl from these surveys are surprisingly low. Water levels during the NRE/RAOU Summer Waterfowl Counts, and the RAOU VicGroup Wetland surveys which occurred over the same period, were low (water coverage, 50-75%). Under such conditions, the lake clearly does not attract large numbers of waterfowl. Counts in surveys in 2001-2002 regularly exceeded these by a large margin. On 13/1/02, 3300 waterfowl, mainly Black Swans, Grey Teal and Chestnut Teal, were present; and on 29/4/02 and 3/5/02, counts of Chestnut Teal alone were 4000 and 2500 respectively. These high counts probably arose from the coincidence of high water at the lake with the summer-autumn season in which some duck species move to the coast from inland wetlands. Large numbers of Grey and Chestnut Teal arrived at Lake Victoria

between December 2001 and April 2002, and a large flock of Blue-billed Ducks visited the lake in July 2002. These records coincided with a general irruption of waterfowl to the Victorian coast following a wet season inland and successful breeding. There were extremely high counts of waterfowl at the Western Treatment Plant, Werribee, and influxes into the Geelong region generally (R. Swindley via R. Loyn; records submitted for Geelong Bird Reports).

Table 2.2. Counts* of waterfowl and waterfowl species at Lake Victoria, 1988-1992

Year	Birds	Species
1988	110	3
1989	459	3
1990	166	2
1991	82	5
1992	36	2

*NRE/RAOU Summer Waterfowl Counts, Feb. 1988-1992 (Hewish 1988a; Peter 1989, 1990, 1991, 1992)

During the same period, there were record high counts of Great Crested Grebes at the lake, also reflecting unusually high numbers throughout the Geelong region (Geelong Bird Reports 1999, 2000). However, although counts of Hoary-headed Grebes were sometimes very high, numbers rose and fell unpredictably (4-558 birds) rather than showing a sustained build-up. This suggests that for this species short-term variations in numbers were the result of local movements rather than immigration to the region.

Lake Victoria is a wetland of state significance for Blue-billed Ducks, Chestnut Teal, Hardhead and Hoary-headed Grebes and is regionally significant for six other waterfowl species (Table 2.1). It is likely that it is an important part of the Swan Bay system for waterfowl, especially for species which regularly use marine and saline wetlands (Barter et al. 1988). The lake acts as a refuge from hunting for ducks during open season.

Waders

Since 1980, 29 species of waders have been recorded from Lake Victoria. The results of twice-yearly Wader Counts since the early 1980s are shown in Table 2.3 (RAOU; AWSG). The most numerous species occurring on a regular basis are Red-necked Stints, Sharp-tailed Sandpipers and Curlew Sandpipers, and Banded Stilts sometimes occur in very high numbers. The accumulated efforts of many bird-observers and societies over two decades has led to the compilation of a long species list for waders, which includes several rarities (Terek Sandpiper, Ruff, Red-necked Phalarope).

During spring and summer, migratory waders from the northern hemisphere spend the non-breeding season in Australia in large numbers. Wader counts and species diversity at the lake are often high in this season (43-5503 birds, 4-10 species), as the peak season for waders coincides with low water levels in summer and autumn and exposure of the mudflats used by waders for feeding. The lake never dries completely and so is suitable throughout the season. When the water level remains high in summer, waders are forced off the flooded margins of the lake, but shallow-water areas in the south-eastern and south-western ponds provide alternative habitat. They are only covered when water levels are high. However they are smaller than the lake and can support fewer birds.

Table 2.3. Counts* of waders and wader species at Lake Victoria, 1981-2001

Year	Summer		Winter	
	Birds	Species	Birds	Species
1981	1094	8	81	5
1982	317	8	415	7
1983	903	6	831	3
1984	1890	7	731	9
1985	3660	7	1163	10
1986	1072	7	152	6
1987	4103	8	79	3
1988	2637	6	255	6
1989	2478	6	28	2
1990	698	6	64	4
1991	1489	6	485	8
1992	825	7	44	4
1993	43	4	112	4
1994	1493	8	115	6
1995	1609	7	60	4
1996	1409	7	350	4
1997	1527	6	107	4
1998	336	9	68	6
1999	5503	8	70	5
2000	2055	6	633	4
2001	1477	10	21	2

* RAOU and AWSG Wader Counts in Jan.-Feb. and June-July, 1981-2001.

When there was more than one complete Wader Count in a season, the highest count is used.

The lake appears to be an important feeding area for waders gaining weight in preparation for migration. When conditions are suitable in late summer and autumn, small waders may take advantage of the opportunity to feed at the lake throughout the tidal cycle. Red-necked

Stints feed at the lake in high numbers between mid-January and mid-April, and during this period have been observed in various stages of breeding plumage (e.g. 3/4/89, 10/2/91, 18/4/91, 14/4/92) and with increased fat reserves (19/4/00; R. Mackenzie, pers. comm.). The highest counts of waders ever recorded occurred during late summer: 5503 in Feb. 1999, mainly Red-necked Stints, and more than 9000 in Feb. 2000, mainly Red-necked Stints, Sharp-tailed Sandpipers and Curlew Sandpipers.

In winter, wader numbers are lower than in summer (21-1163 birds). Most migratory waders leave Australia during the southern winter to return to their breeding grounds in the northern hemisphere. The birds remaining in Australia are mainly first-year birds spending their first 18 months in the non-breeding grounds. In winter, water levels at Lake Victoria are often high from seasonal rainfall, and wader feeding areas around the lake margins are covered, and so the lake is not usually of major importance as a winter feeding area. However occasionally several hundred Red-necked Stints and Curlew Sandpipers occur at the lake in winter, and the highest count of Red Knots occurred in July. Three high winter counts of Red-necked Stints and the highest winter count for Curlew Sandpipers occurred when numbers for these species were high overall on the Bellarine Peninsula. This suggests that the lake may become important as additional habitat when high numbers of adults and young birds return to Australia from the northern hemisphere after successful breeding. As migratory waders do not breed successfully in ever year, overflow habitat for over-wintering young birds when they occur in large numbers is vital for the survival of these species.

Double-banded Plovers breed in New Zealand and some birds spend the non-breeding season in southern and eastern Australia. Before 1992, they occurred in large numbers at the lake in winter, but numbers have declined since.

Lake Victoria is one of the most important components of the Swan Bay system of wetlands. Waders move about within this system, and this is probably the major source of short-term variations in numbers. High counts of waders at the lake are sometimes short-lived e.g. in 2000, 1066 Red-necked Stints were present on 12/2, 6500 on 20/2, and 1000 on 29/2 (Wader Count; M. Cameron, M. Hewish, R. Mackenzie, pers. comm.). Peak numbers of Red-necked Stints at Lake Victoria are comparable with total counts from the whole of Swan Bay (Barter 1992), suggesting that at times most or all of the Stints in the system gather in one huge flock at the lake. If the lake is occasionally called upon to support all these thousands of Swan Bay Stints, it may be more important in the system than its description as a “supplementary feeding and roosting area” suggests (Garnett et al. 1986; Barter et al. 1988). The conditions which stimulate waterbird movements to and from the lake are not fully understood: the need for sheltered roosts or feeding areas during rough weather or

exceptionally high tides may play a role, perhaps especially for waders (Garnett et al. 1986; Barter et al. 1988). However the highest counts do not always correlate with wind strength or with the height of high tide; 9000 small waders were present on 20/2/00, just after low tide on a day of light-moderate wind (M. Cameron, M. Hewish, Geelong Field Naturalists Club).

Several wader species which visit the lake are rare in other terrestrial wetlands in the region: for instance, Black-tailed Godwits, Eastern Curlews, Ruddy Turnstones, Great Knots, Red Knots, Grey Plovers and Lesser Sand Plovers. They probably come from the Swan Bay system, their stronghold in the region. Movements within Swan Bay were demonstrated by records of 10-11 Black-tailed Godwits, assumed to be a single mobile flock, at Lake Victoria, Freshwater Lake, the Salt Lagoon, Duck Island in Swan Bay, and the Sand Island at Queenscliff, between February and October 1998. In winter 1981, a flock of about 20 Grey Plovers appeared to move from Freshwater lake to Lake Victoria within the space of a week (Robinson 1982; Wader Count results).

Lake Victoria is also important for some Australian resident waders. The most significant of these is the Hooded Plover, which is listed as Vulnerable nationally (Garnett and Crowley 2000) and as Threatened in Victoria under Schedule 2 of the Flora and Fauna Guarantee Act (1988). The lake is critical to the survival of the Victorian population of this species, as it serves as a winter refuge for birds from a large section of the central Victorian coast (M. Weston, pers. comm.). In addition, it carries an unusually high proportion of juveniles, is a known nesting site, and has been used for off-duty feeding and roosting by birds nesting on nearby beaches (Weston 2001; M. Weston, pers. comm.). The preferred areas for Hooded Plovers are the central and western ponds, outcrops and islands, which are beyond the limit of the main walking track, protected from disturbance, and sheltered from high winds. As development and disturbance increases near residential and recreational areas around the lake and on the local beaches, such protected areas assume increasing importance.

Banded Stilts have occurred in enormous numbers at the lake, although at irregular intervals. For Banded Stilts and Red-necked Avocets, the lake assumes importance when large numbers of adults and young return to the coast from breeding inland. The habitat at the lake is usually suitable for Banded Stilts, which prefer wetlands of high salinity. If they return when the water level is high and the lake margins are flooded, they may use the shallow-water areas in the south-eastern ponds (e.g. in summer 2002). Red-capped Plovers and Black-winged Stilts also occur in high numbers. There are many breeding records for the Plovers, and juvenile and immature Stilts occur regularly. Pied Oystercatchers occasionally use the lake for roosting. They could have come from the Swan Bay system or from local beaches facing Bass Strait.

Fifteen species of waders with special conservation status and/or significant counts have occurred at Lake Victoria (Table 2.1). The lake is significant for Red-necked Stints at a global level, having carried 1% or more of the estimated population in the East Asian-Australasian flyway, and for Banded Stilts, with 1% of the Australian population (Watkins 1993). It is of state significance for Black-tailed Godwits, Common Greenshanks, Sharp-tailed Sandpipers, Curlew Sandpipers, Red-capped Plovers and Hooded Plovers, with counts of over 5% of the estimated Victorian populations. A winter count of Red Knots was significant at the state level. The lake is regionally significant for a further four wader species.

Other waterbirds

Several species of large wading birds, such as herons, egrets, ibis and spoonbills, occur regularly at the lake. The most important of these is the Little Egret.

Little Egrets arrived in the Geelong region in 1960 (Pescott 1983), and established a breeding colony at Corio, Geelong, only the second known breeding site in Victoria (Emison et al. 1987; Greaves 1990). Lake Victoria is an important feeding area for adults and young from this colony, and as such is of state significance. There are few records at the lake in spring, when the Egrets are nesting at Corio. Numbers at the lake increase in late summer and autumn (February-May) each year after the breeding adults and young disperse from Corio (Pescott 1983; Greaves 1990). In autumn-winter, Lake Victoria often carries the highest numbers of any site in the region, up to 30-40 birds (Geelong Bird Reports; Birds Australia Atlas). Egrets use the lake for both feeding and resting, and on 13/6/90, flocks took tiny fish from the lake shallows (W. Borrie, I. Borrie, pers. comm.). However, numbers can vary over the course of a day, and the birds probably move between the lake and the Swan Bay-Queenscliff area, which is another of their strongholds in the region. Little Egrets are Critically endangered in Victoria (Victorian Dept. of Natural Resources and Environment 2000) and are listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

Of the other egrets and herons, White-faced Herons are the most numerous, but Great Egrets, ibis and spoonbills also occur regularly. Like Little Egrets, Royal Spoonbills can vary in numbers during the day, and probably move to and from Swan Bay (Barter et al. 1988). All the large wading birds feed in shallow water and in soft mud around the lakeshore and in the ponds.

Australian Pelicans and the four species of cormorants which use terrestrial wetlands occur at the lake. Little Black Cormorants are the most numerous, and feed in the lake in rafts of up to 150 birds. In summer 2001-2002, Little Black Cormorants rested between bouts of feeding

on posts, railings and fallen timber along the north-western shore, on sandspits along the south-eastern shore, and on the island off the south central lakeshore, often with Great Cormorants. There is little information on habitat use for Little Pied and Pied Cormorants.

Schools of fish at the lake may attract Pelicans, cormorants, herons and egrets. In June 1990, White-faced Herons and Little Egrets captured tiny fish in the shallows of the lake (W. Borrie, I. Borrie, pers. comm.), and in February 2002 a small flock of Australian Pelicans fed co-operatively and captured prey, probably fish, in open water. Great, Pied and Little Black Cormorants feed mainly on fish (Marchant and Higgins 1990).

Until the summer of 2001-2002, there were no confirmed records of crakes and rails at Lake Victoria. Then, between December and February, there were three sightings of a Buff-banded Rail, probably the same individual, in Sea Rush at the western end of the golf course, and one sighting of two Australian Spotted Crakes in the south-eastern ponds. As bird observers have visited the lake regularly over the last 20 years without producing other records, it seems that these species must be uncommon. The recent records probably related to the unusually high water levels, lowered salinity and flooding of the rushbeds during summer 2001-2002. Buff-banded Rails are mainly summer visitors to southern Victoria, and prefer to feed in damp areas in vegetated freshwater wetlands (Emison et al. 1987). The crakes were feeding in the south-eastern ponds, where receding shallow water from earlier flooding carried abundant aquatic vegetation.

Black-tailed Native-hens were recorded at Lake Victoria for the first time during summer 2001-2002. They were restricted to the south-eastern ponds, where they fed along the shores and in the golf course, and sheltered in beds of Chaffy Saw-sedge and Prickly Spear-grass on the banks when disturbed. Native-hens had been widespread at many wetlands in the Geelong region since late 2000, part of a general irruption (Geelong Bird Report 2000; records submitted in 2001 and 2002 for Geelong Bird Reports).

Coastal birds

Silver Gulls feed and roost at the lake, sometimes in very large numbers. In February 1990, 1750 birds roosted with small waders on the lakeshore. Gulls mingle and feed vigorously with other waterbirds: on 3/2/02, they joined feeding flocks of Little Black Cormorants and Hoary-headed Grebes.

Swan Bay is a local stronghold for Fairy and Little Terns (Barter et al. 1988; Carter 1998), and both species occur at the lake in significant numbers. They are listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000), and as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988). The lake is used for both

feeding and resting, and dependent young Fairy Terns move to the lake in January and February. When the lake is full, the terns use sandbanks in the south-eastern ponds for resting; when the level is low, they rest on islands and exposed limestone outcrops, especially those along the central southern lakeshore. An irruption of Fairy Terns into the lake over ten days in February 2000 (highest count, 240) was extraordinary. The Terns appeared to remain for this entire period, at least during daylight hours, feeding by diving in the lake and resting in crevices in an exposed outcrop and along the shores of mudflats. Counts in the Swan Bay system rarely if ever exceed 100 birds (Geelong Bird Reports), and this flock may have gathered from a wider area, perhaps encompassing much of Port Phillip Bay.

Little Terns occur in much lower numbers, and are usually found among larger flocks of Fairy Terns. They are at the western limit of their continuous range along the Victorian coast (Higgins and Davies 1996). Birds at the lake include both Australian breeding birds, in breeding plumage or post-breeding moult in late summer, and migrants from northern-hemisphere breeding populations, in non-breeding plumage at that time (Starks 1992a; R. Mackenzie, M. Cameron, C. Morley, pers. comm.; M. Hewish). A bird observed on 24/2/00 carried a leg flag and had been banded at a breeding colony at the Gippsland Lakes, eastern Victoria (R. Mackenzie, Victorian Wader Study Group, pers. comm.). Fairy Terns and Little Terns can be difficult to differentiate, especially in flight or if they are in non-breeding plumage.

Other gulls and terns of several species occur at the lake. Pacific Gulls, Gull-billed Terns, Crested Terns, Caspian Terns and Common Terns are usually in low numbers. There are few observations of habitat use. In summer 2001-2002, Caspian Terns rested on low sand islands in the south-eastern ponds and off the south central lakeshore. For marine gulls and terns, the lake is only a short distance from the beach, the waters of Bass Strait and the reef at Point Lonsdale lighthouse, and it may act as a sheltered roost-site for birds feeding in these areas. Whiskered Terns use terrestrial wetlands more often than marine habitats. In December and January 2001-2002, these terns dived for prey and rested on sandbanks, mainly in the south-eastern ponds. The lake was full during this period, and there were few other shoreline and island resting sites. However, the terns occasionally hunted over the lake. Terns were present on every visit during the early surveys, but departed when the shallow-water areas in the ponds dried out.

Schools of fish at the lake may attract Silver Gulls, and Fairy and Little Terns. In June 1990, Silver Gulls captured tiny fish in the shallows of the lake (W. Borrie, I. Borrie, pers. comm.), and Little and Fairy Terns feed predominantly on small fish (Higgins and Davies 1996).

Birds of prey

Swamp Harriers are partial summer migrants to southern Victoria (Emison et al. 1987), and are frequently recorded at Lake Victoria in that season. In summer 2001-2002, Harriers often made passes over large flocks of teal on the lake, and two birds were perched in Shrubby Glasswort at the western end of the lake during a visit in February 2002. Observations of flight paths at Freshwater Lake in summer 2001-2002 suggested that some Harriers followed a regular route from Swan Bay, over Freshwater Lake, and then south towards Lake Victoria. At the time, both Freshwater Lake and Lake Victoria were at capacity and carried large numbers of waterfowl. It would be interesting to make observations of flight paths in other years, as Freshwater Lake is often dry and unproductive in summer.

There are occasional records of Whistling Kites. There are no observations of habitat use, but the birds probably hunt over the shores and the lake as they do at other wetlands in the region.

The single record of an immature White-bellied Sea-Eagle flying over in June 1996 is interesting. Sea-Eagles are recorded in low numbers in the Geelong region in most years. There are several records from the Swan Bay system (Swan Bay, Mud Islands, Edwards Point, Queenscliff), and an immature bird was observed at Edwards Point in September 1991 (Pescott 1983; Geelong Bird Reports). The bird passing over Lake Victoria may have come from Swan Bay, or from the other stronghold in the region, the Lake Connewarre-Reedy Lake system.

Orange-bellied and Blue-winged Parrots

Orange-bellied Parrots are critically endangered in Australia (Environment Protection and Biodiversity Conservation Act 1999; Garnett and Crowley 2000), and each year migrate from their breeding grounds in Tasmania to spend the autumn and winter on the southern mainland.

In some years, the saltmarsh around the lake margins supports up to 19 birds or 10% of the estimated total population (Garnett and Crowley 2000), making the lake significant for parrots at a global level. Occasionally birds remain at the lake for an extended period; in October 1988 they were present for at least one week, and in 1994 they were repeatedly recorded over a period of eight weeks in July and August. Even when the parrots are recorded at Lake Victoria over a period of time, they appear to come and go from the lake. The lake is close to other wintering areas such as Swan Island and Swan Bay, and interchange could occur. Lake Victoria, Swan Island and Swan Bay are unusual among sites on the Bellarine

Peninsula, in supporting parrots in October, late in the winter season (Barter et al. 1988; RAOU OBP Count reports).

Two sites at the lake have proved to be important for Orange-bellied Parrots in the past. A strip of land between the south-western ponds and the lakeshore has been used on two occasions, once probably over an extended period. Seeding Shrubby Glasswort, on which the parrots were feeding, was the attraction in this area in October 1988. In 1994, parrots fed for almost 2 months on the seeds of Beaded and Thick-head Glasswort growing on levelled mining spoil on the north-eastern lakeshore. Recently-established areas of saltmarsh on reclaimed land may be particularly attractive to parrots; at Lake Connewarre, fresh growth of Beaded Glasswort is luxuriant, seeds prolifically, and is preferred by feeding parrots (Hewish and Starks 1988).

The seeding times of Beaded Glasswort, Thick-head Glasswort and Shrubby Glasswort encompass the period from autumn to early spring. The lake is therefore suitable for parrots for most of the winter season which they spend on the mainland, and this is reflected in the spread of records from May to October. In this respect the lake is unusual among feeding sites west of Port Phillip Bay, most of which are dominated by a limited range of saltmarsh plants which produce seed either early or late in the season (Yugovic 1984; Loyn et al. 1986). Beaded Glasswort carries seed and is used by parrots between March and August; Thick-head Glasswort carries seed at approximately the same time; and Shrubby Glasswort carries seed and is used by parrots between August and October (Loyn et al. 1986; Australian Plants Society Maroondah 2001.). Other parrot food plants, Austral Seablite, Grey Glasswort and Southern Sea Heath, occur around the lakeshore (Yugovic 1984; Loyn et al. 1986), but there are no observations of parrots taking the seeds of these species.

As Orange-bellied Parrots are irregular visitors to the lake, they may be overlooked if monitoring is carried out only once or twice in each season. Both the preferred areas are on or close to private land and access is difficult, especially in winter when rainfall often floods the lake margins. However in years when Beaded Glasswort, Shrubby Glasswort or any other parrot food plants are seen to be carrying flowers or seed, an effort should be made to carry out regular searches throughout autumn and winter, particularly between May and October.

Blue-winged Parrots are recorded irregularly at Lake Victoria. They visit between winter and early spring, the season when they move into open habitats such as saltmarsh (Emison et al. 1987). The highest counts of flocks of 100 or more birds are significant at the state level. Like Orange-bellied Parrots, Blue-winged Parrots use the area of Shrubby Glasswort beside the south-western ponds. In July 1991, 150 birds were present in a field at the eastern end of the

lake, possibly in the regenerating saltmarsh used by Orange-bellied Parrots in 1994. However, the exact location and habitat was not specified, and Blue-winged Parrots use a greater variety of habitats than Orange-bellied Parrots.

Land birds associated with wetlands

Striated Fieldwrens, White-fronted Chats and Little Grassbirds occur in vegetation around the lake margins, and are probably resident. They are most common in stands of Shrubby Glasswort on the south-western shore, but also occur in other shrubland and saltmarsh, and in or near rushbeds. During RAOU VicGroup Wetland Surveys in 1987-1992, in which records of wetland-associated passerines were requested, counts of White-fronted Chats were often very high (up to 180 birds). Golden-headed Cisticolas are reported occasionally. Only one record mentions habitat use: a single bird was calling from a bed of Sea Rush in January 2002. Welcome Swallows hunt over the shore, the ponds and the lake. Huge flocks at Lake Victoria in autumn 1991 were feeding on swarms of flying insects; some autumn peaks in numbers may represent birds gathering prior to migration.

Fairy Martins, Tree Martins and Clamorous Reed-Warblers are summer migrants to the region. They occur at the lake rarely and in low numbers in late summer and autumn. The single record of Reed-Warblers in February 1991 occurred when water coverage at the lake was 50%, and the salinity was presumably high. This is puzzling as Reed-Warblers prefer beds of rushes and reeds in freshwater wetlands (Emison et al. 1987), and Lake Victoria should rarely be suitable, even at capacity.

There are breeding records only for White-fronted Chats, a search in September 1998 revealing three nests. A determined search in spring would probably produce nest records for this and other species of wetland-associated land birds.

Land birds

An annotated list of the land birds of Lake Victoria contains records of 73 species (Appendix 2). The remnant woodland at the Emily Street entrance, in the golf course, and along the south central lakeshore supports a community of birds typical of coastal woodlands in the region, including Superb Fairy-wrens, White-browed Scrubwrens, Brown Thornbills, Spiny-cheeked Honeyeaters, Singing Honeyeaters, Eastern Yellow Robins, Golden Whistlers, Grey Fantails, Grey Butcherbirds, Mistletoebirds and Silvereyes.

In the area surrounding Port Phillip Bay, any site containing an intact community of bush birds is considered regionally significant (Garnett et al. 1986). The woodland at the lake cannot be considered completely “intact”, as it is fragmented and surrounded by cleared and

residential land. However, the species diversity is high, considerably higher than for woodland at St Leonards Salt Lagoon or Freshwater Lake. Lake Victoria receives greater attention from observers, but the critical factor is probably the connection with the larger area of dune woodland in the Buckley Park Foreshore Reserve facing Bass Strait. This woodland, which adjoins the Moonah thicket on the south central lakeshore, is dense and largely impenetrable, offers protection from predators and disturbance, and is avoided by most species of introduced birds, except for Common Blackbirds. There are few patches of remnant coastal woodland in the region, and this rich example should be protected from further clearing, development and disturbance.

In other areas around the lake, the destructive effects of clearing and residential development are obvious. Introduced and urbanised birds are common. Many of these birds occur around the lakeshore and on the edges of the woodland, some in large numbers: e.g. Spotted Turtle-Dove, Red Wattlebird, Magpie-lark, House Sparrow, European Greenfinch and Goldfinch, Common Blackbird, Common Starling and Common Myna. The Common Myna is a recent invader, probably first appearing in the early 1980s. The records of grassland birds such as Richard's Pipit, Brown Songlark and the introduced Skylark show the effect of clearing of the woodland around large areas of the lakeshore.

There are many breeding records for land birds, most originating from intensive surveys in the golf course and the surrounding woodland in 1980-1981 (RAOU Atlas). Species recorded breeding include Brown Goshawk, Yellow-tailed Black-Cockatoo (dependent fledged young), Tawny Frogmouth, Superb Fairy-wren, Eastern Yellow Robin, Grey Fantail, Willie Wagtail, Little Raven (dependent fledged young), and Red-browed Finch. Black-Cockatoos have been visiting the lake since 1999, as part of an expansion in range along the coast from Torquay and into the southern and eastern Bellarine Peninsula (Bottomley 2002). It is interesting that Charles Belcher, the author of the classic book on the birds of Geelong (1914), also noted Brown Goshawks breeding at the lake in the late 1800s.

Mammals, reptiles and frogs

The Atlas of Victorian Wildlife contains records of five native mammals, six introduced mammals, five lizards, two snakes and three frog species for the 5-minute grid block including Lake Victoria (Table 2.4). This excludes species recorded only in parts of the grid more than 2 km from the lake (e.g. on the tip of Point Nepean, which protrudes into the south-eastern corner of the grid block). Another native mammal species and a snake can be added from historical records and local knowledge (L. Jackson, pers. comm.). Few of the Atlas records were accompanied by precise locations, so some of the species may not occur close to the lake. However, little systematic work has been done in this area, and it is likely

that more species would be found with further searching. Seven species of bat have been recorded during surveys at Swan Island and Edwards Point (G. Baverstock, pers. comm.) (Table 2.5), and are likely to occur at Lake Victoria but do not currently appear on the database.

The Glossy Grass Skink is classed as Lower Risk Near Threatened in Victoria. Brush-tailed Phascogales are classified as Vulnerable in Victoria and listed under the Flora and Fauna Guarantee Act 1988. Several specimens were taken historically by Donald F. Thomson from Swan Bay to Ocean Grove up to the late 1950s (Dixon and Huxley 1989; Menkhorst 1995). Presumably the species was relatively common at the time in dry woodland in this general area, but has not been recorded subsequently. Southern Brown Bandicoots have declined greatly in Victoria since they were recorded in Point Lonsdale town in the 1950s (local residents to L. Jackson, pers. comm.). The species is now classed as Endangered nationally. Suitable habitat remains around the lakes, but the species is unlikely to persist in the face of predation by Red Foxes and feral or domestic cats and dogs. None of the other species are listed as threatened in Victoria or nationally. Saltmarsh round the lake could provide suitable habitat for Swamp Skinks *Egernia coventryi* (classed as Vulnerable in Victoria, and listed under the Flora and Fauna Guarantee Act 1988) and ephemeral freshwater pools could be important breeding sites for various frog species.

Table 2.4. Mammals, reptiles and frogs recorded from vicinity of Lake Victoria and Freshwater Lake*.

English	Latin	Comments
Short-beaked Echidna	*Tachyglossus aculeatus*	Common in nearby dunes and woodland
Brush-tailed Phascogale	*Phascogale tapoatafa*	Historical specimens to 1959 from Swan Bay to Ocean Grove, where presumably inhabited woodland.
Southern Brown Bandicoot	*Isoodon obesulus*	Recorded in Point Lonsdale town in late 1950s (via L. Jackson, pers. comm.)
Common Ringtail Possum	*Pseudocheirus peregrinus*	Common nearby (e.g. on golf course)
Black Wallaby	*Wallabia bicolor*	Recent records nearby (Ocean Grove Nature Reserve)
Black Rat #	*Rattus rattus*	
House Mouse #	*Mus musculus*	
European Rabbit #	*Oryctolagus cuniculus*	
Brown Hare #	*Lepus capensis*	Two recently at Ocean Grove Nature Reserve (L. Jackson, pers. comm.), but otherwise rare or absent on Bellarine Peninsula.
Red Fox #	*Canis vulpes*	
Feral Cat #	*Felis catus*	

English	Latin	Comments
Tree Dragon	*Amphibolurus muricatus*	Recorded between Point Lonsdale and Collendina, 1994, and near Ocean Grove
White's Skink	*Egernia whitii*	
Garden Skink	*Lampropholis guichenoti*	
Metallic Skink	*Niveoscincus metallicus*	
Glossy Grass Skink	*Pseudemoia rawlinsoni*	
White-lipped Snake	*Drysdalia coronoides*	
Tiger Snake	*Notechis scutatus*	
Eastern Brown Snake	*Pseudonaja textilis*	Occasionally observed (L. Jackson, pers. comm.)
Southern Bullfrog	*Limnodynastes dumerilii*	
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	
Southern Brown Tree Frog	*Litoria ewingii*	

*The list is taken from the Atlas of Victorian Wildlife, based on the 5-minute grid that includes these lakes, but excluding species recorded only in parts of the grid more than 2 km from these lakes.

Additional records were supplied by L. Jackson (Parks Victoria) and Peter Menkhorst (NRE). Species introduced to Australia are marked #.

Table 2.5. Bats recorded at Swan Island and Edwards Point by Grant Baverstock (City of Greater Geelong), pers. comm.

These species would also be expected to occur in wooded habitats near Lake Victoria, Freshwater Lake and Salt Lagoon, where no specific surveys have been documented.

English	Latin	Comments
White-striped Freetail Bat	*Tadarida australis*	Often heard at night
Gould's Wattled Bat	*Chalinolobus gouldii*	4th commonest bat caught
Chocolate Wattled Bat	*Chalinolobus morio*	Uncommon
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	2nd commonest bat caught
Large Forest Bat	*Vespadelus darlingtoni*	3rd commonest bat caught
Southern Forest Bat	*V. regulus*	Uncommon
Little Forest Bat	*V. vulturnus*	Commonest bat caught

Options for future monitoring

For Lake Victoria, the gaps in information on waterbirds do not appear to be as great as for Freshwater Lake or for St Leonards Salt Lagoon. Nevertheless, intensive surveys in 2001-2002 extended the bird list and produced record counts for several species. Some important gaps in knowledge remain, and can be addressed by monitoring important species, examining the effect of changes in habitats and conditions on waterbird numbers, and extending observations of breeding. A special need is to obtain more comprehensive

information on annual use of habitat by the endangered Orange-bellied Parrot, as this has been an important site for the species in some years. Some specific suggestions follow:

- Annual checks on the food plants for Orange-bellied Parrots (Beaded, Thick-head, Grey and Shrubby Glasswort, Southern Sea Heath, Austral Seablite), would be helpful in predicting when parrots are likely to visit the area. These plant species may show great annual variation in seed production. If extensive flowering or seeding is noted, follow-up intensive surveys for parrots could be carried out over March-October. Known feeding areas in Shrubby Glasswort near the south-western ponds and Beaded Glasswort on the north-eastern shore should be searched, especially any areas with fresh growth.
- Intensive monitoring in late summer and autumn by interested individuals could provide additional information on peak numbers and movements of birds to and from the lake. Surveys indicating presence or absence only (e.g. Birds Australia Atlas) will probably add little information at this point.
- Even if surveys target particular species or groups of birds, records of all species associated with wetlands should be documented.
- Searches in early spring would probably extend the observations of breeding, especially for wetland-associated land birds.
- Studies of diurnal and seasonal changes in waterbird numbers, the effects of tide height, weather, water coverage, salinity and vegetation, and information on habitat usage would be valuable.
- A separate study of birds using the coastal woodland is warranted, perhaps in conjunction with a study of the adjoining Buckley Park Foreshore Reserve.

LAKE VICTORIA: ANNOTATED LIST OF WATERBIRDS AND BIRDS ASSOCIATED WITH WETLANDS (81 SPECIES)

Sources of information are in Chapter 1; survey codes, observer codes and abbreviations are in Appendix 1; references are in Chapter 5.

Blue-billed Duck *Oxyura australis*

Only records at lake occurred during surveys for this study: male and female together in centre of lake, 3/2/02, diving repeatedly and coming up with waterweed in bills; kept away from flocks of Teal, but Black Swans also dabbling in area (MHe); flock of 117 on open water at W end of lake, 24/7/02 (MHe, BSt). Apparently the ducks visited Lake Victoria for only short time on each occasion: not observed during 9 other visits between 9/12/01 and

22/10/02 (MHe, RHL, MAC, GT, SL). Lake may be suitable only when at or near capacity and salinity reduced.

Records coincided with an influx and occurrence of exceptionally high numbers in other parts of Geelong region: 416 at Portarlington Sewage Ponds on E Bellarine Peninsula, 18/10/01 (PB); up to 400-500 birds at Freshwater Lake, Dec. 2001 to Mar. 2002 (MHe, RHL, PC, GT); 11,000 at Western Treatment Plant, Werribee, in Feb. 2002 (R. Swindley via RHL). The birds at Lake Victoria on 3/2/02 may have come from the flocks at Freshwater Lake, only 1 km away; when the large flock was seen at Lake Victoria in July 2002, there were no birds remaining at Freshwater Lake.

Conservation status

In Vic., Vulnerable (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988). Listed in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because sparse throughout range, but not considered to be threatened nationally.

State significance

The count at Lake Victoria in July 2002 is comparable with those at high-ranking wetlands in Victoria in Summer Waterfowl Counts, 1988-1992.

Musk Duck *Biziura lobata*

Rarely recorded: present, 3/11/99 (BellBOCA); 2 on lake, feeding by diving, 3/2/02, 3/5/02, 24/7/02 (MHe, BSt).

Black Swan *Cygnus atratus*

Regularly recorded, sometimes in high numbers. Highest counts: 104 on 20/10/91 (VG); 48 on 27/3/96 (WD); 180-580 between 9/12/01 and 3/2/02, the highest count on 13/1/02 (MHe, RHL, MAC). Present in all seasons. In surveys in 2001-2002, majority of Swans swimming and feeding on lake, with lower numbers, up to 52 birds, in ponds on SE and SW shores. Rested on sandspits on lakeshore, and in shallow water in ponds. Numbers decreased in SE ponds when shallow pools dried out in late Jan., but 3 birds remained on deeper water by golf course (MHe, MAC).

Breeding

Nest with 5 eggs on islet in SE ponds, 21/10/95; very little vegetation, stones pulled up around nest (RMc).

Regional significance

The maximum counts at Lake Victoria are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Australian Shelduck *Tadorna tadornoides*

Regularly recorded, sometimes in high numbers. Present in all seasons, but more records and the highest counts in summer-autumn: 396 on 4/2/89 (Peter 1989); 108 on 18/4/91 (VG); 130 on 30/1/93 (IB, WB); 77 on 20/2/00 (MHe, MAC). In Jan.-Feb. 2002, 47-51 birds feeding in SW ponds and in shallow W part of lake, and resting on islands and on lakeshore.

The lake may have been, and may still be, a moulting site, but no direct evidence. In Feb. 2002, Shelducks were confined to south-western ponds and western lakeshore, in protected areas with wide visibility; when disturbed, swam slowly away and appeared reluctant to fly. Before 1993, numbers in moulting season (summer) occasionally very high, more than 100 birds; have decreased since Shelducks moved into nearby Portarlington Sewage Ponds in large numbers to moult (King 1997).

Regional significance

Lake Victoria was the third-ranking wetland in the Geelong region for numbers of Shelduck in the Summer Waterfowl Count, 1989.

Australian Wood Duck *Chenonetta jubata*

Recorded from lake before 1984, no details (JW).

Pacific Black Duck *Anas superciliosa*

Recorded irregularly and in low numbers. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas and this study. Highest counts: 14 on 16/4/90 (VG); 10 on 22/6/91, 12/12/00 (VG, RMc); 67 on 27/3/96 (WD). Records in all seasons, but few in spring.

Few observations of habitat use. Birds appear to use SE ponds regularly. In surveys in 2002, Ducks swam and fed on ponds and rested on saltmarsh-covered banks, moving to deeper ponds near golf course after shallow pools dried out (MHe, RHL, MAC, SL). During that time, only one record away from ponds: 2 swimming in shallow water at lake's edge, 13/1/02 (MAC, MHe).

Australasian Shoveler *Anas rhynchotis*

Occasionally recorded: 2 on 6/5/95 (RMc); 1 on 3/2/96 (RMc); 6 on 24/4/99 (RMc). In 2002, present for extended period, 7/7-22/10. On 7/7, 49 Shovelers resting on sandspit on SE shore with Grey and Chestnut Teal and later swimming in tight flock in open water in centre of lake (MHe); 54 in same area, 24/7 (MHe, BSt); 19 on SE ponds, 20/9 (MHe); 10 on SE ponds, 22/10 (MHe, RHL).

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

Regional significance

The maximum count at Lake Victoria is comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992. Shovelers of restricted distribution in Geelong region.

Grey Teal *Anas gracilis*

Regularly recorded, sometimes in high numbers. Highest counts: 620 on 22/6/91 (VG); 126 on 14/4/92 (VG); 150 on 28/6/92 (VG); 400-760 between 13/1/02 and 10/2/02, the highest count on 13/1/02 (MHe, MAC, SL). Many reports in summer, autumn and winter, but recorded only once in spring.

