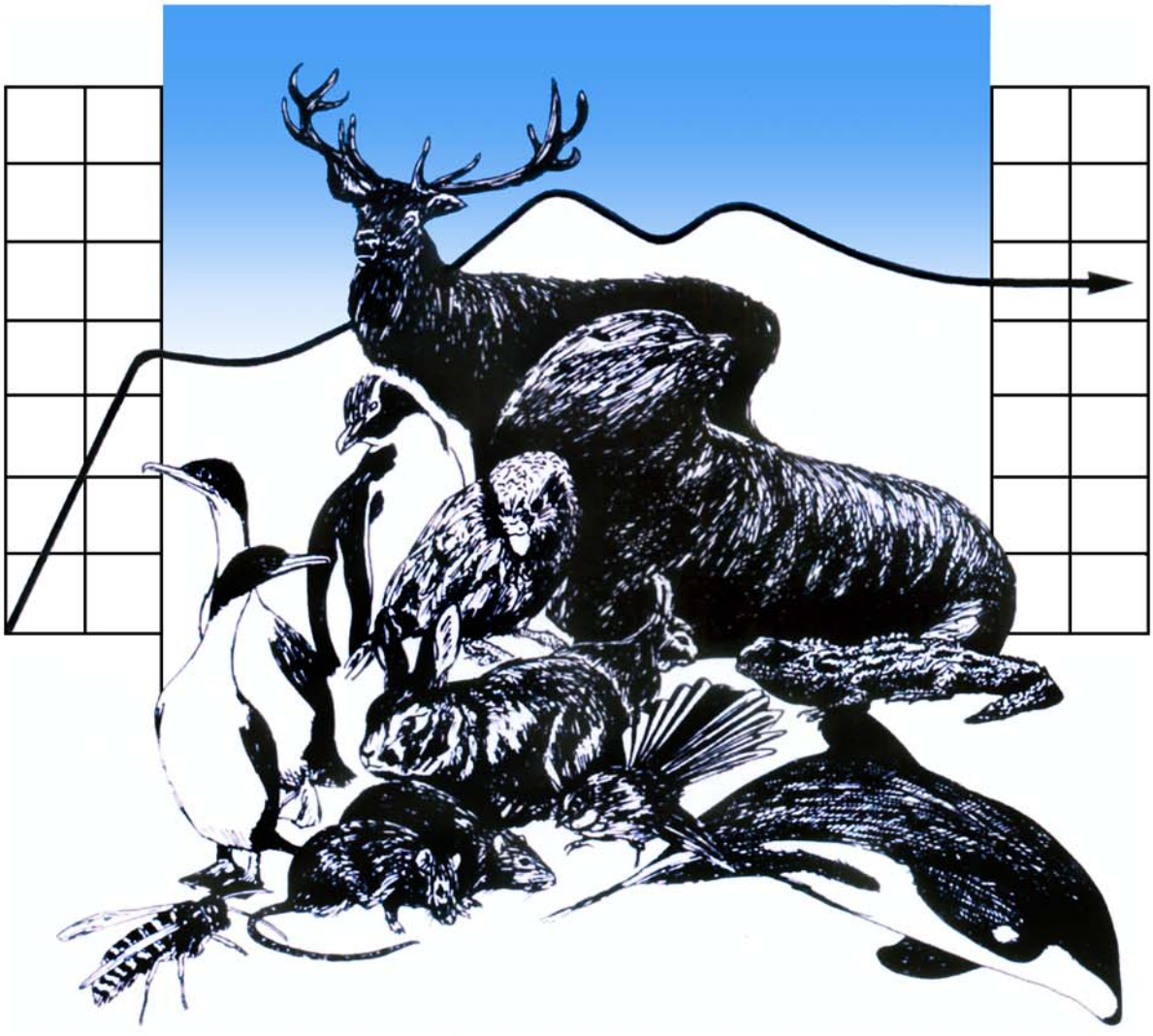
UNIVERSITY of OTAGO

Te Whare Wānanga o Otāgo

NEW ZEALAND

DEPARTMENT OF ZOOLOGY



WILDLIFE MANAGEMENT

Nesting success in Ahuriri River

V. Smith

A report submitted in partial fulfillment of the Post-graduate Diploma in Wildlife Management

University of Otago

2006

University of Otago
Department of Zoology
P.O. Box 56, Dunedin
New Zealand

WLM Report Number: 201

Introduction

Setting

The Ahuriri Valley lies on the western edge of the Mackenzie Basin, Canterbury, New Zealand (Fig. 1). The majority of the Ahuriri River is braided in nature; there are however some sections upstream of the Avon Burn confluence that are meandering. The total catchment of the Ahuriri River is 557km^2 with a mean flow of 23.8m^{3}sec(ECAN, 2005).

