

Australasian Bittern (Matuku) and Spotless Crake (Puweto) Survey
Eastern and Southern Wetlands
Wairarapa Moana
Spring 2017



Australasian Bittern. Photo by Dick Veitch

Prepared for
Wairarapa Moana Wetlands Project
by
John Cheyne
Wetland Works

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1.0 Summary

Since 2012 Greater Wellington Regional Council (GWRC) and Department of Conservation (DOC) have supported a number of wetland bird surveys of the fringe wetlands of Wairarapa Moana, particularly on the eastern, southern and northern sides. These wetlands were split into three groups:

- Boggy Pond, Matthew's Lagoon and Wairio wetland (core area)
- Pounui Lagoon and Barrage Gates (southern sites)
- Bartons Lagoon, Donald Block (northern sites)

The 2012 bird survey showed that there were significant numbers of bittern (Matuku) and spotless crane (Puweto) present at Boggy Pond, Matthew's Lagoon and Wairio wetland and these wetlands have been surveyed each spring since then. The other wetlands have been covered in alternate years with Pounui Lagoon and Barrage Gates being surveyed in spring 2017.

A significant number of ferrets and feral cats were observed during the day in the 2012 survey with some approaching within one metre of us attracted by the spotless crane calls played on a tape recorder. An intensive mammalian predator control programme was implemented by GWRC around the three core area wetlands (Boggy, Matthews, Wairio) in 2013. The trapping area was expanded in 2016 and now 113 trap sites are maintained throughout the year by GWRC and DOC staff. A trapping programme around part of Pounui Lagoon has also been operating since 2013. No ferrets or cats have approached the playback spotless crane calls at sites where predator trapping has been undertaken.

The latest 2017 survey of bittern and spotless crane focused on the wetlands in the core area and southern sites.

Over the period 2012-2017 numbers of booming male bittern recorded at Boggy, Matthew's and Wairio increased initially from five to nine, dropped to six in 2016 then back to nine in 2017. The initial increase may have been in response to the predator control programme but this is difficult to determine because of the complexity of predator-prey relationships. Over this period there were also changes in the size and quality of wetland habitat in these areas (Ducks Unlimited Wairio bund construction, change in Boggy water levels, willow control at Boggy and Matthews). During the 2016 survey we experienced consistently strong winds which can reduce the intensity/frequency of booming by male bittern and also make hearing the booming calls difficult. Weather conditions for the surveys were much better in spring 2017 which may help explain the nine males recorded compared to the six heard in 2016.

There are also other potential factors that could impact on the bittern population. This includes insufficient recruitment to the local bittern population (fewer females than males in the population due to greater predation of females, lack of breeding success through predation of chicks and eggs, chick starvation through insufficient food supplies). This may result in a population becoming dominated by old males which could lead to a gradual population decline as has occurred with other bird species (kakapo, kaka) where females are more vulnerable to predation through being smaller and solely responsible for egg incubation and chick rearing.

A dramatic reduction in bittern numbers in the 7,000 ha Whangamarino wetland in the Waikato has also occurred over the last 10 years and the reasons for this has been difficult to confidently identify but changes in water levels and water quality, and predation are

suspected. In 2016 only 13 male birds were recorded when 10 years earlier the male population was estimated to be 40-50 birds (Emma Williams pers com).

The 2013 the survey of male bittern in all Wairarapa Moana fringe wetlands recorded 20 birds which is significant on both a national and regional scale.

In June 2016 the conservation status of bittern in New Zealand was reassessed by DOC and they are now a "Threatened - Nationally Critical" species which puts them in the same category as kakapo and takahe

This highlights the serious threats faced by bittern and the challenge biodiversity managers have in saving another species. Bittern are a flag ship species for wetland conservation and the change in threat status provides greater impetus and urgency for us to do something about their current demise.

Over the same period the number of sites that spotless crane were recorded at Boggy Pond initially increased then declined in 2015 and 2016 (2012 - 5 locations, 2014 - 9 locations, 2015 – 7 locations, 2016 - 3 locations and 2017 – 6 locations). This probably resulted from changes in water levels which changes the availability of suitable habitat around Boggy Pond. At Matthew's numbers have declined from 5 locations in 2012 to 1 location in 2014 with no birds recorded in 2015, 2016 and 2017. The decline at Matthew's appears to have occurred because a portion of their favoured habitat (raupo reedland, carex sedgeland) was inadvertently destroyed during a raupo spraying operation.

Formal spotless crane surveys had not been carried out previously at the Barrage Gates or Pounui Lagoon, although birds had been recorded at two locations around Pounui Lagoon previously. In the 2017 survey no birds responded to play back recorders at either site but one bird was heard calling at Pounui while listening for bittern. Unfortunately not all resident crane respond to play back calls in spring like we would wish them to do.