Detailed records in Dec.-Jan., 2001-2002, showed an influx of 700+ birds in at least 2 waves: 19 on 9/12 (MHe); 220 on 7/1 (MHe, RHL); 760 on 13/1 (MAC, MHe).

Often in large numbers in shallow areas of lake. Early in season (Jan.) in 2002, up to 150 birds fed on the water and rested on banks in SE ponds; smaller numbers (up to 47) on SW ponds. As shallow parts of SE ponds dried out, Teal moved onto lake. Then, large numbers (up to 700) rested in lee of island off S central lakeshore, especially during high winds, and spread out over surrounding water feeding; also rested with Chestnut Teal on NE shore.

Regional significance

The maximum counts at Lake Victoria are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Chestnut Teal *Anas castanea*

Regularly recorded, sometimes in very high numbers. Highest counts: 580 on 27/2/93 (WD); 1300 on 5/3/99 (RMc); 600-1900 between 13/1/02 and 10/2/02 (MHe, MAC, SL); 4000 on

29/4/02 (RMc); 2500 on 3/5/02 (MHe). Present in all seasons, but highest counts in summer-autumn.

In surveys in 2001-2002, there were large influxes of Teal between Dec. and Apr., in several waves. Detailed records: 78 on 9/12 (MHe); 270 on 7/1 (MHe, RHL); 1900 on 13/1 (MAC,MHe); 600 on 3/2 (MHe); 760 on 10/2 (MHe, SL); 4000 on 29/4 (RMc); 2500 on 3/5 (MHe). Similar temporary summer-autumn influxes observed in other years: e.g. in 1999, 400 on 28/1, 1300 on 5/3, 500 on 24/4 (RMc).

Often in large numbers in shallow areas of lake. Early in season (Jan.) in 2002, up to 150 birds fed on the water and rested on banks in SE ponds; low numbers (up to 4) on SW ponds. As shallow parts of SE ponds dried out, Teal moved onto lake. On occasions, thousands of birds rested in lee of island off S central lakeshore, especially during high winds, and spread out over surrounding water feeding; large numbers (up to 760) also rested with Grey Teal on NE shore.

State significance

The maximum counts at Lake Victoria are comparable with those at high-ranking wetlands in Victoria in Summer Waterfowl Counts, 1988-1992.

Hardhead *Aythya australis*

Present only over period of few months in mid-2001: 5 on 27/5 (Atlas 2); present, 1/7 (Atlas 2); 300 on 29/7 (TP); present, 11/8 (Atlas 2). Hardhead prefer large open fresh waters (Marchant and Higgins 1990). The 300 birds present on 29/7/01 were on the south-eastern ponds. The lake probably marginal habitat at best, and usually too saline, but salinity in the smaller ponds could be greatly reduced by run-off. There had been heavy rainfall in April 2001, and the water level was high in the lake and presumably also in the ponds. No reports from other periods when lake at capacity (e.g. 15/10/88, 13/10/90, 20/10/91).

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

State significance

The maximum count at Lake Victoria is comparable with those at high-ranking wetlands in Victoria in Summer Waterfowl Counts, 1988-1992.

Australasian Grebe *Tachybaptus novaehollandiae*

A few reports, mainly in 1990-1991. Most records and all high counts in autumn-winter: 2 on 16/4/90 (VG); 17 on 13/6/90 (VG); 5 on 10/2/91 (Peter 1991); 14 on 18/4/91 (VG); 20 on 22/6/91 (VG); present, 1/8/99 (Atlas 2); 10 on 27/5/01 (Atlas 2).

No direct information on habitat use. When large numbers present on 18/4/91, water coverage of lake 25% and salinity probably high; not ideal habitat for Australasian Grebes which prefer freshwater wetlands (Marchant and Higgins 1990). Birds may use ponds rather than the lake.

Regional significance

The maximum counts at Lake Victoria are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Hoary-headed Grebe *Poliocephalus poliocephalus*

Regularly recorded, sometimes in very high numbers. Highest counts: 2000 on 6/5/94 (RMc); 1500 on 6/5/95 (RMc); 350 on 29/3/99 (Atlas 2); 558 on 3/2/02 (MHe). Most high counts (>100 birds) occurred in summer-autumn.

In summer surveys, 2001-2002, counts varied widely, indicating movement of birds to and from lake: 120 on 9/12 (MHe); 4 on 7/1 (MHe, RHL); 11 on 13/1 (MAC,MHe); 558 on 3/2 (MHe). Numbers have also changed markedly over short periods at other times: e.g. in 1995, 200 on 4/5, 1500 on 6/5 (GBR 1995, RMc).

Largest numbers found on open water in lake, where birds form rafts while resting and feeding (RMc, MHe, MAC); in summer surveys, 2001-2002, also on SE ponds in low numbers, up to 8 birds, and 1 on SW ponds.

State significance

The maximum counts at Lake Victoria are comparable with those at high-ranking wetlands in Victoria in Summer Waterfowl Counts, 1988-1992.

Great Crested Grebe *Podiceps cristatus*

Records in late spring and summer in 1998-1999 (28/12, 6/1), 1999-2000 (3/11, 24/2) and 2001-2002 (5/12-10/2), and 1 winter record (1 on 7/7/02). In the first 2 summers, only single birds recorded, but in 2001-2002 up to 14 birds (3/2/02) regularly on open water of lake, diving for food and resting on surface (PB, BellBOCA, MHe, MAC, SL).

In 1999-2001, Great Crested Grebes present in unusually high numbers in Geelong region (GBR 1999, 2000; records submitted for GBR 2001), which may explain the recent records at the lake.

Regional significance

The maximum counts at Lake Victoria are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992. Great Crested Grebes of restricted distribution in the Geelong region and in Victoria generally (Hewish 1988a; Peter 1989, 1990, 1991, 1992).

Little Pied Cormorant *Phalacrocorax melanoleucos*

Regularly recorded in low numbers, 1-3 birds. Present in all seasons. Little information on habitat use. SE ponds possibly a regular site: single birds on 15/3/00, 20/2/01 and 9/12/01 (RMc, MHe).

Pied Cormorant *Phalacrocorax varius*

Occasional records, but none with counts. No apparent seasonal pattern, but few records overall. Present on 27/5/01, 16/2/94, 20/3/94, 3/11/99 and 10/6/00 (Atlas 2, PB, BellBOCA).

Conservation status

Listed as Lower Risk, Near Threatened in Vic. (Victorian Dept. of Natural Resources and Environment 2000).

Little Black Cormorant *Phalacrocorax sulcirostris*

Regularly recorded in moderate numbers. Highest counts: 150 on 21/3/95 (GBR 1995); 30 on 3/2/96 (RMc); 25 on 20/2/00 (MHe, MAC). Present in all seasons. Swim and feed vigorously in rafts on open water of lake; most commonly used resting-sites are posts, wooden railings and fallen branches along NW shore of lake; also rest on sandspits, and on island off S central lakeshore (RMc).

Great Cormorant *Phalacrocorax carbo*

Occasionally recorded in low numbers, 2-3 birds. No apparent seasonal pattern, but few records overall. In summer surveys, 2001-2002, 1-2 birds regularly rested on posts in water on NW shore of lake, and 1 on island off S central lakeshore on 13/1/02.

Australian Pelican *Pelecanus conspicillatus*

Regularly recorded in low numbers. Highest counts: 11 on 5/3/99 (RMc); 13 on 20/2/00 (MHe, MAC); 14 on 18/1/02 (MHe, GT). Winter records rare. In early Jan. 2002, single bird in SE ponds. After shallow parts of SE ponds dried out, all records from lake, birds feeding in shallows and resting on island off S central lakeshore. In Feb. 2002, small flock fed co-operatively and captured prey in open water, probably fish.

White-faced Heron *Egretta novaehollandiae*

Regularly recorded in low-moderate numbers. Highest counts: 29 on 16/4/90 (VG); 30 on 13/6/90, 24/4/99 (VG, RMc); 36 on 29/3/99 (Atlas 2). Present in all seasons but several high counts in autumn. In summer surveys, 2001-2002, single birds in SE ponds and scattered around S lakeshore. When numbers high in Apr.-June 1990, water coverage 50%, and flocks feeding on tiny fish in lake shallows (VG). 1 immature present on 6/2/88 (VG).

Little Egret *Egretta garzetta*

Arrived in Geelong region in 1960 (Pescott 1983), and breeding at Corio, Geelong, since at least 1986 (Greaves 1990). Regularly recorded at lake since 1990. Highest counts: 28 on 13/6/90 (VG); 30 on 9/5/95 (GBR 1995); 25 on 29/4/98 (GBR 1998); 40 on 27/5/01 (Atlas 2).

Present in all seasons. Few records in spring, when birds nesting at colony in Corio; numbers at lake increase in autumn after breeding adults and young disperse (Pescott 1983; Greaves 1990).

Observations at lake over summer-autumn in several years show influx to lake and indicate time of arrival, Feb.-May: e.g. in 1999, 3 on 29/3, 15 on 24/4 (Atlas 2, RMc); in 2001, 2 on 20/3, 40 on 27/5 (RMc, Atlas 2); in 2001-2002, 1-3 birds between 9/12 and 18/1, 14 on 3/2 (MHe, MAC, RHL, GT, SL). 1 bird in breeding plumage, 16/10/99 (GBR 1999). This bird probably about to breed at Corio, where nesting occurs in Dec.-Feb. (Greaves 1990).

Widespread in ponds and around lake, feeding singly or in flocks in shallow water and resting on shores (IB, WB, RMc, MHe). On 13/6/90, flocks feeding on tiny fish in shallows of lake (VG). Numbers at lake can vary over course of a day (MHe), birds probably moving between lake and the Swan Bay-Queenscliff area.

Conservation status

Critically endangered in Vic. (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

State significance

Lake Victoria is an important feeding area for adults and young from colony in Corio, only second known breeding site in Victoria (Emison et al. 1987). Little Egrets of restricted distribution locally (Pescott 1983), and in autumn-winter the lake often carries highest numbers of any site in region (Geelong Bird Reports).

White-necked Heron *Ardea pacifica*

Only one record: 1 on 27/3/96 (AVW).

Great Egret *Ardea alba*

Often recorded. In low numbers, 1-3 birds, scattered around lake on shores and exposed mudflats, and in ponds (King and Conole 1978; PB, BellBOCA, MHe, SL). Present in all seasons.

Conservation status

Endangered in Vic. (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

Australian White Ibis *Threskiornis molucca*

Often recorded, in low numbers. Highest counts: 4 on 22/6/91 (VG); 9 on 8/2/92 (VG); 5 on 3/2/96 (RMc). Recorded in all seasons. For most records, not known whether birds using lake, feeding in nearby fields, or flying over. In surveys in 2001-2002, single birds flew over, 13/1, 10/2 (MHe, MAC, SL); 2 feeding along NE lakeshore, 7/7/02 (MHe).

Straw-necked Ibis *Threskiornis spinicollis*

Occasionally recorded, usually in low numbers. Highest counts: 100 on 30/4/88 (VG); 5 on 22/6/91, 24/4/99 (VG, RMc); 7 on 3/2/02 (MHe). Present in all seasons. Little information on habitat use. For most records, not known if birds using lake, feeding in nearby fields, or flying over. Highest count on 30/4/88 involved 2 flights of 50 passing overhead towards Swan Bay (VG); birds also flying over on 18/1/02, 3/2/02 (MHe, GT). Record of 2 birds feeding in shallows on NE lakeshore (3/2/02; MHe).

Royal Spoonbill *Platalea regia*

Often at lake (RMc, MAC), but few records with dates and numbers. Highest known counts: 4 on 27/3/96 (WD); 5 on 5/3/99 (RMc); 14 on 26/3/99 (Atlas 2); 8-9 on 13/1/02, 10/2/02 (MHe, MAC, SL). Present in all seasons.

In surveys in 2001-2002, rested on sandspits on SE and SW lakeshores; sheltered in lee of island off S central lakeshore during high winds; 9 fed in shallow water in SE ponds, 13/1/02 (MAC, MHe). Birds move to and from lake, probably interchange between lake and Swan Bay-Queenscliff area: during intensive searches at lake in summer 2002, 9 present on 13/1, none on 3/2, 8 on 10/2 (MAC, MHe, SL).

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

Yellow-billed Spoonbill *Platalea flavipes*

Recorded occasionally. In low numbers, 1-4 birds. No records in winter, but unclear if this represents regular seasonal pattern as few records overall. Occur mainly on SE ponds and on lakeshore at E end (PB, BellBOCA, RMc). In surveys in 2002, 1 feeding with Royal Spoonbills in shallow water in SE pond, 13/1 (MAC,MHe), and 3 resting with Royal Spoonbills on spit on SW lakeshore, 10/2 (MHe, SL).

Whistling Kite *Haliastur sphenurus*

Occasionally recorded. Present at golf course at some time within period 1/9/80-1/3/81 (Atlas 1); present, 20/3/94 (PB, BellBOCA); 1 on 22/5/98 (RMc); present, 30/5/99, 21/2/00, 10/6/00 (Atlas 2). No information on habitat use.

White-bellied Sea-Eagle *Haliaeetus leucogaster*

1 immature flew over, 20/6/96 (RMc).

Sea-Eagles recorded in low numbers in Geelong region in most years. Previous records of single birds in Swan Bay system in 1975, 1989, 1991, 1997, 1999, 2000 (Swan Bay, Mud Islands, Edwards Point, Queenscliff); an immature at Edwards Point, 29/9/91 (Pescott 1983; Geelong Bird Reports).

Swamp Harrier *Circus approximans*

Often recorded. In low numbers, 1-3 birds. Partial summer migrants to region (Pescott 1983; Emison et al. 1987). At Lake Victoria, regular records in summer-autumn; occasional in winter and spring. In summer surveys, 2001-2002, regularly flew over lake and lakeshore; 1 put up a flock of 600 Chestnut and Grey Teal resting on shore of island, but no attack made; 2 Harriers flushed from Shrubby Glasswort at W end of lake (MHe, SL).

Buff-banded Rail *Gallirallus philippensis*

Recorded on three occasions in summer 2001-2002, in area of Sea Rush tussocks between golf course and lakeshore: single birds on 5/12/01 (PB, BellBOCA), 7/1/02 (RHL) and 20/2/02 (GMc).

Lewin's Rail *Rallus pectoralis*

Possibly 1 on 21/10/87; seen only briefly (WB). Inclusion in species list conditional on further sightings.

Australian Spotted Crake *Porzana fluminea*

Single record: 2 feeding in open in shallow channel with aquatic vegetation in SE ponds, 18/1/02; when disturbed, ran into dense bed of Chaffy Saw-sedge and Prickly Spear-grass on bank (MHe, GT, GS). May depend on shallow water persisting in ponds long enough for aquatic vegetation to develop.

Black-tailed Native-hen *Gallinula ventralis*

Regular records of birds in low numbers in summer 2001-2002. Fed in small groups on edge of golf course and along open shores of SE ponds; when disturbed, swam, flew or ran into dense beds of Chaffy Saw-sedge and Prickly Spear-grass on banks. Detailed records: 2 on 9/12 (MHe, DHe); 6 on 13/1 (MAC, MHe); 3 on 3/2 (MHe); 2 on 10/2 (MHe, SL).

This occurrence part of an irruption into Geelong region since late 2000 (GBR 2000; records submitted in 2001 and 2002 for Geelong Bird Reports).

Eurasian Coot *Fulica atra*

Only one record, no details: present, 25/4/99 (Atlas 2).

Black-tailed Godwit *Limosa limosa*

Rare spring-summer migrant in region. Rarely recorded at lake: 2 on 21/2/97 (WC); 11 on 12/5/98, resting with Common Greenshanks in shallow water off S central lakeshore when water level low and mudflats exposed (RMc).

Flocks of similar size (10-11 birds) observed between Feb. and Oct. 1998 in various parts of the Swan Bay-Queenscliff-Lake Victoria system: probably a single mobile flock as the species rare in Geelong region, and large flocks and overwintering unusual (GBR 1998). These records demonstrate wader movements between Duck Island in Swan Bay, Lake Victoria, Freshwater Lake, Sand Island and St Leonards Salt Lagoon.

State significance

Highest count at Lake Victoria more than 5% of the estimated minimum Victorian population. In Victoria, Black-tailed Godwits occur in low numbers and distribution restricted.

Eastern Curlew *Numenius madagascariensis*

Rarely recorded. Although a spring-summer migrant in region, all records in winter: 1 on 29/6/85 (WC); 1 on 13/6/88 (VG); 1 on 26/7/92 (GBR 1992). Birds probably visited from Swan Bay-Queenscliff-Mud Islands where numerous (Barter et al. 1988).

Marsh Sandpiper *Tringa stagnatilis*

Rarely recorded, in low numbers: 4 on 23/6/84 (WC); 3 on 17/2/96 (AVW); 1 on 21/2/97 (WC); 3 on 1/2/98 (WC); 1 on 29/4/02 (RMc). Spring-summer migrant in region, with occasional winter records.

Common Greenshank *Tringa nebularia*

Regularly recorded, sometimes in high numbers. Spring-summer migrant in region. Highest summer counts: 65 on 15/10/88 (VG); 43 on 12/5/98 (RMc); 62 on 7/2/99 (WC); 100 on 26/3/99 (Atlas 2). Occasional records in winter, when population consists largely of first-year birds from previous breeding season in northern hemisphere; winter numbers very low, 1-4 birds.

Usually scattered around S shore of lake and in SE and SW ponds, feeding in shallow water and resting on shores and islands (RMc, WC, MHe).

State significance

Highest count at Lake Victoria more than 5% of the estimated minimum Victorian population.

Terek Sandpiper *Xenus cinereus*

1 on 13/11/83 (MAC). Irregular spring-summer visitor to Swan Bay-Queenscliff-Mud Islands system (Barter et al. 1988).

Common Sandpiper *Actitis hypoleucos*

4 on 15/10/88 (VG). Irregular spring-summer visitor to Swan Bay-Queenscliff-Mud Islands system (Barter 1992; MAC).

Ruddy Turnstone *Arenaria interpres*

Spring-summer migrant in region. Records in 1988 and over extended period in 1998: 6 on 15/10/88 (VG); 3 on 12/3/98 (RMc); 2 on 22/3/98 (RMc); 3 on 12/5/98 (RMc); 2 on 22/5/98 (RMc). In 1998, occurred near exposed limestone outcrop on S central shore of lake (RMc).

Not known if the birds recorded in Mar.-May 1998 stayed at the lake throughout this period, or if they moved between lake and Swan Bay-Queenscliff-Mud Islands system, where Turnstones are numerous in spring and summer (Barter et al. 1988).

Great Knot *Calidris tenuirostris*

4 on 3/2/90 (VG); 8 on 17/2/96 (AVW). Spring-summer migrant in region. Birds may have come from Swan Bay-Queenscliff-Mud Islands system, where Great Knots numerous (Barter 1992).

Red Knot *Calidris canutus*

Occasionally recorded, usually in low numbers. Spring-summer migrant in region, and majority of records in those seasons, 1 on 23/6/84 (WC); 1 on 7/9/85 (MAC); 4 on 4/2/89 (VG); 20 on 17/2/96 (AVW); 3 on 21/2/97 (WC); 7 including 1 in full breeding plumage, 3/5/02 (MHe). However, highest count occurred in winter when population consists largely of first-year birds from previous breeding season in Arctic: 170, including 4 in breeding plumage, resting in tight flock on sandspit on SE shore among Teal, 7/7/02 (MHe, DHe); strong NW wind, tide on coast falling from high water.

State significance (winter)

The count in July 2002 comparable with winter numbers for the whole of Port Phillip Bay in years when high numbers of first-year birds present from successful breeding in the Arctic (e.g. 1986; Hewish 1987). On occasions, Knots may gather at lake in winter from several areas in Swan Bay system, perhaps even from wider area of Port Phillip Bay.

Sanderling *Calidris alba*

2 on 15/1/83 (AVW).

Red-necked Stint *Calidris ruficollis*

Regularly recorded; at times in very high numbers, often more than 1000 birds. Spring-summer migrant in region. Highest summer counts: 2690 on 31/1/87 (WC); 5315 on 7/2/99 (WC); 3000 on 26/3/99 (Atlas 2); 6500 on 20/2/00 (MAC, MHe).

The lake appears to be an important feeding area for birds gaining weight in preparation for migration. Stints feed at the lake in high numbers in late summer-autumn (mid Jan. to mid Apr.), and during this period observed in various stages of breeding plumage (e.g. 3/4/89, 10/2/91, 18/4/91, 14/4/92; VG) and with increased fat reserves (19/4/00; RMc).

The occurrence of very high numbers at lake apparently sometimes short-lived e.g. in 2000, 1066 on 12/2, 6500 on 20/2, 1000 on 29/2 (WC, MAC, MHe, RMc). The lake probably used as temporary feeding and roost-site for Stints in the Swan Bay area, the peak numbers suggesting that at times it holds most or all of the birds in the system (Barter 1992). Waders from Swan Bay said to use Lake Victoria as supplementary feeding and roosting area during bad weather and during exceptionally high tides (Garnett et al. 1986; Barter et al. 1988); however no clear correlation of highest counts with wind strength or with height of high tide; in fact, the highest count of Stints at lake (6500) occurred just after low tide when the wind was light-moderate (MHe).

Regularly recorded in winter, when population consists largely of first-year birds from previous breeding season in Arctic. Although winter numbers lower than summer numbers, often more than 100 birds and counts high relative to other sites on Bellarine Peninsula. Highest winter counts: 290 on 13/6/88 (VG); 270 on 22/6/91 (VG); 310 on 30/6/96 (WC); 570 on 9/7/00 (WC).

Important areas for Stints are the southern lakeshore, mudflats and islands, and the shallow parts of the SE ponds when they contain water. When the mudflats and the limestone outcrop off the S central lakeshore are exposed, Stints feed in large numbers there and roost in crevices in the rock and on the lee side (RMc, MHe, PB). In summer surveys, 2001-2002, up to 1200 Stints fed along shores and roosted in saltmarsh in SE ponds, then spread out along length of S lakeshore as ponds dried (MHe, MAC, RHL, SL).

Two records of flocks of Stints being attacked by Australian Hobbies (27/10/99, 19/4/00; GB, RMc). On 19/4/00, Hobby flushed a flock from shore and attacked a Stint which became separated from others; Stint escaped attack by climbing hard, circling, side-stepping (RMc).

International significance

The highest counts at the lake exceeded 1% of the estimated minimum population in the East Asian-Australasian flyway (Watkins 1993). Winter counts at lake regionally significant. In some years with high winter counts (1988, 1996, 2000), winter numbers on Bellarine Peninsula exceptionally high overall, suggesting successful breeding in Arctic in previous year. Lake may become important in region as additional habitat when high numbers of adults and young birds return to Australia from northern hemisphere.

Pectoral Sandpiper *Calidris melanotos*

3 on 31/1/98 (PB); 1 on 10/3/02 (TD).

Sharp-tailed Sandpiper *Calidris acuminata*

Regularly recorded; sometimes in high numbers. Spring-summer migrant in region. Highest summer counts: 600 on 1/2/86 (WC); 713 on 31/1/87 (WC); 840 on 12/2/00 (WC); 1500 on 20/2/00 (MHe, MAC). Autumn counts low. Only one winter record; almost all adult and immature Sharp-tailed Sandpipers leave southern Australia for winter (Lane and Jessop 1984).

Important areas for Sharp-tailed Sandpipers are the southern lakeshore, mudflats and islands, and the shallow parts of the SE ponds when they contain water. When the mudflats and the limestone outcrop off the central S shore are exposed, birds feed in large numbers there and roost in crevices in the rock and on the lee side (RMc, MHe, PB). In summer surveys, 2001-2002, Sandpipers fed along shores and roosted in saltmarsh in SE ponds in Dec.-Jan.; when the ponds dried, numbers decreased and the remaining birds fed along the S lakeshore (MHe, MAC, RHL, SL).

State significance

The highest count at the lake exceeded 5% of the estimated minimum population in Victoria (Watkins 1993).

Curlew Sandpiper *Calidris ferruginea*

Regularly recorded; sometimes in high numbers. Spring-summer migrant in region. Highest summer counts: 1572 on 11/2/84 (WC); 859 on 16/2/85 (WC); 612 on 31/1/87 (WC); 1000 on 20/2/00 (MAC, MHe).

In autumn 1999 (Mar.), 220-300 birds present, most showing breeding plumage, but in other years autumn counts low; suggests that lake only occasionally an important feeding area for birds gaining weight prior to migration. However, most autumn records indicate presence only, and temporary influxes of birds may have been missed.

Occasionally recorded in winter, when population consists largely of first-year birds from previous breeding season in Arctic. Numbers generally low (<50 birds); but 585 present in June 1984.

Important areas for Curlew Sandpipers are the southern lakeshore, mudflats and islands, and the shallow parts of the SE ponds when they contain water. When the mudflats and the limestone outcrop off the central S shore are exposed, birds feed in large numbers there and

roost in crevices in the rock and on the lee side (RMc, MHe, PB). In summer surveys, 2001-2002, low numbers of Sandpipers fed and roosted along shores in SE ponds in Dec.-Jan., then moved to S lakeshore as ponds dried (MHe, MAC, RHL, SL).

State significance

The highest summer count at the lake exceeded 5% of the estimated minimum population in Victoria (Watkins 1993). Winter count at lake in 1984 regionally significant. In that year, summer and winter numbers on Bellarine Peninsula exceptionally high overall, suggesting successful breeding in Arctic in 1983. Lake may become important in region as additional habitat when high numbers of adults and young birds return to Australia from northern hemisphere.

Ruff *Philomachus pugnax*

1 in non-breeding plumage on S lakeshore with other small waders, 4/3/98; water level very low; bird identified by 6 observers (DHa, BellBOCA).

Red-necked Phalarope *Phalaropus lobatus*

1 adult in non-breeding plumage, 31/12/82 to at least 10/2/83; swimming in lake, generally keeping to centre about 200 m from shore; tame and allowed close approach (Smith 1983).

Pied Oystercatcher *Haematopus longirostris*

Occasionally recorded in low numbers: 5 roosting, 13/10/90 (VG); 2 on 6/7/91 (WC); present, 29/10/00 (Atlas 2). Lake probably an occasional high-tide roost rather than feeding area. Swan Bay-Queenscliff-Mud Islands are strongholds for Pied Oystercatchers. Birds at Lake Victoria may have come from there or from local beaches facing Bass Strait.

Black-winged Stilt *Himantopus himantopus*

Regularly recorded, sometimes in high numbers. Highest counts: 100 on 16/7/78, 6/5/94, 6/5/95 (King and Conole 1978; RMc); 105 on 21/2/97 (WC). Highest counts mainly in summer-autumn. In some years, gradual increase in numbers noted over this period (1995, 1997, 1999, 2001, 2002).

Feed in shallow water along S shores of lake and around islands, and in the SE and SW ponds. When the mudflats near limestone outcrop off the central S lakeshore are exposed, birds feed there, sometimes in large numbers (RMc). Rest on spits and islands, often in or near low saltmarsh.

Juveniles and immatures occur at lake: 1 immature on 6/2/88 (VG); 2 juveniles in SE ponds, 20/3/01 (RMc); 2 immatures, 3/2/02 (MHe). No evidence of breeding at lake, but lake and ponds provide relatively undisturbed feeding and resting area for young birds.

Regional significance

Highest numbers occurred outside Wader Counts, but are comparable with those obtained at high-ranking wetlands on count dates.

Banded Stilt *Cladorhynchus leucocephalus*

Sometimes present in very high numbers: 800 on 9/7/83, 29/6/85 (WC); 2000-2500 on 6/5/94, 8/5/94 (RMc, WD); 1700-2000 on 3/2/02, 10/2/02 (MHe, SL). Clusters of records in 1984-1987, 1994-1995, 2001-2002. Records available suggest Banded Stilts irregular at lake, but there are indications that many occurrences unreported: flocks of 100s seen several times, 1995-2001 (MW), but only one dated record of >100 birds in that period.

Arrival at lake can be sudden, and occur in several waves. In summer surveys, 2002, 500 birds already at lake, 7/1-18/1; then two influxes, 1200 between 18/1 and 3/2, further 300 between 3/2 and 10/2 (MHe, RHL, MAC, GT, SL).

Banded Stilts prefer shallow hypersaline wetlands for feeding (Lane 1987). Water levels at lake not recorded in 1984-1987 and 1994-1995, when Stilts in high numbers. In 2002, lake full but salinity still high (51 ppt, 18 Jan. 2002). Early in season, most birds fed by wading in shallow water in SE ponds; a few around lakeshore, swimming with Grey Teal. As ponds dried, Stilts moved to lake; fed and roosted at various times off E shore, around island off S central lakeshore, and at W end of lake. The island was the preferred roost-site during this period; when wind strong, birds packed into tight mass on lee shore. Probably always present at lake between 7/1 and 22/10: observed on every visit independent of time of day or tide; on 3/2, numbers did not change over 7 hours, birds completing several cycles of feeding and resting during that time.

Banded Stilts periodically leave coast of southern and eastern Australia, and move to arid inland after flooding to breed in extensive system of salt lakes (Hewish 1989; Bellchambers and Carpenter 1990; C. Minton, pers. comm.). High numbers at Lake Victoria coincided with return of adults and young birds to coast in 1984, 1994 and 2001.

International significance

Highest count at lake exceeded 1% of estimated minimum global population (Watkins 1993). Banded Stilts of restricted distribution in Geelong region. Lake Victoria particularly important when high numbers of adults and young return from nesting inland.

Red-necked Avocet *Recurvirostra novaehollandiae*

Irregular records of birds in low numbers. Highest counts: 34 on 10/7/82 (WC); 29 on 7/9/85 (MAC); 20 on 11/7/99 (WC); 21 on 7/7/02 (MHe). Records in all seasons, but mainly autumn-winter. Some records occurred in clusters: several records in 1982, 1984-1987, 1991, 1998-1999 and 2002. Isolated single records on 3/7/94 (WC), 30/6/96 (WC), 20/3/01 (RMc).

Limited information on habitat use: 12 at lake when water coverage 25% and lake very saline, 18/4/91 (VG); recorded at E end of lake in area with sandspits, bare shores and shallow water, 30/6/96 and 24/5/99 (WC, RMc); 21 on 7/7/02, 13 on 20/9/02, resting on sandspit on SE shore and feeding in adjacent shallow water (MHe); low numbers in SE ponds, 25/10/02 (JB, CMo, MHe).

Red-necked Avocets periodically leave coast of southern and eastern Australia and move inland after flooding, presumably to breed (Lane 1987; Hewish 1990). The records at Lake Victoria coincided with return of adults and young birds to coast in 1982-1983, 1984-1987, 1991, 1993-1994, 1996 and 1998 (Wader Count results).

Regional significance

Red-necked Avocets of restricted distribution on Bellarine Peninsula; lake useful as additional habitat when high numbers of adults and young return from nesting inland.

Pacific Golden Plover *Pluvialis fulva*

1 in non-breeding plumage on lake's edge, 16/7/78 (King and Conole 1978). Spring-summer migrant in region. Winter records unusual; most adults and young birds leave southern Australia for winter (Lane and Jessop 1984; Hewish 1988b).

Grey Plover *Pluvialis squatarola*

Rare: 20 on 4/7/81 (WC). 26 Grey Plovers also recorded at Freshwater Lake in that winter, 27/6/81 (Robinson 1982); probably single flock moving between the wetlands. Birds probably visited from Swan Bay-Queenscliff-Mud Islands where numerous (Barter et al. 1988); interesting as a winter record.

Red-capped Plover *Charadrius ruficapillus*

Regularly recorded, often in high numbers. Highest counts: 248 on 30/4/88 (VG); 234 on 13/6/90 (VG); 200 on 12/5/98 (RMc); 180 on 15/3/00 (RMc). Recorded in all seasons, but all high counts (>100 birds) in autumn-winter, when birds form flocks in Swan Bay area (Barter et al. 1988).

Occur around lakeshore and on islands, on bare shores, sandspits and flats, exposed mud, and sparse or patchy low saltmarsh; also in similar habitats in SE and SW ponds (RMc, MHe).

Breeding

Many breeding records. Nesting recorded in all seasons though mainly in summer. Breeding locations generally not specified, but nests seen in area of SW ponds (RMc) and pair performed distraction display in this area, Feb. 2002 (MHe). Detailed records: nest with 2 eggs, 1/2/86 (WC); 1 dependent young, 4/2/89 (VG); 1 dependent young, 5/2/89 (WC); 1 on nest, 10/2/91 (VG); 2 nests, 22/6/91 (VG); 1 nest, 20/10/91 (VG); 3 on nests, 8/2/92 (WC); 4 nests, 14/4/92 (VG); nest with 2 eggs, 26/11/94 (RMc); 2 small young, 21/3/95 (GBR 1995); 10, including young, 3/2/96 (RMc); breeding record, no details, 19/3/00 (Atlas 2); 2 nests on shelly mudflat, 2 eggs each, 12/2/01; 1 nest a depression in mound of shells; other lined with tiny shell fragments (JH).

State significance

Highest counts at lake exceeded 5% of estimated minimum population in Victoria (Watkins 1993).

Double-banded Plover *Charadrius bicinctus*

Autumn-winter visitor in region from breeding grounds in New Zealand. Apparently an irregular visitor to lake, but not known if gaps represent absence of birds or of documented records. Highest counts: 47 on 13/6/90 (VG); 84 on 22/6/91 (VG); 104 on 6/7/91 (WC); 70 on 14/4/92 (VG). Feed and roost on S shore of lake; when water level low, scattered over mudflats, and around island and limestone outcrop off central S lakeshore (RMc, MHe).

A decline in numbers and change in seasonal pattern of occurrence since 1992. Between 1984 and 1992, all records in autumn-winter, and winter counts regularly reached 40 or more birds (range, 40-104). Since 1998, all records in late summer to autumn, and counts of only 1-13 birds. A similar decline observed at Freshwater Lake since 1990. Numbers in Swan Bay system have remained high during this period, and reason for changes at the lakes not known.

Regional significance

In Winter Wader Count 1991, Lake Victoria carried second-highest numbers of any site on Bellarine Peninsula, and 21% of all birds counted in that region. However, significance in region has decreased since 1992.

Lesser Sand Plover *Charadrius mongolus*

Spring-summer visitor in region. Irregular records of birds in low numbers at lake: 1 on 3/4/89 (VG); 2 on 1/2/94 (WC); present, 20/3/94 (PB, BellBOCA); 3 in shallows by limestone outcrop on S shore, 12/5/98 (RMc). Birds probably visited from Swan Bay-Queenscliff-Mud Islands where numerous (Barter et al. 1988).

Black-fronted Dotterel *Elseyornis melanops*

Present, no details, 10/6/00 (Atlas 2).

Hooded Plover Thinornis rubricollis

Regularly recorded in moderate-high numbers. Present in all seasons, but highest counts in autumn-winter, outside breeding season: 20 on 4/7/81, 26/3/99 (WC, Atlas 2); 25 on 10/7/82 (WC); 44 on 13/6/88 (VG); 22 on 6/5/00 (WD).

Information from Mike Weston (study of Hooded Plovers from Cape Otway to Wilson's Promontory, 1995-2001), with additional observations from Wendy Borrie, Ian Borrie, Rob Mackenzie, Margaret Cameron, Peter Bright and Wader Counts.

Lake Victoria is critical habitat for Hooded Plovers. Banding study shows winter flocks include local breeding birds from beaches and dunes at Point Lonsdale, 13th beach, Collendina, Breamlea, Black Rocks, and occasionally birds from Mornington Peninsula. Flocks contain high proportion of juveniles, higher than for other local areas e.g. count of 44 birds on 13/6/88 included 12 juveniles (IB, WB). Young birds of season move to lake as early as Feb.: 1 juvenile present, 8/2/92; (WC); 1 juvenile, 25/2/95 (GBR 1995); 2 juveniles with very pale colouring on heads, 7/2/99 (WC); 1 juvenile, 13/2/01 (WC).

Favoured areas at Lake Victoria are: (1) 2 areas of ponds, shellbanks and spits constructed for shell-grit mining at SW end of lake; (2) low-lying limestone outcrop and island off central S shore of lake; (3) shell and sand flats at E end of lake (MW, WB, IB, RMc, PB). Hooded Plovers feed and roost at Lake Victoria. The lake is an important refuge when beaches and dunes disturbed, or in bad weather. Birds often shelter from strong winds in SW ponds or in crevices or on lee side of limestone outcrop (RMc, MAC). Even though Lake Victoria is disturbed by people and dogs, it is probably less so than beaches and dunes.

Lake Victoria is important for breeding: pair nested at Lake Victoria in the 1980s, no details (J. Pratt in Weston 2001). Another possible nest: on 25/2/92, pair present at shell-grit ponds on SW shore; 1 sitting on scrape but nest contents and changeover of adults not observed (WB, IB). A bird which was nesting at Collendina fed and roosted at Lake Victoria, not on the beach or dunes, during its time off-duty. The high proportion of juveniles at lake

demonstrates its importance as a relatively undisturbed and sheltered feeding and resting area for young birds.

Conservation status

Eastern subspecies of Hooded Plover Vulnerable nationally because of small population and declining numbers; on beaches near settlement, subjected to disturbance and crushing of nests by people, dogs and off-road vehicles (Garnett and Crowley 2000). In Vic., Endangered (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

State significance

Highest count at lake exceeded 5% of estimated minimum population in Victoria (Watkins 1993; Marchant and Higgins 1993). The lake important as winter refuge for birds from large section of central Victorian coastline.

