

Seasonal variation in duck populations on the Waihopai River, Invercargill, New Zealand

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Abstract Seasonal variation in size of duck populations was examined using weekly surveys along a 1.5 km section of the Waihopai River, Invercargill, New Zealand, between Jul 1995 and Jul 1996. Six species were recorded: mallard (*Anas platyrhynchos*) (n = 8307), New Zealand shoveler (*A. variegata*) (n = 285), grey duck (*A. superciliosa*) (n = 36), paradise shelduck (*Tadorna variegata*) (n = 4), grey teal (*A. gracilis*) (n = 1), and New Zealand scaup (*Aythya novaeseelandiae*) (n = 1). Asynchronous seasonal trends were observed for mallard/grey duck and shoveler populations: mallard/grey duck numbers peaked during duck hunting season, whereas New Zealand shoveler peaked just prior, and declined during hunting season. A relatively constant rise in mallard/grey duck from Jan to late Jun highlights the difficulties in distinguishing the relative effects of post-breeding moult congregations vs. dispersal to refugia from hunting-related disturbance.

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INTRODUCTION

New Zealand waterfowl do not undertake the long-distance seasonal migrations that are performed by waterfowl on major continents, yet there are well-known natural seasonal population movements on localised scales (Williams *et al.* 2006). These typically involve cycles of dispersal and low population density during breeding season, followed by congregation into large flocks during the post-breeding moult (Williams *et al.* 2006).

In addition to natural seasonal movements, the displacement of waterfowl during hunting seasons to refuge sites (such as wildlife reserves) has been reported in numerous studies across the world (e.g. Madsen & Fox 1995; Väinänen 2001; Bregnballe & Madsen 2004; Roy *et al.* 2007). Understanding the effects of both hunting and seasonal habitat use on

waterfowl movement patterns can be important in monitoring the effects of hunting on wider population dynamics and in designing reserves.

In New Zealand, the use of refugial rivers and lakes by waterfowl during hunting season, particularly within urban habitats, has been observed since at least the late 19th century. For example, the Timaru Herald (1893) reported: "We hear that the luck of sportsmen in the Geraldine district on Friday was only moderate, the birds on taking flight found refuge in the adjoining districts too easily". Hatrick (1907) described a visit to a lake in the Cambridge domain: "I happened to be there the day after shooting season opened last year. The beautiful lake was simply alive with teal, grey duck, pukaki, etc. To say that there were thousands of birds would be no exaggeration... They appeared to know intuitively that in this, their place of refuge from the sportsman's gun, no harm could befall them".

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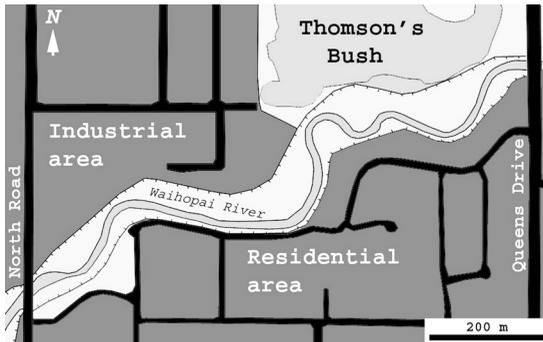


Fig. 1. Map of surveyed section of Waihopai River, Invercargill.

Understanding of disturbance-related dispersal to refugia in New Zealand appears to be based largely on casual observations, and published long-term or high-resolution survey data showing the full range of seasonal movements are limited. Smith (1972) and Caithness & Pengelly (1973) provided glimpses of large seasonal population fluctuations of ducks in Hagley Park, Christchurch, and Pukepuke Lagoon, Manawatu, respectively, yet neither study assessed patterns over an entire year. Perhaps as a result of limited data, the relationship between influxes of waterfowl and local hunting disturbance has been questioned for some urban areas (e.g. Cunningham 1972; Taranaki Herald 2009). To provide further data on seasonal waterfowl population trends within New Zealand, we present survey data collected weekly over a one year period along a section of the Waihopai River, Invercargill.

