

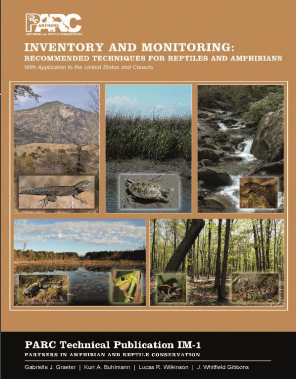
Techniques for Inventory & Monitoring of Amphibians

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Outline

- Why survey amphibians?
- Defining your goal
- Before selecting a technique
- Techniques
 - o Active
 - o Easy Passive
 - o Intensive Passive
- Limitations and Tips
- Resources



PARC Technical Publication IM-1
PRACTICES IN AMPHIBIAN AND REPTILE CONSERVATION
Gabrielle J. Graeter | Curt A. Satterman | Lucas R. Vervaeke | J. Winfield Gibbons

Why survey for Amphibians?

Why survey for amphibians?

- Amphibians are declining. A better understanding of a species' status = better ability to conserve the species and their habitat
- Need more information about distribution of many species
- To learn more about the life history (e.g., breeding times, growth curves, movement, clutch size)
- To answer important research questions



Defining your Goal

Defining the Goal

What is the Question?

- Identifying the species that inhabit a defined area or habitat? Therefore, there is a need for *presence* or *absence* data.
- Determining the geographic distribution of a species or group of species? Either among habitat types or across a defined region(s)
- Sounds like INVENTORY

Defining the Goal

What is the Question?

- Determine the status of a species at a given site or habitat? Therefore, there is a need for *abundance* or *density* data.
- Determine population changes in single species or species assemblages over time. Either at a given habitat, among habitat types, or across a defined region(s)
- Sounds like MONITORING

Inventory vs. Monitoring

- They are not the same (and probably should not be discussed in the same sentence)
- However, some of the techniques have overlapping uses

Inventory Comes Before Monitoring

First conduct an inventory

Based on the results discovered during the inventory process, further decisions are made to monitor particular species

Examples of species may want to monitor: those endangered, suspected in decline, vulnerable to land management manipulations

Value of Long-Term Monitoring

Just as the results of an *Inventory* will elucidate the needs and goals of a *Monitoring* program,

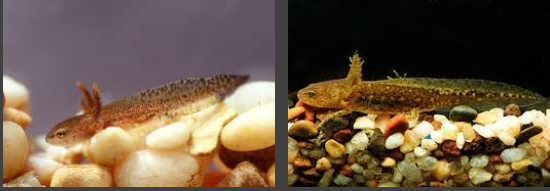
Repeated *Monitoring* may morph into a *Research* study

Points to consider before selecting Techniques

Before Selecting Techniques

- Know biology & life history of the species
- Know the habitats
- Consider natural environmental fluctuations
- Consider time, funds, and personnel available
- Account for influence of detectability

Species and life stages are sometimes difficult to distinguish



Species and life stages are sometimes difficult to distinguish

It is important to find all life stages so there are no misidentifications
Finding larva is important because you know they are breeding



Some species are boom or bust breeders

It is not uncommon for a species to not breed for multiple years, and then.....



Know the habitats

- Know the habitat types the species uses
- Complexity of the habitat
- Learn about how the species uses the habitat
 - Microhabitat selected? Woody debris, leaf litter, etc.
 - Above/below ground?
- Map the habitat to help with planning
- Size of the area to be studied



Habitat Mapping

- The first basic step in designing an inventory or monitoring plan is mapping out your habitat types
- Will help you identify the types of habitat present
- If you have GIS resources utilize them, if not, can use Google Earth
- Often very small habitat features contain a disproportionate amount of amphibian and reptile diversity
 - Seeps
 - Streams
 - Wetlands
 - Rock outcrops
 - Etc.

Natural Environmental Fluctuations

- Activity & reproduction of a species varies with natural environmental fluctuations
- Fluctuations occur at small scales (local thunderstorms) and at larger seasonal and annual scales
- Examples: precipitation, temperature, humidity, drought, hurricanes

Seasonality Affects Sampling

- Immigration
- Calling by adults
- Egg deposition
- Larval period
- Metamorphosis
- Emigration

Seasonal wetlands hydrology



Dry Bay – Summer 1993





Be realistic

- How much time do you have to devote to this?
- Is funding a limitation? What is the budget?
- How many personnel are available?