Red-kneed Dotterel *Erythrogonys cinctus*

Recorded before 1983, no details (Pescott 1983). Not on Jack Wheeler's list (pre-1984), so probably rare at lake.

Masked Lapwing *Vanellus miles*

Regularly recorded, sometimes in high numbers. Highest counts: 100 on 10/7/82, 1/2/86 (WC); 104 on 12/2/83 (WC); 75 on 16/2/85 (WC); 57 on 6/2/94 (WC). Present throughout year, but most high counts in summer. In flocks of up to 60 birds (1/2/86; WC).

Lapwings occur in all open areas around lake: on shores and islands, on mudflats, in low saltmarsh, in SE and SW ponds, and on grassy areas and fairways of golf course behind lakeshore.

Decline noted. The 4 highest counts (75-104) occurred between 1982 and 1986; numbers have not exceeded 57 since. Reason for decrease in numbers not known, but also observed at Freshwater Lake since 1986-1988 and at Lake Lorne in the central Bellarine Peninsula since 1986 (King and Cameron 1997).

Breeding

Breeding record at golf course at some time within period, 1/9/80-1/3/81 (Atlas 1); 1 on nest, 8/2/92 (WC); nest with 4 eggs, 29/7/01 (TP).

Regional significance

In Summer Wader Count 1990, lake held second-highest numbers of any site on Bellarine Peninsula, and 9% of all birds counted in that region; in summer 1994, highest numbers and 15% total. Also ranked highly in 1983 and 1986, but numbers at lake have recently decreased.

Pacific Gull *Larus pacificus*

Occasional records of birds in low numbers, all in autumn-winter: 2 on 18/4/91 (VG); 1 on 22/6/91 (VG); present, 23/5/93 (PB, BellBOCA), 10/6/00 (Atlas 2), 12/6/00 (Atlas 2), 4/3/01 (Atlas 2). No information on habitat use, but birds probably use lake as resting area, as they do at St Leonards Salt Lagoon. Some records may have been of birds flying over.

Conservation status

Listed as Lower Risk, Near Threatened in Vic. (Victorian Dept. of Natural Resources and Environment 2000).

Silver Gull *Larus novaehollandiae*

Recorded regularly, sometimes in very high numbers. Highest counts: 1750 on 3/2/90 (VG); 330 on 16/4/90 (VG); 280 on 20/2/00 (MHe, MAC); 1000-1500 on 15/3/00 (RMc). A series of high counts (>100 birds) in 1989-1992.

Gulls feed and rest at lake, often gathering at E end (RMc). 1750 roosted with Red-necked Stints on 3/2/90 (VG). On 13/6/90, flocks feeding on tiny fish in shallows of lake (VG). Some records may have been of birds flying over.

In surveys in 2001-2002, low numbers (1-19) resting around lake and SE ponds, on posts, islands, sandflats, spits and shores. On 3/2, 19 fed vigorously in lake among flock of Little Black Cormorants, and later among raft of Hoary-headed Grebes; fluttering, dipping and taking prey from water surface (MHe).

Gull-billed Tern *Sterna nilotica*

Recorded from lake before 1984, no details (JW); 1 on 18/4/91 (VG). Uncommon visitor in low numbers to wetlands around Geelong (Pescott 1983; Geelong Bird Reports).

Caspian Tern *Sterna caspia*

Occasional records, but possibly regular at lake: records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas and BellBOCA excursions. In low numbers, usually 1-2 birds, but 5 on 4/3/95 (WD), 4 on 20/9/02 (MHe). Present in all seasons

except winter. Birds rest on sandspits, outcrops and islands off S lakeshore and in SE ponds (RMc, MHe, RHL, SL).

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

Crested Tern *Sterna bergii*

Recorded occasionally, usually in low numbers. Highest counts, 50 on 13/6/88 (VG), 4 on 3/2/90 (VG). All other records of 1-2 birds. Records in summer and winter. Two records involved birds flying over lake: 50 on 13/6/88, flying W to E (VG); 2 flying over, 20/2/00 (MHe, MAC). No details on other records.

Conservation status

Listed as Lower Risk, Near Threatened in Vic. (Victorian Dept. of Natural Resources and Environment 2000).

Common Tern *Sterna hirundo*

Rarely recorded: present, no details, 20/3/94 (PB, BellBOCA). Usually marine; occur regularly in summer-autumn on reef and beaches at nearby Point Lonsdale lighthouse (Geelong Bird Reports).

Little Tern *Sterna albifrons*

Recorded occasionally in low numbers in summer-autumn, often with more numerous Fairy Terns: 1 on 6/5/95 (RMc); present, 31/3/99 (Atlas 2); up to 10 birds, 20/2/00-7/3/00 (MAC, MHe, GFNC, RMc, JH, Atlas 2); 2, 12/2/01-4/3/01 (RMc, Atlas 2); up to 7 birds, 7/1/02-3/5/02 (MHe, RHL, SL, RMc).

Intense feeding activity at lake on 10/2/02 and 3/5/02, Terns diving to take prey from on or just under water surface (MHe, SL); probably attracted by abundance of small fish, their major food source (Higgins and Davies 1996). Rest on island off the S central shore, on sandbar in the SE ponds, on shoreline of mudflats when water level low, and in crevices in limestone outcrop (RMc, MHe, RHL, SL, MAC).

Little Terns occur in Swan Bay, and have been recorded nesting on the Sand Island, Queenscliff (Barter et al. 1988; Carter 1998). Birds at Lake Victoria probably come from the Swan Bay system. On 7/1/02 and 10/2/02, gale-force winds may have forced Terns out of

Swan Bay to more sheltered lake (MHe, RHL, SL), but wind only light-moderate on 20/2/00, and weather at times of other records not known.

Presence of birds in breeding plumage (6 on 10/2/02) and in post-breeding moult (1 on 10/2/02, 6 on 24/2/00) in late summer indicates that some birds at lake belong to Australian population, breeding in summer (Starks 1992a). This is confirmed by record on 24/2/00 of bird with leg flag, banded at breeding colony at Gippsland Lakes (RMc; VWSG, pers. comm.). On 20/2/00, 10 birds observed, most in non-breeding plumage (CMo, MAC); probably migrants from northern-hemisphere breeding populations, which are known to occur in the Swan Bay-Queenscliff area in summer (Carter 1998).

Conservation status

Listed in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because nesting colonies threatened by disturbance and predation, but not considered to be threatened nationally. In Vic., Vulnerable (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

Regional significance

Little Terns in low numbers in Port Phillip Bay (Emison et al. 1987). The Bay is W limit of continuous distribution along Victorian coast (Higgins and Davies 1996).

Fairy Tern *Sterna nereis*

Regularly recorded, numbers very variable. Highest counts: 36 on 24/4/99 (RMc); 100-240, 20/2/00-29/2/00 (MAC, MHe, GFNC, RMc, JH); 8 on 12/2/01, 20/2/01 (RMc); 135 on 4/3/02 (RMc). Records in all seasons, but uncommon in winter and spring; two irruptions of very large numbers in late summer, 2000, and early autumn, 2002.

Extraordinary numbers at lake in late summer 2000: 240 on 20/2 (MHe, MAC, GFNC); 100 on 24/2 (RMc); mixed flock of several hundred Fairy and Little Terns, mainly Fairy, 29/2 (JH). Birds were flying and diving for prey in lake and resting in crevices in exposed limestone outcrop and on shoreline of mudflats. The limestone outcrop is a favoured roost-site (RMc); at other times, birds observed roosting on sandspits and flats on SE shore, on island off S central shore, and on sandbar in SE ponds, sometimes among waders (PB, BellBOCA, RMc).

Fairy Terns feed, roost and nest in the Swan Bay system (Barter et al. 1988), and low numbers of birds using the lake probably come from there. The hundreds of Terns present at the lake in Feb. 2000 may have gathered from a wider area encompassing much of Port

Phillip Bay (Emison et al. 1987), as counts in Swan Bay are usually lower than 100 (e.g. GBR 1995). From the intense feeding activity of the Terns, the attraction at the lake was probably an abundance of small fish, the Terns' major food source (Higgins and Davies 1996); exposure of the limestone outcrop by low water levels provided a sheltered roost-site and enabled the Terns to remain at the lake near the food supply.

Importance of lake for juveniles

Fairy Terns nest in Swan Bay system and elsewhere in Port Phillip Bay (Emison et al. 1987; Barter et al. 1988). Dependent young visit the lake in Jan. and Feb., resting with adults on limestone outcrop, islands, and sandbars isolated by water: 1 speckled brown immature, 24/2/00 (RMc); 2 begging speckled juveniles on island off S central lakeshore, 12/2/01, 20/2/01 (RMc); 1 speckled immature on sandbar in SE ponds, 13/1/02 (MAC, MHe).

Conservation status

Listed in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because of local declines, but not considered to be threatened nationally. In Vic., Vulnerable (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

National significance

Estimated breeding population in Australia, 6000 birds (Garnett and Crowley 2000); 240 Terns observed at lake in 2000 likely to constitute more than 1% of national population, even taking non-breeding birds into account.

Whiskered Tern *Chlidonias hybridus*

Records at lake uncommon. Spring-autumn migrant to region. Present, 4/3/98 (PB, BellBOCA); present, 22/12/99 (Atlas 2); 9 on 9/12/01 MHe); 19 on 7/1/02 (MHe, RHL); 16 on 13/1/02 (MAC, MHe); present, 22/10/02 (MHe, RHL). In summer 2001-2002, birds were hunting by diving in SE ponds and in lake, and resting in SE ponds on posts, sandbars, sandspits and in low sparse saltmarsh on shore. Birds disappeared from lake when shallow-water areas in SE ponds dried out.

Conservation status

Listed as Lower Risk, Near Threatened in Vic. (Victorian Dept. of Natural Resources and Environment 2000).

Blue-winged Parrot *Neophema chrysostoma*

Recorded irregularly, sometimes in very high numbers: small group feeding on strip of land beside SW ponds, in area of Shrubby Glasswort, 15/10/88 (WB, IB); 150 in field at E end of lake, 28/7/91 (Starks 1993; original OBP Count sheet); 200-300 on 26/7/92 (Starks 1994); 1 on 25/10/98 (GBR 1998).

State significance

29-629 Blue-winged Parrots counted in Victoria during monitoring surveys for Orange-bellied Parrots, July 1984-1997 (RAOU Reports on OBP Counts, summarised in Higgins 1999). Although surveys not designed to monitor Blue-winged Parrots and not all suitable habitat searched, 200-300 birds at lake likely to constitute substantial proportion of Victorian population.

Orange-bellied Parrot *Neophema chrysogaster*

Autumn-winter visitor to mainland Australia from breeding grounds in Tasmania. Recorded irregularly at lake: 10 on 15/10/88, on strip of land beside SW ponds (Starks 1992b; original OBP Count sheet; original VG count sheet); 10 on 22/10/88 (GBR 1998); 6 on 3/6/89, including 2 males and 2 females (Starks 1992b); 10 on 4/7/94, feeding in area of levelled mining spoil 50-100 m from NE shore of lake (Starks 1996; original OBP Count sheets); 5 on 5/7/94, in same area (Starks 1996); 10 reported at Point Lonsdale on 8/7/94, feeding on regenerating saltmarsh on reclaimed gravel pits, probably in same location (GBR 1994); 19 on 27/8/94, in same area (PB); 1 immature near SW ponds, 22/5/98 (RMc).

Birds not recorded in every year, and when present do not stay at lake for entire winter season. Sometimes at lake over extended period, although may come and go within this time. In 1988, the 10 birds on 15/10 and 22/10 probably the same individuals and present at lake for at least 1 week. In 1994, Parrots recorded several times at one site over almost 8 weeks, 4/7-27/8, but none present on 6/7 (Starks 1996).

Two sites are clearly important for Parrots: a strip of land with stands of Shrubby Glasswort between SW ponds and lakeshore was used on two occasions, possibly three; and low saltmarsh of Beaded and Thick-head Glasswort on NE lakeshore was used for almost 2 months in one season.

Observations of feeding in 1988 and 1994. On 15/10/88, 10 Parrots were feeding vigorously on seeds of Shrubby Glasswort on strip of land beside SW ponds (Starks 1992b; VG, original count sheet); on 22/10/88, probably in same area and taking same seeds. On 4/7/94, 10 Parrots feeding in field 50-100 m from NE shore of lake, on area of levelled mining spoil with

patches of Beaded Glasswort and Thick-head Glasswort. Flew from patch to patch feeding on seeds of both species (Starks 1996; original OBP Count sheets). Parrots recorded at this site over next 8 weeks, to late Aug., probably using same food source. August is late in season for Beaded and Thick-headed Glasswort to be carrying seed, but those are the only saltmarsh plants available for Parrots in this area (RHL, MHe, personal observation). Recently-established areas of Beaded Glasswort on mining spoil may be particularly attractive to Parrots; at Lake Connewarre, new growth is lush, seeds prolifically, and is preferred by feeding Parrots (Hewish and Starks 1988).

The seeding times of Beaded Glasswort, Thick-head Glasswort and Shrubby Glasswort encompass autumn-early spring, and the lake is therefore suitable for Parrots for most of season that they spend on mainland: Beaded Glasswort carries seed and is used by Parrots early in season, Mar.-Aug.; Thick-head Glasswort carries seed at approximately the same time as Beaded Glasswort; and Shrubby Glasswort carries seed and is used by Parrots late in season, Aug.-Oct. (Loyn et al. 1986; Australian Plants Society Maroondah 2001.).

No feeding observations made for the birds seen on 3/6/89 or 22/5/98; the immature observed on 22/5/98 was on the ground under Shrubby Glasswort, but was not observed taking seeds (RMc). Shrubby Glasswort unlikely to carry seed in May, and food source could have been Beaded Glasswort or some other Parrot food plant which seeds early in season e.g. Austral Seablite or Grey Glasswort (Yugovic 1984; Loyn et al. 1986).

Conservation status

Endangered nationally (Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia). Listed as Critically Endangered nationally in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because of decline in numbers and range, very low population size (180 mature birds), and habitat loss in wintering grounds. In Vic., Critically Endangered (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

International significance

Lake Victoria has supported up to 10% of the estimated population of Orange-bellied Parrots (Garnett and Crowley 2000). Because of the variety of food plants available, the lake is suitable for Parrots through the entire season which they spend on the mainland; areas of Grey Glasswort are particularly valuable, as it is of restricted distribution around Port Phillip Bay and produces seed in July-August when food for Parrots is limited (Yugovic 1984; Loyn et al. 1986). The lake is close to other major wintering areas for Parrots, Swan I., Sand I., Swan Bay and Lake Connewarre, and interchange probably occurs. All areas of suitable

habitat, especially those that are used by Parrots, are of great value and should be preserved (Barter et al. 1988). Regular winter monitoring at the lake should continue; additional surveys early and late in season would also be advisable, to cover seeding times of all food plants.

Striated Fieldwren *Calamanthus fuliginosus*

Regularly recorded, in low numbers, 1-6 birds. Present throughout year, and no correlation of highest counts (5-6 birds) with any particular season. Widespread around shores of lake and ponds wherever dense shrubs occur: in tall shrubland in and around coastal woodland and Moonah thickets, and numerous in Shrubby Glasswort stands on SW shore. Often sing from prominent perches on tops of bushes (Hubbard 1997).

White-fronted Chat *Epthianura albifrons*

Regularly recorded, sometimes in high numbers. Highest counts: 89 on 15/10/88 (VG); 81 on 17/6/89 (VG); 130 on 3/2/90 (VG); 180 on 16/4/90 (VG). All counts of >50 birds in 1988-1992, but probably no decline since; this was the period of RAOU VicGroup Wetland Surveys, the only surveys in which wetland-associated passerines were counted. Present throughout year, and high counts not associated with any particular season.

In summer surveys, 2001-2002, Chats widespread along shores of ponds and lake, preferring saltmarsh areas: numerous in low samphire herbland (Beaded, Grey and Black-seeded Glasswort) and samphire shrubland (Shrubby Glasswort).

Breeding

Probably regular at lake. 1 on nest, 23/10/92 (VG). On 13/9/98, 3 nests found: nest with 1 egg, 30 cm above ground in Spear-grass tussock; nest with 1 egg, 30 cm up in Buffalo Grass; this nest on E side of tangled mass of grass, protected from SW winds; nest with 3 eggs, 30 cm up in Buffalo Grass; also on E side of grass tangle, protected from wind; this nest contained 2 young, nearly fledged, on 9/10 (GBR 1998).

Welcome Swallow *Hirundo neoxena*

Regularly recorded, sometimes in very high numbers. Highest counts: 150 on 18/4/91 (VG); 1000 on 8/5/98 (GBR 1998); 100 on 12/5/98 (RMc); 75 on 19/4/00 (RMc). Partial spring-summer migrant in region. In 1998-2001, when many records documented for Birds Australia Atlas and BellBOCA excursions, Swallows observed regularly in all seasons, though highest counts in autumn, Apr.-May. In Apr. 1991, the birds gathered to feed among large swarms of

insects (VG); other high counts may have represented similar feeding concentrations or gathering of birds prior to or on migration (Emison et al. 1987).

In summer surveys, 2001-2002, Swallows present in low numbers, hunting in flight and patrolling over SE ponds, short-grass area behind SE shore, lakeshore sandflats, rushbeds, and the lake itself (MHe, RHL, MAC, GT). Seen resting on only one occasion: 10 perched on sandspit on SE lakeshore and making hunting sallies over water, 3/2/02 (MHe).

Tree Martin *Hirundo nigricans*

Spring-summer migrant in region. Rarely recorded: 4 with Welcome Swallows, 20/2/01 (RMc).

Fairy Martin *Hirundo ariel*

Spring-summer migrant in region. Rarely recorded: present, 20/3/94, 1/2/98 (PB, BellBOCA).

Clamorous Reed-Warbler *Acrocephalus stentoreus*

Spring-summer migrant in region. Rarely recorded: 3 on 10/2/91. No information on habitat use (VG).

Little Grassbird *Megalurus gramineus*

Occasionally recorded, in low numbers: 4 on 22/6/91 (VG); 2 on 24/4/99 (RMc); 1 on S shore, 20/2/01 (RMc); 1 heard from bed of Sea Rush mixed with Prickly Spear-grass, 1 seen in Shrubby Glasswort on SW lakeshore, 3/2/02 (MHe). Probably resident in low numbers; reasons for scarcity of records not known.

Golden-headed Cisticola *Cisticola exilis*

Occasionally recorded, in low numbers: 2 on 18/4/91 (VG); present, 16/2/94, 20/3/94 (PB, BellBOCA); 1 on 6/5/95 (RMc); present, 3/11/99 (PB, BellBOCA); 1 calling from extensive rushbed on SE shore, 13/1/02 (MHe).

Probably resident in low numbers in areas with rush, tall grass and other rank vegetation; reasons for scarcity of records not known. No winter records; the species does not migrate but birds become quiet and inconspicuous in winter (Emison et al. 1987).

3. Freshwater Lake

SUMMARY

- The list for Freshwater Lake includes 60 species of waterbirds. These include waterfowl, waders, pelicans, herons, egrets, ibis, spoonbills, crakes, gallinules, coastal birds, and wetland-associated birds of prey, parrots and land birds.
- There are breeding records for six species. The lake becomes important for breeding when the water is high, salinity low, and fringing and aquatic vegetation becomes established in spring and summer.
- The lake often supports more than a thousand waterbirds. The highest count was 2823 on 9/12/01. When the water level is low, dabbling waterfowl and waders tolerant of salinity are numerous: when the lake is full, deep-diving and freshwater waterfowl become dominant.
- The lake is of international significance for Blue-billed Ducks, Banded Stilts and the globally endangered Orange-bellied Parrot, and of state significance for Eurasian Coots, Red-capped Plovers and breeding Whiskered Terns. In total, 26 species occur in numbers significant at international, national, state or regional levels, have special conservation status, or are listed in international treaties.
- There is interchange between the lake and the other wetlands of the Swan Bay system (waders and probably waterfowl) and with the Portarlington Sewage Ponds (waterfowl).
- Waterbird numbers vary seasonally. The lake is often dry in summer, and so peak numbers generally occur in winter. The lake is sometimes important for migratory waders in autumn as they gain weight before migration, and over winter for the remaining first-year birds.
- Numbers of waterbirds can vary at any time of year, as water levels and salinity fluctuate, birds move within Swan Bay and other wetland systems, and irruptions bring waterbirds to the coast from inland. Waterfowl occur in the highest numbers when the lake is at or near capacity in late summer; migratory and resident waders when the water level is low and mudflats exposed.
- The important sites for waterbirds include:
- areas of Glaucous Goosefoot on the southern and eastern shores, of particular significance for Orange-bellied Parrots.
- the north-eastern mudflats, for waders, dabbling waterfowl and large wading birds.

- the shallow southern and western shores and associated backwaters, for waterfowl and waders, and waterfowl breeding.
- the deepest northern and western parts of the lake, for diving waterfowl.
- The rushbeds (when the water is at high level), for Latham's Snipe, crakes, and wetland-associated land birds.
- Since 1980, Australian Shelducks, Double-banded Plovers and Masked Lapwings have declined. These changes appear to relate to regional changes and shifts in population rather than changes at the lake.
- Mammals, reptiles and frogs recorded from the vicinity of Freshwater Lake have been listed. Few of the records include precise locations.

Figure 3.1 Freshwater Lake

Waterbird species and numbers

Since 1980, 60 species of waterbirds and wetland-associated birds have been recorded at Freshwater Lake. The VicGroup Wetland Survey (RAOU) was the only regular monitoring programme in which all species of waterbirds were counted. Total counts varied greatly (31-1176 birds), the lowest numbers usually occurring in summer and autumn when the lake is often dry. Other surveys have shown that these counts cannot be taken as indications of peak numbers of waterbirds occurring at the lake. They have been exceeded before and since by counts of waders alone (e.g. 2088 in winter 1986, 1776 in summer 1990), counts of single species (e.g. Banded Stilts, 2000 in winter 1986; Eurasian Coots, 2300 on 9/12/01), and total counts obtained in surveys for this study.

The species list is not particularly long. However, it is probably incomplete, as almost every survey for this study in 2001-2002 added new species. A noticeable feature of the bird list is that it contains waterbirds with apparently incompatible habitat preferences. Freshwater Lake shows the greatest variations in water level, salinity and vegetation of the three wetlands under study. When the lake is full, it is relatively deep, weakly saline, dominated by rush, and flooded around the margins; when the water level is low, the lake is shallow, hypersaline, dominated by saltmarsh, and surrounded by exposed mudflats. At their extremes, these habitats attract different suites of waterbirds.

Breeding records and the importance of the lake for juveniles and immature birds

There are breeding records for six species of wetland-associated birds, including two species of waterfowl, two waders, one tern and one land bird associated with wetlands. Most occurred when the lake was at or near capacity in the spring-summer breeding season, probably in response to the lowered salinity and the availability of fringing and aquatic vegetation used for nest-building, feeding habitat, and shelter for nests and young. Such conditions occurred in summer 2001-2002, but intensive surveys of the lakeshore did not begin until January and appeared to catch only the end of the breeding season. If conditions are suitable in spring in future, searches should be made for nests and dependent young.

When the water level was high in 2001-2002, Black Swans and Australian Shelducks used the lake for breeding and as a brooding area for dependent young. For many waterfowl species, successful nesting depends on the presence of emergent vegetation to provide cover for the young, aquatic vegetation and the associated invertebrate fauna for feeding, and a source of fresh water, as ducklings are intolerant of high salinity. At the lake, these conditions are unusual during the waterfowl breeding season in spring-summer, as the water level is rarely maintained for long enough for aquatic vegetation to develop. Breeding of Australian Shelducks using the lake may be partly opportunistic. Small ducklings were present in Dec.-Jan. 2001-2002, which is unusually late in the season for Shelducks (Marchant and Higgins 1990), and a female continued to show territorial behaviour into February.

Black-winged Stilts nested at the lake in spring 1987, when the water level was high. In other years, immature Stilts have been observed in summer and winter. The lake provides a sheltered and undisturbed feeding and roosting area for young birds, whether or not they originated from nesting at the lake itself. Of the three records of breeding or breeding display for Red-capped Plovers, two occurred when the water coverage was approximately 50%.

The dominant vegetation was probably saltmarsh, a favoured breeding habitat for this species.

There are few known breeding sites for Whiskered Terns in Victoria (Emison et al. 1987). One record for this species at the lake included an observation of a bird sitting on a nest. Whiskered Terns breed in shallow fresh-brackish swamps with aquatic vegetation and rushes (Pescott 1983). Freshwater Lake would be suitable for nesting only if the water level was maintained for long enough for aquatic vegetation to develop. The water coverage at the time of the breeding record was 95% (Wetland Database, NRE).

For White-fronted Chats, breeding is probably not the rare occurrence which the single record of a dependent young bird suggests. The birds are common at the lake year-round, apparently unaffected by changes in water level, salinity and vegetation, and even remain when the lake is dry.

Freshwater Lake is important for young birds of a number of resident and migratory wader species. Banded Stilts and Red-necked Avocets occur in large numbers when adults and young return to the coast from nesting inland, and in winter the lake carries regionally significant populations of first-year birds for Common Greenshanks, Red Knots, Red-necked Stints and Curlew Sandpipers (Table 3.1).

Species with significant populations and/or conservation status

Table 3.1 lists 26 species recorded from the lake, which occur in numbers significant at an international, national, state or regional level, have special conservation status, or are listed in international treaties. The lake is of international significance for endemic Blue-billed Ducks and Banded Stilts, carrying in some surveys 1% or more of the estimated total populations in Australia. The lake is also of international significance for Orange-bellied Parrots (Brown and Wilson 1984), which are endangered globally. There are observations of 20-28 birds, approximately 10-15% of the estimated population, and other records of smaller numbers. Parrots apparently do not visit in every year, but when conditions are suitable may remain for most of the winter season e.g. May-August 1980 (Brown and Wilson 1984).

The majority of the other species for which the lake carries significant populations are waterfowl and waders. For some wader species, the significant counts occurred in winter, reflecting the fact that the lake often dries out in summer.

New information from surveys in 2001-2002

A series of intensive surveys in 2001-2002 produced much new information:

- Many new species for the bird list (Blue-billed Duck, Cape Barren Goose, Little Egret, Great Egret, Australian Spotted Crake, Spotless Crake, Black-tailed Native-hen, Latham's Snipe, Marsh Sandpiper, Red-kneed Dotterel, Clamorous Reed-Warbler, Little Grassbird).
- A total count which was higher than any recorded previously (2823 on 9/12/01).
- The highest counts ever recorded for Australasian Shovelers, Hardhead, Hoary-headed Grebes, White-necked Herons, Australian White Ibis, Straw-necked Ibis, Yellow-billed Spoonbills, Eurasian Coots, Sharp-tailed Sandpipers, Whiskered Terns and Welcome Swallows.
- Records of Black Swans using the lake as a moulting site.

Table 3.1. Waterbird species* at Freshwater Lake with significant populations and/or special conservation status

Species	Significance (1)	Conservation status
Blue-billed Duck	International (endemic)	Vulnerable in Vic. (4); threatened (5)
Musk Duck		Vulnerable in Vic. (4)
Black Swan	Regional	
Australian Shelduck	Regional	
Australasian Shoveler	Regional	Vulnerable in Vic. (4)
Grey Teal	Regional	
Chestnut Teal	Regional	
Hardhead	Regional	Vulnerable in Vic (4)
Hoary-headed Grebe	Regional	
Little Egret		Critically endangered in Vic. (4); threatened (5)
Royal Spoonbill		Vulnerable in Vic. (4)
Eurasian Coot	State	
Latham's Snipe		JAMBA; CAMBA
Common Greenshank	Regional (winter)	JAMBA; CAMBA
Red Knot	Regional (winter)	JAMBA; CAMBA
Red-necked Stint	Regional (winter)	JAMBA; CAMBA
Sharp-tailed Sandpiper	Regional	JAMBA; CAMBA
Curlew Sandpiper	Regional (winter)	JAMBA; CAMBA
Black-winged Stilt	Regional	
Banded Stilt	International (endemic)	

Species	Significance (1)	Conservation status
Grey Plover		JAMBA; CAMBA
Red-capped Plover	State	
Double-banded Plover	Regional	
Masked Lapwing	Regional	
Whiskered Tern	State (breeding)	Near threatened, lower risk in Vic. (4)
Orange-bellied Parrot	International (endemic)	Endangered nationally (2); critically endangered nationally and in Vic. (3, 4); threatened (5)

*Includes non-vagrant birds with 5 or more records; species with breeding record/s or any high count; critically endangered species.

Criteria for significance in Chapter 1.

Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia.

The Action Plan for Australian Birds 2000. S.T. Garnett and G.M. Crowley. Environment Australia, Canberra.

Threatened Vertebrate Fauna in Victoria 2000. A systematic list of vertebrate fauna considered extinct, at risk of extinction or in major decline in Victoria. Dept. of Natural Resources and Environment, East Melbourne.

Flora and Fauna Guarantee Act, 1988 (Vic.).

JAMBA, CAMBA: species listed under the Japan-Australia Migratory Birds Agreement, China-Australia Migratory Birds Agreement.

Species diversity at the lake: one lake, two wetland communities

It seems surprising that surveys at the lake over a few short months in 2001-2002 could extend the bird list by so many species and set so many records for waterbird numbers. This reflected the unusual habitats available at the lake, as flooding produced deep open water of low salinity and attracted large numbers of deep-diving waterfowl (Blue-billed Ducks, Musk Ducks, Hardhead, Hoary-headed Grebes, Eurasian Coots). Many new species also occurred in the extensive rushbeds which had been rejuvenated by flooding and were the dominant vegetation at that time (Latham's Snipe, Australian Spotted Crake, Spotless Crake, Clamorous Reed-Warbler, Little Grassbird). Dusky Moorhens and Purple Swamphens have occurred at the lake during previous episodes of flooding (M. Cameron, pers. comm.), but not during surveys in 2001-2002. They prefer freshwater wetlands, and the lake would probably only be suitable for a short time after filling.

The summer flooding which occurred at the lake in 2001-2002, and the resulting concentration of these unusual waterbird species, appear to occur rarely but are probably not unique. However, this is clearly the first time that there has been an intensive survey effort under such conditions.

When the water level is low and the lake saline, the waterbird population at the lake is different. It is dominated by species that are salt-tolerant, particularly dabbling waterfowl (Black Swans, Australian Shelduck, Pacific Black Ducks, Grey Teal, Chestnut Teal) and waders attracted to the exposed mudflats and fringing low saltmarsh. Numbers can also be very high under these conditions, with previous records of 811 Grey Teal, 790 Chestnut Teal, more than 1000 Red-necked Stints, 2000 Banded Stilts and more than 200 Red-capped Plovers.

The greatest diversity of waterbirds occurs during the transition period between the two habitat types. In Feb.-Mar. 2002, the lake was still deep enough for diving waterfowl and the rushbeds were extensive and in good condition, but the water had receded to expose a limited area of mudflats, and aquatic vegetation had developed around the lake margins. The declining deep-water specialist species (Blue-billed Duck, Hardhead, Hoary-headed Grebe, Eurasian Coot) overlapped with the dabbling ducks and large wading birds building up in numbers on the shallow north-eastern shore (Australasian Shoveler, Grey Teal, Chestnut Teal, ibis, spoonbills). A few waders had also begun to move onto the mudflats by Jan.-Feb. 2002 (Common Greenshanks, Red-necked Stints, Red-capped Plovers, Masked Lapwings).

Variability in waterbird numbers

All surveys at the lake, whether for waders, waterfowl or all waterbirds, have demonstrated that bird numbers at the lake can vary widely. The lake is ephemeral and often dry in summer and autumn. Waterbird numbers are therefore generally low in that season; the only species likely to be present when there is no water are Red-capped Plovers, Masked Lapwings, and occasionally Double-banded Plovers. Winter and spring numbers are generally higher (M. Cameron, pers. comm.), as water is usually present from seasonal rainfall. This seasonal pattern is similar to that at St Leonards Salt Lagoon, which is also often dry in summer, but differs from that at Lake Victoria, which always contains water in summer-autumn and so can support large populations of waders and waterfowl in their peak season.

At any time of year, variations in water level and habitat at the lake can combine with fluctuations in numbers of waterbirds in the region, to produce a system marked by unpredictable and sometimes rapid changes. Record numbers of many species of waterfowl were recorded when high water levels in summer 2001-2002 coincided with the usual summer concentration of many species of waterfowl at the coast in response to drying of inland wetlands.

The critical features attracting large numbers of migratory and Australian resident waders appear to be low-moderate water levels and exposure of the mudflats used for feeding. Under these conditions, high counts of migratory waders can occur at any time of year, even though most adults leave Australia for their breeding grounds in the northern hemisphere in winter. High summer counts of waders in 1988, 1990 and 1992 coincided with low water levels (50-60% water coverage). High counts of Banded Stilts at the lake have coincided with large influxes to the coast from inland Australia, but again only when the water level was low.

Irruptions of some species into the Geelong region also show up as unusually high counts or first records in survey data for Freshwater Lake. In 2001-2002, Blue-billed Ducks occurred in record numbers not only at the lake, but also at other regional wetlands such as Werribee Sewage Treatment Works, Portarlington Sewage Ponds and Lake Victoria (R. Swindley via R. Loyn; P. Bright, M. Hewish, B. Stent). The first observations of Black-tailed Native-hens at the lake were also part of a wider regional invasion, beginning in late 2000 (Geelong Bird Report 2000; records submitted in 2001 and 2002 for Geelong Bird Reports).

In such a variable system, counts at fixed times of year are not ideal for monitoring waterbird species and numbers using the lake, especially if the counts are made in summer (e.g. NRE/RAOU Summer Waterfowl Counts). It is significant that a few surveys in 2001-2002 could add so much new information after 20 years of regular monitoring for waterbirds and waders. Under these circumstances, opportunistic surveys are probably more useful, concentrating effort during periods when numbers of waterbirds or particular species are observed to be high. Unfortunately Freshwater Lake does not have a high profile among bird observers in the region, and it is rarely visited by casual observers as it is not visible from major roads.

The role of Freshwater Lake in regional wetland systems, particularly the Swan Bay system

Freshwater Lake is a component of the Swan Bay system of wetlands and marine environments, which includes Swan Bay, Queenscliff, Edwards Point, Mud Islands, Lake Victoria and St Leonards Salt Lagoon. This system is of international importance for waterbirds. There is extensive movement within it, certainly of waders and probably also of waterfowl (Barter et al. 1988). All the component wetlands of the Swan Bay system are important. Although the lake holds large numbers of birds only irregularly, all the wetlands are essential to provide food and shelter for birds over a range of seasonal and weather conditions.

Because of this interaction, many of the waterbirds which are common in the Swan Bay system also occur at Freshwater Lake (Barter et al. 1988; Barter 1992). When the lake is at low level and saline, it is particularly suitable for those species from Swan Bay which are salt-tolerant and which feed in shallow water or on intertidal mudflats e.g. Black Swans, Australian Shelducks, Pacific Black Ducks, Chestnut Teal, ibis, spoonbills, herons, egrets and many species of waders (Barter et al. 1988; NRE/RAOU Summer Waterfowl Counts; Geelong Bird Reports). Waders are generally more mobile in winter than in summer (Minton 1981; Fletcher et al. 1982; Paton et al. 1982), and that season occasionally produces records of unusual species, unusually high numbers and probable movements to and from the lake (see Black-tailed Godwit, Ruddy Turnstone, Great Knot, Red Knot, Red-necked Stint, Curlew Sandpiper and Grey Plover, in Species List).

A connection with the Swan Bay system is also indicated by records from the lake of species which are known from Swan Bay but are rare at other terrestrial wetlands in the region: for instance, Ruddy Turnstone, Great Knot, Red Knot and Lesser Sand Plover. During this study, Yellow-billed Spoonbills and Swamp Harriers were observed flying in to the lake from the direction of Swan Bay.

There is more direct evidence of waterbird movements within the Swan Bay system. Between late summer and early spring in 1998, a flock of 10-11 Black-tailed Godwits, which are rare locally, visited Lake Victoria, St Leonards Salt Lagoon, Duck Island in Swan Bay, and the Sand Island at Queenscliff. They were observed flying away from Lake Victoria and descending over Freshwater Lake only one kilometre away. In winter 1981, a flock of about 20 Grey Plovers appeared to move within the space of a week from Freshwater Lake to Lake Victoria (Robinson 1982; Wader Count results).

Many of the waterfowl occurring at Freshwater Lake also occur at Portarlington Sewage Ponds, which were constructed in 1982 and began to carry large numbers of waterfowl in the early 1990s (NRE/RAOU Summer Waterfowl Counts; King 1997; Geelong Bird Reports). The ponds are close to Swan Bay and about 15 km from Freshwater Lake, and there is probably some interchange. Large flocks of Musk Ducks, Black Swans, Australian Shelducks, Chestnut Teal and Hoary-headed Grebes occur at the sewage ponds, as well as in Swan Bay and its associated wetlands.

The sewage ponds have also provided suitable habitat for some waterfowl species which were in the past uncommon on the eastern Bellarine Peninsula and in the Swan Bay system, particularly Australasian Shovelers and the deep-diving freshwater species, Blue-billed Ducks, Hardhead and Eurasian Coots (King 1997). The sewage ponds may be the source of some of the unusual waterfowl occurring at Freshwater Lake in summer 2001-2002. Counts

of Blue-billed Ducks at the sewage ponds and the lake during summer 2001-2002 provided circumstantial evidence that interchange was occurring. Numbers of Blue-billed Ducks varied between counts at both wetlands, demonstrating movements; maximum counts at the two wetlands were similar (400-500 birds); and counts showed an inverse relationship (P. Bright, P. Cutcliffe, R. Loyn, G .Tribe, M. Hewish, pers. comm.). As there are no other local wetlands carrying such numbers of Blue-billed Ducks (Geelong Bird Reports), it seems that the two wetlands are linked for at least one species, and possibly for others that they hold in common, such as Musk Ducks, Black Swans, Australian Shelducks, Australasian Shovelers, Chestnut Teal, Hoary-headed Grebes and Eurasian Coots.

