FRAMEWORK FOR DESIGNING SAMPLING PROGRAMS

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Management agencies have often underestimated the intellectual effort required to design and operate monitoring programs, and have been unprofessional in their on going scrutiny of the outputs of these programs. Some Scientists also have often not spent sufficient effort designing appropriate field sampling to enable hypotheses to be adequately tested.

We see sampling and monitoring issues to be an interesting science in their own right, and one where significant payoffs can be achieved. We have outlined a process which we believe leads to cost effective sampling in that the data are useful for considering some specified question. The main points to be considered when designing a sampling program are summarised in Figure 1.

Considerations when Planning a Sampling Program

1. Has the problem/reason for sampling been clearly stated?

2. Are specific objectives:

    - clear and concisely defined
    - sufficient to specify what is to be achieved
    - specific enough to indicate when each stage is complete.
    - Agreed between the users of data and the collectors

3. Has a conceptual model of the system been made explicit and agreed?

    - have the study boundaries been agreed?
    - has the length of study been agreed?
    - has the scale of the study been agreed?

4. Have appropriate indicators been identified?

5. Have testable hypotheses been established?

    - will data from different sources be compatible?
    - will data collected yield information to test the hypotheses?
    - are statistical procedures clearly identified?
    - are the assumptions of the proposed statistical tests met?
    - has the smallest differences to be detected been specified?

6. Have the potential sources of variability been identified?

   - Are there sufficient stations to accommodate variability?
   - On what basis is frequency of sampling proposed
   - are there procedures to identify, measure and control errors?

7. Does the sampling device collect a representative sample?

   - how are samples to be preserved before analysis
   - have sampling protocols been written for samplers?
   - can the integrity of the sample be guaranteed?

If you cannot specify what is to be achieved, then sampling issues are hardly important. Measure what you like, when and where you like it. Don't expect these measurements to be interpretable and don't expect taxpayers to pay for them.

Professionalism involves helping the client understand the observed symptoms or phrase the critical question. It involves using state of the art physical and statistical tools to collect information that can be interpreted using a conceptual, deterministic or stochastic model of some sort. Professionalism also involves critical reflection on the whole sampling process to ensure cost effectiveness and to manage errors so they are kept within known and acceptable limits.

SCHEMATIC FOR DESIGNING A MONITORING PROGRAM