Size, quality and inter-connectedness of wetland habitat, adequate food supplies and predation are all important factors for wetland bird species like bittern and spotless crane.

The current predator control programmes (Boggy, Matthews, Wairio and Pounui) are justified as has been the willow and alder control programme. These should continue. At some sites predator control should be expanded to achieve better outcomes.

Ideally a bittern management plan for the Wairarapa Moana and associated wetlands should be prepared and maybe this should be extended to include the rest of the GWRC region. There are many challenges in managing habitat and threats for bittern, but as a guide what is good for bittern is good for many other species of wetland birds and native fish.

The following recommendations are made:

1. Predator Control - The existing Wairarapa Moana Wetlands Project predator control programme at Boggy, Matthew's and Wairio should continue and could be expanded south towards Jury Island to create a larger buffer control zone to improve protection for bittern and other wetland birds.
2. Predator Control – Consider implementing a predator trapping programme at Barton's Lagoon, Simmon's Lagoon, Tauherenikau Delta and Donald wetlands to provide protection for bittern and other wetland birds.
3. Predator Control – Consider implementing a predator control programme at the Barrage Gates and expanding the current Pounui Lagoon programme to provide better protection for bittern and other wetland birds.
4. Population Monitoring - Continue the existing annual monitoring of male bittern and spotless crane at Boggy Pond, Matthew's Lagoon and Wairio wetland.
5. Population Monitoring - Resurvey every 2nd year the male bittern population at the northern end of Wairarapa Moana (Barton's, Simmond's, Tauherenikau Delta, Donald Block and lakeside wetlands) last completed in 2016.
6. Population Monitoring - Resurvey every 2nd year the male bittern population at the southern end of the Wairarapa Moana (Pounui Lagoon and Barrage Gates) last completed in 2017.
7. Wetland Habitat Enhancement Plans – Detailed plans should be prepared initially for all sites where male bittern are known to establish booming territories and other sites where bittern are regularly sighted. There are also sites such as Oporua Spillway and the edge of the lake north of the spillway that should be considered for wetland enhancement work. The successful Ducks Unlimited Wairio project should be used as a guide. These plans should cover: habitat improvement (management of water levels and raupo reedbeds); enhance food supply by re-establishing native fish migration routes; predator control and invasive plant control (willows, alders).
8. Bittern Management Plan – Prepare a bittern management plan to guide future conservation work in the Wellington-Wairarapa region starting with Wairarapa Moana. This needs to cover current knowledge of population and habitat use, future monitoring requirements, identification and management of threats, detailed habitat enhancement plans for individual sites (water level management, reedbed management, predator control). This work will also benefit many other freshwater wetland birds.

2.0 Background

In 2012 GWRC commissioned a programme of wetland bird surveys of five publicly owned wetlands (Boggy Pond, Matthew's Lagoon, Wairio wetland, Donald Block, Barton's Lagoon on the eastern and northern edge of Wairarapa Moana. The survey recorded a number of threatened bird species including the Australasian bittern (Matuku) and spotless crane.

During the survey work in 2012 a number of ferrets and cats approached Wetland Works personnel when we were playing tape recorded calls of spotless crane to elicit a response from this secretive species. This highlighted the number of mammalian predators present and encouraged the GWRC to implement an on-going predator control programme for the core Boggy, Matthew's and Wairio wetlands. The programme is now jointly run by GWRC and DOC.

The 2012 survey recorded eight booming male bittern and, along with the observations of the high predator numbers, were a catalyst for further bittern monitoring.

It also coincided with an increasing national awareness of the dire position bittern were in with the major threats being identified as:

- Loss of wetland habitat (area, connectedness and quality) particularly tall dense reed, sedge and rushlands
- Changes in wetland hydrology (flood protection schemes reversing natural seasonal water regimes, wetland drainage)
- Deterioration in water quality affecting water clarity (bittern are sight feeders)
- Decline in food supplies (barriers to native fish migration, commercial harvest of eels, competition from pest fish)
- Impact of mammalian predators on bittern particularly females, chicks and eggs
- Human disturbance during the sensitive breeding season (September - February) by construction of walkways/cycle ways through sensitive wetlands

Many of these threats are likely to be impacting on the Wairarapa Moana bittern population.

In 2013 a spring survey of all likely bittern habitat around the lake edge was completed and 20 male birds were recorded booming. This is a significant number. Since then annual spring surveys of booming male bittern have been carried out at Boggy Pond, Matthew's Lagoon and Wairio wetland, and spotless crane at the first two sites, to help gauge any benefits of the predator control programme.

Bittern surveys have been completed of the southern sites (Pounui Lagoon, Barrage Gates) and the north-eastern fringe wetlands (Donald Block and lake edge wetlands, Barton's, Simmon's) in alternate springs.

