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Counts of waterbirds at Western Springs Lake, Auckland, New Zealand

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Abstract Waterbirds were counted over ~ 12 ha of Western Springs Lakeside Park, Auckland, twice-monthly from November 2012 to October 2014. On average there were 742 water-birds per count (s.d. = 151.7, range = 511–1081), equating to a mean density of about 62 birds/ha within the study area. The 3 commonest species (mallard, *Anas platyrhynchos*, black-backed gull, *Larus dominicanus* and feral goose, *Anser anser*) made up 63% of all waterbirds counted. Mallard (and all waterbirds combined) were most abundant in summer and autumn. Black-backed gull, Eurasian coot (*Fulica atra*) and New Zealand scaup (*Aythya novaeseelandiae*) were seasonally uniform in numbers but red-billed gull (*Larus novaehollandiae*) were virtually absent from September to December. Spring was the peak season for numbers of black swan (*Cygnus atratus*), but the seasonal minimum for feral geese. Incidental historical counts trace temporal changes at Western Springs Lake, with a rapid increase of coots in the 1980s and of scaup in the 1990s. Royal spoonbill (*Platalea regia*) arrived more recently. The counts quantify for the first time the importance of the lake as a habitat for common waterbirds on the Auckland isthmus.

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Keywords fresh-water lake; aquatic birds; waterfowl; gulls; rails; shags; census

INTRODUCTION

Western Springs Lake in central Auckland is one of few remaining fresh-water wetlands on the Auckland isthmus, and supports various species of anseriforms, gulls, rails and shags, some of which breed at the lake (Anon. 1995). However, we are not aware of any systematic seasonal counts of waterbirds at the site. The aim of the study was to count birds systematically at Western Springs Lake to document the avifauna present, quantify abundance and investigate seasonal changes in numbers.

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Many projects have involved counting waterbirds in New Zealand, but these have mostly been at brackish-water sites (*e.g.,* Pierce 1980; Crossland *et al*. 2015) or focused on waders (*e.g.,* Veitch & Habraken 1999). Published studies quantifying the densities and relative numbers of waterbirds at New Zealand freshwater lakes appear to be lacking.

METHODS

Study area

Western Springs Lake (36°52′S, 174°44′E; Fig. 1) is a small, shallow, spring-fed, freshwater lake in the suburb of Western Springs about 4 km south-west of the Auckland city centre (Anon. 1982, 1995, no date [*c.* 2000]). The lake is the centre piece of Western

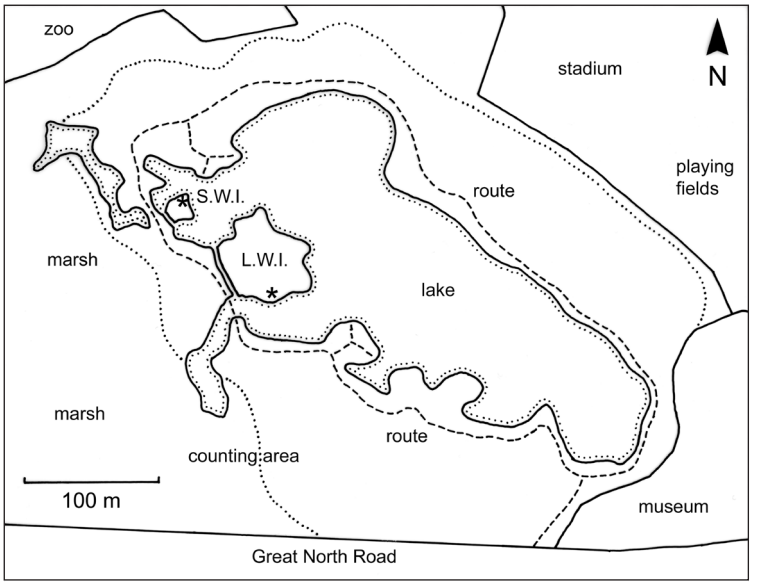

Fig. 1. Map of Western Springs Lake, showing the route walked during the counts (dashed line) and the approximate boundary of the counted area (outer dotted line), which extended further from the route where the vegetation was more open and birds more visible. L.W.I. = Large Wooded Island, S.W.I. = Small Wooded Island. Asterisks show the positions of the 2 shag colonies.

Springs Lakeside Park (W.S.L.P.) which occupies ~25 ha. The lake itself is ~5 ha and has a maximum depth of 2.9 m.

There are extensive marshy areas beside the western end of the lake that have been enriched by planting of native trees and shrubs to create a "wilderness" effect. Elsewhere, W.S.L.P. is more formal, with mowed lawns, specimen trees and shrubby borders. A sealed footpath encircles the lake-shore, with small bridges over wet areas (Fig. 1).

