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SHORT NOTE

Monitoring of an Australasian bittern (*Botaurus poiciloptilus*) following release into the wild

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The Australasian bittern (matuku, *Botaurus poiciloptilus*) is a cryptic wetland specialist species, found in New Zealand, Australia and New Caledonia (BirdLife International 2014). Populations are declining and the species is classified as Endangered by the IUCN and Nationally Endangered in New Zealand due to drastic reductions in their range (BirdLife International 2014; Buchanan 2009; Miskelly *et al.* 2008). In New Zealand, population estimates vary but it is thought that <1000 birds remain (Heather & Robertson 1996). Little information is available about the causes of population decline for this species, although declines in habitat area (~90% since human settlement), invasive predators, lack of food and fluctuating water levels, water quality and/or turbidity are all considered potential threats to bittern populations (Ausseil *et al.* 2011; O'Donnell 2011).

The lack of information on the causes of decline for bitterns is in part due to the difficulties in detecting these birds. Bitterns are well camouflaged in their natural habitat, have a tendency to inhabit inaccessible densely vegetated wetland areas, are secretive in nature, and appear to be most active during nocturnal or crepuscular hours (Heather & Robertson 1996; Marchant *et al.* 1990; O'Donnell 2011). These factors, as well as the rarity of this species, have made it difficult to collect data on the nest success and survival of individual birds over time. Few dead, sick or injured bitterns have been recovered and even fewer have been treated for injury or illness in captivity (B. Gartrell, Massey University, *pers. comm.)*. Of those birds treated in captivity, few survived to be released back into the wild (B. Gartrell, Massey University, *pers. comm.*). Those bitterns that did survive to release (<10) were rarely, if ever re-sighted. It is not possible to know if this lack of re-sightings is due to low detection rates or the failure to effectively treat the bird. As bitterns appear easily stressed in captivity, rehabilitation efforts focus on minimising the time in captivity and releasing as soon as is feasible (B. Smith, Bird Rescue, *pers. comm.*). With so few opportunities to treat bitterns, it is important to know whether rehabilitation attempts are successful (*i.e.*, birds survive for a reasonable post-release period), and if not, determine the causes of mortality so that treatment can be adjusted accordingly. In the long term, such information may also be useful in identifying the key causes

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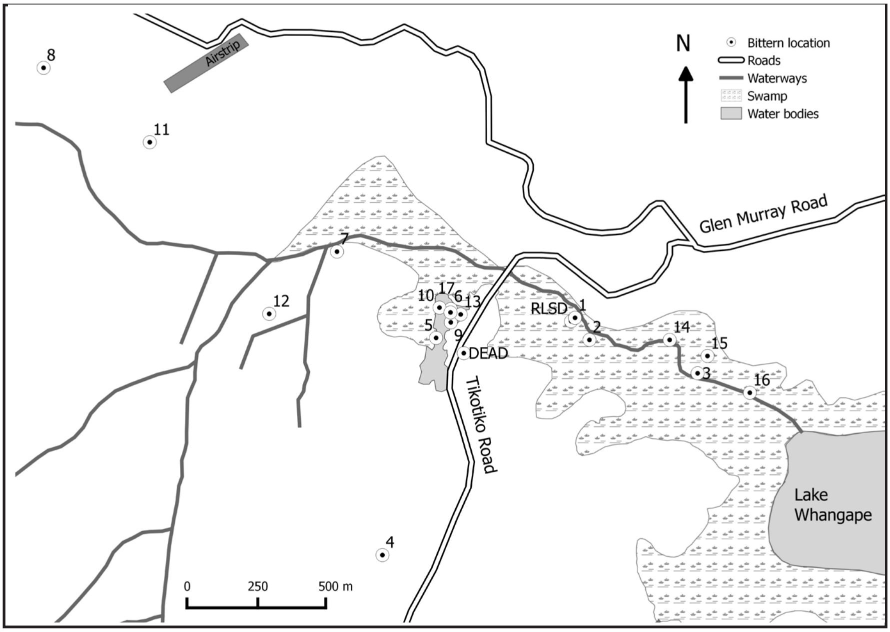

Fig. 1. Locations for an Australasian bittern released in the TikoTiko arm of Lake Whangape following 23 days of captive treatment. The bird was released on 14 April 2012 (RLSD) and found dead on 5 June 2012 (DEAD). Numbered circles refer to the bittern locations listed in Table 1.

of mortality for bitterns in New Zealand, and preventing excess mortality when it threatens a population. Here we followed a sick bittern during captive treatment, release and post-release. We present data on its movements once it was released and demonstrate the importance in conducting post-release monitoring to determine the 'true' success of rehabilitation.