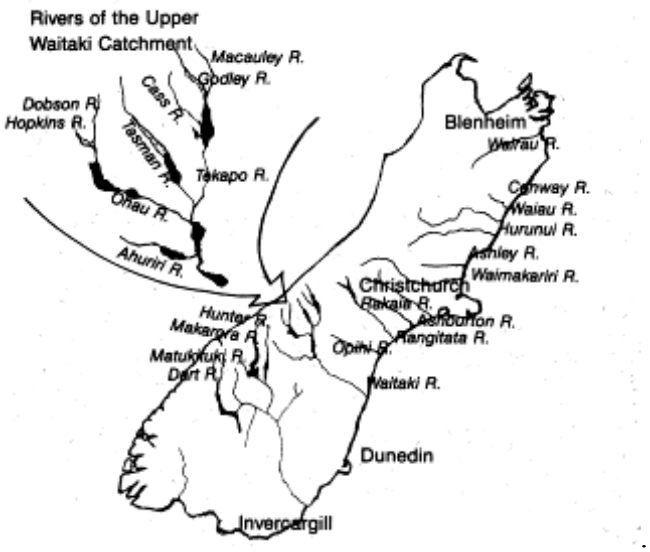


Figure 1. Braided Rivers of the South Island of New Zealand (DoC, 1993).

There are at least 26 bird species which utilise braided rivers throughout New Zealand for nesting and feeding during the spring and summer months (DoC, 1993). In the braided rivers of South Canterbury five of the six endemic bird species that breed are classified as threatened (Murphy et al, 2004). All five of these species breed in the Ahuriri. A major cause of their decline is thought to be predation by introduced mammals (Murphey et al, 2004; Taylor, 2000; Dowding and Murphey, 2001; Sanders and Maloney, 2002).

Bird species of the Ahuriri include the black stilt, or kaki (*Himantopus novaezelandiae*), one of the rarest waders in the world. The black-fronted tern (*Sterna albostriata*) and the wrybill plover (*Anarhynchus frontalis)* are threatened birds of braided rivers with similar adaptations to the black stilt. Other birds which breed on

braided rivers are somewhat less specialised to this habitat, and are able to breed not only on braided rivers but also associated side channels and wetlands (DoC, 1993). These include banded dotterels (*Charadrius bicinctus),* black-billed gulls (*Larus bulleri),* pied stilts (*Himantopus himantopus*) and South Island pied oystercatchers (*Haematopus ostralegus*). These species remain numerous on braided rivers, although their population numbers are in gradual decline (Maloney *et al.,* 2004).

Management of bird species in the Ahuriri is at present only carried out for Kaki. Captive reared Kaki have been released and supplementary fed in the Ahuriri in 2005 and 2006 and all adult birds are monitored and managed during the breeding season. Predator trapping has been undertaken in the upper Ahuriri since August 2005 using 123 DOC250 traps. To date there is no information about nesting success of these species in the upper Ahuriri. Some unpublished bird surveys of all species were conducted by the Kaki Recovery Project from 1992- 1994. Ongoing monitoring of nesting success in the Ahuriri Valley will provide an indication of the effectiveness of the predator control regime.

The species selected for monitoring are banded dotterels, wrybill, and south island pied oystercatchers. Methods used for monitoring these species in the Ahuriri were nesting success and distribution and abundance.

Aims

This study sets out to attain an estimate of nesting success of selected species of braided river birds in the upper Ahuriri River. As well as estimates of nesting success, abundance of territorial pairs of birds will be counted. This will allow correlation of nest sites identified with the total number of pairs who attempted to breed in 2005 in the same section of river.

Comparison of pairs counted in 2005 with data from 1992-1994 will be carried out. This will allow future comparisons of nesting success to assess major trends in relation to ongoing predator trapping initiated in 2005.

