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1 March 2013

TO: U.S. Fish and Wildlife Service, Midwest Region

RE: *Rangewide Indiana Bat Summer Survey Guidance DRAFT- January 2013*

I am writing with regard to the request for comments on the “*Rangewide Indiana Bat Summer Survey Guidance DRAFT- January, 2013.*” I began studying bats in 1990 when working for the Pennsylvania Game Commission (PGC) to conduct cave and mine assessments and other bat inventories. Since 1997 I have worked with Bat Conservation International (BCI) to facilitate weeklong training workshops in Arizona, California, Kentucky, and Pennsylvania. I am now president of Bat Conservation and Management, Inc. (BCM), a company I started in 1999 to provide seasonal bat roost and habitat surveys, U.S. Fish and Wildlife Service (USF&WS) endangered species compliance inventories, acoustic monitoring studies, and large-scale migratory bat radio-tracking projects. This work has led me to develop or distribute specialty survey gear including various mist-net sets, harp traps, bat houses, and of course, bat detectors.

To quickly put my relevant personal experience in perspective, to date I have been involved with thousands of cave and mine visits, well over 2,500 nights (not *net nights*) of Indiana bat summer mist netting, and hundreds of cave and mine trapping surveys. In the past eight years, I have been incorporating acoustic monitoring into various projects and recording voucher calls using equipment from Batbox, Binary Acoustic Technology, Elekon, Pettersson, Titley (AnaBat), and Wildlife Acoustics. I have assisted with teaching over 30 field workshops, at up to 5 nights each, comprised of participants that included biologists from federal, state, or local agencies, college and/or graduate students, and other professionals or enthusiasts with a desire to learn more about basic bat conservation and management, advanced capture techniques, and echolocation recording.

Through all this, the bats have continually humbled me into realizing there are biases to any single capture or inventory method, and bats will continue to elude humans regardless of the best technology we have to throw at them today. Furthermore, the discussion required to properly address just the “acoustic” section of this “guidance” draft could easily fill a graduate thesis, and a short “public comment” period is unlikely to give this crucial topic adequate coverage. I do feel that acoustics can reliably confirm if *Myotis* spp. presence, and perhaps that information can be used to target future physical capture methods. But, considering the variability of *Myotis* spp. call repertoires, I feel it would be a grave mistake to make multi-million dollar decisions on developments based on passively collected call sequences whose ultimate identification can change with a software update. Likewise, I would be concerned basing these decisions on a call library of thousands of known Indiana bat voucher sequences. Yet, the 2012 draft of this protocol referenced a call library built from just a single source, collected during 1997-2001 (i.e., the veritable Stone Age of acoustic monitoring science). Furthermore, the library contains barely 200 examples of Indiana bat sequences from just five states where bats were recorded from more than one capture site (Britzke, 2011). It is irresponsible to consider that the voucher calls from this collection are expected to represent the entire range-wide Indiana bat repertoire that will be

encountered under field conditions. Moreover, the lack of an approved automated classifier has led the Service to consider an even more questionable approach for the 2013 Contingency Plan: “Step 4: Conduct additional acoustic analysis . . . detections of Indiana bats based on current filters, software, and/or qualitative visual analyses.” The rationale that surveyors can use any untested method to arrive to a conclusion in absence of a tested method is fatally flawed.

Many people feel very little consideration was given to the 57 individual comment letters submitted in 2012, as reflected by the lack of substantive changes in this 2013 revision. And, with the lack of an automated acoustic identification system in place and approved for use by the USF&WS, the “Contingency Plan” proposed for 2013 is in many ways the worst possible idea, for it makes huge assumptions that inexperienced/untrained personnel can use untested software with unverified comparison/training data and seriously conclude presence or absence of a federally endangered species, with nothing more than a few pulses of ultrasound which could actually be any one of at least ten different species in the East.

What follows are the 2013 protocol sections with my additional specific comments (in red) on the content printed in red for ease of identification, beginning with the Contingency Plan as this was given higher priority for comments during the USF&WS presentation at the SBDN meeting in February.

Draft 2013 Field Season Contingency Plan for Conducting Indiana Bat Summer Surveys January 2013

We believe that it is essential to survey for Indiana bats using protocols that will maximize the likelihood of their detection and employ tools that are both accurate and efficient to use. Therefore, should we not have a Service-approved automated acoustic identification program(s) available for use in 2013, surveyors would use the following contingency plan.

This entire Contingency Plan refers back to sections of the main protocol and is bound to have unresolved conflicts and other issues. The Contingency Plan should stand alone as a straightforward “all in one” document.

Step 1. Conduct Phase 1 Habitat Assessment.

Should be conducted by a qualified surveyor. Obtaining a FWS endangered species permit is a fairly long process with numerous checks and balances, including input from permitted surveyors who have been shown to police themselves to a certain extent. This Contingency Plan as written starting with the habitat assessment and including the acoustic monitoring, removes all quality control and necessary checks and balances in one move. And this will quickly lead to both false positives and false negatives of Indiana bat occupancy due to intentional and unintentional user error and/or misinterpretation of data.

- 1 a) Suitable summer habitat present, proceed to Step 2.
- 2 b) Suitable summer habitat absent, no further summer surveys required.

Step 2. Can all adverse effects to Indiana bats be avoided?

- a) No, assume presence of Indiana bats or proceed to Step 3.
- b) Yes, no further summer surveys required.

Step 3. Conduct Phase 2 Acoustic Surveys.

- a) No positive detection of high frequency calls (≥ 35 kHz), no further summer surveys required.
- b) Positive detection of high frequency calls, assume presence of Indiana bats or proceed to Step 4.

