Sampling Considerations and Strategies

1 Four kinds of sampling schemes for observational studies:

(1) haphazard sampling, (2) judgment sampling, (3) search sampling, (4) probability sampling
(Morrison et al Fig. 3.1)

2 Haphazard sampling

Philosophy: "any sampling location will do."
– often justified by time, budget, logistic constraints
– effectively encourages sampling at convenient locations (e.g., near roads) or times
– appropriate w/ assumption: target population completely homogeneous
assumption not valid in most wildlife studies
–> Result often biased estimates of population characteristics
Examples: roadside surveys of wildlife sex, age ratios,
study areas adjacent to field stations
streamflow, fish or waterfowl counts @ public access points, etc

3 Judgment sampling

Assumes: researcher can select sites representative of study area or population
Outcome: if researcher very knowledgeable, can give accurate estimates of pop. chars,
even if all population units can not be assessed.
But, while subjective sampling can be accurate, degree of accuracy difficult to determine

Haphazard sampling & Judgment sampling can be appropriate for preliminary study/reconnaissance, but not to provide data for statistical inference.

4 Search Sampling

Requires historical knowledge /data where focal resources exist
(e.g., sea bird nest colony locations prior to oil spill)
Value of data depends on accuracy of info determining where/when to search
Most effective when search locations/times derived from long-term inventories

5 Probability Sampling

Samples selected w/ known likelihood of being chosen [= P(selection)]
Known P(selection) => sampling theory can be applied to draw statistical inferences
Randomization necessary
Examples of probability sampling:
Simple random sampling
Stratified random sampling
Random start systematic sampling
Sequential random sampling

5.1 Simple random sampling

Each sample site (unit) selected independently of others
Sampling without replacement (later – after measurements – can use replacement)

Study region/period (frame) must be completely covered by
distinct, non-overlapping units (some of which will be selected)
Advantage: random sampling has simple mathematical properties
Disadvantages: random locations often more clumped/patchy than expected
w/ small sample sizes, entire regions may be underrepresented
Conc:
use random sampling only if study area very homogeneous wrt variables of interest

5.2 Stratified sampling (Morrison et al Fig. 3.2)

Purpose: increase likelihood that sampling effort distributed among import.subdivisions (strata) of study area/pop/period
Advantages (wrt random sampling):
Increased precision
Greater efficiency
Independent population estimates from each stratum
Allows sampling different areas in different ways => cost savings
Disadvantage: analysis more complex
First identify strata
Then select units w/in strata, usually by random or systematic process
Strata characteristics:
Must not overlap
Must include all areas of interest
No study site/unit can belong to >1 stratum
Strata are homogeneous (ideally) wrt variable(s) of interest
– in practice, stratification based on variables strongly correlated w/variable of interest
Boundaries must not change (e.g., boundaries based on topography, not habitats)
Allocation of effort: larger sample in given stratum if:
(1) stratum is larger
(2) greater variability w/in stratum
(3) sampling w/in stratum less expensive

5.3 Systematic sampling

Population can be listed in order wrt some characteristic, or spatial area well-defined
Ordered list: sample every k^{th} item on list
Spatial sample: systematic grid of points (units)
Result: uniformly distributed sampling effort
Unbiased systematic sample if use random starting rule (1^{st} point selected at random)
Advantages:
(1) easier than random sampling
(2) may be more representative/precise than random sample,
bc uniform coverage of entire population

References: Morrison ML, et al. 2001. *Wildlife Study Design*. Springer-Verlag, NY.
Ch. 3: Sampling Strategies: Fundamentals Ch. 4: Sampling Strategies: Applications
Thompson WL et al. 1998. *Monitoring Vertebrate Populations*. Academic Press, San Diego (ch. 2)