

# Bay of Islands kiwi distribution map – support document



## 1. Background

Northland Brown Kiwi (NBK) is one of four distinct Brown Kiwi taxa in New Zealand. The current distribution of NBK extends from Whakaangi in the north to the translocated population at Tawharanui Open Sanctuary in the south. NBK are present on some offshore islands but they are all but extinct from southern Northland. BirdLife International (2018) considers that the IUCN (International Union for Conservation of Nature) Red List category for Brown Kiwi is “Vulnerable” with a decreasing population trend considered to be facing a high risk of extinction in the wild (H. Robertson, *personal communication*, September 24, 2018).

Current threats to NBK are habitat loss and predation by introduced mammals, especially dogs, ferrets, stoats and cats. Dogs and ferrets are of concern as they are known to kill adults. The loss of any adults greatly reduces population recruitment in long-lived species like kiwi. In Northland, they are also vulnerable to vehicle strikes, capture in possum traps set on the ground, falling into water troughs.

Dogs are identified in the Kiwi Recovery Plan 2018-2028 (Germano et al., 2018) as the greatest threat to adult kiwi in areas where kiwi habitat overlaps with or is close to human populations. Any dog can kill a kiwi, even small dogs or soft-mouthed dogs. The reason for this is that kiwi lack wings, feathers and muscle in the critical area which means that the chest of a kiwi is easily crushed in a dog’s mouth. Even if a dog mouths a kiwi over its back, this can crush its vital organs causing internal bleeding. This issue is most pronounced in Northland, where dog kills are the main cause for the average kiwi life expectancy of 14 years compared with life expectancy of 30-40 years elsewhere in the North Island.

Northland is considered to be a stronghold for Brown Kiwi thanks to the widespread community efforts doing predator control. These include collaborative projects involving landowners, DOC, Northland Regional Council, landcare groups, iwi and forestry companies (appendix 6 map 3). Often adjoining landowners have combined their protection efforts to maximise benefits to kiwi, with some large projects forming charitable trusts or incorporated societies. Currently, most managed kiwi populations, where predator control is in place are growing at rates of 2% per annum or higher. However, the majority of kiwi remain unmanaged and are still in decline. The Kiwi Recovery Plan’s goals for the long-term recovery of all kiwi species are:

- Grow kiwi populations by at least 2% per year;
- Restore their former distribution and;
- Maintain genetic diversity.

DOC's role is to advocate for the protection of kiwi, through the implementation of the Kiwi Recovery Plan. The kiwi distribution maps are one of the tools used to meet Objective 14.1 of the Kiwi Recovery Plan '*to minimise the threats to kiwi and their habitat in area where kiwi habitat and human population overlap*' by including statutory protection of kiwi and their habitat in district plans.

The purpose of this document is to describe how the distribution maps are drawn to assist Far North District Council policy and planning staff to identify when kiwi protection needs to be considered when processing resource consents. This an internal document to be used only by District Council staff.

## **2. Threats to kiwi**

### **2.1 Dogs**

A number of studies in Northland have shown that predation of adult kiwi by dogs has been one of the key factors affecting Brown Kiwi populations. Dogs of all sizes, breeds and training are attracted to the smell of kiwi. The predation events observed with dogs do not fit with traditional predator-prey models because dogs can roam long distances and kill far more prey than is needed to sustain them. Kiwi are particularly vulnerable near clusters of human settlements and their pets where dog-kills can occur during the day as well as at night, the former mainly of birds sheltering beneath dense vegetation e.g. along the edges of roads and tracks (Pierce et al., 1996).

The most dramatic example of the potential scale of destruction by dogs comes from Waitangi Forest in the Bay of Islands, where a single dog is believed to have killed about 500 kiwi over a six-week period in 1987 (Taborsky, 1988). This was not an isolated incident. Of 194 reported kiwi deaths in Northland between 1990 and 1995, dogs were responsible for 135 (70%) of them (Pierce & Sporle, 1997). A study in central Northland from 1994 to 2008 recorded dogs being responsible for 22 (50%) of the 44 adult deaths of known cause (Robertson et al. 2011). Dogs were also the leading cause of death of subadult kiwi (37% of the deaths from a known cause). There is also recent evidence showing that dogs have a significant impact on kiwi locally. In 2015, two dogs hunting together killed at least 8 kiwi over a few months period. More recently, 6 kiwi killed by dogs were found at a Purerua Peninsula site in the Bay of Islands area.

### **2.2 Cats**

Kiwi chicks suffer exceptionally high mortality rates in unmanaged sites, especially in the first 100 days of life. Chicks forage independently and have no behaviours or defences against predators (McLennan et al., 1996). Cats will roam up to 20km from home and they hunt at night when kiwi are active. In unmanaged sites in central Northland, 94% of chicks failed to reach adulthood due mainly to stoat predation, followed by cat predation (Robertson et al, 2011). On Ponui Island in the Auckland District, where cats are the only predators 29% of kiwi chicks died in one year from cat predation (Wilson 2014) but analysis of the cat scats suggest that cat might kill up to 34% of the chicks. Also at least two adult kiwi were confirmed killed by cats (I. Castro, *personal communication*, September 24, 2018).

### 3. Bay of Islands kiwi distribution maps

#### 3.1 Key to the maps

The maps were first drawn in 1996 to identify priority management areas for kiwi recovery. The maps later became a useful tool to advocate for long term kiwi recovery, by identifying areas of high kiwi density, where statutory provisions can be used to manage the threats of dogs and cats. The maps are reviewed every 5 years. The current distribution map is attached as map 1 in appendix 4.