This is a troublesome assumption, especially given that a few “high frequency” *calls* from eastern bat species, taken out of the context of a longer, high-quality call sequence, can be readily misclassified by people and machines as any of the following species: MYLU/MYSO/MYLE/MYSE/LABO/LASE/PESU/NYHU/MYAU/MYGR. Those “high frequency” calls can in reality be any one of 10 different species and demands that experienced personnel (“Qualified Biologist” type, but with additional qualifications) be supervising.

Step 4. Conduct additional acoustic analyses.

- a) No positive detections of Indiana bats (based on current filters, software, and/or qualitative visual analyses), no further summer surveys required.

There is no Service-approved analysis software. There are no Service-approved QIBAS (Qualified Indiana Bat Acoustic Surveyors). There are no Indiana bat acoustic identification training courses. There isn’t even a reliable, vetted public library of Indiana bat call files to compare unknown calls to. If the Service is going to accept manual results of a QIBS using a given software,

- then the Service would accept results from a sound engineer with 20 years experience using the same software,
- then the Service would accept results from a college student with a couple years experience using the same software
- then the Service would accept results from anyone using the same software

Every year there are photographs of “unknown” bats that circulate via email by people looking for species suggestions from other experts. Rarely is there a consensus from these photographs, and bat acoustic ID has many more variables and a lot less data to consider. Again, a few “high frequency” *calls* from eastern bat species, taken out of the context of a longer, high-quality call sequence, can be readily misclassified by people and machines as any of the following

species: MYLU/MYSO/MYLE/MYSE/LABO/LASE/PESU/NYHU/MYAU/MYGR. Those “high frequency” calls can be any one of 10 different species. At this point it is difficult to remove absolutely all doubt that some HF call –isn’t– from an Indiana bat, and there is no incentive for anyone to continue further investigations from a compliance-survey point of view.

Please refer to the table below that demonstrates the results of three different analysis programs when fed 137 hand-verified MYLU bat call files from Pennsylvania:

	LABO	MYLU	MYSE	MYSO	NYHU	UNKN	Total
BCID 2012	13	70	1	17	34	2	137
	9%	51%	1%	12%	25%	1%	
	(NYHU turned off) 50	69	1	15	n/a	2	
	36%	50%	1%	11%		2%	
EchoClass 2012	55	41	7	21	n/a	12	136
	40%	30%	1%	15%		1%	
Kaleidoscope Pro 0.4.0	17	64	26	14	0	16	137
	12%	47%	25.0%	19%	0%	12%	

**Actual Dataset:
100% voucher calls of MYLU
collected by PA Game Commission using AnaBat
(no FS to ZC conversion)**

At the time of this writing, the best these programs could do was to correctly identify 50% of the actual MYLU files to actually be MYLU. For all of the time and huge expense the Service is requesting of this process, at this juncture we demonstrate it is no better than flipping a coin.

- . b) Positive detections of Indiana bats, assume presence of Indiana bats (AND you can proceed to Step 5 to attempt to capture and attach radio transmitters).

The Service needs to clearly state what is a “positive detection” of Indiana bats, for as written now, it is whatever anyone tells the Service *is* an Indiana bat call. True the Service can reject any analysis they see fit; but this will simply bog the whole process down ultimately, and inevitably will need to be resolved in the courts. Due to the overlap of MYLU/MYLE/MYSO call characteristics, it is absolutely critical that only very high-quality call sequences be considered for species ID. A simple suggestion to start assessing this needed quality control to recordings might be:

- recordings should contain more than 12 well, formed individual call pulses, to better determine what type of behavior the call sequence represents
- at least one pulse in the sequence should have a harmonic visible, to show that the bat was in range of the microphone and the call sequence does not consist of only call fragments

Recordings that meet the above criteria will represent only a fraction of the actual files that might be recorded on any given night. Recordings that do not meet the above criteria can be demonstrated to be any one of at least 6 different species in the Northeast, and 10 in the Midwest and Southeast. In addition, “one” file, even if it is deemed high-quality, may not necessarily establish presence, particularly among acoustically cryptic species such as MULU/MYSO/MYLE

where a number of representative files should be necessary to confidently establish presence.

Step 5. Conduct Phase 3 Mist-netting Surveys.

Mist net surveys should be:

- Conducted **concurrently** with acoustic surveys throughout the 2013 season, and until enough data is acquired to conclusively document and describe workable acoustic protocols. Results from a single project, conducted in a very limited geographic area, do not provide a valid test of the application for acoustic protocols on a range-wide scale.
- An increased level of effort, just moving to 6 net nights per site instead of the current requirement of 4, does not increase staff requirements or costs but likely increases capture success.

False positives and false negatives will occur in the foreseeable future and as demonstrated by several projects (including the Tyburec and Chenger presentations at the 2013 NEBWG and SBDN meetings) combining physical capture effort simultaneously with acoustic capture effort returned the best chance to detect Indiana bats today, due to both methods being equally flawed.

IL/MO-MYOSOD Results

	RECORDED			CAP
	SonoBat	EchoClass	KaPro	
SITE 8	✓	✓	✓	✓
SITE 9				✓
SITE 10				✓
SITE 11				✓
SITE 12	✓	✓		
SITE 13	✓	✓	✓	
SITE 14	✓	✓	✓	✓



Only 2 of 7 sites returned MYOSOD recordings that were also backed up with MYOSOD captures. MYOSOD was **physically captured** at 3 additional sites where there were no highly confident MYOSOD recordings collected using either the SonoBat or the EchoClass classifiers. MYOSOD was recorded at 2 additional sites where there were no MYOSOD captured.