Species studied

Banded Dotterels

Banded Dotterels breed throughout New Zealand in both coastal areas and inland. Their main stronghold is the riverbeds and terraces of Canterbury where about 5000 pairs breed each year (Heather and Robertson, 1996). In February most Banded Dotterels migrate to Australia or the northern areas of New Zealand. In the Canterbury breeding areas eggs are laid from September to December. Clutches of 2-3-4 blue-green eggs with black markings are laid in a small scrape in the gravel. Incubation is shared by both parents for 25-27 days and starts with the second or third egg (Heather and Robertson, 1996).

Wrybills

Wrybills are found only in New Zealand. They breed in the braided rivers of the south island and spend winter on the tidal flats of the Auckland region. Breeding is from late August to January. Most pairs lay 2 pale grey eggs on bare gravels beds. Both sexes incubate for 30 days (Heather and Robertson, 1996).

South Island Pied Oystercatchers

South Island Pied Oystercatchers breed in the braided rivers of Canterbury as well as around lakes, farmland and in sub alpine bogs (Heather and Robertson, 1996). In late December to early March most migrate to the estuaries of the North Island. Eggs are mainly laid from September to December and are in clutches of 1-3 eggs (Heather and Robertson, 1996). In riverbeds nests are in small scrapes and are often on or near landscape features. In farmland however they are placed randomly away from fences and trees. Eggs are brownish stone in colour and are incubated by both sexes for 24-28 days (Heather and Robertson, 1996).

Methods

Field methods:

Nest success

Nests were located by observing breeding adults from a distance until they returned to the nest. Nests were marked using GPS and with a small rock cairn 2m upstream of the nest. Nest checks were made every 3-5 days until eggs were gone (hatched or failed) or the nest was found with chicks in it.

Once nests had disappeared signs for failure were identified where possible, eg flood, predation and desertion. Searches for chicks in the immediate nest area were made once the nest was gone to try and determine if it had recently hatched. Chicks found in the immediate nest area of less than a week old were assumed to be from the marked nest.

The following outcomes were examined for each nest:

1/ Exposure days of the nest

2/ Hatching success (where 1 or more eggs hatch).

Distribution of nesting pairs.

The distribution of pairs of birds showing nesting behaviour was surveyed on three occasions throughout the breeding season. The area between the Canyon Creek car park and the cattle yards was walked on 1 November, 1 December and 15 December. The river was divided into sections following the large braids of the river (Fig.2). Length of each line was determined by the presence of gravel riverbed and islands. These sections were walked 20m from the edge of the water, crossing braids where necessary and walking downstream at a constant speed. Sections of the river with no braids were excluded. Birds were counted when a pair showing territorial behaviour was passed, with care taken not to recount birds that flew downstream.

