North American Amphibian Monitoring Program – Protocol Description

Route Creation

Routes are generated in a stratified random block design at USGS Patuxent Wildlife Research Center. Routes are then distributed to Regional Coordinators. These roadside routes are then groundtruthed to determine suitability (not too dangerous, not too noisy to hear) and stop placement. There are 10 stops per route. Two methods of stop placement are permitted: equidistant stops or stratified by habitat. In equidistant stop placement, each stop is 0.5 miles apart. When stratified by habitat, the stops are at least 0.5 miles apart and are located at wetland habitats. The wetland habitat should be appropriate potential habitat (pond, vernal pool, roadside ditch, etc) but the presence or absence of amphibians should not be used as a selection factor. Some alteration of the route may occur during groundtruthing, see Groundtruthing Guidelines section more information. Stop locations and any route alterations should be shared with NAAMP to keep route maps accurate and up to date. Once a route has been groundtruthed and the 10 stops determined the route and stops are not changed, unless exceptional circumstances occur, see Stop Inaccessibility, Stop Relocation, and Stop Retirement section of this document. In addition, some regions may have nonrandom routes that were created by other methods.

Seasonal Sampling Periods

Each state establishes three or four sampling periods to cover the calling phenology of its local species. States use three sampling periods, unless an additional period to target wood frogs is desired. The sampling periods are created to target the peak vocalization times for early-, mid- and late-season breeding amphibians and to assist observers in understanding when to collect data. A state may subdivide into regions and establish different sampling dates within these regions. Sampling periods may not overlap, but can be separated by an interval or begin and end on adjoining dates. To maintain regional consistency as much as feasible, states are provided with sampling periods used in neighboring states to consult when developing their own sampling periods. States are permitted to adjust the sampling dates each year to account for an early or late arrival of the calling season.

Nightly Sampling Conditions

A survey may begin 30 minutes after sunset or later. No matter what time a route is started, it should be completed by 1 a.m. Appropriate sampling conditions are based upon wind, sky, and air temperature conditions. For most regions the wind code should be at level 3 or less, but the wind prone Great Plains region is permitted to sample at level 4 or less. Surveys should not be conducted during heavy rainfall, but light rainfall is acceptable (sound of the rain may impair hearing ability).

The air temperature criteria are the minimum allowable temperatures, varying for each sampling period.

3 Run System	Minimum Temperature
Run 1	5.6° C (42° F)
Run 2	10° C (50° F)
Run 3	12.8° C (55° F)
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A regional program may choose to set higher minimum temperatures based upon regional phenology information.

Data Collection

Stops are conducted in numerical order, in one night by one observer. We encourage, but do not require, that one observer conduct all surveys of a route in a given year. Because some observers have assistants who may also wish to collect data, multiple observers are instructed to each fill out their own datasheet, separately and independently. One observer is the official recorder of the route whose data will be entered into the NAAMP database. All datasheets are returned to the Regional Coordinator for archival purposes. This “one observer per datasheet” rule allows each survey conducted to be of equal effort.

Observers record the time, sky code, and wind code, at the beginning and end of each survey to verify that the sampling conditions were met on the evening of the survey. At each stop air temperature is recorded to verify that sampling conditions were met on the sampling night; at least eight of the 10 stops must meet temperature guidelines. For Gulf Coast states that record air temperature only at the beginning and end of a survey, both temperature readings must meet these guidelines. Gulf Coast and Great Plains states require documentation of the last rainfall event, since possible routes should be conducted within 3 days of rainfall.

At each stop the observer listens for 5 minutes, and then records the amphibian calling index for each species heard. The 5 minute listening period has no initial waiting period. Starting in 2006, the observer also records the number of cars that passed during the listening period and whether the moon or moonlight was visible. Car counting may be conducted by an assistant. The observer indicates whether background noise impaired his/her ability to hear (most surveys use yes/no checkbox; some have adopted the noise index developed by Massachusetts). If there is a major noise disturbance, lasting one minute or longer, the observer may break the listening period to avoid sampling during the excessive noise. If such a time out is taken, this is noted on the

datasheet. After the major disturbance ends, the observer resumes listening for the time remaining. The time out should not be used for background noise.