The maps identify areas of high kiwi density and kiwi present areas based on annual kiwi call monitoring which has been the accepted methodology to determine kiwi presence, abundance and distribution since 1993. At first the demarcation between “high” and “kiwi present” was an average of 7 kiwi calls per hour but it was later decided by the Kiwi Recovery Group (a national committee of DOC and external kiwi experts) to lower it to 5 kiwi calls per hour because it seemed to better capture the range of kiwi calls throughout Northland where there are high densities on the East coast but lower numbers on the West Coast and Far North (J. Scrimgeour, *personal communication*, May 2018).

- **High Density Kiwi Areas (average of 5 calls per hour or more)**

Since 1998 DOC has advocated for ‘no cats and dogs’ consent conditions to proposed land intensification as a way to manage the number of dogs and cats, therefore the threat to kiwi, in high kiwi density areas.

- **Kiwi Present Areas (average of less than 5 calls per hour)**

DOC does not advocate for ‘no dogs and cats’ consent conditions in identified ‘kiwi present’ areas, however landowners are encouraged to minimise the potential risk their cats and dogs may pose to kiwi by being responsible pet owners.

- **Buffer Zone**

The ‘buffer zone’ category has been introduced upon discussion with the Council Planning Team to mitigate the challenge of advocating for pet restrictions when land intensification is proposed in sites abutting ‘high kiwi density’ areas or that fall across the boundaries between high and present kiwi density. If the application falls within

- 1 km from a high kiwi density boundary;
- And/or there is predator control in place;
- And/or there is contiguous kiwi habitat (e.g. bush or a watercourse with riparian margins) allowing kiwi to easily move across the landscape out of the high kiwi density area into the buffer zone;
- And/or there is contiguous kiwi habitat forming a corridor through the buffer zone between high kiwi density areas;
- And/or there is a listening station in the buffer zone with an average of 5 or more kiwi calls per hours over the previous 5 years;

If one or more of these criteria are met, DOC will consider cat and dog restrictions.

– **Data deficient (not enough information to determine kiwi presence or absence)**

Reports of kiwi heard or seen in areas where they were not thought to be present, are fast becoming more common thanks to better communications and awareness within communities and active predator control helping kiwi to breed successfully. It is not possible to state with certainty that kiwi are not present outside the identified areas as they are nocturnal and not all birds call, they also may have such low numbers in that particular area it is difficult to detect their presence. Therefore, areas marked as kiwi absent should be interpreted as 'data deficient', meaning there is not enough information to determine whether kiwi are presence or absent due to lack of exhaustive kiwi survey.

### **3.2 Creating kiwi distribution maps**

Despite the comprehensive data provided by the annual call counts carried out at multiple listening sites in Northland (map 2, appendix 5), populations are dynamic with juvenile kiwi moving to find suitable territories and the boundaries of the different density areas are never going to be exact. Distribution maps are at times challenged. This is often the case around the high kiwi density areas boundaries and sites that are not in the immediate vicinity of listening stations or perceived to have unsuitable habitat for kiwi. However, it is important to note that kiwi will live almost anywhere – they don't need pristine native forest, and are also found in scrub, exotic plantation forests, rough farmland and sand dunes, even mangroves. They especially like places with wetland vegetation, and where trees run down to river edges and they will easily travel to find suitable habitats.

#### **3.2.1 The kiwi call count methodology**

Since 1993, the kiwi call count has been taking place annually. Northland was originally divided into four geographic areas, each with 6 permanent stations:

- Northern: Herekino-Raetia-Puketi area;
- Eastern: forest remnants and extensive exotic forestry in the Bay of Islands;
- Western: Waipoua-Trounson-Kaitui forests area;
- Southern: within 30km of Whangarei.

Over the years, many listening stations have been added, predominantly in areas where community groups are working to protect kiwi. At the 2017 kiwi listening period, counts took place at 24 permanent stations in the Eastern cluster with an average of 16.7 calls per hour. Over the years there have been many natural fluctuations but overall there has been upwards trend in number of calls heard with returning results consistently the highest for Northland (Craig, 2017). However, the mean call rate per hour in the Western cluster has dropped from 20 in 1995 to 6 in 2017 while the call count results for the Southern and Northern clusters have been more or less steady. This highlights the importance of maintaining, and increasing where possible, the protection effort to achieve the long-term recovery goal. High kiwi call rates don't necessarily indicate a low risk of a population crash, as call rates can decline rapidly. For example at Katui, near Trounson Kauri Park, call rates dropped from 40 per hour to zero just in a few years (H. Robertson, *personal communication*, September 24, 2018).

The kiwi call count method detects relative rather than absolute abundance of kiwi thus it is not possible to predict the actual number of kiwi present. Although there is a good correlation between call rates and kiwi density in high kiwi density, the relationship is weaker at low densities. The correlation between call rates and number of kiwi present can change due to population density, the age structure (young kiwi don't call) and relationship status (newly paired kiwi call more frequently than well-established pairs).

Kiwi call primarily to maintain territories but also to maintain the pair bond. Not all kiwi call as frequently or loudly as each other. Most birds call occasionally but very loudly, birds can be heard calling up to 2km away in ideal listening conditions. Males are heard approximately 3 times more often than females, likely due to a combination of them calling more often and their whistle-like calls carrying further than the lower pitched calls of females. Juveniles don't generally start calling till 18-24 months old. Pairs and breeding kiwi often duet, with birds responding to their partner's call by calling shortly afterwards.