Counts

Each count consisted of a walk into W.S.L.P. and around the lake along the lake-side path (a route ~1.5 km long; Fig. 1) tallying all waterbirds (of all ages) seen on land or on the lake surface. Counts began and ended at Great North Road.

Two counts per month were conducted over a period of 2 years (24 months, 48 counts) from November 2012 to October 2014 (inclusive). There were roughly equal numbers of morning counts (started between 0820 h and 1057 h) and afternoon counts (started between 1310 h and 1607 h) with Daylight Saving Time observed. Most counts (71%) commenced between 0930 h and 1530 h. Counts lasted ~40 minutes (range 33–48 minutes). Counting was done only on fine days without persistent rain and all counts were conducted by BJG.

The numbers counted were not totals for the whole of W.S.L.P., but were tallies of birds on the lake, and that were able to be seen adjacent to the lake during the circumnavigation of the lakeshore. At several large areas of open mown grass, waterbirds could be counted up to 140 m away. The total counting area (lake surface plus adjoining land visible from the lakeside track; Fig. 1) was about 12 ha, equating to approximately half the park.

All birds of a species were totalled, including downy chicks (in or out of nests) and immature birds. Sightings of active nests (with sitting adults or visible eggs or young) or of birds in immature plumage were taken as signs of breeding by that species. The counts for "mallards" are actually for New Zealand's introgressively hybridised population of mallards and grey ducks (*Anas superciliosa*). These 2 species were treated as one entity since individual discrimination was impossible during the counts.

Statistical analyses

Counts were grouped by season (winter = June, July and August, etc.). For each of the 8 commonest species and the 3 shag species, "Minitab 17" was used to produce seasonal boxplots showing descriptive statistics for the number of birds counted per visit. Seasonal distributions were tested for normality and equal variance (Levene's Test). Where both assumptions were met, ANOVA (Analysis of Variance) was performed to test for a significant difference in the mean counts between seasons. Where there was a difference, post-hoc Tukey HSD Tests described these differences. When only the equal variance assumption was violated, ANOVA with post-hoc Games-Howell Tests were performed. Outliers were confirmed as authentic and included in analyses. All tests that were significant at a 5% significance level are reported with ANOVA results ($F_{\text{d.f.}}$) or Tukey/Games-Howell post-hoc test results (t) and corresponding P values are denoted as follows: *** $P \leq 0.001$, ** $P \leq 0.01$, * $P \leq 0.05$, n.s. $P > 0.05$.

Table 1. Mean numbers per count (n = 48) for the 16 most numerous waterbirds, and the total for all waterbirds (including minor species), at Western Springs Lake, Auckland, 2012–14. The numbers are also expressed as mean density (birds/ha), based on an estimated counting area (lake surface plus adjoining open land) of 12 ha. Crosses show the species breeding at W.S.L.P.; also the use by each species of the three main habitats.

Species	Mean	s.d.	Min	Max	Percent of total	Density	Breeding	Open water	Lake edge	Open lawn
Mallard	207.2	103.11	68	464	28	17.3	x	x	x	x
Black-backed gull	147.8	57.12	53	295	20	12.3		x	x	x
Feral goose	112.8	28.55	68	188	15	9.4	x	x	x	x
Black swan	71.9	24.98	27	126	10	6.0	x	x	x	x
Pukeko	55.7	15.20	16	89	8	4.6	x		x	x
Red-billed gull	46.0	56.79	0	301	6	3.8		x	x	x
Eurasian coot	45.7	8.14	31	72	6	3.8	x	x	x	x
NZ scaup	24.4	9.86	6	46	3	2.0	x	x	x	
Pied shag	8.3	3.80	1	18	1	0.7	x	x	x	
Paradise shelduck	5.0	3.86	0	13	<1	0.4	x	x	x	x
Little shag	4.9	5.12	0	18	<1	0.4	x	x	x	
Little black shag	4.6	6.68	0	26	<1	0.4	x	x	x	
Royal spoonbill	2.1	4.04	0	19	<1	0.2			x	
Feral domestic duck	2.0	1.55	0	9	<1	0.2	?	x	x	x
Canada goose	0.9	0.79	0	2	<1	0.1		x	x	x
Black shag	0.4	0.71	0	3	<1	0.03		x	x	
All water-birds	741.6	151.69	511	1081	100	61.7				

Literature search

For waterbird species that recently colonised W.S.L.P. (coot, scaup and royal spoonbill) or whose breeding attempts at the lake have been intermittent (shags, New Zealand dabchick, *Poliocephalus rufopectus*), previous records were searched for in the Classified Summarised Notes (C.S.N.) published in *Notornis* from 1943 to 2006 (the last data are actually for 2002). We note that there is a gap in these historical records for the lake from 2003 to 2012 (start of the present study).