METHODS AND STUDY AREA

Weekly surveys were carried out along the 1.5 km long meandering section of the Waihopai River between the North Road and Queens Drive bridges, Invercargill (Fig. 1). Surveys were carried out each week between 8 Jul 1995 and 7 Jul 1996, except for the week of 13-19 Jan. The 1995 duck shooting season ended 30 Jul, and the 1996 season began 4 May. In addition to hunting, a further major disturbance to waterfowl occurred on the 16 Mar 1996 when a raft race was held on the river.

The surveyed section of river was bordered by c.2 m tall grassed stop-banks, beyond which were areas of industrial and residential zones, and plantation and native forest. The riparian margin was mostly grassed, although rushes occurred along some parts. Rocks had been placed on the outside banks of meanders to prevent erosion, although the majority of the riverbanks were grassed, or held small beaches of either silt or quartz gravel. The surveyed river section was 3.8 km upstream from

the New River estuary (Stead Street Bridge), and is subject to limited tidal influences.

The exact days and times of each survey varied. Surveys consisted of walking the south stop-bank of the river from North Road to Queens Drive, and returning via the north bank (30 – 60 minutes depending on the abundance of ducks). To reduce the chance of counting individual ducks twice, the only birds recorded from the north bank were those which had obviously not been seen from the south bank (i.e. different species). Also, during each survey, the locations of all ducks observed were marked on a map of the river, and we used binoculars to observe ducks which took to flight in order to determine whether they landed further along the river. Where our view of the river was obscured from the stop-bank by vegetation (such as meander loops) we walked along the edge of the river to ensure all ducks were observed and recorded.