On 22 March 2012 a male bittern was found on Churchill Road, near Lake Whangape, in the Waikato region of New Zealand. It was brought into the Department of Conservation Waikato area office appearing malnourished. The bird weighed <850 g, which is 550 g less than the expected weight of an adult male bittern (1400 g; Heather & Robertson 1996). X-rays inconclusively suggested that some tiny flecks of metal may have been present in the gut but haematological and chemical tests of blood taken from the bird's leg returned normal, showing no signs of blood poisoning (M. Leech, Anexa Animal Health, *pers. comm.*). Based on this initial assessment, and as nothing else appeared to be abnormal in relation to the bird, it was assumed that the bird had at some point eaten a foreign object but had successfully passed this item before being found (M. Leech, Anexa Animal Health, *pers. comm.*). Care of the bittern was transferred to an experienced local carer (B. Smith, Bird Rescue), who kept the bird in captive care for 23 days. During this time, the bird showed signs of a good appetite and put on over 400 g of weight (B. Smith, Bird Rescue, *pers. comm.*). On 12 April 2012 it had reached a weight of over 1100 g and was considered ready to be released back to into its natural habitat.

Two days before release, the bird was fitted with a numbered metal butt-end band (size M) and a 2-stage Sirtrack® transmitter weighing 30 g (2.7% of the bird's total body weight). The transmitter was attached to the bird using a back-mounted harness design (Karl & Clout 1987). Once the transmitter was attached, the bird was released into an aviary and observed remotely for 2 days via an infra-red video camera. In the aviary, the bird did not show any signs of discomfort relating to the transmitter and continued to maintain a healthy appetite and put on weight.

The bird was released into the wild in TikoTiko arm of Lake Whangape (E1778089, N5852933) on 14 April 2012. At the time it weighed 1292 g. The release site was chosen because it represented an area of suitable habitat that was in the general area of where the bird was originally found, and where bitterns had been previously sighted (National Bittern Database, Department of Conservation). After the bird's release, it was located by following the signal emitted by the transmitter using a TR-4 receiver. This was done opportunistically when other work in the area allowed. Whenever the bittern was located, observers attempted to re-sight the bird to record its exact location, as well as any key habitat characteristics such as proximity to water (<15 m) and most dominant plant species.

Following release, 17 locations were obtained for the live bird across a 51 day observation period. Of these locations, observers were able to re-sight the bird 88% of the time (15/17; Table 1). During the observation period the bird remained within the

Table 1. List of observations made of a released Australasian bittern following 23 days of captive treatment. The bird was fitted with a transmitter 2 days before release and tracked opportunistically over 51 days, from release to its eventual demise. Occasions marked with an asterix (*) are those where the bittern was physically sighted. Distance moved is the distance moved since the last observation.

Bittern location number	Date	Time	Distance moved (m)	Distance to centroid of MCP (m)
Released	14 April 2012	13:06:50	-	508
1*	15 April 2012	13:19:19	20	526
2*	16 April 2012	13:29:32	92	565
3*	18 April 2012	15:43:59	401	955
4*	20 April 2012	16:31:40	1280	760
5*	24 April 2012	15:46:44	788	35
6	26 April 2012	13:59:48	103	144
7*	27 April 2012	17:11:52	451	467
8	30 April 2012	10:26:52	1225	1682
9*	1 May 2012	10:42:18	1697	111
10*	4 May 2012	10:09:45	66	137
11*	7 May 2012	14:41:47	1177	1223
12*	11 May 2012	14:06:56	736	576
13*	16 May 2012	13:37:55	675	153
14*	18 May 2012	14:04:35	746	850
15*	22 May 2012	14:19:26	143	986
16*	25 May 2012	10:26:29	200	1149
17*	1 May 2012	15:28:25	1097	137
Found dead	5 May 2012	14:51:54	149	125

TikoTiko gulley system, which incorporates an area of wetland approximating 125 ha. The minimum convex polygon (MCP; Mohr 1947) of the bird's range was 131.6 ha, with >50% of observations being within 600 m of the centroid of the MCP, where a large (1.95 ha) pond with shallow fringes was situated (Fig. 1). Throughout the observation period, the bird's movements remained short, with distances <400 m being covered per day for >75% of observations. The average observed distance that the bird moved between sightings was 286.7 m per day (± 394.7 SD; Table 1).