Some of the rapid changes in numbers at the lake are clearly related to short-term movements within these systems. The conditions that stimulate waterbird movements to and from the lake are not fully understood. The need for sheltered roosts or feeding areas during rough weather may play a role, perhaps especially for waders (Barter et al. 1988), but there is no direct evidence in the records collected for this study linking waterbird numbers with wind strength or direction.

Important habitats and sites for waterbirds

The important areas for waterbirds, as determined mainly from observations of habitat use in 2001-2002, are listed below. Information from other times, especially when the water level is low and mudflats and saltmarsh surround the lake, is limited.

Extensive areas of Glaucous Goosefoot along the southern and eastern shores.

- Feeding area for 10-15% of the known population of the globally endangered Orange-bellied Parrot in some years. Glaucous Goosefoot carries seed in April-August and is the major food source for Parrots at the lake.

The North-Eastern Mudflats

The north-eastern mudflats are the first to be uncovered as the water retreats. This area is protected on the landward side by banks of reeds, and being furthest from the Clows Road entrance and the housing areas, is relatively undisturbed. Significant observations include:

- A record of 7 Orange-bellied Parrots in June 1989 (Starks 1992b: original OBP Count forms).
- Large concentrations of waterfowl (e.g. more than 600 birds on 16/3/02).
- Moulting-site for Black Swans in late summer.

- Large flocks of Black Swans, Australian Shelducks, Grey and Chestnut Teal feed offshore and roost on the mudflats.
- Large flocks of Australasian Shovelers feed in aquatic vegetation in shallow water, and rest offshore.
- White-faced Herons, spoonbills and ibis feed and rest on the mudflats; this is the site of the only observations of a Cape Barren Goose.
- A preferred feeding area for waders: Marsh Sandpipers, Common Greenshanks, Red Knots, Red-necked Stints, Sharp-tailed Sandpipers, Curlew Sandpipers, Red-capped Plovers and Masked Lapwings were observed in 2001-2002.
- Hunting area for Swamp Harriers.
- Waterfowl and waders moved to this area after disturbance at other sites.

Southern and western shores, associated inlets and backwaters

This area is shallow. If a high water level is maintained for some months, it becomes covered with aquatic vegetation, firstly in the inlets and eventually over the lake proper for a considerable distance out from shore.

- Large flocks of Eurasian Coots and Blue-billed Ducks feed and rest among aquatic vegetation offshore.
- Large wading birds, Purple Swamphens and Dusky Moorhens feed in the vegetated inlets when the lake is full.
- Supports large numbers of small waders as water recedes.
- Important for breeding: in spring and summer 2001-2002, Black Swans nested and Australian Shelducks cared for dependent young in flooded backwaters and along shores here.
- Hunting area for Welcome Swallows.

The lake off the northern and western shores

The areas off these shores are apparently the deepest parts of the lake.

- Very large concentrations of waterfowl (e.g. more than 2700 birds on 9/12/01).
- Feeding and resting area for large flocks of deep-diving waterfowl, Blue-billed Ducks, Hardhead, Hoary-headed Grebes and Eurasian Coots.

The rushbeds

- Favoured areas for Black-tailed Native-hens, Latham's Snipe, Australian Spotted Crakes, Spotless Crakes and Swamp Harriers, and the margins are used by Red-kneed Dotterels.
- Habitat for White-fronted Chats, Clamorous Reed-Warblers, Little Grassbirds, Golden-headed Cisticolas.
- Hunting areas for Welcome Swallows.

The remnant woodland

- Though small and degraded, the woodland supports a small population of birds typical of coastal woodlands in the region.

Have any waterbirds declined or increased in numbers since 1980?

Although numbers of waterbirds are variable and the timing of surveys is often inappropriate, some trends in waterbird numbers are apparent. The few noticeable long-term changes appear to relate to regional changes in numbers or shifts in population, rather than alterations at the lake itself.

Since 1990, there has been a possible decline in numbers of Australian Shelducks using the lake in summer. The highest counts were obtained in 1988 (150 birds) and 1990 (200), and counts since have never exceeded 100 birds. It is possible that Freshwater Lake was formerly a moulting-site for Shelducks, and that at least some of the birds now using Portarlington Sewage Ponds for this purpose moved from the lake. However, this suggestion is tentative, as there were few summer records before 1990, the lake often being dry in that season, and there is no direct evidence that birds moulted at Freshwater Lake.

Before 1990, Double-banded Plovers were regularly recorded at the lake in their usual winter season and counts were often high (up to 97 birds). There have been no winter records since that time, and counts of 1-2 birds in the summers of 1992 and 1995 constitute the only recent records. A similar decline has been observed at Lake Victoria since 1992. Numbers in the Swan Bay system have remained high during this period, and the reason for the reduced use of the lakes is not known.

In early Wader Counts, Masked Lapwings were regularly recorded in high numbers (up to 195), but there have been no counts of 50 or more since 1986 and none of 20 or more since 1988. The reason for the decrease in numbers is not known, but similar declines have

occurred at Lake Victoria and at Lake Lorne in the central Bellarine Peninsula since 1986 (King and Cameron 1997).

The occurrence of several previously-unrecorded species at the lake in 2001-2002 probably represents an opportunistic invasion by local waterbirds in response to unusual conditions at the lake, rather than any long-term alteration in the lake itself. Although waterfowl surveys have not been made under such conditions before, this situation is probably not unique. If anything, new records at the lake of Blue-billed Ducks, Australasian Shovelers, Hardhead and Eurasian Coots demonstrate regional rather than local changes in waterbird sites and habitats. There is now a large population of waterfowl at Portarlington Sewage Ponds, available to respond to favourable conditions in the local natural ephemeral wetlands. For Blue-billed Ducks, a regional invasion over a wide area in summer 2001-2002 probably also played a part in their appearance at Freshwater Lake.

Waterfowl

Twelve species of waterfowl (swans, geese, ducks, grebes, coots) have been recorded from the lake. Depending on conditions, the lake can accommodate high numbers of deep-diving or shallow-water dabbling ducks, freshwater specialists or species tolerant of high salinity, and sometimes all at once. In this, the lake is unusual and possibly unique in the region.

The NRE/RAOU Summer Waterfowl Counts, 1988-1992, are the major source of systematic counts of waterfowl at the lake (Table 3.2). Unfortunately the lake was dry for two of these surveys, and the water level was low for the others (<60% coverage). Because of the timing of the surveys and the variability of the system, the counts of 0-905 birds do not reflect the true importance of the lake for waterfowl. Other counts give a more realistic assessment. In summer 2001-2002, when species diversity at the lake was high, counts ranged between 1414 (31/1/02) and 2810 (9/12/01). Even when species diversity is restricted because of low water and high salinity, counts of waterfowl can be high: for instance, 1200 waterfowl were present on 17/5/98, mainly Chestnut Teal, Grey Teal and Black Swans (M. Cameron, pers. comm.).

Table 3.2. Counts* of waterfowl and waterfowl species at Freshwater Lake, 1988-1992

Year	Birds	Species
1988	678	5
1989	0	0
1990	282	3
1991	0	0
1992	905	3

*NRE/RAOU Summer Waterfowl Counts, Feb. 1988-1992 (Hewish 1988a; Peter 1989, 1990, 1991, 1992)

Freshwater Lake is a significant wetland for nine species of waterfowl (Table 3.1). The count of 400-500 Blue-billed Ducks at the lake in Jan. 2002 was significant at an international level, Eurasian Coots have occurred in numbers of state significance, and Black Swans, Australian Shelducks, Australasian Shovelers, Grey Teal, Chestnut Teal, Hardhead and Hoary-headed Grebes in numbers of regional significance. Three of these, Blue-billed Ducks, Australasian Shoveler and Hardhead, are considered to be Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000). Blue-billed Ducks have been listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

It is remarkable that such a small and ephemeral wetland is important for so many waterfowl species and can support such high numbers overall. The highest count at Freshwater Lake represents a density of more than 90 birds/hectare.

It is likely that Freshwater Lake is an important part of the Swan Bay wetland system for waterfowl, especially for species that regularly use marine and saline wetlands (Barter et al. 1988). There is also probably also interchange with Portarlington Sewage Ponds approximately 15 km away, especially for Blue-billed Ducks and possibly for other waterfowl which they hold in common, such as Musk Ducks, Black Swans, Australian Shelducks, Australasian Shovelers, Chestnut Teal, Hoary-headed Grebes and Eurasian Coots (King 1997). In years when it holds water in autumn, the lake acts as a refuge from hunting for ducks during open season.

Waders

Since 1980, 20 species of waders have been recorded from Freshwater Lake. The results of twice-yearly Wader Counts since the early 1980s are shown in Table 3.3 (RAOU; AWSG). The most numerous species occurring on a regular basis are Red-necked Stints, Sharp-tailed Sandpipers and Curlew Sandpipers, and Banded Stilts sometimes occur in very high numbers.

During spring and summer, migratory waders from the northern hemisphere spend the non-breeding season in Australia in large numbers. However numbers and species diversity at the lake are generally low in this season (range, 0-1776). This reflects the timing of the counts. In late summer (Jan.-Feb.) the lake is often dry, and the only waders likely to occur under these conditions are Red-capped Plovers, Masked Lapwings, and occasionally Double-banded Plovers. If the lake is partly full in spring-summer and the mudflats are exposed, waders are able to use the lake in high numbers. For example, in the summers of 1988, 1990 and 1992 water coverage was 50-60% and 402-1776 waders were present, and

in Oct. 2002, 500-750 Sharp-tailed Sandpipers fed on the mudflats when the coverage was 50%.

Table 3.3. Counts* of waders and wader species at Freshwater Lake, 1981-2001

Year	Summer		Winter	
	Birds	Species	Birds	Species
1981	179	7	155	6
1982	93	2	375	6
1983	0	0	17	3
1984	147	6	824	6
1985	110	3	328	8
1986	40	4	2088	5
1987	106	6	31	4
1988	562	4	522	6
1989	44	1	393	6
1990	1776	7	248	4
1991	50	2	124	5
1992	402	5	216	6
1993	24	2	25	4
1994	3	1	10	3
1995	31	4	83	5
1996	0	0	2	1
1997	8	1	5	2
1998	97	4	30	4
1999	38	1	151	4
2000	0	0	215	5
2001	37	5	3	2

* RAOU and AWSG Wader Counts in Jan.-Feb. and June-July, 1981-2001.

When there was more than one complete Wader Count in a season, the highest count is used.

Latham's Snipe are spring-summer migrants to Australia from Japan and the Kurile Islands. Their habitat requirements differ from those of other migratory waders, in that they inhabit dense waterside vegetation, especially beds of reeds or rush, rather than open mudflats. The only records of Snipe at the lake occurred in summer 2001-2002, when rushbeds around the lakeshore had been rejuvenated by flooding and were surrounded by shallow water and soft mud. Snipe feed by day and night, and showed a preference at the lake for roosting by day in open stands of Sea Club-rush and Sea Rush. The lake would also have been suitable as a nocturnal feeding area during that time, as Snipe feed by probing soft mud in densely-

vegetated freshwater wetlands (Emison et al. 1987). Snipe probably occur at the lake only occasionally, as the water level is usually low in their usual spring-summer season.

The lake sometimes holds large numbers of waders in autumn, presumably during the occasions when it holds water in this season. For instance, there was an influx of 1100 Red-necked Stints to the lake between February and April 2001. When conditions are suitable in autumn, small waders may take advantage of the opportunity to feed at the lake throughout the tidal cycle and gain weight for migration.

In winter, Freshwater Lake is of considerable importance for waders in the region (range of winter counts, 2-2088 birds). More high counts (>200 birds) occur in winter than in summer, even for migratory waders, most of which leave Australia during the southern winter to return to their breeding grounds in the northern hemisphere. The birds remaining in Australia are mainly first-year birds spending their first 18 months in the non-breeding grounds. In winter, there is usually water in the lake from seasonal rainfall. The water level may sometimes be too high for waders, but the lake usually dries rapidly, exposing the surrounding mudflats. The lake appears to be especially important as overflow habitat for over-wintering young birds following exceptional breeding years, when they occur in large numbers. Migratory waders do not breed successfully in every season. and the lake is therefore vital for the survival of these species (see Common Greenshank, Red Knot, Red-necked Stint, Curlew Sandpiper, in Species List).

Waders which visit the lake only rarely also occur predominantly in winter: for instance, Black-tailed Godwits, Ruddy Turnstones, Great Knots and Grey Plovers. They probably come from the Swan Bay system, the stronghold in the region for these species. Waders are known to wander more widely in winter than in summer (Minton 1981; Fletcher et al. 1982; Paton et al. 1982), leading to temporary appearances at the lake and marked changes in numbers over short periods for some species. The lake is so attractive to waders in winter that it often holds numbers of Sharp-tailed Sandpipers in that season. Winter records and counts of up to 20 birds are exceptional for this species, as the vast majority of adults and young birds leave Australia in winter (Lane and Jessop 1984); e.g. in national winter counts in 1986-1989, only 13-32 Sharp-tailed Sandpipers remained from summer populations of 20,000-30,000 (AWSG Population Monitoring Counts).

Winter movements within the Swan Bay system were demonstrated by flock of 10-11 Black-tailed Godwits, which are rare locally, visiting the Salt Lagoon, Lake Victoria, Freshwater Lake, Duck Island in Swan Bay, and the Sand Island at Queenscliff, between late summer and early spring in 1998. In winter 1981, a flock of about 20 Grey Plovers appeared to move

from Freshwater lake to Lake Victoria within the space of a week (Robinson 1982; Wader Count results).

Double-banded Plovers breed in New Zealand and some birds spend the non-breeding season in southern and eastern Australia. Before 1990, they occurred in high numbers at the lake in winter (up to 97 birds), but numbers have declined since that time.

Freshwater Lake is also important for some Australian resident waders. Banded Stilts in particular have occurred in enormous numbers, although at irregular intervals. For Banded Stilts and Red-necked Avocets, the lake assumes importance when large numbers of adults and young return to the coast from breeding inland. However, the habitat at the lake is not always suitable for Banded Stilts, which prefer wetlands of high salinity. If they return when the water level is high and the salinity is low, they may avoid the lake even if numbers at other wetlands in the Swan Bay system are high. For Black-winged Stilts, the highest numbers occur in winter, when the lake is most likely to hold water. In 2002, small numbers of Red-kneed Dotterels were seen at the lake in June and July. They are uncommon visitors in the Geelong region, with occasional irruptions, mainly in winter (Wader Count results). These were the first records for the species at the lake, but birds could have been overlooked in the past. They fed among Sea Rush tussocks and only came into the open when flushed. It is interesting that there are no records of Pied or Sooty Oystercatchers. Oystercatchers occur in the Swan Bay system and occasionally roost at St Leonards Salt Lagoon and Lake Victoria. Perhaps the lake is less attractive to Oystercatchers than the other two wetlands because it is marginally further from the sea.

Twelve species of waders with special conservation status or significant counts have occurred at the lake (Table 3.1). The lake is of significance for Banded Stilts at a global level, having carried 1% or more of the estimated Australian population (Watkins 1993), and of state significance for Red-capped Plovers, with counts of over 5% of the estimated Victorian population. The lake is regionally significant for several other wader species: for many, the significant counts occurred in winter, confirming the importance of the lake for first-year migratory waders.

Other waterbirds

Several species of large wading birds, such as herons, egrets, ibis and spoonbills, occur at the lake. Herons and egrets have been observed only rarely, with the exception of White-faced Herons and, for a limited period in Jan.-Oct. 2002, White-necked Herons. There is only one record each for Little Egret and Great Egret, although the habitat during this study in 2001-2002 appeared to be suitable. Ibis and spoonbills feed in low numbers around the

lakeshore, especially on the north-eastern mudflats. In summer 2001-2002, both species of spoonbills were observed to use the lake for only part of the day for bouts of feeding and resting, Yellow-billed Spoonbills were observed flying in to the lake from the direction of Swan Bay, and Royal Spoonbills probably also came from the Bay where they are numerous (Barter et al. 1988).

Dusky Moorhens and Purple Swamphens occur at the lake only when the water level is high and the salinity low, and feed among flooded or damp vegetation on the lakeshore (M. Cameron, pers. comm.). It is not clear why none were present in summer 2001-2002 when conditions appeared suitable. Black-tailed Native-hens were recorded at the lake for the first time in summer 2001-2002. It would have been remarkable if there had been no records, as Native-hens were widespread at many wetlands in the Geelong region from late 2000, part of a general irruption (Geelong Bird Report 2000; records submitted in 2001 and 2002 for Geelong Bird Reports).

In 2002, Spotless Crakes were flushed from the extensive bed of Sea Rush on the north-eastern shore in February and May, and single Australian Spotted Crakes were flushed from Sea Rush on the northern shore in July and October. These were the first records of crakes at the lake. Crakes inhabit wetlands with beds of rush or reeds, and the lake is probably suitable at any time when high water levels flood the rushbeds. The presence of many ‘crake holes’ in the rushes suggested that more crakes or rails may have been in the area, but the birds are noted for their cryptic behaviour. The crakes seen in 2002 did not flush until they were almost trampled. Searches of dense rushbeds when conditions are suitable would probably produce more records for these and other species of crakes and rails, but the deep soft black mud around flooded rushbeds is a challenge for observers.

Whiskered Terns are spring-summer migrants to Victoria, visiting swamps, lakes and saltworks. There are three records from the lake. Nesting birds were seen in spring 1987. This is one of the few breeding records in the Geelong region. The other two records were of large flocks hunting over aquatic vegetation on the lake surface in October 2002.

Coastal birds

Silver Gulls are the only coastal birds which occur at the lake regularly. Pacific Gulls are rare visitors, and there are no records of beach-frequenting waders such as Pied Oystercatchers. The crucial factor may be that Freshwater Lake is a little further from the sea than the other terrestrial wetlands in the Swan Bay system, Lake Victoria and St Leonards Salt Lagoon, where gulls and terns occur regularly.

Birds of prey

In summer 2001-2002, Swamp Harriers regularly made passes over large flocks of Coots on the water and Teal and Australian Shelducks resting on the north-eastern shore, but no attacks were observed. Observations of flight paths at Freshwater Lake during that period suggested that at least some Harriers moved along a regular hunting route, possibly part of a circuit, from Swan Bay, over Freshwater Lake, and then south towards Lake Victoria. At the time, both Freshwater Lake and Lake Victoria were at capacity and carried large numbers of waterfowl. It would be interesting to make observations of flight paths in other years, as Freshwater Lake is often dry and unproductive in summer.

Whistling Kites occur occasionally, and have been observed patrolling over the lake and along the shoreline.

Orange-bellied and Blue-winged Parrots

Orange-bellied Parrots are critically endangered in Australia (Environment Protection and Biodiversity Conservation Act 1999; Garnett and Crowley 2000), and each year migrate from their breeding grounds in Tasmania to spend the autumn and winter on the southern mainland.

In some years, Freshwater Lake is of international significance for Orange-bellied Parrots (Brown and Wilson 1984). Since 1980, there have been records in four years, possibly five. In 1980 and 1991, the lake supported 20-28 birds (10-15% of the estimated population), and in 1980 Parrots remained at the lake for most of the autumn-winter season (Loyn and Kinhill Planners 1979; Brown and Wilson 1984; Starks 1992b; Starks et al. 1992; Geelong Bird Report 1991; Birds Australia OBP count; J. Starks, pers. comm.). Parrots are clearly irregular visitors to Freshwater Lake. Interchange may occur with other nearby wintering areas for Parrots, Swan I., Sand I. and Swan Bay in the Swan Bay system, and Lake Connewarre, although Parrots generally occur later in the season at Swan Bay than at the lake (Barter et al. 1988).

Feeding was observed at Freshwater Lake in 1980, the seeds of Glaucous Goosefoot constituting the major food source (Brown and Wilson 1984). Goosefoot is widespread around the lake, growing in large patches on the southern and eastern shores. Elsewhere around Port Phillip Bay, Goosefoot produces seed and is used by Parrots between April and August (Loyn et al. 1986). In 1980, observations occurred at the lake over an extended period between May and August, and in other years within the May-June period. Birds may have fed on Glaucous Goosefoot on every visit. Goosefoot is particularly valuable as a food

source for Parrots, as it carries seed over mid-winter, July to early August, when other food for Parrots is scarce (Loyn et al. 1986).

The lake is probably not suitable for Parrots in every year. The vegetation dies back if the lake is dry for extended periods (Brown and Wilson 1984) and seeding of Goosefoot may vary between years depending on water level, salinity and seasonal conditions. Other Parrot food plants occur at the lake: Southern Sea Heath was present and used by Parrots in 1980 (Brown and Wilson 1980), and Beaded Glasswort fringes the shore when the water level is low (Garnett et al. 1986). All areas of suitable habitat, especially those that have been used by large numbers of Parrots, are of great value and should be preserved (Barter et al. 1988).

As Orange-bellied Parrots are irregular visitors to the lake, they may be overlooked if monitoring is carried out only once or twice in each season. In years when Goosefoot is seen to be carrying flowers or seed, the lake should be searched regularly throughout autumn and winter, particularly between April and August.

Blue-winged Parrots are rare at the lake. There is only one record, a single bird present in winter 1991. Orange-bellied Parrots were also present in this season, but it is not known whether the two species associated.

Land birds associated with wetlands

Several land birds associated with wetlands have been recorded from shrubs, rushbeds and low vegetation around the lakeshore (fieldwrens, chats, swallows, martins, grassbirds and cisticolas).

White-fronted Chats are common in saltmarsh and other low vegetation, sometimes occurring in huge flocks between autumn and early spring (e.g. 500 on 27/6/82). They persist at the lake even when the water is at low level or absent. Presumably the vegetation under these conditions is predominantly saltmarsh. When the water is high and rushes are the dominant vegetation, Chats feed in backwaters of the lake and in low vegetation at the base of the rushes.

Striated Fieldwrens occur in low numbers, mainly in dense shrubs along the southern and south-eastern side of the lake. Welcome Swallows hunt over the lake and the shores. In 2001-2002, Clamorous Reed-Warblers, Little Grassbirds and Golden-headed Cisticolas occurred in rushbeds around the lake margins. Of these, only Cisticolas had been recorded previously. It is not known if Reed-Warblers and Little Grassbirds occur sporadically at the lake, perhaps only when rush is the dominant vegetation. Perhaps they have been overlooked in the past, or observations have not been documented. The RAOU VicGroup

Wetland survey and the RAOU/Bird Australia Atlas surveys were the only programmes in which records of wetland-associated passerines were specifically requested.

Land birds

An annotated list of the land birds of Freshwater Lake contains records of 46 species (Appendix 3). The remnant woodland at the access from Clows Lane is small and degraded, but it supports small numbers of birds typical of coastal woodlands in the region, including Superb Fairy-wrens, White-browed Scrubwrens, Brown Thornbills, Spiny-cheeked Honeyeaters, Grey Fantails, Grey Butcherbirds and Silvereyes.

In the area surrounding Port Phillip Bay, any site containing an intact community of bush birds is considered regionally significant (Garnett et al. 1986). The woodland bird community at the lake is certainly not “intact”: the woodland is small, opened up by clearing and by the death of many trees and shrubs, and invaded by bracken; it is fringed and isolated by agricultural and residential land; and introduced and urbanised birds are common. However, there are few patches of remnant coastal woodland in the region, and this example should be protected. Parks Victoria has instituted a programme of replanting indigenous vegetation in the woodland area.

Behind the lakeshore, the dominant birds are introduced and urbanised birds, attracted by farm buildings, housing, home gardens, stands of non-indigenous trees and shrubs, and clearing of the natural woodland for agriculture e.g. Spotted Turtle-Dove, Red Wattlebird, White-plumed Honeyeater, Magpie-lark, House Sparrow, European Greenfinch and Goldfinch, Common Blackbird, Common Starling and Common Myna. The Common Myna is a recent invader, first appearing in 2001. Grassland birds such as Stubble Quail, Richard’s Pipit and Skylark are numerous in cleared areas around the lake.

There are breeding records for only two species of land birds. Adult Silvereyes were feeding dependent young in the remnant woodland in February 2002, and a pair of Black-faced Cuckoo-shrikes nested and cared for their two young in the same season.

Mammals, reptiles and frogs

The lake falls in the same 5-minute block as Lake Victoria, and the same lists of species could apply (Table 2.4 and 2.5). It is highly likely that further work would reveal more species. Frogs in particular are likely to be more diverse than these records suggest, in permanent or ephemeral freshwater habitats near the lake. Despite its name, salinity levels in the lake itself are likely to be excessive for frogs when water levels are low.

Options for future monitoring

The recent revelations after 20 years' regular monitoring at the lake demonstrate that the information on waterbirds obtained thus far is by no means complete. As the waterbird community varies greatly with water level, it is possible that important ephemeral habitats may be provided for brief periods for species of conservation significance. A special need is to obtain more comprehensive information on annual use of habitat by the endangered Orange-bellied Parrot, as this has been an important site for the species in some years. Some specific suggestions follow:

- Checks should be made on Glaucous Goosefoot plants in autumn and early winter in every year, and if flowering and seeding is noted, followed up by intensive surveys for Orange-bellied Parrots over May-August.
- Waterbird surveys at fixed times of year and separated by intervals of months are clearly not sufficient for monitoring such a variable system. Continual low-level monitoring of waterbirds by interested individuals, and additional intensive surveys when numbers of waterbirds are high, would be useful.
- Surveys are needed to clarify the importance of the lake for waterbirds, especially waders, when the water level is low, and the lake is fringed by mudflats and saltmarsh. There is virtually no information on habitat use under these conditions.
- Records obtained of breeding have thus far been opportunistic, but have still yielded valuable results. Careful searches for nests and dependent young should be made in spring and summer, especially when the water level is high in those seasons.
- Even if surveys are directed towards monitoring particular species or groups of waterbirds, records of all species associated with wetlands should be documented.
- Additional studies of diurnal and seasonal changes in waterbird numbers, the effects of tide height, weather, water coverage, salinity and vegetation, and any information on habitat usage would be valuable.

FRESHWATER LAKE: ANNOTATED LIST OF WATERBIRDS AND BIRDS ASSOCIATED WITH WETLANDS (60 SPECIES)

Sources of information are in Chapter 1; survey codes, observer codes and abbreviations are in Appendix 1; references are in Chapter 5.

Blue-billed Duck *Oxyura australis*

Records from only one period, Dec. 2001 to Mar. 2002, when water level had been high for long period and aquatic vegetation well-developed. Consistently present in large numbers at that time, feeding by diving, resting on water, mainly in deeper W, NW and central parts of lake. Detailed records show decline in numbers after water began to recede in Jan.: 5 on 5/12 (PB); 180-200 on 9/12 (MHe); 112 on 7/1 (MHe, RHL); 100-110 on 12/1 (MHe); 400-500 on 13/1 (PC); 126 on 18/1 (MHe,GT); 120 on 31/1 (MHe); 126 on 10/2 (MHe); 82 on 20/2 (MHe); 61 on 17/3 (MHe); none, 3/5-22/10 (MHe, DHe, BSt, RHL).

Birds clearly moving to and from lake in this period, and perhaps interchange between Freshwater Lake and Portarlington Sewage Ponds about 15 km away: maximum counts at both wetlands similar (400-500); decrease in numbers at sewage ponds coincided with appearance at Freshwater Lake; and increase occurred at sewage ponds after 70-90 birds left Freshwater Lake. Counts at Portarlington Sewage Ponds: 416 on 18/10/01, 87 on 15/12/01, 200 on 6/1/02 (PB).

Conservation status

In Vic., Vulnerable (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988). Listed in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because sparse throughout range, but not considered to be threatened nationally.

International significance

Estimated breeding population in Australia, 12,000 birds (Garnett and Crowley 2000); 400-500 Ducks observed at lake in 2002 likely to constitute more than 1% of national population, even taking non-breeding birds into account. An exceptionally high count at Western Treatment Plant, Werribee, in Feb. 2002 (more than 11,000 birds: R. Swindley via RHL) suggests that the recent high numbers at Freshwater Lake were part of a general influx into Geelong region.

Musk Duck *Biziura lobata*

Observed at lake in low numbers over 4 periods: 2 on 23/8/78 (AVW); present, 15/2/97 (MAC), and 4 on 16/2/97 (IB, WB); present, 1/7/01 (AVW); and 1-2 birds (male and female) regularly, 7/1/02 to 14/6/02 (MHe, RHL, GT). In Jan.-June 2002, kept mainly to centre of lake, resting on water and feeding by diving on occasions; present on every visit and birds probably resident at lake over that period. None present on or after 7/7/02. Water at high

level in Feb. 1997, July 2001 and 2002; Musk Ducks may occur mainly when lake full and aquatic vegetation has developed.

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

Black Swan *Cygnus atratus*

Regularly recorded, sometimes in high numbers. Present in all seasons, but 4 highest counts and most counts of >100 in summer-autumn: 1000 on 17/5/87 (RMc); 250 on 7/2/88 (VG); 193 on 21/2/93 (WD); 340 on 17/5/98 (MHe, MAC). Winter counts generally low, except in 2002: 2-14 birds (AVW, MAC, VG).

In 2001-2002, birds rested on mudflats exposed on NE shore as water receded; on the water, kept mainly to shallow areas off mudflats and around lake margins, dabbling and upending to feed. Detailed records: 62 on 9/12; 120 on 7/1; 136 on 12/1; large numbers, 18/1; 69 on 31/1; 110 on 10/2; 168 on 20/2; 186 on 17/3; 165 on 3/5; 150 on 14/6; 69 on 7/7; 102 on 28/7; 106 on 22/10 (MHe, GT, RHL).

Lake used as moulting site: on 20/2/02, 168 Swans present, constantly stretching and shuffling wings, and black and white feathers scattered over NE mudflats and on water. On that date, 2 dead partly-eaten Swans on bank behind mudflats, possibly taken by foxes (MHe).

Breeding

2 adults with 5 cygnets, 12/12/00 (RMc). In spring 2001, pair nested in lake overflow from flooding on S shore (SH); in Jan.-Feb. 2002, pair with 3 half-grown cygnets and pair with 3 3/4-grown cygnets observed regularly (MHe, RHL, GT); one family probably from nest observed in spring 2001.

Regional significance

The maximum counts at Freshwater Lake are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Cape Barren Goose *Cereopsis novaehollandiae*

1 bird on NE mudflats, 17/3/02-14/6/02; often fed among aquatic vegetation in shallows (MHe, DHe).

Australian Shelduck *Tadorna tadornoides*

Regularly recorded, sometimes in high numbers. Present in all seasons, but 4 highest counts in late summer and autumn, water coverage 50-95%: 150 on 7/2/88 (VG); 200 on 18/2/90 (VG); 100 on 28/3/92 (MAC); 95 on 10/2/02 (MHe). High counts in summer-autumn suggest lake is a moulting site, or may have been in past, but no direct evidence. Shelducks have used nearby Portarlington Sewage Ponds for moulting since 1990, which may account for decline in numbers at Freshwater Lake (King 1997).

In 2001-2002, counts variable, indicating build-up to maximum in late summer and movement to and from lake: none on 9/12; 10 on 7/1; 11 on 12/1; 57 on 18/1; 54 on 31/1; 95 on 10/2; 30 on 20/2; none on 3/5; 2 on 14/6; none, 7/7-22/10 (MHe, RHL, GT). Shelducks rested on mudflats exposed on NE shore as water receded; on the water, kept mainly to shallow areas off mudflats and around lake margins. Observed dabbling and upending to feed.

Breeding

Breeding pair and 7 small ducklings among flooded rushes at W edge of lake, 27/12/01; stayed in same area throughout Jan. 2002 (SH, JHi). On 31/1/02 and 20/2/02, female swam back and forth in front of rushbed, calling repeatedly (MHe); possibly female from family, as adults defend brood territory and ducklings, but no male or ducklings seen nearby. The brood territory for Shelducks must contain fresh water, as ducklings are intolerant of high salinity. Freshwater Lake, despite its name, is only rarely suitable. Breeding may be partly opportunistic. December and January are unusually late dates for breeding in Victoria (Marchant and Higgins 1990).

Regional significance

Freshwater Lake ranked highly in the Geelong region for Australian Shelducks in the Summer Waterfowl Count, 1988 (Hewish 1988a).

Pacific Black Duck *Anas superciliosa*

Regularly recorded, usually in low numbers. Present in all seasons, but only rarely in spring. Highest counts in summer-autumn: 100 on 28/3/92 (MAC); 32 on 18/2/90 (Peter 1990); 30 on 17/5/98 (MAC,MHe); 28 on 7/2/88 (Hewish 1988a). Water level appears to affect numbers: when large numbers present, water coverage (when recorded) 50-70%. In surveys in 2001-2002, appeared at lake in mid-Jan. when water had receded from lakeshore: not present 9/12, 7/1; 1 on 12/1; then low numbers (5-11), 18/1-20/2; none on 17/3, 3/5; 1 on 14/6 (MHe).

Observed swimming and resting on water in shallow areas around lake margins; no feeding observations (MHe).

Australasian Shoveler *Anas rhynchotis*

Occasional records, usually in low numbers. Highest counts: 50 on 3/7/94 (WC); 85 on 20/2/02 (MHe); 103 on 17/3/02 (MHe); 230 on 3/5/02 (MHe). Up to summer 2001-2002, all records in winter: 25/7/82, 21/6/92, 25/7/93, 3/7/94, 23/7/00 (MAC, VG, WC, AVW).

Detailed records in 2001-2002 indicate build-up in numbers over summer-autumn and decline in winter: 2 on 9/12, 7/1; 9-15 birds, 12/1-10/2; 85 on 20/2; 103 on 17/3; 230 on 3/5; 30 on 14/6; none on 7/7; 7 on 28/7; none on 22/10 (MHe, RHL, GT). Birds usually in shallow water off NE mudflats, feeding by dabbling among aquatic vegetation close to shore and resting on water, often with Teal (MHe). Sudden increase in numbers in Feb. (10 on 10/2; 85 on 20/2) coincided with establishment of mats of aquatic vegetation on water surface. On 3/5, flock of 230 took flight when Swamp Harrier flew over (MHe).

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

Regional significance

The maximum counts at Freshwater Lake are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992. Shovelers of restricted distribution in Geelong region.

Grey Teal *Anas gracilis*

Regularly recorded, sometimes in high numbers. Highest counts mainly in summer-autumn, included a series over early-mid 1992: 180 on 7/2/88 (Hewish 1988a); 811 on 24/2/92 (Peter 1992); 200 on 28/3/92 (MAC); 240 on 21/6/92 (VG). The single high count in winter (21/6/92) still showed marked decrease from numbers in previous summer. No records in spring. Water level appears to affect numbers: when large numbers present, water coverage (when recorded) 50-60%. In surveys in 2001-2002, numbers increased gradually over summer, and then declined from late autumn: none on 9/12; 35-50, 7/1-10/2; 60 on 20/2, 17/3; 0-5, 3/5-22/10 (MHe, RHL). Preferred shallow areas and associated mudflats, where fed by dabbling in water with aquatic vegetation, and rested on shore and on water.

Regional significance

In Summer Waterfowl Count, 1992, Freshwater Lake was the third-ranked wetland in the Geelong region for Grey Teal (Peter 1992).

Chestnut Teal *Anas castanea*

Regularly recorded, often in high numbers. Highest counts occur in autumn-winter: 340 on 18/6/88 (VG); 171 on 17/6/90 (VG); 790 on 17/5/98 (MHe, MAC); 200 on 17/3/02 (MHe). Only one spring record. Numbers can vary markedly over period of weeks: e.g. in 1988, 340 on 18/6, 60 on 24/7 (VG, MAC). Water level appears to affect numbers: when large numbers present, water coverage (when recorded) 50-70%. In surveys in 2001-2002, appeared at lake when water had receded, partly exposing mudflats. Numbers gradually increased over summer and early autumn, and then declined from late autumn: none on 9/12, 7/1; 10-20 on 12/1, 18/1, 31/1; 80 on 10/2, 20/2; 200 on 17/3; 0-11, 3/5-22/10 (MHe, RHL). Birds kept mainly to NE shore, resting on mudflats and on water, and feeding by dabbling in shallow water with aquatic vegetation.

Regional significance

The maximum counts at Freshwater Lake are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Hardhead *Aythya australis*

Rarely recorded: present, 29/1/01 (Atlas 2); present, 1/7/01 (AVW); regular, up to 51 birds, 9/12/01-20/2/02 (MHe, RHL, GT). Lake at capacity in July 2001, and Dec. 2001-early Feb. 2002; water level in Jan. 2001 not recorded. Numbers decreased over course of summer and autumn, 2001-2002, perhaps because water level fell and salinity increased: 50 on 9/12; 51 on 7/1; 50 on 12/1; 8 on 31/1; 5-10 on 10/2; 1 on 20/2; none on or after 17/3 (MHe, RHL). Kept to open water in deeper W area of lake, where scattered among other waterfowl. Observed feeding by diving; roosting on bare NW shore with Grey Teal (MHe, RHL).

Conservation status

Listed as Vulnerable in Victoria (Victorian Dept. of Natural Resources and Environment 2000).

Regional significance

The maximum counts at Freshwater Lake are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992. Restricted

distribution in Geelong region and in Victoria generally (Hewish 1988a; Peter 1989, 1990, 1991, 1992).

