Ngāti Mutunga Rohe Frog Survey

2018.

CONTRACT REPORT 2019/3

Red Admiral Ecology

CURIOUS MINDS
HE HIHIRI I TE MAHARA

NGĀTI MUTUNGA

kimihia KERMIT

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Cover photo: typical Northern Taranaki pond habitat. All photos courtesy of Marlene Benson.

Survey planned and supervised by Patrick (Paddy) Stewart for Ngāti Mutunga. Marc Hasenbank completed the statistical analysis. Marlene Benson, Anne-Maree McKay, members of the community, parents, teachers and students from Mimi, Urenui and Uruti Schools all helped collect the data.

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Executive summary

Small scale listening surveys were completed by students and community members from Mimi, Urenui and Uruti Schools during the spring of 2018. Southern Bell frog was detected at half of the sites surveyed. The school visits were well supported by staff and parents. The field trips generated numerous real world teaching situations for the students, further opportunities to apply biological concepts and to engage in continued scientific investigation.

Landowners generously allowed access to multiple sites across the rohe landscape. This enabled a larger scale autonomous acoustic survey that detected Southern Bell frog at most locations. This species is threatened with extinction in Australia. Also detected was Green Golden Bell Frog in three instances. The southern distribution limit for this species was previously thought to be Mokau. Brown Tree frog was not detected from the location previously heard by residents about the Urenui green belt.

Incidental detections of kiwi and penguins were also made, showing the students that many native nocturnal species inhabit the modified landscape alongside non-native species.

Contents

1. Introduction

1.1 Objectives

The initial objectives of this project are to determine:

1. What species frogs are present and where they were.
2. If their population is declining or stable.

1.2 Background

Ngāti Mutunga understand that the frogs within the rohe are most likely all introduced but are interested in these herpetofauna, as they are a useful bio indicators (Simon et al, 2011). Ngāti Mutunga consider any change or threat to a living animal a valuable tool to assist and direct society's activities throughout the natural environment.

The two most likely candidates present within the rohe are:

1. The Southern Bell frog (*Litoria raniformis)* which is a threatened species in Australia and breeds from spring until late summer.
2. Brown Tree frog (*Litoria ewingii)* is not a threatened species in its native Australia and breeds year round.

Bounded by the Waitara River to the east, the 63,000 ha rohe encompasses lands from the Waiau Stream in the south to Titoki Ridge in the north (near Uruti). Ecologically it lies within the North Taranaki Ecological Area. It comprises maori, private and public land including the Pouiatoa Conservation Area (39°08' S, 174°52' E). Elevation ranges from sea level about the valleys of Waitara and Urenui Catchments to 392 m a.s.l. in the Pouiatoa Ranges.

In the headwaters precipitous papa hillsides feed tight first and second order streams. Tawa forest dominates these slopes although there are also some remnant totara and rata that have survived the ravages of previous possum invasions. Miro provides a seasonally abundant food source to kereru along ridgelines.

The steep side streams combine to form broad associated terraces alongside the Mimi, Urenui, Onaero and Waitara Rivers. Here podocarps (kahikatea, rimu and matai) are more abundant in the remaining forest areas. Forest on lower slopes, valley floors and coastal terraces has generally been modified by logging and developed into farmland and production forestry.

2. Methods

2.1 Communality liaison

Landowners and residents were asked for information on both present and historical frog presence. This information was collated on a spreadsheet and this information used to identify potential monitoring sites for the student observation sessions and the autonomous survey effort.

2.2 Field method

Observer distribution survey

Call surveys for Southern Bell Frog commence in November onwards in Australian temperate regions (Commonwealth of Australian, 2009). Informal frog listening sessions were completed from early November to see if frogs were active prior to fieldwork.

The method was slightly modified due to logistical considerations. Class visits were completed by Ngāti Mutunga personnel (IMAGE 1) and students subsequently completed their own research into native and non-native frogs.

IMAGE 1: URUTI SCHOOL NATIVE FROG PRESENTATION

Evening observation sessions were completed with students from Mimi, Urenui and Uruti Schools. They completed 15 minute listening sessions from repeatable sites during calm warm dry weather[1].

