The 2006 birdlife survey of the Hurunui River – results and management implications

Ken F.D. Hughey
Lincoln University

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Summary

A formal survey of birdlife of the Hurunui River was undertaken during December 2006, following a long period of intense flooding in the river. Braided parts of the upper river contained relatively intact natural habitat but relatively low numbers of most bird species. The highest numbers of key braided river bed bird species observed in the upper catchment were on the South Branch between the Lake Mason outlet stream and the gorge and on the North Branch delta between the swing bridge and Lake Sumner.

On the lower river, the braided sections from Mandamus to Lowry Hills and from State Highway 1 to the sea, including the lagoon, contained impressive numbers of three nationally important braided river-dependent bird species; black-fronted tern, black-billed gull and banded dotterel.

The braided sections of the Hurunui and the river in total should be considered nationally important for birdlife. Most notably the river supports between 5-12% of the endemic black-fronted tern population, classified by the Department of Conservation as ‘Chronically threatened: nationally endangered’.

The management and research recommendations included in this report should be implemented prior to further water resource development on the river.

1. Introduction

Formal surveys of the birdlife of Canterbury's braided rivers have been undertaken both systematically and opportunistically since the 1970s. The longest running surveys are on the Ashburton River and rivers in the Mackenzie Basin (O'Donnell 2000), although the most comprehensive report for all rivers remains that of O'Donnell and Moore (1983). Some rivers ranked highly by O'Donnell and Moore (1983), including the Hurunui, Rakaia and Waimakariri, have formally been surveyed only once. This lack of ongoing monitoring typically reflects the enormous difficulties faced in undertaking such surveys, e.g., often unpredictable flows, inclement weather, the large amount of time required and logistical and safety issues. Normally repeat surveys have only occurred as a result of proposed water resource development or in preparation for water conservation order applications. In the case of the Hurunui there have been ongoing discussions about water resource developments including proposed dams on the main stem of the river near Mandamus, on the South Branch in the Gorge and at the outlet of Lake Sumner (a weir). These proposals led the Department of Conservation to request a new survey of the Hurunui in the spring of 2006, as a follow up to that of 1978 (reported in O'Donnell and Moore (1983)). This report presents the results of the survey, the conservation and management implications, and ongoing research needs should further water resource development of the river be envisaged.

2. Description of the survey area

In the following section I outline the main physical characteristics of the Hurunui River – these characteristics are used as the basis for identifying discrete sections[1] (See Figure 1 and numbered 1-12) which are used as the basis for the bird survey.

The Hurunui is perhaps the most complex and diverse of Canterbury's rivers. It has two main branches with sources in the Southern Alps:

- the South Branch which is largely rain and seasonally snow-fed – it features a largely single channel upper reach (S1) and then a substantial section of braided riverbed from the confluence of the Lake Mason outlet stream to the gorge (S2), a long gorge, and then a short partially braided section before it meets the North Branch. The river is bordered in its upper reaches by mostly beech forest and lower down by extensively farmed pastoral hill country and some beech forest;
- The North Branch which is also largely rain and seasonally snow-fed but which includes several lakes in its catchment, most notably Lake Sumner. The upper North Branch flows into Lake Sumner via a riverbed which varies from largely single channel (S3) to open and very braided over its final few kilometres (S4). The upper section is largely bordered by the Lake Sumner Forest Park while lower down it is surrounded by grassed alluvial flats to the north and extensively farmed pastoral land to the south. Below Lake Sumner the North Branch is largely single channelled with sections that are enclosed in gorges and some of which are relatively more open with shingle bars and occasional mostly

[1] It should be noted that not all parts of the Hurunui River were surveyed as most emphasis was on the braided sections.

vegetated (with gorse) islands (S5). Much of the surrounding land is in woody native vegetation interspersed with grazed pastures.

Below the confluence of the two branches the river continues in a pattern of relatively open and mostly single channelled form (S6) until Maori Gulley where it is deeply incised in a gorge, it then opens out again before entering another narrow gorge which ends at Mandamus (S7). From Mandamus to State Highway 7 (S8) the river is largely open and braided, although often heavily vegetated with exotic weeds, mostly lupin, gorse and willow – this part of the river is bordered by mostly intensively farmed areas to the south and exotic pine forest to the north. The next part of the river from State Highway 7 to the Lowry Hills entrance to the lower Gorge (S9) is mostly open and braided with many areas of dense exotic vegetation, mostly gorse, lupin and willow. It is bordered by extensive hill country on the south bank and intensively farmed irrigated pastures to the north. The lower gorge (S10) is mostly incised into extensively farmed hill country. There are several short reaches where the river opens out into two or more channels interspersed mostly by islands often heavily infested with exotic vegetation, especially gorse, lupin and willow. The lower gorge ends at State Highway 1 with the river then opening out to a largely braided reach (S11) surrounded by mixed hill and intensively farmed low country until it reaches the coast where there is an extensive lagoon running to the north (S12).