Stop Inaccessibility, Stop Relocation, and Stop Retirement

1. Stop Inaccessibility: Temporary stop inaccessibility may occur for some transient reason (i.e. traffic accident blocks road access).
    a. If only one stop will be missed, then route can be considered complete. The observer should write on the datasheet which stop was missed and note why in the comments section. When entering the data into the database, mark the checkbox indicating which stop was missed.
    b. If more than one stop would be missed, the route should be re-run on another night.
2. Stop Relocation: Stop relocation is when a stop needs to be shifted to a new location, after the groundtruthing phase has occurred. During groundtruthing the permanent stop locations are set (see groundtruthing guidelines). Stop relocations should be a rare event.
    a. Stop relocation should only occur for safety reasons (i.e. route was safe before- or appeared to be, but perhaps a homeowner fired a gun in the air as warning to observer).
    b. Stops should NOT be relocated because of habitat loss or lack of calling amphibians at the site.
    c. To relocate (for safety reasons) a stop, the Regional Coordinator should use their best judgment on when it is necessary and where to relocate. If can be moved a short distance away, not impacting the 0.5 mile apart rule this is preferable. If that is not possible, then relocate by creating a new stop at the end of the route and renumbering all the stops. Keep a written record of when, why, and how a stop relocation occurred. If time permits we will build into the database a checkbox or someway to indicate that a route has had some post-groundtruthing alteration. When data are analyzed all the stops of a route are considered one unit (the route), so it is okay that the individual stops are renumbered.
3. Stop Retirement: Once the route has been groundtruthed and listening stations established, these locations are permanent and locations may not be changed unless a safety issue arises. If habitat destruction occurs at a listening station, and a local extinction of amphibians occurs, this is important information. To document habitat destruction the location should be surveyed for three seasons beyond the destruction date. After three seasons of non-activity, the listening station may be retired, and null data will be assumed for this site. A listening station cannot be retired merely because the wetlands are uninhabited by anurans. Retired stops should be visited periodically to verify that no suitable habitat exists, but five minutes of listening is no longer required.

Data Review Process

What checks on data collection and data entry will Regional Coordinators perform each year to ensure all data follows the same review procedures? Some checks and balances are incorporated

into the database design (pop-up warning boxes, etc), while others are procedures Coordinators will need to do. These procedures were adopted at the Nashville NAAMP Coordinators meeting.

1. **All data entered same way:** All datasheets will be entered "as they appear" and then "checked" for any errors. This pattern is obvious if the volunteer did the data entry, the Regional Coordinator would not be able to "check" the data before it was entered. This pattern should be followed, even for datasheets that the Regional Coordinator will enter. That way all data goes through the same data review process. Also, the database documents changes, so by entering the data "as is" and then making the correction, the database will have a record of the correction and why it occurred.
    a. The only exceptions are "simple obvious errors" such as the observer wrote 70 degrees and then marked Celsius (when meant Fahrenheit). The database wouldn't let you enter such an error anyway, so the Coordinator may make that "correction" during the data entry process. If any such corrections are made to data, then these changes should be marked on the datasheet. The change should be initialed on the datasheet and the reason noted.
    b. An example of an error that should not be changed during data entry is the observer wrote down they heard a species that you know was highly unlikely they heard (you will handle this during step three - documenting other changes).
2. **Manual check of data:** After data are entered (by Volunteer or Coordinator), there will be a manual check - comparing the electronic entry to the physical datasheet. This will help catch any data entry errors. If a data entry error is found, the correction is made and since the data are already in the database, the database will be able to keep track of who did the change and why. To indicate data has been through the manual check, the database has a checkbox to mark when you have completed the review for each run of each route (see the NAAMP Regional Coordinator Database Guide).
3. **Documenting other changes**: How do we deal with other potential errors (i.e. misidentification)? Rule: Do not change the data until you have conferred with the volunteers. If the volunteer agrees that they made an error, then the entry should be changed using the edit button. If the volunteer does not agree, then the data can be flagged as suspect data. In either case it will be documented by the database as to who is making the change (or marking as questionable) and why.
    a. Reasons for changing data will be designated as: observer error or data entry error.
    b. Reasons for questionable data will be documented as: questionable identification, observer uncertainty, outside known distribution, or outside phenology.
    c. More details will be available in the NAAMP Regional Coordinator Database Guide once the Data Review section is completed.
4. **Deadline**: Data entry and review should be completed each year by October 30th. Review includes the physical comparison of the datasheet to the data entry, viewing the flags created by the database, and any subjective questions/review by Coordinator. Having a deadline for when to finish entry and review is helpful for your fellow Regional Coordinators. It allows report generation to be complete: other states may want to use information from neighboring states in newsletters, etc. Having one deadline allows