The Australasian bittern is a specialist freshwater swamp bird found in both Australia and New Zealand and it is the rarest bittern in the world. The total population is possibly less than 1500 birds with approximately similar numbers in each country. This makes it rarer than brown kiwi and blue duck (Whio). The national conservation status of the bittern in New Zealand was reviewed by a specialist panel of experts established by DOC and reclassified in June 2016 as a *Threatened - Nationally Critical* species. This now places bittern in the same threat category as kakapo and takahe with the next category being *Extinct*. This highlights the serious threats faced by bittern in NZ and

the continuing decline in both distribution and population. This is a challenge we face as biodiversity managers and provides greater urgency for us to do something for the species. Bittern are now being recognised as a flag ship species for wetland conservation.

3.0 Introduction 2017 Survey

A survey of bittern and spotless crane was carried out at Boggy Pond, Matthew's Lagoon, Wairio and two southern sites at Barrage Gates and Pounui Lagoon during spring 2017 (5-8 and 18-24 October). The purpose was to determine population estimates, distribution and habitat use. The survey would also provide an opportunity to determine whether the predator trapping programme at Boggy Pond, Matthew's Lagoon and Wairio wetland has led to an increase in the abundance or conspicuousness of either species. These sites had been surveyed a number of times since 2012.

Bittern were also surveyed at the southern fringe wetlands (Barrage Gates, Pounui Lagoon) to check population levels against an earlier bittern survey in 2014. Spotless crane had not previously been surveyed at the two southern sites but were in 2017.

An initial assessment of potential habitat protection and management measures was also undertaken.

4.0 Survey Methods

Surveys of booming male bittern were carried out at dawn and dusk. From experience gained from previous surveys 2012-2016 we were able to position ourselves close (<400 metres) to the most likely sites. Occasionally triangulation was involved using compass and map if the birds were more distant. This followed the methodology described in O'Donnell et al (2013).

Spotless crane were surveyed on foot (Boggy Pond, Barrage Gates, Pounui Lagoon) and by kayak (Matthews Lagoon) following a set route using the standard playback calls. The initial route for Boggy Pond was however, changed in response to rising water levels which caused spotless crane to abandon some areas and move to new areas. Surveys were completed in the mornings and late afternoons. The entire Matthew's Lagoon and Boggy Pond were not surveyed because of access difficulties in places and the need for the surveys to be readily repeatable and completed in a cost effective manner. The surveys do however cover the routes followed in previous surveys and include most of the better habitat.

At some locations it was possible to combine the bittern and spotless crane surveys.

Surveys were timed to coincide with peak calling for both species and for this survey were carried out in October 2017 (5-9 and 18-24). Windless days are preferable to enhance the chance of birds being heard but this can never be guaranteed at Wairarapa Moana.

5.0 Results

5.1 Bittern

The following booming male bittern were recorded in 2017 compared to previous years

Site	2017	2016	2015	2014	2013	2012
Boggy Pond	5	2	4	3	3	2
Matthew's Lagoon	1	1	2	2	1	1
Wairio wetland	3	3	3	3	3	2
Total Core Wetlands	9	6	9	8	7	5
Barrage Gates	2	ns	1	ns	3	ns
Pounui Lagoon	3	ns	3	ns	2	ns
Total Southern Wetlands	5	ns	4	ns	5	ns
Barton's Lagoon	ns	1	ns	ns	1	2
Tauherenikau Delta	ns	1	ns	ns	1	ns
Donald Block	ns	1	ns	ns	2	1
Lake Edge (south of Donald Block)	ns	1	ns	ns	2	ns
Total Northern Wetlands	ns	4	ns	ns	6	3

Note: ns not surveyed

5.1.1 Bittern at Boggy Pond, Matthew's Lagoon, Wairio Wetland

Spring surveys of booming males have been carried out at these sites for six consecutive years and numbers increased from five in 2012 to nine in 2015, dropped to six in 2016 and back to nine in 2017. A number of localised sites have held a male bird each year and this is highlighted on the maps. We are unsure whether any of the males at Wairarapa Moana return to the same site each year but we suspect so. A recent study by Williams (2016) at Lake Whatuma in Hawkes Bay has used tracking transmitters on 10 male birds and this has highlighted some males show strong site fidelity in successive springs. This is also likely to be the case in the Wairarapa as birds have been recorded at the same sites in consecutive years.

All male birds, with the exception of one on the west side of Wairio wetland, were recorded booming each year out of raupo reedbeds. The exception was a bird heard booming out of oioi rush/ Isolepis wetland closer to the lake edge each spring 2012-2017. The regular pattern of raupo reedland use by booming males has been very consistent at Boggy, Matthews and Wairio. All other male birds recorded booming on other fringe wetlands around Wairarapa Moana have also been located in raupo. In other regions extensive dense stands of raupo are a common choice when available but bittern will also use other tall reeds, rushes and sedges when raupo is not present.