Kiwi call all year around, but the peak in calling usually coincides with mating and the start of each incubation period (April-June in Northland) (Robertson & Colbourne, 2017). Thus, the annual call count is done at the same time of the year to take advantage of the optimum conditions for kiwi calling during the darker moon phases as there is evidence of kiwi calling frequently on moonlit nights at some sites.

Listening is for two consecutive hours on 4 different nights (not necessarily in a row as listening should not take place on rainy or windy nights) and starts no earlier than 30 minutes after sunset when kiwi start to emerge from their burrows. Peak calling usually occur in the first half of the night for both sexes. They continue to call sporadically until sunrise when they return to their burrows to sleep (Coulbourne & Digby, 2016).

### **3.3 Determining high kiwi density and kiwi present zones**

The challenge of drawing density maps is that listening stations give calls count at the specific sites, but a number of factors, which affect the feasibility and sustainability of local population recovery, must be considered when drawing the density areas:

1. Proximity to listening sites with known high kiwi density

Adult brown kiwi in Northland occupy permanent home ranges that are shared by a number of birds and they will remain in an area for as long as suitable habitat is retained. Young kiwi can disperse up to 20km away from their natal site looking for a new territory. The Kiwi Recovery Group's advice is that it would be acceptable to draw a high density area of approx. 10km radius around a listening station known to have high number of calls.

2. Habitat type

The preferred habitat are damp gullies in both native and exotic forest and dense shrubland but with increasing predator control and increasing number of birds, kiwi are dispersing throughout the landscape and adapting well to modified habitat and they are also common in wetlands, gorse-dominant shrub and rough pasture.

### 3. Kiwi corridors

Local corridors are important within a population clusters because interconnected forest remnants are needed to ensure that kiwi can find new territories and partners. An example is Waimate North Landcare management area which has numerous discrete forest remnants with varying levels of connectivity. Long distance corridors are desirable between populations to enable maintenance of gene flow across a region. Potential corridors in the Eastern cluster are Hupara, Waimate North, Kerikeri peninsula, Purerua peninsula, Puketi and Puketotara Landcare management areas.

### 4. Pest control

Ongoing pest control to keep number of cats and stoats down to allow for chicks' recruitment is important for kiwi population recovery. Predator control over a large area (ideally larger than 1000ha) is ideal as it can ultimately support several hundred pairs of kiwi.

### 5. Tangata whenua and/or community group led predator control project and promoting responsible pets ownership

Long term commitment from local landowners and tangata whenua to control pests and advocate for responsible dog and cat ownership is important for the long-term survival of local kiwi populations.

### 6. Population trends

The number of kiwi calls naturally fluctuates each year due to natural events or management. Annual call count has to take place for at least for 5 years, preferably 10 years or more to track long-term changes, or trends.

### 7. Acoustic Listening Devices (ALD)

Acoustic devices' recordings have been used to supplement listening results at sites where it is not practical having human listeners. ALDs are deployed in the field for five nights of fine weather for 6 hours each night. Recordings from these devices have been proved to reliably detect kiwi in Northland when they are present. The average number of calls per hours (calculated over 30hrs of recording) is very similar to the average recorded by human ears (based on 8hr listening) (Peter Graham, NRC, personal communication, April 2018). ALDs results used to inform the review of the kiwi distribution maps had been collected in 2016 during a Kiwi Coast Listening Blitz (Sachtleben & Tyson, 2016) and DOC Pewhairangi over the last two years. Refer to Appendix 2 for a full list of sites.

## 4. Conclusions and recommendations

The kiwi distribution maps are only one of the many tools and strategies used by the Department to achieve the long-term recovery of kiwi by way of managing the threat of dogs and cats to kiwi. While the average call count at specific sites is the key to maps, several factors are considered when drawing the maps. The more favourable factors are found at a site, such as large community-led predator control with high kiwi call count for at least 5 years, connected by corridors to other project areas, the

more important is to advocate kiwi protection through statutory protection. Some important points to acknowledge when using the maps:

- Exhaustive kiwi surveys have not been undertaken over all of Northland;
- There will be kiwi in varying densities outside the high kiwi density areas;
- Kiwi populations are dynamic as kiwi will disperse therefore the area boundaries are only indicative.

Appendix 1 give some methods that can be used to collect additional data in cases of dispute over the boundary lines, or area of high density, or to find kiwi in areas where there is no previous information or there is believed to be a small kiwi population.

#### **4.1 Department of Conservation's Recommendations to the Far North District Council**

In case of resource consent application for land intensification within a high kiwi density area or meets all the criteria within a buffer zone the recommended restrictions are:

##### General

No occupier of, or visitor to the site, shall keep or introduce cats, dogs and mustelids

##### Working dog

In situations where the site is part of a working farm and working dogs are kept on site, provisions:

maximum of two working farm dogs used for farm management are permitted;

- They are working dogs as per the Dog Control Act 1996
- Any working dog must be micro-chipped and have a current kiwi aversion training certificate
- Any working dog must within a dog proof fence area, on a lead or under effective control at all times when outside the fenced area
- At night any working dog must be kept in a kennel or tied up from dusk to dawn

Prior to the introduction or keeping of any dog or cat on either lot, the occupier must provide the Monitoring Manager of the Far North District Council the following:

- a photograph of the cat or dog;
- written confirmation that the cat or dog has been microchipped;
- for any dog written confirmation that the dog has current kiwi aversion training certification;
- for any dog a plan showing the extent to the dog proof fenced area.

##### Grandfathering clause:

In case of subdivision when the existing owner remains on site and has existing cats and/or dogs, the following conditions may be applied:

No carnivorous animals (such as cats, dogs or mustelids) which have the potential to be kiwi predators shall be introduced or kept on this lot; except the one existing cat/or dog on the lot for their natural life.