Litoria spp. frogs have been found to prefer larger ponds and those that are within a network (Hammer and Mahony, 2010). Information including pond size and also proximity to other ponds was collected. All aquatic habitats were systematically sampled and the frog detection data cross referenced with microhabitat data.

Field protocol

Overview

Data will be collected by small field parties from pre-planned listening stations.

Steps for frog survey:

1. Complete all boxes within the Frog data sheet (Appendix 2).
2. Transfer data to class data sheet.
3. Plot survey result on class map.

Site protocol

a) Each site shall be surveyed three times during the field survey, subject to the following conditions:

No site shall be surveyed on a day if the survey co-ordinator decides that weather conditions are unsuitable for surveying. Such decisions will be made by the co-ordinator and communicated to the survey parties before 1:00pm on any given day. Weather conditions will be deemed to be unsuitable if rain is falling; if winds are too strong; or if any other factor precludes the safe and proper collection of survey data.

No site shall be surveyed more than once on any given day.

b) The field party shall visit each site during daylight hours before commencing any survey, in order to familiarise themselves with the terrain and features that might affect the field party's ability to hear frogs. Surveys should not be completed near fast running water, busy roads etc.

c) Each survey shall commence at least 30 mins after sunset and run for 15 minutes.

d) During each survey the field party will position themselves approximately five metres from the water body in such a way as to maximise their ability to hear frogs without compromising personal safety.

[1] Frogs may disperse from ponds during wet weather.

e) Before commencing each survey the field party shall accurately record all details required on the front page of a Frogs Call Scheme Card including the start and finish time of each survey.

Environmental care

a) The field party shall take all practicable steps to ensure that the natural environment within which they are working is not damaged or polluted.

b) The field party will take all practicable steps to minimise damage to private property and will leave all gates as found (open/shut).

2.3 Autonomous acoustics

Automated recorders (ARs) can accurately predict wildlife population changes over time (Stewart and Hasenbank, 2018). They are ideal for cryptic species with predictable vocalisations and also work well in places that are difficult of access. They were utilised to sample both the observer area and also the greater landscape. The ARs were mounted on standardised poles and deployed for at least five fine still nights at each site. Where multiple AR units were deployed at the same pond they were at least 200m apart. The Observer data card will be completed for each AR site.

Data analysis

The 15 minute sound files were be manually inspected in RAVEN PRO 1.5© at default settings (Charif et al. 2010), except that we selected a 512-sample Hann window to improve spectral resolution. A digital log was exported from Raven for data analysis.

2.4 Statistical analysis

The data collected during the acoustic surveys of Southern bell frogs (SBF) was transcribed into presence/absence data for each site and survey. Other frog species detected during the acoustic survey were omitted from this analysis as calls made during the acoustic surveys were only detected in insufficient numbers. The potential effect of vegetation tier (i.e. submerged, floating or emergent vegetation) on presence/absence of SBF calls was analysed using a generalized linear mixed effects model (LME). The model included SBF presence/absence as response variable, and vegetation tier as three separate fixed effects (each as presence/absence of vegetation tier at a given site). In addition, the LME included a random effects intercept for site in order to account for the repeated measures nature of the acoustic survey. Secondly, occupancy probability (Psi)

and probability of detection (P) were calculated for SBF in regards to different vegetation tiers. A Bayesian single-species single-season site occupancy model was fitted to the data set. All statistical analysis was conducted in the statistical computing language R.

3. Results

3.1 Community liaison

Frogs were reported to have been present in 23 locations. There were a further 10 historic locations that had not been verified for some time. This included Green Golden Bell Frog (GGBF) - *Litoria aurea*. The southern range of this frog was formerly considered to be 20 km north at Mokau[2]. Students completed school directed projects (IMAGE 2).

IMAGE 2: SAMPLE MIMI SCHOOL FROG CLASS WORK

[2] Still within the North Taranaki Ecological Area. These are areas where geological, topographical, climatic, and biological features and processes, including the broad cultural pattern, interrelate to produce a characteristic landscape and range of biological communities.

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3.2 Field survey

Students used data sheets to collect frog detections and habitat information at their study sites (IMAGE 3 and Appendix 2).