RESULTS

General

On average, waterbirds around Western Springs Lake during the 2 year period numbered 742 per count (Table 1). The mean density of waterbirds within the study area was ~62/ha. The 8 commonest waterbirds comprised 2 duck species (mallard and scaup), feral goose, black swan, 2 gull species (black-backed and red-billed) and 2 rail species (pukeko, *Porphyrio melanotus* and coot; Table 1). The 3 commonest species (mallard, black-backed gull and feral goose) accounted for 63% of all waterbirds counted.

At least 10 species of waterbirds were recorded breeding at Western Springs Lake (Table 1). All of the 16 commonest water-birds used the lake-edge habitats, and all used the open lake except pukeko and royal spoonbill. Ten species regularly used open grassy areas away from the lake-edge.

The total water-bird counts showed peak numbers in summer (mean = 857.8, s.d. = 160.52, range = 569–1081) declining sequentially through autumn (mean = 787.3, s.d. = 110.83, range = 632-1040) and winter (mean = 712.9, s.d. = 134.19, range = 530–932) to a low in spring (mean = 608.4, s.d. = 70.61, range = 511–722). This pattern was driven by mallards (Fig. 2), the most abundant species. The summer and autumn mean aggregated waterbird counts were both significantly higher than for spring (t = 4.95*** and t = 3.55**, respectively). The summer mean count was significantly higher than that of winter (t = 2.87*). Seasonal data for 11 species are shown in Figs. 2–5, 7.

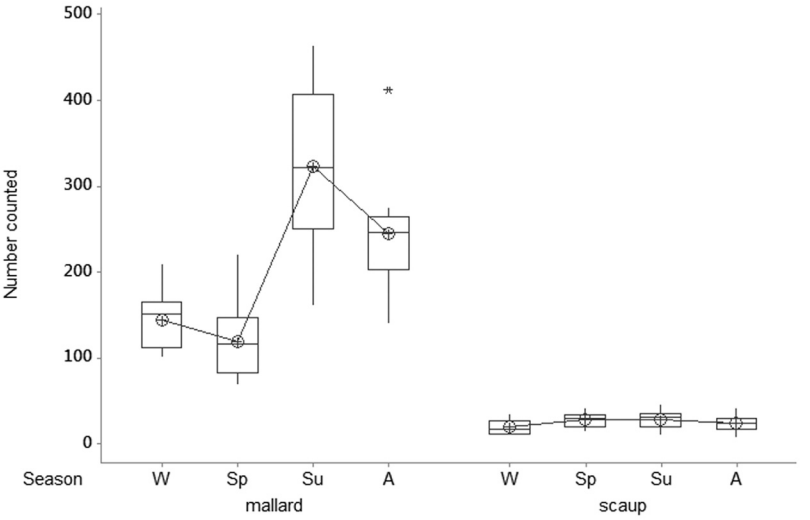

Fig. 2. Counts of mallards and New Zealand scaup at Western Springs Lake, 2012–14, grouped by season (winter, spring, summer, autumn). In Figs. 2–5 and 7 each boxplot shows the mean (circle), median (central horizontal line), quartiles (upper and lower limits of box), range excluding outliers (vertical line) and any outliers (asterisks).

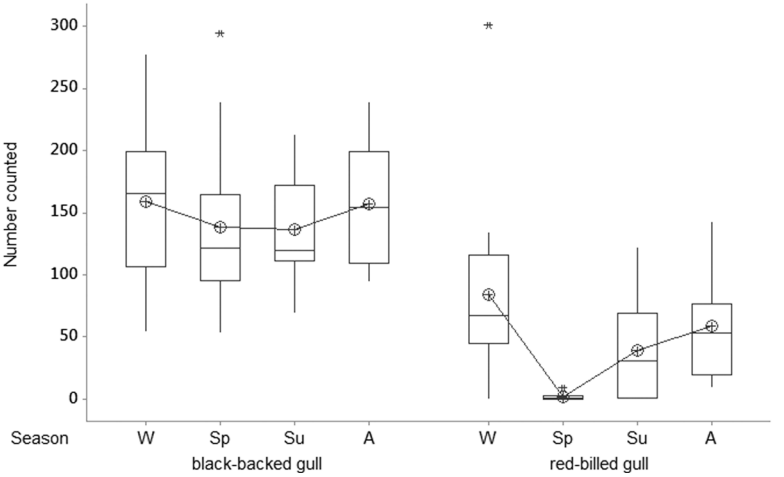

Fig. 3. Counts of black-backed and red-billed gulls at Western Springs Lake, 2012–14, grouped by season. See Fig. 2 for explanation of boxplots.

