Radio-transmitters impose energetic costs on a flightless bird

Conservation biologists often use radio-telemetry to monitor individuals within endangered populations. If transmitters affect their bearers, the well-being of those animals, and the value of the radio-tracking study may be compromised. Transmitters are known to induce costly drag effects on swimming animals.

For Takahe (*Porphyrio mantelli*), a critically-endangered, non-swimming, flightless rail, we found direct evidence of an impact of transmitters on their daily energy expenditure (DEE).

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Methods

To assess possible impact of transmitters, we measured the DEE of 6 Takahe (mean mass = 2580 ± s.e.132 g) living in a mixed tussock grassland/forest area at Burwood Bush, Fiordland, using the doubly-labelled water (DLW) technique.

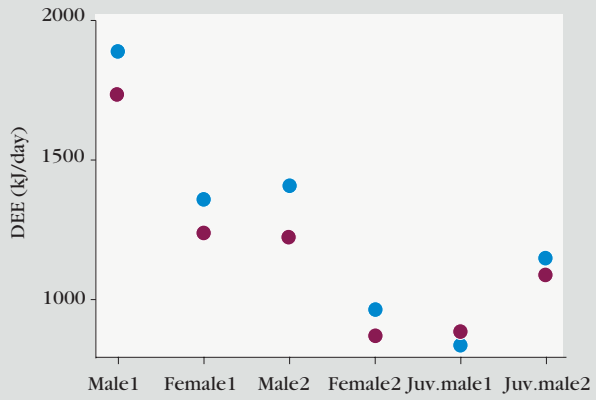
Measurements of each bird were conducted over two consecutive 3-day periods: once tagged, and once untagged. Half were tagged in the first period, and half in the second.

None had previously carried transmitters. Transmitters were of a wing-loop backpack design weighing 48.1 ± 0.8 g, (mean % body weight = 1.83 ± 0.13%, range=1.39–2.28%).

Results

Energy expenditure

Carrying transmitters significantly increased DEE ($P<0.03$) with tagged birds expending 1274 ± 17 kJ/day, compared with 1174 ±17 kJ/day when untagged. This is an 8.5% increase in DEE due to transmitters.



Daily energy expenditure (DEE) for 6 Takahe, each measured twice. ● - tagged; ● - untagged expenditures.

Time-budgets

Behaviour	% Time (±SE)		P<
	Tagged	Not tagged	
Feed	75.57 (±4.06)	75.36 (±2.44)	0.86
Stand	8.45 (±1.97)	10.34 (±2.90)	0.75
Walk	12.12 (±2.09)	13.82 (±1.80)	0.96
Run	0.15 (±0.08)	0.06 (±0.06)	0.56
Preen	1.72 (±0.90)	0.42 (±0.24)	0.38

P values are from a general linear model using 3 factors: tagged status; sequence and individual. None of the factors explained significant variation in any behaviour (proportion of time (arcsine-square root transformed)).

Time-budgets of birds when tagged and untagged were similar, providing no evidence that transmitters affected behaviour. We calculated that the increased muscular effort necessary to support and move the weight of the transmitter could explain at most 15% (mean = 7.5%) of the observed increase in energetic costs. Drag-effects are trivial for such a slow-moving animal. This excludes both behavioural and locomotive effects, leaving only a physiological explanation for increased costs.

Conclusion

We suggest these costs arose from heat-loss through the tag, and from feather disruption caused by the package. *In situ* tags felt warm to the touch.

Although heat loss through transmitters has been demonstrated previously, our use of a repeated-measures design allowed us to quantify a hidden biological cost of carrying radio-transmitters.

Applications

Heat loss through external transmitters may be general in birds, and potentially large enough to influence survival.

We urge caution in extrapolating from radio-telemetry data to an untagged population, even where evidence of transmitters affecting behaviour has been sought and not found.

The DLW technique provided a snapshot of potential chronic effects of tags without actually imposing those effects on the animals, and may have other useful applications for endangered species.

Radio-transmitters fitted to Takahe now have a basal layer of insulatory closed-cell foam to prevent heat loss.

The published version of this study may be found in *Biological Conservation* 114(2003):35-38 or *Science for Conservation 214* at www.doc.govt.nz/publications

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