everyone know when data should be finalized and available for use. Also, we can archive the year at that point. You can still enter a late datasheet after the deadline; it just will not be part of the year-end reports.

5. **Datasheet archiving**: State/provincial programs should maintain the original datasheets.

Observer Training

Volunteers receive training from the State Coordinators. Training covers how to collect calling survey data following the NAAMP unified protocols and identification of calling amphibians of their state or region. USGS provides State Coordinators with a PowerPoint presentation describing the unified protocol and how to collect data. States provide observers with local distribution and phenology information, to help observers learn what species are expected in their area and when they are likely to vocalize. States also provide observers with a training tape or CD-Rom to help them learn the vocalizations of the frogs and toads of the state. USGS has also created an on-line training resource, the Frog Call Quiz, where observers can practice and assess their frog call identification skills. Starting in 2006, observers need to take the assessment portion of the Frog Call Quiz (NAAMP Quiz) for their state or region and meet the detection index requirement each year. See the Frog Call Quiz section below for more information.

Frog Call Quiz

USGS has created an on-line resource, the Frog Call Quiz for observer training and assessment. The Frog Call Quiz includes:

- Frog Call Look-Up - a reference section where users can select species by common or scientific name to hear example frog calls and a description of the call. This section also includes state species lists.
- Public Quiz - a practice section where users can select a state and then receive a 10 question quiz. Each quiz session is unique, as the sound file library includes several hundred sound files for each state. Each sound file has one or more calling amphibians and users are asked to identify all species on the sound file. The public quiz provides immediate feedback and an opportunity to replay the sound files.
- NAAMP Quiz - an assessment section available for NAAMP participants only. Login required using the participants Route Number and Observer Number. As with the Public Quiz, each quiz session is unique and each question has one or more calling amphibians. The number of questions varies, depending on the number of species in the state or region. For the NAAMP Quiz, State Coordinators decide whether to have a state-wide quiz or regional quizzes within their state.

Starting in 2006, observers need to take the assessment portion of the Frog Call Quiz (NAAMP Quiz) for their state or region and meet the detection index requirement each year. Observers may retake the NAAMP Quiz as many times as needed to achieve this requirement. Observers are permitted to use any reference materials that would be used while collecting data (the quiz is "open book"). The minimum detection index is 65. The detection index is calculated as ((user's correct responses) - (misidentifications)) / (total possible correct identifications). Since

misidentifications are subtracted from a user's correct responses, wild guesses may lower the detection index. It is possible to have a negative value.

Ideally observers take the quiz as part of the beginning of their field season, to ensure the observers are ready to collect data. Since some southern states begin surveying in January, the Frog Quiz considers November and December as belonging to the next year's field season. Thus an observer can take the 2006 NAAMP Quiz as early as November 1, 2005 and as late as October 31, 2006.

State Coordinators may create route (and quiz) assignments at any time, but should make sure to do so for the coming field season before asking volunteers to take the NAAMP Quiz. The NAAMP Quiz checks the quiz assignments for the current year only and previous assignments will not enable a user to take the quiz. State Coordinators can refer to the NAAMP Coordinator Manual for more instructions on creating quiz assignments.

State Coordinators decide whether to have a state-wide NAAMP Quiz or to create regions within their state. The default is state-wide. States interested in creating regional quizzes need to provide to USGS: region names, species list for each region, and route list for each region.