Counts and observations of individual species

Mallard

Never fewer than 68 mallards were counted at Western Springs Lake with a maximum of almost 500 (Table 1). Mallards were most abundant in summer and autumn (Fig. 2). Both the summer and autumn mean counts were significantly higher than for spring ($t = 6.71$*** and $t = 5.53$***, respectively) and for winter ($t = 6.11$*** and $t = 4.75$***, respectively). An outlying high autumn count was on a day when stages were being erected for the Pasifika Festival, and this may have shifted mallards to locations that made them more visible. Downy chicks were present from September to February.

Black-backed gull

Small numbers of black-backed gulls scavenged food from humans, but most appeared to use W.S.L.P. for "loafing" and were present in large groups, either floating near the centre of the lake or resting in the open on the largest areas of mown grass. Birds were recorded in every count and in roughly even numbers year-round (Fig. 3), with no significant differences in the seasonal mean counts ($F_{3,44} = 0.54$, n.s).

Feral goose

With the exception of a low in spring, feral geese were in fairly uniform numbers seasonally (Fig. 4). Mean counts for winter and autumn were significantly higher than for spring ($t = 3.22$* and $t = 2.89$*, respectively). Nests were not observed during the counts, though they may have been sited under cover of vegetation as downy chicks were present from September to February, and immature geese from December to February.

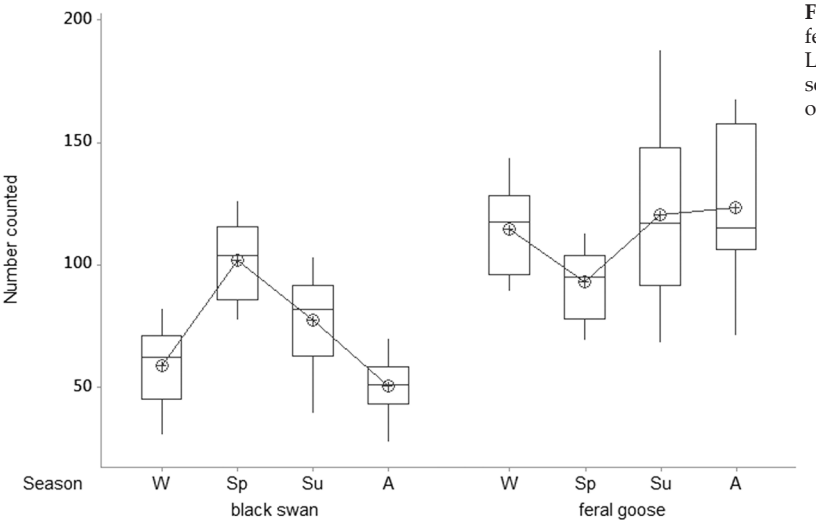

Fig. 4. Counts of black swans and feral geese at Western Springs Lake, 2012–14, grouped by season. See Fig. 2 for explanation of boxplots.

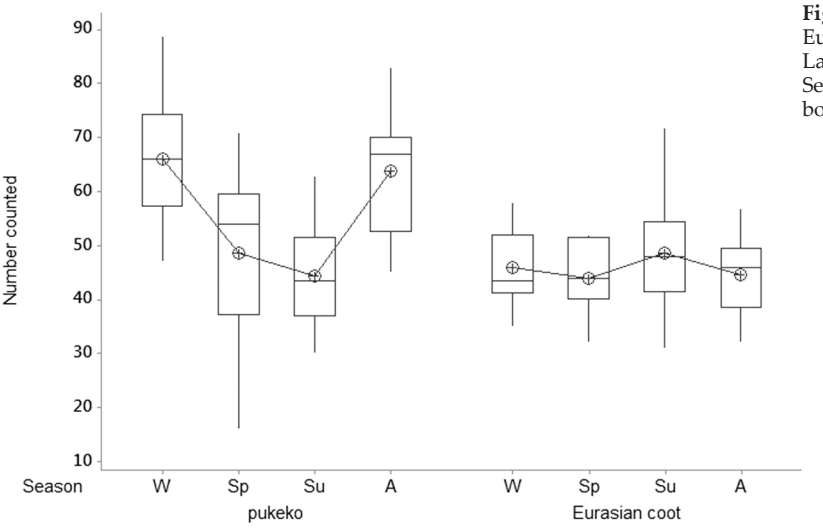

Fig. 5. Counts of pukekos and Eurasian coots at Western Springs Lake, 2012–14, grouped by season. See Fig. 2 for explanation of boxplots.

Black swan

Black swan were abundant in all seasons (Fig. 4) but with more variability than for feral geese, with a peak in spring when geese were at their lowest numbers. The spring mean count of swan was significantly higher than for summer, autumn and winter (t = 3.81**, t = 8.08*** and t = 6.8***, respectively). Summer's mean count was significantly higher than both autumn's (t = 4.27***) and winter's (t = 2.99*). Downy chicks were seen in all months except June and July, and birds in immature plumage in all months except September and November.

