BIRDLIFE:

APPLICATION OF THE RIVER SIGNIFICANCE ASSESSMENT METHOD TO THE CANTERBURY REGION

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1.   INTRODUCTION

1.1   PURPOSE

Regional councils are faced with the task of identifying water bodies of importance in their region – there is no objective method for undertaking this evaluation. As part of developing a 'tool' to achieve this task this report applies the method for significance assessment[1] outlined in a companion report, *A significance assessment method for river values* (Hughey et al., 2009), to birdlife. Its purpose is to:

- Provide a case study of how to apply the method to birdlife in the rivers of the Canterbury region;

- Provide a tool to enable regional councils, and others, to evaluate the value of their rivers to birdlife.

1.2   PREPARATORY STEP: ESTABLISH AN EXPERT PANEL AND IDENTIFY PEER REVIEWERS

The Expert Panel for the birdlife trial in the Canterbury region comprised Ken Hughey, Colin O'Donnell, Frances Schmechel and Andrew Grant. Peer reviewers were Murray Williams and Paul Sagar. Ken Hughey managed the case study.

Credentials of the Expert Panel and peer reviewers are provided in Appendix 1.

2.   APPLICATION OF THE METHOD

STEP 1: DEFINE RIVER VALUE CATEGORIES AND RIVER SEGMENTS

RIVER VALUE CATEGORIES

There is a distinction, typically, between the birdlife of braided rivers and that of single channel rivers. The former is typified by a community of birds that includes gulls and terns, waders, shags and a variety of waterfowl – multiple species are considered 'threatened or at risk'[2]; the latter is typified by waterfowl and shags with far fewer species threatened or at risk, Despite this distinction it is proposed to treat all rivers primarily in the same way, except where distinctive indicators for the prime attributes (see steps 3 and 4 below) can be identified and used appropriately.

RIVER SEGMENTS

Work in advance of the expert panel meetings to collate existing data, identified that the multiple riverbed bird surveys, organised primarily by the Department of Conservation[3], but also by Environment Canterbury on occasions, would be the primary data source. The surveys span almost all rivers in Canterbury considered of significant value to birdlife (but see also the following two paragraphs). A few rivers considered of potentially significant value to birdlife have not been formally surveyed, but are included where the expert panel had sufficient information to warrant such inclusion

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[1] This tool was developed under FRST Envirolink funding and involves development of a method that enables regional and district councils to prioritise, in terms of national, regional and local importance, the various values of rivers in their region.

[2] This phrase is used here as an all encompassing term for the range of bird species defined to be, and listed as, at some conservation management risk in New Zealand, as listed in Miskelly et al. (2008). We use this listing of species as appropriate for the purposes of this report.

[3] Note that there are also occasional surveys undertaken by individuals, consultants and NGOs (e.g., community groups, Forest and Bird, the Ornithological Society of NZ).

(e.g., the Avon and Selwyn). For the purposes of this analysis we generally consider catchments as a whole (except the Waitaki because of its large geographic separation between upper (and the main rivers therein) and lower catchments, due to hydro electric power development. Thus, in the Waitaki case we have identified and separately evaluated both upper and lower sections, and then we have separately listed and evaluated the major tributaries of the upper Waitaki. We think for a river of the geographic scale of the Waitaki this approach has merit and for completeness have included both categorisations.

Following a preliminary scanning exercise many rivers within the Canterbury region were excluded from further assessment. Criteria considered as part of this preliminary scanning were that the river or stream has:

- no known or suspected presence of breeding threatened or at risk species;

- a very small amount of habitat (e.g., less than 50ha for a braided river or less than 3km for a single channel river) of very low quality;

- very low numbers (e.g., less than 100 and no breeding 'threatened or at risk' species) of native riverine birds; and/or

- little or no flow at critical times, e.g., during the breeding season.

Examples of these rivers or streams include most of the streams of Banks Peninsula, and many other streams along the Canterbury and Kaikoura coastline (e.g., Kowhai). This still left some streams of potentially significant value to birdlife but currently data deficient, and therefore subject to consideration when data becomes available, e.g., the Halswell where breeding of southern crested grebe is suspected and which has been included in the evaluation. The system is designed to provide for updating and a plan for surveying and evaluating likely rivers and streams should be developed and implemented accordingly in all regions.

River mouths, estuaries, lagoons, etc., considered an integral/seamless part of a river with a significant birdlife value are typically included within that river's assessment, e.g., the Rakaia, Hurunui and Ashburton lagoons. However, where they are somewhat separate from a river's main birdlife values, e.g., Brooklands Lagoon on the Waimakariri and Milford Lagoon on the Opihi, then they have been excluded from this evaluation (and notably are not included in surveys of such rivers). Estuaries or lagoons with high birdlife values, e.g., Te Waihora/Lake Ellesmere and Avon-Heathcote Estuary are also not evaluated. A separate evaluation of all lagoons, estuaries, etc., is required.

