IN THE MATTER OF the Resource Management Act 1991

AND

IN THE MATTER OF applications by Central Plains Water Trust to:

Canterbury Regional Council for resource consents to take and use water from the Waimakariri and Rakaia Rivers and for all associated consents required for the construction and operation of the Central Plains Water Enhancement Scheme

Selwyn District Council for resource consents to construct and operate the Central Plains Water Enhancement Scheme

AND

IN THE MATTER OF Response to S42A Officers' reports of Craig Bishop

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BRIEF OF EVIDENCE OF CRAIG DOUGLAS BISHOP

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Introduction

1. My name is Craig Bishop, and my qualifications and experience, and the basis on which I am preparing this brief, are set out in my previous brief of evidence prepared for this hearing.

2. I have prepared this supplementary brief of evidence to address issues raised in the s42A reports of Dr. Phillip Grove and Mr Mark Davis. Many issues raised were common to both officer reports, so I have taken the approach of responding on an issue-by-issue basis, rather than responding to the two reports separately.

Lack of comprehensive survey data

3. A number of comments were made about the lack of specific detail on terrestrial ecological values provided in the various technical reports, by both Dr. Grove and Mr Davis.

4. I accept that few detailed field surveys of indigenous habitat were undertaken in the preparation of the various technical reports. However, for the reasons outlined below, I believe that sufficient information on terrestrial ecosystems has been presented in the application, and in subsequent reports and evidence, to be able to assess the sensitivity of the receiving environment and the significance of potential effects of the Central Plains Water enhancement (CPW) scheme.

5. While an intensive survey of all potentially affected indigenous flora and fauna (including reptiles, invertebrates and small remnants of indigenous vegetation) across the whole CPW affects area has not been undertaken, I believe that the basic approach used is appropriate. This is primarily because of the highly modified nature of most ecosystems in question. Furthermore, CPW have proposed to undertake more detailed surveys of areas that are likely to be affected, and mitigation options should any of the surveyed areas contain significant indigenous vegetation or fauna.

6. Ecosystems in the CPW scheme irrigation area and the Waianiwaniwa Valley are characterised by an overwhelming dominance of introduced species; indigenous ecosystems perhaps comprising as little as 0.3% (180 ha) of the entire CPW irrigation area (Table 3 in my earlier evidence).

Therefore I believe that while the construction of CPW scheme infrastructure has the potential to disrupt indigenous habitat, this risk is low by virtue of the fact that it is very uncommon, highly localised and can mostly be avoided if it is identified during the surveys.

7. Baseline terrestrial ecological information in technical reports accompanying consent applications included information from sources such as the Department of Conservations (DoC) Sites of Special Wildlife Interest, Wetlands of Ecological and Regional Importance and Sites of Natural Significance databases, and the Plains Protected Natural Areas Programme reconnaissance survey. Identification of these sites is the result of the combined efforts of many local specialists over a number of decades, and is likely to include the highest quality areas of indigenous vegetation.

8. The locations that are most likely to support important 'undiscovered' areas of indigenous habitat, most notably the extensive riverbeds and terraces of the Waimakariri and Rakaia Rivers, are not likely to be affected by the proposed development, and hence a high level of detail in surveying the natural values of these sites is inappropriate. The exception to this is the intake structures and terrace riser canals, which will be carefully surveyed prior to construction.

9. Indigenous reptiles and invertebrates are generally associated with areas of indigenous vegetation. The focus in the various technical reports on indigenous vegetation is assumed to encompass the highest quality habitat and best areas for indigenous fauna. The highly modified, intensive agricultural landscapes of the CPW area mean that presence of rare or uncommon indigenous reptiles and (most) bird species on these farms is unlikely.

10. Golder Associates staff have been involved in the preparation of many AEE's for locations throughout New Zealand in the past. While we have carried out invertebrate and lizard surveys for recent large-scale developments (e.g., Mt Cass Wind Farm, Project Hayes Wind Farm), these surveys have been done because there was a substantial risk of these faunal groups being affected by the development and/or due to the likelihood of species occurring there (e.g., in areas with a high native species component and degree of remoteness). We would not typically

carry out reptile or terrestrial invertebrate surveys in highly modified environments, such as the Waianiwaniwa Valley or the CPW irrigation area.