The three core wetlands (Boggy, Matthew's, Wairio) have been subject to a sustained GWRC/DOC predator trapping programme and they have shown initially an increase in the numbers of booming males from 5 in 2012 to 9 in 2016, dropping to 6 in 2016 and back to 9 in 2017. In 2016 we experienced sustained strong winds over the survey period which we know can have a negative

influence on frequency and audibility of male calls. Over the same period predator control has continued at the same intensity, extensive willow and alder control has been carried out, water levels being held higher in Boggy and extensive shallow habitat created by Ducks Unlimited at Wairio, all of which could have an influence, either positive or negative, on the numbers of birds present. Survey methodology based on a small number of spring visits to individual sites may also contribute to under recording of males.

While no booming male bittern were recorded in the DU Wairio Block the number of feeding bittern observed there during our surveys and by other people is increasing. This indicates that this part of the Wairio wetland is maturing and now supports a greater and more diverse fish and eel population which bittern feed on. Numbers of other fish eating birds like shags has also increased. This wetland habitat restoration project has been an outstanding success and should be used as a template for other sites around Wairarapa Moana.

5.1.2 Bittern at Barrage Gates

Previous surveys of booming males were carried out at the Barrage Gates in 2013 (3 birds) and 2015 (1 bird). In 2017 two birds were recorded, one north and one south of the Gates. Refer to attach map. Both of the 2017 sites were precisely where birds had previously been recorded.

5.1.3 Bittern at Pounui Lagoon

A survey of booming males was previously carried out in 2013 (2 birds) and 2015 (3 birds). The 2017 survey recorded three birds and two of the sites were where birds had previously been recorded.

5.1.4 Significance of Female Bittern

Females are difficult to detect because unfortunately they are not as focal as booming males. They are smaller than the male and when observed alongside a male, the size difference is detectible. In addition, sometimes while the female is in flight with a male during the breeding season the female can exhibit differences in flight behaviour and a distinctive “crakk” call.

In an intensive bittern study during spring 2016 at Lake Whatuma, in Central Hawkes Bay, a total of 12 males but only 4-5 females were recorded (Emma William’s pers comm). The difference in numbers possibly results from the female’s smaller size and sole nesting and chick rearing responsibilities which may lead to greater exposure to predation by cats and ferrets, compared to male birds. This difference in mammalian predator impact has been reported for some other New Zealand birds (kaka, kakapo and kokako) where females are responsible for all nesting and parental responsibilities. The probable difference in abundance of females, and possible reasons for it, is gaining support amongst wetland bird specialists. This is however, difficult to prove categorically because females are less vocal and therefore more difficult to monitor and capture to place transmitters on which is necessary to track movements, behaviour and survival. Obviously without females the population is doomed.

5.2 Spotless Crake at Matthew's Lagoon & Boggy Pond

Spotless crake surveys have focused on Matthew's Lagoon and Boggy Pond because the sites are large with extensive beds of raupo reedland and carex sedgeland, they had previously been surveyed, and contained reasonable numbers of birds in 2012. Refer table below.

	2017	2016	2015	2014	2012
	No of Sites	No of Sites	No of Sites	No of Sites	No of Sites
Boggy Pond	6 (5 Pairs, 1 single)	3 (2 pairs, 1 single)	7 (4 pair, 3 singles)	9 (5 pair, 4 singles)	5 (4 pair, 1 single)
Matthew's Lagoon	0	0	0	1 (1 single)	5 (2 pair, 3 singles)

Site	Date	Birds	GPS E	GPS N
Boggy Pond	6-10-17	Pair	1789553	5431413
	6-10-17	Pair	1788815	5430460
	6-10-17	Single	1788824	5430491
	7-10-17	Pair	1788777	5430370
	7-10-17	Pair	1789019	5430661
	7-10-17	Pair	1789610	5431417
Matthew's Lagoon	19-10-17	Nil		

5.2.1 Spotless Crake at Boggy Pond

Numbers of spotless crake recorded at Boggy Pond initially increased with birds recorded at 5 sites in 2012, 9 sites in 2014, 7 sites in 2015, 3 sites in 2016 and 6 sites in 2017. We know from previous surveys that birds, both singles and pairs, appear to move around the margin of Boggy depending on the time of year and in response to changes in water levels. If water levels rise, these short legged birds appear to move to a site which may have been dry on an earlier visit. Alternatively in summer, when water levels are lower, they appear to move to sites that may have been too deep in spring for them to use. In recent surveys most birds have been found in the carex sedgelands with shallow water (<0.1m) along the western edge. In 2012, when the water levels in Boggy were at their lowest, spotless crake were located mainly in the raupo reedland fringe around the main body of open water which could only be accessed by kayak.