Hoary-headed Grebe *Poliocephalus poliocephalus*

Frequently recorded, sometimes in high numbers. Highest counts: 109 on 23/8/78 (AVW); 114 on 7/9/85 (MAC); 200 on 19/11/94 (RMc); 300-350 on 31/1/02, 10/2/02 (MHe). High counts (>100 birds) have occurred in all seasons except autumn, perhaps because water level often low at this time. In surveys in 2001-2002, numbers consistently high, though sometimes varied markedly in consecutive counts: 200-220 on 9/12, 7/1, 12/1; 300-350 on 31/1, 10/2; 150 on 20/2; 90 on 17/3; 174 on 3/5; 120 on 14/6, 7/7; 156 on 28/7 (MHe, RHL). Kept mainly to open water on deeper W and N sides of lake; scattered among other waterfowl in small groups. Often observed feeding by diving; on 20/2/02, a few birds were feeding by dabbling in mats of aquatic vegetation on water close to shore.

Regional significance

The maximum counts at Freshwater Lake are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Australian Pelican *Pelecanus conspicillatus*

Rare: 2 on 23/7/00 (AVW).

White-faced Heron *Egretta novaehollandiae*

Regularly recorded, usually in low numbers around lakeshore. Recorded in all seasons, but highest counts Feb.-Apr.: 30 on 24/4/88 (MAC); 28 on 4/3/95 (WD); 30 on 1/2/98 (WC). Occurrence apparently independent of water level; high count on 24/4/88 when lake dry (MAC). In surveys in early 2002, recorded on every visit and probably always present over that period. Observed feeding in shallow backwaters and among flooded rushbeds; moved onto NE mudflats when water receded. Rested at rear of mudflats, and perched on fence posts around lake margins.

Little Egret *Egretta garzetta*

1 in shallow water by lakeshore, near Clows Lane entrance, 7/1/02 (MHe, RHL).

Of restricted distribution in Geelong region; Swan Bay-Queenscliff-Lake Victoria system a stronghold. Birds in this area probably came from colony at Corio, Geelong, only second known breeding site in Victoria. The individual observed at Freshwater Lake probably a non-breeding bird; breeding adults and young do not disperse from Corio colony and nearby feeding areas until Feb.-Mar. (Pescott 1983; Greaves 1990).

Conservation status

Critically endangered in Vic. (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee Act (1988).

White-necked Heron *Ardea pacifica*

Uncommon: 1 on 18/2/90 (VG); 1 on NE mudflats, 18/1/02 (MHe, GT); 4 feeding in shallows off NE mudflats, 28/7/02 (MHe, DHe); 3 on 22/10/02, 26/10/02 (MHe, RHL, RMc).

Great Egret *Ardea alba*

1 feeding in shallows on N shore of lake, 18/1/02 (MHe, GT). Scarcity of records surprising, as Great Egrets moderately common in region and occur on Swan Bay (Pescott 1983).

Australian White Ibis *Threskiornis molucca*

Frequently recorded, in low numbers. Highest counts: 9 on 1/6/91, 17/5/98 (VG, MHe, MAC); 22 on 31/1/02 (MHe); 17 on 3/5/02 (MHe). Recorded in all seasons. Have occurred when lake dry (4/4/91, 1/6/91), but birds may have been feeding in surrounding fields rather than in wetland area. Highest count in surveys in 2002 occurred when 2 flocks feeding in fields with Straw-necked Ibis. However, birds also feeding and resting on lakeshore on every visit during that period, among flooded rushbeds, in swampy inlet behind lakeshore, and, as water receded, on exposed NE mudflats (MHe, RHL, GT).

Straw-necked Ibis *Threskiornis spinicollis*

Occasionally recorded, usually in low numbers. Regular in surveys, Jan.-May 2002; previous records: 7/9/85 (MAC), 17/5/87 (RMc), 7/10/90 (VG), 4/3/95 (WD). Highest counts: 14 on 18/1/02 (MHe, GT); 60 on 31/1/02 (MHe); 70 on 3/5/02 (MHe). No records in winter, but may be no seasonal differences as few records overall. High counts in 2002 involved flocks feeding in a crop and in grassland beside lake. However, 1-2 birds also observed regularly on lakeshore during this period, feeding and resting on NE mudflats and on wet mud among rushes on S side of lake (MHe, GT).

Royal Spoonbill *Platalea regia*

Occasionally recorded; in low numbers, 1-2 birds. Previous records, 18/2/90 (VG), 24/2/92 (VG), 28/6/97 (IB, WB). Recorded in surveys in Jan.-Feb. 2002 (MHe, GT). No birds observed 9/12/01-12/1/02 (MHe, RHL); appearance at lake, 1-2 birds from 18/1-20/2, coincided with exposure of mudflats and development of aquatic vegetation as water receded. Present on NE mudflats, resting on shore and feeding in shallow water. However,

not resident at lake during this period, as often absent early in day and appeared at lake during course of observation.

Conservation status

Vulnerable in Vic. (Victorian Dept. of Natural Resources and Environment 2000).

Yellow-billed Spoonbill *Platalea flavipes*

Only one previous record, 1 on 28/6/97 (IB, WB); but up to 4-5 birds regularly during surveys in Jan.-Mar. 2002 (MHe, RHL, GT). Fed in shallow water covered with aquatic vegetation, on NE mudflats and in swampy backwater behind S shore. Regularly observed from 7/1/02 to 17/3/02, but not resident at lake during this period: on 7/1, 4 flew in to lake from N-NE, the direction of Swan Bay (MHe, RHL); on 20/2, 5 birds appeared in ones and twos over course of morning's observation (MHe).

Whistling Kite *Haliastur sphenurus*

Occasional records, usually in low numbers. Records in all seasons. On 20/2/02, 1 patrolled and circled low over lake and along shore, and was attacked by pair of Masked Lapwings (MHe); on 3/5/02, 3 soared over lake (MHe); 5 at once on 7/7/02, 2 pairs over opposite ends of lake, and a single bird chased off by one pair (MHe).

Swamp Harrier *Circus approximans*

Frequently recorded in low numbers, 1-2 birds, mainly in spring-summer-autumn. Regular in surveys in 2001-2002, flying over lake, and, on one occasion, perching in top of dense bed of Sea Rush (GT, MHe). Often made passes over large flocks of Eurasian Coots on water; on 10/2/02, 1 flew low over NE flats and hovered and dropped over resting Teal and Australian Shelducks, but no attack made (MHe); on 3/5/02, passed low over flock of Australasian Shovelers, which took flight (MHe). On several occasions, Harriers flew in from N-NE (direction of Swan Bay) and left flying S (direction of Lake Victoria).

Australian Spotted Crake *Porzana fluminea*

1 flushed from flooded Sea Rush bed on N shore, 28/7/02 (MHe, DHe); 1 in same area, 26/10/02 (RMc).

Spotless Crake *Porzana tabuensis*

2 flushed from flooded edge of extensive bed of Sea Rush on NE shore, 20/2/02; 1 in same area, 3/5/02; disappeared into rush tussocks. Many 'crake holes' in bases of tussocks in that

area, several roofed over with matted horizontal rushes and flood debris (MHe). Presence of crakes at lake may depend on water level; more likely when water reaches base of rushbeds.

Purple Swamphen *Porphyrio porphyrio*

Recorded occasionally, especially when water level high and fresh floodwaters intrude into vegetated backwaters and inlets (MAC). However, only 1 dated record, and water level not known in this instance: present on 29/1/01 (Atlas 2).

Dusky Moorhen *Gallinula tenebrosa*

Recorded occasionally, especially when water level high and fresh floodwaters intrude into vegetated backwaters and inlets (MAC). However, only 1 dated record, and water level not known in this instance: present on 29/1/01 (Atlas 2).

Black-tailed Native-hen *Gallinula ventralis*

Present for extended period in 2002, feeding on bare ground behind Sea Rush bed on W shore: flock of 29, 7/1 (MHe, RHL); 16 on 31/1 (MHe); 9 on 28/7 (MHe, DHe); 3 on 22/10 (RHL, MHe); 4 on 26/10 (RMc). Very shy; when disturbed, disappeared into rushes or long grass.

This occurrence part of an irruption into Geelong region since late 2000 (GBR 2000; records submitted in 2001 and 2002 for Geelong Bird Reports).

Eurasian Coot *Fulica atra*

Regular in high numbers in summer surveys, 2001-2002. Only 3 previous records: 81 on 23/8/78 (AVW); present, 29/1/01 (Atlas 2); present, 1/7/01 (AVW). Water level high in July 2001 and between Dec. 2001 and Feb. 2002, and birds may have been present throughout; level not known at times of other records. In surveys in 2001-2002, numbers highest initially when lake at capacity, and declined over late summer-autumn as water level dropped and salinity increased: 2300 on 9/12; numbers lower and stable at 800-1000 birds between 7/1 and 17/3; 240 on 3/5; none, 14/6-22/10 (MHe, RHL). Coots usually in open water in deeper W part of lake, feeding by diving and resting in lee of beds of Sea Rush. When water level receded, small numbers moved into shallows and fed by pecking and dabbling in mats of aquatic vegetation (MHe). Apparently often the target of Swamp Harriers, although no attacks observed; Coots often swam and flew to form tight rafts when Harrier flew over.

State significance

The maximum count at Freshwater Lake is comparable with those at high-ranking wetlands in Victoria in Summer Waterfowl Counts, 1988-1992.

Latham's Snipe *Gallinago hardwickii*

Regularly recorded between 7/1/02 and 20/2/02, but no previous records. Spring-summer migrant in region. Highest count: 10 on 20/2/02 (MHe). Single birds and small groups (up to 3) flushed or heard calling from beds of rush around most of lakeshore and in backwaters: rarely within dense continuous rushbeds, apparently preferring more open stands, edges of dense rushbeds, or areas where rush tussocks interspersed with lower vegetation such as Australian Salt-grass or Glaucous Goosefoot. Of total of 15 birds recorded, 6 in Sea Club-rush, 6 in Sea Rush, 2 in Bare Twig-rush, and 1 in dense Austral Bracken at edge of remnant woodland. May occur at lake only when water level high in spring and summer and rushes are the dominant vegetation.

Conservation status

Listed in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because habitat has been reduced by loss of wetlands, but not considered to be threatened nationally.

Black-tailed Godwit *Limosa limosa*

Rare spring-summer migrant in region. 11 flew from Lake Victoria, 12/5/98; flight followed with binoculars and birds descended over Freshwater Lake (RMc).

Flocks of similar size observed between Feb. and Oct. 1998 in various parts of the Swan Bay-Queenscliff-Lake Victoria system: probably a single mobile flock as the species rare in Geelong region, and large flocks and overwintering unusual (GBR 1998). These records demonstrate wader movements between Freshwater Lake, Lake Victoria, Duck Island in Swan Bay, Sand Island and St Leonards Salt Lagoon.

Marsh Sandpiper *Tringa stagnatilis*

3 on 26/10/02 (RMc).

Common Greenshank *Tringa nebularia*

Recorded occasionally, usually fewer than 10 birds. Although a spring-summer migrant in region, present in all seasons; highest counts in winter when population consists mainly of first-year birds from previous breeding season in northern hemisphere: 24 on 4/7/81 (WC); 35 on 23/8/86 (RMc). However, winter records generally uncommon and none have occurred since 1987. Highest count for spring-summer (20 on 12/1/02; MHe) was of birds feeding and roosting on margin of NE mudflats where water had receded.

Regional significance (winter)

The count of 24 in the Wader Count in July 1981 was the highest number at any site on Bellarine Peninsula. The 35 birds observed in Aug. 1986 may have been early spring arrivals as none present during Winter Wader Count in June of that year.

Ruddy Turnstone *Arenaria interpres*

Rare: 4 on 4/7/81 (WC). Spring-summer migrant in region. Birds probably visited from Swan Bay-Queenscliff-Mud Islands where numerous (Barter et al. 1988); interesting as a winter record.

Great Knot *Calidris tenuirostris*

Rare: 1 on 27/6/81 (Robinson 1982); 1 on 7/10/90 (VG). Spring-summer migrant in region. Birds probably visited from Swan Bay-Queenscliff-Mud Islands where numerous (Barter et al. 1988); first record interesting as a winter count.

Red Knot *Calidris canutus*

Recorded occasionally, usually fewer than 10 birds. Although a spring-summer migrant in region, most records and highest counts were in winter, when population consists largely of first-year birds from previous breeding season in northern hemisphere. Highest counts: 50 on 29/6/85 (WC); 40 on 24/7/88 (MAC). Other records in June-Aug. 1986 (WC, RMc), 25/6/88 (WC), 17/6/89 (VG), 8/7/95 (WC) and 14/6/02 (MHe). Spring records unusual: 2 feeding along NE mudflats, 22/10/02 (RHL, MHe); 1 in same area, 26/10/02 (RMc). Influxes to lake may occur: e.g. in 1988, 3 on 25/6, 40 on 24/7 (WC, MAC).

Regional significance (winter)

In the Winter Wader Count, June 1985, lake held the highest numbers (50) of any site on Bellarine Peninsula. The count of 40 birds in July 1988 exceeded the count total for the whole Bellarine Peninsula obtained during the Wader Count held 2 weeks earlier.

Red-necked Stint *Calidris ruficollis*

Regularly recorded in all seasons, sometimes in high numbers. Spring-summer migrant in region. Highest spring-summer counts: 1000 on 27/9/86 (RMc); 1422 on 3/2/90 (WC); 1000 on 24/2/92 (VG). Few autumn records as lake often dry during this period (e.g. 2/4/89, 1/4/90, 4/4/91). However when water available, numbers in autumn can be high (e.g. 1100 on 9/4/01; RMc); if conditions suitable, birds may be attracted to lake where they can feed throughout tidal cycle and gain weight for migration.

Regularly recorded in winter, when population consists largely of first-year birds from previous breeding season in Arctic. Although winter numbers lower than summer numbers, often more than 100 birds and counts high relative to other sites on Bellarine Peninsula. Highest winter counts: 250 on 24/6/84 (WC); 284 on 25/6/88 (WC); 380 on 17/6/89 (VG). In winters of 1984 and 1989, numbers higher than in previous summers; suggests birds came from elsewhere and congregated at lake, a preferred winter site. In both summer and winter, numbers at lake can change rapidly within short period, indicating movement to and from lake: e.g. in 1989, 380 on 17/6, 191 on 1/7, 5 on 22/7 (VG, WC, RMc); in 1982, 300 on 9/2, 1000 on 24/2 (WC, VG).

Water level affects numbers: when large numbers present, water coverage (when recorded) 50-75%. Little direct information on habitat use, but there is a record of large numbers of Stints scattered thinly over wide area of mudflats (380 in June 1989; RMc). This is consistent with preference for low water levels. In summer surveys, 2001-2002, a few Stints moved onto exposed NE mudflats as water receded (MHe, RHL).

Regional significance (winter)

In June 1984 Wader Count, Freshwater Lake had highest numbers of any site on Bellarine Peninsula and 60% of all Stints counted in that region; in June 1988, second highest numbers and 20% total; in June 1989, highest numbers and 70% total.

Sharp-tailed Sandpiper *Calidris acuminata*

Frequently recorded, sometimes in moderately high numbers. Spring-summer migrant in region, and highest counts in these seasons: 270 on 7/2/88 (VG); 117 on 3/2/90 (WC); 180 on 24/2/92 (VG); 500-750 on 22/10-26/10/02 (MHe, RHL, RMc). Few autumn records, perhaps because lake often dry in that season.

Occasional in winter: 20 on 10/7/82 (WC); 3 on 9/7/83 (WC); 7 on 23/8/86 (RMc); 3 on 18/6/88 (VG); 1 on 27/6/93 (WC). It is unusual for Sharp-tailed Sandpipers to be recorded in winter, as almost all adults and immatures leave southern Australia for winter (Lane and Jessop 1984). Regular winter records at the lake and the count of 20 in July 1982 exceptional.

Numbers at lake can change rapidly within short period, suggesting that birds move to and from lake: e.g. in 1988, 270 on 7/2, 76 on 13/2 (VG, WC). Water level affects numbers: when large numbers present, water coverage (when recorded) 50-75% and mudflats exposed. The large flocks (500-750) observed in Oct. 2002 were feeding along NE mudflats (MHe, RHL, RMc).

Regional significance

The highest count at Freshwater Lake is comparable with those at high-ranking wetlands in the Geelong region in Summer Wader Counts.

Curlew Sandpiper *Calidris ferruginea*

Frequently recorded, sometimes in moderately high numbers. Although spring-summer migrant in region, only occasionally recorded in summer. Highest summer counts: 199 on 3/2/90 (WC); 100 on 18/2/90 (VG); 50 on 24/2/92 (VG). Few autumn records, perhaps because lake often dry in that season.

Remarkably, more often recorded and counts generally higher in winter, when population consists largely of first-year birds from previous breeding season in Arctic. Highest winter counts: 390 on 24/6/84 (WC); 100 on 25/6/88, 24/7/88 (WC, MAC); 79 on 18/6/88 (VG). In winters of 1984, 1985, 1986, 1988, 1989 and 1992, numbers higher than in previous summers; suggests birds came from elsewhere and congregated at lake, and lake a preferred winter site. Water level affects numbers: when large numbers present, water coverage (when recorded) 50-75%. In Oct. 2002, up to 15 birds feeding on exposed mudflats on NE shore (MHe, RHL, RMc).

Regional significance (winter)

In June 1984 Wader Count, Freshwater Lake had second highest numbers on Bellarine Peninsula and 40% of all birds counted in that region; in June 1985, highest and 60%; in June 1988, second highest and 40%; in July 1991, second highest and 30%; in June 1992, second highest and 20%.

Black-winged Stilt *Himantopus himantopus*

Regularly recorded, in moderate numbers. Highest counts: 40 on 9/10/87 (VG); 43 on 9/7/00 (WC); 38 on 14/6/02 (MHe). Observed in all seasons, but more records and higher counts (>30 birds) in winter. Adults and immatures occur at lake: 2 adults and 4 immatures, 20/6/87 (WC); 3 adults and 3 immatures, 3/2/90 (WC). In summer surveys, 2001-2002, when water at high level, only one record: 2 birds feeding in swampy backwater of lake, 12/1/02 (MHe). Water had receded by 14/6/02, when 38 feeding along lakeshore and in shallows (MHe).

Breeding

3 birds sitting on nests, 9/10/87; water at high level (VG).

Regional significance

Freshwater Lake ranked second on Bellarine Peninsula in Wader Counts in winter 1984, summer 1993, winter 1995 and winter 2000. In winter 2000, held 27% of all birds counted in that region. When lake ranked highly, numbers usually low overall on Bellarine Peninsula; lake possibly more important in region when other strongholds (e.g. Moolap Saltworks, Reedy Lake, Hospital Swamp) unsuitable.

Banded Stilt *Cladorhynchus leucocephalus*

Occasionally recorded; numbers variable but one count exceptionally high. Most records, 1985-1987: 3 on 29/6/85 (WC); 75 on 27/7/85 (MAC); 2000 on 22/6/86 (WC); 3 on 31/1/87 (WC); 60 on 17/5/87 (RMc); 5 on 3/7/94 (WC). Banded Stilts prefer shallow hypersaline wetlands for feeding (Lane 1987). Water levels at lake when Stilts present not recorded, 1985-1987. However, birds described as feeding on soft mud above waterline on 27/7/85 (MAC), suggesting lake not at capacity, mudflats exposed and water saline.

Banded Stilts periodically leave coast of southern and eastern Australia and move to arid inland after flooding, to breed in extensive system of salt lakes (Hewish 1989; Bellchambers and Carpenter 1990; C. Minton, pers. comm.). Records at Freshwater Lake coincided with return of adults and young birds to coast in 1985 and 1994 (Wader Count results). However, use of lake probably depends on availability of suitable habitat. If water level high and salinity low, Banded Stilts may use lake only in low numbers or not at all, even if numbers elsewhere on Bellarine Peninsula high: e.g. in mid 1994 (MAC) and Jan.-Feb. 2002 (MHe).

International significance

The criterion for site to be designated of international importance for Banded Stilts is that it have any count of 2060 or more: 1% of the estimated population (Watkins 1993). The count of 2000 at the lake is considered to meet this criterion. Banded Stilts form large tight flocks, and counting is often only possible to the nearest 100 (or even 1000). Although lake rarely used by Stilts, it is sometimes important in region as additional habitat when high numbers of adults and young return from nesting inland (Hewish 1989).

Red-necked Avocet *Recurvirostra novaehollandiae*

Occasional records, in low numbers: 30 on 29/6/85 (WC); 2 on 22/6/86 (WC); 4 on 21/6/92 (VG); 3 on 27/6/92 (WC).

Red-necked Avocets periodically leave coast of southern and eastern Australia and move inland after flooding, presumably to breed (Lane 1987; Hewish 1990). The records at

Freshwater Lake coincided with return of adults and young birds to coast in 1984-1987 and 1992 (Wader Count results).

Grey Plover *Pluvialis squatarola*

Rare: 26 on 27/6/81 (Robinson 1982). 20 birds also recorded at Lake Victoria in that winter, 4/7/81 (WC); probably single flock moving between the wetlands. Birds probably visited from Swan Bay-Queenscliff-Mud Islands where numerous (Barter et al. 1988); interesting as a winter record.

Red-capped Plover *Charadrius ruficapillus*

Regularly recorded, sometimes in high numbers. Present in all seasons, but highest counts mainly in winter: 158 on 13/2/88 (WC); 200 on 24/7/88 (MAC); 220 on 17/6/89 (VG, RMc); 146 on 7/7/90 (WC). Numbers sometimes vary over short period, suggesting that birds move to and from lake: e.g. in 1988, 43 on 7/2, 158 on 13/2 (VG, WC).

When large numbers present, water coverage (when recorded) 50-75%, suggesting preference for low water levels, and on 17/6/89, 220 thinly scattered over wide area of mudflats (VG, RMc). Several records when lake dry (WC). In summer surveys, 2001-2002, no birds recorded when water level high; first appeared on 20/2/01 when about 10 metres of NE mudflats exposed by receding water and there was sparse cover of low regenerating vegetation (MHe).

Breeding

1 chick present, 11/2/84 (WC); 2 dependent young and nest with 2 eggs, 18/2/90 (VG); 3-4 females performing broken-wing distraction display, 9/2/92 (WC).

State significance

Highest counts at Freshwater Lake more than 5% of the estimated minimum Victorian population (Watkins 1993).

Double-banded Plover *Charadrius bicinctus*

Up to 1990, often recorded, sometimes in moderately high numbers. Winter visitor to region. Majority of records and all high counts, 1986-1990: 40 on 24/7/88 (MAC); 75 on 17/6/89 (RMc); 97 on 7/7/90 (WC). Occasional in summer and autumn in low numbers: 1-5 birds (MAC, WC). When large numbers observed, water coverage (when recorded) 50-75%; birds scattered over wide area of mudflats on S and E shores, and in large numbers in inlet on S shore (RMc). Birds present on 24/4/88 when lake dry.

Recent decline noted: no high counts since 1990 and no records since 1995. A similar decline observed at Lake Victoria. Numbers in Swan Bay system have remained high during this period, and reason for changes at the lakes not known.

Regional significance

In 1990 Winter Wader Count, Freshwater Lake ranked second for numbers of Double-banded Plovers on Bellarine Peninsula, carrying 20% total birds counted in that region. However, significance in region has decreased since 1990.

Lesser Sand Plover *Charadrius mongolus*

Rare: 2 on 21/2/81 (WC). Birds probably visited from Swan Bay-Queenscliff-Mud Islands where moderately common (Barter et al. 1988).

Black-fronted Dotterel *Elseyornis melanops*

Rarely recorded: 1 on 1/7/89 (WC); 9 on 25/7/93 (MAC); 1 on soft muddy shoreline among Sea Rush tussocks, SW shore, 31/1/02 (MHe). Water coverage in July 1989, 75%; in Jan. 2002, water just receding after flooding.

Red-kneed Dotterel *Erythrogonys cinctus*

Present for extended period in winter 2002, feeding along soft muddy margins of NE rushbed and sheltering among Sea Rush tussocks: 2 on 14/6 (MHe); 3 on 7/7 (MHe); 2 on 28/7 (MHe, DHe).

Masked Lapwing *Vanellus miles*

Regularly recorded. Several high counts: 63 on 6/2/82 (WC); 195 on 10/7/82 (WC); 61 on 24/6/84 (WC); 54 on 29/6/85 (WC). Present in all seasons. Often recorded when lake dry, sometimes in high numbers (e.g. 63 on 6/2/82). In surveys in 2001-2002, noted feeding and resting in open swampy backwater on W side of lake, on expanse of drying mud behind shoreline rushbeds, and, after water receded, often on NE mudflats (MHe). Invariably called and sometimes attacked when Swamp Harriers flew over.

Decline noted. All counts of 50 or more before 1987 and all of 20 or more before 1989. Counts since 1989 low, 1-14 birds. Reason for decrease in numbers not known, but also observed at Lake Victoria and at Lake Lorne in the central Bellarine Peninsula (King and Cameron 1997).

Regional significance

Before 1987, Freshwater Lake sometimes ranked highly for numbers of Masked Lapwings in Wader Counts on Bellarine Peninsula. However, no recent high counts.

Pacific Gull *Larus pacificus*

Rare: 1 on 24/7/88 (MAC).

Silver Gull *Larus novaehollandiae*

Frequently recorded, numbers variable. Highest counts: 220 on 9/10/87 (VG); 40 on 13/10/88 (VG); 70 on 18/2/90 (VG); 200 on 21/6/92 (VG). No records in autumn, perhaps because lake often dry in this season. For records before 2001, no information on whether birds using lake and its surrounds, or flying over. In surveys in 2001-2002, records of single birds only: on 3 occasions, flying over the lake; once swimming on lake (MHe, GT).

Whiskered Tern *Chlidonias hybridus*

Spring-summer migrant in region. Only three records, but these include a breeding record and two high counts: 3 birds on 9/10/87, including 1 sitting on nest; lake at 95% capacity (VG, WD); 195 patrolling over lake and dipping at surface of aquatic vegetation, 22/10/02 (RHL, MHe); 135 on 26/10/02 (RMc).

In Geelong region, breed in shallow fresh-brackish swamps with aquatic vegetation and rushes, which are used to build and support nests (Pescott 1983). Freshwater Lake would be suitable for nesting only if water level maintained for long enough for aquatic vegetation to develop.

Conservation status

Listed as Near Threatened, Lower Risk, in Vic. (Victorian Dept. of Natural Resources and Environment 2000).

State significance

One of few known breeding sites in Geelong region and in Victoria generally (Pescott 1983; Emison et al. 1987).

Blue-winged Parrot *Neophema chrysostoma*

Rare: 1 on 28/7/91 (Starks 1993).

Orange-bellied Parrot *Neophema chrysogaster*

Autumn-winter visitor to mainland Australia from breeding grounds in Tasmania. Occasional visitor to lake, birds sometimes in high numbers: possibly 2 on 27/5/79 (Loyn and Kinhill Planners 1979); 16-28 in winter 1980 (Brown and Wilson 1984; Starks et al. 1992); 7 on 10/6/89 (Starks 1992b); 20 on 16/6/91 (GBR 1991); 2 on 21/5/00 (JS; OBP count). Parrots have been observed along the S and E shores of the lake, and at the inlet of a natural drainage line (creek) on the N shore (DK; original OBP Count froms). Although records irregular, counts occasionally high (1980, 1991), possibly depending on seeding of Glaucous Goosefoot, which was the major food source in 1980. In that year, birds present from May to August, the period over which Goosefoot carries seed (Loyn et al. 1986). Brown and Wilson (1984) suggest that much of the vegetation lost and habitat unsuitable for Parrots if lake dry for extended periods. However, the record of 20 birds in June 1991 occurred when the lake had been dry for at least 4 months (dry on 17/2/91, 4/4/91, 1/6/91).

Conservation status

Endangered nationally (Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia). Listed as Critically Endangered nationally in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because of decline in numbers and range, very low population size (180 mature birds), and habitat loss in wintering grounds. In Vic., Critically Endangered (Victorian Dept. of Natural Resources and Environment 2000) and listed as Threatened under Schedule 2 of the Flora and Fauna Guarantee A**ct** (1988).

International significance

Freshwater Lake considered to be important for Orange-bellied Parrots (Brown and Wilson 1984), occasionally supporting 10-15% of the estimated population (Garnett and Crowley 2000). In years when Goosefoot seeding, it could provide food for Parrots over mid-winter, July to early Aug., when other food scarce (Loyn et al. 1986). The lake should be monitored regularly in winter, especially in years when Goosefoot is seen to be carrying flowers or seed. The lake is close to other major wintering areas for Parrots, Swan I., Sand I., Swan Bay and Lake Connewarre, and interchange probably occurs. All areas of suitable habitat, especially those that are used by Parrots, are of great value and should be preserved (Barter et al. 1988).

Striated Fieldwren *Calamanthus fuliginosus*

Regularly observed along lakeshore in surveys in Jan.-Oct. 2002 (MHe, RMc). Previous records: 4 on 7/9/85 (MAC); present on 24/7/88, 28/3/92, 25/7/93 (MAC); 1 on 17/5/98 (MHe,

MAC). Probably always present in low numbers. In 2002, single birds and pairs in dense cover around lake perimeter: sapling eucalypts, shrubs, Austral Bracken, tall grass, rushes, tall hummocks of Australian Salt-grass and Sea-berry Saltbush. Birds sang frequently and often perched on fences and in the tops of bushes.

White-fronted Chat *Epthianura albifrons*

Regularly recorded around lake margins, sometimes in very high numbers. Present in all seasons, but highest numbers between autumn and early spring when large flocks occurred: 500 on 27/6/82 (MAC); 60 on 7/9/85 (MAC), 21/6/92 (VG); 80 on 2/4/89 (VG); 75 in several flocks, 3/5/02 (MHe); flock of 150, 28/7/02 (MHe, DHe). Occurrence independent of water levels; often present when lake dry, sometimes in high numbers (e.g. 2/4/89); habitat at lake apparently suitable whether dominated by rush or by saltmarsh. In surveys in summer-autumn 2002, pairs and small flocks fed on bare muddy ground or among low vegetation between rushbeds, perched on fences and in shrubs; in July 2002, large flock fed on NE mudflats (MHe, DHe).

Breeding

1 female performed broken-wing act, 7/1/02 (RHL); 1 very young bird (yellowish gape and mouth, no breast markings) perched on fence giving begging calls, 12/1/02; male flew past observer several times, apparently as distraction (MHe).

Welcome Swallow *Hirundo neoxena*

Occasionally recorded; in all seasons, but most high counts made in spring and summer: 40 on 7/9/85 (MAC); 50-60 on 12/1/02 (MHe); 43 on 31/1/02 (MHe); 100 on 7/7/02 (MHe, DHe). Scarcity of records surprising, considering Swallows common in region and recorded at lake on every visit for this study in 2001-2002. Not dependent on presence of water; occasionally present when lake dry (24/4/88, 1/6/91). In surveys in 2001-2002, small flocks patrolled and hunted for insects over rushbeds and mudflats around the shore, over the lake, and in the surrounding fields. On 31/1/02, flock of 30 flying and swooping to take prey from surface of still water in lake shallows (MHe); on 7/7/02, many flocks hunting over mats of aquatic vegetation across entire lake surface (MHe).

Fairy Martin *Hirundo ariel*

Rare: 2 on 7/9/85 (MAC).

Clamorous Reed-Warbler *Acrocephalus stentoreus*

1 bird calling from dense bed of Sea Rush, 17/3/02; water receding after flooding (MHe).

Little Grassbird *Megalurus gramineus*

Recorded on 5 occasions in surveys in Jan.-June 2002: single birds calling from rushbeds around lakeshore, particularly dense stands of Sea Rush and Bare Twig-rush (MHe, RHL, GT). No other records; unclear whether birds overlooked in past or whether rare at lake, perhaps occurring only during brief periods when rush is dominant vegetation.

Golden-headed Cisticola *Cisticola exilis*

Occasionally recorded: present on 24/4/88 (MAC); present on 25/7/93 (MAC); 1 calling from rushbed, 18/1/02 (MHe, GT); 5-7 in rushbeds, 3/5/02-7/7/02 (MHe).

4. St Leonards Salt Lagoon

SUMMARY

- The list for St Leonards Salt Lagoon includes 41 species of waterbirds. These include waterfowl, waders, cormorants, pelicans, herons, ibis, spoonbills, coastal birds, and wetland-associated birds of prey and land birds. Only one species has been recorded breeding (Red-capped Plover).
- The lagoon occasionally supports more than a thousand waterbirds. The highest count was 1402 on 7/2/02. Waterbird species, numbers and breeding are probably restricted by the extreme salinity.
- The lagoon is of national significance for Common Greenshanks, and state significance for Black-tailed Godwits, Marsh Sandpipers, Black-winged Stilts and Banded Stilts. There is one record of the globally endangered Orange-bellied Parrot from St Leonards, possibly from the lagoon. In total, 16 species occur in numbers significant at national, state or regional levels, have special conservation status, or are listed in international treaties.
- There is interchange between the lagoon and the other wetlands of the Swan Bay system (waders and probably waterfowl) and probably with the Portarlington Sewage Ponds (waterfowl).
- Waterbird numbers vary seasonally. The highest numbers of waders generally occur in winter and early spring, as the lagoon is often dry in summer. They are most numerous when the water level is low and the mudflats exposed. The lagoon is especially important for first-year migratory waders in winter.
- Numbers of waterbirds can vary at any time of year, as water levels and salinity fluctuate, birds move within Swan Bay and other wetland systems, and irruptions bring waterbirds to the coast from inland.
- The important sites for waterbirds include:
- the south-western shore, as a feeding and roosting area for waders and waterfowl.
- The sandspits and bay on the north-eastern shore, for waders and waterfowl.
- The northern inlet, for waders; potential habitat for Orange-bellied Parrots.
- The salt meadow, for Sharp-tailed Sandpipers and Latham's Snipe; potential habitat for Orange-bellied Parrots.

- The saltmarsh on the southern shore, for large wading birds, wetland-associated land birds, and breeding Red-capped Plovers; potential habitat for Orange-bellied Parrots.
- No long-term trends in waterbird numbers have been noted in survey results. The inherent variability in waterbird numbers at the lagoon may have obscured any changes, including the movement of 300-400 Australian Shelducks from the lagoon to Portarlington Sewage Ponds to moult since 1990.
- There are gaps in information in almost every aspect of waterbird usage of the lagoon. In particular, little is known about numbers of waterfowl, their habitat requirements, and seasonal and other temporal patterns of use.
- Mammals, reptiles and frogs recorded from the vicinity of the Salt Lagoon have been listed. Few records include precise locations.

Figure 4.1. St Leonards Salt Lagoon

Figure 4.2 St Leonards Salt Lagoon

Waterbird species and numbers

Since 1980, 41 species of waterbirds and wetland-associated land birds have been recorded at St Leonards Salt Lagoon. An assessment of the total numbers of waterbirds using the lagoon is more difficult, as numbers are very variable and most surveys have concentrated on particular species or groups of birds (e.g. Wader Counts, Waterfowl Counts, Orange-bellied Parrot Counts) The VicGroup Wetland Survey (RAOU) in 1987-1992 was the only regular monitoring programme in which all species of waterbirds were counted. During these surveys, total counts varied between 0 and 885, most recording fewer than 200 birds. However, there are indications that the Salt Lagoon is more important for waterbirds than the available figures indicate. During intensive surveys for this study, counts of over 1300 birds were made on two occasions. Further investigation could dramatically alter our estimates of how many waterbirds use the lagoon.

In comparison with Lake Victoria and Freshwater Lake, the species list at the Salt Lagoon is limited and the numbers of birds are low. This is probably a consequence of the consistently high salinity at the lagoon, making it unsuitable for many waterbird species, and the fact that it is often dry in summer and autumn, the usual season for migratory waders and the concentration of waterfowl at the coast.

Breeding records and the importance of the lagoon for juveniles and immature birds

The lagoon is clearly not important for waterbird breeding. There is only one record for the lagoon: an observation of a Red-capped Plover family with one chick. The consistently high salinity at the lagoon is probably the limiting factor, as the young of many species of waterbirds, especially waterfowl, require a source of fresh water.

The Salt Lagoon is important for young birds of a number of resident and migratory wader species. In summer 2001-2002, the lagoon was used as a sheltered resting and feeding site by juvenile and immature Black-winged Stilts. Banded Stilts and Red-necked Avocets occur in large numbers when adults and young return to the coast from nesting inland. In winter, the lagoon has supported significant populations of first-year birds of the migratory wader species, Marsh Sandpipers, Red-necked Stints and Curlew Sandpipers (Table 4.1). The highest counts for Black-tailed Godwits and Common Greenshanks occurred in early spring, but these birds were probably also first-year birds, as counts at the lagoon and in the region had been high throughout the preceding winters.

Species with significant populations and/or conservation status

The lagoon has been shown to be important for several waterbird species which can tolerate high salinity. Table 4.1 lists 16 species recorded from the lagoon which occur in numbers significant at a national, state or regional level, which have special conservation status, or which are listed in international treaties. The majority are waterfowl and waders. The lagoon is important for some of these species only in winter, reflecting the fact that it is often dry in summer.

