

The effect of jetboat wake on braided riverbed birds on the Dart River

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Abstract We investigated the effect of jetboat wakes on feeding wrybill (*Anarhynchus frontalis*), banded dotterel (*Charadrius bicinctus*), black-billed gull (*Larus bulleri*), and black-fronted tern (*Sterna albostrata*) on the Dart River, Otago. We found that all species feed in areas likely to be affected by jetboat wake. On average, banded dotterel ($n=8$) were 43.2 mm above the water level and 4.37 m from the water's edge, wrybill ($n=16$) were 49 mm above the water level and 0.8 m from the water's edge. Jetboat wake ($n=7$) extended 91.3 mm above the water's edge and on average 1 m from the edge of the river channel. The implications of the wash and the extent of the likely effect are discussed.

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INTRODUCTION

Braided rivers are uncommon globally and result from substantial amounts of material eroded from high rainfall areas being deposited in dry areas with minimal slope. The build-up of material has a distinctive effect on the structure and hydrology of the river, such that the bed extends laterally and splits into many channels or braids. The braids vary in width and depth and constantly form, change and reform. They contain distinctive riffle and pool systems.

In New Zealand, braided rivers are common on the east coast of the South Island. The braided rivers are occupied by a specialised riverbed bird community including 5 endemic species – wrybill (*Anarhynchus frontalis*), black stilt (*Himantopus novaeseelandiae*), banded dotterel (*Charadrius bicinctus*), black-fronted tern (*Sterna albostrata*) and black-billed gull (*Larus bulleri*) – and South Island pied oystercatcher (*Haematopus ostralegus finschi*), an endemic subspecies. The biology of these and other members of the riverbed bird community has been described in detail by Hughey (1977), Lalas (1977),

Robertson *et al.* (1983), Hay (1984), Robertson *et al.* (1984), and Maloney *et al.* (1997).

The Dart River is the southernmost braided river in New Zealand. It arises in the Southern Alps and starts braiding at approximately 400 m a.s.l. and extends for c.20 km before entering the north end of Lake Wakatipu at 300 m a.s.l. The Dart River is significant because it provides habitat for 50 wrybills, 100-200 banded dotterels, 60-1000 black-billed gulls, and 40-200 black-fronted terns (McKinlay unpubl. data). The Dart is not as degraded with exotic weeds as are most of the low altitude stretches of braided rivers in Canterbury (Balneaves & Hughey 1989).

The broad and shallow braided riverbeds provide challenges for boat-users, because they cannot be traversed by traditional outboard motor vessels. This has led to the development of the jetboat, which has greatly expanded commercial and recreational use of braided rivers in the eastern South Island.

When a jetboat proceeds up and down a braided river it displaces water in the form of a wave that washes along the edges of the channel. The wave varies depending on the speed and direction of the boat, whether it is cornering, and other factors. The distance of the boat from the shore and the steepness of the shore can affect the size of the wave at the channel edge. *The effect of*

the use of jetboats on the bird community of braided riverbeds has not been previously described or assessed.

In 1997, commercial jetboat users sought (through the resource consent process of the Resource Management Act 1991) to increase the number of commercial jet boat trips on the Dart River from 20 day⁻¹ to 32 day⁻¹. Although at that time no quantitative data had been collected to determine whether increased activity would impact on the bird populations on the riverbed, commercial users assumed there would be no significant impact. If granted and fully exercised, the consent would have increased by over 50% the number of commercial jetboating trips on the Dart during spring and summer, when birds depend on the river for breeding and feeding (Robertson *et al.* 1983).

The aims of this study were: (i) to test the hypothesis that jetboats and selected bird species used the same or similar areas of the braided river habitat; and (ii) to quantify what effect, if any, an increase in jetboat traffic would have on the amount of time that birds would have to exploit food and other resources on the river.

METHODS

On 3–6 November 1997 we walked the lower Dart River (44° 45'S, 168° 00'E) looking for wrybill, banded dotterel, black-fronted tern, South Island pied oystercatcher, and black-billed gull along the edges of river channels. Once we found a bird or a group of birds beside a river channel we used a "dumpy" level, surveyor's staff (accurate to ± 10 mm), and tape measure (accurate to ± 1 mm) to record how far the birds were away from the water at first sighting, and how high above the water level they were.

We also observed jetboat passes in both upstream and downstream directions as they occurred and marked the extent of wash onto the shoreline including distance from and height above the observed river level. For each pass, we took the mean of 3 measurements. Sites where we sampled jetboat wake were separated by distances of hundreds of metres as we moved about the riverbed searching for birds.

Jetboats are restricted to the larger channels on braided rivers. Commercial jetboats are substantially larger than private boats, and so have less choice as to which channels they use. The Dart River in the middle and late 1990s has usually had only 1 main channel on the western side of the delta. We concentrated our efforts along main channels to maximise the number of jetboats encountered.

Alternative approaches would have been to monitor breeding success to see what effect different jetboat regimes had on reproductive effort or to count birds on the river to see if they changed with the changes in the level of use. As the investigation took place before an increase in jetboat use was approved, results from nest monitoring could have established the current situation rather than possible effects of increased usage. Numbers

Table 1 Summary of distances above and away from river channels for feeding observations of banded dotterel (*Charadrius bicinctus*), wrybill (*Anarhynchus frontalis*) and black-billed gull (*Larus bulleri*), Dart River, November 1997.