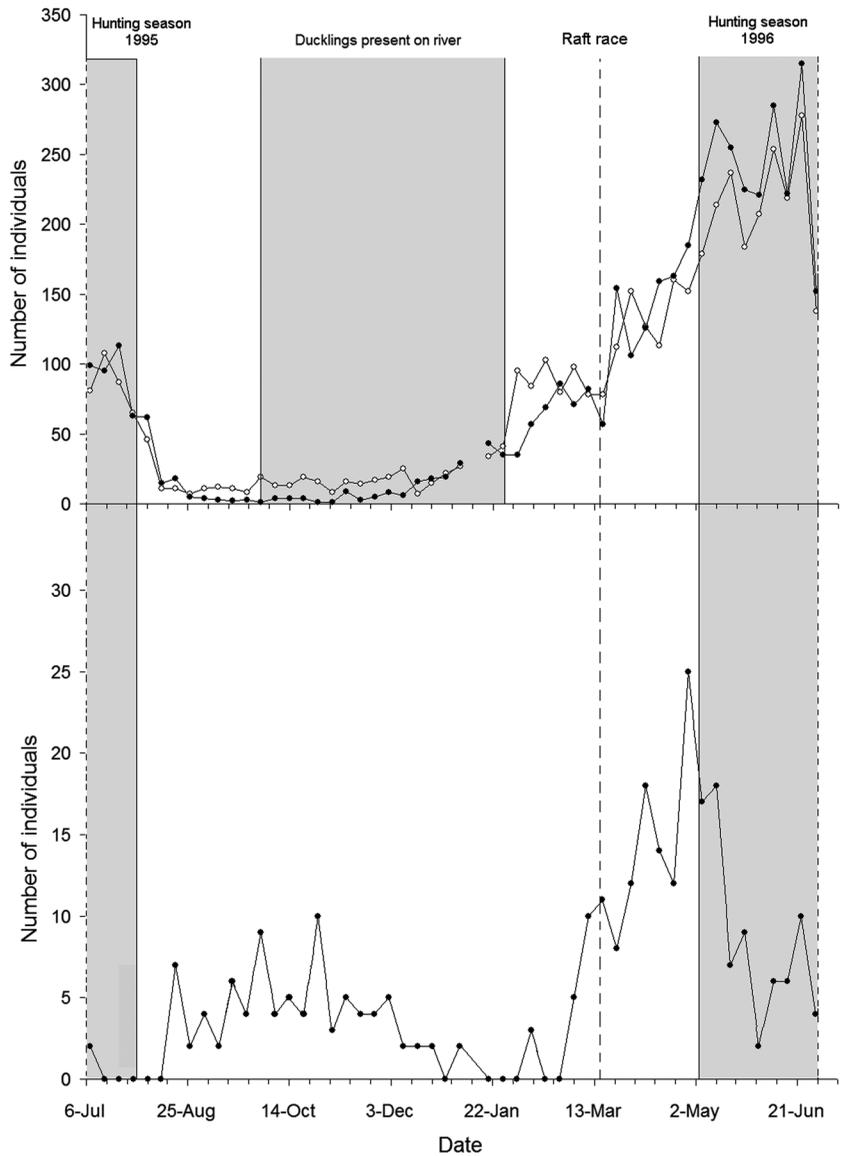
RESULTS

Six species of duck were recorded during the surveys. The most common were mallard (*Anas platyrhynchos*) ($n = 8307$, mean = 162.9 birds/survey), followed by New Zealand shoveler (*A. rhynchotis variegata*) ($n = 285$, mean = 5.6 birds/survey). Several birds resembling "grey duck" (*A. superciliosa*) were recorded ($n = 36$, mean = 0.7 birds/survey). Because pure grey duck are rare in New Zealand these were most likely hybrids, and as hybrids more commonly express mallard-like plumage, (Gillespie 1985), we combined our 'grey duck' records with female mallard in the analysis. The number of 'grey duck' records was minor compared with the number of mallard observations, and therefore this is not expected to significantly affect the analyses. Paradise shelduck (*Tadorna variegata*) ($n = 4$, mean = 0.08 birds/survey), grey teal (*A. gracilis*) and New Zealand scaup (*Aythya novaeseelandiae*) ($n = 1$, mean = 0.02 birds/survey) were also recorded.

Mallard/grey duck

Mallard/grey duck were recorded on all surveys. Males and females were equally represented, with 49.7% of all records males, and 50.3% females. The lowest number of mallard counted was 9 (6.2 birds km^{-1}) on the week of 4-10 Nov. From Aug to Jan, numbers of mallards were relatively low, and from Sep to early Dec, males were more common than females (Figs. 2, 3). The population of mallards increased at a relatively constant rate from early Sep until Jun (Fig. 4), with a slight decrease in numbers recorded for the survey in the week following the raft race (Fig. 2). The highest numbers of mallard/grey duck were recorded during the duck hunting season (Fig. 2). The peak of 593 (406.2 birds km^{-1})

Fig. 2. Seasonal variation in: Top, mallard and grey duck (*Anas platyrhynchos*; *A. superciliosa*); and bottom, New Zealand shoveler numbers on the Waihopai River between North Road and Queens Drive, Invercargill, between Jul 1995 and Jun 1996. For mallard/grey duck: filled circles, females; open circles, males.



was recorded on the week of 23-29 Jun. From mid Apr until Jul, females were more common than males. Populations declined from Jun until Sep (Fig. 4). Mallard/grey ducklings were first observed on the 8 Oct, with the last record on 27 Jan.

New Zealand shoveler

New Zealand shoveler were recorded on 40 (78.4%) of the surveys. The highest number counted on a single survey was 25, on the week of 28 Apr – 4 May. There were 2 periods during the year when shoveler were most common; from the end of Aug to end of Dec, and from early Mar until early Jul (Fig. 2). In contrast to mallard/grey ducks, the population of

shoveler declined on the Waihopai River during duck hunting season (Figs. 2, 4).

Other duck species

Single pairs of paradise shelduck were recorded on 2 surveys, on the weeks of 30 Sep – 6 Oct, and 9 – 15 Jun. A single grey teal was recorded during the week of 14 – 20 Apr, and a single New Zealand scaup was recorded during the week of 6 – 12 Jan.

