Field Sampling Techniques: Fact Sheet

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What do field scientists do — and why do they do it? Scientists have specialized methods or techniques that they use to gather data in the field about individuals, populations or communities. Good scientific technique is essential and must produce results that are both unbiased and representative of what is happening in the entire study area. This fact sheet serves as an overview of some of the common sampling techniques used by scientists to monitor rocky shores.

1. SUBSAMPLING: Is it possible to determine abundance of mussels, snails or limpets by counting all of the individuals on an entire rocky reef? In almost all cases, the answer is no. So subsampling (taking smaller samples as a subset of a larger potential sampling area) is performed to provide an estimate of abundance.

a) Tools Used: Scientists use different tools such as transects and quadrats to subsample an area.

b) Purpose of Tools: Different tools all serve a slightly different purpose with the common goal of providing a standardized way to conduct field sampling. Transects are simply lines of a known length (e.g. a measuring tape) laid out across the sampling area. Transects serve as a baseline for placement of other types of sampling tools such as quadrats. Each of these tools is of a known size so that scientists can determine how much of an area was sampled.

c) Application for LiMPETS Rocky Intertidal Monitoring: Think of how challenging it would be to identify and count all of the different species at the rocky shore! To avoid this time consuming (and nearly impossible) task, you will subsample a smaller part of the rocky intertidal using transects, quadrats, and permanent plots.

2. REPLICATION: taking more than one sample in a given sampling area. Scientists take more than one subsample in a given location in order to make sure that their samples represent the actual number of organisms in a given area and that the number they got didn't happen just by chance.

a) Representative Sample: By using the tools and techniques described above, scientists collect data from multiple samples in one location. Together these samples constitute a representative sample, in that it accurately represents what is happening in a given area. When a representative sample is obtained, this information can then be applied to the rest of the sampling area.

b) Application for LiMPETS Rocky Intertidal Monitoring: Let's say that your class is sampling at the rocky intertidal. You want to know how many purple sea urchins are in the area. You count urchins within one quadrat, randomly placed in a permanent area, and find 15 urchins total. You count urchins in 4 more quadrats, and this is what you find: Quadrat 2 = 0 urchins, Quadrat 3 = 1 urchin, Quadrat 4 = 0 urchins, Quadrat 5 = 2 urchins. You can now determine that Quadrat 1 with 15 urchins is not consistent with what you found in other quadrats. This doesn't mean that you shouldn't use this sample, by all means it should be included; however, in order to get a representative sample, you need to sample enough times in one location to address the variability that is characteristic of most rocky intertidal communities.

3. STANDARDIZING DATA: a calculation made with data that takes into account the size of the area where the samples were collected and provides a way for scientists to compare samples across locations and research projects. For example, if you counted 20 ochre sea stars in a given

area, it is important to note the size of the area you sampled. Did you find 20 sea stars in an area $10m^2$, $50m^2$, $100m^2$? The size of your study area can make a big difference when trying to determine the population sizes of a particular organism.

a) Calculating Abundance: In order to be able to compare samples of the same type of organism from research projects conducted by different groups of scientists, there needs to be a common way to standardize data — or calculate how many organisms there are in a particular location. We call this calculating abundance. Abundance can be calculated in many ways. A common abundance calculation (e.g. for sea stars) = # of stars/area sampled.

b Application for LiMPETS Rocky Intertial Monitoring: In the case of sea stars and other relatively large invertebrates at the rocky shore, scientists often report findings:

Abundance = # of stars / square meter (m^2)

4. DATA ANALYSIS: The goal of data analysis is to organize your data into tables and graphs and look for patterns. Your analysis revolves around the questions you are asking and the independent and dependent variables you are testing. By analyzing your data, you are looking for ways that independent variables (e.g. water temperature) affect the dependent variables (e.g. mussel abundance) that you are interested in researching.

a) Baseline Data: Analyzing data and looking for patterns allow scientists to find evidence to support or refute their hypotheses. This evidence is not conclusive (in other words, it's not the final answer) but adds to the knowledge base that scientists have about a particular organism. An accumulation of evidence and information about an organism (e.g. life history patterns, population dynamics) allows scientists to establish baseline data about a population of organisms.

b) Application for LiMPETS Rocky Intertidal Monitoring: Baseline data concerning the abundance and zonation of algae, sea stars, mussels and other organisms allow scientists to know what is normal for the organism under natural conditions. If scientists understand the natural ups and downs (the variability) in a system, they can then determine if something about the organism has changed over time. Gathering baseline data requires repeated samples in a variety of locations where the organism lives over the course of many years. The data you collected as a class contribute to what we know about the 'the baseline' for many organisms living along rocky shores throughout California.

5. POPULATION SAMPLING TECHNIQUES: There are many ways that scientists can estimate the abundance of organisms. In our case, transect lines, quadrats and permanent areas are used to estimate abundance in standardized ways. For large invertebrates that can be easily counted, abundance is calculated as the # of individuals/ m^2. These data can then be used to estimate abundance at a particular location and compared over time at the same location and between different locations.

Scientists use different methods to estimate abundance for organisms living in different environments, like the open ocean. Think about scientists trying to estimate the abundance of tuna in the Pacific Ocean. Using quadrats would obviously not work very well. Different types of environments present unique challenges for estimating populations sizes. How might you sample organisms that live in a marsh, deep in the mud, or in dark caves? Additionally different types of organisms present challenges based on their lifestyle characteristics. For example, think about the different methods required to research the population sizes of particular species of birds, fish, insects, and mammals with large ranges (e.g. wolves). Both different environments and different lifestyle characteristics of organisms create the need for various sampling methods. These challenges allow scientists to be innovative and creative in their work as they design new ways to estimate population sizes or modify existing methods that will work in their particular sampling environment.