Pukeko

Pukeko numbers were lowest in spring and summer (Fig. 5). The winter mean count was significantly higher than for summer (t = 4.38***) and spring (t = 3.53**). Likewise, the autumn count was significantly higher than for both summer (t = 3.94**) and spring (t = 3.09*). Downy chicks were recorded from September to April.

Red-billed gull

This species was only about one-third as common overall as black-backed gull (Table 1), but used the habitats in the park in a similar way. Whereas black-backed gull had a uniform presence all year, red-billed gulls were noticeably scarcer in spring (Fig. 3); the spring mean count being significantly lower than for summer (t = 3.07*), autumn (t = 4.63**) and winter (t = 3.59*). Calculation of monthly means showed that red-billed gulls were virtually absent at W.S.L.P. for 4 months: spring (September to November) and also December. One very high count (n = 301, 11 July

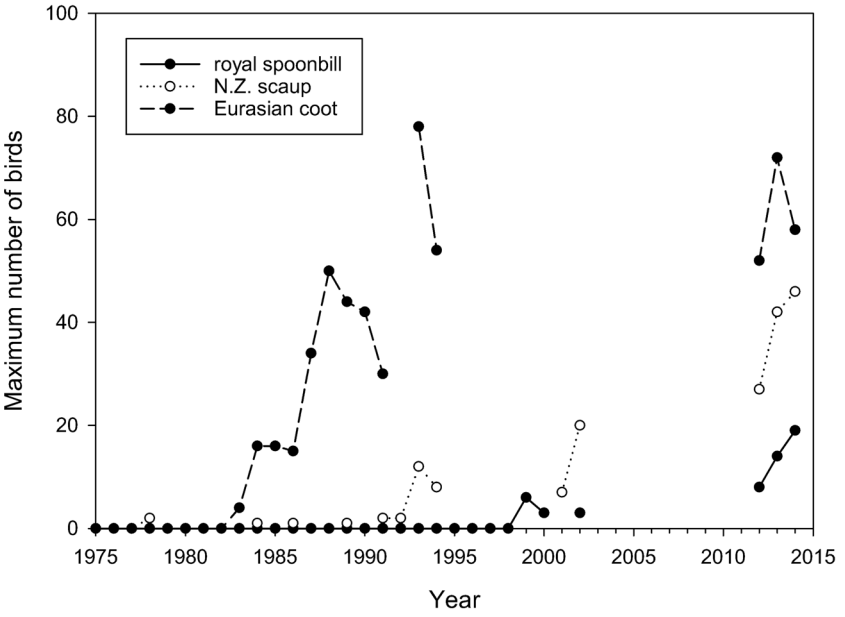

Fig. 6. Historical records (maximum numbers seen per year) of royal spoonbills, New Zealand scaup and Eurasian coots at Western Springs Lake. Counts for the 3 most recent years are from the present study; earlier records are mostly from C.S.N., published in *Notornis* for data up to 2002.

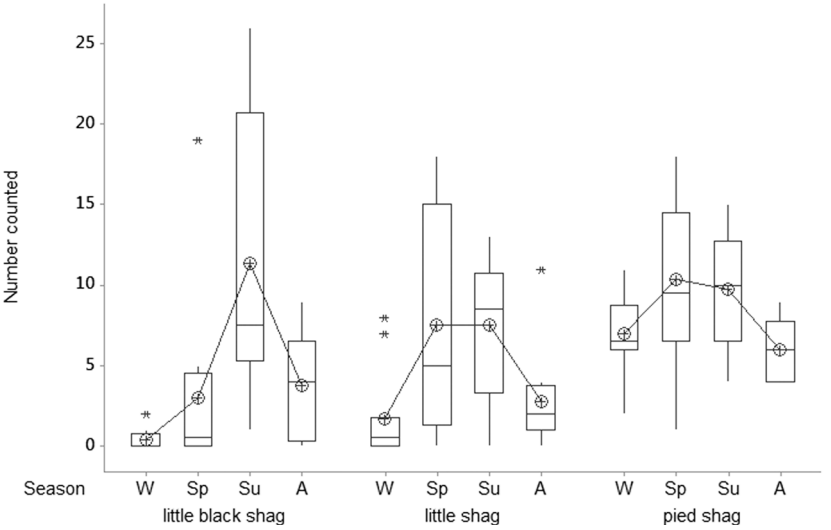

Fig. 7. Counts of little black shags, little shags and pied shags at Western Springs Lake, 2012–14, grouped by season. See Fig. 2 for explanation of boxplots.

2014) coincided with a persistent storm and birds may have congregated at the lake for shelter.

Eurasian coot

Two pairs of Eurasian coot seen at Western Springs Lake in July 1983 bred that spring and had increased to 16 birds by 1984–85 (Chapman 1985). In 1987, seven pairs nested and about 20 young were raised (Haslett 1987). Thus, coot increased rapidly after arrival at the lake (Fig. 6) and the area appears to have reached carrying capacity by the mid-1990s, with similar numbers as seen today.