- Any dog must:
  - be micro-chipped and have a current kiwi aversion training certificate;
  - be kept within a dog proof fence area, on a lead or under effective control at all times when outside the fenced area;
  - must be kept in a kennel or tied up from dusk to dawn;

Any cat must be neutered, microchipped and kept inside at night.

The occupier must provide proof to the Monitoring Manager of the Far North District Council the following:

- a photograph of the cat or dog
- written confirmation that the cat or dog has been microchipped
- for any dog written confirmation that the dog has current kiwi aversion training certification
- for any dog a plan showing the extent to the dog proof fenced area
- report annually if the pet is still alive

In case of resource consent application for land intensification within a buffer zone when one or more criteria (as defined in section 3.1) the recommended restrictions are:

#### General

Any occupier of, or visitor to the site, shall keep only one dog and no cats

#### Working dog

In situations where the site is part of a working farm and working dogs are kept on site, provisions:

maximum of two working farm dogs used for farm management are permitted provided;

- They are working dogs as per the Dog Control Act 1996
- Any working dog must be micro-chipped and have a current kiwi aversion training certificate
- Any working dog must within a dog proof fence area, on a lead or under effective control at all times when outside the fenced area
- At night any working dog must be kept in a kennel or tied up from dusk to dawn

Prior to the introduction or keeping of any dog on either lot, the occupier must provide the Monitoring Manager of the Far North District Council the following:

- a photograph of the dog;
- written confirmation that the dog has been microchipped;
- for any dog written confirmation that the dog has current kiwi aversion training certification;
- for any dog a plan showing the extent to the dog proof fenced area.

In case of resource consent application for land intensification within a kiwi present area, DOC does not advocate for 'no dogs and cats' consent conditions however landowners are encouraged to minimise the potential risk their cats and dogs may pose to kiwi by:



- Dog should be housed within a dog proof fence, and on a lead or under effective control at all times when outside the fenced area;
- At night any dog should be kept in a kennel or tied up from dusk to dawn;
- Consider kiwi aversion training for working or hunting dogs;
- Cats should be kept inside at night;
- Consider neuter or spray cats.

#### **4.2 A note on Kiwi avoidance training for dogs**

DOC, in partnership with Kiwis for kiwi, has developed an avian (bird) awareness and avoidance training programme for dogs and their owners. The programme is designed to educate owners of the dangers their dogs can be to ground-dwelling native birds, and to teach the dogs to avoid these birds. Following an educational talk, database descriptions of the dogs are recorded, along with contact details for their owners. Kiwi/bird aversion training helps reduce the number of kiwi and other native ground nesting birds being killed or disturbed by dogs. Hunters are encouraged to have their dogs undergo this aversion training, and it is a requirement in Northland to have a hunting permit.

How dogs are trained:

Dogs are fitted with electric collars and exposed to dead ground-dwelling native birds and faeces in a controlled situation. Whilst sniffing these, the dog is 'warned' with a small electric shock.

Most dogs quickly learn to avoid the birds following this experience. The owner is encouraged to reinforce this message when the dog shows interest in other birds, at home or out hunting. Following the training, certificates of attendance are issued.

Within a year of initial training, the dog is tested for its learned avoidance or, if required, the dog is retrained. This testing or training is required annually until the dog consistently demonstrates strong avoidance. When a dog achieves this standard, the dog is certified for periods longer than one year.

Avoidance training is not a guarantee that the dog is safe because not all dogs are trainable. In general, avian avoidance training works better on working/hunting dogs than pet dogs.

Avoidance training is not a silver bullet. Even after it has been trained, an uncontrolled or roaming dog may still attack kiwi, especially if it is not regularly re-trained. The best option is simply to keep dogs away from places where wild kiwi live. If it is unavoidable to take a dog into a kiwi area, it should always be under control. In many cases this means on a lead, regardless of whether it has been avoidance trained.

For more information: <https://www.doc.govt.nz/parks-and-recreation/know-before-you-go/dog-access/avian-awareness-and-avoidance-training/>

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## **Appendix 1: Survey and monitoring methodologies**

These methodologies can be used to supplement information collected through the annual kiwi listening to determine the presence and distribution of kiwi over wide areas. The list includes using acoustic recorders which is used by DOC to inform the kiwi distribution maps.

### **1) Surveys and monitoring using acoustic recorders**

Acoustic devices record sound in a digital format onto removable SD memory cards. These recordings are then downloaded onto a computer and with an appropriate software the sounds can be displayed as pictures. The key advantage is that data can be collected over large number of hours and areas than what a human listener could reasonably do. The devices can perform as well as humans, but it relies on there being a standard protocol for deploying the devices that ensure are at their optimal e.g. use more devices and leave them in the field for a longer period. Devices are a useful tool to determine presence or absence of kiwi at sites where their presence is uncertain. Longer period of listening allows birds that have a very large home range (sometimes >100ha) time to randomly walk into and call within range of the device. They can be also used at remote site with difficult access.

### **2) Trail cameras**

Video cameras have been used in kiwi research projects for over 30 years. Modern cameras function day and night and detect kiwi-sized birds.

Cameras can be used to determine the presence of kiwi in an area especially if set up near an automated call broadcast system that can attract kiwi to a site, or if placed on favoured pathways such a small footbridge or gaps in a fence line.

## Appendix 2: Listening site locations and average kiwi calls per hour

The table below lists all the kiwi listening stations, mended by human listeners, used to inform the distribution maps.