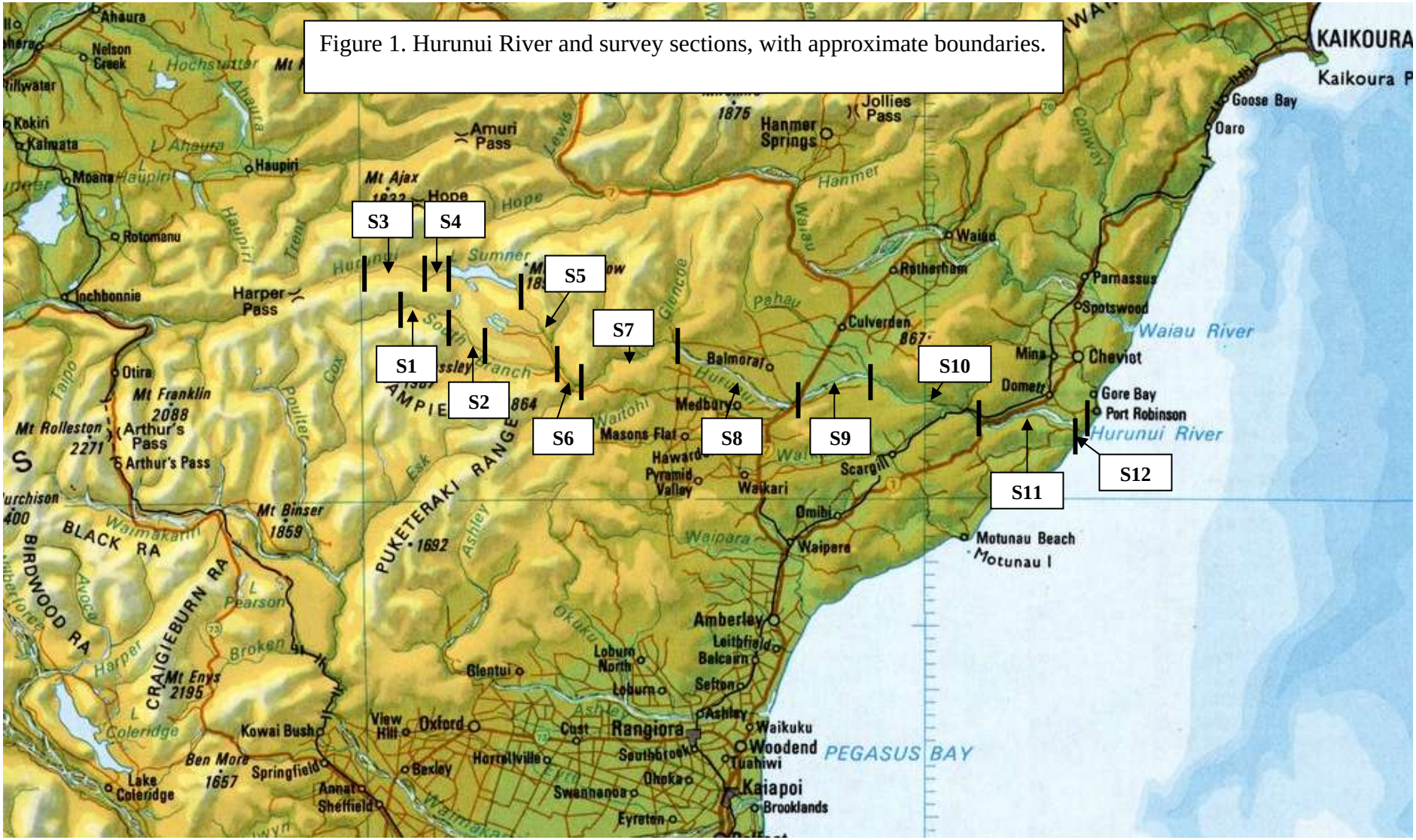


Figure 1. Hurunui River and survey sections, with approximate boundaries.

3. Survey methods

There is a generally accepted and standardised method for conducting surveys of braided rivers – the method used in this survey typically involved:

- having 2 or more observers[2] spaced 100-200m apart across the riverbed; and
- counting birds only as they flew or were walked past or if they flew away from the riverbed.

In some sections of the river, i.e., 5 and 6, I observed from points of ready road or walking access and consequently only one person was needed but reliability and coverage was limited. Surveying lower sections of the river, i.e., 7-11, involved use of the North Canterbury Fish and Game Council jet boat to ferry observers across otherwise impassable channels.

As with all surveys of braided rivers it must be emphasised, as noted in O'Donnell and Moore (2003: 3), the totals recorded must be considered as indices of relative abundance of species rather than as absolute counts. This is because some species are relatively more conspicuous than others, e.g., black-fronted dotterels are more difficult to find than are banded dotterels, southern black-backed gulls and black-fronted tern colonies are often difficult to count because of the random nature of the circling birds and the sometimes very large numbers encountered, and paradise shelducks and pied stilts often fly large distances and can be confusing to confirm observations for.

Results from this survey are tabulated by river section, by species and in total. These totals have been plotted against those recorded in the previous 1978 survey (see O'Donnell and Moore (2003: 16-18). It must be noted at this point that comparisons between surveys on the same river must be treated with great caution. First, in this instance, there are only two surveys and thus trends in relative abundance cannot be drawn, i.e., three or more data points are required to determine trends of this sort. Nevertheless, and despite the limitations associated with indices of relative abundance, some absolute comparisons may be drawn, for example the presence or absence of species can be noted, and where very large numerical differences in numbers of key species are observed then conclusions may be drawn which can also be related to observations elsewhere. Given these constraints the results of the Hurunui survey are now presented.

[2] Experienced surveyors were being used intensively in 2006 due to other planned surveys of the Rakaia and Waimakariri rivers, and of rivers in Mid and South Canterbury. Consequently, the surveyors used here were all inexperienced but received extensive briefings prior to participating and were themselves subject to close scrutiny throughout the surveys.