IMAGE 3: URENUI SCHOOL FROG SURVEY

3.3 Autonomous acoustics

Habitat

Pond size

Pond size was estimated in 35 instances. Average estimated pond area was 1,203 m^2 (Range 9 – 7,500 m^2 (N= 35 water bodies)). Two of the areas were known or considered to dry out in summer. The other 5 sites were classified as swamp, drains or seepages.

Vegetation

Vegetation appeared to be absent from in or on 4 of the 31 ponds. Frogs were not detected from 3 of these non-vegetated ponds.

Frog detection results

All site types combined

Data from 42 AR stations was collected between 20 and 24 November 2018. Frogs were detected from 76% of the 42 sites. The Green and Golden Bell Frog (GGSB) - *Litoria*

aurea was detected from 3 locations within the coastal bioclimatic zone. SBF was not detected within these ponds. SBF was detected from the other 29 sites.

Pond size

SBF was detected from in a very small (16 m^2) ephemeral pond 15 km inland up the Okoki Valley. They were absent from a network of 3 large ponds near Urenui.

SBF pond results relative to local rainfall

SBF was detected from 28 of the 31 pond sites (GGBF detected from the other 3). Little or no rain fell at Motunui from the 10th of November until the 21st. There was only one night/day of meaningful rainfall and during the five night sampling period (22/11/2018) (FIGURE 1).

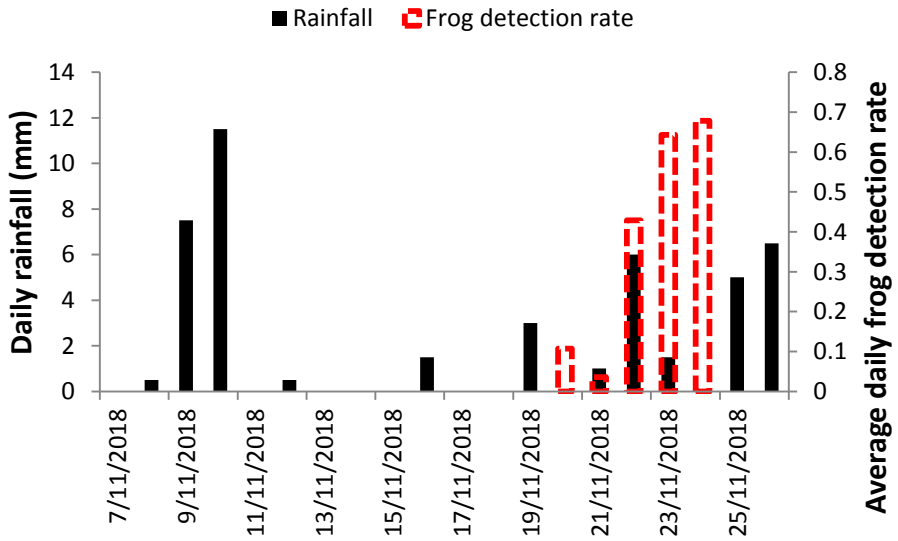

FIGURE 1: SBF FROG DETECTIONS RATES RELATIVE TO LOCAL RAINFALL (N=28 PONDS)[3]

Linear mixed effect model results for occupancy and vegetation tiers

The linear mixed effects model (LME) fitted to the data indicated a non-significant trend of higher detected presence of frogs in pods that contained emergent vegetation, while neither floating nor submerged vegetation appeared to have any effect on presence of calling frogs (FIGURE 2). For the emergent vegetation tier the 95% Ci has a minimal

[3] Records collected from TRC Motunui site and so there will be some local variation as there was not a district wide rainfall event over the autonomous sampling period.

overlap with zero, which indicates a non-significant trend. The p-values provided by the LME for each fixed effect show a similar result.

