

Superfund Records Center
SITE: Centredale Manor
BREAK: 3.4
OTHER: 29557

**ANURAN CALL SURVEY OF THE
WOONASQUATUCKET RIVER IN THE VICINITY OF
THE CENTREDALE MANOR SUPERFUND SITE
NORTH PROVIDENCE, RHODE ISLAND**

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Introduction

At the request of the U.S. Environmental Protection Agency (EPA), staff from the New England Field Office of the U.S. Fish and Wildlife Service (FWS) conducted a survey of calling frogs on the Woonasquatucket River in the vicinity of the Centredale Manor Superfund Site. The study site consisted essentially of four contiguous impounded areas on the Woonasquatucket River in North Providence, Rhode Island, one of which is defined as a Superfund Site. The purpose of the survey was to determine if there was a notable difference in species and numbers between areas impacted by dioxin and reference areas.

Methods

Identification of Monitoring Stations:

Monitoring stations were chosen by EPA and FWS. Monitoring station locations were chosen upstream of the contamination, within the area of contamination, downstream of the contamination, and one location on a tributary stream. The specific locations of the monitoring stations were chosen based on the apparent availability of habitat (surface water, aquatic vegetation, and lack of water current), and the ability to survey as large an area as possible.

Nine monitoring stations were chosen. Three were upstream of the contamination (Rangely Court, Green Property on Chamberlain Road, and Adams Road); two were in Allendale Impoundment which is the most contaminated area (Stevens Street and Wiscasset Avenue); two were in the next lower impoundment, Lymanville Impoundment (Warren Street and Oak Street); one was in the next lower impoundment, the Manton Impoundment (Brennan Oil); and one was on an impounded area of Assapumpsett Brook, which drains into the Lymanville Impoundment (Assapumpsett Pond). Maps with rough locations of the monitoring stations are provided in Figures 1 and 2 at the end of the report.

Call Counts:

The anuran call count protocol was based on the protocol used in the North American Amphibian Monitoring Program (NAAMP). NAAMP protocols were fashioned after the long-running Wisconsin Frog and Toad Survey (Mossman *et al.* 1998). The protocol establishes four separate monitoring periods to account for frog species that call at different times during the spring mating season. For Rhode Island the monitoring periods are: floating (depending on when wood frogs begin to call); April 10 to April 25; May 10 to May 31; and June 15 to June 31 (Dr. Peter Paton, University of Rhode Island, NAAMP coordinator for the State of Rhode Island, pers. comm.). The first monitoring period is for wood frogs (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*), and possibly American toads (*Bufo americanus*). The second is for spring peepers, American toads, northern leopard frogs (*Rana pipiens*), and pickerel frogs (*Rana palustris*). The third is for northern leopard frogs, pickerel frogs, green frogs (*Rana clamitans*), gray treefrogs (*Hyla versicolor*), Fowler's toads (*Bufo woodhousei fowleri*), and spadefoot toads

(*Scaphiopus holbrooki holbrooki*). The fourth is for bullfrogs (*Rana catesbeiana*), green frogs, gray treefrogs, Fowler's toads, and eastern spadefoot toads. However, each calling period is temperature-dependent and, therefore, may vary from year to year. The first monitoring period requires a minimum air temperature of 42 °F; the second requires a minimum air temperature of 50 °F; the third requires a minimum air temperature of 50 °F; and the fourth requires a minimum air temperature of 55 °F. The other requirements for monitoring include little wind and no rain significant enough to impair the ability to hear calling frogs at a distance. Observations are expected to take place between one-half hour after sunset and 2:00 am.

In 2001, NAAMP was interested in comparing a three-minute listening period to a five-minute listening period. Therefore, observations were recorded for a three-minute period and then an additional two minutes. Because the intent of the NAAMP survey is to record population trends over time, the protocol does not require that individual frog calls be counted but rather that a Call Index Value (CIV) be recorded. A CIV of 1 is recorded when calls can be counted and calls do not overlap. A CIV of 2 is recorded when calls can be distinguished and some overlap. A CIV of 3 is recorded when there is a full chorus, which means that calls are continuous and overlapping. Additional data to be recorded include: start time and end time, temperatures at start and end time, sky conditions, wind conditions, and whether there was any noise during the listening period that would hamper the ability to hear the frogs.