During this large-scale effort, in the heart of the MYOSOD range, acoustics proved to be no more effective at documenting MYOSOD presence than capture methods were, but when both were used together, MYOSOD could be confidently identified across more of the survey area.

- a) No Indiana bats are captured, coordinate with local Service FO to determine what type population of Indiana bat is assumed to be present.

A court will want to know how the Service determined age/species/sex/reproductive condition from acoustic files.

Indiana bats are relatively easy to capture. This is perhaps a shock to those, who for whatever reason, capture few bats in general (this is another issue and could be addressed in a number of ways, though beyond the scope of this letter). The Service must agree that at some level of physical capture effort with negative results, the Service must concede that if Indiana bats are still present in a particular sampled area but not captured, the numbers may be so low as to not be detrimental to the survival of the species. Many papers have been published on the subject of species accumulation curves and some level of effort could easily be determined that would be an effective tool to further investigate and dismiss false positives.

In conclusion, I contend there may be some use of acoustic monitoring in certain regions to screen Indiana bat habitat for possible Indiana bat call sequences and eliminate some study locations from further investigation. The reality is that in most regions the possibility for Indiana bat call activity will never be completely dismissed. Any serious attempt at documenting presence/absence of Indiana bats should simultaneously incorporate a physical capture and acoustic capture method at each site. Until acoustic sampling can be proven to be a reliable indicator of presence or absence, some level of physical capture effort should be the more heavily weighted factor when decision making. To permanently designate an endangered species X-mile radius buffer zone around an acoustic recording that in reality could be any one of ten species is a gross misinterpretation of what data acoustic monitoring can presently provide. In addition, failure to identify actual Indiana bats sites due to over reliance on software and people misclassifying calls as any one of nine other species is a failure to protect the species.

Respectfully,



John Chenger

Bat Conservation and Management, Inc.

Enc. Additional Comments on 2013 Draft Guidance and Associated Documents

Acoustic Bat Identification Software Testing Criteria – Draft January 2013

Software programs meeting all the criteria outlined below and validated by the U.S. Fish and Wildlife Service (Service) (through testing by the U.S. Geological Survey) will be approved for use for analysis of bat calls obtained during summer surveys of Indiana bats. A list of candidate and approved programs will be maintained on the Service's Indiana bat summer survey guidance website:

<http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html>

- 1 The program must be quantitative and automated to ensure repeated consistency in analysis.
- 2 Any call identification analysis program must be based upon an extensive call library of free-flying bats (see question #27 in the FAQs). Program developers must provide the Service with a copy of their call library, which must indicate the number of calls per species, call recording location and the method of collection (e.g., free-flying bats, hand release, light tag).

No. The Service needs to obtain their own call library of carefully vetted sample recordings of absolutely known individuals of species of interest, recorded in a number of different habitats under varying conditions. It is those files the Service can then use to evaluate automated call classifiers that were never part of some software development; it is simple enough to determine if these packages either work or not. The Service has no right, use, or authority to request private call libraries.

- 3 Each program and/or its supporting materials must explicitly state which species and geographic area(s) it covers.
- 4 The program must include filtering to remove extraneous noise and non-bat files, as well as feeding buzzes, files with multiple bats, poor-quality passes that are recognizable as a bat but not to species, and medium-quality passes that are only recognizable to genus.
- 5 The program must include an "unknown" category for classifying calls that are not characteristic of species in the call library to ensure that such calls are not forced to a species identification.

The Service should only be concerned whether a classifier correctly outputs Indiana bats as Indiana bats, and everything else as something else. Items 4&5 are irrelevant and should be saved for a classification program contracted, developed, and maintained by the Service. Quality of call recordings will always be out of the control of a surveyor and therefore it is up to a surveyor to assess the quality of what recordings to use. Classification outputs consist of a species decision per file or are "unknown".

- 6 Accuracy rates of the program must be derived through cross-validation (e.g., qualitative assessment). Correct classification rates of files identified to individual bats species for the underlying analytical program within identification software, i.e., discriminant function analysis, neural networks, classification and regression tree (CART) or other statistical tests (see #6) must be provided to show the initial basis used for maximum-likelihood estimator calculations. Minimum correct classification rate on the software's training data must be 90% or better for all *Myotis* species that may occur within the range of the Indiana bat. Post-hoc maximum-likelihood estimator p-values will be used to determine acceptance thresholds for final identification determination.

Allowing software criteria to meet a 90% correct classification rate on its own training data used to build its classifiers is just plain silly. I would expect it to do 100%. The question is how these applications perform using data collected under typical field conditions. The Service needs to assemble and maintain its own acoustic library of bat calls for all species of interest. Calls in this library must (1) be of sufficient number to adequately represent the call repertoire of each species, (2) be of sufficient quality insofar as signal-to-noise ratio and proximity to the microphone, indicating individual echolocation call pulses are fully rendered, capturing the true F_{hi} of the bat call, (3) be typical of open-air, search-phase type echolocation calls which have been determined to be among the most acoustically distinct call sequences in a species' repertoire, and (4) be collected from individual bats, identified with 100% accuracy and confidence, that were followed with the appropriate ultrasonic microphones during collection, in areas where no other interloping species could be possible. Calls that do not meet these criteria must be excluded from the call library used to vet the software and should not be included in any call libraries used to design classifiers used by the software. I.e., passively recorded echolocation calls, identified by an automated classifier or by manual, human vetting because they "look" like what is known for a species cannot be used to build or test classifiers.

- 7 As species identifications are never perfect, all analysis programs must utilize a maximum-likelihood estimator approach to determine species presence at the site rather than relying on a single sequence.