11. As outlined in the draft sustainability protocol Central Plains Water Limited (CPWL) will support the implementation of the draft 'Biodiversity Strategy for the Canterbury Region' (ECan 2007) which will identify and prioritise the protection of remaining indigenous remnants in the Region. To this end, individual farm plans should seek to preserve significant indigenous biodiversity, where these values are present.

12. The general vegetation of the areas likely to be directly affected by the intake structures and Waianiwaniwa reservoir has been directly examined, and is overwhelmingly dominated by introduced species. While more detailed survey work has not been carried out, it is my opinion that this preliminary data is sufficient to suggest that there is a relatively low risk of negative environmental effects for indigenous ecosystems during construction. Furthermore, there are many options for mitigation should it be necessary to clear any small areas of indigenous habitat that are detected in the more detailed future surveys.

Development of farms in the CPW irrigation area

13. Both Mr Davis' (paragraphs 4.21, 5.18) and Dr. Grove's (paragraph 41, 49 and 50) reports discuss the likely environmental consequences of an increase in land-use intensity for indigenous ecosystems in and around the CPW irrigation area. They believe the change in land-use will be a substantial negative effect, and this has not been addressed by the applicant.

14. I agree that there will probably be a substantial increase in the amount of clearance of shelterbelts etc. associated with the intensification of land use. However the overwhelming majority of these areas are dominated by introduced species. The sustainability protocols also mean that this decrease in introduced vegetation will be accompanied by an increase in the area of fenced waterways and indigenous riparian plantings.

15. I disagree with Dr. Grove's statement that the farm management plan approach 'lacks sufficient rigour and detail'. I think, with a few exceptions, that the reporting, monitoring, nutrient and water budgeting, and environmental standards outlined in the CPWL Sustainability Protocol (Mulcock 2008) are rigorous and highly prescriptive. I do, however

appreciate that Dr. Grove has likely seen an earlier version of the Sustainability Protocol and I therefore accept that his opinion may change once he has seen the most recent draft of the document.

16. It is my opinion that replacement shelterbelts, amenity plantings and riparian plantings should use appropriate indigenous species. There is considerable guidance on the suitability and biodiversity value of different native plants for shelterbelts and amenity planting in various publications (e.g., *Native Plant Communities of the Canterbury Plains* (DoC); *Establishing shelter in Canterbury with nature conservation in mind* (ECAN)), and as outlined in the CPW draft sustainability protocols. At this stage, the use of indigenous species to replace shelterbelts for CPW water users will be voluntary and 'will be encouraged' (Mulcock 2008). In my opinion, this should be strongly encouraged. The use of indigenous plantings has the potential to provide real benefits to terrestrial ecology. However, plantings will need to be of appropriate species and genotypes for these benefits to be fully realised.

17. The Environmental Enhancement Fund also provides a mechanism for slowly increasing the areas of indigenous habitat, and encouraging landscape linkages, in the longer term. Overall, I consider that the CPW scheme provides an opportunity to promote a long-term increase in indigenous vegetation throughout the CPW irrigation area. The value of this new habitat for indigenous fauna without further active management – e.g., using 'bird attractant' species in any plantings or translocating indigenous birds - is less certain.

18. Destruction of existing indigenous habitat in ephemeral streams should not occur if the provisions of the sustainability protocol are followed, and adherence to these protocols (including the Dairying and Clean Streams Accord) is compulsory.

19. It is my opinion that wetland habitat will actually be enhanced and increased by greater flows of freshwater. Planting of indigenous species in riparian areas, if done using appropriate species and best practice techniques in relation to planting density, weed control and post-planting maintenance, should result in a substantial increase in the distribution of indigenous plants over a wide area.

20. The risks of soil compaction and trampling of waterways are low if CPW scheme participants adhere to the regulations in the sustainability

protocols, and past experience has shown that the adverse effects of increased soil nutrients and effluent pollution can be considerably reduced by implementation of these same measures.

21. Increased groundwater levels are not expected to affect 'dryland' ecosystems due to the low groundwater table in many areas of concern (paragraphs 147-149 in my evidence) and general resilience of these ecosystems, provided that adequate buffers are retained around any significant areas of dryland vegetation. These are outlined in paragraph 148 in my evidence.