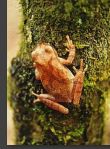
Detectability – the probability of finding a species given some unit of search effort.

- A lot of herps have a very low detectability, so to have any chance of finding some rare species you must have a lot of effort (sometimes years) before you can confidently say it is not present

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Detectability is influenced by...

- Unpredictable seasonal events – droughts, cold winters, heat wave, heavy rains, etc.
- Reproductive cycles - some species may only be detected during their brief breeding season
- Landscape and habitat – complexity, won't find a species if habitat not present
- Current weather: relative humidity, barometric pressure, cloud cover
- Air, water & substrate temperature
- Soil moisture & rainfall
- Moon brightness
- Diurnal v. nocturnal activity



Techniques

Sampling techniques

3 broad categories of techniques

- Active sampling
- Easy passive sampling
- Intensive passive sampling

For most studies it is likely you would need to combine techniques for best results

- You can almost never document all of the diversity in an area using a single category of sampling techniques

Design component

Time constrained

Time constrained - A predetermined time is chosen

of observers X time sampled; for catch or visual encounter

- You can also predetermine if you are looking for not only a certain species but for a specific life stage, sex, size, or characteristic

What this tells you

- Presence
- Life history info - e.g. when eggs are deposited
- Species habitat info
- A rough estimate of population size (not actual size, but for comparison)



Area constrained

Area constrained- a defined amount of habitat is selected for sampling

- Randomly selected plots
- Certain habitat types- ponds, cave entrances, etc

Same strengths and weaknesses of time constrained but you can also get a very crude estimate of density

Must be wary of different sized habitats if you go the habitat type route







Transect Surveys

Transects- a survey line length is selected and combined with a detection method

Very versatile- for example, here are some detection methods that can be used

- Visual encounter
- Flipping cover objects within 1 m of transect
- Counting egg masses in a pond
- Etc.



Active Sampling

Active Sampling



Active sampling is easy to use

- Very effective for species that are easily seen or that leave traces of their presence (egg masses, burrows, etc.)
- Not effective for some species, especially if staff are not experienced

The most basic form is presence-absence searches

- Search a habitat and if you find a species you know it's there (obviously)
- Presence/Absence tells you very little about population sizes and other population parameters (e.g. growth, decline, etc.)
- A good tool to get people involved in your program (e.g. Bio Blitz) but not good as the only tool



Active sampling includes:

- Hand collecting
- Sign and tracking
- Visual encounter surveys
- Dipnetting and sweep samples
- Kick sampling
- Egg mass counts
- Snorkeling surveys
- Electroshocking
- Auditory surveys
- Road cruising

Hand collecting & Sign and Tracking

• Hand Collecting – capture via hand or tools (snake hooks, long-handled dipnets). May involve looking through leaf litter, under logs, or behind bark.

- Important to leave searched habitats as undisturbed as possible – put rocks and logs back



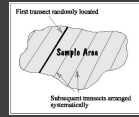
• Sign & Tracking – may locate them by following distinctive footprints, locating recently used burrows, hibernacula, or nests and by identification of scat

- More useful with reptiles than amphibians



Visual Encounter Surveys

- VES is a time-constrained method: observers sample a pre-defined area
 - Time and # of observers must be recorded
 - Differs from Transect survey in that does not have to be linear



3 VES Sampling Designs:

- Randomized walk – use a series of compass directions, distance.
- Quadrat – systematically survey by walking parallel or diagonal pathways
- Transect – linear transects are established and walked by observers.

Dipnetting

- Definition: A net is swept through an aquatic habitat
 - Mesh size is important

Most useful:

- In small shallow aquatic habitats (smaller area means greater chance all species present will be captured)
- When searching for evidence of reproduction

- When doing Inventory, must search as many microhabitats as possible

- Timing: should coincide with when species are most likely found in aquatic habitats (breeding, larval seasons, etc.)