For this survey we followed the NAAMP protocol with a few modifications. First, we attempted to conduct surveys on two nights within each monitoring period understanding that frog activity varies from night to night even when conditions appear optimal. Also, in addition to recording the CIV we attempted to estimate the number of individuals calling, which we recorded in parentheses after the CIV numbers.

Monitoring was conducted by the same two people at each event. At the end of the listening period at each station, the two listeners compared observations. At some monitoring stations the two listeners intentionally stood some distance apart to maximize the area of coverage. At the end of the listening period, the listeners conferred and came to agreement on the locations from which individuals were heard calling from and, therefore, developed the best estimate of the number of calling individuals.

Each survey was conducted in a slightly different sequence to reduce any influence that the time of evening could have on frog calling. Also, if there was a question about the lack of activity at a site, particularly the first site monitored in the evening, the site was remonitored at the end of the evening.

The data sheets used were developed for NAAMP surveys conducted on national wildlife refuges in the northeast.

Results

Surveys were conducted on four nights: April 24, April 30, June 5, and June 26. This effort was not fully coordinated until after the wood frogs would have been expected to stop calling, although a few wood frogs were heard in one location on April 24. Wood frogs use vernal pools exclusively and since little of this habitat is present in the study area we were not concerned about this omission. The spring of 2001 was exceptionally cold and rainy, particularly during the month of May, so we had difficulty coordinating nights with acceptable weather conditions. We believe that these cold conditions tended to postpone some of the mating activity, so although we did not manage to conduct any surveys in May, we did manage to hear all of the expected species during the April and June surveys.

Below are descriptions of the monitoring locations and the results for each location. Results are also summarized in Table 1. Copies of the field data sheets are provided at the end of the report.

Rangely Court Park - This is the most upstream station and is considered a reference site. A small dam, Upper Esmund Dam, impounds water and some of the area is vegetated with emergent vegetation. The west side of the river is treed; the east side has shrubs and mowed grass and is near a busy road. Listening was conducted from the forested west edge upstream enough to lose the overpowering noise of the water flowing over the dam. Monitoring from this side also minimized traffic noise from the road on the east side. We heard very few frogs at this site. One pickerel frog was heard during the first two surveys, one green frog during the third survey, and one green and one bullfrog during the fourth survey.

Green Property - This property is located at the end of Chamberlain Road. Grassed yard extends to the edge of the river on the east side. On the west side of the river is a water treatment plant which creates a loud hum. There is a complex of vegetation on both sides of the river. During the April 24 survey, wood frogs were heard on the west side of the river suggesting the presence of vernal pool habitat. Observations were conducted from a lawn on the east side of the river. Pickerel frogs and green frogs were heard in abundance at this location. A bullfrog and a small number of spring peepers were also heard during the surveys.

Adams Road - This site is also a reference site just downstream of the Green Property. Grassed yard extends to the eastern shore of the river. The opposite shore is vegetated with trees but houses are not far behind. There are patches of emergent vegetation throughout the area. This area was abundant with frogs including spring peepers, pickerel frogs, American toads, green frogs, and bullfrogs.

Stevens Street - This monitoring location is in the upper end of the Allendale Impoundment, which is the most contaminated of the impoundments. This area is mostly forested/scrub-shrub wetland with the main river channel flowing along the west bank and small streams braiding throughout the rest of the area. A narrow (about a foot wide), shallow (several inches deep) water channel with a gentle flow is present next to the east bank where the monitoring took

The Table 1. Frog species heard (Call Index Value^a with approximate number of individuals in parentheses) during a frog call survey on the Woonasquatucket River in North Providence, Rhode Island in the spring of 2001. The call survey was conducted as part of an assessment of the Centredale Manor Superfund Site. Values given are the maxima of four surveys.

