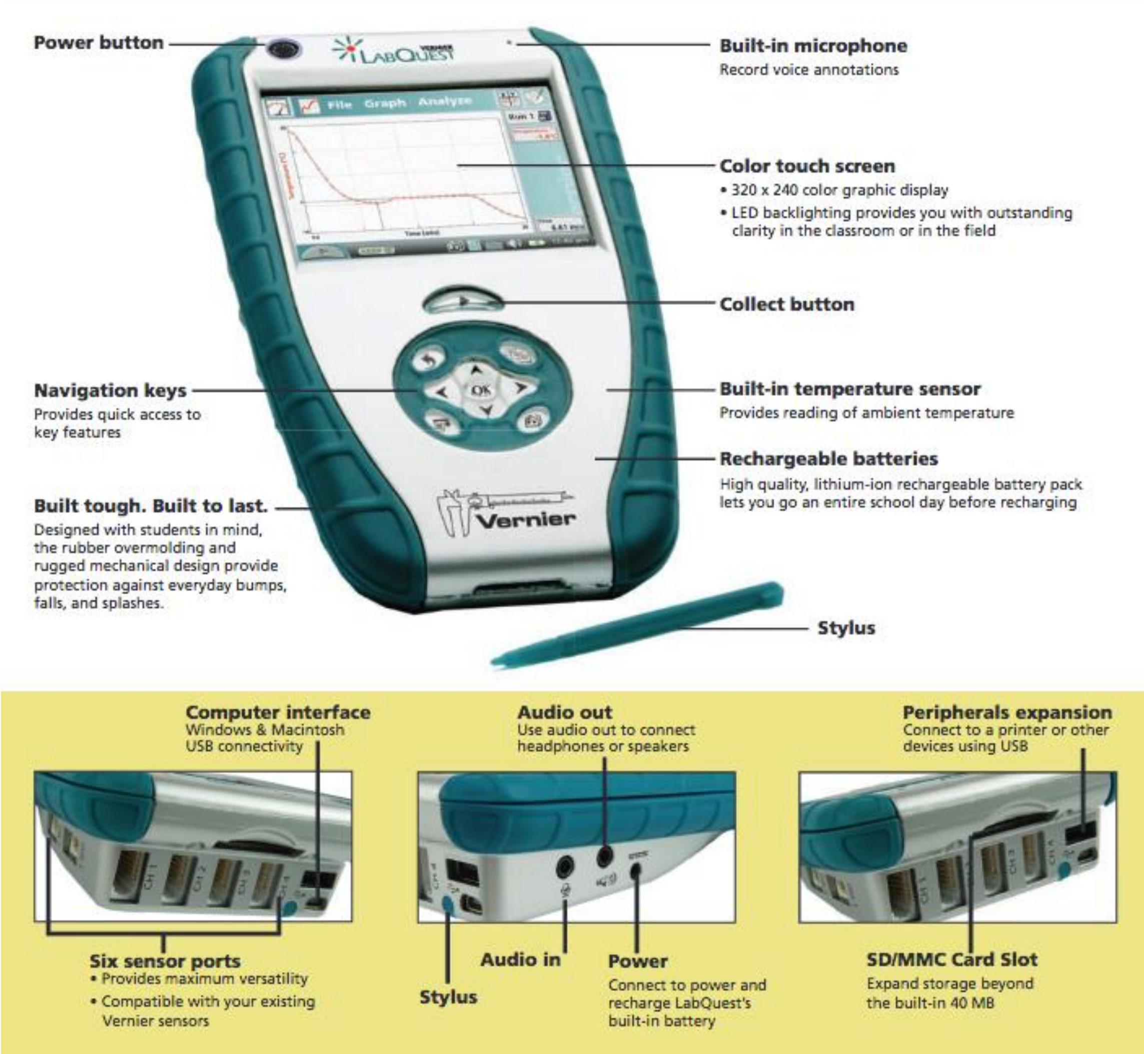
Field methods in biology

Journaling/Field Notes: It is important to keep a detailed record of each time you work in the field or lab. Recording things like recent weather, habitat descriptions, length of time in spent in the field. It can help you place your data and observations into context later. Journaling will records observations and data you might have forgotten several months or years later when you are preparing the manuscript. Be as descriptive as you can and write down everything, sometimes the seemly most insignificant observation or thought become highly important later. If something looks out of place, interesting, you have an idea, or notice a connection or pattern write it down in your notes. You may want to purchase a write-in-the-rain or weather-proof brand of journal. Usually lab notes are kept in pen for permanency, but field notes may be written in pencil especially when the notebook may get wet. It's generally a good idea to photocopy field notes and data sheets immediately after a day in the field as a backup.

Photography: Using photos in field biology is a very effective and nondestructive way of sampling organisms. When taking pictures in the field it is important to remember to not disturb wildlife or to put yourself in dangerous situations. Also, make sure you include an object for scale such as a ruler or something that you can measure later to determine the size of the object. Sometimes you may also want to include a photo reference number to correspond photo notes in your journal. Make sure to get detailed photos with clear line of sight.

Measuring abiotic factors: Probes and other handheld devices are often used to measure abiotic factors in the field such as temperature, salinity, pH, light, turbidity, and nitrates. In our lab, we will be using Vernier LabQuest 2 handheld devices with various probe attachments. Learn how to use the Vernier LabQuest 2 with the links below and diagrams on the following page.