Monitoring for adverse environmental affects

22. Dr. Grove recommends an extensive monitoring programme for the effects of the CPW scheme (paragraphs 6, 7 and 8) including weed spread in a representative range of sites, and thresholds for compulsory weed control if these thresholds are exceeded (paragraph 30). I agree that some form of quantitative targets or thresholds in the environmental monitoring protocols is desirable.

23. Regular monitoring across the scheme as a whole, and on individual farms, is outlined in the draft sustainability protocols for CPW scheme users. This monitoring includes environmental outcomes.

24. The need for monitoring of key wetland ecosystems was outlined in my earlier evidence (paragraphs 102, 140(h) and 150), and I agree that this monitoring should be extended to include several key dryland ecosystems in the CPW effects area, and birds in the Lower Waimakariri River.

Potential adverse effects on braided river birds

25. Dr Grove outlined some concerns regarding the impact of the CPW scheme on braided river birds in paragraphs 17, 18, 27, 28 and 31 of his evidence.

26. Some additional information on the size of different braided river bird populations in the Waimakariri and Rakaia Rivers, and the breeding habitat, food resources and threats to these bird species, is provided in Table 1 attached to this evidence.

27. Additional information on the year to year variation in braided river bird numbers on these two rivers is provided in Figure 1 attached to this evidence.

28. I agree that the complex nature of ecological systems means that it is impossible to predict with absolute certainty the impact of water flow reductions in the Waimakariri River on braided river birds. However, it is my opinion that the degree of risk and potential severity of any impacts can be understood by assessing the effects of the CPW scheme on some key drivers of braided bird populations, including risk of invasion of introduced shrubs (which reduces breeding habitat), availability of food resources, and increases in predation.

29. As outlined in my earlier evidence (paragraphs 131-133) the limited impact of CPW water extraction on large flood events, which are the key disturbance driver with regard to braided river vegetation (Rogers et. al 2005), means that the scheme is unlikely to result in the invasion of introduced shrubs.

30. Evidence from Dr Burrell and in paragraphs 125-128 of my evidence has shown that the effect of the CPW on feeding habitat is relatively minor, and reductions in some types of foraging habitat and invertebrates are balanced by increases in other types. As discussed by Dr Burrell, the CPW scheme is actually likely result in an increase in the total productivity of the plants and animals that form the base of the food chain for braided river birds.

31. Previous studies have shown the importance of braids in protecting birds from predation (Sanders 2007), and the impact of the CPW scheme on the distribution of braided channels is considered in the following paragraphs.

32. The modelled effect of the CPW take on Waimakariri River median flows were outlined in flow data provided by URS and are summarised as follows:

- Median flow (all year data) reduced from 75 m^3/s to 63 m^3/s.
- Median summer flow (1 November to 30 April data) reduced from 66 m^3/s to 44 m^3/s).
- The effect of these reductions on the depth and velocity of river braids has been modelled by NIWA for an approximately 3 km section of the lower Waimakariri River, and a graphical representation of the data is presented in Attachments 1 and 2 to this evidence. Comparison of the graphics for 60 m^3/s flows and 40 m^3/s flows is the most appropriate comparison to show the likely impact of these types of water level reductions on the pattern of braids during

the breeding season for species such as black-fronted tern, Caspian tern, white-fronted tern, black-billed gull and red-billed gull.

33. Almost all river 'islands' that are present in the 60 m^3/s scenario are also present in the 40 m^3/s scenario, and the depths and velocities of the channels which protect the 'islands' is essentially unchanged. The one exception is a relatively long channel which forms the northern boundary of a large 'island' (marked as "A" in attachments 1 and 2), which is not protected by a channel under the 40 m^3/s flow scenario. This type of change in the pattern of braids could be expected under CPW scheme-induced changes to summer median flows

34. These data show that there is likely to be some change in the pattern of braids due to CPW scheme water take, but that the magnitude of these changes (and hence the impact on bird predation) is relatively minor.

35. The complex and dynamic nature of these braided ecosystems mean that breeding success of braided river birds is related to a wide range of different environmental, biological and stochastic variables (c.f. Figure 1 attached to this evidence), and it is difficult to determine the impact of CPW scheme on their populations with great certainty. For this reason I recommend that the environmental monitoring programme for the CPW scheme includes some monitoring of braided river birds in the Waimakariri River. This monitoring should include some assessment of any new weed encroachment into formerly open breeding habitat.