Since 2014 the water levels have risen and the kayak survey was replaced by a walking/wading survey along the western and southern wetland edge including the full length of the Boggy Pond stopbank.

This apparent pattern of movement has been observed on a number of occasions and could only be substantiated by conducting a spotless crake capture, marking and monitoring programme over 2-3 years, something which I consider not justified at this time.

During 2016 the water level in Boggy was higher compared to previous springs and in October DOC staff justifiably removed some boards in the outlet structure to facilitate the outward migration of mature short finned eels which lowered the water level by c 0.3m. As crake have very short legs (5cm) they are vulnerable to sudden water level changes even in the order of 0.3m as occurred on this occasion. They have the ability to move to more suitable sites when unsuitable habitat conditions prevail, but also return if conditions return to "normal." In 2016 all known crake locations were checked on and around Boggy Pond but birds were only recorded at three sites. However, in the 2017 spring survey water levels at Boggy Pond had increased slightly and spotless crake were located again at sites similar to the 2015 survey. They are capable of moving significant distances (2km) by flying and there is a possibility they moved elsewhere in the meantime and returned when habitat conditions (water levels) at those sites improved.

Significant aerial willow control had been carried out at Boggy Pond between surveys (2012-2015) but minimal damage to raupo reedlands and carex sedgelands was observed.

5.2.2 Spotless Crake at Matthews Lagoon

The spotless crake situation at Matthew's Lagoon was quite different. In 2012 spotless crake were recorded at five sites around the margin of the main areas of open water on the muddy edge of raupo where the water depth was c 0.1m. In spring 2014 they were recorded at one site and in 2015, 2016 and 2017 no spotless crake were recorded. Water levels at Matthews are not controlled like Boggy and appeared suitable with areas of very shallow (<0.1m) water and wet mud available at sites where birds had previously been recorded. The main difference between 2012 and 2014-2017 was the raupo and carex beds were dead at each previous recorded site and this was reflected in the absence of spotless crake. The dead plants appeared to have resulted from a raupo spray programme. While the raupo and carex beds were still present they were dead, decomposing and much reduced in size. Spotless crake require a live and robust plant community to provide the necessary small invertebrates, seeds and fruits of aquatic plants that they feed on.

Under normal circumstances most suitable spotless crake habitat would be occupied and when a significant habitat modifying event occurs (change in water levels, raupo/carex sprayed) the birds are forced to move and occupy other possibly sub optimum habitat. These sites are likely to be more prone to predators and have poorer cover and food resulting in lower survival of crake. If the raupo and carex beds at the original site recover overtime (c 5-10 years) spotless crake may well reoccupy these sites.

There are still significant areas of raupo remaining around Matthews Lagoon but it is generally where deeper water occurs which is unsuitable for the short legged crake. The timing, method and

extent of future raupo and willow control will always require careful consideration to minimise non target impacts.

5.2.3 Spotless Crake at Barrage Gates

The edge of the main outlet channel from Wairarapa Moana, both upstream and downstream of the Barrage Gates, supports a discontinuous strip of raupo which is potential crake habitat. Water levels in this area fluctuate significantly in response to how the gates are operated and prevailing levels in the adjacent Ruamahanga River. It was therefore not unexpected when we didn't record any spotless crake in this area. They may only use this habitat on a temporary basis.

5.2.4 Spotless Crake at Pounui Lagoon

Formal surveys of spotless crake using playback recorders had not been carried out in previous years when in the area doing bittern surveys but birds had previously been heard calling at two sites adjacent to the peninsula at the southern end. In October 2017 we surveyed the entire length of the stopbanks on both the eastern and western sides of the Lagoon using playback recorders but received no responses. However, one bird was heard calling from raupo close to the base of the peninsula one evening while listening for bittern. Water levels in the lagoon also fluctuate seasonally and this will undoubtedly influence when and where crake live. There appears to be a small population present and future surveys should be carried out to assess any changes in population.

6.0 Bittern & Spotless Crake Habitat Requirements

The habitat requirements of bittern and spotless crake are very similar as they are both specialist freshwater swamp birds. They are however, greatly different in size and leg length which determines the depth of water they can walk around. They both use the permanent shallow freshwater reedlands, sedgelands and rushlands around the edge of the larger open water areas like Boggy Pond, Matthews Lagoon, Pounui Lagoon and Bartons Lagoon or throughout a much shallower and ephemeral swampland like Wairio wetland and Tauherenikau Delta wetland. Often these two species will be co-located at the same sites.

Bittern require: large mainly permanent shallow freshwater (<0.3m) with extensive areas of dense reeds, rushes and sedges; a good source of food (small eels and fish); and low predator numbers.