Date refers to when listening started at any given station. Stations that were listened only once, have the year when that monitoring took place. The listening staion numbers match the station numbers in map 2.

\*National call count site

Geographic Area	Listening Station Number	Leading Community Group	Date	Average number of kiwi calls per hour
Mahinepua	90	Mahinepua Radar Hill Landcare	Annually since 2007	6.2
Mahinepua	83	Mahinepua Radar Hill Landcare	Annually since 2005	8.1
Mahinepua	84	Mahinepua Radar Hill Landcare	annually since 2003	12.5
Mahinepua	85	Mahinepua Radar Hill Landcare	annually since 2003	12.5
Mahinepua	88	Mahinepua Radar Hill Landcare	annually 2003-2017	7.5
Mahinepua	99	Mahinepua Radar Hill Landcare	annually 2003-2017	9.3
Marsden Cross*	10	DOC	Annual monitoring since 1995	39.6
Rangitane SR*	12	Kerikeri peninsula project	Annual monitoring since 1995	18.2
Waitangi*	13	DOC	Annual monitoring since 1995	11.5
Waitangi*	14	Iwi Kiwi	Annual monitoring since 1995	8.2
Waitangi	58	Iwi Kiwi	2018	6.6
Bay of Islands	219	Private landowner	2018	1.0
Bay of Islands	185	Kerikeri peninsula project	2018	2.7
Bay of Islands	206	Private landowner	annually 2008-2016	6.2

Bay of Islands	218	Private landowner	2018	2
<b>Geographic Area</b>	<b>Listening Station Number</b>	<b>Leading Community Group</b>	<b>Date</b>	<b>Average number of kiwi calls per hour</b>
Puketotara, Kerikeri	11	Puketotara Landcare	annually since 1995	11
Puketotara, Kerikeri	226	Puketotara Landcare	2018	12.7
Puketotara, Kerikeri	227	Puketotara Landcare	2018	12.2
Puketotara, Kerikeri	911	Puketotara Landcare	2018	12.7
Puketotara, Kerikeri	912	Puketotara Landcare	2018	12.1
Russell Peninsula	15	Russell Kiwi Project	annually since 1995	20.4
Russell Peninsula	59	Russell Kiwi Project	annually since 2005	13.5
Russell Peninsula	60	Russell Kiwi Project	annually since 2010	5.7
Russell Peninsula	62	Russell Kiwi Project	annually since 2005	11.1
Russell Peninsula	170	Russell Kiwi Project	annually since 2005	10.4
Russell Peninsula	171	Russell Kiwi Project	annually since 2008	21.6
Russell Peninsula	172	Russell Kiwi Project	annually since 2008	3.6
Russell Peninsula	173	Russell Kiwi Project	2017	1.2
Russell Peninsula	174	Russell Kiwi Project	annually since 2006	12.2
Russell Peninsula	177	Russell Kiwi Project	2017	9.2
Hupara	258	Hupara Landcare	Annually since 2011	24.7
Hupara	245	Hupara Landcare	2015	16
Hupara	246	Hupara Landcare	2013	19.4
Hupara	257	Hupara Landcare	Annually since 2014	19.9
Waimate North	113	Waimate North Landcare	annually since 2009	31.4
Waimate North	114	Waimate North Landcare	annually since 2004	8.9

Waimate North	115	Waimate North Landcare	annually since 2011	1.1
<b>Geographic Area</b>	<b>Listening Station Number</b>	<b>Leading Community Group</b>	<b>Date</b>	<b>Average number of kiwi calls per hour</b>
Waimate North	116	Waimate North Landcare	annually since 2010	12.1
Waimate North	118	Waimate North Landcare	annually since 2004	10.9
Waimate North	120	Waimate North Landcare	annually since 2004	5.2
Waimate North	121	Waimate North Landcare	annually since 2013	2.6
Waimate North	122	Waimate North Landcare	annually since 2006	5.2
Waimate North	124	Waimate North Landcare	annually since 2004	6.1
Puketi Forest	112	Puketi Forest Trust	annually since 2011	3.4
Puketi Forest	108	Puketi Forest Trust	annually since 2008	6.7
Puketi Forest	8	Puketi Forest Trust	annually since 1995	12
Puketi Forest	111	Puketi Forest Trust	annually since 2014	5.4
Puketi Forest	107	Puketi Forest Trust	annually since 2015	3.7
Puketi Forest	7	Puketi Forest Trust	annually since 1995	9.7
Puketi Forest	104	Puketi Forest Trust	annually since 2006	10.5
Puketi Forest	106	Puketi Forest Trust	annually since 2006	1.2
Puketi Forest	102	Puketi Forest Trust	annually since 2006	3.9
Puketi Forest	109	Puketi Forest Trust	annually since 2008	8

### Appendix 3: Acoustic devices location

Acoustic devices sites as per map 2. Survey year/agency refer to the year the ALD were deployed by Kiwi Coast or DOC.

Kiwi presence is ranked as kiwi present or not detected.