If single sequences are not to be trusted with species identification, the MLE method seems to acknowledge that there are major inherent flaws with acoustic monitoring and seems to cast reasonable doubt on the idea in general. The Service should consider contracting a 3rd party review of these methods.

- 8 Results must include file level summaries (e.g., # of pulses, species IDs, unknown species, invalid), site/night analyses (e.g., # of files, # of invalid files, # of files ID'd to species vs. unknown, IDs for each species), and the maximum-likelihood estimator value assignments.

APPENDIX B

PHASE 2 ACOUSTIC SURVEYS

SUMMER ACOUSTIC SURVEY SEASON: May 15 – August 15 PERSONNEL

Acoustic surveyors must have a working knowledge of the acoustic equipment, analysis tools, and Indiana bat ecology. Surveyors must be able to identify appropriate detector placement sites and establish those sites in the areas that are most suitable for recording high-quality Indiana bat calls. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the proper placement of their field equipment.

This sets no measurable criteria for personnel to meet and is therefore meaningless. If the Service wants to see some level of expertise of personnel conducting these surveys, the above paragraph is a complete failure. Anyone who has read the instruction manual for a bat detector and has read a book on Indiana bats yesterday meets the Service’s suggested experience criteria.

DETECTOR AND MICROPHONE REQUIRED CHARACTERISTICS - Full spectrum and/or zero-crossing detectors are suitable for use in this survey protocol. Directional microphones are the only microphone type accepted for acoustic surveys at this time.

It is up to the surveyor to obtain high quality recordings to identify to species. The Service should only be concerned of a surveyor does not return some level of acceptable results. If there is concern over types and brands of microphones, the Service should realize that there is variability with each brand and even large variability between individual microphones of certain less expensive devices and be prepared to dictate specifically exactly what model from what manufacturer is acceptable.

ACOUSTIC SAMPLING PROTOCOL

Detector Placement

- Detector placement is critical to the successful isolation of

The following locations are likely to be suitable sites for detectors, including, but not limited to: (a) forest-canopy openings that are no more than 164 feet (50 meters) wide; (b) water sources; (c) wooded fence lines that are adjacent to large openings or connect two larger blocks of suitable habitat; (d) blocks of recently logged forest where some potential roost trees remain; (e) road and/or stream corridors with open tree canopies or canopy height of more than 33 feet (10 meters); and (f) woodland edges (Britzke et al. 2010). If detectors are placed in unsuitable locations, effective data analysis may be impossible, and the results of the sampling effort may be invalid.

Surveyors should deploy detectors/microphones in the following manner: (a) at least 5 feet (1.5 meters) in any direction from vegetation or other obstructions (Hayes 2000; Weller and Zabel 2002); (b) in areas without, or with minimal, vegetation within 33 feet (10 meters) in front of the microphone; (c) orient detectors parallel when sampling woodland edges; (d) at least 49 feet (15 meters) from water surfaces (Johnson et al 2012); (e) at least 328 feet (100 meters) from artificial high-frequency emitters (e.g., wind turbines, high-tensile power-lines, and micro-wave towers) (Johnson et al 2012); and (f) at least 49 feet (15 meters) from known or suitable roosts⁷ (e.g., trees/snags, buildings, bridges, bat houses, cave or mine portal entrances).

⁶ If necessary, surveyors can remove small amounts of vegetation (e.g., small limbs, saplings) from the estimated detection cone at a site, much like what has been done while setting up mist-nets in the past. Deployment of detectors in closed-canopy locations that typically are good for mist-netting are acceptable as long as the area sampled below the canopy does not restrict the ability of the equipment’s detection cone to record high-quality calls (i.e., the vegetation is outside of the detection cone).

⁷ If the surveyor discovers a potential roost and wishes to document bat use, please refer to Appendix E for guidance on conducting emergence surveys and contact the USFWS FO(s).

Surveyors should distribute acoustic sites throughout the project area or adjacent habitats. In most cases, detector sites should be at least 656 feet (200 meters) apart. If closer spacing is determined to be necessary or beneficial (e.g., multiple suitable habitats and acoustic sites immediately adjacent to each other), sufficient justification must be provided in the acoustic survey report submitted to USFWS FO(s).

Verification of Deployment Location

It is recommended to

to manufacturer’s instructions) to directly record accurate location coordinates for each acoustic site that is paired with the acoustic data files. Regardless of technique used, accurate GPS coordinates must be generated and reported for each acoustic survey site.

Verification of Proper Functioning

It is highly recommended

properly through a periodic verification of performance to factory specifications (a service currently offered or in development by several manufacturers). It may be possible that independent service bureaus would be willing to perform this service, providing that a standard test/adjustment procedure can be developed.