During breeding, the lake-shore is now fully populated with coot territories spaced out around the lake's perimeter. The mean count in the current study was 45.7 birds (range 31–72; Table 1) with seasonal uniformity (Fig. 5). Differences in mean counts between seasons were not significant ($F_{3, 44}$ = 0.74, n.s.). Signs of nesting (nest-material being collected, adult on nest, or eggs or chicks in nest) were seen in every month except June, and downy chicks from September to April.

New Zealand scaup

This species, like the coot, seems to have been a recent colonist at Western Springs Lake; the earliest record found was of 2 birds seen in 1978 (C.S.N., *Notornis* 26: 404, 1979). There are occasional records

of ones and twos (*e.g.*, Anon. 1991) until the mid-1990s when numbers increased (Fig. 6). Numbers rose again in the early 2000s and have doubled between then and now.

During the current study, scaup were recorded in every count (mean = 24.4, range 6–46; Table 1) with an even presence seasonally (Fig. 2). Differences in mean counts between seasons were not significant ($F_{3,44}$ = 2.25, n.s.). No nests were noticed during the counts, presumably because they were hidden in vegetation. Breeding is firmly established around the lake, with downy chicks observed from early December to mid-February and immature birds in February and March.

Pied shag (Phalacrocorax varius)

In May 1954, seven pied shag were noted at W.S.L.P. (C.S.N., *Notornis* 6: 90, 1955). A small nesting colony was present in 1985–1986 (C.S.N., *Notornis* 34: 121–122, 1987) and in 1986–1987 (C.S.N., *Notornis* 35: 288, 1988). In December 1990, 16 nests were counted (C.S.N., *Notornis* 39: 170, 1992). In January 1993, pied shag were in a mixed breeding colony with little shag (*Phalacrocorax melanoleucos)* and little black shag (*P. sulcirostris*; C.S.N., *Notornis* 41: 243, 1994). A count in December 1994 recorded 38 pied shag and 18 nests (C.S.N., *Notornis* 43: 122, 1996). Pied shag were recorded breeding at W.S.L.P in October 2000 (C.S.N., *Notornis* 49: 102, 2002).

During the present study, pied shag were seen at every count (mean = 8.3, s.d. = 3.8, range = 1–18). The mean count for summer was significantly higher than for autumn (t = 3.14*; Fig. 7). Pied shag were observed nesting in a tall, sparsely-foliated tree (pohutukawa, *Metrosideros excelsa*) on the south side of the Large Wooded Island (Fig. 1). Active nests (up to 6) were seen in all months of the year.

Little shag

In February 1950, more than 40 little shags and 23 nests were counted, and in February 1952 there were 4 nests with eggs and 8 nests with a total of 16 chicks (C.S.N., *Notornis* 5: 88, 1953). In May 1954, 27 little shags were counted at the lake (C.S.N., *Notornis* 6: 90, 1955). Around 1957 the breeding site seemed to have been abandoned (C.S.N., *Notornis* 7: 193, 1958). A nesting colony was present in 1985–1986 (C.S.N., *Notornis* 34: 122, 1987). In January 1993, little shag were breeding in a mixed colony (C.S.N., *Notornis* 41: 243, 1994) and again in October 2000 (C.S.N., *Notornis* 49: 102, 2002).

During the present study, little shag were observed in low erratic numbers. They were recorded during 38 counts (79%), with the peak number (18 birds) in September. Spring and summer had the highest mean counts and variation (Fig. 7). There were 2 unusually high winter counts and one unusually high autumn count.

Little shags were observed nesting from August to February in a dense mass of foliage (a tall willow *Salix* sp. in contact with shorter karo trees, *Pittosporum crassifolium*) on the north-east side of the Small Wooded Island (Fig. 1). A maximum of 8 active nests were seen at one time (February 2013) but there may have been more in the dense foliage. Nesting at this colony failed to resume in spring 2014, towards the end of the counts.

Little black shag

January 1993 was the first record found for this species at the lake, at which time a few pairs were noted in a mixed breeding colony with pied and little shags (C.S.N., *Notornis* 41: 243, 1994). In October 2000, one bird was recorded feeding a chick in a mixed-species colony (C.S.N., *Notornis* 49: 102, 2002).

During the present study, little black shags were recorded during 30 counts (63%). Their numbers built up from October, to a peak of up to 26 birds in January, and then declined through to May. Summer had the highest mean count and variation, and winter the lowest (Fig. 7). From January to April, little black shags were observed nesting in the same tree as the pied shags, with up to 5 active nests at a time (February 2014).