4. Survey results

Riverbed surveys are normally undertaken in October and November when breeding activity for most species is most intense. However, due to a variety of constraints, including persistent floods over the November-early December period it was only possible to undertake surveys in mid-late December of 2006. Even then river flows were unusually high and thus surveys were sometimes difficult to organise and undertake and jet boating was somewhat hazardous.

4.1. Overall findings

Full results and related observations for the December 2006 survey are provided in Appendix 1, while Appendix 2 shows some images of key sections of the Hurunui, including habitats and other observations of note. Table 1 lists (and Figure 2 graphs) the species observed and the index counts from both the 1978 and 2006 surveys. Total numbers counted in 2006 were almost double those of 1978, with an 'increase' in southern black-backed gulls accounting for around 1/3 of this difference. Other species to have much larger numbers in 2006 are: Canada goose, paradise shelduck, spur-winged plover and black-fronted tern. Three species defined by DoC as being of conservation concern are highlighted in Table 1: banded dotterel, black-billed gull and black-fronted tern – both dotterels and terns were recorded in much higher numbers in 2006, whereas fewer gulls were recorded in that survey.

Bird numbers and species distribution (Figure 3) varied greatly along the river. Highest bird numbers were recorded on:

- most of the braided sections
- downstream of Mandamus; and
- the lagoon.

In terms of species distributions I clumped like-species, e.g., Canada goose, paradise shelduck and the various duck species were clustered into 'ducks and geese', to improve descriptive ability. The most notable findings from this analysis are that:

- the vast majority of southern black-backed gulls occur in S8 (Mandamus to SH7);
- dotterels and plovers are distributed reasonably evenly in all of the highly braided sections, although S11 (SH1 to the Lagoon) had over twice as many as any other section;
- most terns were found downstream of Mandamus;
- almost all of the red-billed and black-billed gulls (a breeding colony of the latter) were found at the lagoon.

Table 1. Species and index counts for 1978 and 2006 surveys.

Species	**1978**	**2006**
Black shag	24	59
Pied shag		11
Little shag		5
Spotted shag		2
White-faced heron	16	60
Canada goose	35	239
Paradise shelduck	68	802
Duck species	251	293
Grey teal		1
NZ shoveler		2
South Island pied oystercatcher	124	237
Variable oystercatcher		2
Pied stilt	121	71
Banded dotterel	290	450
Black-fronted dotterel		13
Spur-winged plover	83	709
Turnstone		1
Southern black-backed gull	1040	2299
Red-billed gull		39
Black-billed gull	1163	758
Black-fronted tern	338	604
Caspian tern		7
White-fronted tern		190
Kingfisher		7
Welcome swallow		67
Pipit		41
TOTAL	**3553**	**6969**

Figure 2. The 1978 and 2006 Hurunui index counts by species.