Sweep samples

Sweep samples- sweeping a large dip net through the water column or submerged detritus to capture submerged individuals

- Usually amphibian larvae and breeding adults

Total # of sweeps per area and # of individuals captured are recorded

Example- 5 dip net sweeps on the edge of a pond every 15 meters

What this tells us

- Larval species present at that time
- Life history traits such as when eggs are deposited and when larva develop
- Habitat info
- Microhabitat preferences
- Density



Kick Sampling

- Definition: Lifting and removing all loose cobble from stream bottom and hand raking or kicking loose pebbles into a net or series of nets.
 - Can do Area or Time-constrained
- Nets used:
 - D-frame nets most commonly used
 - Seine nets can be used to capture missed individuals
- Remember:
 - Always replace any large habitat items ($\geq 200\text{mm}$ cobble, woody debris)
 - Timing – when species present, when water flow/depth is suitable
- Can determine occupancy and abundance



Egg Mass Counts

- Searching a pond/wetland/stream for globular masses or strings of eggs
- Useful to have more than one observer to help with detection
- Keep in mind that one egg mass may contain eggs from more than one female AND that one female may deposit more than one egg mass in a breeding pond
- Some amphibians lay eggs on dry ground (e.g., marbled salamanders, *Ambystoma opacum*)



Egg Mass Counts



Wood frog

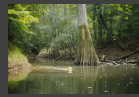


Spotted salamander



American toad

Snorkeling

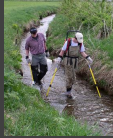


- Useful in aquatic environments with clear water conditions
 - May be done at night or day (depending on activity of target species)
 - E.g., Hellbender salamanders
- Sampling:
 - Can have a permanently established transect line - for monitoring
 - In deep water, SCUBA may be needed
- In some cases, substrate may be moved, but this can be detrimental to habitat and should be avoided for long-term studies or with a species of conservation concern.
- Safety:
 - Can be dangerous if strong currents, very cold water, or slippery rocks
 - Must not be done alone



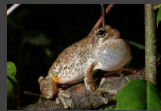
Electro-shocking

- Use high currents of electricity to temporarily stun aquatic animals
- Primarily used for fish, but also aquatic amphibians, mostly salamanders
- Current – AC, DC or DC pulsed
 - Use of DC pulse has less lethal effect on amphibians
 - DC pulse most effective for drawing hiding animals out
- Most effective:
 - In water not exceeding 1 m depth
 - Used successfully to survey: hellbenders, sirens, mudpuppies
- Utility:
 - Pros: Can find hard-to-find species, quick, less habitat disturbance
 - Cons: Physiological impact to animals, expensive, potentially dangerous
- Tips:
 - Do not use during egg deposition and nesting (Sept-Nov) especially when species of concern are present (hellbenders)
 - Good for inventory. Do not use for monitoring.



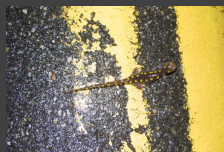
Auditory surveys

- Call surveys- some species of frogs are only easily detectable by hearing their call
- Are training programs online: NAAMP
- Provide info on
 - Inventory of species composition
 - Breeding times
 - Male abundance
 - Climatic conditions that lead to breeding
 - Location of breeding ponds



Road cruising

- With Amphibians, most useful in areas where the road bisects or is peripheral to a body of water with species that are moving between breeding and/or foraging locations.
- Timing is important – heavy precipitation and warm weather
- Are biases associated with method (e.g., roads affect populations, some species will avoid roads) so should pair with other techniques



Road Cruising

- Get a positive I.D.
- Picking up road-killed specimens
- Scientific use of otherwise wasted individual



Constraining Effort

- Constraining effort can help make active sampling more useful
 - Time constrained (results are reported as # of species/individuals per person per hour)
 - Area constrained- a defined amount of habitat is selected for sampling
 - Randomly selected plots
 - Same strengths and weaknesses of time constrained but you can also get a very crude estimate of density
 - Example: Sweep net sampling (# of sweeps per person per species)



Easy Passive Sampling

Easy Passive Sampling

Easy passive sampling requires no observer effort and causes no harm to animals

Basically it is putting out habitat-like contraptions that might attract amphibians, but won't trap them.

- Cover boards
- Leaf litterbags



Easy Passive surveys includes:

- Artificial cover
- PVC Pipe surveys
- Leaf litterbag surveys
- Automated recording systems

Artificial Cover – “coverboards”

Target Species

Advantages and Disadvantages

Useful for Monitoring

Tin vs. Wood (plywood vs particle board)

Placement of Arrays

Flagging

Numbering



Coverboards

<p>PROS</p> <ul style="list-style-type: none"> Suitable for variety of species Excellent for salamanders and small aquatic snakes Do not restrict animal movements- don't have to be checked daily 	<p>CONS</p> <ul style="list-style-type: none"> Time to install Unightly appearance? Catch rate relatively low Capture success subject to immediate weather conditions
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Four-toed salamander
Hemidactylium scutatum

Picking the array pattern best suited for your *habitat*

COVERBOARD MATERIALS

Consider the pros & cons

Paper by Grant et al. 1992

Materials for creating artificial cover

Plywood 1/2 inch thick or greater. 2' x 4' or 4 x 4' are workable sizes.