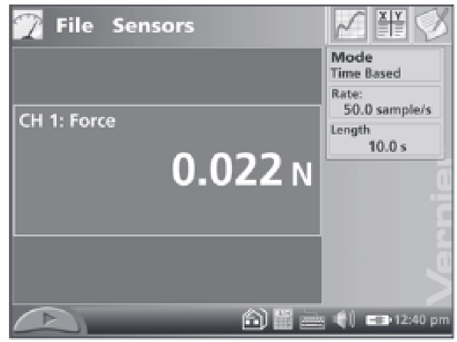
If you would like more detailed information on how to use the handheld or probes see (http://www2.vernier.com/manuals/labquest_quickstart_guide.pdf and https://www.vernier.com/support/manuals/)


LabQuest
Vernier
Power button
Built-in microphone
Record voice annotations
Color touch screen
• 320 x 240 color graphic display
• LED backlighting provides you with outstanding clarity in the classroom or in the field
Collect button
Navigation keys
Provides quick access to key features
Built-in temperature sensor
Provides reading of ambient temperature
Rechargeable batteries
High quality, lithium-ion rechargeable battery pack lets you go an entire school day before recharging
Built tough. Built to last.
Designed with students in mind, the rubber overmolding and rugged mechanical design provide protection against everyday bumps, falls, and splashes.
Stylus
Computer interface
Windows & Macintosh USB connectivity
Audio out
Use audio out to connect headphones or speakers
Peripherals expansion
Connect to a printer or other devices using USB
Six sensor ports
• Provides maximum versatility
• Compatible with your existing Vernier sensors
Audio in
Stylus
Power
Connect to power and recharge LabQuest's built-in battery
SD/MMC Card Slot
Expand storage beyond the built-in 40 MB

Quick Data Collection

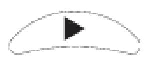
Here's how to quickly collect some data with your new LabQuest.

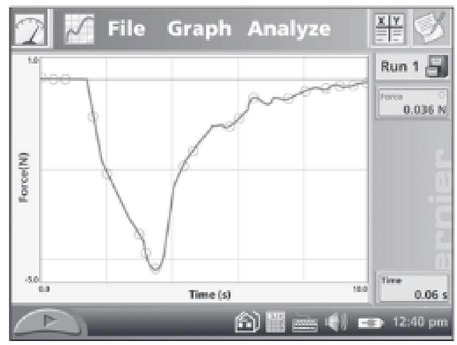
1 Wake your LabQuest by pressing the silver power button on the upper left corner.* If no File menu is visible, tap the Home icon and tap LabQuest App. Using the stylus, choose New from the File menu, and discard any existing data.