OTHER CONSIDERATIONS

The Expert Panel noted that the Freshwater Environments of New Zealand database, developed by the Department of Conservation, and other initiatives provide a basis for finer scale rankings for other purposes. However, they also noted that a ranking based first at the river scale provides later scope for subsequent finer scale rankings – this argument is based partly on the desire to express connectivity at the catchment scale, and partly for pragmatic reasons.

It was also noted that while many bird surveys of rivers have been undertaken they are often characterised by:

- Only partial river coverage, even for nationally important rivers like the Rakaia;

- Differences between methods used;

- Large temporal gaps between surveys or only surveys undertaken some decades ago.

Given the need to use the 'best available information' it was decided that such data would still be used but that particular caveats around the source, reliability and other issues would be noted in the contents of the supporting decision making spreadsheet (Appendix 4) where appropriate.

Related to the above, an important feature of many surveys and much evidence presented in hearings is associated with total bird numbers of a river. We note the imprecision of the survey data, but again reiterate it is the best available information. Note the following:

Birdlife: Application of the significance assessment method

- On some rivers with only partial survey coverage, e.g., the Rakaia, the value is so high that a full river survey is not considered necessary, but would be desirable to fill an information gap;

- On some other rivers, e.g., the Ashley, ongoing surveys are only over a small (c.<10%) part of the river and should be used cautiously when interpolating for overall river value;

- Some species are particularly difficult to find, e.g., crake and bittern, and until a reliable survey method is found, are excluded from this analysis. Equally, threatened and at risk species such as grey duck are present, but difficult to identify correctly – they too are excluded from that part of the analysis dealing with threatened and at risk species. At least one other species identified as 'threatened or at risk', i.e., NZ pipit, is not considered as it is mostly not recorded (for some unknown reason) in surveys.

A potentially larger issue is the influence that southern black-backed gulls (*Larus dominicanus*) have, on occasions, as a significant predator of threatened and at risk bird species, particularly where they comprise a large proportion of total bird numbers on some rivers, e.g., the Waimakariri. We recognise that Maori consider this a taonga species (see: Te Rūnanga o Ngāi Tahu. 2005. Te Waihora Joint Management Plan. Te Rūnanga o Ngāi Tahu and Department of Conservation, Christchurch), but we note that numbers now are sometimes extremely large (in the order of many thousands) (as a result of the scavenging and opportunistic nature of this species and the large increase in resources available to it, largely as a result of agricultural practices). Consequently, the species is now considered a threat to some key bird species on some (e.g., the Waimakariri) braided rivers. While we recognise the taonga value we have decided to exclude the species from total native birdlife counts presented in this evaluation.

OUTCOMES

Treat birdlife as one river value (no separate categories for braided river vs single channel river species).

Use whole catchments as the primary data set and populate with existing river bird survey data and/or expert panel considerations.

Present data for native bird species counts without southern black-backed gulls.

Ignore the presence of swamp species such as bittern and marsh crake until reliable survey data become available.

Do not include NZ pipit until routinely required within the standard survey method, and then record appropriately.

STEP 2: IDENTIFY ATTRIBUTES

Attributes i.e., the facets of the birdlife river value. Taken collectively, attributes *describe* the river value. For example, salmonid angling includes the attributes of level of use, anticipated catch rate, and perceptions of scenic attractiveness. Attributes which describe birdlife were based initially on O'Donnell, C.F.J. 2000. (The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand. Environment Canterbury Unpublished Report U00/37. Environment Canterbury, Christchurch). A workshop of key ECan and DoC staff on 4 June 2009, including the report authors, subsequently refined these attributes.

Attributes for birdlife encompass only one (environmental) of the four well-beings defined in the Local Government Act 2002.. However, cultural attributes are also relevant for birdlife and further discussion is needed on how this might be addressed, or if iwi values for rivers should be expressed separately to all others (Gail Tipa in prep.). Social attributes, e.g., recreational hunting, are also relevant but were not considered as important for this evaluation as environmental and were thus excluded. Economic aspects, perhaps associated with bird watching-based tourism, have little data and also are not considered.

A list of all attributes is provided in Appendix 2.

STEP 3: SELECT AND DESCRIBE PRIMARY ATTRIBUTES

From the list of attributes outlined in Step 2, primary attributes were selected to *represent* birdlife. Selection was based on:

1. The need for pragmatism – only six attributes were identified, but these were considered to be the most important and to describe most of the variation around relative importance.

2. Research literature on the attributes identified by O'Donnell (2000) is important. In addition, the opinion of Expert Panel members about the contribution of attributes to an understanding of birdlife was used.

3. Consideration was not given to the availability of existing data, as later steps account for data deficiency (via the Expert Panel) and provide for input into future research needs (to overcome future data deficiencies).

OUTCOME

Appendix 2 identifies the six primary attributes (in bold) and describes them, with emphasis on explanation of the attribute's validity and reliability as a representative measure of birdlife on rivers.