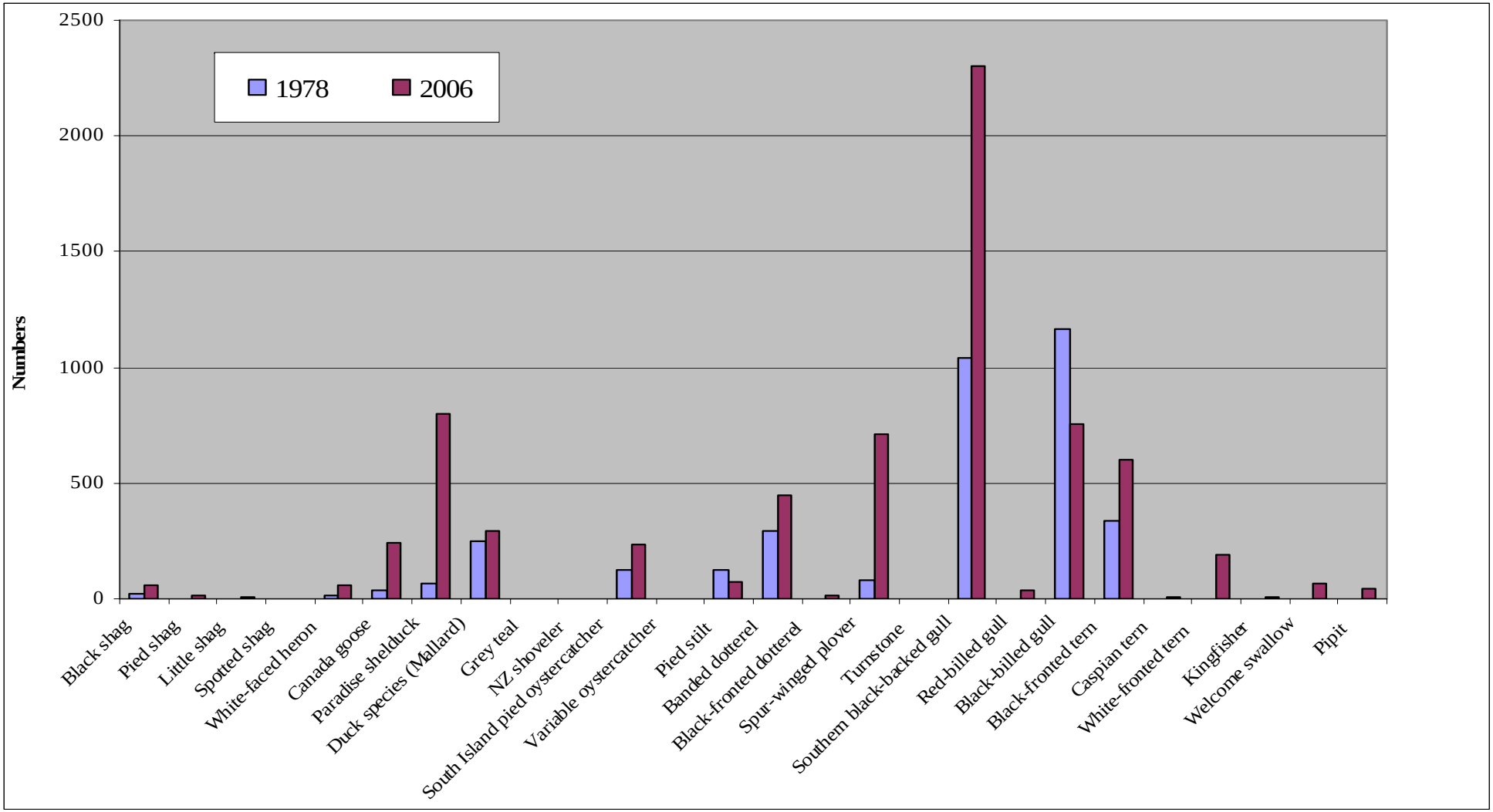
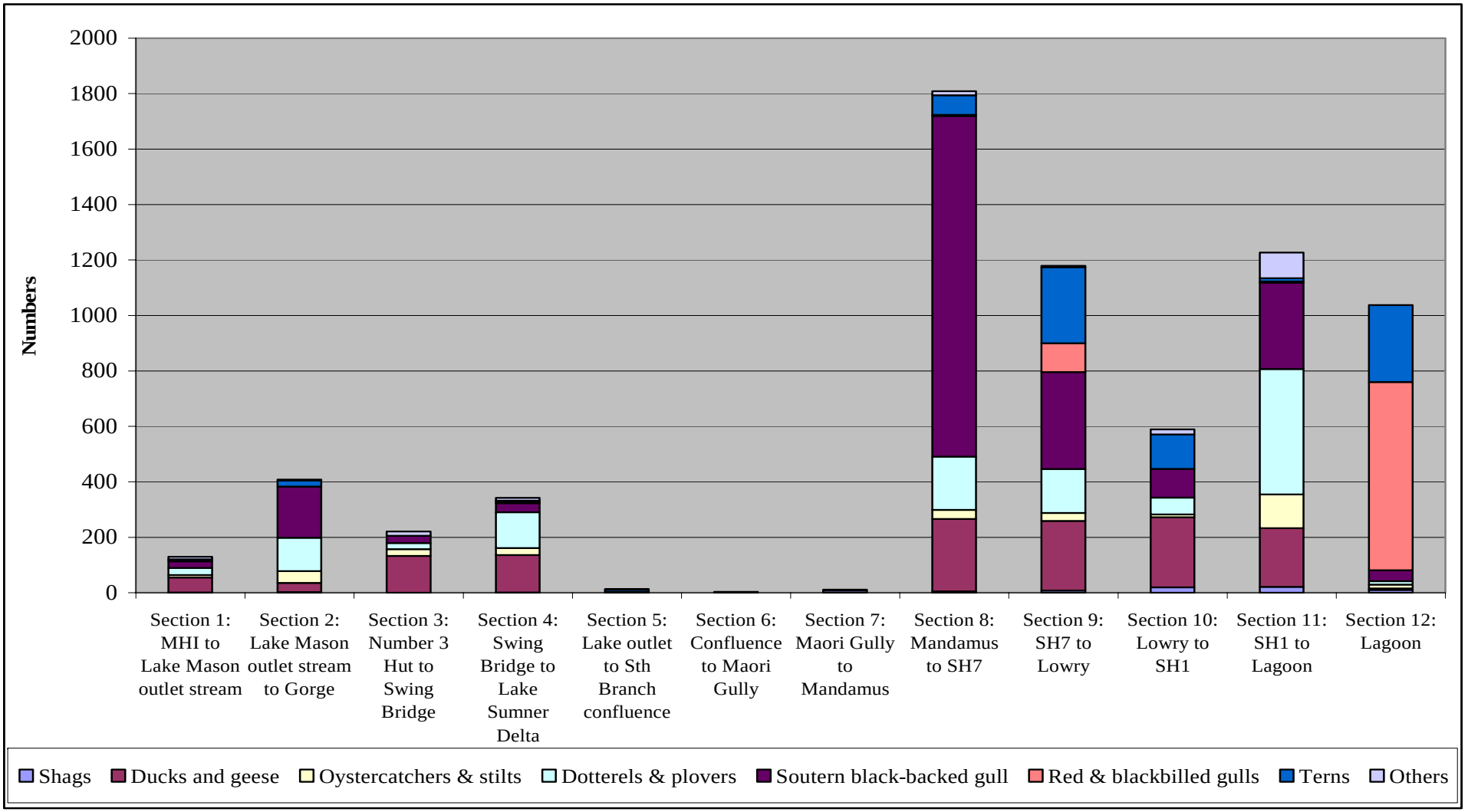


Figure 3. Distribution by species' groupings.