2 Connect a sensor such as Temperature, Light or Force to one of the ports on the top of LabQuest. LabQuest will set itself for data collection with that sensor. Note the live readout on the Meter screen.

3 Press the Collect button just below the LabQuest screen. Data collection begins, and a graph shows your data being plotted in real time.





*If LabQuest does not wake, your battery may need charging. Attach the LabQuest power supply, and in several minutes your LabQuest will be ready to go.

LabQuest Quick-Start Guide | 2

We have many probes available for the LabQuest2. Make sure you know how to use them by briefly reading the manuals. Several cannot be fully submerged and others require a rinsing with DI water.

Temperature Probe
pH and Tris-Compatible Flat pH sensors
Turbidity Sensor
Salinity Probe
Light Sensor
Dissolved Oxygen and Optical DO probes
Chloride Ion Selective Electrode
Nitrate Ion Selective Electrode
Colorimeters
Conductivity Probe
Ammonium Ion-Selective Electrode
Calcium Ion-Selective Electrode
Co2 Gas Sensors

Sampling organisms

Sometimes measuring all of something is not feasible or practical due to limited time, energy, or money. **Sampling** is the process of selecting a part of something with the intent of representing the whole. Imagine that you want to know how many elephants are in the Serengeti. It would be nearly impossible to do a census and count every elephant. A sampling unit may be anything from an individual plant to a 20-acre plot of forest. Sampling methods are best when they are random, unbiased, and independent. Random samples mean that they are not chosen out of convenience or because of a preexisting reason. Independence means that samples are spatially (in space) or temporally (in time) spaced far enough apart to not be autocorrelated. For instance, pretend you are comparing old growth and new growth forest species composition. It may influence the representation of your samples if you only measure plants off the trail at each of the plots. It may also compromise the inference of your study if you only sampled species at the edge of one forest plot vs. the interior of another.

Relative abundance is a frequently used metric in biology. Let's say we sample five 10 m quadrats and find a mean of 1.5 oak trees. Provided our sampling was representative and unbiased we can extrapolate this estimate to the entire study area of 100 m^2. This puts our estimate of oak trees in the study area to be approximately 150 individuals. Other methods allow us to have more robust estimates and may allow us to develop a confidence interval (a range of estimates that we have a particular comfortability with their accuracy). Another related measure that is less accurate, but less time consuming is frequency (Braun-Blanquet method). Frequency is commonly expressed as the percentage of sampling units occupied by a target species. One example would be the number of cells (sampling unit) containing a four leaf clover (target) within our quadrat divided by the total number of cells.

Another commonly used metric in biology is biomass. With something like plants, insects, or fungi, biomass can be measured destructively or non-destructively. For instance, a destructive method could involve you harvesting all plants in a plot, drying them, and then weighing them. This is obviously not ideal; and some biologists use non-destructive methods like measuring plant growth (i.e., biomass accumulation) over time. For many animals you can find biomass data available online (https://animaldiversity.ummz.umich.edu/quaardvark/) and extrapolate based on your estimates of relative abundance of each species to compare biomass.

You can estimate percent cover using visual techniques and placing an observation in a cover class (e.g., 0–25, 26–50, 51–75, 76–100% mangrove shade cover).

Exercise: In this exercise, you will look at plant community composition using quadrat sampling and estimate the cloud cover at the sampling site. For quadrat sampling, one member should randomly toss the quadrat 3 times. Each time, you should record species, % cover, and number of individuals per species. Use the data sheet at the end of this task sheet to record your data.