Spotless crake require: permanent shallow water (c 0.1m) with muddy margins in and around the dense wetland plant communities; a good source of food (small invertebrates, seeds and fruits); and low predator numbers.

6.1 Water Levels

Shallow relatively stable freshwater less than 0.3 metres deep are important for bittern booming, feeding and nesting. Water level management regimes and water depths vary at the sites surveyed for booming males and this appears to have an influence on where and the number of birds recorded. Suitable water levels need to be accompanied by the appropriate plant communities.

6.1.1 Water Levels at Mathews Lagoon

The water levels are maintained by a natural earth sill on the outlet close to the main drain and the amount of water entering the lagoon from the Te Hopai pump station. At Mathews the male bittern territory, used since 2012, is away from the main open water areas of the lake where, in spring, water depths generally exceeded 1.0 metres. The bird was located in an extensive area of shallow (<0.3m) reed/sedge/rushland on the western side of the lagoon closer to the stop bank between Mathews and Boggy.

6.1.2 Water Levels at Boggy Pond

At Boggy, where the outlet structure under Parera Road was blocked off for at least four years, water levels slowly increased until early spring 2016 when some water level control boards were removed and culvert opened by DOC staff to assist outward migration of mature eels. This lowered the water level by c 0.3m over a relatively short period. Use by booming males is focused on those raupo reedbeds associated with shallow water margins (<0.3m) primarily on the western and southern sides. In spring 2009, when the water levels in Boggy were lower, DOC staff carried out a survey of booming bittern and they recorded two birds close to the stop bank separating Boggy and Matthew's close to the public viewing hide. Water levels at that time were significantly shallower in spring compared to what occurred during our 2012-17 surveys when we did not record any birds using these raupo beds. Even subtle changes in water levels can result in a change in use by bittern and other species.

DOC staff and other Wairarapa Moana technical experts are currently reviewing the operation of the Boggy Pond outlet structure to balance the (sometimes conflicting) needs of the different threatened species that live in the area.

6.1.3 Water Levels at Wairio

Water levels at Wairio wetland (lakeside) west of the recently constructed Ducks Unlimited Wairio wetland (c100 ha and 2.5 kms bunds) are directly influenced by lake levels which fluctuate greatly (c 2m annually). Between the bunds and Parera Road water levels are more stable and dependent on very high lake levels back flowing into the area over the specially constructed lower sections of the bund to allow this to happen. Rainfall and possibly some ground water sources complement this. This extensive shallow area provides excellent feeding for bittern and many other species of birds. An additional water supply by diverting the water flowing out of Matthew's into the northern end of Wairio is currently under consideration. This would have positive benefits for both birds and fish

although it would not operate over most summers because of the lack water from the pump station. Establishment of larger beds of tall reeds, sedges and rushes would also benefit bittern which may in time start establishing booming territories in the Ducks Unlimited part of the Wairio wetland. There are also opportunities to excavate additional shallow scrapes to create a range of water depths which would provide a mosaic of permanent and ephemeral areas.

6.1.4 Water Levels at Barrage Gates

Water levels on the edge of the large Wairarapa Moana outlet channel, both upstream and downstream of the gates, are primarily determined by levels in the Ruamahanga River and operation of the gates. However there is a small raupo wetland, regularly used by booming males, on the true left downstream (400 m) of the gates which is connected to, but slightly perched above, the main channel which would benefit from some minor work. This involves raising the outlet so it retains more water when the high river levels drop. Similar work could also be considered upstream of the gates.

6.1.5 Water Levels at Pounui Lagoon

Pounui Lagoon is primarily a freshwater lagoon because it is mainly supplied by the Pounui Stream. Inflows of saline water from Onoke Lagoon are restricted by a flap on the culvert linking the two. The ecology of Pounui Lagoon and use by bittern for breeding requires a freshwater system which is what currently exists. This is highlighted by the scattered raupo beds which indicate a freshwater system as raupo is intolerant of saline and semi saline water. Removal of the culvert flap or interference with its current operation will alter the freshwater nature of the lagoon and should be avoided.

There is scope to create more permanent shallow open water wetlands for bittern at the northern and north-western ends of the lagoon by constructing a system of low bunds to hold back some of the water from the Pounui Stream. A smaller version of the Wairio Ducks Unlimited project is possible.

6.2 Vegetation

Booming male bittern clearly favoured the raupo reedbeds along with with shallow water at all the fringe wetlands and highlights the importance of raupo for booming males. While no evidence of female breeding (nests, chicks) was recorded at the above sites it is known from personal observations at Lake Whatuma in Hawkes Bay that raupo is also very important for nesting.