STEP 4: IDENTIFY INDICATORS

One indicator, generally, for each primary attribute was identified, using SMARTA (Specific, Measurable, Achievable, Relevant, Timely, Already in use – see for example Hughey and Coleman 2007) criteria, based on:

1. Existing data – for birdlife, there is a wealth of appropriate if not always (due to data issues already described) fit-for-use-now data.

2. Expert Panel judgment – especially required for bird numbers, which is relevant to several attributes and their indicators.

Appendix 3 shows the assessment of each indicator against the SMARTA criteria.

No primary attributes were omitted owing to difficulty in devising measurable indicators. Data deficiencies are outlined in Step 10.

Each indicator was considered carefully, and three were subject to considerable debate:

(a) The question of habitat distinctiveness within a national and regional context was raised by one of the peer reviewers – it was his view that we might potentially be double counting, i.e., a highly distinctive habitat might also be one that also has very high diversity, numbers, etc? While this point is accepted in part we are of the view that for this sort of method there will frequently be some similarity in measures, but that this should not prevent us from including them in the final analysis. Ultimately there is a limit on the number of attributes and every attempt is made to define separation, where possible.

(b) Evaluation of numbers of birds poses a real challenge, for several reasons. First, some rivers like the Rakaia have never been fully surveyed and recent surveys have covered only a small part of the river. We know from other work and panel member experience that the river holds very large numbers of some key species, e.g., likely greater than 30% of the wrybill population (see Appendix 2), and these are not well covered by the surveys. We also know that the survey methodology leads to highly variable counts (see for example Brown and Robinson 2009) as some species, e.g., wrybill, are very difficult to find, and others are prone to double counting, or may be off-river during the survey, e.g., black-fronted tern. It was proposed that rather than considering the absolute survey numbers we convert the number to an index of numbers per kilometre of river surveyed. We tried this index but it

too is flawed, e.g., river width can vary hugely and many braided rivers include relatively short single channel gorge sections which distort the results. Finally, we decided to remain with survey numbers as an index of abundance and to adjust where necessary based on our expert judgement.

(c) Some rivers, by their very nature, contain far more species and guilds of species than others, e.g., wide braided rivers cf narrow single channel rivers. It was argued that this distinction gave an 'unfair' advantage to braided rivers and that rather we should develop an index of observed vs expected species or guild presence depending on river type. We gave this suggestion considerable thought and acknowledge that it may be a useful future development of the ranking system, but that it would require considerable further research before it could be adopted. We further considered that the 'unfair' advantage is really, simply, an indication of why braided rivers are often relatively more important for birdlife cf single channel rivers, and thus we retained the guild presence or absence indicator.

(c) Discussion about threatened or at risk species included consideration of both *number of such species* and *strongholds (i.e., a significant proportion of the total population) for species*:

1. Was it appropriate to combine the two indicators into one, which was our initial starting point? or

2. Should there be two separate indicators because both diversity and stronghold are important for threatened and at risk species?

Ultimately we came to the view there should be two separate indicators given the importance of signalling the relative significance that threatened and at risk species management poses, for example with respect to the New Zealand Biodiversity Strategy (DoC and MfE 2000).

OUTCOME

Indicators are listed in Appendix 2 and assessed against SMARTA criteria in Appendix 3.

STEP 5: DETERMINE INDICATOR THRESHOLDS

Thresholds are applied to an indicator to determine high, medium and low relative importance for that indicator. Thresholds are defined by real data (e.g. for recreational fishing <1,000 angler days per annum = relatively low importance, or expert panel judgements) for each indicator and were identified by the Expert Panel. Because birdlife is comparatively data rich (c.f. some other river values), this step was informed by 'hard' data for five of the six indicators.

Consideration was given to the meaning of the thresholds. For example:

For the attribute, *amount of habitat*, the indicator relied upon two measures depending on river and bird type, e.g., if predominantly a braided river then the measure was area, conversely if predominantly a single channel river then the measure was distance. In both cases we needed the thresholds to reflect an either/or set of thresholds that covered both area and distance. In this case the driver for distance criteria was the mean home range distance for blue duck pairs (1.5km)[4] – thus the minimum needed to score a '1' was the approximate distance needed to support 4-7 breeding pairs, i.e., 6 to c.10km of river length.

OUTCOME

Thresholds are identified in Appendix 2.

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[4] Note that while blue duck is not a species widely abundant in Canterbury it is nevertheless extremely important nationally and is arguably the most significant of the single channel species. For this reason, and ultimately therefore for the national level application of the method, we have chosen to report this species for this criterion and associated threshold.

STEP 6: APPLY INDICATORS AND INDICATOR THRESHOLDS

Most indicators were assessed using objective and quantitative survey data - this step involved entering data from the relevant data sources (primarily the riverbed bird surveys). Data were kept in their original format (e.g. *actual area* of habitat, *number* of birds). This assisted the Expert Panel when evaluating the data, and helps achieve process transparency.

OUTCOME
Applications of thresholds are given in Appendix 2.