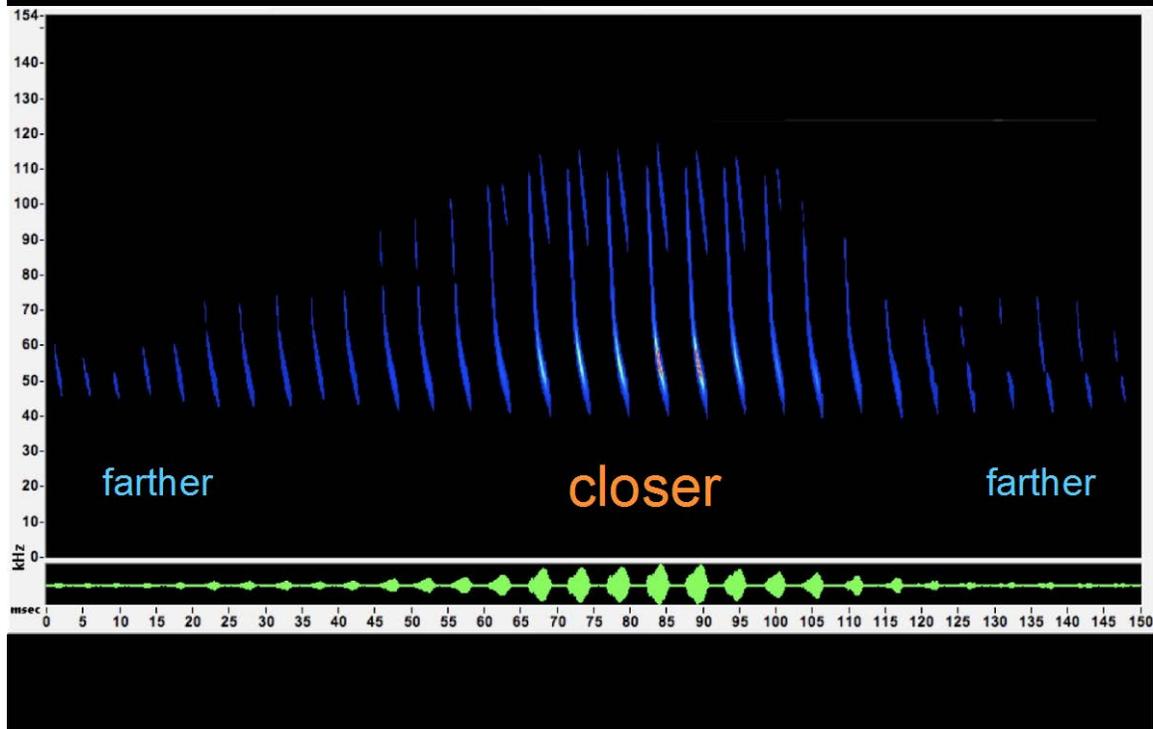
It is also recommended to ensure equipment is working during set-up in the field. This can be done simply by producing ultrasound (e.g., finger rubs) in front of the microphone at survey start and survey finish. This documents that the equipment was working when deployed and when picked up (and by assumption throughout the entire period). Many types of detectors allow for setting timers that initiate and end recording sessions. This saves battery life as well as reducing the number of extraneous noise files recorded. However, if the units are visited when the timer is off, the surveyor cannot verify that the unit is functioning properly. This is particularly important in areas where no bat activity is recorded for the entire night or during the last portion of the night. In these cases, if the surveyor cannot demonstrate that the detector was indeed functioning properly throughout the survey period, then the site will need to be re-sampled, unless adequate justification can be provided to the USFWS FO(s).

Suitability of the selected acoustic survey sites will also be assessed in the data-analysis stage. Suitable set-up of the equipment should result in high-quality calls that are adequate for species identification. Thus, at least 10 bat calls (i.e., greater than or equal to 3 high-quality pulses in a call) must be recorded AND a minimum of 40% of all recorded bat calls must be identified to the species level for each detector on each survey night for the site to be deemed suitable.

Bat call recordings are random. On some nights there are no calls recorded, despite perfectly adequate equipment deployments. It is unacceptable for the Service to not recognize and accept that zero data is not data.

A bat CALL is a single pulse of ultrasound. A CALL SEQUENCE is a collection of calls in a file. I presume the Service is looking for a minimum of 3 “high quality” call pulses in each call sequence, yet fails to describe what constitutes a “high quality” call pulse. A file containing only 3 call pulses in the Eastern US that statistically shares the same data space of Indiana bats can be generated by no less than nine other bat species. Files containing 3 call pulses generated by Indiana bats can also share the same data space of nine other species, rendering this entire exercise meaningless. A much more reasonable criteria for number of calls in a call sequence to more confidently identify *Myotis* species would be closer to a dozen. Below is an example of a typical high quality recording that demonstrates that fully formed call pulses near the microphone become progressively fragmented from a distance. We know the bat was in range and we are capturing the entire bandwidth of the ultrasound because of the presence of harmonics in those calls. The current protocol as written would find the first three and last three pulses of this file perfectly acceptable if presented out of context. Fragmented call pulses, out of context to the rest of the sequence, are routinely misclassified by automated programs and humans alike, who attempt to assign a file to every species without an understanding of what they are looking at.

Distance obscures details



The 40% rule is not bad idea with the caveat that there be NO MINIMUM number of recordings necessary to be recorded each night, provided it is shown that there was no equipment malfunction, human error, or extreme weather that prevented bats from being recorded. Zero bat passes is still data.

Nights of sampling at individual sites that do not meet these minimum requirements will need to be re-sampled unless adequate justification can be provided to the USFWS FO(s). Modifications of the equipment (e.g., changing the orientation) at the same location on subsequent nights may improve quantity and quality of calls recorded, which can be determined through daily data downloads. If modifications of the equipment do not improve call identification, then the detectors will need to be moved to a new location.

The word “QUANTITY” should be removed. Zero data is still data. “Quality” is a different matter and can almost always be improved.

Orientation

openings), it might be desirable to aim the detector vertically. This has shown to record high quality calls but precludes the use of weatherproofing for protection of the microphone, since no currently-approved weatherproofing system will adequately protect the microphone of a detector aimed vertically. Deploy detectors at or below the lowest expected height of the bats but high enough above ground vegetation to avoid interference within the detection cone.