The species present on the Hurunui can be further classified on the basis of eight guilds identified for river birds by O'Donnell (2000). The classification presented in Table 2 also gives an indication of the range of microhabitats required by these species and the diversity of both birds and habitats present on the river, and the conservation status of the species as defined by Hitchmough (2006).

Table 2. Species richness, foraging guild and conservation status of native riverbed bird species on the Hurunui River.

Species	Scientific name	Conservation status (Source: Hitchmough 2002)	Foraging guild						
			Open water divers	Deep water waders	Shallow water waders	Dabbling waterfowl	Aerial hunting gulls and terns	Swamp specialists	Riparian wetland species
black shag	*Phalacrocorax carbo*	At Risk: Sparse	✓						
pied shag	*P. varius*		✓						
little shag	*P. melanoleucos*		✓						
spotted shag	*Stictocarbo punctatus*		✓						
white-faced heron	*Ardea navaehollandiae*			✓					
pied stilt	*H. himantopus*			✓					
spur-winged plover	*Vanellus miles*			✓					
South Island pied oystercatcher	*Haematopus ostralegus finschi*			✓					
variable oystercatcher	*H. unicolor*								
banded dotterel	*Charadrius bicinctus*	Chronically threatened: Gradual decline			✓				
black-fronted dotterel	*C. melanops*				✓				
paradise shelduck	*Tadorna variegata*					✓			
grey duck (duck spp)	*Anas superciliosa*	Chronically threatened: Nationally endangered				✓			
grey teal	*A. gracilis*					✓			
NZ shoveler	*A. rhynchotis*					✓			
black-fronted tern	*Sterna albostriata*	Chronically threatened: Nationally endangered					✓		
white-fronted tern	*S. striata*	Chronically threatened: Gradual decline					✓		
Caspian tern	*S. caspis*	Acutely Threatened: Nationally vulnerable					✓		
black-billed gull	*Larus bulleri*	Chronically threatened: Serious decline					✓		
red-billed gull	*L. scopulinus*	Chronically threatened: Gradual decline					✓		

southern black-backed gull	*L. dominicanus*						✓		
NZ pipit	*Anthus novaeseelandiae*								✓
welcome swallow	*Hirundo tahitica*								✓
NZ kingfisher	*Halcyon sancta*								✓

4.2. Results by survey section

See Figure 1 for a map of the river and the approximate section boundaries.

Section 1: South Branch: Hurunui Mainland Habitat Island to Lake Mason outlet stream
This reach was mostly single channel except for a small braided part at the top end where banded dotterels were relatively abundant. Overall species diversity was low. The riverbed was clear of exotic vegetation. A small southern black-backed gull colony was present at the top of the section.

Section 2: South Branch: Lake Mason outlet stream to Gorge
This long section was mainly of 1-3 braids and was free of all forms of exotic standing vegetation and should thus be considered as relatively in a highly natural state. Substantial areas of gravel islands and bermlands are vegetated with mat and cushion plants which provide excellent banded dotterel habitat. Two small black-fronted tern colonies were found in this section, along with small-moderate sized southern black-backed gull colonies.

Section 3: North Branch: Number 3 Hut to Swing Bridge
A mostly narrow section of river generally flowing in one channel with a bouldery substrate. Relatively few species were recorded and then mostly in low numbers. Main species recorded were paradise shelduck, SIPO and SBBG.

Section 4: North Branch: Swing Bridge to Lake Sumner Delta
This is a highly braided section of river which at the delta with Lake Sumner is over 1km wide. Habitat is a mix of recently exposed gravels and islands and terraces vegetated with prostate cushion and mat plants. The most stable areas are more heavily vegetated with mostly native plants including matagouri. Species diversity was high in this section with all key species present, i.e., black-fronted tern, black-billed gull and banded dotterel. However, only the latter was recorded in large numbers and breeding. Other species recorded in relatively large numbers were paradise shelduck and spur-winger plover. A few scattered gorse plants were observed lower down on this section and these should be controlled.

Section 5: North Branch: Lake outlet to South Branch confluence
A largely single channel section of river with low bird numbers. Only parts of this section were surveyed and it is possible that isolated islands or point bars support colonies of black-fronted terns but overall low numbers suggest any such colonies would be small. Most islands are heavily infested with exotic weeds.

Section 6: Confluence to Maori Gully
This single channel section of river had very low bird numbers. The few islands that are present are heavily infested with exotic weeds.

Section 7: Maori Gully to Mandamus
Only the lower part of this section was surveyed. Black shags are breeding in the gorge above the Mandamus confluence.

Section 8: Mandamus to State Highway 7
This long section varies between 1-4 braids and is often heavily infested with exotic weeds. Almost all islands where vegetation growth was most advanced were plagued by rabbits indicated also the likelihood of high predator numbers in this section. Despite these observations bird species diversity was relatively high and numbers of several species were high. Notably numbers of SBBG (c.1228) were very high with several widely dispersed colonies. Two small black-fronted tern colonies (c.10 and c.30) were found but only moderate numbers of banded dotterels recorded. The large numbers of SBBG could be predating on key bird species in this and lower river sections and appear likely to have increased since the 1978 survey as agricultural land use intensification has occurred.

Section 9: State Highway 7 to Lowry Hills
This is a braided section (1-4 channels) with characteristics similar to Section 8. Notably, however, numbers of SBBG were much lower and there was a very large black-fronted tern colony (c.274 birds) present. Around 100 black-billed gulls were found but no evidence of breeding. Extensive exotic vegetation growth was present with more mature willows than upstream.