DISCUSSION

Natural movements within New Zealand waterfowl are typically characterised by dispersed, low-

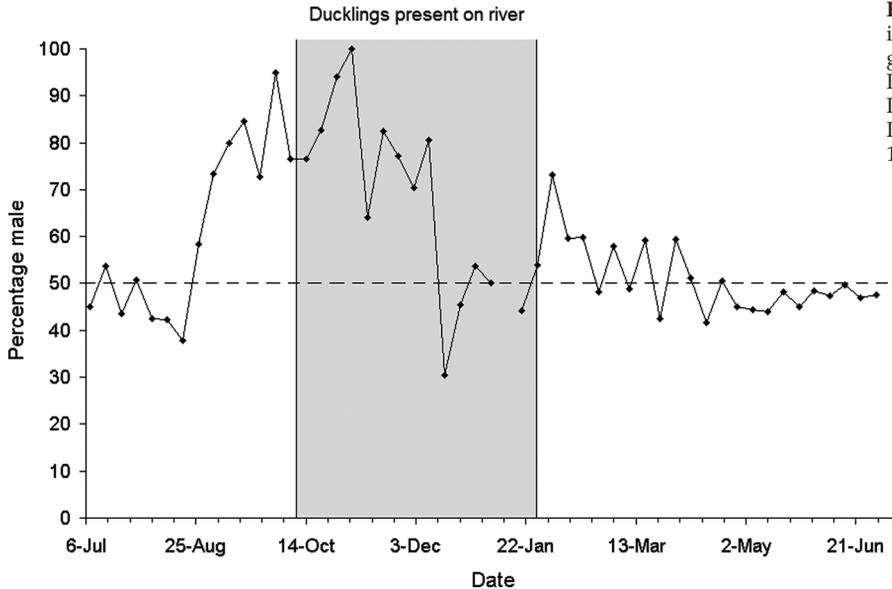


Fig. 3. Percentage of males in total counts of mallard/grey duck on the Waihopai River between North Road and Queens Drive, Invercargill, between Jul 1995 and Jul 1996.

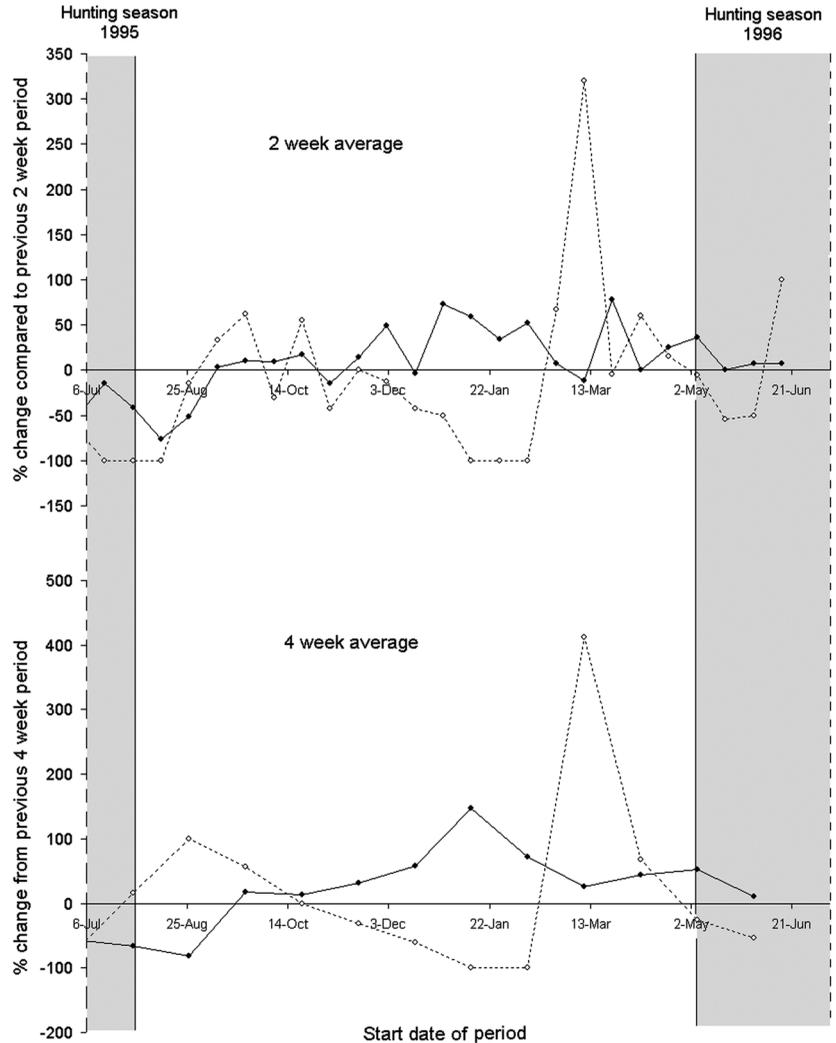
density populations during the breeding season (Aug - Nov), followed by dense post-breeding moult congregations (Dec-Mar) (Williams *et al.* 2006). This cyclical pattern was evident in some species of waterfowl inhabiting the surveyed stretch of Waihopai River. The population fluctuations of mallard/grey duck fit this characteristic pattern, but movements of shoveler did not (Fig. 2). An asynchronous pattern of seasonal movements between mallard/grey and shoveler populations was also observed by Caithness & Pengelly (1973). Although shoveler are known to congregate for moulting (Williams 1981), the drop in numbers of shoveler during the post-breeding period on Waihopai River (Fig. 2) may be due to selection of remote sites with dense vegetation for moulting, where they are rarely seen by humans (Caithness *et al.* 2002).