36. There is ample scope for mitigation for any adverse effects through weed control in the many thousands of hectares of broom and gorse dominated scrub and shrubland along the Waimakariri River terraces.

37. Control of braided river bird predators is also an option. While I accept that current predator control techniques have been shown to have little impact on predation of braided river birds (Sanders 2007), this does not mean that it is impossible to develop more suitable techniques following future research and trials. The proposed CPW Environmental Enhancement Fund offers one possible mechanism for funding some trials.

38. In summary, it is my opinion that the risk of the CPW scheme resulting in significant adverse effects on braided river birds in the Waimakariri River is low because the river will remain highly flood-disturbed, food sources will remain in plentiful supply, and the risk of greater exposure to predators

(e.g., through invasion of woody vegetation or reduced abundance of island refuges) is low. However, I also concede that there remains some uncertainty regarding effects, and I have therefore recommended monitoring for any adverse effects.

Potential adverse effects on non-braided-river birds

39. Mr Davis highlighted the lack of evidence about the effects of the CPW scheme on non-braided river birds in paragraph 3.26 of his report.

40. Birds that are likely to be directly affected by vegetation removal, for example due to habitat destruction associated with the construction of the intakes or by-wash outlets, will be more thoroughly examined prior to construction. This is standard practice for any construction project, as the locations of nesting sites will vary from season to season.

41. The largest tracts of potential bird habitat in the CPW effects area are provided by the many thousands of hectares of mostly introduced scrub, shrubland and forest vegetation on elevated terraces and terrace risers alongside the Waimakariri and Rakaia Rivers, and in similar vegetation on other Central Plains Rivers. The terrestrial bird species in these environments are mostly common introduced passerines (e.g., house sparrow, goldfinch, chaffinch, greenfinch, yellowhammer, starling and magpie), or widely-distributed indigenous species such as grey warbler, silvereye, kingfisher, kahu (harrier hawk) and fantail (see Table 12 in the main body of my evidence). Except for localised construction disturbances, these habitats will not be greatly affected by the CPW scheme.

42. Similarly, in the CPW irrigation area, bird habitat is largely exotic shelterbelts, and the bird fauna is dominated by introduced species. I agree with Mr Davis that, due to habitat destruction, indigenous bird fauna is likely to be adversely affected by the clearance of old shelterbelts. However, the indigenous bird species that use these shelterbelts are widespread, and replacement planting of indigenous amenity trees and riparian corridors will increase in extent over time, re-instating areas of lost habitat. Specific obligations for the re-planting of cleared shelter belts are not listed in the Sustainability Protocol, although it does state that ‘CPWL will encourage replacement of these with suitable native vegetation plantings in locations that assist to develop a network of native vegetation patches and corridors from the mountains to the sea’.

43. Adverse effects of CPW on wetland birds have the potential to be more significant as some of these birds (e.g., spotless crake and marsh crake) are threatened or uncommon. Wetland habitat in Lake Ellesmere, the CPW irrigation area and Central Plains rivers is unlikely to be adversely affected by the CPW scheme (paragraphs 157-161 in my evidence) as freshwater inflows will increase in these habitats, and wetland areas will be fenced from stock and in some cases benefit from planting of riparian areas.

44. In my opinion, wetland vegetation and associated birds alongside the Rakaia River are not likely to be affected by the CPW scheme, due to the relatively small amount of water taken from this river.

45. The potential for adverse effects on wetland vegetation (and associated birds) in the Waimakariri River is higher, as the relative water take is higher. However, Weir (2008) has shown that the CPW water take is not expected to significantly affect shallow groundwater levels in the vicinity of the Waimakariri River (paragraphs 133-135 in my evidence). Therefore, in my opinion, the impact on wetland vegetation and birds is likely to be relatively minor.

Detail and likelihood of compliance to farm management plans

46. Both Mr Davis (paragraphs 5.13, 5.18 and 7.6) and Dr. Grove (paragraphs 9, 25, 49, and 50) raise the point that many of the proposed mitigation options refer to future works which lack detail, and are non-binding.