Site	Species Heard (Call Index Value and Number of Individuals ())							
	Spring Peeper	Wood Frog	Pickereel Frog	American Toad	Fowler's Toad	Green Frog	Bullfrog	Gray Treefrog
Rangely Court	0	0	1(1)	0	0	1(1)	1(1)	0
Green Property	1()	1(2)	1(5)	0	0	1(6)	1(1)	0
Adams Road	1(3)	0	1(4)	1(2)	0	2(8)	1(3)	0
Stevens Street	0	0	0	0	0	0	0	0
Wiscasset Street	0	0	0	0	2(4)	0	0	0
Warren Street	2()	0	2(8)	1(2)	1(3)	2(6)	1(2)	0
Oak Street	0	0	1(3)	0	0	0	1(2)	0
Brennan Oil	0	0	1(3)	0	0	0	1(2)	0
Assapumpsett Pond	3()	0	1(1)	2(4)	0	2(7)	1(2)	0

^a Call Index Value: 1=Calls can be counted, no overlapping; 2=Calls can be distinguished, some overlapping; 3=Full chorus, calls continuous and overlapping.

place. No frogs were heard in this area during any of the survey dates. However, the Allendale Dam breached in early April of 2001 causing dewatering of the impoundment with the exception of the stream channels.

562 Wiscasset Ave. - Monitoring of this location took place from a large ledge on the eastern shore of the impoundment which allowed for hearing over a large area, from the dam up to near the Stevens Street monitoring location. There was very little water in the impoundment for the first two surveys, but it was about one-third full for the second two surveys. No frogs were heard during the first two surveys. Fowler's toads were heard (four and three individuals, respectively) during the second two surveys. At least one toad was clearly heard in the water of the impoundment. The others could have been near the impoundment on the upland. However, since this is the only water body in the area, it was presumed that all of the toads were breeding in the Allendale Impoundment (due to private buildings and fencing it was impossible to precisely determine the locations of the calling toads).

Warren Street - This monitoring station is located toward the upper end of the Lymanville Impoundment. Contamination in this impoundment is approximately an order of magnitude less than in the Allendale Impoundment (EPA pers. comm.). This site probably had the highest abundance and diversity of frogs of all the monitoring locations. Species heard included: spring peeper, pickerel frog, American toad, Fowler's toad, green frog, and bullfrog.

Oak Street - Monitoring from this location was conducted from a yard that juts into the Lymanville Impoundment, providing for a large listening area. Trees, lawns, and houses edge the shoreline. The water has patches of emergent vegetation. This area also had high numbers and diversity of frogs including: spring peeper, pickerel frog, American toad, green frog, bullfrog, and one gray treefrog.

Brennan Oil - This is the only monitoring location in the Manton Impoundment because the impoundment is relatively small. The monitoring location was sited in about the only area with emergent vegetation. Listening occurred from a parking lot on the east bank. There is a factory on the west bank that has a loud hum. There is a lot of pavement around the river at this point. This site had a few pickerel frogs and bullfrogs.

Pond on Assapumpsett Brook - This is a small tributary to the Woonasquotucket River that empties into the Lymanville Impoundment. This is a reference site and the only site that is not located on the Woonasquotucket River. It is a small impounded area surrounded by houses. It has a parking lot at the east end and emergent/scrub-shrub wetland and forest at the west end. The monitoring location was at the end of Bowen Street overlooking the scrub-shrub wetland. The pond is a distance down a sloped yard but we did not have permission from the landowner to use the yard. This site had the most spring peepers of any of the sites, as well as one pickerel frog, American toads, green frogs and bullfrogs.

Discussion

This survey faced a number of complicating factors. One was the weather. The spring of 2001 was exceptionally cold and rainy making it difficult to coordinate a night with acceptable survey conditions, particularly during the month of May. Also, unexpected strong winds developed during the April 24 survey. However, there was a lot of frog calling activity that evening so we continued the survey. A second complicating factor is the heavily-developed nature of the area, so there are lots of sources of noise. Noise issues that we faced include: traffic, water flowing over dams, sirens, airplanes, helicopters, factory noises, water treatment plant noises, and local people stopping us to ask questions. A third factor was the difficult access to the site. We planned around this when we set up the monitoring stations, however, on one occasion we wanted to specifically determine the locations of the Fowler's toads in or around the Allendale Impoundment and we were unable to get close to them because of buildings and fences. A fourth factor, was that the Allendale Dam breached in April 2001, causing a drastic change in habitat during the breeding season. The site converted from an impoundment to a habitat resembling mudflat with a stream running through it. In June, a small area of ponding developed just behind the dam.