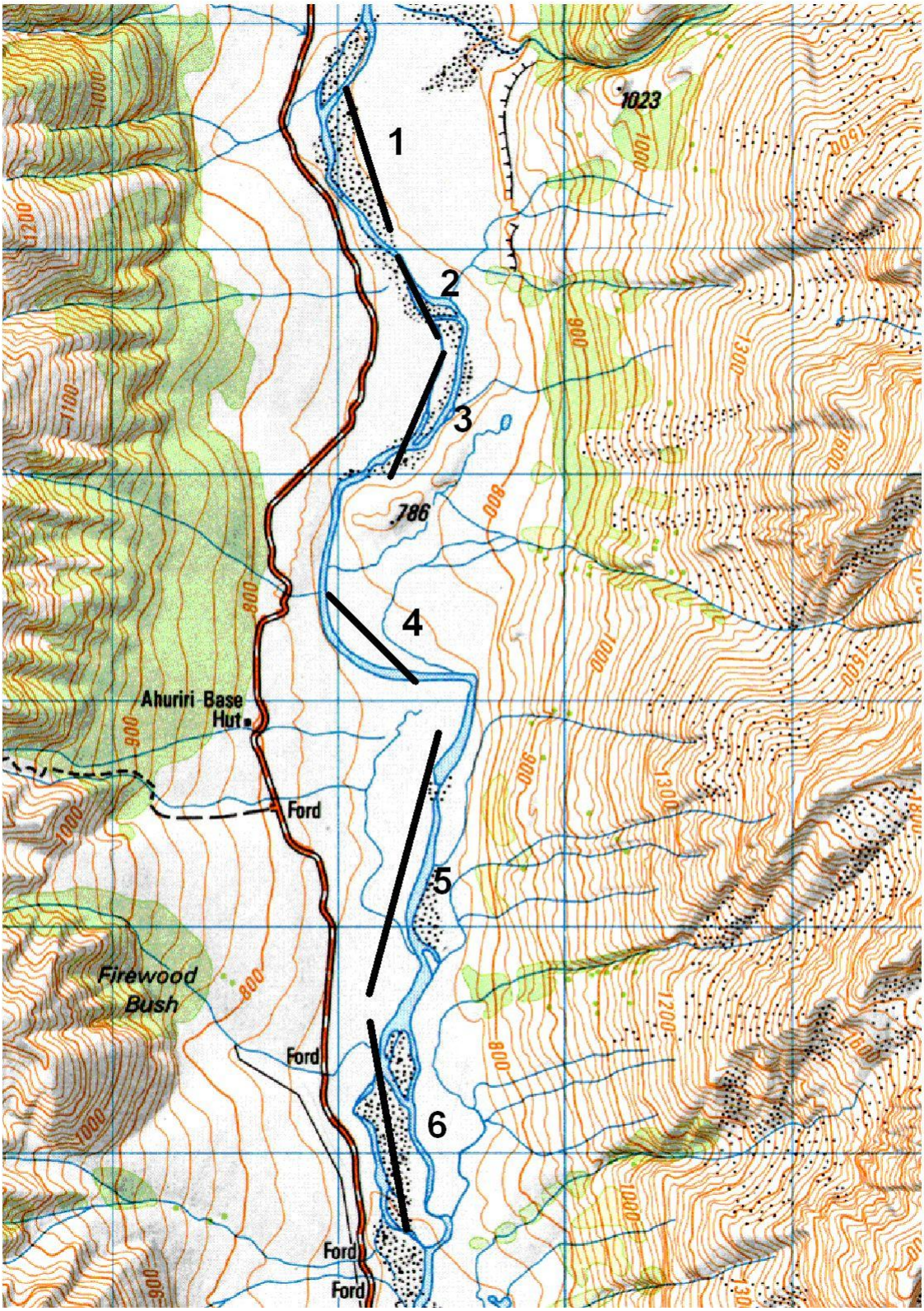


Figure 2. Map of approximate survey lines for counts of territorial pairs.

Calculating nesting success from exposure

Nesting success was calculated using exposure time, as described by Mayfield, 1960 and Mayfield 1975. Nest days are calculated as the number of days from when the nest was first identified, until it no longer existed- either through hatching or failure. Mortality was calculated as the total losses divided by total number of nest days. Survival per nest day is calculated as the inverse of mortality, ie

$$1\text{-}mortality = survival.$$

The probability a nest will therefore survive its full incubation period is calculated whereby:

$$survival^{incubation\ length} = probability\ of\ hatching.$$

Results

A total of 24 nests were found in the upper Ahuriri River between 15 October and 9 December 2005 (Fig.3). They were monitored throughout the breeding season until 14 December when the final nest failed. The area searched for nests extended from the Canyon creek gate (road end) to the cattle yards. This was the same area surveyed for territorial birds. Nests located reflect the concentration of birds resident in this section of the river during the breeding season.

Of these 24 nests, 14 were Banded Dotterel, 8 were South Island Pied Oystercatcher and 2 were Wrybill, with 35, 17 and 4 eggs respectively. Of all nests found 8 are known to have hatched, 8 failed and 1 was abandoned; the rest had unknown outcomes. The 24 nests were monitored for 273 nest exposure days. Results are presented in tables 1-4 below.

Table1. Number of nests and apparent nest success in the Ahuriri River 2005-2006.

Banded Dotterel	2005-2006
Total no. of nests	14
Total no. of nests with known outcome (A)	6
Total no. of nests hatched (B)	4
Total no. of eggs	35
Total no. of nests failed	2
Total no. of nests with unknown outcome	8
Hatching success =B/A	0.66

South Island Pied Oystercatcher	2005-2006
Total no. of nests	8
Total no. of nests with known outcome (A)	6
Total no. of nests hatched (B)	2
Total no. of eggs	17
Total no. of nests failed	4
Total no. of nests with unknown outcome	2
Hatching success =B/A	0.33

Wrybill	2005-2006
Total no. of nests	2
Total no. of nests with known outcome (A)	2
Total no. of nests hatched (B)	1
Total no. of eggs	4
Total no. of nests failed	1
Total no. of nests with unknown outcome	0
Hatching success =B/A	0.5