Pros: Good insulation. Effective in warm to hot weather. Lasts 2-4 years in the field.

Cons: Expensive. Heavy.

Galvanized roofing tin comes in various lengths, usually about 2ft wide.

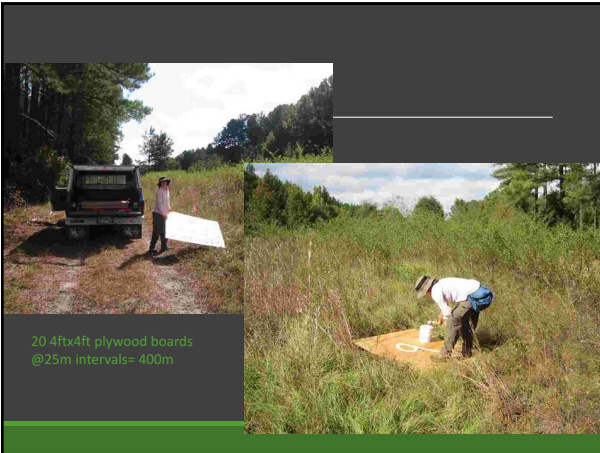
Pros: Lasts 20 years or more in the field - even in water. Effective in cooler weather. Relatively lightweight.

Cons: Too hot in summer. May be somewhat costly.

Tar paper comes in long rolls to 50 ft

Pros: May be cut into sections of the desired length. Lightweight. Inexpensive.

Cons: Hot in summer. Breaks down in water.





Sampling Arboreal Species

They won't stay in the bucket!



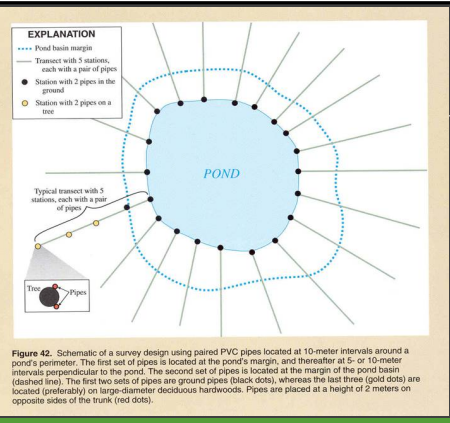
Barking treefrog (*Hyla gratiosa*)

PVC Pipes

Can create PVC pipe habitat for tree frogs

- Can be attached to trees, stakes, or stuck directly in the ground





Leaf Litterbag surveys

- Plastic netting with 1.9cm mesh, small rocks placed on the netting and covered with leaves and cable ties bind it together – many variations
- Can be used to sample for stream-dwelling salamanders
 - Especially useful for detecting presence of more rare and elusive species
 - Larval salamanders (bag must be submerged completely)
- Bags placed in stream at regular intervals – weighed or staked down so can't float away
- After acclimation period, each bag is checked for salamanders (details in Graeter et al. 2013)



Automated Recording Systems: "Frogloggers"



Frogloggers -- Pros:

- Explosive breeders that are missed with other surveys
- Good for remote or inaccessible sites
- Vouchers



• May reveal novel behaviors

Frogloggers -- Cons:

- Somewhat expensive
- Time consuming and tedious to listen to recordings
- May be more involved than necessary for inventory



Intensive Passive Sampling

Intensive Passive Sampling

Creating traps that amphibians and reptiles cannot get out of without assistance

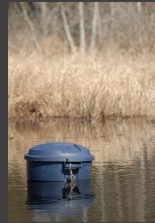
Only for the very dedicated

- Labor, time, and financially expensive
- Traps must be checked regularly to avoid harm to the animals captured
- You must be prepared to get things out of traps that you might not have intended to catch



Intensive Passive includes:

- Aquatic and terrestrial funnel trapping
- Terrestrial drift fences and pitfall traps



Funnel Trapping

- *Labor, time, and financially expensive
- *Traps must be checked daily to avoid harm to the animals captured
- *Trap types:
 - Aquatic Funnel traps: minnow traps, trashcan traps, hoop traps
 - Terrestrial: wire hardware cloth cylinder or wooden box traps
- *Inventory vs. Monitoring:
 - Good for inventory, but must use a lot of traps, sample all habitat types, and trap in multiple seasons
 - Monitoring – must standardize scheme so can repeat it and allow comparison of capture rates over time.