Animal capture methods: We will use several methods to capture animals. Pitfall traps are one method to capture insects, small mammals, reptiles, and amphibians. They require 1 or 2 ground-embedded containers sometimes with an aboveground barrier between them and/or rain cover. Sometimes a killing/preservative agent (e.g., ethyl alcohol) is used to prevent predation or escape. A dip net is an easy to use method to sample aquatic animals that involves a cone-shaped net and wooden handle swept across the sampling area. A butterfly net works the same way except on land. Another tool called a seine net is a long, rectangular net with weights attached to the bottom and floats to the top so that it spans the water column. Usually one person stands at the edge of a bank and another swings the net in a wide arc and eventually drags the net to the bank or meets up with the other end of the net. Generally, animals should be handled with caution. For instance, a small dip net or wet hands should be used for fish to avoid damaging mucous membranes or causing thermal shock.

Rudimentary pitfall trap. Image from Ontario Ministry of Ag, Food, and Rural Affairs.

Seine net. Image from Collier Sea Grant.

Exercise: Try using each of the methods in the field and become proficient enough to be able to conduct your own fieldwork. Find the seine net data sheet and pit fall trap data sheet at the end of the task sheet to record your data.

Animal behavior and observation

Behavior is the sum of an organism's responses to stimuli in its environment. It's what an organism does. For instance, if a lion notices another lion it may attack, flee, court, eat, or do something else.

Scientists generally classify behavior into two causes: proximate and ultimate. **Proximate causes** include the immediate events that led to the behavior, whereas **ultimate causes** refer to the adaptive value and evolutionary origin of the behavior. A lone male lion may respond to a female lion by rolling around the dirt with her. The proximate cause may be the scent of the female and the release of hormones in the blood to trigger muscle contractions to tackle the other lion. The ultimate cause is essentially the desire to mate and produce offspring.

It is also helpful for behavioral scientists to categorize behavior into two major categories: orientation and antagonistic. **Orientation behavior** helps an organism locate the best environment available through taxis, or movement toward or away from a stimulus. For example, many insects have positive photo-taxis like a moth approaching a porch light. **Antagonistic behavior** involves conflict with other organisms. For example, two alligators may try to use the same general area to ambush prey. However, one animal may be aggressive and appear threatening in order to force the other animal to be submissive and retreat. The results of contests may be important for an animal to have greater access to food, mates, or space.

Field observations of wildlife

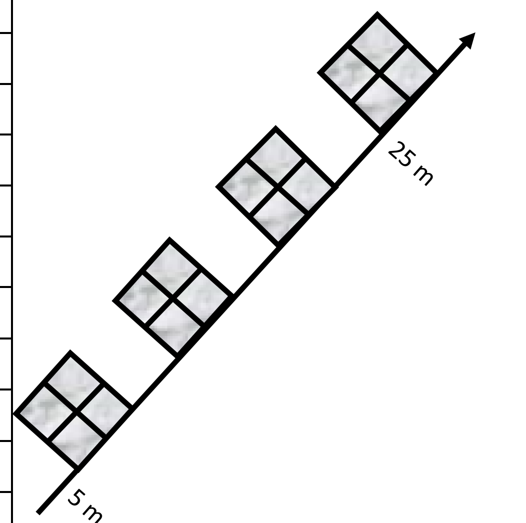
Remember that observation is the first step of the scientific method! **Observe three different wild species for at least five minutes each.** Below is an example of a way to outline your field journal. Most smartphones have a coordinates feature under compass or map settings. Use the behavioral data sheet at the end of this task sheet to record your data.