Detectors should be aimed 45

It is up to the surveyor to obtain high quality recordings to identify to species. The Service should only be concerned if a surveyor does not return some level of acceptable results. There are far greater issues the Service should be concerned with rather than utterly wasting everyone’s time seeking justification on why a microphone was pointed in some direction and if there was a pipe or reflector or umbrella used to deflect weather. The above recommendation is *completely* flawed in that it totally biases recordings close to ground level. Bats occupy airspaces. Microphones should be placed elevated in airspaces approximately in the middle of the airspace to be sampled and as such will have the best chance to capture high quality call sequences above and below the microphone. Bats will approach microphones from completely random directions and positions in three-dimensional space, therefore it is futile and laughable to be concerned over “cones of reception” and other minor details of microphone orientation and weatherproofing. This protocol already contains significantly dated information and will never keep up with advances in microphones, recorders, weatherproofing tricks, placement techniques and ideas and so it shouldn’t even bother. The Service should leave it to surveyors to return acceptable results and not try to write an acoustic guidebook, which as of this writing is mediocre at best.

Once acoustic sites are identified, photographs documenting the orientation, detection cone (i.e., “what the detector is sampling”), and relative position of the microphone should be taken for later submittal to the USFWS FO(s) as part of the acoustic survey report.

Weather Conditions

the time and duration of such conditions, and repeat the acoustic sampling effort for that night: (a) temperatures fall below 50°F (10°C) during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period;

If any of the following weather

Intermittent light rain does not depress bat activity as documented by numerous telemetry reports and mist net experience actually shows an increase of captures during light rain or in advance of a major precipitation event. Acoustic monitoring needs to be suspended only with heavy rain occurs for more than half of the night.

and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) during the first 5 hours of the survey period. At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and summarized in the survey reports.

Weatherproofing

market weatherproofing is preferred as the addition of these systems may result in some signal degradation. For directional microphones, the use of a polyvinyl chloride (PVC) tube, generally in the form of a 45-degree elbow the same diameter as the microphone (Britzke et al. 2010) is acceptable, if the situation requires the use of after-market weatherproofing. Attach the elbow to a weatherproof box that houses the main portion of the detector. Point the microphone into one end of the elbow and point the open end of the elbow in the direction to be monitored (generally 45 degrees to horizontal). Another option for weatherproofing detectors is to detach the microphone from the detector so that the detector can be placed in a weatherproof container but the microphone (tethered by a cable) remains unobstructed.

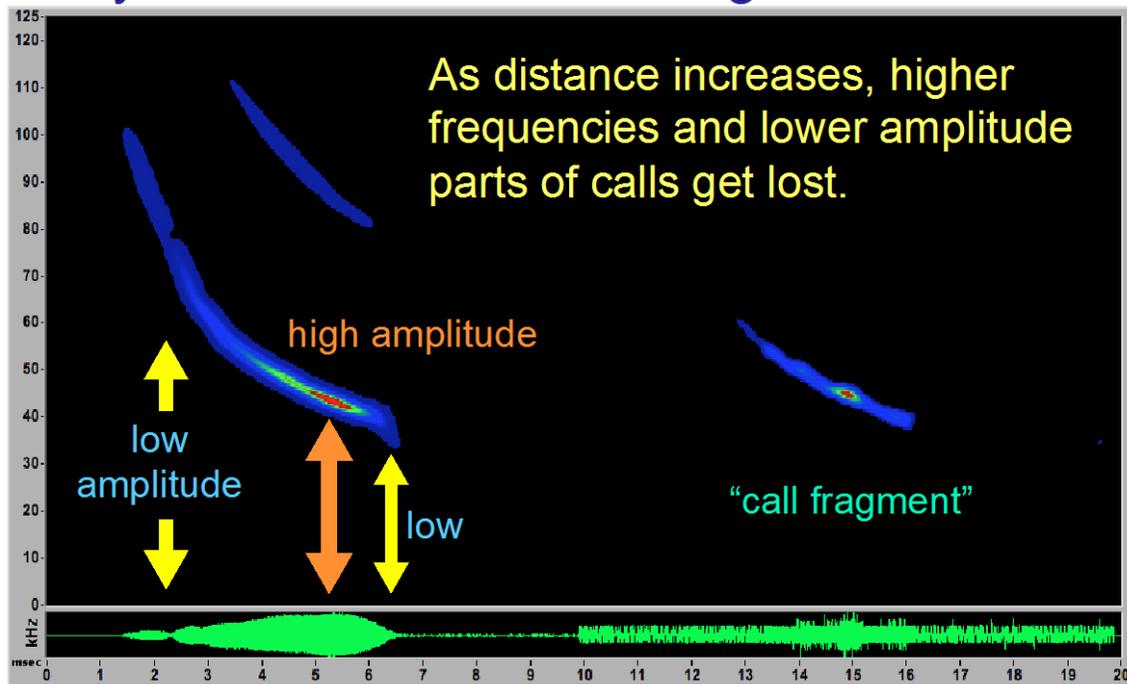
- Most bat detectors are not

Other after-market weatherproofing systems may become available and approved by the Service provided they show that call quality and the number of calls recorded are comparable to those without weatherproofing.