On those occasions where the bird could be re-sighted (15/17), it was found within close proximity to water on an almost equal number of occasions compared with when no open water was nearby (53% near water, 47% no water). The predominant vegetation type that the bird was found in was willow weed, *Persicaria* spp. (53%), followed by *Juncus* spp. and rush/sedge (20% and 13%, respectively). The bird was sighted in *Bolboschoenus* spp. and pastoral grass less frequently (7%).

On 5 June 2012, 54 days after being released, the bird was found dead on the wetland edge, in a dry area dominated by *Juncus* and *Persicaria* spp. When found, the carcass was in good condition with no sign of decomposition or predation. It was obvious from the carcass that the bird was malnourished. The necropsy report confirmed that the bird was a non-breeding male and described its condition as 'severely emaciated' but could not discern any other causes of death. Further tests were not possible as the carcass had been frozen. Additionally, dorsal rubbing was noted in the necropsy as being present on the carcass. This shallow 2 cm long abrasion was thought to have been caused by rubbing from the transmitter 'due to the severe emaciation and protruding spine' of the bird but 'probably would not occur in a bird in good body condition'.

It is unusual for injured birds to be monitored post release and this is the first time a bittern has been monitored post-release in New Zealand. In this study, retrieval of the body, and therefore the observations and conclusions reported here, would not have been possible had the bird not been fitted with a transmitter. Instead it would have been easy to assume that the bird had passed the heavy metals that were originally thought to have affected the health of the bird, allowing us to falsely conclude that treatment and rehabilitation had been a success. The lack of re-sightings after this bird was released could easily have been attributed to the cryptic nature of this species, rather than the death of the individual. Instead, results here confirm the importance of correctly identifying the original cause of a bird's illness (where possible) and stress the need to monitor individuals that have undergone treatment even after they have been released.

We cannot say with certainty what caused the death of this bird. However, the depleted weight of the bird upon capture, its high appetite during captivity and the emaciated state of the dead carcass suggest to us that the bird was perfectly capable of processing food but was unable to obtain enough prey to sustain itself. Despite the dorsal rubbing present on the carcass, we are confident that the presence of the transmitter did not contribute to this bird's death. Our observations to support this are as follows: (1) whilst in captivity, the bird showed no signs of concern with regard to its harness and continued to maintain a healthy appetite, and move freely throughout its enclosure; (2) post-release sightings of this bird provided little cause for concern, with the bird appearing to carry itself normally when sighted; and (3) the necropsy judged that the dorsal rubbing was a by-product of the bird's protruding spine, and therefore could only have occurred in the latter stages of emaciation, once the birds condition had already deteriorated.

Instead we think that low food intake was the mostly likely cause of death. Australasian bitterns are thought to be predominantly fish eaters but are also known to be opportunists, feeding on amphibians, mammals, bird, spiders and insects (Teal 1989). Such opportunistic feeding would suggest that the species could adapt if preferred food sources become scarce. However, the Eurasian bittern (*Botaurus stellaris*) is also an opportunistic feeder. For this species, low food intake has been suggested as the second-largest factor limiting populations in Europe (Gilbert *et al.* 2007; Noble *et al.* 2004; Poulin *et al.* 2007). Several factors could contribute to this low food intake at the release site. For example: (1) prey density could be low, (2) prey density could be high but prey are problematic to catch or of insufficient quality to compensate for energy expenditure, or (3) the bittern was unable to capture prey due to inexperience (*i.e.*, it may have been a juvenile). We do not have any data regarding prey availability in the TikoTiko arm of Lake Whangape, and therefore cannot conclusively say which of these factors are applicable. However, we can say that all sightings of this bittern coincided with habitat that was consistent with other areas where bitterns are regularly observed foraging successfully, implying that the release site at least had the potential to be productive. We also know that the MCP of the bird's range (131.6 ha) was much higher than the autumn/winter home range sizes reported from other studies of this species (2-4 ha; Teal 1989) or with other bittern species (1.8 - 35.7 ha; Bogner & Baldassarre 2002; Gilbert *et al.* 2005). This suggests that the bird may have been looking for new sites rather than remaining at 1or 2 localised feeding areas. Furthermore, the necropsy noted that the testes of the bittern were small, suggesting the bird may have been a juvenile. This information is inconclusive alone, as few bitterns have been necropsied, making it difficult to know if under-developed testes would also be expected in adult males outside of the breeding season. However, buff freckling was also present on the outer primaries, a characteristic associated with juveniles (Marchant *et al.* 1990). We also noted that fractures visible on all 11 tail feathers (one feather, R1, was missing) matched in position across feathers. These matching tail feather fractures imply that the bird was yet to experience a complete moult and therefore is still within the first year of life. These combined observations suggest the bird was a juvenile and therefore likely to lack foraging experience.