Section 10: Lowry Hills to State Highway 1
This is the lower gorge of the Hurunui although it contains several short sections with islands and up to 3 braids. In one of these sections a large black-fronted tern colony was found. Otherwise, this section was characterised by paradise shelduck and the largest number of black shags seen on the river.

Section 11: State Highway 1 to Lagoon
This was the only section of the river to contain black-fronted dotterels, a species not recorded on the Hurunui during the 1978 survey. This section of braided river (1-5 channels) also had large numbers of banded dotterel (c.138), spur-winged plover (c.301) and the largest number of pied stilts recorded during the survey. Exotic vegetation growth is prolific in places although the spring floods had cleared large areas.

Section 12: Lagoon
This short section contained substantial numbers of breeding black-fronted terns (c.70 in a colony) and black-billed gulls (c.640) that were nesting on the bar between the remnant lagoon and the sea. Recent floods had bypassed the lagoon with the river flowing directly to the sea. The extent to which these species normally breed at the lagoon is unknown but is considered unusual.

5. Conclusions

In this section I first discuss the overall significance of the survey findings, including the implications for species with defined conservation status. I then identify the key management requirements for key species and groups of species and amplify where necessary on the work and recommendations of O'Donnell (2000). Finally, recommendations are made for further research should further water resource development be formally proposed for the river.

5.1. Conservation implications

In 1983 O'Donnell and Moore rated the Hurunui River as being of 'High' conservation value for birdlife. The results of this survey at worst confirm that rating but at best suggest that the river rates as 'Outstanding' against the criteria used then (Appendix 2). I have also assessed the Hurunui River against the multiple criteria identified by O'Donnell (2000: 21) to categorise habitat significance (Table 3). The summed score of 52 achieves a ranking of High 1, 'national/international' significance under this system, the highest ranking that is possible. O'Donnell (2000: 21) states with respect to High 1:

> *"They are among the best examples of the habitat types present in New Zealand, are relatively unmodified, and not well represented elsewhere in the country. They are of large size, have diverse microhabitats and water bird faunas, and contain viable populations of all or almost all species and guilds which are typical of the habitat type."*

From my own observations and from experience with all of the braided rivers along the eastern South Island I consider this conclusion applies to the Hurunui River.

Three species that occur in substantial numbers on the Hurunui are considered to be of conservation concern: namely black-billed gull, black-fronted tern and banded dotterel. Numbers of black-fronted tern in particular, as recorded in this survey, are extremely important. The total population of this species is thought to be somewhere between 5-10,000 and declining rapidly (Keedwell 2006). As also indicated by the data in Table 4 the numbers counted in this survey would indicate that somewhere between 5-12% of the total population occurs on the Hurunui, a very significant proportion for the conservation of this species. Indeed, it appears likely the Hurunui is one of the remaining strongholds for this endangered species. The substantial numbers of dotterels and black-billed gulls are also important.[3]

[3] There are other threatened species on the Hurunui lakes, which were not the subject of this survey.

Table 3. Habitat significance of the Hurunui River.

Criteria	Scale	Detail	Hurunui
Representativeness	1 to 7		6
Life supporting capacity	L1: 1-4	Habitat size	4
	L2: 1-4	Numbers	3
	L3: 0-7	Breeding guilds	6
	L4: 0-7	Feeding guilds	6
	L5: 0-7	Roosting guilds	6
Natural diversity	N1: 1-2	Within guilds	1
	N2: 1-10	Microhabitat diversity	7
	N3: 0-7	Number threatened species	3
Distinctiveness	D1: 1	Overwintering	0
	D2: 1	Migration stopover	0
	D3: 1	Significant breeding site	1
	D4: 1	Significant moulting site	1
	D5: 1	Only region typically supporting a particular species	1
	D6: 1	Habitat for specialist needs	1
	D7: 1	Habitat for species with special diet or foraging behaviour	0
Intactness/naturalness	1 to 4	Level of modification	3
Long term viability	1 to 3	Vulnerability to natural perturbations	3
		Score:	52

Some discussion is also necessary about the relationship of the Hurunui to other local braided rivers, e.g., the Clarence, Waiau and Ashley. It is possible that the currently high numbers of some of the key species occurring on the Hurunui is because some colonial nesting species, e.g., black-fronted tern, have moved here as the quality of other rivers has declined. There is insufficient data to test this proposition. It is also possible that while numbers are very high for some species on the Hurunui they have declined on other rivers, thus making the Hurunui relatively more important for conservation management purposes. Once again there is insufficient data to test this proposition. Irrespective of both the above propositions it is clear the Hurunui is very important in a national context for braided river birdlife.