However, we feel that we got calling data on every species expected in the study area. The two possible species that we did not hear within the study area are northern leopard frog and spadefoot toad, and only one gray treefrog was heard. The northern leopard frog is primarily a species of wet meadows and grasslands so would not necessarily be expected within the study area. Also, the northern leopard frog appears to be declining in numbers throughout the northeast for unknown reasons. The spadefoot toad is a species which is exceptionally difficult to document as they are nocturnal, they completely burrow themselves into sandy soils, and they tend to mate during heavy night-time rainstorms. Since the NAAMP protocol discourages surveying during heavy rains, this species would not be expected to be observed during normal survey periods (Tyning 1990). The lack of gray treefrogs is not easy to explain, especially since gray treefrogs were heard calling in other areas around Providence on the survey nights.

This study was not designed for statistical analysis, therefore, interpretation is qualitative. In general, there appeared to be a reasonable abundance of frogs at all of the listening stations with the exception of Rangely Court, Stevens Street, and Wiscasset Avenue. Rangely Court was chosen because the emergent vegetation above the dam suggested that the area offered good frog habitat. However, there was observable water current in the area so the current may have been too strong for most frog species. The few frogs that were heard were in the same locations (*ie*, a green frog was heard from about the same location as where we had heard a pickerel frog during previous surveys) each time so there may be only a few pockets of habitat that are suitable.

Both Stevens Street and Wiscasset Avenue are in the Allendale Impoundment. The results for the Allendale Impoundment are difficult to interpret because of the breaching of the dam in April. Because the habitat was disturbed during the breeding season, and the site was greatly de-watered, it is difficult to discern whether the lack of frogs was due to contamination or because

of the habitat disturbance. It is also difficult to discern why only Fowler's toads appeared to be breeding in the Allendale Impoundment. Fowler's toads are reported to use shallow water habitats and river margins (Dickerson 1969). They are also associated with sandy upland (Conant 1975; Green 1989). It is possible that this is the only species that will tolerate the present habitat conditions: shallow water impoundment with fairly strong stream current. We presume that there is sandy upland nearby.

However, it should be noted that Fowler's toad is a relatively terrestrial animal in contrast to the relatively aquatic life history of some of the other species of anurans, particularly green frogs and bullfrogs. Fowler's toads only take to the water to breed. The eggs hatch in approximately one week, and the tadpoles metamorphose in 40 to 60 days (DeGraaf and Rudis 1992). In contrast, green frog adults live primarily along the edge of the water and hibernate underwater. The eggs hatch in three to five days but it takes one to two years for the tadpoles to metamorphose (DeGraaf and Rudis 1992). Bullfrogs are also highly aquatic and the tadpoles can take two to three years to transform (DeGraaf and Rudis 1992). There is some evidence that the late-stage tadpoles are the most vulnerable to the effects of contaminants, and that the jelly coating around the eggs offers some protection from water-borne contaminants (Henry 2000). Further, overwintering tadpoles have close epidermal contact with sediments. Therefore, there is reason to believe that Fowler's toads may be less vulnerable to aquatic contamination than more aquatic species.

No frogs were heard from the Stevens Street monitoring location. This is the upper end of the Allendale Impoundment which is scrub-shrub/forested wetland with rivulets braiding through it. This area would not be expected to be prime breeding habitat because of the lack of standing water (we were unable to enter the site to know for sure). However, it would not be unreasonable to expect a few frogs to be in the area or call in the area, particularly gray treefrogs that use forested habitats and do not always call adjacent to their breeding habitat (Tyning 1990). It does appear from the survey that the frog population in the Lymanville Impoundment (Warren Street and Oak Street) which is contaminated, but to a lesser degree than the Allendale Impoundment, has a fairly large and diverse population of breeding frogs.

We would like to note that the number of individual frogs recorded at Assampumpsett Pond may have been greater if we were standing closer to the pond during monitoring. The call of the pickerel frog is particularly hard to hear as it is a soft snore which is often emitted under water (Conant 1975). According to Conant (1975), spring peepers often prefer habitats where trees and shrubs are standing either in the water or nearby. This site may have had the highest population of spring peepers because of the presence of the scrub-shrub wetland.