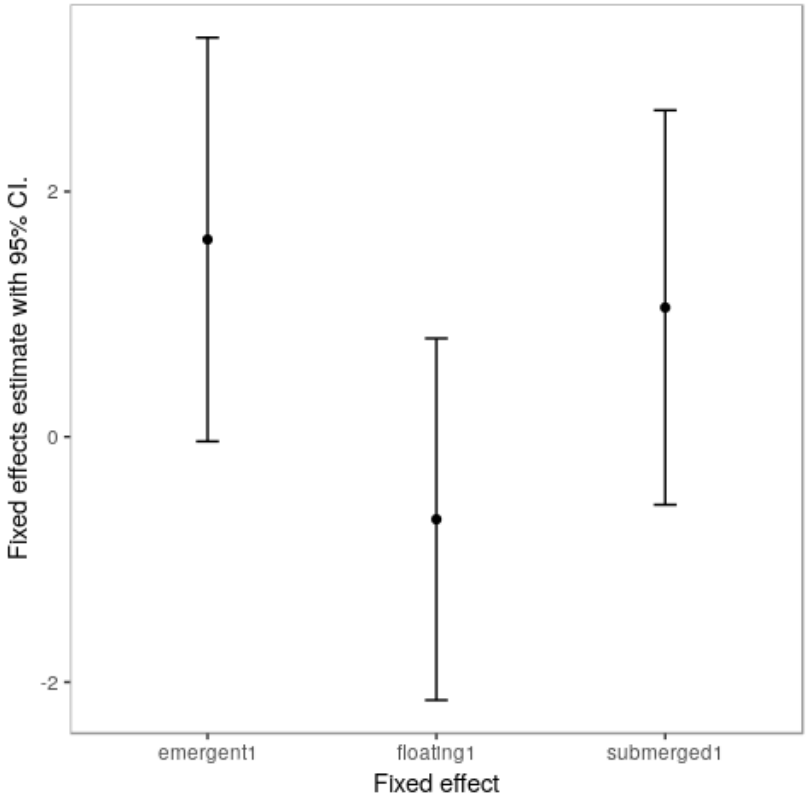

FIGURE 2: SBF FIXED EFFECTS ESTIMATES BASED ON LME, WITH 95% CONFIDENCE INTERVAL (CI). OVERLAP OF 95% CI WITH ZERO INDICATES NON-SIGNIFICANCE OF MODEL TERM (N= 28 PONDS).

4. Discussion

Students enjoyed their field work and had lots of questions.

Objective 1 was adequately completed. SBF were found to reasonably well distributed throughout the rohe, although there were some unexplained gaps. They were found in some very small ponds, and yet were absent from large networked ponds. This is not what we expected to find. Spring rainfall in the local district had been 50 % of what would normally be expected (TRC Motunui data). And so it could simply be that the dry season has affected frog productivity prior to the survey.

The question regarding a potential correlation between preceding rainfall events and changes in SBF call activity could not be answered based on the data collected. As it stands the data set does only provide a single data point for that comparison: the survey period only captured a single rain event and dry period and does not provide a second set of data to allow a statistical comparison.

Any future autonomous survey should run for a longer period, thus enabling more comparison with the variables such as rainfall. Pond vegetation may affect frog occupancy rates. A larger sample would be required to test this variable.

We are unaware of any data from other sites outside of Australia to compare the result with, but activity was quite episodic indicating that calling active male frog densities were relatively low during the survey period. They tended to be more intermittent than casually observed when analysing other nocturnal acoustic data (pers obs).

More field work is required to answer Question 2 and this provides learning opportunities for the students. There are a number of factors which could affect frog densities, such as predation of tadpoles by pest fish mosquito fish (Klop-toker et el, 2017), disease and habitat modification (Stuart et al, 2004). Confirming the presence of pest fish would require fishing surveys which could be completed, but would require extra resources (E.g. mini G traps).

Disease was thought to be responsible for a crash of New Zealand non-native frog populations in the late 1990's but it appears that they are able to recover naturally from those chytrid infections (P Bishop, pers comm). It would also be a good idea for the students to test frogs for disease over time.

If the schools had resources they could create ponds of certain vegetation composition etc. and see how released frogs would potentially alter their calling behaviour. This would mean the data collected would be under more controlled conditions. At the moment it is hard to say what causes shifts in calling behaviour, especially since none of the results are statistically significant, more indicating a certain trend. Manipulating the environment under controlled conditions would help to better answer those questions.