Funnel Traps

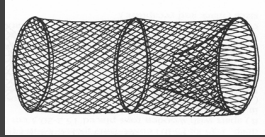


Figure X.X. Basic terrestrial funnel traps can be constructed from a cylinder and two cones made of hardware cloth.



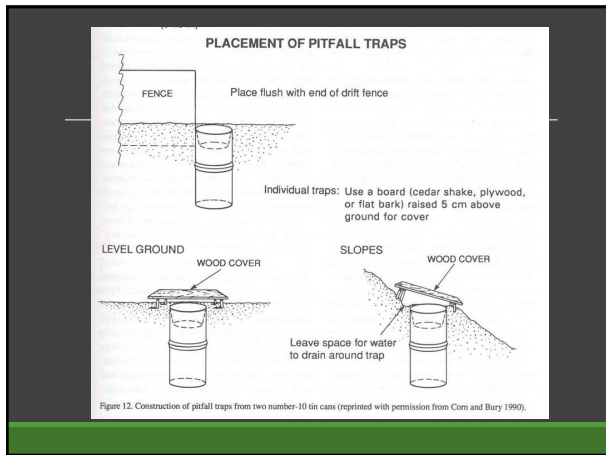
Drift Fences

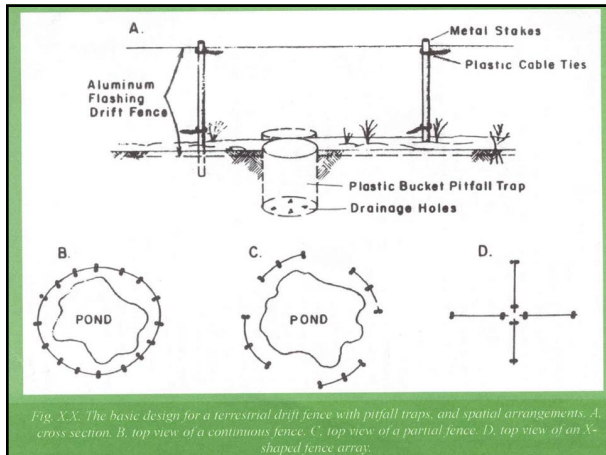
Essentially a wall that the individual walks up to and then along. The wall leads them to one of a variety of traps

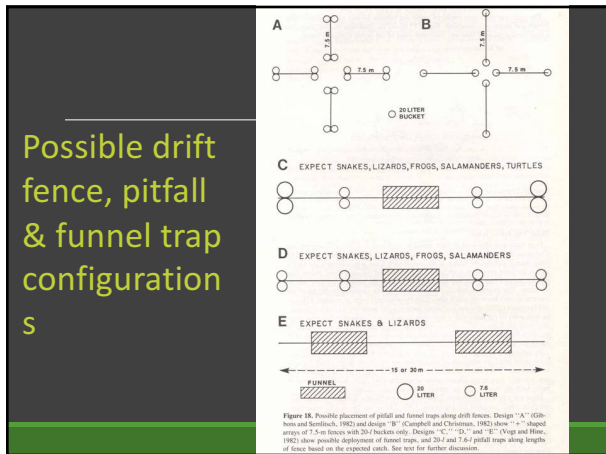


DRIFT FENCES









Drift Fence Concerns

- Too much rain
- Too hot
- Fire Ants
- Personnel to check- holidays, weekends
- Raccoons
- Too many captures to deal with!
- Monitoring can cost \$\$

Limitations & Tips

Techniques have Limitations

- Each technique has underlying assumptions, biases and limitations.
- Unlikely that one technique can be used to sample an entire community
- There are human based constraints (money, people, time) -- be practical

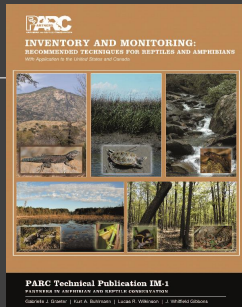
Tips:

1. Use several methods
2. Know the species – identification, natural history
3. Consider timing and seasonality
4. Habitat and microhabitat is key
5. Consult with experts
6. Get hands-on training

Resources

PARC Products

All available on Amazon!



Techniques Table – very useful when deciding which techniques to use



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Questions?