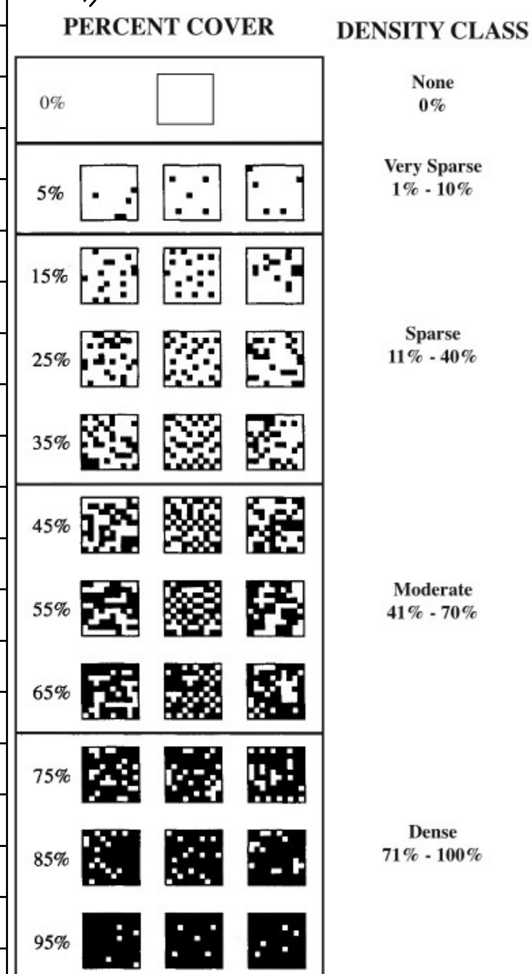
Quadrat Data Sheet

BSC2011L ______/20____ **Section:______** **Group:** **Scribe:**

Date:	Time:	Start Latitude:	Start Longitude:
Site Name:	Transect #:	End Latitude:	End Longitude:
Transect length (m):	1 quadrat ever ______ meters Quadrat Size: 1 m x 1 m	CO_2:	pH:
Air Temp (C):	Lux:		

Quadrat #	Common Name	Species Name	% Cover	Notes





Pit Fall Trap Data Sheet

BSC2011L ______/20____ **Section:______** **Group:** **Scribe:**

Date Start:	Date End:	Time Start:	Time End:
Site Name:	Latitude:	Longitude:	Cup size:
Air Temp (C):	Lux:	CO_2:	Bait:
		pH:	Bait amount:

Common Name	**Species Name**	**# of Individuals**	**Notes**

Seining Data Sheet

BSC2011L ______/20____ **Section:______** **Group:** **Scribe:**

Date:	Time Start:	Time End:	Sweep #:___ of ____ (# at site per day)
Site Name:	Latitude:	Longitude:	Tide:
Water Temp (C):	Air Temp (C):	Conductivity:	Turbidity:
DO:	Lux:	Chloride ion:	pH:
Salinity:	Nitrite ion:	Ammonium ion:	Calcium ion:

Common Name	**Species Name**	**TL (cm)**	**FL (cm)**	**PCL (cm)**	**Notes**

Behavioral Observation Data Sheet Date: ________________

BSC2011L ______/20____ **Section:______** **Group:** **Scribe:**

Air Temp (C):	Lux:	Weather:

Latitude	Longitude	Time start	Species	Common name	Size (cm)	Group size	Min	Substrate type	Observed behavior	Notes

Notes:

Review #6— (Field Methods)
BSC2011L B5__
Spring 2020

Name: ______________________
Panther ID:____________________

Directions: In paragraph form, address (at minimum) the below questions/topics.

- In a few sentences, what was done in today's lab?
- What was your main take-away?
- What are some key concepts that you think might be on your quiz next week?
- Applying knowledge: Look at the PDF document **"BSC2011L_Data_Sheets.pdf"**. Choose one data sheet and discuss the different tools that you could use to collect the data to complete the data sheet. What are three example questions you could answer using data from this data sheet? Look at the map of BBC below. Choose one of your three questions and discuss potential areas on campus where you could collect the data needed to answer that question. Create a null and alternative hypothesis for this question.

Writing should take about a page (more is ok)
Font: Calibri, 11pt font
Single spaced
1" Margins (except for headers)