References

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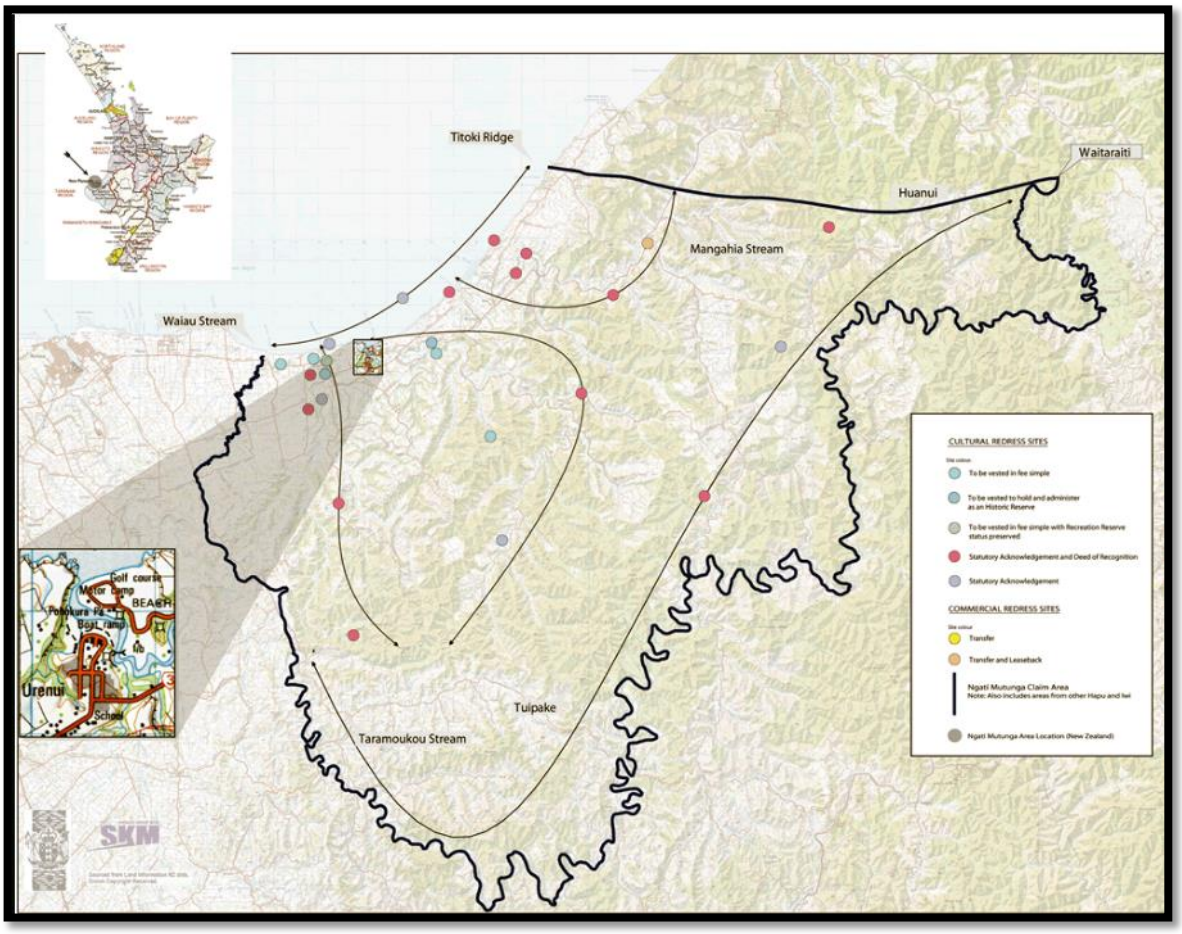
Appendix 1