47. I agree that the use of future management plans has not worked in some previous developments. However, adherence of farms to any sustainability protocols required by CPW and consenting authorities as a condition of their participation in the irrigation scheme. The consequences of not following regulations are therefore quite severe in this case. A regular inspection process to ensure that all farms are compliant with regulations, and nutrient and irrigation budgets, are also part of the sustainability protocol. These give some guarantee of future adherence to sustainable land management practices.

48. Use of indigenous species in shelterbelt re-placement and riparian plantings is an important part of the biodiversity ‘gains’ from this development and I accept that, at present, there is no compulsion to use these species in the plan. However one of the goals of the Sustainability Protocol is to protect and enhance indigenous biodiversity in the CPW

scheme and effects areas, and results towards the achievement of this goal will presumably form part of the yearly monitoring process.

49. I agree that the protecting of any as yet unrecognized areas of indigenous habitat is also important, and the highly modified nature of the Central Plains environment means these areas are more likely to be ecologically significant. There is no specific compulsion in the Sustainability Protocol to carry out surveys for areas of unrecognized indigenous habitat, however many existing areas of indigenous vegetation will receive protection due to their association with waterways.

Effects of the Waianiwaniwa reservoir on indigenous values

50. Dr Grove's report (paragraphs 52 and 53) mentions some sites and ecological values that are present in the Waianiwaniwa valley that were not recognised in earlier technical reports. I agree that this was the case, however the two wetlands he mentioned have now been identified (in paragraphs 32, 37-38, 110, 113 of the main body my evidence), and it is acknowledged that their inundation will have a more than minor environmental effect.

51. Proposed mitigation involves increasing the extent of these wetlands by extending their boundaries further upstream from their current locations.

52. It is my opinion that works sufficient to re-create an area of indigenous wetland vegetation at least twice the size of that which is inundated by the storage lake is appropriate mitigation for this loss. If feasible, mitigation could be carried out in conjunction proposed mudfish mitigation.

53. Paragraph 5.14 in Mr Davis' report highlights the difficulties of successful wetland planting around the reservoir margins. I agree that water level fluctuations will make it difficult to establish wetland vegetation around the margin of the Waianiwaniwa Reservoir. However, there is very little indigenous wetland vegetation along the Waianiwaniwa River, and therefore substantial areas of mitigation plantings for its loss are not envisaged. Even small areas of new indigenous habitat would be an improvement on the current situation. The major ecological effects of the reservoir are associated with inundation of indigenous wetlands within Selwyn Plantation Board pine forest in two of the side streams.

54. Neither I nor my colleagues have undertaken a detailed reptile habitat survey of the Waianiwaniwa Reservoir footprint. If, as Mr Davis has

suggested, there are areas of potential lizard habitat in parts of the Waianiwaniwa Valley that will inundated, then it would be appropriate to carry out a more detailed survey prior to vegetation clearance commencing. If any significant populations of lizards, or threatened lizard species, are found then a plan should be prepared for their capture and translocation to suitable nearby habitat.

Framework for significance assessment

55. Paragraphs 3.15 and 3.18 in Mr Davis' report raised concerns about the lack of reference to accepted ecological frameworks within which significance assessment occurs, specifically Ecological District and LENZ data. This background information is referred to in paragraphs 14-16 of the main body of my evidence and is largely compatible with the information provided in paragraphs 3.16 and 3.17 of Mr Davis' report.

56. In Paragraph 7.2 of his report Mr Davis states that the AEE focuses on assessing significance of ecosystems and does not consider other aspects of indigenous biodiversity, such as ecosystem functioning and the finite characteristics of indigenous remnants.

57. Most of the CPW irrigation area is overwhelmingly dominated by introduced species, and the contributions of indigenous plants to 'ecosystem functioning' (with the exception of a few scattered localities) are nil or negligible. Indigenous-dominated ecosystems are rare and significant in this landscape and the development approach will be to use more detailed surveys (at the intake locations, in the Waianiwaniwa Valley and throughout the CPW irrigation area) to delineate and avoid significant areas.