The control of willows and alders on the edge of Wairarapa Moana has fortunately prevented these invasive plants taking over the shallow water areas of oioi/*Isolepis* and raupo. Follow up spraying of regrowth and missed plants will be a key to ensuring long term success. Willow spraying at the above sites has not impacted on any known booming sites.

6.3 Predator Control

A well maintained predator control programme has proven to be important for the conservation of numerous native species of birds (eg. blue duck, brown teal, kokako, kaka) at many mainland sites. To be effective management of traplines needs to follow best practice and regular maintenance is essential (trap location and presentation, bait selection, vegetation clearance around traps, mowing the vegetation on top of the stopbanks for trapper/staff access, good record keeping). Until successful biological control agents or appropriate toxins have been developed for the suite of mammalian predators found in wetlands, trapping is currently the best method available. DOC, GWRC staff and volunteers have done an excellent job trapping predators around a number of the wetlands on the edge of Wairarapa Moana. It is important that a high standard is maintained if we are going to achieve the conservation outcomes we desire, one of which is an increasing bittern population. A range of other bird species will equally benefit.

6.3.1 Predator Control at Boggy, Matthews & Wairio

These three wetlands have been subject to a predator trapping programme set up in 2013 by GWRC staff as a result of the number of ferrets and feral cats we observed during the 2012 bird surveys.

In the first year 85 trap sites were established with mainly a double set of a DOC 250 and Timms trap, and in the second year this was increased to 94 traps sites. In 2016 this was further increased to 113 sites when a new trap line was established along the top of the stop bank around the southern side of Matthews Lagoon. Traps are serviced two weekly from late September until February over the main breeding season and four weekly for the remainder of the year. GWRC and DOC staff now jointly service the traps with trapping data held on the national trapping database.

	August 2015-July 2016	August 2014-July 2015	August 2013-July 2014
Feral cat	19	20	20
Ferret	20	60	43
Stoat	3	2	1
Weasel	13	18	13
Hedgehog	202	169	159
Rat	109	87	52
Mice	54	70	29
Magpie	6	10	10
Harrier hawk	12	11	2
Rabbit	4	4	1
Possum	1		
Total	443	451	330

The large number of predators killed has remained relatively constant and highlights the large number of predators that live in and around wetlands. The interaction between different predators and prey is very complex. Occasionally taking out a higher order predator can result in an increase in

numbers of lower order predator. An example is reducing cats and mustelids can result in an increase in rodents (rats, mice). Monitoring these interactions is also very challenging.

Spotless crane are susceptible to most of the predators caught, while adult bittern are more susceptible to the larger feral cat and ferret. Bittern chicks and eggs are however, exposed to a greater suite of predators (cat, ferret, stoat, rat) compared to adult birds. Uncontrolled dogs also have the capacity to predate adult bittern.

Over the six years of these surveys the number of booming male bittern recorded in the core predator control site has increased from five in 2012 to nine in 2015 back to six in 2016 and nine again in 2017. While it would be convenient to attribute this increase to the predator control programme there are possibly other factors which may influence the results (changing water levels, willow control, increase in habitat, difficulty in detecting booming birds because of strong winds).

6.3.2 Predator Control at Barrage Gates

Predator control is not currently carried out at this site. No evidence of female bitterns using the site has been recorded and I would therefore only consider implementing a programme after an ongoing trapping programme had been implemented at the other higher priority sites covered by this report. The two Barrage Gate stopbanks adjacent to the raupo beds should be the focus of the trapping programme.

6.3.3 Predator Control Pounui Lagoon

The current predator control programme carried out on the eastern stopbank by volunteers, GWRc and DOC appears to be achieving excellent kills and it should be expanded to include the western stopbank. This stop bank should be mowed prior to establishment of the new trapline to enable better access along this side. Annual mowing should follow.

6.3.4 Predator Control Benefits

Since 2013 the predator control programme at Boggy, Matthew's and Wairio has consistently removed 300 - 400 mammalian predators each year from these wetlands and we expect this to be of benefit to bittern and spotless crane along with other bird species. Increasing numbers of male bittern since 2012 -17 at Boggy, Matthews and Wairio tend to support this conclusion and we hope that lower numbers of bittern recorded in 2016 is an anomaly.

The only other wetland in New Zealand where large scale predator control work is being carried out is in the 7000ha Whangamarino wetland in the Waikato where DOC funded predator control is being measured against changes in bittern, spotless crane and fern bird populations. The results from this project are apparently promising but yet to be published (Colin O'Donnell pers comms). The important point is sustained predator control has been effective with enhancing the populations of similarly threatened bird species (kakapo, kaka, brown teal) and it is probably best to await the results of the DOC Whangamarino wetland predator control research project. In this project they

have large matched control and experimental areas which will provide a sounder basis for conclusions. The practicality and cost of doing a similar in depth study at Wairarapa Moana wetlands is beyond the scope of the current GWRC and DOC project. In the meantime continuation and expansion of the current predator control programme following best practice is in my opinion justified.