STEP 7: WEIGHTING OF PRIMARY ATTRIBUTES

The Expert Panel reviewed the six primary attributes and considered whether some made a relatively greater contribution to birdlife as a whole. Initial thoughts were that they made an equal contribution. The decision was reached to keep weightings equal.

Considerations in choosing equal weights were:

1. Testing various weighting sets showed no fundamental difference in river ranking.

2. Applying weighting to attribute/s potentially introduced spurious accuracy.

3. It reinforced the importance of selecting appropriate primary attributes earlier in the process.

4. Any concern that endangered species are not being appropriately considered is dealt with already by having two 'related' measures regarding this attribute.

OUTCOME
Equal weighting.

As a consequence of this decision it was decided to introduce a 'species stronghold' criterion into the decision support system for defining priorities, i.e., if a river contains 5% or more of a population of a threatened or at risk species then it is of national importance – such a criterion is consistent with decisions made for national water conservation orders.

STEP 8: DETERMINE RIVER SIGNIFICANCE

STEP 8A: RANK RIVERS
The spreadsheet in Appendix 4 was used to sum the indicator threshold scores for each river. The sums of the indicator threshold scores were placed in a column and then sorted in descending order. This provided the list of rivers ranked by their significance scores.

STEP 8B: IDENTIFY RIVER SIGNIFICANCE
Using the ranked list from Step 8a, the Expert Panel closely examined the rivers, and their attribute scores. It was noted that a strong correlation existed between birdlife and rivers which scored a 3 (high) for the indicator *Number of 'threatened or at risk' species present*. Intuitively this made sense – a high number of such species is likely to be indicative of relatively high scores in many other attributes as well. It was also noted that the final indicator, relating to stronghold rivers for particular species or groups of species was important. The expert panel was of the view that this indicator and its related attribute should be a national importance trigger. The following criteria were thus applied to defining importance within the Appendix 4 evaluation:

National significance:

Criterion 1: *Species strongholds* – if any river contained one or more species with over 5% of the total population(s) then = 3, and automatic national significance. We chose 5% as this level has

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been used in a number of Water Conservation Order decisions as being a threshold for national importance (despite the fact that the World Conservation Union (IUCN) uses a 1% level for international significance); or

Criterion 2: total score is 15 or more then national significance.

Regional significance:

Those rivers in the table not defined as nationally or locally significant, and scoring 11-14.

Local significance:

Sole criterion: *Number of 'threatened or at risk' species present* = 0 and all other indicator columns (i.e., 1-5) are 2 or less then automatic local significance; or if the total score <11 = local significance.

Translation of these functions to rivers is shown in Appendix 4.

The Expert Panel assessed the output from this process against the results of existing assessments and other relevant considerations, including:

1. Sites of Special Wildlife Interest for braided rivers in Canterbury – O'Donnell and Moore (1983)

2. Existing Water Conservation Orders associated with birdlife

3. Existing planning documents, including Regional Plans under the RMA, and

4. Reference to MfE Waters of National Importance work.

The results of these considerations showed that this significance assessment corresponded to the most significant water bodies for birdlife identified through other processes. The current method was considered to effectively discriminate rivers having attributes favourable to birdlife.

Other assessments confirmed that, compared with a national average, a much higher proportion of Canterbury rivers is likely to be nationally significant for their birdlife, due to the region having most of New Zealand's 'unique' large braided rivers. It is acknowledged that, owing to the judgmental nature of this exercise, rivers close to the threshold points could 'swing either way'.

Finally, and as a partial test against potentially very important single channel rivers elsewhere in New Zealand we included a hypothetical very high value 'blue duck' river in our evaluation. The river achieved a relatively low total score (12) but was considered of national importance because it contained over 5% of the total blue duck population – the system worked for this test.

OUTCOME

A list of rivers ranked by a scoring system from highest to lowest, which represents an initial significance ranking list. See Appendix 4 (columns highlighted in green).

Rivers identified as significant at the national, regional and local level. See Appendix 4.

Rivers in the Canterbury Region not listed have either low value to birdlife dependent on rivers or streams.

STEP 9: OUTLINE OTHER FACTORS RELEVANT TO THE ASSESSMENT OF SIGNIFICANCE

Perhaps the most telling other issue concerns the 'state' of the survey data. Braided rivers are very difficult to survey for a variety of reasons, e.g., large, expensive to survey, and prone to flooding in the breeding season (thus making it difficult to co-ordinate volunteer effort). For these and other reasons it has not been possible to survey all rivers or sections thereof fully. As a result total counts are frequently not undertaken and data presented are significant underestimates.

OUTCOME

Notes have been made in Appendix 4 about the year of the data and the relative river coverage if appropriate.

DoC's ongoing river bird surveys in Canterbury provide a rich, but incomplete, regional database which greatly assists with indicator measurement. However, some desired data are not available or are out of date. For future assessment, desired data are noted in Appendix 6.