Summary and Conclusions

Based on our survey, it appears that most of the study area has a breeding population of frogs comparable to other highly disturbed sites. However, some sites are in question. Rangely Court Park (a reference site), Stevens Street and Wiscasset Avenue (Allendale Impoundment) appear to

have poorly-represented anuran populations. The low population of calling frogs at Rangely Court Park may be due to water current that is too strong to provide quality frog habitat. The possible reason for the lack of frogs at the Allendale Impoundment is more difficult to discern because of the change in habitat due to the breaching of the dam. The fact that there was a relatively large and diverse population of calling frogs in the Lymansville Impoundment and that Fowler's toads were present in the Allendale Impoundment, might suggest that the lack of frogs in the Allendale Impoundment is due to physical habitat conditions rather than to contamination. However, it is noted that the life history of the Fowler's toad may make it less vulnerable to aquatic contamination than more aquatic species. Also, this study only assessed the presence of calling males. It did not assess the success of the reproduction effort.

Literature Cited

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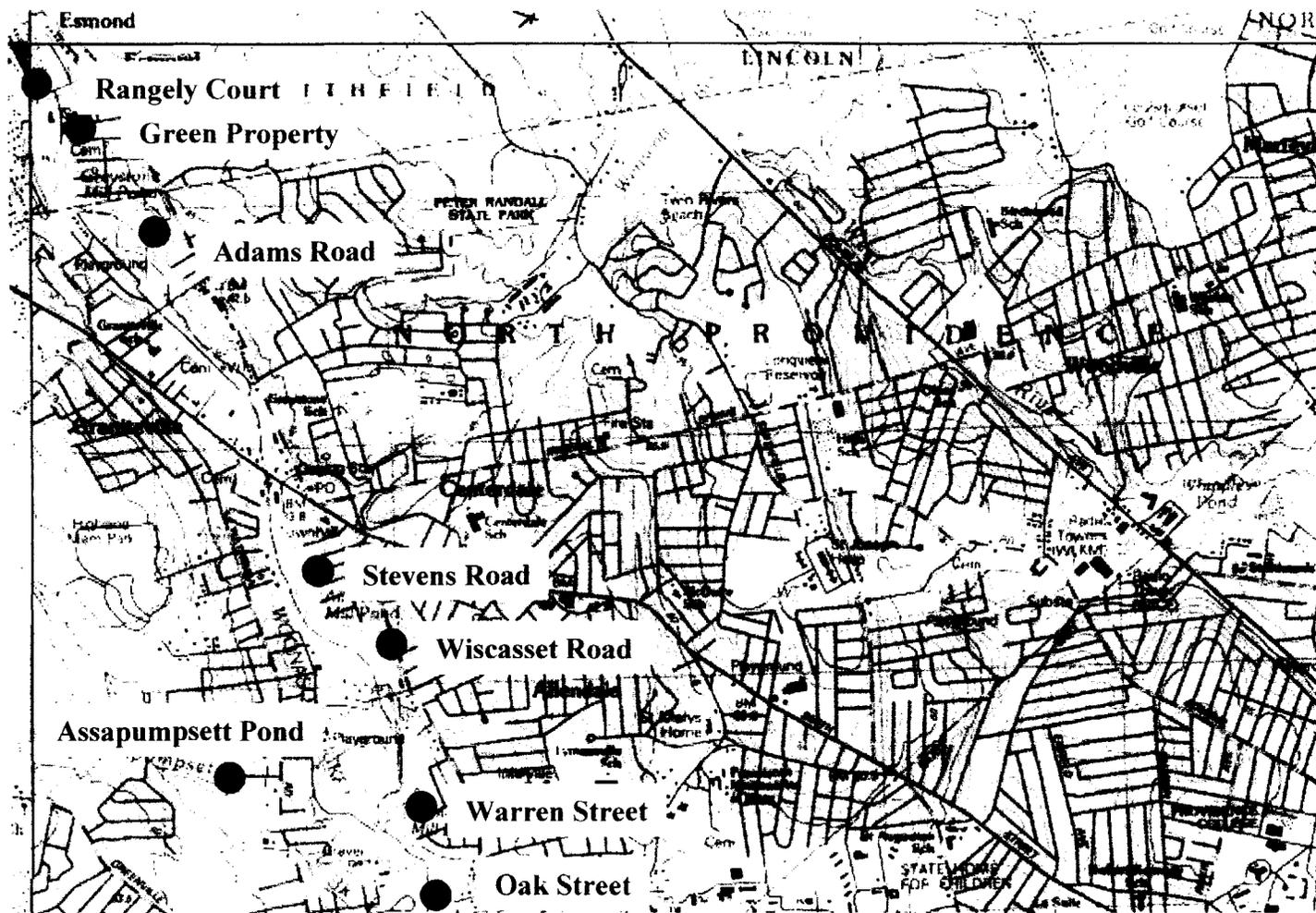