Geographic Area	Devices location	Kiwi Presence	Year/Agency
Whangaroa	1	Kiwi present	Kiwi Coast Blitz 2016
Moerewa	2	Not detected	Kiwi Coast Blitz 2016
Ngaiotonga	3	Kiwi present	Kiwi Coast Blitz 2016
Karetu - Waitino	6	Kiwi present	Kiwi Coast Blitz 2016
Taupo Bay	9	Kiwi present	Kiwi Coast Blitz 2016
Pungaere	12	Not detected	Kiwi Coast Blitz 2016
Matangirau	13	Kiwi present	Kiwi Coast Blitz 2016
Whangaroa	14	Kiwi present	Kiwi Coast Blitz 2016
Opua	19	Kiwi present	Kiwi Coast Blitz 2016
Puketona - Quarry	22	Kiwi present	Kiwi Coast Blitz 2016
Otangaroa	23	Kiwi present	Kiwi Coast Blitz 2016
Kaeo TeHuia	26	Kiwi present	Kiwi Coast Blitz 2016
Kaeo	27	Kiwi present	Kiwi Coast Blitz 2016
Whangae	29	Kiwi present	Kiwi Coast Blitz 2016
Pupuke - Coppermine	30	Kiwi present	Kiwi Coast Blitz 2016
Kaikohe Cumber Trig	31	Not detected	Kiwi Coast Blitz 2016
Pakaraka	33	Not detected	Kiwi Coast Blitz 2016

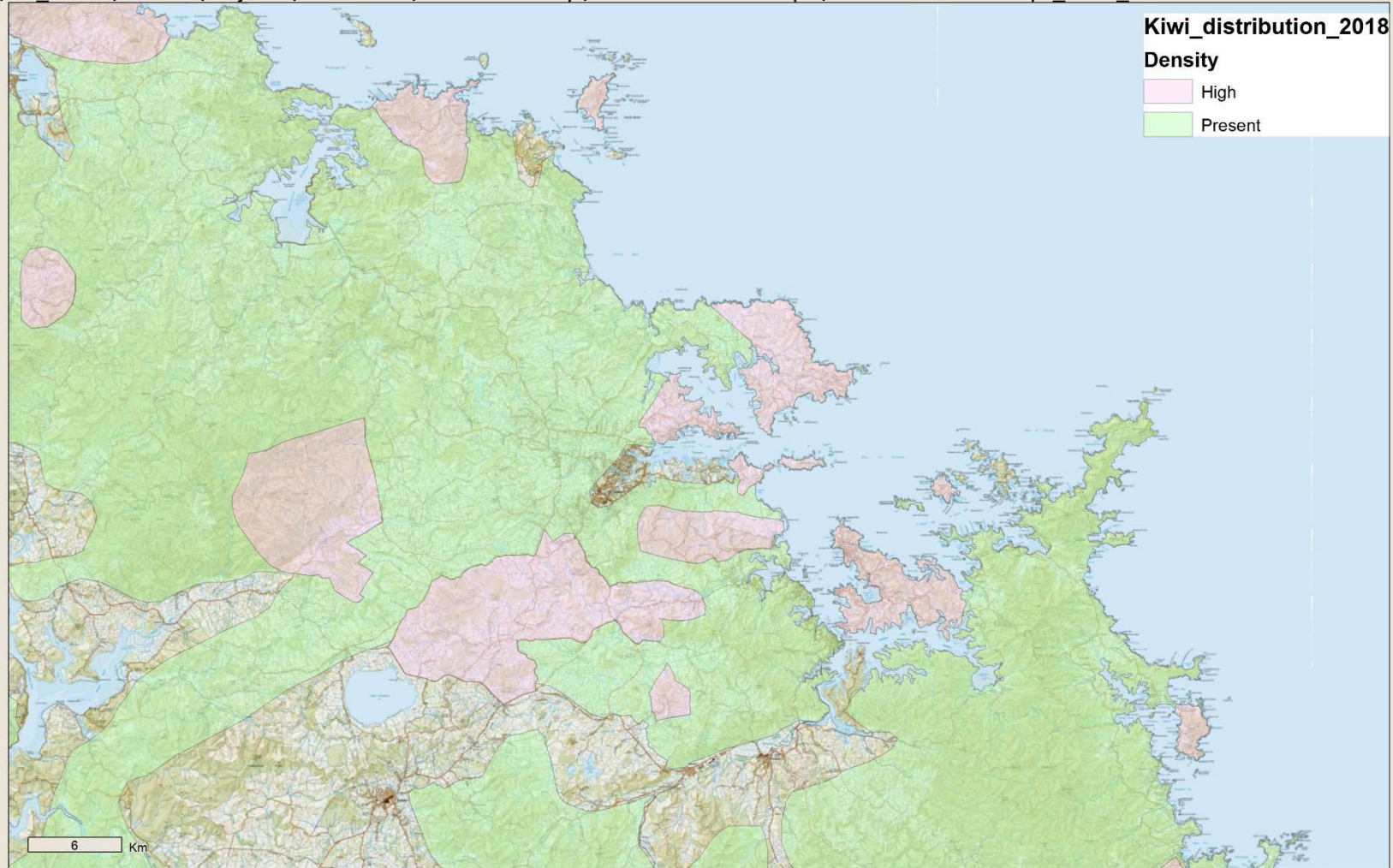
Oroterre - Taraire	38	Kiwi present	Kiwi Coast Blitz 2016
<b>Geographic Area</b>	<b>Devices location</b>	<b>Kiwi Presence</b>	<b>Year/Agency</b>
Punaruku	42	Not detected	Kiwi Coast Blitz 2016
Totara North - Ranfurly	43	Kiwi present	Kiwi Coast Blitz 2016
Totara North - Salvation Rd	44	Kiwi present	Kiwi Coast Blitz 2016
Takou Bay	45	Kiwi present	Kiwi Coast Blitz 2016
Taratara	46	Kiwi present	Kiwi Coast Blitz 2016
Pupuke - Takakuri	49	Kiwi present	Kiwi Coast Blitz 2016
Otangaroa - Te Ranga	50	Kiwi present	Kiwi Coast Blitz 2016
Waikare	51	Not detected	Kiwi Coast Blitz 2016
Karetu Pakaru	56	Kiwi present	Kiwi Coast Blitz 2016
Kaikohe Reservoir	58	Kiwi present	Kiwi Coast Blitz 2016
Ruapekapeka	59	Kiwi present	Kiwi Coast Blitz 2016
Taratara - Tara	61	Not detected	Kiwi Coast Blitz 2016
Waiare	62	Kiwi present	Kiwi Coast Blitz 2016
Puketotara 231	63	Kiwi present	Puketotara Landcare 2018
Puketotara 232	64	Kiwi present	Puketotara Landcare 2019
Hupara7	65	Kiwi present	DOC 2018
Hupara1	66	Kiwi present	DOC 2018
Hupara3	67	Kiwi present	DOC 2018
Hupara5	68	Kiwi present	DOC 2018
Hupara6	69	Kiwi present	DOC 2018
Waimate North 1	70	Kiwi present	DOC 2018
Puketi Forest 259	71	Kiwi present	DOC 2018
SKIL1	72	Not detected	DOC 2018
SKIL2	73	Not detected	DOC 2018
SKIL3	74	Not detected	DOC 2018