Royal spoonbill

Earlier records (Fig. 6) show low numbers of royal spoonbill recorded at the lake in June 1999 (n = 3; C.S.N., *Notornis* 47: 221, 2000), October 1999 (n = 6; C.S.N., *Notornis* 48: 168, 2001), December 2000 (n = 3; C.S.N., *Notornis* 49: 103, 2002) and September 2002 (n = 3; C.S.N., *Notornis* 53: 242, 2006).

During the present study a seasonal influx of spoonbill was observed, with birds being absent from January to May (inclusive; Fig. 8). A maximum of 19 birds were seen at one time (Table 1). Based on the earlier records, the large numbers seen during the current study appear to be a recent development. Spoonbill were mostly noted roosting in trees on the Large Wooded Island near the shag colony. All individuals observed with binoculars during the study period were adults, often with yellow eyebrow marks and with nuptial plumes on the head.

Paradise shelduck (Tadorna variegata)

At least a few paradise shelducks were seen during nearly every count. The highest numbers recorded (up to 13 in January and September 2014) comprised single families with up to 7 downy chicks.

Feral domestic duck

These assorted ducks were usually larger than mallards, and had various patterns of plumage unlike those of any species of wild ducks. They are assumed to be feral domestic ducks (muscovy ducks, *Cairina moschata*, domestic forms of *Anas*

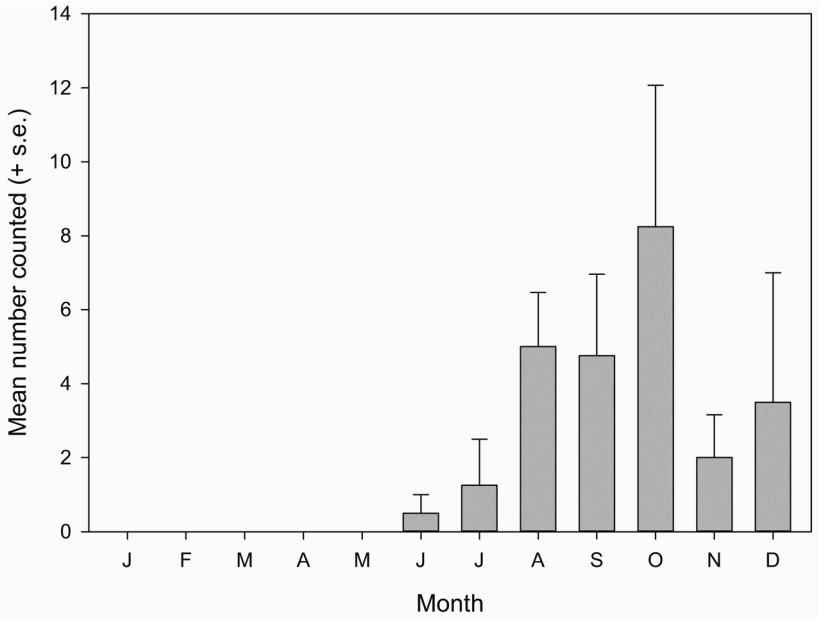

Fig. 8. Counts of royal spoonbills at Western Springs Lake, 2012–14, grouped by month.

platyrhynchos or hybrids between them). They were seen during nearly every count but only in low numbers (Table 1). No signs of breeding were noted.

Canada goose (Branta canadensis)
None was seen for the first 4 months of counting, then a single bird in 2013 and a pair for much of 2014.

Black shag (Phalacrocorax carbo)
Up to 3 black shag were present during the first 5 months of counting, then never more than one bird for the next 10 months, followed by no birds for the last 9 months. In May 1954, there were 5 black shags at the lake (C.S.N., *Notornis* 6: 90, 1955), suggesting that they have been present in low numbers for many decades.

New Zealand dabchick
A single New Zealand dabchick was observed at W.S.L.P. in February 1989 (C.S.N., *Notornis* 37: 185, 1990). In the summer of 2000–01, two pairs of adults and an immature bird were present and 1 pair nested several times producing at least 1 independent juvenile (Pulham 2001). In July 2002, there were 3 adults and 2 juveniles (C.S.N., *Notornis* 53: 241, 2006). No dabchicks were observed during the current study; as such it appears that this species has not remained as a permanent resident at W.S.L.P.

DISCUSSION

The counts in this study mostly scored true and absolute numbers of birds in open habitats and were not index-counts for which apparent abundance is actually a blend of abundance and conspicuousness. Results are therefore easily and validly expressed as density (birds/ha). However, during the breeding season, counts of breeding species were probably diminished slightly by the inability to see some adults that had retreated from view to sit on nests hidden in vegetation. For many species, this was probably roughly compensated by the inflation of numbers caused by the inclusion of downy chicks and immatures in the counts, not all of which would survive to become permanent residents at the lake.