Key drivers of weed encroachment in river fairways

58. Dr Grove states in paragraph 29 of his evidence that frequency and duration of large flood events is not the only determinant of exotic vegetation encroachment. I agree that this may be the case when weed species are first invading an area of habitat. However, most important weed species have been in the catchments of these rivers for a very long time and in my opinion, major flood events are the most important regulators of the current distribution of riverbed weeds. Existing areas of open habitat, and in particular the 'island' breeding sites used by braided river birds, are regularly swept clean by large floods. In a recent detailed review of the disturbance in eastern dryland ecosystems, Rogers et al.

(2005) identified large floods as the key disturbance drivers in braided river ecosystems.

Positive conservation outcomes for threatened plant species

59. I agree with paragraph 4.17 in Mr Davis' report that states there is no data to support the statement that the CPW scheme may improve the conservation of *Juncus holoschoenus* var. *holoschoenus* and *Melicytus flexuosus*. However, it is my opinion that an increase in wetland habitat quality and quantity following irrigation may benefit the *J. holoschoenus*, as more habitat will be available for this species to colonize. If *J. holoschoenus* is used in any restoration plantings, its range and population size will definitely increase. The greatest potential for *M. flexuosus* lies in its use for riparian or other dryland amenity plantings.

Additional information on bywash and emergency water discharges

60. The adequacy of information concerning the specific locality, size and effects of by-wash discharges was raised as an issue in Mr Davis' report (paragraph 4.18) and in Dr. Grove's report (paragraphs 55 and 56). More detail on the size and location of these is provided in paragraphs 143 and 150-153 of the main body of my evidence. As discussed in Mr Tipler's evidence, operational discharges are expected to be of very low volumes and will be channelled through wetlands. Emergency bywash discharges are regarded by Mr Tiper to be a very infrequent event, and water flows during these discharges are likely to be less than current flood maximums in these systems.

61. I agree that there is currently a lack of detail concerning indigenous values that may be present at the bywash discharge locations. I have therefore recommended that a detailed survey of the area that will be affected by construction of wetlands and discharge structures will be undertaken prior to construction commencing, with survey and monitoring methods to follow those outlined for the intake structures and surrounds.

Uncertainty around effects and mitigation

62. I agree with Mr Davis' statement (paragraph 5.13) that there is uncertainty in the ecological effects of the CPW scheme. However I feel that the risks of many of these adverse effects occurring are low, and that proposed monitoring and mitigation options are sufficient to detect and offset any changes and create new areas of indigenous habitat. Monitoring of key

wetlands, and birds in the Waimakariri River, sufficient to detect any deterioration in natural values of these systems, has been proposed in paragraphs 102, 140(h), 207, 228 of the main body of my evidence.

63. The highly modified nature of the CPW irrigation area means that any indigenous plantings that are carried out (and there is likely to be many hectares of plantings over the first few decades of the scheme) will substantially increase the area of indigenous vegetation in the Central Plains area. Creation of wetland areas for by-wash discharges and restoration plantings associated with intake construction works will also being carried out in locations that are currently overwhelmingly dominated by introduced ecosystems.

64. There has been a substantial amount of growth in the practical restoration knowledge base in New Zealand over the past decade, and application of best practice methods for restoration plantings is likely to result in good outcomes for successful indigenous re-plantings in wetland, dryland and riparian habitats.

Craig Bishop.
February, 2008.

References

Mulcock, P. 2008: Central Plains Water Ltd. Sustainability Protocol.

Rogers, G.; Walker S.; Lee, B. 2005: The role of disturbance in dryland New Zealand: past and present. Science for Conservation No. 258. Department of Conservation, Wellington.

Sanders, M. 2007: North Bank Tunnel Concept: Black-fronted tern trial: Effects of flow and predator control on breeding success. Report prepared for Meridian Energy Ltd. 15 p.