Table 4. Key summary bird, vegetation status and hydrological data for Canterbury and Marlborough braided rivers reported to contain more than 100 black-fronted terns (Source: adapted from Hughey 2006)

River	Recorder Site	Mean flow[4]	Floods		Most recent tern count (Source: Keedwell, unpublished collated data, & this survey)	Riverbed area and vegetation (Source: Wilson 2001)		
			Mean annual	10 year return period		Riverbed area (ha)	Open riverbed area (ha)	% vegetation cover
Wairau	at scheme discharge	82.1	535	1500	1423	6837	5825	14.8
Clarence	Jollies	14.9	195.7	317	147	4169	3004	28
Waiau	Marble Pt	98	1059	1413	217	7412	5389	27
Hurunui	Mandamus	52.9	531	831	604	5138	2546	49
Ashley	Gorge	12.3	298	539	218	3610	1783	48
Waimakariri	Old Highway Bridge	122	1495	2344	143	14342	10487	27
Rakaia	Fighting Hill	221	2514	3701	877	32102	21853	32
Sth Ashburton	Mt Somers	11.2	103	181	251	2441	942	75
Rangitata	Klondyke	100	1085	2324	804	18091	11249	38
Tasman					120	6897	4927	28
Tekapo					501	3178	1063	66
Ohau - Upper					137	111	37	71
Ohau - Lower					295	322	246	24
Ahuriri	Sth Diadem	23.8	255	434	656	4353	1661	60
Waitaki	Kurow	373			632	8104	3509	57

5.2. Management requirements

The management requirements for bird guilds are well described by O'Donnell (2000) and will not be repeated here. However, it is important to reinforce two particular attributes that could easily be modified by further water resource development on the Hurunui, namely feeding and nesting habitat.

Feeding habitat and food supply

The key bird species feed on fish, aquatic and terrestrial invertebrates. For fish and aquatic invertebrates an appropriate flow regime is required. Key elements of such a regime include the setting of a baseline minimum flow and the managed occurrence of flow variability to provide for the key physical parameters that maximise food production. Research would be required to quantify the flow regime required to provide key foods at key times for key species and guilds of species.

Nesting habitat

Key species including black-fronted tern (see Appendix 3) and banded dotterel are recorded nesting mainly in areas of relatively little to no standing vegetation cover. Areas of significant exotic vegetation cover harbour predators and are generally not used by these species. There is clearly a major weed encroachment issue on the

[4] Data sources: ECan web site and the Wairau HEP AEE.

middle to lower reaches of the Hurunui, the only control on which is currently the natural flood flow regime of the river. A key component of the weed removing capacity of floods is a mobile bed and sustained supply of sediment. The South Branch of the Hurunui having unconstrained flows may well play a pivotal role in providing for these habitat needs on the Hurunui – research is necessary to explore this hypothesis.

A related nesting habitat requirement is for river flows that provide a measure of protection for ground nesting birds against mammalian predators. While the exact nature of the river flow-nest site protection relationship is currently poorly understood, it is nevertheless thought to exist and would require more research on this river if further water resource development was proposed.

5.3. Further research

If further water resource development is seriously considered then research into the specific needs of black-fronted terns and banded dotterels on this river (in particular) is required, as argued in section 5.2. In particular research is needed to:
- quantify the flow regime that would maximise food production and availability for key birdlife and critical life stages, including the role of freshes; and
- explore the relationship between river flows and sediment supply, and the provision of suitable nesting habitat and nest site protection.

It should be noted that the latter research in particular will take time, perhaps in the order to 2-3 breeding seasons and should be undertaken before resource consents are applied for. In the interim further full-river bird surveys should be undertaken on an annual basis to determine more precisely the exact nature of bird use of the Hurunui River.

Acknowledgements

I thank Chris Todd in particular who helped on all of the key survey sections of the river, sometimes in very trying conditions. With respect to these sometimes difficult conditions I also thank Brian Ross of Fish and Game North Canterbury who expertly piloted the jet boat for 3 of the survey days. This report has been peer reviewed by Andrew Grant and Dr Colin O'Donnell of the Department of Conservation – I appreciate their helpful comments. Finally I thank those who helped make the survey possible by participating as volunteers: Ali Erickson, Sam Mahon, Richard Clark and Jean McFarlane.

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Appendix 1 – Summary data from the 2006 Hurunui survey.

Species	Section 1: MHI to Lake Mason outlet stream	Section 2: Lake Mason outlet stream to Gorge	Section 3: Number 3 Hut to Swing Bridge	Section 4: Swing Bridge to Lake Sumner Delta	Section 5: Lake outlet to Sth Branch confluence	Section 6: Confluence to Maori Gully	Section 7: Maori Gully to Mandamus	Section 8: Mandamus to SH7	Section 9: SH7 to Lowry	Section 10: Lowry to SH1	Section 11: SH1 to Lagoon	Section 12: Lagoon	Totals
Black shag	1	2		1	1		8	3	8	20	15		59
Pied shag											3	8	11
Little shag								2			3		5
Spotted shag												2	2
White-faced heron			6					8	3	12	31		60
Canada goose	24	13	30	4				71	14	68	15		239
Paradise shelduck	27	15	97	119				105	202	155	82		802
Duck species (Mallard)	3	5	6	9				85	35	29	115	6	293
Grey teal				1									1
NZ shoveler				2									2
South Island pied oystercatcher	9	43	24	16	2			33	12	2	85	11	237
Variable oystercatcher												2	2
Pied stilt				9					17	8	37		71
Banded dotterel	17	97		82				60	42	2	138	12	450
Black-fronted dotterel											13		13
Spur-winged plover	9	23	22	47				132	116	59	301		709
Turnstone												1	1

Southern black-backed gull	23	185	26	33				1228	350	104	311	39	2299
Red-billed gull												39	39
Black-billed gull				6				4	104		4	640	758
Black-fronted tern	7	22		3	8	3		71	274	120	12	84	604
Caspian tern										4		3	7
White-fronted tern												190	190
Kingfisher								3	1	1	2		7
Welcome swallow				1	2		3			5	56		67
Pipit	10	3	10	9				4	1		4		41
TOTAL	130	408	221	342	13	3	11	1809	1179	589	1227	1037	6969
Date	7-Dec-06	7-Dec-06	20-Dec-06	20-Dec-06	14-Dec-06	14-Dec-06	8-Dec-06	8-Dec-06	10-Dec-06	10-Dec-06	12-Dec-06	12-Dec-06	
Distance (km)	9.0	4.5	10.0	4.5	NA	NA	NA	22.5	12.0	20.0	17.5	2.0	102.0

Appendix 2 – Wildlife Service criteria for rating habitats for conservation values.