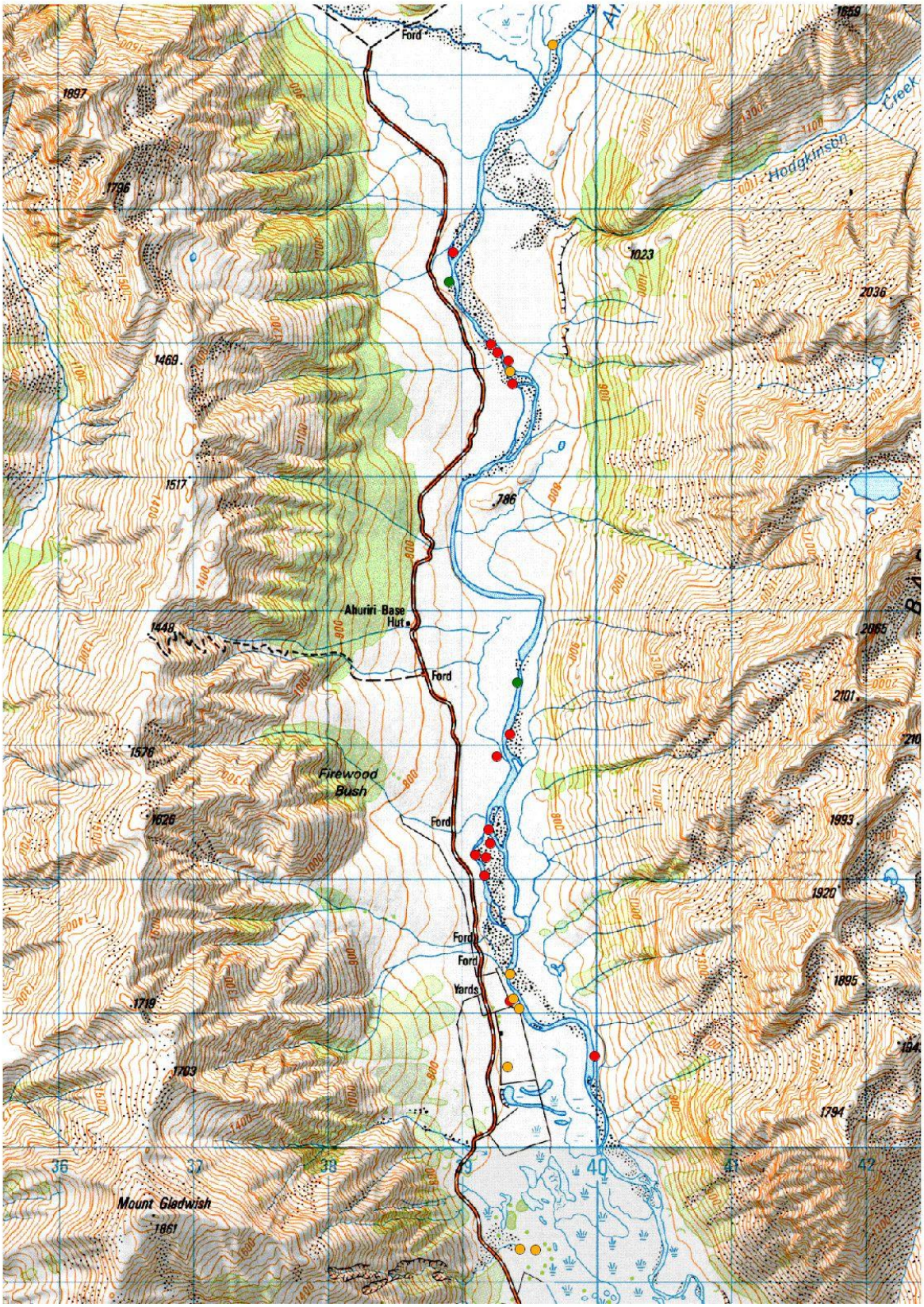


Figure 3. Map of nest sites in Ahuriri. Red=Banded Dotterel, Green= Wrybill, Yellow= SIPO

Table 2. Exposure days and outcomes for nests in the Ahuriri River.
(a)Banded Dotterel

Nest no.	Exposure days	Known outcome
1	16	Hatched
2	7	
3	8	Failed
4	6	
5	14.5	
6	17	Abandoned
7	21	Hatched
8	3.5	Failed
9	3.5	Failed
10	17	Hatched
11	14.5	
12	5.5	
13	15	Hatched
14	5	Hatched
Total	153.5	

(b) South Island Pied Oystercatcher

Nest no.	Exposure days	Known outcome
1	18	
2	18.5	Hatched
3	12	Hatched
4	2	Failed
5	6	Failed
6	13	
7	19.5	Failed
8	2.5	Failed
Total	91.5	

(c) Wrybill

Nest no.	Exposure days	Known outcome
1	3.5	Failed
2	24.5	Hatched
Total	28	

Using the methods suggested by Mayfield (1975) the likelihood of nests surviving the full incubation period was calculated.