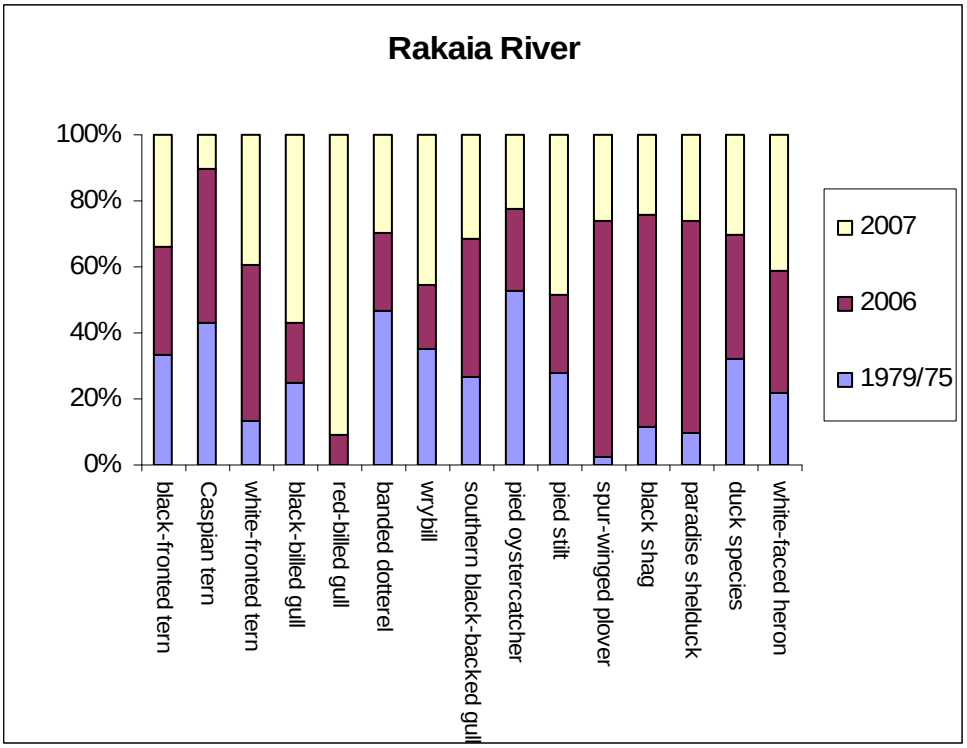
Table 1: Bird species in the lower Rakaia and Waimakariri Rivers. Data summarised from unpublished Department of Conservation surveys in 2007. Threat status from Hitchmough (2007). Breeding season, feeding habitat, colony structure and conservation data summarised from Heather and Robertson (2000).

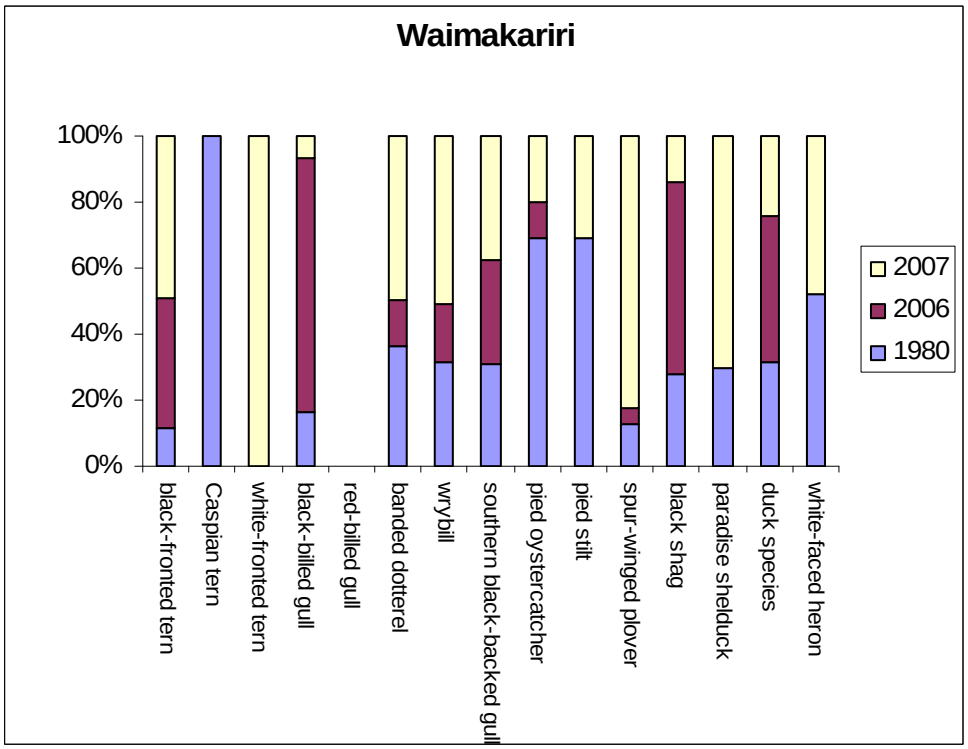
Bird species	# birds Rakaia	# birds Waimakariri	Threat status	Breeding season	Feeding habitat	Colony structure and location	Conservation
black-fronted tern	170	402	Nationally endangered	early Oct-Jan	Freshwater invertebrates and ploughed or wet farmland	Small colonies (up to 50 pairs) on braided riverbeds, mostly inland.	Predators. Willow and lupin invasion of breeding habitat.
Caspian tern	3	0	Nationally vulnerable	late Sep-Dec	Small surface swimming fish, including freshwater fish in inland waterways.	Open habitat. Loose colonies of variable (from year to year) size. Rarely exceed 100 pairs.	Recent immigrant? Threats include dogs, off-road vehicles and clearance of breeding habitat.
white-fronted tern	328	73	Gradual Decline	mid Oct-Jan	Coastal waters and estuaries	Open areas near coast. Large (50-1000 pairs) colonies of tightly packed birds.	Predation (cats, rats, mustelids) of adults, chicks and eggs.
black-billed gull	2830	78	Serious decline	late Sep-Dec	Flying freshwater invertebrates, small fish, ploughed farmland and scavenging.	Large colonies of up 1000 pairs on braided river 'islands'	Predation and breeding habitat loss due to weed invasion.