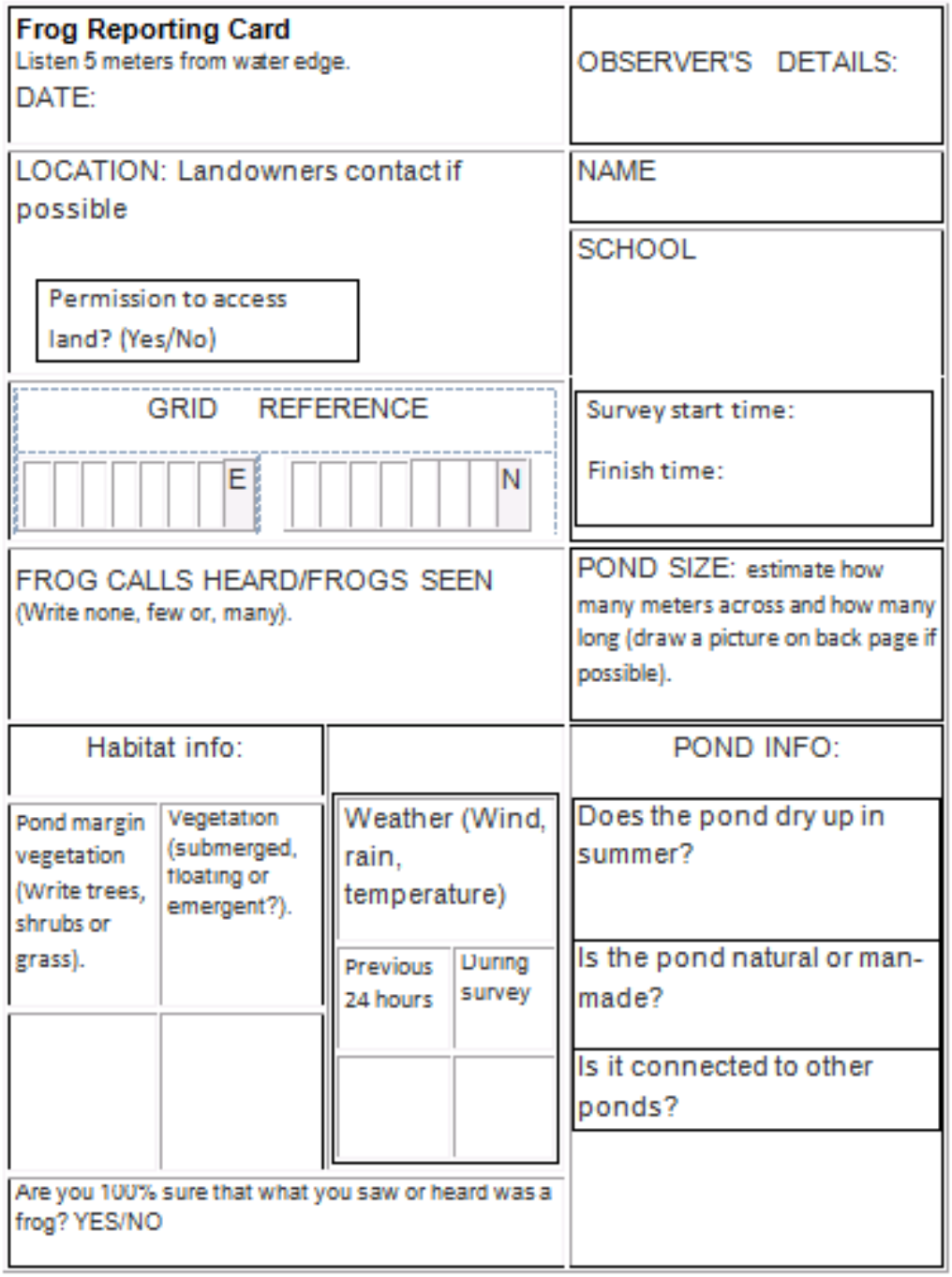
Ngāti Mutunga Rohe Map



Source: http://Ngātimutunga.iwi.nz/wp-content/uploads/2014/05/map_large.gif

Appendix 2

Frog reporting card



Frog Reporting Card
Listen 5 meters from water edge.
DATE:

OBSERVER'S DETAILS:

LOCATION: Landowners contact if possible

Permission to access land? (Yes/No)

NAME

SCHOOL

GRID REFERENCE

E

N

Survey start time:

Finish time:

FROG CALLS HEARD/FROGS SEEN
(Write none, few or, many).

POND SIZE: estimate how many meters across and how many long (draw a picture on back page if possible).

Habitat info:

Pond margin vegetation (Write trees, shrubs or grass).

Vegetation (submerged, floating or emergent?).

Weather (Wind, rain, temperature)

Previous 24 hours

During survey

POND INFO:

Does the pond dry up in summer?

Is the pond natural or man-made?

Is it connected to other ponds?

Are you 100% sure that what you saw or heard was a frog? YES/NO

Draw a rough picture of the Pond:

Mark on the pond – any places you have seen or heard a frog with a X

Any other signs that frogs live in this pond? Such as eggs or tadpoles.

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