- Banded Dotterels nests had 153.5 exposure days and 4 nests known to fail within the sample. This giving 0.026 mortality per nest day and survival of 0.974 per day. Probability that Banded dotterel nests would last to 24 days (standard incubation period) was therefore 0.5175.

- South Island Pied Oystercatcher nests had 91.5 exposure days within the sample and 4 nests were known to fail. This giving mortality of 0.437 per nest day and survival of 0.9563 per day. The probability SIPO nests would last 24 days (standard incubation period) was therefore 0.3422.
- Wrybill nests had 28 exposure days within the sample, mortality of 0.0357 per nest day and survival of 0.9643. The probability of standard incubation period of 30 days being reached was 0.336.

Table 3. Nesting success using Mayfield method.

	Banded Dotterel	South Island Pied Oystercatcher	Wrybill
Standard incubation period.	25	24	30
Exposure days	153.5	91.5	28
Mortality	0.026	0.437	0.0357
Survival	0.974	0.9563	0.9643
Probability of surviving full incubation.	0.5175	0.3422	0.336

Table 4. Survey of pairs showing territorial behavious.

(a) 1 November

Species	Line1	Line 2	Line 3	Line 4	Line 5	Line 6	Total
Banded Dotterel	5	7	4		4	9	29
SIPO		1				1	2
Wrybill	1			1	1		3

Species	Line1	Line 2	Line 3	Line 4	Line 5	Line 6	Total
Banded Dotterel	4	4	3		9	1	21
SIPO						1	2
Wrybill	1		2		1		4

Species	Line1	Line 2	Line 3	Line 4	Line 5	Line 6	Total
Banded Dotterel	4	5	3		6	5	23
SIPO						1	1
Wrybill	1		1		1		3

(b) 1 December

(c)15 December

Comparison of nests identified with territorial pairs.

- Line one consisted of one Wrybill and one Banded Dotterel nest, there were territorial pairs of dotterels exceeding this number on all three dates (5,4,4).

- Line two included 4 Dotterel nests and one SIPO nest. Territorial counts identified one SIPO pair on one earlier occasions and a maximum of 7 dotterel pairs on the first count made.

- Line three did not include any nest sites but did identify both dotterel and wrybill pairs on territory.

- Line 4 only identified territorial birds on the first occasion and included no nest sites.

- Line 5 included two dotterel nests and one Wrybill nest. The numbers of territorial dotterels exceeded this number on all three occasions.

- Line 6 included 5 dotterel nests and one SIPO nest at its southern end. This correlates with the final count made for both species, but with more birds with territorial behaviour on the first survey and less on the second.

- Total numbers of territorial pairs on all three occasions were not significantly different from one another.

Table 5: Territorial pairs compared with Identified nests.

a) Banded Dotterel

Line	Average no. of territorial pairs	No. of nests found
1	4.66	1
2	5.33	4
3	3.33	
4		
5	6.33	2
6	5	5

b) SIPO

Line	Average no. of territorial pairs	No. of nests found
1		
2	.33	1
3		
4		
5		
6	1	

c) Wrybill

Line	Average no. of territorial pairs	No of nests found
1	1	1
2		
3	1	
4	.33	
5	1	1
6		

Surveys of braided river birds were conducted in the Ahuriri in the 1990s. Data for 1993 and 1994 is available for the same section of river as surveyed in 2005. These counts were for individual birds rather than territorial pairs, for this reason the 2005 results are also presented as individuals rather than pairs. The highest number of birds from the three 2005 counts is presented as the greatest possible number of pairs that attempted to breed.

Table 6. Historical counts compared to 2005 surveys from Canyon creek gate to stockyards.