ACKNOWLEDGEMENTS

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Hughey, K.F.D., Coleman, D.C. 2007. Adding another top and bottom line to Sustainability thinking in small to medium sized local authorities – application to a small New Zealand local authority. In: Proceedings of the 2007 ANZSEE Conference: Re-inventing Sustainability: A Climate for Change. 3-6 July 2007, Noosa Lakes, Queensland.

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O'Donnell, C.F.J. 2000. The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand. Environment Canterbury Unpublished Report U00/37. Environment Canterbury, Christchurch.

O'Donnell, C.F.J., Moore, S.M. 1983. The wildlife and conservation of braided river systems in Canterbury. Fauna Survey Unit Report No. 33. NZ Wildlife Service, Wellington.

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APPENDIX 1: Credentials of the Expert Panel members and peer reviewers

The Expert Panel comprised four members. Their credentials are:

1. <u>Ken Hughey</u> is Professor Environmental Management at Lincoln University. His expert knowledge of river birdlife spans the period 1981-2009, including his PhD thesis (habitat needs of birds of braided rivers), multiple river bird surveys in almost all regions of the South Island, expert evidence at multiple hearings and published research papers (e.g., Hughey 1997, 1998, Duncan et al., 2008). Ken is overall project manager of the river values project.

   Selected references:
   Duncan, M.J., Hughey, K.F.D., Cochrane, C.H., Bind, J. 2008. River modelling to better manage mammalian predator access to islands in braided rivers. In: Sustainable Hydrology for the 21st Century, Proc. 10th BHS National Hydrology Symposium, Exeter. 487-492.
   Hughey, K.F.D. 1997. The diet of the wrybill (*Anarynchus frontalis*) and the banded dotterel (*Charadrius bicinctus*) on two braided rivers in Canterbury, New Zealand. Notornis 44: 185-193.
   Hughey, K.F.D. 1998. Nesting home range sizes of wrybill (*Anarynchus frontalis*) and banded dotterel (*Charadrius bicinctus*) in relation to braided riverbed characteristics. Notornis 45: 103-111.

2. <u>Colin O'Donnell</u> is a wildlife scientist with over 30 years experience, based with DoC in Christchurch. He has contributed to, or had oversight of, the TBA

3. <u>Frances Schmechel</u> is a Land Resources Officer (Ecology) at Environment Canterbury in Christchurch. Her experience in bird life spans the period 1992 – 2009 and includes her PhD thesis on the habitat needs and conservation management of the endangered Chatham Island oystercatcher. She authored a draft recovery plan for braided river bird species, provided expert evidence on braided river birds during hearings for a Water Conservation Order, has worked for the Black Stilt project, and coordinated and/or taken part in numerous riverbird surveys in Canterbury.

   Schmechel FA. 2001. Aspects of habitat selection, population dynamics, and breeding biology of the endangered Chatham Island oystercatcher (*Haematopus chathamensis*). PhD thesis, Lincoln University, Canterbury.
   Schmechel FA. 2008. Braided river bird surveys of the Waiau River and eight smaller Canterbury rivers, spring 2008. Christchurch: Environment Canterbury. Report No. R08/92.

4. <u>Andrew Grant</u> is a technical support officer with over 30 years experience, based with DoC in Christchurch. He has coordinated multiple braided river bird surveys and maintains the database for bird surveys in the Canterbury Conservancy of DoC.

Peer reviewers for this work were:

1. Dr Murray Williams was a waterfowl and wetlands scientist with the New Zealand Wildlife Service (1966-1987) and Department of Conservation (1987-2005) and presently teaches a postgraduate programme in restoration ecology at Victoria University. He has contributed approx. 50 papers to peer-reviewed science journals on the ecology and management of New Zealand's waterfowl (including blue ducks), chapters to international compilations on waterfowl biology (e.g. J. Kear (ed.), 2005, Ducks, geese and swans of the world) and compilations on New Zealand wetlands (e.g. W. Vant (ed.) 1987, Lake manager's handbook; J. Harding et al.(eds) 2005, Freshwaters of NZ). He has appeared as an expert witness on riverine bird ecology at tribunal and water conservation hearings, has been a technical advisor on waterfowl to New Zealand Fish & Game Council and Game Council New South Wales, and from time to time contributes peer review and evaluations on waterbirds and wetland management to Department of Conservation and private ecological consultancies. .

2. Paul Sagar is a senior scientist with NIWA, Christchurch. Paul has studied wetland birdlife, has published widely in the peer reviewed literature (e.g., Sagar, P.M. 2008. Birds. Chapter in *The Natural*

History of Canterbury 3rd ed. Winterbourne, M.J.; Burrows, C.J.; Knox, G.A.; Marsden, I.D. (eds). Canterbury University Press. Sagar, P.M.; Shankar, U.; Brown, S. 1999. Distribution and numbers of waders in New Zealand, 1983-1994. *Notornis 46*: 1-43. Whelan, M.B.; Hume, T.M.; Sagar, P.M.; Shankar, U.; Liefting, R. 2003. Relationship between physical characteristics of estuaries and the size and diversity of wader populations in the North Island of New Zealand. *Notornis 50*: 11-22. Miskelly, C.M.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Powlesland, R.G.; Robertson, H.A.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2008. Conservation status of New Zealand birds, 2008. *Notornis 55*: 117-135.