The material that follows is sourced from O'Donnell and Moore (1983: 67):

"The following criteria, modified from Imboden (1978), were used as guidelines for the allocation of a conservation value.

Outstanding

a) Presence of a breeding population of a highly endangered or rare endemic species.
b) Presence of a population of an endemic species of very restricted distribution and which could become endangered.
c) Areas essential to species from (a) and (b) for purposes other than breeding.
d) Areas of vital importance to internationally uncommon species (breeding and/or migratory).
e) Areas of vital importance to internally migratory species with very limited distribution or abundance.
f) Largely unmodified ecosystem or example of original habitat type not represented elsewhere in the country, of large size and containing viable populations of all or almost all species which are typical of the ecosystem or habitat type."

Appendix 3 – Images of important birdlife sections of the Hurunui, December 2006.

Plate 1. South Branch of the Hurunui looking upstream between the Gorge and Lake Mason outlet (Section 2). Large numbers of banded dotterels were counted in this section and the only black-fronted tern colonies were found here.

Plate 2. North Branch of the Hurunui above Lake Sumner looking downstream toward Lake Sumner (Section 4). A substantial area of bare braided riverbed was found here. Large numbers of banded dotterels were counted in this section.

Plate 3. The delta of the North Branch at Lake Sumner (Section 4) supports large numbers of birds including banded dotterel, paradise shelduck, black-fronted tern and black-billed gulls.

Plate 4. The central Hurunui between Mandamus and Lowry Hills contains a wide variety of habitats including heavily vegetated areas and areas recently cleared by floods – black-fronted terns nested in large numbers in Section 9.

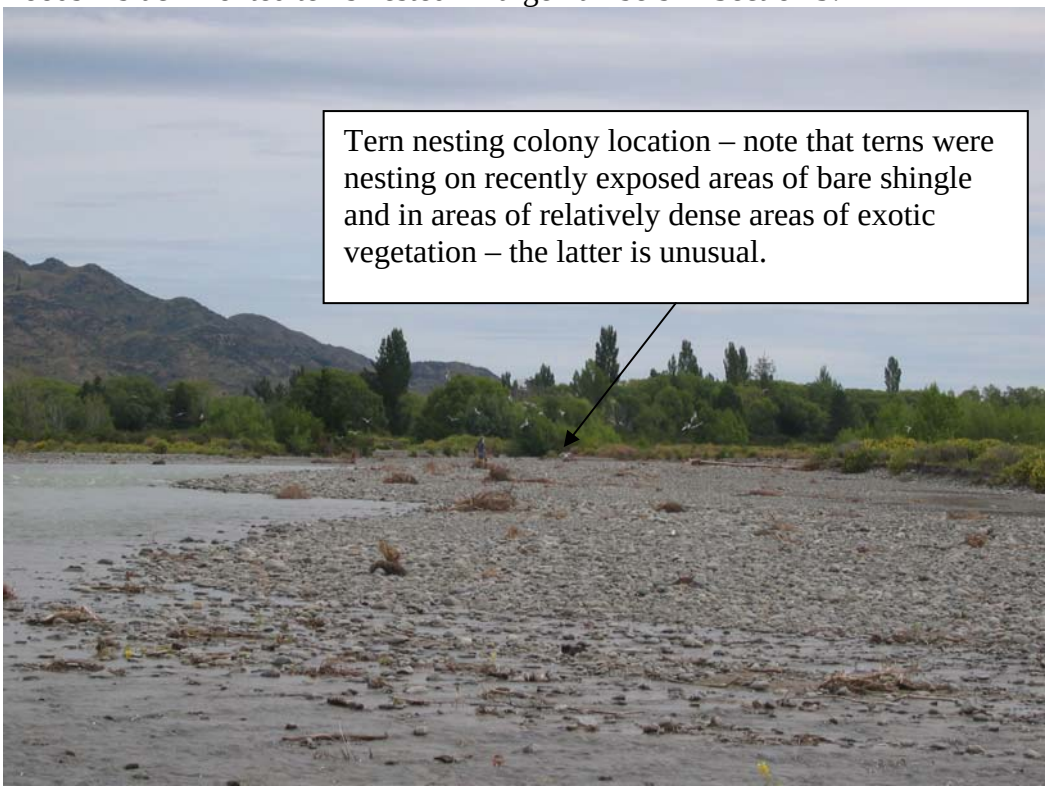

Plate 5. A bare shingle island in the lower Hurunui Gorge was used as a black-fronted tern breeding colony site (Section 10).

Plate 6. The lower Hurunui is a large section of mainly braided riverbed that is normally heavily infested with exotic vegetation – recent floods cleared substantial areas in the spring of 2006.