SKIL4	75	Not detected	DOC 2018
SKIL5	76	Not detected	DOC 2018
<b>Geographic Area</b>	<b>Devices location</b>	<b>Kiwi Presence</b>	<b>Year/Agency</b>
SKIL6	77	Kiwi present	DOC 2018
SKIL7	78	Not detected	DOC 2018
Kowhairoa 1	79	Kiwi present	DOC2016
Kowhairoa 2	80	Kiwi present	DOC2016
Kowhairoa 3	81	Kiwi present	DOC2016
Kowhairoa 4	82	Kiwi present	DOC2016
Kowhairoa 5	83	Kiwi present	DOC2016
Kowhairoa 6	84	Kiwi present	DOC2016
Kauri Cliff 1	85	Kiwi present	DOC2016
Kauri Cliff 2	86	Kiwi present	DOC2016
Kauri Cliff 3	87	Kiwi present	DOC2016
Kauri Cliff 4	88	Kiwi present	DOC2016
Kauri Cliff 5	89	Kiwi present	DOC2016
Kauri Cliff 6	90	Kiwi present	DOC2016
Matauri Trust 1	91	Kiwi present	DOC2016
Matauri Trust 2	92	Kiwi present	DOC2016
Matauri Trust 3	93	Kiwi present	DOC2016
Matauri Trust 4	94	Kiwi present	DOC2016
Matauri Trust 5	95	Kiwi present	DOC2016
Matauri Trust 6	96	Kiwi present	DOC2016
Blunden 1	97	Kiwi present	Puketotara Landcare 2018
Blunden 2	98	Kiwi present	Puketotara Landcare 2018

#### Appendix 4: Map 1 - Bay of Islands area kiwi distribution map issued October 2018

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Kiwi distribution maps Dec.18  
High kiwi density & kiwi Present Areas



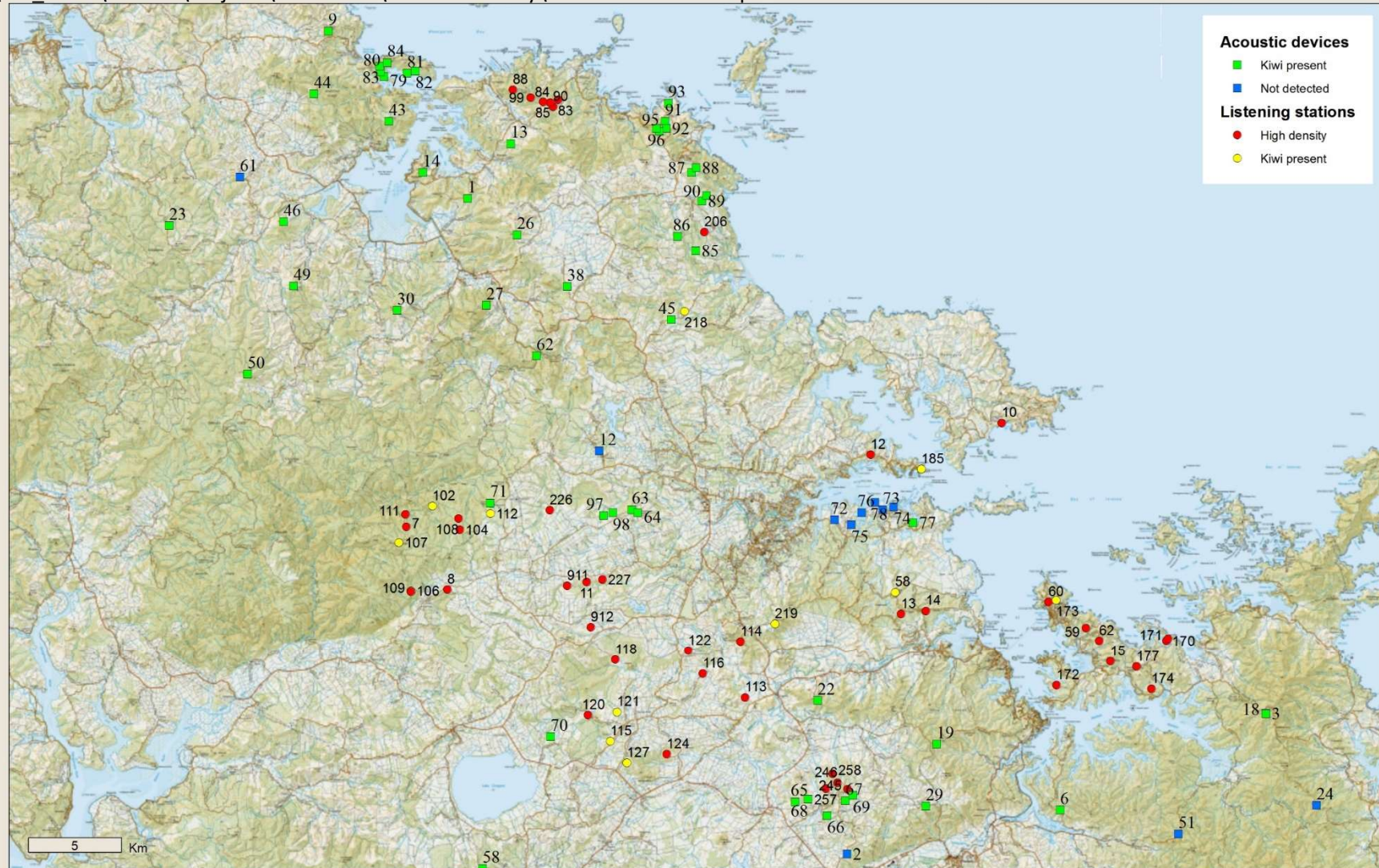
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## Appendix 5: Map 2 - Kiwi listening sites (human listening stations and acoustic devices)