Species	1993	1994	2005 (highest count of three surveys)
Banded dotterel	45	19	58
SIPO	7	4	4
Wrybill	7	2	8

Discussion

Nesting success estimators

When nesting success of birds is examined there are several factors to consider. The stage at which a nest is discovered is one factor which has significant bearing on results obtained. In the field it is always difficult to identify a nest prior to incubation unless nest building is observed, this is especially the case with braided river birds. A solution to this problem was proposed by Mayfield, 1960, 1975. The method Mayfield develops does not require each nest to be found at its initiation, rather it utilises fragments of information to calculate exposure days for each nest. Using this method it is possible to correlate the number of nests found with the total percentage of nests built and eggs laid. The Mayfield method not only utilises data from nests not found at initiation, but also allows information from nests where the outcome is unknown to be used.

Since Mayfield proposed methods of analyising nesting success 1960, 1975 there have been modifications to this original method as well as other new methods proposed. Apparent nest success is the traditional method of analysing nest success, whereby the number of successful nests is divided by the total number of nests found. The Stanley method allows for stage specific daily survival rates when transition and failure dates are unknown. Program MARK evaluates variation in nesting success as a function of biologically relevant factors (Jehle et al, 2004). The Apparent nest success is positively bias whereas the other methods all compare reasonably across time(Johnson and Shaffer, 1990). Because of the widespread acceptance of the Mayfield method and its applicability to braided river birds in particular it was chosen for this study as the most robust method for analysing nesting success.

Exposure days vs apparent nest success

Although the traditional method of calculating apparent nesting success is widely held to be positively bias (Johnson, 1990; Jehle, 2004) I have included it in this study for two reasons. Firstly because other nesting success monitoring carried out by DOC in the Mackenzie basin uses this method. It is useful to have some correlation with previous data. Secondly I have included it to compare with the results obtained from the Mayfield estimates.

The probability of hatching success can be compared with the probability that nests would survive to hatching, as calculated using the Mayfield method. For banded dotterels hatching success using apparent nest success was calculated at 0.66 and using the Mayfield method 0.5175. Apparent nest success was calculated at 0.33 for South Island Pied Oystercatchers and probability of success using the Mayfield method at 0.3422. For Wrybills these figures were 0.5 and 0.336 respectively. For any accurate comparison to be made between these two methods larger sample sizes over a longer period of time are required. With the amount of data collected in this study the apparent nest success calculations are misleading. The Mayfield estimators are a better indication of actual nesting success but still have limitations due to the low numbers of nests identified, particularly for oystercatchers and wrybills.

Nest failure

In most cases of nest failure the cause of failure is unknown. Nests were checked for obvious reasons for failure, eg broken egg shells. Only 2 nests were found with signs of predation, SIPO 4 and 5. One Banded Dotterel nest also failed due to flooding of the island it was on. The only way to more accurately define reasons for failure is to have more frequent checks of each nest; this may still not give any new information as predation could occur without leaving any conclusive evidence. This would also create more disturbance and therefore risk biasing results due to increased researcher interference. Cameras on each nest would give accurate information about activity at each nest, however this is expensive and labour intensive as once collected all footage needs to be analysed. Previous studies in the Mackenzie basin using cameras to determine causes of predation found cats, hedgehogs and ferrets to be responsible for 43, 20 and 18% respectively of all lethal events (Sanders and Maloney, 2002). Hedgehogs and ferrets are target species of predator control in the Ahuriri and over time it would be desirable to continue monitoring outcomes of nesting attempts in order to quantify the effect predator control is having on braided river species.

Territorial pair surveys

The survey of territorial pairs in the upper Ahuriri gives an estimate of the number of birds that may have attempted to breed in the area in 2005-2006. For both Wrybill and SIPO the number of nests actually located was similar to the pairs identified with territorial behaviour. There were significantly more pairs of banded dotterels identified with

breeding behaviour than the number of nests found. This is likely to be for a number of reasons. Firstly dotterel nests are harder to find than the other two species considered, resulting in the number of nests not located being higher. Secondly, there are more of them, so with higher numbers differences become inflated.

Overall the numbers of pairs located was similar for each survey; however the distribution of pairs varied from survey to survey. This may be due to birds moving around prior to actually laying eggs; also pairs between nesting attempts will still be mobile.

Historical data

There are a number of issues involved in using historical data that affect results in different ways. Firstly methods will always differ slightly over the years, as will observer bias in data collection. From the available data the numbers of birds counted in 1993 and 2005 are relatively similar. The 1994 results are significantly lower for both banded dotterels and wrybills. With no data available from 1995 until 2005 it is not possible to tell if there was a gradual recovery in bird numbers or whether 1994 was simply an isolated bad year. Bird count data is available for other years in the 1990s but these counts were not made in the same sections of river as 1993, 94 and 05. They are recorded as whole river counts. These counts are useful however in gaining an overall idea of fluctuating bird numbers in the Ahuriri, and would be useful to assess outcomes of predator control in the future. What can be inferred from this data is that recovery of numbers is possible after years of lower success. More research would be necessary to determine the rate of recovery as well as other environmental factors prompting breeding failure and successes and whether a drop in numbers was isolated to a particular section of river.