We also do not have to look too far to find other supporting evidence. On some predator free offshore islands spotless crane live successfully in forest type habitat at greater densities than what we find on the mainland where they are now confined to wetlands. The Wairarapa Moana predator trapping programme is, in my opinion, well justified and should continue and even be expanded into additional important sites.

6.4 Bittern Food

Bittern are sight feeders and known to feed on a range of small fish, both native and introduced, small eels, frogs, large aquatic and terrestrial invertebrates, occasional mice and small birds. It is therefore important that habitat is managed for the main food items (fish, eels, frogs) and in particular barriers to fish migration should be avoided. Shallow clear water is also important for bittern to see and successfully capture prey.

7.0 Bittern National Conservation Status

Bittern or matuku is a specialist freshwater swamp bird whose presence can be an indicator of wetland health. They are becoming a flagship species for freshwater wetland conservation in New Zealand just like they are in many overseas countries.

In 2012 the conservation status of bittern was defined by the DOC convened expert bird panel as Threatened – Nationally Endangered (Robertson et al 2012). In June 2016 the panel met again and reclassified bittern as Threatened – Nationally Critical which places it in the highest category before the Extinct category (O'Donnell per com). This is the same threat status as takahe and kakapo. They based their assessment on recently published information provided by Dr Colin O'Donnell and Dr Hugh Robertson which highlighted the serious decline in distribution and abundance of this species.

This reclassification is significant both nationally and regionally for bittern. In the 2013 survey of booming male bittern we located 20 birds around the edge of Wairarapa Moana which is probably the largest population of bittern in the Greater Wellington-Wairarapa Region. Numbers of the smaller female are unknown because they do not call like the males and this makes it very difficult to assess their numbers. It is possible that bittern could be on the brink of local extinction if we don't overcome the threats that they face (predators, habitat loss, poor food supply, human disturbance).

The Wairarapa population is therefore very important and population surveys should in the meantime continue along with current predator control programmes.

Urgent consideration should be given to preparing a bittern threat management plan for Wairarapa Moana. This should identify their current distribution, abundance, threats and how these threats can be addressed. Habitat enhancement opportunities should be a key component of the plan.

Ideally this should include ongoing population surveys and an annual review of the management plan. It is important that Iwi, GWRC, DOC and other statutory agencies, NGO's and community groups work together in this exercise. If we have a healthy bittern (Matuku) population we will also have a healthier Wairarapa Moana.

8.0 Recommendations

1. Predator Control - The existing Wairarapa Moana Wetlands Project predator control programme at Boggy, Matthew's and Wairio should continue and could be expanded south towards Jury Island to create a larger buffer control zone to provide better protection for bittern and other wetland birds.
2. Predator Control – Consider implementing a predator trapping programme at Barton's Lagoon, Simmon's Lagoon and Tauherenikau Delta wetlands to improve protection for bittern and other wetland birds.
3. Predator Control – Consider implementing a predator control programme at the Barrage Gates and expanding the current Pounui Lagoon programme to benefit bittern and other wetland birds.
4. Population Monitoring - Continue the existing annual monitoring of male bittern and spotless crane at Boggy Pond, Matthew's Lagoon and Wairio wetland.
5. Population Monitoring - Resurvey every 2nd year the male bittern population at the northern end of Wairarapa Moana (Barton's, Simmond's, Tauherenikau Delta, Donald Block and lakeside wetlands) last completed in 2016.
6. Population Monitoring - Resurvey every 2nd year the male bittern population at the southern end of the Wairarapa Moana (Pounui Lagoon and Barrage Gates) last completed in 2017.
7. Wetland Habitat Enhancement Plans – Detailed plans should be prepared for all sites where male bittern are known to establish booming territories and other sites where bittern are regularly sighted. The successful Ducks Unlimited Wairio project should be used as a guide. These plans should cover: habitat improvement (management of water levels and raupo reedbeds); enhance food supply by re-establishing native fish migration routes; invasive plant control (willows, alders); and predator control.
8. Bittern Management Plan –Prepare a management plan to guide future conservation work in the Wellington-Wairarapa region starting with Wairarapa Moana. This needs to cover current knowledge of population and habitat use, future monitoring requirements, identification and management of threats, detailed habitat enhancement plans for individual sites (water level and reedbed management). This will also benefit a number of other freshwater wetland birds.

9.0 Acknowledgements

I am most grateful for the assistance received from staff from GWRC and DOC in completing this report. Dougal McKenzie's assistance with the bird survey at Pounui Lagoon is also appreciated as is the access permission from landowners.

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