Proportions of male and female mallard/grey ducks on the Waihopai River varied throughout the year. It is likely our identifications of male/female mallard were slightly biased, due to potential hybridisation between the two species. While most mallard/grey hybrids express mallard-like plumage, some males can have plumage similar to a female mallard (Gillespie 1985). However, the relatively even sex ratio of male and female mallards (49.7% male vs. 50.3% female) indicates that there was little bias by including possible grey ducks as female mallards in the analysis. Overall, our observed pattern of males being more common from Sep to Dec (Fig. 3) reflects the period when females are incubating, and was also noted for both mallard and shoveler at Pukepukē Lagoon by Caithness & Pengelly (1973).

The effect of human disturbance on local populations of waterfowl was demonstrated by the short-term decline in duck numbers following the raft race held on the Waihopai River (Fig. 2). However, the effect of shooting on waterfowl movements is difficult to distinguish from movement due to post-breeding moulting congregation (Fig. 2). There was a slight plateau in mallard/grey numbers from Mar-Apr that may represent the transition between normal post-breeding population increase and an increase due to duck shooting. During hunting season the number of mallard/grey duck on the river was high but variable (e.g. changes of up to approximately 100 birds (> 20 %) between surveys). This may reflect variations in the timing and intensity of shooting in nearby areas during the preceding days.

What is more revealing is when the results of our study are incorporated with others in a comparison of waterfowl population patterns between areas where shooting is carried out and refugia (Fig. 5). This comparison reveals 2 distinct seasonal patterns. First, local waterfowl populations decline dramatically at sites where hunting is carried out (e.g. Caithness & Pengelly 1973; Pierce 1980; Miller 1993). However, these birds must go somewhere, and the second distinct pattern reflects this; local populations of waterfowl in refugia peak during duck shooting season (e.g. Smith 1972; Sagar 1976; this study). The discrepancy in the timing of the post-duck shooting season decline in local mallard/grey duck populations (Fig. 5); occurring earlier in the study of Smith (1972) than on the Waihopai River, can be explained by the corresponding hunting seasons, which ended on different dates (5

Fig. 4. Rates of local population change for mallard/grey duck (*Anas platyrhynchos*; *A. superciliosa*) (filled circles) and shoveler (open circles) on the Waihopai River between North Road and Queens Drive, Invercargill, between Jul 1995 and Jul 1996. Counts were averaged over 2 (top) and 4 (bottom) week periods, and are shown as percentage change compared with previous period.



Jun for Smith 1972; 28 Jul for this study). However, the decline in mallard/grey numbers on the Waihopai River began prior to the end of the duck-shooting season, suggesting that either the intensity of shooting declined towards the end of the season, or the dispersal of ducks to their breeding territories began prior to the close of the season.