Initial assessments of the bird suggested its malnourished state was the by-product of consuming an artificial object. We still cannot confirm this. However, with the additional information obtained from monitoring this bird post-release, we now suspect that regardless of what this bird had or had not consumed, it lacked the ability to forage productively and that this contributed to both the initial malnourishment of this bird, as well as its demise. This result highlights concerns that juvenile survival in bitterns may be particularly low in New Zealand, something that is currently unmeasured. Despite so many unknowns, without post-release monitoring of this bird we would not have been able to determining the true success of treatment. Continuation of similar monitoring practises in the future will allow conservationists to improve captive treatments, collect evidence of threats to bittern populations and eventually provide further context for the information presented here.

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LITERATURE CITED

Ausseil, A.-G.E.; Chadderton, W.L.; Gerbeaux, P.; Stephens, R.T.T.; Leathwick, J.R. 2011. Applying systematic conservation planning principles to palustrine and inland saline wetlands of New Zealand. *Freshwater Biology 56*: 142-161.

BirdLife International. 2014. Species factsheet: *Botaurus poiciloptilus*. http://www.birdlife.org/

Bogner, H.E.; Baldassarre, G.A. 2002. The effectiveness of call-response surveys for detecting least bitterns. *Journal of Wildlife Management 66*: 976-984.

Buchanan, K.L. 2009. Wetland conservation in the Murray-Darling Basin-is it going down the drain? *Emu 109*: i-iv.

Gilbert, G.; Tyler, G.; Smith, K.W. 2005. Behaviour, home-range size and habitat use by male great bittern *Botaurus stellaris* in Britain. *Ibis 147*: 533-543.

Gilbert, G.; Tyler, G.A.; Dunn, C.J.; Ratcliffe, N.; Smith, K.W. 2007. The influence of habitat management on the breeding success of the great bittern *Botaurus stellaris* in Britain. *Ibis 149*: 53-66.

Heather, B.; Robertson, H. 1996. *The Field Guide to the Birds of New Zealand*. Auckland: Penguin Books (NZ) Ltd.

Karl, B.J.; Clout, M.N. 1987. An Improved Radio Transmitter Harness with a Weak Link to Prevent Snagging (Nuevo arnés para colocar radiotransmisores en aves). *Journal of Field Ornithology 58*: 73-77.

Marchant, S.; Higgins, P.J.; Ambrose, S.; Davies, S.; Steele, W.K. 1990. *Handbook of Australian, New Zealand & Antarctic birds*. *Vol. 1*. Melbourne: Oxford University Press.

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.

Mohr, C.O. 1947. Table of equivalent populations of North American small mammals. *American Midland Naturalist 37*: 223-249.

Noble, R.; Harvey, J.; Cowx, I. 2004. Can management of freshwater fish populations be used to protect and enhance the conservation status of a rare, fish-eating bird, the bittern, *Botaurus stellaris*, in the UK? *Fisheries Management and Ecology 11*: 291-302.

O'Donnell, C.F.J. 2011. Breeding of the Australasian bittern (*Botaurus poiciloptilus*) in New Zealand. *Emu 111*: 197-201.

Poulin, B.; Lefebvre, G.; Crivelli, A.J. 2007. The invasive red swamp crayfish as a predictor of Eurasian bittern density in the Camargue, France. *Journal of Zoology 273*: 98-105.

Teal, P.J. 1989. Movement, habitat use and behaviour of Australasian bittern (*Botaurus poiciloptilus*) in the lower Waikato wetlands. M.Sc. thesis, Waikato University, New Zealand.

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