Figure 1. Locations of the frog call monitoring sites on the Woonasquatucket River in Providence, Rhode Island.

Originals in color.



Figure 2. Location of the frog call monitoring sites on the Woonasquatucket River in North Providence, Rhode Island.

Listening Point

1. Area amazingly devoid of frog calls except for 1 lonely but determined pickerel frog. Traffic noise and noise from water flowing over the dam were a problem so we walked across bridge to shoreline opposite Rt 140. Could hear peepers in the distance - turned out to be an athletic field next to Cumberland Farms Store. We revisited site at end of night and was still quiet.
2. Noise issues included a loud hum from water treatment plant across the river, wind chimes in the yard, and the wind started to get stronger. Mr. Green - the landowner - interrupted us to say hi after 2 minutes so listening period had a timeout. The peepers we heard were not in the immediate area but rather were downstream so are probably same peepers as for Site #3. Heard wood frogs across river - sounded like they were near waste water treatment plant - estimated 2 animals calling but could have been more.
3. Noise - traffic in distance & wind. Peepers were probably the same group as #2.
4. Some background noise but no frogs. Gentlemen at house #40 came out to see what we were doing. He mentioned he used to catch lots of frogs of different species there when he was a kid.

Notes

5. Ken & I stood ~ 15 yards apart to make sure we were hearing the whole area. The place was silent. Impoundment was more dewatered than two weeks ago.
6. Strong wind blowing made hearing difficult.
7. Good listening spot.
8. Factory across river makes a lot of noise.
9. Only noise factor was the toads which called continuously and made it hard to hear the pickerel frogs.

FWS Anuran Call Count Survey

Observer: Laura Eaton-Poole
 Observer: Ken Munney Refuge Route: Cantedale Manor Survey Date: 6/26 Run Number: 04

Survey Data

	Time	Temp (°F)	Wind Scale	Sky Code
Start	9:10	76°	1	0
Finish	11:15	66°	1	0

Point Data

	Point Data									
	Aspenhurst <u>Poplar</u>		Brennan Ct. <u>2</u>		Oak St. <u>3</u>		Waveren St. <u>4</u>		562 Wiscasset <u>5</u>	
Start Time	9:10		9:25		9:35				10:00	
Air Temperature (°F)	76°									
Sky Code	0									
Was noise a factor? (✓ = yes)	no		Yes - factory noise		no		Yes - Very loud air conditioner		no	
Did you take a timeout? (✓ = yes)										
Species Heard:	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
green frog	1(3)	1(7)	1(2)	1(2)	1(4)	1(6)	1(5)	1(5)		
bull frog			1(2)	1(2)	1(3)	1(3)	1(2)	1(2)		
Gray tree frog					0	1(1)				
Fowler's toad									*1(3)	1(3)

Comments: *The Fowler's toads did not sound like they were in the impoundment. They sounded like they were at the far edge on the upland but since impoundment is the only water body presence this is breeding site.

Call Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

Sky Code: 0 = Clear / few clouds. 1 = Partly cloudy / variable. 2 = Cloudy (broken) or overcast. 4 = Fog / Smoke
 5 = Drizzle / light rain 7 = Snow *8 = Showers (do not conduct survey)

Wind Scale: 0 = Smoke rises vertically. *4 = Small branches move, raises dust and loose paper.
 1 = Light air movement, smoke drifts. *5 = Small trees in leaf begin to sway, crested wavelets.
 2 = Wind felt on face, leaves rustle. *6 = Large branches in motion.
 3 = Gentle breeze, leaves and small twigs in motion. * Unacceptable wind strengths for survey.