Bird species	# birds Rakaia	# birds Waimakariri	Threat status	Breeding season	Feeding habitat	Colony structure and location	Conservation
red-billed gull	123	0	Gradual decline	early Oct-Dec	Marine and freshwater invertebrates, small fish, terrestrial insects and worms, scavenging.	Marine and freshwater invertebrates, small fish, terrestrial insects and worms, scavenging.	Predation and breeding habitat loss due to weed invasion.
banded dotterel	172	525	Gradual decline	Aug-Sep	Terrestrial and aquatic invertebrates	Solitary nests on riverbeds and coastal locations.	Predation. Loss of breeding habitat.
wrybill	105	87	Nationally vulnerable	late Aug-Jan	Freshwater and terrestrial invertebrates.	Solitary nests on bare shingle islands.	Invasion of breeding habitat by weeds.
southern black-backed gull	5525	5828	NT	mid Oct-Nov	Generalist opportunists.	Large colonies on open braided riverbeds and coastal sites.	Widespread species, not currently threatened.
pied oystercatcher	62	62	NT	Sep-Nov	Pasture, freshwater and estuarine molluscs, worms and invertebrates.	Solitary nests on riverbeds or in pasture.	Predators and human disturbance of nests.
pied stilt	98	45	NT	Sep-Nov	Aquatic and terrestrial invertebrates.	Loose colonies of up to 100 pairs near water (including riverbeds).	Recent colonizer, not currently threatened.
spur-winged plover	150	642	NT	late Jun-Nov	Worms and insects of short-grassed pasture.	Solitary nests on bare ground (including riverbeds) or rough open pasture.	Recently introduced, not currently threatened.

Bird species	# birds Rakaia	# birds Waimakariri	Threat status	Breeding season	Feeding habitat	Colony structure and location	Conservation
black shag	29	6	Sparse	Jun-Oct	Small to medium sized fish.	Small colonies of up to 50 pairs in trees overhanging water.	Predation and habitat destruction.
paradise shelduck	16	21	NT	Aug-Oct	Pasture and aquatic vegetation.	Solitary nests in and around wetlands and lakes.	Predation, but numbers are high and stable.
duck species	190	92	various most NT	Various	Various	various	Various
white-faced heron	21	13	NT	Sep-Nov	Pasture and freshwater insects, frogs and fish.	Solitary or loose group of nests in trees.	Recently introduced, not currently threatened.

Figure 1: Changes in the abundance of common braided riverbed bird species in the Waimakariri and Rakaia Rivers. Data summarised from unpublished Department of Conservation surveys in 1975, 1979, 1980, 2006 and 2007. Percentages denote the % contribution of the survey year to individual species totals (i.e., they show the variability in number of birds recorded between different measurements)





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