In addition, Paul has appeared as an expert witness at tribunal and Environment Court hearings on behalf of Environment Canterbury, Christchurch City Council, Department of Conservation, Marlborough District Council, Meridian Energy, and Kuku Mara Partnerships

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APPENDIX 2: Assessment criteria for birdlife (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
Representativeness	Guild presence				
	Endemism				
	Quality of habitat				
	Distinctiveness	Measures the relative distinctiveness of the habitat type and/or bird species presence compared to others represented in New Zealand	Relative distinctiveness	1= low; 2= medium; 3= high Threshold data result from the following assessment: 1= Habitat type or species assemblage/presence widely represented elsewhere in NZ; 2= Habitat type or species assemblage/presence rarely represented elsewhere in NZ; 3= Habitat type or species assemblage/presence not represented in other regions in NZ	This is a subjective assessment based on the knowledge of the expert panel. As reliable as the experience and knowledge represented by the panel – in this case very high.
Life supporting capacity	**Habitat size**	Amount of Habitat - measured in area for braided rivers and distance for single channel rivers. Note that while some braided rivers also have single channel	Objective and quantitative measures of: Area (ha) of riverbed for braided rivers; Distance (km) for single channel rivers	For area/distance combined: 1=<5000ha and/or <10km; 2=5000-9999ha and/or 11-30km; 3= >10000ha and/or >30km	Area is based on Wilson, J. 2001. National Distribution of Braided Rivers and the Extent of Vegetation Colonisation. Landcare Research Contract Report LC0001/068, Lincoln. Distance based on Google Map estimate.

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ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		reaches it is the dominant habitat that is recorded.			
	Numbers	Measures 'actual' numbers of native birds surveyed on the river (excluding southern black-backed gulls – see main text at section 2, step 1).	Total number for all (except Southern black-backed gull) native species recorded	1 = <1000 individuals; 2= 1000-4999 individuals; 3= >5000 individuals	Most 'significant for birdlife' NZ rivers have been subject to some survey effort but it varies greatly in spatial coverage and sometimes reliability. Where possible all survey information is referenced; otherwise expert panel judgement is also included.
	Foraging guilds	Provides a measure of species diversity on the river	Number of guilds present ranges from 0-8, i.e., a= open-water divers; b= deep water waders; c= shallow water waders; d= dabbling waterfowl; e= torrent specialists; f= aerial hunting gulls and terns; g= swamp specialists; h= riparian wetland birds	1= 1-4 = low; 2= 5-6= medium; 3= 7-8= high	Guilds for wetland birds are defined in O'Donnell, C.F.J. 2000. The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand. Environment Canterbury Unpublished Report U00/37. Environment Canterbury, Christchurch.
	Feeding guilds				
	Roosting guilds				
Natural diversity	Within guilds				
	Microhabitat diversity				
	Number threatened species	Provides a measure of the diversity	Actual number of species within 'threatened or at	1=1 species; 2= 2-3 species; 3= 4 or more	Based on actual surveys or expert panel knowledge:

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ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		of threatened or at risk bird species using the river.	risk' conservation status categories, i.e., blue duck (BD); black stilt (BS); pied stilt (PS); wrybill (WB); banded dotterel (BDo); NZ pied oystercatcher (NZPO); black-fronted tern (B-FT); black-billed gull (B-BG); white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); southern crested grebe (SCG); dabchick (DC)	species	generally very reliable although some potential to under report.
Distinctiveness/ stronghold site	Overwintering				
	Migration stopover				
	Significant breeding site	Provides a measure of relative importance of rivers as strongholds for populations of 'threatened or at risk' species in New Zealand. (Note that Australasian bittern, marsh crake, and grey duck have been excluded due to imprecision with survey technique (first two species) and with identification	Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations, ranges from 0-10, i.e., blue duck (BD), black stilt (BS), pied stilt, NZ pied oystercatcher (NZPO), wrybill (WB), banded dotterel (BDo), black-fronted tern (B-FT), black-billed gull (B-BG), white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); ; southern crested grebe (SCG); dabchick (DC)	0= no species >1%; 1= 1 species at 1-4.9% = low; 2= 2 species at 1-4.9% = medium; 3= 1 or more species > 5%, or 3 or more 1-4.9% of total population = high	Based on actual surveys or expert panel knowledge: for some rivers and species, e.g., blue duck, the reliability is likely to be only moderate because of doubt about total population size and doubt about numbers on the river concerned, i.e., two sources of error.