Table 4.1. Waterbird species* at St Leonards Salt Lagoon with significant populations and/or special conservation status

Species	Significance (1)	Conservation status
Australian Shelduck	Regional	
Chestnut Teal	Regional	
Hoary-headed Grebe	Regional	
Latham's Snipe	Regional	JAMBA; CAMBA
Black-tailed Godwit	State	JAMBA; CAMBA
Marsh Sandpiper	State (winter)	JAMBA; CAMBA
Common Greenshank	National	JAMBA; CAMBA
Red Knot		JAMBA; CAMBA
Red-necked Stint	Regional (winter)	JAMBA; CAMBA
Sharp-tailed Sandpiper		JAMBA; CAMBA
Curlew Sandpiper	Regional (winter)	JAMBA; CAMBA
Black-winged Stilt	State	
Banded Stilt	State	
Red-necked Avocet	Regional	
Pacific Gull		Lower risk, near threatened in Vic. (4)
Crested Tern		Lower risk, near threatened in Vic. (4); JAMBA
Orange-bellied Parrot (possible record)		Endangered nationally (2); critically endangered nationally and in Vic. (3, 4); threatened (5)

*Includes non-vagrant birds with 5 or more records; species with any high count; critically endangered species.

Criteria for significance in Chapter 1.

Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia.

The Action Plan for Australian Birds 2000. S.T. Garnett and G.M. Crowley. Environment Australia, Canberra.

Threatened Vertebrate Fauna in Victoria 2000. A systematic list of vertebrate fauna considered extinct, at risk of extinction or in major decline in Victoria. Dept. of Natural Resources and Environment, East Melbourne.

Flora and Fauna Guarantee Act, 1988 (Vic.).

JAMBA, CAMBA: species listed under the Japan-Australia Migratory Birds Agreement, China-Australia Migratory Birds Agreement.

There is one record of an Orange-bellied Parrot at St Leonards, possibly at the lagoon. This warrants further investigation. The saltmarsh around the lagoon contains several food-plants for Parrots, but they do not appear to flower and seed in every year. Parrots could easily be missed if they use the lagoon saltmarsh irregularly or for short periods.

New information from surveys in 2001-2002

A series of intensive surveys in 2001-2002 produced much new information:

- New species for the bird list (Swamp Harrier, Whiskered Tern, Striated Fieldwren).
- Two total waterbird counts which were higher than any recorded previously (1402 on 7/2/02; 1309 on 20/2/02).
- The first breeding record for any waterbird species at the lagoon: a Red-capped Plover family with a chick, Feb. 2002.
- The highest counts ever recorded for Black Swan, Australian Shelduck, Grey Teal, Chestnut Teal, Hoary-headed Grebe, Latham's Snipe, Banded Stilt and Welcome Swallow.
- Records of flocks of Australian Shelducks, Grey Teal, Chestnut Teal and Silver Gulls using the lagoon for early-morning and late-afternoon feeding, and as a night-time roost.
- Records of Pacific Gulls using the lagoon as a night-time roost.

Variability in waterbird numbers

The new records obtained in 2001-2002 serve to highlight the variability of this wetland and its usage by waterbirds. The lagoon is ephemeral and often dry in summer and autumn. Waterbird numbers are generally low in that season; the only species likely to be present when there is no water are Pied Oystercatchers, Red-capped Plovers, Masked Lapwings, and resting gulls and terns. Winter and spring numbers are generally higher (M. Cameron, pers. comm.), as water is usually present from seasonal rainfall. This seasonal pattern is similar to that at Freshwater Lake, which is also often dry in summer, but differs from that at Lake Victoria, which always contains water in summer-autumn and so can support large populations of waders and waterfowl in their peak season.

Changes in habitat (vegetation, water level, salinity) occur as a result of seasonal and climatic conditions. These combine with fluctuations in numbers of waterbirds, many of which are seasonal migrants or move widely in response to rainfall, to produce a system marked by rapid and unpredictable changes. The high numbers in summer 2001-2002 arose from an unusual combination of factors: the lagoon had been full for at least 3 and probably 7

months, including the summer season when it is usually dry or at low level; summer is the peak season for migrant waders from the northern hemisphere, and for some duck species to concentrate in coastal regions; and there was a large influx of Banded Stilts returning to the coast after breeding inland (C. Minton, pers. comm.).

In early spring there also often appears to be a similar coincidence of factors leading to high waterbird numbers: migratory waders returning from the northern hemisphere often find the lagoon holding water from the previous winter's rainfall. Local bird observers report that the highest numbers of waders at the lagoon often occur during this period, but only for a short time (P. Bright, pers. comm.). The birds probably spread out over the Swan Bay system shortly after arrival.

This spring influx has not been captured in survey data, probably because of its short duration and the timing of waterbird surveys, many of which fall in late summer when the lagoon is often dry.

The role of the Salt Lagoon in regional wetland systems, particularly the Swan Bay system

There is a further source of variability at the Salt Lagoon. It is a component of the Swan Bay system of wetlands and marine environments, which includes Swan Bay, Queenscliff, Edwards Point, Mud Islands, Lake Victoria and Freshwater Lake. This system is of international importance for waterbirds. There is extensive movement within it, certainly of waders and probably also of waterfowl (Barter et al. 1988; Barter 1992). It is important to retain the Salt Lagoon as a functioning part of the Swan Bay system. Although the lagoon holds large numbers of birds only irregularly, all the component wetlands are essential to provide food and shelter for birds over a range of seasonal and weather conditions.

The waterbirds which occur in high numbers at the Salt Lagoon are largely those which are common in the Swan Bay system (Barter et al. 1988; Barter 1992). These include many species which are tolerant of high salinity and feed in shallow water or on intertidal mudflats e.g. Black Swans, Australian Shelducks, Grey Teal, Chestnut Teal, and several species of waders (Barter et al. 1988; NRE/RAOU Summer Waterfowl Counts; Geelong Bird Reports). A connection is also indicated by records from the lagoon of species which are known from Swan Bay but are rare at other terrestrial wetlands in the region: for instance, Black-tailed Godwits, Ruddy Turnstones, Red Knots, Sooty Oystercatchers and Lesser Sand Plovers. Waders are generally more mobile in winter than in summer (Minton 1981; Fletcher et al. 1982; Paton et al. 1982), and influxes and sudden departures from the lagoon are

commonplace in that season. In most cases, this probably reflects interchange between the Salt Lagoon and the Swan Bay system.

There is some more direct evidence for such winter movements. Between late summer and early spring in 1998, there were several records of 10-11 Black-tailed Godwits within the Swan Bay system. As flocks of this size are rare on the Bellarine Peninsula, especially in winter, this was assumed to be a single wandering flock. They touched down at various times at the Salt Lagoon, Lake Victoria, Freshwater Lake, Duck Island in Swan Bay, and the Sand Island at Queenscliff, and gave a perfect demonstration of wader movement within the system. In winter 1994, ten Ruddy Turnstones appeared to move from the Salt Lagoon to Edwards Point between repeat Wader Counts held two weeks apart.

The conditions under which large numbers of waterbirds move to the lagoon are not fully understood: the need for sheltered roosts or feeding areas during rough weather and exceptionally high tides on the bay may play a role (Garnett et al. 1986; Barter et al. 1988), but high numbers are sometimes maintained over days or longer, and have occurred when the weather and tides were unexceptional.

There may also be interchange between the Salt Lagoon and other wetlands. Latham's Snipe move between ephemeral wetlands and occurred briefly at the lagoon in Jan. 2002. They are not known to occur in any numbers elsewhere in the Swan Bay system (Barter 1992). The recently-constructed sewage ponds at Portarlington are only 2 km away, and carry many species of waterfowl in common with the Salt Lagoon and Swan Bay. Interchange may occur; Australian Shelducks are thought to have shifted from the Salt Lagoon, adopting the sewage ponds as their preferred moulting site since 1990 (King 1997).

Important habitats and sites for waterbirds

From observations of habitat use in 2001-2002 and information from local observers (P. Bright, D. King), the important areas for birds appear to be:

The south-western shore of the lagoon.

This area is sheltered from observation and disturbance from the road and the lakeside houses, and is partly protected from strong winds by the adjacent dune. It is shallow and provides feeding areas for waders and waterfowl even when the lagoon is full. Significant observations in this area include:

- Very large numbers of Banded Stilts and smaller numbers of other waders feeding and roosting. On days with westerly winds, Banded Stilts particularly favoured the still water off this lee shore.

- Several records of juvenile and immature Black-winged Stilts.
- Black Swans resting on the shore during the day.
- Flocks of Australian Shelducks, Grey Teal and Chestnut Teal feeding in early morning and late afternoon, and using the shore as a night-time roost-site.
- Pacific Gulls using the shore as night-time roost.
- Movement of waterfowl and waders to the area after disturbance at other sites.

The sandspits and bay on the north-eastern shore.

The bay is shallow, partly sheltered from the wind by the elevated roadway bank, out of sight of the entrance track to the lagoon, and protected by very soft mud.

- A favoured roosting and feeding area for large flocks of small waders and Banded Stilts, and smaller numbers of Black-tailed Godwits and Red Knots.
- A roost-site for Pied and Sooty Oystercatchers.
- Flocks of Grey and Chestnut Teal and Silver Gulls fed in still water in this bay in the late afternoon, and used the shore as a night-time roost.

The northern inlet.

- The surrounding saltmarsh is potential habitat for Orange-bellied Parrots.
- Large numbers of small waders, Banded Stilts and Red-necked Avocets gather to feed when shallow water is present.

The salt meadow.

- Potential habitat for Orange-bellied Parrots.
- When flooded in summer, a feeding area for large flocks of Sharp-tailed Sandpipers and smaller numbers of White-faced Herons, Masked Lapwings and Black-winged Stilts (including an immature bird on 8/1/02).
- A roost-site for Latham's Snipe when flooded in summer.

The strip of saltmarsh and backing sedgebeds along the southern shore.

- Potential habitat for Orange-bellied Parrots.
- Site of the breeding record for Red-capped Plovers; the chick hid within the low saltmarsh.

- A favoured resting area for White-faced Herons.
- Favoured area for wetland-associated land birds (Cisticolas, Chats, Grassbirds) and hunting area for Welcome Swallows.
- A hunting area for Whistling Kites.

The dune woodland

- Supports a community of bush birds typical of coastal woodlands in the region.

Have any waterbirds declined or increased in numbers since 1980?

Where there is such inherent variability in a system and the timing of surveys is often inappropriate, it is difficult to detect any trends in waterbird numbers. Even declines which are known to have occurred do not show up in count data.

The movement of Australian Shelducks from the lagoon to the nearby Portarlington Sewage Ponds since 1990 can be inferred by the increase in numbers at the sewage ponds during NRE/RAOU Summer Waterfowl Counts in 1988-1992. However, there is no hint in count data of a corresponding decrease at the Salt Lagoon, even though it involved 300-400 birds (D. King, pers. comm.). Other waterfowl may now also use the sewage ponds in preference to the lagoon, as the two wetlands carry other species in common (Hoary-headed Grebe, Black Swan, Chestnut Teal) (King 1997).

Any assessment of trends in wader numbers requires more complete information. The count data for waders up to 2001 does not appear to do the lagoon justice; even a few surveys in 2001-2002 produced counts for some species which were the highest ever recorded, and there are no counts from early spring when qualitative observations show that wader usage of the lagoon is often high (P. Bright, pers. comm.).

Waterfowl

Six species of waterfowl (swans, ducks, grebes) have been recorded from the lagoon. Salinity appears to be a limiting factor; the five common species are salt-tolerant, and also occur in the marine environments of Swan Bay in large numbers (Barter et al. 1988). Pacific Black Ducks have been recorded only once. They prefer freshwater wetlands (Emison et al. 1987).

The NRE/RAOU Summer Waterfowl Counts, 1988-1992, are the major source of systematic counts of waterfowl at the lagoon. Unfortunately the lagoon was dry or at very low level for most of these surveys, and waterfowl were present in only one year (48 Australian Shelduck on 9/2/89; Peter 1989). Other count data also do not appear to reflect the true importance of

the lagoon for waterfowl, probably because of inappropriate timing of surveys and the variability of the system. A few surveys in 2001-2002 produced new observations and counts, but the picture is far from complete.

- Australian Shelducks, Grey Teal, Chestnut Teal and Hoary-headed Grebes sometimes use the lagoon in large numbers (100 or more birds).
- The lagoon is a feeding and resting area for Black Swans, Australian Shelducks, Grey Teal, Chestnut Teal and Hoary-headed Grebes.
- Flocks of Australian Shelduck, Grey Teal and Chestnut Teal sometimes use the lagoon as a night-time roost.
- Variable counts indicate waterfowl movements to and from the lagoon.
- Australian Shelducks, Grey Teal and Chestnut Teal sometimes use the lagoon for only part of the day, for bouts of feeding or resting.

Three species of waterfowl occur at the lagoon in numbers of regional significance (Table 4.1). It is likely that waterfowl move between the Salt Lagoon and other Swan Bay wetlands, and perhaps there is also interchange with Portarlington Sewage Ponds. In years when it holds water in autumn, the lagoon acts as a refuge from hunting for ducks during open season.

Much more information is needed. Surveys need to be targeted towards periods when the lagoon holds water, and towards determining the effect of water level and salinity on waterbird numbers. Surveys at dawn and dusk throughout the year are needed to extend the observations on roosting and morning- and afternoon-feeding.

Waders

Since 1980, 18 species of waders have been recorded from the Salt Lagoon. The results of twice-yearly Wader Counts since the early 1980s are shown in Table 4.2 (RAOU; AWSG). The most numerous species occurring on a regular basis are Red-necked Stints, Sharp-tailed Sandpipers and Curlew Sandpipers, and Banded Stilts sometimes occur in very high numbers.

During spring and summer, migratory waders from the northern hemisphere spend the non-breeding season in Australia in large numbers. It appears from Wader Count results that wader numbers and species diversity at the lagoon are generally low in this season (0-328 birds). Unfortunately the counts give a misleading impression, as they are held in late summer (Jan.-Feb.) when the lagoon is often dry. The only wader species likely to be found

under these conditions are Pied Oystercatchers, Masked Lapwings and Red-capped Plovers, and they are probably using the dry lagoon as a resting area rather than for feeding. Local bird observers have noted that the highest wader numbers usually occur during a brief period in early spring, when large numbers of migratory waders return from the northern hemisphere, and water remaining in the lagoon from the previous winter's rainfall is receding and exposing extensive mudflats. Small waders are said to occur in thousands at this time (P. Bright, pers. comm.). A realistic assessment of the lagoon's importance in spring and summer awaits records with counts and dates from this period.

Table 4.2. Counts* of waders and wader species at St Leonards Salt Lagoon, 1981-2001

Year	Summer		Winter	
	Birds	Species	Birds	Species
1981	18	1	6	1
1982	46	2	28	2
1983	5	1	9	2
1984	0	0	21	3
1985	0	0	95	4
1986	10	1	16	5
1987	57	4	3	2
1988	17	2	167	6
1989	328	4	741	7
1990	17	3	56	2
1991	2	1	143	6
1992	16	3	13	4
1993	8	3	196	5
1994	256	7	431	7
1995	48	4	26	3
1996	227	8	232	3
1997	16	3	99	3
1998	13	2	367	6
1999	30	1	150	5
2000	6	1	95	5
2001	39	2	11	2

* RAOU and AWSG Wader Counts in Jan.-Feb. and June-July, 1981-2001.

When there was more than one complete Wader Count in a season, the highest count is used.

The salt meadow is even more ephemeral than the lagoon. It rarely holds water in summer, but when it does so it can become important for a limited suite of migratory waders. In December and January 2001-2002, the salt meadow held the highest numbers of Sharp-

tailed Sandpipers and Latham's Snipe ever recorded at the lagoon. The Sandpipers were feeding in flocks of 250-400 in flooded saltmarsh and the Snipe were roosting across a wide area under Black-seeded and Grey Glasswort shrubs. These birds departed immediately when the salt meadow dried out in mid-January. There are no records to show which waterbirds, if any, use the salt meadow when it is flooded in winter and early spring.

In winter, the Salt Lagoon assumes great importance for waders in the region. Numbers (3-741 birds) in Winter Wader Counts are usually higher than in summer. This holds true even for migratory waders, most of which leave Australia in autumn to return to their breeding grounds in the northern hemisphere; the birds remaining are mainly first-year birds spending their first 18 months in Australia. Migratory waders do not breed successfully in every season. The Salt Lagoon appears to be especially important as overflow habitat for over-wintering young birds when they occur in large numbers following exceptional breeding years, and is therefore vital for the survival of these species (see Marsh Sandpiper, Common Greenshank, Curlew Sandpiper, in Species List). In winter, the lagoon usually carries water, and as it is so shallow there are often exposed muddy edges and flats for feeding waders. Other larger wetlands in the region often become flooded in winter and are too deep for waders.

In winter, waders are very mobile, and there is evidence for movements within the Swan Bay system. A flock of 10-11 Black-tailed Godwits, which are rare locally, visited the Salt Lagoon, Lake Victoria, Freshwater Lake, Duck Island in Swan Bay, and the Sand Island at Queenscliff, between late summer and early spring in 1998. Ruddy Turnstones apparently also moved between the lagoon and Edwards Points within a week in winter 1994.

The Salt Lagoon is also important for a few species of Australian resident waders; numbers visiting the lagoon are of state significance for two species, and of regional significance for one species. For Black-winged Stilts, the highest numbers occur in winter, when the lagoon is most likely to hold water. Red-necked Avocets and Banded Stilts occur irregularly, sometimes in significant numbers. The lagoon seems to be important for these species as overflow sites when large numbers of adults and young return to the coast from breeding inland. The lagoon maintains its high salinity even when full, and so the habitat is usually suitable if water is present (Jessop 1987). Limited observations of Banded and Black-winged Stilts over late 2001 and 2002 suggested that they were resident at the lagoon during that time. They rarely occur in the marine environments of Swan Bay, and the need for movements is limited while the lagoon retains water. Pied and Sooty Oystercatchers occasionally use the lagoon as a high-tide roost; they feed entirely in marine environments and probably visit the lagoon from Swan Bay.

Five species of migratory waders have occurred at the Salt Lagoon in numbers which are significant at a national (1 species), state (2 species), or regional (2 species) level; see Table 4.1. For three of these species, Marsh Sandpiper, Red-necked Stint and Curlew Sandpiper, the counts which caused them to be listed occurred in winter, indicating that the lagoon carries significant populations of first-year migratory waders.

Other waterbirds

The Salt Lagoon supports several species of waterbirds, such as cormorants, pelicans, herons, ibis, spoonbills and terns. Little Pied Cormorants, Australian Pelicans and White-faced Herons occur more regularly at the lagoon than the other species, but there are feeding observations only for the Herons. Whiskered Terns are spring-summer migrants to the region. They occurred at the lagoon for a limited period in Sept.-Oct. 2002, small numbers hunting over the water surface. For the other species, there are few records, numbers are low, and there are no observations of habitat use. The populations using the lagoon are not significant.

The scarcity of records for these waterbirds and for others which are numerous in the region is surprising. The lagoon does not appear to be suitable for feeding for most species; perhaps the high salinity, rapidly-changing water levels, or some other factors prevent the build-up of prey populations for larger wading birds.

Coastal birds

Pacific Gulls, Silver Gulls and Crested Terns occur regularly, probably visiting from the nearby beachfront. They use the lagoon mainly as a resting site. Pacific Gulls and Silver Gulls have been observed using the lagoon shore for night-time roosting. There is one observation on 20/2/02 of Silver Gulls feeding in the early morning at the lagoon, mingling with a large flock of Banded Stilts. More observations of habitat use are needed, especially when other waterbirds are feeding in numbers at the lagoon and are likely to attract Silver Gulls.

Birds of prey

Whistling Kites occur occasionally, and have been observed hunting along the shoreline. Surprisingly there are only two records of Swamp Harriers, single birds flying over. Swamp Harriers are partial migrants to the region in summer. The lagoon may not be as attractive to Harriers as the other wetlands in the Swan Bay system, as it is often dry in summer and even when it holds water it supports smaller populations of waterfowl. Observations of flight paths at Freshwater Lake suggest that some Harriers move along a regular hunting route, possibly

a circuit, passing through Swan Bay, Freshwater Lake and Lake Victoria. The Salt Lagoon lies to the north of and outside the line of this flight path.

Orange-bellied Parrots

Orange-bellied Parrots are critically endangered in Australia (Environment Protection and Biodiversity Conservation Act 1999; Garnett and Crowley 2000), and each year migrate from their breeding grounds in Tasmania to spend the autumn and winter on the southern mainland.

There is one Orange-bellied Parrot record at St Leonards, with no details provided: a single bird was collected by N.J. Favaloro on 1/1/58 (skin number B17317, National Museum of Victoria; J. Starks, pers. comm.). This record was possibly made at the Salt Lagoon, an area of suitable saltmarsh habitat near the township.

Beaded Glasswort, Grey Glasswort and Southern Sea Heath, known food plants for Parrots (Loyn et al. 1986), are abundant around the lagoon shores and in the salt meadow. The occurrence of Grey Glasswort is particularly noteworthy, as it is of restricted distribution around Port Phillip Bay and produces seed in July-August when food for Parrots is limited (Yugovic 1984; Loyn et al. 1986). However the health of the saltmarsh plants at the lagoon may vary according to water levels and salinity (King 1987), and flowering and seeding probably do not occur in every year.

On the evidence, Parrots appear to be at best vagrants to the lagoon. However, even one possible record of this critically-endangered species is intriguing. The Salt Lagoon is close to other major wintering areas, Swan Island, Sand Island and Swan Bay, and interchange could occur (King 1987).

For birds occurring irregularly, annual searches at a fixed time of year do not constitute a thorough investigation (RAOU OBP Counts). The Parrot food-plants available carry seed between April and August, and additional surveys should be made over that period, concentrating effort in years when these plants are flowering and seeding. The broad areas of saltmarsh around the southern lakeshore and the northern inlet should be searched, especially the salt meadow, where Grey Glasswort is common. Whether or not Parrots have been recorded in the past, all areas of suitable habitat are of potential value and should be preserved (Barter et al. 1988).

Land birds associated with wetlands

Several land birds associated with wetlands have been recorded from sedgebeds, rushbeds and saltmarsh around the lakeshore and in the salt meadow (fieldwrens, chats, swallows,

grassbirds and cisticolas). Records of these birds have been sporadic, and it is not known whether they occur irregularly at the lagoon, they have been overlooked in the past, or observations have not been documented. The RAOU VicGroup Wetland survey and the RAOU/Birds Australia Atlas projects were the only programmes in which records of wetland-associated passerines were specifically requested.

Welcome Swallows hunt over the lagoon and the shore, White-fronted Chats are common in saltmarsh, and Little Grassbirds occur in beds of Chaffy Saw-sedge. There are few past records of Golden-headed Cisticolas, but they were present in good numbers in a bed of Sea Rush during one recent survey. In surveys in 2001-2002, Striated Fieldwrens were often heard singing from dense coastal shrubland on the southern shore of the lagoon, but there are no earlier records.

Land birds

An annotated list of the land birds of the Salt Lagoon contains records of 43 species (Appendix 4). The remnant woodland along the dune on the southern and western shores supports a community of birds typical of coastal woodlands in the region, including Superb Fairy-wrens, Brown Thornbills, Spiny-cheeked Honeyeaters, Grey Fantails, Mistletoebirds and Silvereyes. The Spiny-cheeked Honeyeater is the most common honeyeater in the woodland.

In the area surrounding Port Phillip Bay, any site containing an intact community of bush birds is considered regionally significant (Garnett et al. 1986). Whether the land bird community at the Salt Lagoon is “intact” or not is problematical: the woodland is small, and fringed and isolated by clearing and development; introduced and urbanised birds are common; and the bird list is probably incomplete. However, there are so few patches of remnant coastal woodland in the region, that this example should be protected from further development around its fringes.

The destructive effects of nearby development and clearing are demonstrated by the records of several introduced and urbanised birds in the reserve. They have been attracted by the township of St Leonards and spread out with it as it extended north along the Portarlington Road. Many of these birds occur around the lakeshore and on the edges of the woodland, some in large numbers, and some breeding: e.g. Spotted Turtle-Dove, Red Wattlebird, New Holland Honeyeater, House Sparrow, European Greenfinch and Goldfinch, Common Blackbird, Common Starling and Common Myna. The Common Myna is a recent invader, first appearing between 1994 and 2001 (Bottomley and Calvert 1994). The records of

grassland birds such as Stubble Quail, Richard's Pipit and Skylark show the effect of the complete clearing of the woodland on the northern lakeshore.

Observations of Willie Wagtails and Common Starlings indicated that they nested in the 2001-2002 season. A Willie Wagtail family with a begging juvenile was present in shrubland on the southern shore, and a Starling repeatedly flew off carrying food, probably to feed young.

Mammals, reptiles and frogs

The Atlas of Victorian Wildlife contains records of six native mammals, five introduced mammals, four lizards and two frog species for the two 5-minute grid blocks lying north and south of Salt Lagoon (Table 4.3). A seventh mammal species (Short-beaked Echidna) and at least one snake can be added to the list from local knowledge (L. Jackson, pers. comm.). Surveys of bats on nearby Edwards Point have revealed seven species (G. Baverstock, pers. comm.) (Table 2.5), all of which would be expected to occur in wooded habitats near Salt Lagoon. Few of the Atlas records were accompanied by precise locations, so some may not occur close to the lake. However, little systematic work has been done in this area, and it is likely that more species would be found with further searching. Brush-tailed Phascogales are classified as Vulnerable in Victoria and listed under the Flora and Fauna Guarantee Act 1988. Several specimens were taken historically by Donald F. Thomson from Swan Bay to Ocean Grove up to the late 1950s (Dixon and Huxley 1989; Menkhorst 1995). Presumably the species was relatively common at the time in dry woodland in this general area, but has not been recorded subsequently. Southern Brown Bandicoots have declined greatly in Victoria since they were recorded in St Leonards town, where the last record was in July 1970. The species is now classed as Endangered nationally. Suitable habitat remains around the lagoon, but the species is unlikely to persist in such a small area in the face of predation by Red Foxes and feral or domestic cats and dogs from the adjacent town. The Swamp Skink is classed as Vulnerable in Victoria, and is listed under the Flora and Fauna Guarantee Act 1988. It has been found in saltmarsh at Swan Bay, and Salt Lagoon appears to provide potentially suitable habitat. Further surveys for mammals and reptiles would be valuable.

Table 4.3. Mammals, reptiles and frogs recorded from vicinity of St Leonards Salt Lagoon*.

English	Latin	Comments
Short-beaked Echidna	*Tachyglossus aculeatus*	Common (L. Jackson, pers. comm.)
Brush-tailed Phascogale	*Phascogale tapoatafa*	Historical specimens to 1959 from Swan Bay to Ocean Grove, where presumably inhabited woodland.
Southern Brown Bandicoot	*Isoodon obesulus*	Recorded in St Leonards town, 1967-70

English	Latin	Comments
Common Ringtail Possum	*Pseudocheirus peregrinus*	
Eastern Grey Kangaroo	*Macropus giganteus*	Inhabits nearby woodland (Edwards Point and Queenscliff), and a few are resident on Duck Island and Swan Island in Swan Bay (P. Menkhorst, pers. comm.).
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	
Little Forest Bat	*Vespadelus vulturnus*	
Black Rat #	*Rattus rattus*	
House Mouse #	*Mus musculus*	
Water Rat	*Hydromys chrysogaster*	
European Rabbit #	*Oryctolagus cuniculus*	
Red Fox #	*Canis vulpes*	
Feral Cat #	*Felis catus*	
Tree Dragon	*Amphibolurus muricatus*	Recorded Portarlington Sewage Ponds, Oct. 1992
Swamp Skink	*Egernia coventryi*	Recorded Swan Bay, May 1989
Metallic Skink	*Niveoscincus metallicus*	
Grass Skink sp.	*Pseudemoia sp.*	
Tiger Snake	*Notechis scutatus*	Many records of snakes from residents are likely to be mainly of this species (L. Jackson, pers. comm.)
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	
Common Froglet	*Crinia signifera*	

* The list is taken from the Atlas of Victorian Wildlife, based on the 5-minute grid that includes the lagoon, and the 5-minute grid lying immediately south of the lagoon (which includes St Leonards town and Swan Bay).

Additional records were supplied by L. Jackson (Parks Victoria) and Peter Menkhorst (NRE).

Species introduced to Australia are marked #.

Options for future monitoring

The work that has been done thus far is valuable, but, despite the best efforts of bird counters and observers, there is still much missing information. The data we have suggests several avenues for further study. Even so, it may take years or even decades to reveal a comprehensive picture of the lagoon and its birdlife. The lagoon has the potential to provide important ephemeral habitat for waterbirds and Orange-bellied Parrots in some years, and more frequent observations are needed to document such habitat use. Some specific suggestions follow:

- The salt meadow should be searched in all surveys when it contains water.

- Intensive wader surveys in early spring (Sept.-Oct.), when numbers are said to be highest, are needed to clarify the role of the lagoon in the Swan Bay system in this season.
- Annual checks should be made on the food plants for Orange-bellied Parrots in autumn and early winter, and if extensive flowering and seeding is noted, followed up by intensive surveys for Parrots over April-August.
- Waterbird surveys at fixed times of year and separated by intervals of months are clearly not appropriate for monitoring such an unpredictable system. Continual low-level monitoring of waterbirds by interested individuals, and intensive surveys when numbers of waterbirds are high, would be more useful than fixed-season surveys.
- Even if surveys target particular species or groups of birds, records of all species associated with wetlands should be documented.
- Studies of diurnal and seasonal changes in waterbird numbers, the effects of tide height, weather, water coverage, salinity and vegetation, and information on habitat usage would be valuable in improving our understanding of the role the lagoon plays in the larger system, and the likely effects of management on habitat values of the lagoon.

ST LEONARDS SALT LAGOON: ANNOTATED LIST OF WATERBIRDS AND BIRDS ASSOCIATED WITH WETLANDS (41 SPECIES)

Sources of information are in Chapter 1; survey codes, observer codes and abbreviations are in Appendix 1; references are in Chapter 5.

Black Swan *Cygnus atratus*

In surveys in 2001-2002, numbers variable: 28 on 27/12; 47 on 8/1; none on 7/2; 2 on 20/2; none on 3/5, 14/6, 7/7 (MHe). Status at lagoon uncertain; moderate numbers in some of these surveys, but only one previous record: 4 on 14/10/87 (VG). In summer 2001-2002, Swans rested on shore, in shallow water along lagoon margins, and on water; on 8/1/02, a few were feeding in lagoon by dabbling and upending (MHe).

Australian Shelduck *Tadorna tadornoides*

Often recorded; numbers variable. Noted in all seasons, but rarely in autumn when lagoon often dry. Up to summer 2001-2002, the highest counts where dates known: 50 on 26/7/87 (King 1987); 48 in 9/2/89 (Peter 1989); 65 on 18/2/96 (WD).

In surveys in 2001-2002, only 1-3 birds present during surveys conducted in day, but evidence that large numbers of Shelducks use lagoon as night-time roost; not known if

regular occurrence, or conditions under which it occurs. On 20/2/02, 245 roosting on W shore before sunrise (06:45 EDST); small groups moved out onto water, fed for short time, then flew off; none remaining, 07:15.

Lagoon used as moulting site by 300-400 birds up to mid 1980s (DK), but Shelduck have used nearby Portarlington Sewage Ponds for this purpose since 1990 (King 1997).

Regional significance

The highest recent count (245) at the Salt Lagoon is comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Pacific Black Duck *Anas superciliosa*

Rare on lagoon: 2 on 22/7/88 (VG).

Grey Teal *Anas gracilis*

In surveys in 2001-2002, numbers of Grey Teal variable: none on 27/12; 80 on 8/1; none on 18/1; 312 on 7/2; 5 on 20/2; none on 3/5, 40 on 14/6; 10 on 7/7 (MHe, GT). Although numbers occasionally high during these surveys, only one previous record: 24 on 16/6/92 (VG).

Evidence that Grey Teal use lagoon irregularly for early-morning and late-afternoon feeding, and as a night-time roost. On 7/7/02, 10 feeding vigorously in lagoon, late afternoon (16:15-17:30 EST); as darkness fell, moved to roost on shore among Chestnut Teal. On 7/2/02, 290 dabbling and upending vigorously in calm water along lagoon margins, 1 hour after sunrise (07:45 EDST); only a few remaining, 10:00. However, do not feed in numbers at lagoon every morning: only 5 birds present early on 20/2/02. Also rest on lagoon by day: 80 in centre of lagoon in mid-afternoon, many resting with heads under wings, 8/1/02. Conditions under which Grey Teal gather in numbers at lagoon and use it for feeding and roosting not known.

Chestnut Teal *Anas castanea*

In surveys in 2001-2002, regular records but numbers variable: 120-150 on 27/12; 80 on 8/1; 5 on 18/1; 148 on 7/2; none on 20/2, 3/5; 200 on 14/6; 128 on 7/7; 230 on 28/7 (MHe, GT, DHe). Although numbers occasionally high during these surveys, only two previous records: 35 on 16/6/92 (VG); 50 on 23/7/99 (Atlas 2).

Evidence that Chestnut Teal use lagoon irregularly for early-morning and late-afternoon feeding, and as a night-time roost. On 7/7/02, 128 feeding vigorously in lagoon in late afternoon (16:15-17:30 EST); as darkness fell, small flocks moved to shore and roosted, scattered around lagoon margins. On 7/2/02, 130 dabbling and upending vigorously in calm

water along lagoon margins, 1 hour after sunrise (07:45 EDST); only a few remaining, 10:00. However, do not feed at lagoon every morning: no birds present early on 20/2/02. Also rest on lagoon by day: 120-150 resting on water beside W shore of lagoon in mid-afternoon, 27/12/01; 80 in centre of lagoon in mid-afternoon, many resting with heads under wings, 8/1/02 (MHe). Conditions under which Chestnut Teal gather in numbers at lagoon and use it for feeding and roosting not known.

Regional significance

The maximum counts at the Salt Lagoon are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Hoary-headed Grebe *Poliocephalus poliocephalus*

In surveys in 2001-2002, numbers variable: approx. 100 on 27/12; 90 on 8/1; low numbers, 18/1; 12 on 7/2; 2 on 20/2; none on 3/5, 14/6, 7/7 (MHe, GT). Although numbers occasionally high during these surveys, only two previous records: 16 on 22/8/78 (WD); 2 on 14/10/87 (VG).

When numbers high on 27/12/01 and 8/1/02, Grebes were scattered across lagoon in small groups in mid-afternoon, resting on water and feeding by diving. On 8/1/02, 1 swimming in shallow channel in flooded salt meadow.

Regional significance

The maximum counts at the Salt Lagoon are comparable with those at high-ranking wetlands in the Geelong region in Summer Waterfowl Counts, 1988-1992.

Little Pied Cormorant *Phalacrocorax melanoleucos*

Occasionally recorded in low numbers; usually 1-2 birds, but 7 on 14/2/92 (VG). Records in all seasons except spring, but few records overall and seasonal pattern unclear. Only information on habitat use: 1 resting on log on lakeshore, 8/1/02 (MHe).

Australian Pelican *Pelecanus conspicillatus*

Occasional records of birds in low numbers. Highest counts: 3 on 22/7/88 (VG), 13/4/89 (VG), 9/1/02 (MHe); 4 on 26/6/89 (VG). Records in all seasons except spring, but few records overall and seasonal pattern unclear. In summer surveys, 2001-2002, resting on lagoon and soaring overhead (MHe). Feeding not observed.

White-faced Heron *Egretta novaehollandiae*

Regularly recorded in low numbers. Highest counts: 7 on 10/4/90 (VG), 7/2/02 (MHe); 8 on 10/4/92 (VG); 12 on 16/6/92 (VG). Records in all seasons. Often recorded when lagoon dry: e.g. 22/3/88, 10/4/90, 9/4/91, 10/4/92 (VG). In surveys in 2001-2002, often on margins in ones and twos; feeding in shallow water on W shore and in N inlet, and resting on fence posts, in saltmarsh, or among rush or sedge tussocks. On 27/12/01 and 8/1/02, single birds feeding in flooded salt meadow.

Australian White Ibis *Threskiornis molucca*

Occasionally recorded: 2 on 18/6/90 (VG); 1 flying over lagoon, 8/1/02 (MHe); 2 on shore, 14/6/02, 28/7/02, 20/9/02 (MHe).

Straw-necked Ibis *Threskiornis spinicollis*

Rarely recorded: 20 on 17/6/93 (AVW); 2 flying over lagoon, 8/1/02 (MHe). Not known if Ibis recorded in June 1993 were using lagoon or adjacent fields, or flying over.

Yellow-billed Spoonbill *Platalea flavipes*

Rarely recorded: 3 on 13/4/89 (VG).

Whistling Kite *Haliastur sphenurus*

Occur occasionally in low numbers (DK); 1 on 22/7/88 (VG); 2 hanging over lagoon in strong wind and working slowly along shore, 20/2/02 (MHe); 1 on 7/7/02 (MHe).

Swamp Harrier *Circus approximans*

Usually common visitor to region's wetlands, mainly in spring-summer (Pescott 1983; Emison et al. 1987), but only 2 records from lagoon: 1 flew over, attacked by Masked Lapwings, 7/2/02 (MHe); 1 flew over, 7/7/02 (MHe). Lagoon often dry in summer-autumn, which may explain infrequent records.

Latham's Snipe *Gallinago hardwickii*

Spring-summer migrant in region. Up to 2001-2002, rarely recorded and in low numbers: 1 on 12/2/95 (WC); 2 on 28/1/96 (WC). However, on 8/1/02, 35 birds were flushed from wide area of Grey and Black-seeded Glasswort shrubs in salt meadow, which was partly flooded at the time. Another single bird flushed from below Glasswort shrubs on lagoon shore. Probably roosting. On 18/1/02, the salt meadow was dry and no birds were present. Snipe are mobile and readily use ephemeral wetlands.

Conservation status

Listed in The Action Plan for Australian Birds 2000 (Garnett and Crowley 2000) because habitat has been reduced by loss of wetlands, but not considered to be threatened nationally. Assessment of suitable habitat and protection from drainage or development recommended.