During the current study, mallards, feral geese or scaup were not observed on nests, which were presumably out of view. In comparison, a few black swan, pukeko and coot were observed on nests, though there were likey other nests of these species out of view. The scrubby and marshy land in the western half of W.S.L.P. is probably an important refuge for nesting waterbirds. Nests of pied and little black shags were in plain view, and the counts included larger chicks that were visible in the nests from a distance. However, little shags nested in dense foliage at a site that was difficult to view. Their nests and nest contents were hard to see, and the counts of their numbers while breeding were probably under-estimates.

The Avon-Heathcote Estuary and adjacent Bromley Oxidation Ponds (suburban Christchurch) provide about 1,300 ha of wetland habitat, where Crossland (2013) estimated total wetland bird numbers varying between about 11,000 and 36,000. We calculate this as equating to some 9–28 birds/ha. Pierce (1980) counted between 4,000 and 9,100 waterbirds at Lake Wainono, South Canterbury

(335 ha), which is a density of 12–27 birds/ha. These are all brackish-water sites with large numbers of migratory waders. In their summary of maximum densities recorded for waterbirds in Australia (often including waders, and often for ideal habitat conditions following rain), Halse *et al*. (2005) reported 8.5 birds/ha at the Macquarie Marshes (N.S.W.), 13.5 birds/ha at floodplains of the Alligator Rivers (N.T.), 16.8 birds/ha at Mandora Marsh (W.A.) and 34.0 birds/ha at Lake Eyre (S.A.). These habitats and methodologies do not make close comparisons with Western Springs Lake, however, the numbers at least show that the overall mean density of 62 waterbirds/ha in the counting area at the Auckland lake is relatively high.

In the Auckland area, black-backed gull breed at Rangitoto Island, north-east of the city, and they may also breed on roof-tops within the suburbs (see review by Galbraith *et al*. 2015). They may fly up to 50 km between feeding, roosting and nesting sites (Galbraith *et al.* 2015), and this may account for the use of the lake and park at Western Springs for loafing by black-backed gull in all seasons and even during the breeding season. By contrast, red-billed gulls in the Auckland area mostly breed at sites in the Hauraki Gulf more distant from Western Springs than Rangitoto Island. Exceptions are small breeding colonies at a boating slipway in St Mary's Bay (*c.* 170 pairs) and on the Okahu Bay wave-break (*c.* 50 pairs; P. Frost, *pers. comm*.). Red-billed gulls collect marine food during breeding (Heather & Robertson 2015). This factor, and the distance of most breeding sites from Western Springs Lake, presumably explain the absence of red-billed gulls at the lake in spring and early summer.

At Western Springs Lake, there were peak numbers of mallards during summer and autumn (Fig. 2), a pattern also seen at Lake Wainono by Pierce (1980), and at the Avon-Heathcote Estuary and Bromley Oxidation Ponds by Crossland (2013) who noted that this coincided with a post-breeding flocking and moulting period. New Zealand scaup maintained fairly even seasonal numbers at Avon-Heathcote/Bromley (Crossland 2013), as at Western Springs (Fig. 2). At both sites, pukeko (Fig. 5) reached lowest numbers in spring and summer, which Crossland (2013) put down to an autumn-winter influx and flocking. Black swan numbers peaked in spring at Western Springs (Fig. 4) but were not seasonal at Avon-Heathcote/Bromley (Crossland 2013), where they instead fluctuated in accordance with good or bad feeding conditions (related to water-levels) at Lake Ellesmere, 24 km away.

Many royal spoonbill move north to northern New Zealand for the winter (May to August) and south to spend summer (November to February) at their breeding sites, most of which are in the South Island (Thompson 2014). Yet in the current study, spoonbill were present at Western Springs Lake from June to December (Fig. 8) and many were adults in breeding plumage. Royal spoonbill numbers at Western Springs dropped in November and December (Fig. 8) which may mean that many of the birds were merely in transit from northern wintering sites to breeding sites south of Auckland. However, others may be prospecting for a breeding site at Western Springs Lake. In December 2000, one of 3 royal spoonbills at the lake was "building [a] stick platform in [a] tree" near the water's edge (C.S.N., *Notornis* 49: 103, 2002). Spoonbill have recently been observed manipulating sticks at the lake (M. Galbraith and N. Ward, *pers. comm*.). At Western Springs Lake, spoonbills were usually roosting in trees close to where the pied and little black shags breed on the Large Wooded Island, a site protected from the close approach of people and dogs.

Our counts have confirmed Western Springs Lake as one of the few sites on the Auckland isthmus that supports large numbers of freshwater birds. It seems to be the only location in Auckland City with 3 species of shags breeding at one site. The small but seemingly stable breeding population of the endemic New Zealand scaup, following its colonisation of the lake in the 1990s, helps to increase the city's biodiversity.

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