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ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	(final species)				
	Significant moulting site				
	Only region typically supporting a particular species				
	Habitat for specialist needs				
	Habitat for species with special diet or foraging behaviour				
Intactness/ naturalness	Level of modification				
Long term viability	Vulnerability to natural perturbations				

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APPENDIX 3: Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Relative distinctiveness	Yes	Subjective measure	Experts available	Yes	Experts available	Yes
Amount of habitat: Area (ha) of riverbed for braided rivers; Distance (km) for single channel rivers	Yes	Area and Number of km	Data available	Yes	Data available	Yes
Total number for all native species recorded, with and without an adjustment of 'excessive' numbers of southern black-backed gulls	Yes	Quantitative and relatively easily measured	Survey data available	Yes	Data available	Yes
Number of guilds present, ranges from 0-8, i.e., a= open-water divers; b= deep water waders; c= shallow water waders; d= dabbling waterfowl; e= torrent specialists; f= aerial hunting gulls and terns; g= swamp specialists; h= riparian wetland birds	Yes	Quantitative and relatively easily measured	Survey data available	Yes	Data available	Yes
Actual number of species within 'threatened or at risk' conservation status categories	Yes	Quantitative and relatively easily measured	Survey data available (except for Australasian bittern and grey duck – they are excluded from the analysis)	Yes	Data available including experts	Yes
Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations	Yes	Quantitative and relatively easily measured – some expert assessment also needed	Survey data available, but experts also needed	Yes	Data available including experts	Yes

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APPENDIX 4: Significance assessment calculations for birdlife (Steps 1 and 5-8)

River	PRIMARY ATTRIBUTES — Step 6A: Apply indicators and thresholds						SCORING OF PRIMARY ATTRIBUTES — Step 6B: Apply indicators and thresholds						Step 8: River significance			
	1. Relative distinctiveness (Subj)	2. Amount of Habitat (Obj)	3. Numbers (Obj)	4. Foraging guilds (Obj)	5. Number of 'threatened or at risk' species present (Obj)	6. Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations (Obj/Subj)	1. Relative distinctiveness of habitat	2. Amount of Habitat	3. Numbers (ranked with SBBG removal adjustment)	4. Foraging guilds	5. Number of 'threatened or at risk' species present (Obj)	6. Species strongholds	Sum Weights 1	Rank1	Overall evaluation of importance	Data source
Clarence	3	4168	315	a,b,c,d,f,h	BDo; B-FT; NZPO; PS	B-FT	3	1	1	2	3	1	11	14	Regional	1992 part
Kahutara	2	702	321	a,b,c,d,f,h	B-FT, B-BG, BDo, R-BG, NZPO, PS		2	1	1	1	3	0	8	22	Local	A. Grant,
Hapuka	1	656	6	b,c,f	BDo		1	0	1	1	1	0	4	36	Local	A. Grant,
Conway	2	845	556	a,b,c,d,f,h	BDo; B-FT; B-BG; R-BG; NZPO; PS;	W-FT	1	1	1	2	3	0	8	22	Local	A. Grant,
Waiau	3	7412	3825	a,b,c,d,f,h	B-FT, B-BG, R-BG, CT, NZPO, PS, BDo, WB,	B-FT (>5%); B-BG; BDo	3	2	2	2	3	3	15	7	National	ECan 2008
Hurunui	3	5138	2386	a,b,c,d,e,f,h	B-FT, B-BG, R-BG, CT	B-FT (>5%); B-BG; BDo	3	2	2	3	3	3	16	6	National	A. Grant, DoC, 2008 su