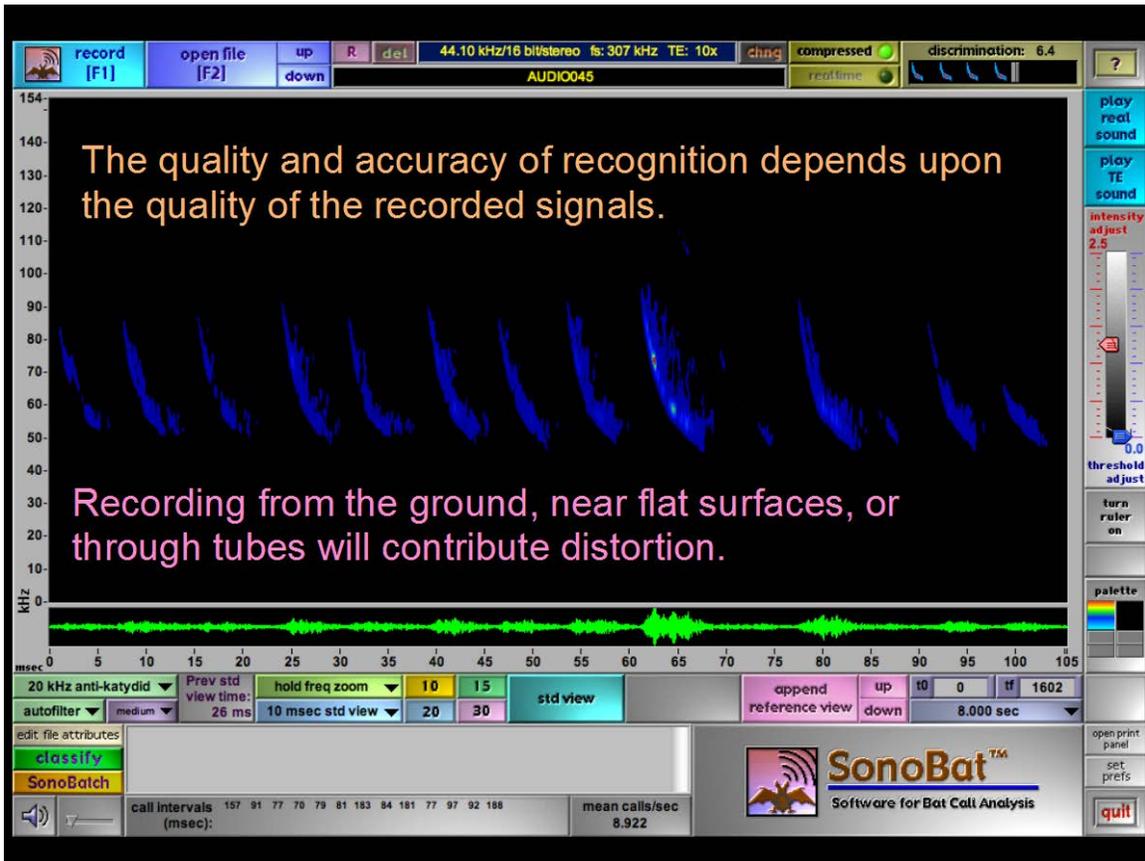
It is up to the surveyor to obtain high quality recordings to identify to species. The Service should only be concerned of a surveyor does not return some level of acceptable results. Bats will approach microphones from completely random directions and positions in three-dimensional space, therefore it is a waste of ink to be concerned over “cones of reception” and other minor details of microphone orientation and weatherproofing. This protocol is already contains significantly dated information and will never keep up with advances in microphones, recorders, weatherproofing tricks, placement techniques and ideas and shouldn't bother. The Service should leave it to surveyors to return acceptable results and not try to write an acoustic guidebook, which as of this writing is mediocre at best.

The Service's weatherproofing recommendation is ridiculously dated. The suggestions *only* apply to the Anabat detector (one manufacturer in the world) because of the inherently simpler sound recording method that is Frequency Division/zero-cross. The Service's weatherproofing recommendation should never be used for full spectrum detectors manufactured by nearly a dozen companies around the world, as that technology is capable of resolving higher detail in the call pulses that are distorted by obstructions immediately surrounding the microphone. Below is an example of a perfectly fine call pulse on the left, which we can tell is in range of the microphone because of the presence of a harmonic.

Fully formed call vs. Call fragment



The next image below is a typical call sequence recorded using the Service’s ill-advised weatherproofing tube:



Again, my contention is the Service should only be concerned of a surveyor does not return some level of acceptable results and should not be in the business suggesting equipment or techniques.

MINIMUM LEVEL OF EFFORT

The number of acoustic survey sites required for a project will be dependent upon the overall acreage of suitable habitat proposed to be impacted by the action. To determine the acoustic survey effort, quantify the amount of suitable habitat within the project area. Using detection probabilities as determined in post-white-nose syndrome (WNS) environments as the baseline necessary to document Indiana bats, all projects will require (1) a minimum of two acoustic survey sites, (2) the deployment of a minimum of one detector per survey site, and (3) all sampling to be conducted for at least six suitable nights. To reduce the survey duration, additional detectors may be added at individual survey sites accordingly: 5 nights for 2 detectors per site, 4 nights for 3 detectors per site, and 3 nights for 4 detectors per site (MacKenzie and Royle 2005). The acoustic sampling period for each site must begin before sunset and continue throughout the entire night (i.e., until after sunrise) for each night of sampling.

- 1 For non-linear projects: one site per 30 acres (12 hectares) of suitable habitat
- 2 For linear projects up to 328 feet (100 meters) wide: one site for each 0.6 mile (1 kilometer) of the project corridor that contains suitable habitat.

kilom eter) of the project

ANALYSIS OF RECORDED ECHOLOCATION CALLS

The analysis of acoustic ca

this guidance must be conducted with a USFWS- approved call identification software program. A list of approved programs will be available on the USFWS’s website at:

<http://www.fws.gov/midwest/angered/mammals/inba/inbasummersurveyguidance.html>

Interpretation of Acoustic Analysis Results

affairs acoustic

in the identification of Indiana bat calls with high levels of certainty (e.g., a maximum likelihood result of $P < 0.10$), then the project proponent should mist-net in an attempt to capture recorded bats, although instead, the option to assume the presence of a maternity colony exists. Additional survey work should follow the mist-netting guidance found in Appendix C. While mist-netting is encouraged immediately after acoustic surveys are completed, additional

survey work to capture and radio track Indiana bats can occur at any time within the mist-netting survey window. Additionally, if the data are endangered bat species (e.g., gray bats, *Myotis grisescens*), then the USFWS FO(s) in the state(s) where calls were detected should be notified immediately to determine if any additional survey effort for those species is necessary.