The seasonal pattern of waterfowl populations along the surveyed stretch of the Waihopai River, particularly mallard/grey ducks, reflect previously published survey data for refugial sites, where numbers peak during duck shooting season. However, determining the relative effects of post-breeding moult congregation and hunting disturbance on these populations was difficult due to likely temporal overlap between the two. To fully understand the role of hunting-disturbance on duck movements, surveys of duck populations

over a period of several years would be important, particularly if the timing of hunting season varied between years. Short periods of simulated hunting disturbance could also be carried out in relation to surveys of local duck numbers. The results of our survey provide valuable baseline data that can be compared with future population counts of waterfowl along this stretch of river in order to determine long-term population trends.

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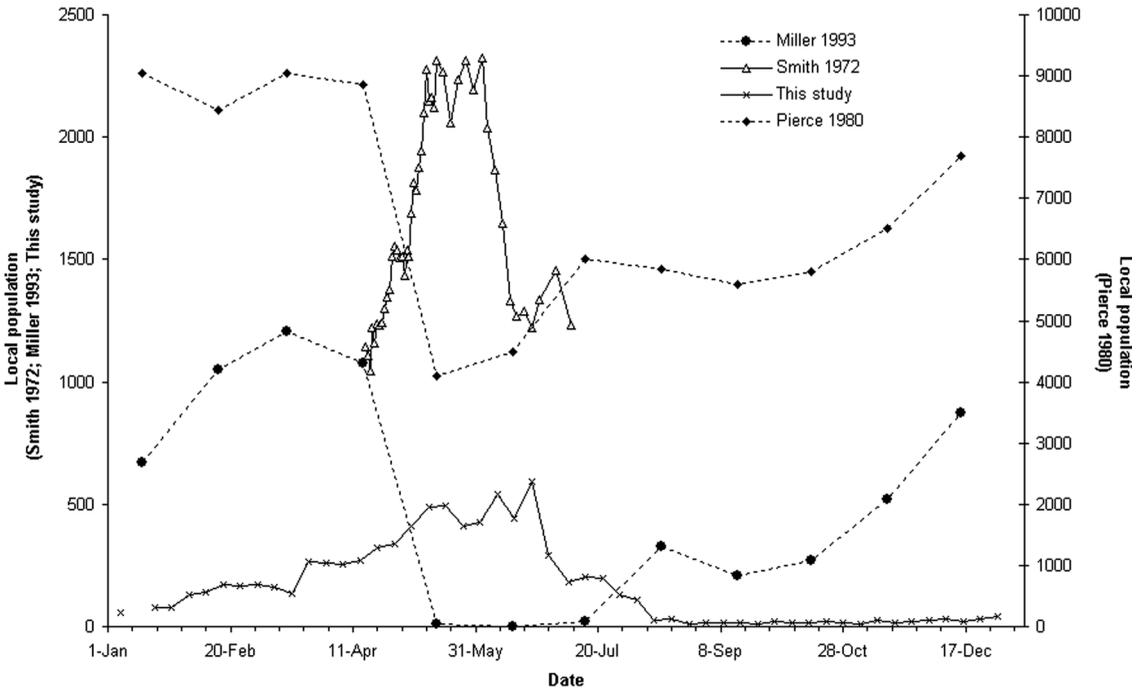


Fig. 5. Comparison of trends from 4 New Zealand studies showing seasonal variation in local waterfowl populations. Data for Kaikorai Estuary (Miller 1993), Hagley Park (Smith 1972) and this study are mallard/grey duck, and data for Lake Wainono (Pierce 1980) are combined counts of all waterfowl species. Two distinct patterns are apparent; sites where duck shooting is carried out and local populations decline during the May to Jul hunting season (dashed lines), and refuge sites where local populations peak during hunting season (solid lines). Data for Miller (1993) and Pierce (1980) are plotted for the 15th of the month in which they were carried out, as the exact date of surveys was not reported.

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