Site					Habitat features	Threats							Total	Rank	Significance	Source
Avon	2		c.30	1500	a,b,c,d,f,h	B-BG, R-BG, PS		2	2	2	2	2	0	10	16	Local	Expert pa
Kaituna	1		c.10	200	a,d,h	SCG		1	2	1	1	1	0	6	32	Local	Expert pa
Okuti			c.5	c.20	a,c,d,f	B-FT,BDo		1	1	1	1	2	0	6	32	Local	C.O'Donn
Halswell	2		c.25	<100	a,d,h	SCG		2	2	1	1	1	0	7	30		
Selwyn	3		90	<300	a,b,c,d,h	BDo; NZPO		3	3	1	1	1	0	9	20	Local	K. Hughey
Rakaia	3	32102		4342	a,b,c,d,f,h	WB, B-FT, BDo, B-BG, R-BG, CT, W-FT, NZPO, PS	B-FT; B-BG (>5%); WB (30%); BDo	3	3	3	2	3	3	17	1	National	A. Grant, none of u
Rangitata	3	18091		6926	a,b,c,d,f,h	WB, B-FT, BDo, B-BG, R-BG, CT, W-FT, NZPO, PS	B-FT (>5%); B-BG (>5%); WB (30%); BDo	3	3	3	2	3	3	17	1	National	Butcher 2
Ashburton	2	2441		7856	a,b,c,d,f,h	B-FT; B-BG; R-BG; BDo; WB; W-FT; CT; NZPO; PS	B-FT; B-BG (12.5%)	2	1	3	2	3	3	14	9	National	A. Grant, I
Orari	1	2043		179	a,b,c,d,f,h	BDo; B-FT; B-BG; NZPO, PS		1	1	1	2	3	0	8	22	Regional	A. Grant, I
Opihi	1	1711		485	a,b,c,d,f,h	BDo; B-FT; NZPO; PS		1	1	1	2	3	0	8	22	Regional	A. Grant, I
Pareora	1	1070		68	a,b,c,d,f,	BDo; NZPO; PS; W-FT		1	1	1	2	3	0	8	22	Local	A. Grant, I
Waitaki - Upper	3	c.30000		7907	a,b,c,d,f,h	BS, WB, B-FT, BDo, NZPO, PS, CT	BS (100%); B-FT (15%); B-BG; WB (20%); BDo	3	3	3	2	3	3	17	1	National	C. Woolm
Macaulay	1	1533		141	a,b,c,d,f	BDo, WB, B-FT, NZPO, PS		1	1	1	2	3	0	8	22	Local	C. Woolm
Godley	3	6833		373	a,b,c,d,f,h	BDo, WB, B-FT, BBG, CT, NZPO, BS, PS	WB	3	2	1	2	3	1	12	11	Regional	C. Woolm
Cass	3	1432		498	a,b,c,d,f,h	BDo, WB, B-FT, BBG, CT, NZPO, PS		3	1	2	2	3	0	11	14	Regional	C. Woolm
Tekapo	1	3178		1034	a,b,c,d,f,h	BDo, WB, B-FT, W-FT, B-BG, R-BG, CT, NZPO, BS, PS	B-FT (>5%)	1	1	2	2	3	3	12	11	National	C. Woolm
Tasman	3	6897		1588	a,b,c,d,f,h	BDo, WB, B-FT, B-BG, CT, BS, PS, NZPO	WB, B-FT, BS (>15%)	3	2	2	2	3	3	15	7	National	C. Woolm
Pukaki	2	512		57	a,b,c,d,f,h	BDo, B-FT, NZPO, PS		2	1	1	2	3	0	9	20	Local	C. Woolm
Hopkins	3	3548		126	a,b,c,d,f,h	BDo, WB, B-FT, CT, NZPO, BS, PS		3	1	1	2	3	0	10	16	Local	C. Woolm
Dobson	3	2007		187	a,b,c,d,f,h	BDo, WB, B-FT, CT, NZPO		3	1	1	2	3	0	10	16	Local	C. Woolm
Twizel	1	<1000		115	a,b,c,d,f,h	BDo, B-FT, B-BG, NZPO		1	1	1	2	3	0	8	22	Local	C. Woolm

Waitaki - Lower	3	8104		6136	a,b,c,d,f,h	B-FT, B-BG, BDo, NZPO, PS	B-FT (8%); B-BG; BDo	3	3	3	2	3		3	17	1	National	Sanders 2
Blue duck river	3		90	150	a,e,h	BD	BD (10%)	3	3	1	1	1		3	12	11	National	Hypotheti
Colour coding	Orange cells - less reliable data, including expert based estimates																
	Red typeface - data checked by Expert Panel and may have been adjusted																

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APPENDIX 5: Other factors relevant to the assessment of significance for birdlife (Step 9)

General
While the assessment of braided rivers is relatively simple, the subsequent comparative evaluation against important single channel rivers is more challenging. This is because single channel rivers typically contain much less species diversity and a much lower presence of 'threatened or at risk' species. As a result even the most important single channel rivers will score lower than even 'average' or regionally important braided rivers across the range of attributes and most indicators. However, given the importance of some single channel rivers to the blue duck it was decided that a decision criterion related to the final indicator, species strongholds, was warranted, i.e., rivers that are considered a stronghold for blue duck or any other threatened or at risk species for that matter are considered to be of national importance.
Some threatened and at risk species are extremely difficult to survey, e.g., Australasian bittern because of its secretive habits and cryptic plumage, and grey duck because it is very easily confused with the predominant mallard duck. No attempt has been made to include the bittern in any evaluation in this case study although it is likely to be present on most of the rivers but extremely low numbers, e.g., ones and twos. Grey duck has been excluded from total bird counts even thought it may be present in significant numbers in some back country catchments – where confirmed it is included in presence of threatened or at risk species. Where verifiable survey data are available then it should be considered for inclusion.
There are some rivers and streams that flow extensively through wetlands, e.g., the Whangamarino in the Waikato. We have considered these to be primarily wetlands in their own right and consider they should be dealt with separately. In Canterbury the closest example of this sort of 'mix' is Hart's Creek, a tributary of Te Waihora/Lake Ellesmere – it has been excluded from our evaluation.

APPENDIX 6: Future data requirements for birdlife

Data need
Whole river surveys of nationally important (e.g., Rakaia particularly), and some regionally important rivers
Update many upper Waitaki river surveys, e.g., Ahuriri
Include New Zealand pipit on list of species to be surveyed for on all braided rivers
Enter Ministry of Works 1956 list of rivers (i.e. make into electronic list) or link directly to the REC or similar, but as agreed nationally.

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