Species	No. of Individuals	Distance above water (mm)	Distance from water (m)
Banded dotterel	1	15	5
	1	22	10
	2	100	5.7
	1	11	3.5
	3	47	3.15
	1	0	0
Mean (SD)		43.2 (36.47)	4.37 (2.74)
Wrybill	1	0	0
	1	10	0.3
	1	0	0
	2	0	0
	1	0	0
	2	10	0.95
	2	0	0
	3	200	2.5
	1	0	0
	2	80	2.1
Mean (SD)		49.4 (79.2)	0.80 (1.03)
Black-billed gull	7	5.8	
	7	0	0
	1	0	0
Mean (SD)		4.5 (2.6)	-

of birds on the river can vary dramatically within and between seasons, and so direct counts would have been confounded by many factors.

RESULTS

Birds

We recorded 9 banded dotterels, 16 wrybills, and 15 black-billed gulls along the edges of river channels (Table 1). Eight wrybills were feeding at the waters edge, and 50% of the black-billed gulls were feeding at or in the waters edge. We did not record any South Island pied oystercatchers feeding along the edge of braids.

We saw 1 wrybill feeding at the water's edge as a jetboat passed upstream on the far side of the channel c.30 m away, with a wake consisting of about 5 waves. By the time the first wave reached the bank where we were standing, it was c.100 mm high. The wrybill moved up the beach in front of each successive wave, and then followed the water back as it receded.

Most banded dotterels we observed higher up the riverbank and further away from the waters edge than wrybill (Table 1).

Black-fronted terns do not forage along the edge of river braids but rather they hover over the stream looking

for small fish and hawk insects directly over the water. In all instances ($n = 9$) where we saw jetboats pass black-fronted terns, the terns were directly displaced from feeding by the jetboats. Sometimes a tern resumed feeding after the boat had passed, but others moved to another part of the river. Black-fronted terns appeared to be disturbed by the boats themselves as opposed to the boat wake.

Jetboats

We recorded 7 jetboats heading upstream along straight channels. The wakes had a mean height of 91.3 mm (range 17.5–205.0 mm) and washed up a mean distance of 1 m (range 0.66–1.43 m). The variation was attributed to factors such as the distance of the boat from the shore, and the speeds of the boat, and the current.

DISCUSSION

The presence of jetboats on the Dart River affects individual riverbed birds feeding near the main channels. Birds cannot feed in the space occupied by a jetboat or its wake so the amount of wet channel edge is reduced by jetboats for short periods. This is likely to affect mostly those species that spend most of their time feeding along main river channels, including wrybills, black-billed gulls, banded dotterels, and black-fronted terns. We did not quantify effects on South Island pied oystercatcher because they were found mainly on the open gravel bars and not at the waters edge.

We focused on wrybill and black-fronted tern because they have “threatened” status and their specialised feeding habits and habitats were most likely to be adversely affected by jetboats. Other species, such as South Island pied oystercatcher, will also be displaced from feeding along main channels, but they have larger populations and are less restricted in their habitat choices (Robertson *et al.* 1984).

Although collected over a much shorter timeframe our study reinforces the findings of (Robertson *et al.* 1983) who documented habitat use for braided riverbed birds on the Ahuriri River. Over a year, they showed that wrybill fed predominantly on the edges of main channels and in shallow riffles surrounded by water. In contrast, banded dotterel fed in both terrestrial and shallow water habitats but used more terrestrial habitats during spring and summer. Black-fronted terns were recorded as aerial feeders capturing prey from above or below the water surface. They fed mainly over main channels and riffles. Black-billed gulls fed more in flowing aquatic habitats in winter and to a lesser extent, in spring. In spring and summer, black-billed gulls moved away from the river for feeding more than other species. Based on this year-long study the preferred feeding habitats of wrybill and black-fronted terns in particular are often in the same areas of river affected by jetboats and the wake from jetboats.

Jetboats do not use the Dart River all the time. The issue to be considered when assessing the original application was what proportion of daylight hours (when birds feed), could be allocated to jetboat use before any adverse effects become so prolonged as to adversely affect an individual’s ability to feed itself or its chicks. For a threatened species, such effects may be magnified because of its already small population.

Female wrybill incubating on the Rakaia and Cass Rivers have only 22% of daylight time available for foraging, which equated in October to about 3 h (Pierce 1976). In comparison, males had 89% or 12–13 h for foraging. During the chick-guard phase, females had 46% of total daylight time to forage both with and without the chicks, males had about 71% (Pierce 1976). For banded dotterels, (Bomford 1978) reported that females undertook between 67–99% (mean 82%) of incubation which meant even less time to forage. Black-fronted terns forage for fish in backwaters in the early morning, and then move to the major channels as the day warms up and insects start to hatch (Lalas 1977). These data suggest that incubating female wrybill and banded dotterel are most likely to be affected by jetboat activity. Conversely it is likely that the entire population of black-fronted terns will be affected by jetboats. Obviously determining the strength of these relationships will require additional work.

The Dart River is one of the few braided rivers where commercial jetboating occurs. Private jetboats are used on all braided rivers, subject to the policies and rules of local government pursuant to the Resource Management Act 1991. Private jetboating involves smaller boats and less frequent trips. The smaller boats have a much greater choice of navigable channels for the driver, which could spread the potential effects over much greater areas of riverbed. Robertson *et al.*’s. (1983) observations suggest that the difference may lead to a greater impact from smaller boats on banded dotterels as the birds are more often found on smaller channels. Although private jetboating is less frequent and the overall effect may be less disturbing, up to 60 jetboats have used the Dart in one weekend as part of an organised club outing (R. Kennett, pers. comm.).

The assumption that braided riverbed birds are not affected by jetboats was found to be incorrect. Even the limited data gathered so far show that the interaction between jetboating on braided rivers and birdlife needs further investigation before the effects on individuals and populations, particularly of threatened species, can be properly understood.

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