The NAAMP Quiz will include all species of the state or region, unless a species is missing from the sound file library. The number of questions in a state or regional quiz must be equal to or greater than the number of species. For each quiz session, the program selects sound files based on the species list of the state (or region). Each state (or region) has several hundred sound files. Sound files are randomly selected to provide a variety of species. Rare species are treated the same as more common species and may appear more frequently on the quiz than what is expected on survey nights.

Data will not be used for population trend analyses or be publicly available unless the observer has met quiz requirements. Observers are expected to annually meet the detection index requirements. For observers who met the requirements in the previous year but were unable to take the quiz in the current year, their data will still be used in analyses for both years. Data will not be used for population trend analyses or be publicly available in the following circumstances: observer never takes the quiz, does not meet minimum detection index requirement for the current year, or goes two or more years without taking the quiz after having met index requirement previously.

Groundtruthing Guidelines

Placement of Stops Along Routes

You have a new route that has never been run. A provided map shows a set of initial roads, randomly chosen by the computer, but to complete the route 10 stops need to be established. The route needs to be groundtruthed during an early spring/late winter day to locate potential amphibian breeding sites that are within 200 meters of the road.

If the starting point is a potential amphibian-breeding site, then, that is Stop # 1. If not, then travel along the marked roads until a potential breeding site is found, this would be Stop # 1. To find Stop # 2, look at your car odometer and travel 0.5 miles. After traveling 0.5 miles begin looking for the next appropriate potential breeding site (which could actually be right there at this point); that becomes Stop # 2. This continues until all 10 stops are in place, described, and marked on the map.

The USGS NAAMP office has mapped each route; routes are approximately 15 miles long, which allows plenty of room for the placement of 10 stops, at least 0.5 miles apart. Once the route has been groundtruthed, please send a copy of any revisions to the USGS NAAMP office for re-mapping.

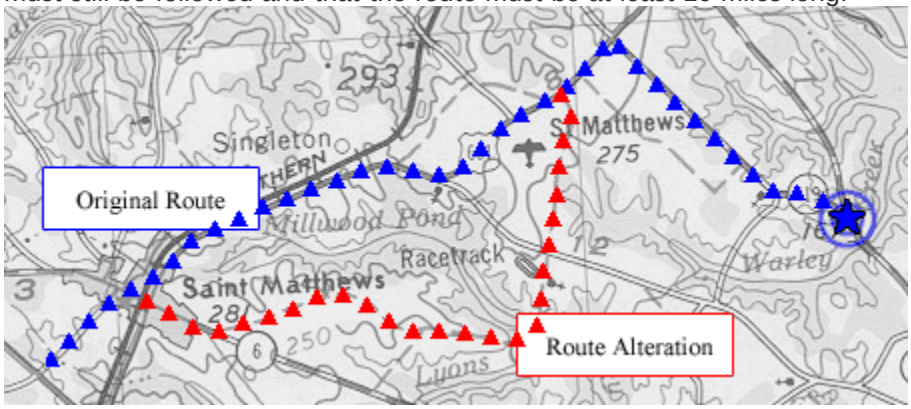
When might routes need to be altered?

Some example problems: road does not exist, road is private (no entry allowed), road too dangerous (due to traffic levels), or inability to hear (due to traffic or industry noise). All of these problems would require alterations to the route. Ideally, the Regional Coordinator would make any necessary alterations. When this is not possible, it is necessary for the Regional Coordinator to work with the volunteers to ensure the alteration guidelines are followed and to ensure duplicate use of roadways does not occur.