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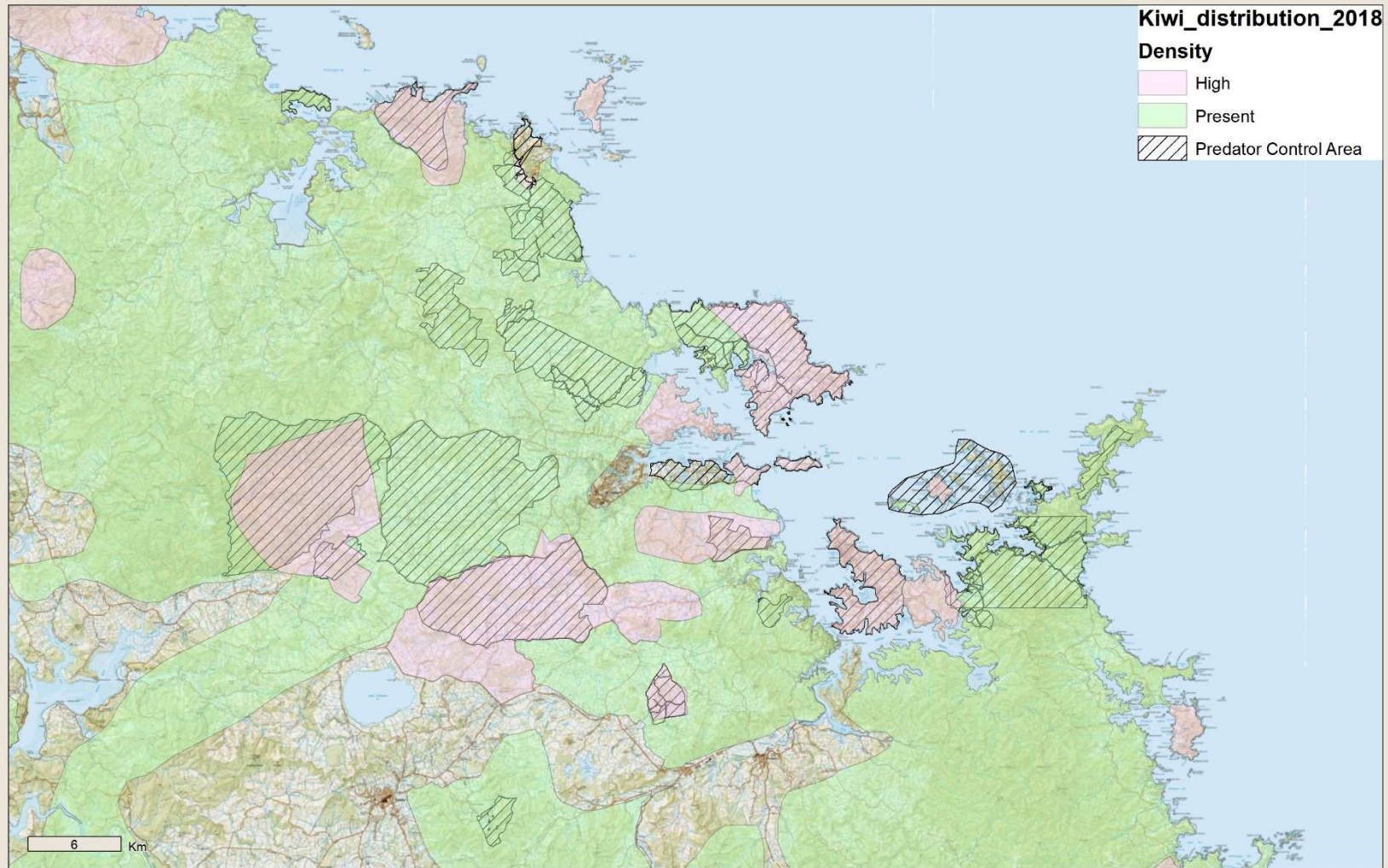
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### Kiwi listening sites in the Bay of Islands District



## Appendix 6: Map 3 – Areas under active predator control

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Kiwi distribution & Predator Control Areas Dec.18



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