Regional significance

Counts of 30 or more unusual on Bellarine Peninsula (Dedman et al. 1998; Hewish et al. 1999; GBR 1997, 1998). However, large numbers of Snipe occur only rarely at lagoon; probably because Snipe are summer migrants to Australia, and salt meadow rarely holds water in this season.

Black-tailed Godwit *Limosa limosa*

Rare spring-summer migrant in region. Occur in low numbers at Salt Lagoon in most years (PB), but only 2 records with dates: 10 on 24/10/98 (GBR 1998); 1 with Banded Stilts, 12/12/00 (MHe). Usually on shores and spits on E side, but if water low and mudflats exposed can be anywhere around lagoon (PB).

Flocks of similar size (10-11 birds) observed between Feb. and Oct. 1998 in various parts of the Swan Bay-Queenscliff-Lake Victoria system, including Salt Lagoon: probably a single mobile flock as the species rare in Geelong region, and large flocks and overwintering unusual (GBR 1998). These records demonstrate wader movements between Duck Island in Swan Bay, Lake Victoria, Freshwater Lake, Sand Island and the Salt Lagoon.

State significance

One count at Salt Lagoon more than 5% of the estimated minimum Victorian population. In Victoria, Black-tailed Godwits occur in low numbers and distribution restricted; Salt Lagoon one of few sites where occurrence semi-regular.

Marsh Sandpiper *Tringa stagnatilis*

Spring-summer migrant in region, but 2/3 records and highest count at lagoon in winter, when population consists largely of first-year birds from previous breeding season in northern hemisphere: 1 on 1/7/89 (WC); 1 on 28/1/96 (WC); 22 on 21/6/98 (WC). Occur on shores with exposed mud and shallow water; mainly NE shore of lagoon, and N inlet when water present (DK). Birds observed in June 1998 resting on shore; no feeding observations.

State significance (winter)

In 1998 Winter Wader Count, Salt Lagoon held more than 5% of estimated minimum population in Victoria. This is remarkable as a winter count: population estimates based on summer counts, which are considerably higher. During this count, numbers on Bellarine Peninsula were highest ever recorded; suggests successful breeding in 1997. Although lagoon used only occasionally by Marsh Sandpipers, it may be important in region as additional habitat when high numbers of adults and young birds return to Australia from nesting in the northern hemisphere.

Common Greenshank *Tringa nebularia*

Spring-summer migrant in region. Recorded occasionally at lagoon. Usually in low numbers (≤15 birds), but two high counts in 1989 and one in 2002. One high count in winter when population consists largely of first-year birds from previous breeding season in northern hemisphere: 110 on 1/7/89 (WC); 250 on 20/10/89 (VG); flock of 60, 22/10/02 (RHL, MHe). Occur mainly on NE shore of lagoon on exposed mud and in shallow water; also on N inlet and SW shore when shallow water or wet mud present (DK). Flock of 60 observed in Oct. 2002 feeding and resting in shallows along lagoon shore.

National significance

The count of 250 in Oct. 1989 exceeded 1% of the estimated minimum population in Australia (Watkins 1993). The winter count in the same year was also remarkably high, and both counts probably reflected presence of high numbers of first-year birds and successful breeding in northern hemisphere in 1988. These counts were matched by unusually high numbers on Bellarine Peninsula generally. Although lagoon used only occasionally by Greenshanks, it may be important in region as additional habitat when high numbers of adults and young birds return to Australia from nesting in the northern hemisphere.

Ruddy Turnstone *Arenaria interpres*

Two records: 10 on 18/6/94 (WC); present, 14/11/99 (AVW). Spring-summer migrant in region; first record interesting as a winter count. No information on habitat use.

Birds probably mobile in Swan Bay area in winter: the 10 birds seen at Salt Lagoon on 18/6/94 had gone by 3/7/94, and 10 (possibly the same individuals) appeared at Edwards Point within this period (N Swan Bay; about 6 km S of lagoon; WC).

Red Knot *Calidris canutus*

Recorded regularly at lagoon (PB) but only 3 records with dates: 4 on 24/10/98 (GBR 1998); present, 14/11/99 (AVW); 1 on 22/10/02 (RHL, MHe). Spring-summer migrant in region. More regular and in greater numbers early in season, Sept.-Oct., when lagoon most likely to hold water (PB). Usually on shores and spits on E side, but if mudflats exposed can occur anywhere around lagoon margins (PB). The bird observed in Oct. 2002 feeding in shallows along lagoon shore.

Red-necked Stint *Calidris ruficollis*

Regularly recorded. Spring-summer migrant in region. Highest numbers, sometimes 1000s of birds, early in spring, Sept.-early Oct. (PB), when lagoon most likely to hold water; but no dated records from this period. Later in season, highest counts: 300 on 24/10/88 (VG); 200 on 19/10/91 (VG). Numbers consistently low in summer (≤72 birds), even when lagoon and salt meadow carrying water (e.g. summer 2001-2002).

Regular records and several high counts in winter, when population consists largely of first-year birds from previous breeding season in Arctic: 119 on 26/6/88 (VG); 205 on 1/7/89 (WC); 100 on 6/7/91 (WC); 150 on 7/7/02 (MHe). In winter, numbers at lagoon can change markedly over short period, suggesting birds mobile in this season: e.g. in 1988, 119 on 26/6, 35 on 22/7 (VG).

Preference for low water levels: when high numbers present (≥100 birds), water coverage 25-75% and mudflats exposed. Feed and roost mainly on NE shore of lagoon, on shores and spits; also on N inlet when shallow water or wet mud present; if mudflats exposed, can occur all around lagoon (PB, DK).

Regional significance (winter)

In July 1989 Wader Count, lagoon had highest numbers of any site on Bellarine Peninsula and 38% of all Stints counted in that region.

Sharp-tailed Sandpiper *Calidris acuminata*

Recorded occasionally. Spring-summer migrant in region. In highest numbers, often in 100s, early in spring, Sept.-early Oct. (PB), when lagoon most likely to hold water; but no dated records from this period. In summer surveys, 2001-2002, 250-400 birds fed and roosted early in season in flooded salt meadow; birds left salt meadow when it dried out, and only 20-40 birds remained along lagoon shore. Demonstates mobility of species and use of ephemeral habitat; salt meadow would rarely be flooded in summer.

A few records in winter: 1 on 20/6/88 (VG); 2 on 9/7/00 (WC); 1 on 6/7/91 (WC). It is unusual for Sharp-tailed Sandpipers to be recorded in winter in region, as almost all adults and immatures leave southern Australia for that season (Lane and Jessop 1984).

Often on shores and spits on E side of lagoon; in salt meadow and saltmarsh on S side; on N inlet when shallow water or wet mud present; if mudflats exposed, can occur anywhere around lagoon (DK, PB, MHe). On 27/12/01, male displaying and chasing females on lagoon shore (Hewish 2002).

Curlew Sandpiper *Calidris ferruginea*

Irregular records. Spring-summer migrant in region. In high numbers, often in 100s, early in spring, Sept.-early Oct. (PB), when lagoon most likely to hold water; but no dated records from this period. Later in season, highest counts: 70 on 24/10/88 (VG); 300 on 9/2/89 (VG); 165 on 19/10/91 (VG).

Several records in winter, when population consists largely of first-year birds from previous breeding season in Arctic. Winter numbers usually low (≤12 birds), but one count the highest ever obtained at the lagoon: 370 on 1/7/89 (WC). In winter, numbers at lagoon can change markedly over short period, suggesting birds mobile in this season: e.g. in 1989, 12 on 26/6, 370 on 1/7 (WC).

Usually on shores and spits and in shallow water on E side of lagoon; on N inlet when shallow water or wet mud present; if mudflats exposed, can occur all around lagoon (PB, DK). No observations of feeding, but preference for low-moderate water levels suggest they feed along mudflats and in shallow water at lagoon, as they do elsewhere. When high numbers present (≥100 birds), water coverage 50-75%.

Regional significance (winter)

In July 1989 Wader Count, lagoon carried second highest numbers of any site on Bellarine Peninsula and 28% of all birds counted in that region. In that year, summer and winter numbers on Bellarine Peninsula exceptionally high overall; suggests lagoon becomes important in region as additional habitat when high numbers of adults and young birds return to Australia from nesting in the Arctic.

Pied Oystercatcher *Haematopus longirostris*

Irregular records of birds in low numbers. Present in both summer and winter. Highest counts: 23 in one group, 11/7/82 (WC); 8 on 9/7/83 (WC); 7 on 14/2/92 (VG). On 7/2/82, 11/7/82, 12/2/83, 9/7/83, 22/6/96 and 22/10/02, resting on E shore or on dry bed of lagoon (WC, DK, MHe, RHL).

Most records were from Wader Counts, timed to coincide with high tide in Swan Bay; lagoon probably used as occasional high-tide roost rather than feeding area. However no clear correlation between occurrence at Salt Lagoon and height of high tide (1.1-1.6 m).

Swan Bay-Queenscliff-Mud Islands are strongholds for Pied Oystercatchers and birds at Salt Lagoon probably come from there. The largest group recorded at Salt Lagoon occurred in winter, when Oystercatchers form flocks at Swan Bay (Barter et al. 1988).

Sooty Oystercatcher *Haematopus fuliginosus*

Rest occasionally in low numbers on lakeshore on E side (DK), but only 2 dated records: 2 on 9/4/91 (VG); 3 in 6/2/94 (WC).

Salt Lagoon probably an occasional high-tide roost for birds from Swan Bay-Queenscliff-Mud Islands, where low numbers have occurred since at least 1983 (Barter et al. 1988; Geelong Bird Reports).

Black-winged Stilt *Himantopus himantopus*

Regularly recorded, sometimes in high numbers. Highest counts: 250 on 21/6/98 (WC); 76 on 10/7/99 (WC); 72 on 14/6/02 (MHe); 89 on 28/7/02 (MHe). Recorded in all seasons, but majority of records and high counts (≥30 birds) in winter. Records infrequent in autumn, when lagoon often dry.

In surveys in 2001-2002, numbers rose gradually between Dec. and July: 11 on 27/12, 8/1; 7 on 18/1; 30 on 5/2; 22 on 7/2; 42 on 20/2; 50 on 3/5; 72 on 14/6; 58 on 7/7; 89 on 28/7 (MHe, GT, PB, DHe). Probably always present at lagoon during this period: observed on every visit independent of time of day or tide; recorded both feeding and roosting (including once before sunrise); on 7/2/02, numbers did not change over 6 hours.

Observed feeding in flooded saltmarsh and in shallow water along lagoon margins, and in very shallow water in salt meadow (until it dried out in mid-Jan.). Rested along shore and on spits in lagoon, usually in low saltmarsh. During hot weather (7/2/02), rested in shade under taller shrubs of Black-seeded Glasswort. Several previous records of birds feeding at lagoon, including the flock of 250 observed in June 1998.

Occurrence of immatures

No evidence of breeding, but lagoon provides relatively undisturbed feeding and resting area for young birds. One in juvenile plumage, 7/2/02, young of previous spring (Marchant and Higgins 1993); accompanied by 2 adults which were restless and calling constantly. One bird in immature plumage present regularly, probably same individual, 8/1/02-7/2/02.

State significance

In June 1998 Wader Count, numbers at Salt Lagoon exceeded 5% of estimated minimum population in Victoria (Watkins 1993).

Banded Stilt *Cladorhynchus leucocephalus*

Irregular records, but birds present for extended periods in 1994 and 2002. Numbers variable, sometimes high. Records up to 2001: 82 in 6/2/94 (WC); 300 on 18/6/94 (WC); 42 on 3/7/94 (WC); 49 on 28/1/96 (WC); 250 on 12/12/00 (MHe).

In surveys in 2002, numbers rose as summer progressed, then declined in autumn-winter: 300-400 on 8/1, 9/1; 400-500 on 18/1, 4/2; 600 on 5/2; 810 on 7/2; 900 on 20/2; 33 on 3/5; 190 on 14/6; 90 on 7/7 (MHe, GT, PB). Probably always present at lagoon during this period: observed on every visit independent of time of day or tide (including once before sunrise); on 7/2/02, numbers did not change for 6 hours, while birds completed several cycles of feeding and resting.

Banded Stilts prefer shallow hypersaline wetlands (Lane 1987). Salt Lagoon always highly saline, even when water level high, and thus usually suitable for Stilts if water present. Stilts occur on shores and spits on E side and in SW section of lagoon; also in N inlet when water present (DK); if mudflats exposed, birds can occur anywhere around lagoon (PB). In summer 2002 when lagoon at capacity, Stilts crowded up against shoreline in shallow water; often fed while swimming; 5 roosted in dry saltmarsh on lakeshore on 8/1/02, an unusual occurrence. As water receded, moved further out into lagoon, particularly in still water off lee shores.

Stilts recorded feeding on Brine Shrimps in Moolap Saltworks in Geelong region (Pescott 1983), but only one outbreak of Brine Shrimps at Salt Lagoon in 20 years' monitoring (Oct. 1989), and Stilts not present at that time (DK).

Banded Stilts periodically leave coast of southern and eastern Australia, and move to arid inland after flooding to breed in extensive system of salt lakes (Hewish 1989; Bellchambers and Carpenter 1990; C. Minton, pers. comm.). High numbers at Salt Lagoon coincided with return of adults and young birds to coast in 1994 and 2001 (Wader Count results). Highest counts at lagoon when numbers high overall on Bellarine Peninsula; birds at lagoon possibly overflow from usual sites.

State significance

In Feb. 2002, numbers at Salt Lagoon exceeded 5% of estimated minimum population in Victoria (Watkins 1993). Banded Stilts of restricted distribution in Geelong region: although

Salt Lagoon used irregularly by Stilts, it is important in region as additional habitat when high numbers of adults and young return from nesting inland.

Red-necked Avocet *Recurvirostra novaehollandiae*

Irregular records, but birds present for extended periods in 1993-1994 and 2002. Numbers variable: 200 in Oct. 1989 (DK); 73 on 17/6/93, 27/6/93 (DK, WC); 137 on 6/2/94 (WC); 95 on 18/6/94 (WC); 46 on 3/7/94 (WC); 170 on 30/6/96 (WC); 68 on 21/6/98 (WC); 1 on 18/1/02 (MHe, GT); 30 on 14/6/02 (MHe); 37 on 7/7/02 (MHe); 70 on 28/7/02 (MHe, DHe); 12 on 22/10/02 (MHe, RHL).

Several observations of feeding: feeding by swimming and up-ending on 17/6/93, 7/7/02 (DK, MHe); feeding over entire area of lagoon, 18/6/94 (WC). Feed in shallow water, rest on shores and spits, often on E side of lagoon (DK, PB).

In Oct. 1989, outbreak of Brine Shrimps at Salt Lagoon for only time in 20 years' monitoring; large numbers of Avocets moved in to feed (DK). Brine Shrimps recorded as food source for Avocets at Port Hedland, WA (Lane 1987).

Red-necked Avocets periodically leave coast of southern and eastern Australia and move inland after flooding, presumably to breed (Lane 1987; Hewish 1990). The records at Salt Lagoon coincided with return of adults and young birds to coast in 1989, 1993-1994, 1996 and 1998 (Wader Count results).

Regional significance

Salt Lagoon carried second highest numbers of any site on Bellarine Peninsula in Winter Wader Counts in 1993, 1994, 1996 and 1998. Avocets of restricted distribution in Geelong region. Although lagoon used irregularly by Avocets, it is important in region as additional habitat when high numbers of adults and young return from nesting inland.

Red-capped Plover *Charadrius ruficapillus*

Regularly recorded, sometimes in moderate numbers. Present in all seasons, but highest counts in autumn-winter: 43 on 10/4/92 (VG); 60 on 27/6/93, 30/6/96 (WC). Occurrence apparently independent of water level: recorded when lagoon dry (10/4/90, 19/2/91) and at capacity (20/10/89, 27/12/01).

In surveys in 2001-2002, numbers increased between summer and winter: 3 on 27/12; 9 on 7/2; 19 on 20/2; 35 on 28/7 (MHe). When water level high, birds fed and roosted on small area of cracked mud on SE shore of lagoon. As water receded, some birds still in this area,

apparently a favoured roost-site sheltered by the elevated roadway; other birds moved onto sandy margins and spits around E and S shores to feed and roost.

Breeding

On 20/2/02, 1 chick ran away through saltmarsh, adult pair gave sharp piping calls and tried to distract observer by running away; another pair behaved in same manner, but no chick seen (MHe).

Lesser Sand Plover *Charadrius mongolus*

Rare: present, 22/10/99 (Atlas 2). Spring-summer migrant in region. Birds probably visited from Swan Bay-Queenscliff-Mud Islands where occur in moderate numbers (Barter et al. 1988).

Black-fronted Dotterel *Elseyornis melanops*

A few records, in low numbers: 1 on 1/7/89 (WC); 2 on 27/6/93 (WC); 5 on 6/2/94 (WC). Occur singly or in small groups in saltmarsh on SE shore of lagoon (DK).

This habitat unusual as birds favour fresh water (Pescott 1983), but in some other parts of Geelong region regularly use saltmarsh and near-coastal saline wetlands (Hewish et al. 1999).

Masked Lapwing *Vanellus miles*

Regularly recorded, in moderate numbers. Highest counts: 42 on 7/2/82 (WC); 38 on 18/6/90 (VG); 40 on 7/7/90 (WC); 35 on 13/2/01 (WC). Present in all seasons and high counts (>30 birds) in all seasons except spring. Often present when lagoon dry, sometimes in high numbers (e.g. 7/2/82), resting on mud or salt deposits on lagoon bed. In surveys in summer 2001-2002, when water level high, present on every visit, up to 8 birds. When lagoon full, fed and rested in flooded salt meadow and in saltmarsh on lagoon shore. When water receded, moved onto exposed muddy shores and dry saltpan of northern inlet: flock of 28, 28/7; 22 on 22/10 (MHe, DHe, RHL).

Pacific Gull *Larus pacificus*

Regularly recorded, usually in low numbers. Highest counts: 6 on 26/6/88 (VG); 15 on 21/10/92 (VG); 7 on 25/1/98 (RMc). Records in all seasons. Regularly rest on shore (DK); large numbers on dry lagoon on 7/2/82 (WC). On 7/7/02, 2 adults and an immature used lagoon as night-time roost, flying in from sea at dusk and settling in different areas around lagoon shore (MHe). However, not known for most other individual records whether birds at lagoon or flying over from sea or beach.

Conservation status

In Vic., Lower Risk, Near Threatened (Victorian Dept. of Natural Resources and Environment 2000).

Silver Gull *Larus novaehollandiae*

Regularly recorded, often in high numbers. Highest counts: 130 on 14/10/87 (VG); 120 on 22/7/88 (VG); 350 on 20/10/89 (VG). Recorded in all seasons. Use lagoon bed as resting area (DK); under these circumstances, water level irrelevant, and often present when lagoon dry, sometimes in high numbers (e.g. 7/2/82, 9/4/91). However, also observed using lagoon for early-morning and late-afternoon feeding and as a night-time roost. On 7/7/02, 20 flew in from sea at dusk, fed from water surface at lagoon for short time; as darkness fell, moved to roost on shore with flock of Chestnut Teal (MHe). On 20/2/02, 56 fed vigorously at edge of flock of Banded Stilts just after sunrise (07:00 EDST); flew out in small groups and all gone by 08:00 (MHe).

Crested Tern *Sterna bergii*

Occasional records, birds in low numbers. Highest counts: 4 on 26/6/88 (VG); 12 on 9/4/91 (VG). Other records: 7/2/82 (WC), 24/10/88 (VG), 14/2/92 (VG), 10/4/92 (VG). Use lagoon bed as resting area (WC). Probably do not feed there, and water level largely irrelevant; recorded when lagoon dry (7/2/82, 9/4/91) or at very low level (26/6/88, 10/4/92). Lagoon may be less attractive when at capacity, as mudflats and shores used for resting limited in extent.

Conservation status

In Vic., Lower Risk, Near Threatened (Victorian Dept. of Natural Resources and Environment 2000).

Whiskered Tern *Chlidonias hybridus*

28 patrolling and dipping over lake surface, 20/9/02 (MHe, DHe); only 1 remaining, 22/10/02 (MHe, RHL).

Orange-bellied Parrot *Neophema chrysogaster*

Autumn-winter visitor to mainland Australia from breeding grounds in Tasmania. 1 collected at St Leonards, possibly at or near Salt Lagoon, by N.J. Favaloro, 1/1/58; skin number B17317, National Museum of Victoria (JS). An unusual summer record.

No recent observations despite presence around lagoon shores and in salt meadow of Beaded Glasswort, Grey Glasswort and Southern Sea Heath, known food plants for Parrots (Loyn et al. 1986). Although saltmarsh in good condition and some species flowering in summer 2002, apparently not always so (King 1987). Intensity of flowering and seeding may depend on water levels and salinity.

Conservation status

Endangered nationally (Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia).

Significance

All areas of suitable habitat are of potential value and should be preserved (Barter et al. 1988), especially those with abundant Grey Glasswort, which is of restricted distribution around Port Phillip Bay and produces seed in July-August when food for Parrots is limited (Yugovic 1984; Loyn et al. 1986). The lagoon should be monitored regularly in winter, especially between April and August in years when any of the three major saltmarsh plants are carrying flowers or seed. The lagoon is close to other major wintering areas for Parrots, Swan I., Sand I. and Swan Bay, and interchange could occur (King 1987).

Striated Fieldwren *Calamanthus fuliginosus*

Regularly observed in low numbers (1-2 birds) during surveys in Dec.-July, 2001-2002. Often heard and seen singing in shrub thickets along SE shore of lagoon (MHe, GT). No previous records. Not known if occurrence at lagoon sporadic, or if observations not documented in past.

White-fronted Chat *Epthianura albifrons*

Regularly recorded around lagoon margins. Highest counts: 14 on 14/10/87, 18/6/90 (VG); 8 on 8/1/02 (MHe). Recorded in all seasons, but only once in autumn. No records when lagoon known to be dry. In summer surveys, 2001-2002, small groups of 1-3 birds around lagoon shores in saltmarsh, among low shrubs, and on bare areas on shore, along tracks and in salt meadow.

Welcome Swallow *Hirundo neoxena*

Occasionally recorded around and over lagoon. Highest counts: 20 on 19/10/91 (VG); 20 on 27/12/01 (MHe); 17 on 7/2/02 (MHe). Partial spring-summer migrant in region, and all records except one in those seasons. In summer surveys, 2001-2002, observed regularly in

small flocks hunting over lagoon, saltmarsh and sedge beds. On 27/12/01 and 8/1/02, hunting in swarms of midges over saltmarsh.

Little Grassbird *Megalurus gramineus*

Occasionally recorded in low numbers around lagoon margins. Usually 1-2 birds recorded, but 5 on 7/2/02 (MHe). Observed in all seasons, and possibly resident. In summer surveys, 2002, seen and heard in extensive beds of Chaffy Saw-sedge and Prickly Spear-grass, and occasionally perched in nearby shrub thickets.

Golden-headed Cisticola *Cisticola exilis*

1 on 26/6/89 (VG); 1 on 19/10/91 (VG); 4 in large bed of Sea Rush on S shore of lagoon, 7/2/02 (MHe). Not known if occurrence at lagoon sporadic, or if observations not documented in past.

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Appendix 1

SURVEY CODES, OBSERVER CODES AND ABBREVIATIONS

Survey codes	
Atlas 1	RAOU Atlas of Australian Birds, 1977-1981
Atlas 2	Birds Australia Atlas of Australian Birds, 1998-2001
AVW	Atlas of Victorian Wildlife, Dept of Natural Resources and Environment, Victoria.
OBP count	RAOU/Birds Australia Orange-bellied Parrot Count
VG	RAOU VicGroup Wetland Survey
WC	Wader Count (RAOU and Australasian Wader Studies Group)
WD	Wetlands Database, Dept of Natural Resources and Environment, Victoria, 2002, unpublished information.
Observer codes	
BellBOCA	Bellarine Branch of the Bird Observers Club of Australia
BSt	Bill Stent
CMo	Craig Morley
DHa	Denise Hanson
DHe	Dean Hewish
DK	Dave King
GS	Graeme Stockton
GT	Graeme Tribe
IB	Ian Borrie
JB	John Bottomley
JHi	Jodie Hill
JS	Jonathan Starks
JW	Bird list for Lake Victoria compiled by the late Jack Wheeler
MAC	Margaret Cameron
MHe	Marilyn Hewish
MW	Mike Weston
PB	Peter Bright
PC	Polly Cutcliffe
RHL	Richard Loyn
RMc	Rob Mackenzie
SH	Sue Hill
SL	Sue Longmore
TD	Tim Dolby
TP	Trevor Pescott

Survey codes	
WB	Wendy Borrie
Abbreviations	
JAMBA	Japan-Australia Migratory Birds Agreement
CAMBA	China-Australia Migratory Birds Agreement
GBR	Geelong Bird Report
NRE	Dept of Natural Resources and Environment, Victoria
RAOU	Royal Australasian Ornithologists Union (now Birds Australia)
AWSG	Australasian Wader Studies Group
VWSG	Victorian Wader Study Group
GFNC	Geelong Field Naturalists Club

Appendix 2

LAKE VICTORIA: ANNOTATED LIST OF LAND BIRDS (73 SPECIES)

Sources of information are in Chapter 1; survey codes, observer codes and abbreviations are in Appendix 1; references are in Chapter 5.

Cattle Egret *Ardea ibis*

2 feeding with sheep on slope above E end of lake, 22/10/02 (RHL, MHe).

Black-shouldered Kite *Elanus axillaris*

Occasional records; no seasonal pattern evident, but few records overall. Present at golf course at some time within period 1/9/80-1/3/81 (Atlas 1); present at lake, 4/3/98, 20/2/99, 3/11/99, 11/8/01 (PB, BellBOCA, Atlas 2); 1 hovering over grassland, NE shore of lake, 18/1/02 (MHe); 1 perched in Shrubby Glasswort at W end of lake, 10/2/02 (MHe, SL).

Brown Goshawk *Accipiter fasciatus*

Occasional records; no seasonal pattern evident, but few records overall. Most records indicate presence only: but 1 on 6/5/94 (RMc); 1 on 9/12/01, perched in tree on SE side of lake (MHe).

Breeding

Breeding record at golf course, at some time within period 1/9/80-1/3/81, no details (Atlas 1). Interestingly, Charles Belcher (1914) reported finding a nest with 2 eggs at lake on 24 Sept., no year given but in late 1800s.

Wedge-tailed Eagle *Aquila audax*

Recorded from lake before 1984, no details (JW); 1 flew over golf course, at some time within period 1/9/80-1/3/81 (Atlas 1).

Little Eagle *Hieraaetus morphnoides*

Present, 27/8/94 (PB, BellBOCA); 1 on 24/7/02 (MHe, BSt).

Brown Falcon *Falco berigora*

Occasional records: present at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); present on 28/7/84 (MAC); 1 on 7/9/85 (MAC); present, 3/11/99, 7/4/00 (PB, BellBOCA, Atlas 2).

Australian Hobby *Falco longipennis*

Occasional records of single birds: 24/4/99 (RMc), 27/10/99 (GB), 29/1/01 (Atlas 2), 7/7/02 (DHe, MHe). Hunt among flocks of waders and swallows. On 27/10/99, 1 put up flock of Red-necked Stints (GB). On 19/4/00, 1 flushed Red-necked Stints from S shore and attacked a bird which became separated from others; Stint evaded capture; later, a Hobby, probably the same one, attacked Swallows, but gave up after 3 or 4 attempts (RMc). On 7/7/02, 1 flew out from shore, flying low and at speed over water, attacked Swallow 500 m out in centre of lake (DHe, MHe).

Black Falcon *Falco subniger*

2 over fields near lake on 16/7/78 (King and Conole 1978).

Peregrine Falcon *Falco peregrinus*

Present on 13/11/83 (MAC).

Nankeen Kestrel *Falco cenchroides*

Occasional records; no seasonal pattern evident, but few records overall. Present on golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); 1 on 7/9/85 (MAC); present, 23/5/93, 1/2/98 (PB, BellBOCA); 1 on 26/6/98 (MAC); present, 3/11/99 (PB, BellBOCA); 1 pursuing Welcome Swallow, 22/10/02 (RHL).

Rock Dove *Columba livia*

Present, 23/5/93 (PB, BellBOCA).

Spotted Turtle-Dove *Streptopelia chinensis*

Recorded regularly since 1980-1981, when present at golf course (Atlas 1). Present in all seasons. Most records indicate presence only. Records with counts: 2 on 3/2/96 (RMc); 1 calling from near Moonah thicket on S shore of lake, 13/1/02 (MAC, MHe); single birds calling from trees on SE lakeshore, 18/1/02, 3/2/02 (MHe).

Common Bronzewing *Phaps chalcoptera*

Recorded from lake before 1984, no details (JW).

Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*

Occasional records since 1999, mainly in autumn-winter: present, 29/8/99 (PB, BellBOCA); present, 19/3/00 (Atlas 2); 37 flying W, 19/4/00 (RMc); present, 3/6/00 (Atlas 2); 7 flew into pine tree near golf course and fed on pine seeds, 3/2/02 (MHe).

Breeding

Flock of 7 including 1 young begging persistently and being fed on pine seeds by adult, 3/2/02 (MHe). Cockatoos did not necessarily nest near lake, as juveniles are strong fliers and can travel far from nest-site after fledging.

Records at Lake Victoria began in 1999, when Black-Cockatoos expanded range along coast E of Torquay and into the southern and eastern Bellarine Peninsula (Bottomley 2002).

Galah *Cacatua roseicapilla*

Present at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); 2 on 17/6/89 (VG); present, 29/7/01 (TP), 24/7/02 (MHe, BSt).

Sulphur-crested Cockatoo *Cacatua galerita*

5 on 7/9/85 (GBR 1985).

Crimson Rosella *Platycercus elegans*

Present at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); present, 26/7/98 (PB, BellBOCA).

Eastern Rosella *Platycercus eximius*

Recorded from lake before 1984, no details (JW); present at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1).

Red-rumped Parrot *Psephotus haematonotus*

3 on 3/4/89 (VG).

Pallid Cuckoo *Cuculus pallidus*

Recorded from lake before 1984, no details (JW).

Fan-tailed Cuckoo *Cacomantis flabelliformis*

Records irregular; more frequent since 1998, perhaps because observations documented for Birds Australia Atlas and BellBOCA excursions. Spring-summer migrant in region, but records cover all seasons except autumn, suggesting woodland around lake is a regular overwintering area. Winter records: 27/8/94, 26/7/98, 11/7/99, 29/8/99, 1/7/01, 24/7/02 (PB, BellBOCA, GBR 1999, Atlas 2, MHe, BSt).

Few records with counts: single birds, 13/9/98 (GBR 1998), 21/12/98 (RMc), 11/7/99 (GBR 1999), 24/7/02 (MHe, BSt).

Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*

Records irregular; more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Spring-summer migrant in region, but records cover all seasons except autumn. Winter records at lake: 28/7/84 (MAC), 19/8/00 (Atlas 2); may have been overwintering birds or early arrivals; often arrive in region in Aug.

Few records with counts: 2 in shrubs at edge of woodland on SE lakeshore, 13/1/02 (MAC, MHe); 1 calling from Moonah copse by S lakeshore, 3/2/02 (MHe).

Shining Bronze-Cuckoo *Chrysococcyx lucidus*

Records irregular. Spring-summer migrant in region, but records cover all seasons except autumn, suggesting woodland around lake is an overwintering area. Winter records: 27/7/85 (MAC), 1/7/01 (Atlas 2). Few records with counts: 3 on 27/7/85 (MAC); single birds, 3/2/96 (RMc), 9/12/01 (MHe), 13/1/02 (MAC, MHe).

From little information available, woodland in golf course appears to be preferred habitat.

Southern Boobook *Ninox novaeseelandiae*

Recorded from lake before 1984, no details (JW).

Barn Owl *Tyto alba*

Present at golf course, at some time within period 1/9/80-1/3/81; no details (Atlas 1).

Tawny Frogmouth *Podargus strigoides*

Breeding: nested in same pine tree on golf course in spring in 3 consecutive years, 1978-1980 (Atlas 1).

White-throated Needletail *Hirundapus caudacutus*

100 flying W, 5/3/99 (RMc).

Laughing Kookaburra *Dacelo novaeguineae*

Recorded from lake before 1984, no details (JW).

Sacred Kingfisher *Todiramphus sanctus*

Present at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1).

Superb Fairy-wren *Malurus cyaneus*

Regularly recorded; around lake margins, wherever shrubs and adjacent open areas. Highest counts: 46 on 17/6/89 (VG); 30 on 10/2/91 (VG); 32 on 18/4/91 (VG); 50 on 6/5/95 (RMc). Present throughout year. In surveys in 2001-2002, small parties present on every visit: in and around coastal woodland, along banks and tracks near SE ponds, in golf course and on lakeshore; in Shrubby Glasswort and adjacent low saltmarsh and bare ground at W end of lake, 13/1/02 (MAC, MHe).

Breeding: breeding record at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); nest with 3 pin-feathered young at lake, 21/10/95 (RMc).

Spotted Pardalote *Pardalotus punctatus*

Records irregular; more frequent since 1998, perhaps because observations documented for Birds Australia Atlas and BellBOCA excursions. Observed in all seasons. Only 2 records with counts: single birds, 24/4/99 (RMc), 20/2/00 (MHe, MAC). No information on habitat use, but most likely occur in woodland on S side of lake.

Striated Pardalote *Pardalotus striatus*

Recorded from lake before 1984, no details (JW).

White-browed Scrubwren *Sericornis frontalis*

Regularly recorded and present in all seasons. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Highest counts: 4 on 7/9/85, 22/5/98 (MAC, RMc); 10 on 6/5/95 (RMc); 6 on 24/4/99 (RMc).

Some information on habitat use: present at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); common in Shrubby Glasswort on S side of lake, 19/4/00 (RMc); in surveys in 2002, numerous in Moonah thicket on S shore of lake, in dense coastal woodland on SE shore, and in Shrubby Glasswort on SW shore (MHe, RHL, MAC).

Brown Thornbill *Acanthiza pusilla*

Regularly recorded and present in all seasons. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Highest counts: 50 on 10/2/91 (VG); 18 on 18/4/91 (VG); 16 on 28/6/92 (VG); 10 on 6/5/95, 24/4/99 (RMc).

Some information on habitat use: 10 in Shrubby Glasswort, 24/4/99 (RMc); in surveys in 2002, numerous in Moonah thicket on S shore and in dense coastal woodland on SE shore, and present in shrubs by ponds on SE side of lake (MHe, RHL, MAC, GT).

Yellow-rumped Thornbill *Acanthiza chrysorrhoa*

Regularly recorded and present in all seasons, though unaccountably absent in surveys in 2001-2002. Highest counts: 4-5 on 16/7/78 (King and Conole 1978); 14 on 18/4/91, 20/10/91 (VG); 3 on 20/2/00 (MHe, MAC).

Little information on habitat use: 4-5 near golf course on 16/7/78 (King and Conole 1978); at golf course at some time within period 1/9/80-1/3/81 (Atlas 1); on grassy area near Emily Street entrance, 28/7/84 (MAC).

Striated Thornbill *Acanthiza lineata*

Present, 23/5/93; no details (PB, BellBOCA).

Red Wattlebird *Anthochaera carunculata*

Regularly recorded and present in all seasons. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Highest counts: 8 on 6/5/95 (RMc); 5 on 5/3/99 (RMc); 4 on 24/4/99 (RMc). In surveys in 2001-2002, recorded around houses, in coastal woodland, and in golf course on SE shore.

Spiny-cheeked Honeyeater *Acanthagenys rufogularis*

Regularly recorded. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Possibly less regular in winter. In BellBOCA surveys and visits for this study, 1993-2002, observed on 5/9 visits in summer, 3/6 in autumn, 1/5 in winter, 2/5 in spring. Reporting rate too low in Birds Australia Atlas surveys to draw conclusions. Those few records with counts indicate low numbers, 1-2 birds. In surveys in 2001-2002, calling from woodland and golf course on SE shore.

Yellow-faced Honeyeater *Lichenostomus chrysops*

An autumn visitor to lake surrounds, probably during passage movements: 1 on 24/4/99 (RMc); present, 25/4/99 (Atlas 2); present, 28/4/99 (Atlas 2); 2 on 15/3/00 (RMc); 12 flying along S side of lake, 19/4/00 (RMc). Concentration of records in 1999-2000, when lake visited on many occasions (RMc; Birds Australia Atlas).

Movements through area in other years may have been missed if they occurred on only a few days in each year. A dead bird found on lakeshore on 16/7/78 (King and Conole 1978) indicates that Honeyeaters occurred around lake before 1999-2000.

Singing Honeyeater *Lichenostomus virescens*

Recorded occasionally; no seasonal pattern evident, but few records overall. Present, 23/5/93, 26/7/98, 29/3/99, 26/3/00, 19/4/00, 9/12/01, 3/2/02 (PB, BellBOCA, Atlas 2, RMc, MHe). Few records with counts or information on habitat use: 1-2 birds in coastal woodland and dense shrubs on S shore of lake, 19/4/00, 9/12/01, 3/2/02 (RMc, MHe).

Crescent Honeyeater *Phylidonyris pyrrhoptera*

Present, 10/6/00 (Atlas 2). Local movements from wet forests into more open habitats in autumn-winter (Emison et al. 1987).

New Holland Honeyeater *Phylidonyris novaehollandiae*

Regularly recorded; present throughout year. Highest counts: 12 on 10/2/91 (VG); 10 on 5/3/99 (RMc); 5 on 20/2/00 (MHe, MAC); 5 on 15/3/00 (RMc). In surveys in 2001-2002, all records from coastal woodland near Emily St entrance (MHe, RHL, MAC, GT).