No permit is required to do acoustic surveys so the Service has no authority to request acoustic survey results. If the survey was conducted as a result of a development project, project proponents can simply hire as many “second opinions” as necessary. Due to the lack of permits required and any significant experience/training criteria necessary to complete acoustic surveys as written, the Service would be required to accept acoustic reports created by project proponents themselves, which possibly could be a conflict of interest.

SUBMISSION OF ACOUSTIC SURVEY RESULTS of acoustic surveys of Indiana bats, then the appropriate USFWS FO(s) must be notified within 48 hours by providing the project name, date, and GPS location(s) of positive detection.

No permit is required to do acoustic surveys so the Service has no authority to request acoustic survey results let alone a time frame. Confidentiality agreements do not allow consultants to share data on private property.

APPENDIX C PHASE 3 MIST-NETTING

SUMMER MIST-NETTING SEASON: May 15 – August 15

Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year during May 15 – August 15 confirms the presence of a maternity colony in the area. (Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to determine the presence or absence of a maternity colony or large concentrations of bats in the area when males and/or non-reproductive females are captured.)

PERSONNEL A qualified biologist(s) throughout the survey period,

-for capturing Indiana bats, (2) be p

I contend that selecting acoustic survey sites, ensuring high quality sound recordings, and responsibly interpreting acoustic results is actually MORE DIFFICULT than conducting the physical capture (mist net) surveys. If the Service has reason to believe widespread abuse of mist netting protocols and mis-identification of bats, the Service could simply ask each capture bat be photodocumented. There is no way to legally prove or disprove the species ID of a sound recording of a random free-flying bat echolocating above ~35 kHz that could be any one of at least nine species in the East. Therefore, not only should personnel conducting acoustic surveys have the knowledge base of “Qualified Bat Surveyor” but should also have additional criteria imposed to afford the Service some sort of assurance protocols are not being abused.

and (3) confirm all bat species identifications. This biologist may manage more than one mist-net set-up if the net-check timing (i.e., every 10 minutes) can be maintained while **walking** between nets (which is similar to managing two net set-ups at one net site in past guidance).

Qualified Biologists have an army of qualified technicians to conduct physical net checks, remove bats, complete data sheets. The Qualified Biologist needs to be responsible for quality control of this process, inspections, species ID, and is ultimately responsible for the function of the site. As written there is no longer a need to employ technicians and Qualified Biologists will be pressed to only do the bare minimum level of effort required. We understood the spirit of previous permit language stating that “a named permittee remain present at each mist-net site while it is being operated,” to mean that a named permittee oversee all bat-handling and identification activities. This included identifying *Myotis sodalis*, as well as ensuring the efficient, humane treatment of *all* bats captured and processed, and that bats are released back into the wild as soon as possible. As we know, mist-netting bats is much like fishing: long periods of watchful waiting punctuated by rare bursts of activity when an animal is encountered. Lately, the marked decrease in bat populations due to WNS has resulted in woefully low capture rates throughout the region. For mist-net surveys, this has dramatically increased the watchful waiting time while significantly decreasing the active catching time. In fact, it was not at all uncommon in 2011 to have one or more sites each night that failed to catch a single bat. In one of our surveys on 10 of the 16 nights, one or more sites reported no captures. Of the 76 monitoring efforts (38 sites,

each netted twice) 17 had no captures and an additional 17 had only one bat. Given the decreased capture rates throughout the season and in order to minimize our environmental impact, we selected several sites in very close proximity to each other which could be manned concurrently, with no site ever being left unattended, and all sites receiving proper oversight from permittees. This reduced our day-to-day disturbance on local wildlife for the duration of the project, while conducting as comprehensive a survey as possible in the area. Moreover, it has often been reported that capture rates decrease on the second-night of a 2-night, paired survey effort (see Robbins, 2008; Winhold, 2008), therefore experience gained during the first night at a site could help in making staffing adjustments for the second night's effort. Finally, to allow us to be effective with this multi-site approach each night, and because we realize that wildlife, especially bats, can be unpredictable, our entire team remains in constant radio contact should a need for immediate oversight arise at intervals shorter than our regular 10-15 minute net checks (i.e., should one net become unusually busy with multiple bats caught concurrently, or should assistance be needed with field equipment).

In summary, the Service should be concerned with bats being treated humanely, processed in a timely manner, and identified correctly and not so much concerned that a biologist with 35 years of Indiana bat experience is "walking between nets" instead of jogging, crawling, or skipping. I do not understand why there is questions concerning who is identifying bats and time between net checks. The precise staffing is logged on data sheets, detailing each night of the survey, the site surveyed, the person responsible for overseeing operations and identification during bat-handling, the agent(s) stationed full-time at the site who were responsible for each 10-15 minute net check, the travel-time between adjacent sites, the number of bats captured at each site, the average capture rate in bats-per-hour (bph), the number of bats that escaped at each site, and the approximate time each bat was captured. From this data it is easy to determine if the site was properly staffed or if the site may have been overwhelmed and additional resources were not properly allotted. Given all of the above, it is clear that some in the Service still do not believe a Qualified Surveyor can effectively supervise more than one net site (more than 2 nets). This would lead me to believe that there is some evidence that Qualified Surveyors have falsified datasheets in the past. The Service needs to consider that the acoustic monitoring requirements makes it *extremely easy to manipulate data* and they have left the protocol wide open for major abuse, misuse, and misinterpretation far greater than physical capture surveys ever were.