Monitoring Protocol for Larger Vernal Pools

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Applicability

- Population estimates for long-term monitoring with repeated surveys during the season
- Pools where studies from the perimeter are not sufficient
- Designed for individual vernal pools (not regional inventory of pools)

Objectives

- Egg mass and larvae population estimates
- Determine presence/absence of obligate and facultative species
- Identification of independent variables affecting population
  - Observational factors
  - True population factors

Protocol Overview

- Random parallel transects marked with rope
- Egg mass counts for each m^2 on the transect
- Double observer procedure
- Relevant parameters that could impact observation quality
- Environmental factors that could influence vernal pool productivity
- Periodic dip net samples for larvae and macro invertebrates

Monitoring Protocol

(Description of what to do is green and discussion of why to do it is blue)

Transects defined perpendicular to the long axis of the vernal pool at random intervals

Random spacing gives equal probability of sampling any location in the pond so extrapolating from sample to total population is statistically valid.

Transects across narrow dimension of pool

Survey is easier to conduct along shorter dimension.

Transects marked with stakes every 5 m labeled with location and connected with rope.

Allows observer with meter stick to easily determine which egg masses are within 1 meter of the transect

Rope marked every meter with color coded tags

Supports recording of egg mass count for each square meter. Color coding provides visual match to data sheet to confirm correct location. Colored plastic cable ties attached between the strands of rope were used.

Only walk on the side of the rope opposite where egg masses are counted

Minimizes disturbance of pool, decreases clouding due to stirred up sediment

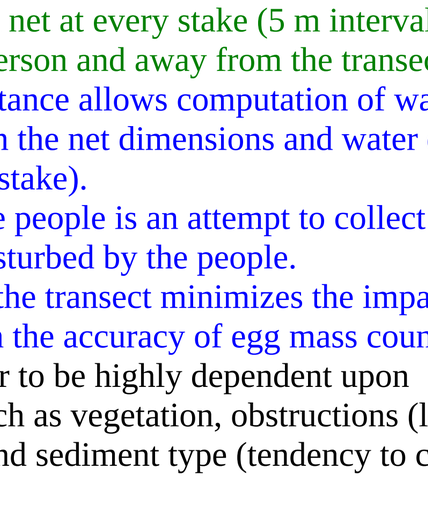
Water depth recorded every 5 meters (at stake)

- Water depth allows for a depth-weighted estimate of population.
- 5 m intervals balanced measurement effort and observed low slope.
- Why is depth recorded at stake?
  - Well defined, repeatable position
  - Easy reminder for observers to measure
- With repeated measures, the topography should be consistent, (i.e. for each pair of points, the difference in water depth should be constant regardless of the absolute depth), providing for quality control. Fewer depth measurements are needed for subsequent measurements after consistency is observed.

Transects defined for maximum pool extent.

Must define enough so there is a statistically significant number of samples even when the pool is at less than full size.

This means there may be more transects than available labor to sample all when pool is full. Select transects using one of the following:



Outline of vernal pool at maximum extent, showing transects as marked for 2008 study. North end marking is incomplete since that portion of the pool is the last to fill.

Random selection

Disadvantage — may not select same transects as prior survey reducing direct comparison of plot to plot over time. Could be overcome by selecting the transects in the sequence in which the random numbers originally defining the transects were generated.

Stratified Random selection

Would be important if there is obvious variation in the pool. (In our case, the pool has two distinct sections.) Transects should be randomly selected from each of the areas instead of from the whole pool to avoid an unintended over– or under-sampling of an area.

Dip Net Protocol

Sample 1 m length with net at every stake (5 m interval). Take sample in front of the person and away from the transect rope.

- Sampling for a set distance allows computation of water volume sampled given the net dimensions and water depth (also measured at the stake).
- Sampling ahead of the people is an attempt to collect from an area not already disturbed by the people.
- Sampling away from the transect minimizes the impact of stirred up sediment on the accuracy of egg mass counting.

Procedure details appear to be highly dependent upon pool-specific factors such as vegetation, obstructions (logs, etc), floating material and sediment type (tendency to cloud the water).

Double Observer Protocol

- Pairs of people work together.
- The first points out and counts the egg masses
- The second records the count from the first person and silently notes the number of egg masses missed or double counted.
- Half way across the transect, the pair exchange roles.

  Having two counts allows for statistical analysis of the amount of error in the counting process.

*Grant, E.H.C., et al., "Double-observer approach to estimating egg mass abundance of pool-breeding amphibians". *Wetlands Ecology and Management*, 2005. **13**: p. 305 - 320

Observational Factors

Duration of each transect

Wind speed (Beaufort scale)

Ripples on water surface could reduce visibility

Sub-surface visibility factors:

- Water turbidity (Secchi depth or turbidity tube measurement)
- Time of day (ideally the same if repeated)

  Variation in solar angle and reflections
- Sky cover (percent leaf coverage) photo

  Coverage can also decrease GPS accuracy.
- Clouds and solar radiation level

  PAR value available for our site

Population Factors

Water quality:

pH, dissolved oxygen, nutrients

Weather related:

Soil, water and air temperature, precipitation, humidity

Vernal Pool Size

Needed to extrapolate sample to population estimate.

Two measurements

- Distance of water along each transect
- GPS track around perimeter of pool

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