Eastern Spinebill *Acanthorhynchus tenuirostris*

1 on 22/5/98 (RMc); visit open areas in autumn-winter (Pescott 1983).

Scarlet Robin *Petroica multicolor*

Recorded from lake before 1984, no details (JW). No records from other sources in period covered by this study, 1980 onwards.

Flame Robin *Petroica phoenicea*

Occasional records in autumn, when birds visit lowlands and open areas (Pescott 1983). 1 brown bird, female or immature, 30/4/88 (VG); 2 on 18/4/91 (VG); present, 9/4/97 (PB, BellBOCA); 4 on 29/3/99 (2 males, 2 brown birds) (GBR 1999); present, 16/4/00 (Atlas 2); 9 on 19/4/00 (3 males, 6 brown birds) (RMc).

Concentration of records in March-April suggests birds move through during dispersal but do not spend winter at lake. Observed on ground and perched in shrubs in open areas around lake: on shore, sandspits, banks, and in grassy area near Emily Street entrance (RMc, PB, BellBOCA).

Eastern Yellow Robin *Eopsaltria australis*

Occasional records; too few to discern seasonal patterns. Present, 9/4/97, 3/11/99 (PB, BellBOCA); 1 on 20/2/00 (MHe, MAC); 4 on 29/7/01 (TP); 1 on 7/1/02 (MHe, RHL), 13/1/02 (MAC, MHe), 24/7/02 (MHe, BSt). Little information on habitat use: in July 2001, Jan. and July 2002, birds in Moonah thicket on lakeshore, W end of golf course.

Breeding: breeding record at golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); probably in coastal woodland.

Golden Whistler *Pachycephala pectoralis*

Few records: heard on 7/9/85 (MAC); 1 on 26/6/98 (MAC); 1 heard in Moonah thicket on lakeshore, W of golf course, 3/2/02 (MHe).

Rufous Whistler *Pachycephala rufiventris*

Present, 14/11/98; no details (PB, BellBOCA).

Grey Shrike-thrush *Colluricincla harmonica*

Recorded from lake before 1984, no details (JW).

Magpie-lark *Grallina cyanoleuca*

Regularly recorded in low numbers; present in all seasons. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Most records indicate presence only, few counts available: 4 on 5/3/99 (RMc); 5 on 24/4/99 (RMc); 3 on 20/2/00, 3/2/02 (MHe, MAC).

Little information on habitat use: present on golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); in surveys in 2002, in open areas around houses on SE shore, golf course, and fields at E end of lake.

Grey Fantail *Rhipidura fuliginosa*

Regularly recorded in low numbers, up to 5 birds. Visitor to lake in spring-autumn, no winter records: earliest record in spring, 7 Sept. (1985; MAC); latest in autumn, 6 May (1995, 2000; RMc, Atlas 2). Little information on habitat use: in summer surveys, 2001-2002, in coastal woodland on SE shore, and several birds in Moonah thicket on S shore of lake (MHe, RHL, MAC, SL).

Breeding: breeding record at golf course at some time within period 1/9/80-1/3/81; no details (Atlas 1).

Willie Wagtail *Rhipidura leucophrys*

Regularly recorded in low numbers; present in all seasons. Most records of 1-3 birds; but 14 on 18/4/91 (VG), 6 on 3/2/02 (MHe). In surveys in 2001-2002, in open areas along S shore of lake: grassy area near Emily St entrance, golf course, tracks and bare sandy areas beside SE and SW ponds, field at W end of lake. On 3/2/02, 2 moving up and down sandspit at E end of lake, apparently hunting for insects.

Breeding: breeding record at golf course at some time within period 1/9/80-1/3/81 (Atlas 1).

Black-faced Cuckoo-shrike *Coracina novaehollandiae*

A few records: present on golf course at some time within period 1/9/80-1/3/81 (Atlas 1); present, 9/4/97 (PB, BellBOCA); present, 3/11/99 (PB, BellBOCA). No information on numbers or habitat use.

Dusky Woodswallow *Artamus cyanopterus*

Pair with 3 immatures at golf course at some time within period 1/9/80-1/3/81; suspected that birds nested in Cypress tree (Atlas 1).

Grey Butcherbird *Cracticus torquatus*

Regularly recorded in low numbers, 1-2 birds; present in all seasons. In surveys in 2001-2002, recorded on most visits, calling from mixed woodland near Emily Street entrance and from several areas of Moonah woodland in golf course. 1 immature bird observed on 21/10/87 (VG).

Australian Magpie *Gymnorhina tibicen*

Regularly recorded, sometimes in moderate numbers; present in all seasons. Highest counts in autumn-winter: 21 on 17/6/89 (VG); 11 on 12/5/98 (RMc); 9 on 19/4/00 (RMc). In surveys in 2001-2002, in grassy area near Emily Street entrance and on golf course fairways; 3 perched in treetop in Moonah thicket, 3/2/02.

Pied Currawong *Strepera graculina*

Recorded from lake before 1984, no details (JW).

Australian Raven *Corvus coronoides*

Recorded from lake before 1984, no details (JW); present, 1/8/99 (Atlas 2); present, 20/4/00 (Atlas 2).

Little Raven Corvus mellori

Regularly recorded, single birds to small flocks; present in all seasons. Highest counts in late summer: 19 on 4/2/89 (VG); 12 on 10/2/91 (VG); 24 on 3/2/02 (MHe). In surveys in 2001-2002, in golf course, and in coastal woodland and other trees on SE side of lake. Often at water's edge: 2 took off from shore of pond SE of lake, 13/1/02 (MAC,MHe); 3 walked along shore and through shallow water in same pond, 18/1/02 (MHe, GT); 3 walked on NE lakeshore, 3/2/02 (MHe).

Probable breeding: 1 young bird (dark eyes, downy flanks) perched on fence and gave constant begging calls, no adults seen, 9/12/01 (MHe); on 18/1/02, 2 adults and 1 young bird, possibly the same individual, in same area (MHe, GT).

Ravens not identified to species in several VG surveys; most probably Little Ravens, as Australian and Forest Ravens rare near Geelong (Pescott 1983; Lingham 2001).

Skylark *Alauda arvensis*

Regularly recorded; present in all seasons. Highest counts: 12 on 20/10/91 (VG); 8 on 28/6/92 (VG); 6 on 23/10/92 (VG). Little information on habitat use: in surveys in 2001-2002, calling from grassy area near Emily Street entrance and from fields on NE shore of lake (MHe, RHL).

Richard's Pipit *Anthus novaeseelandiae*

Occasional records; too few to discern seasonal patterns. Only records with counts: 2 on 13/10/90 (VG); 1 on 18/4/91 (VG); 1 on sandy lakeshore among sparse low saltmarsh, 20/9/02 (MHe). Probably also use short-grass areas as they do elsewhere.

House Sparrow *Passer domesticus*

Present in area since at least 1983 (MAC), but records from lake surrounds uncommon: 1 on 13/6/90 (VG); present, 27/6/99 (Atlas 2); 1 on 20/2/00 (MHe, MAC); present, 29/1/01 (Atlas 2), 3/5/02 (MHe). Probably more common in housing estates behind lakeshore.

Red-browed Finch *Neochmia temporalis*

Occasionally recorded around lake in low numbers, up to 10 birds. No records in spring, but seasonal pattern not clear as few records overall. Apparently more numerous at golf course, but no recent records there: flock of 15 on golf course, 16/7/78 (King and Conole 1978); in period 1/9/80-1/3/81, often in flocks of 20-30 on golf course, feeding on grass seeds (Atlas 1). Occasionally occur around lakeshore: 2 in Shrubby Glasswort, 19/4/00 (RMc); in mixed coastal woodland at E end of lake, 12/12/00 (2 birds; RMc), 29/7/01 (10 birds; TP).

Breeding: breeding record at golf course at some time within period 1/9/80-1/3/81 (Atlas 1).

European Greenfinch *Carduelis chloris*

Occasionally recorded in low numbers, 1-2 birds. Apparently a spring-autumn visitor to lake, but this needs confirmation as few records overall; no winter records. Little information on habitat use: present on golf course, at some time within period 1/9/80-1/3/81 (Atlas 1); in summer surveys, 2002, calling from coastal woodland on SE shore of lake, and Moonah thicket on S shore.

European Goldfinch *Carduelis carduelis*

Regularly recorded, single birds to small flocks; present in all seasons. Highest counts: 10 on 7/9/85 (MAC); 20 on 18/4/91 (VG); 8 on 6/5/95 (RMc). Little information on habitat use: in surveys in 2001-2002, in coastal woodland and shrubs on SE lakeshore, and often perched and flying around in area of Moonah thicket and adjacent Shrubby Glasswort.

Mistletoebird *Dicaeum hirundinaceum*

Occasional records of 1-2 birds: mainly in autumn-winter, Apr.-Aug. Probably attracted to Wire-leaf Mistletoe *Amyema preissii* which parasitises Wirilda Wattle at the lake (SL). This Mistletoe produces fruit in autumn (Sue Longmore, pers. comm.) and is a food source for Mistletoebirds at Swan Island and Edwards Point in the Swan Bay system (Pescott 1983).

Rufous Songlark *Cinclorhamphus mathewsi*

8 on 15/10/88 (VG). Irregular spring-summer migrant to Geelong region (Pescott 1983).

Brown Songlark *Cincloramphus cruralis*

Several records in 1988-1989: 5 on 6/2/88 (VG); 4 on 30/4/88 (VG); 3 on 13/6/88 (VG); 2 on 15/10/88 (VG); 2 on 3/4/89 (VG). Irregular and irruptive in Geelong region and southern Victoria generally (Pescott 1983; Emison et al. 1987).

Silvereye *Zosterops lateralis*

Regularly recorded; occur in both spring-summer (when central and e. Victorian race *familiaris* in region) and autumn-winter (Tasmanian race *lateralis*). Most records indicate presence only, but a few moderately high counts recorded: 12 on 10/2/91 (VG); 20 on 24/4/99 (RMc); 20 on 3/2/02 (MHe).

Little information on habitat use: present on golf course at some time within period 1/9/80-1/3/81 (Atlas 1); in surveys in 2002, in woodland and shrubs by Emily Street entrance and

near ponds SE of lake, common in Moonah thicket on S shore of lake, and in Shrubby Glasswort on SW lakeshore.

Bassian Thrush *Zoothera lunulata*

1-2 birds occasionally in Moonah woodland by lake (SL).

Common Blackbird *Turdus merula*

Recorded regularly since at least 1978 (King and Conole 1978); present throughout year. Records more frequent since 1998, perhaps because observations documented for Birds Australia Atlas, BellBOCA excursions and this study. Usually 1-2 birds observed, but 7 along S shore of lake on 9/12/01 (MHe).

Described as common in golf course (King and Conole 1978); in summer surveys, 2001-2002, in woodland near Emily Street entrance, in dense shrubs near ponds SE of lake, and in Moonah thicket on S shore (MHe, MAC).

Common Starling *Sturnus vulgaris*

Regularly recorded since at least 1978 (King and Conole 1978); present throughout year. Highest counts: 12 on 15/10/88 (VG); 40 on 23/10/92 (VG); 45 on 19/4/00 (RMc). In surveys in 2001-2002, in low numbers: a few birds in grassy area near Emily Street entrance; 6 feeding on sandy shore of SE pond and 1 on lakeshore, 13/1/02 (MHe, MAC).

Common Myna *Acridotheres tristis*

Occasional records since the first in 1999: present, 3/11/99 (PB, BellBOCA), 20/2/00 (Atlas 2), 19/8/00 (Atlas 2).

Apparently new in the area, possibly responding to increased development next to lake. Not on Jack Wheeler's bird list, compiled before 1984 and including all birds noted to that time, both native and introduced. Range of Common Mynas is still expanding along south coast in Geelong region (Peter 1998; GBR 1998).

APPENDIX 3

FRESHWATER LAKE: ANNOTATED LIST OF LAND BIRDS (46 SPECIES)

Sources of information are in Chapter 1; survey codes, observer codes and abbreviations are in Appendix 1; references are in Chapter 5.

Stubble Quail *Coturnix pectoralis*

Birds recorded by call several times in Jan.-May 2002: 7/1, 18/1, 31/1, 10/2, 20/2, 17/3, 3/5 (MHe, RHL, RMc). All records from long grass in field at Clows Lane entrance. Common in Geelong region, and probably present since area cleared.

Black-shouldered Kite *Elanus axillaris*

Single birds on 7/9/85 (MAC), 17/6/89 (RMc); single birds flying low over lakeshore, 7/1/02, 3/5/02, 14/6/02, 7/7/02 (MHe, RHL). On 17/5/98, 2 birds flew up from remnant woodland and attacked and chased off 2 Brown Falcons; then 1 Black-shouldered Kite circled high up making repetitive calls (MHe, MAC). This call said to be given during defence of territory or nest (Marchant and Higgins 1993), but no nest found.

Brown Goshawk *Accipiter fasciatus*

Occasional records of single birds: 7/9/85 (MAC), 24/4/88 (MAC), 24/7/88 (MAC), 17/5/98 (MHe, MAC). On 7/1/02 and 7/7/02, single birds flushed from shrubs on lakeshore (MHe, RHL).

Little Eagle *Hieraaetus morphnoides*

Present on 24/7/88 (MAC); 1 on 3/5/02 (MHe); 2 on 14/6/02, patrolling low over lake and shore (MHe); 1 attacked by Nankeen Kestrel, 7/7/02 (DHe, MHe).

Brown Falcon *Falco berigora*

Occasional records of 1-2 birds: 2 calling on 27/6/82 (MAC); 1 on 7/9/85 (MAC); 2 on 17/6/89 (RMc); 2 were attacked and chased off by pair of Black-shouldered Kites, 17/5/98 (MHe, MAC); single birds flying over lakeshore, 9/12/01, 20/2/02, 28/7/02, 22/10/02 (MHe).

Australian Hobby *Falco longipennis*

Occasionally recorded: present on 24/4/88 (MAC); 1 on 1/6/91 (VG); 1 flying fast and low along lakeshore, 14/6/02 (MHe); 1 on 28/7/02 (MHe, DHe).

Black Falcon *Falco subniger*

1 on 7/9/85 (MAC).

Peregrine Falcon *Falco peregrinus*

Present on 24/7/88 (MAC); 1 on 25/2/02 (RMc).

Nankeen Kestrel *Falco cenchroides*

Occasional records: present on 25/7/82 (MAC); single birds on 7/9/85 (MAC), 17/6/90 (VG), 7/7/02 (MHe, DHe).

Spotted Turtle-Dove *Streptopelia chinensis*

In area in low numbers for at least last 20 years: present on 25/7/82 (MAC); 2 on 7/9/85 (MAC); 2 on 17/5/87 (RMc); present on 24/4/88 (MAC); calling near Clows Lane entrance, 20/2/02 (MHe).

Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*

14 on 26/10/02 (RMc). Cockatoos have recently expanded range into Bellarine Peninsula (Bottomley 2002).

Galah *Cacatua roseicapilla*

Occasional records of low numbers: 6 on 27/6/82 (MAC); 2 on 17/5/98 (MHe, MAC).

Eastern Rosella *Platycercus eximius*

Sometimes present in low numbers: 2 on 27/6/82 (MAC); 4 on 7/9/85 (MAC).

Fan-tailed Cuckoo *Cacomantis flabelliformis*

Present, 1/7/01, 11/8/01 (AVW); 1 calling, 26/10/02 (RMc). Spring-summer migrant in region but some birds overwinter.

Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*

Occasional records of single birds, covering all seasons: 1 on 7/9/85 (MAC); present on 25/7/93 (MAC); 1 on 17/5/98 (MHe,MAC); 1 calling from remnant woodland, 31/1/02 (MHe). Spring-summer migrant in region, but some birds overwinter, especially around wetlands (e.g. GBR 1997, 1998).

Shining Bronze-Cuckoo *Chrysococcyx lucidus*

Present, 1/7/01 (AVW). Spring-summer migrant in region but some birds overwinter.

Barn Owl *Tyto alba*

1 on 7/9/85 (MAC); no details.

Superb Fairy-wren *Malurus cyaneus*

Regular records in all seasons. Small parties around lake perimeter in dense shrubs, bracken, remnant woodland, sapling eucalypts, patches of tall weedy growth; on 7/1/02, calling from rushbeds on lakeshore (MHe, RHL); on 31/1/02, several parties seen around houses on S side of lake. Highest count: 30 on 7/9/85 (MAC). 2 adults and 2 juveniles observed, 19/11/94 (RMc).

Spotted Pardalote *Pardalotus punctatus*

2 on 17/5/98 (MHe, MAC); 1 in eucalypt plantation, 3/5/02 (MHe); 1 in remnant woodland, 14/6/02 (MHe).

White-browed Scrubwren *Sericornis frontalis*

Occasional records of birds in low numbers: present on 27/6/82 (MAC); 4 on 7/9/85 (MAC); present on 28/3/92 (MAC); 1 on 17/5/98 (MHe, MAC); calling from shrubs in remnant woodland, 20/2/02 (MHe), 22/10/02 (MHe, RHL).

Brown Thornbill *Acanthiza pusilla*

Occasional records: present on 28/3/92, 25/7/93 (MAC); 1 on 17/5/98 (MHe, MAC); 2 in shrubs in remnant woodland, 1 in shrub on NW side of lake, 31/1/02 (MHe).

Yellow-rumped Thornbill *Acanthiza chrysorrhoa*

Occasional records: 1 on 7/9/85 (MAC); present on 24/4/88 (MAC); 2 on 17/6/90 (VG); 6 on 17/5/98 (MHe, MAC); flock of 8 on track in remnant woodland, 20/2/02 (MHe).

Red Wattlebird *Anthochaera carunculata*

Occasional records: present, 29/1/01 (Atlas 2); 2 in planted eucalypts along S lake margin, 18/1/02 (MHe, GT); 1 heard from woodland at Clows Lane entrance, 31/1/02, 28/7/02 (MHe).

Spiny-cheeked Honeyeater *Acanthagenys rufogularis*

Regularly recorded in remnant woodland in 2002: 1 perched in dead tree, 18/1/02 (MHe); 2 perched in dense shrub, 31/1/02 (MHe); 2 on 3/5/02 (MHe); 1 calling, 14/6/02 (MHe); 2 on 26/10/02 (RMc).

White-plumed Honeyeater *Lichenostomus penicillatus*

Several records of 1-2 birds in 2001-2002 suggest birds resident. Regular in planted eucalypts at Clows Lane entrance and in house gardens on S side of lake, and occasional in remnant woodland (MHe, GT). Earlier records: present, 28/5/00 and 29/1/01 (Atlas 2).

New Holland Honeyeater *Phylidonyris novaehollandiae*

Occasional records: 6 in remnant woodland on 17/5/98 (MHe, MAC); present, 28/5/00 (Atlas 2); present in remnant woodland, 10/2/02 (MHe); present near houses, W side, 28/7/02 (MHe).

Flame Robin *Petroica phoenicea*

Occasional autumn-winter visitor to lakeshore: present, 17/5/87 (RMc), 24/7/88 (MAC) and 25/7/93 (MAC); 1 brown bird, female or immature, 21/7/01 (JHi), 3/5/02 (MHe).

Golden Whistler *Pachycephala pectoralis*

1 calling from remnant woodland, 3/5/02 (MHe).

Magpie-lark *Grallina cyanoleuca*

Regular in low numbers around lake perimeter, in fields and near houses; records in all seasons and probably resident (MAC, RMc, MHe, RHL, GT, Atlas 2). Highest count: 5 on 31/1/02 (MHe). On 12/1/02, 10/2/02 and 20/2/02, observed walking and feeding along muddy shores of lake and among compacted dead vegetation on exposed mudflats (MHe).

Grey Fantail *Rhipidura fuliginosa*

Records in remnant woodland at Clows Lane entrance in 2002: single birds on 18/1/02 (MHe, GT), 31/1/02 (MHe), 3/5/02 (MHe), 7/7/02 (MHe), 22/10/02 (MHe, RHL).

Willie Wagtail *Rhipidura leucophrys*

A few pairs usually observed around lake perimeter; records in all seasons and probably resident. Mainly in open areas with scattered shrubs: in fields, around houses, and on bare dry ground behind rushbeds and in backwaters of lake (MAC, RMc, VG, MHe, Atlas 2, RHL, GT). Highest count: 6 on 17/6/90 (VG).

Black-faced Cuckoo-shrike *Coracina novaehollandiae*

Breeding: nest with 2 chicks found on 5/12/01 (PB,BellBOCA); family remained in area of remnant woodland until at least 31/1/02; on 20/2/02, young birds not seen, but adults calling and appeared agitated (MHe).

Grey Butcherbird *Cracticus torquatus*

Single birds regularly recorded calling from trees near Clows Lane entrance between Dec. 2001 and Oct. 2002 (MHe, GT). Previous record: 1 heard on 7/9/85 (MAC).

Australian Magpie *Gymnorhina tibicen*

Regularly recorded in low numbers around lake margins, in fields, near houses, and perched in trees (MAC, RMc, MHe, Atlas 2). Records in all seasons and probably resident. Highest counts: 6 on 27/6/82 (MAC); 5 on 31/1/02 (MHe).

Little Raven *Corvus mellori*

Regularly recorded in low numbers or small flocks around lake margins, in fields, near houses, perched in trees and flying over (MAC, RMc, MHe, Atlas 2). Records in all seasons and probably resident. Highest count: flock of 8 hanging around in remnant woodland, 18/1/02 (MHe, GT).

Skylark *Alauda arvensis*

Regularly recorded from grassy areas around lake perimeter, sometimes in high numbers (MAC, MHe, RMc, VG, Atlas 2, RHL, GT). Records in all seasons and probably resident. Highest counts: 100s on 7/9/85 (MAC); 60 on 17/6/90 (VG); 30 on 27/6/82 (MAC). On 17/5/98, 6 feeding in open on mat of compacted dead vegetation on exposed mudflat (MHe, MAC). Many birds hovering and singing, 12/1/02 and 31/1/02 (MHe).

Richard's Pipit *Anthus novaeseelandiae*

Single birds regularly recorded on ground and perched on fences in open areas around lake perimeter; 1 flushed from among low regenerating vegetation on NE mudflats, 20/2/02 (MHe). Records in all seasons and probably resident (MAC, RMc, VG, Atlas 2).

House Sparrow *Passer domesticus*

Present since at least 1982 (MAC). Regularly recorded, sometimes in large flocks, in fields around lake perimeter; on 12/1/02, flock of 50 feeding on exposed mud in drying backwater of lake; on 31/1/02, many around houses on S shore. Records in all seasons and probably resident (MAC, RMc, MHe, Atlas 2). Highest counts: 60 on 27/6/82 (MAC) and 17/5/98 (MHe, MAC); flock of 50, 12/1/02 (MHe).

Red-browed Finch *Neochmia temporalis*

Present, 29/1/01 (Atlas 2); heard from dense growth of bracken on S side of lake, 31/1/02; flock of 5 in bracken, 17/3/02 (MHe).

European Greenfinch *Carduelis chloris*

20 on 27/6/82 (MAC); 3 calling from trees near houses, 31/1/02 (MHe). In Geelong region, flocks occur around wetlands in winter (GBR 1997; Hewish et al. 1999).

European Goldfinch *Carduelis carduelis*

Regularly recorded, sometimes in high numbers, in farmland and around houses on lake perimeter; flushed from ground among grass and weeds, perched in trees and shrubs and on fences (MAC, VG, MHe, RMc, Atlas 2, GT). Records in all seasons, but highest numbers and largest flocks in autumn-winter: 40 on 27/6/82 (MAC); 100 on 17/6/90 (VG); one flock of 250, 17/5/98 (MHe, MAC).

Silvereye *Zosterops lateralis*

Frequently recorded between Dec. 2001 and July 2002, in small groups in dense shrubs and bracken in remnant woodland. Earlier records on 27/6/82, 28/3/92 and 17/5/98 (MAC, MHe). On 3/5/02 and 28/7/02, birds of Tasmanian race *lateralis* present; birds present in spring-summer probably of central and e. Victorian race *familiaris*. Highest counts: 20 on 27/6/82 (MAC); flock of 15, 10/2/02 (MHe).

Breeding: 2 begging young lurking in bracken in remnant woodland and being fed by adults, 10/2/02 (MHe).

Common Blackbird *Turdus merula*

In Jan. and Feb. 2002, regularly heard calling from dense shrubby areas and bracken in remnant woodland and around S perimeter of lake (MHe, RHL, GT). Previous records (17/5/87, 28/5/00, 27/6/82, 25/7/82, 7/9/85) suggest birds present throughout year and probably resident (MAC, RMc, Atlas 2). Highest count: 4 males on 7/9/85 (MAC).

Song Thrush *Turdus philomelos*

1 perched on fence beside remnant woodland, 17/5/87 (RMc). Unusual habitat; usually an urban species (GBR 2000; Emison et al. 1987).

Common Starling *Sturnus vulgaris*

Present since at least 1982 (MAC, MHe), and regularly recorded, sometimes in large flocks (MAC, MHe, RHL, GT, RMc, VG). Feed in fields in farmland and around houses; on 12/1/02, flock of 70 feeding on exposed mud in drying backwater behind S shore (MHe); on 18/1/02, 1 feeding on exposed mudflats on NE shore of lake (MHe, GT). Highest counts: 200 on 17/6/90 (VG); 250 on 1/6/91 (VG); flock of 120 feeding in field, 31/1/02 (MHe).

Common Myna *Acridotheres tristis*

Local homeowner observed in Jan. 2002 that Mynas appeared around houses on S side in last year, and rapidly became regular (SH). Only dated record: present along Clows Lane, 11/8/01 (AVW). Range is still expanding along south coast in Geelong region (Peter 1998; GBR 1998).

APPENDIX 4

ST LEONARDS SALT LAGOON: ANNOTATED LIST OF LAND BIRDS (43 SPECIES)

Sources of information are in Chapter 1; survey codes, observer codes and abbreviations are in Appendix 1; references are in Chapter 5.

Stubble Quail *Coturnix pectoralis*

Few records but probably moderately common in grassland around lagoon: present, 28/2/99 (AVW); 2 calling from long grass in different areas, 7/2/02 (MHe).

Black-shouldered Kite *Elanus axillaris*

Occur occasionally in low numbers, hunting over fields and in saltmarsh along lagoon shore (DK, MHe); 4 on 22/3/88 (VG); 1 on 26/6/88 (VG); 1 on 18/6/91 (VG); 1 hunting over field NW of lagoon, 7/2/02 (MHe); 1 perched in tall Moonah and watching saltmarsh below, 20/2/02 (MHe).

Grey Goshawk *Accipiter novaehollandiae*

1 on 18/6/90, morph not specified (VG). Uncommon winter visitor to open areas in Geelong region, mainly white morph birds.

Brown Falcon *Falco berigora*

Occasional records of birds in low numbers: 3 on 13/4/89 (VG); 2 on 19/2/91 (VG); 1 on 9/4/91 (VG); 1 on 18/6/91 (VG); 1 flushed from tree on W side of lagoon, 8/1/02 (MHe).

Australian Hobby *Falco longipennis*

1 on 19/2/91 (VG); 1 hunting by flying fast alongside dune woodland shortly after sunrise, 20/2/02 (MHe).

Nankeen Kestrel *Falco cenchroides*

1 on 24/10/88 (VG); 1 on 18/6/90 (VG); 1 on 28/7/02 (MHe, DHe).

Spotted Turtle-Dove *Streptopelia chinensis*

Often recorded in summer surveys, 2001-2002, perched in shrubs and trees near houses, in dune woodland and around lagoon shore. Highest count in that period: 5 on 7/2/02 (MHe). Previous records: 1 on 26/6/89 (WC); 1 on 10/4/90 (WC).

Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*

2 flew over lagoon, others heard in pines by N shore, 3/5/02 (MHe); heard on 7/7/02 (MHe). Black-Cockatoos regular in winter at St Leonards since 1997, part of recent range expansion into Bellarine Peninsula (Bottomley 2002).

Galah *Cacatua roseicapilla*

1 flew over lagoon, 7/2/02 (MHe); 8 flew over, 7/7/02 (MHe).

Little Corella *Cacatua sanguinea*

20 on 14/12/99, feeding in field by lagoon (GBR 1999); 30 flying S, 3/5/02 (MHe).

Sulphur-crested Cockatoo *Cacatua galerita*

4 perched in tree by lakeside and present for most of morning, 7/2/02 (MHe).

Purple-crowned Lorikeet *Glossopsitta porphyrocephala*

1 flew over lagoon, coming from direction of St Leonards township, 12/12/00 (MHe); heard in trees near houses, 3/5/02 (MHe).

Eastern Rosella *Platycercus eximius*

2 perched in tree on lagoon shore by houses, 7/2/02 (MHe).

Pallid Cuckoo *Cuculus pallidus*

Present, 28/2/99 (AVW).

Fan-tailed Cuckoo *Cacomantis flabelliformis*

1 silent bird perched in tree on cleared slope above lagoon, 7/2/02 (MHe); 1 calling at dusk, 7/7/02 (MHe).

Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*

Often recorded in summer surveys, 2001-2002, usually calling from dune woodland around lagoon: 1 on 27/12; 2 on 8/1; 1 on 7/2 (MHe). Possibly a regular spring-summer visitor.

Shining Bronze-Cuckoo *Chrysococcyx lucidus*

Present, 24/10/98 (GBR 1998).

Superb Fairy-wren *Malurus cyaneus*

Regularly recorded in summer surveys, 2001-2002 (MHe, GT). In small parties all around lagoon, wherever shrubs and nearby open ground: near houses, bare sandy areas of dune, lagoon shore, and partly-cleared slopes (NW section). On 8/1/02 and 7/2/02, parties calling from beds of Chaffy Saw-sedge beside dune woodland (MHe). No counts made.

Brown Thornbill *Acanthiza pusilla*

Single birds in scrubby woodland on S shore of lagoon, 9/1/02, 7/2/02 (MHe); probably resident.

Yellow-rumped Thornbill *Acanthiza chrysorrhoa*

Parties of 2-3 birds feeding on mown grass near house on S side of lagoon, and perched in nearby shrubs, 8/1/02, 7/2/02 (MHe).

Red Wattlebird *Anthochaera carunculata*

Regularly recorded in low numbers in surveys, 2001-2002; usually in trees near houses on S shore of lagoon, but once in dune woodland on W shore (MHe, GT). One previous record: 1 on 19/10/91 (VG). On 3/5/02, passage of 200 birds in several flocks flying N, 09:30-11:00, some perching briefly in shoreline trees (MHe).

Spiny-cheeked Honeyeater *Acanthagenys rufogularis*

Regularly recorded in surveys in 2001-2002, in dune woodland around lagoon shores and in trees near houses. In summer 2001-2002, the most common honeyeater in the woodland, up to 4-5 calling at once. Pairs perched in shrubs and trees and constantly flew around. Very vocal (MHe, GT). One previous record: 1 on 12/12/00 (MHe).

White-plumed Honeyeater *Lichenostomus penicillatus*

1 in trees near houses, 3/5/02 (MHe).

New Holland Honeyeater *Phylidonyris novaehollandiae*

Regularly recorded in summer surveys, 2001-2002; in low numbers in shrubby woodland and trees near houses. Highest count: 6 on 7/2/02 (MHe). Appeared to be mainly confined to S area near houses, rather than occurring throughout dune woodland; however, additional surveys needed to confirm this suggestion. Previous records: 2 on 20/2/90 (VG); present, 12/12/00 (MHe). Probably resident.

Flame Robin *Petroica phoenicea*

1 on 26/6/89 (WC). Winter visitor to lowlands in Geelong region.

Rufous Whistler *Pachycephala rufiventris*

2 birds calling from different areas in dune woodland, 8/1/02, 7/2/02 (MHe). Probably regular spring-summer visitor in low numbers.

Magpie-lark *Grallina cyanoleuca*

Often recorded around lagoon in low numbers; present in all seasons and probably resident in area. Highest counts: 4 on 19/10/91 (VG); 2 pairs on 7/2/02 (MHe). In summer surveys, 2001-2002, often on mown grass and in trees near houses on both N and S shores of lagoon, on power lines along road, and in fields on NW shore. On 27/12/01, 1 feeding in recently-flooded saltmarsh and on soft mud on lagoon shore (MHe).

Grey Fantail *Rhipidura fuliginosa*

In summer surveys, 2001-2002, often seen and heard in dune woodland and shrubby growth around lagoon shores: appeared to be at least 3-4 pairs on 8/1/02 (MHe). Probably resident.

Willie Wagtail *Rhipidura leucophrys*

Regularly recorded in low numbers; present in all seasons and probably resident (VG, WC, MHe). Highest count: 2 pairs on 8/1/02 (MHe). Pairs in SE and SW areas near houses, where shrubs next to open areas: on mown grass, along tracks, and among low vegetation and on bare mud in saltmarsh. On 7/2/02, 1 made aerial sallies from sandy lakeshore to take insects over water (MHe).

Breeding: Pair with 1 short-tailed begging juvenile, 8/1/02; adults defending juvenile vigorously (MHe).

Black-faced Cuckoo-shrike *Coracina novaehollandiae*

1 calling from tree near house on S shore, 7/2/02 (MHe); 4 perching in shrubs and feeding in Beaded Glasswort on lakeshore, northern inlet, 28/7/02 (MHe, DHe).

Australian Magpie *Gymnorhina tibicen*

Regularly recorded; present in all seasons and probably resident in area. Highest counts: 10 on 26/6/89 (WC); 6 on 24/10/88 (VG). In summer surveys, 2002, single birds observed on mown grass near houses on S side of lagoon, and perched on power line along road (MHe).

Little Raven *Corvus mellori*

Regularly recorded in low numbers; present in all seasons and probably always around the town and adjacent farmland. Highest counts: 5 on 13/4/89 (VG); 6 on 19/10/91 (VG); 6 on lagoon mudflats, feeding, 3/5/02 (MHe).

Skylark *Alauda arvensis*

1 on 20/10/89 (VG); 4 on 19/10/91 (VG). Records in spring when Skylarks conspicuous, hovering and singing. Probably always present in fields around lagoon.

Richard's Pipit *Anthus novaeseelandiae*

Regularly recorded and in large numbers in grassy fields along N shore of lagoon (DK; King 1987). Highest counts: 6 on 24/10/88 (VG); 7 on 20/10/89, 18/6/90 (VG); 10 on 19/10/91 (VG).

House Sparrow *Passer domesticus*

In surveys in 2001-2002, regularly recorded in low numbers (up to 10 birds) feeding on mown grass and in salt meadow near houses, and perched nearby in shrubs along lagoon shore. Larger flocks have been recorded: 50 on 26/6/89 (WC); 18 on 2/5/99 (Atlas 2).

Red-browed Finch *Neochmia temporalis*

2 perched in shrub at edge of scrubby woodland along S lagoon shore, 18/1/02 (GS); 5 in same area, 7/2/02 (MHe).

European Greenfinch *Carduelis chloris*

In summer surveys, 2001-2002, recorded between 27/12 and 18/1, calling from dune woodland and trees near houses on S shore of lagoon; on 27/12, appeared to be 3-4 birds present (MHe, GT). Status in area uncertain.

European Goldfinch *Carduelis carduelis*

In summer surveys, 2001-2002, two records of 1-2 birds flying between trees and perching in dune woodland on S shore of lagoon (MHe). Large flocks occur in winter: in large numbers on 26/7/87 (King 1987); 25 on 26/6/89 (WC); 20 on 18/6/91 (VG).

Mistletoebird *Dicaeum hirundinaceum*

1 calling from dune woodland on S side of lagoon, 8/1/02 (MHe). Numerous in coastal woodland at nearby Edwards Point, but status at Salt Lagoon unknown.

Silvereye *Zosterops lateralis*

In surveys in 2001-2002, regularly recorded in small flocks in shrubby areas and dune woodland around lagoon shore. Count on 7/2/02: 30-40 birds in woodland on S and W shores (MHe). Silvereyes probably common throughout year at lagoon, as they are in other coastal woodlands and shrublands on Bellarine Peninsula.

Common Blackbird *Turdus merula*

In surveys in 2002, regularly recorded in low numbers. Highest count: 3 on 7/2/02 (MHe). Mainly in shrub thickets on S lakeshore, but also heard from several different areas of dune woodland and shrubland, and probably widespread and resident. Previous records: 1 on 20/2/90 (VG); 1 on 19/10/91 (VG).

Common Starling *Sturnus vulgaris*

In summer surveys, 2001-2002, regularly recorded and in large flocks. Often near houses, on mown grass, in fields, and perched on power lines. Flocks also fed in saltmarsh, on muddy edges of lagoon and in inundated salt meadow, and perched in shrubs along shore (MHe, GT). Previous records indicate that Starlings present in all seasons, and probably resident. Highest counts: 85 on 26/6/89 (WC); 60 feeding in saltmarsh, 27/12/01 (MHe); 90-100 (40 on shore, 50-60 in salt meadow) on 8/1/02 (MHe).

Breeding: On 27/12/01 and 8/1/02, single birds flew away from lagoon carrying food; probably feeding young (MHe).

Common Myna *Acridotheres tristis*

Recorded in low numbers in summer surveys, 2001-2002: 2 flew over lagoon from houses on S side, 27/12/01; 1 on ground by houses, 18/1/02 (MHe, GT); 2 calling from near houses, 7/2/02 (MHe).

In a study of Common Myna distribution in the Geelong region in 1993-1994, no birds were reported from the north-eastern Bellarine Peninsula, including St Leonards (Bottomley and Calvert 1994). This study shows that Mynas arrived in the town at some time between 1994 and 2001, and that they are still expanding their range in the Geelong region.

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