Recommendations

Having conducted this study I would like to suggest ways in which it could be improved upon.

- A larger sample size is always better, more time in initial nest finding would be desirable and upwards of 20 nests per species located.
- For the study to be of greater use in determining the impact of predator control several other factors need to be considered. Information about initial predator

numbers is not available, however data on killed predators is, which over time may be able to be incorporated.

- The lack of a control is the major scientific limitation to this study. Nest sites outside of the predator control area would ideally be set up as controls, however finding similar habitat and bird numbers may prove difficult. The lack of information about initial predator numbers causes issues, as the control and treatment site should begin with similar predator densities. However a well set up control site with a decent sample size would still be very useful.
- Despite the limitations of this study it still has value. The nesting success information will become even more valuable if repeated in years to come. Despite not being able to provide conclusive scientific evidence about the effectiveness of the predator control the small scale nesting success study conducted does provide some information that could show changes over time.

References

DoC. 1993. *Conservation of braided river beds.* Miscellaneous publications, Department of Conservation

ECAN. 2005. Environment Canterbury Website. North Canterbury River flows and South Canterbury River flows. http://www.ecan.govt.nz/Our+Environment/Water/Rivers/RiverFlows/htm Accessed:2/2/06.

Heather, B,; Robertson, H. 1996. *The field guide to the birds of New Zealand*. Penguin Books, Auckland.

Jehle, G.; Adams, A.; Savidge, J.; Skagen, S. 2004. Nest survival estimation: a review of alternatives to the Mayfield estimator. *The Condor* 106, 472-484.

Johnson, D.H. 1979. Estimating nest success: the Mayfield method and an alternative. *The AUK* 96:651-661.

Johnson, D.; Shaffer, T. 1990. Estimating nest success: when Mayfield wins. *The Auk*, 107, 595-600.

Maloney, R.; Rebergen, A.; Nilsson, R.; Wells, N. 1997. Bird density and diversity in braided river beds in the Upper Waitaki Basin, South Island, New Zealand. *Notornis*, 44, 219-232

Mayfield, H. 1961 Nesting success calculated from exposure. *The Wilson Bulletin* 73,3,255-261.

Mayfield, H. 1975 Suggestions for calculating nesting success. *The Wilson Bulletin*, 87, 4,456-466.

Murphy, E.C.; Keedwell, R.J.; Brown, K.P.; Westbrook, I. 2004. Diet of mammalian predators in braided river beds in the central South Island, New Zealand. *Wildlife Research,* 31:631-638.

Sanders, M.; Maloney, R. 2002. Causes of mortality at nests of ground-nesting birds in the upper Waitaki Basin, South Island, New Zealand : a 5-year video study. *Biological Conservation* 106, 225-236.

Appendix A:

GPS Co-ordinates of nest sites

Oystercatcher	2239359 / 5651300
Banded Dotterel	2239264 / 5655930
Banded Dotterel	2239348 / 5655867
Oystercatcher	2239357 / 5655787
Banded Dotterel	2238936 / 5656674
Wrybill	2238903 / 5656455
Banded Dotterel	2239220 / 5655991
Banded Dotterel	2239379 / 5655696
Banded Dotterel	2239355 / 5651094
Oystercatcher	2239425 / 5651039
Oystercatcher	2239338 / 5650605
Oystercatcher	2239434 / 5649248
Wrybill	2239415 / 5653468
Oystercatcher	2239677 / 5658220
Banded Dotterel	2239170 / 5652031
Banded Dotterel	2239199 / 5652375
Banded Dotterel	2239211 / 5652269
Banded Dotterel	2239167 / 5652180
Oystercatcher	2239436 / 5649240
Banded Dotterel	2239360 / 5653079
Banded Dotterel	2239257 / 5652914
Banded Dotterel	2239182 / 5652160
Banded Dotterel	2239985 / 5650679
Oystercatcher	2239382 / 5651108

Acknowledgements:

Thanks to Antje Leseberg, Richard Maloney, Megan Henderson, Tiff Browne and Pete Lei.