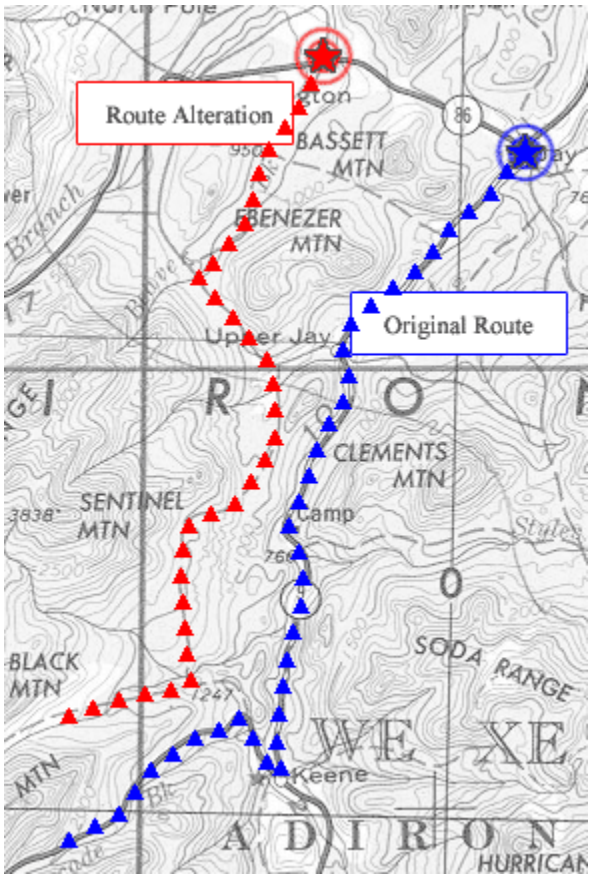
How to alter routes

When a route has been determined to require alteration due to reasons listed above, please follow the guidelines listed here to ensure proper substitution. The site generation includes a starting point and direction of travel, to maintain these parameters please alter routes by shifting to the nearest set of appropriate roads that travel in the same direction. Busy connecting roads can be used to bridge sections of “good” roads. Some hypothetical examples are included with this guideline to help interpret the flexibility and intent of route alterations.

Example #1: Partial Alteration. Sometimes it is determined that only a part of the original route needs adjustment. In this case, preserve the portion of the route that is appropriate and then look for an intersection or adjoining road with suitable conditions that allows the observer to avoid the inappropriate portion of the original route. This more suitable road may or may not reconnect with the original route. Remember that the same general direction of the original route must still be followed and that the route must be at least 10 miles long.



Example #2: Complete Alteration. During groundtruthing, it is sometimes found that the entire assigned route is placed on roads that are either too busy or too dangerous to listen for amphibians. In this case it is necessary to completely alter the route. Look for a smaller road that is close to the original road in order to alleviate the traffic noise/danger issues. It is very important that the new route run in the same general direction and have a starting location that is as near as possible to the starting location of the original route. The new route does not have to be 15 miles long, but it must run at least 10 miles to allow enough space for the 10 stops.



Index and Code Definitions

Amphibian Calling Index	
1	Individuals can be counted; there is space between calls
2	Calls of individuals can be distinguished but there is some overlapping of calls
3	Full chorus, calls are constant, continuous and overlapping

Beaufort Wind Codes	
0	Calm (<1mph) Smoke rises vertically
1	Light Air (1-3 mph) smoke drifts, weather vane inactive
2	Light Breeze (4-7 mph) leaves rustle, can feel wind on face
3	Gentle Breeze (8-12 mph) leaves and twigs move around, small flags extend
4*	Moderate Breeze (13-18 mph) moves thin branches, raises loose papers * Do not conduct survey at Level 4, unless in Great Plains
5**	Fresh Breeze (19 mph or greater) small trees begin to sway ** Do not conduct survey at Level 5 in ALL REGIONS

Sky Codes (numbers 3 and 6 are not used)	
0	Few clouds
1	Partly cloudy (scattered) or variable sky
2	Cloudy or overcast
4	Fog or smoke
5	Drizzle or light rain (not affecting hearing ability)
7	Snow
8*	Showers (is affecting hearing ability). *Do not conduct survey.

Noise Index*		
Massachusetts Noise Index	**Yes/No System**	**Definition**
0	No	No appreciable effect (e.g. owl calling)
1	No	Slightly affecting sampling (e.g. distant traffic, dog barking, one car passing)
2	Yes	Moderately affecting sampling (e.g. nearby traffic, 2-5 cars passing)
3	Yes	Seriously affecting sampling (e.g. continuous traffic nearby, 6-10 cars passing)
4	Yes	Profoundly affecting sampling (e.g. continuous traffic passing, construction noise)

*A regional program may choose whether ambient noise is documented in yes/no format or by using the Massachusetts noise index.